Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for scanning. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of scanning are checked below.

L'Institut a numérisé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de numérisation sont indiqués ci-dessous.

- ☐ Coloured covers / Couverture de couleur
- ☐ Covers damaged / Couverture endommagée
- ☐ Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- ☐ Cover title missing / Le titre de couverture manque
- ☐ Coloured maps / Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- ☑ Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- ☐ Bound with other material / Relié avec d'autres documents
- ☐ Only edition available / Seule édition disponible
- ☑ Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.

- ☐ Coloured pages / Pages de couleur
- ☐ Pages damaged / Pages endommagées
- ☐ Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- ☑ Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- ☑ Pages detached / Pages détachées
- ☑ Showthrough / Transparence
- ☑ Quality of print varies / Qualité inégale de l'impression
- ☐ Includes supplementary materials / Comprend du matériel supplémentaire
- ☐ Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from scanning / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été numérisées.

☑ Additional comments / Commentaires supplémentaires:

In Sessional paper No. 8, Canada. Report of the Minister of Public Works ... 30th June, 1891 starts at page xi.

In Sessional paper No. 8, Appendix No. 1, page 60 is incorrectly numbered page 06.

In Sessional paper No. 8, Appendix No. 9, page 178 is incorrectly numbered page 17.

Sessional paper No. 9 starts at page v.

In Sessional paper No. 9, page 120 is incorrectly numbered page 012.

SESSIONAL PAPERS.

8 - 9

VOLUME 7.

SECOND SESSION OF THE SEVENTH PARLIAMENT

OF THE

DOMINION OF CANADA.

SESSION 1892.

VOLUME XXV.

OTTAWA

PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST EXCELLENT MAJESTY

1892

☞ See also Numerical List, page 4.

ALPHABETICAL INDEX

TO THE

SESSIONAL PAPERS

OF THE

PARLIAMENT OF CANADA.

SECOND SESSION, SEVENTH PARLIAMENT, 1892.

NOTE.—In order to find quickly whether a paper has been printed or not, the mark (n.p.) has been inserted when not printed ; papers not so marked, it may be understood, are printed. Further information concerning each paper is to be found in the List, commencing on page 4

See also Alphabetical Index, page 1.

LIST OF SESSIONAL PAPERS

Arranged in Numerical Order, with their Titles at full length; the Dates when Ordered and when Presented to both Houses of Parliament; the Name of the Member who moved for each Sessional Paper, and whether it is Ordered to be Printed or Not Printed.

CONTENTS OF VOLUME 1.

1. Report of the Auditor General on Appropriation Accounts for the year ended 30th June, 1891. Presented 15th March, 1892, by Hon. G. E. Foster—
Printed for both distribution and sessional papers.

CONTENTS OF VOLUME 2.

2. Public Accounts of Canada for the fiscal year ended 30th June, 1891. Presented 1st March, 1892, by Hon. G. E. Foster. 2*a*. Estimates for the year ending 30th June, 1893; presented 14th March, 1892. 2*b*. Supplementary Estimates for the year ending 30th June, 1892; presented 31st March, 1892. 2*c*. Supplementary Estimates for the year ending 30th June, 1893; presented 27th June, 1892..... ....*Printed for both distribution and sessional papers.*

3. List of Shareholders in the Chartered Banks of Canada as on the 31st December, 1891; presented 22nd March, 1892, by Hon. G. E. Foster..... *Printed for both distribution and sessional papers.*

CONTENTS OF VOLUME 3.

3*a*. Report of dividends remaining unpaid and amounts, or balances, in respect to which no transactions have taken place, or upon which no interest has been paid for five years or upwards, prior to 31st December, 1891, in chartered banks of Canada. Presented 12th May, 1892, by Hon. G. E. Foster.
Printed for both distribution and sessional papers.

4. Report of the Superintendent of Insurance for the year ending 31st December, 1891.
Printed for both distribution and sessional papers.

4*a*. Preliminary abstract of the business of Canadian Life Insurance Companies for the year ending 31st December, 1891. Presented 1st March, 1892, by Hon. G. E. Foster.
Printed for both distribution and sessional papers.

4*b*. Abstract of statements of Insurance Companies in Canada for the year ending 31st December, 1891. Presented 10th May, 1892, by Hon. G. E. Foster.
Printed for both distribution and sessional papers.

CONTENTS OF VOLUME 4.

5. Tables of the Trade and Navigation of Canada for the fiscal year ended 30th June, 1891, compiled from official returns. Presented 1st March, 1892, by Hon. M. Bowell.
Printed for both distribution and sessional papers.

6. Report, Returns and Statistics of the Inland Revenues of Canada, for the fiscal year ended 30th June, 1891; Part I, Excise, etc. Presented 31st March, 1892, by Hon. J. Costigan.
Printed for both distribution and sessional papers.

VOLUME 4—*Continued.*

6a. Inspection of Weights, Measures and Gas, being a supplement to the Report of the Department of Inland Revenue, 1891 ....*Printed for both distribution and sessional papers.*

6b. Report on Adulteration of Food, for the fiscal year ended 30th June, 1891.
Printed for both distribution and sessional papers.

CONTENTS OF VOLUME 5.

7. Report of the Minister of Agriculture of Canada, for the calendar year 1891. Presented 6th April, 1892, by Hon. J. Carling. Appendices to the Report of the Minister of Agriculture of Canada, for the year 1891. Presented 20th June, 1892, by Hon. J. Carling.
Printed for both distribution and sessional papers.

7a. Report on Canadian Archives, 1891. Presented 8th April, 1892, by Hon. J. Carling.
Printed for both distribution and sessional papers.

7b. Report of the High Commissioner of Canada, with Reports from Agents in the United Kingdom, for the year 1891. Presented 6th April, 1892, by Hon. J. Carling.
Printed for both distribution and sessional papers.

7b.* Supplementary Report of the High Commissioner of Canada. Presented 29th March, 1892, by Hon. G. E. Foster... .....*Printed for sessional papers only.*

7c. Report on the production and manufacture of Beet Sugar by William Saunders, Director Dominion Experimental Farms. Presented 4th March, 1892, by Hon. G. E. Foster.
Printed for both distribution and sessional papers.

CONTENTS OF VOLUME 6.

7d. Mortuary Statistics of the principal cities and towns of Canada, for the year 1891. Presented 30th May, 1892, by Hon. J. Carling .....*Printed for both distribution and sessional papers.*

7e. Criminal Statistics for the year 1891..... .*Printed for both distribution and sessional papers.*

7f. Reports of the Director and Officers of the Experimental Farms for the year 1891. Presented 5th July, 1892, by Hon. J. Carling.. ..... *Printed for both distribution and sessional papers.*

7g. Second Annual Report of the Dairy Commissioner of Canada, for 1891.
Printed for both distribution and sessional papers.

CONTENTS OF VOLUME 7.

8. Annual Report of the Department of Public Works of Canada, for the fiscal year 1890-91. Presented 21st April, 1892, by Hon. J. A. Ouimet .....*Printed for both distribution and sessional papers.*

9. Annual Report of the Minister of Railways and Canals, for the past fiscal year, from the 1st July, 1890, to the 30th June, 1891. Presented 6th April, 1892, by Hon. J. Haggart.
Printed for both distribution and sessional papers.

CONTENTS OF VOLUME 8.

9a. Canal Statistics for Season of Navigation, 1891.....*Printed for both distribution and sessional paper*

9b. Railway Statistics, and Capital, Traffic and Working Expenditure of the Railways of Canada, for 1891. Presented 30th June, 1892, by Hon. J. Haggart.
Printed for both distribution and sessional papers.

9c. Annual Report of the Canals Revenue Branch for 1891.
Printed for both distribution and sessional papers.

10. Twenty-fourth Annual Report of the Department of Marine, for the fiscal year ended 30th June, 1891. Presented 1st April, 1892, by Hon. C. H. Tupper.
Printed for both distribution and sessional papers.

10a. Report of the Chairman of the Board of Steamboat Inspection, etc., for calendar year ended 31st December, 1891 ... .*Printed for both distribution and sessional papers*

CONTENTS OF VOLUME 9.

11. Annual Report of the Department of Fisheries, for the year 1891. Presented 2nd June, 1892, by Hon. C. H. Tupper.... ....*Printed for both distribution and sessional papers.*

11*a*. Fisheries Statements and Inspectors' Reports for the year 1891.
Printed for both distribution and sessional papers.

12. Report of the Postmaster General of Canada, for the year ended 30th June, 1891. Presented 13th April, 1892, by Sir A. P. Caron.....*Printed for both distribution and sessional papers.*

13. Annual Report of the Department of the Interior, for the year 1891. Presented 2nd June, 1892, by Hon. E. Dewdney ....*Printed for both distribution and sessional papers.*

13*a*. Summary Report of the Geological Survey Department, for the year 1891. Presented 5th May, 1892, by Hon. E. Dewdney..... ... .*Printed for both distribution and sessional papers.*

CONTENTS OF VOLUME 10.

14. Annual Report of the Department of Indian Affairs for the year ended 31st December, 1891. Presented 9th March, 1892, by Hon. E. Dewdney...*Printed for both distribution and sessional papers.*

15. Report of the Commissioner of the North-West Mounted Police, 1891. Presented 28th June, 1892, by Hon. E. Dewdney. ... .*Printed for both distribution and sessional papers.*

16. Report of the Secretary of State of Canada for the year ended 31st December, 1891. Presented 9th July, 1892, by Hon. J. C. Patterson..... .*Printed for both distribution and sessional papers.*

16*a*. The Civil Service List of Canada, 1891. Presented 9th July, 1892, by Hon. J. C. Patterson.
Printed for both distribution and sessional papers.

16*b*. Report of the Board of Civil Service Examiners for the year ended 31st December, 1891. Presented 1st June, 1892, by Hon. J. C. Patterson.. .....*Printed for both distribution and sessional papers.*

CONTENTS OF VOLUME 11.

16*c*. Report of the Royal Commission appointed to investigate the working of the Civil Service Act, and other matters connected with the Civil Service generally. Presented 20th May, 1892, by Sir John Thompson.... .....*Printed for both distribution and sessional papers.*

16*d*. Annual Report of the Department of Public Printing and Stationery of Canada, for the year ending 30th June, 1891. Presented 15th June, 1892, by Hon. J. C. Patterson.
Printed for both distribution and sessional papers.

17. Report of the Joint Librarians of Parliament for the session of 1892, on the state of the Library of Parliament. Presented 25th February, 1892, by Hon. Mr. Speaker—
Printed for sessional papers only.

CONTENTS OF VOLUME 12.

18. Report of the Minister of Justice as to Penitentiaries in Canada for the year ended 30th June, 1891. Presented 23rd March, 1892, by Sir John Thompson.
Printed for both distribution and sessional papers.

19. Annual Report of the Department of Militia and Defence of Canada, 31st December, 1891. Presented 7th April, 1892, by Hon. M. Bowell.....*Printed for both distribution and sessional papers.*

20. Statement of Governor General's Warrants issued since the closing of parliament and of the expenditure made on them, in accordance with the Consolidated Revenue and Audit Act. Presented 29th February, 1892, by Hon. G. E. Foster.....*Printed for distribution only.*

20*a*. Return to an address of the House of Commons to his excellency the Governor General, dated 8th March, 1892, for copies of all reports of ministers of the crown upon which any Governor General's warrants have been issued during the recent recess of parliament, and of the orders in council authorizing such issue. Presented 7th April, 1892.—*Mr. Mulock*.....*Not printed.*

21. Report of the Commissioner, Dominion Police, for the year 1891, under Revised Statutes of Canada, chapter 184, section 5. Presented 29th February, 1892, by Sir John Thompson.....*Not printed.*

VOLUME 12—*Continued.*

22. Statement of expenditure under vote for miscellaneous unforeseen expenses, from July, 1891, to date. Presented 1st March, 1892, by Hon. G. E. Foster..... ..*Printed for distribution only.*

23. Statement in reference to fishing bounty payments for 1890-91, required by chapter 96 of the Revised Statutes of Canada. Presented 1st March, by Hon. C. H. Tupper..*Printed for sessional papers only.*

23*a*. Return to an order of the House of Commons, dated 3rd August, 1891, for a return of the names of proprietors to whom licenses have been granted for salmon net fishing on the Restigouche River, in the county of Bonaventure, for 1890 and 1891. Presented 3rd March, 1892—*Mr. Fauvel.*

Not printed.

23*b*. Draft of proposed regulations for the lobster fishery. Presented 17th March, 1892, by Hon. C. H. Tupper... .....*Printed for distribution only.*

23*c*. Copies of papers relating to the mutual recognition by Canada and Newfoundland of licenses issued to United States fishing vessels, under the *modus vivendi*, and the division of the fees collected by the same. Presented 18th March, 1892, by Hon. C. H. Tupper...*Printed for sessional papers only.*

23*d*. Return to an order of the House of Commons, dated 14th March, 1892, for a return showing the quantity, value and kinds of fish, fish oil and fish products imported into Canada from Newfoundland, each year, for past five years; also amount of duty thereon which would have been paid if the duties levied upon similar imports from other countries had been levied. Presented 22nd March, 1892.—*Mr. White (Shelburne).* ... .*Printed for sessional papers only.*

23*e*. Further papers respecting the fisheries on the Atlantic coast, including the separate arrangement proposed to be entered into by Newfoundland with the United States, and also the enforcement by the government of Newfoundland against Canadian vessels of the Newfoundland Bait Act. Presented 30th March, 1892, by Hon. C. H. Tupper.....*Printed for sessional papers only.*

23*f*. Additional papers respecting the fisheries on the Atlantic coast, including the separate arrangement proposed to be entered into by Newfoundland with the United States, and also the enforcement by the government of Newfoundland against Canadian vessels of the Newfoundland Bait Act. Presented 7th April, 1892, by Hon. C. H. Tupper.*Printed for both distribution and sessional papers.*

23*g*. Return to an order of the House of Commons, dated 6th April, 1892, for a copy of all correspondence between F. Charlebois, of Byng Inlet, North (Ontario), and the fisheries department concerning the payment of a claim for service performed by the said Charlebois for the said department. Presented 21st April, 1892—*Mr. Laurier*.....*Not printed.*

23*h*. Further papers respecting the enforcement against Canadian fishing vessels by the government of Newfoundland of the Newfoundland Act respecting the sale of bait to foreign fishing vessels. Presented 11th May, 1892, by Sir John Thompson .....*Printed for sessional papers only.*

23*i*. Return to an order of the House of Commons, dated 14th March, 1892, for a return showing the number of Newfoundland vessels and men therein, and number of fixed fishing establishments owned by Newfoundlanders, with number of employees engaged last year in fishing, in whole or in part, within the waters adjacent to Canadian Labrador and Magdalen Islands. Presented 12th May, 1892.—*Mr. White (Shelburne)*.....*Printed for sessional papers only.*

23*j*. Further papers respecting the enforcement by the Newfoundland authorities against Canadian fishing vessels of the Newfoundland Act respecting the sale of bait to foreign vessels. Presented 20th May, 1892, by Sir John Thompson..... .....*Printed for sessional papers only.*

24. Return to an address of the House of Commons to his excellency the Governor General, dated 21st April, 1890, for copies of any and all communications that may have passed between the imperial and dominion governments with reference to the abrogation of such articles in the various treaties of commerce between her majesty's government and the government of foreign nations as preclude preferential fiscal treatment of goods of British and colonial production by the government of the dominion. Presented 7th March, 1892.—*Mr. Laurie.*

Printed for both distribution and sessional papers.

24*a*. Copy of a despatch from the right honourable the secretary of state for the colonies in reply to an address to her majesty praying that her majesty would take such steps as might be necessary to denounce and terminate the provisions contained in the most-favoured nation clauses of the treaties with the German zollverein and the kingdom of Belgium. Presented 22nd April, 1892, by Hon. G. E. Foster ..... *Printed for sessional papers only.*

VOLUME 12—*Continued.*

25. Return to an order of the House of Commons, dated 3rd March, 1892, showing the date of the Speaker's warrant, the date of the writ, and the date of the appointment of a returning officer, in the case of election of members to the House of Commons, since the close of last session; also a statement of the causes of delay in reference to any of these matters where delays have taken place. Presented 7th March, 1892.—*Mr. Mills (Bothwell).* ..... *Not printed.*

25*a*. Supplementary return to an order of the House of Commons, dated 3rd March, 1892, for a return showing the date of the Speaker's warrant, the date of the writ, and the date of the appointment of a returning officer, in the case of election of members to the House of Commons, since the close of last session; also a statement of the causes of delay in reference to any of these matters where delays have taken place. Presented 3rd June, 1892.—*Mr. Mills (Bothwell).* ..... *Not printed.*

26. Ten days' statement of the receipts and payments of Canada, from the 11th to the 20th February, and from the 21st to the 29th February, 1892, and the corresponding periods of 1891. Presented 7th March, 1892, by Hon. G. E. Foster..... .... *Not printed.*

26*a*. Ten days' statement of the receipts and payments of Canada, from the 1st to the 10th March instant, and the corresponding period of 1891. Presented 15th March, 1892, by Hon. G. E. Foster.
Not printed.

26*b*. Ten days' statement of the receipts and payments of Canada, from the 11th to the 20th of March, instant, and the corresponding period of 1891. Presented 23rd March, 1892, by Hon. G. E. Foster.
Not printed.

26*c*. Ten days' statement of the receipts and payments of Canada, from the 11th to the 20th of April, instant, and the corresponding period of 1891. Presented 22nd April, 1892, by Hon. G. E. Foster.
Not printed.

26*d*. Ten days' statement of the receipts and payments of Canada, from the 21st to the 30th of April, ultimo, and the corresponding period of 1891. Presented 4th May, 1892, by Hon. G. E. Foster.
Not printed.

26*e*. Ten days' statement of the receipts and payments of Canada, from the 11th to the 20th May, instant, and the corresponding period of 1891. Presented 30th May, 1892, by Hon. G. E. Foster.
Not printed.

26*f*. Ten days' statement of the receipts and payments of Canada, from the 21st to the 31st May last, and the corresponding period of 1891. Presented 3rd June, 1892, by Sir John Thompson.—
Not printed.

26*g*. Ten days' statement of the receipts and payments of Canada, from the 1st to the 10th June, instant, and the corresponding period of 1891. Presented 27th June, 1892, by Hon. G. E. Foster.—
Not printed.

26*h*. Ten days' statement of the receipts and payments of Canada, from the 21st to 31st June last, and the corresponding period of 1891. Presented 9th July, 1892, by Hon. G. E. Foster. *Not printed.*

27. Statement of all superannuations and retiring allowances in the civil service, giving the name and rank of each person superannuated or retired, his salary, age and length of service, his allowance and cause of retirement, whether vacancy has been filled by promotion or new appointment, etc., for year ended 31st December, 1891. Presented 7th March, 1892, by Hon. G. E. Foster.—
Printed for both distribution and sessional papers.

28. Statement of the affairs of the British Canadian Loan and Investment Company, as on the 31st December, 1891. Presented 9th July, 1892, by Hon. Mr. Speaker..... .... *Not printed.*

29. Return to an address of the Senate to his excellency the Governor General, dated 4th August, 1891, for a statement in detail of the amount of money paid to A. F. Wood, Esq., for services, etc., as commissioner for canals and railways in different places in 1890. Presented 4th March, 1892.—*Hon. Mr. Flint*..... .... *Not printed.*

30. Return to an address of the Senate to his excellency the Governor General, dated 5th June, 1891, for a statement of all receipts in the unorganized territories of Keewatin and the Mackenzie River Basin on account of revenue under the Customs Act or otherwise, for the last three years, and of the expenditure for public purposes during the same period. Presented 4th March, 1892.—*Hon. Mr. Girard*... .... *Not printed.*

VOLUME 12—*Continued.*

31. List of public officers to whom commissions have issued under chapter 19 of the Revised Statutes of Canada, during the past year, 1891. Presented 10th March, 1892, by Sir John Thompson.—
Printed in No. 16.

32. Detailed statement of all bonds and securities registered in the department of the secretary of state of Canada, since last return, 1891, submitted to the parliament of Canada under section 23, chapter 19, of the Revised Statutes of Canada. Presented 10th March, 1892, by Sir John Thompson.
Not printed.

33. Return to an order of the House of Commons, dated 1st July, 1891, for a return giving : 1. The number of Chinese immigrants that have entered Canada since the date of the last return ordered by the House, specifying : (*a*). The ports at which said Chinese immigrants were entered ; (*b*). The amount of duty or head-money collected ; (*c*). The number that entered by virtue of return certificates ; (*d*). The number of return certificates issued during the same period, and the number of Chinese that during the same period passed through Canada in bond to destinations out of Canada. 2. The number that entered Canada as belonging to the diplomatic or consular service of China. 3. The number of Chinese that entered Canada during the same period, either as tourists, men of science, students or merchants. 4. Copies of all correspondence, if any, between the imperial government and this government, or between this government and the government of China, if any, or between the government of British Columbia and this government, or with any labour organization, or with any company, corporation or person, having reference to the Chinese Restriction Act or suggesting amendments to the same. Presented 10th March, 1892.—*Mr. Gordon.*
Not printed.

34. Return under resolution of the 20th February, 1882, in so far as the same is furnished by the department of interior, respecting the Canadian Pacific Railway Company. Presented 11th March, 1892, by Hon. E. Dewdney..... *Printed for sessional papers only.*

34*a*. List of lands sold by the Canadian Pacific Railway Company from the 1st October, 1890, to the 1st October, 1891. Presented 6th April, 1892, by Hon. J. Haggart .... *Not printed.*

35. Return to an order of the House of Commons, dated 13th July, 1891, for a return of all letters, correspondence, petitions and papers, not otherwise brought down, between all persons in the department of marine and fisheries relating to sawdust in the LaHave River, Lunenburg County, N.S., with the object of having the river relieved from the operation of the said act. Also a list of rivers and streams exempted from the operations of the act, and a return of all letters, correspondence, petitions and papers between all persons and the department of marine and fisheries relating to such exemptions. Presented 14th March, 1892.—*Mr. Kaulbach and Mr. Flint*.....*Not printed.*

36. Return of orders in council relating to the department of the interior, in accordance with sub-clause (*d*) of section 38 of the Regulations for the Survey, Administration, Disposal and Management of Dominion Lands, within the 40 mile Railway Belt, in the province of British Columbia. Presented 15th March, 1892, by Hon. E. Dewdney..... ... . *Printed for sessional papers only.*

36*a*. Return of orders in council relating to the department of the interior, in accordance with clause 91 of the Dominion Lands Act, chapter 54, Revised Statutes of Canada. Presented 15th March, 1892, by Hon. E. Dewdney ....*Printed for sessional papers only.*

37. Copies of documents relating to the negotiations at the conference recently held at Washington, between the delegates from the Canadian government and the secretary of state of the United States, respecting the extension and development of trade between the United States and Canada, and other matters. Presented 16th March, 1892, by Sir John Thompson.
Printed for both distribution and sessional papers.

38. Statements of the quantity of pig iron manufactured in Canada, upon which bounties are claimed, the names of claimants and the amount paid in each case. Presented 16th March, 1892, by Hon. M. Bowell..... ....*Printed for sessional papers only.*

39. Return to an address of the Senate to his excellency the Governor General, dated 3rd March, 1892, praying that his excellency will cause to be laid befor this House, a copy of the resignation, by the Honourable John Carling, Minister of Agriculture, of the seat in the Senate occupied by him at close of the last session of parliament. Presented 17th March, 1892.—*Hon. Mr. Power.*—
Not printed.

VOLUME 12—*Continued.*

40. Return to an order of the House of Commons, dated 5th May, 1891, for copy of all correspondence between the government or the postmaster general's department with Mr. Andrew Allan or any other parties, for the conveyance of the mails between Canada and the United Kingdom. Presented 18th March, 1892.—*Mr. Mills (Bothwell)*.....*Not printed.*

41. Return (in part) to an order of the House of Commons, dated 14th March, 1892, for copies of all the original lists and papers, including all declarations, notices of appeal, objections to preliminary lists, and relating to all other proceedings, now in the possession of the revising barrister or the clerk of the crown in chancery, in any way affecting the voters' lists for the electoral division of the county of Lennox as settled by the revision of 1891, together with a certified copy of the revised voters' list of 1891 furnished by the revising barrister to the returning officer. Presented 21st March, 1892.—*Mr. Wilson (Lennox)* ..... *Not printed.*

41*a*. Return to an address of the House of Commons to his excellency the Governor General of the 21st March, 1892, for: 1. Copies of the judgment given by the revising officer on objections taken to the names of Lewis Allin, S. F. Glass and James P. Moore and 226 others on the voters' list of the city of London, province of Ontario, and which 229 names were subsequently struck off the said voters' list, by the revising officer, on the hearing of the objections, but which were nevertheless printed on the said voters' list is the subject of an appeal, together with copies of the notices of objection to such names and copies of the evidence taken before and decision given by the revising officer on each such name. 2. Copies of all proceedings in appeal taken to the county court judge from the judgment of the revising officer on any or all of such cases, together with any judgment or decision given by such county court judge thereon. 3. Copies of the judgment of the Queen's bench division, high court of justice, Ontario, in the matter of an application to said court for a mandamus to said revising officer in respect of the said votes or any of them, together with copies of the judgment of the court of appeal (Ontario) in respect of the same matter. Presented 11th April, 1892.—*Mr. Sutherland*.....*Not printed.*

41*b*. Supplementary return to an order of the House of Commons, dated 14th March, 1892, for copies of all the original lists and papers, including all declarations, notices of appeal, objections to preliminary lists, and relating to all other proceedings, now in the possession of the revising barrister or the clerk of the crown in chancery, in any way affecting the voters' lists for the electoral division of the county of Lennox as settled by the revision of 1891, together with a certified copy of a the revised voters' list of 1891 furnished by the revising barrister to the returning officer. Presented 21st April, 1892.—*Mr. Wilson*.....*Not printed.*

41*c*. Return to an order of the House of Commons, dated 9th May, 1892, for a return showing the number of voters in the several electoral districts of the province of British Columbia, and the number of voters in each polling district of the electoral district. Presented 12th May, 1892.—*Mr. Mara.*
Not printed.

42. Return to an address of the House of Commons to his excellency the Governor General, dated 17th March, 1892, for a return of the proceedings had at the trial of the recent election petition relating to the election of a member for the electoral district of the county of Welland, together with the findings of the judges who tried the said petition upon the same, and of all evidence taken thereat; also a certified copy of the case and factums filed upon the appeal from such findings or any of them with the registrar of the Supreme Court of Canada. Also a copy of any report and communication made to Mr. Speaker by the said judges in reference to the said petition. Presented 22nd March, 1892.—*Mr. Tisdale* .....*Not printed.*

43. Return to an order of the House of Commons, dated 7th March, 1892, for a return, in the form used in the statements usually published in the *Gazette*, of the exports and imports from the 1st day of July, 1891, to the 1st day of March, 1892, distinguishing the products of Canada from those of other countries; and comparative statements from the 1st day of July, 1890, to the 1st day of March, 1891. Presented 22nd March, 1892.—*Mr. Sutherland* .....*Not printed.*

44. Return to an order of the House of Commons, dated the 9th March, 1892, for a return showing the total quantity of Canadian flour exported to Newfoundland in each of the years 1890 and 1891; the law and regulations of the Newfoundland Government relating to the importation into that colony of flour; the total quantities of Canadian cattle, beef, pork, hogs and cheese exported to Newfoundland in each of the years 1890 and 1891. Presented 22nd March, 1892.—*Mr. Hughes.*
Not printed.

VOLUME 12—*Continued.*

45. Supplementary return to an order of the House of Commons, dated 17th March, 1890, for a return of all correspondence, memorials and agreements between the government and the Temperance Colonization Company, together with correspondence of settlers, employees and members of the company, relative to the operations of the said company. Presented 23rd March, 1892.—*Mr. Wallace*.....*Not printed.*

46. Return to an address of the House of Commons to his excellency the Governor General, dated 14th March, 1892, for a copy of the judgment of the Supreme Court in the appealed case of Barrett *vs.* the City of Winnipeg, commonly known as the "Manitoba School Case." Presented 23rd March, 1892.—*Mr. LaRivière*.....*Printed for both distribution and sessional papers.*

47. Report of the Commissioners appointed to consider the advisability of extending the Trent Valley Canal, and to what extent. Presented 24th March, 1892, by Hon. J. Haggart.

Printed for both distribution and sessional papers.

47*a*. Return to an address of the House of Commons to his excellency the Governor General, dated 10th March, 1892, for a return of all tenders received by the department of railways and canals for sections 11, 12 and 13 of the proposed Soulanges Canal. Such return to comprise: (*a*) The aggregate amount of each tender; (*b*) The quantity of each class of work in the schedules of each section; (*c*) The amount of each tender in detail as "moneyed out" by the product of the quantity and price of each item; (*d*) Copies of all reports to, and orders in council relative to said tenders; (*e*) Copies of all reports of engineers on each of said sections; (*f*) Copies in detail of all estimates of engineers on each section, showing quantity, price and amount of each class of work in schedule; (*g*) Copies of all correspondence relative to said tenders. Presented 9th May, 1892.—*Mr. Sutherland*.....*Not printed.*

47*b*. Return to an order of the House of Commons, dated 17th March, 1892, for copies of engineers' reports which led to the building of the Beauharnois Canal; of engineers' reports in favour of the building of the Soulanges Canal, and of reports, letters, etc., from engineers, masters or pilots, objecting to the building of the canal at Soulanges. Presented 9th May, 1892.—*Mr. Bergeron*....*Not printed.*

48. Return to an order of the House of Commons, dated 17th June, 1891, for a return of all payments and cost of construction of the New Carlisle wharf, including amount paid to the crown lands department and owners of timber limits in the county of Bonaventure, for timber used on the said works. Presented 31st March, 1892.—*Mr. Fauvel*.....*Not printed.*

48*a*. Return to an order of the House of Commons, dated 20th July, 1891, for: 1. A detailed statement of work done on the wharves at Longueuil and Boucherville, in the county of Chambly, since the commencement of the said works in 1886. 2. A detailed statement of the several sums expended by the government in connection with the said works, showing the names of persons to whom such several sums were paid, and why and under what arrangement or contract such payments were made. 3. Copies of all reports of engineers on the said wharves, and of the estimates, and also of all letters addressed to the department of public works in relation to the said works. Presented 13th April, 1892.—*Mr. Beausoleil*.....*Not printed.*

49. Copy of a report of a committee of the privy council, appointed to investigate and report upon the cases of irregularity in the civil service as developed in the public accounts committee, etc. Presented 31st March, 1892, by Hon. G. E. Foster.....*Printed for sessional papers only.*

50. Return to an order of the House of Commons, dated 23rd March, 1892, for a return showing the number of cows kept at the Central Experimental Farm between the first day of January, 1891, and the first day of January, 1892. The number of cows of each of the different breeds; the quantity of milk given by each cow; the quantity of milk to make a pound of butter; the quantity of milk sold; the quantity of butter sold; where sold, and the prices obtained each month; the kinds of food given and the value of the same. Presented 31st March, 1892—*Mr. McMillan (Huron).*

Not printed.

50*a*. Return to an order of the House of Commons, dated 30th March, 1892, for a statement showing: 1. The number and location of the several experimental farms. 2. The amount expended on each of them since the date of its establishment. 3. The name of each and evey employee of each farm, and a statement of the salary and of any other emoluments received from the government by each of them. Presented 2nd June, 1892.—*Mr. Frémont*.....*Not printed.*

VOLUME 12—*Continued.*

51. Return to an address of the House of Commons to his excellency the Governor General, dated 27th May, 1891, for copies of all papers, correspondence and documents, together with reports of the minister of justice and order in council relating to the disallowance of an act passed by the local legislature of the province of Manitoba, on the 31st day of March, 1890, intituled: "An Act respecting the Diseases of Animals." Presented 31st March, 1892—*Mr. Watson* ... ...*Not printed.*

52. Return to an address of the House of Commons to his excellency the Governor General, dated 27th May, 1891, for copies of all papers, correspondence and documents, together with the report of the minister of justice and order in council relative to the disallowing an act passed by the legislature of the province of Manitoba, on the 31st March, 1890, intituled: "An Act to authorize companies, institutions or corporations incorporated out of this province to transact business therein." Presented 31st March, 1892.—*Mr. Watson* ....*Not printed.*

53. Return to an order of the House of Commons, dated 21st March, 1892, for a return showing the quantities of each of the following classes of pork and hog products imported into Canada from the United States, in each of the years 1888-89, 1889-90 and 1890-91; with the value thereof and amounts of duty and rates levied thereon: Bacon and hams, shoulders and sides; lard, tried or rendered; lard, untried; pork; pork barrelled in brine, made from the sides of heavy hogs, after the hams and shoulders are cut off, and containing not more than sixteen pieces to the barrel of two hundred pounds weight; pork, imported in the carcass for exportation. Presented 31st March, 1892.—*Mr. Hughes*..... .....*Not printed.*

54. Return to an order of the House of Commons, dated 21st March, 1892, for a return showing the quantity of the shipments in the following lines from Canada, from 30th June, 1891, to 31st December, 1891, and the country to which shipped: The number of horses of all kinds; the number of sheep; the quantity of eggs; the number of bushels of barley; the quantity of malt; the number of tons of hay; the number of bushels of potatoes; giving the quantity shipped to each country, and the total shipments in the several lines. Presented 31st March, 1892.—*Mr. McMullen.* ....*Not printed.*

55. Return to an order of the House of Commons, dated 21st March, 1892, for a return showing the quantities of beef salted in barrels; dried or salted meats and meats preserved in any other way than salted or pickled; other meats fresh or salted, n. e. s.; butter, cheese and horses imported into Canada from the United States in each of the three years 1888-89, 1889-90 and 1890-91; with the values thereof and rates of duty thereon. Presented 31st March, 1892.—*Mr. Hughes*.....*Not printed.*

56. General Order No. 86 of the Supreme Court of Canada. Presented 1st April, 1892, by Sir John Thompson..... .....*Printed for sessional papers only.*

57. Return to an order of the House of Commons, dated 17th March, 1892, for a statement showing the amount of money expended by the government of Canada in the years 1890-91 on piers, breakwaters, etc., in Prince County, Prince Edward Island; the amount expended on each of these works, the work let by contract and to whom let; also showing the total amount voted during said years and the amount not expended. Presented 5th April, 1892.—*Mr. Perry*....*Not printed.*

58. Return to an order of the House of Commons, dated 7th March, 1892, for a statement showing the number of petitions for prohibition presented to the House of Commons during the session of 1891: 1. Total number of petitions presented. 2. Total number of signatures to these petitions. 3. Number of (1) petitions; (2) signatures: (*a*) presbyterian church; (*b*) methodist church; (*c*) baptist church (separate figures for free baptists); (*d*) episcopal church or church of England; (*e.*) salvation army. 4. Number of (1) petitions; (2) signatures from each province and each territory; name and figures for each province and each territory separately. 5. Number of separate petitions from churches, courts and temperance societies, or any other bodies signed by officials, giving name of church, court, temperance society, etc., sending such petitions, with number of signatures. Presented 7th April, 1892.—*Mr. Fraser*. ...*Printed for sessional papers only.*

59. Return to an order of the House of Commons, dated 30th March, 1892, for a return showing: 1. The corps of the active militia of Canada that have been drilled (*a*) annually, (*b*) biennially, and (*c*) triennially, in the period 1889-1891, inclusive. 2. The number of qualified combatant officers in in each corps. 3. The number of provisionally appointed officers in each corps, specifying those whose period for qualification has expired. 4. The name, length of service and age of each commanding officer upwards of sixty years of age. 5. The actual strength of, and number of enlistments in, during the year 1891, each of the permanent corps located in Ontario, Quebec and New Brunswick. Presented 7th April, 1892.—*Mr. Hughes* ....*Not printed.*

VOLUME 12—*Continued.*

60. Communication and petition from the Quebec Board of Trade concerning the abolition of all dues collected on tonnage in the port of Quebec, etc. Presented 11th April, 1892, by Hon. C. H. Tupper..... *Not printed.*

60a. Copy of certain resolutions passed at a meeting of the Halifax Board of Trade relative to the hostile legislative enactments between the Governments of Newfoundland and Canada, the desirability of arranging, if possible, a *modus vivendi*, under the terms of which the hostile tariffs and enactments of both countries should be held in abeyance, until sufficient time be given to enable diplomatic conferences to adjust the whole difficulty, etc. Presented 21st April, 1892, by Hon. C. H. Tupper... *Not printed.*

61. Return to an order of the House of Commons, dated 29th February, 1892, for a detailed statement showing: 1. Traffic at Mulgrave Station for the six months ending 31st December, 1890 and 1891; also for the months of January, 1891 and 1892. The return to include sale of tickets, freight received and freight sent. 2. The number of staff employed during the said month, salaries paid and amount paid for extra labour, with the names of staff and extra labour employed. 3. Return of work done by shunting engine during said periods, and the number of men employed in shunting, and the cost. 4. If there is a yard-master at said station, when he was appointed, whether he has an assistant, and, if so, when such assistant was appointed and what pay each receives. 5. The number of men employed in the scow at the said station, their names, and whether they are paid by the hour or by the day and at what rate. Presented 13th April, 1892.—*Mr. Fraser. Not printed.*

61a. Return to an order of the House of Commons, dated 4th April, 1892, for copies of all reports and correspondence between the department of railways and canals and the superintendents of the different services of the Intercolonial Railway, in reference to an accident to a train at Truro, in charge of Conductor H. D. Archibald, and his subsequent dismissal. Presented 11th May, 1892.—*Mr. Patterson (Colchester)* .... *Not printed.*

61b. Return to an order of the House of Commons, dated 2nd May, 1892, for a return showing the amount of additional property purchased on or adjacent to government railways for increased accommodation or other purposes; the quantity purchased or paid for within the period from the 1st of July, 1891, to the 1st of April, 1892; the party from whom purchased; the price paid; the purpose for which the property is used or is to be used. Presented 11th May, 1892.—*Mr. McMullen*.....*Not printed.*

61c. Return to an Order of the House of Commons, dated 13th of April, 1892, for a return containing a statement of the expenditure out of income made for permanent improvements, extensions, additions and betterments, exclusive of works of ordinary maintenance and renewals, on account of the Intercolonial Railway from 30th June, 1881, to 1st July, 1891. The return to show such expenditure in summary form for each branch of service as nearly as can be conveniently ascertained from the accounts. Presented 25th May, 1892.—*Mr. McDougald (Pictou).*

Printed for sessional papers only.

61d. Return to an order of the House of Commons, dated 9th May, 1892, for a return showing: 1. Tariffs in force on live stock on the Intercolonial Railway, and all changes in same during last five years. 2. Number of cattle shipped from Sackville, Nappan, Aulac and Amherst stations each year, with destination, distinguishing between car load lots and less than car load lots. Presented 9th June, 1892.—*Mr. Wood (Westmoreland)*..... *Not printed.*

61e. Return to an order of the House of Commons, dated 23rd March, 1892, for copies of all evidence taken at an inquiry held at Lévis, in the month of February, 1892, respecting the discharge of Michael Quinn, a permanent employee in the shops of the Intercolonial Railway at Hadlow, Lévis; and of all correspondence between Alfred Drake, Chief Mechanical Engineer for the said railway at Hadlow, and the railway officials at Moncton, in relation to the dismissal of the said Michael Quinn. Presented 5th July, 1892.—*Mr. Guay*..... *Not printed.*

62. Return to an order of the House of Commons, dated 30th March, 1892, for copies of all petitions, correspondence, letters, telegrams and memoranda received since 1887, asking for or referring to the subsidizing of the Annapolis and Atlantic Railway Company or a line of railway from Liverpool and Shelburne to Annapolis, passing through Caledonia. Presented 13th April, 1892.—*Mr. Forbes*..... *Not printed.*

63. Return to an order of the House of Commons, dated 28th March, 1892, for a return of all petitions of boards of trade, railway companies, and documents generally, concerning the construction of a new bridge across the Lachine Canal at Montreal. Presented 13th April, 1892.—*Mr. Curran.*

Not printed.

VOLUME 12—*Continued.*

63a. Return to an order of the House of Commons, dated 11th May, 1892, for copies of all documents, memorials and correspondence between the government and the corporation and board of trade of the town of Sorel and other persons, respecting the granting of a subsidy for the construction of a bridge on the Richelieu River to connect the town of Sorel with the Montreal and Sorel Railway. Presented 25th May, 1892.—*Mr. Bruneau*..... *Not printed.*

64. Return to an order of the House of Commons, dated 23rd March, 1892, for copies of correspondence exchanged between the government and the postmaster of St. Césaire, county of Rouville, or any other person, with reference to deposits of money to be made by the said postmaster. Presented 19th April, 1892.—*Mr. Brodeur*..... *Not printed.*

65. Return to an order of the House of Commons, dated 18th June, 1891, for a return showing the amount of money expended, and the year of expenditure, in each electoral district since confederation, under the following heads: 1. Public buildings. 2. Harbours and rivers. 3. Roads and bridges. Presented 26th April, 1892.—*Mr. Landerkin*..... *Printed for sessional papers only.*

66. Return to an order of the House Commons dated 1st July, 1891, for a return of all correspondence, telegrams, letters, reports, estimates and other documents relating to the surveys for, and construction and cost of a sub-marine tunnel between Prince Edward Island and the mainland. Presented 27th April, 1892.—*Mr. Davies*..... *Not printed*

66a. Return to an order of the House of Commons, dated 23rd March, 1892, for all correspondence, reports, etc., which may have taken place between the government of Canada and Sir Douglas Fox, or any other engineer, since the 1st day of September, 1891, having reference to building a tunnel from Prince Edward Island to the mainland across the Straits of Northumberland. Presented 3rd May, 1892.—*Mr. Perry*..... *Printed for sessional papers only.*

67. Return to an order of the House of Commons, dated 9th March, 1892, that a map of the Dominion be laid upon the table showing the boundaries of townships, counties and electoral divisions in each province, and the number of votes polled in each township for each candidate at the general election in March, 1891. Presented 27th April, 1892.—*Mr. Mills (Bothwell)*..... *Not printed.*

68. Return to an address of the House of Commons to his excellency the Governor General, dated 14th March, 1882, for copies of all correspondence between the government of Canada or any member thereof, and the British government, or between the government of Canada and any person or persons, relating to the admission of live cattle from the United States. Also for copies of all orders in council relating to the same. Presented 29th April, 1892.—*Mr. Somerville.*

Printed for sessional papers only.

69. Return to an order of the House of Commons, dated 14th March, 1892, for a return of copies of all tenders received for engraving and printing since 1882, and of all contracts entered into for the same, including the contract beginning in this present year; also all correspondence relating to the subject since 1882. Presented 3rd May, 1892.—*Mr. Somerville*..... *Not printed.*

70. Return to an address of the House of Commons to his excellency the Governor General, dated 30th March, 1892, for a return of all correspondence, telegrams or other documents between the government of Canada and the imperial government or the government of Newfoundland, or between any member or representative of either of such governments respecting the admission of Newfoundland into the dominion of Canada; including all correspondence or telegrams to and from the high commissioner on the subject; and all reports to and minutes of council thereon. Also copies of any terms or offers which may have been submitted to the government of Newfoundland or any member thereof, with respect to the admission of that island into the dominion. Presented 4th May, 1892.—*Mr. Davies*..... *Printed for sessional papers only.*

71. Return to an address of the House of Commons to his excellency the Governor General, dated 10th March, 1892, for copies of all correspondence, memorials, departmental orders, and orders in council respecting the north-western, northern and eastern boundaries of the province of Quebec, received or passed during the last five years and not already laid before this House, together with all the reports of surveys or explorations ordered thereon by the government of Canada during the same period. Presented 5th May, 1892.—*Sir H. Langevin.*

Printed for sessional papers only.

72. Return to an address of the House of Commons to his excellency the Governor General, dated 9th May, 1892, for a copy of the instructions appended to commission of the lieutenant governors of the provinces of Canada. Presented 9th May, 1892.—*Mr. Laurier*..... *Not printed.*

VOLUME 12—*Continued.*

73. Return to an order of the House of Commons, dated 14th March, 1892, for a return of all correspondence, engineers' reports, petitions or other documents relating to the survey or deepening of the channel of the Galops Rapids, and for a statement of the work performed by the chain tug "Iroquois," owned by the government, and of the services performed by one John Stitt, in connection with said tug. Presented 9th May, 1892.—*Mr. Somerville*.....*Not printed.*

73a. Return to an order of the House of Commons, dated 11th March, 1892, for a return of all surveys, plans, specifications, contracts, reports and papers connected with the new channel in the Galops Rapids. 2. All reports of engineers as to the striking of steamer "Traveller" in Galops Rapids, in October, 1889. 3. All reports from any steamboat captain who may have reported as to the state of said channel. 4. Statement of cost of investigation by engineers in 1891. 5. Reports from engineers sent to investigate said channel in 1891. 6. Copies of evidence given as to the depth, quantities, etc. Presented 30th May, 1892.—*Mr. Reid.* ... .*Not printed.*

74. Return to an address of the House of Commons to his excellency the Governor General, dated 4th April, 1892, for copies of the original letters patent of incorporation of the Dominion Cotton Mills Company (Limited), and of the supplementary letters patent increasing the capital stock of the said company from $100,000 to $5,000,000, and copies of all correspondence, petitions, statements and evidence submitted to the government in support of the issue of such supplementary letters patent. And also for copies of the original letters patent incorporating the Canadian Coloured Cotton Mills Company (Limited), and of the supplementary letters patent increasing the capital stock of the said company from $100,000 to $5,000,000, and copies of all correspondence, petitions, statements and evidence submitted to the government in support of the issue of said supplementary letters patent. Presented 9th May, 1892.—*Mr. Edgar* .....*Not printed.*

75. Return to an order of the House of Commons, dated 2nd May, 1892, for all correspondence concerning the appointment of Mr. W. H. Ingram as Collector of Customs at St. Thomas, Ont. Presented 10th May, 1892.—*Mr. Casey*.....*Not printed.*

76. Return to an address of the House of Commons to his excellency the Governor General, dated 2nd May, 1892, for copies of all correspondence, memorials and documents exchanged between the government, or any member thereof, and any persons, companies or corporations as to the propriety or advisability of relieving or recouping the county of Pontiac railway indebtedness. Presented 11th May, 1892. —*Mr. Murray*.....*Not printed.*

77. Return to an order of the House of Commons, dated 2nd May, 1892, for a detailed copy of the certificate of acting chief engineer that $32,000 paid to Bancroft & Connolly was done in addition to all previous certificates on Kingston Graving Dock, as mentioned in Auditor General's Report, page C—119. Presented 12th May, 1892.—*Mr. Gibson*..... *Not printed.*

78. Return to an order of the House of Commons, dated 14th March, 1892, for : 1. Copy of the circular issued on the 10th June, 1891, by the department of marine, relative to sick mariners' dues in Canada. 2. A list of persons to whom such circulur was addressed. 3. Copy of all answers received. Presented 16th May, 1892.—*Mr. Laurier*.....*Not printed.*

79. Report of the Royal Commission appointed to investigate the working of Civil Service Act, and other matters connected with the Civil Service generally. Presented 20th May, 1892, by Sir John Thompson.....*See No.* 16c.

80. Return to an address of the House of Commons to his excellency the Governor General, dated 2nd May, 1892, for a return stating, for the last year (1891) : 1. The number of applications which were made to the railway committee of the privy council for an adjudication, order or direction respecting any of the matters or things which, under the provisions of the Railway Act, the railway committee had power or authority to deal with. 2. Showing in general terms the nature of the application. 3. The names of the members of the honourable the privy council who (*a*) Heard each of the applications ; (*b*) Who were present at any one or more adjourned hearings thereof, and at the final adjudication thereof ; (*c*) In cases in which adjournments took place, the dates of hearing, and subsequent adjournment or adjournments of final adjudication. 4. Statement showing how each of said applications was disposed of, viz. : Granted or refused, or partially granted. Presented 25th May, 1892.—*Mr. McCarthy*.....*Not printed.*

80a. Return to an address of the House of Commons to his excellency the Governor General, dated 2nd May, 1892 : 1. For a statement of all applications or complaints made to the railway committee of the privy council respecting the matters or things referred to in sub-sections (*k*), (*l*), (*m*), (*n*) and

VOLUME 12—*Continued.*

(*p*) of clause eleven of the Railway Act. 2. By or against whom such complaints were made. 3. The manner in which the same were dealt with or disposed of. Presented 25th May, 1892.—*Mr. McCarthy*............ ....*Not printed.*

81.—(1891.) Return to an address of the House of Commons to his excellency the Governor General, dated 3rd June, 1891, for copies of all correspondence between the imperial government and the government of Canada, on the subject of the copyright laws of Canada, and all other papers relating thereto, not already brought down. P resented 24th August, 1891.—*Mr. Edgar.*
Printed for sessional papers only.

81. Return (in part) to an order of the House of Commons, dated 23rd March, 1892, for a return showing which of the dominion buildings in Canada are lighted by electricity; the respective system used in each such building, whether arc or incandescent; the number of sixteen candle-power lamps or their equivalents used in each such building; the cost per lamp of sixteen candle power or equivalent in each building; and the average annual cost for lighting each such building. Also showing in what buildings the plants are owned and maintained by the government, and in cases where not so owned and maintained, from whom the current is obtained or supplied, and whether from central station or private parties; also whether in cases of leased currents the renewal lamps are supplied at government expense, and if so, in what buildings and at what annual cost; also the names of the parties contracting to light any of such buildings, with the names of the buildings, and the dates and duration of each such contract. Also showing which of the public buildings of the dominion are lighted with gas, and the annual cost of lighting each such building. Presented 25th May, 1892 .... *Not printed.*

82. Return to an order of the House of Commons, dated 2nd May, 1892, for a return giving all papers, letters, petitions, applications and every other document relating to the dismissal of the postmaster of Eugenia, and the appointment of his successor. Presented 30th May, 1892.—*Mr. Landerkin*—
Not printed.

83. Return to an order of the House of Commons, dated 16th May, 1892, for a return showing the names of the mail conductors superannuated, their number of years of service, the salary given to each of them during the last year of service, and also the names of those who have had several years added to their period of service. Presented 30th May, 1892.—*Mr. Brodeur*......... .*Not printed.*

84. Return to an order of the House of Commons, dated 1st March, 1892, for a return showing the number of royal commissions that have been issued in each and every year since confederation, and to whom issued, together with the subject inquired into, giving the cost of each and the total cost of all. Presented 1st June, 1892.—*Mr. Landerkin*.......... ...*Printed for sessional papers only.*

84*a*. Supplementary return to an order of the House of Commons, dated 1st March, 1892, for a return showing the number of royal commissions that have been issued in each and every year since confederation, and to whom issued, together with the subject inquired into, giving the cost of each and the total cost of all. Presented 9th June, 1892.—*Mr. Landerkin.*—
Printed for sessional papers only.

85. Statement of number of hours of setting upon the daily Senate *Hansard*, and number of ems set, including corrections, up to 20th May. Presented 2nd June, 1892, by Hon. Sir J. C. Abbott.—
Not printed.

86. Return to an address of the House of Commons to his excellency the Governor General, dated 25th April, 1892, for a copy of the petition presented and filed in the supreme court of Nova Scotia, under the Dominion Controverted Elections Act, against the election and return of Joseph A. Gillies, for the county of Richmond, Nova Scotia, at the general election holden on the 5th March, 1891; together with the dates of filing and service of such petition; and also all papers and documents in connection with the following proceedings in the supreme court of Nova Scotia: 1. Application to the honourable the chief justice extending the time for setting the petition down for trial. 2. Application to set the petition down for trial returnable before the Honourable Mr. Justice Weatherbe, and the Honourable Mr. Justice Graham, but heard by the Honourable Judge Weatherbe, sitting alone, on the 19th day of November, 1891. 3. The order made by the said Judge Weatherbe, sitting alone, for the trial of the said petition, fixing the 8th of December, 1891, the date for said trial. 4. The notice of appeal, dated 28th November, 1891, from this decision of the Honourable Judge Weatherbe, to the supreme court of Nova Scotia, the grounds of appeal being as follows: (*a*) Because there was no jurisdiction to make said order, or the portion

VOLUME 12—*Continued.*

thereof extending time; (*b*) Because six months had elapsed since the presentation of the petition; (*c*) Because the time and place of trial were not fixed within six months from the presentation of the petition; (*d*) Because the extension of time granted by said order was not made on application for that purpose, supported by affidavits, and it does not appear from such order, and it was not made to appear when the same was made, that the requirements of justice rendered such enlargement necessary; (*e*) Because the respondent had no notice of any application to extend the time for the commencement of the trial herein; (*f*) Because one judge has no jurisdiction to fix the time and place of trial; (*g*) Because the trial of the petition cannot be commenced during the term of the court at which the judges assigned to try the said petition are bound to sit. 5. The notice of motion on said appeal for the 3rd day of December, 1891. 6. The appointment by the Honourable Judge Weatherbe, then senior judge, for a hearing before the supreme court on the said 3rd day of December, 1891. 7. The postponement of this hearing until a later day. 8. The judgment of the supreme court upon this case. 9. The rule of the supreme court, dated the 19th day of December, 1891, setting aside the order of the Honourable Judge Weatherbe fixing the date of the trial of said petition. 10. The date on which the Honourable Judge Weatherbe and the Honourable Judge Graham received a copy of the order of the supreme court setting aside the said order of Judge Weatherbe for trial. 11. The date on which the said judges reported to the Honourable the Speaker of the House of Commons that the said petition had been heard by them, and that they had declared the election of the said Joseph A. Gillies void, and his seat in parliament vacant. 12. The date upon which application was made to the Honourable Judge Weatherbe to defer the decision in the petition pending the decision of the supreme court of Nova Scotia on the question of jurisdiction, and the refusal of this application. Also copies of the several petitions presented and filed in the supreme court of Nova Scotia under the Dominion Controverted Elections Act, against the election and return of Hon. Sir John Thompson, Hon. C. H. Tupper, Mr. C. E. Kaulbach, Mr. J. B. Mills, Mr. N. W. White and Mr. Hugh Cameron, for six of the several counties of the province of Nova Scotia, at the general election held on the 5th March, 1891. Also all papers and documents in connection with the various proceedings in the said cases in the supreme court of Nova Scotia. Presented 3rd June, 1892.—*Mr. Gillies and Mr. Forbes.*

Not printed.

87. Return to an address of the House of Commons to his excellency the Governor General, dated 30th March, 1892, for copies of all accounts, claims and certificates presented and transmitted (from 1st July, 1885, to this day) to the dominion government, by each of the judges of the superior court for the province of Quebec, in his capacity as such, for all travelling expenses and hotel expenses, in any place other than that in which such judge had orders to reside, or did in fact reside, either for sitting or for acting therein, or for holding therein (in such capacity) any court in civil, criminal or other matters; together with a detailed statement of the several sums paid in conformity with such accounts, claims and certificates. Presented 3rd June, 1892.—*Mr. Flint.*

Not printed.

88. Further supplementary return to an address of the Senate, to his excellency the Governor General, dated 14th September, 1891, for all correspondence between his excellency the Governor General and the Lieutenant Governor of the province of Quebec, in connection with the Baie des Chaleurs Railway, and all other papers and correspondence in the possession of the government on that subject. Presented 31st May, 1892.—*Hon. Mr. Miller*.....*Not printed.*

89. Return to an order of the House of Commons, dated 25th April, 1892, for a return of the amount of crude cotton-seed oil imported into Canada during the year 1891; also the amount of refined cotton-seed oil imported into Canada during the year 1891. Presented 7th June, 1892.—*Mr. McKay.*

Not printed.

90. Return to an address of the Senate to his excellency the Governor General, dated 5th May, 1892, for copies of all letters, communications and reports in the possession of the government, having relation to the fixing of a standard of time, and which have been received subsequent to May, 1891. Presented 14th June, 1892.—*Hon. Mr. Sullivan*.....*Not printed.*

91. Return to an order of the House of Commons, dated 10th June, 1892, for a copy of the Reports of the British Farm Delegates, Messrs. McQueen and Davey, on the Maritime Provinces. Presented 15th June, 1892.—*Mr. McMillan (Huron)*.....*Not printed.*

92. Return to an order of the House of Commons, dated 15th June, 1892, for a copy of the minutes of the evidence taken at the trial, under the Dominion Controverted Elections Act, of the case of A. Sturton *et al*, petitioners, *vs.* P. V. Savard, defendant, in relation to the election for the counties of Chicoutimi and Saguenay, in the year 1891. Presented 15th June, 1892.—*Sir John Thompson.*

Not printed.

VOLUME 12—*Continued.*

93. Return to an order of the House of Commons, dated 18th June, 1891, for copies of all papers and correspondence in the department of marine and fisheries, relating to the saving of the lives of part of the crew of H.M.S. "Lily," wrecked on the coast of Labrador, in September, 1889. Presented 17th June, 1892.—*Mr. Edgar*..... *Not printed.*

94. Return to an address of the House of Commons to his excellency the Governor General, dated 10th August, 1891, for copies of all orders in council, memorials, correspondence and documents respecting the rock-slide from the citadel at Quebec, on the 19th September, 1889. Presented 24th June, 1892.—*Mr. Frémont*..... *Not printed.*

95. Return to an order of the House of Commons, dated 4th April, 1892, for: 1. Return of all correspondence, papers, complaints or memoranda of any kind in relation to "The Temperance Colonization Society," received since or not included in a return furnished the House in 1890. 2. List of all stockholders of the company, 1st May, 1885, with amounts paid on calls of the shares, whether in cash, land credits, or otherwise, each year to date, stating what shares were forfeited, when and why. 3. List of stockholders at date of return, showing when they became such, with dates and amount of shares purchased, with price per share. (*a*) Number of calls on all shares, with details, dates, etc. 4. Amount earned in fees by directors each year to date. 5. Amount of money invested each year, and in what. (*a*) Total amount received on account of scrip and land sales to date. 6. List of scrip holders, with post office address, who purchased from the company (scrip issued) prior to 1st June, 1882, and since that date, giving date of issue, amount of land purchased by each, price per acre, amount paid thereon to date; showing if cancelled, when and on what conditions. 7. List of all other contracts for purchase of land issued, whether exchanged for scrip, amounts paid to date, whether contract is still in existence, why cancelled, and when. 8. Amount and details of land sales now current and for which land is to be supplied by the company. 9. List of all persons whose scrip was located on even-numbered sections in 1883, showing where located, new location subsequently, if any, with form of contract of even-numbered location. 10. List of homestead settlers in 1885. List at date (actual residents). 11. When contract with the company and government expired, with conditions of extension, if any; conditions of final settlement. 12. List of lands to be conveyed to the company under such settlement. The foregoing information to be furnished, if practicable, under affidavit of the president and accountant. Presented 30th June, 1892.—*Mr. Sproule*..... *Not printed.*

96. Census of Canada.—Bulletin No. 11. Nationalities. Birth places of the people. Presented 30th June, 1892, by Hon. J. Carling.. *Not printed.*

97. Return to an address of the House of Commons to his excellency the Governor General, dated 2nd May, 1892, for a copy of location ticket granted to John Alexander McLellan, of Cockburn Island, for lot 15 in the 5th concession, Cockburn Island; copy of all affidavits or declarations, letters and other papers from any person or persons to the department, or any officer of the department, in any way relating to said lot or the cancellation of the said ticket; and copy of any order made for the cancellation of said ticket. Also for a copy of the location ticket granted for lot 16 in the 4th concession, Cockburn Island, and any assignment or transfer thereof to Peter McLellan; copy of affidavits or declarations, letters and other papers from any person or persons to the department in any way relating to said lot or the cancellation of the said ticket, and copy of any order made for the cancellation of said ticket. Presented 5th July, 1892.—*Mr. Lister*. *Not printed.*

98. Return to an order of the House of Commons, dated 28th March, 1892, for a return showing: 1. The number of Indian reserves in British Columbia. 2. The location of each and name of tribe to whom allotted. 3. The area in acreage of each. 4. The area cultivated on each reserve. 5. The population of each tribe when reserves were first established. 6. The present population of each tribe. 7. The area (estimated) of pastoral land on each reserve. 8. The number of horses, cattle and sheep owned by each tribe. 9. The estimated area of timber land on each reserve. Presented 5th July, 1892.—*Mr. Barnard*..... *Not printed.*

99. Copy of a report of a committee of the honourable the privy council, approved by his excellency the Governor General in council, on the 17th June, 1892, on the subject of a despatch dated 4th November, 1891, from Lord Knutsford, inviting an expression of the views of the Canadian government upon the complaint of alleged discrimination on the part of the government of Canada against citizens of the United States in the matter of canal tolls. Presented 6th July, 1892, by Sir John Thompson..... *Printed for sessional papers only.*

VOLUME 12—*Continued.*

100. Return to an address of the Senate to his excellency the Governor General, dated 10th June, 1892, for a return of subsidy paid the Albert Southern Railway Company, showing the dates when paid, and to whom paid; also copies of all correspondence in reference to the payment of the said subsidy, and of all letters or telegrams asking for payment of same or relating thereto; also copies of all returns or reports of government engineers or inspectors, who inspected or reported on said road. Presented 6th July, 1892.—*Hon. Mr. Power*.....*Not printed.*

101. Return to an order of the House of Commons, dated 9th May, 1892, for a return showing: 1. The total number of acres of public lands granted in Manitoba and the Canadian North-West in aid of railway construction, up to 26th April, 1892. 2. The name of each railway company or line to which a land grant has been made; the length of each line thus aided by land grant, and the number of acres granted to each company or line. 3. The total number of acres of land in Manitoba and the Canadian North-West which have been earned up to 26th April, 1892, under provisions of grants through completion of lines or portions of lines to which land grants have been made. 4. The name of each railway company or line which has earned the whole or a portion of its land grant, with the number of acres earned by each of such lines. Presented 9th July, 1892.—*Mr. Charlton*.....*Not printed.*

102. Return to an order of the House of Commons, dated 21st March, 1892, for a map of Canada showing the areas of spruce and white pine timber, respectively, now standing. Presented 9th July, 1892.—*Mr. Ives*.....*Not printed.*

103. Return to an address of the House of Commons to his excellency the Governor General, dated 25th April, 1892, for copies of all resolutions and memorials passed by the North-West Assembly at its last session and addressed to the government. Presented 9th July, 1892.—*Mr. Davin*..*Not printed.*

104. Return to an address of the House of Commons to his excellency the Governor General, dated 21st March, 1892, for copies of all letters, correspondence, petitions, etc., relating to the claims or settlement, or proposed settlement of claims of settlers on the Waldron Ranche Company's territory; copies of all complaints made regarding the treatment settlers have been subject to by the company. Presented 9th July, 1892.—*Mr. McMullen*.....*Not printed.*

105. Return to an order of the House of Commons, dated 28th March, 1892, for a return showing the quantity of binding twine imported for consumption in the Dominion, from the 1st of July, 1891, up to the first day of January, 1892; the country from which the same was imported, and the amount of duty paid thereon. Presented 9th July, 1892.—*Mr. Campbell*.....*Not printed.*

CANADA

ANNUAL REPORT

OF THE

MINISTER OF PUBLIC WORKS

FOR THE FISCAL YEAR 1890-91

ON THE WORKS UNDER HIS CONTROL.

PART I.

SUBMITTED IN ACCORDANCE WITH THE PROVISIONS OF CHAPTER THIRTY-SIX, SECTION 37, OF THE REVISED STATUTES OF CANADA.

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST EXCELLENT MAJESTY
1892

[No. 8—1891.] *Price 20 cents.*

ALPHABETICAL INDEX

TO

REPORT AND APPENDICES.

INDEX.

INDEX.

INDEX.

INDEX.

INDEX.

INDEX.

INDEX.

INDEX.

INDEX.

INDEX.

CANADA.

REPORT

OF THE

MINISTER OF PUBLIC WORKS

FOR THE

FISCAL YEAR ENDED 30TH JUNE, 1891.

To His Excellency the Right Honourable Sir Frederick Arthur Stanley, Baron Stanley of Preston, in the County of Lancaster, in the Peerage of Great Britain, Knight Grand Cross of the Most Honourable Order of the Bath, Governor General of Canada, and Vice Admiral of the same, &c.

MAY IT PLEASE YOUR EXCELLENCY:

In compliance with the requirements of Chapter 36, Section 37, of the Revised Statutes of Canada, I have the honour to present to Your Excellency the Annual Report of the Department of Public Works, for the fiscal year ended 30th June, 1891.

Respectfully submitted,

J. ALD. OUIMET,
Minister of Public Works.

OTTAWA, 10th March, 1892.

DEPARTMENT OF PUBLIC WORKS,

OTTAWA, 9th March, 1892.

To the Honourable

JOSEPH ALDRIC OUIMET,
Minister of Public Works.

SIR,—I have the honour to submit the annual report of the Department of Public Works, for the fiscal year ended 30th June, 1891.

The report contains references to the more important works performed under the direction and superintendence of the department, during the year.

In the numerous appendices annexed thereto, detailed accounts of the expenditure will be found, with reports by officers of the department, on the extent and nature of the services performed, in constructing, repairing and maintaining the public buildings, harbours, government telegraph lines, slides and booms, &c., throughout the Dominion.

The works under the control of the department are:—

BUILDINGS (PUBLIC), their construction and maintenance.
DREDGING AND DREDGE VESSELS.
HARBOURS AND PIERS, their construction and maintenance.
ROADS AND BRIDGES.
SLIDES AND BOOMS, and the collection of revenue therefrom.
TELEGRAPHS.
WORKS ON NAVIGABLE RIVERS.

For convenience of reference, the following brief résumé of the work performed has been, as far as practicable, arranged alphabetically:—

ART GALLERY—NATIONAL.

"MORTGAGING THE FARM."—An oil painting by G. A. C. Reid, R.C.A., was this year handed over to the Government by the Royal Academy, and placed with the collection in the National Art Gallery.

The number of visitors who registered their names during each fiscal year since the gallery was inaugurated have been as follows:—

1882–83	8,261
1883–84	9,928
1884–85	11,893
1885–86	8,792
1886–87	11,943
1887–88	16,593
1888–89	14,241
1889–90	18,048
1890–91	21,289

The curator's report is added hereunto, in Appendix No. 12, page 189.

ACTS OF PARLIAMENT.

LAW AMENDMENTS.—A list of the acts passed during the last session of Parliament, having reference to the Department of Public Works, is given in Appendix No. 20, page 231.

BRITISH COLUMBIA.

BUILDINGS.—Public buildings have been erected, extended, improved, repaired or fitted up at the following places during the fiscal year :—

Agassiz experimental farm,	New Westminster,
Albert Head quarantine station,	Vancouver immigrant building,
Kamloops,	Vancouver post office,
Nanaimo,	Victoria barracks.

(*See* Appendix No. 1, page 8. Appendix No. 2, pages 42-43.)

HARBOURS AND RIVERS.—For facilitating, and for the security of navigation, operations for the removal of obstructions by dredging and otherwise, have been carried on at the following harbours and rivers, viz. :—

Columbia River,	Fraser River,
Coquitlam do	Nanaimo Harbour,
Cowichan do	Nicomeckel River.

VICTORIA HARBOUR.—*See* Appendix No. 1, page 18. Appendix No. 3, pages 92-93.

CANAL.

PORT LA TOUR, NOVA SCOTIA.—A description of the work done in connection with this work will be found in Appendix No. 3, page 67.

CONTRACTS.

APPENDIX No. 16, page 13, contains a statement showing the contracts entered into, the property purchased and sold, and property leased by or to the department, during the fiscal year.

CORRESPONDENCE.

APPENDIX No. 11, page 185, shows a statement of the official correspondence of the department, together with that of its principal officials from 1867 to the 30th June, 1891.

DOMINION BUILDINGS.

APPENDIX No. 1, pages 9 to 13, is a statement by provinces, showing the amounts expended for heat, light and water, for the use of the several public buildings throughout Canada for the fiscal year.

DREDGES.

DREDGING OPERATIONS.—The report on the operations of the various dredges in the different provinces is appended in Appendix No. 3, pages 95 to 134.

ENGINEERS, ENGINEMEN, FIREMEN AND CARETAKERS.

EMPLOYÉS.—A list of the engineers, &c., employed in the public buildings throughout Canada, with a statement showing date of birth, position, date of appointment and salaries, is added in Appendix No. 4, pages 135 to 139.

(*See* also Appendix No. 2, page 43.)

EXPENDITURE.

APPENDIX No. 1.—This appendix is a succinct statement, by the accountant of the department, of the expenditure on the various services during the fiscal year.

GEODETIC LEVELLING.

Part II of this report is a continuation of Mr. R. Steckel, C. E.'s report, respecting the determination of the water line along the River St. Lawrence, between the cities of Montreal and Quebec. The field work, including tide and river gauging, and levelling operations, in connection with the geodetic levelling of the River St. Lawrence, was commenced in 1885 and completed in 1888. Prior to 1889 Parliament made three special appropriations, amounting in the aggregate to $8,000, for this work. The technical office work, however, was performed in this department by employés under the direction and superintendence of Mr. Steckel, who attended thereunto in addition to his other office duties.

Remarks on Mr. Steckel's work by the acting chief engineer of the department will be found with the report, in Part II.

GRAVING DOCKS.

ESQUIMALT GRAVING DOCK.—A report on the operations of this dock will be found in Appendix No. 3, page 93.

KINGSTON GRAVING DOCK.—This work was nearly completed at the end of the fiscal year. (*See* Appendix No. 3, Page 87.)

LÉVIS GRAVING DOCK.—This dock was under the control of the Quebec Harbour Commissioners until October, 1890, when the department assumed the management thereof. Since then some necessary improvements were supplied and the dock kept in good order. (*See* Appendix No. 3, page 78.)

The dimensions of the graving docks in Canada are as follows, viz. :—

Names of Docks.	Length.	Width at Coping Level.	Width at Entrance.	Width at bottom.	Water on Sills at Ordinary Spring Tides.	Spring Tides rise.	Neap Tides rise.
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Esquimalt graving dock	430	90	65	41	26½	7 to 10	5 to 8
Halifax do	585	102	89¼	72	30	6	3
Kingston do	280	79	55	47	15½	*	.....
Lévis do	495	100	62	73	25½	18	13

* Height of water varies 3½ feet.

A statement giving the names, salaries, &c., of persons employed on the graving docks is annexed in Appendix No. 13, page 193.

LOCKS AND DAMS.

RIVER DU LIÈVRE, P.Q.—It is expected that by the end of autumn the dam across the river will be completed, the lock utilized and the whole work finished. (*See* Appendix No. 1, page 16. Appendix No. 3, page 80.)

YAMASKA, P.Q.—The repairing of a break in the dam was not finished, as the appropriation was exhausted. Two shoals below the lock were cut through, and 16,988 yards of clay, &c., removed. 7,744 yards of material were removed by dredging from the channel above the lock. (*See* Appendix No. 1, page 16. Appendix No. 3, page 83.)

OROMOCTO SHOALS ("Shear Dam"), N.B.—Repairs and replacements were effected in connection with this work during the fiscal year. (*See* Appendix No. 1, page 15. Appendix No. 3, page 81.)

MAJOR'S HILL PARK.

The contract for the maintenance and improvement of Major's Hill park has been renewed for three years. The park was kept in good order. It has become shady and attractive, and a popular public resort. (*See* Appendix No. 2, page 36.)

NAVIGATION, OPENING AND CLOSING OF.

DATES.—At page 196, Appendix No. 14, is given an alphabetically arranged list of the principal ports of Canada, showing the date of the formation of ice, and the closing of navigation thereby at each place, in 1890, also the date when the navigation opened in 1891, &c.

This information was kindly furnished to the department by the custom house officers at the respective ports.

NEW BRUNSWICK.

BREAKWATERS.—At each of the following places breakwaters were either commenced, repaired or extended during the fiscal year, viz. :—

Anderson's Hollow,
Gray's Island,
Negro Point,
Shippegan,
Tynemouth Creek.

(*See* Appendix No. 1, page 15. Appendix No. 3, pages 70 to 75.)

BUILDINGS.—Repairing and improving the following public buildings engaged the attention of the department last fiscal year, viz. :—

Bathurst,
Carleton,
Chatham,
Dalhousie,
Fredericton,
Moncton,
Sackville,
St. John quarantine station,
do custom house,
do cattle quarantine,
do marine hospital,
do post office,
do savings bank.

(*See* Appendix No. 1, page 3. Appendix No. 3, pages 27 to 29.)

HARBOURS.—Improvements by dredging, &c., were executed at the following places, viz. :—

Caraquet,	Richibucto.
Pointe du Chêne,	St. John (Negro Point).

(*See* Appendix No. 1, page 15. Appendix No. 3, pages 70 to 75 and 122.)

PIERS.—Extensive works are in progress at Cape Tormentine for the purpose of forming a harbour. (*See* Appendix No. 1, page 15. Appendix No. 3, pages 70 to 75.)

WHARVES.—Two ballast wharves, and one for general purposes, were under construction during the fiscal year at the following places, viz. :—

Campbellton,	Kingston.
Edgett's Landing,	

(*See* Appendix No. 3, pages 71-72.)

NORTH-WEST TERRITORIES.

BRIDGES.—The Belly River bridge, Lethbridge, has been completed, and a bridge across Old Man's River is in course of construction. For particulars *see* Appendix No. 3, page 92.

BUILDINGS.—The following named buildings and other edifices for public purposes, were constructed, improved or fitted up during the year, viz. :—

Calgary barracks,	Regina barracks,
do court house,	do council chamber,
Indian Head experimental farm.	do court house,
Lethbridge barracks,	do gaol, &c.,
Macleod do	do immigration building,
do outposts,	do industrial building,
Maple Creek barracks,	do governor's residence.
Moosomin court house,	Whitewood, immigration building.
Qu'Appelle immigration building,	

(*See* Appendix No. 1, page 6. Appendix No. 2, pages 39 to 42.)

NOVA SCOTIA.

BREAKWATERS.—The following named breakwaters, were repaired, reconstructed or extended during the last fiscal year, viz. :—

Church Point,	Margaretville,
Cow Bay,	McNair's Cove,
Economy,	Port George,
French River,	Port Hood,
Harbourville,	Port Maitland,
Joggins,	Stony Island,
Jordan Bay,	Walton.

(*See* Appendix No. 1, page 14. Appendix No. 3, pages 56 to 70.)

BUILDINGS.—The following public buildings have been repaired, improved, extended or completed during the last fiscal year, viz. :

Annapolis,	New Glasgow,
Antigonish,	Pictou custom house,
Dartmouth,	Pictou quarantine station,
Halifax Dominion building,	Sydney,
do examining warehouse,	Truro,
do immigration building,	Windsor.
Nappan experimental farm buildings,	

(*See* Appendix No. 1, page 3. Appendix No. 2, pages 25 to 27.)

HARBOURS.—During the last fiscal year improvements were made to the undermentioned harbours by dredging, protection work or other means, viz. :—

Cariboo,	Pictou,
Cheticamp,	Port George,
Mabou,	Port Maitland,
Margaree,	Tatamagouche,
Margaretville,	Tracadie,
Merigomish,	Walton,
Meteghan,	Weymouth.

(*See* Appendix No. 1, pages 14 and 18. Appendix No. 3, pages 56 to 70.)

PIERS.—Piers have either been reconstructed, repaired or extended at the following places during the fiscal year, viz. :—

Digby,	Port Latour,
Lobster Rocks,	Port Maitland,
Ogilvie's,	Victoria.

(*See* Appendix No. 1, page 14, Appendix No. 3, pages 56 to 70.)

WHARVES.—Public wharves have been constructed, repaired or extended at each of the undermentioned places during the year, viz. :—

Barrington,	Irish Cove,
Broad Cove,	Lismore,
Brulé,	Little Brook,
Cheticamp,	Merigomish,
Cribbin's Point,	South Gut,
Economy,	South Ingonish,
Georgeville,	Summerville,
Great Village,	Tidnish.

(*See* Appendix No. 1, page 14. Appendix No. 3, pages 56 to 70.)

OFFICIALS.

APPENDIX No. 9 is a statement giving the names, with the dates of appointments, &c., of the chief officers of the Department of Public Works, from 1841 to 1892.

ONTARIO.

BREAKWATER.—The extension of Wiarton Harbour breakwater was completed during the year.

(*See* Appendix No. 3, page 91.)

BUILDINGS.—Public buildings have been commenced, completed, extended, repaired, or fitted up and improved during the fiscal year at the following places, viz. :—

Almonte,	Orillia,
Brampton,	Peterborough,
Brockville,	Petrolea,
Carleton Place,	Port Arthur,
Cobourg,	Prescott,
Gananoque,	Smith's Falls,
Goderich,	Stratford,
Guelph,	St. Thomas,
Hamilton,	Toronto.
Ottawa,	

(*See* Appendix No. 1, page 4. Appendix No. 2, pages 33 to 39.)

CHANNELS, &c.—Dredging or other operations to improve the channel and facilitate navigation were performed in connection with the following rivers, channels, &c., during the last fiscal year, viz. :—

Clapperton Channel,	Port Albert,
Kaministiquia River,	Rideau River,
Little Current,	Saugeen River,
Meaford,	Shannonville,
Ottawa River,	Sydenham,
Parry Sound Narrows,	Trenton,
Pickering,	Whitby.

(*See* Appendix No. 1, page 17. Appendix No. 3, pages 86 to 91.)

HARBOURS.—The improvement of the following harbours engaged the active attention of the department during the fiscal year. A description of the work done at each will be found in Appendix 3, pages 86 to 91 :—

Belleville,	Meaford,
Big Bay,	Owen Sound,
Kingston,	Penetanguishene,
Kincardine,	Wiarton breakwater.

PIERS.—In Appendix No. 3, pages 86 to 91, will be found a description of the work done to the following piers, viz. :—

Beaverton,	Port Hope,
Bowmanville,	Portsmouth,
Kingsville,	Rondeau.
Port Elgin,	

PARLIAMENT HILL GROUNDS.

CONTRACT.—The contract for the keeping and dressing of the Parliament grounds was renewed for three years. The grounds presented the usual neat and attractive appearance.

(*See* Appendix No. 2, page 36.)

PRINCE EDWARD ISLAND.

BREAKWATERS.—The breakwaters at the following places were repaired, extended or reconstructed during the fiscal year, viz. :—

Campbell's Cove,	Rustico (North),
Malpeque,	Souris.
New London,	

(*See* Appendix No. 1, page 15. Appendix No. 3, page 47.)

BUILDINGS.—Improvements in connection with the Dominion building, Charlottetown, and grounds, were effected.

(*See* Appendix No. 1, page 9. Appendix No. 2, page 29.)

HARBOURS.—Harbour improvements were executed at the following places, viz. :—

Cascumpec,	New London,
Gauthier's Creek,	Rustico.
Miminegash,	

(*See* Appendix No. 1, page 15. Appendix No. 3, page 47.)

PIERS.—The following piers were repaired, rebuilt or extended during the fiscal year, viz. :—

Annandale,	Pinette,
Bay View,	Port Selkirk,
Belfast,	Pownal,
Cardigan,	Red Point,
Chapel Point,	Rustico (South),
China Point,	St. Mary's Bay,
Georgetown,	Stevens',
Hickey's,	Sturgeon,
Hurd's Point,	Victoria.
Kier's Shore,	

(*See* Appendix No. 1, page 5. Appendix No. 3, pages 47 to 56.)

PUBLIC BUILDINGS AND GROUNDS, OTTAWA.

MAINTENANCE.—The heating, lighting, bell and water services in connection with the Parliament and other public buildings in the capital were maintained with efficiency and due regard to improvement and economy.

Details are given in Appendix No. 2, pages 35 to 37, and Appendix No. 5, page 143.

QUEBEC.

BREAKWATERS.—Damage to the breakwater at Etang du Nord by a storm was repaired, and a contract entered into for the construction of an isolated block of cribwork at Ste. Anne des Monts. Cribwork protection, &c., was also provided at Gatineau Point, Boucherville and River L'Assomption.

(*See* Appendix No. 1, page 16. Appendix No. 3, pages 75 to 85.)

BUILDINGS.—Improvements, repairs, additions or extensions were made to the following public buildings and institutions during the fiscal year, viz. :—

Aylmer,	Quebec cullers' office,
Chicoutimi,	do citadel,
Coaticook,	do examining warehouse,
Fraserville,	do post office,
Grosse Isle quarantine station,	Richmond,
Hull,	St. Henri,
Joliette,	St. Hyacinthe,
Lachine,	St. Vincent de Paul penitentiary,
Montreal custom house,	St. Jérome,
do examining warehouse,	Three Rivers,
do inland revenue office,	do do Platon,
do post office,	Valleyfield.

(*See* Appendix No. 1, page 4. Appendix No. 2, pages 29 to 33.)

HARBOURS.—The dredge "Nipissing" operated on the channel at Lachine and at Beauharnois, and a large quantity of solid rock, &c., was removed from Point St. Pierre harbour.

(*See* Appendix No. 1, page 19. Appendix No. 3, page 78.)

LAND SLIDE.—The River Champlain was dammed by a land slide. The obstruction was removed.

(*See* Appendix No. 1, page 16. Appendix No. 3, page 81.)

PIERS.—During the past fiscal year, piers have been commenced, completed, repaired or extended at the following places, viz. :—

Belœil,	Rivière des Prairies,
Lake Megantic,	River Richelieu,
Longueuil,	St. Anicet,
Newport River,	Ste. Anne de Sorel,
Nicolet River,	St. Siméon,
Rimouski,	St. Timothée.

(*See* Appendix No. 1, page 16. Appendix No. 3, pages 75 to 85.)

SLIPS.—The movable slip at Berthier *(en bas)*, broken in the fall of 1889, was replaced, and at Kamouraska the old wharf was replaced by an inclined slip.

(*See* Appendix No. 1, page 16. Appendix No. 3, pages 76 and 78.)

WHARVES.—The requirements of public wharves have been attended to by the department at the following places, during the fiscal year, viz. :—

Anse St. Jean,	Rivière du Loup,
Baie St. Paul,	Ste. Famille,
Beauport,	St. François,
Cap à l'Aigle,	St. Jean d'Orléans,
Cap de la Madeleine,	St. Laurent,
Cedars,	St. Michael,
Coteau Landing,	Three Rivers.
Grosse Isle,	Trois Pistoles,
Rivière Ouelle.	

(*See* Appendix No. 1, page 16. Appendix No. 3, pages 75 to 85.)

ROADS AND BRIDGES.

CONSTRUCTION, &c.—A detailed account of the expenditure on roads and bridges will be found in Appendix No. 1, and a description of the work done in Appendix No. 3.

SLIDES AND BOOMS.

COLLECTOR'S REPORT,—The report of the collector of slide and boom dues for the fiscal year will be found at page 201 of Appendix No. 15.

To this report eight statements are attached, viz. : —

1st. Showing the dues accrued on the Government slides and works, on the River Ottawa and its tributaries, during the fiscal year ended 30th June, 1891.

2nd. Statement of the number of pieces of timber, saw-logs, &c., that passed through the Government slides and works on the River Ottawa and its tributaries, during the fiscal year ended 30th June, 1891.

3rd. Statement of slidage and boomage from Ottawa slides and works, outstanding 30th June, 1889, and remaining uncollected 30th September, 1891.

4th. Statement of slide and boom dues accrued from Ottawa River works since 1st July, 1889, outstanding on 30th June, 1891, and remaining uncollected on 30th September, 1891.

5th. Statement of outstanding slide dues, Ottawa district, bonds for which were sent to Quebec for collection, remaining unpaid 30th September, 1891.

6th. Statement of slides and boom dues from the St. Maurice slides and works, outstanding on 30th June, 1891, and remaining uncollected on the 30th September, 1891.

7th. Statement of slide dues accrued at the Saguenay, outstanding on the 30th June, 1891, unpaid 30th September, 1891.

8th. Statement of dues accrued at Fenelon Falls, Ont., outstanding on the 30th June, 1891, unpaid 30th September, 1891.

NEWCASTLE DISTRICT.—A detailed description of the repairs executed, and a statement showing the quantities of timber that passed through the slide is inserted at page 153, Appendix No. 7.

OTTAWA DISTRICT.—A detailed report on the work done, under the direction of the department, will be seen on reference to Appendix No. 6, page 147.

SAGUENAY DISTRICT.—The report of the superintendent of slides in this district is attached at page 227, Appendix No. 19.

ST. MAURICE DISTRICT.—The expenditure in connection with the maintenance of the St. Maurice district works exceeded the appropriation of $16,600 by the sum of $118.53. Of the $5,800 appropriated for repairs a balance of $1,812.59 remained unexpended at the end of the fiscal year. Details of the expenditure are given in Appendix No. 18, page 223.

STAFF EMPLOYED.—In Appendix No. 10, page 180, is given a list showing the names, date of birth, where employed, date of appointment and salary of each one of the staff employed on all the slides and booms in Canada.

SURVEYS AND EXAMINATIONS, &c.

PRELIMINARY.—Surveys, examinations and reports were made at 130 different localities by officers of the department during the fiscal year, a list of which will be found in Appendix No. 3, pages 93 and 94.

TELEGRAPHS.

ANNUAL OPERATIONS.—Two submarine cables were successfully submerged during the year, one from Long Point of Mingan, north shore of St. Lawrence to Mechastie Bay, Anticosti, distance 20½ miles and the other from Meat Cove, C.B., Nova Scotia, to the Island of St. Paul's, at the entrance of the Gulf of St. Lawrence, between Nova Scotia and Newfoundland. The length of this cable is 20·4 nautical miles.

Important improvements to, and extension of, the Government telegraph system were also carried on in all the provinces of the Dominion, the particulars of which are attached in the superintendent's report, Appendix No. 8, page 157.

I have the honour to be, Sir,

Your obedient servant,

A. GOBEIL,
Deputy Minister

APPENDIX No. 1.

STATEMENT OF EXPENDITURE

DURING FISCAL YEAR ENDED 30TH JUNE, 1891,

BY

O. DIONNE, ACCOUNTANT.

APPENDIX No. 1.

(Reference No. 126358.)

STATEMENT showing the amount expended by the Department of Public Works, Dominion of Canada, during the Fiscal Year ended 30th June, 1891.

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
PUBLIC BUILDINGS.	$ cts.	$ cts.	$ cts.	$ cts.
GENERALLY			12,402 35	12,402 35
Nova Scotia.				
Amherst Post Office, &c.		50 66		50 66
Annapolis do	9,961 72			9,961 72
Antigonish		172 15		172 15
Halifax Dominion Building	2,314 50	1,776 91		4,091 41
do Examining Warehouse		1,606 06		1,606 06
do Immigrant Building	2,515 98	974 59		3,490 57
do Penitentiary		0 20		0 20
Nappan Experimental Farm	1,205 67			1,205 67
New Glasgow Post Office, &c.		66 26		66 26
North Sydney do		28 99		28 99
Pictou Marine Hospital		15 00		15 00
do Post Office		136 40		136 40
do Quarantine Station		604 44		604 44
Sydney (South) Post Office, &c	7,396 25			7,396 25
Truro Post Office, &c		749 77		749 77
Windsor do		184 24		184 24
Yarmouth do		51 50		51 50
Prince Edward Island.				
Charlottetown Dominion Building	1,971 01	1,111 91		3,082 92
Montague Post Office, &c		17 31		17 31
Summerside do		14 75		14 75
New Brunswick.				
Bathurst Post Office, &c.		223 87		223 87
Carleton (St. John) Post Office		381 71		381 71
Chatham Post Office, &c	104 36			104 36
Dalhousie do	3,727 52			3,727 52
Fredericton do	1,969 10	44 00		2,013 10
Newcastle do		47 47		47 47
Partridge Island Quarantine Station		18 94		18 94
Portland Post Office		130 90		130 90
St. John Cattle Quarantine Station	259 00			259 00
do Custom House		2,641 40		2,641 40
do Inland Revenue Office		20 00		20 00
do Marine Hospital		389 65		389 65
do Post Office		651 75		651 75
do Savings Bank Building		849 42		849 42
St. Stephen Post Office, &c		17 01		17 01
Sussex do		44 35		44 35
Woodstock do		97 87		97 87
Carried forward	31,425 11	13,119 48	12,402 35	56,946 94

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
	$ cts.	$ cts.	$ cts.	$ cts.
PUBLIC BUILDINGS—*Continued.*				
Brought forward	31,425 11	13,119 48	12,402 35	56,946 94
Quebec.				
Aylmer Post Office, &c		39 25		39 25
Chicoutimi Marine Hospital	1,089 10	63 16		1,152 26
Coaticook Post Office, &c		54 97		54 97
Grosse Ile Quarantine Station	15,932 18			15,932 18
Hull Post Office, &c	471 99			471 99
Joliette do	306 93			306 03
Lachine do	7,182 50			7,182 50
Laprairie do	5 00			5 00
Montreal Custom House, Renewals, &c	9,406 10	305 50		9,711 60
do Sanitary Work	752 50			752 50
Montreal Examining Warehouse	2,837 64	445 46		3,283 10
do Immigration Building		2,812 42		2,812 42
do Inland Revenue Office—Sanitary Works	1,547 50			1,547 50
do do		207 08		207 08
do Post Office	3,033 40	1,043 37		4,076 77
do do Electric Lighting Extension	962 47			962 47
Quebec Citadel Buildings		2,099 93		2,099 93
do Clerk of Works Office		948 00		948 00
do Cullers' Office		123 32		123 32
do Custom House		3,077 56		3,077 56
do Examining Warehouse		271 47		271 47
do Immigrant Buildings		312 21		312 21
do Inland Revenue Office		10 00		10 00
do Marine Hospital		22 01		22 01
do Old Parliament Building Grounds		178 49		178 49
do Post Office		1,136 03		1,136 03
do Queen's Wharf Building		452 67		452 67
do Weights and Measures Office		59 00		59 00
Rivière du Loup Post Office, &c. (Fraserville)	6,226 00			6,226 00
Sherbrooke Post Office, &c		294 13		294 13
Sorel do		177 95		177 95
St. Henri do	419 20			419 20
St. Hyacinthe do	6,351 60			6,351 60
St. Jérôme do		265 25		265 25
St. John's do		83 75		83 75
St. Vincent de Paul Penitentiary	30,735 32			30,735 32
Three Rivers Custom House		810 14		810 14
do Post Office		281 40		281 40
Valleyfield do		426 00		426 00
Ontario.				
Almonte Post Office, &c	14,847 30			14,847 30
Amherstburg Post Office, &c		71 89		71 89
Barrie do		211 15		211 15
Belleville do		215 32		215 32
Berlin do		99 51		99 51
Brampton do	6,133 48			6,133 48
Brantford do		350 49		350 49
Brockville do Sanitary Works	499 67	261 01		760 68
Carleton Place do	5,116 01			5,116 01
Cayuga do	110 00	3 50		113 50
Chatham do		61 71		61 71
Cobourg do	2,777 19			2,777 19
Carried forward	148,168 28	30,394 58	12,402 35	190,965 21

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
PUBLIC BUILDINGS—*Continued.*	$ cts.	$ cts.	$ cts.	$ cts.
Ontario—Continued.				
Brought forward	148,168 28	30,394 58	12,402 35	190,965 21
Cornwall Post Office, &c	1,470 00	356 49		1,826 49
Dundas do		503 75		503 75
Galt do		50 00		50 00
Gananoque Custom House	2,015 71	55 00		2,070 71
Goderich Post Office, &c	6,718 09			6,718 09
Guelph do		229 41		229 41
Hamilton Immigrant Building		147 85		147 85
do Post Office		409 96		409 96
Kingston Civil Service Examination Office		18 25		18 25
Kingston Custom House		644 49		644 49
do Military College, new dormitory	257 01			257 01
do Penitentiary	146 50			146 50
do Post Office		943 61		943 61
Lindsay do	4,825 32	36 23		4,861 55
London Civil Service Examination Office		75 00		75 00
do Custom House	1,779 60	29 00		1,808 60
do Immigrant Building		46 00		46 00
do Infantry School	22 95			22 95
do Military Buildings		95 00		95 00
do Post Office		1,705 07		1,705 07
Napanee do &c		263 88		263 88
Niagara Falls Post Office		5 00		5 00
Orangeville do		47 67		47 67
Ottawa Examining Warehouse		1,114 99		1,114 99
do Experimental Farm	11,413 54			11,413 54
do Geological Museum		1,955 84		1,955 84
do do lighting			662 20	662 20
do Government Printing Bureau	41,846 13	118 03		41,964 16
do do do lighting			2,150 85	2,150 85
do Major's Hill Park			5,879 55	5,879 55
do National Art Gallery			777 43	777 43
do Post Office	453 25	2,251 25		2,704 50
do do lighting			1,804 70	1,804 70
do Public Buildings—Renewing roofs, boiler houses	3,012 74	127,648 71		130,661 45
do do East Block, closets	1,299 98			1,299 98
do do do new vault, Finance Department	8,458 77			8,458 77
do do West Block, new sky-light	1,345 60			1,345 60
do do Copper roofing, Parliament Building	1,631 23			1,631 23
do do Langevin Block	61,572 77	2,559 36		64,132 13
do do do lighting			1,055 40	1,055 40
do do do snow			875 00	875 00
do do Gas and electric light			19,255 74	19,255 74
do do Grounds			5,935 21	5,935 21
do do do *re* Marshall Wood	20 00			20 00
do do Heating			59,925 88	59,925 88
do do Snow			1,176 11	1,176 11
do do Telephonic service			3,218 75	3,218 75
do do Water			15,017 19	15,017 19
do Supreme Court, addition	14,561 41	46 00		14,607 41
do Victoria Hall		26 13		26 13
Pembroke Post Office, &c	9,387 92			9,387 92
Peterborough do		73 73		73 73
do New Custom House	9,062 23			9,062 23
Carried forward	329,469 03	171,850 28	130,136 36	631,455 67

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
PUBLIC BUILDINGS—*Continued.*	$ cts.	$ cts.	$ cts.	$ cts.
Ontario—Concluded.				
Brought forward	329,469 03	171,850 28	130,146 36	631,455 67
Petrolia Post Office, &c	4,053 71			4,053 71
Picton do		12 00		12 00
Port Arthur Immigrant Building		70 00		70 00
do Post Office, &c	29 35			29 35
Port Colborne do		5 40		5 40
Port Hope do		119 25		119 25
Prescott do &c	18,554 52			18,554 52
Rideau Hall		20,152 39		20,152 39
do Fuel and light			8,000 00	8,000 00
do Lighting New Edinburgh street			200 00	200 00
do Removal of snow			475 00	475 00
Seaforth Post Office, &c		60 25		60 25
St. Catharines Post Office		86 70		86 70
St. Thomas do		127 49		127 49
Stratford do		153 80		153 80
Strathroy do	11,349 25			11,349 25
Toronto Civil Service Examination Office		152 43		152 43
do Custom House, Sanitary Works, &c	2,185 52	539 82		2,725 34
do Drill Hall	137 00			137 00
do Examining Warehouse	4,338 90	218 12		4,557 02
do Immigrant Building		41 78		41 78
do Inland Revenue Building		78 04		78 04
do Military School	4 77			4 77
do Post Office	5,767 41	631 81		6,399 22
Trenton do	2,072 21	3 00		2,075 21
Walkerton do	15,497 42			15,497 42
Windsor Inland Revenue Office		160 00		160 00
do Post Office, &c		317 25		317 25
Woodstock do		10 00		10 00
Manitoba.				
Brandon Experimental Farm	13,181 97			13,181 97
do Immigrant Building		341 60		341 60
do Post Office	21,069 90			21,069 90
Minnedosa Immigrant Building		256 95		256 95
Public Buildings generally			1,022 10	1,022 10
St. Boniface Indian Industrial School	8 25			8 25
St. Paul do do	695 00			695 00
Stony Mountain Penitentiary	1,333 41			1,333 41
Winnipeg Clerk of Works Office		2,236 55		2,236 55
do Custom House		257 81		257 81
do Dominion Lands Office		440 42		440 42
do Examining Warehouse		5 75		5 75
do Fort Osborne, Military Buildings	128 07			128 07
do Immigrant Buildings	16,290 25	598 17		16,888 42
do Intelligence Office		13 00		13 00
do Post Office		1,351 69		1,351 69
do Savings Bank		30 65		30 65
North-West Territories.				
Battleford Mounted Police Barracks		7,402 36		7,402 36
do Registrar's House and Office	1,176 38			1,176 38
Big Bend, Mounted Police Barracks		89 58		89 58
Carried forward	447,342 32	207,814 34	139,833 46	794,990 12

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
PUBLIC BUILDINGS—*Continued.*	$ cts.	$ cts.	$ cts.	$ cts.
North-West Territories—Concluded.				
Brought forward	447,342 32	207,814 34	139,833 46	794,990 12
Birtle Immigrant Building		276 95		276 95
Bull's Head Mounted Police Barracks		93 24		93 24
Calgary Clerk of Works Office		14 50		14 50
do Court House, Gaol, Registry Office, &c	8,413 56			8,413 56
do Immigrant Building		1,050 19		1,050 19
do Mounted Police Barracks		6,520 07		6,520 07
do Post Office, Custom House, &c	50 45			50 45
Coutts Mounted Police Barracks	2,619 16			2,619 16
Edmonton Crown Lands Office, &c	154 13			154 13
do Mounted Police Barracks		34 91		34 91
Fort Macleod Custom House		125 91		125 91
do Mounted Police Barracks		6,393 96		6,393 96
Fort Saskatchewan do		3,012 09		3,012 09
Indian Head Experimental Farm	1,601 97			1,601 97
Lethbridge Hospital		32 75		32 75
do Mounted Police Barracks		2,584 82		2,584 82
Maple Creek do do		3,885 06		3,885 06
Medicine Hat Hospital—Govt. Grant	3,000 00			3,000 00
do Mounted Police Barracks		11 20		11 20
Milk River do do		15 83		15 83
Moose Jaw Court House	300 00			300 00
Moosomin do	9,461 71			9,461 71
do Mounted Police Barracks		27 00		27 00
do Post Office		6 00		6 00
Mounted Police Barracks—Fire extinguishers	654 00			654 00
North Alberta Registry Office		16 00		16 00
Pendant d'Oreille Mounted Police Barracks		19 60		19 60
Pincher Creek do do		212 42		212 42
Prince Albert Court House	2,084 68	40 50		2,125 18
do Crown Lands Office	177 26			177 26
do Mounted Police Barracks		904 00		904 00
do Registrar's Office		34 00		34 00
Public Buildings generally			3,161 58	3,161 58
Qu'Appelle Court House		67 70		67 70
do Immigrant Building		593 20		593 20
Red Deer Industrial School		60 64		60 64
Regina Clerk of Work's Office		834 03		834 03
do Court House		886 21		886 21
do do Gaol, water supply, fittings, &c	9,750 92			9,750 92
do Crown Lands Office	195 60	267 85		463 45
do Immigrant Building		132 00		132 00
do Industrial School	10,320 65			10,320 65
do Gaol, Cottages for Officers	4,940 70			4,940 70
do Gaol and Lunatic Asylum		15 75		15 75
do Lieut.-Governor's new Residence	21,067 97			21,067 97
do do old do		607 85		607 85
do Mounted Police Barracks		7,964 47		7,964 47
do North-West Council Chamber	6,375 08			6,375 08
do Post Office		106 62		106 62
do Riding Hall		8 00		8 00
Stand Off Mounted Police Barracks		1,689 90		1,689 90
St. Mary's do do		85 83		85 83
Touchwood do do		70 00		70 00
Whitewood Immigrant Building		134 50		134 50
Wood Mountain Mounted Police Barracks		75 94		75 94
Writing-on-Stone do do		6 10		6 10
Carried forward	528,510 16	246,731 93	142,995 04	918,237 13

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
PUBLIC BUILDINGS—*Continued.*	$ cts.	$ cts.	$ cts.	$ cts.
Brought forward	528,510 16	246,731 93	142,995 04	918,237 13
British Columbia.				
Agassiz Experimental Farm	2,753 39			2,753 39
Nanaimo Post Office		130 50		130 50
New Westminster Custom House		2 00		2 00
do Fishery Office		16 00		16 00
do Penitentiary		63 78		63 78
do Post Office		459 07		459 07
Vancouver Custom House		45 00		45 00
do Immigrant Building		281 25		281 25
do Post Office, &c	15,271 20			15,271 20
Victoria "C" Battery Barracks	20,258 07			20,258 07
do Custom House		80 78		80 78
do Guard Room, &c.—Gateway	8,642 25			8,642 25
do Hog Quarantine Station	445 49			445 49
do Immigrant Building		52 25		52 25
do Post Office, vault, Assistant Rec. Gen.'s Office	2,477 75	902 71		3,380 46
do Quarantine Station		25 00		25 00
England, Great Britain.				
London High Commissioner's house		1,141 23		1,141 23
Carried forward	578,358 31	249,931 50	142,995 04	971,284 85

APPENDIX No. 1.—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Totals.
PUBLIC BUILDINGS—*Continued.*	$ cts.	$ cts.	$ cts.	$ cts.
Brought forward	578,358 31	249,931 50	142,995 04	971,284 85

Expenditure on Account Services Mentioned.	Salaries of Engineers &c.	Supplies for Engineers, &c.	Heating.	Lighting.	Water.	Totals.	
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	
Nova Scotia.							
Amherst Post Office	400 00	15 40	259 50	221 42	.....	896 32	
Annapolis do	115 00	.....	74 21	.....	33 34	222 55	
Antigonish do	409 35	0 82	97 02	0 82	.....	508 01	
Arichat do	15 00	.....	84 00	.....	.....	99 00	
Baddeck do	200 00	.....	108 00	12 88	.....	320 88	
Halifax Appraiser's Office	.....	.....	.....	9 20	.....	9 20	
do Dominion Buildings	2,067 96	72 35	912 59	3,047 10	325 00	6,425 00	
Halifax Examining Warehouse	500 00	.....	249 38	51 40	91 00	891 78	
Halifax Immigrant Building	.....	.....	116 92	214 80	.....	331 72	
New Glasgow Post Office.	400 00	13 77	145 00	243 47	100 00	902 24	
North Sydney do .	433 33	10 95	166 00	23 21	.....	633 49	
Pictou Marine Hospital..	.....	.....	112 56	.....	.....	112 56	
do Post Office.....	400 00	.....	149 15	26 91	.....	576 06	
South Sydney Post Office.	.....	.....	100 00	.....	.....	100 00	
Truro do .	400 00	4 03	136 00	279 41	30 00	849 44	
Windsor do .	400 00	.....	224 88	94 00	50 00	768 88	
Yarmouth do .	400 00	11 36	210 00	328 15	72 00	1,021 51	
Prince Edward Island.							
Charlottetown Dominion Building.....	1,814 21	31 45	557 61	1,188 87	168 75	3,760 89	
Montague Post Office....	120 00	9 95	71 50	26 00	.....	227 45	
Summerside do	400 00	13 54	219 86	42 84	.....	676 24	
New Brunswick.							
Bathurst Post Office.....	400 00	10 74	454 00	40 75	.....	905 49	
Carleton (St. John) Post Office	100 00	.....	34 47	118 75	12 00	265 22	
Chatham Post Office.....	130 00	.....	118 34	63 00	.....	311 34	
Dalhousie do	233 31	24 98	190 00	11 05	.....	459 34	
Fredericton do	400 00	4 10	324 05	441 18	30 00	1,199 33	
Moncton do	400 00	13 75	197 82	538 09	167 50	1,317 16	
Newcastle do	400 00	66 45	358 41	276 00	.....	1,100 86	
Portland do	.....	.....	30 07	.....	.....	30 07	
St. John Custom House..	1,820 04	35 11	1,447 40	133 34	686 70	4,122 59	
do Marine Hospital	.....	1 45	598 30	266 70	46 89	913 34	
do Penitentiary....	450 00	.....	49 40	6 25	.....	505 65	
do Post Office	1,205 00	50 54	607 95	2,149 59	564 48	4,577 56	
do Savings Bank...	.....	.....	255 43	75 61	17 02	348 06	
St. Stephens Post Office..	400 00	.....	132 50	501 60	69 00	1,103 10	
Sussex do ..	400 00	0 66	158 19	11 75	.....	570 60	
Woodstock do ..	433 30	.....	194 75	160 00	34 00	822 05	
Carried forward ...	15,246 50	391 40	9,145 26	10,604 14	2,497 68	37,884 98	971,284 85

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Totals.
PUBLIC BUILDINGS—*Continued.*	$ cts.	$ cts.	$ cts.	$ cts.
Brought forward	578,358 31	249,931 50	142,995 04	971,284 85

Expenditure on account Services Mentioned—*Con.*	Salaries of Engineers &c.	Supplies for Engineers, &c.	Heating.	Lighting.	Water.	Total.
Quebec.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Brought forward	15,246 50	391 40	9,145 26	10,604 14	2,497 68	37,884 98
Aylmer Post Office	100 00	.....	152 25	11 89	.....	264 14
Coaticooke do	400 00	17 40	219 00	87 80	40 00	764 20
Hull do	200 00	.....	298 84	438 05	90 00	1,026 89
Joliette do	400 00	10 85	152 74	67 02	50 00	680 61
Montreal Custom House	375 00	.....	796 35	589 76	348 75	2,109 86
do Drill Hall	540 00	.....	.....	.....	.....	540 00
do Examining Warehouse	2,625 00	.....	2,008 30	653 78	1,071 20	6,358 28
Montreal Immigration Office	.....	.....	243 30	.....	.....	243 30
do Inland Revenue Office	745 00	.....	277 63	232 36	106 50	1,361 49
do Post Office	1,105 00	.....	793 26	3,958 18	1,009 41	6,865 85
Quebec Citadel Buildings	42 25	.....	214 75	204 12	.....	461 12
do Cullers' Office	540 00	8 60	85 60	.....	.....	634 20
do Custom House	540 00	4 15	1,345 00	28 78	30 00	1,947 93
do Examining Warehouse	1,140 00	51 90	1,300 20	29 70	.....	2,521 80
do Observatory	.....	.....	.....	.....	44 00	44 00
do Post Office	.....	.....	476 10	1,273 86	756 00	2,505 96
Sherbrooke do	400 00	34 09	331 05	505 25	37 50	1,307 89
Sorel do	400 00	11 48	291 25	260 00	250 00	1,212 73
St. Jérome do	400 00	46 98	399 63	160 00	.....	1,006 61
St. John's do	350 00	5 39	168 00	253 15	40 00	816 54
St. Vincent de Paul Penitentiary	.....	.....	1,574 91	.....	.....	1,574 91
Three Rivers Custom House	664 31	24 61	397 79	2 29	72 76	1,161 76
Three Rivers Post Office	400 00	19 48	183 70	64 83	60 00	728 01
Ontario.						
Almonte Post Office	168 87	6 25	95 25	1 75	.....	272 12
Amherstburg Post Office	400 00	29 37	223 88	73 37	.....	726 62
Barrie do	400 00	25 04	244 50	250 40	50 00	969 94
Belleville do	600 00	8 10	367 50	510 43	108 75	1,594 78
Berlin do	400 00	.....	280 37	110 75	18 00	809 12
Brampton do	466 62	21 60	150 00	71 30	.....	709 52
Brantford do	600 00	35 24	278 16	315 80	8 00	1,237 20
Brockville do	400 00	12 97	262 00	576 05	170 00	1,421 02
Cayuga do	50 00	2 70	143 75	13 17	.....	209 62
Chatham do	850 00	13 35	134 93	275 70	.....	1,273 98
Cobourg do	400 00	29 75	236 00	146 55	.....	812 30
Cornwall do	400 00	13 25	247 20	545 38	45 00	1,250 83
Dundas do	.....	.....	31 50	88 96	.....	120 46
Galt do	400 00	5 60	215 00	186 20	18 00	824 80
Gananoque Custom House	.....	.....	118 75	141 00	.....	259 75
Carried forward	32,148 55	829 55	23,883 70	22,731 77	6,921 55	86,515 12

	971,284 85

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Totals.
PUBLIC BUILDINGS—*Continued.*	$ cts.	$ cts.	$ cts.	$ cts.
Brought forward	578,358 31	249,931 50	142,995 04	971,284 85

Expenditure on account Services Mentioned—*Con.*	Salaries of Engineers &c.	Supplies for Engineers, &c.	Heating.	Lighting.	Water.	Total.	
Ontario—Concluded.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	
Brought forward	32,148 55	829 55	23,883 70	22,731 77	6,921 55	86,515 12	
Gananoque Post Office	100 00	.....	76 00	211 50	.....	387 50	
Goderich do	400 00	49 28	212 50	39 56	.....	701 34	
Guelph do	400 00	38 01	210 09	236 80	28 08	912 98	
Hamilton Custom House	600 00	.....	.....	134 30	.....	734 30	
do Drill Hall	360 00	.....	.....	.....	.....	360 00	
do Post Office	1,022 50	7 53	1,010 00	1,523 40	1,000 00	4,563 43	
Kingston Custom House	46 80	.....	186 00	103 80	76 80	413 40	
do Examining Warehouse	.....	.....	.....	.....	6 00	6 00	
do Inland Revenue Office	.....	.....	.....	52 40	157 72	210 12	
do Military College	1,468 00	.....	.....	.....	.....	1,468 00	
do Post Office	125 74	21 00	76 13	421 40	56 26	700 53	
Lindsay do	400 00	1 50	99 36	112 44	.....	613 30	
London Custom House	1,000 00	19 30	574 56	301 85	105 00	2,000 71	
do Post Office	600 00	7 75	592 12	613 40	60 00	1,873 27	
Napanee do	400 00	18 45	154 00	103 80	77 23	753 48	
Niagara Falls Post Office	400 00	44 58	258 75	75 46	12 50	791 29	
Orangeville do	400 00	11 90	173 19	145 98	.....	731 07	
Ottawa Experimental Farm	.....	.....	246 75	143 46	.....	390 21	
do Langevin Block	5,848 57	65 13	.....	.....	.....	5,913 70	
do Post Office	.....	.....	.....	258 45	.....	258 45	
Pembroke Post Office	254 42	10 65	329 66	82 00	.....	676 73	
Peterboro' do	400 00	.....	143 92	321 45	75 00	940 37	
Port Arthur do	.....	.....	17 50	.....	.....	17 50	
Port Colborne do	240 00	34 94	156 25	27 30	.....	458 49	
Port Hope do	400 00	18 55	223 50	164 00	.....	806 05	
Prescott do	196 65	24 63	220 85	7 00	.....	449 13	
do Custom House	.....	.....	131 25	.....	.....	131 25	
St. Catharines Post Office	400 00	14 33	252 96	160 60	57 00	884 89	
St. Thomas do	400 00	28 29	348 60	374 10	40 83	1,191 82	
Stratford do	600 00	21 00	362 12	358 00	63 00	1,404 12	
Strathroy do	283 30	24 02	192 29	13 47	.....	513 08	
Toronto Assist. Receiver General's Office	.....	.....	.....	100 35	.....	100 35	
Toronto Custom House	640 00	12 15	413 74	107 00	230 57	1,403 46	
do Dominion Buildings	.....	.....	.....	.....	884 82	884 82	
do Examining Warehouse	5,599 35	36 87	805 36	30 84	112 00	6,584 42	
do Inland Revenue Office	5 36	2 50	262 33	195 76	199 11	665 06	
do Post Office	1,131 50	10 68	720 34	1,121 11	325 59	3,309 22	
Trenton do	400 00	4 00	125 00	343 00	.....	872 00	
Windsor do	1,000 00	3 00	453 50	698 71	82 20	2,237 41	
Carried forward	57,670 74	1,359 59	32,912 32	31,314 46	10,571 26	133,828 37	971,284 85

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
PUBLIC BUILDINGS—*Continued.*	$ cts.	$ cts.	$ cts.	$ cts.
Brought forward	578,358 31	249,931 50	142,995 04	971,284 85

Expenditure on Account Services Mentioned—*Con.*	Salaries of Engineers, &c.	Supplies for Engineers, &c.	Heating.	Lighting.	Water.	Total.	
Manitoba.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	
Brought forward	57,670 74	1,359 59	32,912 32	31,314 46	10,571 26	133,828 37	
Brandon Experimental Farm			58 38			58 38	
do Post Office	100 00					100 00	
Deloraine Dominion Lands Office			51 00			51 00	
Minnedosa Dominion Lands Office			110 00			110 00	
Souris Dom. Lands Office			56 01			56 01	
Winnipeg Custom House		15 00	542 50	225 45	43 20	826 15	
do Dominion Lands Office			231 25	20 79		252 04	
do Examining Warehouse			493 00	9 72		502 72	
do Immigrant Shed			123 25	100 33	31 25	254 83	
do Indian Office			123 00			123 00	
do Intelligence Office			18 50			18 50	
do Post Office	2,888 75	73 38	2,373 00	1,109 16	593 20	7,037 49	
Stony Mountain Penitentiary			40 00			40 00	
North-West Territories.							
Battleford Domin. Lands Office			52 50			52 50	
do Registry Office			65 45			65 45	
Birtle Dominion Lands Office			75 00			75 00	
Calgary Barracks				1,500 00		1,500 00	
do Clerk of Works Office			40 00			40 00	
do Court House		51 00	820 00	70 00		941 00	
do Dom. Lands Office			248 55			248 55	
do Immigrant Building			64 00			64 00	
do Mines Office			220 10			220 10	
do Registry Office			110 50			110 50	
Cannington Manor Dom. Lands Office			45 00			45 00	
Edmonton Crown Lands Office, &c			21 50			21 50	
do Dom. Lands Office			18 25			18 25	
do Registry Office			27 00			27 00	
Fort Macleod Custom House			201 50			201 50	
Indian Head Experimental Farm			237 35			237 35	
Carried forward	60,659 49	1,498 97	39,378 91	34,349 91	11,238 91	147,126 19	971,284 85

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
PUBLIC BUILDINGS—*Concluded.*	$ cts.	$ cts.	$ cts.	$ cts.
Brought forward	578,358 31	249,931 50	142,995 04	971,284 85

Expenditure on Account Services Mentioned—*Con.*	Salaries of Engineers, &c.	Supplies for Engineers, &c.	Heating.	Lighting.	Water.	Total.
North-West Territories—Concluded.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ ct..
Brought forward	60,659 49	1,498 97	39,378 91	34,349 91	11,238 91	147,126 19
Lethbridge Dom. Lands Office			25 50			25 50
Medicine Hat Intelligence Office			23 50			23 50
Moosomin Court House	152 37		55 77			208 14
Prince Albert Court House	400 00	11 00	186 00	22 60		619 60
do Dom. Lands Office			50 50			50 50
do Registry Office			76 00			76 00
Qu'Appelle Dom. Lands Office			29 37			29 37
do Immigrant Building			7 00			7 00
Red Deer Dominion Lands Office			4 00			4 00
Regina Court House	142 00	81 58	509 66	3 36	15 65	752 25
do Dominion Lands Office			174 00			174 00
do Gaol and Lunatic Asylum	861 66	290 22	838 68	18 93		2,009 49
do Lieut. Governor's Residence	300 00		871 03			1,171 03
do Post Office			273 87			273 87
Touchwood Dom. Lands Office			6 25			6 25
British Columbia.						
Kamloops Dom. Lands Office			4 75			4 75
Nanaimo Post Office	600 00		20 00	226 20	36 00	882 20
New Westminster Fisheries Office			3 50			3 50
New Westminster Post Office	600 00		131 25	181 50		912 75
Victoria Appraiser's Office					6 50	6 50
do Custom House			192 24	35 85	119 84	347 93
do Post Office			213 15	906 99	46 24	1,166 38
Dominion Buildings			3,767 04			3,767 04
Ottawa do	98 00					98 00
Totals	63,813 52	1,881 77	46,841 97	35,745 34	11,463 14	159,745 74
Carried forward				578,358 31	249,931 50	302,740 78	1,131,030 59

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
	$ cts.	$ cts.	$ cts.	$ cts.
Brought forward	578,358 31	249,931 50	302,740 78	1,131,030 59
HARBOURS AND BREAKWATERS.				
Nova Scotia.				
Arisaig Pier	685 00			685 00
Barrington Passage Pier	3,199 32			3,199 32
Brulé Cove		626 57		626 57
Broad Cove		216 47		216 47
Cariboo	981 22			981 22
Cheticamp	2,185 76			2,185 76
Church Point		100 81		100 81
Cow Bay Breakwater		3,499 98		3,499 98
Cribbin's Point—Wharf	2,405 40			2,405 40
Delap's Cove Pier		24 49		24 49
Digby—New Pier at the Raquette		2,388 02		2,388 02
do old Pier		111 56		111 56
Economy Breakwater	2,199 92			2,199 92
French River Pier	95 17			95 17
Great Village	290 81			290 81
Georgeville Wharf	971 07			971 07
Halifax Graving Dock—Subsidy	10,000 00			10,000 00
Hampton Pier		21 00		21 00
Harbours Generally			4,949 48	4,949 48
Harbourville Pier		150 13		150 13
Ingonish (South)	722 89			722 89
Irish Cove	1,993 65			1,993 65
Joggins' Breakwater		2,184 56		2,184 56
Jordan Bay Breakwater		30 03		30 03
Kennington Cove (Gabarous)		800 00		800 00
L'Ardoise Breakwater	74 57			74 57
Lismore—Extension of Pier	2,068 06			2,068 06
Little Brook		100 00		100 00
Louis' Head	76 64			76 64
Mabou	3,730 14			3,730 14
Margaree	2,169 09			2,169 09
Margaretville		398 67		398 67
Merigomish		50 00		50 00
Meteghan River Pier		265 19		265 19
Moidart Pier	590 28			590 28
Ogilvy's Wharf		125 00		125 00
McNair's Cove		349 99		349 99
Parrsboro' Pier		48 79		48 79
Porter's Lake Pier		200 00		200 00
Port George Pier	5,137 16			5,137 16
Port Hood Pier	5,424 92			5,424 92
Port Latour Pier		2,999 92		2,999 92
Port Maitland or Green Cove	5,839 92			5,839 92
River Sissiboo (improvement to channel, St. Mary's Bay to Weymouth)	1,968 84			1,968 84
Round Hill	74 59			74 59
Sand River	86 92			86 92
Sheet Harbour		150 00		150 00
Stony Island	1,126 07			1,126 07
South Gut, St. Ann's	1,518 91			1,518 91
Summerville Pier (Hant's Co.)		1,051 69		1,051 69
Tidnish	2,111 53			2,111 53
Victoria Pier		74 98		74 98
Walton	1,515 05			1,515 05
Carried forward	637,601 21	265,899 35	307,690 26	1,211,190 82

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
	$ cts.	$ cts.	$ cts.	$ cts.
Brought forward	637,601 21	265,899 35	307,690 26	1,211,190 82
HARBOURS AND BREAKWATERS—*Con.*				
Nova Scotia—Concluded.				
West Chezzetcook	168 87			168 87
Wreck Cove	700 99			700 99
Yarmouth		1,441 49		1,441 49
Prince Edward Island.				
Annandale Pier		85 00		85 00
Bay View Pier		364 69		364 69
Belfast Pier		396 77		396 77
Brae Harbour Breakwater	56 06			56 06
Campbell's Cove Breakwater		129 82		129 82
Cascumpec Harbour	772 87			772 87
Chapel Point Pier		372 62		372 62
China do		1,224 12		1,224 12
Georgetown Pier		200 00		200 00
Harbours generally			1,562 41	1,562 41
Hickey's Pier		249 97		249 97
Hurd's Point Pier		118 24		118 24
Kier's Shore Pier		199 99		199 99
Malpeque Breakwater		247 14		247 14
Mimimegash do		550 71		550 71
New London do		393 50		393 50
North Cardigan Pier		76 63		76 63
Pinette Pier		198 71		198 71
Port Selkirk Pier	548 54			548 54
Pownal Pier		28 60		28 60
Red Point Pier		700 69		700 69
Rustico—North Breakwater $912 48				
do South do 26 88		939 36		939 36
Souris East—Knight's Point Pier		3,699 82		3,699 82
Stevens' Pier		199 96		199 96
St. Mary's Bay Pier		349 99		349 99
Sturgeon Pier		87 50		87 50
Victoria		613 81		613 81
New Brunswick.				
Campbellton Ballast Wharf	2,032 82			2,032 82
Cape Tormentine Harbour	48,308 96			48,308 96
Caraquet Harbour	433 72			433 72
Edgett's Landing	2,832 65			2,832 65
Gray's Island Breakwater	1,122 25			1,122 25
Harbours generally			4,949 47	4,949 47
Kingston Wharf, Richibucto River	1,912 82			1,912 82
Oromocto Shoals Shear Dam, repairs		499 95		499 95
Richibucto Harbour	1,487 48			1,487 48
River St. John, Fredericton to Woodstock	1,499 82			1,499 82
do River des Chutes do	452 56			452 56
River Tobique	300 00			300 00
St. John Harbour, Negro Point Breakwater	4,688 22			4,688 22
Shediac Harbour	2,837 55			2,837 55
Shippegan Harbour	8,095 57			8,095 57
Carried forward	715,852 96	279,268 43	314,202 14	1,309,323 53

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
	$ cts.	$ cts.	$ cts.	$ cts.
Brought forward	715,852 96	279,268 43	314,202.14	1,309,323 53
HARBOURS AND BREAKWATERS—*Con.*				
Quebec.				
Agnes Pier, Lake Megantic		77 25		77 25
Anse à L'Eau or Tadousac Pier		1,250 04		1,250 04
Anse St. Jean Pier		999 42		999 42
Baie St. Paul Pier	5,262 55			5,262 55
Beauport Pier	300 00			300 00
Belœil Pier	1,470 35	30 00	145 00	1,645 35
Berthier (en bas) Pier		531 86		531 86
Boucherville Pier	3,200 00			3,200 00
Cacouna Pier	3,663 68			3,663 68
Cap à L'Aigle Pier		20 00		20 00
Cap de la Madeleine Pier	1,000 00			1,000 00
Cedars Pier		264 51		264 41
Chicoutimi Pier		1,802 70		1,802 70
Coteau Landing Pier (reconstruction)		4,060 00		4,060 00
Etang du Nord	844 63			844 63
Gatineau River	1,506 96			1,506 96
Grande Rivière	11,001 25			11,001 25
Grosse Isle Quarantine Station Wharf		7,092 94		7,092 94
Harbours generally			8,337 08	8,337 08
Kamouraska Pier	893 83	741 36		1,635 19
Isle Verte Pier	2,994 67			2,994 67
Laprairie revetment wall	658 58			658 58
Les Eboulements Pier		62 48		62 48
Lévis Graving Dock	6,286 24		5,605 31	11,891 55
Longueuil Pier	9,592 91			9,592 91
Lourdes Pier (Lake Megantic)		500 00		500 00
Malbaie Pier		40 52		40 52
Montreal Harbour			1,335 60	1,335 60
do Flood Commission	1,681 00			1,681 00
New Carlisle Pier	5,688 87			5,688 87
Newport River	450 00			450 00
Piers below Quebec			12,520 19	12,520 19
Pointe à Valois Wharf—extension	1,877 09			1,877 09
Pointe St. Pierre—removal of reef	1,500 00			1,500 00
Port Daniel Pier	8,126 21			8,126 21
Rimouski Pier	9,993 83			9,993 83
Rivière Beaudet	198 45			198 45
do Champlain	200 00			200 00
do des Prairies—improvements at Pt. à la Carrière	4,931 04			4,931 04
do du Lièvre	40,019 14			40,019 14
do du Loup *(en bas)*	740 40	440 95		1,181 35
do L'Assomption	899 23			899 23
do McKinac	497 73			497 73
do Nicolet—harbour of refuge	5,162 74			5,162 74
do Ottawa—channel at Mille Isles	975 37			975 37
do Ouelle Pier		1,494 28		1,494 28
do St. François	4,011 05			4,011 05
do St. Lawrence—ship channel between Gaspé and Montreal	121,342 02			121,342 02
do St. Louis	4,501 31			4,501 31
do St. Maurice—west channel	1,500 00			1,500 00
do Yamaska		9,202 87	1,297 01	10,499 88
Sorel—ice piers	1,696 25			1,696 25
St. Alphonse (Bagotville) Pier		1,000 80		1,000 80
Ste. Anne de la Pérade—dredging	2,597 73			2,597 73
Carried forward	983,118 07	308,880 41	343,442 33	1,635,440 81

APPENDIX No. 1—*Continued.*

Name of Work.	Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
	$ cts.	$ cts.	$ cts.	$ cts.
Brought forward	983,118 07	308,880 41	343,442 33	1,635,440 81
HARBOURS AND BREAKWATERS—*Continued*				
Quebec—Concluded.				
Ste. Anne des Monts Pier	5,000 00			5,000 00
Ste. Anne du Saguenay Pier	2,498 96			2,498 96
St. Anicet Pier		635 10		635 10
St. Famille Pier		999 30		999 30
St. François, Isle d'Orleans		748 09		748 09
St. Jean		500 82		500 82
St. Laurent	6,263 56			6,263 56
St. Michel de Bellechasse Pier		999 89		999 89
St. Siméon Pier	4,555 00			4,555 00
St. Timothée Pier	998 47			998 47
Three Rivers Pier	7,081 30			7,081 30
do Harbour	746 98			746 98
Trois Pistoles Pier	2,989 45			2,989 45
Ontario.				
Beaverton Harbour	6,475 46			6,475 46
Belleville Harbour Works	100 00			100 00
do Dredging	6,473 37			6,473 37
Big Bay, North Keppel		2,065 00		2,065 00
Burlington Bay Channel			702 04	702 04
Cobourg Harbour		4,002 57		4,002 57
Georgian Bay—Removal Robertson rocks	1,528 03			1,528 03
Goderich Harbour		600 00		600 00
Harbours Generally			11,033 79	11,033 79
Kaministiquia River	25,201 76			25,201 76
Kincardine Harbour		1,549 82		1,549 82
Kingston Graving Dock	219,646 53			219,646 53
do Harbour	5,948 00			5,948 00
Kingsville do		747 68		747 68
Little Current, Lake Huron	5,390 81			5,390 81
Little Nation River	5,500 00			5,500 00
Meaford Harbour	3,286 13			3,286 13
Midland do	7,721 08			7,721 08
Oakville do	958 49			958 49
Otonabee River	1,330 01			1,330 01
Owen Sound Harbour	30,459 60			30,459 60
do do dredging entrance channel	589 38			589 38
Parry Sound Narrows	4,320 44			4,320 44
Penetanguishene	4,671 82			4,671 82
Port Arthur Harbour	36,990 38			36,990 38
do Elgin do		1,000 00		1,000 00
do Hope do		2,948 30		2,948 30
Portsmouth do		1,091 81		1,091 81
Rideau River, dredging North Branch	2,657 55			2,657 55
River Ottawa, Narrows above Pembroke	1,516 25			1,516 25
Rondeau Harbour		2,000 00		2,000 00
Saugeen River	1,600 00			1,600 00
Southampton Harbour	5,966 20			5,966 20
Sydenham River	3,008 60			3,008 60
Toronto Harbour	95,009 35			95,009 35
Wiarton Breakwater	8,777 44			8,777 44
Carried forward	1,498,378 47	328,768 79	355,178 16	2,182,325 42

APPENDIX No. 1—*Continued.*

Name of Work.		Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
		$ cts.	$ cts.	$ cts.	$ cts.
Brought forward		1,498,378 47	328,768 79	355,178 16	2,182,325 42
HARBOURS AND BREAKWATERS—*Concluded.*					
Manitoba.					
Harbours Generally				4,037 79	4,037 79
Red River, Survey				1,334 81	1,334 81
North-West Territories.					
Harbours Generally				3,223 81	3,223 81
Wascana Dam			133 74		133 74
British Columbia.					
Columbia River, above Golden		4,989 97			4,989 97
do between Revelstoke and Arrow Lake		5,941 43			5,941 43
do mouth of Kootenay River and Boundary line		5,417 99			5,417 99
Coquitlam River		499 87			499 87
Cowichan River		1,000 36			1,000 36
Esquimalt Graving Dock		2,639 65		12,725 90	15,365 55
Fraser River		21,162 47			21,162 47
Harbours Generally				1,272 45	1,272 45
Nanaimo Harbour, Removal of Nicol rock		4,982 61			4,982 61
New Westminster Wharf			783 97		783 97
Nicomeckel River		503 00			503 00
Skeena River		1,255 33			1,255 33
Victoria Harbour		6,032 51			6,032 51
HARBOURS GENERALLY				9,399 96	9,399 96
Dredges, repairs			28,659 42		28,659 42
Dredging Plant, Maritime Provinces	$ 4,590 75				
do Quebec and Ontario	5,999 91				
do British Columbia	4,714 70				
		15,305 36			15,305 36
DREDGING.					
Nova Scotia.					
Cheticamp	$1,360 43				
Mabou Harbour	5,117 16				
Pictou, Dwyer's Wharf	178 08				
do Market do	6,610 06				
Tatamagouche	2,967 70				
Tracadie	1,940 20				
	$18,173 63				
Prince Edward Island.					
Cascumpec	$ 467 24				
Gauthier's Creek	7,208 48				
	$ 7,675 72				
Carried forward	$ 25,849 35	1,568,109 02	358,345 92	387,172 88	2,313,627 82

APPENDIX No. 1—*Continued.*

Name of Work.			Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
			$ cts.	$ cts.	$ cts.	$ cts.
Brought forward		$25,849 35	1,568,109 02	358,345 92	387,172 88	2,313,627 82
DREDGING—*Concluded.*						
New Brunswick.						
Hampton	$1,092 97					
Lamb's Point	2,671 26					
Perry's Point	3,148 43					
Richibucto	811 10					
		$ 7,723 76				
Generally (printing)		26 29				
Total Maritime Provinces		$33,599 40				
Quebec.						
Beauharnois	$1,032 88					
Lachine	836 65					
Lake of Two Mountains	2,749 19					
Ottawa River, Shoals, &c.	924 15					
River Nicolet	2,867 50					
River Yamaska	4,725 67					
Ste. Anne de la Pérade	3,946 50					
St. Placide, Ottawa River	416 73					
St. Maurice, West Channel	500 00					
Generally	2,678 15					
		$20,677 42				
Ontario.						
Bowmanville	$ 285 00					
Goderich	99 00					
Kincardine	1,002 13					
Newcastle	185 00					
Otonabee River	953 40					
Ottawa River	2,232 29					
Pickering	484 38					
Point Edward	6,237 10					
Port Albert	1,168 33					
Port Hope	48 00					
Rideau River, North Branch	188 00					
Shannonville	1,156 64					
Trenton	2,993 69					
Whitby	625 64					
Generally	5,016 65					
		$22,675 25				
Manitoba.						
Red River	9,716 61					
White Mud River	5,284 93					
		15,001 54				
British Columbia.						
Fraser River	4,709 83					
Victoria Harbour	9,975 83					
		14,685 66				
General Service		2,888 93				
			109,528 20			109,528 20
Carried forward			1,677,637 22	358,345 92	387,172 88	2,423,156 02

APPENDIX No. 1—*Continued.*

Name of Work.		Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
		$ cts.	$ cts.	$ cts.	$ cts.
Brought forward		1,677,637 22	358,345 92	387,172 88	2,423,156 02
SLIDES AND BOOMS.					
Saguenay District		774 21	2,247 23	1,080 56	4,102 00
St. Maurice District			6,638 78	17,155 67	23,794 45
Ottawa District				24,900 35	24,900 35
Ottawa River, Mountain slide	$9,575 42	1,061 79			1,061 79
Ottawa River, reconst'n slide Calumet Falls		9,050 41			9,050 41
Ottawa River, reconstruction works Des Joachim, &c		4,797 81			4,797 81
Madawaska River, new pier, &c., Little Rapids	2,939 54	333 74			333 74
Petewawa River	4,089 53	4,995 13			4,995 13
Black River	240 71				
Coulonge River	308 00				
Dumoine River	1,628 00				
Gatineau	2,452 09				
			21,233 29		21,233 29
Newcastle			1,207 71	2,100 22	3,307 93
COLLECTION OF SLIDE AND BOOM DUES.					
St. Maurice District	$1,257 32				
Ottawa District	4,404 01				
Newcastle District	190 58				
				5,851 91	5,851 91
ROADS AND BRIDGES.					
Ontario.					
Ottawa Bridges, &c.—					
Cartier Square	$ 505 08				
Chaudière Bridge	2,392 83				
do New Iron Truss Bridge	2 50				
do Bridge Lighting				100 00	100 00
Dufferin Bridge	33 55				
Maria Street Old Bridge	29 96				
do New do		1,622 70			1,622 70
Nepean Point	84 00				
Wellington Street	5,470 49				
				8,518 41	8,518 41
York Bridge, over Grand River		17,829 65			17,829 65
North-West Territories.					
Battleford Bridge, over Battle River		9,204 30			9,204 30
Belly River Bridge, Lethbridge		16,753 21			16,753 21
Bow do		40 00			40 00
Old Man's River Bridge, Fort Macleod		2,417 88			2,417 88
TELEGRAPH LINES.					
Nova Scotia.					
Cape Sable	$ 224 73				
Cheticamp	598 81				
Low Point	50 00				
Meat Cove	1,555 81				
	2,429 35	3,012 00			3,012 00
Carried forward	$ 2,429 35	1,749,530 05	389,672 93	446,880 00	2,586,082 98

APPENDIX No. 1—*Concluded.*

Name of Work.			Construction and Improvements.	Repairs.	Staff and Maintenance.	Total.
			$ cts.	$ cts.	$ cts.	$ cts.
Brought forward		$ 2,429 35	1,749,530 05	389,672 93	446,880 00	2,586,082 98
TELEGRAPH LINES—*Concluded.*						
Prince Edward Island.						
Prince Edward Island and Mainland—Subsidy					1,946 66	1,946 66
New Brunswick.						
Bay of Fundy	$ 1,212 91					
Escuminac	434 02					
Grand Manan and Whitehead Island	1,136 57					
		2,783 50	2,509 53			2,509 53
Quebec.						
Anticosti Island—North Shore Cable	$ 2,433 94		14,376 79			14,376 79
Grosse Isle Quar. Station	493 92					
Magdalen Islands	2,117 09					
North Shore—Towards Pt. aux Esquimaux			2,301 13			2,301 13
do East Bersimis	4,013 81					
do West do	3,171 20					
		12,229 96				
Generally		11,677 57				
Total Telegraph Lines, Lower St. Lawrence					29,120 38	29,120 38
Ontario.						
Pelée Island			69 83		217 66	287 49
North-West Territories.						
Telegraph lines generally			87 40		22,389 14	22,476 54
British Columbia.						
Ashcroft and Barkerville—Reconstruction			12,917 99		5,334 65	18,252 64
Bonilla Point and Cape Beale to Victoria			3,152 95			3,152 95
Telegraph Service Generally					9,460 61	9,460 61
MISCELLANEOUS.						
Agent and contingencies, British Columbia					5,297 98	5,297 98
Surveys and Inspections					15,752 30	15,752 30
do and Plans of Government properties					294 00	294 00
Extra Clerks preparing returns ordered by Parliament					109 00	109 00
Totals			1,784,945 67	389,672 93	536,802 38	2,711,420 98
WORKS AUTHORIZED BY SPECIAL ACTS OF PARLIAMENT.						
Quebec Harbour Improvements			50,600 00			50,600 00
Grand Totals			1,835,545 67	389,672 93	536,802 38	2,762,020 98

Department of Public Works,
Ottawa, 5th February, 1892.

O. DIONNE,
Accountant.

APPENDIX No. 2.

REPORT

ON

PUBLIC BUILDINGS

THROUGHOUT THE DOMINION,

FOR THE FISCAL YEAR ENDED 30TH JUNE, 1891.

BY

THE CHIEF ARCHITECT.

APPENDIX No. 2.

REPORT OF THE CHIEF ARCHITECT.

DEPARTMENT OF PUBLIC WORKS, CANADA,
CHIEF ARCHITECT'S OFFICE,
OTTAWA, 11th January, 1892.

SIR,—I have the honour herewith to transmit report of the various works performed under my charge, during the fiscal year ended the 30th June, 1891.

I have the honour to be, Sir,
Your obedient servant,
THOMAS FULLER,
Chief Architect.

E. F. E. ROY, Esq.,
Secretary, Department of Public Works.

PROVINCE OF NOVA SCOTIA.

ANNAPOLIS.

POST OFFICE, &C., BUILDING.

This building which was described in my report for 1889-90 has been completed, fitted up, furnished, supplied with a hot water heating apparatus and occupied.

Plans, &c., prepared and work superintended by this Department.

Clerk of works, Mr. Chas. Jacques.

Contractors for building and fittings, Messrs. Rhodes, Curry & Co., Amherst, N.S.

Contractors for the heating apparatus, Messrs. Garth & Co., Montreal, P.Q.

ANTIGONISH.

PUBLIC BUILDING.

Sundry necessary repairs were made and the outside of the building repainted.

Clerk of works, Mr. John E. Turnbull.

DARTMOUTH.

PUBLIC BUILDING.

Negotiations for the purchase of a site are in progress.

HALIFAX.

DOMINION BUILDING.

A granolithic sidewalk was laid completely around the building.

Repairs were made to the heating boiler, the plumbing, basement ceiling and floor, roofs and eavestroughs, the drains were cleaned, the incandescent electric light was installed throughout the ground floor. The Marine and Fisheries offices were repaired, painted, renovated and carpeted. The Post Office Inspector's office was carpeted and the furniture repaired.

Clerk of works, Mr. John E. Turnbull.

EXAMINING WAREHOUSE.

Changes and improvements were made to the heating apparatus. The gauger's office was added to and improved, and the roof was repaired.

Clerk of works, Mr. John E. Turnbull.

IMMIGRATION BUILDING.

This building which was described in my report of last year is completed, fitted up, furnished with electric light and occupied.

Plans, &c., prepared and work superintended by J. C. Dumaresq, architect, Halifax, N.S.

Clerk of works, Mr. D. Grant.

NAPPAN.

EXPERIMENTAL FARM BUILDINGS.

Since the date of my last report the plumbing consisting of the w. c.'s, sinks, &c., have been supplied to the superintendent s residence, under the supervision of this Department.

NEW GLASGOW.

PUBLIC BUILDING.

Some pointing of stonework and minor repairs have been executed. Incandescent electric lighting has been installed in the offices, and electric bells and speaking tubes put in where required.

Clerk of works, Mr. John E. Turnbull.

PICTOU.

CUSTOM HOUSE.

Repairs were made to walls and roof, and to the interior of the building and heating apparatus.

Clerk of works, Mr. John E. Turnbull.

QUARANTINE STATION.

The grounds were enclosed by a substantial fence, and a road made through the grounds from the highway to the hospital building.

Clerk of works, Mr. John E. Turnbull.

SYDNEY.

POST OFFICE, &C., BUILDING.

This building is completed and occupied.

Plans, &c., prepared and work supervised by this Department.

Clerk of works, Mr. T. E. Burchell, Sydney.

Contractors for the building, Messrs. Connor & Donald, Moncton.

Contractor for the fittings, Mr. Ronald Gillis.

Contractors for the heating apparatus, The Cape Breton Foundry Company.

TRURO.

PUBLIC BUILDING.

The pipe furnace being out of repair and unsuitable for the consumption of soft coal, was replaced by two sectional hot water furnaces. Repairs were made to brickwork ; the savings bank office was supplied with additional fittings, and some internal repairs were made.

Clerk of works, Mr. John E. Turnbull.

WINDSOR.

POST OFFICE BUILDING.

Some repairs and pointing to outside and repairs to inside were executed.
The ceilings were whitened, walls tinted and post office screen varnished.
Clerk of works, Mr. John E. Turnbull.

PROVINCE OF NEW BRUNSWICK.

BATHURST.

PUBLIC BUILDING.

The drains were overhauled and the discharge end changed and protected from damage by ice or stoppage, the plumbing was improved and additional ventilation provided; storm sashes were provided for first floor.

Repairs were made to heating, pointing, and new glass dial for clock and fire buckets supplied.

CARLETON.

POST OFFICE.

Owing to the action of the spring tide, water entered the cellar and caused the settling of the filling and falling in of the concrete floor, the breaking of the terra-cotta drain pipes, and the destruction of the water closets. The sewer was relaid with 4-inch cast iron pipe; a new water closet was put in and a brick arched floor constructed.

A change in grade of street necessitated new granite steps to main entrance.

Works carried out under the supervision of Mr. W. J. McCordock, C. E.

DALHOUSIE.

POST OFFICE.

A plentiful supply of water was obtained by two outside wells and an inside brick tank with pipe connections and pump; and all necessary plumbing, basins, sinks, &c., were furnished and connected with the water supply and drainage.

Works carried out under the supervision of Mr. Jno. E. Turnbull, clerk of works.

CHATHAM.

Minor damages produced by neighbouring fire were made good and minor repairs effected under the supervision of Mr. Jno. E. Turnbull, clerk of works.

FREDERICTON.

POST OFFICE, &C., BUILDING.

The hot air heating apparatus was removed and replaced by a hot water apparatus.

Plans, &c., prepared and work supervised by this Department.

Clerk of works, Mr. F. S. Hilyard.

Contractors for heating, Messrs. Garth & Co., Montreal.

MONCTON.

POST OFFICE.

The tubes of the furnace being completely worn out have been retubed with brass tubing, under the supervision of Mr. Jno. E. Turnbull, clerk of works.

PARTRIDGE ISLAND (ST. JOHN).

QUARANTINE STATION.

A new enclosure fence has been made around the grounds, the hospitals have been whitened, and, in part, painted, under the supervision of Mr. Jno. E. Turnbull, clerk of works.

SACKVILLE.

PUBLIC BUILDING.

Negotiations for the purchase of a site are in progress.

ST. JOHN.

CATTLE QUARANTINE.

Sheds and fences, in accordance with the requirements of the Department of Agriculture, were erected at the Old Penitentiary grounds for the cattle quarantine service.

CUSTOM HOUSE.

A new asphalte floor was laid in boiler room. The hoist was supplied with larger shafting, new mitre gear wheels, new platform and iron braces and repaired throughout. In the middle of the building the Customs Long Room, the rooms of landing surveyors, entering and clearance warehouse, gaugers and tide surveyors had woodwork set up, plastering repaired, ceilings cleaned and walls and woodwork cleaned and painted; and in the south wing the rooms of the Marine and Fisheries Agent, Inspector of lights, Master and Mates examination, and those of the Steamboat Inspector and Boiler Inspector treated in the same manner.

Repairs were made to signal mast, heating and plumbing, electric bells, locks, hinges and furniture.

Works executed under the supervision of Mr. W. J. McCordock.

MARINE HOSPITAL.

Repairs were made to sewer, galvanized iron roof, closets and urinals, water pipes, batteries, bells, &c. The gas metre was changed in position. Some new pipes were put in hot water heating furnace and a portion of the mains in basement covered with felt. The iron roofs, gutters, cornices, sashes and frames were painted and the front door varnished.

Work carried out under the supervision of Mr. W. J. McCordock, C.E.

POST OFFICE.

Ventilating pipes were provided from parcel post office to main ventilating shaft. The two inside porches of side doors were removed and an enlarged inside porch to main entrance provided. Ten water closets, obsolete pattern, were removed and replaced by others of improved pattern; new urinals on all flats arranged with acting flush tanks were put in, and the water supply to basins and drinking taps was taken directly from main supply pipe. The 9″ terra-cotta main sewer pipe and 6″ branches were removed and replaced by an 8″ cast iron main with cast iron branches.

Repairs were made to bells and speaking tubes, hose, plumbing, gas, water and steam pipes. The Chief Inspector's office was furnished with chairs, linoleum and mats.

Works carried out under the supervision of Mr. W. J. McCordock, C.E.

SAVINGS BANK.

The outside brick and stonework was pointed. New iron tops were fitted on chimney and painted. The wood strips were removed from outside of sashes and the glass secured with points and putty. The division wall between club and bank pro-

perty and the wall on Canterbury street were repaired and pointed. All sashes and frames, as well as the flagstaff, were painted. The inside woodwork was set up, the plastering repaired, the ceilings cleaned, and in the two upper flats the walls and woodwork were cleaned, painted, grained and varnished.

Repairs were made to gas and water pipes, and new blocks and halyards furnished flagstaff.

Works carried out under the supervision of Mr. W. J. McCordock, C.E.

PROVINCE OF PRINCE EDWARD ISLAND.

CHARLOTTETOWN.

DOMINION BUILDING.

An iron enclosure fence was put up around the grounds. The furnace, drain and tank were repaired and the woodwork painted.

Supervising architect, Mr. W. E. Harris.

PROVINCE OF QUEBEC.

AYLMER.

POST OFFICE.

A tower clock was placed in the attic, having one skeleton dial on the front gable; the facing brick having in some cases disintegrated, were taken out and replaced by new; a fireproof safe was supplied for the postmaster's use, and the pump repaired.

Plans, &c., prepared, and work carried out under the supervision of this Department.

Contractor for clock, Mr. E. Chanteloup, Montreal.

CHICOUTIMI.

MARINE HOSPITAL.

The drain referred to in last year's report was continued into the river and a cribwork built for its protection, the ground and first floors of the covered way were painted; a new stairway of 84 steps was built and a new water tank provided.

Work done under the supervision of this Department.

COATICOOK.

PUBLIC BUILDING.

Storm sashes were supplied for all windows, and minor repairs executed.

FRASERVILLE (RIVIÈRE DU LOUP).

POST OFFICE, &C., BUILDING.

This building which was described in my report of last year has been in progress since then and it is expected will be roofed in by the coming autumn.

Plans, &c., prepared and work superintended by this Department.

Clerk of works, Mr. Elzéar Marquis, Fraserville.

Contractor, Mr. Alfred Lortie, Quebec.

GROSSE ISLE.

QUARANTINE STATION.

Western Division.—Three compartments of the washhouse building each 24 feet by 24 feet were fitted up as lavatories and one compartment 18 feet by 24 feet

as a laboratory. Each lavatory compartment contains 6 bath rooms and 8 water closets, having galvanized iron floor, partitions and doors and galvanized wire mesh ceiling. The baths are connected with a hot water tank, supplied by a hot water heater, and the baths and closets with cold water from a tank supplied by a hand pump. The laboratory is fitted up with sinks, tables, shelving, &c. A fence 81 feet long was constructed to render the entrance to the women's compartment private.

Two semi-detached kitchens 30 feet by 10 feet were built in the rear of the police sergeant's clock, and doors of communication made thereto from the buildings. The Protestant parsonage and outbuildings were repainted outside.

Middle Division.—The stairway halls of the superintendent's residence were painted and a new wardrobe constructed in one of the bedrooms.

The well house was renewed.

An addition was made to the kitchen of one of the boatmen.

Eastern Division.—In the 5 tenements occupied by the hospital corps the plaster was repaired, the walls coloured and the ceilings whitewashed and the inside woodwork painted two coats.

A wood shed 24 feet by 16 was built at the east end of the steward's quarters, and in the rear two sheds 18 feet by 12 feet and 16 feet by 12 feet respectively.

About 380 feet of enclosure fencing, including two small gates, were constructed around the bleach ground, and a new winter sash and frame was provided for the disinfecting house.

Plans, &c., prepared and work carried on under the supervision of this Department.

Contractors for plumbing, Mr. Geo. T. Philips and Mr. James Maguire.

Contractor for the remaining works, Mr. Ferdinand Poitras, Quebec.

HULL.

POST OFFICE.

The internal walls were tinted and the ceilings whitened; a hot water system for bath and sinks was put in, and plumbing repaired.

LACHINE.

POST OFFICE, &C., BUILDING.

This building, which was described in my report for last year, is nearly completed and tenders are about to be called for the Post Office fittings.

Plans, &c., prepared and work supervised by this Department.

Clerk of works, Mr. Jos. Mettayer, Lachine.

Contractor, Mr. Jos. Fitzpatrick, Joliette.

MONTREAL.

CUSTOM HOUSE.

The old wooden skylight over central hall having become leaky and dangerous was replaced by one of iron. Four pan closets and two wash-out urinals were taken out and replaced by closets and urinals of more approved pattern, having tiled floors and marble divisions between urinals; and the lead w. c. pipe was taken out and replaced by heavy cast iron pipe. Owing to the new shed darkening the rotunda of the Custom house and the engineer's kitchen, further gas fittings had to be supplied. A new speaking tube was put in to communicate between collector's office and surveyor's office. Minor repairs were made to hardware, plumbing, &c.

Superintending architect, Mr. James Nelson, Montreal.

EXAMINING WAREHOUSE.

The McGill and Common streets sidewalks were renewed. New wire ropes were put in store hoist and grocery hoist; hatches and cage were repaired, and new oak

floors put in drug hoist and dry goods hoist; the fancy goods hoist was provided with a new steel drum and repaired, and a new steel shaft with extra hanger was provided for the express hoist. The elevator gangways were repaired and furnished with new angle irons. A new ash waggon and shoot therefor was furnished and the track altered and stayed with rods. The galvanized iron gutter in the middle of roof was renewed. The iron drain pipe of the hardware department was renewed, a new heating coil was put in for the assistant appraiser of drugs and chemicals, a new galvanized iron tank put in, and minor repairs done to boiler fittings, plumbing, &c.

Superintending architect, Mr. James Nelson, Montreal.

INLAND REVENUE OFFICES.

Six water closets of obsolete pattern were taken out and replaced by others of approved pattern with ventilator pipes, &c., complete.

To prevent dampness and entrance of water, the flooring of the basement was taken up, and a bed of concrete made and double wood floor laid, involving the taking up and replacing plumbing, base, &c., re-hanging doors, repairing plastering, cleaning, tinting, painting, &c.

Works carried out under the supervision of Mr. A. Raza, architect, Montreal.

POST OFFICE.

In accordance with a request from the Post Office Department a cast iron stairway, giving a more direct communication between basement and ground floor, was constructed, and the unfinished basement was altered, fitted up and furnished for a distribution office.

The large elevator was supplied with a new gangway, new valves in pump chambers, new spindles, new Peet valve and new wire ropes; the valve chest was repaired and marline put on stopper rope. The letter elevator had a new belt and marline on stopper rope. In inspector's suite a new urinal was put in, the w. c. cleaned and plumbing repaired.

Sundry repairs were made to drain pipes, gas pipes, water pipes and plumbing.

Superintending architect, Mr. James Nelson, Montreal.

QUEBEC.

CULLERS' OFFICE.

Additions were made to the heating and plumbing.

CITADEL—HIS EXCELLENCY'S QUARTERS.

A new summer house was erected on the terrace; the floors of the upper room and tennis court relaid; the inside woodwork cleaned, repainted and repaired; the walls repaired and papered; new carpets were supplied for drawing-room and passage; a movable porch was built at entrance; electric bell service was extended; the band-room was enlarged; repairs were made to plumbing and stoves; and the basement and coachman's quarters were distempered.

A tent was fitted up in summer house on terrace; the ball-room was decorated, and repairs made to range, furniture, &c.

Work done under the supervision of this Department.

EXAMINING WAREHOUSE.

Masonry around windows and doors and the setting of frames were pointed in cement; a flagstaff, with hatch and railing, were constructed on roof, a small skylight put in, the plumbing put in good repair, and some minor work done to boiler, &c.

POST OFFICE.

Two galvanized iron chimney tops to furnace flues provided; repairs were made to the money order and stamps safe door, plumbing work, ceiling of care-

taker's rooms, gas fixtures and inspector's office fittings. A letter and newspaper shoot was put in.

RICHMOND.

PUBLIC BUILDING.

Negotiations for the purchase of a site are in progress.

ST. HENRI.

POST OFFICE.

A contract for the erection of this building on part of lot 1925, Notre Dame street, was entered into on 13th October, 1890. It is to have a frontage of 43 feet 6 inches, by a depth of 33 feet 6 inches, and have two stories, basement and cock loft. The front and flank walls are to be stone and the rear wall brick; the partitions, floors and roof to be of wood. The ground floor is to be occupied as a Post Office, and the first floor as caretaker's apartments, excepting a room for the Inland Revenue and w. c.

Plans, &c., prepared by this Department.
Local architect, Mr. Alph. Raza, Montreal.
Contractors, Messrs. Frigon & Peltier.

ST. HYACINTHE.

POST OFFICE, &C., BUILDING.

On 19th May, 1889, a site was purchased having a frontage of 81 feet 6 inches and 133 feet 3 inches on Girouard and St. Joseph streets, respectively, and on 19th July, 1890, a contract for the erection of the building was entered into. The building is to be 56 feet by 48 feet, and have a sub-basement and basement of stone, surmounted by two stories faced with stone and a mansard attic, the floors, partitions and roof being of wood. On the street corner is to be a square tower, 16 by 16, 4 stories above ground. The sub-basement is for the furnace and fuel; the upper basement for examining warehouse, gas inspection and weights and measures; the ground floor for the post office; the first floor for the Customs and Inland Revenue offices; and the attic for caretaker's apartments.

Plans, &c., prepared by this Department.
Clerk of works, Mr. Jos. Chenette.
Contractors, Messrs. Lortie & Naud.

ST. VINCENT DE PAUL.

PENITENTIARY.

The following works were carried out by convict labour under the supervision of this Department.

West Dormitory Wing.—This building has been supplied with steam heating coils connected with the heating boilers. The number of coils appears to be 132 not 120 as stated in my report of last year.

Boundary Wall.—550 ft. lin. of this wall which was described in my report of last year, are built together with the wall of the circular angle tower, 16 feet diameter, to contain the stairs by which the guards are to scale the wall. The stone was brought from the quarries 2 miles distant, for its speedy delivery 4 large derricks and 5 additional tramway trucks were made and used.

North Lodge and Gatehouse.—This building through which are to pass all supplies and all building material required inside the gates, which is to contain dwellings for two gatekeepers, has been commenced and is now in progress.

Chaplain and Chief Keeper's Outbuilding.—A stable and a wood shed each 18 ft. by 20 ft. of wood have been built.

Fencing.—An open paling fence 250 ft. in length and 6 ft. in height enclosing the grounds at the engineer's quarters being beyond repair was replaced by a new one of the same style, and a fence of similar height about the back grounds and garden of warden's residence 120 feet in length of which was built during this fiscal year and 150 ft. in the previous one.

Water Supply.—To supply water for the building operations and for better heating the workshops, an additional 30 H. P. boiler was supplied.

Hospital.—A sulphur bath and w. c. were put in.

Repairs.—The original prison buildings and old outbuildings were extensively repaired, the tin roof covering of the original prison building and that of the smith's shop were removed and replaced by galvanized iron and the outside stone walls pointed in cement.

Painting.—The window and door frames, sashes, door and all exposed woodwork of the prison buildings and the exterior woodwork of eight dwellings, known as guards' cottages, have all been painted, and the exposed ironwork, such as window barriers, cell doors, steam-piping, &c., were japanned.

The eight guards' cottages, owing to their exposed position facing the north, were each supplied with an entrance porch.

Plans, &c., prepared and work supervised by Mr. Jno. Bowes, superintending architect.

ST. JEROME.

PUBLIC BUILDING.

The Customs offices were fitted up and furnished, and sundry repairs done to plastering.

THREE RIVERS, PLATON.

The retaining wall was repaired and pointed.

Superintending architect, Mr. J. A. Pothier, Three Rivers.

THREE RIVERS.

CUSTOM HOUSE.

The shingled roof was repaired.

Superintending architect, Mr. J. A. Pothier, Three Rivers.

JOLIETTE.

POST OFFICE, &C.

The Customs offices were supplied with furniture; a portion of the yard was fenced off, and some usual and ordinary repairs executed.

VALLEYFIELD.

POST OFFICE.

A building was leased by the Department and altered to suit the requirements of the Post Office Department, under the supervision of this Department.

Contractors, Messrs. Bélanger & Préfontaine, Valleyfield.

PROVINCE OF ONTARIO.

ALMONTE.

POST OFFICE, &C., BUILDING.

This building which was described in a previous report has been fitted up, furnished, supplied with a heating apparatus and occupied.

Plans, &c., prepared and work supervised by this Department.

Clerk of works, Mr. Andrew Bell, Almonte.

Contractor for the construction of the building and fittings, Mr. Robert Cameron, Almonte.

Contractors for heating apparatus, Messrs. Dunlop & Chapman, Pembroke, Ontario.

BRAMPTON.

POST OFFICE, &C., BUILDING.

The Customs offices were fitted up and furnished; gas fittings were supplied and a granolithic sidewalk laid on the street front under the supervision of this Department.

BROCKVILLE.

PUBLIC BUILDING.

In accordance with the regulations of the Board of Service Commissioners the w. c., urinals, wash-basins, sinks, &c., were separately trapped and ventilated, and various incidental alterations and improvements made in the plumbing of the building.

CARLETON PLACE.

POST OFFICE, CUSTOM HOUSE AND INLAND REVENUE OFFICES.

On 9th December, 1890, a contract was entered into for the construction of this building on part of lot 8, section D, having a frontage of 60′ by a depth of 104′ 6″. The building is to be of stone, two stories, basement and attics, 45′ by 48′, with a one-story brick annex 31′ by 21′ in rear, and having the floors, partitions and roofs of wood The basement is for furnace and fuel rooms, the ground floor of main building for Post Office purposes and the annex for an examining warehouse.

Plans, &c., prepared by this Department.

Clerk of works, Mr. Andrew Bell, Almonte, Ont.

Contractor, Mr. R. Cameron, Almonte, Ont.

COBOURG.

POST OFFICE, CUSTOM HOUSE, &C.

Further works of plumbing were effected; hose was supplied, and arrangements for the fitting up and furnishing of the Customs offices are being made.

GANANOQUE.

CUSTOM HOUSE.

Owing to the offices being damaged by fire, repairs and new furniture were required and supplied.

GODERICH.

POST OFFICE, &C., BUILDING.

Building completed and occupied.

Plans, &c., prepared and work supervised by this Department.

Supervising architect (since decease of Mr. G. F. Durand) Mr. Joseph Henry, London.

Clerk of works, Mr. Edward Sharman, Goderich.

Contractors for building, Messrs. Tambling & Jones, London.

Contractors for heating apparatus, Messrs. Garth & Co., Montreal.

GUELPH.

POST OFFICE.

The basement walls were kalsomined, and ordinary and usual repairs effected.

HAMILTON.

POST OFFICE, &C., BUILDING.

Minor repairs were made to examining warehouse and main building roof; a new cable was put in elevator machinery; a pigeon-hole case was supplied examining warehouse; some locks, hinges, glass, door-springs, window-shades, linoleum, &c., were supplied.

OTTAWA.

CENTRAL EXPERIMENTAL FARM.

During the fiscal year the following buildings were constructed:

A one-story wooden dairy, comprising a working room 30 ft. by 18 ft., a cheese room 20 ft., an engine room 9 ft. by 10 ft., an ice-house 24 ft. by 18 ft., and two refrigerators 9 ft. by 11 ft.

An engine house of wood, 35 ft. by 15 ft.

A one-story wooden piggery 81 ft. by 24 ft., containing a feed room 24 ft. by 20 ft., and two rows of seven styes each, divided by a passage.

The fence on the line of the railway passing through the farm was taken down and replaced by one similar to that enclosing the farm.

General repairs were made to buildings and fence.

Work done under the supervision of this Department.

Clerk of works, Mr. Wm. Davidson.

EASTERN BLOCK, DEPARTMENTAL BUILDING.

The corridors of basement and first floors were cleaned, tinted and painted, and the covering of the boiler-house was renewed.

Works carried on under the supervision of this Department.

GEOLOGICAL MUSEUM.

The roofs of caretaker's house, store room and woodshed were renewed and the walls painted.

GOVERNMENT HOUSE.

The walls of the conservatory being out of plumb and dangerous and the plates decayed new ones were placed outside of them and connected by iron rods, by which means the walls were made upright and the building secure from spreading, and posts put in to support the ridge ventilator; 150 feet of plant tables which had become decayed were replaced. (Note—The word "conservatory" in report of last year should have been "grapery.")

625 lineal feet of 7 feet fence on McKay street and Bay road were rebuilt.

A tile drain 85 feet in length was laid from the rear of the Gate Lodge across the roadway to edge of cliff to carry off surface water.

The gravel roof of the studio was renewed, the bathroom No. 10, first floor, was divided from w. c.'s by a wood partition; the plastered ceiling of the tennis court sheathed with narrow V-jointed pine, painted white.

Fallen portions of the plastered ceilings and cornices were made good, and the brickwork of furnaces and outside brick walls repaired.

At the curling rink a new stair was built from ground floor to refreshment room, and the waiting room ceiling sheathed with V-jointed stuff, stained and varnished.

The front wall of the guard room being decayed was taken down and rebuilt.

A new sanitary closet was fitted up in the basement of the cottage.

At the stables the messroom was enlarged to double its former size, and a shed for firewood constructed.

Partial renewals of timber of Bay road bridge and sidewalks of ground were made.

All broken glass was renewed in conservatories, vinery, and buildings generally, as well as in double windows.

Repairs were made to the box drain of stable, the toboggan slide, house furniture, blinds, curtains, &c., &c.

1,850 sup. yards of distempering, 1,750 sup. yards of painting, and 1,150 sup. yards of papering were done throughout the house, cottage and stables; 665 yards of new carpet were supplied and laid in ground and first floor corridors of the house and in oval room No. 1, the old carpets taken up being used elsewhere; 34 yards of cocoa matting were laid in passages, and 24 rugs and mats supplied. All the carpets and matting throughout were taken up, cleaned, repaired and relaid.

A large quantity of china and glassware was provided to bring the stock up to the standard, and the remainder of the dinner china formerly used sent to Quebec for use at His Excellency's quarters there.

The worn-out articles of linen were replaced by others; the kitchen coppers were retinned, the flags were renewed and repaired from time to time; loose covers in cretonne were provided for drawing-room chairs, and some lounges and chairs re covered.

The lawns, conservatories, gardens and grounds have been efficiently kept.

Work carried out under the supervision of this Department.

Clerk of works, Mr. Wm. Hutchinson.

Contractors for maintenance of grounds, &c., Messrs. Sorley & Sims.

MAJOR'S HILL PARK.

The contractor having maintained the grounds to the satisfaction of this Department a further contract for a period of three years was entered into.

Contractor, Mr. L. Garello.

PARLIAMENT BUILDING.

The walls of the Library were pointed. The skylights over House of Commons and Senate Chambers were repaired; the roofs of the boiler-house were recovered and the w.c.'s, &c., repaired, under the supervision of this Department.

NEW DEPARTMENTAL BUILDINGS, WELLINGTON STREET.

Rooms for the occupation of the Census branch of the Department of Agriculture were fitted up and furnished, and furniture supplied to the Post Office Department, the Department of Indian Affairs and the Department of Agriculture, under the supervision of this Department.

PARLIAMENT GROUNDS.

The grounds having been maintained efficiently and to the satisfaction of this Department, a further contract for a period of three years was entered into.

Contractor, Mr. N. Robertson, Ottawa.

PRINTING BUREAU.

The Parliamentary distribution was fitted up and a complete electric light plant with 500 lights installed.

Plans, &c., prepared and work supervised by this Department.

Superintending architect, Mr. J. P. M. Lecourt.

Clerk of works, Mr. H. L. Pinard.

Contractor for building and fittings, Mr. Jno. E. Askwith, Ottawa.

Contractor for electric lighting, Messrs. Ahearn & Soper, Ottawa.

PUBLIC BUILDINGS, REPAIRING STREETS, &C.

Scraping, cleaning and repairs were done the roadways of East and West Canal streets, Nepean Point roadway, Wellington, Bank, Metcalfe, Elgin and St. Patrick streets, Major's Hill roadway, Little Sussex street, also the yards of the Printing Bureau, Museums, Post Office and old Pump House. The sidewalks and crossings of Wellington street, Cartier Square, St. Patrick street and at the Museums were repaired; the grass at Geological Museum and Cartier Square was kept clipped;

and the ashes were removed from the Langevin Block, Museums and Printing Bureau.

The various roadways, sidewalks, footpaths, roofs and yards were kept clear of snow during the winter.

SUPREME COURT ADDITIONS.

A contract was entered into on 28th October, 1890, for an extension of the aforesaid building northerly 71 feet in length by 47 feet in breadth, the extension to be two stories, basement and attic and corresponding finish and detail with the present building. There are to be on the first floor, six rooms for judges, a messenger's room and w.c.'s; and on the ground floor a waiting room, a spare room and a room each for registrar, messengers, reporters, Bar and Attorney General.

Plans, &c., prepared by this Department.

Contractor, Mr. Wm. Stuart, Ottawa.

Clerk of works, Mr. J. L. Pinard.

WESTERN BLOCK, DEPARTMENTAL BUILDING,

That portion of the attics extending northward from the eastern entrance stairway was partitioned off, forming a double row of offices separated by a corridor, required by the Mounted Police Department, were finished and furnished. The corridors of the western extension were cleaned, tinted and painted, and the cement floors throughout the building repaired. The roof covering of boiler-house was recovered.

Works carried out under the supervision of this Department.

VICTORIA HALL.

The skylights were renewed and painted, under the supervision of this Department.

ORILLIA.

PUBLIC BUILDING.

Plans are about to be prepared by this Department for this building, which is to be situated on the northerly 75 feet of lot No. 6 survey, measuring 75 feet on Peter street by 105 feet: a site presented to the Government by the Corporation of Orillia.

PETERBOROUGH.

CUSTOM HOUSE.

A site was obtained consisting of lot No. 1 south of Charlotte street and east of George street measuring 80 feet by 114 feet; and on 26th August, 1890, a contract was entered into for the construction of a Custom house building thereon. The building is to have brick walls with stone dressings and foundations, and consist of main building 34 feet by 50 feet having two stories, basement and attic, with a one-story annex, 31 feet by 17 in rear. The basement is to be for furnace and fuel rooms, the ground floor for Inland Revenue Offices, examining warehouse and water closet, the first floor for the Customs Offices and the attic for the caretaker's apartments.

Plans, &c., prepared by this Department.

Architect, Mr. Jno. E. Belcher.

Contractor, Mr. Jno. E. Askwith.

PETROLEA.

POST OFFICE, &C., BUILDING.

A site has been purchased on the corner of Petrolea and Wingfield streets with frontage of 60 feet and 150 feet respectively.

PORT ARTHUR.

POST OFFICE.

Negotiations with a view to obtain a site are now in progress.

Plans for this building are in course of preparation, and it is expected that tenders will be called for at an early date.

PRESCOTT.

POST OFFICE, CUSTOM HOUSE AND INLAND REVENUE OFFICES.

Buildings completed and occupied.
Plans, &c., prepared and work superintended by this Department.
Clerk of works, Mr. David Barr, Prescott.
Contractors for the building and fittings, Messrs. Cairns, Ward & Steele, Prescott.
Contractor for heating apparatus, Mr. Ellswood Smart, Brockville.

SMITH'S FALLS.

PUBLIC BUILDING.

Negotiations for the purchase of a site are in progress.

STRATFORD.

PUBLIC BUILDING.

Repairs to the roof, carpenter work, painting and masonry were made.

ST. THOMAS.

POST OFFICE, &C., BUILDING.

Repairs to plumbing and roof were effected.
Supervising architect, Mr. W. Whale.

TORONTO.

CUSTOM HOUSE.

The plumbing throughout was remodelled, sundry works in connection therewith and minor alterations and repairs were done to building and heating apparatus.
Superintending architect, Mr. D. B. Dick.

DRILL HALL.

Plans, &c., for this building are in grogress.

EXAMINING WAREHOUSE.

Exhaust pipe was extended over roof of building, block pavement was repaired, heating coils in appraiser's office altered and sundry general repairs were effected under the supervision of Mr. D. B. Dick, architect.

INLAND REVENUE OFFICES.

Repairs were made to heating apparatus, connections of hot water boiler, &c., under the supervision of this Department.

POST OFFICE.

The heating apparatus mains in basement were taken down and rearranged, the building was wired for incandescent electric lighting; the interior was repainted and cleaned and rekalsomined; a new hardwood floor was laid in main office, and sundry alterations and repairs effected.
Supervising architect, Mr. D. B. Dick.

PROVINCE OF MANITOBA.

BRANDON.

EXPERIMENTAL FARM BUILDING.

The works referred to in my report of last year are completed and the buildings occupied.

POST OFFICE.

This building is nearly completed, and is furnished with a hot water heating apparatus, but is not yet fitted up or furnished for occupation.

Plans and specifications prepared by this Department.

Superintending architect, Mr. W. R. Marshall, Brandon.

Clerk of works, Mr. F. J. Chubb.

Contractor, Mr. James Hanbury, Brandon.

WINNIPEG.

IMMIGRATION BUILDING.

On 3rd September, 1890, a contract was entered into for its construction.

The building is 30′ x 126′ 8″, of wood, two stories and attics, with a kitchen in rear, and having a stone basement under all. The basement is to contain a wash room, a fuel room, bath rooms, water closets and store rooms, the ground floor men and women's wards, kitchen, intelligence office, agents and assistants offices, &c., the first floor men and women's wards, dressing rooms, store rooms and baggage rooms.

Plans, &c., prepared by this Department.

Resident clerk of works, Mr. D. Smith.

Contractors, Messrs. Parker & Charlesworth.

POST OFFICE.

Additional lock boxes were supplied; the steam boiler in basement was bricked in; repairs were made to plaster, painting, &c., and a large number of minor works of alteration and repairs effected under the supervision of this Department.

Clerk of works, Mr. D. Smith, Winnipeg.

ST. PAUL'S.

INDUSTRIAL SCHOOL.

A fire protection apparatus, as well as hose, hose-reels, &c., were provided.

NORTH-WEST TERRITORIES.

CALGARY.

BARRACKS.

A wash room was formed in basement and a drain taken therefrom to river.

Clerk of works, Mr. H. D. Johnson, Calgary.

COURT HOUSE.

The heating apparatus referred to in my report of last year was completed; the floor of the boiler room was lowered, a cesspit and drain put in; the Court room, Sheriff's office, Clerk's office, &c., fitted up, and the entire building furnished.

Plans, &c., prepared and work supervised by this Department.

Clerk of works, Mr. H. D. Johnson, Calgary.

Contractor for heating apparatus, Mr. W. D. McDonald, Winnipeg, Man.

INDIAN HEAD.

EXPERIMENTAL FARM BUILDINGS.

Three outside latrines were built; a windmill and pump was supplied, also materials for a granary and a stable.

LETHBRIDGE.

BARRACKS.

The hospital kitchen referred to in my report of last year was completed; a tank over bath room with hot and cold water service was put in, and sergeants' mess room and sergeant-major and quartermaster-sergeant's rooms were lined and ceiled with building paper, and 1 in. dressed lumber, oiled and varnished.

Plans, &c., prepared and work carried out under the supervision of this Department.

Clerk of works, Mr. H. J. Peters, Regina.

MACLEOD.

BARRACKS.

A new bake-oven and a blacksmith shop were built, also a house in corral west of barracks. The south end of quartermaster's store was fitted up as a canteen; "H" stable walls have been gutted, new floors, divisions and doors put in and a saddle room wing built, and "D" and "H" Divisions' barracks were re-sided. All the works were done by police labour, under the supervision of this Department.

OUTPOSTS.

A one and one-half story stand-off detachment house, 24 feet by 30 feet, with kitchen lean-to, 14 feet by 14 feet; also, saddle and oats room, 14 feet by 16 feet; stable, 24 feet by 72 feet; latrine and hay corral were built by police labour, under the supervision of this Department.

Clerk of works, Mr. H. J. Peters, Regina.

MAPLE CREEK.

MOUNTED POLICE BARRACKS.

The wing of a proposed new hospital, consisting of one ward 16 ft. by 30 ft. of wood on a stone foundation, to be used as a surgery and bath room with cellar and tank, a kitchen lean-to 12 ft. by 18 ft. and a sick stable 22 ft. by 32 ft., were erected under the supervision of this Department.

Clerk of works, Mr. H. J. Peters, Regina.

MOOSOMIN.

COURT HOUSE.

Building completed and occupied.

Plans prepared and work carried out under the supervision of this Department.

Clerk of works, Mr. Chas. Taylor, Moosomin.

Contractors, Messrs. Williams & Willoughby, Regina.

POLICE BARRACKS GENERALLY.

Various and numerous repairs and renewals, not elsewhere enumerated in this report, were carried out by police labour at the Police posts at Prince Albert, Battleford, Fort Saskatchewan, St. Albert, Calgary, Fort Macleod, Lethbridge, Maple Creek and Regina, also at the Wascana dam, under the supervision of this Department.

QU'APPELLE.

IMMIGRANT BUILDING.

The court room and offices referred to in my report of last year are being fitted up in this building and supplied with furniture, stoves, stovepipes, flagpole and flag.

Clerk of works, Mr. H. J. Peters, Regina.

REGINA.

BARRACKS.

An elevated tank to hold 50,000 imperial gallons for fire protection has been completed ready to receive water. The cellars of the two main barrack buildings were refloored with 2 in. plank and gravel, all the coal shoots enlarged and truss rods of girders tightened.

Plans, &c., prepared and work carried out under the supervision of this Department.

Clerk of works, Mr. H. J. Peters, Regina.

COUNCIL CHAMBER—NEW OFFICES.

On 17th June, 1890, a contract was entered into for this building, which is now nearly completed. It is situated on the Government reserve, consists of a brick building on a stone foundation 86 feet by 24 feet, having basement, one story and mansard, to contain in the basement a boiler room, a fuel room, a vault, w. c.'s, and store rooms; on the ground floor the offices of the Lieutenant Governor, Finance Department, Mr. Gordon, Mr. Bourget, clerks, &c., and two vaults; and on the first floor two offices for Board of Education, two for Public Works, one for Records and one spare office. Drains and cesspit have been provided, and plans for a heating apparatus prepared.

Plans, &c., prepared by this Department.

Resident clerk of works, Mr. H. J. Peters, Regina.

Contractors, Messrs. J. R. Reilly & Co.

COURT HOUSE.

The arrangement of divisions on west side of ground floor were altered by taking down partitions, moving back vestibule door to entrance lobby and making new entrance to the offices occupied by the Dominion Lands officials since December, 1890. These offices have been provided with fittings, carpets and heating apparatus.

The old stable in rear of the building has been fitted up as a caretaker's dwelling.

Works carried out under the supervision of this Department.

Clerk of works, Mr. H. J. Peters, Regina.

GAOL AND LUNATIC ASYLUM.

The soft water system, the boiler-house and the two pairs of cottages mentioned in my report of last year were completed, the cottages being occupied.

A boiler plate flooring has been laid on top of ceiling joists of prison to prevent escape through ceiling.

Works carried out under the supervision of this Department.

Clerks of works, Mr. H. J. Peters, Regina.

IMMIGRANT BUILDING.

Latrines and a fence 6 feet in height with necessary gates to enclose property, were erected under the supervision of this Department.

Clerk of works, Mr. H. J. Peters, Regina.

INDUSTRIAL SCHOOL.

A system of water supply for fire protection consisting of 3 tanks of 7,000 galls. capacity each were constructed in roof, supplied by a force pump in basement. Lava-

tories and bath rooms for boys and girls were fitted up; and drains and cesspit, as well as a large stone pit for ashes, &c., built.

Plans, &c., prepared and work carried out under the supervision of this Department.

Clerk of works, Mr. H. J. Peters, Regina.

NEW RESIDENCE FOR THE LIEUTENANT GOVERNOR.

The heating apparatus was put in and the building is being furnished ready for occupation.

The Government reserve consisting of the N.-W. quarter of section 23, township 17, range 20, west of 2nd meridian, was enclosed with a woven wire fence having cedar posts.

Plans prepared and work carried out under the supervision of this Department.

Clerk of works, Mr. H. J. Peters, Regina.

Contractor, Mr. Wm. Henderson, Regina.

WHITEWOOD.

IMMIGRANT BUILDING.

This building has been fitted up with benches, tables, cots, stoves, stovepipes, lamps, &c., &c.

PROVINCE OF BRITISH COLUMBIA.

AGASSIZ.

EXPERIMENTAL FARM.

On 28th February last a contract was entered into for the erection of a Superintendent's residence, which is now completed and occupied. It is a wooden building consisting of two stories, basement and attics, having on the ground floor a staircase hall, a sitting room, a dining room, an office, a kitchen and a shed, on the first floor 4 bedrooms and in the attic 3 bedrooms.

Plans, &c., prepared by this Department, work supervised by Mr. F. C. Gamble, C. E.

Clerk of works, Mr. Joseph Brown.

ALBERT HEAD.

QUARANTINE STATION.

A desk was supplied to the quarantine officer.

KAMLOOPS.

INDIAN INDUSTRIAL SCHOOL.

The interior has been wainscotted and minor repairs executed, under the supervision of Mr. F. C. Gamble, C. E.

NANAIMO.

POST OFFICE, &C.

Furniture was supplied to the Customs Offices, and trifling repairs to locks, &c., effected under the supervision of Mr. F. C. Gamble, C. E.

NEW WESTMINSTER.

PUBLIC BUILDING.

Preparations for the enlargement of the Post Office room were made, but owing to unforeseen circumstances the works have not been carried out. A stove was supplied to the Fisheries Office, and some broken glass, &c., replaced.

Works carried out under the supervision of Mr. F. C. Gamble, C. E.

VANCOUVER.

IMMIGRATION BUILDING.

Beds, stretchers, tables, chairs, stove, &c., have been furnished.

POST OFFICE, &C., BUILDING.

On 27th October, 1888, a site was purchased on the corner of Pender and Gravelle streets, having frontages of 130 feet and 75 feet respectively, and on 2nd August, 1890, a contract was entered into for the construction of the building. There is to a 3-story and basement stone main building, L shaped in plan, 81 feet by 64 feet, and a one-story and basement annex in rear, 35 feet by 55 feet. The basement under main portion is to be divided by brick partitions and be used for furnace room, fuel room and Post Office storage; the basement under the annex for bonded goods. The ground floor of the main building is to be the Post Office, and that of the annex the examining warehouse; the first floor is to contain the offices of the Customs, Inland Revenue and Post Office Inspector, and the second floor offices not yet distributed. There are to be brick vaults, one on the ground floor for the Post Office, and two on the first for the Inland Revenue and Custom House.

Plan prepared by this Department.

Resident architect, Mr. C. Osborn Wickenden, Vancouver.

Contractor, Mr. A. E. Carter, Vancouver.

VICTORIA.

"C" BATTERY BARRACKS.

A contract was entered into on 31st December, 1890, for the erection and completion of guard house, entrance gate, cook house, married men's quarters and canteen, all of which were completed.

Officers' quarters had water laid on and taken into kitchens, a urinal fitted up and electric bells put in; lumber was supplied for sidewalk, and metal and gravel for road; $3\frac{4}{10}$ acres of barrack property was cleared, grubbed and ploughed; the property was fenced, and cupboard, ranges, iron shelving, hose and hose reels were supplied.

Plans, &c., prepared, and work supervised by this Department.

Supervisor, Mr. F. C. Gamble, C.E., Victoria.

Contractor, Mr. Geo. Macfarland.

GENERALLY.

Usual and ordinary repairs and minor alterations were executed; sundry articles of furniture and fittings were provided, cleaning, colouring, painting and other improvements effected to a large number of buildings not herein referred to.

ENGINEERS, ENGINEMEN, FIREMEN, &c., PUBLIC BUILDINGS.

The various engineers, enginemen, firemen and caretakers, and the heating apparatus of Dominion Public Buildings, with the exception of those at the various penitentiaries and the military buildings, are under the control of this branch of the Department, and number 120 in addition to the Staff of Ottawa buildings.

HEATING DOMINION BUILDINGS (FUEL).

Tenders were invited by public advertisement for the supply of coal at 115 of the public buildings, and coal and wood supplied to over 115 buildings in all.

WATER FOR DOMINION BUILDINGS.

The water supply for the various public buildings, excepting at Ottawa, and the penitentiaries and military buildings, is controlled by this branch of this Department; 61 buildings at 40 localities have water services connected with the water supply of the local water works companies, the remainder being in general supplied with wells, pumps and tanks.

LIGHTING DOMINION BUILDINGS.

The lighting of the various Dominion buildings, excepting at Ottawa, and the penitentiaries and military buildings, is under the control of this branch of the Department. Of these buildings 63 were lighted by gas, 19 by incandescent electric light, 2 by gasoline, 1 by natural gas, and the remainder by coal oil, while at several of the last mentioned the entrance is illuminated by an arc light outside.

APPENDIX No. 3.

REPORT

ON

HARBOURS AND RIVERS, DREDGES, DREDGING AND SURVEYS

THROUGHOUT THE DOMINION,

FOR THE FISCAL YEAR ENDED 30TH JUNE, 1891.

APPENDIX No. 3.

DEPARTMENT OF PUBLIC WORKS OF CANADA,
CHIEF ENGINEER'S OFFICE, OTTAWA, 25th January, 1892.

SIR,—I have the honour to transmit herewith a report on the works performed in the different harbours, &c., throughout the Dominion, during the fiscal year ended 30th June, 1891.

I have the honour to be, Sir,
Your obedient servant,
LOUIS COSTE, *Acting Chief Engineer.*

E. F. E. ROY, Esq., Secretary, Public Works Department, Ottawa.

In No. 125938.

PRINCE EDWARD ISLAND.

ANNANDALE PIER.

Annandale Pier is in King's County, and is situated on the north side of Grand River, near its entrance into Boughton Bay. It is distant 14 miles by road, south from Souris, the eastern terminus of the Prince Edward Island Railway, and is the shipping place for a large agricultural district.

The pier is not much exposed to the force of the sea, owing to the existence of a "bar" at the mouth of the river, but it is very much exposed to the running ice in the spring, and to the ravages of the teredo, which is very destructive in the river.

Since its assumption by the Department, it has received extensive repairs, principally in close-piling along the channel face.

During the last year a small amount was expended in replacing the planking on the pier head where required, in strengthening the short span in the approach, and in levelling up the approach with gravel and sand.

BAY VIEW PIER.

Bay View Pier is situated on the eastern side, and near the mouth of the Hope River which enters New London Harbour, about 3½ miles to the south-east from its entrance.

This pier is not exposed to any heavy sea, but the extreme high tide of the 1st December ult., which with the prevailing gale caused so much damage elsewhere, rose to some 18 inches above the top of the work, washed out the brush, stone and clay filling in part, leaving the structure almost unballasted, and in this condition it was partially lifted, breaking the bolts which secure the pile fenders to the work, or splitting the heads of the piles, and had it not been for the piles around the work, the structure would undoubtedly have floated off.

The work of repair, &c., consisted first in rebuilding the top of the outer end for a distance of 40 feet, to an average depth of 5 feet and in placing 14 new pile fenders around it; second in rebuilding the top on 60 feet of the pier, inside of the outer end, to a depth of 2 feet.

BELFAST PIER.

Belfast Pier, Queen's County, is situated on the south side of Orwell Bay, about one mile distant from the village of Eldon.

This pier is 600 feet in length and from 24 to 35 feet in width, with an L at the outer end 105 feet in length, 28 feet wide, giving a channel face of 140 feet. Excepting two small openings, the work is constructed with square timber faces, the inner end for a distance of 390 feet being filled in with brush, stone and clay, while the outer end and the L are floored over.

Since its assumption by the Department the outer end and the L, as well as the inner end for a distance of 150 feet, have been put in thorough repair.

During last season work was done in the way of renewing the top of a portion of the inner end, for a distance of 185 feet to a depth of from 2 to 3 feet, by placing

new face timbers, cross ties, longitudinals, cap and fenders, and by filling in the top with brush, stone and clay.

CAMPBELL'S COVE BREAKWATER.

Campbell's Cove, King's County, is situated on the north coast of the Island, about nine miles west from East Point, and 14 miles distant from Souris, the eastern terminus of the Prince Edward Island Railway.

In 1872, the Provincial Government constructed a detached breakwater 300 feet in length and 30 feet wide, on the reef which extends out from the western end of the cove, for the protection of small fishing vessels and boats.

During 1882-83 the Department repaired the old structure, raised it 2 feet in height, connected it with the shore (a distance of 70 feet), and constructed an extension thereto, 250 feet long and 20 feet wide on top, making its total length 620 feet. The whole work is constructed of square timber, the faces of the old portion, and of the connection with the shore are built plumb; the extension has a timber slope of 1 to 1 on the seaward side.

A small amount was set apart for repairing the damaged timber slope, during the last season, but the work was scarcely commenced when the place was visited by a terrific gale accompained by an extreme high tide, which entering through the broken face, lifted the top and otherwise damaged the structure to a great extent. The amount was used in saving the materials which was scattered around the Cove.

CARDIGAN (NORTH) PIER.

North Cardigan Pier, King's County, is on the north side of the Cardigan River, near its entrance into the bay of the same name, and is distant about 6 miles from Cardigan Bridge, the head of navigation and a station on the Prince Edward Island Railway.

Its total length is 383 feet, and it consists of a shore abutment and seven blocks with intervening openings, the latter being spanned over and planked. It is from 23 to 25 feet wide out to the outer block, which has a width of 32 feet. The shore abutment is 100 feet in length, the blocks from 19 to 2) feet, and the spans from 14 to 26 feet long. The abutment and all the blocks are constructed with squared timber faces, filled in with brush, stone and clay, excepting the two outer blocks, which, as well as the spans, are planked over.

Since its assumption by the Dominion Government, it has received extensive repairs.

During the fiscal year four mooring posts were renewed, and the shore abutment and the blocks were levelled up with gravel and clay.

CASCUMPEC.

Cascumpec Harbour, Prince County, is on the north coast of the Island, about 17 miles to the southward of North Cape, and about 20 miles to the north-westward of the entrance into Richmond Bay.

The entrance into the harbour is obstructed by two bars, the outer one, composed of sand, lies about a mile from the entrance, and the "inner bar," which is composed of very soft red sandstone lies between the beaches which form the entrance. The bars are about 1,000 feet in width and carry a depth of 10 feet at low water springs, which rise 3 feet.

It is proposed to make a cut through the inner bar, 100 feet in width, with a depth of 15 feet at low water, so as to admit of a larger class of vessels to enter and leave the harbour. It is thought that a deeper channel across the "inner bar" will have the tendency to create a stronger tidal current and deepen the water over the "outer bar."

The work was commenced by the Department in 1885 by submarine blasting, and was continued every season since, but owing to the shortness of the period in which operations could be carried on, the softness of the material, which blasts badly, and the fact that the divers had to handle every piece of stone, by hand, it has not progressed as rapidly as it was expected.

During 1889-90 a new plan for the prosecution of the work was adopted and put in operation, viz., the rock was blasted, but was left in place for removal by the dredge.

On the 11th day of October ult., the dredge commenced working on the bar, and up to the 5th day of November worked 10 days and removed 1,147½ cubic yards of stone from the cut. Owing to bad weather operations had to be discontinued and the dredge was laid up for the winter.

Between the 3rd October and 8th November, 1890, the "Prince Edward" removed 1,157 cubic yards of sandstone, which had been loosened by explosives, from the bar at the entrance to the harbour.

CHAPEL POINT PIER.

Chapel Point Pier, King's County, is on the south side of Grand River, about 3 miles from its entrance into Boughton Bay.

The pier was constructed by the Local Government, and consisted of an approach 205 feet in length, and of a block at the end 22 feet long, they being connected by a span 22½ feet in length making the total length of the pier 244½ feet. The approach is constructed with squared timber faces and is filled in with brush, stone and clay, and the outer block is constructed with squared timber faces, but it is filled with ballast and is, as well as the span, planked over.

On the 31st day of March, 1890, a contract was entered into for repairing the top of the outer block, and for the extension of the pier, by the addition of a new block and of a new span, each being 22 feet wide and 22 feet in length, and the work was satisfactorily completed on the 9th day of August, 1890.

Besides the contract work the bottom of the old outer block which had suffered by the run of ice in the winter of 1889-90 was repaired and twenty piles were placed around it. The approach was levelled up with stone and gravel, and new top face timbers, cap and one mooring post were renewed, and its sides were strengthened by placing forty fender piles.

The pier is now 290 feet in length, and it admits of three small vessels loading at a time, instead of one as formerly.

CHINA POINT PIER.

China Point Pier is in Queen's County and lies on the west side of the mouth of the Orwell River, at the entrance into Orwell Bay.

The pier is 426 feet in length on the south side with a return or L along the channel face, 72 feet in length. It is from 18 to 24½ feet in width, and is composed of a series of 8 solid blocks (not including the shore abutment) with intervening openings, spanned and planked over. The shore abutment and the five inner blocks are built with squared timber faces and are filled in with brush, stone and clay. The two outer blocks and the one forming the L are also built with squared timber, but they, as well as all the openings, are covered with 3 inch plank.

In November, 1889 a contract was entered into for the removal of all flooring, cap timbers, floor stringers and span beams, the raising of the outer block and the reconstruction of the top of the L block and for levelling up the inner blocks and approach with stone and clay.

The work on the main structure was satisfactorily completed, and when the L block was stripped down to low water mark, it was found that it was too far gone to build upon.

It was then considered advisable to abandon it and to build in lieu thereof an entirely new block on the south side of the end, and all the work was completed in a satisfactory manner on the 25th November ult.

Besides the contract work 12 piles were driven around the outer block.

GAUTHIER'S CREEK.

At the beginning of the fiscal year the dredge "Prince Edward" was operating at Gauthier's Creek, North Rustico, improving the channel, and when the work

closed on the 17th September, 17,847 cubic yards of clay, sand and mud had been removed, and a depth of 11 feet at low water springs obtained.

GEORGETOWN PIER.

Georgetown, the shire town of King's County, is situated on the northern side of the Montague River, near its entrance into Cardigan Bay, and is the terminus of the Georgetown Branch of the Prince Edward Island Railway. Its harbour is well known as being one of the best and safest in the Island.

The public wharf known as Queen's Pier was constructed by the Local Government and was handed over to the Dominion Government in 1884. It is composed of a shore abutment 340 feet in length and of six blocks from 25 to 33 feet long, with intervening spans. Its total length is 642 feet and its width varies from 25 to 33 feet. The shore abutment and the blocks are built with squared timber faces, filled in with brush, stone and clay, the spaces between them being spanned over and planked.

During last season a small amount was expended in placing floor stringers and planking on the three outer blocks, and in levelling up the shore abutment, and the three inner blocks with stone and clay.

At the end of the pier there is a depth of 12 feet at low water springs. Spring tides rise 5 feet, and the class of vessels loading and discharging at the pier are large sized schooners, drawing up to 10 feet of water.

HICKEY'S PIER.

Hickey's Pier, Queen's County, is situated on the south-eastern side of the East or Hillsboro' River, about 10 miles distant from the city of Charlottetown.

The Hillsboro' River, being navigable for a distance of about 15 miles inland from the city of Charlottetown, is the most important river on the Island, and Hickey's Pier, since the channel at its end and berths on each side of it were dredged out by the Department, is the first in importance on the river.

The structure was constructed by the Local Government and is 428 feet in length on its centre line and is of different widths, ranging from 22 to 29 feet, the latter being the width of the outer end and for a distance of 180 feet. It is composed of a shore abutment 105 feet in length and of a series of blocks with intervening spans.

On its assumption by the Department the pier was almost a wreck, but since then it has been nearly reconstructed.

During the last session the following works were executed:—

(1.) The outer block was raised to the level of the rest of the work, and new stringers, planking, cap, 4 mooring posts and 6 fender piles were placed.

(2.) The planked portion of the shore abutment for a distance of 145 feet having settled in the centre the planking was removed, the centre stringers were raised and the planking was replaced and where necessary it was renewed.

HURD'S POINT PIER.

Hurd's Point, Queen's County, is situated on the south side of the southern end of Bedeque or Summerside Harbour, and about 3 miles south of the town of Summerside.

The pier is a very important shipping place, being the outlet of a large and rich agricultural district.

A channel 2,700 feet in length, 250 feet wide, with a depth of 12 feet at low water, was dredged by the Department in 1884-85, from the deep water channel to the pier.

The pier is 511 feet in length and is composed of an approach 227 feet long and 26 feet wide, the remaining length of 284 feet by 5 blocks and intervening spans. The outer block is 65 feet wide and 50 feet in length, forming a T, and it is constructed of squared timber, filled with ballast and planked over. The approach as well as the other blocks are also built with squared timber faces, but they are filled

in with brush, stone and clay. At the outer end there is a depth of 13 feet of water at low water.

During the last season a small amount was expended in renewing the planking on the outer block, where necessary, in straightening and strengthening the southern face of the approach, and in levelling up the approach and the inner blocks with stone and gravel.

KIER'S SHORE PIER.

Kier's Shore Pier is situated at Malpeque, Prince County, and lies on the east side of Richmond Bay, about 7 miles from Kensington, a station on the Prince Edward Island Railway.

It was constructed by the inhabitants assisted by the Local Government, and is 1,016 feet in length and from 20 to 24 feet wide. It is built with squared timber faces, filled in with brush and stone, and excepting a short span, 17 feet long, and the outer end for a distance of 25 feet which are planked, the top of the pier is covered with clay.

The amount authorized for expenditure last season was expended in filling up washouts in the roadway caused by the gale and high tide of 1st December, 1890, and in straightening up the timber faces of the inner end which had canted outwards.

MALPEQUE BREAKWATER.

Malpeque Breakwater, Prince County, lies within the eastern or principal entrance of Richmond Bay, on the north shore of the Island, about 90 miles from East Point and 40 miles from North Cape.

During 1877-78-79 a breakwater, 600 feet in length, was constructed by the Department on the western end of "Royalty-Sands," on the eastern side of the harbour, to shelter the anchorage from north-east winds and to afford a shipping place for the produce of the surrounding country.

Since the construction of the breakwater, the sands inside began to waste away by the action of the sea during easterly storms, and to prevent this action, a breastwork was constructed from the inner end of the breakwater to Royalty Point, a distance of 2,370 feet.

During the last season the amount authorized was expended in close-piling the outer end of the breakwater and the sides, for a distance of 10 feet from the outer end.

MIMINEGASH.

Big Miminegash, Prince County, is situated on the north-west coast of the Island, about 15 miles from North Cape and 18 miles from West Point.

Before its improvement, Big Miminegash was one of the numerous ponds along this coast which empty into the Northumberland Straits, through sand beaches. Being sheltered to a great extent by Miminegash Reef, a ledge of rock nearly a mile long, which lies parallel to the shore, at a distance of about half a mile, it had the advantage over the other ponds, and it was the one mostly sought by fishermen during stormy weather.

The outlet of the pond, called the "run," being through sandy soil, it often changed its course. To make it permanent and to improve the depth of water in it, it was confined to a width of 56 feet by works on either side; the Department having expended about $9,000 since 1878.

The works consist, on the north side, of a solid timber pier 417 feet in length, and 150 feet of close piling, and, on the south side, of a pier constructed of piles, brush and stone 150 feet long.

A certain amount of work was done, consisting in re-ballasting and in the renewal of floor stringers and plank on the inner end of the north pier, for a distance of 100 feet.

NEW LONDON.

The harbour of New London is situated on the northern coast of Prince Edward Island, about 10 miles south-east from the entrance into Richmond Bay. Within its entrance, which is about 1,200 feet wide, the bay is 3 miles wide and receives the waters of the South-West, the French, the Stanley and the Hope Rivers.

The works constructed by the Department for the improvement of the entrance into the harbour consist of a breakwater 1,050 feet in length on the sand beach at the eastern side of the entrance, built partly of piling, brush and stone and partly of cribwork, a breakwater 460 feet in length on the beach at the western side of the entrance, the inner end for a distance of 400 feet consisting of pile, brush and stone work, and the outer end being a squared timber block.

During the last season the amount authorized was expended in the construction of a cribwork block 102 feet in length, between the two outer blocks of the eastern breakwater, and in extending this breakwater at the inner end a distance of 82 feet by the construction of a breastwork composed of piling, brush and stone.

PINETTE PIER.

Pinette Harbour, Queen's County, is on the north side of the Northumberland Strait, 4 miles east of Point Prim, and 12 miles north of Wood Islands. It is situated at the mouth of Pinette River and extends about 2½ miles inland to Pinette Bridge, the navigable channel being from 200 at the upper end to 600 feet wide at the lower end, and carrying a depth of water of 3 fathons at low water springs, which rise 8 feet.

A pier 120 feet in length and 28 feet wide was built on the south side of the channel, below and at right angles to Pinette Bridge and connected with the bridge by a span 28 feet long planked over.

The pier is built along the channel and has a frontage including the span of 148 feet. During 1881 the dredge "Prince Edward" operated here in deepening the loading berth off the face of the pier to a depth of 8 feet below low water springs.

During the past season the work done consisted in placing 16 fender piles along the channel face, 16 piles in the centre of the work to keep it from sliding out, and in placing new plank on top where necessary.

PORT SELKIRK PIER.

Port Selkirk Pier, Queen's County, is on the south side of the mouth of the Orwell River, at its entrance into Orwell Bay.

The pier was constructed by the Local Government, and is in the form of a T, its length from the shore to the channel face being 252 feet, and the length of the pier-head 200 feet, the width of the approach is 23 feet and that of the pier-head 35 feet.

The pier-head was originally 250 feet in length on the channel face, but as the upper block was in danger of tumbling into the channel it was removed, together with the span connecting it with the next block, and thus the length was lessened by 50 feet.

During last autumn temporary repairs were made to the lower end of the pier, so as to render it available for traffic.

On 25th February ult. a contract was entered into for the construction of a block and span at the upper end of the pier, and at the end of the fiscal year the work was about half completed.

POWNAL PIER.

Pownal Pier, Queen's County, is situated at the head of Pownal Bay, the north-eastern corner of Hillsboro' Bay, and is distant about 9 miles from the city of Charlottetown.

The pier was built by the Local Government and is 753 feet in length. It consists of a shore abutment, 209 feet in length and 16 feet wide, and of 14 blocks

with intervening spans. The inner blocks are from 16 to 18 feet wide, and the two outer ones are 40 feet wide.

To admit of boats and small craft coming to and leaving the pier at all times of tide, the Department, during 1880-81, dredged a channel up to the pier 1,275 feet in length, 56 feet wide and from 5 to 6 feet in depth, carrying a depth of from 6 to 9 feet of water at low water springs, and a basin on the eastern side of the end of the pier, 90 feet wide and 250 feet in length.

During the past season a small amount was expended in building up the shore abutment and the blocks with stone and clay, which had been washed out by the high tide of 1st December, 1890.

RED POINT PIER.

Red Point Pier is in Queen's County, and is situated on the eastern side of the Hillsboro' River, about 6 miles north-eastwardly from the city of Charlottetown.

It is 650 feet in length, 21 feet in width and is 12 feet high at the outer end, which bares at low water, but as the Department during 1888-89 dredged a channel from the deep water channel of the river to the end of the pier, carrying 12 feet at low water, vessels are now enabled to load at it at all times of tide.

The pier is composed of a shore abutment 310 feet in length and of 5 separate blocks from 29 to 75 feet in length, with intervening spans from 21 to 25 feet in width. The shore abutment and the blocks are filled in with brush, stone and clay, the outer blocks as well as the openings are planked over.

During last fall work was carried on of renewing the top of the shore abutment to an average depth of 3 feet, in fendering it every 10 feet, in placing new span beams, planking and cap on the three inner openings, in placing 5 fender piles on each side of the four inner blocks, in placing four mooring posts in the corners of the fourth block, and in levelling up the top of the shore abutment and of the four inner blocks, with stone and clay.

RUSTICO (NORTH) BREAKWATER.

North Rustico, Queen's County, is the most important fishing station on the northern coast of the Island, and is nearly equidistant from North Cape and East Point.

During the years from 1881 to 1884, the Department constructed breakwaters on each side of the entrance to the harbour for the purpose of concentrating the ebb current upon the "bar" outside, so as to scour away the sand and thus obtain a greater depth of water over it. The results have been most satisfactory, as the depth of water on the bar has been increased by 3 or 4 feet, which, added to the former depth, gives at present at low water springs from 9 to 10 feet of water, and at high water from 12 to 13 feet.

The breakwater on the north side of the entrance, is the most important and was originally 1,240 feet in length, but as the outer end was badly damaged, it was cut off for a distance of 17 feet. The inner end of the breakwater for a distance of 550 feet is constructed of piles, brush and stone, the outer end is close-faced timber work built plumb on the seaward side up to a height of 2 feet above low water and above that level, with a slope of 1 to 1 the inner face is built with a batter of 1 in 4. The top of the outer end is 9 feet wide, and it, as well as the sloping face, are covered with 6 inch plank. The bottom of the sloping face is close-piled.

During last autumn, the outer end for a distance of 20 feet was reconstructed, close-piling on the bottom of the sloping face was replaced, and the plank on the sloping face and on the top was renewed where necessary.

The work was visited by the terrific gale of 1st December, 1890, accompanied by an extreme high tide, and the outer end of the breakwater for a distance of 120 feet sustained severe damages. During the spring the most urgent repairs were started upon the structure, but owing to the stormy weather prevailing during the latter part of June they could not be accomplished by the end of the fiscal year.

RUSTICO (SOUTH) PIER.

South Rustico Pier, Queen's County, is situated immediately below the Oyster Bed Bridge at the mouth of the Wheatley River, which enters Rustico Bay, at its southern end. It is distant about six miles from Hunter River Station on the Prince Edward Island Railway, and about 13 miles to the northward of the city of Charlottetown.

The pier was constructed by the Local Government to accommodate the shipping of produce from and the importation of coal and lumber to the locality. It is 593 feet in length and consists of a shore abutment 450 feet long and 17½ feet wide, and of three detached blocks about 25 feet apart. The inner block is 17 feet wide and 23½ feet long, the two outer blocks are respectively 29 and 30 feet wide and 20 and 24 feet in length. The approach or shore abutment and the blocks are built of square timber, filled in with brush, stone and clay, the outer block and the spans are covered with plank.

During the last autumn, a small amount was expended in levelling up the top of the shore abutment and blocks with broken stone.

ST. MARY'S BAY PIER.

St. Mary's Bay Pier is situated on the south side of St. Mary's Bay, which forms the extreme southern end of Cardigan Bay, and is about 6 miles south of Georgetown, the shire town of King's County.

The pier is 407 feet in length and for a distance of 310 feet is 21 feet wide, the outer end for 97 feet being from 28 to 29 feet in width. It is composed of a shore abutment and of 7 blocks with intervening spans.

During the past season the western face of the shore abutment was repaired, and the roadway levelled up with stone and clay.

SOURIS BREAKWATER.

Souris Harbour, Colville Bay, King's County, is about 16 miles to the westward of East Point, the eastern extremity of the Island. It is a very important shipping port and is the eastern terminus of the Prince Edward Island Railway which has a deep water wharf here.

The anchorage being good and safe with all northerly winds, the Department constructed a breakwater from the end of the one previously built by the Local Government off Knight's Point, on the eastern side of the harbour, to afford shelter during southerly gales and thus form a harbour of refuge. This breakwater is 1,180 feet in length, including the portion constructed by the Local Government, which is 270 feet long. This portion is 25 feet wide with faces plumb; the centre portion is 500 feet in length and 46 feet wide with faces plumb, and the outer section is 410 feet in length and 21½ feet wide on top, with sides sloping 1 in 6.

It is exposed to the full force of the sea during southerly gales, and to the attacks of the teredo, which is very destructive in these waters, and since its construction it has required partial reconstruction and very extensive repairs. The outer end stands in 24 feet of water at low water springs, and being rather narrow for its height (21 feet wide on top and 30 feet high) the top was moved some 3 feet inward by the force of the sea. To protect its weakened face on the seaward side, a heavy stone slope was commenced by the Department during 1888, and at the same time a strongly constructed timber block 30 feet square on the bottom, and close piled all around, was placed on the outer end of the seaward face to prevent the stone from moving around it.

The placing of heavy stone along the seaward face of the outer section has been carried on yearly since, on a limited scale, and it will take several years before the slope is completed, as every successive gale tends to scatter the stone, but when this has obtained a natural slope, the sea will no longer have any effect upon it.

During the last season the sum of $3,699.82 was expended in reconstructing the top of the outer section for a distance of 310 feet, by placing new ballast floors,

ballast to a depth of about 6 feet, new floor stringers, cap, flooring and fender piles. The seaward face of the section was strengthened by a deposit of about 1,200 cubic yards of large quarried stone.

On 1st December, 1890, this work was visited by a terrific gale accompanied by an extreme high tide, but the stone on the seaward side of the outer section broke up the seas before they reached the breakwater, and prevented serious damage.

STEVEN'S PIER.

Steven's Pier is at Montague, King's County, and is situated on the southern side of the Montague River, immediately below Lambert's Pier, and six miles above its entrance into Cardigan Bay.

Since the improvement of the navigable channel of the river by the Department, vessels of considerable size can ascend the river up as far as Montague Bridge, where a large amount of produce is yearly shipped.

The pier consists of two wings, about 50 feet apart, extending out from the shore with a pier-head at the outer end 100 feet long, along the channel. The wings consist of shore abutments 90 and 115 feet in length respectively, built with squared timber faces and filled in with stone and gravel, next of openings 21 and 30 feet in length, spanned and planked over, square timber blocks form the outer end of the wings. The pier-head is constructed on pile bents, spanned and floored over.

On the assumption of this pier by the Department, the pier-head was reconstructed and the weakest portions in the approach were repaired.

During the past season the greater part of the pier-head and spans were replanked, fender piles were placed on the outer face of the eastern shore abutment, stone was placed against the inner face of both shore abutments, and the approaches were levelled up with broken stone.

STURGEON PIER.

Sturgeon Bay, King's County, is situated on the south side of Cardigan Bay, about six miles south of Georgetown, the terminus of the Georgetown Branch of the Prince Edward Island Railway.

The pier was constructed by the Local Government to accommodate the shipping of produce from the locality. Its total length is 436 feet, and is from 20 to 25 feet in width, its height at the outer end is 13 feet, with a depth of 4 feet at low water springs, which rise 5 feet. It consists of a shore abutment 250 feet in length, and four blocks of from 20 to 25 feet in length, with intervening spans of from 22 to 25 feet long. The faces of the approach and blocks are constructed of squared timber, filled in with brush, stone and clay. The two inner openings are filled in with brush at the bottom, and with stone and clay on the top, the sides above the brush being timbered up to keep the stone and clay in place. The two outer openings and the outer block are covered with plank.

During the last season a small amount was expended in levelling up the approach and the top of the blocks with broken stone, in replacing five fender piles and one mooring post, and in renewing some plank on the spans and the outer block.

VICTORIA PIER.

Victoria is a thriving settlement in Queen's County, situated at the head of navigation in Crapaud Basin. It is about 11 miles south of Emerald Junction, a station on the Prince Edward Island Railway, and is about halfway between the towns of Charlottetown and Summerside.

The Government Pier, so called to distinguish it from other wharves owned by private parties, has a total length of 486 feet. The approach is 268 feet long and 20 feet wide; the next section 143 in length has an average width of 37 feet, and the outer 75 feet has a width of 58 feet, so that a large area is available for top wharfage. Its height at the outer end is 19 feet, with a depth of water of 15 feet at high

tides. With the exception of the approach, which is built solid, the work is composed of blocks and spans.

The approach from deep water outside to the wharves has been of late years much improved by dredging.

During last fall the planking on the middle and the outer sections was removed and 50 new floor stringers, 8,150 sup. feet of new 3-in.plank and 2 mooring posts were placed on the work, besides the approach was covered to a depth of 15 inches with stone, and the faces were repaired where necessary.

NOVA SCOTIA.

BARRINGTON.

Barrington, Shelburne County, is distant 45 miles to the south-east of Yarmouth and 30 miles south-west from the town of Shelburne, and is within 10 miles of Cape Sable, the most southerly point of Nova Scotia.

Barrington owes its importance almost entirely to the fishing industry, and not only does considerable shore fishing, but annually fits out and supplies a number of schooners for the Bank fishery. It is a port of call for the line of steamers running between Halifax and Yarmouth, and is the northern terminus of the steam ferry to Cape Sable Island. Owing to the increasing trade in the fresh fish and lobster business a line of local steamers now makes four trips a week between Barrington and Yarmouth, calling at intermediate ports and fishing stations.

Until the present year the only wharf at Barrington at which steamers could land their freights was a private one at the lower part of the Passage, from which the ferry runs to Cape Sable Island. This wharf is not accessible at low water owing to a bar (distant about 1,200 feet from the end of the wharf), on which there is only 4 feet of water at low tide.

An examination was made by the Department in 1888 to ascertain the most suitable site for a public wharf, and one was selected near the head of Sherose Channel as being the most central and sheltered and at the same time having a sufficient depth of water.

The construction of the wharf was begun in 1888-89 and continued during the following year.

During the past year the wharf has been completed.

It consists of first an inshore section, 90 feet long, built entirely of stone; secondly, 135 feet of cribwork to the beginning of the soft mud flats; thirdly, 750 feet of pile wharfing to the edge of the channel, and lastly, an L 70 feet long along the face of the channel, for steamers to lie at. The first three sections are 20 feet in width, and the L or channel portion has a width of 30 feet.

The channel block is furnished with a movable "drop" or landing, to enable vessels to discharge freight readily at all times of tide, and also with a substantial warehouse 19 feet by 35 feet, for receiving and storing freight.

As the fishing schooners which are usually wintered afloat in Sherose Channel would interfere with the movements of the steamers if allowed to remain at anchor there, five good berths have been provided for them along the sides of the wharf. These berths are fitted with pile fenders, mooring posts, rings, &c.

Bunches of piles or "dolphins" have been driven on the flats to mark the bends of the channel, and the whole work is now complete and in thorough working order.

BROAD COVE.

Broad Cove Marsh, Inverness County, is on the Gulf of St. Lawrence, 12 miles south from Margaree Harbour.

A wharf, 400 feet in length and 25 feet in width on top, was completed in 1888. The depth at the outer end, at extreme low water, is 12 feet 10 inches. Spring tides rise 4 feet 5 inches.

In 1889 the ballast was washed out of eight chambers or spaces between the cross ties on the north side of the wharf, and several of the upper face timbers on the south side were loosened.

During the year 1890–91 a small amount was expended in replacing and securing with extra bolting the upper face timbers on the south side, and in placing vertical pieces close together against the face timbers in six chambers on the north side, and refilling to within 4 feet of the covering with stone ballast.

BRULÉ.

Brulé is situated on the south side of Brulé Harbour, Northumberland Strait, in the extreme north-east corner of Colchester County, about midway between River John and Tatamagouche, and is distant about one mile from Denmark station, on the Oxford and New Glasgow branch of the Intercolonial Railway, shortly completed.

The wharf is about 400 feet in length, with an average width of 23½ feet, built entirely of round timber, excepting the top face timbers, the floor stringers and the cap. For a distance of 300 feet from the inner end the top is gravelled, the outer 100 feet are planked over. The work is 14 feet high at the outer end, and the depth of water at the same place, at low water springs, is 3 feet, and as spring tides rise 8 feet the depth at high water springs increases to 10 feet.

The top of the work was much damaged by the heavy gale of the 1st December ult., which was accompanied by a tidal wave which rose some 5 feet above the level of an ordinary spring tide, and during the spring the necessary amount was expended in replacing floor stringers, planking and cap, and three fender piles at the outer end for a distance of 100 feet, in renewing the top of the work inward of the outer portion for a distance of 90 feet to a depth of 3 feet, and in replacing stone and gravel to a depth of 2 feet on the inner end of the wharf.

CARIBOO.

Cariboo Island, Pictou County, is on the Northumberland Strait, 5 miles to the westward of the entrance to Pictou Harbour. It is about 4 miles in length and half a mile in average width.

Cariboo Harbour, sheltered by Cariboo Island and a smaller island lying to the eastward of it, is an extensive place, 6 miles in length and 1 mile in width, occupied by shallow water. The principal entrance, between the two islands, has only 4 feet at extreme low water, and the flats between the mainland and the western extremity of the Cariboo Island are dry at extreme low water except in a few small channels. Spring tides rise 6 feet, neaps 4 feet.

With the amount authorized a work of brush and stone 1,221 feet in length, 19 feet in width on top, and from 2 to 5 feet in height was constructed between the island and the mainland. It is still in an unfinished condition, being covered at about half-tide.

CHETICAMP.

Cheticamp Harbour, Inverness County, is on the west coast of Cape Breton Island, 18 miles north from Margaree Harbour.

It is a secure harbour, being sheltered from the west and south by Cheticamp Island and a connecting beach. The entrance is from the north, through a dredged channel.

During the summer, regular steam communication is maintained between Pictou and intermediate ports.

During the year 1890-91 a contract entered into 10th June, 1889, for the construction of a wharf on the eastern side of the harbour, was completed. This wharf consists of an approach 125 feet in length and 30 feet in width, over a distance of 60 feet from its outer end, with side walls and centre filling of stone, and an extension 80 feet in length, in two blocks with openings of 17 feet 6 inches. The outer block is 60 feet in length along the channel face and has a depth of 11 feet at extreme low water. Spring tides rise 3½ feet.

The "Geo. McKenzie" operated at this place between 22nd September and 7th November, 1890, and from 3rd June, 1891, to the close of the fiscal year, in widening and deepening the channel, which is now 40 feet wide, with a depth of 14 feet at low water springs.

CHURCH POINT.

Church Point, Digby County, is one of the most important shipping places on the south side of St. Mary's Bay. It is nine miles south from Weymouth and directly opposite Petit Passage, Digby Neck.

During the last few years the gravel has been working around the outer end of the breakwater and forming a bar across the entrance to the loading berths. To prevent further movement of the gravel, the Department, during the past fiscal year, built an L or spur, 40 feet long and 24 feet wide, at the north-west corner of the breakwater.

COW BAY.

Cow Bay, Cape Breton County, is on the eastern coast of Cape Breton Island, about 18 miles north-east of Sydney Harbour. Owing to the extensive coal mines in its vicinity it is a place of considerable importance.

The bay is 2½ miles wide at its mouth, and being completely open to the Atlantic Ocean affords no safe anchorage during easterly gales.

A breakwater was built some years ago, on the north side of the bay, by Messrs. Archibald & Co., proprietors of the Gowrie mines, with some aid from the Government of Nova Scotia. It is 1,386 feet in length and was originally about 44 feet in width, with a depth at the outer end, at low water, of 20 feet. The area of the basin enclosed between it and the loading pier of the Gowrie mines, is about 17 acres, 10 acres of which had originally a depth of from 9 to 20 feet at low water. Spring tides rise 5 feet.

Extensive repairs have been made nearly every year, and the work has been strengthened by the addition of counterforts and outer face works, and by close-piling.

The breakwater now consists of an inner work extending from within 220 feet of the shore end to the outer end, with counterforts and connecting works on the seaward side, from within 580 feet of the shore end to the outer end. The outer and inner works are from 20 to 25 feet apart, they are connected at intervals by tie-walls and the spaces are filled with earth and stone ballast.

During the year 1890–91, the amount appropriated was expended in completing the close piling of the inner face from within 560 feet of the inner end to the outer end, in repairing the covering, and in close-piling and other repairs to the outer face works.

CRIBBIN'S POINT.

Cribbin's Point, Antigonish County, is on the west side of St. George's Bay, 8 miles south from Cape George, and 5 miles north from the entrance to Antigonish Harbour.

During the year 1890-91, a contract was entered into for the construction of a wharf to extend 300 feet in a southerly direction from the point, to 11 feet at extreme low water, with an approach 195 feet in length. The wharf is to be 20 feet in width, on top, over a distance of 120 feet from the inner end and 30 feet in width on top over the remaining 180 feet. The inner 50 feet is to be of stone, with stone retaining walls, and the outer 250 feet of close faced timber work, full ballasted and protected by sheathing and fenders. The approach is to consist partly of side cutting and embankment with stone retaining wall, and partly of through cutting 18 feet wide at the bottom with sides sloping 1½ to 1. Spring tides rise 4 feet.

At the close of the year the through cutting of the approach was nearly completed. There was in place 45 feet of the retaining wall of the approach averaging 8 feet in height, and 40 feet of side walls of the shore end of wharf averaging 4½ feet

in height, and there had been delivered a large quantity of timber, and nearly all the iron required.

DELAPS COVE.

Delaps Cove is situated on the south shore of the Bay of Fundy, in Annapolis County, and is about 12 miles to the eastward of Digby Gut.

The spar buoy and anchor which had been placed by the Department to the north-east of the outer end of the breakwater, having been carried out of its position by a heavy storm, was replaced during the present year, and the spar, which was broken, was renewed.

DIGBY.

The town of Digby is situated at the western end of the Annapolis Basin. It is the eastern terminus of the Western Counties Railway, and during the past year has been connected by rail with Annapolis and the general railway system of Nova Scotia.

Owing to the dilapidated state of the present Digby pier, &c., the limited amount of water at its site, it was considered advisable to construct a new pier in deep water to meet the increasing railway and steamboat traffic of the port, and at the last session of Parliament an appropriation of $40,000 was made for this purpose.

The site selected for the work is about ½ mile to the northward of the present pier and on the opposite side of the "Raquette," and a contract for its construction was signed in November last. Owing to difficulties the contractor has had to contend with, the actual construction has not yet been begun, but a considerable amount of materials for the work has been delivered near the site.

The proposed work is to be 780 feet long, 50 feet wide on top, and will extend into 16 feet of water at low tide. All its exposed faces are to be constructed of squared timber, birch being used for the lower portions to within 18 feet of the cap. The pier is intended to meet the requirements of both the railway and steamboats, and will be provided with inclined landings and other improvements, so that freight can be handled at all stages of the tide with as little delay as possible.

Pending the construction of the new pier, the steamers calling at Digby continue to make use of the old steamboat pier, and during the past fiscal year the Department repaired the inclined landing of this latter work. The repairs consisted of some additional ballast, new floor stringers, refastening some of the old covering and replacing the broken covering with new timber.

ECONOMY.

Economy, Colchester County, is situated on the north side of the Basin of Minas, 20 miles to the westward of Great Village and 20 miles east from the town of Parrsboro', the Bay of Fundy terminus of the Cumberland Coal and Railway Co.'s R.R.

A wharf to serve the purpose of a breakwater, 208 feet in length and 25 feet wide on top, was constructed by the Department during 1887-88.

During 1889-90, the pier was extended 100 feet, and an L 25 feet in length was placed on the eastern side of the outer end. The work on the extension, throughout, with the exception of cap-timbers, floor stringers, fenders and covering, is constructed of round logs. All faces are double fenders, two ballast floors were placed in it, and on them ballast to depths of 4 and 3 feet respectively has been placed. Six mooring posts, eight ring bolts and two ladders were also placed and secured.

The amount appropriated has been expended in the extension of the wharf a further distance of 100 feet, constructed in a similar manner as the work done in 1889-90. The total length of the work is now 408 feet, with a depth of 16 feet of water at its outer end at high water springs, which rise here 46 feet. Neaps rise 39 feet.

FOX ISLAND.

Fox Island, Halifax County, is situated on the Atlantic coast of Nova Scotia, about 15 miles to the eastward of Halifax, and lies about 800 feet distant from the mainland.

Until 1879 it was connected with the mainland by a shingle and gravel bar, which being bare at all times of tide was used as a road for carts, hauling water, supplies and stores to the island. Besides serving as a road, the beach with the island formed a harbour for fishing boats. During the early part of 1880, the sea broke through the beach, and these inroads continued until 1885, when it ceased to afford shelter and to serve as a means of communication with the mainland.

To restore its usefulness, during the year 1886-87, the Department constructed beach protection works, extending over the whole length of the beach, a distance of 935 feet. The work consisted of round timber cribwork, with a batter of 1 in 4 on the sides, 13 feet wide on top, and with a stone slope of 2 to 1 on each side, extending up to 2 feet below the top. The whole of the cribwork was filled in with stone up to the level of the top timbers.

Since its completion the beach made up on each side of the work up as high as the work itself, but during the gales of last autumn, the made up beach on the east side for a distance of 190 feet was washed away, and the ballast on the top of the work for the same distance and 2 feet in depth, and for a width of 5 feet, was washed out, and this ballast has been replaced.

FRENCH RIVER.

French River, Victoria County, is on that part of the east or Atlantic coast of Cape Breton Island known as the "North Shore," midway between the harbours of St. Ann's and South Ingonish.

During the year 1890-91 a contract was entered into for the construction of an isolated breakwater, 50 feet in length and 27 feet in width on top, to be placed in from 6 to 7 feet at extreme low water. Spring tides rise 5 feet.

Up to the 30th June nothing had been done, except in the way of procuring materials.

GEORGEVILLE.

Georgeville, Antigonish County is on the Northumberland Strait, 6½ miles south-west from Cape George, and distant by land from Arisaig on Northumberland Strait and McNair's Cove on St. George's Bay, 8 miles.

During the year 1890-91, a contract was entered into for the construction of a wharf 230 feet in length and 20 feet in width on top, with an L 20 feet by 20 feet to consist of an approach 110 feet in length of stone, with stone retaining walls, and an outer work of squared timber, close faced and fully ballasted.

At the close of the year 45 feet of the approach had been built, and there had been delivered a small quantity of the timber and nearly all the iron required for the outer work, as well as nearly all the stone for the remainder of the approach.

The depth at the outer end of the wharf at extreme low water will be 5 feet. Spring tides rise 4 feet.

GREAT VILLAGE.

Great Village, Colchester County, is situated on the north side of Cobequid Bay and on the Great Village River, about 1½ miles from its entrance into the Bay. It is distant about 15 miles north-west from Truro, the shire town of the county and the head of Cobequid Bay, and 3½ miles from Londonderry Station on the I. C. R.

For the accommodation of the inhabitants of the locality, during the last session of Parliament an apropriation was made for the construction of a public wharf immediately below the village, the proposed structure being 70 feet long and 70 feet wide, with a depth of 15 feet of water along its river face during spring tides, and a contract was entered into by the Department, on 19th January, 1891, for the construction of the wharf. At the end of the fiscal year the old wharf on the site had been taken down and a fair start made with the new work.

HAMPTON.

Hampton, or Chutes Cove, Annapolis County, is on the south side of the Bay of Fundy, about 25 miles east of Digby Gut.

In February, 1889, during a heavy freshet the brook which empties into the Bay immediately to the eastward of the breakwater tore away its banks and the gravel beach and threatened to undermine the breakwater.

During the past fiscal year a small sum was expended in repairing the damage, and in turning the brook into its original channel.

HARBOURVILLE.

Harbourville, King's County, is on the south shore of the Bay of Fundy, about 55 miles east of Digby Gut.

During the past fiscal year some small but necessary repairs were made to the breakwater. These repairs consist of replacing and fastening some 41 new pieces of sheathing on the seaward face of the breakwater, some slight repairs to the "break," and reballasting a portion of the work where the covering had worked loose, and securing this latter again in position.

IRISH COVE.

Irish Cove, Cape Breton County, is on the south-east shore of the Great Bras d'Or Lake, near the entrance to East Bay. The distance to the head of East Bay is 20 miles, to St. Peter's Canal about 22 miles and across the lake to Grand Narrows 10 miles.

During the year 1890-91 a part of the amount appropriated was expended in procuring material for, and in the partial construction of, a wharf extending 162 feet to 12 feet at the lowest lake level. The difference between low and high lake level is 15 inches.

The wharf will consist of a shore block 49 feet 6 inches by 20 feet, a central block 20 feet by 20 feet, and an outer block 57 feet 6 inches by 20 feet with an L 20 feet by 20 feet, with two openings of 17 feet 6 inches each.

JOGGINS BREAKWATER.

Joggins Harbour, Cumberland County, is situated on the south-eastern side of and near the head of the Chignecto Channel, the north-east arm of the Bay of Fundy. It is the terminus of the Joggins Railway and the shipping place for the coal from the Joggins Mines to points on the Bay of Fundy.

The works consist of a loading pier about 160 feet in length and 65 feet wide, and a breakwater 280 feet in length and 20 feet wide on top, running nearly parallel to the shore, to which it is connected by an approach 145 feet in length and from 16 to 20 feet in width.

The sheltered area inside of these works is about one acre in extent and can only be entered at three quarter flood. Tides rise here about 35 to 41 feet, and the flats dry at low water out to a distance of about a quarter of a mile outside of the breakwater.

During the fiscal year extensive repairs and renewals were made on the breakwater.

JORDAN BAY BREAKWATER.

Jordan Bay, Shelburne County, is on the Atlantic coast of Nova Scotia, about midway between Shelburne and Lockeport.

In 1875 a breakwater 550 feet long was built on the eastern side of the bay, about 6 miles from its mouth, to give shelter to vessels resorting here to load lumber, a considerable quantity of which is cut on the Jordan River which falls into the head of the bay.

Some slight repairs were made to the work during the past fiscal year; a portion of the plank covering and sheathing having been torn off during a heavy storm was replaced.

KENNINGTON COVE.

Kennington Cove, Cape Breton County, is on the north side of Gabarus Bay, about 5 miles to the westward of the entrance to Louisburg Harbour.

During the year 1890–91 the amount appropriated was expended in improving by the removal of rocks and boulders, the landing place for boats at White Point, one mile to the westward of the entrance to Louisburg Harbour.

LISMORE.

Lismore, Pictou County, is on the Northumberland Strait, 10 miles to the eastward of the entrance to Merigomish Harbour, and the same distance from Merigomish Station on the Eastern Extension of the Intercolonial Railway.

A wharf was commenced by the Department in 1886–87 and completed the following year. It is 200 feet in length and 20 feet wide, strongly constructed, full ballasted and close fendered at the outer end. The depth at extreme low water at the outer end is 1 foot 9 inches. Spring tides rise 4 feet 6 inches.

During the year 1890–91 material for a proposed extension 200 feet in length to 6 feet at extreme low water was procured, and 150 feet was built up to about 2 feet above extreme low water, and full ballasted.

LITTLE BROOK.

The Little Brook Wharf, Digby County, is situated on the southern shore of St. Mary's Bay, about 3 miles to the southward, and westward of Church Point.

During the past season $100 was expended in repairing the upper portions of the wharf which were considerably damaged by a very high tide in the autumn of 1890, a portion 20 feet square and 5 feet deep was rebuilt, and 100 tons of additional ballast placed in the work.

LOBSTER ROCKS, YARMOUTH HARBOUR.

The Lobster Rocks in Yarmouth harbour are on the western side of a sharp bend in the channel immediately below the steamboat wharf and in front of the marine railway.

Owing to the narrowness and crookedness of the channel these rocks have always been a source of danger to steamers and other vessels leaving the harbour on an ebb tide. Some years ago the inner portions of these rocks were covered with a cribwork block built at the expense of the local authorities.

It has several times been proposed to remove the outer portion of the rocks by blasting and dredging but, after careful surveys and examinations, the estimated cost was found to be so large that it was finally decided to build a second cribwork abutment a short distance outside the old one, so that it would be impossible for vessels to strike or ground upon them; and in August last an appropriation was made for this purpose.

The work was completed during the past fiscal year and has already proved of great service, on one occasion saving the new iron steamer "Boston" from serious injury.

The block is sunk in from 8 feet to 12 feet of water, at low tide, and is 22 feet square on top, its sides are built with a batter of 1 foot in 8 feet and the four sides sheathed with hardwood plank and the corners protected with heavy fenders and iron straps.

MABOU.

Mabou Harbour, Inverness County, is on the west coast of Cape Breton Island, 6 miles north-east from Port Hood.

The entrance was formerly at the southern extremity of a range of sand hills, by an intricate channel obstructed by a bar, over which there was a depth of only 4 feet at low water.

In 1870, a survey was made and a report submitted on the project of opening a new channel through the sand hills, at their northern extremity, and closing the existing channel.

The work was commenced in 1872. A pier on the south side of the new channel, 753 feet in length, was completed in 1876, and the same year the old channel was closed. Expenditures have been made nearly every year since 1876, in constructing a brush and stone dam on the south side near the outer end of the pier, constructing and repairing a breastwork on the north side, and since 1885, in constructing a work of brush and stone in shoal water on the south side of the channel extending 1,087 feet beyond the outer end of the pier.

The new channel is straight and in every way a great improvement on the former entrance, which is now closed by a sand bar from 900 to 1,000 feet in width. The depth at low water in the new channel, over the bar opposite the outer end of the brush and stonework, was, at the close of the year, about 6 feet. In the channel, from the outer end of the brush and stonework to the outer end of the pier, the depth varied from 8 to 12 feet, and opposite the pier where it is about 100 feet wide, from 12 to 15 feet, at low water. From the inner end of the pier there is a channel 4,000 feet in length, expanding into a fine basin 2½ miles long and from a quarter to half a mile wide inside the 10 feet lines, and having a depth of from 2½ to 4 fathoms over a large part of its area.

During a succession of gales in December last, a portion of the pier on the south side of the channel 280 feet in length (80 to 360 feet from the outer end) was destroyed. The breastwork on the north side of the channel was destroyed several years ago.

The amount appropriated for the year 1890–91 was expended in the construction of a brush and stone dam 250 feet in length and 10 feet in width, on the south side of the channel between the outer end of the pier and the sand hills, and in raising the brush and stone extension nearly to high water level from end to end.

At the commencement of the fiscal year, the "Canada" was working at this place alongside the breakwater and at the site of a proposed wharf, work being closed on 10th November, 1890, at which date 20,700 cubic yards of material had been removed.

MARGAREE.

Margaree Harbour, at the mouth of the Margaree River, Inverness County, is on the west coast of Cape Breton Island, about 30 miles north-east of Port Hood. It has a narrow and intricate channel through which the tides run at the rate of 4 knots, and its entrance is obstructed by a bar of shifting sand, over which there is at times a depth of only 5 feet at extreme low water. Spring tides rise 4 feet.

A pier constructed on the west side of the entrance to the harbour by the Provincial Government prior to Confederation, was repaired and extended by the Department in 1876 and again in 1879.

During the year 1890–91 a contract entered into in 1889 for repairs to the pier, and for an extension 200 feet in length, was completed, and some repairs to the old work, not included in the contract, were effected. The extension is 20 feet in width on top over a distance of 170 feet and 25 feet over the remaining 30 feet. It is of round timber, full ballasted and close fendered.

MARGARETVILLE.

Margaretville, Annapolis County, is on the south shore of the Bay of Fundy, about 42 miles east of Digby Gut.

The breakwater, which was built by the inhabitants many years ago, was badly damaged by storm in December, 1885. The work was repaired by the Department in 1887–88, at which time a section 150 feet long of the inshore end was rebuilt.

In October last a succession of heavy gales tore away the beach near the outer end of the work and having exposed the decayed and worm-eaten foundation soon made a breach directly through the breakwater.

An appropriation of $400 was immediately made to save the work from further damage during the coming winter's storms, both ends of the breach were bulkheaded up, some of the wreckage was removed and all timber that was fit for further building operations was saved and piled above the reach of tide water.

MERIGOMISH.

Merigomish Harbour, Pictou County, is on the Northumberland Strait, 10 miles to the eastward of the entrance of Pictou Harbour. The depth at low water over the bar at the entrance is 14 feet. Spring tides rise 5¼ feet, neaps, 3¼ feet.

In 1880, a wharf was built by the Department in a cove to the eastward of Hard Wood Point, and about 1 mile from Merigomish Station on the Eastern Extension of the Intercolonial Railway. It is 154 feet in length and 20 feet in width, on flats dry at extreme low water to the outer end and, consists of an approach 70 feet in length, of earth with stone side walls, and 84 feet of block and span work with covering.

During the year 1890–91, the covering over 65 feet of the outer end of the wharf was renewed.

METEGHAN RIVER.

Meteghan River falls into St. Mary's Bay about 2 miles north-east of Meteghan Cove and 9 miles south of Church Point.

The harbour is formed by two breakwaters, one on either side of the river mouth, both of which were built many years ago by the Provincial Government. These works have been extensively repaired and otherwise improved by the Department on several occasions.

During the past fiscal year an expenditure was made by the Department in the removal of some rocks from the channel which interfered with the keels of vessels when lying at the wharf, and also in effecting some slight repairs to both breakwaters.

MOIDART.

Moidart, Antigonish County, is on the Northumberland Strait, 3 miles west from Arisaig.

In 1887–88 a landing place for boats was made by levelling off the top of a large rock and constructing a narrow approach 73 feet in length of stone, with cribwork top. The approach was destroyed during a succession of northerly gales in October, 1890.

The remains of the old work have been removed and a new approach 75 feet in length, 16 feet in width and 6 feet in average height, constructed of round timber, full ballasted, covered and fendered.

The depth at extreme low water at the east side of the rock is 2 feet. Spring tides rise 5 feet.

M'NAIR'S COVE.

McNair's Cove, Antigonish County, is on the west side of St. George's Bay, about 1½ miles south of Cape George.

A contract entered into in 1872 for the construction of a breakwater to extend 400 feet from a point on the north side of the cove, was completed the following year. The work was 20 feet in width over a distance of 200 feet from the shore end, 30 feet over a further distance of 160 feet and 40 over the remaining 40 feet. The depth at the outer end at extreme low water was about 16 feet. Spring tides rise 4 feet. Repairs were made from time to time till 1879 when the work was carried away to within 100 feet of the shore end down to from 6 to 3 feet below low water. During the summer of 1883, 70 feet of the work was rebuilt, and during the winter of 1883-84 it was extended 94 feet. In April, 1884, the 94 feet extension was badly damaged by drift ice and subsequently carried away.

A contract entered into in 1887 for the reconstruction of 160 feet of the work, was completed in 1888. The new work is 32 feet in width on top and 42 feet at the bottom and has a sloping face from one foot above low water on the north side and the outer end. It is strongly constructed and founded on a bottom prepared by removing the remains of the former structure down to 12 feet below low water at the outer end, and to 6 feet at the inner end. At the outer end there is now from 9 to 12 feet at extreme low water, and from 7 to 9 feet over a distance of 100 feet out. Access to its sheltered side is obstructed by a deposit of ballast and gravel, over which there is a depth of from 5 to 4 feet at the outer to 2 feet at the inner end.

During the year 1890-91 the amount authorized was expended in renewing the covering, floor stringers and cap timbers of the work over a distance of about 100 feet from the inner end, and in procuring 125 pieces of piling.

OGILVIE'S PIER.

Ogilvie's Pier is situated on the southern shore of the Bay of Fundy, about 3 miles west of Harbourville and 52 miles east of Digby Gut.

The inshore end of the work is old and much worm-eaten and a hole had been made by the sea into the interior of the work. The gravel was removed to a depth of 3 feet, new timbers were inserted where practicable and the interior of the cribwork filled with brush and large stone ballast.

PARRSBORO' PIER.

Partridge Island or Parrsboro' Pier, Cumberland County, is situated on the north side of the Basin of Minas, about a mile to the westward of the mouth of the Partridge Island River and about 2 miles distant from the town of Parrsboro', the terminus of the Cumberland Railway and Coal Company's Railway.

The pier which is 500 feet in length, being directly on the seashore, has the benefit of the full extent of the tides, and as vessels can approach it and leave it at half-tide, it is the principal point of communication between Cumberland County and the counties of King's and Hants, on the south shore of the basin, and the steamers of the Basin of Minas, and St. John and Basin of Minas routes call there regularly during the season.

During a heavy south-easterly gale on 1st of October, 1889, the top of the outer end of the pier for a distance of 30 feet, and 4 feet in depth, was wrecked, the face timbers having been knocked out of their places, the ballast washed out, and a portion of the top flooring removed.

During last spring a small sum was expended in placing and securing some long piles on the inner face of the outer end, to fender off the steamers which during high water springs were in danger of going on the wrecked portion of the pier.

Spring tides rise 41 feet, neap tides rise 34 feet.

PICTOU.

Pictou Harbour is pronounced by Admiral Bayfield to be in every respect the finest on the southern shore of the gulf eastward of Gaspé. It is situated at the head of a bay which is $1\frac{3}{4}$ miles wide and $1\frac{1}{2}$ miles deep. The mouth of the harbour is over one-quarter of a mile wide, and there is a depth of from 30 to 40 feet in the channel as far as the town, which stands on the north side 2 miles distant from the lighthouse. The flats, however, extend some distance beyond the ends of the wharves. On the south side is the terminus of the Pictou branch of the Intercolonial Railway, the principal point of connection between Nova Scotia and Prince Edward Island.

Opposite the town the harbour divides into three large arms called the East, Middle and West Rivers. The last two may be navigated without much difficulty for two or three miles above their confluence, but higher up they become divided into several small channels obstructed by oyster beds.

During the year the dredges "St. Lawrence" and "Canada" did some work on the channel leading to the market wharf, while the latter did three days' work deep-

ening along Dwyer's wharf. Full details of this work are given under the various dredges at the end of this report.

PORT GEORGE.

Port George, Annapolis County, is 37 miles east of Digby Gut on the south shore of the Bay of Fundy.

The harbour is dry at low water and is formed by a western breakwater and an eastern pier, both of which works were built by the local authorities.

In 1875, the Department expended the sum of $7,000 in repairing and refacing the breakwater, which was much decayed and worm-eaten.

In the autumn of 1888, the outer end of the breakwater was destroyed by a severe storm, the outside 165 feet being swept away, and the adjoining 30 feet being much shattered and injured.

During the spring of 1890 a contract was entered into for rebuilding the destroyed section, and subsequently a second contract was made for removing and rebuilding the 30 feet or damaged section.

During the past fiscal year these contracts have been completed. The work is built of round timber, and all the cribs filled solidly with stone ballast; the seaward face has a double set of face timbers, and is sheathed outside of them with 7 inch sheathing. The work is 33 feet wide on top, and there is a break of square timber 7 feet high and heavily kneed, extending the entire length of the seaward side.

PORT HOOD.

Port Hood, the shire town of the County of Inverness, is on the west coast of Cape Breton Island, 20 miles north of the northern entrance to the Strait of Canso.

The harbour was formerly a secure and natural one; Smith's Island, which is two miles in length, and forms its western side, having been connected with the main land by a range of sand hills. In 1839, the sea made a breach in this protection; the opening, at first narrow, was enlarged by the tidal currents with increasing rapidity, until it was swept entirely away and its site covered by 15 feet of water. The harbour is now unsafe during north-easterly gales, except in a small cove on the east side of Smith's Island.

A pier 550 feet long and 24 feet wide, with an L 100 feet by 25 feet, was built on the eastern shore of the harbour in 1865-66 by the Provincial Government. When first taken in charge of by the Department it was in need of repair. Owing to its exposed position the pier has been frequently damaged by ice and storms and the damage done made good.

During this fiscal year the amount authorized was expended during the autumn of 1890 in cutting down, rebuilding and close-piling the outer face of the 71 foot block, and in slight repairs to the covering and to the stone slope on the north side. The following spring the work was considerably damaged by ice. Repairs were effected by reconstructing from low water, and close-piling 80 feet of the north face; reconstructing the upper portion of the work, including the renewal of the covering, floor stringers, upper cross ties and about 2 feet of ballast from the inner to the outer end; reconstructing 40 feet of the south face near the inner end, and in replacing some pieces of covering and cap timbers of the L.

The depth at extreme low water at the outer face of the 71 foot block, varies from 15 at the north to 9 feet at the south end. Spring tides rise 4 feet.

PORT MAITLAND.

Port Maitland, formerly called Green Cove, Yarmouth County, is about 13 miles north of the town of Yarmouth.

The harbour, which is dry at low water, is formed by a western breakwater and an eastern loading pier. It is an important fishing station, and besides the number of small boats and vessels employed, considerable capital is invested in the fitting out and management of "traps" or deep water weirs.

In the winter of 1887-88 the breakwater was seriously damaged by a succession of westerly storms and a breach of 86 feet in length was made directly through the work.

On the 24th June, 1890, a contract was made for rebuilding the destroyed section and repairing the other parts of the work.

The wreckage of the old work was removed down to its foundation and the breach filled in and rebuilt entirely with new timber. The balance of the seaward face—that is to say 83 feet in length outside the new work, and 100 feet between it and the shore—was close-piled, the entire top (including the cap, covering. floor stringers, the first set of cross ties and the "break" of these two sections was rebuilt, and new fenders were fitted to the inside face.

PORT LA TOUR CANAL.

Port LaTour Canal, Shelburne County, commonly called the "Haulover," is a cutting or boat canal about 1,250 feet long, 12 feet wide and 6 feet deep, across the isthmus which separates Port LaTour from Negro Harbour.

This cutting was made many years ago by the local authorities to enable fishermen and others to pass from one harbour to the other, effecting a saving in distance of from 7 to 10 miles and avoiding the dangerous passage around Blanche Point and its neighbouring shoals and ledges. The isthmus is low and flat, and the beaches at both ends are hard and stony, but the middle is a soft marsh.

The work having been poorly constructed in the beginning, and no repairs having been made for some years, the whole work fell into a dilapidated condition and become almost impassable for boats even at high water.

At the last session of Parliament an appropriation was made for repairing the work and during the past fiscal year the canal has practically been rebuilt. It has been widened, deepened, and the walls on both sides for the entire length of the work rebuilt. The canal is now 12 feet 6 inches wide in the clear at the bottom, and 14 feet 6 inches on top and at ordinary spring tides there is 4 feet 6 inches of water for the total length of the canal, and it is available for the passage of fishing boats from 2 hours flood to 4 hours ebb, or 8 hours out of each 12.

At the Port LaTour or western end cribwork guide piers have been built 75 feet long, 10 feet wide, and 6 feet 6 inches high, these are built of round timber with a substantial ballast floor over the lower tier of timber and fitted to the top with ballast. The Negro Harbour or eastern piers are constructed in a like manner and are 87 feet long. The centre portion of the canal which is through the marsh has its walls constructed of ballasted cribwork and the ends which are through harder material have stone walls. The ebb and flow of tide makes a strong current through the canal and scours the bottom clear of mud and silt.

SOUTH GUT.

South Gut, Victoria County, is the local name of the south arm at the head of St. Ann's Harbour The latter is a fine basin, 7 miles in length, the entrance to which is a few miles to the westward of the principal entrance to the Great Bras d'Or Lake.

During the year 1890-91, the construction of a wharf extending 198 feet, to 6 feet at extreme low, or 12 feet at extreme high water, was commenced. It consists of a shore abutment 48 feet long and 20 feet wide, and of 3 central blocks each 20 feet by 20 feet, and an outer block 20 feet by 40 feet with openings of 17 feet 6 inches.

At the close of the fiscal year when operations were suspended, the work was within 3 or 4 feet of required height, and all the material required to complete it had been procured.

SOUTH INGONISH.

The harbour of South Ingonish, Victoria County, is on the east coast of Cape Breton Island, midway between Sydney Harbour and Cape North.

On the completion in 1876 of works undertaken to improve the entrance to the harbour, there was left a channel 200 feet in width with a depth at extreme low

water of not less than 14 feet, and with a protection work on the north side 560 feet in length. The protection work has since been destroyed, and the channel has narrowed and shoaled to some extent, but it is still nowhere less than 100 feet in width, and has a depth of not less than 13 feet 6 inches at extreme low water. Spring tides rise 5 feet.

With the amount appropriated for the fiscal year 1890-91, material to be used in the construction of a wharf 53 feet in length and 30 feet in width has been procured, but pending the selection of a suitable location, work of construction was not commenced.

STONY ISLAND.

Stony Island is a prosperous fishing station on the east side of Cape Sable Island, Shelburne County, about midway between Cape Sable and North-East Point.

At the last session of Parliament an appropriation was made for the construction of a breakwater for the protection of fishing boats, and in the autumn of 1890 a contract was entered into for the construction of the work.

As there is no timber on Cape Sable Island the materials were obtained on the mainland during the winter months and building operations were begun in the spring as soon as the timber could be rafted to the site.

The proposed breakwater when completed will be 300 feet long and 24 feet wide on top; its inner end for a distance of 125 feet will be constructed of cribwork and the remaining or outer portion of pile bents. The latter section will be protected on its seaward side by a row of close-piling, their ends being left 4 feet above the top of the work to act as a "break" to prevent the sea from coming over and the cribwork section will have a "break" of squared timber of a similar height.

SUMMERVILLE WHARF.

Summerville, Hants County, is situated on the eastern side of the Avon River, about midway between the town of Windsor, the shire town of the county, and the mouth of the river where it empties into the Basin of Minas.

The wharf was constructed many years ago by the inhabitants, aided by the Local Government, and with the exception of some trifling repairs, no work had been placed upon it until 1887. At that time the structure had been abandoned as useless for the want of repairs, and Messrs. Churchill of Hantsport, intending to place a ferry steamer on the route between Summerville, Hantsport and Windsor, repaired the broken end and extended it a distance of 36 feet at their own expense.

During the years 1889–90 the Department commenced the reconstruction of the top of the work and in strengthening the sides, by removing the old top to a depth of from 3 to 5 feet and in rebuilding it to a depth of from 5 to 7 feet, and by placing fenders along the faces 5 feet apart, and during the past year the repairs commenced in 1889–90 were completed and the wharf is now in first-class condition.

The total length of the wharf is 300 feet, varying in width from 25 to 31 feet, and in height from 4 to 23 feet, the latter being the height at the outer end.

TATAMAGOUCHE.

The Tatamagouche River, Colchester County, empties into the south-west corner of Tatamagouche Bay, Straits of Northumberland.

Between the 4th August and 12th September, 1890, the "Geo. McKenzie" was engaged in dredging at different points in the harbour, 7,755 cubic yards of mud and clay being removed.

TRACADIE.

Big Tracadie Harbour, Antigonish County, is situated on the southern shore of St. George's Bay, about 4 miles to E. S. E. from Pomquet Island.

It is an extensive sheet of water having a depth of from 10 to 14 feet over a large part of its area, the entrance channel however is narrow and crooked.

By the 24th July, 1890, the dredge "Geo. McKenzie" completed a channel 750 feet in length, 200 feet wide at the river end and 170 feet at the outer, with a depth of 7 feet at low water springs.

TIDNISH.

The Tidnish River enters Bay Verte on the southern side and near its head. It is the largest stream entering the bay, and for a short distance from the mouth it forms the boundary line between the Counties of Westmoreland, in New Brunswick, and Cumberland, in Nova Scotia, the western shore being in the former and the eastern in the latter province.

Tidnish Head, about 1½ miles to the eastward of the mouth of the river, is the eastern terminus of the Chignecto Marine Railway, now under construction.

On the 4th day of July, 1890, a contract was entered into for the construction of a public wharf on the south-eastern side of, and near the mouth of the river in Cumberland County, and it was satisfactorily completed on the 13th May.

The wharf is 220 feet in length and 20 feet wide, with an L on the upper side of its outer end, 20 feet long by 20 feet wide. It is built of round timber, thoroughly ballasted and covered with plank, and its sides and end are well protected by fenders and fender piles.

VICTORIA.

Victoria pier is situated on the Bay of Fundy shore of King's County, and is distant about 2 miles east of Morden, and about midway between this latter and Ogilvie's pier.

During the past fiscal year some repairs were made to the covering, a portion of the structure was ballasted and two additional mooring posts placed in convenient positions.

WALTON.

Walton Harbour, Hants County, is the outlet of the LaTete River, and is situated on the southern shore of the Basin of Minas, Bay of Fundy, about 14 miles to the westward of Noel Bay, and 14 miles to the north-eastward of Cheverie at the mouth of the Avon River.

A contract was entered into in December, 1890, for the construction of a breakwater on the eastern side of, and near the mouth of the harbour, 250 feet long and 20 feet wide, sloping 1 in 8 on the inside, and 1 in 2 on the outside, for the purpose of forming a harbour inside.

The work has been carried on in a very vigorous manner, and at the end of the fiscal year the bottom of the outer end for a distance of 130 feet inward had been built up to an average height of 6 feet and thoroughly ballasted.

WEYMOUTH.

Weymouth, Digby County, is situated at the entrance of the Sissiboo River, which empties into St. Mary's Bay, and is distant 20 miles from Digby.

The "St. Lawrence," having been ordered for work in the River Sissiboo at Weymouth, left Pointe du Chêne on 25th October. The passage was long and stormy and the season late, and when Weymouth was reached and the dredge got to work it was found impracticable to continue owing to the hard nature of the bottom.

WRECK COVE.

Wreck Cove, Victoria County, is on that part of the east or Atlantic coast of Cape Breton Island known as the "North Shore," between the Harbours of St. Ann's and South Ingonish, and distant from the former 18 and from the latter 12 miles.

A former landing place for boats, near the mouth of Wreck Cove Brook, was rendered unsafe by a divergence of the stream and the opening of a second outlet.

During the year 1890–91 the amount appropriated, together with $200 paid by the locality, was expended in the construction of a dam of brush and stone 675 feet

in length, 16 feet in average width, and 6 feet in average height, designed to confine the stream to its former channel and thus restore the landing place to its original condition.

NEW BRUNSWICK.

ANDERSON'S HOLLOW.

Anderson's Hollow, Albert County, is situated on the northern shore of the Chignecto Channel or north-eastern arm of the Bay of Fundy and on the eastern side of Salisbury Bay lying between Cape Enragé and Matthew's Head.

The formation of a harbour was first commenced by the Department in 1879–80, an isolated block 100 feet in length and 25 feet in width being constructed at a distance of 500 feet from the shore and some 300 feet from extreme low water mark, additions being made in 1883–84–85–86, and 1887–88, of 90, 100 and 260 feet respectively, forming a connection with the shore, to which also the Local Government in 1888 built a public road and approach, the Marine Department also erecting and maintaining a light on its outer end.

During the fiscal year repairs were made to a portion of "break" damaged by a severe storm that occurred in early part of November, 1890.

CAPE TORMENTINE.

Cape Tormentine is on the New Brunswick coast of Northumberland Strait, and is the nearest point to Prince Edward Island, from which it is distant about 9 miles.

At the point of the Cape an artifical harbour is in course of construction. The work consists of a straight pier 2,500 feet in length with a head and return, each 400 feet in length, enclosing a basin a little over 4 acres in extent, having an extreme depth of 15 feet at low water, or 22 feet 8 inches at high water spring tides.

For a distance of 1,300 feet from the shore, the pier is composed of stone embankment 20 feet wide on top with slopes of 2 to 1; the remaining 1,200 feet is close-faced cribwork 30 feet wide. The head and return will be of similar cribwork, but the width from the bottom up to low water will be 40 feet, decreasing to 30 feet at the finished level of the work and presenting a sloping face sheathed with hardwood to the south and east.

During the fiscal year the substructure of the cribwork of the pier has been extended 700 feet to a point 2,400 feet from high water mark, while a length of 860 feet of superstructure has been nearly completed; a stone slope has also been carried out 580 feet in length on the north side and 330 feet on the south side of the work, while the slopes of the stone embankment were brought around crib No. 1.

At the close of the fiscal year the work was still in progress.

CARAQUET.

Bridgetown, Gloucester County, is the name of the railway station situated at the upper or western end of Caraquet Harbour and Settlement, and is 2 miles east of the bridge crossing the Caraquet River and 6 miles west of existing public wharf near Caraquet Church.

Directly off Bridgetown extensive oyster beds are situated, causing this portion of Caraquet Harbour to be known as the "Oyster Grounds."

To provide shelter and a landing place for boats, a contract was entered into 25th October, 1890, for the construction of a work in all 350 feet long, consisting of a shore approach 160 feet long, four blocks each 15 by 15 feet, 5 spans or openings of 20 feet each, and an outer block 30 by 30 feet. The shore approach and the several blocks to be constructed of round logs open cribwork, the spaces or spans between being each spanned with four 10 by 12 stringers, the blocks and approach to be fendered on the sides and full ballasted, the whole being covered with 3-inch planking.

The timber required having been got out during the winter, construction was commenced about the 1st June, and by the end of the fiscal year the work was well under way; all of the blocks as well as the approach being commenced and built up to about one-third of height required.

CAMPBELLTON.

Campbellton, Restigouche County, is situated on the southern side of the Restigouche River, about 15 miles west of Dalhousie, the shire town and where the river enters the Baie des Chaleurs; it is an important station on the line of the Intercolonial, as well as a thriving and growing town, latterly doing an extensive business in the shipment of lumber.

Campbellton is practically at the head of navigation although the tide flows up the river some 9 miles further, but shoals and the intricacy of the channel prevents the passage of vessels of any size, except on the "Traverse" about 4 miles below Campbellton where the depth is only about 12½ feet, a depth of 18 feet at low water springs can be carried up to the town, which, with the rise of 10½ feet at springs and 7 feet at neaps, affords a good depth of water for the class of vessels engaged in trading to and from the port, these being generally barques of from 400 to 900 tons. The greater number of these arrive in ballast, the disposal of which has been a matter of serious inconvenience, owing to there being no convenient place of deposit. To remedy this a contract was entered into on the 23rd April, 1889, for the construction of a "ballast wharf," the structure being an isolated block, 140 feet in length by 35 feet in width on top and having a minimum depth of 18 feet at low water spring tides; this work which had been in progress during the previous year, was completed on the 30th of August, 1890.

The work done during the fiscal year consisted in putting on covering, constructing ballast traps and ladders, some little ballasting and further bolting of fenders.

To complete the landing and approach required for the accommodation of the ferry steamer plying between Campbellton and Cross Point (directly opposite), on the Quebec shore of river, a contract was entered into 31st March, 1891, for the construction of the work to extend 250 feet in length from the outer end of the work built by the Department by day's labour in 1889-90 at site selected and provided by the Campbellton Town Council. The work contracted for consists of four cribwork blocks, respectively 50, 20, 20 and 100 feet long and three spans or openings of 20 feet each, the latter spanned by four 10 by 12 inch stringers, the work being covered with 4 inch planking. The first three blocks and all the spans are to be 20 feet in width from outside to outside of cap timber, the fourth or outer block for a distance of 40 feet, to be 30 feet wide, while its remaining length or that portion of it forming the incline will be 20 feet in width.

At the close of the fiscal year, most of the materials required had been provided, and construction would shortly commence.

EDGETT'S LANDING.

Edgett's Landing, Albert County, is situated on the west side of the Petitcodiac River, about 10 miles from its mouth, and two miles south of the Village of Hillsboro', a railway and telegraph station, and also business centre of the county.

To facilitate the discharge of ballast from vessels, a contract was entered into, 15th of January, 1889, for the construction of a "ballast wharf" at Edgett's Landing, on the site where many years ago the Government of New Brunswick had constructed what was known as the "Steamboat Wharf." The wharf contracted for is 400 feet in length, and reaching to about 150 feet of low water mark, having at its outer end 30 feet of water at high water spring tides which rise 45 feet, neaps 38 feet.

Owing to the failure of the contractors to prosecute the work, in September, 1889, the contract was cancelled by Order in Council, and materials that had been supplied taken charge of by the Department, the construction of the work being resumed under direct charge on the 20th May, 1890, and continued until end of November, at which date the outer 100 feet was built up to the proposed height, and partly fendered; the next section, 100 feet long by 30 feet wide, composed of round logs, open cribwork, to within 4 feet of required height, while of the remaining

length of proposed cribwork, 150 feet long and 20 feet wide, one-half has been built up to within 4 feet of the top.

GRAY'S ISLAND.

Gray's Island, Albert County, is situated on the west side of the Petitcodiac River, two miles north of the village of Hillsboro'.

A contract was entered into 27th October, 1890, for the construction of a breakwater, for the protection of shipping, 300 feet long over all, to extend from the shore a short distance above the site of the wharves. The first 100 feet or inner end of the work is merely "clay dyking," 5 feet wide on top sloping 1 to 1 on the sides. The next 100 feet outwards is of round logs, open cribwork, 15 feet wide on top, and sloping 1 in 4 on the sides; the next 50 feet to have its upper 30 feet similar to last described, excepting that the northern or upper side shall have the face longitudinals of square timber, and face close sheathed with spruce spars, flatted to 6 inches in thickness, the bottom being built plumb, and its northern or upper side protected by close-piling. The outer 50 feet is 25 feet wide on top, and for its upper 30 feet has a slope of 1 in 12 on the end, 1 in 4 on north side, and 1 in 2 on the southern or lower side, the bottom being built plumb, and having both sides and end protected by close-piling, and the upper portion of the work by close-sheathing of spruce and hardwood. Materials having been procured during the winter, delivery of timber was commenced on the opening of navigation, and construction began about the latter part of May, and at the close of the fiscal year good progress had been made.

KINGSTON.

Kingston, Kent County, is situated on the Richibucto River, 3 miles south of Richibucto, the shire town, and 6 miles from the mouth of the river which enters the Straits of Northumberland.

The river above Kingston being poorly provided with shipping facilities, a contract was entered into in May, 1890, for the construction of a wharf on the upper side of the Kingston bridge, to provide additional accommodation and a means of warping vessels through the "draw." The proposed work is to be 200 feet long and 35 feet wide on top, the ends and outer or north face being built close faced of square timber, and the inner or south side open faced, both sides and ends to have a slope of 1 in 18. It will be connected with the public road bridge by an approach 63 feet long (measured along its centre) and 20 feet wide, to be built of round logs, open cribwork, ballasted, with floor stringers and planked over.

Materials for the wharf were procured during the winter and construction commenced early in the spring, but the work has been much delayed owing to a stranded schooner at the inner end of the site of the work. At the close of the fiscal year the outer 100 feet was two-thirds completed and the building of the approach commenced.

NEGRO POINT BREAKWATER.

St. John Harbour, on the north side of the Bay of Fundy, is the estuary of the River St. John, and lies at the head of a small bay, the distance between "Red Head" and "Negro Town Point" at the eastern and western sides of the mouth being about 2½ miles. Partridge Island, which lies a little more than a half mile outside of the line of points named, divides the entrance of the harbour into two channels. During south-easterly winds the sea is broken by Inner Mispec Point (which bears south by west two miles from Red Head), and by the shoal water between Red Head and the main or eastern channel. South-westerly winds throw in a heavy sea through the western channel, which rendered it difficult for vessels to enter the harbour, as they were in danger of being driven on to the "Ford Sound," on the eastern side of the main channel.

During 1874–75 a thorough survey of the harbour was made by the engineers of the Department, and in the spring of 1875 a breakwater 2,250 feet long, to partially close the western channel, was begun, and in September, 1877, completed.

Injury having been done to portions of the slopes, top and outer end of the work by storms, a contract was entered into 19th January, 1891, for supplying a quantity of stone for its repair, delivery of which was in progress; by end of fiscal year, about 1,000 cubic yards having been delivered and placed at the most exposed parts of the work.

OROMOCTO SHOALS.

The obstructions known as the "Oromocto Shoals" are situated on the St. John River, about 10 miles below Fredericton, and at low stages of the water in the river have always proved serious to navigation. At this point the river widens, separating into three channels divided by Oromocto and Thatch Islands, the navigable channel being the central one between the islands, although not so wide as that on the eastern side of Oromocto Island, while the one west of Thatch Island is but small. This latter in 1877-78-79-80-81 was closed by a "Shear Dam." 2,200 feet in length, extending from the "Lincoln Shore" to the head of the islands in order to increase the current and prevent sediment being deposited on the "Shoals."

Owing to natural decay of the wood, and injury received from drift logs, ice, &c., many portions of the covering of the top and slope had been damaged as well as other portions of the work, and during the past fiscal year, a length of 627 feet of the slopes and 780 feet in length of the top have been replanked, and general repairs effected.

POINTE DU CHÊNE (SHEDIAC).

Pointe du Chêne is on the south-east side of the entrance to Shediac Harbour, and is the eastern terminus of the New Brunswick division of the Intercolonial Railway.

The dredge "St. Lawrence" operated in the harbour of Pointe du Chêne from 27th July to 24th October, 1890, giving a depth of 16 feet at low tide from outside the "spit" to the wharf, as well as making a basin 500 feet long by 150 feet wide at the western front of the railway wharf.

RICHIBUCTO.

Richibucto Harbour, Kent County, is situated on the south-west shore of the Gulf of St. Lawrence, about 40 miles north from Pointe du Chêne (Shediac Harbour) the eastern terminus of the Intercolonial Railway.

The work done during the present fiscal year consisted in putting on additional walings to a lenpth of some 300 feet of beach protection, and filling in ballast where settlement had taken place, and in filling with brush and ballast two portions of the breakwater proper, and extending the beach protection a distance of 140 feet.

The "St. Lawrence" arrived at this place on the 12th June, 1891, and at the close of the fiscal year was engaged in improving the Albion or Middle Channel.

RIVER KENNEBECASIS.

River Kennebecasis takes its rise near the sources of the Petitcodiac and after a south-west course of about 20 miles enters the St. John through Kennebecasis Bay.

At the commencement of the fiscal year the "New Dominion" was engaged in deepening and straightening the channel at Perry's Point till the 13th September, when work was begun at Lamb's Point above the bridge, where the dredge remained until 11th November.

On the 16th May, 1891, work was begun at Hampton in deepening the channel to 8 feet; but the water falling too low for the dredge to work it was again taken to Lamb's Point where it was operating at the close of the fiscal year.

RIVER ST. JOHN.

The St. John is the largest river in the Maritime Provinces, having a length of about 500 miles; it takes its rise in the State of Maine near the source of the Penobscot

and Connecticut Rivers, and falls into the Bay of Fundy at the harbour and city of St. John. Its length in New Brunswick may be divided into three sections: the first, 75 miles in length, between the mouth of the St. Francis (where the river first touches Canadian territory) and the "Grand Falls" (to within 2 miles of which latter point it forms the boundary line between Maine and New Brunswick.) The second, 140 miles in length, between "Grand Falls" and Fredericton, and the third, 80 miles in length, between Fredericton and St. John. The first section is navigated only by tow boats, though at one time a small steamer plied on it occasionally. The second is navigable by steamers of light draft during high water in spring and fall, and generally by tow boats during open water, the rapidity of the current preventing the employment of sailing vessels beyond "Spring Hill," 6 miles above Fredericton. The third section (over all of which the influence of the tide is slightly felt) is navigable for steamers and sailing vessels drawing not more than 10 feet.

During the fiscal year, for the improvement of the navigation of the river on the portions above Fredericton, the following work was performed: At the "Grand Pass" at foot of (Sugar Island) 7 miles above Fredericton and "Bear Island Bar" 25 miles above, the channel was deepened by use of scrapers, and boulders were removed.

At "Meductic Falls," "Belvisor's Bar" and "Howe's Point," 40 to 50 miles above Fredericton, the channel was deepened by the use of scrapers, and dangerous rocky ledges were blasted, in addition to which a number of large boulders were removed from the channel. At Grand Falls, a small amount was expended in repairing the breakwater or shear dam built many years ago.

The tow paths between Grand Falls and the St. Francis were repaired, while on the Tobique River, a tributary of the St. John, boulders, rocky ledges, &c., were removed.

SHIPPEGAN.

Shippegan Harbour, Gloucester County, is situated near the entrance of the Baie des Chaleurs, about 60 miles east of Bathurst.

At the southern end of Shippegan Harbour connection is made with the Gulf of St. Lawrence by "Shippegan Gully," a shoal and difficult channel formerly used during fine weather by the smaller fishing boats and vessels of very light draft.

By the use of the "gully" a saving in distance is made of from 25 to 40 miles for the fishermen going or returning to their homes from the fishing grounds situated off this part of the shore, while the harbour is also a most desirable shelter during storms, being perfectly protected from all winds and largely used by all of the fishing vessels of the extensive fishing establishments of Caraquet and other parts of the south shore of the bay.

To make the "gully" available for vessels of a larger class and permit of it being entered at all time of tide or during stormy weather, the Department in 1875 commenced the construction of a breakwater to protect the entrance, and a "dam" to close an opening known as the "east gully." Difficulty was had with the contractors, who suspended operations at the close of the summer of 1876, and the work was re-let in December, 1877, operations being resumed April, 1878, but the second contractors, about the end of July, stated their inability to proceed further with the work, and it was taken over by the Department.

At this time the "dam" was completed, about 900 feet of the breakwater was raised to its proper height and a further length of 500 feet partly built.

In October, 1879, a storm occurred during which the tide rose much higher than before known, seriously injured the "dam," while the unfinished outer 500 feet of the breakwater was completely destroyed and the inner portion much damaged. In 1880-81 the dam was repaired, raised and strengthened by piles driven 10 feet apart, connected by caps and walings. During 1883 portions of it that had again settled were raised where deemed unsafe, and an extension of 120 feet added to the remains of the breakwater, a gap that had been made being closed as well, and other portions of the structure raised.

General repairs were again made in 1884-85, when 50 feet of the outer end was close-piled, the "dam" at the time being raised where settlement had taken place. Further close-piling and some general repairs of the work were also done in 1886-87, while during 1888-89 a length of 60 feet which had been seriously damaged the previous winter was reconstructed.

In November, 1889, a contract was entered into for an additional block of 50 ft. at the end of the eastern or existing breakwater, and the construction of a breakwater to extend 1,100 feet in a southerly direction from the beach west of the "gully."

Materials for the works were got out during the winter of 1890 and work commenced in the spring of that year, since which it has been actively carried on so that at the close of the fiscal year, 30th June, 1891, it was well advanced towards completion.

TYNEMOUTH CREEK.

Tynemouth Creek, St. John County, empties into the northern side of the Bay of Fundy, about 25 miles to the eastward of the harbour and city of St. John.

At its mouth the creek is contracted by a sea wall of coarse gravel extending from the western side, enclosing extensive flats having over them a good depth of water (10 to 15 feet) at high water springs, thus forming an excellent harbour for small vessels.

In 1874-75 the Department constructed a small breakwater on the eastern side of the entrance to protect vessels from danger of striking on the rocky ledges that formed the eastern side of the entrance, a similar work being built in 1882-83 on the western side to prevent the wearing away of the end of the sea wall.

During the past fiscal year the western breakwater was repaired and extended, and some dangerous rocky ledges were removed from the channel.

QUEBEC.

ANSE ST. JEAN.

Anse St. Jean is situated on the south-west bank of the Saguenay River, about 25 miles from its mouth.

That portion of the wharf which settled in the spring of 1889 was raised from 2½ to 3 feet over a length of 135 feet, and the flooring was renewed with 6 x 6 in. tamarack.

A quantity of stone was placed in the eastern portion of the wharf, and the freight shed repaired.

BAIE ST. PAUL.

Baie St. Paul, County of Charlevoix, is situated on the north shore of the St. Lawrence, 60 miles below Quebec.

During the past fiscal year the extension of 75 feet to the wharf at this place was completed, and there is now a depth of 9 feet at low water spring tides at its outer end.

The wharf is now 861 feet long with a width of 30 feet.

Spring tides rise 24 feet, neaps 13.

BEAUHARNOIS.

The "Nipissing" operated at this place between 16th July and 25th August, 1890, digging up old piers and cribwork and deepening the channel in front of the village wharves to a depth of 10 feet; 12,060 cubic yards of clay, stone and boulders being removed.

BELŒIL.

Belœil piers and booms are on the Richelieu River, south of the Grand Trunk Bridge, which crosses the river at Belœil; they were built to facilitate the passage

of steamers and barges through the swing and to prevent them from being carried out into shallow water.

There are five mooring piers, three of which were rebuilt from water line last season.

BERTHIER (EN BAS).

Berthier, 24½ miles below Quebec on the south shore of the St. Lawrence, is in the County of Montmagny.

The works performed during last fiscal year consisted in the construction of a new movable slip, to replace the one broken in the fall of 1889.

BEAUPORT.

Beauport, Quebec County, is on the north shore of the St. Lawrence, 2 miles east of Quebec.

A wharf 100 feet in length was built some years ago near the mouth of the Beauport River, and parallel with the river.

During September, 1890, the filling was completed and brought to the level of the face timbers and the approach to the wharf raised.

Spring tides rise 21 feet, neaps 13 feet.

BOUCHERVILLE.

Boucherville, in the County of Chambly, is situated on the south shore of the River St. Lawrence, 6 miles east of Longueuil.

During the winter of 1888-89, the Boucherville Navigation Company built a block 54 feet 6 inches in length by 23 feet in width, with a breakwater 10 feet in length, at the upper end, at a distance of 175 feet from the shore. The Boucherville Navigation Company handed this block over to the Municipality of Boucherville in the summer of 1890. This block is situated at the upper end of the village.

Last October the Department entered into an agreement with the Municipal Council of Boucherville to build an approach 175 feet in length and 24 feet in width of solid cribwork. The work was completed on the 30th June last.

CAP À L'AIGLE.

Cap à l'Aigle wharf, Charlevoix County, is 5 miles east of Murray Bay.

During the month of August, 1890, some slight repairs were made to the wharf. The depth of water at the end is 17 feet at low water spring tides.

Spring tides rise 19 feet, neaps 12 feet.

CAP DE LA MAGDELEINE.

The parish of Cap de la Magdeleine is in the County of Champlain, on the north shore of the River St. Lawrence, 3 miles below Three Rivers.

A pier and approach were built in 1887. This pier measures 60 by 24 feet at bottom, and 51 feet 6 inches by 22 feet 8 inches on top; it was built in 5 feet of water in front, with from 1 to 2 feet in rear.

During the ice shove in the spring of 1890, the approach was damaged, all the cribwork on a height of 3 feet being carried away. This timber when recovered was too much damaged to be of any use for repairs.

During the year the damage done was repaired, and the wharf put in good order.

CEDARS.

Cedars is situated on the north shore of the River St. Lawrence, 15 miles east of Coteau Landing and in the County of Soulanges.

The landing wharf is 115 feet in length and 24 feet in width. There are at the outer end 7½ feet of water at its lowest stage.

The repairs made last year consisted in renewing some of the stringers and planking.

CHICOUTIMI.

Chicoutimi is at the head of navigation on the River Saguenay, 71½ miles above Tadousac.

During the year the retaining wall of cribwork 14 feet in width which is being built along the slab wharf, was extended a further length of 130 feet; a waiting room 28 x 20 feet built at the southern end of the wharf, and the plank of the wharf was repaired at various places.

COTEAU LANDING.

Coteau Landing is situated on the north side of the River St. Lawrence, at the foot of Lake St. Francis. It is the chef-lieu of the County of Soulanges, two miles from Coteau Station, Grand Trunk Railway, and 36 miles west of Montreal. It is also a station on the Canada Atlantic Railway.

During the season of navigation, the Richelieu and Ontario Navigation Company's steamers call at Coteau Landing, besides several local lines of boats. It is the chief grain shipping port of the county.

There are several wharves at Coteau Landing, but the wharf known as the Richelieu and Ontario Navigation Company's is the one referred to in this report.

It is 904 feet in length including a block 279 feet by 24 feet at the outer end.

The bridge or approach has a general width of 12 feet, with two sidings for the crossing of teams.

Last fall the reconstruction of the outside block 279 feet by 24 feet was commenced, but was not completed at the close of the fiscal year.

ETANG DU NORD.

Etang du Nord is at the western end of Grindstone Island, one of the Magdalen Islands in the Gulf of St. Lawrence.

The breakwater at this place, which had received damage from storms, was repaired where required, and heavy stones placed in the talus to fill gaps which had been made.

GATINEAU RIVER, EAST BANK.

In November last, a grant was made for the building of a retaining wall on the east bank of the river, about one mile above the Gatineau Point church, to stop any further encroachment of the river bank, along which runs the public highway.

This retaining wall is 340 feet in length and is built of pile work. The space between the front row of piles and the bank is filled with fascines and stone.

GRANDE RIVIÈRE.

Grande Rivière, is in the County of Gaspé, and is situated on the Baie des Chaleurs.

At the close of the fiscal year the wharf under construction by contract at Robin's Point was well advanced towards completion.

This wharf when completed will have a total length of 457 feet, with a width varying from 25 feet 9 inches on top to 38 feet at its outer end, where there is a depth of water of 19 feet at low water springs.

On the northern side of the wharf there will be a slip and two stairways for the accommodation of those using the wharf at different stages of tide.

GROSSE ILE QUARANTINE STATION.

Grosse Isle is an island on the St. Lawrence, 33 miles below Quebec, and is the place where steamers and vessels on their way to Quebec report any case of infectious diseases they may have on board.

The outer end of the wharf having become much damaged owing to natural decay, it was found necessary to repair the same to make it available for any vessel or steamer that might have to tie up to it. Accordingly extensive repairs and renewals were commenced, but had not been completed at the close of the fiscal year.

ISLE VERTE.

Isle Verte, on the south shore of the St. Lawrence, is in the County of Temiscouata, 17 miles below River du Loup.

The work during the last fiscal year has consisted in the construction of a further length of 164 feet of continuous open cribwork, to form the roadway to the isolated block.

KAMOURASKA.

Kamouraska is on the south shore of the St. Lawrence, in the County of Kamouraska, 90 miles below Quebec.

The work performed at Kamouraska during the last fiscal year consisted in demolishing part of the old wharf, on its easterly side, and in rebuilding it with an inclined slip, 76 feet in length and 17 feet wide.

A stone protection wall of about 60 feet in length, 5 feet wide, has also been commenced on the easterly side of the old wharf from the inclined slip shorewards.

LACHINE.

At the commencement of the fiscal year the "Nipissing" was working at this place dredging a channel in front of local wharves, removing 2,385 cubic yards of material.

LAKE MEGANTIC.

Lake Megantic is a fine sheet of water lying between the Counties of Beauce and Compton.

In October, 1890, the Agnes pier at the foot of the lake was sheathed at the outer end, the plank covering renewed and the shed repaired.

The pier at Lourdes which had been considerably damaged by the ice received the necessary repairs.

LÉVIS DRY DOCK.

In October, 1890, the Department of Public Works assumed control of this dock, which had up to that time been under the management of the Quebec Harbour Commissioners.

During January, 1891, iron beams made of boiler plate were placed under the bearings of the shaft of the main pumps in order to strengthen the bearings and do away with vibration. The machinery was painted and generally overhauled.

During June the sluice valves in the caisson and culverts were taken out of their seats, cleaned of all rust and replaced.

The inside of the caisson is being cleaned, and two coats of cement wash will be applied.

Since the Department assumed control the following vessels have used the dock:

1. SS. "Barcelona," 1,886 tons, docked Oct. 31, undocked Nov. 4
2. SS. "Oregon," 3,672 do Nov. 7 do Nov. 12
3. SS. "Barcelona," 1,886 do Nov. 13 do May 12
4. Whale back str. "Jos. L. Colby," 1,243 tons, docked June 22, undocked June 28
5. Whale back steel barge No. 110, 1,227 do June 29, do July 1

Of these vessels the two last only have been repaired permanently while in dock.

A quantity of gravel and stones were removed by one of the departmental dredges assisted by a stone lifter, from the shoal off the entrance to the dock.

LONGUEUIL.

The town of Longueuil, the chef-lieu of the County of Chambly, is situated on the south side of the River St. Lawrence, nearly opposite the eastern end of the city of Montreal.

The Richelieu and Ontario Navigation Company own a wharf at the upper end of the town, but the long distance from the business or centre portion, besides the increasing trade of the locality, demanded more wharf accommodation, and in the spring of 1887, at the request of the town council, the Department commenced the construction of a pier.

Last session the connection of the outside block was made with the shore under contract with Mr. J. A. Chagnon. The work was completed in November, 1890.

The pier is 1,105 feet in length, including a block 40 by 90 feet, 90 feet of the pier is 30 feet in width, and the remaining 975 feet, 20 feet. Seven buttresses, 10 by 30 feet, were built on the lower side. At the block there are 7 feet of water at its lowest stage. The pier is 9 feet 6 inches above low water line.

Considerable damage having been done by the ice to the portion of the pier built in 1887, some repairs were made.

MILLE ILES (NORTH BRANCH OF OTTAWA RIVER.)

The Mille Iles referred to here are situated in the north branch of the Ottawa River, north of Ile Jesus, in the County of Laval.

The work performed consisted in deepening the rapids at the foot of Lake of Two Mountains, so as to increase the flow of water through that branch of the Ottawa. A large quantity of stone was removed by blasting.

NEW CARLISLE.

New Carlisle is the chef-lieu of the County of Bonaventure, and is situated on the Baie des Chaleurs.

A contract having been entered into for the extension of the existing wharf at this place the work was brought to a satisfactory completion.

NEWPORT RIVER.

One of the retaining piers was widened and repaired, in order to make it available as a landing for boats and small craft, and the right of way has been given from the high road to this pier; a certain amount of blasting was done at the cliff, to make it accessible.

NICOLET RIVER.

The town of Nicolet, distant 13 miles from Three Rivers and 28 from Sorel, is situated upon the eastern side of the river of that name, which takes its rise in Lake Nicolet, in the centre of Wolfe County, and after a course of 80 miles, flows through the parishes of L'Espérance, St. Paul of Chester, St. Christophe, St. Albert, St. Clothilde, St. Monique, and St. Jean Baptiste de Nicolet, emptying into the St. Lawrence on its southern shore at the foot of Lake St. Peter.

In order to protect schooners loading in the harbour from the force of the storms on Lake St. Peter, a jetty was commenced in 1881, additions being made each consecutive year. The work in 1890 was resumed on the 31st July, the water having been too high to admit of its being commenced before.

It was discontinued on the 20th September, and during this time 300 feet of pile work was built, making the jetty 3,567 feet in length. It is 13 feet 2 inches in width and is 4 feet above low water.

The channel way, dredged opposite that part of the jetty built, has maintained its depth, but further out, beyond the jetty, the channel dredged has shoaled, owing to the working in of sandy deposits.

The total dredging done during the fiscal year 1890–91 was 11,470 cubic yards of sand material, in a cut of about 750 feet in length and 40 feet wide.

POINTE ST. PIERRE,

Gaspé County, is situated at the western entrance of Gaspé Bay, and is 21 miles distant from Gaspé Basin, and 15 miles from Percé.

A large amount of solid rock as well as dangerous boulders were, during the fiscal year, removed from the harbour.

POINTE À VALOIS.

Pointe à Valois is situated on the south shore of Lake of Two Mountains, in the County of Vaudreuil, 4½ milles from the village of Vaudreuil, which is the nearest railway station.

The wharf referred to and described in the report of last year has been completed.

PORT DANIEL.

Port Daniel, Bonaventure County, lies on the northern shore of the Baie des Chaleurs, 45 miles from Percé, and 22 miles north-east of New Carlisle.

In November, 1889, a contract was entered into for the construction of an additional length to the wharf at Port Daniel, consisting in a block of cribwork, 75 feet in length, 50 feet in width, and 27 feet in height, and the same was completed in October, 1890.

RIMOUSKI.

Rimouski is situated on the south shore of the St. Lawrence, in the County of Rimouski, 180 miles below Quebec.

The protection work 325 feet in length on the westerly side of the wharf and to which reference was made in my report of last year has been completed.

The south-east inclined slip has been repaired and pile sheathing commenced on the easterly side of the wharf.

RIVIÈRE DES PRAIRIES—ILE BIZARD AND STE. GENEVIÈVE—JACQUES CARTIER CO.

On the 24th October, 1889, a contract was entered into for the construction of two piers on the Rivière des Prairies, one on Ile Bizard side of the stream and the other at Ste. Geneviève.

These piers are similar in construction and dimensions. They consist of 4 cribs with ice breakers, 20 by 30 feet at low water line and 20 feet square on top, placed 20 feet apart. The roadway is covered with 3 inch pine plank.

The approach on the Ile Bizard side is 43 feet in length, and the other at Ste. Geneviève 76 feet, making the Ile Bizard pier 206 feet in length and Ste. Geneviève 239 feet.

The work is completed.

RIVIÈRE DU LIÈVRE.

The Rivière du Lièvre flows into the Ottawa River 18 miles below the city of Ottawa; its general course is northerly and its width for 20 miles above the mouth varies from 300 to 600 feet.

At the Little Rapids, 12 miles above the village of Buckingham, the lock and dam which are being built are in a fair way of completion. The masonry of the lock is completed, and the gates will be shortly finished.

By the end of autumn it is expected that the dam across the river will be completed, when the water will be let into the lock and the whole work finished.

RIVIÈRE DU LOUP.

Rivière du Loup is situated on the south side of the St. Lawrence, 108 miles below Quebec, in the County of Temiscouata.

The works performed during the last fiscal year have been the construction of a hand-railing on the easterly side of the wharf over its whole length, and in repairing the top planking where required.

Several shoals and boulders have been removed from the channel of the river.

RIVER L'ASSOMPTION.

The L'Assomption flows into the St. Lawrence at Repentigny.

Some improvements were made at the Chute Monte-à-peine, which is 25 miles above the town of Joliette, in the County of Joliette. They consisted in removing some points of rock and large boulders which obstructed the channel.

Some protection works to the river bank, extending over a length of 400 feet, were also constructed.

RIVER BEAUDETTE.

This river flows through the Parish of Ste. Marie de Blandford, in the County of Nicolet, and empties into the St. Lawrence on its southern shore at Gentilly, about 15 miles below Three Rivers.

The banks of this river are very low in the vicinity of Ste. Marie de Blandford, and the bed of the river is much obstructed by trees and boulders, which keep back the water and cause the river to overflow the low-lying neighbourhood.

During the year obstructions were removed from the bed of the river, from the rapids south, for a distance of 3½ miles, on an average width of 25 feet.

RIVER CHAMPLAIN.

This river takes its rise in the Parish of St. Maurice, in the County of Champlain, crosses the Parish of St. Luc and empties into the St. Lawrence on its north shore, about 14 miles below the city of Three Rivers.

The banks of this river are very high and composed of a clayey material.

Last year a landslide occurred at the village of St. Luc, which had the effect of jamming the river.

The obstructions caused by this landslide were removed over a length of 4½ arpents on an average width of 20 feet, which had the effect of reducing the water level 6 feet.

RIVER MEKINAC.

The River Mekinac flows from the north and empties into the St. Maurice 49½ miles above Three Rivers.

There are several rapids on this river, some of which do considerable damage to the timber floating down, they being full of large boulders, which cause the jamming of the timber. At the beginning of August, some of these boulders were removed from the channel. This would have been done earlier in the season, had it not been that the water was too high to admit of the work.

During the progress of the work 1,624 boulders of various dimensions were removed with a scow and derrick; in the case of large boulders explosives having to be used.

RIVIÈRE OUELLE.

Rivière Ouelle is 33 miles above River du Loup, and 75 miles below Quebec, on the south shore of the St. Lawrence, in the County of Kamouraska.

The work done at this place, during last fiscal year, consisted in resheeting the two outer corners of the head of the wharf, and in replacing missing sheet piles where most wanted.

RIVER RICHELIEU.

The river is about 80 miles in length and flows from Lake Champlain to the St. Lawrence through the Counties of St. John, Iberville, Chambly, Verchères, St. Hyacinthe and Richelieu, and empties into the St. Lawrence at Sorel.

In order to protect the properties at the outlet of this river and the boats which winter there from ice shoves in the spring, an additional ice breaker was built at the outlet of the river on the northern end of the western shore of the Richelieu.

The pier measures 30 feet by 24 feet at the base and 23 feet in height and stands 3 feet 11 inches above the extreme high water level, and has already proved of great service.

RIVER ST. FRANCIS.

This river empties into Lake St. Peter on its south shore, 3 miles below the mouth of the Yamaska and 11 miles below Sorel.

On the 27th of May, 1890, dredging was commenced opposite the wharf at St. Thomas de Pierreville, and after a good channel had been cut through the shoal, 60 feet wide and 6 feet at low water, the dredge was removed a little below to remove boulders and other impediments in the channel. These operations were brought to an end on the 3rd July, 1890, at which date 15,620 cubic yards of clay and stone had been removed, at a cost of $3,997.50 out of the appropriation for 1890-91.

The dredging done previously in the river has been of good service, the channel dredged has filled in very little.

RIVER ST. LAWRENCE—SHIP CHANNEL BETWEEN QUEBEC AND MONTREAL.

The work done during the fiscal year consisted in the further deepening of the Ship Channel at Cap à la Roche, Pouillier Rayer and Cap Charles, from its present depth of 24 feet to a full depth of 27½ feet at low water; and the commencement of the work of removing the dangerous shoals at Grondines and the Richelieu Rapids.

At Cap à la Roche three dredges and one stone lifter were engaged on the work at the point during the year. 105,959 cubic yards of shale and rock and boulders being removed at a cost of 41⅔ cents per cubic yard.

At Pouillier Rayer one dredge and one stone lifter were employed, completing the work at this point by removing 43,923 cubic yards of clay, hard-pan and boulders, at a cost of 37 cents per cubic yard.

At Cap Charles the channel was completed before the end of the season of 1890. 37,454 cubic yards of hard shale, rock and boulders were removed at a cost of 47¾ cents per yard, and before the dredge was removed, the channel was thoroughly tested and found clear to 27½ feet at low water.

At Grondines two dredges and one stone lifter were employed during part of the year in giving the necessary depth of 27½ feet. 27,016 cubic yards of material have been removed at a cost of 53½ cents per cubic yard. The work however at this place is not completed.

A stone lifter commenced work on Barre à Boulard at the head of the Richelieu Rapids, and worked for a short time towards the end of the season of 1890, removing 1,224 cubic yards in 34 days.

RIVER ST. LOUIS.

This river flows through the County of Beauharnois into Lake St. Louis, at the town of Beauharnois.

It is connected with Lake St. Francis, at the head of Beauharnois, by means of a feeder and canal, which has a width of about 20 feet and average depth of 4½ feet.

To give an easier flow to the water during freshets, and increase the volume during the dry seasons, the shoal at the "Coteau" in the feeder was removed. A great quantity of stone and boulders were also removed in the rapids, six in number, between the village of St. Louis and Narcisse Laberge's farm. This work is not completed.

RIVER ST. MAURICE.

This river flows southward and empties into the St. Lawrence at Three Rivers.

In order to enable the barges used by the lumber merchants to load at the highway bridge, the western channel of the St. Maurice has, during the past season, been dredged to a depth of 9 feet at low water.

Between the 12th August and the 6th September, 1890, 7,760 cubic yards of sand were removed and dumped on the south shore of the St. Lawrence below Doucet's Landing.

The channel dredged is 1,250 feet in length by 30 feet in width, with a depth of 9 feet at low water.

RIVER VERMILION, CHUTE AUX IROQUOIS.

The Chute aux Iroquois is a fall on the River Vermilion, 4 miles from its mouth. The Vermilion is one of the chief tributaries of the St. Maurice, into which it empties 93 miles north of Three Rivers. It runs in a westerly direction, and on each side of the river are large timber limits owned by important firms.

In 1874 the main channel at the head of the Iroquois falls was closed and the eastern channel of the old slide has since been used for the descent of timber. The dam having partly given way at two places, there was not enough water flowing through the eastern channel to admit of the timber being driven through it. The dam in the main channel was repaired and raised 18 inches, and that of the side channel was closed to the same height.

RIVER YAMASKA.

This river flows through the County of Yamaska and empties into the St. Lawrence on its southern shore, at the head of Lake St. Peter, eight miles below Sorel.

On the 14th July, 1890, an agreement was passed with Mr. J. D. Cameron for the construction of 168 feet of the Yamaska dam, to close the gap made by a break in the dam in September, 1889. The work was commenced on the 1st September and was discontinued on the 20th November, 1890. Its progress was several times retarded by the rising of the water. Four cribs were sunk, one of 50 feet in length, two of 40 feet and the last crib 38 feet. The last crib was sunk on the 6th November, and as soon as the sheet piles were driven the water commenced to rise, so that the work was delayed until the 17th November.

So soon as the planking of the last crib was completed and very little clay put above it, the work had to be discontinued owing to the appropriation being exhausted.

Dredging was also done on the river below the lock; two shoals being cut through and 16,988 cubic yards of clay and sand removed.

The dredge "Queen" commenced work in the channel above the lock on the 30th May, 1891, and at the close of the fiscal year had removed 7,744 cubic yards of material.

ST. ALPHONSE (BAGOTVILLE).

The village of St. Alphonse, Bagotville, is situated at the head of Ha! Ha! Bay Saguenay River, Saguenay County, 12 miles from Chicoutimi.

The planking of the wharf was renewed over the western 200 feet, and a quantity of stone placed in the wharf near the centre. The cap timbers on both sides were renewed and heavy repairs were made to the movable slip.

ST. ANICET.

St. Anicet, in the County of Huntingdon, is situated 56 miles south-west of Montreal, on the south shore of Lake St. Francis.

This pier was built in 1862. It is 300 feet in length, the width of the 200 feet nearest to shore is 18 feet and the other 100 feet, 35 feet. Last spring, the portion nearest to shore, that is, that portion which is 18 feet in width and 200 feet in length and which consists of cribs 9 by 18 feet placed 20 feet apart, was rebuilt from water line. The wharf proper is still in a much dilapidated state.

STE. ANNE DE LA PÉRADE.

The River of Ste. Anne takes its rise in the County of Quebec, it crosses the Counties of Portneuf and Champlain and empties into the St. Lawrence on the north shore at the Parish of Ste. Anne de la Pérade, 54 miles above Quebec and 23 miles below Three Rivers. It is for the most part very shallow.

Some dredging was done at the mouth of the river. This work was in progress at the beginning of the fiscal year 1890–91, and was discontinued on the 2nd August, 1890.

The dredging consisted in a cut 3,900 feet in length and about 22 and 44 feet in width to a depth of from 4 to 6 feet at low water, necessitating the removal of 15,406 cubic yards of material.

STE. ANNE DE SOREL.

Ste. Anne de Sorel, in the County of Richelieu, is 3 miles below Sorel, on the southern shore of the St. Lawrence.

The land in this district is very low. It is very fertile; the soil being remarkably rich and productive. The inhabitants are all engaged in agriculture, the products of their farms finding a market in Sorel.

The construction of an additional ice pier opposite the church, was commenced on the 15th August, 1890, and was discontinued on the 31st October, owing to the appropriation being exhausted.

The pier measures 60 feet by 25 feet at bottom and 56 feet by 24 feet on the top. It is built in 7 feet of water and stands 5 feet 2 inches above water level, having an aggregate height of 12 feet 2 inches.

STE. ANNE DES MONTS.

Ste. Anne des Monts, Gaspé County, is on the south shore of the St. Lawrence, 108 miles east of Rimouski.

In November, 1890, a contract was entered into for the construction of an isolated block of cribwork, 100 feet in length by 46 feet in width measured on top.

At the close of the fiscal year the contractor had delivered a quantity of materials, but active operations of construction had not been commenced.

STE. ANNE DU SAGUENAY.

Ste. Anne du Saguenay is in the County of Chicoutimi, on the River Saguenay, opposite Chicoutimi.

The wharf has been extended a further length of 50 feet on a width of 28 feet and 25 feet in height, covered with flooring, cap timbers and mooring posts put in position. The slip on the north-east of the wharf was planked.

STE. FAMILLE.

Ste. Famille is on the north shore of the Island of Orleans, 17 miles east of Quebec.

During September, 1890, the top planking of the wharf was renewed and additional floor stringers placed. One of the piers supporting the floor stringers was rebuilt and new fenders were put on the end of the wharf which is now in a good state of repair.

ST. FRANÇOIS.

St. François is at the eastern end of the Island of Orleans, 25 miles from Quebec.

During the year the top planking of the wharf was renewed, two additional rows of stringers placed under the planking, and fenders on the outer end renewed, and the structure is now in a good state of repair.

ST. JEAN D'ORLÉANS.

St. Jean d'Orléans is situated on the south shore of the Island of Orleans, 18 miles east of Quebec.

During August and September, 1890, the top planking of the wharf was partially renewed and the approach repaired where necessary.

Spring tides rise 22 feet, neaps 14.

ST. LAURENT.

The village of St. Laurent is on the south shore of the Island of Orleans, in the County of Montmorency, 15 miles east of Quebec.

The construction of the additional length of wharfing, to which reference was made in the report of last year, has been completed, and the wharf is now 643 feet in length with a depth of 9 feet at low water spring tides at the outer end.

Spring tides rise 23 feet, neaps 14 feet 6 inches.

ST. MICHEL.

St. Michel, on the south shore of the St. Lawrence, is in the County of Bellechasse, 16 miles below Quebec.

The works executed during the last fiscal year, consisted in completing the 180 feet left unfinished on the westerly side of the wharf, in the fall of 1889, viz., one course of timber has been added, and the whole length of the 180 feet has been planked for a width of 20 feet, and cap pieces and fenders placed. In addition 144 feet in length of the rotten part of the wharf, shoreward, have been demolished and rebuilt, 30 feet wide, with an average height of 7 feet, and cap pieces, fenders, &c., placed.

ST. SIMÉON.

St. Siméon, County of Charlevoix, is on the north shore of the St. Lawrence, 108 miles below Quebec.

The construction of a cribwork block 50 by 40 feet commenced in the preceding fiscal year has been completed.

Spring tides rise 20 feet, neaps 12½ feet.

ST. TIMOTHÉE.

St. Timothée, in the County of Beauharnois, is situated on the south shore of the River St. Lawrence. It is 6 miles east of Valleyfield and 9 miles west of the town of Beauharnois.

During the summer of 1889, the wharf which has a length of 100 feet was extended out 45 feet, the extension being 45 by 100 feet.

With the appropriation made last session, the warehouse was enlarged and removed to a more convenient place. The approach from the main road to the wharf was raised one foot and put in a thorough state of repairs.

TADOUSAC (ANSE À L'EAU).

Tadousac, or Anse à l'Eau, is at the mouth of the River Saguenay, on the southern bank.

Further repairs and improvements were effected to the wharf during the fiscal year.

THREE RIVERS.

The city of Three Rivers is situated upon the northern bank of the River St. Lawrence, at the mouth of the River St. Maurice, and covers an area of 9 square miles. It is half-way between Montreal and Quebec (71 miles below Montreal and 68 above Quebec) and is the capital of the district.

On the 13th November, 1889, a contract was entered into with Mr. T. E. Normand, for the construction of a wharf between the Richelieu Company's wharf and that of the Harbour Commissioners.

At the beginning of the fiscal year 1890–91 the work was in progress and was completed in November, 1890.

The wharf has a frontage of 172 feet on the St. Lawrence, is 36 feet 1 inch in height, and stands 11 feet above mean low water and is 20 feet wide on top.

TROIS PISTOLES.

Trois Pistoles is in the County of Temiscouata on the south shore of the St. Lawrence, 148 miles below Quebec.

The block at the head of the wharf commenced last year has been completed. It is 50 feet square, with a stair 10 feet wide on each side.

ONTARIO.

BEAVERTON.

Beaverton is situated on the east shore of Lake Simcoe, in the electoral district of the County of Ontario.

In February last a contract was entered into for the construction of a landing pier for the accommodation of vessels plying on Lake Simcoe, and the work was completed and accepted from the contractor on the 12th June, 1891.

BELLEVILLE.

Belleville is situated at the mouth of the River Moira, which flows into the Bay of Quinté 43 miles west from Kingston.

In September, 1890, a contract was entered into for certain dredging in the harbour, in order to give an easier and more ready egress to the waters of the Moira, and so lessen the danger of floods during spring freshets, and the work was brought to a close at the end of December.

There were removed 40,118 cubic yards of earth and 320 cubic yards of rock.

BIG BAY—NORTH KEPPEL.

Big Bay is situated on Georgian Bay, near the entrance to Colpoy's Bay, in the township of Keppel, about 15 miles north of Owen Sound harbour.

The work consisted in rebuilding, where required, the whole of the cribwork blocks from low water level to flooring; placing new stringers and corbels, and replanking the whole of the superstructure; refilling blocks with stone and constructing a crib 25 x 25 feet, and placing same inside the space between the outer crib and the adjoining one, thus giving a solid block of cribwork, 90 feet long on the east side and 65 feet on the west side. In addition, the outer corners were sheathed with hardwood, and new mooring posts placed in position.

BOWMANVILLE.

The harbour of Bowmanville (properly called Port Darlington) is on the north shore of Lake Ontario, 40 miles east of Toronto.

At the commencement of the fiscal year the "Ontario" was working at this place, completing dredging on the 3rd July, 1890, removing 780 cubic yards of sand.

CLAPPERTON CHANNEL.

Clapperton Channel is the main passage between Clapperton and Croker's Island, Georgian Bay, through which vessels pass from ports on the Georgian Bay to Sault Ste. Marie and Lake Superior.

This channel is obstructed by dangerous points of rocks called "Robertson's Rocks" and in order to remove these and so give a safe, navigable channel, having a depth of 18 feet at low water, the Department commenced the removal of these points of rock.

The necessary plant was taken to the spot early in October, 1890, and operations were continued until 1st of November.

The rock to be removed is of the hardest kind of red granite which makes the work of drilling very difficult, but at the time mentioned, the close of operations, good progress had been made, but a considerable amount of rock yet remained to be removed to give the depth of water required, namely, 18 feet.

COBOURG.

The harbour of Cobourg is on the north shore of Lake Ontario, 96 miles west from Kingston and 72 miles east from Toronto.

Repairs and renewals were made to the superstructure on the east and west sides of the central pier.

GODERICH.

Goderich is situated in the County of Huron, at the mouth of the Maitland River, about 68 miles north of Sarnia.

General repairs were made to the harbour works at this place, the expenditure amounting to $600.

KINCARDINE.

Kincardine is on the east coast of Lake Huron, 31 miles north of Goderich.

At the commencement of the fiscal year the dredge "Challenge" was working at this place, in removing an accumulation of sand in the basin and along the piers, work being closed on the 21st August, 1890, at which date 17,460 cubic yards of material had been removed.

KINGSTON.

Kingston is at the foot of Lake Ontario, 172 miles west of Montreal.

The work of removal of Point Frederick shoal, which was in progress at the close of the last fiscal year, was continued to the 23rd October, when operations ceased for the season. It was resumed on the 26th May, 1891, and at the close of the fiscal year a further quantity of 2,629 cubic yards of rock had been removed.

KINGSTON DRY DOCK.

At the close of the fiscal year but little remained of the dock proper to be completed. Contracts for the pumping plant and caisson had been awarded, plans and specifications had been prepared for the engine-house and chimney, and the dock will be ready for the reception of vessels before the close of navigation.

KINGSVILLE.

Kingsville is in the electoral district of South Essex, on Lake Erie; it is also a station upon the Detroit, Essex and Lake Erie Railway, and is distant about 25 miles from the mouth of the Detroit River.

Some necessary general repairs were made to the landing pier, consisting, principally, of cutting off old piles, building new trestle bents, renewing stringers, and new sheathing on the end of the pier.

LITTLE CURRENT.

Little Current is the passage between Cloche Island and the Great Manitoulin, is on the direct road to Sault Ste. Marie for vessels taking the north channel, and is distant from Collingwood about 140 miles.

The work of widening and deepening the channel which was in progress at the close of the last fiscal year was continued until 30th September, during which time 3,775 yards of rock were blasted and removed from the channel.

During the winter of 1890 and 1891, necessary repairs and renewals were made to the plant and a new derrick scow 70 by 20 feet, with steam hoisting apparatus, was added to the plant.

MEAFORD.

Meaford, an incorporated town in the County of Grey, is situated on the Georgian Bay, 18 miles west from Collingwood and 20 miles east of Owen Sound.

During the past year the dredge "Challenge" was engaged on a bar at the inside of the breakwater on end of west pier and in deepening the channel between the piers, and was still working at the close of the fiscal year; 10,260 cubic yards of material having been removed.

MIDLAND.

Midland, Simcoe County, is the terminus of the Midland division of the Grand Trunk Railway, on the Georgian Bay.

The construction of the 2,000 feet of work on the harbour front, referred to in report of last year, was finished on the 8th July, 1890.

OTTAWA RIVER.

During the year the dredge "Queen" was working on shoal No. 1, three miles below the city of Ottawa, and at the close of navigation had removed 12,372 cubic yards of material.

The dredge "Nipissing" operated off Goose Island in dredging a channel to a depth of 10 feet, and at the close of navigation had removed 15,915 cubic yards of sand and sawdust.

Between the 6th and 25th of June, 1891, the "Nipissing" was engaged along the east side of wharf at St. Placide, removing 1,590 cubic yards of material. Considerable delay was caused by the breaking of the dredge owing to the hard digging.

The dredges "Nipissing" and "St. Louis" operated on the shoal below Jones' Island, and worked there up to close of fiscal year, at which date 7,910 cubic yards of clay had been removed.

The dredging of the shoal which obstructs the channel leading to the Culbute Canal was carried on during the fiscal year ending 30th June, 1891.

The dredge commenced work on the 25th August, 1890, and closed on the 4th October. During that time, 896 cubic yards of sand and gravel were removed.

The channel dredged out has a depth of 8 feet at low water, and 14 buoys have been placed on its north side, 6 of which have been put in place last season.

OWEN SOUND.

Owen Sound, in the County of Grey, is situated at the mouth of the Sydenham River, and is the terminus of the Canadian Pacific Railway, on the Georgian Bay.

A contract was entered into for dredging and other improvements in the harbour, and but little work was done, when in May, 1890, the contractor was relieved of the work and it was awarded the next lowest tenderers.

At the close of the fiscal year 1890 the contractors had delivered a large amount of material and were getting their plant in readiness for active operations, which were commenced in August, 1890, and by the 30th June, 1891, the pile protection work had been nearly completed, and a large amount of dredging and excavation performed.

The "Challenge" having been ordered for work in the harbour at Owen Sound, left Meaford on the 8th June, 1891, and worked there until the 20th, removing a shoal at the outer range light, at which date 3,360 cubic yards of material had been removed.

PARRY SOUND NARROWS.

These narrows are situated respectively 7 and 2 miles south of Parry Sound, and form a portion of the channel called the North or Inner Channel of Georgian Bay, usually taken during rough weather and in the autumn by steamboats plying between Midland, Penetanguishene and Parry Sound.

At low water both these channels are impracticable to boats drawing over 5 feet, and it often happens, when heavily laden, they are obliged to follow the outside channel regardless of weather.

To obviate this necessity of taking the outside channel, the Department during the fiscal year commenced the necessary work of improvement to give a depth of 8 feet at lowest stage of water in Lake Huron.

The work was commenced on the 1st June, 1891, and was in progress at the close of the fiscal year.

PENETANGUISHENE.

Penetanguishene Harbour is situated on the north of the eastern peninsula in Georgian Bay, formed between Nottawasaga Bay and the waters of the Severn River.

To give a better depth of water in the harbour, from which large quantities of lumber are shipped to other points, the Department secured the services of a dredge which worked until 4th August, 1890, removing 18,750 cubic yards of material, and thus improved the harbour to a large extent.

PICKERING, FRENCHMAN'S BAY.

The harbour of Pickering, formerly known as Frenchman's Bay, is situated on Lake Ontario, 21 miles east of Toronto.

During the year the "Ontario" did some work on the channel running from the piers to elevator at the wharf, and removed an old sunken pier, which was a great obstruction to vessels; work being closed on the 5th August, 1890, at which date 12,000 cubic yards of sand, mud and gravel had been removed.

PORT ALBERT.

Port Albert is situated at the mouth of Nine Mile Creek, which empties into Lake Huron, 9 miles north of Goderich.

During the year the "Challenge" was engaged in making a channel through a sand bar which had formed between the piers, removing 4,860 cubic yards of material.

PORT ARTHUR.

Port Arthur is situated at the head of Thunder Bay, Lake Superior, and is one of the ports of call for the Canadian Pacific Railway steamers and other lines plying on Lake Superior.

The work under contract with Messrs. Kirby & Stewart, to which reference was made in the report of last year, was completed in November, 1890.

A large quantity of extra stone talus was placed in front of the breakwater, sheet piling was constructed round the ends of the blocks and repairs were made to the other parts of the structure where required.

PORT ELGIN.

Port Elgin is in the electoral division of the northern portion of the County of Bruce, on the eastern shore of Lake Huron, about 24 miles north of Kincardine.

Repairs were effected to the pier and breakwater, a quantity of stone and brush being deposited to protect the breakwater, while the pier was replanked over a length of 105 feet and protected with longitudinal guards.

PORT HOPE.

Port Hope is on Lake Ontario, 7 miles west of Cobourg and 107 from Kingston.

Repairs and renewals were effected to the east pier and coal wharf, as well as to the eastern side and end of the railway wharf in the inner harbour.

PORTSMOUTH.

Portsmouth is situated on Lake Ontario, 2 miles west from Kingston.

The work of rebuilding the superstructure of the pier at this place was completed in August, 1890, and the structure is now in good condition.

RIDEAU RIVER—NORTH BRANCH.

At the commencement of the fiscal year the dredges "Queen" and "St. Louis" were working in making a channel and basin in front of the proposed wharf to join the channel to Rideau Canal, to a depth of 7 feet; 5,575 cubic yards of material being removed.

RIVER KAMINISTIQUIA.

This river empties into Thunder Bay, Lake Superior, to the west of Port Arthur.

A further amount of dredging was done on the bar which lies off the mouth of the river, and also in the river itself, to accommodate the large steamers which now call at Fort William to load with grain for shipment by rail at other ports.

RONDEAU.

Rondeau Harbour, is situated on the north shore of Lake Erie, about 140 miles West of Port Colborne, the Lake Erie entrance to the Welland Canal; it is a harbour of refuge.

During the past year extensive repairs and renewals were effected to the east pier which was in a very bad state, and there still remains a considerable portion of the structure in a most unsafe condition.

SAUGEEN.

Saugeen River empties into Lake Huron at the village of Southampton. The mouth of the river is used as a harbour for fishing craft and tug boats.

The mouth of this river being obstructed by boulders and other obstructions, the services of a dredge were obtained, resulting in the removal of 6,700 cubic yards of material, besides a large number of boulders. Good ingress and egress can now be obtained by vessels.

SHANNONVILLE.

Shannonville is situated on the Salmon River which empties into the Bay of Quinté, about 9 miles from Belleville, and 40½ west of Kingston.

Between the 6th September and 15th October, 1890, the "Ontario" was engaged on a bar at the mouth of the Shannon River, removing 13,830 cubic yards of material.

SOUTHAMPTON.

Southampton, in the electoral district of North Bruce, is situated at the mouth of the Saugeen River, which empies into Lake Huron 143 miles above Sarnia, and is the terminus of the Wellington, Grey and Bruce branch of the Grand Trunk Railway.

But little work was done by the contractors on the extension of the landing pier, and in April, 1891, the work was taken out of their hands.

SYDENHAM.

The Sydenham River has its outlet in Chenal Ecarté, which is the passage between Ste. Anne's Island and the mainland. At Wallaceburg, the river divides into two branches, north to Wilkesport 14 miles, and east past Dresden 15 miles.

The work of sheet-piling the north-western side of the turning basin at the town of Dresden, which was under construction in the last fiscal year, was being completed, and vessels can now turn in the river without disturbing the banks.

TORONTO.

The harbour of Toronto is formed by the Island and has its principal entrance at present from the westward.

For purposes of navigation dredging was continued during the year to keep the eastern channel open to a depth of 12 feet. This necessitated a large amount of work owing to the continual filling in of the channel dredged, caused principally by easterly storms; 106,004 cubic yards of sand having been removed. The channel will, however, it is anticipated, be a permanent one when the protection works on either side have been completed.

For the construction of these works a contract was entered into in May, 1889, and at the close of the fiscal year seven cribs had been sunk in place and twenty-three others were in course of construction.

It is expected the works will be completed and the channel permanently opened during the fiscal year 1892-93.

A further quantity of heavy stone talus was constructed in front of the Island breakwater, making a total length of 4,900 lineal feet of work thus protected. This work is done by day's labour under direct charge.

TRENTON.

Trenton is at the head of the Bay of Quinté, 60 miles above Kington and 12 from Belleville.

The dredges "Ontario" and "St. Louis" operated at this place during the past year on the new channel through a shoal between the town of Trenton and the Murray Canal; 11,350 cubic yards of material being removed.

WHITBY.

The harbour of Whitby, formerly Windsor Harbour, is on the north shore of Lake Ontario, about 135 miles above Kingston and 30 from Toronto.

The "Ontario" arrived at this place on the 7th August, 1890, and commenced work on a channel through the harbour on the east side of west pier, and in front of lumber dock, removing 9,930 cubic yards of material. Considerable delay was caused here, owing to the high winds and heavy sea.

WIARTON.

Wiarton is a very prosperous town in the County of Bruce, situated at the head of Colpoy's Bay (Georgian Bay), about 32 miles north of Owen Sound. It is the terminus of the Georgian Bay and Lake Erie branch of the Grand Trunk Railway.

The harbour is a natural one, extending 8 miles from its entrance to the town. It is protected at the mouth by three large islands—White Cloud, Griffith and Hay. The water is deep to within a few feet of the shore, and the harbour has not a reef, bar or shoal in its whole area.

The construction of a breakwater 380 feet in length, near the head of the harbour on the west side, to afford protection to small craft, was completed on the 17th July, 1890.

It having been decided to extend this breakwater a further length of 220 feet, a contract was entered into for the work in question, and the same was completed in October, 1890.

Fenders were placed along the southern side of the breakwater, and a further quantity of stone was placed in the talus at the outer end to prevent scour.

MANITOBA.

RED RIVER.

Dredging was continued in the lake at the mouth of the river, and the channel in the river near what is known as Salimony's Channel, where the water is very shallow, was deepened.

The lake boats had no difficulty in making the mouth of the river through the dredged channel, even in the roughest weather.

THE WHITE MUD.

The mouth of the White Mud River is 9 miles north of Westbourne, in the County of Marquette. Westbourne is on the Manitoba and North-Western Railway, and is a place of transhipment to and from the lake in connection with the lake trade.

During the year, the dredge "Priestman" was engaged in opening up the outer end of the channel, which had somewhat filled in, giving five feet of water throughout. It was then placed to widen the mouth of the channel, the intention being to give a width of 300 feet at the entrance.

NORTH-WEST TERRITORIES.

BELLY RIVER BRIDGE, LETHBRIDGE.

Belly River bridge is situated in the north-west quarter of Section 1, Township 9, Range 22, west of the Fourth Principal Meridian, and about 2 miles from the town of Lethbridge.

The bridge to which reference was made in the report of last year, has been completed.

An approach, 90 feet long, of timber, was built at the west end of the bridge. The three piers had a large amount of rip-rap placed around them to prevent scour, and the bolts and rods of the bridge proper were tightened.

OLD MAN'S RIVER BRIDGE.

This structure crosses the Old Man's River about $1\frac{3}{4}$ miles west of the town of Macleod, in the centre of the west half of Section 10, Township 9, Range 26, west of the 4th Initial Meridian.

In April, 1891, a contract was entered into for the construction of a bridge across the river, to consist of two spans of 150 feet each, one pier, two abutments and excavation and trestle work approach on north side, and an embankment on the south side.

At the close of the fiscal year the greater portion of the trestle work on the north side was nearly finished; the timbers for the abutments had been framed and a considerable quantity of timber delivered on the ground.

BRITISH COLUMBIA.

COLUMBIA RIVER.

Below Revelstoke.—During the year a large number of snags were removed from the channel of the river below Revelstoke, overhanging trees were cut, dams were built in order to divert sub-channels into the main channel, and wing dams to increase the depth of water over various shallow "bars," and most satisfactory results have been obtained.

Below Kootenay.—The navigation of this part of the river was improved by the removal of rocks and boulders and by the construction of wing dams.

Above Golden.—The improvement of the river has been continued during the past fiscal year, dams under course of construction during previous year being completed and others built; one 154 feet long being constructed to divert the water into one channel at the Forks, below Spillamacheen.

COQUITLAM RIVER.

The source of the Coquitlam River is Coquitlam Lake, whence it flows southerly and empties into the Fraser, on its northern side about 5 miles above New Westminster.

During the year, a further quantity of drift timber and snags were removed from the bed of the river.

COWICHAN RIVER.

This river is one of the rivers of Vancouver Island, and is distant from Victoria about 35 miles.

The work of improving this river below the railway bridge, near the Indian village, has been continued.

ESQUIMALT DRY DOCK.

The total number of vessels docked during the fiscal year has been 30, with a tonnage of 43,994 tons; the revenue derived therefrom being $29,603.14, which amount has been placed to the credit of the Hon. the Receiver-General.

General repairs and improvements were effected to the works and plant by the dock staff; drains, pumps, wells, &c., were cleaned, and in fact the dock and dock premises were kept in good order.

A coal shed 58 x 36 feet, divided into four compartments, was constructed by the dock staff.

FRASER RIVER.

The Sand Heads at the mouth of the Fraser River extend about 5 miles into the Strait of Georgia.

The improvement of the channel across the Sand Heads was continued during the fiscal year, the north and south dams being extended.

The snag boat "Samson" was also engaged during the year in removing snags from the river.

NICOL ROCK.

The harbour of Nanaimo is situated on the east coast of Vancouver Island, 73 miles from Victoria, with which it is connected by rail.

Nicol Rock, lying about 450 feet north-west from the wharf of the Vancouver Coal Company, and about 120 feet east of their ballast wharf, was a danger to shipping, and the Department has been engaged for some time in removing the same to a depth of 16 feet at ordinary low water springs, and operations were continued thereon during the past fiscal year.

NICOMECKLE RIVER.

The channel of this river was cleared of obstructions, and overhanging brush removed from its banks.

VICTORIA HARBOUR.

During the past fiscal year, the work of improving Victoria Harbour was continued, a commencement being made in removing Pinnacle Rock, lying opposite to and 500 feet from the wharf front.

About 200 cubic yards of rock have been removed, but there still remains a small area to be blasted and removed, to give a depth of 14 feet at ordinary low water springs.

The dredge "Pacific" was engaged during the year, in widening and deepening the entrance to the harbour, abreast of "Shoal Point," with the most satisfactory results.

SURVEYS AND EXAMINATIONS.

During the year surveys and examinations were made at the undermentioned localities; and with some exceptions, plans, reports and estimates have been submitted:—

Long Point,	King's Co.	P.E.I.	Cocagne,	Kent Co.	N.B.
St. Peter's Bay	do	do.	Campbellton,	Restigouche Co.	do
Summerside,	Prince Co.	do	Dalhousie	do	do
Bay View,	Queen's Co.	do	Fort Dufferin, Negro Point		
Belfast	do	do	Breakwater,	St. John Co.	do
Cape Traverse	do	do	Gardner's Creek	do	do
China Point	do	do	Quaco	do	do
Hope River	do	do	West Quaco	do	do
Hunt's Point	do	do	River St. John, Grand Falls,	Victoria Co.	do
New London	do	do	Baie Verte,	Westmorland Co.	do
Wood Islands	do	do	Cape Tormentine	do	do
Anderson's Hollow,	Albert Co.	N.B.	Dover	do	do
Coverdale	do	do	Pointe du Chêne	do	do
Edgett's Landing	do	do	Margaretville,	Annapolis Co.	N.S.
Bathurst,	Gloucester Co.	do	Hampton	do	do
Belledune	do	do	Port Lorne	do	do
Clifton	do	do	Arisaig,	Antigonish Co.	do
Grand Anse	do	do	Bayfield	do	do
Tracadie	do	do	Georgeville	do	do

McNair's Cove	Antigonish Co.	N.S.	Pointe Jaune	Gaspé Co.	P.Q.
East Bay,	Cape Breton Co.	do	Rivière au Renard	do	do
Grand Narrows	do	do	Rivière à Claude	do	do
Brulé,	Colchester Co.	do	St. Anicet,	Huntingdon Co.	do
Port au Pique	do	do	Lanoraie,	Joliette Co.	do
Eatonville,	Cumberland Co.	do	St. André de Kamouraska,	Kamouraska Co.	do
Joggins	do	do	Lévis Graving Dock entrance,	Lévis Co.	do
Little River	do	do	L'Islet,	L'Islet Co.	do
Minudie	do	do	St. Jean Port Joli	do	do
Shulee	do	do	St. Jean d'Orléans,	Montmorency Co.	do
Two Rivers	do	do	St. Laurent,	do	do
Church Point,	Digby Co.	do	North Nation River,	Ottawa Co.	do
Digby	do	do	Quebec Harbour, Queen's Wharf,	Quebec Co.	do
East Ferry	do	do	Rivière Pot au Buerre,	Richelieu Co.	do
Salmon River	do	do	Matane,	Rimouski Co.	do
Saulnierville	do	do	Ste. Cécile du Bic	do	do
Salmon River,	Halifax Co.	do	Cacouna,	Temiscouata Co.	do
Sheet Harbour	do	do	River Richelieu,		do
Three Fathom Harbour	do	do	River St. Maurice, Grand Piles to Latuque		do
Margaree,	Inverness Co.	do	Rivière Noire,		do
Canada Creek,	King's Co.	do	Lake Temiscamingue bridge		
Chipman's Brook	do	do	River Ottawa,		do
Hall's Harbour	do	do	Port Elgin,	Bruce Co.	Ont.
Morden	do	do	Southampton	do	do
Pictou, East River,	Pictou Co.	do	Port Stanley,	Elgin Co.	do
Port Joli,	Queen's Co.	do	Kingsville,	Essex Co.	do
Pudding Pan	do	do	Owen Sound,	Grey Co.	do
Baccaro or Cat Point,	Shelburne Co.	do	Oxenden	do	do
Cape Negro Island	do	do	Bayfield,	Huron Co.	do
Cape Sable Island	do	do	Oliver's Ferry,	Lanark Co.	do
Red Head	do	do	Little Nation River,	Prescott Co.	do
Clyburn,	Victoria Co.	do	Collingwood,	Simcoe Co.	do
Englishtown	do	do	Hamilton Harbour,	Wentworth Co.	do
Nyanza	do	do	Red River, St. Andrew's Rapids,		Man.
South Gut	do	do	Red River at Tache Ave.,		do
Cranberry Head or Sanford,	Yarmouth Co.	do	Burrard Inlet, First Narrows		B.C.
Pt. Maitland or Green Cove	do	do	Fraser River at Garrybush		do
Pubnico	do	do	Fraser River at Miller's Landing and Chilliwack		do
West Pubnico	do	do	Fraser River, Lytton to Lillooet		do
Yarmouth	do	do	Harrison River		do
Carlton	Bonaventure Co.	P.Q.	Haslam's, Middle and James Creeks		do
New Carlisle	do	do	Nanaimo Harbour, Nicol Rock		do
Knowlton's Landing	Brome Co.	do	Victoria Harbour entrance		do
Ste. Anne de la Pérade,	Champlain Co.	do			
St. Irénée,	Charlevoix Co.	do			
River Mistassini, Lake St. John,	Chicoutimi Co.	do			
Rivière à la Pipe, Lake St. John	do	do			
Grande Rivière,	Gaspé Co.	do			
Pabos	do	do			

DREDGING.

"THE ST. LAWRENCE."

At the beginning of the fiscal year this dredge was at work at Pictou, N.S., deepening up to and along the market wharf. By 23rd July a further quantity of 9,980 cubic yards of clay, mud, &c., had been excavated and the dimensions of the cut were then as follows:—Length from main channel to market wharf, 155 fathoms. Length along the wharf, 45 fathoms, width at outer entrance 160 feet, midway to wharf 120 feet, outside the wharf 120 feet. Depth at outer entrance (half-width channel) 18 feet, balance to 15 feet, midway to wharf 16 and 15 feet, outside the wharf 15 to 12 feet, width along the wharf, outer part 51 feet, midway of wharf 40 feet, inside end wharf 20 feet, depth ½ width 18 feet, balance 12 feet.

Orders were received for this dredge to go to Pointe du Chêne, Westmoreland County, N.B., and on 26th July she left Pictou for that place arriving there on 27th.

Operations were commenced in deepening the channel from Chêne Spit into and along the wharf. The whole length of the cutting made from outside spit to upper side of wharf was 632 fathoms, part of the channel having been found of sufficient depth. Outside cut through Chêne Spit 54 fathoms long 258 feet wide. On middle

ground 40 fathoms by 72 feet, inside up to and along wharf 458 fathoms, by 70 feet average width, and a basin 500 feet long by 150 feet wide at western front of railway wharf, the whole to a depth of 16 feet at low tide.

The quantity removed was 35,950 cubic yards, consisting principally of mud and oyster beds.

Orders were received to send dredge to Sissiboo River, Weymouth, Digby County N.S., and work was closed at Point du Chêne on 24th October. Dredge left 25th for Weymouth. The passage after coaling at Pictou was long and stormy, the season was late, and when Weymouth was reached and the dredge finally got to work it was found impracticable to continue, and it was finally ordered to St. John, N.B., to repair 6th December. Only 88 cubic yards of boulders were removed in the trial at Weymouth and the bottom appeared to be either boulders or a ledge covered with a thin layer of sand.

On the arrival of the dredge at St. John, N.B., it was placed in winter quarters, the engines and machinery examined and placed in working order, new tubes were placed in boiler and other necessary repairs effected to make it available for another season's work. The old buckets, links and tumblers were removed and new ones, constructed last year, put in place and other improvements effected.

The dredge left St. John on 3rd June and arrived at Richibucto, Kent County, N.B., on the 12th, when it was placed to work at the Albion or Middle Channel, and is now, at the close of the year, improving the same, 1,313 cubic yards of fine sand having been removed.

The total quantity removed by the "St. Lawrence" during the year is 47,331 cubic yards, costing 32·524 cents per cubic yard.

"CANADA."

The dredge "Canada" on 1st July was working at Mabou, Inverness County, N.S., and continued there till 10th November, except from 6th to 24th October, when it was at Pictou for repairs.

At Mabou a cut 240 feet long, 100 feet wide, was made alongside of the breakwater, leaving a depth at low water of 12 feet. Off the end of the breakwater, where 12 feet depth was obtained, a cut 1,840 feet long was made, from 55 to 85 feet in width, continuing the depth to 12 feet L. W. S.

At the site of the proposed new wharf a cut 200 feet long, 50 feet wide, and 3 feet deep, was made, leaving 13 feet L. W. S., the material removed being principally mud and sand. The amount excavated at Mabou in the above mentioned period was 20,700 cubic yards of gravel, clay, stone, sand and boulders.

At Pictou market wharf, where dredge operated 26 days in November and December, previously to going on marine slip for winter berth, 1,800 cubic yards of mud were taken out.

Length of cut 250 feet, 50 feet wide, over which 4 feet were taken off leaving 12 feet L. W. springs.

This dredge was placed on the marine slip at Pictou and wintered. The engine, boiler and machinery were examined and placed in working order. The old belting around dredge removed, new and larger belting put on, rudder new plated and repaired.

While at Mabou last fall the vessel touched on the rocks and injured her bottom. Several plates and angle irons were found broken, all of which were removed and new plates and angle irons put in, also two new water tanks.

On 15th May the dredge came off the slip and made preparations for getting to work, and when fitted out worked for 3 days from 19th to 21st May, at Dwyer's wharf, Pictou, N.S., removing 720 cubic yards of mud. Orders were received that dredge be sent to Mabou, N.S., and on 24th May the dredge left Pictou for that place, arriving on 25th.

Work was commenced next day and at the end of the year was in progress, at which time a further quantity of 6,930 cubic yards of sand had been removed, improving and deepening the work of last season.

The total quantity removed by this dredge during the year was 30,150 cubic yards, costing 39·336 cents per cubic yard.

"NEW DOMINION."

On 1st July the above dredge was at work on the Kennebecassis River, King's County, N.B., at Perry's Point, remaining till 13th September, when Lamb's Point was taken up on the other side of the bridge up the river. The work consisted in deepening and straightening the channel of the river at these places.

At Perry's Point by 13th September, a cut 420 feet long by 50 feet, and 14 feet deep, up to and through the western draw of the bridge, was made; also one cut 700 feet long by 45 and 12 feet deep at the point, and a second cut 250 feet by 100 wide in front of where it is proposed to build a wharf; also, a basin 20 by 40 feet at upper side and 20 by 60 feet at lower side of proposed wharf for swinging vessels, a further quantity of 27,020 cubic yards of sand and mud being removed.

At Lamb's Point from 14th September till 11th November, 19,110 cubic yards of gravel, clay, mud and sand were removed, in making a cut 1,100 feet long, 45 wide and 12 feet deep. The season getting late the dredge was ordered into winter quarters at St. John, N.B., on the 11th November.

During the winter the engine, boiler, machinery and scows were examined, repaired and made ready for work.

In the spring the dredge commenced work at Hampton, Kennebecassis River, King's County, N.B., and after being made ready and coal supplied it was towed on 16th May to the place named.

The work at Hampton was deepening the channel over a length of 760 feet, 45 feet wide, to a depth of 8 feet, 9,380 yards being removed.

The water getting too low for further work there the dredge was removed to Lamb's Point and resumed the work of deepening the channel at that place, continuing till the end of fiscal year when a cut 200 feet long, 45 wide and 12 feet deep, had been made, and 3,815 cub. yards of material removed, principally sand and mud.

The total quantity removed during the year was 59,325 cub. yards, at a cost of 13·913 cents per cubic yard.

"PRINCE EDWARD."

At the beginning of the fiscal year the dredge "Prince Edward" was operating at Gauthier's Creek North Rustico, Queen's Co., P. E. Island, and continued work until 17th September when orders were given for its removal to Cascumpec, Alberton, Prince Co., P. E. Island.

The dimensions of the work at Gauthier's Creek, North Rustico, are 461 yards in length, 64 feet wide, 11 feet deep at L. W. springs. A cut from main channel a distance through flats towards said creek and improving main channel. The quantity removed was 17,847 cub. yards, principally clay, sand and mud.

After some delay on account of storms the dredge was towed to Cascumpec, arriving 3rd October. The work there was the removal of 1,157 yards blasted sandstone rock from the bar at entrance of harbour.

On 8th November, it being found too late in the season to continue work, the dredge and scows were prepared for towing to winter quarters at Duck Creek. The engine, boiler, machinery and scows were examined and placed in working order, a new crane was contracted for and completed by the end of June.

The total quantity removed during the year was 19,004 cubic yards, at a cost of 46·537 cents per cubic yard.

"GEO. MCKENZIE."

On 1st July this dredge was at work improving the channel at Big Tracadie, Antigonish Co., N. S., continuing there till 24th of that month, removing a further quantity of 5,070 cubic yards of clay and gravel. The dimensions of the work are 750 feet in length by 200 in width at inner end and 170 feet at outer end, where the

channel was only 30 feet wide before the dredging commenced, giving a depth of 7 feet at L. W. springs.

At Tatamagouche, Colchester County, N. S., which place the dredge reached 30th July, work was under way by 4th August, and closed 12th September, and consisted in making a basin in front of Patterson's wharf, 360 feet long, 160 feet wide at outer end and 80 feet at inner end, 7 feet deep L. W. S; a channel 378 feet by 30 feet, up to Campbell's wharf, and from the forks to Campbell and Patterson's basin a channel 376 feet by 45, the total quantity excavated being 7,755 cubic yards of mud and clay.

Orders were given for the dredge to proceed to Cheticamp, Inverness County, N. S. After detention on account of storm that place was reached and work commenced 22nd September and continued till 7th November, when the dredge was placed in winter quarters.

During the winter repairs were made to engines, boiler, machinery and scows, and on 3rd June the dredge resumed work at Cheticamp widening and deepening the channel, the dimensions of work being a cut along side of former channel 1,100 feet long by 40 wide, 14 feet deep L. W. springs, where the depth before dredging ranged from 8 to 12 feet deep.

Up to the close of the fiscal year the quantity of kelp, seaweed and sand removed was 8,655 cubic yards, and the work is being further prosecuted.

The total quantity removed by this dredge during the year is 21,480 cubic yards, at a cost of 43·070 cents per cubic yard.

"THE CHALLENGE."

On the 2nd July, 1890, the dredge "Challenge" and plant was working at Kincardine, Ont., removing an accumulation of sand in the basin and along the piers. Two cuts were made along the north pier, one 1,385 feet long, 25 feet wide, extending from the bridge to the outer end of pier, and a second cut 800 feet long, 25 feet wide, from the basin to outer end of pier to a depth of 13 feet in the basin and 16 feet between the piers. One cut was also made along west side of harbour, 500 feet long, and one cut along south side 285 feet long, to a depth of 13 feet. 17,460 cubic yards of ordinary sand and mud was removed.

The plant left Kincardine on the 21st August for Port Albert, but, owing to the extreme high winds, had to put into Goderich for shelter, and only began operations at Port Albert on the 25th and worked there up to the 30th September, making a channel through a sand bar which had formed between the piers. One cut was made 500 feet long, 25 feet wide and 10 feet deep, removing 4,860 cubic yards of ordinary sand, gravel and clay.

Owing to the prevailing high winds and exposed position of this harbour, causing great loss of time, operations at this place were discontinued and the dredge taken to Meaford, Ont., beginning work there on the 9th October on a bar at the inside of breakwater on end of west pier, making one cut 200 feet long, and one 175 feet long, leaving a channel 45 feet wide, with a depth of 15 feet at low water. Also made two cuts on west side of basin. One 475 feet long, and one 275 feet, 13 feet deep, 4,320 cubic yards of clay, hard-pan and clay being removed.

On the 24th October, the plant was towed to Collingwood, Ont., and laid up for the winter.

In the spring of 1891, the plant was taken to Meaford, Ont., and commenced operations there on the 20th May, deepening the channel between the piers, and worked there up to the 8th June, when the plant was ordered to Owen Sound, to remove a sand shoal at the outer range light, and worked there until the 20th, making one cut 600 feet, and one 300 feet long, leaving a channel 150 feet wide, with 16 feet of water at outer light. The material removed consisted of 3,360 cubic yards of ordinary sand. Operations were resumed at Meaford on the 22nd June, and continued up to the close of the fiscal year, making a cut 675 feet long and 25 feet wide, to a depth of 15 feet. 200 feet of this cut was done last autumn, but owing to the loose nature of the deposit, had filled up again

to a considerable extent. 5,940 cubic yards of hard-pan and gravel were removed, making a total of 10,260 cubic yards removed at this place during the fiscal year.

During the winter of 1890-91, the dredge and tug were overhauled and repaired at the dry dock, Collingwood. A thorough repair was also given to the boiler of the tug. This plant is now in fair condition, except the hull of the tug, which will require rebuilding at an early date.

The total quantity removed by the "Challenge" during the year is 35,940 cubic yards; cost, $21\frac{3}{10}$ cents per cubic yard.

"NIPISSING."

On the 2nd July, 1890, this dredge was working at Lachine, Que., making three cuts in front of the local wharves, one cut 168 feet long, one cut 200 feet long, and one cut 378 feet long, to a depth of 8 feet; 2,385 cubic yards of mud, clay and stone, and boulders being removed.

The plant was next towed to Beauharnois on the 16th July, and commenced work, digging up old piers and cribwork and deepening channel in front of the village wharves to 10 feet, removing 12,060 cubic yards of clay, clay and stone and boulders.

On the 25th August, the plant was towed to Shoal No. 4 (near Goose Island), Ottawa River, and worked there up to the close of navigation, making two cuts 2,530 feet long and 25 feet wide, and one cut 800 feet long and 25 feet wide to a depth of 10 feet.

The materials removed consisted of 15,915 cubic yards of ordinary sand, mixed with sawdust.

On 4th November, the plant was towed to Ottawa, and laid up for the winter in the Rideau Canal basin.

After the usual outfitting and repair in the spring of 1891, the dredge and plant was taken to the Lake of Two Mountains, on 25th May, and commenced work on the clay shoal below Jones Island, and worked there until the 6th June, when the plant was removed to Ste. Placide, making two cuts along east side of wharf, 112 feet long, to a depth of 8 feet, removing 1,590 cubic yards of hard-pan and boulders.

Considerable delay was caused at this place by the breaking of the dredge machinery owing to the hard digging.

On the 25th June, the dredge resumed work on the shoal below Jones Island and worked there up to close of the fiscal year, removing 2,460 cubic yards of clay.

This plant is in good condition and will require very little expenditure for some years beyond ordinary repairs.

The total quantity removed by the "Nipissing" during the year is 34,410 cubic yards, at a cost of $20\frac{9}{10}$ cents per cubic yard.

"THE ONTARIO."

On the 2nd July, 1890, the dredge "Ontario" and plant was finishing work at Bowmanville, Ont., removing 780 cubic yards of ordinary sand. Completed work there on the 3rd and towed to Frenchman's Bay (Pickering, Ont.); commenced work on the 4th and continued there up to the 5th August, making two cuts between the piers out to deep water, 775 feet long, 50 feet wide and 12 feet deep. Also belled off one side of channel running from piers to elevator at the wharf and removed an old sunken pier which was a great obstruction to vessels, and removed 12,000 cubic yards of sand, mud and gravel.

The plant was next taken to Whitby, Ont. Commenced operations there on the 9th August, making two cuts through the harbour on the east side of west pier, 975 feet long, 50 feet wide, to a depth of 12 feet. Also belled off inner end of cuts in front of lumber dock, removing 9,930 cubic yards of sand.

Considerable delay was caused here owing to the high winds and heavy sea.

On the 2nd September the dredge and plant was towed to Shannonville, and commenced work on the 6th on a bar at the mouth of the Shannon River, making two cuts 1,270 feet long, 50 feet wide, to an average depth of $11\frac{1}{2}$ feet. Also made one

cut through first bend in the river 200 feet long, by 25 feet wide, removing 13,830 cubic yards of clay, sand, mud and gravel.

A considerable quantity of sawdust and logs were also removed at this place.

The plant left Shannonville for Trenton on the 15th October, arrived there on the 17th, and commenced work on the new channel through a shoal between the town of Trenton and the Murray Canal, made one cut 1,050 feet long, 25 feet wide at bottom, and giving a depth of 8½ feet at low water, and removed 5,000 cubic yards of clay, mud, boulders and gravel.

On the 13th November, at the close of navigation, the plant left Trenton and arrived at Belleville on the 17th where it was laid up for the winter.

In the spring of 1891, the plant was towed to Trenton and resumed operations on the 16th May, cutting new channel through the shoal and worked there up to the 10th June, when the plant was taken to Picton, Ont., and placed on the dry dock where a thorough caulking and repair was given to the hulls of dredge, tug and both scows. On the 27th June, the plant was towed back to Trenton, and worked there up to close of the fiscal year, removing 5,225 cubic yards of clay, gravel, boulders and mud, making a total of 10,225 cubic yards of material taken out at this place during the fiscal year.

One new scow was added to this plant during the season and the general condition of the dredge and tug is good.

The total quantity removed by the "Ontario" during the year is 46,765 cubic yards, at a cost of $18\frac{2}{10}$ cents per cubic yard.

"THE QUEEN."

On the 2nd July, 1890, this dredge was working on the north branch of the Rideau River at Kemptville, Ont., making a channel and basin in front of proposed wharf to join channel to Rideau Canal to a depth of 7 feet, removing 2,575 cubic yards of clay, mud, hard-pan and boulders.

The plant was taken to the Ottawa River on the 17th September and commenced work on Shoal No. 1, three miles below the City of Ottawa, and worked there up to the close of navigation, making one cut 2,400 feet long, and one cut 1,250 feet long, to a depth of 10 feet, removing 12,372 cubic yards of ordinary sand.

On the 3rd November, the close of navigation, the plant was towed to Ottawa and laid up for the winter in the Rideau Canal basin.

After the usual outfitting and repair, the plant left Ottawa on the 23rd May, 1891, and was towed to Yamaska River, where it commenced work in the channel above the lock on the 30th, making two cuts of 625 feet long, to a depth of 7 feet, and one cut below the lock 875 feet long, to the same depth, removing 7,744 cubic yards of ordinary sand, fine sand and clay.

The plant was still working there at the close of the fiscal year.

Owing to the hard digging at Kemptville, considerable repairs were required and given this dredge during the past winter. The plant is now in a fair condition, except the boiler of the tug "Sensation" (tender for this dredge) which is very old, requiring frequent repair and curtailing of the steam pressure. A new boiler is absolutely necessary.

The total quantity removed by the "Queen" during the year is 22,691 cubic yards, at a cost of $33\frac{1}{3}\frac{1}{2}$ cents per cubic yard.

"ST. LOUIS."

On the 2nd July 1890, this dredge was working in conjunction with the dredge "Queen" at Kemptville, Ont., dredging a basin in front of proposed wharf to a depth of 7 feet, and remained there up to 2nd August, removing 3,000 cubic yards of clay and ordinary sand.

The plant was next towed to the Lake of Two Mountains, Que., and commenced work on the shoal below Jones Island, making one cut 1,500 feet long, 25 feet wide and 10 feet deep, removing 5,450 cubic yards of sand.

On the 25th October the plant was towed to Ottawa, and laid up for the winter in the canal basin.

This dredge having been built for special work on the St. Louis feeder, was found to be too small for lake and river service, consequently, during the spring of 1891, a complete new hull was built, and a thorough overhaul given to the machinery, after which the plant was taken to Trenton, Ont., to work in conjunction with the dredge "Ontario," on the new channel through shoal between the town of Trenton and the Murray Canal, and worked there up to the close of the fiscal year, making 9½ feet of water, and removing 1,125 cubic yards of mud.

The dredge and scows are in good condition, but the hull of the tug "Davis" (tender for this dredge) is in a very unreliable condition, and will require rebuilding at an early date.

The total quantity removed by the "St. Louis" during the year is 9,575 cubic yards, at a cost of $74\frac{7}{10}$ cents per cubic yard.

THE "WINNIPEG."

Dredging operations, at the mouth of the Red River, commenced 1st July, and ceased at the middle of November.

The quantity of material removed during the season has been fairly satisfactory, but the work done in the lake at the mouth of the Red River was not so, owing to constant high winds. In fact, work in the lake had to be abandoned. The dredge was moved into the river, and did very necessary work in widening the channel near what is known as Salimony's channel, where the water is very shallow.

The lake boats had no difficulty in making the mouth of the river through the channel as dredged, during the roughest weather experienced.

The plant was placed for the winter at the head of the west slough, near West Selkirk. Owing to the dredge leaking near the anchor timbers, it was necessary to haul her out in readiness for repairs, which were done this spring.

The total quantity of material removed amounts to 45,420 cubic yards, costing 26½ cents per cubic yard.

The plant is in every way in thorough repair.

THE "PRIESTMAN."

During the beginning of the season 1890, the outer end of the channel of the White Mud River had somewhat filled in, and the dredge was set to work early in August, giving 5 feet of water throughout. Work was then commenced widening the mouth of the channel to give a width of 300 feet at the entrance.

The quantity of material removed during the season has not been satisfactory, owing to constant high winds.

The material dredged is principally stiff clay and a small amount of quicksand. Operations ceased in the middle of November, and the plant was put into winter quarters at the mouth of the river.

The quantity of material removed amounts to 7,347 cubic yards, at a cost of 73 cents per cubic yard.

During the year necessary repairs were made to the dredge and tug, but the former is very much out of repair and needs overhauling.

THE "PACIFIC."

During the past fiscal year the "Pacific" was engaged in widening and deepening the entrance to Victoria harbour, abreast of Shoal Point, with satisfactory results.

From July to the end of April 22,130 cubic yards of material were removed, consisting of mud and shingle.

During the past year numerous and necessary repairs were effected to the dredge and attendant vessels, and the plant is now in good working order.

THE "SAMSON."

The snag-boat "Samson" was employed during the year in removing the snags from the channel of the Fraser, and also in seeing that the buoys marking the channel across the sand heads were in their proper places.

During the past year the "Samson" lifted and placed ashore 121 snags, which were obstructing navigation and interfering with the salmon nets.

Various necessary repairs were made to the hull and machinery, and the plant put in good order.

DREDGING PLANT.

The dredging plant belonging to the Department is as follows:—

In the Maritime Provinces.

The steam hopper dredge "St. Lawrence.
do do "Canada."
The dipper dredge "New Dominion," and 8 scows.
do "Prince Edward," and 6 scows.
do "Geo. McKenzie," 5 scows and 1 water scow. Also five old scows belonging to the lost dredge, "Cape Breton."
One stone scow, boiler, engine, derrick and grips.

In Quebec.

The dipper dredge "Queen," 2 scows and tug "Sensation."
do "Nipissing." 2 scows and tug "Ottawa."
do "St. Louis," 2 scows, living scow and tug "Davis."
The sand dredge "Octopus."
Stone lifters, Nos. 1 and 2.

Ship Channel, River St. Lawrence.

Six elevator dredges, tugs "John Pratt," "St. James," "St. Francis," "St. Paul," "C. J. Brydges," "Minnie Parsons," "Delisle," three stone lifters, two coal barges, one stone ship, twelve dump scows of eighty yards capacity, five scows of 150 yards capacity, one sounding scow and two flat scows.

In Ontario.

The dipper dredge "Challenge," 2 scows and tug "Trudeau."
do "Ontario," 2 scows and tug "Sir John."

In Manitoba.

Dredge "Winnipeg," tug "Sir Hector" and two scows and one coal barge.
Dredge "Priestman," tug "Victoria" and two scows.

In British Columbia.

The elevator dredge "Pacific," scows and tug "Princess."
The snag boat "Samson."

CLASSIFICATION of disbursements of the Dredge "St. Lawrence," during the Year ending 30th June, 1891.

Items.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand Totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	509 15	508 33	505 52	509 78	508 33	461 51	275 26	270 33	273 09	344 52	440 04	542 10	5,147 96
Coal	234 60	254 16	.....	349 02	142 50	635 50	.....	.....	.....	.....	.....	638 25	2,254 03
Provisions	227 90	.....	277 96	377 09	134 48	.....	95 07	.....	123 60	67 39	65 38	307 38	1,676 25
Stores	.....	3 25	64 69	11 95	.....	.....	.....	.....	91 97	.....	30 58	361 25	563 69
Equipment	.....	.....	.....	.....	.....	.....	16 50	15 15	.....	250 00	.....	940 82	1,222 47
Water	.....	.....	14 30	.....	.....	3 25	.....	.....	.....	.....	.....	.....	17 55
Repairs	88 71	.....	119 80	44 79	170 77	.....	.....	.....	68 70	274 02	526 30	1,151 56	2,444 65
Pilotage	57 50	65 00	65 00	65 00	.....	40 00	.....	.....	.....	.....	.....	106 00	398 50
Towage	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wharfage	.....	.....	.....	.....	154 40	43 75	.....	.....	.....	100 00	.....	59 00	357 15
Contingencies	5 89	16 92	.....	.....	14 94	.....	11 15	.....	6 88	.....	10 50	.....	66 28
Totals	1,123 75	847 66	1,047 27	1,357 63	1,125 42	1,184 01	397 98	285 48	564 24	1,035 93	1,072 80	4,106 36	14,148 53
Working expenses	1,035 04	847 66	927 47	1,312 84	954 65	1,184 01	397 98	285 48	420 15	250 00	525 36	2,155 23	10,295 87
Repairs, ordinary	75 53	.....	.....	.....	1 75	.....	.....	.....	.....	.....	.....	26 04	103 32
D. V. repairs and wintering	13 18	.....	119 80	44 79	169 02	.....	.....	.....	144 09	785 93	547 44	1,925 09	3,749 34
Totals	1,123 75	847 66	1,047 27	1,357 63	1,125 42	1,184 01	397 98	285 48	564 24	1,035 93	1,072 80	4,106 36	14,148 53

[1891

CLASSIFICATION of disbursements of the Dredge "Canada," during the Year ending 30th June, 1891.

Items.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	408 21	390 33	390 33	390 33	390 33	347 88	230 33	230 33	286 38	687 59	400 88	480 33	4,633 25
Coal		110 40	145 48		27 60						55 20	188 89	527 57
Provisions	63 44	39 72	119 33	139 24			111 18		50 70	99 86	61 32	246 30	931 09
Stores		83 89							80 20	35 44			220 99
Equipment		4 40					13 15	17 60		6 00			41 15
Water		1 00											1 00
Repairs	30 54	1 00		492 12		221 74			15 05		184 63	2,192 65	3,137 73
Pilotage	67 50	55 00	65 00	30 00	42 50		5 00				7 50		272 50
Towage													
Wharfage									389 60	66 60	118 40	501 78	1,076 38
Contingencies		8 34	9 96				17 52			9 30		12 33	57 45
Totals	569 69	694 08	730 10	1,073 15	460 43	569 62	377 18	247 93	821 93	904 79	827 93	3,622 28	10,899 11
Working expenses	539 15	693 08	730 10	581 03	460 43	347 88	377 18	247 93	130 90	115 16	524 90	915 52	5,663 26
Repairs, ordinary	30 54	1 00											31 54
do extraordinary				492 12		221 74			691 03	789 63	303 03	2,706 76	5,204 31
Total	569 69	694 08	730 10	1,073 15	460 43	569 62	377 18	247 93	821 93	904 79	827 93	3,622 28	10,899 11

[1891]

Classification of Disbursements of the Dredge "New Dominion," during the Year ending 30th June, 1891.

Items.	July.	August.	September	October.	November	December	January.	February.	March.	April.	May.	June.	Grand Totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	489 31	494 50	494 50	497 75	401 19	157 50	157 50	150 00	183 00	399 06	503 06	494 50	4,421 87
Coal		164 60	191 34	8 00							163 07		527 01
Provisions													
Stores					10 83	22 01	3 73				292 89		333 32
Equipment													
Water											17 25		17 25
Repairs				14 00	8 62				7 37	59 69	197 87	2 00	289 55
Pilotage						2 00						2 00	4 00
Towage	328 80	325 00	310 14	280 00	156 60						209 00	312 00	1,921 54
Wharfage											50 00		50 00
Contingencies	2 00				2 00	8 40						8 35	20 75
Totals	820 11	984 10	995 98	799 75	579 24	189 91	161 23	150 00	190 37	458 75	1,433 14	822 71	7,585 29
Working expenses	820 11	984 10	995 98	785 75	570 62	189 91	161 23	150 00			771 09	806 50	6,235 29
Repairs, ordinary					8 62								8 62
D.V. repairs and wintering				14 00					190 37	458 75	662 05	16 21	1,341 38
Totals	820 11	984 10	995 98	799 75	579 24	189 91	161 23	150 00	190 37	458 75	1,433 14	822 71	7,585 29

[1891]

CLASSIFICATION of Disbursements of the Dredge "Prince Edward" during the Year ended 30th June, 1891.

Items.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand Totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	497 75	494 50	494 50	517 17	339 41	157 50	157 50	150 00	155 00	267 00	155 00	228 68	3,614 01
Coal	224 54	110 40	209 00	14 98	.....	.....	.....	.....	.....	.....	.....	.....	558 92
Provisions	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stores	28 04	.....	.....	25 34	57 30	.....	52 74	.....	.....	.....	.....	20 00	183 42
Equipment	.....	.....	.....	.....	.....	.....	3 23	.....	.....	.....	.....	.....	3 23
Water	40 00	40 00	44 00	40 00	40 00	.....	14 45	.....	.....	5 00	.....	.....	223 45
Repairs	32 27	.....	14 50	12 50	47 00	.....	128 00	10 60	4 60	.....	226 20	253 40	729 07
Pilotage	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5 00	5 00
Towage	.....	.....	.....	.....	.....	2,761 25	.....	.....	.....	.....	.....	.....	2,761 25
Wharfage	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Contingencies	.....	.....	.....	.....	.....	.....	9 00	.....	.....	.....	.....	40 00	49 00
Totals	822 60	644 90	762 00	609 99	483 71	2,918 75	364 92	160 60	159 60	272 00	381 20	547 08	8,127 35
Working expenses	790 33	644 90	747 50	597 49	436 71	2,918 75	236 92	150 00	.....	5 00	.....	233 68	6,761 28
Repairs, ordinary	32 27	.....	14 50	12 50	.....	.....	128 00	10 60	.....	.....	.....	.....	197 87
do extraordinary	.....	.....	.....	.....	47 00	.....	.....	.....	159 60	267 00	381 20	313 40	1,168 20
Totals	822 60	644 90	762 00	609 99	483 71	2,918 75	364 92	160 60	159 60	272 00	381 20	547 08	8,127 35

Classification of Disbursements of the Dredge "Geo. McKenzie," during the Year ended 30th June, 1891.

Items.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand Totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	497 75	574 75	472 37	497 75	381 65	251 25	157 50	150 00	155 00	216 95	330 12	414 64	4,099 73
Coal	82 80	97 76	157 80										338 36
Provisions			16 23										16 23
Stores		6 50		164 77	24 15	3 90				10 68			210 00
Equipment										4 75			4 75
Water	36 00	45 50	40 50	25 00									147 00
Repairs	3 00	10 36			22 03					17 86	138 92	46 11	238 28
Pilotage													
Towage					1,282 05	1,451 24						645 25	3,378 54
Wharfage													
Contingencies					25 92			33 20				10 00	69 12
Totals	619 55	734 87	686 90	687 52	1,735 80	1,706 39	157 50	183 20	155 00	250 24	469 04	1,116 00	8,502 01
Working expenses	619 55	724 51	686 90	687 52	1,713 77	1,612 64	157 50	183 20				1,100 75	7,486 34
Repairs, ordinary		10 36			22 03								32 39
do extraordinary						93 75			155 00	250 24	469 04	15 25	983 28
Totals	619 55	734 87	686 90	687 52	1,735 80	1,706 39	157 50	183 20	155 00	250 24	469 04	1,116 00	8,502 01

[1891]

CLASSIFICATION of disbursements of the Dredge "Nipissing," during the Year ended 30th June, 1891.

Items.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	346 50	346 50	321 00	515 00	122 00						305 48	293 50	2,249 98
Coal	723 65	450 20									312 00		1,485 85
Wood													
Provisions	108 68	100 00	105 74	91 26	31 95						34 58	92 70	564 91
Stores					5 20				85 20	108 59	36 69		235 68
Equipment										114 95	56 25		171 20
Repairs	89 05		66 85		255 74	190 80	189 53	237 60	401 82	598 71	248 57	69 05	2,347 72
Pilotage													
Towage											5 00		5 00
Contingencies	19 35	42 75	16 41	5 35	1 45					14 27		23 17	122 75
Totals	1,287 23	939 45	510 00	611 61	416 34	190 80	189 53	237 60	487 02	836 52	998 57	478 42	7,183 09
Working expenses	1,198 18	939 45	443 15	611 61	160 60				85 20	237 81	750 00	409 37	4,835 37
Repairs, ordinary	2 10		66 85		255 74	13 23			111 15	257 24	158 25	7 36	871 92
do extraordinary	86 95					177 57	189 53	237 60	290 67	341 47	90 32	61 69	1,475 80
Totals	1,287 23	939 45	510 00	611 61	416 34	190 80	189 53	237 60	487 02	836 52	998 57	478 42	7,183 09

[1891]

Classification of disbursements of the Dredge "St. Louis," during the Year ended 30th June, 1891.

Items.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	279 00	279 00	279 00	448 00							199 00	264 16	1,748 16
Coal	452 29	380 00	85 05	118 47							130 00	90 75	1,256 56
Wood			5 00										5 00
Provisions	90 00	92 40	90 00	84 75								109 12	466 27
Stores	5 50		2 00						66 90	74 55	24 13		173 08
Equipment										84 99	85 51	27 10	197 60
Repairs	13 10	9 60							1,154 97	571 90	1,282 18	101 06	3,132 81
Pilotage		5 00										15 00	20 00
Towage													
Contingencies	4 10	6 45	2 30	130 00						11 50			154 35
Totals	843 99	772 45	463 35	781 22					1,221 87	742 94	1,720 82	607 19	7,153 83
Working expenses	830 89	762 85	463 35	781 22					66 90	171 04	438 64	506 13	4,021 02
Repairs, ordinary	13 10	9 60								71 90	5 87	101 06	201 53
" extraordinary									1,154 97	500 00	1,276 31		2,931 28
Totals	843 99	772 45	463 35	781 22					1,221 87	742 94	1,720 82	607 19	7,153 83

[1891]

CLASSIFICATION of disbursements of the Dredge "Queen," during the Year ended 30th June, 1891.

Items.	July.	August.	September	October.	November	December	January.	February.	March.	April.	May.	June.	Grand Totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	271 26	294 42	292 34	432 59	114 32					190 84	292 82	333 50	2,222 09
Coal	182 00	192 90	416 00		50 00						375 40		1,216 30
Wood												2 50	2 50
Provisions	90 00	90 00	91 50	90 00	30 90						35 63	97 00	525 03
Stores	7 29	28 80		5 50	60				71 10	101 42	21 77		236 48
Equipment		17 71		3 60						76 10	70 35		167 76
Repairs	16 45	347 60	87 46		297 87	203 92	189 54	237 60	407 95	723 96	359 29		2,871 64
Pilotage											7 00		7 00
Towage													
Contingencies	4 84	8 89	108 89	6 79	1 60					13 60	100 00	1 67	246 28
Totals	571 84	980 32	996 19	538 48	495 29	203 92	189 54	237 60	479 05	1,105 92	1,262 26	434 67	7,495 08
Working expenses	555 39	632 72	908 73	538 48	197 42				71 10	381 96	902 97	434 67	4,623 44
Repairs, ordinary	16 45	22 65	87 46		84 27	26 44			117 28	136 03	268 97		759 55
do extraordinary		324 95			213 60	177 48	189 54	237 60	290 67	587 93	90 32		2,112 09
Totals	571 84	980 32	996 19	538 48	495 29	203 92	189 54	237 60	479 05	1,105 92	1,262 26	434 67	7,495 08

[1891]

Classification of Disbursements of the Dredge "Ontario," during the Year ended 30th June, 1891.

Items.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand Totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	322 00	354 31	316 33	524 00	271 50	30 00	30 00	30 00	30 00	195 66	387 63	332 18	2,823 61
Coal			257 68	260 40	141 36						95 00	215 06	969 50
Wood				1 35									1 35
Provisions	100 00	92 91	98 67	100 00	66 67							103 34	561 59
Stores		18 78		5 00				88 50		141 65	63 45		317 38
Equipment				96 00	4 50					104 18		8 55	213 23
Repairs			34 48		164 25	101 97	94 77	186 63	176 98	1,049 92	579 22	843 05	3,231 27
Pilotage			12 00									12 50	24 50
Towage													
Contingencies	14 38	111 64		1 58		6 92				24 38	110 58	115 45	384 93
Totals	436 38	577 64	719 16	988 33	648 28	138 89	124 77	305 13	206 98	1,515 79	1,235 88	1,630 13	8,527 36
Working expenses	436 38	577 64	684 68	988 33	484 03	36 92	30 00	118 50	30 00	465 87	656 66	787 08	5,296 09
Repairs, ordinary			34 48		57 45	13 23		67 83	176 98	258 86	185 36		794 22
do extraordinary					106 80	88 74	94 77	118 80		791 03	393 86	843 05	2,437 05
Totals	436 38	577 64	719 16	988 33	648 28	138 89	124 77	305 13	206 98	1,515 79	1,235 88	1,630 13	8,527 36

CLASSIFICATION of disbursements of the Dredge "Challenge" during the Year ended 30th June, 1891.

Items.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	383 00	333 00	333 00	541 00	30 00	30 00	30 00	30 00	30 00	194 33	299 12	325 50	2,558 95
Coal	4 75	256 17	277 80	280 00								770 00	1,588 72
Wood													
Provisions	100 00	100 00	100 00	110 40							39 35	101 35	551 10
Stores		18 77	11 85		1 25				90 00	107 82	68 97	7 00	305 66
Equipment										198 00			198 00
Repairs	20 41		96 86		268 94	13 23			120 63	1,427 38	218 28	65 98	2,231 71
Pilotage				23 75	5 50							5 00	34 25
Towage													
Contingencies	105 75	19 70	4 40	19 91						18 52	34 47	5 50	208 25
Totals	613 91	727 64	823 91	975 06	305 69	43 23	30 00	30 00	240 63	1,946 05	660 19	1,280 33	7,676 64
Working expenses	593 50	727 64	727 05	975 06	36 75	30 00	30 00	30 00	120 00	518 67	441 91	1,214 35	5,444 93
Repairs, ordinary	20 41		96 86		268 94	13 23			120 63	106 39	218 28	65 98	910 72
do extraordinary										1,320 99			1,320 99
Totals	613 91	727 64	823 91	975 06	305 69	43 23	30 00	30 00	240 63	1,946 05	660 19	1,280 33	7,676 64

PUBLIC WORKS

STATEMENT showing Classification of Cost of Dredging on Ship Channel

Vessel.	Fuel.	Wages.	Board.	Stores and Materials.	General Repairs.	General Expenses.	Salaries and office Expenses.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Dredge No. 8	1,416 19	2,483 21	808 96	295 90		2,639 45	554 81
Proportion of tug service	1,215 90	1,640 50	656 20	270 20	656 85	2,335 30	482 50
Dredge No. 11	2,213 16	3,636 74	1,161 77	508 54	3,226 60	5,668 36	1,191 46
Proportion of tug service	1,522 52	2,054 19	821 69	338 34	821 67	2,924 20	604 17
Dredge No. 12	1,483 89	2,297 08	801 67	128 01	568 79	2,784 60	585 39
Proportion of tug service	1,274 47	1,719 78	687 82	284 69	688 48	2,447 72	505 68
†Dredge No. 13	3,168 79	3,723 22	1,263 46	877 67	3,165 78	6,434 24	1,352 33
Proportion of tug service	1,787 94	2,413 34	964 92	398 12	964 92	3,433 98	709 50
Stone Lifter No. 2	15 30	156 20	13 67	117 37		159 57	33 54
Proportion of tug service	12 62	16 77	6 80	3 33	6 81	24 31	5 07
Stone Lifter No. 3	444 04	1,991 95	730 33	704 50	1,006 79	2,572 66	540 75
Proportion of tug service	531 09	716 55	286 62	119 66	286 62	1,020 03	210 75
*Dredge No. 8							
*Tug "St. Paul"							
*Tug "C. J. Brydges"							
Totals	15,085 91	22,849 53	8,203 91	4,046 33	11,393 31	32,444 32	6,775 95

* Fitting out and repairing vessels now used in the Montreal Harbour.

OF CANADA.

between Montreal and Quebec for the Fiscal Year ended 30th June, 1891.

No. 1 Stone Lifter Service.	Repairs not Charged to Dredging.	Total Cost.	Total Cost including Tug Service.	Number of Working Days.	Cost per Day.	Number of Cubic Yards.	Cost per Cubic Yard.
$ cts.	$ cts.	$ cts.	$ cts.		$ cts.		$ cts.
183 24		8,381 76					
		7,257 45	15,639 21	119	131 42½	40,461	38 65
229 16		17,835 79					
		9,086 78	26,922 57	149	180 68¾	60,254	46 68
183 02		8,832 45					
		7,608 64	16,441 09	119	138 16	57,510	28 58
214 55		20,200 04					
		10,672 72	30,872 76	175	176 41½	57,032	54 15
		495 65					
		75 71	571 36	21	27 20		Assisting Dredge at Lévis.
		7,991 02					
		3,171 32	11,162 34	154	72 48¼	3,431	3 25
	2,422 75	2,422 75	2,422 75				
	331 20	331 20	331 20				
	463 12	463 12	463 12				
809 97	3,217 07	104,826 40	104,826 40				

† Cost per cubic yard greatly increased by work done at Lévis Ferry wharf in 1891.

CLASSIFICATION of disbursements, dredging in Manitoba, for fiscal year 1990–91.

DREDGE "WINNIPEG."

Items.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	570 00	570 00	570 00	570 00	222 50	80 00	80 00	80 00	440 00	231 00			3,413 50
Coal		981 05	927 85										1,908 96
Wood					17 50								17 50
Provisions	282 86	292 28	282 86	292 28	58 93				219 21				1,428 42
Stores													
Equipment					12 52								12 52
Repairs				17 55						69 00			86 55
Pilotage													
Contingencies	105 46	273 12	55 00	385 00	139 70				92 51	115 52			1,166 31
Totals	958 32	2,116 45	1,835 71	1,264 83	451 15	80 00	80 00	80 00	751 72	415 52			8,033 70
Working expenses	958 32	2,116 45	1,835 71	1,247 28	451 15	80 00	80 00	80 00	751 72	346 52			7,947 15
Repairs, ordinary				17 55						69 00			86 55
do extraordinary													
Totals	958 32	2,116 45	1,835 71	1,264 83	451 15	80 00	80 00	80 00	751 72	415 52			8,033 70

DREDGE "PRIESTMAN."

Wages	370 00	370 00	370 00	370 00	147 50	30 00	30 00	30 00	150 00	220 00			2,087 50
Coal		266 63											266 63
Wood					18 75								18 75
Provisions	267 92	267 92	259 28	267 92	58 93					117 85			1,239 82
Equipment				53 91									53 91
Repairs													
Contingencies	40 01	76 52	284 70	118 80	26 06					155 35			701 44
Totals	607 93	981 07	913 98	810 63	251 24	30 00	30 00	30 00	150 00	493 20			4,368 05
Working expenses	607 93	981 07	913 98	810 63	251 24	30 00	30 00	30 00	150 00	493 20			4,368 05
Repairs, ordinary													
do extraordinary													

[1891]

CLASSIFICATION of disbursements dredge "Pacific," during the year ended 30th June, 1891.

Items.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May	June	Grand totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages	615 00		1,230 00		1,230 00	615 00		655 00	615 00		1,071 32		6,031 32
Coal	360 90				531 44			242 80	266 55				1,401 69
Wood			13 50										13 50
Water	10 34			8 01				6 65			3 23		28 23
Provisions	68 06	79 80	289 31	81 37	150 56	122 92	159 84		155 22	162 49	93 25	68 15	1,430 97
Stores	44 92	51 34	152 20	24 78	18 65	77 94	31 85		29 80	68 96	17 70	44 25	562 39
Equipment		82 15		19 63	50 63	12 60	39 36	126 40	98 47	28 89	12 35	2 50	472 98
Repairs													
Pilotage													
Towage													
Wharfage													
Contingencies			11 75		12 00		1 50	7 00				2 50	34 75
Totals	1,099 22	213 29	1,696 76	133 79	1,993 28	828 46	232 55	1,037 85	1,165 04	260 34	1,197 85	117 40	9,975 83
Working expenses	1,099 22	213 29	1,696 76	133 79	1,993 28	828 46	232 55	1,037 85	1,165 04	260 34	1,197 85	117 40	9,975 83
Repairs, ordinary		30 01	35 84	38 48					43 30	56 67	18 00		222 30
do extraordinary	1,030 84	106 20	386 10		100 00	208 00	21 00	47 61				672 58	2,572 33
Totals	2,130 06	349 50	2,118 70	172 27	2,093 28	1,036 46	253 55	1,085 46	1,208 34	317 01	1,215 85	789 98	12,770 46

Classification of Disbursements of Snag Boat during the Year ended 30th June, 1891.

Items.	July.	August.	September	October.	November	December	January	February.	March.	April.	May.	June.	Grand Totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Wages		540 00	540 00	540 00			296 16		301 42	452 93		300 00	2,970 51
Coal			274 05	83 20				64 00		192 00			613 25
Wood						44 00				22 00			66 00
Water													
Provisions			275 37	137 02	6 95		9 75		173 82	140 95		71 61	815 47
Stores			35 80										35 80
Equipment				37 70	2 25	26 74		7 62	7 50				81 81
Repairs													
Pilotage													
Towage													
Wharfage													
Contingencies			9 75		6 25			2 00		7 25	8 00	25 40	58 65
Totals		540 00	1,134 97	797 92	15 45	70 74	305 91	73 62	482 74	815 13	8 00	397 01	4,641 49
Working expenses		540 00	1,134 97	797 92	15 45	70 74	305 91	73 62	482 74	815 13	8 00	397 01	4,641 49
Repairs, ordinary			18 04				70 94		28 53	121 53		212 64	451 68
do extraordinary	555 75		460 96	50 75									1,067 46
Totals	555 75	540 00	1,613 97	848 67	15 45	70 74	376 85	73 62	511 27	936 76	8 00	609 65	6,160 63

CLASSIFICATION and Quantities of Material Removed by the following Dredges during the year ending 30th June, 1891.

"ST. LAWRENCE."

Description of Material Dredged.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand Totals.
	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.
Hard-pan													
Boulders	5	240	185		40								470
Gravel													
Clay	5,590	3,200											8,790
Oyster-bed	700	2,000	2,100	2,975									7,775
Sand, ordinary	620	6,000											6,620
do very fine			5,775		48							1,313	7,136
Mud	4,290	2,800	6,475	2,975									16,540
Totals	11,205	14,240	14,535	5,950	88							1,313	47,331

"CANADA"

Hard-pan													
Boulders			90										90
Gravel	4,410		360	2,070	90							1,260	8,190
Clay													
Clay and stone	1,440	900	3,870										6,210
Sand—ordinary	2,520	3,780			600						1,440	4,230	12,570
Sand—very fine					2,370								2,370
Mud											720		720
Totals	8,370	4,680	4,320	2,070	3,060						2,160	5,490	30,150

CLASSIFICATION and Quantities of Material removed by the following Dredges, &c.—*Continued.*

"NEW DOMINION."

Description of Material Dredged.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand Totals.
	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.
Hard-Pan													
Boulders													
Gravel				980									980
Clay			1,068	1,208	1,383								3,659
Clay and stone													
Sand—ordinary	2,240	5,075	7,822	8,067	1,382						3,185	8,775	36,546
Sand—very fine													
Mud	11,165	5,075	665									1,235	18,140
Totals	13,405	10,150	9,555	10,255	2,765						3,185	10,010	59,325

"PRINCE EDWARD."

Hard-pan				761									761
Boulders		90			396								486
Gravel													
Clay		3,324	61										3,385
Clay and stone			1,632										1,632
Sand, ordinary	4,033												4,033
Sand, very fine													
Mud	3,689	3,324	1,694										8,707
Totals	7,722	6,738	3,387	761	396								19,004

"GEO. McKENZIE."

Hard-pan													
Boulders													
Gravel			300	2,000	300							500	3,100
Clay	5,070												5,070
Clay and stone													
Sand, ordinary		1,500	3,480	2,020	330							1,720	9,050

Sand, very fine													
Mud		4,260											4,260
Totals	5,070	5,760	3,780	4,020	630							2,220	21,480

"NIPISSING."

Hard-pan												615	615
Boulders	2,168	638										975	3,781
Gravel													
Clay	1,230	6,367										2,460	10,057
Clay and stone	3,105												3,105
Sand, ordinary			7,305	8,310	300								15,915
do very fine													
Mud	937												937
Totals	7,440	7,005	7,305	8,310	300							4,050	34,410

"ST. LOUIS."

Hard-pan													
Boulders													
Gravel													
Clay	2,551												2,551
Clay and stone													
Sand, ordinary	449	450	800	1,550									3,249
do very fine		925	1,725										2,650
Mud												1,125	1,125
Totals	3,000	1,375	2,525	1,550								1,125	9,575

"QUEEN."

Hard-pan	100	164											264
Boulders	325	492											817
Gravel													
Clay	350	44									32	3,033	3,459
Clay and stone	725												725
Sand, ordinary			5,028	7,216	128							384	12,756
do very fine											32	4,263	4,295
Mud	375												375
Totals	1,875	700	5,028	7,216	128						64	7,680	22,691

Abstract of work done in deepening the Ship Channel in the River St. Lawrence, between Montreal and Quebec, during the Fiscal Year ended 30th June, 1891.

Vessel.	Locality of Dredging.	Time of Service.		Nominal Working Time, 12 hrs. per day.		Dredging Machinery in Motion.		Quantity dredged in Cubic Yards, Scow Measurement.			Character of Soil.	Quantity dredged at each Place in Cubic Yards.					
		Days.	Total Days.	Hours.	Total Hours.	Hours.	Total Hours.	Earth.	Rock.	Total.		Cap à la Roche.	Pouillier Rayer.	Cap Charles.	Grondines.	Lotbinière.	Lévis.
Dredge No. 8...	Cap à la Roche ...	56	.....	672	.....	522¼	.....	.....	28,810	.....	Soft shale rock and boulders	28,810	.....	.....	.....	.....	.....
	Grondines	63	119	756	1,428	381¾	904	11,550	.....	40,360	Clay, gravel and stones	.....	.....	.....	11,550	.....	.....
do No. 11..	Cap Charles	99	....	1,188	...	804½	.....	.....	37,380	.....	Hard shale rock...	.....	.....	37,380	.....	.....	.....
	Cap à la Roche ...	50	149	600	1,788	450½	1,255¼	.....	22,800	60,180	do ...	22,800	.....	.....	.....	.....	.....
do No. 12...	Pouillier Rayer ...	83	.....	996	...	790¾	...	42,480	.....	.....	Clay, hard-pan and boulders	.....	42,480	.....	.....	.....	.....
	Grondines.....	36	119	432	1,428	241¾	1,032½	15,030	.....	57,510	Sand, gravel and stones	.....	.....	.....	15,030	.....	.....
do No. 13..	Cap à la Roche ...	139½	.....	1,674	.....	1,151	.....	.....	53,925	.....	Hard shale rock...	53,925	.....	.....	.....	.....	.....
	Lévis	35½	175	426	2,100	165½	1,316½	2,955	.....	56,880	Sand, gravel and stones	.....	.....	.....	.....	.....	2,955
Stone Lifter No. 1	Cap à la Roche..	Assisting dredges when needed.						.....	124	.....	Boulders and large pieces of shale rock.....	124	.....	.....	.....	.....	.....
	Cap Charles							.....	74	.....		.....	.....	74	.....	.....	.....
	Grondines							.....	101	299		.....	.....	.....	101	.....	.....
do No. 2.	Lévis	21	Assisting Dredge No. 13.					.....	28	.....	Boulders	.....	.....	.....	.....	.....	28
do No. 3.	Grondines....	17	...	204	.....	187	.....	.....	335	.....	do	.....	.....	.....	335	.....	.....
	Pouillier Rayer ...	66	.....	792	....	675	.....	.....	1,443	.....	do	.....	1,443	.....	.....	.....	.....
	Lotbinière.....	30	....	360	....	249½	.....	.....	1,224	.....	do	.....	.....	.....	.....	1,224	.....
	Lévis	16½	....	198	.....	70	.....	.....	129	.....	do	.....	.....	.....	.....	.....	129
	Cap à la Roche ...	24½	154	294	1,848	206	1,387½	.....	300	3,431	do	300	.....	.....	.....	.....	.....
	Totals.....	716	716	8,592	8,592	5,895¾	5,895¾	72,015	146,673	218,688	.....	105,959	43,923	37,454	27,016	1,224	3,112

CLASSIFICATION and Quantities of Material removed by Dredges, &c.—*Continued.*

"ONTARIO."

Description of Material Dredged.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Grand Total.
	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.	c. yds.
Boulders				1,214	534						443	510	2,701
Gravel	660	450	1,095	1,513	533						1,041	930	6,222
Clay			7,575	3,793	533						1,041		12,942
Sand, ordinary	10,560	9,480	1,500										21,540
Mud		660		1,440								1,260	3,360
Totals	11,220	10,590	10,170	7,960	1,600						2,525	2,700	46,765

"CHALLENGE."

Hard-pan				1,200							1,740	3,900	6,840
Gravel			1,860								300		2,160
Clay			240	660									900
Clay and stone				2,460									2,460
Sand, ordinary	11,100	5,220	2,460									3,360	22,140
Mud		1,440											1,440
Totals	11,100	6,660	4,560	4,320							2,040	7,260	35,940

"PACIFIC."

Sand, ordinary						780		1,440	510		2,730
Hard shingle									1,630		1,630
Mud	2,940	3,540	3,360	3,340	2,730	360	1,260	240			17,760
Totals	2,940	3,540	3,360	3,340	2,730	1,140	1,260	1,680	2,140		22,130

Working days	284	
Days worked		185
do repairing		59
do laid up		40
Total	284	284

DETAILS of Dredging in the Maritime Provinces

Dredge.	Locality.	County.	New Brunswick.		
			Quantity.	Cost of each Work.	Total Cost.
			C. yds.	$ cts.	$ cts.
"New Dominion".	Perry's Point	Kings	27,020	3,759 31	
	Lambs Point	do	22,925	3,189 65	
	Hampton	do	9,380	1,305 08	8,254 04
"Canada ".....	Mabou	Inverness			
	Market Wharf Pictou	Pictou			
	Dwyer's Wharf Pictou	do			
"Prince Edward".	Gauthier's Creek	Queens			
	Cascumpec	Prince			
"St. Lawrence"..	Market Wharf Pictou	Pictou			
	Point du chene	Westmead	35,950	11,693 92	
	Weymouth	Digby			
	Richibucto	Kent	1,313	427 10	12,121 02
"Geo. McKenzie".	Tracadie	Antigonish			
	Tatamagouche	Colchester			
	Cheticamp	Inverness			
			96,588	20,375 06	20,375 06

Dredge.	New Brunswick.		Nova Scotia.	
	Quantity.	Cost.	Quantity.	Cost.
	C. yds.	$ cts.	C. yds.	$ cts.
"New Dominion"	59,325	8,254 04		
"Canada"			30,150	11,860 03
"Prince Edward"				
"St. Lawrence"	37,263	12,121 02	10,068	3,274 93
"Geo. McKenzie"			21,480	9,251 61
	96,588	20,375 06	61,698	24,386 57

for the Year ended 30th June, 1891.

Nova Scotia.			Prince Edward Island.			Quantity by each Dredge.	Total Expenditure.
Quantity.	Cost of each Work.	Total Cost.	Quantity.	Cost of each Work.	Total Cost.		
C. yds.	$ cts.	$ cts.	C. yds.	$ cts.	$ cts.	C. yds.	$ cts.
						59,325	8,254 04
27,630	10,868 76						
1,800	708 05						
720	283 22	11,860 03				30,150	11,860 03
			17,847	8,305 50			
			1,157	538 42	8,843 92	19,004	8,843 92
9,980	3,246 31						
88	28 62	3,274 93					
						47,331	15,395 95
5,070	2,183 69						
7,755	3,340 14						
8,655	3,727 78	9,251 61				21,480	9,251 61
61,698	24,386 57	24,386 57	19,004	8,843 92	8,843 92	17,290	53,605 55

Prince Edward Island.		Total Quantity.	Expenditure Dredging.	Superintendence.	Total. Expenditure.	Cost per Cubic Yard.
Quantity.	Cost.					
C. yds.	$ cts.	C. yds.	$ cts.	$ cts.	$ cts.	$ cts.
		59,325	7,585 29	668 75	8,254 04	0 13·913
		30,150	10,899 17	960 92	11,860 03	0 39·336
19,004	8,843 92	19,004	8,127 35	716 57	8,843 92	0 46·537
		47,331	14,148 53	1,247 42	15,395 95	0 32·528
		21.480	8,502 01	749 60	9,251 61	0 43·070
19,004	8,843 92	177,290	49,262 29	4,343 26	53,605 55	0 30·23

STATEMENT showing the material removed at different localities, the Total Annual Expenditure on each Dredge, and the Average Cost per Cubic Yard, for Fiscal Year, 1890–91.

DREDGE "WINNIPEG."

Date.	Localities.	Clay.	Totals.
		cu. yds.	cu. yds.
June and July, 1890...	West Selkirk, Red River, for Drake & Co	3,000	
	do do do	3,600	
	do do for Capt. Robinson	3,060	
	Mouth of Red River, Lake Winnipeg....(sand and clay)	3,180	
	do do	4,080	
			16,920
August, 1890..	Mouth of Red River, Lake Winnipeg	3,960	
	do do	4,620	
	Salamony's channel	3,360	
	do	3,360	
			15,300
September, 1890.	Salamony's channel	3,960	
	do	3,480	
	do	3,360	
	do	2,400	
			13,200
	Total		45,420

SUMMARY.

Material removed at West Selkirk		9,660	cubic yards.
do	at mouth of Red River	15,840	do
do	at Salamony's channel	19,920	do
	Total	45,420	do
Expenditure for 1890-91			$12,119.62
Cost per cubic yard			0.26½

DREDGE "PRIESTMAN."

Date.	Localities.	Clay.	Sand, Ordinary.	Mud.	Totals.
					c. yds.
June and July, 1890....	Mouth of White Mud River, Lake Manitoba	62	708	.....	770
	do	.....	788	.....	788
	do	298	712	.....	1,010
	do	685	.....	.....	685
	do	.....	585	.....	585
August, 1890..	do	642	.....	.....	642
	do	430	458	.....	888
Sept. and October, 1890	do	.....	578	.....	578
	do	.....	856	200	1,056
	do	*345	.....	.....	345
Totals		2,462	4,685	200	7,347
	Expenditure for 1890-91, $5,369.94. Cost of removing material per cubic yard, 73 cents.				

*Sand and clay.

DREDGE STATEMENT showing Material removed at different localities, Total Annual Expenditure on each Dredge and Average Cost per cubic yard.

DREDGE "CHALLENGE."

Location.	Hard Pan.	Boulders.	Gravel.	Clay.	Clay and Stone.	Sand, Ordinary.	Sand, Fine.	Mud.	Totals.
Kincardine						16,020		1,440	17,460
Port Albert			1,860	240		2,760			4,860
Meaford	6,840		300	660	2,460				10,260
Owen Sound						3,360			3,360
Total	6,840		2,160	900	2,460	22,140		1,440	35,940

Total annual expenditure, $7,676.64. Cost per cubic yard, $21\frac{3}{10}$ cents.

DREDGE "NIPISSING."

Lachine		938			510			937	2,385
Beauharnois		1,868		7,597	2,595				12,060
Goose Island						15,915			15,915
St. Placide	615	975							1,590
Jones' Island				2,460					2,460
Total	615	3,781		10,057	3,105	15,915		937	34,410

Total annual expenditure, $7,183.09. Cost per cubic yard, $20\frac{9}{10}$ cents.

DREDGE "ONTARIO."

Bowmanville						780			780
Frenchman's Bay			1,110			10,230		660	12,000
Whitby						9,930			9,930
Shannonville			2,235	10,335		600		660	13,830
Trenton		2,701	2,877	2,607				2,040	10,225
Total		2,701	6,222	12,942		21,540		3,360	46,765

Total annual expenditure, $8,527.36. Cost per cubic yard, $18\frac{2}{10}$ cents.

DREDGE "QUEEN."

Kemptville	264	817		394	725			375	2,575
Ottawa River						12,372			12,372
Yamaska				3,065		384	4,295		7,744
Total	264	817		3,459	725	12,756	4,295	375	22,691

Total annual expenditure, $7,495.08. Cost per cubic yard, $33\frac{1}{3\frac{1}{2}}$ cents.

DREDGE "ST. LOUIS."

Kemptville				2,551		449			3,000
Jones' Island						2,800	2,650		5,450
Trenton								1,125	1,125
Total				2,551		3,249	2,650	1,125	9,575

Total annual expenditure, $7,153.83. Cost per cubic yard, $74\frac{7}{10}$ cents.

County.	Locality.	Total for the Eighteen Years ended 30th June, 1890.			For the year 1890-91.			Total Quantities.	Total. Cost.	Cost for each County.
		Quantity.	Cost.	Cost for County.	Quantity.	Cost.	Cost for County.			
		c. yds.	$ cts.	$ cts.	c. yds.	$ cts.	$ cts.	c. yds.	$ cts.	$ cts.
Antigonish	Antigonish	22,025	3,649 15					22,025	3,649 15	
	Harbour au Bouche	10,568	2,498 48					10,568	2,498 48	
	Tracadie	7,175	3,346 60		5,070	2,183 69		12,245	5,530 29	
	McNair's Cove	1,725	4,443 82					1,725	4,443 82	
	Bayfield	1,710	4,405 19					1,710	4,405 19	
	Arisaig	3,540	3,853 30	22,196 54			2,183 69	3,540	3,853 30	24,380 23
Annapolis	Annapolis	2,825	1,635 68					2,825	1,635 68	1,635 68
Cape Breton	Lingan	22,267	9,275 56					22,267	9,275 56	
	Sydney	54,600	17,781 54					54,600	17,781 54	
	Little Glace Bay	46,450	16,936 02					46,450	16,936 02	
	Port Caledonia	17,413	8,242 21					17,413	8,242 21	
	Benacadie Pond	20,860	5,993 90					20,860	5,993 90	
	Christmas Island	19,045	3,364 98					19,045	3,364 98	
	Cow Bay	3,255	1,892 32					3,255	1,892 32	
	Main-à-dieu	4,680	2,720 76	66,207 29				4,680	2,720 76	66,207 29
Colchester	Tatamagouche	57,725	17,032 93	17,032 93	7,755	3,340 14	3,340 14	65,480	20,373 07	20,373 07
Cumberland	Parrsboro'	42,595	12,804 68					42,595	12,804 68	
	Wallace	60,835	14,573 49	27,378 17				60,835	14,573 49	27,378 17
Digby	Digby	12,585	5,056 29	5,056 29				12,585	5,056 29	
	Weymouth				88	28 62	28 62	88	28 62	5,084 91
Guysboro'	Guysboro'	5,400	1,413 53					5,400	1,413 53	
	Larry's River	26,230	6,546 70					26,230	6,546 70	
	Port Mulgrave	3,532	1,749 78					3,532	1,749 78	
	Sherbrooke	1,260	496 49	10,206 50				1,260	496 49	10,206 50
Halifax	Chezzetcook	3,920	2,593 71					3,920	2,593 71	
	Halifax Ferry	6,177	2,063 38					6,177	2,063 38	
	Herring Cove	12,111	8,015 05					12,111	8,015 05	
	Ketch Harbour	2,989	985 59					2,989	985 59	
	Richmond Wharf	792	182 53					792	182 53	
	Roche's Wharf	1,750	620 28					1,750	620 28	

	Halifax Railway Terminus. .	19,290	6,187 38	.....	.....	.....	.....	19,290	6,187 38	.....
	Jeddore	21,515	4,958 56	.....	.....	.....	.....	21,515	4,958 56	.....
	North-West Arm.....	7,350	2,970 39	.....	.....	.....	.....	7,350	2,970 39	.....
	Cunard's Wharf..	1,400	530 04	29,106 91	.....	.....	.....	1,400	530 04	29,106 91
Inverness	Whycocomagh.	19,760	3,491 31	.....	.....	.....	.....	19,760	3,491 31	.....
	Campbell's Pond	4,940	872 83	.....	.....	.....	.....	4,940	872 83	.....
	Port Hastings..	270	190 37	.....	.....	.....	.....	270	190 37	.....
	Cheticamp.	113,445	34,622 87	.....	8,655	3,727 78	.....	122,100	38,350 65	.....
	Mabou.....	72,967	31,110 10	.....	27,630	10,868 76	.....	100,597	41,978 86	.....
	Port Hood	2,800	855 44	71,142 92	.....	.....	14,596 54	2,800	855 44	85,739 46
Lunenburg. . . .	Lunenburg..	70,510	22,194 57	.....	.....	.....	.....	70,510	22,194 57	.....
	Mahone Bay	21,844	5,958 65	.....	.....	.....	.....	21,844	5,958 65	.....
	Vogler's Cove.....	11,610	5,075 53	33,228 75	.....	.....	.....	11,610	5,075 53	33,228 75
Pictou.....	Acadia Coal Co. Wharf	10,240	3,560 26	.....	.....	.....	.....	10,240	3,560 26	.....
	Albion Mines..	9,475	2,181 25	.....	.....	.....	.....	9,475	2,181 25	.....
	East River.	104,795	25,067 22	.....	.....	.....	.....	104,795	25,067 22	.....
	Halifax Coal Co. Wharf.....	1,650	359 90	.....	.....	.....	.....	1,650	359 90	.....
	Pictou Public Wharf.	7,020	1,634 82	.....	.....	.....	.....	7,020	1,634 82	.....
	do Market Wharf.....	62,150	16,573 19	.....	11,780	3,954 36	.....	73,930	20,527 55	.....
	do Railway Wharf.	32,164	9,959 34	.....	.....	.....	.....	32,164	9,959 34	.....
	do Landing..	7,345	2,880 01	.....	.....	.....	.....	7,345	2,880 01	.....
	Vale Colliery Wharf.	1,395	682 15	.....	.....	.....	.....	1,395	682 15	.....
	River John.....	85,173	22,243 98	.....	.....	.....	.....	85,173	22,243 98	.....
	Granton	25,110	10,707 59	.....	.....	.....	.....	25,110	10,707 59	.....
	New Glasgow...	26,310	5,705 09	.....	.....	.....	.....	26,310	5,705 09	.....
	Middle River	7,000	2,138 60	103,693 40	.....	.....	.....	7,000	2,138 60	.....
	Dwyer's Wharf	.....	.....	.....	720	283 22	4,237 58	720	283 22	107,930 98
Queen's.....	Liverpool.....	12,940	4,762 38	4,762 38	.....	.....	.....	12,940	4,762 38	4,762 38
Richmond	D'Escousse..	11,860	5,962 13	.....	.....	.....	.....	11,860	5,962 13	.....
	St. Peter's Canal	79,161	24,434 52	.....	.....	.....	.....	79,161	24,434 52	.....
	St. Peter's.....	7,150	2,407 41	.....	.....	.....	.....	7,150	2,407 41	.....
	Grand Goulet..	23,584	5,570 49	.....	.....	.....	.....	23,584	5,570 49	.....
	River Bourgeois..	18,920	4,468 87	.....	.....	.....	.....	18,920	4,468 87	.....
	Marine Slip..	320	56 53	42,899 95	.....	.....	.....	320	56 53	42,899 95
Shelburne	Lockeport	34,048	10,591 41	.....	.....	.....	.....	34,048	10,591 41	.....
	Barrrington.....	20,205	7,658 50	18,249 91	.....	.....	.....	20,205	7,658 50	18,249 91
Yarmouth.....	Yarmouth	105,524	38,951 26	38,951 26	.....	.....	.....	105,524	38,951 26	38,951 26
Hants..	Windsor	5,450	1,627 60	1,627 60	.....	.....	.....	5,450	1,627 60	1,627 60
Victoria.....	Aspey Bay.....	3,820	1,569 95	1,569 95	.....	.....	.....	3,820	1,569 95	1,569 95
Dredge "C. B." losses.....	....	.....	762 98	762 98	.....	.....	.....	.....	762 98	762 97
Total.....	....	1,546,549	495,709 41	495,709 41	61.698	24,386 57	24,386 57	1,608,247	520,095 98	520,095 98

County.	Locality.	Total for the Eighteen Years ended 30th June, 1890.			For the Year 1890-91.			Total Quantity.	Total Cost.	Cost for each County.
		Quantity.	Cost.	Cost for County.	Quantity.	Cost.	Cost for County.			
		C. yds.	$ cts.	$ cts.	C. yds.	$ cts.	$ cts.	C. yds.	$ cts.	$ cts.
Gloucester	Bathurst	72,607	20,629 52	20,629 52				72,607	20,629 52	20,629 52
Kent	Richibucto	65,872	20,558 54		1,313	427 10		67,185	20,985 64	
	Cocagne	27,180	9,601 45					27,180	9,601 45	
	Buctouche	13,005	4,934 24					13,005	4,934 24	
	do Priests' Point	3,510	1,110 70					3,510	1,110 70	
	do Chapel Point	4,140	1,310 07					4,140	1,310 07	
	do Robertson's Wharf	45	14 23	37,529 23			427 10	45	14 23	37,956 33
Northumberland	Horse Shoe, Miramichi	160,417	44,594 13					160,417	44,594 13	
	Outer Bar	13,125	4,032 67					13,125	4,032 67	
	Grand Dune	37,975	10,121 67	58,748 47				37,975	10,121 67	58,748 47
Queen's	Grand Lake	93,555	16,372 96					93,555	16,372 96	
	do McMann's Cove	20,440	4,522 82					20,440	4,522 82	
	Jemseg	61,305	12,117 74					61,305	12,117 74	
	Waashademoak	48,975	6,340 83	39,354 35				48,975	6,340 83	39,354 35
Restigouche	Dalhousie	22,301	6,543 08					22,301	6,543 08	
	Traverse	29,400	9,008 64	15,551 72				39,400	9,008 64	15,551 72
St. John	I. C. Railway terminus	139,810	37,130 01					139,810	37,130 01	
	Navy Island	25,294	9,296 79					25,294	9,296 79	
	Marble Cove	29,925	4,374 40					29,925	4,374 40	
	Murray's Mills	23,880	3,441 65					23,880	3,441 65	
	Indiantown Wharf	1,615	192 83					1,615	192 83	
	Long Wharf	7,137	2,680 24					7,137	2,680 24	
	Adams Wharf	7,513	3,247 29					7,513	3,247 29	
	Miller & Woodman's	9,275	1,090 42					9,275	1,090 42	
	Hayford & Stetson's	8,015	942 29					8,015	942 29	
	International Wharf	450	52 90					450	52 90	
	Anchor Line Wharf	4,695	996 81	63,445 63				4,695	996 81	63,445 63
Sunbury	Oromocto	188,678	36,311 11	36,311 11				188,678	36,311 11	36,311 11
Westmoreland	Point du Chêne	33,750	9,432 00	9,432 00	35,950	11,693 92	11,693 92	69,700	21,125 92	21,125 92

[1891]

York	Fredericton	39,385	7,699 15	..	..	..	..	..	..	39,385	7,699 15	..	
	St. Mary's Ferry	15,570	6,827 36	..	..	..	..	..	..	15,570	6,827 36	..	
	Gibson	30,385	4,379 52	18,906 03	..	..	..	..	..	30,385	4,379 52	18,906 03	
King's	Belleisle Point	60,170	8,156 76	..	..	..	..	..	..	60,170	8,156 76	..	
	Hampton	4,750	1,200 25	..	..	..	..	..	..	14,130	2,505 33	..	
	Perry's Point	11,000	1,926 50	11,283 51	9,380	1,305 08	..	..	..	38,020	5,685 81	..	
	Lamb's do	..	..	..	27,020	3,759 31	..	..	..	22,925	3,189 65	19,537 55	
		..	..	..	22,925	3,189 65	8,254 04	..	..	..	..	..	
Total		1,315,169	311,191 57	311,191 57	96,588	20,375 06	20,375 06	1,411,757	331,566 63	331,566 63	331,566 63		

EXPENDITURE for Dredging in Prince Edward Island

County.	Locality.	Total for the Eighteen Years ended 30th June, 1890.		
		Quantity.	Cost.	Cost for County.
		C. Yds.	$ cts.	$ cts.
King's	Grand River	46,110	8,963 97	
	Montague River	106,140	17,119 43	
	Murray Harbour	44,430	7,378 33	33,461 73
Queen's	Charlottetown Wharf	41,303	10,264 56	
	do Ferry	4,045	670 61	
	Crapaud	89,782	27,493 03	
	Pownal	44,400	9,604 55	
	Rocky Point	91,440	14,661 16	
	Vernon River	17,860	6,326 72	
	Wood Islands	2,780	548 00	
	Nine-Mile Creek	31,650	6,286 46	
	Hickey's Wharf	750	150 51	
	Carr's Point	12,165	2,441 28	
	Pinette	3,825	756 24	
	Fort Augustus	3,195	631 68	
	South Port Ferry	33,015	5,528 75	
	Red Point	7,161	3,879 60	
	Charlottetown Steam Nav. Co.	7,668	4,904 15	
	do Connolly's Wharf	5,343	3,417 17	
	do Peake Bros. do	5,355	3,424 85	
	do P. E. I. Ry. do	4,950	2,077 52	
	North Rustico	13,536	4,775 38	
	South Rustico	11,649	4,109 67	
	Gauthier's Creek			111,951 89
Prince	Summerside	15,855	2,495 34	
	Hurd's Point Pier	41,070	7,289 95	
	Tignish	11,387	13,005 45	
	Cascumpec			22,790 74
		696,864	168,204 36	168,204 36

EXPENDITURE for Dredging in Quebec for the Nineteen years

Magdalen Islands, County Gaspé	House Harbour	6,800	2,392 92	
	Amherst Harbour	495	242 05	2,634 97
Temiscouata	River du Loup	2,587	825 47	825 47
*Rimouski	Rimouski	8,123	3,997 59	3,997 59
		18,005	7,458 03	7,458 03

*From amount voted Quebec dredging.

for the Nineteen years ended 30th June, 1891.

For the Year 1890-91.			Total Quantity.	Total Cost.	Cost for each County.
Quantity.	Cost.	Cost for County.			
C. Yds.	$ cts.	$ cts.	C. Yds.	$ cts.	$ cts.
			46,110	8,963 97	
			106,140	17,119 43	
			44,430	7,378 33	33,461 73
			41,303	10,264 56	
			4,045	670 61	
			89,782	27,493 03	
			44,400	9,604 55	
			91,440	14,661 16	
			17,860	6,326 72	
			2,780	548 00	
			31,650	6,286 46	
			750	150 51	
			12,165	2,441 28	
			3,825	756 24	
			3,195	631 68	
			33,015	5,528 75	
			7,161	3,879 60	
			7,668	4,904 15	
			5,343	3,417 17	
			5,355	3,424 85	
			4,950	2,077 52	
			13,536	4,775 38	
			11,649	4,109 67	
17,847	8,305 50	8,305 50	17,847	8,305 50	120,257 39
			15,855	2,495 34	
			41,070	7,289 95	
			11,387	13,005 45	
1,157	538 42	538 42	1,157	538 42	23,329 16
19,004	8,843 92	8,843 92	715,868	177,048 28	177,048 28

ended 30th June, 1891, from Appropriations—Maritime Provinces.

			6,800	2,392 29	
			495	242 05	2,634 97
			2,587	825 47	825 47
			8,123	3,997 59	3,997 59
			18,005	7,458 03	7,458 03

STATEMENT of Dredging, showing Quantities removed in each Province, and cost of each work, for Nineteen years ended 30th June, 1891.

Fiscal Year.	New Brunswick.		Nova Scotia.		Quebec.		Prince Edward Island.		Total Quantity.	Total Expenditure.	Cost per cubic yard.
	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.			
	c. yds.	$ cts.	c. yds.	$ cts.	c. yds.	$ cts.	c. yds.	$ cts.	c. yds.	$ cts.	$ cts.
1872-73	38,060	13,240 50	23,260	8,422 70	.....	.....	.....	.....	61,320	21,663 20	0 35.328
1873-74	58,725	14,395 57	18,600	6,545 61	6,800	2,392 92	.....	.....	83,125	23,334 10	0 28.071
1874-75	78,223	17,325 05	24,416	13,238 83	.....	.....	18,655	9,892 89	121,294	40,456 77	0 33.354
1875-76	79,935	17,040 52	91,974	21,885 90	.....	.....	58,283	10,891 80	230,192	49,818 22	0 21.642
1876-77	97,690	23,161 90	127,785	34,846 74	.....	.....	74,460	12,758 27	299,935	70,766 91	0 23.594
1877-78	81,070	23,323 92	106,857	29,607 94	.....	.....	82,860	12,011 18	270,787	64,943 04	0 23.983
1878-79	132,555	27,400 22	116,307	28,267 59	.....	.....	46,490	9,164 07	295,352	64,831 88	0 21.951
1879-80	63,540	16,581 79	127,684	34,765 84	765	374 08	36,390	12,674 98	228,379	64,396 69	0 28.197
1880-81	44,315	12,385 85	87,118	23,061 64	2,317	693 44	46,335	9,298 53	180,085	45,439 46	0 25 232
1881-82	79,640	18,626 87	89,566	33,363 71	.....	.....	47,325	9,356 57	216,531	61,347 15	0 28.331
1882-83	48,565	13,422 70	143,616	42,996 93	.....	.....	68,535	11,080 37	260,716	67,500 00	0 25 890
1883-84	47,058	17,103 38	157,560	49,050 58	.....	.....	79,750	13,355 05	284,368	79,509 01	0 27.959
1884-85	128,997	24,460 35	76,164	25,250 73	8,123	3,997 59	55,075	8,668 01	268,359	62,376 68	0 23.242
1885-86	68,505	14,874 63	56,790	21,482 05	.....	.....	17,137	10,349 66	142,432	46,706 34	0 32 792
1886-87	69,440	11,452 86	53,400	25,621 19	.....	.....	6,137	6,214 74	128,977	43,288 79	0 33.56
1887-88	50,152	9,252 50	84,175	29,847 60	.....	.....	3,775	5,899 90	138,102	45,000 00	0 32.58
1888-89	63,633	16,598 08	56,910	32,697 00	.....	.....	24,240	15,502 95	146,783	64,798 03	0 27.29
1889-90	86,068	20,544 93	59,783	22,821 55	.....	.....	31,422	11,085 39	177,273	54,451 87	0 30.71
1890-91	96,588	20,375 09	61,698	24,386 57	.....	.....	19,004	8,843 92	177,290	53,605 55	0 30.23
Totals	1,411,759	331,566 71	1,563,663	508,160 70	18,005	7,458 03	715,873	177,048 28	3,711,300	1,024,233 69	0 27.59

STATEMENT of Dredging, showing Quantities Removed by hand in each Province and cost of each Dredging, for the Nineteen years ended 30th June, 1891.

Fiscal Year.	New Brunswick.		Nova Scotia.		Quebec.		Prince Edward Island.		Total Quantity.	Total Expenditure.	Cost per cubic yard.
	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.			
	c. yds.	$ cts.	c. yds.	$ cts.	c. yds.	$ cts.	c. yds.	$ cts.	c. yds.	$ cts.	$ cts.
1878-79			245	555 13					245	555 13	2 26·58
1879-80			12,370	3,666 90					12,370	3,666 90	0 29·64
1880-81			11,140	2,560 25					11,140	2,560 25	0 22·98
1881-82			10,640	2,650 00					10,640	2,650 00	0 24·90
1882-83			8,190	2,500 00					8,190	2,500 00	0 30·52
1883-84			5,460	2,500 00					5,460	2,500 00	0 45·78
1884-88											
1888-89											
1889-90											
1890-91											
Totals			48,045	14,432 28					48,405	14,432 28	2 30.03

STATEMENT of Dredging in the Maritime Provinces, showing Quantities removed by, and Expenditure of each Dredge for the Nineteen Years ended 30th June, 1891.

Dredge.	Total Quantities and Cost for Eighteen Years ended 30th June, 1890.			1890 91.			Total for Nineteen Years, ended 30th June, 1891.		
	Total Quantity.	Cost.	Per Cubic Yd.	Quantity.	Cost.	Per Cubic Yd.	Total Quantity.	Total Cost.	Per Cubic Yd.
	Yds.	$ cts.	Cts.	Yds.	$ cts.	Cts.	Yds.	$ cts.	Cts.
"New Dominion"	747,508	142,656 42	19·08	59,325	8,254 04	13·913	806,833	150,910 46	18·70
"Canada"	501,396	174,693 68	34·84	30,150	11,860 03	39·336	531,546	186,553 71	35·09
"Cape Breton"	534,938	139,074 33	25·99	.....	.....	.....	534,938	139,074 33	25·99
"Prince Edward"	707,699	169,955 29	24·02	19,004	8,843 92	46·537	726,703	178,799 21	24·60
"St. Lawrence"	677,750	211,036 36	31·13	47,331	15,395 95	32·528	725,081	226,432 31	31·22
"Geo. McKenzie"	351,136	126,714 47	36·08	21,480	9,251 61	43·070	372,616	135,966 08	36·48
Totals	3,520,427	964,130 55	27.38	177,290	53,605 55	30 23	3,697,717	1,017,736 10	27·52

STATEMENT of Dredging performed by hand in the Maritime Provinces, showing Quantities removed and Expenditure at each Locality, for Nineteen Years ended 30th June, 1891.

Locality.	Seventeen Years, from 1872-73 to 1888-89.			1890-91.	1888-89.		
	Total Quantity.	Total Cost.	Per Cubic Yard.		Total Quantity.	Total Cost.	Per Cubic Yard.
	Yds.	$ cts.	Cts.		Yds.	$ cts.	Cts.
Parrsboro', N.S.	42,595	12,804 68	30·06	.....	42,595	12,804 68	30·06
Windsor, N.S.	5,450	1,627 60	29·86	.....	5,450	1,627 60	29 86
Totals	48,045	14,432 28	30·03	.....	48,045	14,432 28	30·03

APPENDIX No. 4.

LIST

OF

ENGINEERS, ENGINEMEN, FIREMEN AND CARETAKERS

OF

PUBLIC BUILDINGS THROUGHOUT THE DOMINION,

GIVING

Date of Appointment, Salary Paid, &c.

APPENDIX No. 4.

STATEMENT showing the Engineers, Enginemen, Firemen, Caretakers, Hoist Attendants and Watchmen employed at the Dominion Public Buildings on 30th June, 1891.

Place.	Building.	Name.	Date of Birth.	Position.	Date of Appointment.	Salary per Month.	Time Employed per Annum.	Total Salary per Annum.
						$ cts.		$ cts.
Amherst.....N.S.	Post Office.....	James Morrison.....	May 2, 1824	Caretaker.....	Nov. 2, 1886	33 33	12 months..	400 00
Antigonish..... "	Public Building.....	Angus McDonald.....	Mar. —, 1820	do	Feb. 5, 1891	33 33	12 do ..	400 00
Arichat..... "	Building on P. O. site..	John McAskill.....	.....	do	Sept. 16, 1887	.....	12 do ..	15 00
Annapolis ..... "	Post Office and C. House.	John McKay.....	Oct. 26, 1847	do	April 1, 1891	33 33	12 do ..	400 00
Baddeck..... "	Public Building.....	Alex. S. McDonald	Dec. 11, 1855	do	Dec. 23, 1886	16 67	12 do ..	200 00
Halifax..... "	Dominion Building.....	John Powell.....	Aug. 21, 1836	Engineer.....	Oct. 1, 1871	62 50	12 do ..	750 00
do ..... "	do	Richard Power.....	do 15, 1834	Fireman	do 1, 1871	50 00	9 do ..	450 00
do ..... "	do	M. Sullivan.....	Sept. 16, 1822	Caretaker.....	do 31, 1885	33 33	12 do ..	400 00
do ..... "	do	John Dunn.....	.....	Watchman	April 1, 1887	39 00	12 do ..	468 00
do ..... "	Examining Warehonse..	Wm. Power	Feb. 6, 1834	Caretaker.....	Jan. 26, 1887	41 67	12 do ..	500 00
New Glasgow..... "	Post Office.....	Daniel McDonald.....	Dec. 17, 1832	do	Oct. 1, 1889	33 33	12 do ..	400 00
North Sydney..... "	Public Building.....	Angus McEachren	do 24, 1847	do	Jan. 20, 1890	33 33	12 do ..	400 00
Pictou..... "	Custom House.....	Geo. Robson.....	do 22, 1822	do	do 31, 1888	33 33	12 do ..	400 00
Sydney (South)..... "	Post Office and C. House.	N. H. McNeil.....	 1816	do	Dec. 8, 1890	33 33	12 do ..	400 00
Truro..... "	Post Office.....	Hugh McCulloch.....	June 2, 1826	do	Sept. 22, 1888	33 33	12 do ..	400 00
Windsor..... "	do	J. W. Smith.....	May 30, 1823	do	July 30, 1886	33 33	12 do ..	400 00
Yarmouth..... "	Public Building.....	Robert Speers.....	Sept. 15, 1824	do	Dec. 23, 1886	33 33	12 do ..	400 00
Charlottetown.....P.E.I.	Dominion Building.....	D. McLeod.....	June 9, 1842	Engineer.....	Sept. 12, 1872	33 33	12 do ..	400 00
do ..... "	do	J. S. McLeod.....	Nov. 14, 1868	Fireman	Dec. 13, 1887	28 00	12 do ..	336 00
do ..... "	do	Geo. Walker.....	Aug. 28, 1826	Messenger.....	Jan. 19, 1875	37 00	12 do ..	444 00
do ..... "	do	C. J. Michell.....	June 18, 1873	do	Oct. 29, 1890	37 00	12 do ..	444 00
do ..... "	do	D. S. Macdonald.....	.....	Caretaker.....	Dec. 1, 1890	33 33	12 do ..	400 00
Montague ..... "	Public Building.....	Martin Lambert.....	Nov. 12, 1845	do	Jan. 12, 1887	10 00	12 do ..	120 00
Summerside ..... "	Dominion Building.....	James Brazil	 1816	do	Nov. 5, 1885	33 33	12 do ..	400 00
Bathurst.....N.B.	Post Office.....	J. A. Mélancon.....	Jan. 20, 1825	do	April 13, 1887	33 33	12 do ..	400 00
Chatham..... "	do	R. B. Adams.....	do 13, 1854	do	May 16, 1889	10 83	12 do ..	130 00
Carleton, St. John..... "	do	Jas. R. Reid.....	Aug. 15, 1823	do	Oct. 1, 1889	8 33	12 do ..	100 00
Dalhousie ..... "	do	Wm. Gould.....	Jan. 1, 1853	do	Nov. 26, 1890	33 33	12 do ..	400 00
Fredericton ..... "	do	Jas. Perkins.....	Oct. 5, 1847	do	May 31, 1881	33 33	12 do ..	400 00
Moncton..... "	do	E. B. Hicks	Jan. 11, 1832	do	Jan. 11, 1886	33 33	12 do ..	400 00
Newcastle..... "	do	Patrick Keating	Mar. 13, 1840	do	Oct. 23, 1886	33 33	12 do ..	400 00

St. Stephen	"	do	Samuel Topping	April	2, 1839	do	May	25, 1887	33	33	12	do	400 00
Sussex	"	do	Thomas Asbill	Feb.	18, 1826	do	Oct.	19, 1883	33	33	12	do	400 00
St. John	"	Custom House	G. H. Jones	June	2, 1865	Engineer	Feb.	17, 1880	60	00	12	do	720 00
do	"	do	Christopher White	Nov.	20, 1844	Fireman	Nov.	9, 1885	50	00	6	do	300 00
do	"	do	T. W. Shaw	Sept.	2, 1844	Caretaker	Dec.	8, 1881	41	67	12	do	500 00
do	"	Post Office	Henry Howe	May	1, 1853	Engineer	Nov.	4, 1881	55	00	12	do	660 00
do	"	do	Ed. Haney	Feb.	22, 1849	Hoist attendant	do	27, 1882	50	00	12	do	600 00
do	"	Penitentiary	Geo. Campbell	do	22, 1817	Caretaker	Oct.	29, 1880	37	50	12	do	450 00
Woodstock	"	Post Office	Wm. Kennedy	May	2, 1825	do	Feb.	1, 1890	33	33	12	do	400 00
Aylmer	P.Q.	do	J. R. Woods	Mar.	18, 1817	do	Nov.	8, 1889	8	33	12	do	100 00
Coaticook	"	Public Building	Israël Baldwin	Nov.	16, 1839	do	June	27, 1889	33	33	12	do	400 00
Hull	"	Post Office, &c	Thomas Paquin	Sept.	2, 1866	do	Jan.	9, 1888	16	66	12	do	200 00
Joliette	"	do	Chas. Guilbault	do	29, 1826	do	Oct.	15, 1889	33	33	12	do	400 00
Montreal	"	Dominion Buildings	Thos. Ryan	June	18, 1836	Foreman engineer	Mar.	4, 1882	100	00	12	do	1,200 00
do	"	Examining Warehouse	M. Boyer	Feb.	18, 1848	Fireman	do	4, 1882	50	00	12	do	600 00
do	"	do	D. St. George	Oct.	8, 1844	do	Oct.	1, 1890	45	00	12	do	540 00
do	"	Post Office	John Watson	Feb.	21, 1820	Engineer	do	18, 1876	65	00	12	do	780 00
Montreal	"	do	L. D. Thibault			Electric light and hoist attendant	June	1, 1885	60	00	12	do	720 00
do	"	Inland Revenue	F. Greene	Oct.	4, 1837	Engineer	Jan.	1, 1885	60	00	12	do	720 00
do	"	Custom House	W. Wallace	Augt.	12, 1837	Fireman	Oct.	1, 1882	50	00	8	do	400 00
do	"	do	J. H. Marchand	Sept.	6, 1849	do	Dec.	2, 1882	50	00	8	do	400 00
do	"	Drill Hall and Armonies	Wm. McDonald	Sept.	17, 1832	Engineman	Feb.	21, 1888	45	00	12	do	540 00
Quebec	"	Examining Warehouse	Jas. Mathews	Sept.	25, 1856	Engineer	Dec.	4, 1885	55	00	12	do	660 00
do	"	do	Wm. Stephens			Fireman	Oct.	29, 1886	40	00	8	do	320 00
do	"	Culler's Office	John O'Neil	June	23, 1819	do	Sept.	8, 1886	45	00	8	do	360 00
do	"	Custom House	John R. Mountain	Nov.	1, 1848	Acting Fireman	Nov.	10, 1888	45	00	12	do	540 00
Sherbrooke	"	Post Office	Thos. Rawson	May	20, 1841	Caretaker	Dec.	12, 1884	33	33	12	do	400 00
Sorel	"	do	P. St. Michel	Feb.	26, 1829	do	Sept.	22, 1886	33	33	12	do	400 00
St. John's	"	do	Widow J. Forrant	Oct.	27, 1814	do	May	30, 1888	16	66	12	do	200 00
do	"	do	Wm. Comper	May	20, 1826	Watchman	Dec.	28, 1881	12	50	12	do	150 00
St. Jérome	"	Public Building	Médard Grignon	June	25, 1828	Caretaker	March	11, 1890	33	33	12	do	400 00
Three Rivers	"	Custom House	Ph. Gravel	June	3, 1828	do	Fev.	1, 1891	25	00	12	do	300 00
do	"	Post Office	Jos Carbonneau	June	24, 1828	do	July	27, 1883	33	33	12	do	400 00
do	"	Custom House	Geo. McLeod	April	16, 1838	Messenger	Feb.	1, 1891	25	00	12	do	300 00
Amherstburg	Ont.	Post Office	John Lovegrove	Dec.	19, 1836	Caretaker	Nov.	5, 1885	33	33	12	do	400 00
Almonte	"	do	Wm. Moulton	March	23, 1839	do	Jan.	30, 1891	33	33	12	do	400 00
Brockville	"	do	Wm. Shepherd	June	13, 1831	do	April	6, 1888	33	33	12	do	400 00
Brantford	"	do	John Squires	April	24, 1842	do	Oct.	27, 1880	50	00	12	do	600 00
Barrie	"	do	Fred. Edwards	March	3, 1844	do	March	2, 1886	33	33	12	do	400 00
Belleville	"	do	J. P. Reeves	Nov.	27, 1820	do	Oct.	17, 1883	50	00	12	do	600 00
Berlin	"	do	Widow Aug. Meinke	Nov.	23, 1844	do	Dec.	22, 1887	33	33	12	do	400 00
Brampton	"	do	James McBride	Oct.	5, 1840	do	Jan.	29, 1891	33	33	12	do	400 00
Clifton	"	do	Gilbert Campbell	Feb.	11, 1849	do	Oct.	8, 1885	33	33	12	do	400 00
Chatham	"	do	Henry Dunn	May	25, 1841	Engineman	Sept.	23, 1884	50	00	7	do	350 00
do	"	do	W. W. Mitchell	May	25, 1848	Caretaker	Jan.	7, 1885	33	33	12	do	400 00
Cornwall	"	do	Thos. Murphy	May	1, 1843	do	March	7, 1885	33	33	12	do	400 00
Cayuga	"	do	*J. H. Cameron	May	29, 1826	do	March	26, 1890	4	16	12	do	50 00
Cobourg	"	do	H. J. Payne	Jan.	31, 1854	do	April	24, 1890	33	33	12	do	400 00

*Resigned Mar. 27, 1891.

STATEMENT showing the Engineers, Enginemen, Firemen, Caretakers, Hoist Attendants and Watchmen employed at Dominion Public Buildings etc.—*Continued.*

Place.	Building.	Name.	Date of Birth.	Position.	Date of Appointment.	Salary per Month.	Time Employed per Annum.	Total Salary per Annum.
						$ cts.		$ cts.
Galt.....Ont.	Post Office.....	Wm. Kilgour.....	March 3, 1857	Caretaker.....	Sept. 23, 1886	33 33	12 months..	400 09
Guelph..... "	do	Robert Higham.....	May 20, 1834	do	Oct. 29, 1889	33 33	12 do ..	400 00
Gananoque ..... "	do	Thos. P. Richardson ..	Feb. 25, 1834	do	May 1, 1889	8 33	12 do ..	100 00
Goderich..... "	do etc.....	Lewis Elliot.....	April 8, 1832	do	July 2, 1890	33 33	12 do ..	400 00
Hamilton..... "	Dominion Building.....	Wm. Hornby.....	Nov. 14, 1829	do	Oct. 9, 1886	50 00	12 do ..	600 00
do ..... "	do	Thos. Beatty.....	Nov. 14, 1848	Fireman.....	Nov. 7, 1887	45 00	12 do ..	540 00
do ..... "	do	Thos. Nicholson.....	Dec. 17, 1857	Engineer.....	March 2, 1887	50 00	12 do ..	600 00
do ..... "	Drill Hall.....	Wm. Harris.....	May 20, 1841	Fireman.....	Dec. 12, 1889	45 00	12 do ..	540 00
Kingston..... "	Military College.....	William Johnson.....	Sept. 12, 1842	Engineer.....	May 31, 1881	65 00	12 do ..	780 00
do ..... "	do	M. Maddon.....	Dec. 22, 1838	Fireman.....	Oct. 12, 1878	55 00	6 do ..	330 00
London..... "	Custom House.....	M. Mulkern.....	Sept. 4, 1837	Engineman.....	Sept. 18, 1888	50 00	12 do ..	600 00
do ..... "	Post Office.....	Wm. Greer.....	Oct. 12, 1839	Caretaker.....	March 16, 1884	33 33	12 do ..	400 00
do ..... "	do	John Price.....	Oct. 6, 1836	Engineer.....	Jan. 14, 1884	50 00	12 do ..	600 00
Lindsay..... "	Post Office & C. House...	William McMann.....	May 27, 1831	Caretaker.....	March 15, 1889	33 33	12 do ..	400 00
Napanee..... "	do do ...	John Hearn.....	March 28, 1853	do	June 22, 1889	33 33	12 do ..	400 00
Orangeville ..... "	Post Office	John Wilkins	May 29, 1830	do	Sept. 15, 1886	33 33	12 do ..	400 00
Peterborough..... "	do	John Irwin.....	May 17, 1842	do	Sept. 8, 1887	33 33	12 do ..	400 00
Port Colborne ..... "	do	Wm. Armstrong.....	Sept. 9, 1846	do	June 11, 1888	20 00	12 do ..	240 00
Port Hope..... "	do	Levy Reynolds.....	Feb. 15, 1839	do	Nov. 17, 1885	33 33	12 do ..	400 00
Pembroke..... "	Public Building.....	Samuel Hamilton.....	June 14, 1834	do	Oct. 29, 1890	33 33	12 do ..	400 00
Prescott..... "	Post Office and C. House.	Rufus Henderson	April 6, 1822	do	Dec. 23, 1890	33 33	12 do ..	400 00
Stratford..... "	do &c.....	J. H. Roberts.....	May 1, 1847	Engineer.....	Feb. 7, 1884	50 00	12 do ..	600 00
St. Catharines..... "	do &c.....	Wm. Bryson.....	Feb. 4, 1843	Caretaker.....	Aug. 9, 1883	33 33	12 do ..	400 00
St. Thomas..... "	do &c.....	Jas. Russell.....	Sept. 15, 1832	do	Sept. 4, 1885	33 33	12 do ..	400 00
Strathroy ..... "	Public Building.....	Wm. J. Johnston.....	May 12, 1840	do	Oct. 25, 1890	33 33	12 do ..	400 00
Toronto ..... "	Dominion Buildings.....	J. A. Wills.....	Aug. 6, 1845	Foreman Engineer	Aug. 23, 1873	125 00	12 do ..	1,500 00
do ..... "	Inland Revenue Building	Chs. H. Baillie.....	Sept. 22, 1852	Fireman.....	Jan. 13, 1891	50 00	6 do ..	300 00
do ..... "	Custom House.....	Fred. Faragher.....	Oct. 16, 1865	do	Nov. 1, 1889	50 00	12 do ..	600 00
do ..... "	Examining Warehouse...	Jas. Cosgrave.....	Feb. 10, 1844	Engineer.....	Dec. 28, 1874	65 00	12 do ..	780 00
do ..... "	do ...	Ed. Appleton.....	Sept. 26, 1864	Fireman.....	Sept. 23, 1886	55 00	12 do ..	660 00
do ..... "	do ...	Alex. Dey.....	do 27, 1863	Hoist Attendant..	Dec. 1, 1887	50 00	12 do ..	600 00
do ..... "	do ...	Wm. Chenery.....	Dec. 19, 1851	do	do 1, 1887	50 00	12 do ..	600 00
do ..... "	do ...	W. J. Slean	July, 5, 1855	do	Mar. 2, 1888	50 00	12 do ..	600 00
do ..... "	do ...	Jas. Richardson	Feb. 23, 1831	Watchman	Sept. 3, 1888	46 50	12 do ..	558 00
do ..... "	Post Office.....	Henry L. Bell	Dec. 29, 1864	Engineer.....	May 9, 1885	50 00	6 do ..	300 00

do	"	do	Samuel Fitzgerald	do 26, 1859	Fireman	Nov. 1, 1889	50 00	6	do	300 00
do	"	do	John Somers	April 8, 1835	do	Dec. 1, 1889	50 00	6	do	300 00
Trenton	"	Public Building	David Allan	May 13, 1844	Caretaker	Aug. 31, 1889	33 33	12	do	400 00
Windsor	"	Post Office	F. Parker	Aug. 6, 1833	Engineman	Oct. 3, 1888	50 00	12	do	600 00
do	"	do	W. Courtis	Mar. 6, 1844	Caretaker	Nov. 9, 1880	33 33	12	do	400 00
Brandon	Man.	Public Building	John Faucett	May 11, 1857	do	Aug. 18, 1890	33 33	12	do	400 00
Winnipeg	"	Post Office	J. P. Alexander	Aug. 19, 1852	Engineman	June 1, 1888	70 00	12	do	840 00
do	"	do	Patrick Dillon	Mar. 17, 1849	Fireman	Jan. 1, 1889	45 00	6	do	270 00
do	"	do	Jos. Coutu	May 10, 1843	Hoist Attendant	Mar. 16, 1887	45 00	12	do	540 00
do	"	do	Ernest Lecourt	July 15, 1853	Watchman	Oct. 27, 1887	45 00	12	do	540 00
do	"	do	Jos. Cauchon	Mar. 12, 1856	Caretaker	June 12, 1888	50 00	12	do	600 00
Moosomin	N.W.T.	Court House	A. G. Hamilton	May 14, 1848	do	Jan. 31, 1891	33 33	12	do	400 00
Prince Albert	"	do	George Northgraves	do 20, 1838	do	June 14, 1888	33 33	12	do	400 00
Regina	"	Lt. Governor's Residence	Paul Turenne		Fireman	Dec. 18, 1890	50 00	12	do	600 00
do	"	Goal	Jas. McKee	Dec. 11, 1859	Engineer	Oct. 27, 1890	70 00	12	do	840 00
do	"	do	Philip Thomas	Mar. 4, 1834	Asst. Engineer	Nov. 25, 1890	60 00	12	do	720 00
Nanaïmo	B.C.	Post Office	John Thompson		Caretaker	do 10, 1883	50 00	12	do	600 00
New Westminster	"	do	John McMurphy	Aug. 12, 1812	do	Oct. 1, 1884	50 00	12	do	600 00

R. STECKEL.

APPENDIX No. 5.

REPORT

ON THE

HEATING APPARATUS, GAS, WATER AND BELL SERVICES, &c.

IN THE

PUBLIC BUILDINGS, OTTAWA,

FOR THE FISCAL YEAR ENDED 30TH JUNE, 1891.

APPENDIX No. 5.

DEPARTMENT OF PUBLIC WORKS,
MECHANICAL ENGINEER'S OFFICE,
OTTAWA, 14th October, 1891.

SIR,—I have the honour to report as follows in reference to the Public Buildings, Ottawa, during the fiscal year ended the 30th June, 1891:—

PARLIAMENT BUILDINGS.

In the House of Commons the electric light was extended to the rooms occupied by the Clerk of Votes and Proceedings.

The old pan w. c.'s in connection with the Commons and Library having been so long in use were in a very unsatisfactory state, and it was found necessary to replace them with those of a more modern pattern, which has much improved the sanitary condition of the building.

To moderate the temperature of the Commons Chamber during the present session quantities of ice were introduced into the fresh air duct during the month of June, which had the desired effect of cooling the air admitted to the Chamber.

Beyond the above improvements ordinary maintenance only was required to the general apparatus of heating, boilers, gas, water, bells, electric light and ventilation services during the fiscal year.

EAST AND WEST BLOCKS.

The old style w. c.'s in these buildings were replaced with more modern appliances. Nothing was required to be done to the heating apparatus, boilers, water, gas and bell service beyond ordinary maintenance.

SUPREME COURT.

Beyond the ordinary maintenance, nothing was required to be done in this building.

OTTAWA POST OFFICE AND CUSTOM HOUSE.

It was found necessary to replace the old pan w. c.'s in this building with those of a more modern pattern.

Nothing further was required except ordinary maintenance to the general apparatus of heating, boiler, gas, water and bell services.

GEOLOGICAL MUSEUM.

The old style pan w. c.'s in this building were replaced with those of a more modern pattern.

Beyond this there was nothing but ordinary maintenance required to the heating apparatus, water, gas and bell services.

FISH HATCHERY.

Nothing was required in this building beyond ordinary maintenance.

RIDEAU HALL.

Ordinary maintenance only was required to the general apparatus for heating, water, gas and electric bells.

GOVERNMENT PRINTING BUREAU.

With the exception of a ventilating pipe that was placed from the gas metre room in the basement and ran up through the roof, nothing was required beyond ordinary maintenance to the heating apparatus, gas, water and electric bell services.

INTERIOR DEPARTMENT (LEASED) WELLINGTON STREET.

Ordinary maintenance only was required for the water, gas and bell services in this building.

FRENCH TRANSLATOR'S ROOMS (LEASED) SUSSEX STREET.

These premises were fitted up with stoves, water and gas fixtures.

PARLIAMENT GROUNDS, FLOWER PROPAGATING HOUSE AND MAJOR HILL PARK.

No alterations or extensions have been made during the year to these premises, ordinary maintenance only was required to the heating apparatus and hose required for sprinkling purposes to any of the three foregoing.

GOVERNMENT COAL SHEDS.

With the exception of a new floor put in the central part of large shed, no other work was required beyond ordinary repairs to these buildings.

I have the honour to be, Sir,
Your obedient servant,

WM. KING,
Acting Chief Mechanical Engineer.

E. F. E. Roy, Esq.,
Secretary Dept. Public Works.

APPENDIX No. 6.

REPORT

ON THE

OTTAWA DISTRICT SLIDES AND BOOMS

FOR THE

FISCAL YEAR ENDED 30TH JUNE, 1891.

APPENDIX No. 6.

OTTAWA RIVER WORKS.

No. 36662.

DEPARTMENT OF PUBLIC WORKS OF CANADA,
CHIEF ENGINEER'S OFFICE,
OTTAWA, 27th October, 1891.

SIR,—I transmit herewith a report by Mr. G. P. Brophy, Superintending Engineer of the Ottawa District Works, on the works under his charge, for the fiscal year ended 30th June, 1891.

I have the honour to be, Sir,
Your obedient servant,
LOUIS COSTE,
Acting Chief Engineer.

E. F. E. ROY, Esq.,
Secretary, Department of Public Works,
Ottawa.

OFFICE OTTAWA RIVER WORKS, 1st August, 1891.

SIR,—As requested by you in your letter, No. 35483, of the 10th instant, I have the honour to submit the following report on the works under my charge, for the fiscal year ended 30th June last:—

During the latter portion of the season of navigation, 1890, the waters of the Ottawa and tributary rivers fell to a low pitch, but most of the timber which had passed the upper works reached its destination. The foundations of the various structures were examined at the lowest water period during the autumn months, and preparations were made for the commencement of the necessary works of repair and reconstruction, as follows:—

REPAIRS AT STATIONS ON THE MAIN STREAM OR OTTAWA RIVER.

At Carillon Station.—The guide boom at the head of slide was strengthened by placing support timbers fastened with screw bolts alongside the weaker portions, and the mooring and snubbing appliances improved. The boom planking was also overhauled and additional chains provided.

Ottawa or South Chaudière Station.—The side piers of the lower slide were repaired by the insertion of new timbers and the removal and refilling of stone in the cribwork and the sheeting of the slides made good where defective; iron plates were placed on the more exposed portions of the slide entrances; the platforms and superstructures of bulkheads repaired; the stop logs and apron timbers overhauled, and the station buildings extended and repaired, where necessary.

Hull or North Chaudière Station.—The slide planking at this station was patched and the boom fastenings and timbers strengthened.

Bridges.—The line of iron bridges over the slide and hydraulic channels at Chaudière in the city of Ottawa had the planking of the roadway extensively repaired and the tension rods and braces of the superstructure adjusted. The Union bridge roadway planking was also repaired and certain portions of the iron-

work which had been damaged by passing teams made good. The wooden bridge over the Hull slide had its planking and sidewalks kept up, and the causeway or thoroughfare between the latter structure and the Union bridge was graded up and macadamized.

The Dufferin and Sappers' Bridges, over the Rideau Canal, were repaired in their roadway coverings, iron works and footpaths; while the

Maria Street Bridge, spanning the same waterway, was thoroughly overhauled, strengthened and repaired from foundation to superstructure, by the insertion of new timbers and the placing of additional support braces, iron bolts, plates and straps.

Chats' Station.—At this place the side piers of the slide, the bottom planking, guide booms and support piers were repaired and improvements made in the bulkhead equipment.

Chenaux Station.—The strength of the current here necessitated additional supports for the main boom, consequently three anchor piers had to be built, together with a float and boat house for the accommodation of the men operating the trip for the passage of steamboat towing rafts. Certain other minor repairs were also executed on the boom chains, moorings and attachments.

Portage du Fort Station.—The main guide booms at the head of the slide had become useless through the decay of their timbers and had to be replaced, the top courses of timber on the side piers of the slide having also given out from the same cause, new ones were substituted, and the plank covering of the dams in the side channels stanched and repaired.

Mountain Station.—New hardwood stop logs were provided for the regulating bulkhead, the guide booms repaired and the slide planking, &c., renewed where worn out or displaced.

Rocher Capitaine Station.—At this place the slide bulkhead, dam, piers and booms were repaired. At the entrance bulkhead where the corners of the piers had been very much damaged by the battering of cribs making for the head of the slide, steel plates were spiked on the exposed portions of the work.

REPAIRS OF WORKS ON TRIBUTARIES OF THE OTTAWA.

Gatineau River.—At the main boom near the mouth of the stream sunken piers were placed with the view of furnishing additional sorting facilities in passing logs out through the gaps; the bridges over the canals having become dilapidated through the decay of their timbers, they with their abutment piers were for the most part rebuilt, and large quantity of bark, slabs and other description of mill rubbish, which had been deposited in the outlet creek from the pond, was removed at the season of low water, and soundings were taken to indicate the position of sand bars obstructing the navigation in the vicinity of the main boom and having a tendency to change the direction of the current of the Gatineau River to the extent of its undermining the banks and encroaching in the roadways and thoroughfares necessary for the important works at this station.

Madawaska River.—The ice in passing out during the spring floods of 1890, carried away a pier at Little Rapids; this had to be replaced, and some other repairs done in connection with the booms and the dam at head of rapid. The slide, piers and booms at Arnprior were repaired in their timbers and stone filling, and the dams, piers and booms at Flat Rapids and Goodfellow's Eddy were overhauled and the damages caused by the shoving ice and high water made good; repairs were also carried out, where necessary, at Springtown and Ragged Chute Stations.

Coulonge River.—On this stream on the 20th of April last a portion of the long slide which overcomes the High Falls, was smashed by the fall of a large piece of rock from the mountain side flanking the works. The necessary repairs were made to the bents, cribwork and planking; and steps taken to guard against a recurrence by the gradual removal of loose stones that might have caused damage to the works later on.

Black River.—The planking of the slide which had become worn or displaced by the friction of the passing logs and timber was renewed and the seams caulked. The side pier timbers were levelled up and the boom timbers and braces strengthened.

Petewawa River.—The improvements on this important tributary have been many years in existence, and the timber work is very much decayed. A thorough reconstruction of the greater number of the dams, slides, piers, booms, &c., on this stream will have to take place immediately, as many of the structures are beyond repairing. In order that the works could be made available for the business of 1891, repairs were made from the Cedar Lake dam down to the Boisdur station. The work done being chiefly repairs to the timber and planking of the dams, piers and single stick slides, and the strengthening of the main retaining dam at Cedar Lake.

Dumoine River.—The repairs executed on this stream were in connection with the damage caused by high water at Ryan's Chute dams, and also at the long single-stick slide and entrance and outlet piers at High Falls.

WORK OF RECONSTRUCTION.

At the Calumet Station, on the Ottawa River, the lower bulkhead of the upper slide was built anew; cribwork repaired at the entrance, and the side piers rebuilt in part.

The waste gate at basin between first and second slides was renewed and made of greater width than the old one, and rocks obstructing the channel removed. At the second or long slide the piers on both sides were renewed from the foundations upwards; maple plank laid as flooring for the slide; a new apron provided and the long pier dam which retains the water forming the basin between the second and third slides wholly rebuilt. The third or lower slide had the side piers and bulkhead reconstructed and the boulders removed from the outlet.

Joachim Station on the Ottawa.—The main dam on the south side of the river was made secure and the plank covering renewed in part; additional chains were furnished for the booms and their fastening and moorings strengthened.

On the Petewawa River the slide at Crooked Chute was rebuilt in its principal parts, and the single stick slide at McDonald's Chute overhauled, where the foundation timbers, side posts and planking had become dilapidated.

At the lower stations, viz., first, second and third chutes, the decayed timbers in sills and posts, as well as the defective planking in the single stick slides were renewed and new material substituted.

Notwithstanding the severity of last winter with its great snowfall in the woods and the formation of very heavy ice on the lakes and streams, the spring freshets did comparatively little damage to the works on the tributaries where many of the improvements have been in use for upwards of twenty-five and in some cases thirty years, and cannot by any means short of reconstruction, be made serviceable for the passage of timber.

High water in the early spring was followed by a protracted period of drought, which had the effect of bringing the waters of the creeks and rivers to a lower pitch than the raftsmen have experienced on the drives for many years.

The logs and timber which were got under way at the breaking up in the spring were later in the season kept moving through the works and over the lower shoals, mainly by flushing with the reserved waters from the retaining dams or reservoirs on the upper reaches of the streams, and in consequence the works were subjected to great strain and wear and tear.

The following statement furnished by the collector of slides dues in your department, shows the quantities of the various descriptions of timber that passed the works, together with the amount of revenue accrued as tolls for the fiscal year covered by this report:—

	Pieces.
White pine timber	119,339
Red do	2,365
Boom and dimension timber flat	15,629
Spruce and tamarack (round)	854
Dimension timber	34,898
Cedars	9,984
Fence posts	200
Square traverses	48
Railroad ties	46,707
Sawlogs	2,900,290
	3,130,314

and 1,752⅓ cords pulpwood.

The revenue accrued on the above was $73,188.06.

In respectfully submitting the above,

I have the honour to be, Sir,

Your obedient servant,

GEO. P. BROPHY,

Superintending Engineer of Ottawa River Works.

APPENDIX No. 7.

REPORT

ON THE

NEWCASTLE DISTRICT SLIDES AND BOOMS

FOR THE

Fiscal Year ended 30th June, 1891.

APPENDIX No. 7.

NEWCASTLE DISTRICT SLIDES AND BOOMS.

Ref. No. 36661.

DEPARTMENT OF PUBLIC WORKS,
CHIEF ENGINEER'S OFFICE, OTTAWA, 27th October, 1891.

SIR,—I transmit herewith a report by Mr. R. B. Rogers, Superintending Engineer of the Trent and Newcastle District works, on the works under his charge for the fiscal year ended 30th June, 1891.

I have the honour to be, Sir,
Your obedient servant,
LOUIS COSTE,
Acting Chief Engineer.

E. F. E. ROY, Esq.,
Secretary, Department of Public Works,
Ottawa.

TRENT VALLEY CANAL,
SUPERINTENDING ENGINEER'S OFFICE, PETERBORO', 28th July, 1891.

SIR,—I have the honour to submit the annual report on the works under my charge in connection with the Department of Public Works for the fiscal year ended 30th June, 1891.

The water during the spring was much above the average, in fact higher on some stretches than it has been since the flood of 1870. The ice also came down in a much more solid condition than usual, and did more or little damage at every station on the works. However no serious damage was done at any station.

The following repairs were executed:—

FENELON FALLS.

About 50 feet of the cap of the dam was taken out, and part of the apron of the slide. These were repaired.

BUCKHORN.

The ice lifted two of the piers and broke the guide boom to the slide. In order to prevent constant stoppage to navigation, two piers were built about half a mile below the lock, to which a boom will be attached. This will provide a navigation channel clear of the logs.

BURLEIGH.

The apron of the large slide was taken out by the logs. A new apron was put on, also a new apron was put in the small slide. The apron in the small slide was raised so that not so much water is used in running logs.

YOUNG'S POINT.

The boom leading into Clear Lake was broken by the ice. This was repaired and two rounds of timber placed on the piers at the entrance.

KATCHEWANNOE LAKE.

The anchors of the boom in several places were dragged by the ice. These were replaced. This boom is of great benefit both to lumbermen and navigation.

PETERBORO'.

Two crab winches mounted on small trucks, which run on a track, were placed on the dam. The apron on one of the slides was rebuilt and some minor repairs were done to the booms and piers. A short boom was placed from the railroad bridge to the first pier.

OTANABEE RIVER.

The accumulations of sawdust at the mouth of the river at Rice Lake became so great that it was stopping navigation. It is almost impossible to get rid of this nuisance. A large heavy rake was attached to a scow, and this was dragged backwards and forwards through the sawdust. This rake agitated the sawdust, and it was carried away by the current. A fair navigation channel was thus formed.

HASTINGS.

The guide booms were broken by the ice, and part of the lower end of the slide pier was taken out. These were repaired. Some three years ago the dues were taken off the slides at Heeley's Falls, Middle Falls and Chisholm's Rapids, in consideration that the lumbermen would keep the slides in repair. Very little repairs have been done by them, and the slides are in poor condition. If this state of things continues, I would recommend that the dues be again imposed, and the slides kept in proper repair by this department.

I have the honour to be, Sir,
Your obedient servant,
RICHD. B. ROGERS,
Superintending Engineer.

The Acting Chief Engineer,
Department of Public Works,
Ottawa.

STATEMENT showing the total number of pieces of sawlogs, boom timber, cedar railway ties, that passed through the different slides on the River Trent and Newcastle District Works, for the fiscal year ended 30th June, 1891.

Station.	Sawlogs.	Boom Timber.	Cedar, 16 ft.	Cedar, 8 ft.	Railway Ties.	Telegraph Poles.
Fenelon Falls	121,127	595				
Buckhorn	40,000	275				
Lovesick	250,000	1,525				
Burleigh Falls	250,000	1,525				
Young's Point	250,000	1,525				
Lakefield	200,000	1,200				
Peterborough	98,000	1,000				
Hastings	115,000	1,100				
Heeley's Falls	64,754	1,100	26,537	13,912	20,915	
Chisholm's Rapids	166,374	2,960				16

APPENDIX No. 8.

REPORT

ON

GOVERNMENT TELEGRAPH LINES,

FOR THE FISCAL YEAR ENDED 30TH JUNE, 1891.

APPENDIX No. 8.

GOVERNMENT TELEGRAPH LINES.

TELEGRAPH SERVICE OFFICE,
DEPARTMENT OF PUBLIC WORKS,
OTTAWA, 6th August, 1891.

SIR,—I have the honour to submit the following report upon the Telegraph Service for the twelve months ended 30th June, 1891, with tabular statements of lines, operating staff, &c., established in the several districts.

I have the honour to be, Sir,
Your obedient servant,
F. N. GISBORNE,
General Superintendent Government Telegraph Lines.

E. F. E. ROY, Esq.,
Secretary, Department of Public Works.

TELEGRAPH SERVICE—1890-91.

NEWFOUNDLAND.

The extension line connecting "Cape Ray with Port au Basque," 14 miles in length, has been operated and maintained, at a cost of $250 per annum, as in previous years, under an agreement entered into with the Anglo-American Telegraph Company.

MARITIME PROVINCES.

The Sydney-Meat Cove line, and the cable thence to the Magdalen Islands, has remained in good working order throughout the year, and 1,600 new poles have been delivered *in situ* for renewing 50 miles of the route during the present summer. Poles have also been delivered *in situ* for the construction of a branch loop line, 7 miles in length, to White Point, C. B., which will be erected during this summer; the required additional sum of $350, beyond last year's appropriation, having been provided for in the estimates.

The "Mabou to Cheticamp," Cape Breton, line, 60 miles in length, in good working order throughout the year.

The "Grand Manan-Campobello," Bay of Fundy, cable again ceased working on the 3rd May, 1890, and was repaired on the 24th September, the service of the SS. "Newfield" not being available before that date. District Superintendent Hartley Gisborne then reported that the cable had been broken by a vessel's anchor one mile out from Campobello Island, that said cable was in bad condition, having been already spliced in 17 places. It was finally renewed as follows:—

	Nautical Miles.
Old shore end previously laid, about	0·25
New shore end	1·41
New intermediate	2·55
Old deep sea, about	2·55
Old shore end, previously laid	0·25
Total	7·01

with a recommendation that when next out of order new shore end cable should replace the old deep sea portion.

N. B.—This cable again gave out 9th May, 1891, but cannot be repaired until the services of the SS. "Newfield" will be available, about the end of August next.

A branch line has now been constructed between Grand Harbour Station, Grand Manan, and Whitehead Island, 6¼ miles, including two cables of ·53 and ·71 nautical miles in length, and has remained in good working order.

The "Cape Sable Island," N. S., line has continued in good working order throughout the past year.

RIVER AND GULF OF ST. LAWRENCE.

The "Grosse Isle Quarantine" land lines and heavy cables have remained in good order throughout the year.

The "Manicouagan-Godbout" cable, 30 miles in length, after being operated with much difficulty for several months was repaired by the Assistant Superintendent, the damage being about half a mile distant from Godbout. Nearly one inch of the copper conductor had been entirely corroded away, the water completing an imperfect circuit.

The "North Shore land lines"—Chicoutimi and Point Esquimaux—586 miles in length, were satisfactorily operated throughout the year, to the marked benefit of the fishing population of that district. Throughout the entire route a traversable pathway has been cut out through the forest, shelter huts have been constructed and many bridges built; flat boats or canoes being placed at the widest river crossings. The winter mail carriers greatly appreciate such necessary accommodation, and it will be advisable to gradually improve all such facilities by small annual grants for the service.

A cable from "Long Point of Mingan, North Shore St. Lawrence, to Mechastie Bay," Anticosti, 20½ miles in length, was successfully laid by District Superintendent Hartley Gisborne on 19th August, 1890, the cable having just previously been broken when 1½ knots had been paid out, in order to save the life of Jos. McDonald, one of the workmen, who was entangled in it, as it was being paid out from the tank. McDonald whose leg and ribs were broken has happily since recovered and is now again on duty. A few weeks after the cable had been laid a fault developed itself, which has since been located by the Assistant Superintendent at the point where the cable was broken as above explained and it will be repaired by him so soon as the SS. "Newfield" is available for such service.

The "Bird Rock Cable," as mentioned in my last annual report, has been removed. This cable was submerged in October, 1880—19·20 nautical miles—and after being repaired eight times it was finally determined (per Order in Council) to utilize it for a connection between Meat Cove Station and St. Paul's Island. It was recovered under the direction of District Superintendent Hartley Gisborne in 15 sections; of which 16·12 miles of deep sea and 1·66 miles shore end were in good order; ·91 nautical mile of the cable was hopelessly damaged; and ·57 nautical mile deeply buried in sand bank was abandoned. Where the cable had rested on mud and sand, it was recovered in as good order as when submerged; but over rocks and seaweed the outer covering was almost entirely corroded away.

The St. Paul's Island cable, 20·04 nautical miles in length, was made up from 9 sections of the Bird Rock cable, plus 2·93 miles of new cable, and was, under the management of District Superintendent Hartley Gisborne, successfully submerged and operated by telephone, 8th September, 1890, and is at present in good working order.

The Gaspé-Anticosti cable and the land lines of the Island have been satisfactorily operated and maintained during the past year. A branch line, one mile in length, to West Hardwicke, has been added to the Point Escuminac, New Brunswick, line, which has continued to be in good order throughout the year.

ONTARIO.

The Bath-Amherst Island and Kingston-Wolfe Island land lines and cables have been satisfactorily worked since their transfer, at a nominal rental, to the North American Telegraph Company.

The Leamington-Pelee Island cable and land telephone lines have worked satisfactorily; but the cable 10 miles in length, has ceased working since 2nd June, probably from damage by a vessel's anchor. The Assistant Superintendent will shortly proceed to Lake Erie for the purpose of repairing the damage.

NORTH-WEST TERRITORY.

The Qu'Appelle-Edmonton line *viâ* Battleford has worked in a satisfactory manner; and the Clarke's Crossing-Prince Albert branch, 83 miles in length, has been transferred to the Canadian Pacific Railway Company.

BRITISH COLUMBIA.

The Victoria-Cape Beale telephone line, 115 miles in length, has been completed, and the advisability of converting it into a telegraph line, with skilled operators, is now under consideration.

The Ashcroft-Barkerville line, 273 miles in length, has been entirely repoled, and is now in satisfactory working order.

REVENUE AND EXPENDITURE.

The following table shows the revenue and expenditure figures for each of the lines in the several districts covered by the foregoing report:—

	Revenue.	Expenditure.	Remarks.
	$ cts.	$ cts.	
Gulf of St. Lawrence and Maritime Provinces:—			
Anticosti Island line	865 81	2,433 94	
Magdalen Islands	649 10	2,117 09	
Meat Cove line	1,349 62	1,555 81	
Cape Sable do	54 52	224 73	
Escuminac do	136 23	434 02	
Cheticamp do	291 87	598 81	
Bay of Fundy line	440 70	2,349 48	
Quarantine do	617 97	493 92	
North Shore of St. Lawrence (W.B.) line	2,867 86	3,171 20	
do do (E.B.) do	936 81	4,013 81	
Cape Ray, Newfoundland, line		250 00	
Low Point, C.B., line		50 00	
Subsidies, stationery, line and office material, cable repairs and contingencies, chargeable to the appropriation for Gulf lines		11,427 57	
	8,210 49	29,120 38	Signal service and meteorological service messages transmitted free of charge.
Ontario-Pelee Island line	106 75	217 66	
	8,317 24	29,338 04	
North-West telegraph line	4,859 95	22,389 14	
Total	13,177 19	51,727 18	

F. N. GISBORNE,
Gen'l. Supt. Government Telegraph Service.

GOVERNMENT TELEGRAPH SERVICE.

NEWFOUNDLAND TELEGRAPH SYSTEM.

No.	Stations.	Intermediate Distances.	Operators.	Salaries per Annum.	Date of Appointment.	Memo.
		Miles.		$ cts.		
1	Port au Basque	0		50 00 or com'n		N.B.—The commission is 25 per cent upon all business to and from the office; said commission guaranteed not to be less than at the rate of $50 per annum.
2	Cape Ray Lighthouse	14		50 00 do		
	Totals	14		100 00		

N.B.—The above short line is constructed in connection with the Signal Service, and connects at Port au Basque with the land line system of the Anglo-American Telegraph Company.

ANTICOSTI TELEGRAPH SYSTEM.

ANTICOSTI ISLAND SERVICE.

No.	Stations.	Intermediate Distances.	Operators.	Salaries per Annum.		Date of Appointment.	Memo.
		Miles.		$ cts.			
1	*Fox Bay	0	J. Stubbert	50 00 or com'n.		Nov. 1, 1888.	N.B.—The commission is 25 per cent on all business to and from the office; and commission guaranteed not to be less than at the rate of $50 per annum.
2	Heath Point Lighthouse	23	T. Gagné	50 00	do	July 20, 1881.	
3	South Point Lighthouse	32½	A. Nadeau	50 00	do	Oct. 1, 1888.	
4	*Shallop Creek	17½	B. Bradley	50 00	do	July 7, 1881.	
5	Salt Lake	52½	J. Carbray	360 00	do	do 1, 1891.	General Repairer. Plus $1 per day when absent on duty.
6	South-West Point Lighthouse	15	Miss G. Pope	200 00	do	Oct. 18, 1880.	Chief Operator since 1st August, 1882.
			E. Pope	100 00	do	Aug. 1, 1882.	District Superintendent. Plus $1 per day when absent on duty.
7	Jupiter River	7		50 00	do		
8	Otter River	17½		50 00	do		
9	*Becscie River	22	M. Duguay	50 00	do	Oct. 1, 1886.	
10	Cape Eagle (Ellis Bay)	10		50 00	do		
11	West Point Lighthouse	14	A. Malouin	50 00	do	Aug. 1, 1881.	NOTE—A special allowance for maintenance of office, $50 per annum, has been added to the commission for offices marked*, since September, 1887.
12	*English Bay	3	F. Cabot	50 00	do	July 1, 1882	
	Totals	214		1,160 00			

GASPÉ SECTION.

1	L'Anse à Fougère		N. Bernier	17 00	do		N.B.—A special allowance for the cable terminus. A testing station only.
2	Gaspé Basin	28	J. J. Annett	150 00	do	Oct. 16, 1881.	
		28		200 00			

GOVERNMENT TELEGRAPH SERVICE—*Continued.*

MAGDALEN ISLANDS TELEGRAPH SYSTEM.

MAGDALEN ISLANDS SECTION.

No.	Stations.	Intermediate Distances.	Operators.	Salaries per Annum.	Date of Appointment.	Memo.
		Miles.		$ cts.		
1	Amherst	0	Miss J. Shea	50 00 or com'n.	Oct. 1, 1882.	N.B.—The commission is 25 per cent on all business to and from the office; said commission guaranteed not to be less than at the rate of $50 per annum.
2	Amherst Lighthouse	9	Wm. Cormier	50 00 do	June 11, 1881.	
3	Etang du Nord Village	15	P. Pelletier	400 00	Dec. 1, 1881.	Plus $20 per annum for rent. General line repairer.
4	do Lighthouse	1	T. O'Brien	50 00 do	do 1, 1881.	2-wire loop.
5	Cap aux Meules		W. Leslie	50 00 do	Aug. 9, 1883.	
	do		A. LeBourdais, D. Supt.	500 00	do 17, 1880.	Plus $1 per day when absent on duty.
6	House Harbour	8	P. L. Joncas	50 00	June 1, 1888.	
7	Wolfe Island	28½				
8	Grosse Isle	11	N. Clark	200 00	June 1, 1888.	
9	Grand Entry	11	Mrs. F. Aikins	50 00	Feb. 18, 1882.	
	Totals	83½		1,400 00		

MAGDALEN ISLANDS TELEGRAPH SYSTEM.

CAPE BRETON SECTION.

No.	Stations.	Intermediate Distances.	Operators.	Salaries per Annum.	Date of Appointment.	Memo.
		Miles.		$ cts.		
1	Meat Cove (Cable Station). ...	0	A. B. McDonald.. .	420 00	Nov. 7, 1880	N.B.—The commission is 25 p. c. upon all business to and from the office; said commission guaranteed not to be less than at the rate of $50 per annum.
2	Aspy Bay	10½	R. G. Zwicker	50 00 or com'n..	Aug. 1, 1882	
3	Neil's Harbour { ½-way house..... / Loop Line	15 / 1¾	M. McLeod.	50 00 do	April 1, 1887	Note.—This line is at present operated and maintained by the Western Union Telegraph Company, but at the cost of the Government.
4	Ingonish, North Bay	9	J. M. Burke... ...	50 00	do 1, 1882	
5	South Ingonish	10½	Miss A. A. Baker.....	50 00 do	July 1, 1889	
6	French River..	23	John McDonald	50 00 do	April 1, 1889	
7	St. Ann's, South Bay..... .	19	Miss C. Morrison.....	50 00 do	do 1, 1884	
8	Baddeck, (Loop Line).	13	Miss Dunlop.....	50 00 do	Jan. 1, 1882	
9	Englishtown	6	Miss Bingham	50 00 do	July 19, 1882	
10	Kelly's Cove, (N. Campbelton)...	2	Miss M. C. Campbell..	50 00 do	April 1, 1885	
11	Big Bras d'Or.....	5	Mrs. E. Livingston ...	50 00 do	Jan. 1, 1889	
12	North Sydney	12½	....	....	....	
	Totals	128¼		920 00		

GOVERNMENT TELEGRAPH SERVICE—*Continued.*

NOVA SCOTIA TELEGRAPH SYSTEM.

CAPE SABLE SECTION.

No.	Stations.	Intermediate Distances.	Operators.	Salaries per Annum.	Date of Appointment.	Memo.
		Miles.		$ cts.		
1	Barrington	0	W. U. Tel. Co.'s Agent	50 00 or com'n	Dec. 18, 1883	N.B.—The commission is 25 p. cent upon all business to and from the offices; said commission guaranteed to be not less than at the rate of $50 per annum.
2	Newellton (including 1½ miles cable)	11	Miss E. A. Smith	50 00 do	April 1, 1889	
3	Cape Sable Island Lighthouse (including ¼ mile cable)	6¾	I. K. Doane	50 00 do	Dec. 18, 1883	
	Totals	17¾		150 00		

LOW POINT, CAPE BRETON SECTION.

1	Lingan	0	...	50 00 or com'n		N.B.—The commission is 25 p. cent upon all business to and from the office; said commission guaranteed not to be less than at the rate of $50 per annum.
2	Low Point Lighthouse	5	S. Peters	50 00 do	Aug. 1, 1881	
	Totals	5		100 00		

EAST COAST SECTION.

N.B.—In connection with the Signal Service a land line 208 miles in length has been erected between Canso and Halifax for a bonus of $16,000, and is now maintained and operated by the Western Union Telegraph Company without further cost to the Government.

MABOU-CHETICAMP, C.B., TELEGRAPH SYSTEM.

No.	Stations.	Intermediate Distances.	Operators.	Salaries per Annum.	Date of Appointment	Memo.
		Miles.		$ cts.		
1	Mabou	0	Mrs. M. McDonald	59 00 or com'n	April 1, 1887	N.B.—The commission is 25 p. c. of the Government line tariff receipts, and is guaranteed to amount to not less than $50 per annum.
2	Broad Cove	20	Mrs. A. Campbell	do	Sept. 1, 1887	
3	Margaree Harbour	17	Mrs. M. A. McLellan	do	April 1, 1887	
4	N. E. Margaree (loop, 5 miles) Loop Line wire	10	Miss B. M. Ross	do	Jan. 1, 1889	
5	Cheticamp	16	Mrs. M. Fiset	do	April 1, 1887	
	Totals	63				

[1891]

CHATHAM-ESCUMINAC, N. B., TELEGRAPH SYSTEM.

1	Chatham	0	Great North-Western Telegraph Co.	185 00		This amount is paid for supervision of the line and office accommodation at Chatham.
2	Black Brook	5½		50 00 or com'n		The commission is 25 per cent of the Government line tariff receipts, and is guaranteed to amount to not less than $50 per annum.
3	Bay du Vin	15	Miss M. Williston	50 00 do	March 1, 1885	
4	Lower Hardwicke	6	Mrs. M. Brimner	50 00 do	Aug. 1, 1891	
5	Escuminac	3½	Mrs. A. Lewis	50 00 do	Sept. 1, 1885	
6	Point Escuminac Lighthouse	12	H. W. Phillips, jun	50 00 do	Feb. 1, 1885	
	Totals	42		435 00		

GOVERNMENT TELEGRAPH SERVICE—*Continued.*

BAY OF FUNDY, N.B., TELEGRAPH SYSTEM.

GRAND MANAN SECTION.

No.	Stations.	Intermediate Distances.	Operators.	Salaries per Annum.	Date of Appointment.	Memo.
	Long Eddy Cable Hut, to	Miles.		$ cts.		
1	Flagg's Cove	3	Mrs. C. C. Seely (D. Supt.)	420 00	Nov. 18, 1880	N.B. The commission is 25 p.c. upon all business to and from the office; said commission guaranteed not to be less than at the rate of $50 per annum.
			Miss J. S. Daggett	50 00	do 1, 1889	
2	Woodward's Cove	6	E. Cameron	50 00 or com'n	April 1, 1885	
3	Grand Harbour	2	F. A. Newton	50 00 do	do 1, 1887	
4	Seal Cove	4¼	P. Russell	50 00 do	May 1, 1891	
5	Southern Head Lighthouse	5½		50 00 do		Southern Head Office closed 30th November, 1889.
			D. McKay, Repairer	60 00	May 1, 1881	
	Branch Line.					
	Grand Harbour	0				
6	Cheney's Island (½ mile cable)	4¾	W. Cheney	Commis'n, 25 p.c.	Feb. 1, 1891	
7	Whitehead Island (¾ do)	1½	E. Carroll	50 00 or com'n	Dec. 1, 1890	
	Totals	27¼		790 00		

CAMPO BELLO SECTION.

	Liberty Cove Cable Hut, to					
1	Welchpool	7½	M. A. Batson	100 00 or com'n	May 1, 1890	
2	Eastport, Maine, U.S.A.	½	J. Cushing	100 00	Dec. 26, 1881	
	Totals	8		200 00		

GOVERNMENT TELEGRAPH SERVICE—*Continued.*

GROSSE ISLE QUARANTINE TELEGRAPH SYSTEM.

No.	Stations.	Intermediate Distances.	Operators.	Salaries per Annum.	Date of Appointment.	Memo.
		Miles.		$ cts.		
1	Quebec	0	Great North-Western Telegraph Co.	185 00		This amount is paid for supervision of the line, and covers rent of pole line in Quebec to L'Ange Gardien, for which $35 per annum is charged.
	L'Ange Gardien	13				
2	St. Pierre (¾ milecable)	4	C. Turcott	50 00 or com'n	Mar. 1, 1885	This commission is 25 per cent of the Government line tariff, and is guaranteed to amount to not less than $50 per annum.
3	Ste. Pétronille	4½	Mrs. Blais	50 00 do	Oct. 1, 1887	
4	St. Laurent	6½	M. Gobeil	50 00 do	Sept. 15, 1888	
5	St. Jean	7	P. Pouliot	50 00 do	July 1, 1888	
6	St. François (including 4 miles cable)	5½	M. Emond	50 00 do	Mar. 1, 1885	
7	Grosse Isle quarantine office	7	M. Langlois	50 00 do	Sept. 1, 1885	
8	do hospital	1¼	(Telephone)			
	Total	50⅔		485 00		

GOVERNMENT TELEGRAPH SERVICE—*Continued.*

CHICOUTIMI AND NORTH SHORE OF ST. LAWRENCE TELEGRAPH SYSTEM.

CHICOUTIMI SECTION.

No.	Stations.	Intermediate Distances.	Operators.	Salaries per Annum.	Date of Appointment.	Memo.
		Miles.		$ cts.		
1	Bay St. Paul	0	F. Boivin	50 00 or com'n*	Previous to April 1, 1885	*The commission upon business is 25 per cent of the Government tolls of the line; the amount guaranteed to be not less than $50 per annum.
2	St. Urbain	9	A. Boivin	50 00 do	do	
3	La Cruche	37	...	50 00 do	do	
			A. Gauthier (Repairer)	420	May 15, 1887	
4	St. Alexis	31½	O. Pelletier	50 00 or com'n	Jan. 1, 1889	
5	St. Alphonse de Bagotville	3	A. Simard	50 00 do	April 1885	
6	Chicoutimi	11½	D. Boily	50 00 do	do 28, 1886	
	Total	92		720 00		

NORTH SHORE SECTION.

1	Murray Bay	0	Mrs. F. Vincent	50 00 or com'n*	Previous to April 1, 1885	
2	Cap à L'Aigle	4	N. Duchesne	50 00 do	June 1, 1888	
3	Ste. Fidèle	6	A. N. Parent	50 00 do	April 1, 1890	
4	Port au Persil	7	A. Brassard	50 00 do	May 1, 1889	
5	St. Siméon	4	D. Gaudin	50 00 do	Dec. 1, 1887	
6	Baie des Rochers	12	G. Savard	50 00 do	June 1887	
			G. Bouillenne	50 00 do	Nov. 1886	
7	Riv. aux Canards	17	N. Caron (Repairer)	420 00	Sept. 1, 1890	
8	St. Etienne (Loop Line)		J. Savard	50 00 or com'n	Nov. 1886	
9	Tadousac (1¼ mile cable)	13	J. E. Caron	50 00 do	do 1, 1388	
10	Bergeronnes	15	M. Savard	50 00 do	April 1885	
11	Escoumains	12	J. H. Topping	50 00 do	do	
12	Petit Romaine	8	...	...	...	Closed 31st March, 1891.
13	Mille Vaches	8	J. A. Puise	50 00 or com'n	April 1885	
14	Portneuf Mills	11½	...	50 00 do	...	Portneuf Mills office closed June, 1889.

15	Portneuf Light	6	S. Bouchard	50 00	or com'n	July	1,	1890	
16	Sault au Cochon	7	E. Courbron (Repairer)	420 00	or com'n*	April	1,	1888	
			J. Forrest	50 00	or com'n*	Dec.	1,	1887	
17	Betsiamits	31	R. H. Montgomery	50 00	do	Oct.	1,	1889	
18	Pointe aux Outardes (cable)	12	F. C. Ouillet	500 00	per annum	Aug.	8,	1890	
19	Pointe Paradis, Manicouagan	18							
20	River Godbout (cable)	26	N. A. Comeau	50 00	or com'n	Oct.	15,	1883	
21	Pointe des Monts	184	L. F. Faffard	50 00	do	Dec.	28,	1883	
22	Trinity Bay West	54	Z. Poulin	50 00	do	May	16,	1884	
23	Trinity Bay East	24	A. Bilodeau	Accommodation of		do	1,	1889	
24	Caribou Islands	7	L. Comeau	do		Sept.	1,	1889	
25	Pentecost River	17	Dist. Supt.'s Office						
26	Ste. Marguerite	474	A. Therriault	180 00		July	1,	1888	
27	Seven Islands	223	P. E. Vignault	180 00		Jan.	2,	1884	
28	River Moisie	153	D. Portier	50 00		May	1,	1885	
29	Sheldrake	72	P. Touzel	50 00	or com'n	Nov.	1,	1888	
30	Thunder River	64	H. LeBrun	50 00	do	Feb.	1,	1890	
31	Magpie	14	Geo. Molloy	50 00	do	Oct.	1,	1889	
32	St. John's River	9	B. Chambers	50 00	do	do	1,	1889	
33	Long Point	10	J. Vibert	50 00	do	Nov.	1,	1889	
34	Mingan	7	M. J. Maloney	50 00	do	Oct.	1,	1889	
35	Pointe aux Esquimaux	24	A. Lausier	420 00	do	do	1,	1889	
	Total	496							

NOTE.—In the estimates the maintenance of the Chicoutimi and North Shore lines is provided for under head of North Shore Line. They are operated conjointly.

GOVERNMENT TELEGRAPH SERVICE—*Continued.*

ONTARIO: PELEE ISLAND TELEGRAPH SYSTEM.

No.	Stations.	Intermediate Distances.	Agents.	Salaries per Annum.	Date of Appointment.	Memo.
1	Leamington		G. McR. Selkirk	$50	Nov. 1, 1888	Accountant and General Agent.
2	Club House	7	C. Harrison	Comsn. 25 p. c.	April 1, 1889	The commission is upon the receipts for the Government line.
3	Point Pelee	5	W. A. Grubb	do	Nov. 1, 1888	
	Cable to Island	8¾				
4	North Point Lighthouse (½ mile loop)	1	J. E. Quick	do	Dec. 1, 1890	
5	North Dock	1½	C. B. Quick	do	Nov. 1, 1888	
6	West Dock	5	A. M. McCormick	do	do 1, 1888	
7	South Dock	4½	F. B. McCormick	do	do 1, 1888	
	Total	32¾				

This line is operated with telephones.

LINES IN THE NORTH-WEST TERRITORY.

QU'APPELLE-EDMONTON SECTION.

No.	Stations.	Intermediate Distances.	Operators.	Salaries per Annum.	Date of Appointment.	Memo.
		Miles.		$ cts.		
1	Qu'Appelle	0	E. W. Warner	720 00	Jan. — 1883	
2	Fort Qu'Appelle	17	Miss E. Johnston	600 00	Mar. 1, 1885	
3	Touchwood	46	A. Von Lindeburg	600 00	Nov. 1, 1883	
4	Humbolt	78	A. Guimont	600 00	May 1, 1884	
5	Saskatoon (14 miles Loop)	69	R. J. Molloy, Agent	720 00	do 1, 1884	
			J. Harrington, Repairer	600 00	Jan. 1, 1888	
6	Henrietta do	52	W. Salsbury, Repairer	720 00	Oct. 1, 1886	
7	Battleford	47	L. P. O. Noel	720 00	Apr. 15, 1890	
			H. Sikes, Repairer	600 00	May 1, 1889	
8	Fort Pitt	89	W. M. McDonald, Rpr.	600 00	Apr. 15, 1890	
9	Moose	45½	Geo. Voyer, Repairer	600 00	Oct. 1, 1889	
10	Saddle Lake	45	J. F. Lake	600 00	do 1, 1889	
11	Victoria	37	W. C. Gillis, Repairer	720 00	Jan. — 1887	
12	Fort Saskatchewan	49	W. G. Ross, Agent	Com. 25 p. c	Dec. — 1886	
13	Edmonton	24	A. Taylor, Agent	720 00	Prev. to 1882	
			W. McKay, Repairer	720 00	May 1, 1886	
	Branch Line—					
	*Edmonton	0				* The St. Albert branch line is operated with telephones.
14	St. Albert	9				
	Total	607½				

GOVERNMENT TELEGRAPH SERVICE—*Continued.*

NORTH-WEST TELEGRAPH LINES.—WOOD MOUNTAIN AND FORT MACLEOD SECTIONS.

No.	Stations.	Intermediate Distances.	Operators.	Salaries per Annum.	Date of Appointment.	Memo.
		Miles.		$ cts.		
	Fort Macleod Line—					
1	Galt Junction	0				The Fort Macleod line has been sold to the North-West Coal and Navigation Co.
2	Lethbridge	107				
3	Macleod	28½				
4	Fort Macleod	½				
	Wood Mountain Line—					
1	Moose Jaw	0	J. M. Rutherford	240 00	June 1, 1885	The Wood Mountain line has been operated by telephone since May, 1890.
2	Wood Mountain	90½	J. H. Thompson	180 00	do 1, 1890	
	Total	226½				

GOVERNMENT TELEGRAPH SERVICE IN BRITISH COLUMBIA.

ASHCROFT—BARKERVILLE.

Office.	Intermediate Distances.	Names.	Positions.	Salaries per Month.	Date of Appointment.	Memo.
	Miles.			$ cts.		
Ashcroft Station	0	C. P. Ry. Telegraph.				This line is now operated by the Canadian Pacific Railway Co. for the Government. The arrangement being terminable at any time.
Cache Creek	4	H. L. Good	Operator and repairer	60 00	Feb. 16, 1885.	
Clinton	26	J. A. Le Bourdais	do do	50 00	do 1883.	
Bridge Creek	53	W. Walker	do do	50 00	May 1, 1880.	
Soda Creek	78	H. Yeates	do do	60 00	June 1, 1866.	
Quesnelle	54½	Miss I. Barlow	Operator	47 00	Apr. 28, 1882.	
Stanley	48					
Barkerville	13	Jas. Stone	Operator and repairer	83 33	Feb. 17, 1873.	
	276½					
Branch.						
New Westminster	18					This line was leased for 99 years to Messrs. J. A. Laidlaw and J. Wilson, on the 30th October, 1887.
Ladner's Landing (½ mile cable)						
Total	294½					

VICTORIA—CAPE BEALE.

Victoria	0					This line is operated by the Canadian Pacific Railway Co. for the Government. The arrangement being terminable at any time.
Otter Point	26					
Port San Juan	40					
Carmanah Lighthouse	24					
Cape Beale	28					
Total	118					

GOVERNMENT TELEGRAPH SERVICE—*Continued.*

GOVERNMENT SUB-MARINE CABLES.

Location.	Terminal Points.	Nautical Miles.
Anticosti Island	South West Point to Gaspé	44¼
do	Mechastie Bay to Mingan	21
Magdalen Islands	Old Harry to Meat Cove, C.B.	55
do	Grindstone to All Right Islands	½
Nova Scotia	Meat Cove, C.B., to St. Paul's Island	20
do	Across Ingonish Harbour, C.B.	¼
do	do St. Ann's do	¼
do	do Big Bras d'Or Passage	½
do	Cape Sable Island to Bear Point	1¼
do	Across channel to lighthouse, Bear Point	¼
New Brunswick	Campo Bello Island to Eastport	1¾
do	do do Grand Manan Island	7¼
do	Cheney Island to Ross Island	¼
do	Ross Island to White Head Island	¾
Prov. of Quebec	L'Ange Gardien to Orleans Island	¾
do	Orleans Island to Isle aux Reaux	2
do	Isle aux Reaux to Grosse Isle	2
do	Across Saguenay River	1¼
do	Bersimits to Manicouagan	12
do	Manicouagan to Godbout	26
Ontario	Point Pelee to Pelee Island, Lake Erie	8¾
	Total	207

GOVERNMENT TELEGRAPH SERVICE—*Concluded.*

GOVERNMENT CABLES TRANSFERRED.

Location.	Terminal Points.	Nautical Miles.	Remarks.
Nova Scotia	Digby to Long Island	⅛	Bonus to a local telephone company.
do	Long Island to Bryer Island	⅛	
Ontario	Bath to Amherst Island	2	Transferred to North American Telegraph Co., perpetual lease.
do	Howe Island to Wolf Island	1	
do	Mainland to Howe Island	¼	
British Columbia	Nanaimo to Gabriola Island	1	Sold to Canadian Pacific Ry. Co.
do	Valdes Island to Point Grey	21	
do	Across Fraser River	½	
do	do do to Ladners	½	
do	do Saanich Arm	2	
do	Victoria to Dungeness	17	
Cape Breton	Magdalen Island to Bird Rock	19½	Removed and relaid between Meat Cove and St. Paul's Island.
	Total	69	

F. N. GISBORNE,
Superintendent.

APPENDIX No. 9.

NAMES OF THE CHIEF OFFICERS

OF THE

DEPARTMENT OF PUBLIC WORKS,

WITH DATE OF APPOINTMENT, ETC.,

FROM

1841 TO 1892.

APPENDIX No. 9.

THE NAMES with the date of appointment, &c., of the principal Officials of the Department of Public Works, from 1841 to 1892.

Names.	Capacity or Office.	Date of Appointment. Served. From.	To.
Under Statute 4-5 Vic., Cap. 38.			
CORPORATION BOARD OF WORKS.			
Killaly, Hon. H. H	Chairman	Dec. 29, 1841.	Oct. 3, 1844.
Daly, Hon. D.	Members		
Harrison, S. B.			
Davidson, J., Esq.			
Begly, Thomas A.	Secretary	Aug. 17, 1841.	
Keefer, Samuel	Chief Engineer	do 17, 1841.	
Rubidge, F. B.	Architect and Assistant Chief Engineer	Dec. 15, 1841.	
NEW BOARD OF WORKS.			
Killaly, Hon. H. H	Chairman	Oct. 5, 1844.	June 8, 1846.
Daly, Hon. D	Members		
Draper, Hon. W. H.			
Morris, Hon. W.			
Papineau, Hon. D. B.			
Under Statute 9th Vic., Cap. 37, &c.			
Robinson, Hon. W. B.	Chief Commissioner	July 4, 1846.	Mar. 10, 1848.
Taché, Hon. E. P.	do	Mar. 11, 1848.	Nov. 26, 1849.
Chabot, Hon. J	do	Dec. 15, 1849.	Mar. 31, 1850.
Merritt, Hon. W. H.	do	April 20, 1850.	Feb. 11, 1851.
Bourret, Hon. J	do	Feb. 15, 1851.	Oct. 27, 1851.
Young, Hon. John.	do	Oct. 28, 1851.	Sept. 22, 1852.
Chabot, Hon. J	do	Sept. 23, 1852.	Jan. 26, 1855.
Lemieux, Hon. F	do	Jan. 27, 1855.	Nov. 25, 1857.
Alleyn, Hon. C.	do	Nov. 28, 1857.	Aug. 1, 1858.
Holton, Hon. L. H.	do	Aug. 2, 1858.	do 6, 1858.
Sicotte, Hon. L. V	do	do 6, 1858.	Jan. 10, 1859.
Rose, Hon. John	do	Jan. 15, 1859.	June 12, 1861.
Cauchon, Hon. Jos.	Commissioner	June 15, 1861.	May 23, 1862.
Tessier, Hon. U. J.	do	May 24, 1862.	May 27, 1863.
Drummond, Hon. L. T.	do	do 28, 1863.	July 23, 1863.
Laframboise, Hon. M.	do	July 23, 1863.	Mar. 29, 1864.
Chapais, J. C.	do	Mar. 30, 1864.	June 30, 1867.
Casgrain, Hon. Chas. Eus.	Second Commissioner.	Aug. 1, 1846.	
Cameron, Hon. M.	Assistant Commissioner	Mar. 11, 1848.	
Wetenhall, John	do	Feb. 2, 1850.	
Bourret, Hon. Jos.	do	April 20, 1850.	
Killaly, Hon. H. H.	do	Feb. 15, 1851.	
Keefer, Samuel	Deputy Commissioner.	May 6, 1859.	
Trudeau, Toussaint	do	Mar. 15, 1864.	
Begly, Thomas A.	Secretary	Sept 25, 1847.	
Trudeau, Toussaint	do	Dec. 13, 1859.	
Braun, Frederick	do	March 8, 1864.	
Page, John	Chief Engineeer	Oct. 31, 1853.	July 2, 1890.

APPENDIX No. 9.—The names with the date of appointment, &c., of the principal Officials of the Department of Public Works, from 1841 to 1892—*Concluded.*

Names.	Capacity or Office.	Date of Appointment Served.	
		From.	To.
Under Statute 31 Vic., Cap. 12.			
McDougall, Hon. Wm	Minister	July 1, 1867.	Oct. —, 1869.
Langevin, C.B., Hon. Hector L.	do	Dec. 8, 1869.	Nov. 5, 1873.
McKenzie, Hon. Alexander.	do	Nov. 7, 1873.	Oct. 16, 1878.
Tupper, C.B., K.C.M.G., Sir Charles	do	Oct. 17, 1878.	May 20, 1879.
*Langevin, C.B., K.C.M.G., Sir Hector L.	do	May 20, 1879.	Sept. 8, 1891.
Smith, Hon. Frank	Acting Minister	Aug. 14, 1891.	Jan. 11, 1892.
Ouimet, Hon. Joseph Aldric	Minister	Jan. 11, 1892.	
Trudeau, Toussaint	Deputy Minister	July 1, 1868.	
Baillairgé, G. F	do	Oct. 4, 1879.	Dec. 18, 1891.
Gobeil, A	do	Dec. 18, 1891.	
Chapleau, S.	Secretary	Oct. 4, 1879.	
Ennnis, F. H	do	Nov. 4, 1880.	
Gobeil, A	do	Jan. 23, 1885.	Dec. 18, 1891.
Roy, E. F. E	do	Dec. 18, 1891.	
McPherson, D. A	Assistant Secretary	do 18, 1891.	
*Perley, H. F	Chief Engineer	Nov. 25, 1880.	
Baillairgé, G. F	Assistant Chief Engineer	July 5, 1871.	
Scott, Thos. S	Chief Architect	Feb. 7, 1872.	
Fuller, Thomas	do	Oct. 31, 1881.	

* Resignation tendered 11th August, 1891; accepted 8th Sept., 1891.
* Mr. Louis Coste has been acting Chief Engineer since July, 1891.

APPENDIX No. 10.

STATEMENT OF STAFF EMPLOYED

ON THE

SLIDES AND BOOMS

THROUGHOUT THE DOMINION.

APPENDIX No. 10.

STATEMENT showing Names, Dates of Appointment, Salaries, &c., of persons employed on the different Slides and Booms, on 30th June, 1891.

Name.	Date of Birth.	Position.	Where Employed.	Date of Appointment.	Salary.	Remarks.
Collector of Slide and Boom dues.					$ cts.	
E. T. Smith	Nov. 26, 1846	Collector	Ottawa	July 1, 1889	1,500 00 per annum	Date of first appointment to Crown Timber Office, Ottawa, 23rd June, 1864. Clerk, Dept. of Inland Revenue, 1st July, 1870, to 30th June, 1889.
James Slater	April 30, 1847	Assistant Collector	do	Nov. 14, 1889	1,000 00 do	Date of first appointment to Crown Timber Office, Ottawa, 21st April, 1877. Clerk, Dept. of Inland Revenue, 1st April, 1883, to 30th June, 1889.
James Steen	June 17, 1830	Boatman	do	July 12, 1889	60 00 per month	Employed during the season of navigation, for 8 months each year. Date of first appointment, 26th May, 1861. Timber Counter, Ottawa, for Dept. of Inland Revenue, 7th Jan., 1884, to 30th June, 1889.
John Redmond	Aug. 2, 1833	do	do	do 12, 1889	60 00 do	Employed during the season of navigation, for 8 months each year. Date of first appointment, 1st May, 1872. Assistant Timber Counter, Ottawa, for Dept. of Inland Revenue, 7th Jan., 1884, to 30th June, 1889.
Sévère Dumoulin	Feb. 4, 1829	Collector	Three Rivers	do 12, 1889	200 00 per annum	Date of first appointment to Dept. of Inland Revenue, 3rd May, 1886.
Saguenay District.						
Arthur Boulanger	Sept. 11, 1854	Superintendent	Saguenay	May 19, 1881	475 00 per annum	*Saguenay Works.*—In addition to the Superintendent, there are employed on the Saguenay works 4 flagmen, at 70c. per day each, during the passing of the logs through the slides, which lasts one or two months.
Joseph Boulanger		Asst. Superintendent	do	Oct. 1, 1889	30 00 per month	

St. Maurice District.								
Charles Lajoie	Dec.	28, 1824	Superintendent	Three Rivers	Oct.	7, 1878	1,200 00 per annum	*St. Maurice Works.*—Every year, during the timber running season, the officers in charge of the various stations employ 25 to 30 men during three or four months, at the rate of 80c. to $1.10 per working day, inclusive of 40 to 50 cents per day per man paid for board to the Deputy Slide Masters and Boom Keepers; also, one clerk and foreman, at $1 per day, two watchmen and one gate-keeper.
J. B. Normand	——	—, 1837	Asst. Superintendent	Mouth of St. Maurice	April	12, 1858	3 00 per day	
Cyriac Lymburner	——	—, 1833	Foreman	do	do	25, 1881	565 00 per annum	
N. Dagneau			Paymaster	Three Rivers	Aug.	1, 1886	50 00 per month	
Jos. Pagé	July	7, 1845	Boom Keeper	Cap aux Corneilles	Dec.	10, 1879	469 50 per annum	
Arthur Rousseau	do	30, 1831	Slide Master	Shawenegan	April	12, 1858	3 00 par day	
Louis St. Onge			Asst. Slide Master	do	July	24, 1885	365 00 per annum	
Charles Langlois	——	—, 1840	Foreman	do	Jan.	13, 1880	535 00 do	
Théophile Larue	Sept.	3, 1827	Boom Keeper	Grand Mère	Mar.	15, 1872	2 00 per day	
Frs. Lacroix	——	—, 1833	Asst. Boom Keeper	Les Piles	April	1, 1866	469 50 per annum	
Arthur Pellerin			Boom Keeper	Les Grès	Aug.	5, 1885	365 00 do	
Richelieu District.								
Azaire Bienvenue			Boom Master	Beloeil Station	Jan.	1, 1882	100 00 per annum	
Ottawa District.								
G. P. Brophy	Feb.	24, 1846	Superintendent	Ottawa	July	6, 1873	2,500 00 per annum	*Ottawa River Works.*—In addition to the above officers, &c., there are employed during the running season, one foreman on slide at $1.50 and one assistant foreman at $1.25 per day; also 25 to 30 labourers at from $1 to $1.40 per working day.
D. Scott	do	15, 1830	Accountant	do	Oct.	1, 1854	1,500 00 do	
J. C. Scott	June	—, 1865	Measurer and Time Keeper	do	April	1, 1889	2 00 per day	
Wm. Kane	Dec.	24, 1820	Messenger	do	Aug.	1, 1867	1 25 do	
C. Leduc	July	8, 1846	Paymaster	do	May	1, 1888	1,200 00 per annum	
*Pierre St. Pierre	Mar.	13, 1853	Deputy Slide Master	Carillon	April	21, 1885	1 25 per day	Actively employed about 7 months.
D. Noonan	June	17, 1840	Boom Master	Gatineau	Mar.	21, 1878	500 00 per annum	Actively employed about 7 months. Oversees repairs in winter.
J. Soulière	Nov.	8, 1829	Deputy Slide Master	Chaudière	——	—, 1858	2 00 per day	do do do
J. McDonell	do	1, 1818	do	Hull	Mar.	1, 1877	1 25 do	Employed about 6 months.
D. McFarlane	Feb.	25, 1836	do	Chats	do	27, 1860	480 00 per annum	do Oversees repairs in winter.
John Harvey	May	22, 1831	Slide Master	Arnprior	July	12, 1882	2 50 per day	
Joseph McCrea	Mar.	26, 1859	Boom Master	Springtown	May	15, 1880	300 00 per annum	Employed about 3 months during season of navigation.
Patrick Barry	do	27, 1858	Slide Master	High Falls	Mar.	10, 1888	300 00 do	Employed 5 months during season of navigation. Oversees repairs in winter.
Duncan McLaren	Jan.	7, 1860	Deputy Slide Master	Portage du Fort	Sept.	7, 1881	456 25 do	do do do
J. G. Poupore	Feb.	27, 1857	do	Black River	Oct.	15, 1880	480 00 do	do do do
James Steen Rowan	Aug.	27, 1836	do	Lower Petewawa	Mar.	18, 1887	300 00 do	do do do
Wm. Thomson	May	3, 1843	do	Mountain	Oct.	10, 1879	1 25 per day	do 6 months do do
D. Carmichael	Sept.	26, 1813	do	Calumet	Aug.	—, 1848	40 00 per month.	do 6 to 7 months do do
A. Proudfoot	July	17, 1822	do	Coulonge	April	1, 1865	1 00 per day	do 4 months do do
H. R. Downey	May	16, 1846	do	Des Joachims	July	1, 1889	300 00 per annum	do do do do
Jos. Dufault	Jan.	15, 1840	Boom Master	Dumoine	April	24, 1882	1 50 per day	Employed during timber season.
Hugh Grant	Mar.	25, 1829	Deputy Slide Master	do	do	12, 1872	300 00 per annum	Employed 3 months during season of navigation. Will inspect works when required.
A. McEwen	Aug.	20, 1829	do	Rocher Capitaine	May	1, 1874	480 00 do	do do do
A. H. Johnson	Nov.	28, 1839	do	Cheneaux	——	—, 1865	2 50 per day	Paid during season of navigation, 7 months. Attends to repairs in winter.
G. T. Johnson	Sept.	10, 1841	do	do	——	—, 1872	1 75 do	do do do

* Discharged 1st April, 1891.

APPENDIX No. 10.—STATEMENT showing Names, &c., of persons employed on the different Slides and Booms—*Concluded.*

Name.	Date of Birth.	Position.	Where Employed.	Date of Appointment.	Salary.	Remarks.
					$ cts.	
Newcastle District.						
R. B. Rogers	Jan. 17, 1857	Superintendent	Peterboro'	July 1, 1884	600 00 per annum	Receives $600 per annum from Department of Railways and Canals.
G. H. Giroux		Clerk, Supt.'s Office	do	do 1, 1880	300 00 do	do $300 do do
Clement Armstrong		Slide Master	Chisholm Rapids	April 1, 1883	200 00 do	
John Ingram		do	Fenelon Falls	do 1, 1883	200 00 do	
R. T. Hill		do	Buckhorn	July 1, 1890	100 00 do	do $150 do do
F. Peake		do	Heeley's Falls	April 1. 1891	200 00 do	
Burlington Channel.						
Thos. Campbell	April 1, 1832	Ferrymen	Burlington	April 12, 1887	400 00 do	
J. A. McDonald		do	do	do 1, 1890	30 00 per month.	
Yamaska Lock.						
A. Labbé		Lock Keeper	Yamaska	Sept. 1, 1885	1 25 per day	
O. Mineau		do	do	do 1, 1885	1 25 do	

R. STECKLE.

APPENDIX No. 11.

OFFICIAL CORRESPONDENCE

FROM 1ST JULY, 1867, TO 30TH JUNE, 1891.

APPENDIX No. 11.

OFFICIAL CORRESPONDENCE.

LETTERS Received and Sent from 1st July, 1867, to 30th June, 1891.

Years.	Received.	Sent.
1867—From 1st July to 31st December	2,075	1,511
1868 do 1st January to 31st December	3,498	2,317
1869 do do do	3,448	2,171
1870 do do do	4,961	3,185
1871 do do do	6,268	3,983
1872 do do do	8,333	4,428
1873 do do do	10,072	5,707
1874 do do do	9,800	5,043
1875 do do do	9,006	5,006
1876 do do do	7,971	4,773
1877 do do do	7,517	4,425
1878 do do do	6,886	4,021
1879 do do to 6th October	7,186	4,547
1879 do 7th October to 31st December	2,033	810
1880 do 1st January do	8,451	4,410
1881 do do do	9,599	5,529
1882 do do do	10,505	5,699
1883 do do do	11,633	6,227
1884 do do do	13,114	6,903
1885 do do do	8,977	5,321
1886 do do do	9,644	5,352
1887 do do to 30th June	4,866	2,735
1887 do 1st July do 1888	10,493	6,343
1888 do do do 1889	10,522	7,042
1889 do do do 1890	10,098	7,448
1890 do do do 1891	10,576	7,286

NUMBER of Cheques sent by Accountant's to Secretary's Branch and Mailed, from 1882 to 1891.

Year.	——	No.
1882	From 22nd September to 30th June, 1883	1,566
1883	do 1st July do 1884	3,366
1884	do do do 1885	3,298
1885	do do do 1886	3,466
1886	do do do 1887	4,198
1887	do do do 1888	4,692
1888	do do do 1889	4,960
1889	do do do 1890	4,819
1890	do do do 1891	5,376

CHEQUES issued by Finance Department and Mailed from Secretary's Branch.

Year.	——	No.
1885	From 1st April to 30th June, 1885	245
1885	do 1st July do 1886	954
1886	do do do 1887	1,158
1887	do do do 1888	918
1888	do do do 1889	887
1889	do do do 1890	908
1890	do do do 1891	790

LETTERS Received and Sent, Chief Architect's Office, from 1st January, 1880, to 30th June, 1891.

Years.	Received.	Sent.
1880—From 1st January to 30th June		1,273
1880 do 1st July do 1881		2,943
1881 do do do 1882		2,859
1882 do do do 1883	3,538	4,600
1883 do do do 1884	3,860	6,004
1884 do do do 1885	4,500	6,718
1885 do do do 1886	6,075	6,450
1886 do do do 1887	6,816	6,380
1887 do do do 1888	6,947	6,870
1888 do do do 1889	6,484	7,667
1889 do do do 1890	7,448	6,578
*1890 do do do 1891		7,751

* The exact number of letters received cannot be accurately given, but would bear about the same proportion to letters sent as last year.

LETTERS Sent from Chief Engineer's Office from January, 1880, to 30th June, 1891.

Year.	——	No.
1880	From 10th January to 30th June	418
1880	do 1st July do 1881	1,795
1881	do do do 1882	2,352
1882	do do do 1883	2,651
1883	do do do 1884	3,611
1884	do do do 1885	3,119
1885	do do do 1886	2,867
1886	do do do 1887	3,281
1887	do do do 1888	3,552
1888	do do do 1889	4,229
1889	do do do 1890	3,374
1890	do do do 1891	3,948

NOTE.—The letters, including returns, received in the Chief Engineer's Office may be estimated at the rate of two received to one sent.

APPENDIX No. 12.

NATIONAL ART GALLERY

CURATOR'S REPORT.

APPENDIX No. 12.

NATIONAL ART GALLERY.

DEPARTMENT OF PUBLIC WORKS,
OTTAWA, 22nd September, 1891.

SIR,—I have the honour to report the following addition to the gallery received during the fiscal year ended 30th June, 1891:—

Oil painting "Mortgaging the Farm," by G. A. Reid, R.C.A.

The above is a diploma picture handed over to the Government by the Royal Canadian Academy.

The number of visitors have steadily increased since the opening of Gallery. In 1883 about 8,000 persons registered their names. During the past year there have been no less than 21,289 visitors.

I have the honour to be, Sir,
Your obedient servant,
JOHN W. H. WATTS,
Curator.

E. F. E. ROY, Esq.,
Secretary of the Department of Public Works.

APPENDIX No. 13.

STATEMENT

SHOWING

NAMES, DATES OF APPOINTMENT, SALARIES, &C.,

OF

PERSONS EMPLOYED

ON THE DIFFERENT

GRAVING DOCKS,

30TH JUNE, 1891.

APPENDIX No. 13.

STATEMENT Showing Names, Dates of Appointment, Salaries, &c., of persons employed on the different Graving Docks, 30th June, 1891.

Name.	Date of Birth.	Position.	Where Employed.	Date of Appointment.	Salary.	Remarks.
Esquimalt Graving Dock, British Columbia.						
John Devereux		Dockmaster.	Esquimalt	Sept. 17, 1887	$166.66 per month	
C. Muir		Engineer	do	April 1, 1887	100.00 do	
A. D. Greeves		Carpenter	do	Dec. 1, 1887	80.00 do	
F. M. Jones		Stoker	do		60.00 do	
A. McNiven		do	do		60.00 do	
John Stock		Watchman	do		50.00 do	
Lévis Graving Dock.						
Ulric Valiquette	30th June, 1856.	Dockmaster	Lévis	April 13, 1891.	$1,800.00 per month.	Annual allowance of $200 for house rent. First appointment, 9th May, 1873.
Honoré Lamontagne		Dock foreman	do	do 9, 1891	83.33 do	
Wm. Macdougall		Mech'l engineer	do	June 1, 1888	75.00 do	
Napoléon Lemelin		Asst. mech'l engn'r.	do	do 1, 1888	45.00 do	
Narcisse Lemelin		Fireman	do	do 1, 1888	32.00 do	
Jos. Morin		do	do	April 9, 1891	32.00 do	
Théodore Chabot		Caretaker and watchman	do	do 9, 1891	45.00 do	$45 per month, 1st April to 1st Dec.; $1.25 per day, 1st Dec. to 1st April.

R. STECKEL.

APPENDIX No. 14.

TABULAR STATEMENT

SHOWING THE DATES OF THE

OPENING AND CLOSING OF NAVIGATION

AT THE

PRINCIPAL PORTS OF CANADA,

ON THE SEABOARD, THE RIVER AND GULF OF ST. LAWRENCE, AND ON THE GREAT LAKES.

APPENDIX No. 14.

STATEMENT showing the Dates of the Closing and Opening of Navigation at the undermentioned Ports, in Canada, in 1890 and 1891.

Ports.	Province.	Location.	Date of Closing in 1890-91.	Date of Opening in 1891.	Remarks
			1891.		
Arichat, C. B.	Nova Scotia	Entrance Gulf of St Lawrence	Jan. 30	April 1	Never closed to navigation more than 2½ months in any one year Petit de Grat Inlet, which is a part of harbour, open all the year round.
Bathurst	New Brunswick.	Baie des Chaleurs	Dec. 2	do 21	
Belleville	Ontario	Lake Ontario	Nov. 30	do 17	
Campbellton	New Brunswick.	Baie des Chaleurs	Dec. 1	do 23	
Charlottetown	P. E. Island	Gulf of St. Lawrence	do 13	do 15	
Collingwood	Ontario	Georgian Bay	Nov. 29	do 15	
Gaspé	Quebec	Gulf of St. Lawrence	Dec. 23	May 2	The present is a fair average of dates the latter years, as there is a considerable change in favour of the port.
Georgetown.	P. E. Island	do	Jan. 29	March 30	Ice formed on harbour 17th Jan., 1891. Jan. 19, open to St. Andrew's Point; 23rd, open to railway wharf; 29th, closed to vessels other than winter boats. Ice of no thickness, the steamers making regular trips to and from Pictou and landing freight and passengers at railway wharf.
Goderich	Ontario	Lake Huron	Dec. 16	April 4	The ice was formed at earlier date, but 16th Dec. was latest vessel arrived.
Halifax	Nova Scotia	Atlantic Ocean			Always open and clear of ice.
Kincardine	Ontario	Lake Huron	Nov. 16	April 22	
Kingston	do	Lake Ontario	Dec. 26	do 3	
Louisburg, C. B.	Nova Scotia	Entrance Gulf of St. Lawrence			Open all the year round. No ice forms in this harbour to impede navigation. Some years, in the months of March and April, the port may be blocked for one or two days with drift ice.
Montreal	Quebec	River St. Lawrence	Dec. 3	April 17	First arrival from sea, 30th April, 1890. Last departure for sea, 24th Nov., 1890.
North Rustico	P. E. Island	Gulf of St. Lawrence	Dec. —	do —	Last vessel cleared from this port about the last of November. Port not closed by ice until last of December or later. First vessel cleared 20th April. Ice was clear of shore about a week earlier.
North Sydney, C. B.	Nova Scotia	Entrance Gulf of St. Lawrence	Feb. 2	do 14	On 12th April first steamer arrived. Troubled some with drift ice after that date.
Owen Sound	Ontario	Georgian Bay	Dec. 8	do 18	
Pictou	Nova Scotia	Gulf of St. Lawrence	do 12	do 14	SS. "Egerton" made first trip, New Glasgow to Pictou, April 14, 1891. SS. "St. Olaf" arrived at Georgetown from Pictou April 17. SS. "St. Lawrence" arrived at Pictou from Charlottetown, 2nd April.

Port Arthur	Ontario	Lake Superior	do	21	May	2	
Port Dover	do	Lake Erie	Nov.	6	April	14	Those dates are taken from arrival and departure of vessels. The ice did not form until perhaps the middle of November, and navigation was really open earlier, say 8th April, 1891.
Port Hope	do	Lake Ontario	Dec.	5	do	5	
Port Stanley	do	Lake Erie	do	24	March	17	So far as ice went, navigation could hardly be considered closed all winter, as there was no ice to prevent steamers and vessels passing in and out all winter, with the exception of perhaps a couple of weeks in January, 1891.
Quebec	Quebec	River St. Lawrence	Nov.	25	April	27	
Sarnia	Ontario	Lake Huron	Dec.	11	do	25	
Sault Ste. Marie	do	Lake Superior	do	4	do	28	
Shediac	New Brunswick	Gulf of St. Lawrence	do	2	do	23	Navigation closed about two weeks earlier than for several years past, but the opening last spring is about on an average.
Sorel	Quebec	River Richelieu	Nov.	29	do	20	
St. John's	do	do	do	26	do	2	First boat arrived from Lacelle, 2nd April, 1891. First towing steamer from Rouse's Point arrived 22nd April, 1891. Last boat out, Nov. 26, 1890. River closed with ice on the following day.
St. John	New Brunswick	Bay of Fundy	.....	.....	.....	.....	Always free from ice.
Tadousac	Quebec	River St. Lawrence	Dec.	5	March	14	This port was clear and open all winter.
Three Rivers	do	do	Nov.	20	April	21	
Toronto	Ontario	Lake Ontario	Dec.	24	March	22	Bay was lightly frozen over on the 24th Dec., but was broken up on the 25th. It was frozen again on the 28th, was partially broken up the following day and remained open until 4th January, 1891. Bay clear of ice, 17th Feb. Bay frozen over 1st March. Bay clear of ice 22nd March. First arrival, 24th March.
Wiarton	do	Georgian Bay	Nov.	30	April	23	Although navigation closed 30th November, ice did not form until some time in January; seldom forms till about end of January. Water bold, must be extremely cold and calm before ice forms, excepting near shore.
Windsor	do	Detroit River	.....	.....	.....	.....	Navigation was open every day during the entire season.
Winnipeg	Manitoba	Red River	Nov.	3	Arpil	17	

APPENDIX No. 15.

REPORT

OF THE

COLLECTOR OF SLIDE AND BOOM DUES

1890-1891.

APPENDIX No 15.

COLLECTOR OF SLIDE AND BOOM DUES.

Ref. No. 37069.

DEPARTMENT OF PUBLIC WORKS OF CANADA.
CHIEF ENGINEER'S OFFICE,
OTTAWA, 2nd November, 1891.

SIR,—I transmit herewith a report by Mr. E. T. Smith, Collector of Slide and Boom Dues, Ottawa District, for the fiscal year ended 30th June, 1891.

I have the honour to be, Sir,
Your obedient servant.
LOUIS COSTE,
Acting Chief Engineer.

E. F. E. Roy, Esq.,
Secretary, Public Works Department.

DEPARTMENT OF PUBLIC WORKS,
COLLECTOR'S OFFICE,
OTTAWA, 10th November, 1891.

SIR,—I have the honour of submitting my report on that branch of the service committed to my charge, namely, the collection of slide and boom dues, during the fiscal year ending 30th June last.

OTTAWA DISTRICT.

The revenue accrued as well as the collections have, I regret to say, both fallen off considerably during the past fiscal year as compared with the preceding year.

This deficiency is attributed to the facts that one of the largest saw mill firms in the district abandoned the saw lumber business during the year and most of the other manufacturers reduced the output of saw-logs during the winter of 1889–90; hence the number of saw-logs which passed through the Ottawa works was only 2,900,291 pieces in 1890–91, while in 1889–90 the number was 4,500,518 pieces.

The quantities of square timber which passed down the slides during the past fiscal year exceeded those of 1889–90, consequently the revenue from this source was larger by the sum of $3,914.08.

I beg leave to explain that setting the amount of the revenue accrued during the fiscal year ended 30th June, 1890, against that of the revenue accrued during the past year would not constitute a fair comparison, as by a change in the tariff authorized by Order in Council of 30th June, 1890, the charge of one-third of one cent per saw-log for the Chaudière boom was dropped. Hence to arrive at the actual difference between the revenue of 1890–91 and that of 1889–90, there should be deducted from the latter the sum of $6,903.05, tolls accrued at the Chaudière boom in that year, but for which work there was no charge during the year just closed. There should also be deducted the sum of $221.02 which was written off by Order in Council, being an overcharge. These two amounts being deducted from the revenue accrued during 1889–90, the actual shortage during the past fiscal year was $15,624.62 as compared with the previous year.

With regard to the dues outstanding uncollected at the time when the collection of the slide and boom dues was transferred to this Department (1st July, 1889) I have to state that the sum of $2,317.84 was recovered during the past year.

Of the revenue accrued during the fiscal year ending 30th June, 1890, there remains uncollected only the amounts charged for Chaudière boomage, which are disputed.

Of the dues accrued during the past fiscal year, I have to report all collected but $3,808.51, the particulars of which, less $100 collected since 1st July, 1891, will be found in statement No. 4, herewith.

The total revenue accrued from the Ottawa district during the fiscal year ending 30th June, 1891, including interest was		$73,794 28
Of which there was collected	$69,985 77	
Leaving outstanding on 30th June, 1891	3,808 51	
		73,794 28

The collections were as follows:—

Of dues accrued during the year 1890–91	$69,985 77
do do 1889–90	4,529 79
do prior to 1st July, 1889	2,317 84
Total amount collected and deposited in banks to credit of Receiver General	$76,833 40

Enclosed herewith are five statements, viz.:—

No. 1.—Statement of dues accrued on each of the slides and works on the Ottawa River during the year ended 30th June, 1891.

No. 2.—Statement of the number of pieces of timber, &c., which passed through the works during the same period.

No. 3.—Statement of slide and boom dues accrued from Ottawa River works since 1st July, 1889, uncollected on the 30th September 1891.

No. 4.—Statement of slide and boom dues outstanding on 30th June, 1889, uncollected on 30th September, 1891.

No. 5.—Statement of slide dues outstanding at Quebec, 30th June, 1889, uncollected 30th September, 1891.

ST. MAURICE DISTRICT.

The revenue accrued from this district during the year 1890–91 amounted to the sum of $3,953.87.

The collections for the same period were $663.11.

The amount apparently outstanding on the 30th June last was $19,985.53 of which $12,257.46 is composed of accounts which remain unpaid, as the parties have counter claims for damages which were referred to a special commissioner, the late Judge McDougall, who reported the claims well founded; of the remainder $1,802.34 consists of alleged overcharges which have not yet been allowed; $3,074.27 has been collected after 1st July and previous to 30th September, 1891, leaving of ordinary undisputed dues $2,642.22 uncollected at the latter date.

Statement No. 6, herewith, shows in detail the amounts outstanding on the 30th September last in this district.

SAGUENAY DISTRICT.

The uncollected dues of this district as shown in statement No. 7 are composed of the accumulated accruals since 1877, as there is no record of any collections since that time.

Messrs. Price Bros. & Co. who owe the entire amount, $17,235.38, have a counter-claim against the Government which has not yet been dealt with.

NEWCASTLE DISTRICT.

Statement No. 8 shows in detail the amount due for slidage at Fenelon Falls, which have accumulated, in some instances, since 1877, amounting to the sum of $6,040.20 on the 30th June last.

No dues have been received from this district since 1882, in which year the then slide master, who also acted as collector resigned; when his successor in the former capacity was appointed in the following year he was not authorized to collect the dues, therefore he simply kept a record of the quantities of timber and saw-logs which passed over the slide. The omission of instructions to him to act as collector was only discovered a short time before the collection of slide and boom dues was transferred to this department, and as the papers relating to this district were only transferred to us late in the year 1890 no steps were taken to collect these arrears until early in the present year, when accounts where sent to such of the parties who could be found and further efforts will be made to collect such of the accounts as may yet be good.

I have the honour to be, Sir,
Your obedient servant,
EDWARD T. SMITH.
Collector of Slide and Boom Dues.

No. 1.—STATEMENT showing the Dues accrued on each of the undermentioned Government Slides and Works on the River Ottawa and its tributaries during the Fiscal Year ended 30th June, 1891.

Name of River.	Name of Slide or other Improvement.	Amount Accrued to each Slide.	Amount Accrued to each River.
		$ cts.	$ cts.
Ottawa	Rocher Capitaine Slides	608 00	
	Des Joachim Slides	1,972 00	
	Calumet Slides	3,057 00	
	Portage du Fort Slides	1,995 69	
	Chats Slides	3,445 00	
	Chaudière Slides	7,390 32	
	Cheneaux Boom	6,171 62	
			24,639 63
Petewawa	Cedar Lake to Memo Rapids	752 95	
	New Slide near Lake Traverse	2,488 46	
	Lake Traverse, Trout Lake	2,267 60	
	Crooked Chute	2,224 99	
	Bois dur to River Ottawa	6,155 24	
			13,889 24
Madawaska	Ragged Chute and Highfalls Slides and improvements	11,193 48	
	Improvements below Highfalls to Arnprior	3,286 47	
	Slide at Arnprior	2,291 42	
	Boom at mouth	3,172 25	
			19,943 62
Dumoine	Highfalls Slide	302 89	
	Improvements below Highfalls Slide	336 64	
			639 53
Coulonge	Coulonge Slide		3,429 54
Black River	Black River Slide		3,295 16
Gatineau	Gatineau Boom		7,351 34
			73,188 06

No. 2.—STATEMENT of the number of pieces of Timber, Saw-logs, &c., that passed through the Government Slides and Works on the River Ottawa and its tributaries during the Fiscal Year ended 30th June, 1891.

White pine timber	119,339	pieces.
Red do	2,365	do
Boom, dimension and fleet timber	15,629	do
Spruce and tamarack, round	854	do
Dimension timber	34,898	do
Cedars	9,984	do
Fence posts	200	do
Square traverses	48	do
Railroad ties	46,707	do
Saw-logs	2,900,290	do
Total	3,130,314	pieces.

and 1,752¼ cords pulpwood.

The revenue accrued on the above was $73,188.06.

EDWD. T. SMITH,
Collector of Slide and Boom Dues.

OTTAWA, 30th September, 1891.

No. 4.—STATEMENT of Slide and Boom Dues Accrued from Ottawa River Works since 1st July, 1889, outstanding on 30th June, 1891, and remaining uncollected on 30th September, 1891.

By Whom Due.	Year to Which Dues Belong.	Chaudière Boomage in Suspense.	Ordinary Slide and Boom Dues.	Total Dues Outstanding 1st Sept., 1890.	Remarks.
		$ cts.	$ cts.	$ cts.	
J. R. Booth	1889-90	2,561 69		2,561 69	Chaudière Boomage reported to Council and referred to the Treasury Board. Should be written off.
The Bronsons & Weston Lumber Company	1889-90	2,056 96		2,056 96	
Perley & Pattee	1889-90	1,203 26		1,203 26	
Pierce & Co.	1889-90	913 48		913 48	
Wm. Mason & Sons	1889-90	167 66		167 66	
do	1890-91		664 81	664 81	$400 since paid ; expect balance in a few days.
Robert Gorman	1890-91		397 50	397 50	Dues secured.
Alex. Fraser, acct. of Thos. Stephens	1890-91		28 42	28 42	Timber yet in the Ottawa River.
Hawkesbury Lumber Co	1890-91		2,617 78	2,617 78	Chaudière Slidage—Claim for reduction in rate before the Department under consideration.
Total		6,903 05	3,708 51	10,611 56	

[1891]

RECAPITULATION.

Chaudière Boomage		$ 6,903 05
Ordinary Dues		3,708 51
		$ 10,611 56

MEMORANDUM.

Amount accrued from 1st July, 1889, to 30th June, 1890	$ 96,542 97	
do 1st July, 1890, to 30th June, 1891	73,794 28	
		$ 170,337 25
LESS—Amount collected and deposited during fiscal year ending 30th June, 1890	$ 84,889 11	
Amount written off by Order in Council	221 02	
do collected and deposited during fiscal year ending 30th June, 1891	74,515 56	
do do since 30th June, 1891	100 00	
		159,725 69
Balance uncollected on 30th September, 1891		$ 10,611 56

EDWARD T. SMITH,
Collector of Slide and Boom Dues.

OTTAWA, 30th September, 1891.

No. 3.—STATEMENT of Slidage and Boomage from Ottawa Slides and Works outstanding 30th June, 1889, and remaining uncollected 30th September, 1891.

Name.	Bad and doubtful Debts.	Chaudière Boomage in suspense.	Other Slide and Boom Dues disputed.	Total Dues outstanding 30th Sept. 1891.	Year to which Dues belong.	Remarks.
	$ cts.	$ cts.	$ cts.	$ cts.		
John & Wm. McLean	53 14			53 14	1873	Insolvent.
James Yuill	9 29			9 29	1876	Overcharge.
John Rowan	342 50			342 50	1872 and 1873	Insolvent.
Lemieux & Charette	21 30			21 30	1873	do
Taillon & Lapierre	148 10			148 10	1873 and 1874	do
Mosgrove & McHarry	261 42			261 42	1873 and 1874	do
W. C. Wells	600 90			600 90	1873 and 1874	do
Dufresne & McGarity	528 80			528 80	1874 and 1875	do
Walton Smith	171 46			171 46	1874 and 1875	do
A. H. Baldwin	3,507 92			3,507 92	1871 to 1874	do
Hon. James Skead	9,807 65			9,807 65	1861, 1863, 1864, 1869, 1875 to 1878	do
Batson & Currier	5,558 70			5,558 70	1875 to 1877	do
A. F. A. Knight	546 30			546 30	1878	do
James Walker	11 25			11 25	1877	do
R. Campbell & Son	1,558 50			1,558 50	1879 to 1881	do
James G. Bryson	73 50			73 50	1886	do
Costello Bros	90 62			90 62	1882	do
N. E. Cormier	428 34			428 34	1888	do
John R. Booth		9,871 93	398 88	10,270 81	1881 to 1888	$398.88 counter claim damage by breaking of Coulonge Boom
Perley & Pattee		8,889 85	2,456 06	11,344 91	1867, 1868, 1880 to 1888	$2,035.96 counter claim damage by breaking of Madawaska Boom; $219.10 counter claim damage of breaking of Coulonge Boom.
The Bronsons & Weston Lumber Co		8,180 79		8,180 79	1881 to 1885	*Chaudière Boomage.*—These parties claim that they have maintained these works wholly at their own expense since 1881.
Pierce & Co		462 18		462 18	1888	
G. A. Grier & Co		1,060 59		1,060 59	1886 and 1887	
Estate late L. Young		1,461 20		1,461 20	1881 to 1885	
William Mason		413 85		413 85	1881 to 1883	
Gilmour & Co		406 27		406 27	1884	
John Rochester		258 88		258 88	1881 to 1883	
J. & B. Grier	76 84			76 84	1883	Overcharge.

R. & W. Conroy	95 42			95 42	1882 and 1883	do Reported in return S. 38 for March, 1886.
A. & P. White	101 00			101 00	1881	Overcharge.
J. & G. Bryson			252 20	252 20	1886	Counter claim for damage by breaking of Coulonge Boom.
B. Caldwell & Son	4 33			4 33	1887	Overcharge.
	23,997 28	31,005 54	4,106 14	58,108 96		

EDWARD T. SMITH,
Collector of Slide and Boom Dues.

OTTAWA, 30th September, 1891.

No. 5.—STATEMENT of Outstanding Slide Dues, Ottawa District, Bonds for which were sent to Quebec for collection, remaining unpaid 30th September, 1891.

Name.	From 1860.	From 1861.	Total.
	$ cts.	$ cts.	$ cts.
Hon. James Skead	245 00	210 00	455 00
James Mair		696 75	696 75
	245 00	906 75	1,151 75

These amounts were uncollected, as the parties claimed damages for loss caused by the Madawaska Boom breaking away in 1860.

A decision on their claim was not arrived at until 2nd August, 1869; on the 5th idem Messrs. Skead and Mair were notified that the Department could not recognize their claim.

To the best of my knowledge this decision was never communicated to the Collector of Slide Dues, consequently their accounts remained in abeyance. Since then both parties died, and I believe both were insolvent at the time of their death.

EDWARD T. SMITH,
Collector of Slide and Boom Dues.

OTTAWA, 30th September, 1891.

No. 6.—STATEMENT of Slide and Boom Dues from the St. Maurice Slides and Works outstanding on 30th June, 1891, and remaining uncollected the 30th September, 1891.

——	Year to which dues belong.	Amount.	Total.	Remarks.
		$ cts.	$ cts.	
George Baptist, Son & Co..	1878	469 95		
do do ..	1879	2,110 62		
do do ..	1880	1,696 18		
do do ..	1881	293 69		Have counter claims for damages to logs caused by the booms not being stretched early enough in the spring of 1878 to permit the logs going over the Chutes.
do do ..	1882	165 80		
do do ..	1884	118 50		
do do ..	1888	4 28		
			4,859 02	These claims were submitted to special commissioner Mr. McDougall, afterwards judge, who, after hearing the evidence on both sides, recommended that the claims of the parties should be allowed.
Ross, Ritchie & Co.....	1878	3,072 84		
do	1883	2,173 68		
do	1884	21 96		
do	1886	1 62		
do	1887	4 38		
			5,281 48	
Alexander Baptist	1879	....	2,116 96	
Hall, Neilson & Co. acc't, Hall Bros.....	1886	750 46		
do do ..	1887	690 44		
			1,440 90	Collector holds a bond from the Banque du Peuple for this amount.
Ross & Co.....	1888	624 60		
do	1889	3 08		
			627 68	Refuse to pay; give no reason that I am aware of.
Wm. Ritchie & Co.....	1888	779 24		
do	1889	332 11		
			1,111 35	Of this amount $754.20 is claimed to be an overcharge.
Ritchie Bros.....	1886	413 43		
do	1887	634 71		
			1,048 14	This amount is composed of overcharges in 1886 and 1887 of $842.76, and overpayments in 1884 of $205.38.
I. A. Gagnon.....	1890	.....	124 32	I know of no reason why these amounts have not been paid.
G. B. Hall.....	1890	.....	49 34	
T. E. Normand..... ..	1890	.....	42 83	
Total..... ...	..	....	16,702 02	

OTTAWA, 30th September, 1891.

EDWARD T. SMITH,
Collector of Slide and Boom Dues.

No. 7.—SAGUENAY DISTRICT—Statement of Slide Dues accrued at the Saguenay outstanding on the 30th June, 1891, unpaid 30th September, 1891.

Name.	Year to which Dues belong.	Amount.
		$ cts
Messrs. Price Bros. & Co.....	1877 to 1890.	17,235 38

OTTAWA, 30th September, 1891.

EDWARD T. SMITH,
Collector of Slide and Boom Dues.

NEWCASTLE DISTRICT.

No. 8.—STATEMENT of Slide Dues accrued at Fenelon Falls, Ont., outstanding on the 30th June, 1891, unpaid 30th September, 1891.

Name.	Years to which Dues belong.	Amount.
		$ cts.
M. Boyd	1882, 1884, 1886 and 1891	2,108 31
T. G. Hazlett	1881, 1882, 1884 and 1889	885 25
J. M. Irwin	1882, 1883, 1885 and 1888	698 45
D. Ullyott	1881 and 1887	547 68
Geo. Hilliard	1877, 1883 and 1886	354 90
Greene & Ellis	1880, 1883, 1835, 1888 and 1889	314 02
Irwin & Boyd	1881	59 79
Thomson & McArthur	1880	52 78
A. W. Parkins	1884, 1885, 1888, 1890, 1891	65 92
The Dickson Estate, T. G. Hazlett	1883	137 50
Jabez Thurston	1882	12 50
Alfred McDonald	1888	40 80
Smith & Fell	1880, 1881, 1882, 1883, 1885	38 37
John Dovey	1888, 1891	37 80
John Parkins	1889	13 00
R. C. Smith	1882	7 20
Sadler & Dundas	1888, 1890, 1891	81 17
The Rathbun Company	1888, 1889	88 40
McDougall & Ludgate	1879	65 07
Bigelow & Traunce	1882 and 1885	216 21
R. & G. Strickland	1882, 1883, 1885 and 1887	215 08
	Total	6,040 20

EDWARD T. SMITH,
Collector of Slide and Boom Dues.

OTTAWA, 30th September, 1891.

APPENDIX No. 16.

STATEMENTS.

1st.—STATEMENT OF CONTRACTS LET BY THE DEPARTMENT DURING THE FISCAL YEAR ENDED 30th JUNE LAST.

2nd.—STATEMENT OF PROPERTY PURCHASED AND SOLD BY THIS DEPARTMENT DURING THE SAME PERIOD.

3rd.—STATEMENT OF PROPERTY LEASED TO AND BY THIS DEPARTMENT DURING THE SAME PERIOD.

APPENDIX No. 16.

No. 1.—CONTRACTS let by the Department of Public Works of Canada, from the 30th June, 1890, to the 30th June, 1891.

Works.	Names of Contractors.	Date of Contract.	Amount.
			$ cts.
PUBLIC BUILDINGS.			
Government House, Parliament and Departmental Buildings and Printing Bureau.			
Eastern Block—Safety deposit boxes	Goldie & McCulloch	July 7, 1890.	3,200 00
Parliament Grounds—Maintenance	N. Roberson	Sept. 30, 1890.	5,600 00
Parliament Building—Bronze balusters	Garth & Co	Oct. 22, 1890.	1,804 00
Parliament Grounds—Removal of snow	P. McKenna	do 29, 1890.	525 00
Parliament and Departmental Buildings—Recovering roofs of boiler houses	E. G. Laverdure & Co.	Nov. 4, 1890.	1,224 85
Parliament and Departmental Buildings—Maintenance and repairs of roofs	E. G. Laverdure & Co.	Dec. 27, 1890.	3,250 00
Printing Bureau—Fittings and furniture for Parliamentary Distribution Office	J. E. Askwith	Aug. 23, 1890.	1,030 90
Printing Bureau—Slab firewood	J. Heney	do 31, 1890.	1 25 per cord.
do Incandescent lighting—wiring, &c., dynamo	Ahearn & Sopher	Dec. 9, 1890.	8,492 00
Printing Bureau—Incandescent lighting—Foundation for new engine	J. E. Askwith	Jan. 14, 1891.	1,000 00
Public Buildings—Ice	C. A. Christin	do 29, 1891.	06 per block.
Rideau Hall—Ice	C. A. Christin	do 21, 1891.	07 per block.
do Removal of snow	A. Hunter	Oct. 30, 1890.	475 00
Nova Scotia.			
Amherst Post Office Building—Supply of coal	Jas. Kenna	Sept. 5, 1890.	240 00
Annapolis do do Fittings	Rhodes, Curry & Co.	Oct. 16, 1890.	1,290 00
do do do Heating apparatus	Garth & Co	Nov. 15, 1890.	1,226 00
do do Fittings for Post Office Savings Bank and Custom House	Rhodes, Curry & Co.	June 5, 1891.	438 00
Antigonish Post Office—Supply of coal	Jas. Kenna	Sept. 5, 1890.	90 00
Arichat Post Office—Supply of coal	F. L. Malzard	Aug. 5, 1890.	84 00
Baddeck do do	A. G. McDonald	Sept. 22, 1890.	108 00
Halifax New Immigrant Sheds—Electric lighting—Installation	Halifax Illuminating and Motor Co.	Oct. 31, 1890.	200 00
Halifax New Immigrants Sheds—Electric lighting—To supply current	Halifax Illuminating and Motor Co.	Nov. 17, 1890.	270 00 per annum.
Halifax Public Building—Incandescent lighting—Installation	Halifax Illuminating and Motor Co.	Nov. 17, 1890.	750 00
Halifax Public Building—Incandescent lighting—To supply current	Halifax Illuminating and Motor Co.	Nov. 17, 1890.	1,854 00 per annum.
Halifax Public bulding—Granolithic pavement	R. Forsyth	Sept. 2, 1890.	2,135 00
do Dominion Building and Examining Warehouse—Supply of coal	Intercolonial Coal Mining Co	Aug. 20, 1890.	997 73

No. 1.—CONTRACTS let by the Department of Public Works, &c.—*Continued.*

Works.	Names of Contractors.	Date of Contract.	Amount.
PUBLIC BUILDINGS—*Continued.*			$ cts.
Nova Scotia—Concluded.			
New Glasgow Post Office Building—Supply of coal	J. Muir & Son	Sept. 1, 1890	137 50
North Sydney do do Electric lighting	North Sydney Electric Light Co	April 14, 1891	300 00 per annum.
do do do Supply of coal	Jas. Kenna	Sept. 5, 1890	150 00
Pictou Custom House and Marine Hospital—Supply of coal	Acadia Coal Co	do 22, 1890	258 71
Sydney Post Office Building—Supply of coal	Sydney and Louisboug Coal & Railway Co.	Aug. 12, 1890	100 00
do Post Office fittings	R. Gillis	July 8, 1890	1,188 00
do Fittings for long room, Inland Revenue Office	do	Nov. 12, 1890	150 00
Truro Post Office Building—Supply of coal	J. Muir & Son	Sept. 1, 1890	136 00
do do do Twin Gurney boilers	Truro Foundry and Machine Co.	Oct. 11, 1890	570 00
Windsor do do Supply of coal	Cumberland Ry. and Coal Co	Sept. 3, 1890	224 88
Yarmouth Post Office Building—Supply of coal	Acadia Coal Co.	Sept. 22, 1890	210 00
Prince Edward Island.			
Charlottetown Public Building—Fence	McKinnon & McLean	Aug. 26, 1890	1,665 00
do do Supply of coal	C. Lyons	do 27, 1890	533 61
Montague Post Office Building— do	Jas. Kenna	Sept. 5, 1890	67 50
Summerside do do do	J. Read & Co	Aug. 27, 1890	216 86
New Brunswick.			
Bathurst Post Office Building—Supply of coal	Gillespie & Sadler	Aug. 29, 1890	433 00
Carleton Post Office—Supply of coal	R. P. & W. F. Starr	do 26, 1890	34 47
Chatham Post Office Building—Supply of coal	Gillespie & Sadler	do 29, 1890	118 34
Dalhousie do do	J. Read & Co	do 27, 1890	168 75
do do Fittings	A. G. McKenzie	do 9, 1890	1,360 00
Fredericton Post Office Building—Hot water heating apparatus	Garth & Co	Sept. 29, 1890	1,875 00
Fredericton Post Office Building—Supply of coal	J. Tibbits	do 1, 1890	310 05
Moncton do do	Acadia Coal Co	do 22, 1890	197 82
Newcastle do do	Gillespie & Sadler	Aug. 29, 1890	358 41
Portland do do	R. P. & W. F. Starr	do 26, 1890	30 07
St. John Public Buildings do	do	do 26, 1890	2,684 91
do Post Office—Plumbing	H. Dunbrack	June 6, 1891	650 00
St. Stephen Post Office Building—Supply of coal	C. D. Hill & Co	Sept. 1, 1890	132 50
Sussex do do	R. P. & W. F. Starr	Aug. 26, 1890	158 19
Woodstock do do	C. D. Hill & Co.	Sept. 1, 1890	193 50
Quebec.			
Aylmer Post Office—Supply of coal	Geo. F. Thompson	Aug. 25, 1890	146 25
Coaticook Post Office Building—Supply of coal	W. C. Webster	Sept. 18, 1890	195 00
Hull do do	Geo. F. Thompson	Aug. 25, 1890	207 59
Hull Post Office Building—Incandescent lighting—Installation	Chaudière Electric Light and Power Co.	Nov. 10, 1890	175 00
To supply current	do do		1c. per lamp per hour.
Joliette Post Office Building—Supply of coal	H. Coffin	Aug. 28, 1890	147 14
Montreal Post Office—To provide electric current for 237 incandescent lights	*Gazette* Printing Co	Dec. 17, 1890	3,792 00 per annum.
Montreal Inland Revenue Office—Renewing portion of drain and water closets	E. St. Louis	Aug. 13, 1890	1,388 00
Montreal Post Office and Revenue Buildings—Supply of coal	P. McCrory	do 30, 1890	960 00
Montreal Custom House and Northern Receiving House—Supply of coal	Evans Bros	do 30, 1890	692 50

No. 1.—CONTRACTS let by the Department of Public Works, &c.—*Continued.*

Works.	Names of Contractors.	Date of Contract.	Amount.
PUBLIC BUILDINGS—*Continued.*			$ cts.
Quebec—Concluded.			
Montreal Examining Warehouse—Supply of coal	F. Robertson	Aug. 29, 1890	1,740 00
Quebec Public Buildings and Citadel do	Madden & Ellis	do 21, 1890	3,074 30
Sherbrooke Post Office Building do	Lucke & Mitchell	Sept. 17, 1890	271 30
Sorel do do	H. C. Charland & Co.	do 16, 1890	271 00
St. Henri Post Office—Erection	Frigon & Peltier	Oct. 13, 1890	7,770 00
St. Hyacinthe Post Office—Erection	Lortie & Naud	July 19, 1890	12,860 00
St. Jérome Post Office Building—Supply of coal	Dufresne & Mongenais	Sept. 30, 1890	384 63
St. John's do do	Bissett & Donaghy	Aug. 30, 1890	168 00
Three Rivers Custom House and Post Office—Supply of coal	Z. Marchand	do 28, 1890	581 49
Valleyfield Post Office—Alterations and repairs	Bélanger & Préfontaine	Sept. 26, '90 / Oct. 20, '90	250 00
Ontario.			
Almonte Public Building—Heating apparatus	Dunlop & Chapman	Nov. 19, 1890	875 00
do Laying pipes for water service	R. Cameron	June 18, 1891	365 00
do Interior fittings and porch	R. Cameron	Nov. 10, 1890	1,560 00
do Supplying the water	Young Bros.	June 18, 1891	75 00
			per annum.
Amherstburg Public Building—Supply of coal	Mullen & Co	Aug. 29, 1890	180 00
Barrie Post Office Building—Supply of coal	Johnson & Sarjeant	do 28, 1890	230 00
Belleville do do	The Downey Co	do 29, 1890	345 00
Berlin do do	J. Fennell	do 28, 1890	181 50
Brampton do do	J. Ryan	do 9, 1890	148 50
do do Incandescent lighting	J. O. Hutton	July 11, 1890	30 00
Brantford do Water supply	Water Commissioners of Brantford	Nov. 8, 1890	per annum. 38 00
do do Supply of coal	T. Elliott	Aug. 28, 1890	258 16
Brockville do do	Geo. E. Shields	Sept. 10, 1890	119 00
do do do	W. T. McCullough	do 10, 1890	135 50
Carleton Place Post Office—Erection	R. Cameron	Dec. 9, 1890	12,039 00
Cayuga Post Office—Supply of coal	T. Martindale	Aug. 30, 1890	143 75
Chatham—Post Office Building—Supply of coal	J. L. Scott	do 30, 1890	111 18
Clifton do do	Coulson & Robinson	do 28, 1890	258 75
Cobourg do do	Hargraft & Co	Oct. 9, 1890	236 00
Cornwall do do	Flack Bros.	Sept. 18, 1890	230 00
Galt do do	Perry & Co.	Aug. 29, 1890	171 00
Gananoque—Custom House and Post Office—Supply of coal	The Rathbun Co	Sept. 2, 1890	194 75
Goderich—Post Office Building—Supply of coal	Wm. Lee	Oct. 13, 1890	210 00
Guelph do do	Kloepfer & Co	Sept. 26, 1890	170 84
Hamilton do do	Æ. D. Mackay's Sons	Aug. 29, 1890	936 00
Kingston—Public Buildings do	W. B., & S. Auglin	do 28, 1890	216 00
Lindsay—Post Office Building do	The Rathbun Co	Sept. 2, 1890	93 36
London—Custom House and Post Office—Supply of coal	D. Daly & Son	do 1, 1890	840 00
London—Post Office—Renewing pipes to heating apparatus	Smith Bros.	July 12, 1890	105 00
Napanee—Public Building—Water Service—Connections	Napanee Water Works Co	Aug. 28, 1890	80 00
Napanee—Public Building—Water Service—Supply of water	Napanee Water Works Co	do 28, 1890	79 30
			per annum.
Napanee—Public Building—Supply of coal	The Rathbun Co	Sept. 2, 1890	133 75
Orangeville—Post Office Building—Supply of coal	J. Morrison	do 1, 1890	134 59
Ottawa—Post Office—Incandescent lighting—Installation—For the supply of current, per light, per hour, 1 cent	Chaudière Electric Light and Power Co.	Aug. 5, 1890	373 00
Ottawa—Major's Hill Park—Maintenance	L. Garello	Sept. 19, 1890	3,700 00
do Supreme Court Building—Addition	W. Stuart	Oct. 28, 1890	10,765 00

No. 1.—CONTRACTS let by the Department of Public Works—*Continued.*

Works.	Names of Contractors.	Date of Contract.	Amount.
PUBLIC BUILDINGS—*Concluded.*			$ cts.
Ontario—Concluded.			
Ottawa—Several of the Public Buildings—Removal of snow	T. J. Morris	Nov. 3, 1890	875 00
Pembroke—Customs Office and Inland Revenue Office—Furniture and fittings	Munro & Beatty	Sept. 5, 1890	575 00
Pembroke—Public Building—Incandescent lighting	Pembroke Electric Light Co	Oct. 15, 1890	240 00 per annum.
Pembroke do Customs Office and Examining Warehouse—Fittings for long room	Munro & Beatty	Nov. 21, 1890	4,600 00
Pembroke—Public Building—Supply of coal	Dunlop & Chapman	Sept. 1, 1890	296 41
Peterborough—Post Office Building—Supply of coal	The Rathbun Co	do 2, 1890	141 42
do Custom House and Inland Revenue Building—Erection	J. E. Askwith	Aug. 26, 1890	13,487 00
Port Colborne—Post Office—Supply of natural gas for fuel and light	Mutual Natural Gas Co	April 4, 1891	125 00 per annum.
do do supply of coal	R. Mathews	Aug. 29, 1890	146 25
Port Hope—Post Office Building—Supply of coal	Brown & Henning	Sept. 16, 1890	220 00
Prescott—Custom House and Post Office—Supply of coal	J. W. Plumb	Aug. 29, 1890	341 25
St. Catharines—Post Office Building—Supply of coal	W. O'Loughlin	do 29, 1890	226 71
St. Thomas do do	Ellison & Lewis	do 29, 1890	348 60
Stratford do do	P. R. Jarvis	Sept. 19, 1890	352 62
Strathroy do Fittings for Inland Revenue Office	Lewis & Cluff	July 9, 1890	450 00
Toronto—Excavating for Drill Hall	W. Davis and Sons	April 2, 1891	0 25 per cub. yd.
do Public Buildings—Supply of coal	P. Burns, & Co	Aug. 22, 1890	1,738 32
Trenton—Post Office Building—Supply of coal	J. Funnell	do 28, 1890	125 00
do do Tower clock	O. H. Bunter	Oct. 30, 1890	1,990 00
Walkerton do Erection	Tighe Bros	Aug. 4, 1890	14,560 00
Windsor do Supply of coal	J. & T. Hurly	Sept. 1, 1890	375 50
Manitoba.			
Brandon—Public Building—Heating apparatus	J. Hanbury	Nov. 10, 1890	4,750 00
Winnipeg—Immigrants Building—Erection	Brydon & Charlesworth	Sept. 30, 1890	13,737 00
do Custom House—Dominion Lands Office—Examining Warehouse—Indian Offices—Crown Timber Office—Intelligence Office—Supply of coal	T. D. Robinson	Sept. 17, 1890	1,467 50
do Post Office and Immigration Office—(Galt coal)	Alberta Railway Co	do 22, 1890	2,212 50
British Columbia.			
Agassiz—Experimental Farm—Superintendent's residence	H. A. Bell	Feb. 28, 1891	5,367 00
Vancouver—Post Office Building—Erection	A. E. Carter	Aug. 2, 1890	54,500 00
Victoria—"C" Battery Barracks—Gates, guard house, canteen and reading room, cook house and married men's quarters	Geo. McFarland	Dec. 31, 1890	8,423 00
HARBOURS AND RIVERS.			
Nova Scotia.			
Cribbin's Point—Wharf and approach to	S. O'Donoghue	Dec. 20, 1890	7,650 00
Digby—New pier	J. Nicholson	Nov. 18, 1890	47,578 00
French River—Breakwater	McDonald & Moffatt	Mar. 28, 1891	2,700 00
Georgeville—Wharf	S. O'Donoghue	Dec. 20, 1890	4,500 00

No. 1.—CONTRACTS let by the Department of Public Works—*Continued.*

Works.	Names of Contractors.	Date of Contract.	Amount.
HARBOURS AND RIVERS—*Continued.*			$ cts.
Nova Scotia—Concluded			
Great Village—Public wharf	A. McKinnon	Jan. 19, 1891	1,940 00
Stony Island—Breakwater	J. Nicholson	Oct. 20, 1890	4,650 00
Tidnish River—Public wharf	D. Sutherland	July 4, 1890	1,900 00
Walton Harbour—Breakwater	McDonald & Moffatt	Dec. 23, 1890	6,170 00
Prince Edward Island.			
Brae Harbour—Extension to breakwater	H. McPhee	April 16, 1891	850 00
Port Selkirk—Block and span to pier	F. & F. Panting	Feb. 25, 1891	600 00
do Reconstruction and strengthening lower end of pier	Wightman & T. Mellish	May 9, 1891	1,550 00
New Brunswick.			
Campbellton—Ferry wharf	J. Filion	Mar. 31, 1891	2,800 00
Caraquet Harbour—Public landing	H. Thérian	Oct. 25, 1890	1,000 00
Gray's Island—Breakwater	J. McFarlane	do 27, 1890	5,483 00
Negro Point (St. John Harbour)—Repairs to breakwater	A. McKinnon	Jan. 19, 1891	2 20 per c. yd.
Quebec.			
Ste. Anne des Monts—Isolated block	A. J. Andrews	Nov. 4, 1890	8,898 00
Ontario.			
Beaverton—Landing pier	D. Porter	Feb. 9, 1891	7,500 00
Belleville—Dredging in the harbour	Weddell Bridge and Engine Works	Sept. 9, 1890	14c. p. c. yd.
Kaministiquia River—Dredging	J. Murray	Aug. 9, 1890	Sched. rates.
Kingston Dry Dock—Pumping plant	J. Inglis & Son	Dec. 4, 1890	23,300 00
do Wrought iron caisson	Dom. Bridge Co., Ltd.	do 24, 1890	17,782 97
Wiarton—Extension of breakwater	D. Porter	July 16, 1890	5,900 00
York Village—Abutments and piers of a bridge intended to be built across Grand River at	Burns & Laughran	Oct. 13, 1890	6,450 00
York Village—Iron superstructure of above bridge	Dom. Bridge Co., Ltd.	Dec. 24, 1890	8,800 00
North-West Territories.			
Macleod—Old Man's River bridge	Smith & Heney	April 10, 1891	25,640 00
British Columbia.			
Esquimalt Graving Dock—Steel stop-gate for caisson recess	Albion Iron Works Co.	Mar. 2, 1891	5,976 25
DREDGE VESSELS AND PLANT.			
Alberton, P.E.I.—Crane and circle for dredge "Prince Edward"	J. P. Cunningham	May 21, 1891	449 24
Hull, Que.—Hull for dredge "St. Louis"	P. G. Waters	Feb. 23, 1891	1,500 00
River St. John, N.S.—Three centre dumping scows	McLeod & Kitchin	Mar. 10, 1891	4,495 00
Victoria, B.C.—Three hopper dredge scows	O. Warner	Feb. 25, 1891	4,650 00
TELEGRAPH LINES SERVICE.			
Supply and distribution of poles for Government telegraph line between Broad Cove and Meat Cove	W. Hellen	Feb. 16, 1891	70c. per pole.

F. X. R. SAUCIER.

DEPARTMENT OF PUBLIC WORKS,
OTTAWA, 12th October, 1891.

No. 2.—STATEMENT of Property Purchased or Sold by the Department of Public Works during the Fiscal Year ended 30th June, 1891.

Date of Conveyance.	Vendors.	Purchasers.	Description of Property.	For what Purpose.	Area.	Price.
						$ cts.
July 14, '90.	Edward Phelan	Her Majesty	Strip of land on George St. in Peterborough, Ont.	To increase to proper dimensions a site for public building	20 x 114 ft., 2 in.	2,000 00
Sept. 15, '87.	O. E. Hughes, *ès qualité*.	do	Part of Lot No. 71, Prince Albert Settlement	Prince Albert N.W.M.P. Barracks	$13\frac{26}{100}$ acres	530 40
do 15, '87.	O. E. Hughes, sheriff	do	do do	do do	$15\frac{49}{100}$ acres	615 60
June 27, '87.	C. Mair	do	do 70, do	do do	$23\frac{348}{1000}$ acres	953 00
July 7, '90.	Alex. Baptist	do	Riparian lot in front of lot No. 2,189	Improvement in the harbour of Three Rivers, Que.	28,304 sup. ft	3,276 98
Sept. 10, '90.	Her Majesty	John Rochester.	Portion of Government reserve on lot 39, broken front, Concession A, Ottawa River	Lumbering purposes	53,725 square ft.	Settlement of claim.
Nov. 19, '90.	Canadian Pacific Railway Co.'s town site trustees	Her Majesty	Lots 3, 4, 5 and 6, Block 28, Moosomin, Assa	Site for court house	200 x 125 ft	300 00
Jan. 9, '91.	G. Sanson	do	Part of sub-lot No. 2, in Petrolea, Ont.	Site for public building	20 x 150 ft	1,000 00
do 9, '91.	W. R. Gibson	do	Sub lot No. 1, in Petrolea, Ont	Site for public building	40 x 150 ft	3,000 00
Dec. 29, '90.	Rev. P. Fiset	do	Piece of land at Cheticamp, N.S.	For approaches to wharf.	$\frac{1}{20}$th acre	50 00
do 29, '90.	Chas. Doucet *et ux*	do	do do		$\frac{1}{40}$th acre	20 00
do 26, '90.	Charles Valois	do	Part of cadastral lot No. 1,821, Parish of Vaudreuil	Por Point à Valois wharf		600 00
Feb. 4, '91.	Corp'n City of Toronto	do	Land between University, Osgoode, Chesnut and Armoury streets	Drill hall	497 x 270 ft.	1 00
Mar. 11, '91.	Corporation Town of Port Arthur	do	Portion of lot No. 5, Port Arthur, Ont	Site for public building	10,000 sup. ft	1 00
Aug. 22, '89.	J. R. Kerr *et ux*	do	Lots Nos. 3, 4, 5, 6, 7, 8, 9 and 10, Block 2	Site for drill hall at Brantford, Ont.		4,000 00
do 22, '89.	W. S. Wisner *et ux*	do	Portions of lots No. 11, 12, 13, 14, adjoining preceding ones			2,000 00
June 8, '91.	J. Forgie, W. McArthur, and Young Bros	do	For passage and free access for repairs for pipe (water service) in connection with	Almonte public building		Free for 10 yrs.

DEPARTMENT OF PUBLIC WORKS,
OTTAWA, 12th October, 1891.

F. X. R. SAUCIER.

No. 3.—STATEMENT of Property leased to and by the Department of Public Works during the Fiscal Year ended 30th June, 1891.

Date of Lease.	Lessor.	Lessee.	Property Leased.	For what Purpose.	Duration of Lease.	Rent Payable per Annum.
						$ cts.
July 24, 1890. ..	Her Majesty.... ..	Wm. Dodd	Old Government House at Yale, B.C	Personal use and maintenance.....	3 years.....	1 00
Sept. 4, 1890....	H. Papineau.....	Her Majesty.. . ..	A wooden building at Valleyfield, Que	Post office....	3 do	300 00
May 12, 1891....	Her Majesty.....	J. R. Booth.....	Part of "Toll Gate Reserve" at Union Bridge, Ottawa.....	Milling purposes... ...	21 do	150 00

DEPARTMENT OF PUBLIC WORKS,
OTTAWA, 12th October, 1891.

F. X. R. SAUCIER.

APPENDIX No. 18.

REPORT

ON THE

ST. MAURICE DISTRICT SLIDES AND BOOMS

FOR THE FISCAL YEAR ENDED 30TH JUNE, 1891.

APPENDIX No. 18.

SLIDES AND BOOMS, ST. MAURICE DISTRICT.

Ref. No. 35360.

CHIEF ENGINEER'S OFFICE,
OTTAWA, 4th July, 1891.

SIR,—I transmit herewith a report by Mr. C. Lajoie, Superintendent of the St. Maurice District Slides and Booms, on the works under his charge, for the fiscal year ended 30th June, 1891.

I have the honour to be, Sir,
Your obedient servant,
HENRY F. PERLEY,
Chief Engineer.

E. F. E. ROY, Esq.,
Secretary, Department of Public Works,
Ottawa.

OFFICE OF THE ST. MAURICE WORKS,
THREE RIVERS, 3rd July, 1891.

SIR,—I have the honour to transmit, for the information of the Honourable the Minister of Public Works, my annual report of works done on the St. Maurice under my supervision, for the past fiscal year ended 30th June last.

There have been no accidents on the works and the drive was well made. The number of logs cut last winter will amount to, I am informed, 300,000; all of which will reach their destination, excepting some 30,000 that cannot pass down before next spring.

Appropriation for maintenance	$16,600 00
do repairs	5,800 00
Expenses of maintenance	16,718 53
do repairs	3,987 41

Details of expenditure herewith annexed.

I have the honour to be, Sir,
Your obedient servant,
CHARLES LAJOIE,
Superintendent.

HENRY F. PERLEY, Esq.,
Chief Engineer, Public Works,
Ottawa.

Details of repairs executed as follows :—

Entrance of the St. Maurice.

1. Six pieces of boom strengthened with 11 by 17-inch spruce; 1,500 lbs. of iron bolts.
2. Seven pieces of boom, 30 feet long by 32 inches by 16 inches thickness, spruce.
3. 765 lbs. of iron tie bolts.

Cap aux Corneilles.

1. Five pieces of boom, 150 feet long by 5 feet, sheeted with 3-inch plank.
2. 1,000 lbs. of 7 by $\frac{3}{4}$ inch nails.
3. Repairing 2,000 feet of old doubled booms.

Shawenegan.

1. Sheeting 1,081 feet of boom $3\frac{1}{2}$ feet wide, with 3-inch planking of spruce and hemlock.
2. Repairs to Grand Remous wharf at the foot of the falls, 14 pieces of sheeting of 10 feet and 8 inches in thickness and other minor and indispensable repairs.
3. Reconstructing pier No. 7 in the retaining boom, 33 feet long, 21 feet wide and 30 feet high.
4. Construction of a wharf 67 feet long, 8 feet high; to protect blacksmith shop against eroding of the hill which takes place every spring.
5. Repairing 121 feet of doubled boom, making 6 feet in width, with 3-inch cross-ties every 10 feet.

Grand Mère.

1. Two pieces of boom 150 feet long by 3 feet wide, covered with 3-inch planking; three kegs of nails.
2. Repairing a small wharf, at the foot of the falls, 12 feet square.
3. Building two barges, one 32 feet and the other 22 feet.
4. Covering 225 feet of boom with 3-inch plank; 6 kegs of 6-inch nails.
5. Two anchors, one of 1 500 lbs. and the other 3,000 lbs.
6. 1,500 feet of chain of $\frac{3}{4}$ and $\frac{7}{8}$ inches.
7. Repairs to a scow.

Grandes Piles.

1. Repairs to pier No. 1; 2 pieces of elm cap timbers, 20 feet by 18 inches; 4 pieces, 20 feet by 12 inches square; 150 lbs. $\frac{3}{4}$-inch iron, 3-inch sheeting and $2\frac{1}{2}$ kegs of 6-inch spikes.
2. Repairs to pier No. 2; 2 elm cap timbers, 20 feet by 18 inches; 4 pieces 20 feet by 12 inches square; 150 lbs. $\frac{3}{4}$-inch iron.
3. Repairs to pier No. 3; face sheeting on three sides with 3-inch plank; 4 kegs of 6-inch nails; 4 cap-timbers, 20 feet of 12 inches by 12 inches.
4. Repairs to pier No. 4: sheeted on three sides with 3-inch planks; 4 kegs of 6-inch nails; 4 cap timbers, 30 feet of 12 inches by 12 inches.
5. 10 toises of stone to fill in wharves.
6. To complete repairs to station house; build and paint a ceiling, 36 by 24 feet; plastering upper part of house and framing 3 doors and 3 windows; build and paint a ceiling in kitchen, 18 by 18 feet; plastering and framing of 3 doors and 3 windows; also, a large cupboard.
7. Repairs to two pieces of boom of 150 feet, sheeted with 3-inch plank; 4 kegs of nails.

Amount of expenditure for maintenance and repairs for fiscal year ended 30th June, 1891:

Appropriation for repairs	$ 5,800 00	
Expenditure do	3,987 41	
Balance unexpended		$1,812 59
Expenses for maintenance:—		
Appropriation for maintenance	$16,600 00	
Expenses do	16,718 53	
Over-expenditure		118 53
Unexpended surplus of both appropriations		1,694 06

CHARLES LAJOIE,
Superintendent.

THREE RIVERS, 3rd July, 1891.

APPENDIX No. 19.

REPORT

ON THE

SAGUENAY SLIDE

FOR THE FISCAL YEAR ENDED 30TH JUNE, 1891.

APPENDIX No. 19.

SAGUENAY SLIDE.

CHIEF ENGINEER'S OFFICE,
OTTAWA, 29th March, 1892.

SIR,—I transmit herewith a report by Mr. Joseph Rosa, Assistant Engineer on the Saguenay Slide, for the fiscal year ended 30th June, 1891.

I have the honour to be, Sir,
Your obedient servant,
LOUIS COSTE,
Acting Chief Engineer.

E. F. E. ROY, Esq.,
Secretary, Department of Public Works,
Ottawa.

QUEBEC, 3rd August, 1891.

SIR,—I have to report as follows on the works executed at the Saguenay Slide, for the fiscal year ended 30th June, 1891.

The mooring pier, to which is attached the head of the main boom, was taken down and rebuilt, and repairs were made to the slide and the booms, and dam No. 7 was strengthened.

The number of logs of different dimensions which passed through the slide during the year was 79,100.

I have the honour to be, Sir,
Your obedient servant,
JOSEPH ROSA,
Superintendent.

The Acting Chief Engineer,
Public Works Department,
Ottawa.

APPENDIX No. 20.

LIST

OF SOME OF THE

ACTS OF PARLIAMENT PASSED AT THE SESSION OF 1891

AND HAVING REFERENCE TO THE

DEPARTMENT OF PUBLIC WORKS

OR WORKS UNDER ITS CHARGE.

APPENDIX No. 20.

LIST of some of the Acts passed at the First Session of the Seventh Parliament of Canada, prorogued on the 30th day of September, 1891, and having reference to the Department of Public Works, or Works under its charge.

Subject.	Full Title of the Statute.	Chapter.	Page in Statute Book.
Sums granted to Her Majesty for the financial year ending 30th June, 1892, and the purposes for which they are granted.	An Act for granting to Her Majesty certain sums of money required for defraying certain expenses of the public service, for the financial years ending respectively the 30th June, 1891, and the 30th June, 1892, and for other purposes relating to the public service. (Assented to 10th July, 1891.)	1	3
do do . .	An Act for granting to Her Majesty certain sums of money required for defraying certain expenses of the public service for the financial year ending the 30th June, 1892, and for other purposes relating to the public service. (Assented to 28th August, 1891.)	2	37
Transfer of certain Public Property to the Provincial Governments.	An Act authorizing the transfer of certain Public Property to the Provincial Governments.	7	84
Frauds upon the Government...	An Act respecting Frauds upon the Government..... ...	23	139
In amendment of the Act respecting Government Harbours, Piers and Breakwaters.	An Act to amend the Act respecting Government Harbours, Piers and Breakwaters.	52	214

F. X. R. SAUCIER.

DEPARTMENT OF PUBLIC WORKS,
OTTAWA, 29th March, 1892.

CANADA

ANNUAL REPORT

OF THE

MINISTER OF PUBLIC WORKS

FOR THE FISCAL YEAR 1890-91

PART II.

WATER LEVELS, RIVER ST. LAWRENCE

BETWEEN

QUEBEC AND MONTREAL.

REPORT BY R. STECKEL, ENGINEER IN CHARGE OF LEVELLING AND GAUGING OPERATIONS, ETC., TRANSMITTED BY L. COSTE, ACTING CHIEF ENGINEER OF PUBLIC WORKS, 1891.

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST EXCELLENT MAJESTY.
1893

DEPARTMENT OF PUBLIC WORKS OF CANADA,
CHIEF ENGINEER'S OFFICE,
OTTAWA, 2nd December, 1891.

SIR,—I have the honour to transmit herewith the report of Mr. R. Steckel, of this department, in connection with the determination of water levels along the River St. Lawrence by geodetic levelling, between the cities of Montreal and Quebec.

The work done by Mr. Steckel, and the results attained thereon are, in my opinion, of such interest and importance, that I have no hesitation in recommending that his report be printed as an appendice to the Honourable the Minister's report.

The field work performed, including tide and river gauging as well as levelling operations, was commenced in 1885 and completed in 1888; the total length of time spent in the field being about 14 months. The office work, which was of a very laborious nature, had to be performed by Mr. Steckel and his assistants so as to interfere as little as possible with his departmental duties, and the proficiency with which it has been done is deserving of the highest praise.

Three special appropriations were made by Parliament for this work: $3,000 in 1886–87, $2,500 in 1887–88, and $2,500 in 1888–89, in all $8,000, but this amount does not represent the total cost of the work performed in the field and in the office, as the technical part of the work was done chiefly by employees of the department under Mr. Steckel's superintendence.

This was considered the most satisfactory and most economical way of doing this work, and the results attained give, without doubt, a fair return for the outlay incurred.

Before closing my remarks on this Report, I would take the liberty of strongly advising that this work of establishing geodetic bench-marks along the River St. Lawrence be continued: 1st. Easterly from Quebec to the Atlantic coast, and westwardly from Montreal to the great lakes, and up the Ottawa River. Such a general system of accurate levels would prove of immense value for public works of all kinds, as well as for agricultural, hydrological and geological researches, and would be more especially useful to the Departments of Public Works and Marine, under whose dual control the navigation of the whole of the St. Lawrence is vested.

The work below Quebec would be of great service, in connection with the projected determination of the low water plane to which soundings should be properly reduced in the "Beaujeu Channel," previous to engaging in expensive sounding operations with the object of ascertaining the cost of removing the obstructions at the upper end of that channel, which are represented by the Marine Department as a source of danger to sea-going vessels of over 25 feet draught.

However, pending the completion of the eastern section of the projected work along the St. Lawrence between Quebec and the Atlantic coast, which should be the first undertaken—and the determination of the correct mean sea level at some point on the gulf shore, by the Marine Department, by means of an extended series of tidal observations, towards which Parliament has voted the sum of $10,000 at its session of 1891,

the result of the levelling operations so far obtained between the cities of Montreal and Quebec could be issued in pamphlet form for the use of engineers, surveyors, etc., the present approximate mean sea level datum being provisionally retained.

Of the 28 illustrations (plans, diagrams and charts) transmitted with Mr. Steckel's report, only 15 need, strictly speaking, be reproduced by lithography to render the report intelligible. These are Nos. I to VI and Nos. IX, XI, XIV, XV, XIX, XXIII, each on one sheet; also Nos. XXVI and XXVII, each as a whole or in two parts, and No. XXVIII, on one sheet.

As regards the appendices, Nos. 13, 14, 15, 16, 17, 18, 19, 20, 21 should be published.

I have the honour to be, sir,
Your obedient servant,

LOUIS COSTE,
Acting Chief Engineer.

E. F. E. Roy,
Secretary, Department of Public Works.

WATER LEVELS, RIVER ST. LAWRENCE,

BETWEEN

QUEBEC, MONTREAL AND LACHINE.

DEPARTMENT OF PUBLIC WORKS,
OTTAWA, 24th November, 1891.

The Chief Engineer of Public Works.

SIR,—I have the honour to submit the following report on the levelling and gauging operations which have been carried out under my direction between Quebec and Montreal, as per instructions received from you, with a view of determining the water levels of the St. Lawrence above the mean level of the sea during high and low stages of the river, for various phases of characteristic fluvial tide waves and establishing reliable permanent bench marks along this, the principal Canadian highway of navigation, for use in connection with the ship channel and other harbour and river works.

The levelling performed between Sorel and Quebec forms the second link of the projected circuit of precision levels, from the tide-gauging station which has been established by the United States Coast and Geodetic Survey, on the Atlantic Ocean at Governor's Island,* Harbour of New York, back to the same ocean in the Gulf of St. Lawrence, *viâ* the Hudson River, the Champlain Canal, Lake Champlain, the River Richelieu and the River St. Lawrence. It appears from the accompanying "Extract "from a report dated 10th October, 1887, on fluctuations in the level of Lake Champlain "and the average height of its surface above the sea, by assistant C. A. Schott" †(*see* Appendix No. 14), that in the United States, the spirit levelling commenced in 1857-58 at New York, has lately been completed up to Putnam station on the Delaware and Hudson Canal Company's Railway near the head of Lake Champlain, and that from the station just named the elevation of the lake was transferred by water level to Rouse's Point, at the foot of the said lake.

The precision levelling commenced on Canadian territory, in 1883-84 near Rouse's Point, is now completed inclusive of office computation: 1st, along the River Richelieu from the last named village to the town of Sorel; 2nd, along the St. Lawrence between the city of Quebec and the town of Lachine.

The system of simultaneous double levelling and the methods of observation and computation adopted for the work performed along the River Richelieu between Lake Champlain and the St. Lawrence, and which are fully described in the report addressed to you under date of 16th September 1885,‡ I have continued to follow in all essential parts, between Quebec and Montreal. Moreover, geodesic level No. 1 and improved rods A, B, C, D, illustrated and described in detail in the said report, were again made use of; but in addition to these instruments a second level, No. 2, constructed by the same celebrated makers as No. 1, M. M. Fauth & Co., of Washington, D.C., was brought into requisition when wide streams had to be crossed, and also the two new rods E and F with accessories constructed by the late Mr. E. Chanteloup of Montreal, which have been exhibited at the London Indian and Colonial Exhibition of 1886.

* The absolute heights of the great lakes are referred to the mean sea level deduced from gaugings made at Governor's Island, 1852 to 1879.

† Extract transmitted to this department 11th May, 1888, by B. A. Colonna, Esq., assistant in charge of U.S. C. and G. Survey Office at Washington, in reply to a request made at my suggestion (*see* No. 77573, 29th May, 1887), for the heights of some prominent bench marks in the vicinity of Rouse's Point, or in some other locality near the frontier easily accessible from the Canadian side—above the mean level of the sea as determined at one of the tide-gauging stations established by the survey on the Atlantic coast.

‡ This report is published inclusive of illustrations in the official report of the Department of Public Works for the fiscal year 1884-85, as Appendix No. 7.

The new pivot level No. 2 had also to be used for a short time at Montreal and vicinity on the north shore of the St. Lawrence, while repairs were being made to level No. 1.

This instrument (No. 2) carries a horizontal circle five inches in diameter, which permits of reading angles to thirty seconds instead of single minutes only as in No. 1, mean value of one level division, 2 millimetres long = 3·3 seconds; one division of micrometer head, keyed on screw for raising or depressing telescope and level, corresponds to 2·22 seconds. Aperture of telescope = 0·124 feet; focal distance of object lens = 1·34 foot.

It is provided with two astronomical eye pieces which afford magnifying powers of about 40 and 60 diameters, in connection with the objective of the telescope.

The angular distances from the horizontal wire in the optical axis of the telescope, to the stadia wires on either side are: 2′ 25″·5 and 4′ 29″·5; the angle between the extreme wires being therefore 6′ 55.″

Inclination due to inequality of collars = $\frac{1}{10}$ of a micrometer division or 0·2 second; the eye end collar being smaller than that at the object end of the telescope, for which reason the correction required according to distance had to be added to each reading.

LEVELLING OPERATIONS PERFORMED.

Two continuous lines of levels, marked A and B on the computation sheets and abstracts, were run simultaneously on the south shore of the St. Lawrence between Caughnawaga and the graving dock at St. Joseph de Lévis, viz., in seven sections of from about 25 to 35 miles in length, numbered from 4 to 10; the levelling operations being carried on in opposite directions on alternate sections, as was done along the River Richelieu, with a view of preventing in a measure, the gradual accumulation of error supposed to arise from working constantly in the same direction.

The sections of the continuous line, together with the cross-sections, check lines, loop lines, &c., levelled in connection with the same, are indicated approximately in red on Admiralty charts Nos. 2830*a* and 2830*b* of the river from Quebec to Lachine, to a scale of 10·335 feet nearly per inch, which are submitted herewith. (*See* illustrations Nos. XXVI. and XXVII.)§

These sections of the main line inclusive of check lines, &c., may be described as follows; the order in which the levelling operations had to be carried out and the bench marks made numbered, for reasons of economy and others, being adhered to with the object of preventing confusion.

SECTION NO. 4.	Statute Miles.
The levelling operations were commenced in the City of Sorel, at $B\frac{C}{78}M$ on a boundary stone of South-Eastern Railway property, west side of King Street, nearly opposite Jacques Cartier Street, and carried on in an easterly direction through Victoria Street, and along the post and concession roads, &c., as shown approximately on Illustration No. XXVI., until the Village of St. Antoine de la Baie du Febvre was reached.	
Total length of Section No. 4.....	30·4058
Description and elevations of bench marks, &c., given in abstract of results No. IV-A embodied herein, pages 10 to 17. Corresponding computation sheets, 78 in number, contained in Appendix No. *1. Levelling operations recorded in geodesic level books Nos. 36, 37, 38, 39, 40, 41, 42, handed in herewith.	
In connection with this section of the main continuous double line, levels were run, as shown in level books Nos. 96, 105 and 113, on the 23 computation sheets contained in Appendix No. 1* and in abstract of results No. IV.-B, Appendix No. 12*, viz.:—	
Carried forward.....	30·4058

*Not published.

§ Chart No. 2830*a*, with additions (Ill. XXVI.), reproduced by lithography in two parts, numbered XXVIa and XXVIb, to a scale of 10,000 ft. per inch.

Chart No. 2830b, with additions (Ill. XXVII), also lithographed in two parts, numbered XXVIIa and XXVIIb, to a scale of 10,000 ft. per inch.

	Statute Miles.
Brought forward. ...	30·4058
(*a*). On the south shore of the St. Lawrence :—	
1st. Twice from $B^{C}_{XLI}M$ on D. Cardin's brick house, west side River Yamaska, near cross road leading to Abenakis Springs, down to the Yamaska lock, viz. : the first time, 26th September, 1884, and again 3rd July, 1888, with a view of verifying the reported considerable settlements of the last named structure. Total subsidence of side walls together with sill at upper end of lock chamber, found to have been only 0·0336 ft. since 1884. 0·93 miles × 2 = ..	1·8600
2nd. From gauges put up on east and west shores, River Yamaska, near lock, to flood marks, &c. Total mileage.....	0·1819
3rd. From $B^{C}_{XLIV}M$ on D. Courchesne's brick house, opposite the Abenakis Springs hotel, along the road on the west side of River St. Francis, in a north-westerly direction towards Lake St. Peter, to flood marks made by Mayor Crevier, of the parish of St. François du Lac and other parties.....	2·3414
4th. From $B^{C}_{XLV}M$ on Jos. Laramée's brick house, Pierreville Mills, to $B^{C}_{XLVI}M$ on a cut stone monument planted at mouth of main channel, River St. Francis....	2·4057
5th. From $B^{C}_{LI}M$ on Nestor Duguay's stone house, Village of Baie du Febvre, at intersection of road leading to the parish church with the post road, northward to Lake St. Peter.....	2·1022
(*b*). On the north shore of the St. Lawrence :	
1st. From St. Lawrence to flood marks pointed out by Louis Gervais in his house, west side of road along River, Rang Nord, parish of St. Barthélémy.....	0·0329
2nd. From high water marks pointed out by Honoré Vadeboncœur around his dwelling house, shed and stables, south-west side River du Loup *(en haut)*, near its mouth, to Lake St. Peter.....	0·9544

SECTION No. 5.

This section extends from $B^{C}_{146}M$ on stump on beach, in the division line between the parishes of Ste. Croix and Ste. Antoine de Tilly down to $B^{C}_{LXXIV}M$ made on the west wall of the Government Graving Dock at St. Joseph de Lévis.

Levelling carried on in a north-easterly direction for a distance of	30·7233

Results given in Abstract V., page 18 of this report. For corresponding computation sheets, see Appendix No. 2*, 78 pages.

Levels on main line, loop lines and cross sections, recorded in geodesic level books Nos. 46, 47, 48, 49, 50, 54, 55, 56, 57, 58, 63, 64, 96, 98, 102, 114 and 115.

A loop line was levelled from $B^{C}_{LXV}M$ made on the solid rock at the foot of Basile's Hill, parish of St. Nicholas, *viâ* north shore of St. Lawrence to $B^{C}_{LXXI}M$ at foot of retaining wall, Davidson's Hill, in George Couture's yard, Lévis, together with an extension to the Louise Docks at Pointe à Carcy, and a spur line from $B^{C}_{G}M$ on the Church of Notre Dame de la Garde, Champlain Street, Quebec, to the Quebec Observatory, on the Cove Fields, and Martello Tower No. 2, near Grande Allée, 344 feet above the mean sea level. Total distance passed over ..... 10·7641

[N.B.—This loop line comprises two crossings of the St. Lawrence estuary, which were effected by making each time two sets of simultaneous observations with instruments placed at nearly equal altitudes on opposite shores. One of these crossings was made at the contracted part of the river opposite Basile's Hill, and the other from the Queen's Wharf, Quebec, the whole as explained at length in the progress report submitted to you under date of December 9, 1886, a copy of which is annexed hereto. See Appendix No. 15.]

Results of loop line levelling contained in Abstract No. V½, pages 24 to 26 of this report; corresponding computation sheets, 51 in number, to be found in Appendix No. 3*.

Carried forward...	81·7717

* Not published.

	Statute Miles.
Brought forward	81·7717
On the south shore of the St. Lawrence levels were run from the main line to tide-water gauges, etc., at 22 points; the total distance gone over being	5·1097
On the north shore levelling was done for similar purposes at six points; the sum of the distance covered forming	2·4072

For water levels, elevations of gauges, &c., see abstract of results No. V-A, in Appendix No. 12*; computation sheets, 28, contained in Appendix No. 2.*

SECTION NO. 6.

Commenced at B$\ominus^{\frac{C}{146}}$M in division line between the parishes of St. Antoine de Tilly and Ste. Croix, was levelled along the beach in a westerly direction, up to B$\ominus^{\frac{C}{LXXXIX}}$M made on stone foundation of Louis Lafond's house at mouth of Petite Rivière du Chêne.

Total length of section	25·4581
Additional levelling performed in connection with eight special bench marks	2·1861

Results given hereunder in Abstract No. VI.; computations shown in Appendix No. 4*, 64 pages.

On south shore of St. Lawrence, water levels established at 24 places; also elevations of several gauges put up around Pointe Platon wharf and at Lotbinière; moreover, Grondines gauge connected with main line by water level. Total distance gone over with spirit level...

	8·6802
On north shore, flood levels established at Portneuf, Deschambault and Grondines; also elevations of Grondines and Deschambault gauges, involving levelling over a total length of..	6·6671

For results: see Abstract VI-A, Appendix No.12*; corresponding computation sheets, No. 68, contained in Appendix No.4.*

Levels taken in connection with this section recorded in books Nos. 51, 52, 53, 59, 60, 61, 62, 63, 99, 102, 103, 104, 114 and 115.

SECTION NO. 7.

Levelled from B$\ominus^{\frac{C}{XC}}$M on stone basement of David Provencher's residence, near division line between parishes of Bécancour and Gentilly, westwardly along the post road to B$\ominus^{\frac{C}{LI}}$M on Nestor Duguay's stone house, Village of Baie du Febvre.

Total length of section	29·5451
Additional levelling required for determining elevations of four special bench marks	4·3373

Results will be found in Abstract No. VII. embodied in this report; computation sheets in Appendix No. 5*. Water levels taken on south shore at nine points; also elevations of Doucet's Landing and Port St. Francis gauges established, necessitating the running of levels over a distance of

	2·8832
On north shore, elevations of flood marks established at Cap de la Magdeleine, Three Rivers and Pointe du Lac; also height of gauge used by Three Rivers Harbour Commissioners, which involved the running of levels over a total distance of	0·8037

Water levels, etc., given in Abstract No. VII., Appendix No. 12*; computation sheets in Appendix No. 5.*

Field operations performed in connection with Section No. 7, recorded in geodesic level books 64, 65, 66, 67, 68, 69, 70, 71, 100, 101, 104, 105, 113 and 114.

SECTION NO. 8.

Run from B$\ominus^{\frac{C}{XC}}$M near division line between parishes of Bécancour and Gentilly, at eastern end of Section No. 7 just described, in an easterly direction to B$\ominus^{\frac{C}{LXXXIX}}$M at upper end of Section No. 6, mouth of Little River du Chêne, parish of St. Jean des Chaillons.

Total length of section	24·6028
First 8 miles levelled along the post road, viz., as far as the lower end of Gentilly village; beach followed for the remainder of the distance. Extra levelling entailed by the establishment of four special bench marks	2·7729

See abstract of results No. VIII. which here follows. Details of computations shown in Appendix No. 6.*

Carried forward	197·2251

*Not published.

	Statute Miles.
Brought forward	197·2251
Flood and other river levels established at ten places on the south shore of the St. Lawrence, and Batiscan and Champlain gauges connected with main line by water level, which necessitated the running of levels over	5·9973
On the north of the St. Lawrence, check line levelled from Champlain Church to Richelieu and Ontario Navigation Company's wharf at Batiscan; also elevations of flood marks determined at Champlain village and on Rivers Champlain and Batiscan, involving altogether levelling operations over a distance of	8·6535

N.B.—Difference of height between B⊖M (C CXIII) on parish church of St. Pierre les Becquets, opposite Batiscan gauge at Brunelle's wharf, and B●M (C 205) on stump at Gentilly opposite Champlain gauge at Gagnon's wharf, deduced from main line levelling on south shore, found to agree within 0·16 feet, with difference of elevation between same points deduced from water level crossings and connecting line of check levels run on north shore. Abstract of results on check line north shore and cross sections, etc., run from this line to the river, etc., will be found in Appendix No. 12,* pages 39 to 42, as also the corresponding computation sheets, 40 in number, in Appendix No. 6.*

Field work performed in connection with Section No. 8, recorded in geodesic level books Nos. 72, 73, 74, 75, 76, 78, 99, 100, 101, 104 and 115.

Section No. 9.

Started at B⊖M (C) on the Sorel market hall and levelled along the post road, the whole way up to B●M (C XXVI 271) on large elm tree on Fabien Lozeau's farm, parish of Varennes, about 2 miles below the parish church.

Total length of section	31·2609

On Saturday, August 25th, 1888, bench well G put down in 1884, close to the old windmill, east side River Richelieu, in the city of Sorel, was transferred to St. Joseph de Sorel on the west side of the said river, for the following reasons: 1st. I was informed by Mr. John McCarthy that B⊖M (C XXIV) cut on the brickwork of Messrs. McCarthy's residence—the only permanent bench in that locality—would probably soon have to be removed as they intended to rebuild the stone foundation under that part of their house. 2nd. Bench well G, as first put down, proved to be a very convenient post for snubbing purposes, in consequence of which the cover had been removed and the well partly filled with rubbish.†

Extra levelling done in connection with this transfer	0·1122
Details of computations, Section No. 9, given in Appendix No. 7*, containing 126 sheets. Abstract of results, Section No. 9, viz., : No. IX. follows hereunder. *See* pages 48 to 55. On south shore 44 spur lines run to River St. Lawrence; also elevations established of several high and low water and other gauges put up at St. Joseph de Sorel, Contrecœur and Verchères, all of which necessitated spirit levelling over a distance of	7·3855
On north shore the heights reached by floods determined at four places, viz., at Berthier, Lanoraie, Lavaltrie and Repentigny; total distance gone over	0·4234

See abstract of results, No. IX—A in Appendix No. 12*, pages 43 to 69, and corresponding computation sheets in Appendix No. 7*.

Field work recorded in level books Nos. 82, 83, 84, 85, 86, 87, 96, 97, 106, 113, 114 and 116.

Section No. 10.

Begun at bench mark △/▽ on coping east side of abutment at southern end of new Canadian Pacific Railway bridge across the St. Lawrence, between Caughnawaga and Lachine was levelled following the post road north-easterly all the way down to B●M (C 271), already described, about 2 miles below the village of Varennes, with the exception of the last 1½ miles which were run through the fields between the road and the river, to cut off a long detour of the road along the brow of the high ground.

Total length of section	33·9344
Carried forward	284·9923

*Not published.

†N.B.—In order to prevent boys from unscrewing the bolts which keep down the covers, breaking off the lugs and throwing stones, earth or other rubbish into the wells, those most exposed to be tampered with, viz., A, E and G have in 1888 been protected by cast-iron cylinders about 1·85 feet in diameter and 4 to 5 feet high, having flanges at bottom and closed at top by segmental caps all in one piece, and weighing from 400 to 500 lbs. each, which are supported on pieces of cedar placed about 1 foot underground.

	Statute Miles.
Brought forward	284·9923
Additional levelling between B C M 251 and special bench mark B C M CXXXV made from 10 to 11 feet above low water on upper side of southern abutment of bridge, near the north-west angle of the former	0·8580
N.B.—This bench mark is now buried in the earth protection slope formed around the base of the abutment.	
Check line run from B C M 63 on large elm stump on northern bank of Little Montreal River, 30 to 40 feet above the bridge at the intersection of the turnpike road between Chambly Basin and Longueuil, with the post road along the west side of River Richelieu, to B C M CXXIII on the Roman Catholic parish church of Longueuil, viz., with a view of closing the circuit of levels, 103·6186 miles long, which were run from this town along the River St. Lawrence to Sorel and thence to Chambly Basin, *viâ* the valley of River Richelieu.	
0·26 feet of elevation was lost in making this circuit of 103·6186 miles.	
Mean error for whole distance = 0·07875 feet.	
Probable error do = 0·05312 "	
Total length of check line	12·0754
Loop line headed Section No. 10½, levelled *viâ* north shore of St. Lawrence from B C M 263 balm of Gilead tree on south shore opposite lower end of St. Helen's Island, across the River St. Lawrence and the said island to B C M on east face southern abutment Canadian Pacific Railway subway at Brock Street, Montreal, and thence westward to bench mark △ on coping of southern or Caughnawaga abutment, new Canadian Pacific Railway bridge, and eastward to new sugar refinery, Hochelaga, together with an extension at the upper end from B C M in second course of stone above ground, west face of first pier at north or Lachine end new Canadian Pacific Railway bridge, to the upper end of the Lachine Canal entrance channel at Lachine.	
Total mileage of levelling done on these check and loop lines	20·9507
N.B.—The 1·1211 miles run from B C △ M on coping west side of abutment, Caughnawaga end of new Canadian Pacific Railway bridge, over this bridge and along the post road up to B C M on the Roman Catholic parish church of the town of Lachine form part of the section, say No. 11, proposed to be levelled thence westward.	
The loop line just described was run with a view of connecting the Lachine Canal with the main line of levels; establishing permanent geodesic bench marks along the Montreal Harbour front, and determining the slope of the St. Lawrence between the said city and the town of Lachine along the north shore, as well as the elevations of flood marks made on this shore, below the Lachine rapids; beyond the western city limits the post road was followed the greater part of the way to Lachine. Results arrived at on main line section No. 10 given in Abstract No. X., and those of the other lines just described are contained in Abstract No. X-A, both of which are embodied herein. For details of computations, see Appendices Nos. 8*, 9*, 10* and 11*.	
In addition to the above, the following operations were carried out in connection with section No. 10, viz.:—	
1. Establishing the heights of several high and low water gauges which were read in different seasons of the year at Laprairie, Longueuil and Varennes, and also flood, ordinary and low water levels at 106 points on the south shore up to the new Canadian Pacific Railway bridge, which entailed the running of levels over a distance on the north shore of	8·2373
2. Determining ordinary river and flood levels at 128 points; also the elevations of mitre sills, etc., of locks Nos. 1 and 5, Lachine Canal, etc.; the total distance passed over with the spirit level being	3·7760
For results, see Abstract No. X-B, Appendix No. 12*, pages 70 to 122. Computation sheets included in Appendices Nos. 8*, 9*, 10* and 11*.	
For record of field operations, see level books Nos. 79, 80, 81, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 106, 107, 108, 109, 110, 111, 112, 113, 115 and 117.	
Add for:—	
1. Connection, in 1888, of bench well A near the International Boundary at Rouse's Point, with BM⊕, U.S.C. and G.S. on water sill under window north side of Chapman's block of stores, Village of Rouse's Point, and verification of levels taken in 1883-84 to base course of scarp wall, bastion B, Fort Montgomery, etc.	2·1525
Carried forward	333·0422

* Not published.

	Miles.
Brought forward.....	333·0422
Abstract of results given on page 123, Appendix No. 12*; computation sheets contained in Appendix No. 11*, pages 29 to 39. Field work recorded in level book No. 107. 2. Verification, in August, 1890, of crossing effected in October, 1887, by water level from Leclercville or Ste. Emmèlie, south shore, to Grondines wharf, on the north shore of the St. Lawrence..... The result of this work was to disclose the fact, that the large white birch tree on the slope of the hill opposite Grondines wharf, on which $B \frac{C}{180} M$ had been made July 7, 1886, had moved northward with the hill between July, 1886, and October, 1887, to a level 0·53 foot below that which it occupied originally; and furthermore, that between October, 1887, and August, 1890, the hill had subsided and additional depth of nearly 1·44 feet (see Appendix No. 12*, page 25 for abstract of results). Computation sheets in Appendix No. 4*, pages 54, 54½ and 120½ and 120¾. Field work recorded in level book No. 118.	0·6028
Total mileage of levelling performed in connection with sections Nos. 4 to 10, etc.	333·6450

*Not published.

It will be seen by referring to the mean and probable errors which have been computed for all the sections separately, that the levelling operations continue to be kept up to the standard of accuracy usually called for in Europe and the United States of America. As already explained in my report dated 26th June, 1884, the observer may, according to the rules adopted in these countries, accept for short distances l between two bench marks, discrepancies $d = 5^{m.m.} \sqrt{\frac{1 \text{ mile}}{1 \text{ kilom}}} \times 2\,l$ corresponding to nearly 0·03 foot per mile; but for sections of 25 to 50 or 100 miles or more the mean error developed per mile should not exceed $3^{m.m.} \sqrt{\frac{1 \text{ mile}}{1 \text{ kilom}}} = 0{\cdot}0126$ feet, or that developed in the whole distance L, should not exceed $0{\cdot}0126 \sqrt{L}$.

Taking up the seven sections of the continuous line of levels run between Quebec and Caughnawaga as a whole, the following mean and probable errors indicating the degree of accuracy of the field work performed on the 205·9305 miles covered by these sections, are arrived at:—

μ,	Mean error for whole distance.....	0·09728 feet.
ν,	Probable error for whole distance = 0·6745 μ .. =	0·06562 "
M,	Mean error per mile..... =	0·00678 "
νM,	Probable error per mile = 0·6745 M ..... =	0·00457 "

DATUM.

The plane of reference adopted for all elevations established between Quebec and Montreal is the mean level of the Atlantic at the mouth of the Gulf of St. Lawrence, the vertical position of which was approximately determined by me at Quebec in 1880-82, by means of data afforded by the Admiralty charts of the St. Lawrence and series of tide and river gaugings made under the supervision of this department and the Montreal Harbour Commissioners.

The method I adopted in fixing at the city of Quebec, in an approximate manner, the mean sea level of the Atlantic in the Gulf of St. Lawrence, pending the accurate determination of the same by means of extended tidal and barometric and other meteorological observations made at some point along the Gulf shore, such as Cape Rosier, Percé, &c., and the completed circuit of levels above alluded to, is fully described in note A appended hereto. (*See* Appendix No. 21.)

It will be seen by a perusal of this note, that two computations of the approximate elevation of the mean sea level in reference to the 0 of a gauge that was put up by my direction in 1881-82 at the foot of St. James street, St. Peter's ward, Quebec, were made. One, or say No. 1, was based on data taken from a cross-section of the River St. Lawrence, designated by the letter A, which was taken at a point 1¼ mile west of the village of Lanoraie, where the river bed is contracted to a width not exceeding 1¼ mile, and the other, or No. 2, on data taken from a section, C, made across the Lake St. Peter flats where the stream is nearly 7½ miles wide. The two results thus arrived at differ by about 2·0 feet, mean sea level No. 1, viz., that based on cross-section A being found to be about 2·0 feet lower than No. 2, or that based on cross-section C.

When levelling operations were commenced at Quebec in 1885-86, the lowest height arrived at was adopted as a datum; but having examined more closely into the matter after the first season's work was completed, I came to the conclusion, for the reasons stated at the end of note A, that the higher of the two levels determined, viz., that based on cross-section C would probably turn out to be the most correct. I consequently raised the datum first used, 2·0 feet, so as to make its height correspond with the results of computation No. 2. This will explain why the elevations of bench marks, &c., given in the report submitted to you under date of 26th December, 1886, on the determination of the relative coping heights of the walls of the graving dock at Lévis, and those of the Louise Basin at Quebec are two feet less than the corresponding elevations which appear in the abstracts of results now transmitted.

In July, 1888, 11th to 13th, bench well A planted on the international boundary line, near the village of Rouse's Point, was connected with bench mark ⊕, made in 1882 by Mr. Assistant Tittmann, of the U.S. C. and G. Survey on stone water sill under second window, 21·5 feet from N. E. corner north front of Chapman's brick block, which stands at the S. W. corner of Lake and Champlain streets in the said village.

The Coast and Geodetic Survey authorities place the elevation of this B. M. at 110·06 feet above the mean sea level at Governor's Island, New York harbour, in the report by Mr. Assistant Schott dated 10th October, 1887, already referred to, with an extract of which the department was favoured 11th May, 1888. (*See* Appendix No. 14.)

In this report it is stated: 1st, that the mean sea level adopted is that deduced from tidal observation in New York harbour, made by Coast Survey at Governor's Island between 1852 and 1879 inclusive (comprising, therefore, one and a half revolutions of the moon's nodes), which was transferred by water level to east bank Hudson River, foot of 18th street; 2nd, that the elevation of the bench mark on the Chapman block depends on spirit levelling along the eastern side of the Hudson River by J. B. Vose in 1857-58, and on operations performed by O. H. Tittmann up to 1887 with the spirit level, along the Erie and Champlain Canals and the track of the Delaware and Hudson Canal Company's Railroad, as far as Putuam station at the southern end of Lake Champlain, and thence by water level to Rouse's Point, where he connected the lake level with the bench mark on the Chapman block.

Mr. Schott places the probable error or uncertainty of the average elevation of Lake Champlain (97·17 feet) which has been deduced by him from the readings of the water level made by the United States engineers at Fort Montgomery between 1871 and 1882, when taken in connection with the levelling operations just described: at about 0·3 feet (exclusive of uncertainty due to secular change), and the elevation of the bench mark on the Chapman block, viz., 110·06 feet, must be at least as nearly correct as the average lake level referred to. On the other hand, I make out the elevation of Mr. Tittmann's bench mark at Rouse's Point to be 114·5010 feet above the mean level of the Atlantic in the Gulf of St. Lawrence, as approximately determined by me at Quebec in 1882, which result shows that my datum is (114·5010—110·0600) = 4·4410 feet below the plane of reference adopted by the U.S. C. and G. Survey, viz., the mean level of the Atlantic at Governor's Island, as transferred to Rouse's Point.

The law according to which the estuary would be drawn down Quebec harbour at low water, by tides of smaller amplitude than that corresponding to the minimum astronomical coefficient 30· until all trace of tidal influence would disappear, cannot, of course, be

represented graphically by a curve or a right line drawn with the aid of co-ordinates denoting experimental results, the same as has been done for several of the complete series of gaining and losing tides with coefficients varying between 39 and 117 observed in 1887-88; we may assume, however, without risk of going far astray, that in the said harbour the average rate of depression of the low water level is sensibly uniform for all tidal oscillations whether the amplitudes correspond to theoretical coefficients between 30 and 118 or between 30 and 0.

In so doing we can err only on the right side, as regards the object now in view, for, the general geometrical loci of the low water levels of both the gaining and losing series of tides observed in the fall of 1887, while the fresh water discharge remained nearly constant, are sensibly straight lines but slightly inclined to the horizon, and the width of the estuary at low tide increases as the tidal undulations decrease in importance. Now I find, proceeding on the basis just defined, that according to the results of the operations performed between New York harbour and Rouse's Point which are given by Mr. Schott, in his report of October, 1887, above referred to, the Governor's Island mean sea level is more than three feet above the level at which the St. Lawrence would stand in Quebec harbour if the estuary was tideless and the river at the stage when its discharge is equal to some 300,000 cubic feet per second and the depth on the sill of old lock No. 1, foot of Lachine Canal, about 16 feet.

As it is manifestly impossible for the mean level of the Atlantic in the Gulf of St. Lawrence, to be at a greater absolute height than the level of the river abstracted from the influence of the tides would be at Quebec, some 800 miles inland, the greater portion, if not the whole of the difference of 4·44 feet between the elevation of the approximate mean sea level datum adopted by me and the Governor's Island mean sea level, and possibly more than 4·44 feet, will have to be accounted for in some other way. Under the circumstances, I concluded, after mature consideration, to retain my own datum pending the completion of the proposed line of levels from Quebec down to a place on the Gulf shore suitable for the establishment of a properly equipped gauging station, as suggested by me in the progress report submitted to you on the 9th December, 1886 (*see* Appendix No. 15), and the determination of the mean level of the Atlantic at this station by means of continuous series of accurate gaugings made during several years.

IV A—GEODETIC LEVELLING—RIVER ST. LAWRENCE—1884-85.

ABSTRACT of Results, Section No. 4, Sorel to La Baie du Febvre—(Continuous line).

From	To	M. Distance.	Difference of Height. Line A. *	Line B.	Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below - approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
											SOREL (*City and Parish*).
								C. B. ● M. 78	140·7350	53·1762	B.M. 78—Top of boundary stone on property of S. E. R.R., west side King st., between J. Cartier and Victoria. Stone marked W D on back.
B.M. 78....	B.M. 116....	0·7646	— 3·6392	— 3·6335	— 3·6364	— 2·9	22·00	C. B. ● M. 116	139·9704	49·5398	B.M. 116—Brass-headed nail in root of red pine tree, east side of post road, on Senator J. Bte. Guévremont's property.
B.M. 116....	B.M. 117....	0·9904	+15·5064	+15·5183	+15·5124	— 5·9	70·29	C. B. ● M. 117	138·9800	65·0522	B.M. 117—Brass-headed nail in root of pine stump in Ed. Baxter's field, 10 ft. west of road wire fence.
B.M. 117...	B.M. 118.....	1·0594	+ 5·4659	+ 5·4725	+ 5·4692	— 3·3	20·56	C. B. ● M. 118	137·9206	70·5214	B.M. 118—Brass-headed nail in root of white pine tree in line of road fence, south-west side of post road.
B.M. 118...	B.M. 119.....	1·1564	—25·1493	—25·1613	—25·1553	+ 6·0	62·27	C. B. ● M. 119	136·7642	45·3661	B.M. 119—Brass-headed nail in root of elm stump at foot of hill to Hotel de Sorel, 40 ft. north of road fence.
B.M. 119...	B.M. XXXVIII.	0·2293	+17·6363	+17·6340	+17·6352	+ 1·2	12·56	C. B. ⊖ M. XXXVIII.	136·5349	63·0013	M.B.XXXVIII—Copper plug in north-west gable of Benjamin Larochelle's brick house, at junction of post road and road to Ste. Victoire.

B.M. 119...	B.M. 120.....	1·0845	+12·9455	+12·9426	+12·9440	+ 1·4	3·61	B. C. M. 120	135·6797	58·3101	B.M. 120—Brass-headed nail in root of white pine tree, south side of post road, 105 feet south of road fence, north con. No. 2, Pot au Beurre River.
											Parish of Ste. Anne de Sorel.
B.M. 120...	B.M. 121.....	1·0292	— 9·6970	— 9·7046	— 9 7008	+ 3·8	28·05	B. C. M. 121	134·6505	48·6093	B.M. 121—Brass-headed nail on top of stump of elm tree cut down for bench on north side of post road. South concession Second, Pot au Beurre River.
											Parish of St. Robert.
B.M. 121...	B.M. 122.....	0·9211	— 5·0002	— 5·0073	— 5·0038	+ 3·5	26·59	B. C. M. 122	133·7294	43·6055	B.M. 122—Brass-headed nail in root of maple tree, 20 ft. south of road fence, between brook and road to St. Robert church.
											Parish of St. Michel de Yamaska.
B.M. 122...	B.M. 123.....	1 0177	+ 0·0286	+ 0·0289	+ 0·0288	— ·1	·02	B. C. M. 123	132·7117	43·6343	B.M. 123—Brass-headed nail in root of balm of Gilead tree in Joseph Desrosier's field, west side of road, on edge of gully.
B.M. 123...	B.M. xxxix...	0·0520	+ 5·6137	+ 5·6161	+ 5·6149	— 1·2	55·39	B. C. M. XXXIX	132·6597	49·2492	B.M. XXXIX—Line on copper plug in stone monument planted (6 ft. in the ground) at junction of two roads, near Temperance Cross, opposite Jos. Desrosier's and Jean St. Germain's properties.
B.M. 123...	B.M. 124.....	0·9387	+ 5·3818	+ 5·3959	+ 5·3889	— 7·0	104·40	B. C. M. 124	131 7730	49·0232	B.M. 124—Brass-headed nail in root, south side of white pine tree in Jean St. Germain's field, 68 paces north of road fence, 812 ft. west of fence between St. Germain and Allard.
B.M. 124...	B.M. 125.....	0·5296	+ 2·9605	+ 2·9458	+ 2·9531	+ 7·3	201·25	B. C. M. 125	131·2434	51·9763	B.M. 125—Brass-headed nail in root of large elm tree in Joseph Fortier's fence line, 700 ft. from road; concession St. Louis.
	Carried forward.....	9·4916	— 1·1970	— 1·2027	— 1·1999	+ 2·8	539·04				

* All the figures in this column are written in red, to correspond with the tables, etc., for line A on the computation sheets, which are also shown in red, in order to reduce the chance of making errors to a minimum.

IV A—GEODETIC LEVELLING—RIVER ST. LAWRENCE, 1884-85—*Continued.*

ABSTRACT of Results, Section No. 4, Sorel to La Baie du Febvre (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A ← / → B)	Difference of Height. Line B.	Difference of Height. Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward.....		9·4916	— 1·1970	— 1·2027	— 1·1999	+28·	539·04				*Parish of St. Michel de Yamaska* —Continued.
B.M. 125...	B.M. 126.....	0·8719	+ 3·2481	+ 3·2281	+ 3·2381	+10·0	229·38	C. B. ● M. 126	130·3715	55·2144	B.M. 126—Brass-headed nail on top of pine stump at border of small bush, in rear of church; Hercule Mineau's land.
B.M. 126...	B.M. XL....	0·8257	+ 9·0326	+ 9·0331	+ 9·0329	— 0·2	0·97	C. B. ⊖ M. XL.	129·5458	64·2473	B.M. XL—Copper plug in 1st quoin above plinth course, front Roman Catholic parish church, south-east corner, west River Yamaska.
B.M. 126..	B.M. 127.....	1·3036	—20·3415	—20·3399	—20·3407	— 0·8	0·98	C. B. ⊖ M. 127	129·0679	34·8737	B.M. 127—Brass-headed nail in root of large elm tree on slope of hill, east side of river, opposite church, on Edward Lavaux's land.
B.M. 127...	B.M. 128.....	0·8959	— 4·7526	— 4·7244	— 4·7385	—14·1	443·82	C. B. ● M. 128	128·1720	30·1352	B.M. 128—Brass-headed nail on ash stump, foot of steep hill, east bank of Yamaska River; Tonnancourt's land.
B.M. 128...	B.M. XLI....	0·1745	+20·1936	+20·1916	+20·1926	+ 1·0	11·46	C. B. ● M. XLI	128·3465	50·3278	B.M. XLI—Copper plug in south gable of Daniel Cardin's brick house, a few hundred feet from lower road to St. François du Lac.

B.M. 128...	B.M. 129.....	0·9458	+ 3·8370	+ 3·8638	+ 3·8504	—13·4	379·70	C. B. ● M. 129	129·1178	33·9856	B.M. 129—Brass-headed nail on ash stump in Lachance de Tonnancourt's field, west side of road to Yamaska lock.
B.M. 129...	B.M. XLII..	0·1592	— 9·2238	— 9·2281	— 9·2260	+ 2·1	55·40	C. B. ⊜ M. XLII	129·2770	24·7596	B.M. XLII—Copper plug in second course below coping, west side upper end of Yamaska lock.
B.M. 128....	B.M. 130... ..	0·8771	+19·5802	+19·5816	+19·5809	— ·7	1·12	C B. ● M. 130	127·2949	49·7161	B.M. 130—Brass-headed nail on top of white pine stump, 19 paces north of road fence on Autotte's land.
B.M. 130....	B.M. 131.....	0·9268	+0·8840	+ 0·8842	+ 0·8841	— ·1	0·22	C B. ● M. 131	126·3681	50·6002	B.M. 131—Brass-headed nail on root, west side of pine tree, 4 ft. south of southern road fence.
											Parish of St. François du Lac.
B.M. 131....	B.M. XLIII.	1·0213	+3·7158	+ 3·7286	+ 3·7222	— 6·4	80·21	C B. ⊜ M. XLIII	125·3468	54·3224	B.M. XLIII—Copper plug about 7 feet from N.W. corner of Théophile Joyal's story and a-half brick house, S.E. side of post road.
B.M. XLIII	B.M. 132.....	1·2700	— 7·9455	—7·9427	— 7·9441	— 1·4	3·09	C B. ● M. 132	124·0768	463·783	B.M. 132—Brass-headed nail in root of soft maple tree, about 200 paces north of roadway on Moïse Cartier's property.
B.M. 132....	B.M. 133.....	0·9540	+ 0·8021	+0·8066	+ 0·8044	— 2·2	10·15	C B. ● M. 133	123·1228	47·1827	B.M. 133—Brass-headed nail in root, S.E. side of soft maple tree, 3 ft. from fence, west side of road.
B.M. 133....	B.M. XLIV..	0·4874	+ 8·0514	+8·0638	+ 8·0576	— 6·2	157·74	C B. ⊜ M. XLV	122·6354	55·2403	B.M. XLIV—Copper plug in rear wall, 2½ ft. from N.W. corner of Dominique Courchesne's brick house west side of post road to St. François du Lac church.
B.M. 133....	B.M. 134.. ...	0·7759	—18·2890	—18·2876	—18·2883	— ·7	1·26	C B. ● M. 134	122·3469	28·8944	B.M. 134—Brass-headed nail on root, north-west side of large ash tree, south of line fence between Dominique and Calixte Courchesne, opposite the Abenakis hotel.
Carried	forward	18·3881	—24·2954.	—24·2682	—24·2818	—13·6	1309·27				

IV A—GEODETIC LEVELLING—RIVER ST. LAWRENCE, 1884-85.—*Continued.*

ABSTRACT of Results, Section No. 4, Sorel to La Baie du Febvre (Continuous line)—*Continued.*

From	To	M Distance.	Difference of Height. Line A. (A →)	Difference of Height. Line B. (← B)	Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward		18·3881	—24·2954	—26·2682	—24·2818	—13·6	1309·27				*Parish of St. Michel de Yamaska* —Continued.
B.M. 134....	B.M. 135.....	0·7872	+ 3·5535	+3·5318	+ 3·5426	+ 10·8	296·34	C B. ● M. 135	121·5597	32·4370	B.M. 135—Brass-headed nail on root, east side of basswood tree, on north east bank of Ile Ronde, about one mile, above Pierreville Mills wharf.
											Parish of St. Thomas de Pierreville.
B.M. 135....	B.M. 136.....	0·8739	— 3·2965	—3·2972	— 3·2969	+ ·3	0·21	C B. ● M. 136	120·6858	39·1401	B.M. 136—Brass-headed nail on root, west side of balm of Gilead tree, 20 ft. from waters edge, about ¾ mile above cross-road; to mills, Jean Bernier's land.
B.M. 136....	B.M. XLV...	0·6703	+11·4973	+11·4770	+11·4872	+10·2	310·43	C B. ⊖ M. XLV	120·0155	40·6273	B.M. XLV—Copper plug in south gable of Joseph Laramé's story and a-half brick house, east side of post road, a few hundred feet from cross-road to Pierreville Mills.
B.M. XLV.	B.M. 137.. ...	0·5185	— 12·3120	— 12·3005	— 12·3063	— 5·8	129·76	C. B. ● M. 137	120·5340	28·3210	B.M. 137—Brass-headed nail on root, west side of balm of Gilead tree, close to Jean Bernier's fence at a little bridge near the Richelieu Co.'s wharf.

B.M. 137....	B.M. 138.....	1·0327	— 1·3936	— 1·4179	— 1·4057	+ 12·2	288·25	B. ● M. 138 C.	121·5667	26·9153	B.M. 138—Brass-headed nail in root, west side of balm of Gilead tree, about 60 ft. from east shore of St. Francis River, say 1½ miles above its mouth.
B.M. 138....	B.M. XLVI..	0·8545	— 2·0872	— 2·1076	— 2·0974	+ 10·2	243·51	B. ⊖ M. XLVI C.	122·4212	24·8179	B.M. XLVI—Copper plug in head of stone monument planted purposely 4 ft. 9 in. in the ground for a bench mark on north-east bank of St. Francis River where it joins the St. Lawrence.
B.M. XLV.	B.M. 139.....	0·6903	— 13·1755	— 13·1611	— 13·1683	— 7·2	150·19	B. ● M. 139 C.	119·3252	27·4590	B.M. 139—Brass-headed nail in root, east side of elm tree near water's edge in field south side of bridge across Chenal Tardif at Pierreville Mills.
B.M. 139....	B M. XLVII.	0·1150	+ 10·2642	+ 10·2679	+ 10·2661	— 1·8	56·35	B. ⊖ M. XLVII C.	119·2102	37·7251	B.M. XLVII—Copper plug in north gable of Pierre Lord's brick-veneered house, east side of post road, along north bank of Chenal Tardif.
B.M. 139....	B.M. 140.....	1·2428	+ 4·6287	+ 4·6325	+ 4 6306	— 1·9	5·81	B. ● M. 140 C.	118·0824	32·0896	B.M. 140—Brass-headed nail in root, south-west side of balm of Gilead tree in division line between Jos. Beaubien and François Laforce, north side of road.
B.M. 140....	B.M. 141.....	1·3504	+ 3·7068	+ 3·7068	+ 3·7068	+ ·0	0·00	B. ● M. 141 C.	116·7320	35·7964	B.M. 141—Brass-headed nail in root of small ash tree in Victor Jutra's field, north side of post road, lot No. 105.
B.M. 141....	B.M. XLVIII	0·2771	+ 5·7128	+ 5·7130	+ 5·7129	— ·1	0·72	B. ○ M. XLVIII C.	116·4549	41·5093	B.M. XLVIII—Copper plug in western gable of Wm. Allard's story and a-half brick house on south side of post road, 5·75 ft. from north-west corner of house.
B.M. 141....	B.M. 142.....	1·1347	+ 6·0190	+ 6·0101	+ 6·0146	+ 4·5	35·70	B. ● M. 142 C.	115·5973	41·8110	B.M. 142—Brass-headed nail on north side of balm of Gilead tree on south side of road, on Calixte Fontaine's property.
Carried forward. . . .		25·1377	—11·3621	—11·3683	—11·3652	+ 3·1	2107·95				

IV A—GEODETIC LEVELLING—RIVER ST. LAWRENCE, 1884-85—*Continued.*

ABSTRACT of Results, Section No. 4, Sorel to La Baie du Febvre—(Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A ←)	Line B. (← B)	Mean.	V Difference from Mean.	$2V^2/M$.	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above × below – approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought	forward.....	25·1377	−11·3621	−11·3683	−11·3652	+ 3·1	2107·95				*Parish of St. Thomas de Pierreville*—Continued.
B.M. 142....	B.M. 143.....	1·1153	— 0·3967	— 0·4217	— 0·4092	+ 12·5	280·19	C. B. ● M. 143	114·4820	41·4018	B.M. 143—Brass-headed nail on root, south side of large elm tree, north side of post road on Calixte Drolet's property.
											Parish of St. Antoine de la Baie du Febvre.
B.M. 143...	B.M. XLIX..	0·8693	+ 7·7898	+ 7·7918	+ 7·7908	— 1·0	2·30	C. B. ⊖ M. XLIX	113·6127	49·1926	B.M. XLIX—Copper plug in east gable of Isaïe Couillard's solid brick house on south side of post road.
B.M. XLIX	B.M. 144.....	1·3192	— 8·5214	— 8·5362	— 8·5288	+ 7·4	83·02	C. B. ● M. 144	112·2935	40·6638	B.M. 144—Brass-headed nail in root of balm of Gilead tree on north side of post road, in Philibert Côté's field.
B.M. 144...	B.M. 145.....	0·8304	— 5·0336	— 5·0242	— 5·0289	— 4·7	53·20	C. B. ● M. 145	111·4631	35·6349	B.M. 145—Brass-headed nail in root, north side of white oak tree close to southern road fence on Zoël Camiret's land.
B.M. 145...	B.M. L.....	1·1731	+48·0606	+48·0442	+48·0524	+ 8·2	114·64	C. B. ⊖ M. L	110·2900	83·6873	B.M. L—Copper plug in rear corner western tower of Roman Catholic parish church on hill, west side of road.

B.M. 145...	B.M. LI.....	1·1339	+12·8506	+12·6187	+12·8347	+16·0	436·89	B. ⊖ M. LI	110·3292	48·4696	B.M. LI—Copper plug in south-easterly corner of basement under Nestor Duguay's stone store, foot of hill leading to church.
Totals.....	.....	30·4058	— 4·6734	— 4·7399	— 4·7066	+33·3	2963·55				

Section No. 4 = 30·4058 miles.

Mean error per mile..... = M = 0·00691 feet. Probable error per mile..... = Ḿ = 0·6745 M = 0·00466 feet.

Mean error for whole distance..... = μ = 0·03812 feet. Probable error for whole distance.... = μ́ = 0·6745 μ = 0·02571 feet.

V—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued*—1885-86.

ABSTRACT of Results, Section No. 5, St. Antoine de Tilly to St. Joseph de Lévis (Continuous line).

From	To	M. Distance.	Difference of Height. Line A. (A ← / → B)	Difference of Height. Line B. (A → / ← B)	Difference of Height. Mean.	V. Difference from Mean.	$\frac{2V^2}{M}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below — approximate mean level Atlantic Ocean established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
											Parish of St. Antoine de Tilly
								C. B. ● M. 146	30·7233	23·7001	B.M. 146—Brass-headed nail on top of elm stump on beach in parish line between St. Croix and St. Antoine.
B.M. 146...	B.M. 147. ..	0·9758	—0·4570	—0·4582	—0·4576	+ ·6	·74	C. B. ● M. 147	29·7475	23·2425	B.M. 147—Brass-headed nail on top of soft maple stump on beach opposite lot No. 247, owned by Benonie Houde.
B.M. 147...	B M. 148.....	0·9306	—1·7897	—1·7751	—1·7824	—7·3	114·54	C. B. ● M. 148	28·8169	21·4601	B.M. 148—Brass-headed nail on root of large soft maple tree on beach back of Capt. Aug. Bergeron's house, west side of wharf.
B.M. 148...	B.M. 149.....	0·5670	+1·6855	+1·6837	+1·6846	+ ·9	2·86	C. B. ● M. 149	28·2499	23·1447	B.M. 149—Brass-headed nail on top of stump of white birch tree, foot of hill opposite lot No. 188.
B.M. 149...	B.M. 149½....	0·9372	—0·8009	—0·7500	—0·7555	—25·5	.. . .	C. B. ● M. 149½	27·3127	22·3692	B.M. 149½—Brass-headed nail on root of soft maple tree opposite lot No. 161.
B.M. 149...	B.M. LII....	0·6269	—4·0594	—4·0690	—4·0642	+4·8	73·50	C. B. ⊖ M. LII	27·6230	19·0805	B.M. LII—Copper plug in soft shale rock, foot of cliff, on beach opposite lot No. 170.
B.M. LII ..	B.M. LIII ..	1·0539	+1·1854	+1·1709	+1·1782	+7·3	101·13	C. B. ⊖ M. LIII	26·5691	20·2587	B.M. LIII—Copper plug in shale, foot of cliff, on beach opposite lot No. 92.

B.M. LIII.	*B.M. 150.....*	1·0583	+1·9848	+1·9833	+1·9840	+·7	·09	C. B. ● M. 150	25·5108	22·2427	B.M. 150—Brass-headed nail on hemlock stump, on beach, foot of cliff, opposite lot No. 69.
B.M. 150...	B.M. LIV....	1·1434	—1·7307	—1·7227	—1·7267	—4·0	27·99	C. B. ⊖ M. LIV	24·3674	20·5160	B.M. LIV—Copper plug in shale on beach, foot of cliff, about opposite lot No. 48.
B.M. LIV..	B.M. LV	1·5437	—0·8448	—0·8631	—0·8540	+9·1	107·22	C. B. ⊖ M. LV	22·8237	19·6620	B.M. LV—Copper plug in solid rock on beach, a few hundred feet west of Pointe Aubin wharf, and opposite lot No. 4.
B. M. LV ..	B. M. 150½....	1·7449	+18·1066	+18 1071	+18·1069	— ·2	....	C. B. ● M. 150½	24·5686	37·7689	B. M. 150½—Brass-headed nail on root of cedar tree, foot of François Côté's hill, about opposite lot No. 53.
											Parish of St. Nicholas.
B. M. LV ..	B. M. LVI....	0·9112	— 1·1016	— 1 1080	— 1·1048	+ 3·2	22·47	C. B. ⊖ M. LVI	21·9125	18·5572	B. M. LVI—Copper plug in solid rock on beach, foot of cliff, about opposite lot No. 299.
B. M. LVI..	B. M. 151	0·8954	+ 3·0076	+ 3·0030	+ 3·0053	+ 2·3	11·81	C. B. ● M. 151	21·0171	21·5625	B. M. 151—Brass headed nail on root of cedar stump on beach, foot of cliff, about opposite lot No. 276.
B. M. 151...	B. M. 152	0·9080	— 0·0802	— 0·0846	— 0·0824	+ 2·2	10·66	C. B. ● M. 152	20·1091	21·4801	B. M. 152—Brass-headed nail on root of stump near tall balm of Gilead tree on beach, about opposite lot No. 260.
B. M. 152...	B. M. LVII .	0·8806	— 0·6015	— 0·5929	— 0·5972	— 4·3	41·99	C. B. ⊖ M. LVII	19·2285	20·8829	B.M. LVII—Copper plug in solid rock on beach, foot of cliff, opposite lot No. 246.
B. M. LVII.	B. M. LVIII.	1·1924	— 4·0604	— 4·0704	— 4·0654	+ 5·0	41·94	C. B. ⊖ M. LVIII	18·0361	16·8175	B. M. LVIII—Copper plug in solid rock on beach, foot of cliff, about opposite lot No. 228.
B.M. LVIII	B. M. LIX...	0·6944	+ 4·8151	+ 4·7904	+ 4·8028	+12·4	442·85	C. B. ⊖ M. LIX	17·3417	21·6203	B.M. LIX—Copper plug in solid rock in first point above Ross's wharves, about opposite lot No. 211.
Carried	forward	13·3816	— 2·0469	— 2·1127	— 2·0798	+32·9	999·79				

V—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued*—1885-86.

ABSTRACT of Results, Section No. 5, St. Antoine de Tilly to St. Joseph de Lévis (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A → B)	Difference of Height. Line B. (B → A)	Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST., &c.	Distance from Lévis Graving Dock *vid* line of levels.	Elevation, above + below – approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought	forward.....	13·3816	— 2·0469	— 2·1127	— 2·0798	+32·9	999·79				*Parish of St. Nicholas*—Con.
B.M. LIX..	B. M. LX....	1·2624	+ 5·4834	+ 5·5076	+ 5·4955	—12·1	231·95	C. B. ⊖ M. LX	16·0793	27·1158	B.M. LX—Copper plug in solid rock, foot of hill on back road leading from beach to Lagueuex's hotel.
B. M. LX..	B. M. LXI...	0·3401	— 4·8836	— 4·8842	— 4·8839	+ ·3	·06	C. M. ⊖ B. LXI	15·7392	22·2319	B.M. LXI—Copper plug in solid rock on beach, about 200ft. west of Baker's wharf.
B. M. LXI..	B. M. LXII..	1·1168	— 3·9945	— 4·0190	— 4·0068	+12·2	266·55	C. M. ⊖ B. LXII	14·6224	18·2251	B.M. LXII—Copper plug in solid rock on beach, about opposite lot No. 88.
B.M. LXII.	B.M. LXIII.	1·1591	— 1·0386	— 1 0507	— 1·0446	+ 6·1	64·21	C. B. ⊖ M. LXIII	13·4633	17·1805	B. M. LXIII—Copper plug in solid rock on beach, a few hundred ft. west of Demers' wharf.
B.M. LXIII	B.M. 153.	1·0742	+ 1·5112	+ 1·4941	+ 1·5027	+ 8·6	137·70	C. B. ● M. 153	12·3891	18·6832	B.M. 153—Brass-headed nail on root, N.W. side of cedar stump 14 ins. in diameter on beach, about opposite lot No. 40.
B.M. 153...	B.M. LXIV..	0·8046	— 5·6700	— 5·6455	— 5·6578	—12·3	376·06	C. B. ⊖ M. LXIV	11·5845	13·0254	B. M. LXIV—Copper plug in solid rock on beach, foot of cliff, opposite lot No. 26.

B.M. LXIV	B.M. LXV...	0·8866	+ 9·9576	+ 9·9476	+ 9·9526	+ 5·0	56·39	C. B. ⊖ M. LXV	10·6979	22·9780	B.M. LXV—Copper plug in solid rock on beach, foot of cluster of four white birch trees, 49 paces S.E. of Basile's road, from post road to river.
B.M. LXV.	B.M. 154.....	0·7375	— 4·9639	— 4·9605	— 4·9622	— 1·7	7·83	C. B. ● M. 154	9·9604	18·0158	B.M. 154—Brass-headed nail on root, N.W. side of ash tree in swamp, a few hundred ft. west of mouth of Chaudière River.
											Parish of St. Romuald.
B.M. 154...	B.M. LXVI..	0·4411	+11 5399	+11·5187	+11·5293	+10·6	509·45	C. B. ⊖ M. LXVI	9·5193	29·5451	B. M. LXVI—Copper plug in face of cliff of hard sandstone near last abutment of Chaudière (new) iron bridge and in rear of ferryman's house, owned by Hall Bros. & Co.
B.M. LXVI	B.M. 155.....	0·7472	— 6·3252	— 6·3118	— 6·3185	— 6·7	120·15	C. B. ● M. 155	8·7721	23·2266	B.M. 155—Brass-headed nail in root, N.W. side of large cluster of elm trees in Hugh Ritchie's garden, east side of post road.
B.M. 155....	B.M. 156.....	0·8208	— 3·9883	+ 3·9862	+ 3·9873	+ 1·1	2·95	C. B. ● M. 156	7·9513	27·2139	B.M. 156—Brass-headed nail on large elm stump, alongside of large elm tree, in Benson's yard on beach N.W. side of post road.
B.M. 155....	B.M. LXVII.	0·9802	+12·3310	+12·3276	+12·3293	+ 1·7	5·89	C. B. ⊖ M. LXVII	7·7919	35·5559	B. M. LXVII—Copper plug in hard sandstone point, east side of road, opposite Benson's large saw-mill.
B.M. LXVII.	B.M. 157.....	0·8080	+ 7·2183	+ 7·2322	+ 7·2253	— 6·9	117·84	C. B. ● M. 157	6·9839	42·7812	B.M. 157—Brass-headed nail on top of large elm stump in Ferdinand Villeneuve's field, east side of post road.
											Parish of St. David.
B. M. 157...	B.M. LXVIII	1·2524	—14·4859	—14·4766	—14·4813	— 4·7	35·28	C. B. ⊖ M. LXVIII	5·7315	28·2999	B. M. LXVII—Copper plug in spur of cliff of hard sandstone, east side of road from Etchemin, a few hundred feet below Grand Trunk Ry. crossing.
Carried	forward.....	24·9918	+ 4·6328	+ 4·5668	+ 4·5998	+33·0	2929·15				

V—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Concluded*—1885-86.

ABSTRACT of Results, Section No. 5, St. Antoine de Tilly to St. Joseph de Lévis (Continuous line)—*Concluded.*

From	To	M. Distance.	Difference of Height. Line A.	Line B.	Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *vid* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward.....		24·9918	+ 4·6328	+ 4·5668	+ 4·5998	+3·30	2929·15				*Parish of St. David.*
B.M. LXVIII	B. M. 158.....	0·5544	— 1·8059	— 1·8875	— 1·8967	—9·2	305·34	C. B. ● M. 158	5·1771	26·4032	B. M. 158—Brass-headed nail in root of small elm tree, east side of post road, on Young's heirs' property.
B.M. LXVIII	B. M. LXIX.	1·1462	+15·2757	+15·2818	+15·2788	—3·0	15·70	C. B. ⊖ M. LXIX	4·5853	43·5787	B. M. LXIX—Copper plug in knoll of hard sandstone, west side of road, back of G. T. Ry. round-house.
B.M. LXIX	B. M. 159.....	0·7091	—19·3130	—19·3217	—19.3174	+4.3	52·15	C. B. ● M. 159	3·8762	24·2613	B. M. 159—Brass-headed nail on top of mooring post along railway track, opposite Patton's old residence.
											City of LÉVIS.
B. M. 159...	B. M. LXX..	0·9938	— 1·3644	— 1·3808	— 1.3726	+8·2	135·31	C. B. ⊖ M. LXX	2·8824	22·8887	B.M. LXX—Copper plug in hard rock, north end of J.C. Hamel's yard and warehouse, east side of road.
B. M. LXX	B. M. LXXI.	0·6163	+6·1327	+6·1476	+6·1402	—7·4	177·70	C. B. ⊖ M. LXXI	2·2661	29·0289	B.M. LXI—Copper plug in stone foot of retaining wall of Davidson's hill, in George Couture's yard, east side of post road.

B.M. LXXI	B. M. LXXII	0·8066	— 2·9283	— 2·9445	— 2·9364	+8·1	162·68	C. B. ⊖ M. LXXII	1·4595	26·0925	B. M. LXXII—Copper plug in hard sandstone rock on beach, east side of I. C. Ry. and about opposite Foisy's house.
											Parish of St. Joseph de Lévis.
B.M. LXXII.	B.M. LXXIII	1·2842	+37·7419	+37·7213	+37·7316	+10·3	235·62	C. B. ⊖ M. LXXIII	0·1753	63·8241	B. M. LXXIII—Copper plug in centre of large stone, north face east abutment of I. C. Ry., crossing, opposite graving dock.
B.M. LXXII.	B.M. LXXIV	1·4595	— 4·4693	— 4·4827	— 4·4760	+6·7	103·72	C. B. ⊖ M. LXXIV	0·0000	21·6165	B. M. LXXIV—Copper plug in 2nd altar step, S. W. end of Lévis graving dock.
	Totals... ...	30·7233	— 2·0338	— 2·1335	— 2·0836	+49·9	3576·41				

Section No. 5=30·7233 miles.

Mean error per mile..... = M =0·00736 feet. Probable error per mile..... = $\acute{M}$ = 0·6745 × M = 0·00496 feet.

Mean error for whole distance. = μ = 0·04080 do do for whole distance.... = $\acute{\mu}$ = 0·6745 × μ = 0·02752 do

V½.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued*—1885-86.

ABSTRACT of Results, Line on North Shore from crossing at Basile's Hill to Pointe à Carcy.

From	To	M. Distance.	Difference of Height. Line A. (A →)	Line B. (← B)	Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock, *vid* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
[1891]											*Parish of Sillery.*
.....	.....	....	.....	.....	.....	.....	.....	C. B. ⊖ M. A.	11·2510	22·5380	B.M.A.—Copper plug in solid rock, foot of cliff, some 800 ft. below Beverin Point, opposite Basile's Hill.
											Parish of St. Nicholas.
B.M.A.	B.M. LXV...	0·5531	+ 0·4415	+ 0·4385	+ 0·4400	— 1·5	....	C. B. ⊖ M. LXV	10·6979	22·9780	B.M. LXV—Copper plug in rock, foot of cliff, near cluster of four white birch trees, 49 paces south-east of roadway, Basile's Hill.
											Parish of Sillery.
B.M.A.	B.M.B.	0·5697	+ 4·1948	+ 4·2105	+ 4·2027	— 7·8	187·17	C. B. ⊖ M. B.	11·8207	26·7407	B.M.B.—Copper plug in rock north side of road, about 200 ft. below Chamber's Cove at upper end of Victoria Cove.
B.M.B.	B.M.C.	0·4124	— 1·7946	— 1·7833	— 1·7890	— 5·7	157·56	C. B. ⊖ M. C.	12·2331	24·9517	B.M.C.—Copper plug in rock north side of road at base of cliff, about 100 ft. below lower wharf of Victoria Cove.
B.M.C.	B.M.D.	0·7068	+ 1·2343	+ 1·2212	+ 1·2278	+ 6·6	123·26	C. B. ⊖ M. D.	12·9399	26·1795	B.M.D.—Copper plug in rock north side of Rocky Point, some 75 ft. west of Falardeau's wharf, near centre of Bridgewater Cove.

B.M.D. ...	B.M.1	0·5654	— 6·0499	— 6·0689	— 6·0594	+ 9·5	319·25	B. C. M. 1.	13·5053	20·1201	B.M.1.—Brass headed nail in root of large elm tree on beach, south side of road behind William Munro's Hotel, centre of New London Cove.
B.M.I.	B.M.E. . . .	1·1780	+ 8·7762	+ 8·7898	+ 8·7830	— 6·8	76·21	B. C. M. E.	14·6833	28·9031	B.M.E.—Copper plug in north side of rocky point, about 700 ft. below Point à Pizeau, and a little below the Church of St. Columban of Sillery.
B.M.E. ...	B.M.F.	1·1501	— 0·3875	— 0·4044	— 0·3960	+ 8·4	110·10	B. C. M. F.	15·8334	28·5071	B.M.F.—Copper plug in rock on north side of road, at sharp turn, lower end of Spencer Cove.
											QUEBEC CITY.
B.M.F.	B.M.G.	1·3012	— 4·1888	— 4·1942	— 4·1915	+ 2·7	10·39	B. C. M. G.	17·1346	24·3156	B.M.G.—Copper plug in façade of Notre Dame de la Garde stone church, in 3rd course of stone above floor level, between main entrance and side door, north side.
B.M.G.	B.M.J.	1·0018	+ 271·2504	+ 271·2566	+ 271·2535	— 3·1	.....	B. C. M. J.	18·1364	295·5691	B.M.J.—Copper plug in chamfered stone on east corner of east tower of jail inclosure wall.
B.M.J.	B.M.	0·4364	+ 48·5803	+ 48·5595	+ 48·5699	+ 10·4	.....	B.M. ⊼ . .	18·5728	344·1390	B.M. ⊼.—This bench mark was made by the Royal Engineers on the east side of Martello Tower, close to St. Louis st.
B.M. ⊼	Zero of Quebec Barometer.	0·3501	— 45·3818	— 45·3606	— 45·3712	+ 10·6	.....	0 of Barometer	18·9229	298·7678	ZERO of Barometer used at Quebec City Observatory, back of citadel, near jail.
B.M.G. . . .	B.M.H	1·1420	+ 6·5301	+ 6·5049	+ 6·5175	+ 12·6	226·62	B. C. M. H.	18·2766	30·8331	B.M.H.—Copper plug in stone quoin at north-east angle front on Queen's store on Champlain street, about 3½ ft. above street level.
Carried	forward	.....	7·0256	+ 8·3146	+ 8·2951	+ 19·5	1210·56				

V½—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued*—1885-86.

ABSTRACT of Results, Line on North Shore from crossing at Basile's Hill to Pointe à Carcy—*Concluded.*

From	To	M. Distance.	Difference of Height. Line A. (← A)	Line B. (← A)	Mean.	V. Difference from Mean.	$2V^2/M$.	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock, *vid* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought	forward	7·0256	+ 8·3146	+ 8·2756	+ 8·2951	+ 19·5	1210·56				
											City of LÉVIS.
B.M.H.....	B.M. LXXI..	0·6505	— 1·8045	— 1·8041	— 1·8043	— ·2	....	C. B. ⊖ M. LXXI	18·9271	29·0288	B. M. LXXI—Copper plug in stone, foot of retaining wall of Davidson's hill, in George Couture's yard, about 3½ ft. above street level.
											City of Quebec.
B.M.H.....	R.E. bench on Quebec bank	0·4343	— 6·9550	— 6·9692	— 6·9621	+ 7·1	232·14	R.E. bench.	18·7109	23·8710	B.M. — Made 1864-67, by Royal Engineers, on north side of portico of Quebec Bank building, St. Peter street, viz., 16·11 ft. above their datum at assumed mean tide level.
B.M.H. ...	B.M.I.....	0·6772	— 7·5297	— 7·5513	— 7·5405	+ 10·8	344·48	C. B. ⊖ M. I.	18·9538	23·2926	B.M.I.—Copper plug in second course, below water table, stone plinth, under 5th window, eastern façade of Quebec Examining Warehouse, in rear of Custom House, and 45·9 ft. east of Leadenhall street.
B.M.I.....	Coping of Princess Louise embankm't.	0·3398	+ 0·7268	+ 0·7253	+ 0·7261	+ ·8	3·77	Coping ...	19·2936	24·0187	COPING of Louise embankment, St. Charles estuary.

B.M.I.....	Zero of Q.H.C. gauge.	0·0993	— 23·3143	— 23·3099	— 23·3121	— 2·2	97·48	0 of Gauge	19·0531	— 0·0195	ZERO of Quebec Harbour Commissioner's gauge, on S.E. face of Commissioner's wharf at Pointe à Carcy.
Totals	.....	7·8021	— 22·5294	— 22·5856	— 22·5575	+ 28·1	1652·52				

From crossing at Basile's Hill to Pointe à Carcy—7·8021 miles.

Mean error per mile ..... M = 0·0091 foot.
" for whole distance ..... μ = 0·0254 "

Probable error per mile..... $\grave{M}$ = 0·6745 M = 0·0061 foot.
" for whole distance ..... $\grave{\mu}$ = 0·6745 μ = 0·0171 "

VI—GEODETIC LEVELLING—RIVER ST. LAWRENCE—1886-87.

ABSTRACT of Results, Section No. 6, St. Antoine de Tilly to St. Jean Deschaillons (Continuous line).

From	To	M. Distance.	Difference of Height. Line A. (A ← B)	Line B. (B ← A)	Mean.	V. Difference from Mean.	$2V^2/M$	B. M. W. S. ST. &c.	Distance from Lévis *vid* Graving Dock line of Levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
											Parish of Ste. Croix.
								C. B. ● M. 146.	30·7233	23·7001	B.M. 146.—Brass-headed nail on top of elm stump on beach foot of cliff, in line between the parishes of Ste. Croix and St. Antoine de Tilly.
B.M. 146....	B.M. 160.....	0·8179	—0·8723	—0·8762	—0·8743	+1·9	8·8275	C. B. ● M. 160.	31·5412	22·8258	B.M. 160.—Brass-headed nail on root of elm stump on beach foot of cliff, about opposite lot No. 6.
B.M. 160....	B.M. 161.....	1·0547	—0·5208	—0·5229	—0·5219	+1·0	1·8963	C. B. ● M. 161.	32·5959	22·3039	B.M. 161.—Brass-headed nail on root south-west side of ash stump on beach edge of bush, about opposite lot No. 16.
B.M. 160....	B.M. LXXV.	1·3050	—0·5327	—0·5187	—0·5257	—7·0	75·0958	C. B. ⊖ M. LXXV	32·8462	22·3001	B. M. LXXV.—Copper plug in shale on beach foot of cliff, about opposite lot No. 19.
B.M. LXXV.	B.M. LXXVI	2·2503	+0·9517	+0·9386	+0·9452	+6·6	38·7148	C. B. ⊖ M. LXXVI	35·0965	23·2453	B.M. LXXVI.—Copper plug in soft rock on beach foot of cliff, about opposite lot No. 53, 2 or 3 hundred feet east of wharf.
B.M. LXXVI	B.M. 162.....	1·0732	—0·3175	—0·3150	—0·3163	—1·3	3·1492	C. B. ● M. 162.	36·1697	22·9290	B.M. 162.—Brass-headed nail on root of large elm tree on beach foot of cliff, about opposite lot No. 111.

[1891]

B.M. 162....	B.M. 161½.....	0·3514	—1·7522	—1·7658	—1·7590	+6·8		C. B. ● M. 161½.	35·8183	21·1700	B.M. 161½.—Brass-headed nail on root north-east side of small elm tree on beach, edge of bush, opposite lot No. 91.
B.M. 161½...	B.M. LXXVI A	0·6725	+3·9727	+3·9916	+3·9822	—9·4		C. B. ⊖ M. LXXVI A.	35·1458	25·1522	B.M. LXXVI.—Copper plug in face of stone, planted about 5 ft. into the ground, and standing about 1 ft. above ground, some 200 ft. east of Ste. Croix wharf.
B.M. 162....	B.M. 163.....	1·0805	+0·3821	+0·3787	+0·3804	+1·7	5·3494	C. B. ● M. 163.	37·2502	23·3094	B.M. 163.—Brass-headed nail on root west side of butternut tree on beach, edge of bush, about opposite lot No. 150.
B.M. 163....	B.M. 164.....	0·6801	—0·0586	—0·0468	—0·0527	—5·9	102·3672	C. B. ● M. 164.	37·9303	23·2567	B.M. 164.—Brass-headed nail on top of small ash stump on beach edge of bush, about opposite lot No. 160.
B. M. 164...	B. M. 165.....	1·5292	+ 1·3766	+ 1·3979	+ 1·3873	—10 6	146·9526	C. P. ● M. 165	39·4595	24·6440	B. M. 165—Brass-headed nail in crooked trunk of maple tree on beach edge of bush, about opposite lot No. 179.
B. M. 165...	B. M. 166.....	1·3407	— 1·9442	— 1·9697	— 1·9570	+12·7	240·6057	C. B. ● M. 166	40·8002	22·6870	B. M. 166—Brass-headed nail on root east side of large elm tree on beach edge of bush, opposite lot No. 191.
B. M. 166...	B. M. 167.....	0·9349	+ 3·1136	+ 3·1216	+ 3·1176	— 4·0	34·2283	C. B. ● M. 167	41·7351	25·8046	B. M. 167—Brass-headed nail on root west side of butternut stump, on beach edge of bush foot of hill.
B. M. 167...	B. M. 168.....	0·6869	— 1·7917	— 1·7818	— 1 7868	— 5·0	72·7908	C. B. ● M. 168	42·4220	24·0178	B. M. 168—Brass-headed nail on top of snubbing post on beach, east side of Platon wharf.
B. M. 168...	B.M.LXXXVII A	0·1364	+11·8507	+11·8466	+11·8487	+ 2·1	.....	C. B. ⊖ M. LXXXVII A	42·5584	35·8665	B. M. LXXXVII—Copper plug in A face of stone monument planted some 5 feet into the ground, with head one foot or so above, opposite Hon. H. G. Joly de Lotbinière's farm-house, west side of road leading to Point Platon wharf.
Carried	forward	11·0118	+ 2·0987	+ 2·1104	+ 2·1045	— 5·9	655·2905				

VI—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued*—1886-87.

ABSTRACT of Results, Section No. 6, St. Antoine de Tilly to St. Jean Deschaillons (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A ←)	Difference of Height. Line B. (→ B)	Difference of Height. Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *vid* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward		11·0118	+ 2 0987	+ 2·1104	+ 2·1045	— 5·9	655·2905				*Parish of St. Louis de Lotbinière.*
B. M. 167...	B. M. LXXVII.	1·3492	— 8·9849	— 8·9849	— 8·9849	+ 0·0	0·0000	C. B. ⊖ M. LXXVII	43·0843	16·8197	B.M. LXXVII—Copper plug in shale on beach foot of cliff, about ¼-mile west of Platon wharf.
B M.LXXVII	B.M. LXXVIII	0·5716	+ 1·4424	+ 1·4444	+ 1·4434	— 1·0	3·4989	C. B. ⊖ M. LXXVIII	43·6559	18·2631	B.M. LXXVIII—Copper plug in solid rock on beach foot of cliff, about one mile above Platon wharf.
B M.LXXVII	B.M. LXXIX	1·1395	— 5·6613	— 5·6612	— 5·6612	+ 0·0	0·0000	C. B. ⊖ M. LXXIX	44·2238	11·1585	B. M. LXXIX—Copper plug in solid rock on beach foot of cliff, opposite Pointe à Poudrier.
B.M. LXXIX	B.M. LXXX.	0·9128	+ 9·1924	+ 9·1902	+ 9·1913	+ 1·1	2·6512	C. B. ⊖ M. LXXX	45·1366	20·3498	B.M. LXX—Copper plug in solid rock, a few hundred feet east of Hon. H. G. Joly's farm wharf.
B. M. LXXX.	B.M. LXXXI	0·6637	+27·1747	+27·1964	+27·1856	—10·8	351·4841	C. B. ⊖ M. LXXXI	45·8003	47·5354	B. M. LXXXI—Copper plug on 4th stone quoin above ground, S. W. angle Hon. H. G. Joly's grist mill, foot of cliff, near farm wharf.

B.M. LXXX.	B.M. 169.....	0·9196	+ 8·9829	+ 8·9870	+ 8·9850	— 2·0	8·6994	B. C. ● M. 169	46·0562	29·3348	B.M. 169—Brass-headed nail in root S. W. side of basswood tree in gully on beach, foot of cliff, about ¼ mile below l'Isle or Richelieu Rapids Island.
B.M. 169...	B.M. 170.....	0·0138	— 7·1596	— 7·1596	— 7·1596	+ 0·0	0·0000	B. C. ● M. 170	46·0700	22·1752	B.M. 170—Brass-headed nail in root S. W. side of elm tree in gully on beach, foot of cliff, about ¼ mile below Richelieu Island.
B.M. 169...	B.M. 171.....	0·0119	— 3·7971	— 3·7937	— 3·7954	— 1·7	485·7143	B. C. ● M. 171	46·0681	25·5394	B.M. 171—Brass-headed nail in root east side of elm tree in gully on beach, about ¼ mile east of Richelieu Island.
B.M. 169...	B.M. LXXXII..	0·2641	—10·0299	—10·0280	—10·0290	— 1·0	7·5729	B. C. ⊕ M. LXXXII	46·3203	19·3058	B.M. LXXXII—Copper plug in solid rock on beach, foot of cliff, opposite Richelieu Rapids Island.
B.M. LXXXII ..	B.M. LXXXIII	0·5386	+ 1·7028	+ 1·7174	+ 1·7101	— 7·3	197·8834	B. C. ⊕ M. LXXXIII	46·8589	21·0159	B.M. LXXXIII—Copper plug in large flat boulder, some 15 feet north of lighthouse on Richelieu Rapids Island.
B.M. LXXXII ..	B.M. 172.....	0·2985	+ 4·1212	+ 4·1161	+ 4·1187	+ 2·6	45·2931	B. C. ● M. 172	46·6188	23·4245	B.M. 172—Brass-headed nail on top of large elm stump, S. E. side of small brook on beach, opposite upper end of R. R. Island.
B.M. LXXXII ..	B.M. 173.....	0·9433	+ 8·8721	+ 8·8769	+ 8·8745	— 2·4	12·2124	B. C. ● M. 173	47·2636	28·1803	B.M. 173—Brass-headed nail on top of sound ash stump, foot of cliff, in fence line between Pierre Lemay and Hospice Auger.
B.M. 173...	B.M. 174.....	0·5090	+ 6·8681	+ 6·8784	+ 6·8733	— 5·1	102·2004	B. C. ● M. 174	47·7726	35·0536	B.M. 174—Brass-headed nail in root east side of ash tree at foot of farm road, one mile below Lotbinière parish church.
B.M. 174...	B.M. 175.....	0·5800	— 2·4181	— 2·4249	— 2·4215	+ 3·4	39·8621	B. C. ● M. 175	48·3526	32·6321	B.M. 175—Brass-headed nail in root west side of butternut tree near fence, about ¼ mile below church.
	Carried forward.....	17·6293	+ 8·9200	+ 8·9439	+ 8·9320	—11·9	828·4889				

ABSTRACT of Results, Section No. 6, St. Antoine de Tilly to St. Jean Deschaillons (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A.	Line B.	Mean.	V Difference from Mean.	$2V^2/M$.	B. M. W. S. ST. &c.	Distance from Levis *vid* Graving Dock line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward		17·6293	+ 8·9200	+ 8·9320	+ 8·9320	— 11·9	828·4889				*Parish of St. Louis de Lotbinière*—Continued.
B.M. 175...	B.M. 175½....	0·4361	— 2·3958	— 2·3971	— 2·3965	+ 0·6	.....	C. B. ● M. 175½	48·7887	30·2356	B.M. 175½—Brass-headed nail in root of large poplar tree, edge of beach, opposite parish church.
B.M. 175....	B. M. LXXXIV	0·5833	+62·9963	+63·0036	+63·0000	— 3·6	44·4368	C. B. ⊖ M. LXXXIV	48·9359	95·6321	B.M. LXXXIV—Copper plug in south-west corner of foundation of Lotbinière parish church.
B.M. 175....	B. M. LXXXV.	0·7078	—11·2935	—11·2992	—11·2964	+ 2·8	22·1531	C. B. ⊖ M. LXXXV	49·0604	21·3357	B.M. LXXXV—Copper plug in shaly rock near brook, foot of cliff, about ¼ mile west of parish church.
B.M.LXXXV	B. M. LXXXVI	0·8358	— 0·5710	— 0·5580	— 0·5645	— 6.5	98·0139	C. B. ⊖ M. LXXXVI	49·8962	20·7712	B.M. lxxxvi—Copper plug in shaly rock about 25 ft. north east of stream from J. B. Laliberté's saw-mill.
B.M. LXXXVI..	B.M. 176.....	0·9130	— 0·5358	— 0·5546	— 0·5452	+ 9·4	193·5597	C. B. ● M. 176	50·8092	20·2260	B.M. 176—Brass-headed nail in root of bent elm on beach, foot of cliff, about ½ mile west of wharf of Vieille Eglise.

[1891]

B.M. 176....	B.M. 177.....	0·7516	+ 0·3765	+ 0·3707	+ 0·3736	+ 2·9	22·3789	C. B. ● M. 177	51·5608	20·5996	B.M. 177.—Brass-headed nail on root north side of elm tree in bush along beach, about 2 miles below Ste. Emmélie church.
B.M. 177....	B.M. 178.....	0·9593	+ 5·7662	+ 5·7557	+ 5·7610	+ 5·3	58·5635	C. B. ● M. 178	52·5201	26·3606	B.M. 178—Brass-headed nail in root south-east side of white birch tree, some 25 ft. up cliff, about one mile below church of Ste. Emmélie.
											Parish of Ste. Emmélie.
B.M. 178....	B.M. 179.....	1·3598	— 1·5568	— 1·5626	— 1·5597	+ 2·9	12·3695	C. B. ● M. 179	53·8799	24·8009	B.M. 179—Brass-headed nail in root south west side of butternut tree on beach, on west bank, mouth of Grande Rivière du Chêne.
B.M. 179....	B.M. LXXXVII.	0·1949	+ 13·7813	+ 13·7794	+ 13·7804	+ 1·0	10·2616	C. B. ⊖ M. LXXXVII	54·0745	38·5813	B.M. LXXXVII—Copper plug in stone foundation east side of Damase Beaudet's brick house, village of Leclercville, foot of hill leading to Ste. Emmélie parish church.
B.M. 179....	B.M. LXXXVIII..	0·3400	+ 74·9792	+ 74·9899	+ 74·9846	— 5·3	165·2353	C. B. ⊖ M. LXXXVIII.	54 2199	98·7855	B.M. LXXXVIII—Copper plug in east side stone foundation, under tower and spire of parish church of Ste. Emmélie (brick).
B M. 179....	B.M. 180.....	0·3760	+ 17·9052	+ 17·9105	+ 17·9078	— 2·7	38·7766	C. B. ● M. 180	54·2559	42·7087	B.M. 180—Brass-headed nail in root north east side of white birch tree, some 30 ft. up cliff, north side of gully, ¼ mile west of Grande Rivière du Chêne.
B.M. 180...	B.M. 181.....	1 6883	— 15·0804	— 15·0750	— 15·0777	— 2·7	8·6359	C. B. ● M. 181	55·9442	27·6810	B.M. 181.—Brass-headed nail in root north-west side of Balm of Gilead tree, along cliff, about ¼ mile below Petite Rivière du Chêne.
	Carried forward.....	25·2209	+3·9304	+3·9314	+3·9309	—0·5	1282·9400				

VI—GEODETIC LEVELLING—RIVER ST. LAWRENCE—1886-87—*Concluded.*

ABSTRACT of Results, Section No. 6, St. Antoine de Tilly to St. Jean Deschaillons (Continuous line)—*Concluded.*

From	To	M. Distance.	Difference of Height. Line A. (A)	Line B. (B)	Mean.	V Difference from Mean.	$2V^2/M$.	B.M. W.S. ST., &c.	Distance from Lévis Graving Dock *vid* line of levels.	Elevation above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward.....		25·2209	+ 3·9304	+ 3·9314	+ 3·9309	− 0·5	1282·9400				*Parish of Ste. Emmélie*—Con.
B.M. 181...	B.M. LXXXIX	0·2371	— 1·1879	— 1·1923	— 1·1901	+ 2·2	40·8266	C. B. ⊖ M. LXXXIX	56·1813	26·4409	B.M. LXXXIX—Copper plug in stone foundation west side of Louis Lafond's wooden house at mouth of Petite Rivière du Chêne.
Totals....	.. . .	25·4580	+ 2·7425	+ 2·7391	+ 2·7408	+ 1·7	1323·7666				

B. M. 146 to B. M. LXXXIX = 25·4580 miles.

Mean error per mile ..... M = 0·00504 feet.	Probable error per mile..... M = 0·6745 M = 0·00340 feet.
" for whole distance..... μ = 0·02546 "	" for whole distance..... μ = 0·6745 μ = 0·01717 "

VII—GEODETIC LEVELLING—RIVER ST. LAWRENCE—1886-87—*Continued.*

ABSTRACT of Results, Section No. 7, Bécancour to La Baie du Febvre (Continuous line).

From	To	M. Distance.	Difference of Height. Line A. (A ←)	Line B. (← B)	Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
											Parish de la Nativité de Bécancour.
.....	.....	.....	.....	.....	.....	.....	.....	C. B ⊖ M. XC	80·7841	33·4704	B.M. XC.—Copper plug in stone foundation of L. Provencher's wooden house, west side of Post Road, a few hundred feetwest of parish line between Gentilly and Bécancour.
B.M. XC...	B.M. 182.....	0·2025	— 0·1554	— 0·1535	— 0·1545	— 1·0	9·8765	C. B. ● M. 182	80·9866	33·3159	B.M. 182.—Brass-headed nail on root of large elm tree in Godfroi Carignan's field, north side of Post Road.
B.M. XC...	B.M. XCI...	0·4010	+ 3·4101	+ 3·4118	+ 3·4110	— 0·8	3·1920	C. B. ⊖ M. XCI	81·1581	36·8814	B.M. XCI.—Copper plug in north-east side of stone foundation of Moïse Genest's house, on south side of Post Road.
B.M. XCI.	B.M. 182½....	1·1563	— 9·0909	— 9·1218	— 9·1064	+15·4	410·2049	C. B. ● M. 182½	82·3414	27·7750	B.M. 182½.—Brass-headed nail on root of small oak tree at junction of route from new road with old road on Clovis Boisvert's property, lot No. 41.
B.M. 182½..	B.M. 182¾...	0·5175	— 2·2734	— 2·2645	— 2·2690	— 4·5	78·2609	C. B. ● M. 182¾	82·8589	25·5060	B.M. 182¾.—Brass-headed nail on top of small elm stump on beach, foot of long route, opposite lot No. 40.
Carried	forward.....	0·4010	+3·4101	+3·4118	+3·4110	—0·8	3·1920				

VII—GEODETIC LEVELLING—RIVER ST. LAWRENCE—1886-87—*Continued.*

ABSTRACT of Results, Section No. 7, Bécancour to La Baie du Febvre (Continuous line)—*Continued.*

From	To	M Distance.	Difference of Height. Line A. (A ← / → B)	Line B.	Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below — approximate mean level Atlantic Ocean, established at Quebec by R. Stecket, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought	forward	0·4010	+3·4101	+3·4118	+3·4110	—0·8	3·1920				*Parish de la Nativité de Bécancour*—Continued.
B.M. XCI..	B.M. XCII...	0·8940	+ 5·7290	+ 5·7297	+ 5·7293	— ·4	·3579	C B. ⊖ M. XCII	82·0791	42·6107	B.M. XCII--Copper plug in stone foundation, south face of Ferdinand Leblanc's wooden house on north side of Post Road.
B.M. XCII.	B.M. XCIII..	0·8347	— 3·2429	— 3·2617	— 3·2523	+ 9·4	211·7167	C B. ⊖ M. XCIII	82·9138	39·3584	B.M. XCIII—Copper plug in stone basement, north face of Louis Massé's wooden house on north side of Post Road.
B.M. XCIII	B.M. 183.....	1·2823	— 9·0969	— 9·0966	— 9·0968	— ·2	·0624	C B. ● M. 183	84·1961	30·2616	B.M. 183—Brass-headed nail on root, west side of large butternut tree, Lot No. 105, on east side of road, about 6 feet from junction of old road with road to Ste. Angèle.
B.M. 133...	B.M. 184.....	0·5295	— 0·0724	— 0·0681	— 0·0703	— 2·2	18·2814	C B. ● M. 184	84·7256	30·1913	B.M. 184—Brass-headed nail on top of large elm stump in David Mayrand's field, south-east side of Post Road.
B.M. 184...	B.M. 185.....	0·5059	— 5·0483	— 5·0367	— 5.0425	— 5·8	132·9905	C B. ● M. 185	85·2315	25·1488	B.M. 185—Brass-headed nail in root, east side of large soft maple tree on N. W. bank of River Bécancour, north side of bridge.

B.M. 185...	B.M. XCIX..	1·0873	+18·9353	+18·9392	+18·9373	— 1·9	6·6403	C B. ⊖ M. XCIX	86·3188	44·0861	B.M. XCIX—Copper plug in top course of stone basement of new Roman Catholic church on east side of Post Road.
B.M. 185...	B.M. 186.....	0·7888	+ 1·5106	+ 1·5233	+ 1·5170	— 6·3	100·6339	C B. ● M. 186	86·0203	26·6658	B.M. 186—Brass-headed nail in root of large oak tree about 150 feet east of roadway at sharp turn of road, lot No. 529.
											Parish of Ste. Angèle de Laval.
B.M. 186...	B.M. XCIV..	1·2406	+ 6·9434	+ 6·9242	+ 6·9338	+ 9·6	149·2619	C B. ⊖ M. XCIV	87·2609	33·5996	B.M. XCIV—Copper plug in stone-wall, under sill of first window, east side of front door in Clovis Tourigny's stone house, on lot No. 6.
B.M. XCIV	B.M. 187.....	1·1781	— 1·2828	— 1·2596	— 1·2712	—11·6	228·4365	C B. ● M. 187	88·4390	32·3284	B.M. 187—Brass-headed nail on root, north-west side of large ash tree, on south side of road, opposite centre of lot No. 21, or thereabouts.
B.M. 187...	B.M. XCV...	0·6903	+ 3·1139	+ 3·1055	+ 3·1097	+ 4·2	51·1082	C B. ⊖ M. XCV	89·1293	35·4381	B.M. XCV—Copper plug in stone basement of Honoré Lenneville's house on lot No. 32, south side of Post Road.
B.M. XCV.	B.M. XCVI..	1·0053	+ 5·4897	+ 5·5005	+ 5·4951	— 5·4	58·0125	C B. ⊖ M. XCVI	90·1346	40·9332	B.M. XCVI—Copper plug in stone front, north side of main entrance to Roman Catholic Church, south-east side of Post Road.
B.M. XCVI	B.M. 188.....	0·9302	— 3·9180	— 3·9471	— 3·9326	+14·5	452·0533	C B. ● M. 188	91·0648	37·0006	B.M. 188.—Brass-headed nail in root south side of large pine tree lot No. 137, on north side of Post Road, opposite William Patterson's house.
											Parish of St. Grégoire.
B.M. 188...	B.M. 189.....	1·1742	—11·0138	—10·9900	—11·0019	—11·9	241·2026	C B. ● M. 189	92·2390	25·9987	B.M. 189.—Brass-headed nail in root, south-west side of ash tree in field on lot No. 13, south side of Post Road.
	Carried forward....	11 4549	—7·4784	—7·4648	—7·4717	—6·9	1647·3098				

VII—GEODETIC LEVELLING—RIVER ST. LAWRENCE—1886-87—*Continued.*

ABSTRACT of Results, Section No. 7, Bécancour to La Baie du Febvre (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A ← / B →)	Line B. (A → / B ←)	Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B.M. W.S. ST. &c.	Distance from Lévis Graving Dock, *vid* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward.....		11·4549	—7·4784	—7·4648	—7·4717	—6·9	1647·3098				*Parish of St. Grégoire*—Con.
B.M. 189...	B.M. 190.....	0·5317	+13·4078	+13·4163	+13·4121	— 4·2	66·3532	C B. ● M. 190	92·2707	39·4108	B.M. 190.—Top of stone planted by D. C. Morency, D.L.S. at request of Crown Lands Department, Quebec, on lot No. 36 on west side of Road.
B.M. 190...	B.M. 191.....	0·9863	— 5·0939	— 5·1205	— 5·1072	+13·3	358·6931	C B. ● M. 191	93·7570	34·3036	B.M. 191.—Brass-headed nail in root of small elm tree, Lot No. 55, on west side of Post Road, at its intersection with cross road to Nicolet.
B.M. 191...	B.M. XCVII.	0·4834	+ 1·4738	+ 1·4643	+ 1·4690	+ 4·7	91 3943	C B. ⊖ M. XCVII	94·2404	35·7726	B.M. XCVII—Copper plug in north east wall of Napoléon Poirier's stone house on lot No. 59 south side of old main road.
B.M. XCVII	B.M. 192.....	0·5922	— 6·0188	— 6·0349	— 6·0268	+ 8·1	221·5805	C B. ● M. 192	94·8326	29·7458	B.M. 192.—Brass-headed nail in root south side of white oak tree on Lot No. 69, Napoléon Picard's property, north side of Post Road.
B.M. 192 .	B.M. XCVIII	0·9759	+ 7·4475	+ 7·4413	+ 7·4444	+ 3·1	19 6927	C B. ⊖ M. XCVIII	95·8085	37·1902	B.M. XCVIII—Copper plug, south wall of Basile Plourde's stone house on Lot No. 76 north-west side of road.

[1891]

BMXCVIII	B.M. 193	1·0857	— 6.4748	— 6·4621	— 6·4685	— 6·4	75·4537	B. ● M. 193 C	96·8942	30·7217	B.M. 193.—Brass-headed nail in root south-west side of large elm tree on Lot No. 100 north side of Post Road.
											Parish of St. Jean Baptiste de Nicolet.
B.M. 193	B.M. 194	1·2886	+ 6·0351	+ 6·0093	+ 6·0222	+12·9	258·2703	B. ● M. 194 C	98·1828	36·7439	B.M. 194.—Brass-headed nail in root north-west side of large elm tree on lot No. 16, Mrs. Bernard Cécile's property; close to fence south side of road.
B.M. 194	B.M. 195	0·4812	+10·2170	+10·2075	+10·2123	+ 4·8	95·7606	B. ● M. 195 C.	98·6640	26·5316	B.M. 195—Brass-headed nail in root of large soft maple tree (north-west side) near beach, north-east side of road to wharf of Port St. Francis.
B.M. 194	B.M. C.	0·1726	+ 3·3890	+ 3·3933	+ 3·3912	— 2·1	51·1008	B. ⊕ M. C C.	98·3554	40·1351	B.M. C—Copper plug in north-east gable of Antoine Brassard's stone house, west side of post road.
B.M. 194	B.M. 196	1·2044	— 3·8475	— 3·8542	— 3·8508	+ 3·4	19·1963	B. ● M. 196 C.	99·3872	32·8931	B. M. 196—Brass-headed nail in top of large soft maple stump in field, west side of post road, lot No. 381.
B.M. 196	B.M. 197	1·2140	+ 2·3424	+ 2·3322	+ 2·3373	+ 5·1	42·8501	B. ● M. 197 C.	100·6012	35·2304	B.M. 197—Brass-headed nail in root north-east side of large elm tree, west side of post road, on Gédéon Brassard's property, lot No. 381.
B.M. 197	B.M.CI	0·6763	+13·3313	+13·3228	+13·3270	+ 4·2	52·1662	B. ⊕ M. CI C.	101·2775	48·5574	B.M. CI—Copper plug in south wall of Antoine Beaubien's stone house on north side of post road, and opposite lower crossing of Nicolet River.
B. M. CI	B.M. 198	0·6496	+ 3·8024	+ 3·8028	+ 3·8026	— ·2	·1232	B. ● M. 198 C.	101·9271	52·3600	B.M. 198—Brass-headed nail on top of large red oak stump in field, south side of post road.
Carried	forward..	20·4934	+15·1245	+15·0497	+15·0870	+37·3	2852·9602				

VII—GEODETIC LEVELLING—RIVER ST. LAWRENCE—1886-87—*Continued.*

ABSTRACT of Results, Section No. 7, Bécancour to La Baie du Febvre (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A ←)	Line B. (→ B)	Mean.	V. Difference from Mean.	$\frac{2V^2}{M}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought	forward	20·4934	+15·1245	+15·0497	+15·0870	+37·3	2852·9602				*Parish of St. Jean Bte. de Nicolet.*
B.M. 198...	B.M. CII.....	0·4454	+22·6161	+22·6111	+22·6136	+ 2·5	26·0647	C. B. ⊖ M. CII	102·3725	74·9736	B.M. CII--Copper plug in north-west corner of Roman Catholic Cathedral (cut stone), town of Nicolet.
B.M. CI....	B.M. 199.. .	0·4235	—21·7943	—21·7862	—21·7903	— 4·1	79·4097	C. B. ● M. 199	101·7010	26·7671	B.M. 199—Brass-headed nail in root north side of small elm tree on beach south landing of lower ferry across River Nicolet.
B.M. CI....	B.M. CII.....	0·8639	— 0·0482	— 0·0450	— 0·0466	— 1·6	5·9266	C. B. ⊖ M. CIII	102·1414	48·5108	B.M. CIII--Copper plug in north-east corner of Eusèbe Brassard's stone house on lot No. 510 at junction of lower ferry route and main road.
B.M. CIII..	B.M. 200.....	0·8924	—14·8712	—14·8857	—14·8785	+ 7·2	116·1811	C. B. ● M. 200	103·0338	33·6323	B.M. 200—Brass-headed nail in root of soft maple tree on lot No. 516, east side of road and about 30 feet south of school house.
B.M. 200...	B.M. 201.....	0·7134	+ 1·1476	+ 1·1609	+ 1·1543	— 6·6	122·1194	C. B. ● M. 201	103·7472	34·7866	B.M. 201—Brass-headed nail in root, north-west side of white oak tree, on lot No. 529, east side of post road.

[1891]

B.M. 201..	B.M. 202.....	1·0292	+ 4·8828	+ 4·8835	+4·8831	— ·4	·3109	B. C. M. 202	104·7764	39·6697	B.M. 202—Brass-headed nail in root, west side of small elm tree, east side of post road, on lot No. 561, owned by Herbert Duguay.
B.M. 202...	B.M. CIV....	0·4675	+ 6·9024	+ 6·8943	+ 6·8984	+ 4·1	71·9146	B. C. M. CIV	105·2439	46·5681	BM. CIV--Copper plug in stone of foundation under gallery, west side of steps leading up to front door of Jean Rousseau's house, east side of post road.
											Parish of St. Antoine de la Baie du Fèbvre.
B.M. CIV..	B.M. CV.....	0·9786	— 8·3963	— 8·3883	— 8·3923	— 4·0	32·7008	B. C. M. CV	106·2225	38·1758	B.M. CV—Copper plug in stone foundation, front of William Houle's house, east side of post road.
B.M. CV...	B.M. CVI....	1·1480	— 0·2002	— 0·2078	— 0·2040	+ 3·8	25·1569	B. C. M. CVI	107·3705	37·9718	B.M. CVI—Copper plug in stone foundation of Anselme Lafond's house, north-west side of post road.
B.M. CVI..	B.M. CVII...	1·0235	+ 6·1397	+ 6·1378	+ 6·1387	+ ·9	1·5829	B. C. M. CVII	108·3940	44·1105	BM. CVII—Copper plug in stone foundation of Edward Lenière's house, on east side of post road, lot No. 427.
B.M. CVII.	B.M. 203....	1·1310	— 4·6364	— 4·6115	— 4·6239	— 12·4	271·9010	B. C. M. 203	109·5250	39·4866	B.M. 203—Brass-headed nail in root, north-west side of hickory tree on lot No. 459, Frs. Futra's property, east side of post road.
B.M. 203...	B.M. LI.	0·8042	+ 8·9823	+ 8·9837	+ 8·9830	— ·7	1·2186	B. C. M. LI	110·3292	48·4696	B.M. LI—Copper plug in eastern wall of stone basement of Nestor Duguay's store, foot of hill leading to parish church of St. Antoine de la Baie du Febvre.
	Totals....	29·5451	+15·0270	+14·9716	+14·9992	+27·6	3501·9730				

Section No. 7 = 29·5451 miles.

Mean error per mile .... = M = 0·00729 feet. Probable error per mile..... M = 0·6745 M = 0·00492 feet.

Mean error for whole distance..... ....= μ = 0·03959 feet. Probable error for whole distance..... μ = 0·6745 μ = 0·02670 feet.

VIII—GEODETIC LEVELLING—RIVER ST. LAWRENCE—1886-87—*Continued.*

ABSTRACT of Results, Section No. 8, Bécancour to St. Jean Deschaillons (Continuous line).

From	To	M. Distance.	Difference of Height. Line A. (A ← / → B)	Line B.	Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock, *viâ* line of levels.	Elevation above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
											Parish of de la Nativité de Bécancour.
....	....	....	....	....	....	.....	.....	B. C. ⊖ M. XC	80·7841	33·4704	B.M. XC—Copper plug in stone foundation of L. Provencher's wooden house, west side of post road, some 300 ft. west of parish line between Gentilly and Bécancour.
											Parish of St. Edouard de Gentilly.
B.M. XC...	B.M. CXVII.	0·8962	— 1·4958	— 1·4887	— 1·4922	— 3·5	27·3377	B. C. ⊖ M. CXVII	79·8879	31·9782	B.M. CXVII—Copper plug in stone foundation of P. Reault's wooden house on west side of post road.
BM.CXVII	B.M. 204.....	0·6092	— 0·0114	— 0·0031	— 0·0073	— 4·2	57·9120	B. C. ● M. 204	79·2787	31·9709	B.M. 204—Brass-headed nail on top of pier of new bridge over Gentilly River, east side of post road.
B.M. 204...	B.M. CVII..	1·0849	+ 12·1200	+ 12·1153	+ 12·1177	+ 2·4	10·6185	B. C. ⊖ M. CVIII	78·1938	44·0886	B.M. CVIII—Copper plug in stone basement of Ludger Genest's wooden house on east side of post road.
B.M. CVIII	B.M. CIX.. .	0·8445	— 6·1986	— 6·1946	— 6·1966	— 2·0	9·4731	B. C. ⊖ M. CIX	77·3493	37·8920	BM. CIX—Copper plug in south-east corner of stone basement of Joseph Ludger Brunel's wooden house, west side of post road.

B.M. CIX..	B.M. 205.....	1·4065	— 10·2962	— 10·2850	— 10·2906	— 5·6	44·5929	B. ● C. M. 205	75·9428	27·6014	B.M. 205—Brass-headed nail in root of small ash tree on beach foot of old church road, and opposite the property of Hector Turcot, about 50 ft. from high water mark.
B.M. CIX .	B.M. CX. ..	1·5901	+ 32·0744	+ 32·1042	+ 32·0893	— 14·9	279·2403	B. ⊖ C. M. CX	75·7592	69·9813	B.M. CX—Copper plug on 2nd lowest stone quoin, south-east corner of Roman Catholic parish church, on west side of post road.
B.M. CX...	B.M. 205½....	0·5619	— 48·1622	— 48·1403	— 48·1513	— 11·0	430·6818	B. ● C. M. 205½	75·1973	21·8390	B.M. 205½—Brass-headed nail on top of remains of small balm of Gilead tree, foot of road leading from Gentilly church to beach.
B.M. CX...	B.M. 206.. ..	1·2062	+ 7·6207	+ 7·6340	+ 7·6274	— 6·6	72·2268	B. ● C. M. 206	74·5530	77·6087	B.M. 206—Brass-headed nail in root of small white birch tree in Ludger Mailhiot's field, east side of post road.
B.M. 206...	B.M. CXI....	0·7027	— 56·0607	— 56·0694	— 56·0651	+ 4·3	52·6256	B. ⊖ C. M. CXI	73·8503	21·5436	B.M. CXI—Copper plug in large flat stone, embedded in south bank of Rivière du Moulin, near its mouth.
B.M. CXI..	B.M. 207.....	1·1232	+ 9·5115	+ 9·5353	+ 9·5234	— 11·9	252·1546	B. ● C. M. 207	72·7271	31·0670	B.M. 207—Brass-headed nail on root, north side of large elm tree in field, about 300 ft. from high water mark, opposite lot No. 33
B.M. 207...	B.M. 208.....	1·1039	— 6·2993	— 6·3147	— 6·3070	+ 7·7	107·4192	B. ● C. M. 208	71·6232	24·7600	B.M. 208—Brass-headed nail on root, west side of balm of Gilead tree on north side of mouth of Rivière aux Orignaux, opposite lot No 1.
											Parish of St. Pierre les Becquets.
B.M. 208...	B.M. 209.....	1·0684	+ 6·6752	+ 6·6825	+ 6·6789	— 3·6	24·2606	B. ● C. M. 209	70·5548	31·4389	B.M. 209—Brass-headed nail on root, south-west side of white pine tree, foot of high cliff and opposite lot No. 153.
	Carried forward	10·2293	—2·0640	—1·9992	—2·0315	—32·3	893·2684				

VIII—GEODETIC LEVELLING—RIVER ST. LAWRENCE—1886-87—*Continued.*

ABSTRACT of Results, Section No. 8, Bécancour to St. Jean Deschaillons (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A ← / → B)	Difference of Height. Line B. (A ← / → B)	Difference of Height. Mean.	V. Difference from Mean.	$2V^2/M$.	R. M. W. S. ST. &c.	Distance from Lévis Graving Dock *rid* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought	forward . . .	10·2293	−2·0640	−1·9992	−2·0315	−33·3	893·2684				*Parish of St. Pierre les Becquets* —Continued.
B.M. 209 . . .	B.M. CXII. . .	1·2289	+ 1·5781	+ 1·5651	+ 1·5716	+ 6·5	68·7605	C. B. ⊖ M. CXII	69·3259	33·0105	B.M. CXII—Copper plug in stone foundation, north side of Wm. Massicot's carding mill on beach, foot of high cliff.
B.M. CXII.	B.M. 210. . .	0·8959	− 7·2920	− 7·2858	− 7·2889	− 3·1	21·4535	C. B. ● M. 210	68·4300	25·7216	B.M. 210—Brass-headed nail in root, south-west side of small elm tree on beach, foot of cliff, about opposite lot No. 116.
B.M. 210 . . .	B.M. 211.	0·9068	− 4·6142	− 4·6341	− 4·6242	+ 9·9	216·1667	C. B. ● M. 211	67·5232	21·0974	B.M. 211—Brass-headed nail in root, west side of small balm of Gilead tree on beach, foot of cliff, opposite lot No. 103 or thereabouts.
B.M. 211 . . .	B.M. CXIII. .	0·9596	+ 88·5842	+ 88·5909	+ 88·5875	− 3·4	24·0934	C. B. ⊖ M. CXIII	66·5636	109·6849	B.M. CXIII—Copper plug in 4th cut stone quoin above ground and foundation, front of Roman Catholic parish church of St. Pierre les Becquets, north-west corner.
B.M. 211 . . .	B.M. 212. . . .	0·9180	+ 4·4121	+ 4·4107	+ 4·4114	+ ·7	1·0679	C. B. ● M. 212	66·6052	25·5088	B.M. 212—Brass-headed nail on root, west side of large elm tree, foot of cliff, opposite lot No. 54. In the summer of 1887 this bench had already come down to 24·6886 as the result of the sliding of the river banks in the spring.

[1891]

B.M. 212...	B.M. 213....	0·8511	— 3·6846	— 3·6990	— 3·6918	+ 7·2	121·8189	B. C. ● M. 213	65·7541	21·8170	B.M. 213—Brass-headed nail on root, west side of large balm of Gilead tree on beach, foot of cliff, opposite lot No. 53.
B.M. 213...	B.M. 214.....	0·9513	+ 2·1820	+ 2·1742	+ 2·1781	+ 3·9	31·9773	B. C. ● M. 214	64·8028	23·9951	B.M. 214—Brass-headed nail on root of large balm of Gilead tree on beach, foot of cliff, opposite lot No. 9.
											Parish of St. Jean Deschaillons.
B.M. 214...	B.M. CXIV..	0·7817	+ 1·4355	+ 1·4250	+ 1·4303	+ 5·3	71·8690	B. C. ⊖ M. CXIV	64·0211	25·4254	B.M. CXIV—Copper plug in large flat stone on beach, foot of cliff opposite lot No. 9.
B.M. CXIV	B.M. 215.....	0·8885	+ 6·2472	+ 6·2235	+ 6·2353	+ 11·8	313·4271	B. C. ● M. 215	63·1326	31·6607	B.M. 215—Brass-headed nail on root of small stump on beach, west side of route leading up to post road.
B.M. 215....	B.M. 216.. ...	1·0822	— 0·7798	— 0·9579	— 0 9689	— 11.0	223·6187	B. C. ● M. 216	62·0504	30·6918	B.M. 216—Brass-headed nail on west side of root of large elm tree, opposite lot No. 76.
B.M. 216....	B.M. 217.....	0·6307	— 5·0408	— 5·0298	— 5·0353	— 5·5	95·9252	B. C. ● M. 217	61·4197	25·6565	B.M. 217—Brass-headed nail on root of small balm of Gilead tree, on beach foot of cliff, opposite lot No. 95.
B.M. 217....	B.M. CXV..,	0·7165	— 2·0332	— 2·0301	— 2·0316	— 1·5	6·2719	B. C. ⊖ M. CXV	60·7032	23·6249	B.M. CXV—Copper plug in immense boulder, on beach foot of cliff, opposite lot No. 125. In the fall of 1888 this bench had sunk down to 23·5349.
B.M. CXV.	B.M. 218.....	0·2986	+ 58·7816	+ 58·7607	+ 58·7562	— 4·5	135 6364	B. C. ● M. 118	60·4046	82·3811	B.M. 218—Brass-headed nail on root of soft maple tree, west side of plateau, half-way up wharf hill. In 1888, on account of the sliding of the cliff in the spring, this bench had descended to 81·8287.
B.M. CXV.	B.M. CXVI..	0·4904	+ 136·3965	+ 136·4090	+ 136·4028	— 6·2	156·7699	B. C. ⊖ M. CXVI	60·2128	160·0277	B.M. CXVI—Copper plug in stone basement, north-west corner of parish church, St. Jean des Chaillons, some 4 feet above ground.
	Carried forward.....	20·0809	—9·8537	—9·8374	—9·8455	—8·1	2065·6251				

VIII—GEODETIC LEVELLING—RIVER ST. LAWRENCE—1886-87—*Continued.*

ABSTRACT of Results, Section No. 8, Bécancour to St. Jean Deschaillons (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A →)	Line B. (← B)	Mean.	V. Difference from Mean.	$2V^2/M$.	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c,
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward		20·0809	—9·8537	—9·8374	—9·8455	— 8·1	2065·6251				*Parish of St. Jean Deschaillons*—Continued.
B.M. CXV..	B.M. 219.....	0·5933	— 2·4192	— 2 4218	— 2·4205	+ 1·3	5·6969	C. B. ● M. 219	60·1099	21 2044	B.M. 219—Brass-headed nail on top of small elm tree stump on beach foot of cliff, about opposite lot No. 173.
B.M. 219....	B.M. 220.....	0·9803	+ 32·1808	+ 32·1825	+ 32·1817	— ·8	1·3057	C. B. ● M. 220	59·1296	53·3861	B.M. 220—Brass-headed nail on root of large elm tree, about ⅓ the way up the cliff, opposite centre of lot No. 180.
B.M. 220....	B.M. 221.. ...	1·1291	— 27·2106	— 27·2035	— 27·2071	— 3·6	22·9563	C. B. ● M. 221	58·0005	26·1790	B.M. 221—Brass-headed nail on root of white pine tree, on beach opposite lower end of lot No. 206.
B.M. 221...	B.M. 222....	1·1321	— 1 2104	— 1·2243	— 1·2173	+ 7·0	86·5648	C. B. ● M. 222	56·8684	24·9617	B.M. 222—Brass-headed nail on root of white birch tree on beach, foot of high cliff, about opposite lot No. 224.
											Parish of St. Emmelie.
B.M. 222...	B. M. LXXXIX	0·6871	+ 1·4772	+ 1·4813	+ 1·4792	— 2·1	12·8368	C. B. ⊖ M. LXXXIX	56·1813	26·4409	B. M. LXXXIX—Copper plug in stone foundation, west side of Louis Lafond's wooden house, at the mouth of Petite Rivière Duchêne.
	Totals....	24·6028	— 7·0359	— 7·0232	— 7·0295	— 6·3	2194·9856				

Section No. 8 = 24·6028 miles.

Mean error per mile..... = M = 0·00650 ft. Probable error per mile ..... = $\grave{M}$ = 0·6745 M = 0·00438

Mean error for whole distance ..... = μ = 0·03223 ft. Probable error for whole distance ..... = μ = 0·6745 μ = 0·02174

IX—GEODETIC LEVELLING—RIVER ST. LAWRENCE—1888-89.

Abstract of Results, Section No. 9, Sorel to Varennes (Continuous line).

From	To	M. Distance.	Difference of Height. Line A. (A →)	Line B. (← B)	Mean.	V. Difference from Mean.	$\frac{2V^2}{M}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *via* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
								C. B. M. CXXIV	141·8139	39·5848	*Parish of St. Joseph de Sorel.* Copper plug in brick wall, about 3 feet above ground, under gallery at N. W. corner of McCarthy's brick house, south of post road.
B.M. CXXIV.	Cavity in top of bronze cap of bench well G.	0·1127	— 2·2963	— 2·2956	— 2·2960	... .	.....	Cavity in cap.	141·9266	37·2888	Bench well (G) protected by heavy bell cover in second position, viz., as placed in 1888, opposite Louis Bibault's house, at intersection of post road and cross road from St. Joseph de Sorel to St. Roch.
do ..	Top of bronze cap of bench well G.	0·1123	— 2·2591	— 2·2582	— 2·2587	.....	.....	Top of cap	141·9262	37·3261	
do ..	Top of inside tube of bench well G.	0·1122	+ 5·7800	+ 5·7809	+ 5·7805	.....	....	Insidetube	141·9261	45·3653	This bench well (G), had in the fall of 1885, been placed on ordnance land near the Richelieu Navigation Company's wharf in the city of Sorel—a very exposed place; for fear that in this its first position, the well might be damaged and the bench disturbed, G was in 1888 removed to the west side of the Richelieu.
do ..	Top of outside tube of bench well G	0·1124	+ 6·9082	+ 6·9091	+ 6·9087	.....	....	Outside tube.	141·9263	46·4935	
do ..	Top of outside cover of bench well G.	0·1123	+ 7·1726	+ 7·1735	+ 7·1731	.....	....	Outside cover.	141·9262	46·7579	

....	.. ..	....	.....	... .	....	.....	....	C. B. ⊖ M. XXIV	141·4360	46·3541	Copper plug in stone basement of Sorel market hall, 21 feet east of south-east corner, and about 3¼ feet above ground.
B.M. XXVI	B.M. CXXIV	0·3779	—6·7774	—6·7612	—6·7693	— 8·10	347·2349	C. B. ⊖ M. CXXIV	141·8130	39·5848	Copper plug in brick wall, about 3 feet above ground under gallery at north-west corner of Messrs. McCarthy's brick house, south side of post road.
B.M. CXXIV	B.M. 229....	0·3762	+8·2854	+8·2815	+8·2835	+ 2·00	21·2653	C. B. ● M. 229	142·1901	47·8683	Brass-headed nail on top of small pine stump near post road fence, opposite Wm. Nolan's farm.
B.M. 229...	B.M. 230. ...	0·8027	—0·7701	—0·7561	—0·7631	— 7·00	122·0879	C. B. ● M. 230	142·9928	47·1052	Brass-headed nail on top of small white birch stump, in field on north side of post road at end of long bush where road turns to follow the River St. Lawrence.
B.M. 230...	B.M. 231.....	1·0134	—5·8391	—5·8202	—5·8297	— 9·50	178·1133	C. B. ● M. 231	144·0062	41·2755	Brass-headed nail on root of red spruce tree about 120 feet, south of southern road fence on Xavier Peloquin's farm, near fence line between Peloquin and Joly.
B.M. 231...	B.M. CXXV.	0·2914	+1·7636	+1·7615	+1·7626	+ 1·10	8·3047	C. B. ⊖ M. CXXV	144·2976	43·0381	Copper plug in north gable, about 2 feet above ground, of Michel Peloquin's brick house, on south side of post road.
B.M. 231...	B.M. 232... .	1·1196	—1·1998	—1·1968	—1·1983	— 1·50	4·0193	C. B. ● M. 232	145·1258	40·0772	Brass-headed nail in root, south-east side of ash tree, in Wilfred Peloquin's field, south side of post road.
B.M. 232...	B.M. 233.....	0·7671	—3·2051	—3·2120	—3·2086	+ 3·40	30·1395	C. B. ● M. 233	145·8929	36·8686	Brass-headed nail in root, north-west side of ash tree, close to north-east fence of Edouard Blais's farm, 3 feet east of road fence.
B.M. 233. .	B.M. CXXVI	0·5836	+9·0147	+9·0236	+9·0192	— 4·40	66·3468	C. B. ⊖ M. CXXVI	146·4765	45·8878	Copper plug in north-east gable of Louis Cartier's story and a-half brick-veneered house, with good stone foundation, on south side of post road.
Carried	forward	5·0405	—0·4914	—0·4412	—0·4663	—25·10	769·2070				

IX.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued.*

ABSTRACT of Results, Section No. 9, Sorel to Varennes (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A ← B)	Difference of Height. Line B. (B ← A)	Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B.M. W.S. ST. &c.	Distance from Lévis Graving Dock *vid* line of levels.	Elevation, above + below —approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet.			Miles.	Feet.	
Brought	forward	5·0405	— 0·4914	— 0·4412	— 0·4663	—25·10	769·2070				*Parish of St. Joseph de Sorel*—Con.
B.M. CXXVI	B.M. 234.....	0·9611	— 3·0808	— 3·0964	— 3·0886	+ 7·80	126·6049	C. B. ● M. 234	147·4376	42·7992	Brass-headed nail in root of large elm stump, opposite François Laparade's house and on west side of post road.
											Parish of La Sainte Trinité de Contrecœur.
B.M. 234...	B.M. 235.....	0·3684	+17·9762	+17·9665	+17·9714	+ 4·90	130·3474	C. B. ● M. 235	147.8060	60·7706	Small cavity made (at S.W. end) in top of boundary stone planted May, 1775, by S. Z. Watson, D.P.S., west side of post road, in division line between parishes of St. Joseph de Sorel and la Ste. Trinité de Contrecœur.
B.M. 235...	B.M. CXXVII.	1·2600	— 7·4734	— 7·4713	— 7·4724	— 1·10	1·1269	C. B. ⊖ M. CXXVII	149·0660	53·2982	Copper plug in south-west gable of Pierre Vendal's story and a-half brick house on south side of post road.
B.M. CXVII.	B.M. 236.....	0·8838	—12·6530	—12·6512	—12·6521	— 90	1·8330	C. B. ● M. 236	159·9498	40·6461	Brass-headed nail in root south side of white birch tree on river bank, about opposite Auclair's property.

[1891]

B.M. 236 ...	B.M. 237.....	1·1558	+ 6·4100	+ 6·4048	+ 6·4074	+ 2·60	11.6976	C. B. ● M. 237	151·1056	47·0555	Brass-headed nail in root east side of small elm tree, about 3 feet west of road on Joseph Mainville's property.
B.M. 237 ...	B.M. 238	0·9877	+ 1·0171	+ 1·0152	+ 1·0162	+ 1·00	2·0249	C. B. ● M. 238	152·0933	48·0697	Brass-headed nail in root of large ash tree, about 2 feet west of post road fence, opposite M. Duhamel's property.
B.M. 238 ...	B.M. 239 . ..	1·2250	+ 2·3413	+ 2·3668	+ 2·3540	—12·80	267·4939	C. B. ● M. 239	153·3183	50·4237	Brass-headed nail in root, north-west side of large elm tree on Gilbert Rousseau's land, close to fence, west side of post road.
B.M. 239 ...	B.M. 240	0·7371	+ 5·9985	+ 5·9729	+ 5·9857	+12·80	444.5530	C. B. ● M. 240	154·0554	56·4094	Brass-headed nail on top of small willow stump close to Joseph Millet's house on west side of post road.
B.M. 240 ...	B.M. 241	0·9123	+16·3401	+16·3465	+16·3433	— 3.20	22·4487	C, B. ● M. 241	154·9677	72·7527	Brass-headed nail in root of small elm tree, on Magloire Fortier's property, one foot inside of fence, east side of post road.
B.M. 241 ...	B.M. 242	0·3991	— 0·9462	— 0·9444	— 0 9453	— 90	4·0590	C. B. ● M. 242	155·3668	71·8074	Small cavity on top of boundary stone at west end of St. Ours Seigniory, west side of post road, on Louis Millot's property.
B.M. 242 ...	B.M. 243	0·7740	—23·5941	—23·6088	—23·6015	+ 7·30	137·5711	C. B. ● M. 243	156·1408	48·2059	Brass-headed nail in root, north-east side of large elm tree, east side of post road, on Joseph Lamoureux's property.
B.M. 243...	B.M. CXXVIII	0·6621	+ 1·1584	+ 1·1640	+ 1·1612	— 2·80	23·6822	C. B. ⊖ M. CXXVIII	156·8029	49·3671	Copper plug in stone foundation (S.W. corner) of Jos. Dione's story and a-half brick house, on east side of post road.
B.M. CXXVIII...	B.M. CXXIX	0·8191	+ 0·8270	+ 0·8049	+ 0·8160	+11·10	300·8424	C. B. ⊖ M. CXXIX	157·6220	50·1831	Copper plug on lower stone course, 13 inches above steps, north corner of Contrecœur church front, on east side of post road.
Brought	forward	16·1860	+ 3·8297	+ 3·8283	+ 3·8290	+ 0·70	2243·4920				

IX.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued.*

ABSTRACT of Results, Section No. 9, Sorel to Varennes (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A)	Line B. (B)	Mean.	V. Difference from Mean.	$\frac{2V^2}{M}$	B. M. W. S. ST. &c.	Distance from Levis Graving Dock *viâ* line of Levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward		16·1860	+ 3·8297	+ 3·8283	+ 3·8290	+ 0·70	2243·4920				*Parish of La Sainte Trinité de Contrecœur*—Con.
B.M. CXXIX	B.M. 244.....	1·1553	—12·8160	—12·8134	—12·8147	— 1·30	2·9257	C. B. ● M. 244	158 7773	37·3684	Brass-headed nail in root east side of elm tree, near small road bridge, opposite Mathias Giguere's land, on east side of post road.
B.M. 244....	B.M. 245.....	1·3743	+ 4·5220	+ 4·5058	+ 4·5139	+ 8·10	95·4814	C. B. ● M. 245	160·1516	41·8823	Brass-headed nail on root of tree 60 ft. north-east of line fence between François Lacroix and Clément Hubert, east side of post road.
B.M. 245....	B.M. 246.....	1·5900	— 3·0770	— 3·0569	— 3·0670	—10·10	128·3145	C. B. ● M. 246	161·7416	38·8153	Brass-headed nail in root west side of ash tree, 80 ft. west of Maxime Boisjoli's old house and 50 ft. east of old post road.
B.M. 246....	B.M. CXXX.	0·4365	+ 4·6254	+ 4·6215	+ 4·6234	+ 1·90	16·5407	C. B. ⊖ M. CXXX	162·1781	43·4387	Copper plug in front of Jos. Dansereau's stone house. 8·9 ft. from S.W. corner, 3 ft. above ground, east side of post road.

											Parish of Saint François-Xavier de Verchères.
B.M. 246...	B.M. 247.....	1·4050	+ 0·8770	+ 0·9024	+ 0·8897	—12·70	229·5943	C. B. ● M. 247	163·1466	39·7050	Brass-headed nail in root west side of balm of Gilead tree, close to fence on east side of post road, opposite Alphonse Dupré's land.
B.M. 247....	B.M. CXXXI	1·2047	+ 7·3638	+ 7·3691	+ 7·3665	— 2·60	11·2227	C. B. ⊖ M. CXXXI	164·3513	47·0715	Copper plug in wall above verandah floor, south side of front door of Pierre Chicoine's stone house on north-east side of post road.
B.M. CXXXI	B.M. 248.....	1·2497	+14·8659	+14·8570	+14·8614	+ 4·40	30·9831	C. B. ● M. 248	165·6010	61·9329	Brass-headed nail in root of poplar tree, west side of post road, near Louis Dion's house.
B.M. 248....	B.M. CXXXII.	0·9235	+ 8·1892	+ 8·1872	+ 8·1882	+ 1·00	2·1657	C. B. ⊖ M. CXXXII	166·5245	70·1211	Copper plug on base of pillar, north-west side of main entrance door to Verchères R. C. parish church, on east side of post road.
B.M. 248...	B.M. CXXXIII.	0·9230	+ 8·3456	+ 8·3435	+ 8·3446	+ 1·10	2·5547	C. B. ⊖ M. CXXXIII	167·4475	70·2775	Copper plug in stone plinth on south-east side of Priest's house, 7 ft. from S. E. corner, on east side of post road.
B.M. CXXXII	B.M. 249.....	1·2402	+ 1·9030	+ 1·9231	+ 1·9131	—10·00	161·2643	C. B. ● M. 249	167·7647	72·0342	Brass-headed nail in root of large ash tree, near road fence, in Alfred Pigeon's field, east side of post road.
B.M. 249...	B.M. 250.....	1·0438	— 7·2327	— 7·2175	— 7·2251	— 7·60	110·6725	C. B. ● M. 249	168·8085	64·8091	Brass-headed nail in root of elm tree, near eastern road fence, opposite Norbert Geoffrion's property.
											Parish of Ste. Anne de Varennes.
B.M. 250...	B.M. CXXXIV.	0·8846	+ 9·2018	+ 9·1912	+ 9·1965	+ 5·30	63·5089	C. B. ⊖ M. CXXXIV	169·6931	74·0056	Copper plug in stone, north-east gable of Urgèle Cadieux's house, on north-west side of post road.
Carried	forward	28·2571	+27·6267	+27·6763	+27·6515	—24·80	3079·6251				

IX.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued.*

ABSTRACT of Results, Section No. 9, Sorel to Varennes (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A ← / → B)	Difference of Height. Line A. (A → / ← B)	Difference of Height. Mean.	V. Difference from Mean.	$2V^2/M$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward.....		28·2571	+27·6267	+27·6763	+27·6515	—24·80	3079·6251				*Parish of St. François-Xavier de Verchères*—Concluded.
B.M. CXXXIV..	B.M. 250½ ...	1·1931	— 4·5490	— 4·5442	— 4·5466	— 2·40	9·6555	C. B. ● M. 250½	170·8862	69·4590	Brass-headed nail in root of large elm tree on Eustache Bissonnette's property, west side of post road.
B.M. 250½..	B.M. 271. ...	1·8107	—16·4742	—16·4779	—16·4761	+ 1·80	3·5787	C. B. ● M. 271	172·6969	52·9829	Brass-headed nail in root of large elm tree, close to road fence on Fabien Lozeau's property, west side of post road.
Totals..	.....	31·2609	+ 6·6035	+ 6·6542	+ 6·6288	—25·40	3092·8593				

Section No. 9 = 31·2609 miles.

Mean error per mile..... M = 0·00712 foot. Probable error per mile..... M = 0·6745 M = 0·00480 foot.

Mean error for whole distance..... μ = 0·03980 foot. Probable error for whole distance.... μ = 0·6745 μ = 0·02685 foot.

X.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued.*

ABSTRACT of Results, Section No. 10, Caughnawaga to Varennes (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A →)	Line B. (← B)	Mean.	V. Difference from Mean.	$2V^2/M$.	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *vid* line of levels.	Elevation above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
[1891]											*Parish of Sault St. Louis.*
.....	....	.....	.....	.....	.....	.....	.....	C. B. △ M.	206·6313	136·2105	B. M. △—Chisel mark on coping, about 4 inches below top, near inner corner, S. E. angle southern abutment C. P. R. bridge, Caughnawaga.
B. M. △	B. M. 251.....	0·8776	—49·2583	—49·2505	—49·2544	— 3·90	34·6627	C. B. ● M. 251	205·7537	86·9561	B. M. 251—Brass-headed nail in root west side of elm tree in Lazaire Dailbout's field, about 150 feet south of road fence.
B. M. 251...	B.M. CXXXV..	0·8580	— 7·4752	— 7·4686	— 7·4719	— 3·30	25·3846	C. B. ⊖ M. CXXXV	206·6117	79·4842	B. M. CXXXV—Copper plug in third course from ground, south-west face of abutment new of C. P. R. bridge, Caughnawaga side of St. Lawrence.
B. M. 251...	B. M. 252.....	0·9115	—12·4000	—12·3934	—12·3967	— 3·30	23·8947	C. B. ● M. 252	204·8422	74·5594	B. M. 252—Brass-headed nail in root of small balm of Gilead tree, west side of post road on Ignace Chicot's property.
B. M. 252...	B. M. 253.....	1·1767	+ 4·2248	+ 4·2094	+ 4·2171	+ 7·70	100·7734	C. B. ● M. 253	203·6655	78·7765	B. M. 253—Brass-headed nail driven horizontally into telegraph pole on Joseph Rinfret's property, east side of post road.
Carried	forward	2·9658	—57·4835	—57·4345	—57·4340	+ 0·50	159·3308				

X.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued.*

ABSTRACT of Results, Section No 10, Caughnawaga to Varennes (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A → B)	Line B. (B → A)	Means.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis *viâ* Graving Dock line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward		2·9658	— 57·4335	— 57·4345	— 57·4340	+ 0·50	159·3308				*Parish of Sault St. Louis*—Concluded.
B. M. 253...	B. M. 254.....	0·5498	— 6·2098	— 6·2277	— 6·2188	+ 8·90	288·1411	C. B. ● M. 254	203·1157	72·5577	B. M. 254—Brass-headed nail in root of elm tree, east side of post road, about 3 feet from road fence on Thomas Seer's property.
											Parish of La Nativité de Laprairie.
B. M. 254...	B.M. CXXXVI.	0·6480	+ 4·2080	+ 4·2117	+ 4·2099	— 1·80	10·0900	C. B. ⊖ M. CXXXVI	202·4677	76·7672	B M. CXXXVI—Copper plug in north-east gable of J. E. Cherrier's brick house, in 6th course above stone foundation, near rear or north-east corner.
B.M. CXXXVI.,...	B. M. 255.....	1·1589	—17·1523	—17·1541	—17·1532	+ ·90	1·3979	C. B. ● M. 255	201·3088	59·6144	B. M. 255—Brass-headed nail in root of large elm tree on river side of post road, opposite Ste. Catherine's school-house and Gilbert Brousseau's land.
B. M. 255...	B. M. 256....	1·0350	+ 0·9914	+ 0 9651	+ 0·9783	+13·20	336·6957	C. B. ● M. 256	200·2738	60·5927	B. M. 256—Brass-headed nail in root of large balm of Gilead tree near centre of main road, opposite Louis Guérin's property and La Tortue wharf.

B.M. 256....	B.M. CXXXVIII..	0·9662	+ 5·3124	+ 5·3265	+ 5·3194	— 7·10	104·3469	C. B. ⊖ M. CXXXVII	199·3076	65·9121	B. M. CXXXVII—Copper plug in north gable of Moïse Brault's story and a-half brick house at junction of roads to St. Pierre and Caughnawaga.
B.M. CXXXVII..	B.M. 257.....	0·6417	— 3·2151	— 3.2187	— 3·2169	+ 1·80	10·0982	C. B. ⊖ M. 257.	198·6659	62·6952	B. M. 557—Brass-headed nail on root, east side of large ash tree, near line fence between Pierre and Alphonse Brousseau.
B.M. 257....	B.M. CXXXVIII..	0·9292	— 1·5773	— 1·5647	— 1·5710	— 6·30	85·4283	C. B. ⊖ M. CXXXVIII	196·7367	61·1242	B. B. CXXXVIII—Copper plug in stone quoin, north-east corner of S. Pagnuelo's cut stone house on east side of Post Road.
B.M. CXXXVIII..	B.M. CXXXIX.	1·2260	+ 1·4904	+ 1·4641	+ 1·4772	+13·10	279·9511	C. B. ⊖ M. CXXXIX	196·5107	62·6014	B.M. CXXXIX—Copper plug in stone plinth 1·35 ft. above entrance step at north-west corner of Roman Catholic parish church, village of Laprairie.
B.M. CXXXIX....	B.M. 258.....	0·3950	—14·8615	—14·8524	—14·8570	— 4 60	107 1392	C. B. ● M. 258.	196·1157	47·7444	B. M. 258—Brass-headed nail in root north-west side of a group of large balm of Gilead trees on east side of Post Road, some 350 ft. below wharf.
B.M. 258....	B.M. 259.....	1·4032	+ 2·8482	+ 2·8446	+ 2·8464	+ 1·80	4·6180	C. B. ● M. 259.	194·7125	50·5908	B. M. 259—Brass-headed nail in in root of large elm stump in gully, about 250 ft. east of road, on Alexis Moquin's field.
B.M. 259....	B.M. CXL...	1·3823	+11·8592	+11·8741	+11·8667	— 7·40	79·2303	C. B. ⊖ M. CXL	193·3302	62·4575	B. M. CXL—Copper plug in 3rd course above foundation, 3·2 ft. from north-west corner of X. Perrat's story and a-half brick house on east side of Post Road.
B.M. CXL.	B.M. 260.....	0·9709	—12·4116	—12·4323	—12.4220	+10·30	218·5395	C. B. ● M. 260.	192·3593	50·0355	B. M. 260—Brass-headed nail in root of large elm tree east side of Post Road, close to fence, on Moïse Genest's property.
Carried	forward	14·2720	—86·1515	—86·1983	—86·1750	+23·30	1684·9168				

X.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued.*

ABSTRACT of Results, Section No. 10, Caughnawaga to Varennes (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A → B.)	Difference of Height. Line B. (B → A.)	Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *vid* line of level.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Feet.	Feet.	
Brought	forward	14·2720	—86·1515	—86·1983	—86·1750	+23·30	1684·9168				*Parish of La Nativité de Laprairie* —Continued.
B.M. 260...	B.M. 261.....	1·1183	+ 3·0290	+ 3·0205	+ 3·0248	+ 4·30	33·0680	B. ● M. 261.	191·2410	53·0603	B.M. 261—Brass-headed nail on root of elm tree east side of Post Road, on the property of Jos. David.
B.M. 261....	B.M. CXLI..	0·9400	+ 2·4859	+ 2·4704	+ 2·4782	+ 7·80	129·4468	C. B. ⊖ M. CXLI	190·3010	55·5385	B.M. CXLI—Copper plug in 3rd course of stone, west side of passage way under G. R. Ry. track, on road along river.
B.M. CXLI	B.M. 262.	0·9492	− 8·6472	− 8·6344	− 8·6408	− 6·40	86·3043	C. B. ● M. 262	189·3518	46·8977	B.M. 262—Brass-headed nail on root west side of large elm tree on west side of post road, opposite the property of Messrs. Marcoux, Barsalou & Co.
B.M. 262.. .	B.M. 263.....	1·2837	− 1·9386	− 1·9588	− 1·9487	+10·10	158·9312	C. B. ● M. 263	188·0681	44·9490	B.M. 263—Brass-headed nail on root south side of large balm of Gilead tree about 75 feet west of post road, on Michel Camille's property.
B.M. 263...	B.M. CXXIII	1·3081	+11·8632	+11·8719	+11·8675	− 4·40	29·6002	C. B. ⊖ M. CXXIII	186·7600	56·8165	B.M. CXXIII—Copper plug in third course of cut stone base, north-east side of Longueuil parish church, near side entrance steps south-west side of road to Chambly Basin.

[1891]

B.M. CXXIII	B.M. 264.....	1·0645	− 9·2408	− 9 2400	− 9·2404	− ·40	·3006	C. B. ● M. 264	185·6955	47·5761	B.M. 264—Brass-headed nail in root of large elm tree on east side of post road, opposite the property of Toussaint Obertin.
B.M. 264....	B.M. 265.....	1·0558	− 1·7803	− 1·7532	− 1·7668	−13·60	350·3694	C. B. ● M. 265	185·6397	45·8093	B.M. 265—Brass-headed nail in root of large elm tree, east side of post road, opposite the property of Arsène Charron.
B.M. 265....	B.M. 266.....	1·0667	− 1·9762	− 1·9716	− 1·9739	− 2·30	4·2186	C. B. ● M. 266	183·5730	43·8354	B.M. 266—Brass-headed nail in root of elm tree, east side of post road, about 20 feet north of fence line between Alex. Dubuc and Geo. Charron.
											Parish of Ste. Famile de Boucherville.
B.M. 266....	B.M. CXLII.	1·1721	+ 2·4654	+ 2·4551	+ 2·4603	+ 5·20	46·1394	C. B. ⊖ M. CXLII	182·4009	46·2957	B.M. CXLII—Copper plug in third row of bricks above stone work, 4 feet from N.W. corner of Antoine Vinet's story and a-half brick house.
B.M. CXLII.	B.M. 267.....	0·8485	− 2·8763	− 2·8706	− 2·8735	− 2·90	19·8221	C. B. ● M. 267	181·5524	43·4222	B.M. 267—Brass-headed nail in root west side of elm tree, in fence line between Jos. Durocher and Toussaint Sicotte, east side of road.
B.M. 267....	B.M. CXLIII	0·8690	+11·7255	+11·7124	+11·7190	+ 6·60	100·2532	C. B. ⊖ M. CXLIII	180·6834	55·1412	B.M. CXLIII—Copper plug in second quoin above steps at S. W. corner of Roman Catholic parish church, east side of post road, village of Boucherville.
B.M. CXLIII	B.M. CXLIV	1·4425	− 6·5552	− 6·5342	− 6·5447	−10·50	152·8596	C. B. ⊖ M. CXLIV	179·2409	48·2963	B.M. CXLIV—Copper plug in stone of foundation under centre of window sill, near S.E. corner of story and a-half brick house belonging to François Birtz.
B.M. CXLIV.	B. M. 268.....	1·3501	— 9·9686	— 9·9707	— 9·9697	+ 1·00	1·4824	C. B. ● M. 268	177·8908	38·6268	B. M. 268—Brass-headed nail in root on south side of large balm of Gilead tree, about 130 ft. west of farm road in Chas. Dubois' field, north-west side of post road.
	Carried forward.....	28·7405	−97·5657	−97·6015	−97·5837	+17·80	2797·7128				

X.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued.*

ABSTRACT of Results, Section No. 10, Caughnawaga to Varennes (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A → B)	Line B. (B → A)	Mean.	V. Difference from Mean.	$2V^2/M$.	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *vid* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought	forward.....	28·7405	—97·5657	—97·6015	—97·5837	+17·80	2797·7128				*Parish of Ste. Anne de Varennes.*
B. M. 268...	B. M. 269.....	1·6990	— 2·8679	— 2·8715	— 2·8697	+ 1·80	3·8141	C. B. ● M. 269	176·1918	35·7571	B. M. 269—Brass-headed nail in root, south side of elm tree, about 300 ft. west of road, near fence line between Eusèbe Savariat and Ambroise Savariat.
B. M. 269...	B. M. CXLV.	1·1281	+24·2180	+24·2188	+24·2184	— ·40	·2837	C. B. ⊖ M. CXLV	175·0637	59·9755	B. M. CXLV—Copper plug in second course of stone plinth, south side of new R. C. parish church, village of Varennes, under west end of first window from the front.
B. M. CXLV.	B. M. 270....	0·7537	—11·5518	—11·5392	—11·5455	— 6·30	105·3191	C. B. ● M. 270	174·3100	48·4300	B. M. 270—Brass-headed nail in root of large elm tree, on west side of post road, in L. H. Massue's field.
B. M. 270...	B. M. 271...	1·6131	+ 4·5504	+ 4·5554	+ 4·5529	— 2·50	7·7491	C. B. ● M. 271	172·6969	52·9829	B. M. 271—Brass-headed nail in root of large elm tree on west side of post road, close to fence on the property of Fabien Lozeau, at sharp turn of road.
Grand	totals.....	33·9344	—83·2170	—83·2380	—83·2276	+10·40	2914·8788				

Section No. 10 = 33·9344 miles.

Mean error per mile..... .... M = 0·00675 feet.

Mean error for whole distance .... μ = 0·03931 do

Probable error per mile..... .... M = 0·6745 M = 0·00455 feet.

Probable error for whole distance .... μ = 0·6745 μ = 0·02652 do

XA.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued.*

ABSTRACT of Results, Section No. 8½, Chambly Basin to Longueuil (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A → B)	Difference of Height. Line B. (B → A)	Difference of Height. Mean.	V. Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *vid* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
											Parish of St. Joseph de Chambly.
								C. B. ● M. 63	198·8354	40·7045	Brass-headed nail on top of large elm stump, near water's edge, north side of Little Montreal River, and about 60 feet west of post road bridge over this river.
B.M 63.....	B.M. 223.....	0·9254	+16·1321	+16·1420	+16·1371	- 4·9	51·8911	C. B. ● M. 223	197·9100	56·8416	Brass-headed nail on root of large elm, south side of post road, in Debardeau's field, lot No. 110.
											Parish of St. Hubert.
B.M. 223....	B.M. CXVIII	0·9624	+29·6467	+29·6332	+29·6399	+ 6·7	93·2876	C. B. ⊖ M. CXVIII	196·9476	86·4815	Copper plug in south-east gable end of Wilfred Daigneault's stone house, on north side of post road, lot No. 84.
B.M. CXVIII	B.M. 224.....	1·3204	+6 ·1312	+ 6·1014	+ 6 1163	+14·9	336·2768	C. B. ● M. 224	195·6272	92·5978	Brass-headed nail on root of large elm tree, south side of post road, on Alfred Brassard's property, lot No. 98.
B.M. 224...	B.M. 225.....	0·8985	- 7·4040	- 7·3986	- 7·4013	- 2·7	16·2270	C. B. ● M. 225	194·7287	85·1965	Brass-headed nail on root of large elm tree, on south side of post road, in Benjamin Brassard's field, lot No. 107.
Carried forward.		4·1067	+44·5060	+44·4780	+44·4920	+14·0	497·6825				

XA.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Concluded.*

ABSTRACT of Results, Section No. 8½, Chambly Basin to Longueuil (Continuous line)—*Concluded:*

From	To	M. Distance.	Difference of Height. Line A. (A → B)	Difference of Height. Line B. (B → A)	Difference of Height. Mean.	V. Difference from Mean.	$2V^2/M$.	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *vid* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward		4·1067	+44·5060	+44·4780	+44·4920	+10·4	497·6825				*Parish of St. Hubert*—Concluded.
B.M. 225...	B.M. CXIX..	0·6633	− 1·8381	− 1·8490	− 1·8436	+ 5·4	87·9240	C. B. ⊖ M. CXIX	194·0654	83·3529	Copper plug in stone foundation, west side of J. B. E. Charron's house, south side of post road, lot No. 116.
B.M. CXIX	B.M. CXX...	1·5676	+ 5·0086	+ 5·0240	+ 5·0163	− 7·7	75·6443	C. B. ⊖ M. CXX	192·4978	88·3692	Copper plug in cut stone foundation of Antoine Rocheleau's stone house, on north side of post road, lot No. 38.
B.M. CXX.	B.M. 226.....	1·1041	+ 4·3506	+ 4·3561	+ 4·3534	− 2·7	13·2054	C. B. ● M. 226	191·3937	92·7226	Brass-headed nail on root of large elm tree alongside of post road fence, at Provost's blacksmith shop door, lot No. 32.
											Parish of St. Antoine de Longueuil.
B.M. 226...	B.M. CXXI..	0·7499	+15·2395	+15·2499	+15·2447	− 5·2	72·1296	C. B. ⊖ M. CXXI	190·6438	107·9673	Copper plug in east gable end of Hillaire Lamarre's stone house, south side of post road, on lot No. 116.
B.M. CXXI	B.M. 227.....	0·9254	−13·1072	−13·1318	−13·1195	+12·3	326·9721	C. B. ● M. 227	189·7184	94·8478	Brass-headed nail in root of large elm tree, in François Millette's field, lot No. 98.

[1891]

B.M. 227...	B.M. CXXII.	0·8531	+ 6·1543	+ 6·1295	+ 6·1419	+12·4	420·9588	C. B. ⊖ M. CXXII	188·8653	100·9897	Copper plug in north-east gable end of Pierre Benoit's stone house, south side of post road, at south-east end of lot No. 132.
B.M. CXXI..	B.M. 228.....	1·1369	—18·7340	—18·7107	—18·7224	—11·7	240·8128	C. B. ● M. 228	187·7284	82·2673	Brass-headed nail on root of large elm tree, south side of post road, in Damase Brissette's field.
B.M. 228...	B.M. CXXIII	0·9684	—25·4404	—25·4613	—25·4508	+10·5	227·6952	C. B. ⊖ M. CXXIII	186·7600	56·8165	Copper plug in cut stone basement wall near door in eastern side of Longueuil new R. C. church, on south-west side of road to Chambly.
Grand	Totals.....	12·0754	+16·1393	+16·0847	+16·1120	+27·3	1963·0247				

Section No. 8½ = 12·0754 miles.

Mean error per mile ..... = M = 0·00905 ft. Probable error per mile..... = $\grave{M}$ = 0·6745 M = 0·00611 ft.

Mean error for whole distance..... = μ = 0·03143 ft. Probable error for whole distance..... = $\grave{\mu}$ = 0·6745 μ = 0·02121 ft.

XA.—GEODETIC LEVELLING—RIVER ST. LAWRENCE– *Continued.*

Crossing of levels from Longueuil to Montreal viâ St. Helen's Island.

ABSTRACT of Results, Section No. 10½, east end of Montreal Harbour to Lachine C. P. R. Bridge (Continuous line).

From	To	M Distance.	Difference of Height. Line A. (A ← / B →)	Line B. (A → / B ←)	Mean.	V Difference from Mean.	$\frac{2V^2}{M}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below — approximate mean level Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
								C. B. ● M. 263	188·0681	44·9490	*Parish of St. Antoine de Longueuil.* B.M. 263—Brass-headed nail on root west side of large elm tree, north-west side of post road, opposite the property of Messrs. Marcoux, Barsalou & Co.
B.M. 263...	B.M.K.	1·4041	+39·0215	+39·0199	+39·0207	+ ·8	0·9116	C. B. ⊖ M. K.	189·4722	83·9697	*City of Montreal.* B.M.K.—Copper plug in solid rock, near closed in grounds, lower end and south side of St. Helen's Island, west side of road around island.
B.M.K. ..	B.M.M.....	1·6190	—36·5525	—36·5475	—36·5501	—2·6	8·3508	C. B. ⊖ M. M.	191·0922	47·4196	B.M.M.—Copper plug in third stone course above ground on east face southern abutment of C. P. R. bridge over Brock street, along Montreal Harbour front.
	Totals. .	2·0231	+ 2·4690	+ 2·4724	+ 2·4706	—1·8	9·2624				

Crossing from Longueuil to Montreal.

2·0231 miles.

Mean error per mile..... = M = 0·00152 foot. Probable error per mile..... = $\dot{M}$ = 0·6745 M = 0·00103 foot.

Mean error for whole distance..... = μ = 0·00216 foot. Probable error for whole distance ..... = $\dot{\mu}$ = 0·6745 μ = 0·00146 foot.

XA.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued*—1888-89.

ABSTRACT of Results, Section No. 10½, East end of Montreal Harbour to Lachine C. P. R. Bridge (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A → B)	Line B. (B → A)	Mean.	V. Difference from Mean.	$2V^2/M$.	B. M. W. S. ST. &c.	Distance from Lévis *viâ* Dock Graving line of levels.	Elevation, above + below — approximate mean level, Atlantic, Ocean established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
											City of Montreal.
.....	.....	...	.....	.....	.....	.....	.....	C. ⊖ B. M. L.	192·1662	43·8614	B.M. L.—Copper plug in stone course above ground, east corner of southern abutment of C.P.R. bridge on Forsyth street, leading to Longueuil ferry.
B.M. L.	B.M. M.	1·0740	+ 3·5715	+ 3·5449	+ 3·5582	+ 13·3	329·4041	C. ⊖ B. M. M.	191·0922	47·4196	B.M. M.—Copper plug in third stone course above ground on east face of southern abutment of C. P. R. bridge over Brock street, along Montreal Harbour.
B.M. M	B.M. N.	0·9075	+ 7·7485	+ 7·7350	+ 7·7418	+ 6·8	101·9063	C. ⊖ B. M. N.	191·9997	55·1614	B.M. N.—Copper plug in southern wall of Custom House, near north-west corner of Commissioners' and Port streets.
B.M. N	B.M. O.	0·2392	— 0·0540	— 0·0691	— 0·0616	+ 7·5	470·3177	C. ⊖ B. M. O.	192·2389	55·0998	B. M. O.—Copper plug on first quoin above front plinth course, near S. E. angle of Examining Warehouse on Commissioners' street, a few feet north of its intersection with McGill street.
B.M. N	B.M. P.	1·6791	— 10·9521	— 10·9581	— 10·9551	+ 3·0	10·7200	C. ⊖ B. M. P.	193·6788	44·2063	B.M.P.—Copper plug on northern or lower side of north shore abutment of Victoria Bridge. Bench is down on beach in third course of stone above ground.
Carried	forward	3·6606	+ 0·3679	+ 0·3218	+ 0·3449	+ 23·1	442·0304				

XA.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued*—1888-89.

ABSTRACT of Results, Section No. 10½, East end of Montreal Harbour to Lachine C.P.R. Bridge (Continuous line)—*Continued.*

From	To	M. Distance.	Difference of Height. Line A. (A→B)	Line B. (B→A)	Mean.	V. Difference from Mean.	$2V^2/M$.	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1889-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
Brought forward. ...		3·6606	+ 0·3979	+ 0·3218	+ 0·3449	+ 23·1	442·0304				*Parish of Montreal.*
B.M. P.....	B.M. Q.....	1·8330	+ 10·6428	+ 10·6346	+ 10·6387	+ 4·1	18·3415	B. C. M. Q.	195·5118	54·8450	B.M. Q.—Copper plug in stone course, under lintel of basement window, front of St. Henri water-works pump-house, about 3 feet from its north-west corner.
B.M. Q.....	B.M. l.....	1·1571	+ 0·6767	+ 0·6849	+ 0·6808	— 4·1	29·0554	B. C. M. l.	196·6689	55·5258	B.M. l.—Brass-headed nail on top of fence post, east side of Lachine River road.
B.M. l.....	B.M. m.....	0·5778	+ 0·7985	+ 0·8049	+ 0·8017	+ 3·2	35·4448	B. C. M. m.	197·2467	56·3275	B.M. m.—Brass-headed nail on root, west side of elm tree, edge of river bank, opposite lot No. 4672, owned by Hugh Stephen.
B.M. m.....	B.M. n.....	0·7864	+ 1·1849	+ 1·1614	+ 1·1732	+ 11·8	354·1200	B. C. M. n.	198·0331	57·5007	B.M. n.—Brass-headed nail on root of short maple tree, nearly opposite the Verdun ferry landing at S. Stephenson's upper line.
B.M. n.....	B.M. o.....	0·5285	+ 5·7479	+ 5·7301	+ 5·7390	+ 8·9	299·7540	B. C. M. o.	198·5616	63·2397	B.M. o.—Brass-headed nail on root, west side of maple tree, on east side of Lachine lower road and opposite the residence of Samuel Greenshields, Esq.

										Parish of Lachine.
B.M. o. . .	B.M. p.	0·5434	— 8·7308	— 8·7466	— 8·7387	+ 7·9	229·7019	B. C. ● p M.	199·1050	54·5010	B.M. p—Brass-headed nail in south side of elm tree, on south side of Lachine lower road, opposite centre of lot No. 999, owned by Frederick Mathews.
B.M. p.	B.M. q.	0·8478	+ 5·9784	+ 5·9797	+ 5·9791	— ·6	·8493	B. C. ● q M.	199·9528	60·4801	B.M. q—Brass-headed nail in root of elm tree, east side of Lachine River road, nearly opposite centre of lot No. 995*a*, part of the estate of the late H. Fraser, Esq.
B.M. q.	B.M. r.	0·6667	+12·2886	+12·2841	+12·2864	+ 2·3	15·8692	B. C. ● r M.	200·6195	72·7665	B.M. r—Brass-headed nail on root, west side of elm, on west side of Lachine lower road, opposite east end of lot No. 993, owned by D. McDonald.
B.M. r.	B.M.R.	0·8858	+ 6·0372	+ 6·0414	+ 6·0393	— 2·1	9·9571	B. C. ⊙ R M.	201·5053	78·8058	B.M.R.—Copper plug in 5th course of cut stone above springing of arches of bridge over old Montreal water works canal, north face of west pier.
B.M.R.	B.M. s.	0·8110	— 8·0598	— 8·0749	— 8·0674	+ 7·5	138·7176	B. C. ● s M.	202·3163	70·7384	B.M.s—Brass-headed nail on root, east side of balm of Gilead tree on beach, nearly opposite lower line of lot No. 973, owned by Daniel Fraser.
B.M. s.	B.M. t.	1·1065	+ 2·9761	+ 2·9848	+ 2·9805	— 4·3	33·4207	B. C. ● t M.	203·4228	73·7189	B.M. t—Brass-headed nail on root of balm of Gilead tree on beach, near lower side of Lachine C.P.R. bridge.
B.M. t.	B.M—.	0·0918	+26·3961	+26·3930	+26·3945	+ 1·5	49·0196	B. C. ⊖ M.	203·5146	100·1134	B.M.—Copper plug in second stone course from ground, S. W. or upper face of stone abutment of C.P.R. bridge, south side of Lachine lower or river road. Not numbered yet.
	Totals. . . .	13·4964	+56·3045	+56·1992	+56·2520	+59·2	1656·2815				

Section No. 10½ = 13·4964 miles.

Mean error per mile . . . . . = M = 0·00743 foot. Probable error per mile . . . . . = $\grave{M}$ = 0·6745 M = 0·00501 foot.

Mean error for whole distance . . . . . = μ = 0·02729 foot. Probable error for whole distance. . . . . = $\grave{\mu}$ = 0·6745 μ = 0·01841 foot.

XA.—GEODETIC LEVELLING—RIVER ST. LAWRENCE—*Continued*—1888-89.

ABSTRACT of Results, Section No. 11, Caughnawaga to Cedars (Continuous line—incomplete).

From	To	M. Distance.	Difference of Height. Line A (A ← / → B)	Line B.	Mean.	V Difference from Mean.	$\frac{2V^2}{M.}$	B. M. W. S. ST. &c.	Distance from Lévis Graving Dock *viâ* line of levels.	Elevation, above + below — approximate mean level, Atlantic Ocean, established at Quebec by R. Steckel, 1880-82.	Locality, &c.
		Miles.	Feet.	Feet.	Feet.	Feet. / 1000			Miles.	Feet.	
								C. B. ◇ M.	266·6313	136·2105	*Parish of Sault St. Louis.* B.M. ◇—Chisel mark made on coping about 4 inches below top, near inner corner, S. E. angle, southern abutment of C. P.R. bridge at Caughnawaga.
											Parish of Lachine.
B.M. ◇	B.M.—.	0·9135	−36·2294	−36·2128	−36·2211	−8·3	150·8265	C. B. ⊖ M.	207·5448	99·9894	B.M.—Copper plug in second stone course above ground, S. W. or upper face of stone abutment of C.P.R. bridge, about 25 feet south of Lachine lower road.
B.M—on C. P.R. bridge	B.M—on Lachine church.	1·2076	−11·0122	−11·0091	−11·0107	−1·6	4·2400	C. B. ⊖ M.	208·7524	88·9787	B.M.—Copper plug in third course of stone above foundation, front of buttress, S. E. corner R. C. parish church, Lachine village.

TIDAL PHENOMENA.

The tides are all, as is well known, secondary effects of the force by which the sun, earth and moon are believed to attract each other, viz., the force of gravitation.

Although containing 27,000,000 times less matter than the sun, the moon, on account of being nearly 400 times nearer to the earth, produces tidal undulations about two and a-half times greater than those which the sun gives rise to. Owing to the largely preponderating influence of the moon, the tidal undulations follow this body in her motions about the earth, generally with comparatively slight variations.

It is often explained that the tidal intumescence is one of the immediate or direct effects of the variation of the intensity of gravitation, which force makes itself felt in the inverse ratio of the square of the distance between the centre of gravity of any quantity of matter subjected to it and that of the attracting body; the consequence being that every wave has to move, so that its summit or crest may always be approximately in the meridian plane, which passes through the last named body, when either above or below the horizon. It is claimed at the same time that this summit would be found to coincide with the meridian plane just mentioned out in the ocean, were it not for the interference with the regular propagation of the wave by such disturbing elements as: abrupt changes in the depths of the sea, islands, jagged coast lines of continents, etc., etc.

This may be termed the statical conception of the tidal phenomenon, according to which the water is supposed to take at every instant, the position of equilibriums, which suits the momentary intensity and direction of the forces at work.

That the diminution or increase of weight which obtains in all matter subjected to the attracting influence of heavenly bodies, is not sufficient to account satisfactorily for the formation of tidal waves, is demonstrated by the ascertained fact that the action of the moon at the surface of the earth is but one twelve-millionth ($\frac{1}{12,000,000}$) part of that of gravity at the same place, while that of the sun is less than $\frac{1}{25,000,000}$, or less than half that of the moon.

Instead of being a vertical displacement of liquid molecules or piling up of the same of a hydrostatic nature, directly induced by the varying attraction of the heavenly bodies, the primary cause of the formation of all tide waves has recently been proved to be the conversion into hydraulic head, of the living force of opposing horizontal currents of about equal strength, to which slight changes in the direction of the vertical brought about by the attracting bodies give rise. Moreover, the wave motion is not simply periodical, but of the pendular kind; the oscillation body moving always past its position of stable equilibrium and in a direction opposed to that of the force acting upon it, by virtue of the acquired velocity.

According to this, the dynamical conception of the phenomenon, the momentary state of equilibrium corresponding to high water is realized in the natural order of things, when the tide is low and *vice versa*, which theory affords a rational and satisfactory explanation of the long interval that generally elapses between the passage of the moon over the meridian and the occurrence of the next succeeding high water, even at the most exposed points along or off the sea coasts of both the old and the new continent.

The tides of the north Atlantic are believed to be contemporaneous on the European and American coasts, that is to say, that the tides that are felt about the same absolute time on the western coast of Europe and the eastern coast of North America, apparently correspond to the same transit of the moon over the meridian passing through a point in the oceanic region where all Atlantic tides may be considered to originate, and which may be termed their common focus. On both coasts each wave is believed to be at least 36 hours, or 1½ lunar days, behind the passage of the moon which gives

rise to it, over the focus meridian; judging by the data afforded by long series of observations made on both sides of the Atlantic.

It is found that when:

V represents the mean rate of propagation or velocity of a tide wave,
L its length,
H the mean depth of the water in which it moves,
T the time occupied by it in travelling over a distance equal to its length, or the duration of its oscillation,
h the semi-amplitude,
v the mean velocity of the stream of flood,
λ the length of the zone of flood, equal for long waves to $\frac{L}{2}$,
l the length of the excursion of or path followed by a particle of water in the stream,
g the acceleration of gravity = 32·16 ft. per second, the whole as exemplified in diagram A,

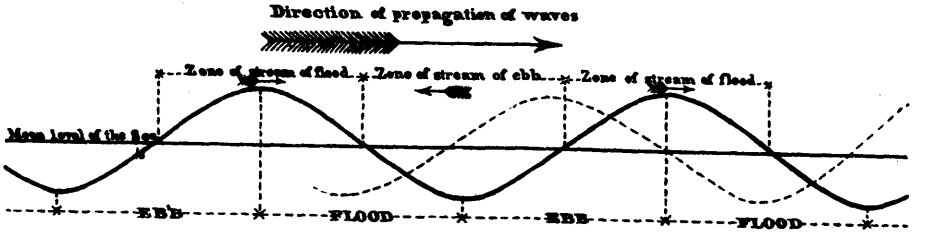


Diagram A.

the following relations hold good, in general, for long sea waves:

$$V = \sqrt{gH} = \frac{L}{T},$$

$$H = \frac{V^2}{g} = \frac{L^2}{T^2 g},$$

$$L = TV = T\sqrt{gH},$$

$$h = \frac{66}{\sqrt{H}},$$

$$v = \frac{h\sqrt{g}}{\sqrt{H}},$$

$T = \frac{L}{V}$, equal, on an average, 12·25 hours = 44,700 seconds,

λ = for long waves, $\frac{L}{2}$,

$$l = \frac{\lambda - h}{H - h}.$$

(*a*) Assuming that in mid-Atlantic the average depth H is 10,000 feet, we find with the aid of the above formulas:

V = 567 ft., L = 25,175,000 ft., h = 0·66 ft., v = 0·037 ft. per second, l = 831 ft.

(*b*) According to the indications of the Admiralty Charts and the St. Lawrence Pilot, the Atlantic wave enters the Gulf of St. Lawrence *vid* Cabot Strait, the southern pass between Newfoundland and Cape Breton Island, in a north-westerly direction towards the Magdalen Islands. Its summit passes opposite Cape Race, at the south-eastern ex-

tremity of Newfoundland and in longitude 53° west, at VII h. on full and change days; and in Amherst Harbour, in longitude 62° on Amherst Island, the most southern one of the Magdalen group, high water was observed to occur at VIII h. 20m. full and change.

If the Atlantic tidal oscillation was propagated in a direction parallel to the southern coast of Newfoundland, by allowing 36 minutes time for the difference of longitude between Cape Race and Amherst Harbour, we would have along this stretch of about 360 nautical miles: $V = \frac{360\text{ m.} \times 6076{\cdot}5\text{ ft.}}{6960\text{ sec.}} = 315$ ft. per second, whence the average depth H of the sea in which the wave moves, as given by the formula: $H = \frac{V^2}{g}$ should be 3,090 feet, which is three to four times greater than the actual depth ascertained by sounding.

The cotidal lines seem to indicate that the tide wave proceeds through Cabot Strait in a more northerly direction, than that indicated by the general outline of the southern coast of Newfoundland from Cape Race to Cape Ray.

Taking 200 fathoms to be the mean depth H in the approach to the southern entrance to the Gulf of St. Lawrence from a point opposite Cape Ray to the Magdalens, the more probable rate of propagation is found to be approximately:

$$V = \sqrt{32{\cdot}16 \times 1{,}200} = 196{\cdot}4 \text{ feet.}$$

Moreover, the general relations given above afford in such case the following results, viz.:—Semi-amplitude $h = 1{\cdot}905$ ft., whence the total rise and fall $= 2h = 3{\cdot}81$ ft., which does not differ materially from some of the amplitudes actually observed; also $L = 8{,}799{,}000$ ft. and $v = 0{\cdot}31$ ft. Again, by making $\lambda = \frac{L}{2} = 4{,}399{,}500$ feet, we obtain: $l = 14{\cdot}013$ feet.

With an average velocity of 196·4 ft. instead of 315 ft., the distance over which the wave travels from a point opposite Cape Ray, say in longitude 56° west, where it is high water at full and change at VII h., up to a point opposite the Magdalens in longitude 61° 30' where the corresponding time of high water is VIII h. 20m., is found to be 6,120 sec. × 196·4 ft. = 1,201,968 ft. = 198 nautical miles instead of 360.

On account of Cabot Strait being from six to seven times as wide and from six to seven times as deep as the Straits of Belle-Isle, affording, therefore, a passage say forty-five times as large, the tidal fluctuations of the St. Lawrence estuary are chiefly governed by the water admitted from the sea through this, the southern inlet; the undulation which finds its way through the northern inlet, manifesting itself rather as a disturbing element of the regular propagation of the principal wave than otherwise.

After passing into the Gulf between Cape Breton Island and the south-western end of Newfoundland, the incoming southern wave may be divided into four sections, following different directions at varying rates of speed. The first or principal section continues to advance in a north-westerly direction towards the Baie des Chaleurs, the mouth of the St. Lawrence estuary proper, the Island of Anticosti and the northern gulf coast in the vicinity of this island. The second section is deflected to the southward, along the eastern side of the Magdalen group towards the Gulf of Canso and the north-eastern entrance to Northumberland Straits, and the third section to the south-west and westward, along the western side of this group of islands towards the north-western entrance to the same straits; both these sections of the main undulation meeting each other about the centre of the straits. The fourth section makes its way in a northerly direction along the western shore of Newfoundland towards the south-western end of the Straits of Belle-Isle and the northern gulf coast east of the Island of Anticosti, where it meets the comparatively unimportant northern undulation which passes inward through these straits at a much slower pace than the southern wave, on account of the decreased average depth of water, say 25 to 150 fathoms, through which the oscillatory motion is propagated, instead in from 200 to 300 fathoms.

It is principally on account of the sudden closing up, or contraction of the tideway at Pointe des Monts and possible consequent reflection of a portion of the southern un-

dulation from the northern coast below this point in an easterly direction; but probably also, to some extent, owing to the juxtaposition or combination of the northern and southern undulations when in different phases, that the times of high water observed at full and change along both the north and south sides of the mouth of the estuary, between Pointe des Monts and the western extremity of Anticosti Island, are from one to two hours later than the time established at Pointe des Monts itself.

Possibly two maxima and two minima may be exhibited by the local tide curves of places in the vicinity of Pointe des Monts, and a swelling raised in the principal curve by the secondary undulation may be felt for a considerable distance westward.

As it is high water, full and change opposite Pointe des Monts in longitude 67° 15′ at XII hours and at VIIIh. 20m. at the Magdalen Islands, and also approximately at the same hour at a point opposite the said islands in longitude 61° 30′ and on the longitudinal axis of the section of the southern wave which advances towards the mouth of the St. Lawrence, this undulation occupies about four hours and three minutes in travelling from the last-mentioned point to Pointe des Monts, distant 265 nautical miles. Here the width of the estuary is reduced to about 23 nautical miles and the amplitude of the tides increased to 12 feet at ordinary springs; opposite the Magdalens it is only from $3\frac{1}{2}$ to 4 feet. For this stretch we have, therefore, approximately the following numerical values for the principal elements of the wave based on the observed actual mean rate of propagation.

$$V = \frac{6076 \cdot 5 \times 265}{(4\,h + 3\,m = 14{,}580\,sec.)} = 110 \cdot 5 \text{ feet per second.}$$

$$H = \frac{V^2}{g} = \frac{12{,}660 \cdot 25}{32 \cdot 16} = 393 \cdot 7 \text{ feet.}$$

$$L = TV = 44{,}700\ V = 4{,}939{,}350 \text{ feet.}$$

$$h = \frac{66}{\sqrt{H}} = 3 \cdot 33 \text{ feet.}$$

$$v = \frac{h\sqrt{g}}{\sqrt{H}} = \frac{18 \cdot 8811}{19 \cdot 84} = 0 \cdot 95 \text{ ft.}$$

$$\lambda = \frac{L}{2} = 2{,}469{,}675 \text{ feet.}$$

$$l = \frac{\lambda h}{H - h} = 21 \cdot 065 \text{ feet.}$$

The mean depth H, as here found, viz., 393·7 feet, appears smaller than that corresponding to the soundings indicated on the Admiralty charts, in the portion of the Gulf over which the undulatory motion of the section of wave under consideration is transmitted. This discrepancy may be due to the interference of the northern wave through the straits of Belle-Isle with the southern wave, already referred to. If only this latter wave found its way into the Gulf, high water might occur at Pointe des Monts before XII on full and change days, that is to say, the propagation of the summit of the said wave by itself from the Magdalens to Pointe des Monts may take less than four hours and three minutes, which represents, properly speaking, the interval between the passage of the crest of the southern undulation opposite the Magdalens and the summit of the composite waves at Pointe des Monts.

From Pointe des Monts the composite wave ascends the narrowing and rising estuary in a regular manner up to Quebec, distant about 222 nautical miles. At this city, which is in longitude 71° 12′ west of Greenwich, high water occurs on full and change days at VIh. 38m. according to Admiralty Charts, and ordinary springs have an average amplitudeof 18 feet. The time occupied by the fluvial tide wave in ascending from Pointe des Monts to Quebec is therefore 7 hours and 54 minutes. Hence we have for this stretch, on an average:

$$V = \frac{6076 \cdot 5 \times 222}{(6\text{ h }54\text{ m}) = 24{,}840\text{ secs.}} = 54 \cdot 30\text{ feet},$$

$$H = \frac{V^2}{g} = 91 \cdot 7\text{ feet.}$$

$$L = TV = 44{,}700\ V = 2{,}427{,}200\text{ feet},$$

$$h = \frac{66}{\sqrt{H}} = 6 \cdot 90\text{ feet.}$$

$$v = \frac{h\sqrt{g}}{\sqrt{H}} = 4 \cdot 09\text{ feet per second},$$

$$\lambda = \frac{L}{2} = 1{,}213{,}600\text{ feet},$$

$$l = \frac{\lambda h}{H - h} = 98 \cdot 748\text{ feet.}$$

As the amplitude of ordinary springs is stated by the Admiralty authorities to be about 12 feet at Pointe des Monts and 18 feet at the city of Quebec, the mean of which is 15 feet, the value of 6·90 feet just deduced for the semi-amplitude h is not very far from being concordant with the said mean.

At the end of a complete semi-tide day of an average duration of 12h. 25m., the summit of the wave which passes opposite Cape Ray at VIIh. full and change, has, according to approximate data from Admiralty charts, reached a point very little below Quebec city, say the new Graving Dock, where it is high water at about VIh. + 25m. local time on full and change days, and the average wave length L corresponding to the stretch between Quebec and Pointe des Monts, as just computed, is very nearly the same for the portion of estuary lying between the latter place and the Graving Dock.

If now we give weights to the computed wave lengths corresponding to the three stretches considered between Cape Ray and the Graving Dock, according to the number of seconds occupied by a wave in passing over each space, and divide the sum of the resulting products by the mean length of a semi-tide day = say 44·700 seconds, we find that the whole length of the wave occupying the space between the two extreme points just mentioned should be:

$$\frac{8{,}799{,}000 \times 6{,}120 + 493{,}950 \times 14{,}580 + 2{,}430{,}000 \times 24{,}000}{44{,}700}, \text{ or}$$

$$\frac{1{,}448 \times 6{,}120 + 812 \cdot 8 \times 14{,}580 + 400 \times 24{,}000}{44{,}700} = 679\text{ nautical miles}$$

as against (198 + 265 + 220) = 683 nautical miles according to direct measurement.

The close agreement of the wave lengths thus determined tends to indicate, that on account of the vast proportions of the lower St. Lawrence, neither a fresh water discharge of from 300,000 to 400,000 cubic feet per second or more, nor the rise of the bed or the contraction of the tideway, materially affect the regular propagation of the oceanic waves in and outward according to the laws which are believed to govern the same in the open sea, even as far inland as Quebec city. We shall see presently, however, upon further investigation, that the tide wave itself suffers some modifications in ascending this vast estuary, the same as in all others.

In calm weather and when the mercury of the barometer stands at about its mean height of say 30 inches, it is found at exposed points along the Atlantic coast, that the mean level of the tide-water lies nearly midways between the average elevations of the two high and the two low water marks of a tide day, as shown in diagram B and, moreover, agrees within narrow limits with that which obtains out in the ocean.

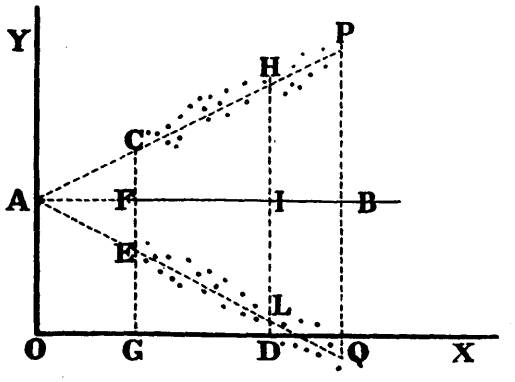


Diagram B.

Hence when the elevations of the crests and troughs of the waves are laid off perpendicularly from a base line in the order of the ranges of the tides, that is to say, if, as shown in diagram B, the ranges HL are measured on the axis of abscissas OX, as from O to G and D, and the corresponding high and low tide levels put down as ordinates DH, DL, a series of these elevations extending over one or two or more lunations, should trace out two paths, the axes CP, EQ of which are approximately inclined to each other at an angle PAQ = 53° 8′, and the mean tide or mean sea level will necessarily be sensibly a horizontal line FB lying midways between the two rectilinear high and low tide loci; the three lines PC, BF and QE evidently should meet when produced at a point A in the axis of ordinates OY.

If, instead of the actual elevations of high and low water, the corresponding tidal coefficients given in "L'Annuaire des Marées" (called "Centièmes"), which indicate the proportional amplitudes of the astronomical tides unaffected by diurnal inequalities, were used as abscissas and ordinates, the result would, of course, be the same. For, along the sea-coast each coefficient bears a sensibly constant ratio to the corresponding elevation of the high water level above or depression of the low water level below the mean level of the sea, and hence also to the total amplitudes; but as we proceed up long estuaries, a somewhat different state of things is found to exist. In the first place, the high water levels rise during series of gaining tides and fall during series of losing tides, at a more rapid rate than the corresponding low tide levels, or—which is the same thing—the geometrical locus of the high water levels of either a series of increasing or one of decreasing tides, has a greater inclination than the locus of the low water levels of the same series of tides of either kind. Secondly, the astronomical tidal coefficient no longer bears a sensibly uniform ratio to the actual tidal amplitude.

Notwithstanding this altered condition of matters, having taken into consideration the fact that in long estuaries of irregular conformation and declivity and with a variable fresh water discharge, the water levels corresponding to stated phases of the tide wave are affected by numerous perturbations of various kinds, after having constructed some trial diagrams with gaugings made under varying circumstances, I came to the conclusion that with a view of acquiring sound general notions as regards the nature and extent of the weekly, monthly, neap tide, spring tide, high and low water or spring and fall and other periodical variations and fluctuations of the estuary, it would be of some advantage to provisionally represent the loci of the high and low water levels observed at all the tide stations, in an approximate manner by right lines, previous to entering upon closer investigations, where these can be satisfactorily made. Besides, there are many cases where the data available for the determination of these loci leave so much to be desired in point of accuracy as well as completeness, on account of being derived from observations and measurements made in exposed places with the aid of ordinary unprotected tide staffs and common watches, generally only in the day time and often at variable intervals, sometimes by inexperienced observers, that it would be of little use to attempt reaching results more satisfactory than those afforded by simple straight lines.

Diagrams Nos. 1, 2, 3, 4, 5 and 6 on Ill. III.* have been constructed by means of data afforded, first: by the tide gauge registers, etc., kept in 1870-71, under the supervision of G. F. Baillairgé, Esq., the late Deputy Minister of Public Works, who was then acting as Assistant Chief Engineer, viz.: (*a*) at Fort Cumberland, head of Chignecto

* Full size lithograph of Ill., No. III. appended to official report for 1890-91.

Channel, Bay of Fundy, and at Baie Verte, Gulf of St. Lawrence, in connection with his survey for the projected Baie Verte Canal, (*b*) at Rimouski, in connection with the soundings taken in view of the projected formation of a harbour of refuge in the vicinity of this town, (*c*) in 1876, at Quebec, during the survey of the St. Charles estuary, previous to the construction of the new docks; second: by the registers of tidal observations, etc., made under my own supervision, 1880-82, at Quebec and several other places above this city in connection with the hydrographic survey of the St. Lawrence ordered by this Department between Quebec and Cap à la Roche, only a small portion of which has been completed in the vicinity of Pointe aux Trembles (en bas), Ste. Croix, etc.

Diagram No. 1 for Cumberland Basin, Bay of Fundy, is based on 54 flood and ebb-ranges observed out of a total of 262 tides which occurred 17th August to 28th December, 1870, viz., on less than one-eighth the whole number of ranges which obtained during the interval between the said dates. The greatest deviations of the highest and lowest mean tide levels from the average of the 54 observed, were respectively +0·76 ft. and—0·74 ft. Least range recorded at neaps, 26·5 ft.; greatest at springs, 47·60 ft.

Mean ratio $\frac{\overline{IH}}{\overline{HL}}$ of tidal intumescence $\overline{HL}$ to portion $\overline{IH}$ above level $\overline{AB}$ supposed to coincide with level of tideless bay, gulf or estuary = 0·484.

Mean ratio $\frac{\overline{IL}}{\overline{LH}}$ of tidal intumescence $\overline{HL}$ to portion $\overline{IL}$ *below* level $\overline{AB}$ = 0·516.

Mean ratio $\frac{\overline{IL}}{\overline{IH}}$ of depth — or of height + of trough L above supposed level $\overline{AB}$ of tideless bay, gulf or estuary, to height of summit of wave above this level = 1·066.

In constructing diagram No. 2, I was guided by 94 ranges registered at the mouth of the River Tidnish on Baie Verte, Gulf of St. Lawrence, between 20th August, 1870, and 1st June, 1871, out of a total of 1,132 ranges. Here the greatest deviations of the highest and lowest mean tide levels from the average of the 94 determined were as great as+1·29 ft. and —1·20ft; minimum range recorded, 0·54 ft.; maximum range, 7·95 ft.

$\frac{\overline{IH}}{\overline{HL}}$ = 0·4634, $\frac{\overline{IL}}{\overline{LH}}$ = 0·5366, $\frac{\overline{IL}}{\overline{IH}}$ = 1·159.

Diagram No. 3 is for Rimouski, where the high and low tide levels of 83 floods and 59 ebbs forming 142 ranges, were registered between 22nd July and 29th November, 1870; being over 25 per cent out of a total of 504 ranges. During the interval mentioned, the water level fluctuated at the foot of the St. Ours Lock, according to the water register regularly kept there, between elevations 20·41 and 23·16 above datum, which correspond to about 20·15 ft. and 22·80 ft. above the 0 of the present Montreal Harbour Commissioners' gauge at Sorel. The vertical displacements of the geometrical loci of the crests and troughs of the tide waves caused by these variations in the fresh water discharge, were, however, too small to permit of distinguishing them from the effects of diurnal line qualities, swells raised by winds, etc. The loci shown may be assumed to correspond approximately to a mean river level 21·3 ft. above the zero of the Sorel gauge.

The greatest deviations of the highest and lowest mean tide levels from the average of the 83 flood and 59 ebb, in all 142 mean tide levels, that were determined are + 2·30 ft. and —2·05 ft.

Maximum range recorded = 15·2 ft.
Minimum range recorded = 3·1 ft.
Mean of the 142 ranges recorded = 9·13 ft.

$\frac{\overline{IH}}{\overline{HL}}$=0·5901, $\frac{\overline{IL}}{\overline{HL}}$ = 0·410, $\frac{\overline{IL}}{\overline{HI}}$ = 0·695.

Diagrams Nos. 4, 5 and 6 show approximately the positions of the loci at Quebec, foot of St. James street, Pointe Platon and Grondines, for river levels at Sorel corresponding, on an average, to 20·50 ft., and 26·50 ft. above the 0 of the Sorel gauge, as, shown on diagram No. 7, or to elevations 20·55 ft. and 25·55 ft. above datum.

These diagrams are respectively based on 380, 261 and 414 high, and 371, 251 and 416 low water levels observed and registered 27th April to 4th December, 1882, viz., during 7½ lunar months, out of a total of 444 high and 444 low tide levels, while the river stood at heights varying between 20·0 ft. and 27·5 ft. above the 0 of the Montreal Harbour Commissioners gauge at Sorel, or 20·05 ft. and 27·55 ft. above datum.

On diagram No. 6 have been added: the loci of the high and low water levels observed at Quebec during the winter of 1876, viz., 11th February to 26th April, while the waterway was partially blocked up by ice from the mouth of the River Chaudière—about 7 miles above the Lévis Graving Dock—westwardly.

TABLE I.

CHARACTERISTIC RESULTS OF TIDAL OBSERVATIONS MADE AT QUEBEC DURING THE WINTER OF 1876.

	Feet.
Maximum flood range observed 25th February after persistent westerly storms	20·9
Maximum ebb range observed 8th March after persistent easterly storms	20·0
Minimum flood range observed 19th March, with westerly storm	6·9
Minimum ebb range observed 19th March, with westerly storm	6·6
Mean range of floods during complete lunar month (No. 1) commencing 26th February and ending 27th March, (all tides observed by night as well as by day)	15·42
Mean range of ebbs during same lunar month (No. 1)	15·39
Mean range of floods during complete lunar month (No. 2) commencing March 27th and ending April 25th, 1876, (all tides observed day and night)	15·29
Mean range of ebbs during same lunar month (No. 2)	15·29

TABLE II.

RESULTS of Tidal Observations made between Quebec and Grondines during the Season of Navigation of 1882, viz., 1st May to 4th December.

	Quebec.		Pointe Platon.	Grondines.
	Feet.		Feet.	Feet.
Maximum ranges observed (non simultaneous)	19·9		14·30	9·37
Minimum do do	9·0		8·10	3·30
Mean range during the complete lunar month, May 19 to June 18, 1882, with river level at a mean elevation of 26·5 feet above 0 Sorel gauge	13·41	(a)	10·85	5·34
Mean range during the complete lunar month, October 13 to November 12, 1882, with river level at a mean height of 20·6 feet above 0 Sorel gauge	13·95	(b)	11·83	7·33
Corresponding amplitudes of ordinary spring tides with river at 23 feet, Montreal Harbour Commissioners' gauge at Sorel	18·00		14·00	8·40
Corresponding ranges of ordinary neap tides, with river at 23 feet per Sorel gauge	11·00		9·40	5·20
Approximate average, rise or fall, of tidal stream in estuary, due to corresponding variations of one foot in river level at Sorel, between the heights of 20·5 feet above the 0 of the Sorel gauge.	0·2		0·6	0·8
Average range of floods for six lunar months, commencing May 19, and ending November 12, 1882, the mean elevation of river at Sorel being 23·17 feet	13·75	(c)	11·46	6·51
Average range of ebbs for same interval of six lunar months, and mean elevation, 23·17 feet of river at Sorel, per Montreal Harbour Commissioners' gauge	13·83	(c)	11·52	6·52

(c) These ranges based on (a) and (b). Number of observations available insufficient to permit of establishing mean for six months in the ordinary way.

It appears from the above statement that because of the general lowering of the stream by $(5{\cdot}9 \times 0{\cdot}18) = 1{\cdot}06$ ft. which took place at Quebec between the end of May and the beginning of November, 1882, viz., from an average monthly level corresponding to a river surface 26·55 ft. above datum at Sorel, to one corresponding to a river surface 5·9 ft. lower, and at an elevation of 20·65 ft. opposite this town, the mean monthly tidal range increased from 13·41 ft. to 13·95 ft. This rate of change, however, although not much in error, cannot be strictly correct, for no account was taken here of the small variation arising from the difference, as regards mean theoretical or astronomical importance, between the two monthly series of tide waves which ascended the estuary, respectively, from 19th May to 18th June, and from 13th October to 12th November, 1882.

The accurate series of gaugings made during the high and low water seasons in 1887 and 1888, go to show that for a rise of 8·20 ft. in the monthly water level at Sorel, from about 19·45 ft. to 27·65 ft. above datum, the general mean monthly tidal amplitude at Quebec decreases from 13·60 ft. to 13·30 ft., viz., 0·30 ft. But, for reasons stated in a subsequent chapter of this report, we may consider that the depths on sill of lock No. 5 at the head of the Lachine Canal, where the river is open all the year around, vary with the discharge much about the same in winter as in summer, and as these average depths for lunar months Nos. 1 and 2 (1876), above defined, were respectively 10′ 9″ and 12′ 3″, the mean of which is 11′ 6″, it follows that the average discharge during the said winter months was not much inferior to the mean summer discharge. Hence it would appear that the greater portion of this comparatively large increase of, say, $15{\cdot}34 - 13{\cdot}60 = 1{\cdot}74$ ft. in the general mean monthly tidal amplitude during the winter season is due to the resistance offered by the ice to the free passage of the fluvial wave to the westward of Quebec harbour, in which part of the estuary a friction head is generated by the tidal streams rubbing against the underside of the ice crust.

During the open season, for an increase of 1·74 ft. in the range or amplitude the low water level sank, on an average, only about $(1{\cdot}74 \times 0{\cdot}09) = 0{\cdot}1566$ ft., while the high water level rose $(1{\cdot}74 \times 0{\cdot}91) = 1{\cdot}583$ ft. During the said lunar months Nos. 1 and 2, when the river was covered by an ice crust above Quebec, the average monthly high water level appears to have been approximately 0·7 ft. higher than that which obtains with the same fresh water discharge during the summer season, while the average monthly low water level had fallen 1·0 ft. lower than the corresponding water level in summer. The reason of this probably is that, in general, during the winter season less tide-water is admitted and retained in the estuary above Quebec, while it is covered by an ice crust, than in summer when it is unobstructed by ice.

Diagram No. 6 shows at a glance (see Ill. III.) that when the tidal undulation passes opposite the ancient capital, it partakes already much more of the nature of a wave of translation than of that a wave of oscillation, considering that on an average, about $\frac{10}{11} = \frac{\overline{IH}}{\overline{LH}}$ of its total amplitude, are above the level which the river would assume if abstracted from tidal influence, or say the level of the tideless river, and only $\frac{1}{11} = \frac{\overline{LH}}{\overline{IL}}$ below it. But in how short or how long a stretch of the estuary immediately below Quebec, or how rapidly the fluvial wave rises so much above the mean level of the tideless stream, I am not, as yet, prepared to say. I may point out, however, that as at Rimouski, which place is about 155 nautical miles below Quebec city, $\frac{6}{10} = \frac{\overline{IH}}{\overline{HL}}$ of the tidal intumescence rose above the supposed mean level of the tideless estuary, as shown on diagram No. 5, it may be inferred that the fluvial wave is nearer to being a regular wave of translation than one of oscillation, for less than one-fifth of the total wave length of 683 nautical miles between Cape Ray and the Lévis Graving Dock above referred to (see page 73). This is probably one of the reasons of the close coincidence

of the computed with the actual wave lengths. Again, it must be remembered that when the depth H is considerable in comparison to the velocity U of the stream and the height h of the undulation, its rate of propagation must be nearly the same whether it be a wave of translation or one of oscillation; the rate of the former being in general equal to $\sqrt{g(H+h)} \pm U$ and that of the latter to $\sqrt{g H}$.

Above Quebec a small portion of the fluvial wave continues to descend below the level of the tideless estuary, as far as Ste. Croix on the south shore or Cap Santé on the north shore, and thence westward up to the point where all trace of tidal influence is lost, (in the vicinity of Contrecœur or Verchères, or even further up), the whole of the tidal intumescence is formed and propagated entirely above the level of the river, the same as in all ordinary simple waves of translation.

While advancing in this, the shallower, steeper and more contracted and obstructed part of the estuary, the undulations naturally become much shorter and somewhat steeper and the rate of propagation is steadily decreasing, until finally both length and amplitude are reduced to 0 and the velocity to a minimum, at the extreme western limit of the maritime portion of the St. Lawrence above Lake St. Peter. Although the fluvial wave continually decreases in length and steepens, while from a perfect wave of oscillation in the Gulf it is being transformed so as to become a regular wave of translation some thirty miles above Quebec harbour, the said wave has not, according to Admiralty chart No. 2516, apparently lost much, if any, in amplitude or range when it reaches this city.

The port of Quebec appears, therefore, to possess all the natural advantages generally afforded by tidal harbours, nearly to the fullest extent possible on the St. Lawrence, besides which, it is also free from the very serious periodical troubles which are caused in some localities situated further up stream, by spring floods and other sudden and irregular fresh water fluctuations, and ice jams and shoves. It is not to be denied, nevertheless, that the lower portions of the city are exposed to be flooded for a short time at high water, when very high spring tides are accompanied by violent north-easterly storms. On the 8th of May, 1874, many vessels were much damaged in their winter quarters by ice jams, owing to the sudden departure of the ice bridge caused by the pressure of the freshet waters against the key of the bridge above the River Chaudière and the ramming operations of steamers; but such ice jams, &c., are of comparatively rare occurrence. (*See* Appendices Nos. 16, 17 and 18.)

In short inlets and most estuaries of moderate length, not only has one undulation time to make a complete evolution before the succeeding wave commences to enter; but a large proportion of the water admitted also finds its way back to the ocean merely by virtue of the slope assumed by the outgoing stream, so that the elevation or swelling of the same caused, on an average, by the influx of sea water is necessarily always smaller, than that which corresponds to the introduction of a complete tidal undulation from trough to trough, from summit to summit, or between any two other corresponding points of two consecutive undulations. On account of the very great length of the maritime portion of the St. Lawrence, over 800 nautical miles from Cape Ray to Contrecœur or Verchères, at least two undulations make their way simultaneously up the estuary; the water brought into it by one wave cannot, therefore, flow out again without being incorporated, wholly or in part, in the next succeeding wave, viz., in a manner to satisfy the conditions of the established oscillatory motion. It follows, that in this vast estuary, the mean increases in the area and depth of the waterway and the elevation of the water contained therein which are produced by the influx of sea water, can at no time be less than the corresponding increases which the wave of least importance and amplitude generated in the Atlantic would bring about, viz., the wave which has a coefficient of semi-amplitude equal to about 0·30.

As the waves gain in importance passing from neaps to springs, the volume of water lodging in the estuary increases also, until the maximum elevation corresponding to full or change of the moon is reached, when, all other things remaining equal, the water again descends towards the mean minimum elevation just referred to until it

attains the level corresponding to the lowest succeedings neaps, to rise again with the gaining tides.

The greatest volume of water which can at any time lodge in the estuary under normal conditions of the atmosphere, in addition to that which would be contained therein, if the stream was abstracted from the influence of the tides, is that which can be brought in by the wave corresponding to the maximum theoretical coefficient of semi-amplitude of 118.

According to the Admiralty Charts, it is high water on full and change days, opposite Cape Ray, in longitude 56° west of Greenwich, at VIIh., which corresponds to 5h. 44m. nearly, eastern standard time, and at Quebec, in longitude 71° 12′ west, at VIh. 38m. local time, which corresponds to 6h. 23m. when referred to the meridian in longitude 75° west; but it must be observed that the tide wave the crest of which passes Cape Ray at 5h. 44m. is not the same as that which reaches Quebec at 6.23 eastern standard time. This latter wave is one-half lunar day or 12 hours older than the former, that is to say the wave observed at Quebec here referred to, corresponds to a pendular oscillation generated by the moon and sun one-half day ahead of that which is looked upon as having produced the wave observed at Cape Ray now under consideration, viz.: two lunar days = 48 hours, instead of only one and a-half lunar days = 36 hours previous, to the moon's meridian transit immediately preceding the time of high water at Quebec.

In comparing the coefficients of semi-amplitude as deduced directly from the tidal observations made in 1887-88 with the theoretical coefficient given in "L'Annuaire des Marées," the difference of age between the tides of the western coast of France and those which make themselves felt simultaneously at and above Quebec city have been duly taken into account.

GAUGING OPERATIONS OF 1887 AND 1888.

All the tide and river gauging performed previous to 1887-88 on the St. Lawrence, and to which reference has just been made, was effected by means of simple staffs divided into feet and tenths; the figures denoting the feet being painted in red and the tenths represented by stripes painted alternately blue or black and white. These gauges had generally been put up alongside of wharves, but sometimes also anchored in the stream, where they were maintained in a vertical position by means of chain or other guys, made fast at the lower ends to cast iron weights or to stones put down for the purpose.

In no instance were any special precautions taken with a view of securing smooth water around the gauge by placing it in a box or in any other way, nor was it considered necessary to note the height of the barometer in a regular and continuous manner for the purpose of determining to what extent the height of the water might have been directly affected by variations in the pressure of the atmosphere; moreover, the registered times could not always be relied on as being correct, within the requisite limits, to render the observations and measurements available for the determination of simultaneous water levels. Again, being in 1881-82 under the impression that the tides affected the river at Sorel only to an inappreciable extent, instead of sometimes as much as 1 foot and more, as found out by actual close observation in 1884-85, I attached little importance to the establishment of a river gauging station at a point above this town in connection with tidal observations; hence there were no means available for separating the rise and fall of the river level proper from the fluctuations produced by the tidal undulations. Finally, most of the bench marks made in the vicinity of the gauging stations of 1881-82 have been carried away, disturbed or obliterated by the ice, or otherwise removed or destroyed.

Therefore, notwithstanding the fact that the observations made previous to 1887, just referred to, have afforded valuable information respecting the relative tidal fluctuations, local tide curves, etc., at various points of the St. Lawrence estuary, as shown above, the results obtained could not be directly utilized in connection with the precision level-

ling afterwards performed along the southern shore of the river, for the determination of absolute elevations of water levels corresponding to various phases of the fluvial wave and particular stages of the fresh water stream. Hence the necessity of undertaking more systematic and precise tidal observations and fresh water gaugings during the high and low stages of the river.

This work was carried out, as you are aware, during the fiscal year 1887-88; one series of observations being made in the fall of 1887, viz., during October and a part of November, when the river is at its lowest, and the other series in the spring of 1888, when the stream carries a greater volume of water than at any other season, viz., during the last week in April and nearly the whole of the month of May.

There can be no doubt that if properly constructed self-registering gauges could have been used at all the stations, the most satisfactory results possible would have been arrived at in every respect; but as some 16 or 17 stations had to be established, on account of the great cost of such instruments*, the idea of securing the necessary information in this manner would have had to be dismissed, even if it had proved practicable to place the apparatus simply on a firm support without providing a special house, etc., for it, as has been attempted by the U. S. C. and G. Survey, with what measure of success I have not learned. But I feel warranted in saying, judging by past experience, that neither on thewharves which are available between Quebec and Montreal for making both high and low water observations, nor at any other point on the river shore that might be found suitable for the object in view, could a gauging apparatus, or, in fact, any other kind of well-finished mechanical contrivance or instrument be safely left in position, unprotected and unwatched even for a few days, much less a month, which is the least space of time generally required for a fairly complete series of observations.

Under the circumstances, it became imperative to devise some simple, inexpensive gauging apparatus which would permit of attaining the desired degree of precision, in results dependent on tidal observations and river gaugings, without running too great a risk of losing a whole season's work by the displacement or destruction, accidental or otherwise, of some of the gauges, or on account of some of their essential parts being broken or put out of order, because of some mishap during the handling of the instrument or at any other time, or owing to mistakes being made in reading or registering the heights, etc., by inexperienced persons such as would, in most localities, have to be employed in order to keep down the expense, and for other reasons not less weighty or more easily got over.

GAUGING APPARATUS.

With the aid of illustrations Nos. I. and II.,* which explain themselves, the construction, installation and manipulation of the gauge designed with a view of meeting the various requirements just referred to, etc., will be fully understood from the following description.

T is a wooden tube of square section 6 inches by 6 inches inside, and 8 inches by 8 inches outside, and of the proper length (15 to 35 feet) to reach from a point on the bottom covered at low tide by 5 to 7 feet water or more up to, but no higher than the top of the capping timber of the wharf to the side of which it is to be fixed, viz., by screwing three or four straps of sheet iron $\frac{1}{8}$ inch thick by $1\frac{1}{2}$ inches wide, or thereabouts, to the tube and the wharf timbers. This tube is made of four pine boards one inch thick, all in one piece, planed on one side and screwed together and to a bottom piece 6 inches by 6 inches by 2 inches thick; four or five round holes $\frac{1}{4}$ inch in diameter are generally pierced in the bottom and from eight to sixteen more are put through the sides, according as the tube stands more or less deep in the water and exposed to the action of the waves. The smooth or planed faces of the boards are turned towards the inside, so that, there being

* The price of the improved self-registering tide gauge manufactured by M. M. A. Légé & Co., of 31 and 32 Kirby street, Hatton Garden, London, England, is from £80 to £100, and M. M. Fauth & Co., of Washington, D.C., U.S., ask $350 for a self-registering apparatus similar to those made by them for the U. S. C. & G. S. The £100 gauge also registers the height of barometer, temperature and force and direction of wind; but not the others.

* Full size lithographs of Nos. I. and II. accompany official report for 1890-91.

no horizontal joint in any of them, nothing can interfere with the free motion of the float, which has to move up and down in the tube. If the cutting off of such portion of the box when resting on the bottom, as may stand above the capping timber of the wharf, was neglected, it would surely be wrenched sooner or later out of its primitive position by the hawsers of vessels; in some cases fenders at least 9 inches thick had to be bolted, one on each side of the tube to protect it. The thickness of the sides of the tube was limited to one inch, to facilitate handling in putting it up and taking it down, for it must be remembered that after the low water observations are completed in the fall, all the float tubes have unavoidably to be taken down, not only to keep them from being crushed by the ice during the winter; but also to render them available for use at highest water, early in the spring, before blocks of ice several feet thick, in which they would be embedded if left standing, could be removed without incurring considerable expense and great risk of breaking up the tubes so as to render them unfit for further use.

The gauging apparatus proper consists of a square wooden box B, open top and bottom, and having precisely the same cross-section as the float tube T, viz., measuring 6 inches by 6 inches inside and 8 inches by 8 inches outside and 9 inches in height. On one side are mounted on a horizontal hollow axle *a* made of $\frac{3}{8}$ inch brass tubing, plugged at both ends to reduce its weight to a minimum: 1st, a reel R, 5 to 6 inches in diameter, constructed of sheet iron or brass, on which is rolled a copper measuring tape or band $\frac{1}{2}$ inch wide, weighing at the rate of 62 feet per pound when etched ready for use, and of the requisite length to indicate the extreme rise and fall of the tide or river; 2nd, a light brass pulley wheel P, having a diameter of 7 inches, so that when the tape *t* is passed from the reel over the wheel, and a small friction roller placed in a slit I at the underside of the box, or simply through an oblique slit with upper side rounded off, as shown on vertical section, it may hang down exactly in the centre of the float tube.

The tape *t* is hooked to a float F, having the form of a truncated pyramid with sides inclined to each other at an angle of about 12°. It is constructed of tinned plate, soldered at top and bottom to hoops of round galvanized iron wire as shown, and measures 5·5 inches by 5·5 at base and 6·06 inches by 6·06 at top by 4 inches in height, which is just sufficient to prevent the float from sinking when put in the water by itself, viz., independently of the tape and counterweights.

The pyramidal form has been adopted with a view of providing increased play room near the water surface between the float and the box, in comparison to that left at the base of the float, in order to prevent small chips of wood, pieces of paper, etc., which might find their way into the tube, from being jammed or caught between the wood and the tin, so as to interfere with the free motion of the float, more especially in cases where it might be found to be unsafe to put up the float tube in a perfectly vertical position.

In the centre of the lower base of the frustum of the pyramid is soldered a brass tube *k* 0·066 foot or about $\frac{3}{4}$ inch in diameter and 1·78 inch in height, the top of which is connected with the upper base by an envelope of tin soldered to the square iron wire hoop around this base and to the upper end of the tube, so as to form a hermetically closed vessel with a cylindrical opening in the centre; this opening is filled with water up to the 0 point of the tape when the gauge is ready for use, and it affords a passage for rain water and small heavy objects dropped inadvertently into the float tube, which would permanently diminish the buoyancy of the float.

The float F is loaded at its underside by means of a sheet of lead having as nearly as possible the same form and area as the lower base to which it is soldered, so that when the spring clip *c*, with lead stretching weight *w*, weighing in all (without discs) 1 pound and 10 ounces—26 ounces—is attached to the tape and the latter hooked to the arched cross bar *m* provided for the purpose at the upper end of the brass tube, the underside of the spring hook *n* which coincides with the zero point of the copper band may be exactly at the water surface.

Four buttons *b* screwed, one on each of the four sides of the gauge box near its base, serve to prevent it from being shifted laterally when once placed fairly over the

float tube, and two counterweights c_1, c_2, consisting of brass tubes filled with lead, are inserted in the side of the box opposite the pulley wheel, to prevent the apparatus from being unwittingly canted over towards the other side and in order to facilitate the carriage of the same by hand.

Thirty-five to forty loose circular discs of lead *d*, of the weight of one foot of tape and having small holes pierced through them near the circumference, accompany each stretching weight W, which is scooped out in the centre for part of its length to afford room for slipping the discs over a cylindrical brass rod *j* secured to the weight. These discs are required for keeping the zero point of the copper tape constantly in the plane of the water surface, viz.: by adding one disc to the weight for each foot of fall and taking one off the same for each foot of rise of the tide; the number of such discs on the weight W having always to be equal to the number of feet of tape hanging below the top of the brass index bar *i* screwed to the sides of the box, as shown in the illustrations. A scale is engraved on the face of the weight W on both sides of the brass pin, each division of which is equal to the thickness of a disc, so that the total number of discs in use may be ascertained at any time without counting them one by one. As the area of the float opposite the 0 of the tape is nearly 0·2 square foot and the weight of each disc 0·26 ounce, the vertical displacement of the float caused by paying out or taking up one foot of tape is only about 0·0013 feet, an insignificant quantity as regards the present object.

The size of the weight W and strength of the copper band *t*, or rather its thickness if it be admitted that ½ inch is the least width compatible with a plain graduation and proper facility for changing the position of the clip before it has risen quite up to the wheel, while the tide is ebbing or after it has descended about one foot below the centre of this wheel during flood tide, without risk of obliterating the divisions in a short time, are regulated by the following considerations, viz., 1st, the force necessary to overcome the friction generated between the band and pulley wheel, etc., should be smaller than that which would permit of the float being raised or lowered in any position to a greater extent than say 0·005 ft. without attempting to regain its original place; 2nd, the tape must be sufficiently taut to indicate the correct depths of the water surface below the top of the index bar *i*, and strong enough to bear repeated winding and unwinding, etc., often, by not over-careful observers, for weeks together without easily kinking and breaking. I may state, in this connection, that a band of only half the thickness of that described above, and weighing at the rate of 124 ft. per pound, instead of 62, was found to be too slight and weak to stand much handling. On the other hand, I believe a weight of somewhat less than 26 ounces, say 1¼ pounds, would answer the purpose better, for, besides causing less friction it could be kept securely in position along the tape by means of a spring clip of smaller holding power than that used, and which would be easier to manipulate.

An opening is made in the side of the box opposite that on which the wheel is mounted to let in the light required for making correct readings opposite the index bar. This opening is disposed so as to permit of transferring the wheel reel, together with weight and tape, from one side to the other in case it should be found necessary or advantageous to do so for one reason or another; in such event, the counterweights $c_1 c_2$ have also to be taken out and pushed into the holes provided for them in the opposite side of the box.

When the gauging operations are suspended or completed, the clip and stretching weight are removed and secured in place in the opening opposite the wheel, as shown on illustration No. I., by passing the hollow axle *a* through a hole bored at the upper end of the weight; the float is then drawn up in the box, the tape being wound up simultaneously on the reel, which is now prevented from unwinding by locking it with the brass bolt *F*.

As the whole apparatus, complete, weighs but 14½ pounds,* and is balanced so as to hang fair when taken hold of by the handle G, it can be easily carried by the gauge keeper from the wharf to his residence, usually close by, and brought back when again

* Total weight of gauge, packed in case for transportation over long distances, 27½ lbs.

wanted. There being absolutely nothing left on the wharf which might be stolen, maliciously broken or put out of order by being played with, besides the bare float tube which should be covered to prevent chips or other light refuse from being thrown into it, there is a fair prospect of a complete series of accurate measurements, etc., being secured, extending, say over one month or more, at a comparatively moderate outlay, provided, of course, the observers will discharge their duties faithfully.

I calculated at first to erect all the float boxes in a truly vertical position, in which event no correction for inclination would have been required, but, on more mature consideration, I became convinced that the danger of having the tubes carried away or displaced by steamers or other vessels, etc., and consequent risk of the whole season's work being spoiled—not to mention the extra expense—were so great, that this course however desirable in other respects, could not be uniformly followed—hence many tedious corrections had to be applied to most of the gauge readings. These corrections were based on accurate measurement, of the inclinations of the tubes to the horizon, made with a clinometer and on the depths of the zero point of the tape below the top of the index bar corresponding to the respective inclinations; these depths were determined with the aid of the vernier pointers attached to the foot of the perfected levelling rod used; a short wooden tube having been held for the purpose in inclined positions in a tub partly filled with water.

The following displacements (elevations) of the 0 point have been determined for declinations from the vertical proceeding by whole degrees from 0° to 10°.

TABLE III.

						Feet.
1°	For float tube, vertical:		displacement =			0·000
2°	do	declined,	1°,	0	raised =	0·004
3°	do	do	2°,	0	do	0·007
4°	do	do	3°,	0	do	0·009
5°	do	do	4°,	0	do	0·010
6°	do	do	5°,	0	do	0·011
7°	do	do	6°,	0	do	0·012
8°	do	do	7°,	0	do	0·013
9°	do	do	8°,	0	do	0·014
10°	do	do	9°,	0	do	0·014
11°	do	do	10°,	0	do	0·015

Two continuous corresponding series of tidal observations and river gaugings, covering each a complete lunar month and a few days to spare, were made at 17 points between the Lévis Graving Dock and the village of Laprairie: one during the low stage of the St. Lawrence in October and November, 1887, and the other between the end of April and the beginning of June, 1888, when the river is at its highest.

Box and float gauges, such as that just described, were used for observing the tidal fluctuations at the first seven stations above the harbour of Quebec, where the amplitude of the fluvial wave was considered too great, to permit of the observations being conveniently and correctly made at all times without the aid of such apparatus, whether in a sheltered or an exposed situation. Besides these a box gauge (No. 8) was also put up at the Laprairie wharf which is struck to a greater or less extent on every side by the waves raised by winds.

The tabular statement which here follows gives the relative positions of the tide and river gauging stations, the kind of gauge used at each station with its declination from the vertical, and also particulars respecting numbers of observations made, etc.

TABLE IV.

No.	Designation of Station.	Intermediate distances measured along axis of estuary or river, in miles.	Kind of Gauge used, how placed, deviation of axis, of copper tape or staff from vertical, &c.	Nature of instructions issued to observers, &c.
1	Lévis Graving Dock, south shore of St. Lawrence.	8·3	Float gauge ; box secured to dock wall side of entrance. Inclination of tape, 2°.	1st. Height of water to be registered in general at intervals of 10 minutes for from ¾ to 1 hour or more, before and after top high and dead low water, day and night—when tide abont to turn, observations to be repeated at intervals from 1 to 5 minutes. 2nd. Observations to be made at every 10 minutes continuously for from 2 to 3 lunar days after new moon, full moon and quadratures. 3rd. Force and direction of wind, state of weather, &c., to be noted from time to time.
2	Chaudière or St. Romuald, south shore of St. Lawrence.	5·2	Float gauge ; box fastened to wharf N.E. side of River Chaudière, in very nearly vertical positions.	
3	St. Nicholas, south shore of St. Lawrence.	24·0	Float gauge ; box put in open space left in crib-work of Capt. A. Baker's wharf. Inclinations of tape, 0° and 1°.	
4	Pointe Platon, south shore of St. Lawrence.	11·3	Float gauge ; box put up at north-east end of Hon. H. G. Joly's wharf. Inclinations of tape, 4° 23′ and 4°.	
5	Grondines, north shore of St. Lawrence.	5·2	Float gauge ; box erected at north-east end of Hardy's wharf. Inclinations of tape, 5° and 4°.	
6	St. Jean des Chaillons, south shore of St. Lawrence.	7·7	Float gauge ; box put up at north-east end of Levasseur's wharf. Inclinations of tape, 2° 16′, 1¼° and ¾°.	
7	Batiscan, north shore of St. Lawrence.	7·4	Float gauge ; box put up at rear or west side of Brunelle's wharf. Inclinations of tape, 6° 20′ to 7° 30.	Do. do do but intervals fixed at 15 minutes, same as No. 1 to No. 7 intervals increased to 20 minutes.
8	Champlain, north shore of St. Lawrence.	11·6	Two tide staffs put up on north-east and south-west sides of Gagnon's wharf. Inclinations, respectively, 2° and 33°.	Height of water to be noted at every half hour, continuously, for from 2 to 3 days after new moon, full moon and quadratures. Also, wind and state of weather and water, &c.
9	Doucet's Landing, opposite Three Rivers.	6·6	Staffs put up on rear face of outer block, ferry wharf at north-east, and sheltered from all prevalent winds. Inclinations, ½° to 5°.	
10	Port St. Francis, south shore, lower end of Lake St. Peter.	20·7	Staffs put up on north-east and south-west sides of R. & O. Co.'s wharf. Inclinations, respectively, 8° and 0°.	Observations to be made at 7 a.m., noon and 6 p.m. in fall, and 7 a.m. and 1 p.m. in spring.
11	Yamaska, south shore of St. Lawrence.	10·0	Staffs put up on upper and lower wing walls, east side of new lock, River Yamaska. Inclinations, 0° to 4°.	Observations required : 1st. At intervals of 30 min., continuously, for from 2 to 3 lunar days after new and full moon. 2nd. Four times a day from 2 to 3 days after quadratures at same hours, as per No. 11, and at midnight. 3rd. On all other days 3 times a day, as for No. 11.
12	Sorel, south shore of St. Lawrence	15·0	Staffs put up on north and south sides of McCarthy's wharf, St. Joseph de Sorel, west side River Richelieu. Inclin., 0° to 2°.	
13	Contrecœur, south shore of St. Lawrence.	8·0	Staffs put up on north-east side and in rear of R. & O. Co.'s wharf. Inclinations, 0° to 3°.	
14	Verchères, south shore of St. Lawrence.	8·5	Staffs spiked to north-east and south-west sides of steamboat wharf. Inclinations, 0° to 7°.	Height of water to be registered, and also wind and state of weather and water near gauge, &c., as at all other stations, three times each day, viz. :—7 a.m., noon and 6 p.m. in the fall, and at 7 a.m., 1 p.m. and 7 p.m. in the spring of the year.
15	Varennes, south shore of St. Lawrence.	10·5	Staffs spiked to north-east and south-west sides of steamboat wharf. Inclinations, 0° to 6°.	
16	Longueuil, south shore of St. Lawrence.	8·2	Staffs spiked to rear of new block of crib-work constructed by Government in 1886-87. Inclination, 0°.	
17	Laprairie, south shore of St. Lawrence.	.....	Float gauge ; box fastened to north-east face of R. & O. Nav. Co.'s wharf. Inclination of tape, 0°. Also, staff used at high water, inclined about 3°.	

[1891]

RESULTS OF TIDAL OBSERVATIONS AND RIVER GAUGING OF 1887–88.

Appendix No. 13 to this report contains 16 tables, Nos. I to XVI., of results deduced from tidal observations made in 1887–88, during high and low-stages of the River St. Lawrence, at eight of the gauging stations established on the shores of the estuary, together with corresponding theoretical data. These tables of comparative results comprise each two series of gaining tides: Nos. I., III., V. and VII., and two of losing tides: Nos. II., IV., VI. and VIII., with the exception of No. VIII. for Champlain station, where only three complete series of tidal observations were made in the fall of 1887, and Nos. II. and V. for the River Chaudière station, where less than two consecutive series of observations were completed in 1887 and the same in the spring of 1888. The said eight series of observations cover two complete lunar months, viz., Nos. I., II., III. and IV., the month in the low water season of 1887, from 12th October to 10th November, and Nos. V., VI., VII. and VIII., the month in the high water season of 1888 from 4th May to 3rd June.

The contents of most of the columns, if not all, are described at such length in the headings, as to call for no further explanations. It is necessary, however, to make special reference to each one of the three sets of eastern standard civil times of high water which have been computed for Quebec. Moreover, a brief description showing the nature of the theoretical or astronomical tidal coefficients, "centièmes," and the uses to which they can be put may not prove superfluous.

The first of the three series of eastern standard times of high water entered on the graving dock table are from the printed Quebec tide tables, for years 1887 and 1888, which have been issued by Mr. Archibald McCallum, who keeps a depot of chronometers and other nautical instruments, charts, etc., in St. Peter street of the said city. The Quebec time of high water, a.m. or p.m. for any given date, appears to have been arrived at by Mr. McCallum by adding sometimes to the corresponding a.m. or p.m. time of high water at London Bridge, as per tide table contained in the Nautical Almanac, and occasionally, for no apparent reason, to the times of high water at London taken out for a half day anterior to that which corresponds to the Quebec time sought, the difference between the respective establishments of the ports of London and Quebec, or, which is the same thing, the difference between the observed times of high water at equinoctial syzygies in the said ports, viz.: 2 H. 7 M. at London, as per McGregor's Seaman's Almanac, and 6 H. 38 M. at Quebec, as per Admiralty charts of the St. Lawrence and the St. Lawrence Pilot.

For example, the Quebec time of high water in the forenoon of 12th October, 1887, No. 2 of series No. 1 of tides observed, was obtained thus, by Mr. McCallum:

	H.	M.
Time of high water, afternoon, 11th October, at London Bridge.	8	53
Add (6 H. 38 M. — 2 H. 7 M.) or	4	31
Time of high water, Quebec, 12th October, forenoon, as per McCallum's tide table for 1887	1	24

NOTE TO TABLE IV.

At all these stations the observations were made invariably by the time of longitude 75° west of Greenwich, known as "Eastern Standard." On the south shore of the St. Lawrence the observers could easily compare their watches once or twice a week, or more, with the station clocks or regulators of the Canadian Pacific Railway. At the Graving Dock, Chaudière and St. Nicholas stations, on the south shore, correct time was obtained from Quebec city nearly every day by telegraph, railway or steamboat. At Pointe Platon a properly regulated marine chronometer was relied on for supplying correct standard time, and at St. Jean des Chaillons the watch used was compared with this chronometer by telegraph twice a week, besides which time was here also obtained twice a week from Quebec by steamboat. At the stations between Three Rivers and Montreal the time used was also kept as closely as possible coincident with "eastern standard" by comparing the time-pieces with steamboat and railway clocks as often as practicable, on an average twice a week. It is believed that between Sorel and Quebec the maximum error in the time as corrected did not exceed one minute; above Sorel where accuracy was of much less importance than at the tide stations further down stream, the error may reach 5 minutes.

This method is frequently followed in computing approximately the local time of high water in ports along the sea-coasts. I may remark, however, that as Mr. McCallum heads his tables "Standard Time," he should deduct 15 minutes from results such as the above, which would have reduced the last total to H. M. 1 9. But then, on the other hand, if the time, H. W. at F. & C., given in the Nautical Almanac for London Bridge, viz.: H. M. 1 58, had been used instead of H. M. 2 7, H. M. 1 18 would have been arrived at instead of H. M. 1 9. Moreover, the lunitidal intervals vary also with the height of the river or the fresh water discharge, to the amount of some 15 minutes or more.

Again, the Quebec time of high water in the afternoon of May 27, 1888, No. 30½, series No. VIII. of tides observed, was arrived at thus:

	H. M.
Time of high water, afternoon, 26th May, 1888, London Bridge.	2 43
Add (6.38—2.7) or	4 31
Time of high water, Quebec, 27th May, evening, as per McCallum's tide table for 1888	7 14

Here the London Bridge time of high water for a half day anterior to that which corresponds to the Quebec time sought, was apparently used for computing the time marked in Mr. McCallum's table.

It is, of course, quite possible that some of the times calculated by Mr. McCallum have been entered opposite the wrong dates, or in the wrong columns; but which are properly and which wrongly entered cannot easily be made out.

On account of the great distance inland from the Atlantic coast to the port of Quebec—say 685 nautical miles—the tide wave, of which the summit reached Quebec city, 12th October, 1887, at about 1h. 24m. a.m., was, as already explained in another part of this report, one-half day older than the wave of which the summit passed London Bridge at 8h. 5m. p.m., 11th October. Hence, for the purpose of transferring the tidal intervals computed for the port of London to the sea-port of Quebec, it becomes necessary: 1st. To increase the establishment of the last named port (Quebec) by H. M. 12 25, the average duration of a half tide day, which brings the establishment in question—say to (6·24 + 12·25) = H. M. 18 49 for the low water season, and to (6·09 + 12·25) = H. M. 18 34 for the high water season; 2nd. To add from (18·49 − 1·58) = H. M. 16 51 to (18·34 − 1·58) = H. M. 16 36 to the computed time of high water at London Bridge taken from the Nautical Almanac, either for the first half day preceding that for which the time of high water at Quebec is sought, or for the second half day previous to the said Quebec time, if found requisite in order to go back a full half day beyond the first anterior London time of high water; 3rd. To add, say 10 minutes for the 5 hours difference of longtitude west from London to Quebec; 4th. To subtract 15 minutes from the local time so obtained to convert it into eastern standard time. A rational mode of determining approximately the eastern standard time of high water at Quebec, for 12th October, in the forenoon, by using the ordinary establishments of the ports of London and Quebec, in connection with data from the tide tables of the Nautical Almanac, is as follows:—

	H. M.
Time of high water, forenoon 11th October, 1887, at London Bridge	8 10
Add (6·38 + 12·25 + 0·10) − (1·58 + 0·15) =	17 00
	25 10
Deduct	24 00
Approximate standard time, high water at Quebec, 12th October, a.m.	1 10

We can, however, arrive at more satisfactory results by using the mean luni-tidal intervals for different seasons of the year in connection with the times of high water, calculated either for London Bridge or some other European port.

The second of the three series of eastern standard times of high water, entered in the Tables of tidal fluctuations at the Graving Dock, is based on the times of high water which are given in "L'Annuaire des Marées" for the port of Brest in France. To these times corrections have been applied, in the vicinity of the quadratures, as was shown to be necessary, by Mr. Gaussin, a celebrated French hydrographic engineer, who made searching investigations in reference to this matter.

The difference between the mean luni-tidal intervals of the ports of Brest and Quebec increased by 12 H. 25 M., plus 10 M. increase in time of moon's meridian passage for nearly 5 hours difference of longitude west, and less 15 minutes difference between Quebec (local) and Eastern standard times, 6 H. 24 M.—3 H. 24 M. + 12 H. 25 M. + 10 M.—15 M. = 15 H. 20 M., has been added in each case to the time of H.W. at Brest, taken for the half day anterior to that which corresponds to the time sought for Quebec.

Taking again the forenoon tide of 12th October, 1887, as an example, we have:

	H.	M.
Time H.W. at Brest, forenoon, 11th October, 1887.....	10	0
Add (6 H. 24 M. + 12 H. 25 M. + 0 H. 10 M.)—(0 H. 15 M. + 3 H. 25 M.) or.....	15	19
	25	19
Deduct	24	0
Standard time H.W., Quebec, 12th October, A.M.....	1	19

The times computed in this manner agree best, on the whole, with the observed times of high water at Quebec and the other tide stations.

By substituting the London Bridge times of the Nautical Almanac, which have been corrected for semi-monthly inequalities by the Hydrographic Office, for the Brest time of high water, and using the corresponding mean luni-tidal interval, viz., 1 H. 26 M. in place of 3 H. 25 M., we arrive at the time of high water of the same forenoon tide, as follows:—

	H.	M.
Time of H.W. at London Bridge, forenoon, 11th Oct., 1887	8	10
Add (6·24 + 12·25 + 0·10)—(0·15 + 1·26), or.....	17	18
Total.....	25	28
Deduct	24	0
Standard time H.W., Quebec, 12th October, A.M.....	1	28

As already stated, in computing the times of H.W. during the high water season, it is evidently requisite to use the corresponding mean luni-tidal intervals; these are from 10 to 20 minutes smaller than those which obtain during the low water season at all points between Quebec and St. Jean des Chaillons inclusive, above which place they appear to be greater; but this apparent excess may be due to irregular fluctuations caused by winds and freshets.

In passing from the very high stage of the river in the spring to low water in the fall, the mean luni-tidal intervals which obtain at the gauging stations of the St. Lawrence should be gradually increased as far up as St. Jean des Chaillons, say in direct proportion to the relative decrease in the elevation of the river at Verchères.

Although the computed times entered in the tables of tidal fluctuations may be considered to agree, on the whole, sufficiently well with the actual or observed times of high water for most practical purposes, the concordance cannot be called perfect; the disagreement between the two sets of times being especially noticeable about the times of

the moon's quadratures. Greater precision can be arrived at in the preparation of high water time tables by employing for the computation of the said times, the formula:

$$H = p + C + E - 19 \text{ minutes},$$

where:

H denotes the time of high water sought,

p denotes the time of the meridian passage of the moon at the port under consideration immediately preceding the time H,

C denotes a function of the distance of the sun and moon from the earth, the declinations of the said heavenly bodies, and the difference between their right ascensions which obtains $1\frac{1}{2}$ days previous to the passage corresponding to p, and

E denotes the establishment of the port.

In order that the more accurate results referred to may be successfully calculated with the aid of the above formula, it is necessary to have at one's disposal continuous series of reliable observations such as those made in 1887-88, extending over a number of seasons.

In the meantime, the times of high water computed, as above indicated, may be corrected with some benefit according to the empirical rule laid down hereunder which has been deduced from diagrams Nos. IV and V.*

These diagrams were constructed as follows, with the aid of the data available :— The lengths of the semi-tide days, H. W. to H. W., according to the times of high water printed in "L'Annuaire des Marées" for the port of Brest, which, as already stated, appear, on the whole, to agree best with the times observed at the Graving Dock gauging station, were laid down consecutively as abscissas along a right line to a scale of 40 hours per inch, and the differences between the said observed St. Lawrence times of H.W. and the computed times based on those calculated for Brest and London Bridge were plotted as rectangular ordinates; one inch being allowed for 20 minutes. On account of the smallness of the scale, the same abscissas could be used without perceptible error, in connection with the St. Lawrence times of high water based on the London Bridge times, as well as in connection with those based on the Brest time.

The diagrams show :

1st. That the greatest diurnal differences between the computed and observed times of high water, arising from the daily variations in the action of the moon when not in the equator—which are usually not taken into account in computing such times—amounts, in the low water season, to 36 minutes at Quebec (see Nos. $12\frac{1}{2}$ and 13, Series No. 11, of tidal fluctuations at Graving Dock, Appendix No. 13), and to 55 minutes at Batiscan (see Nos. 13 and $13\frac{1}{2}$ for Batiscan, Appendix No. 13), and, in the high water season, to 41 minutes at Quebec (see Nos. 36 and $36\frac{1}{2}$ for Graving Dock, Appendix No. 13), and 85 minutes at Batiscan (see Nos. $17\frac{1}{2}$ and 18 for Batiscan, Appendix No. 13); the tide attaining its full height sooner when the amplitude is greater and later, when it is less than that of the mean semi-diurnal wave.

2nd. That on the days of quadrature, or one day ahead or one day after the said days, the observed times are from 20 to 60 minutes greater or later than the computed ones, the whole of which difference, rolled up in from two to three days, disappears again in a similar short space of time. Also, that during the remainder of the lunar month, viz., from about one day preceding one quadrature up to within a day or so of the following one, the observed times are, on an average, from 5 to 15 minutes smaller than the computed ones or in advance of the same, on an average, from say 5 minutes at Quebec during the high water season, to 15 minutes at Batiscan during the low water season.

The approximate times computed for the Graving Dock station, harbour of Quebec, may be amended by applying directly the following empirical rule, based on the rectilinear loci of average high tide hours drawn in red on diagram No. IV, and those calculated for stations to the westward of Quebec can also be amended with some advantage by

* Full size lithographs of these diagrams are annexed to official report for 1890-91.

applying the corrections indicated below to the times of the tides which correspond, as shown by the reference numbers to the particular Quebec tides pointed out in the said rule. (See diagram No. V, for Batiscan station.)

To correct the approximate Graving Dock times of high water:

1st. Retain without change the third and fourth times, (such as Nos. 12 and 12½ in table No. V, which here follows, and in table I of Appendix No. 13), preceding the instant of quadrature of the moon, as well as the sixth and seventh succeeding times of high water (such as Nos. 16 and 16½).

2nd. Add to the seven intervening times (Nos. 12 to 16) taken consecutively from either end, 8, 16, 24, 24, 24, 16 and 8 minutes.

3rd. Deduct 6 minutes from all the following times up to the fourth anterior to the next quadrature, exclusive (Nos. 17 to 26½).

The results obtained by making such corrections are shown hereunder in the cases of the Graving Dock and Batiscan tide-gauging stations, for the low and high water seasons.

TABLE V.

Low Water, Season of 1887.						Appendix No. 13.	High Water, Season of 1888.					
Graving Dock Station.			Batiscan Station.				Graving Dock Station.			Batiscan Station.		
Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.	Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.	Number of high water,	Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.	Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.
H. M.	Min.	Min.	H. M.	Min.	Min.		H. M.	Min.	Min.	H. M.	Min.	Min.
10 10	3	3	1 33	3	3	—1	.....	.....	.....	.....	.....	.....
10 39	11	3	2 2	21	8	— ½	.....	.....	.....	.....	.....	.....
11 11	6	10	2 35	3	13	○ ●	.....	.....	.....	.....	.....	.....
11 46	28	4	3 10	44	20	½	.....	.....	.....	.....	.....	.....
12 19	12	12	3 43	4	20	1	.....	.....	.....	.....	.....	.....
12 57	35	11	4 21	56	32	1½	.....	.....	.....	.....	.....	.....
1 35	5	11	4 59	15	1	2	.....	.....	.....	.....	.....	.....
2 14	15	17	5 37	25	17	2½	.....	.....	.....	.....	.....	.....
2 49	11	11	6 12	5	5	3	.....	.....	.....	.....	.....	.....
3 28	8	8	6 51	14	14	3½	.....	.....	.....	.....	.....	.....
3 55	18	12	6 56	24	4	4	.....	.....	.....	.....	.....	.....
4 24	5	1	7 47	8	2	4½	9 30	7	7	1 21	31	31
4 50	12½	6½	8 13	16	10	5	9 54	2	2	1 45	7	7
5 15	10½	4½	8 38	26	20	5½	10 28	13	5	2 19	12	4
5 38	22	16	9 1	9	11	6	11 3	15	1	2 54	1	17
6 0	12½	6½	9 23	1	7	6½	11 42	29	5	3 33	39	15
6 22	13	7	9 45	4	2	7	12 16	7	17	4 7	30	6
6 44	11	5	10 7	3	3	7½	12 54	47	23	4 45	59	35
7 4	2	5	10 28	20	14	8	1 28	12	4	5 19	34	18
7 27	12	6	10 50	11	5	8½	2 2	31	23	5 53	46	38
7 48	4½	1½	11 11	9	3	9	2 35	1	1	6 26	19	19
8 10	12	6	11 33	6	0	9½	3 12	11	11	7 3	50	50
8 32	0	6	11 55	8	2	10	3 38	1	7	7 29	17	23
8 53	5	1	12 16	8	2	10½	4 5	1	5	7 56	27	33
Forw'd.	274	174	.....	343	218	.....	.....	177	111	.....	372	296

TABLE V—*Continued.*

Low Water, Season of 1887.						Number of high water, Appendix No. 13.	High Water, Season of 1888.					
Graving Dock Station.			Batiscan Station.				Graving Dock Station.			Batiscan Station.		
Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.	Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.		Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.	Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.
H.M.	Min.	Min.	H.M.	Min.	Min.		H.M.	Min.	Min.	H.M.	Min.	Min.
Over ...	274	174	.....	343	218	.....	....	177	111	....	372	296
9 15	9	6	12 38	10	4	11	4 31	8	13	8 21	31	37
9 43	1	0	1 6	14	14	11½	4 52	4	2	8 43	8	2
10 6	18	18	1 29	3	3	12	5 12	3	3	9 3	13	19
10 39	3	11	2 2	22	14	12½	5 30	11	5	9 21	10	4
11 14	33	17	2 37	70	+ 54	13	5 48	4	2	9 39	6	12
11 52	2	22	3 15	15	9	13½	6 4	6	0	9 55	30	24
12 26	33	9	3 49	35	11	14	6 21	3	3	10 12	20	14
1 6	21	7	4 29	20	4	14½	6 36	9	3	10 27	44	38
1 42	24	8	5 5	69	53	15	6 52	3	3	10 43	13	7
2 21	10	2	5 44	20	12	15½	7 7	8	2	10 58	38	32
2 54	23	23	6 17	37	37	16	7 23	1	5	11 14	9	15
3 31	0	0	6 54	2	2	16½	7 38	11	5	11 29	50	44
3 56	5	1	7 19	5	1	17	7 54	8	2	11 45	6	0
4 23	9	6	7 46	12	6	17½	8 10	10	4	12 1	- 38	32
4 49	8	5	8 9	5	11	18	8 26	10	4	12 17	+ 47	+ 53
5 7	0	6	8 30	13	7	18½	8 42	18	12	12 33	19	13
5 26	4	2	8 49	4	2	19	9 0	8	2	12 51	46	52
5 43	5	1	9 6	12	6	19½	9 18	16	10	1 9	1	7
6 0	18	12	9 23	26	20	20	9 43	+ 4	4	1 34	32	32
6 16	33	26	9 39	19	13	20½	10 5	7	7	1 56	15	15
6 31	22	16	9 54	20	14	21	10 37	12	4	2 28	62	+ 54
6 47	13	7	10 10	13	7	21½	11 11	1	15	3 2	33	17
7 1	13	7	10 24	17	11	22	11 49	18	6	3 40	47	23
Forw'd.	581	386	.....	806	533	.....	..	360	227	.....	990	842

TABLE V—*Concluded.*

Low Water, Season of 1887.						Number of high water, Appendix No. 13.	High Water, Season of 1888.					
Graving Dock Station.			Batiscan Station.				Graving Dock Station.			Batiscan Station.		
Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.	Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.		Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.	Corrected times of high water.	Difference between observed and computed approximate times.	Difference between observed and computed corrected times.
H. M.	Min.	Min.	H. M.	Min.	Min.		H. M.	Min.	Min.	H. M.	Min.	Min.
Over ...	581	386	.....	806	533	.....	.....	360	227	.....	990	842
7 16	7	1	10 39	8	14	22½	12 23	12	12	4 14	46	22
7 31	18	12	10 54	12	6	23	1 1	13	11	4 52	48	24
7 46	7	1	11 9	6	.....	23½	1 33	5	21	5 24	27	11
8 2	12	6	11 25	15	9	24	2 4	10	2	5 55	40	32
8 17	2	8	11 40	1	5	24½	2 33	5	5	6 24	21	21
8 33	16	10	11 56	17	11	25	3 7	5	5	6 58	22	22
8 49	2	4	12 12	17	23	25½	3 32	8	2	7 23	11	17
9 7	10	4	12 30	16	10	26	4 0	10	4	7 51	12	6
9 24	14	20	12 47	32	38	26½	4 26	8	2	8 17	10	4
9 50	8	8	1 13	1	1	27	4 51	10	4	8 42	30	24
.....	.....	.....	.....	.....	.....	27½	5 15	3	3	9 6	15	9
.....	.....	.....	.....	.....	.....	28	5 39	— 10	4	9 30	39	33
.....	.....	.....	.....	.....	.....	28½	6 3	5	1	9 54	25	19
.....	.....	.....	.....	.....	.....	29	6 26	7	1	10 17	53	47
.....	.....	.....	.....	.....	.....	29½	6 49	4	10	10 40	8	2
.....	.....	.....	.....	.....	.....	30	7 13	— 11	5	11 4	57	51
.....	.....	.....	.....	.....	.....	30½	7 36	2	8	11 27	24	18
.....	.....	.....	.....	.....	.....	31	8 0	10	4	11 51	45	39
.....	.....	.....	.....	.....	.....	31½	8 24	1	7	12 15	14	8
.....	.....	.....	.....	.....	.....	32	8 47	— 3	3	12 38	32	26
.....	.....	.....	.....	.....	.....	32½	9 10	— 9	15	1 1	11	17
Totals.	677	460	.....	931	650	.....	.....	511	356	.....	1580	1294
Means.	12	8	.....	16	11	.....	.....	9	6¼	.....	28	23

On account of the disturbances caused by winds, in the regular propagation of the tidal undulations in the St. Lawrence estuary, the crests of these waves passed the Graving Dock several times from 20 to 25 minutes earlier or later than indicated by the corresponding computed times of high water even with corrections applied, and at Batiscan the irregularities in the passages of the successive wave summits due to winds are much greater; the discrepancy between the observed and the corresponding corrected computed time having reached in five cases, 50 to 54 minutes.

The mean differences, however, between the observed and the corrected computed times of high water at the Graving Dock and Batiscan, are but 8 and 11 minutes respectively, for the low water season, and 6 and 23 minutes for the high water season, while the mean differences between the observed and the uncorrected approximate computed times are respectively 13 and 16 minutes and 9 and 28 minutes; the ratios between the corresponding mean differences at the two places being thus respectively:

$$\frac{8}{13} = 0{\cdot}61 \text{ and } \frac{11}{16} = 0{\cdot}69, \text{ and } \frac{6}{9} = 0{\cdot}66 \text{ and } \frac{23}{28} = 0{\cdot}82.$$

As morning tides are generally more important than evening tides during the month of May, and lower or smaller in October, it follows from the remarks just made, the indications of the diagrams and the figures given in the last table, No. V., that a day or two after the moon has reached her maximum declination, or thereabouts, owing to the diurnal inequalities high water may occur in the normal order of things during the month of May, at Quebec some 20 minutes, and at Batiscan some 40 minutes earlier in the morning than the hour that would be marked in a table of computed times, and respectively some 20 and 40 minutes later in the case of evening tides, even with corrections applied as above suggested. Also for the same reason the tide may attain its full height in the said localities respectively some 18 and 28 minutes later in the morning and earlier in the afternoon during the month of October. It will be noticed, that as we proceed westward from Quebec, the diurnal inequalities in the priming or lagging of the tides go on increasing, and the irregularities in the propagation of the summits of the fluvial waves, as well as in the advance of the head of the flood, also become greater; moreover, these differences and irregularities are larger during the high than during the low water season. By taking into consideration, in each case, the variations in the times of high water which are caused by changes in the volume of the fluvial discharge, and modifying the rule above laid down for the correction of the approximate times determined for the Graving Dock station accordingly, we might approach, on the whole, closer to the true times for any particulor place on the upper portion of the estuary, where this might be considered to be desirable, than can be done by applying uniformly the said rule as it stands in each locality.

The preparation of reliable tide tables for the use of navigators frequenting the St. Lawrence and others is a matter of sufficient importance to be taken up by the Dominion Government. The annual expenditure of issuing a sufficient number of tide tables constructed as outlined above, for the season of navigation, to meet present requirements would not be large.

It may not be superfluous to recall, that the tidal coefficients called "centièmes," which are published every year in "L'Annuaire des Marées de France" represent the proportional semi-amplitudes of the semi-diurnal luni-solar tide waves; the diurnal, monthly and annual undulations being left out of consideration and the semi-amplitude of the tide, or elevation of high water above or depression of low water below the mean tide level at the time of a syzygy such, that both the moon and sun are on the equator and at their mean distances from the earth, being taken as unity or 1.

The actual semi-amplitude of the tide wave in a seaport at the time when the sun and moon are in the positions just described, is termed "the unit of height" of this port. The units of height are used by masters of vessels in the seaports of France and elsewhere in conjunction with astronomical tidal coefficients (centièmes), principally for ascertaining on any given date the rise or fall of the tide, reckoned from the mean sea level.

If some one had attemted to determine at Quebec, the position of the high or low water level for the morning tide of 11th October, 1887, at low neaps, the coefficient of which is 41, by using the average value of the unit of height during the lunar month from 12th October to 10th November, which is 9·50 ft. nearly, he would have made out low water to stand $41 \times 9{\cdot}50 = 3{\cdot}895$ ft. below and high water 3·895 ft. above the mean tide level of that day. But according to actual observation, high water at 12.07 a.m., 11th October, 1887, was 6·765 ft. above and the preceding low water 5·69 ft. below the mean tide level corrected for diurnal inequalities; the computed elevations would therefore have been respectively 2·87 ft. and 1·80 ft. in error.

Again, if corresponding determinations of high and low water levels had been made for the afternoon tide of 18th October, at high springs, having a coefficient of 117, low and high water would have been found to stand respectively: $117 \times 9{\cdot}50 = 11{\cdot}115$ below and 11·115 above the corrected mean tide level, while in reality, low water observed at 2·42 p.m., 18th October, was but $(10{\cdot}720 - 2{\cdot}066) = 8{\cdot}65$ ft. below and the high water immediately following $(20{\cdot}182 - 10{\cdot}720) = 9{\cdot}46$ ft. above the said mean tide level; the errors being respectively 2.46 ft. and 1·65 ft.

Such computations would seldom prove of any practical utility at Quebec, on account of fluctuations of the mean tide level being too irregular; they serve here to show that even supposing the elevation of the said mean tide level to be accurately known the errors that would be committed are, in the case of neaps, nearly 9 and 20 per cent, and in the case of springs 64 and 10 per cent greater than the errors which have been found to obtain in European seaports under the most unfavourable conditions of wind and weather, although during the whole time the observations were made in 1887-88, and for several days previous, the weather was fair and no high winds were felt at Quebec and vicinity.

These large discrepancies appear to be chiefly due to the following causes:

1st. At spring tides the whole body of water brought up the St. Lawrence estuary by the Atlantic wave has to be raised vertically several feet higher than at neap tides, and as a good portion of the energy of the fluvial undulation is expended in performing this work, the intumescence formed on the estuary must gain less rapidly in importance than the wave from the ocean that gives rise to it.

2nd. At neaps the volume of tide water retained in the estuary—which may be looked upon as a very long narrow pond—is smaller than at springs, and the general level corresponding to any one whole phase of the undulations which are continuously being propagated up the St. Lawrence, is therefore lower than at springs and the importance or amplitude of the tides comparatively greater, than the theoretical one based on the coefficients (centiémes) contained in "L'Annuaire des Marées."

That the volume of tide water which lodges in the estuary increases with the gaining tides and diminishes when these are losing in importance, is shown in a striking manner by illustrations Nos. III.*, VI.*, IX.*, X., XII., XIII., XIV.*, XIX.*, XX., XXI., and XXII., on which are indicated the vertical movements of the tidal undulations at Grondines, St. Jean, Batiscan and Champlain. At these places the St. Lawrence invariably falls to a lower level at neaps than at springs, while the fresh water discharge and river level at Verchères remain constant. Below Pointe Platon, the low water surface of the stream is generally at a higher level at neaps than at springs; but on the whole the filling and emptying of the estuary goes on according to the same law as above this point, which is plainly indicated by illustrations Nos. III.*, VI*., VII., VIII., XII., XIII., XVII. and XVIII. and also by the figures contained in tables of tidal fluctuations Nos. I. to IV. and X. to XIII. of Appendix No. 13.

On all of the tidal diagrams, viz., Illustrations Nos. VI,*, to XV.*, the high, low and mean tide levels observed in 1887–88 during the low and high stages of the river, are plotted in chronological order, together with three corresponding series of tide levels corrected for diurnal inequalities as also approximate rectilinear loci DA, DC, DE for the last three series of levels just mentioned. The observed high, low and

* Lithograph full size to accompany official report of Minister of Public Works for fiscal year 1890-91.

mean tide levels are connected by full lines, and those corrected for diurnal inequalities by dashes alternating with two dots.

On diagram No. VI., viz., that indicating the elevations of the wave summits and troughs and the mean tide levels observed at the Graving Dock during the low water season in the autumn of 1887, are shown in addition to the loci DA, DC, DE just referred to: 1st. Rectilinear loci (compensation lines) $\dot{D}\dot{A}$, $\dot{D}\dot{C}$, $\dot{D}\dot{E}$, of three corresponding series of tide levels (connected by dotted lines) further corrected by variations in the pressure of the atmosphere above and below the mean pressure which obtained 9th October to 10th November, the time during which observations were made, viz., a pressure corresponding to that created by a column of mercury 29·96 inches high. 2nd. High and low water curves indicating the fluctuations of theoretical tide waves due to astronomical causes only, viz., in full red lines. In constructing these curves I have given to the ratio $\frac{AB}{AC}$ of AB, the height of high water mark A above the level BD which the stream would assume approximately if it was abstracted from the influence of the tides, to the whole amplitude AC, and to the ratio $\frac{BC}{AC}$ of BC, the depth to which low water descends below the said level BD to the amplitude AC, the approximate values of about $\frac{8}{9}$ and $\frac{1}{9}$ respectively.

By drawing accurate compensation lines AB, BD, with the aid of the planimeter in connection with the high and low water loci corrected for diurnal inequalities only, for each one of the four series of gaining and losing tides Nos. I., II., III. and IV. of the complete cycle for the lunar month from 12th October to 10th November, 1887, the following mean values of the said ratios more correctly applicable in each case, have been arrived at, viz.:—

For series	No. I.,	$\frac{AB}{AC}$ =	0·829	$\frac{BC}{AC}$ =	0·171
do	II.,	do =	1·015	do =	0·015
do	III.,	do =	0·705	do =	0·295
do	IV.,	do =	1·176	do =	0·176

Mean values for the four series: $\frac{AB}{AC}$ = 0·937, $\frac{BC}{AC}$ = 0·067, or say $\frac{10}{11}$ and $\frac{1}{11}$ respectively.

Moreover, the mean level of the tideless estuary corresponding to the period just described was, for the purpose of constructing the astronomical tide curves, placed about 1·85 feet above datum, so as to occupy an intermediate position between the four river levels determined by the intersections D_1, D_2, D_3, D_4 of the compensation lines drawn in connection with the high and low water loci corrected for diurnal inequalities, but not for variations in the atmospheric pressure, nor for fluctuations in the fresh water discharge. These river levels are at the following elevations above datum, viz., D_1B_1, 3·20 feet; D_2B_2, 1·80 feet; D_3B_3, 6·42 feet; and D_4B_4, 0·42 feet, the mean of which is 2·96 feet, and with corrections applied for variations of atmospheric pressure above and below the average pressure of 29·95 inches of mercury, the said river levels were found to be 3·17, 1·98, 6·10 and 0·40 feet above datum, the mean of which is 2·91 feet, viz., only 0·05 feet less than that deduced from the loci of the tide levels uncorrected for changes in the barometric column. Finally, the unit of height for computing the amplitudes of the astronomical tides at Quebec for the low water season of 1887 has been taken at 9·515 feet, which is the mean value of the same for the complete lunar month, 9th October to November, 1887.

In the construction of the high and low water curves indicating the variations of the theoretical tide waves, viz., those due exclusively to astronomical causes during the high water season and which are shown in red on diagram No. XII., the mean level $\overline{BD}$ of the tideless stream was placed at an elevation of 3·22 feet = $\frac{2\cdot34+3\cdot20+3\cdot34+3\cdot40}{4}$, which fraction denotes the mean of the average levels of the tideless estuary deduced for the

four series of observations Nos. V., VI., VII. and VIII. Moreover, the ratios $\frac{AB}{AC}$ and $\frac{BC}{AC}$ have been given the respective mean values which obtain in the said series of gaining and losing tides, viz., $\frac{AB}{AC} = \frac{0\cdot910+0\cdot797+0\cdot730+0\cdot745}{4} = 0\cdot7955$ and $\frac{BC}{AC} = \frac{0\cdot090+0\cdot203+0\cdot270+0\cdot255}{4} = 0\cdot2045$ and the mean unit of height used for computing the theoretical amplitudes is 9·32 feet, which was its mean value during the same four series of tides.

The sinusoidal curves of theoretical tide levels for the low water season of 1887 which are drawn on illustration No. VI. for the Graving Dock station, show at a glance, that at springs the actual high tide level is from 2·0 to 3·5 feet lower in Quebec Harbour than the theoretical one determined as above explained, and at neaps from 2·5 to 4 feet lower; but as regards low tide, the relative positions of the theoretical and natural loci of water levels are not so well defined or easily made out. The irregularities in the natural low tide locus are so marked and numerous and the typical astronomical low water sinusoidal curve so flat that it is difficult, in many places, to determine in a positive manner, whether the latter locus is higher or lower than the former.

It is not impossible that the interference of the wave passing through the Straits of Belle Isle into the Gulf of St. Lawrence, with that which enters through Cabot Strait, may, to some extent, be instrumental in bringing about the flattening, just pointed out, of the theoretical high and low water curves which indicate the variations due to astronomical causes, in the importance of the tide waves on the shores of the open Atlantic, and in the vertical positions of the summits and troughs of the said waves.

TABLE VI.—*Maximum, minimum and mean results of monthly series of tidal observations made during the high and low water seasons of 1887–88, with river at respective elevations of 21·94 feet and 29·91 feet above datum at Verchères respectively.*

	Lévis Graving Dock.		St. Nicholas.		Pointe Platon		Grondines.		St. Jean Deschaillons.		Batiscan.		Champlain.	
	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.
	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.
Maximum duration of floods observed	5 39	5 18	5 46	5 20	5 23	4 40	5 00	4 02	4 39	3 58	4 38	4 38	5 15	4 38
Minimum do do	4 11	4 14	4 35	4 30	4 01	3 20	3 32	3 12	3 25	3 03	2 54	3 00	2 40	2 43
Mean do do	4 59	4 45	5 0	4 53	4 29	4 04	4 14	3 35	4 05	3 27	3 37	3 47	3 35	3 39
Maximum duration of ebbs observed	8 07	8 21	8 9	8 20	8 26	9 03	8 53	9 47	9 16	9 50	9 46	9 55	10 00	10 13
Minimum do do	6 47	6 54	6 42	6 50	7 05	7 40	7 24	8 00	7 23	8 12	7 37	7 07	7 20	7 20
Mean do do	7 28	7 40	7 26	7 32	7 47	8 22	8 12	8 50	8 21	8 58	8 49	8 37	8 47	8 45
Maximum length of half tide day (H.W. to H.W.) observed	13 05	13 12	13 15	13 00	13 08	13 10	13 10	13 08	13 36	13 09	13 33	13 23	13 20	13 25
Minimum do do do	11 58	11 57	11 50	11 55	11 54	11 55	11 55	11 48	11 51	11 48	11 35	11 10	11 35	11 28
Mean do do do	12 26	12 25	12 25	12 25	12 25	12 25	12 26	12 25	12 25	12 25	12 25	12 25	12 25	12 25
Maximum difference between observed and computed half tide day	36	41	48	33	41	33	43	42	52	45	55	1 25	57	1 02
Mean do do do	13	11	14	15	12	13	11	21	11	20	18	29	21	23
Maximum observed priming of tides	32	26	31	25	27	35	29	25	29	26	38	43	1 15	42
do lagging of tides	53	29	51	40	54	35	51	29	47	25	1 09	38	1 20	52
Mean of observed priming and lagging of tides	16	12	20	12	18	12	18	13	20	12	19	19	33	16
Maximum difference between observed and computed priming of tide	27	12	29	14	38	16	38	21	20	23	42	53	1 02	33
do do do lagging of tide	51	19	49	23	52	18	49	19	42	23	1 07	26	52	31
Difference between mean of observed and mean of computed priming and lagging of tides	01	00	00	00	00	00	00	00	00	00	04	07	05	04
Maximum diurnal inequalities in priming or lagging of observed tides	1 25	28	1 22	1 0	1 12	30	1 7	22	56	29	1 30	1 9	1 50	57
Mean do do do	17	08	19	16	18	10	17	8	18	10	26	22	20	19
Diurnal inequalities in computed priming or lagging corresponding to maximum inequalities observed	7	10	7	6	7	17	7	6	7	9	12	1	3	16
Difference between maximum observed and corresponding computed inequalities	1 18	18	1 15	54	1 5	13	1 0	16	49	20	1 18	1 8	1 47	41

TABLE VI.—Maximum, minimum and mean results obtained during the high and low water seasons of 1887–88, &c.—*Continued.*

—	Lévis Graving Dock.		St. Nicholas.		Pointe Platon.		Grondines.		St. Jean Deschaillons.		Batiscan.		Champlain.	
	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.
	H. M.	H. M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.
Difference between mean observed and mean computed or theoretical inequalities (6 to 7 minutes) in priming or lagging....	10	02	12	10	11	04	10	02	11	04	19	16	13	13
	ft.													
Maximum duration of apparent stand at high water—within. 0·05	31	37	36	.....	32	34	33	1 00	41	1 25	1 44	2 10	2 00	2 30
Minimum do do do .. 0·05	13	10	6	....	7	09	20	18	16	15	17	35	16	20
Mean do do do .. 0·05	22	25	19	....	21	21	26	32	28	37	42	1 26	45	1 00
Maximum duration of apparent stand at low water—within. 0·05	32	36	55	.....	26	36	35	1 05	56	1 14	1 30	2 25	2 50	2 05
Minimum do do do .. 0·05	12	11	4	.....	10	10	21	32	13	20	02	28	15	20
Mean do do do .. 0·05	19	20	18	....	17	22	27	45	31	49	57	1 16	1 10	1 04
General duration of apparent stand at high and low water —within..... 0·05	20	22	20	....	19	22	26	38	30	43	50	1 20	53	1 3
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Elevation of highest wave summit observed...	18·397	20·184	17·890	20·969	18·670	23·051	18·340	23·827	18·494	24·360	18·746	25·248	19·253	25·920
do lowest wave trough observed.....	−1·321	0·500	−0·570	2·449	2·137	6·357	6·640	13·017	9·219	15·940	13·010	19·469	14·353	20·670
Mean elevation of summits and troughs of waves observed.....	7·007	8·911	7·488	10·318	9·306	13·621	11·900	18·018	13·201	19·900	15·149	22·524	16·061	23·740
Maximum flood range observed.	18·915	17·775	17·590	16·700	15·128	13·825	9·684	7 310	7·655	5·130	4·383	2·617	3·800	1·880
Minimum do	9·351	10·126	9·550	9·680	8·930	7·030	4·972	2·190	3·540	1·200	1·600	0·430	0·450	0·140
Mean do	13·869	13·288	13·400	12·768	11·767	10·439	7·502	4·764	5·330	2·960	2·532	1·282	1·869	0·950
Maximum ebb range observed	18·351	17·845	16·960	16·640	14·320	13·585	8·965	7·170	7·190	4·730	3·858	2·547	3·100	1·760
Minimum do	9·326	9·547	9·630	9·230	8·800	6·993	5·175	2·360	3·455	1·330	1·204	0·526	0·800	0·150
Mean do	13·835	13·268	13·380	12·572	11·746	10·452	7·496	4·745	5·291	2·940	2·516	1·265	1·857	0·950
Maximum mean tide level (corrected for diurnal inequalities) observed.	8·987	10·529	9·330	11·952	11·274	15·606	13·624	20·026	14·809	21·420	16·610	23·982	17·434	25·310
Minimum do do do ..	5·158	7·515	5·640	8·734	7·431	11·212	10·044	15·458	11·697	17·380	13·969	20·006	15·128	21·110
General do do do ..	6·987	8·955	7·474	10·352	9·539	13·688	11·885	18·030	13·201	19·900	15·149	22 529	16·091	23·750
Maximum amplitudes corrected for diurnal irregularities corresponding to theoretical coefficients of 114 to 117 for L. W. season and coefficients 104 to 107 for H.W. season.....	17·688	16·441	16·410	15·418	14·019	12·602	8·315	6·325	6·844	4·220	3·763	2·000	3·225	1·430

Minimum amplitudes corrected for diurnal inequalities corresponding to theoretical coefficients of 39 to 44 for L. W. season and coefficients 46 to 51 for H.W. season	10·949	10·752	10·950	10·703	10·113	8·258	6·251	3·075	3·477	1·780	1·703	0·738	0·863	0·480
Mean amplitudes corrected for diurnal inequalities corresponding to theoretical coefficients 72·7 for L. W. season and coefficient 71·4 for H.W. season	13·877	13·279	13·413	12·766	11·766	10·438	7.499	4·753	5·333	2·980	2·532	1·275	1·887	0·960
	H. M.	H. M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.
Maximum diurnal difference in observed durations of floods	1 05	52	58	25	58	48	53	26	50	23	1 01	1 02	1 50	1 24
Minimum do do	0	0	0	0	01	03	00	00	00	00	00	00	00	00
Mean do do	15	14	14	11	14	16	15	09	19	09	17	19	30	30
Maximum diurnal difference in observed durations of ebbs	1 08	58	1 27	1 10	1 18	1 08	1 23	1 22	1 53	1 22	2 08	2 59	2 00	2 20
Minimum do do	01	04	01	05	01	02	01	05	....	01	01	01	00	.....
Mean do do	29	28	31	35	32	37	32	49	29	47	41	59	37	49
Maximum diurnal difference in semi-tide days	1 06	1 15	1 25	1 00	1 32	55	1 10	1 12	1 35	1 12	1 40	2 31	2 25	1 57
Minimum do do	01	02	01	.....	.....	01	...	09	.....	.....	.....	07	00	0
Mean do do	22	12	24	27	27	26	19	42	20	40	32	56	41	42
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Maximum diurnal difference observed in high water levels	4·356	3·349	3·910	3·140	3·605	3·542	2·918	2·420	2·659	1·950	2·345	1·266	1·650	0·960
Minimum do do	0·010	0·010	0·010	0·070	0·045	0·020	0·030	0·010	00	0·030	0·001	0·010	00	0·010
Mean do do	1·637	1·701	1·290	1·585	1·234	1·546	0 979	1·127	0·802	0 910	0·723	0·506	0·649	0·390
Maximum diurnal difference observed in low water levels	1·450	1·540	1·380	1·585	1 035	0·995	1·197	0·500	1·318	0·510	0·968	0·505	1·150	0·550
Minimum do do	00	0·019	00	0·010	0·020	0·020	0·009	0·010	0·010	00	00	00	00	00
Mean do do	0·484	0·426	0·440	0·346	0·408	0·237	0·280	0·170	0·271	0·160	0·214	0·156	0·316	0·150
Maximum diurnal difference in corrected mean tide levels	1·110	0·846	1·120	0·630	1·153	0·684	0·690	0·517	0·899	0·680	0·776	0·435	0·437	0·420
Minimum do do do	0·017	0·000	0·000	0·006	0·010	0·014	0·002	0·004	0·001	0·010	0·002	0·002	0·000	0·010
Mean do do do	0·353	0·204	0·340	0·204	0·350	0·233	0·267	0·191	0·218	0.180	0·187	0·139	0·233	0·140
Maximum diurnal differences in corrected amplitudes	1·230	0·846	0·900	0·650	0·619	0·645	0·557	0·424	0·667	1·170	0·674	0·220	0·812	0·180
Minimum do do do	0·003	0·006	0·010	0·010	0·008	0·014	0·008	0·003	0·012	0·000	0.006	0·000	0·006	0·010
Mean do do do	0·353	0·325	0·340	0·256	0·212	0·247	0·165	0·188	0·219	0·210	0·175	0·081	0·254	0·060
Maximum oscillations of float in gauge box (during stormy weather)	0·300	0·250	0·250	0·150	0·600	0·400	0·140	0·100	0·040	0·220	0·170	0·150	.....	.....
Approximate mean oscillations of float in gauge box	0·030	0·020	0·030	0.020	0·040	0·020	0·020	0·010	0·020	0·030	0·020	0·010	..	.. ..
	H M.	H. M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.
Maximum observed luni-tidal interval	7 32	7 20	7 56	7 51	9 12	8 48	9 47	9 34	9 58	9 53	10 56	11 30	11 46	11 38
Minimum do do	5 12	5 17	5 50	5 58	7 02	6 38	7 41	7 30	8 03	7 56	8 39	8 43	9 19	9 13
Average do do on full and change days	6 40	6 33	7 20	7 08	8 29	8 10	9 04	8 44	9 24	9 03	10 06	9 57	10 48	10 39
Mean do do for whole month (corrected establishments)	6 24	6 10	6 57	6 52	8 06	7 44	8 41	8 28	9 02	8 53	9 47	10 00	10 26	10 26

TABLE VI.—Maximum, minimum and mean results obtained during the high and low water seasons of 1887-88, &c.—*Concluded.*

	Lévis Graving Dock.		St. Nicholas.		Pointe Platon.		Grondines.		St. Jean Deschaillons.		Batiscan.		Champlain.	
	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.	Low water season.	High water season.
	H. M.	H. M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.	H.M.
Corresponding monthly mean times of low water	6 32	6 21	7 04	6 56	8 35	8 40	9 36	9 52	10 07	10 27	11 21	11 14	12 09	11 51
Maximum difference between observed time of high water and computed time based on Brest times corrected at quadratures by Mr. Gaussin, as given in "L'Annuaire des Marées"	36	32	47	31	46	31	47	42	54	52	1 10	1 02	1 19	1 04
Minimum difference between observed time of high water and computed time based on Brest times corrected at quadratures by Mr. Gaussin, as given in "L'Annuaire des Marées"	00	00	00	00	00	09	01	00	00	00	00	01	01	00
Mean difference between observed time of high water and computed time based on Brest times corrected at quadratures by Mr. Gaussin, as given in "L'Annuaire des Marées"	13	09	12	11	11	10	11	14	12	15	18	27	21	20
Maximum difference between observed time of high water and computed time based on London Bridge tide tables contained in Nautical Almanac	1 01	1 01	1 00	54	58	47	1 08	59	1 20	1 04	1 38	1 16	1 41	1 29
Minimum difference between observed time of high water and computed time based on London Bridge tide tables contained in Nautical Almanac	00	00	05	00	00	01	00	01	00	00	01	03	02	01
Mean difference between observed time of high water and computed time based on London Bridge tide tables contained in Nautical Almanac	23	17	24	19	21	18	22	22	22	23	28	36	33	29
Discrepancy between the mean luni-tidal interval according to actual observation and that deduced from the computed times of high water based on the corresponding Brest times and the observed mean luni-tidal interval	00	00	1	1	3	2	3	3	4	4	4	5	4	5

REMARKS.—1. During the low water season of 1887 observations were made continuously from 11th October to 11th November, when the river stood at a mean elevation of 21·94 ft. at Verchères and 16·40 ft. over sill, old lock No. 1, Lachine Canal, and during the high water season of 1888, from 5th May to 3rd June, when the river surface was at a mean height of 29·91 ft. aboue datum at Verchères and 23·00 ft. over said lock sill.

2. *Mean heights of barometrical column, reduced to sea level and 0°/// cent. or : 32° Fahr. (a) QUEBEC : Mean of observations at Lévis Graving Dock and those of Quebec Observatory, low water season of 1887 : 30·020 inches ; high water season of 1888, 29·946 inches. (b) MONTREAL (McGill Observatory) : Mean of observations—low water season of 1877, 30·031 inches ; high water season of 1888, 29·931 inches.*

3 Maximum height of reduced barometric column, Graving Dock, low water season of 1887, 30·618 inches ; high water season of 1888, 30·251 inches.

4. Minimum height of reduced barometric column, Graving Dock, low water season of 1887, 29·241 inches ; high water season of 1888, 29·586 inches.

5. Strongest winds observed— { Quebec, low water season of 1887, S.E. wind 26·00 miles per hour ; high water season of 1888, N.W. wind 17 miles per hour. / Montreal, low water season of 1887, westerly 72 miles per hour ; high water season of 1888, S.W. wind 32 miles per hour.

6. Directions of prevalent winds— { Quebec, low water season of 1887, north-westerly ; high water season of 1888, north-easterly. / Montreal, low water season of 1887, westerly ; high water season of 1888, south-westerly.

7 In the 16 tables of tidal fluctuations for the high and low water seasons of 1887-88, Appendix No. 13, maxima are indicated by a star, thus : *, and minima by a circle, thus : ○

N.B.—Errors to be corrected in table of results of tidal observations of 1887-88, printed on Ill. XXVI. *b*, under the heading of Quebec Graving Dock.

Mean flood range observed	13·648	should be	13·879	as above.
do ebb do	13·816	do	13·835	do
do diurnal difference in low water levels	460	do	484	do
General mean tide level corrected for diurnal inequalities	6·808	do	1·987	do

TABLE VII.—Mean rates of propagation of head of flood and summit of tide wave up the St. Lawrence, for each one of the series of gaining and losing tides observed, during a complete revolution of the moon in the low water season of 1887, viz., 12th October to 10th November; &c.

Tide Station.	Total and intermediate distance in miles.	Mean Duration of Flood, &c.	Mean Rate of Advance of Tide Wave in Miles per Hour. Series I. — Gaining Tides. — Tidal Coefficient =81·57. — Verchères river level =22·01 ft.	Series II. — Losing Tides. — Tidal Coefficient =77·00. — Verchères river level =22·18 ft.	Series III. — Gaining Tides. — Tidal Coefficient =68·40. — Verchères river level =21·77 ft.	Series IV. — Losing Tides. — Tidal Coefficient =65·21. — Verchères river level =21·80 ft.	General Mean of Four Series. — Tidal Coefficient =72·95. — Verchères river level =21·94 ft.	Remarks.
Graving Dock	0·00	H. M. 4 57	Miles.	Miles.	Miles.	Miles.	Miles.	M'n rate of advance of head of flood 11·15 miles greater than that of summit of wave between Graving Dock and River Chaudière.
		H'd of flood	35·00	35·96			35·40	
		Summit	23·17	23·31			24·11	
		Mean	29·17	29·64			29·76	
	8·33							
	13·52							
River Chaudière, East side	8·33	5 04						These rates of propagation, obtain betw'n the Graving Dock, instead of Riv. Chaudière and St. Nicholas.
		H'd of flood	24·37	25·24	25·41	25·41	25·11	
		Summit	22·85	22·82	23·30	24·06	23·26	
		Mean	23·61	24·03	24·36	25·00	24·19	
St. Nicholas	23·85	5 01						Mean differ'ce between velocities of propagation of head of flood and summit: a minimum between Graving Dock and St. Nich'las = 1·85 mile per hour.
Baker's wharf		H'd of flood	16·23	15·82	15·50	15·63	15·80	
		Summit	20·18	21·06	20·26	20·28	20·45	
		Mean	18·21	18·44	17·88	17·96	18·13	
	23·98							
Platon	47·83	4 35						Mean differ'ce between velocities of propagation of head of flood and summit: a maximum between Platon and Grondines = 7·80 miles per hour.
Hon. H. G. Joly's wharf		H'd of flood	11·00	10·53	11·41	11·42	11·09	
		Summit	19·69	17·59	19·54	18·72	18·89	
		Mean	15·35	14·06	15·48	15·07	14·99	
	11·30							
Grondines	59·13	4 13						
Public wharf		H'd of flood	9·45	10·76	11·01	9·09	10·08	
		Summit	13·08	13·61	18·29	13·24	14·56	
	5·20	Mean	11·26	12·18	14·65	11·17	12·32	
St. Jean des Chaillons	64·33	4 04						
Levasseur's wh'f.		H'd of flood	7·04	6·31	5·96	6·02	6·33	
		Summit	11·56	10·41	9·74	9·75	10·40	
	7·75	Mean	9·30	8·36	7·85	7·89	8·35	
Batiscan	72·08	3 37						
Brunelle's wharf		H'd of flood	7·10		14·70	7·70	9·83	
		Summit	16·32		9·00	10·52	11·95	
	7·40	Mean	11·71		11·85	9·11	10·89	
Champlain	79·48	3 40						
Gagnon's wharf								

TABLE VIII.—Mean rates of propagation of head of flood and summit of tide wave up the St. Lawrence, for each one of the series of gaining and losing tides observed, during a complete revolution of the moon in the high water season of 1888, viz., 4th May to 3rd June; etc.

Tide Station.	Total and intermediate distances in miles.	Mean Duration of Flood, etc.	Mean Rate of Advance of Tide Wave in Miles per Hour. Series V. — Gaining Tides. — Tidal Coefficient =65·14. — Verchères river level =28·13 ft.	Series VI. — Losing Tides. — Tidal Coefficient =67·13. — Verchères river level =29·82 ft.	Series VII. — Gaining Tides. — Tidal Coefficient =78·00. — Verchères river level =31·50 ft.	Series VIII — Losing Tides. — Tidal Coefficient =75·71. — Verchères river level =30·21 ft.	General Mean of Four Series. — Tidal Coefficient =71·50. — Verchères river level =29·31 ft.	Remarks.
		H. M.	Miles.	Miles.	Miles.	Miles.	Miles.	
Graving Dock...	0·00	4 44	.....	.....	.....	.....	.....	
		H'd of flood	26·50				26·01	General mean rate of advance of head of flood approx. 9·30 miles greater than that of summit of wave between Graving Dock and River Chaudière.
	8·33	Summit...	20·10				16·71	
		Mean.....	23·30				21·36	
River Chaudière	13·52	4 48	.....	.....	.....	.....	.....	
East side	8·33	H'd of flood	23·81	22·99	23·18	23·49	23·37	These velocities of propagation obtain between the Graving Dock and St. Nicholas.
		Summit...	23·08	18·24	17·91	17·52	19·19	
		Mean.....	23·44	24·62	24·55	20·50	21·28	
St. Nicholas....	23·85	4 53	.....	.....	.....	.....	.....	
Baker's wharf.		H'd of flood	14·11	13·68	13·75	13·69	13·81	Mean difference between velocities of propagation of head of flood and summit: a maximum between St. Nicholas and Platon =12·75 miles per hour.
	23·98	Summit...	24·72	29·85	26·43	25·24	26·56	
		Mean.....	19·42	21·76	20·09	19·47	20 18	
Platon.....	47·83	4 03	.....	.....	.....	.....	.....	
Hon. H.G. Joly's wharf.		H'd of flood	9·14	9·78	9·14	9·49	9·39	
	11·30	Summit...	14·95	13·42	15·46	18·26	15·52	
		Mean.....	12·04	11·60	12·30	13·87	12·46	
Grondines	59·13	3 35	.....	.....	.....	.....	.....	
Public wharf		H'd of flood	9·73	8·04	9·64	9·23	9·16	
	5·20	Summit...	14·32	10·71	11·74	12·34	12·28	
		Mean.....	12·03	9·38	10·69	10·79	10·72	
St. Jean des Chaillons....	64·33	3 24	.....	.....	.....	.....	.....	
Lavasseur's wh'f.		H'd of flood	8·92	10·06	10·47	10·24	9·92	Mean difference between velocities of propagation of head of flood and summit: a minimum between St. Jean and Batiscan =2·94 miles.
	7·75	Summit...	6·12	6 24	7·42	8·14	6·98	
		Mean.....	7·52	8·15	8·94	9·19	8·45	
Batiscan.....	72·08	3 48	.....	.....	.....	.....	.....	
Brunelle's wh'f.		H'd of flood	10·31	12·47	13·25	13·48	12·28	
	7·40	Summit...	16·23	33·64	15·27	12·00	19·29	
		Mean.....	13·27	22·87	14·26	12·74	15·79	
Champlain.....	79·48	3 40	.....	.....	.....	.....	.....	
Gagnon's wharf			.....	.....	.....	.....	.....	

As already stated in another part of this report, the fluvial tide wave partakes of the nature of waves of translation more and more as we proceed inland, and it is found that, in general, the law of propagation of such undulations holds good, viz. :—

$$V = \sqrt{g(H+h)} - U.$$

where V denotes the velocity of propagation, g the acceleration of gravity per second, H the depth of the estuary at low water, h the height of the wave above low water at the instant considered, and U the velocity due to the waters of the riverproper at the same instant.

In regular waves of translation moving along in a horizontal channel of uniform depth and width, this relation holds good, as the above equation implies, for each one of its elementary slices or cross-sections of the channel, after the wave has assumed its definite sinusoidal form in the direction of the longitudinal axis of the said channel. But in a stream of ever-varying cross-section and declivity, the successive elementary slices must move onward at correspondingly varying speeds; those passing over the greater depths advancing more rapidly than those propagated through shallower water and overtaking them. It is for this reason that the fluvial undulations are continually getting steeper as they ascend in the estuaries of rivers, that is to say, the summit of the wave approaches more and more to the head of the flood, until finally, at the extreme upper limit of the maritime portion of the stream, the two coincide.

Owing to the continued foreshortening of the anterior and upper portion of each fluvial undulation, viz. : that contained between the summit and the head of the flood, this intumescence rises, in general, more and more above the level of the tideless stream, or diminishes in height above the said level, at a rate which is getting less and less according as the overlapping of elementary slices referred to is greater or less than would suffice to counterbalance the attenuation caused by friction, the rise of the river bed, &c.

Where this attenuation is taking place at a rapid rate, the slope of the locus of high tide levels has sometimes a contrary direction to that of the locus of low tide levels. On the St. Lawrence, above Quebec, the locus of the high tide levels slopes throughout seawardly, the same as that of the low tide levels, at all times and at all stages of the river during the open season, except on the reach between Quebec and St. Nicholas, where the elevation of the wave summit is occasionally slightly (up to 0·05 ft.) greater at Quebec than at St. Nicholas, at high spring tides during the low water season. How far below Quebec this upward slope in the high water locus may continue, and at what precise point the tides generally reach their maximum amplitude, has, as yet, not been ascertained; but, as previously intimated, it is probably at no great distance below the ancient capital.

According to current measurements made by the Montreal Flood Commission at Lanoraie, in November, 1886, while the river was at an average elevation of 20·80 feet at Sorel, or 20·75 feet above the 0 of the Montreal Harbour Commissioners' gauge, and its mean depth 33·25 feet, the discharge of the St. Lawrence was 315,000 cubic feet per second, and when the water stands 0·75 feet lower, or 20·05 feet above datum at Sorel, the discharge may be assumed to be approximately equal to $315{,}000 \left\{ 1 - \frac{3\ (38{\cdot}25 - 32{\cdot}50)}{2\ (33{\cdot}25)} \right\}$ or say 304,000 cubic feet per second. I may remark, however, *en passant*, that the volume of 315,000 feet was slightly in excess of the actual quantity of surface or drainage water carried by the St. Lawrence per second at the time the current measurements were made, say, roughly, by from 500 to 1,000 cubic feet of water, that had accumulated in the estuary above Lanoraie, during the season of gaining tides immediately preceding new moon of 27th October, 1886, and that had to find its way out again during the succeeding series of losing tides.

Again, in a report made by the late Thos. Guerin, Esq., civil engineer, on what is known as the "Shearer" scheme of harbour improvements at Montreal, under date of 19th March, 1883, it is stated that on 6th June, 1882, when the water stood 23·50 ft.

over the sill of lock No. 1, foot of Lachine Canal, and 27·50 ft. above 0 Montreal Harbour Commissioner's Sorel gauge, the discharge was 431,733 cubic feet per second.

Now, during the time series of observations V., VI., VII. and VIII. were made, viz.: 4th May to 3rd June, 1888, the river remained at an average elevation of 29·90 ft. above datum at Verchères, or 27·60 at Sorel. We may, therefore, assume the mean discharge to have been at the rate of 432,000 cubic feet per second between the dates just mentioned.

Judging by the rate of propagation of the head of the flood and that of the summit of the fluvial wave deduced from the tidal observations made in 1887-88, as indicated above in tables Nos. VII. and VIII., it is evident that neither the former nor the latter advances regularly in accordance with the law indicated by the equation:

$$V = \sqrt{g\,(H+h)} \pm U.$$

Indeed the perturbations caused in the regular propagations of the fluvial waves, by winds, variations in the fresh water discharge, sudden contractions and enlargements of the waterway, etc., are occasionally so great that the head of the flood appears to advance faster than the summit of the same wave. This was notably the case during the low water season of 1887 between the Graving Dock, Chaudière and St. Nicholas stations, and during the high water seasons of 1888 between the Graving Dock and the River Chaudière, and between St. Jean des Chaillons and Batiscan. Notwithstanding that the mean amplitude is 13·58 ft. at low, and 13·19 ft. at high water between the Graving Dock and River Chaudière stations, the head of flood advances, in the fomer case over 11 miles faster per hour, and in the latter nearly 9 miles faster than the wave summit.

It has happened also in a few cases that the tide was high or low at two consecutive stations at nearly the same instant, which, taking for granted that the observations were made with great precision, seems to indicate infinitely great velocities of propagation.

In most instances the variations in the rates of propagation resulting from the increased outflow of water during series of losing tides, as compared to that which takes place during series of gaining tides, are apparently intervolved with other fluctuation of various kinds to such an extent as to prevent their being made out by themselves.

It is worthy of note, however, that notwithstanding great and numerous discrepancies between some of the observed and corresponding theoretical or computed times of high water, the fact of the difference between the mean of the observed and the mean of the computed priming or lagging of the tides being less than one minute at all the gauging stations from Quebec up to St. Jean des Chaillons, inclusive—according to the results entered in table No. VI.—goes to show that irregular variations in the very large fresh water discharge of the St. Lawrence and persistent high winds have, on the whole, little or no effect in checking or accelerating the regular propagation of the luni-solar wave generated in the Atlantic Ocean, up the estuary of the river as far as St. Jean des Chaillons.

At Batiscan and Champlain the average effect of the fresh water discharge and winds appears to have been to increase the lagging and priming of the tides from 4 to 7 minutes.

Again, according to the tabulated results just referred to (see table VI. of this report), the increased fresh water discharge of the high water season invariably diminishes the mean diurnal inequalities in the lagging or priming of the tides; thus, at the Graving Dock these mean observed inequalities amounted to 17 minutes in the fall of 1887, and only to 8 minutes in the spring of 1888.

Finally, I may call attention to the fact that while at the Graving Dock the mean luni-tidal interval is very nearly the same as the corresponding computed interval based on the Brest times of high water, the discrepancies between the said intervals, due to the disturbances in the propagation of the oceanic wave caused by the fresh water, winds, etc., increase continuously as we proceed up stream, reaching on an average 4 to 5 minutes at Batiscan and Champlain.

In table No. IX. are entered the approximate average areas and depths of the St. Lawrence waterway, during the low water season, on the stretches between the tide

stations at mean tide, when it has an average amplitude corresponding to an astronomical coefficient of about 73, which areas and depths have been deduced from the soundings shown on the Admiralty charts and some river plans on record in the department—in connection with the corresponding values of the velocity U and the mean monthly amplitudes just referred to; also the mean depths H at low water, computed with the aid of the formula: $V = \sqrt{g(H + h)} + U$, and those H based on the Admiralty soundings.

TABLE IX.

Section of River.	*Low water—season of 1887. Lunar month, 12th October to 10th November. River surface at Verchères at a mean elevation of 21·94 ft.* Mean Amplitude, h	A Approximate area of waterway at mean tide level, according to soundings on Admiralty charts.	U Velocity due to freshwater discharge at mean tide level, $= \frac{304{,}000}{A}$	$H + \frac{h}{2} = \frac{(V+U)^2}{g}$ Average depth of river at mean tide corresponding to mean rate of propagation of fluvial wave.	H Average depth of river at low water, corresponding to mean velocity V of propagation of fluvial wave.	Approximate average depth of estuary at meantide, according to soundings on Admiralty charts.	H Approximate average depth of estuary at low water, according to soundings on Admiralty charts.
	Feet.	Sq. feet.	Feet per second.	Feet.	Feet.	Feet.	Feet.
Graving Dock to River Chaudière	13·82	225·000	1·35	62·89	55·98	61·0	54·2
Graving Dock to St. Nicholas...	13·64	205·000	1·48	42·63	35·81	49·9	43·2
St. Nicholas to Platon	12·59	170·000	1·79	25·01	18·71	27·1	20·8
Platon to Grondines.....	9·63	130·000	2·34	18·38	13·56		
Grondines to St. Jean des Chaillons.....	6·40	110·000	2·76	13·47	10·27		
St. Jean des Chaillons to Batiscan	3·90	110·000	2·76	7·00	5·04		
Batiscan to Champlain.....	2·19	160·000	1·90	9·91	8·82		

As the soundings given on the Admiralty charts are 600 ft. apart, and the position of the plane to which they are referred could not be satisfactorily established, especially on the portion of the estuary west of Pointe Platon, the average depths which obtain at low tide, when the river water stands at an elevation of 21·94 ft. at Verchères, were deduced directly from the said soundings, only in the cases of the three stretches of tideway comprised between the Graving Dock, River Chaudière, St. Nicholas and Pointe Platon stations.

On the portion of the estuary just mentioned, owing to the fact that the bottom of the thalweg lies here from 22 to 180 ft. below the mean level of the sea: 1st. Fluctuations in the discharge of the river proper, affect the water level correspondingly only from $\frac{2}{10}$ to $\frac{6}{10}$ as much as at Verchères instead of from $\frac{6}{10}$ to $\frac{10}{10}$ above Pointe Platon. 2nd. A small error in fixing the position of the plane of reference adopted for the soundings shown by the Admiralty authorities, vitiates the resulting average depth much less than higher up stream; on the other hand the great contraction of the stream at the River Chaudière must of necessity disturb the regular propagation of tidal undulations considerably. The average depths H, that have been determined by using the charts, agree, on the whole, as well as could be expected under the circumstances, with the values H, corresponding to the mean velocity of the fluvial wave, which have been computed with the aid of the formula $H + \frac{h}{2} = \frac{(V+U)^2}{g}$

Above Pointe Platon the information afforded by the charts in this connection was found to be of too indefinite a nature, to permit of doing more than roughly estimate the probable area of the mean-tide waterway at the stage of the river last mentioned, for the purpose of arriving at an approximate value of the velocity due to the fresh water discharge. Notwithstanding the want of precision in the data derived from the charts, the results arrived at by using the formula just quoted give a good idea of the relative mean depths of the respective stretches of estuary, even on those between the tide-gauging stations established to the westward or above Pointe Platon. It is quite clear from the results given in table No. IX. that the portion of the stream where the resistance encountered by ascending tidal undulations is greatest, and where also the bed is most likely to be blocked up with ice, all things being equal in other respects, lies between St. Jean des Chaillons and Batiscan, and conversely the living force expended per mile by the tidal streams is, therefore, much greater on this stretch than on any other of the portion of the river under discussion, as also the sinking of the general level of the estuary that must ensue from the improvement of the ship channel by deepening, widening or straightening. On account, however, of the vast proportions of the St. Lawrence, any permanent lowering of its low water level due to this latter cause will always prove to be small in comparison to the depth in the thalweg, while at high water the river level will be slightly elevated in a corresponding manner.

An attempt might be made at estimating the probable effect produced on the mean river level by improvements carried out in the ship channel on the upper portion of the St. Lawrence estuary, after the projected accurate hydrographic surveys between Quebec and Cap à la Roche, etc., shall have been completed, when the prospect of reaching a reliable conclusion will be far better than at present.

On the open sea there exists a definite relation between the height h of the tide wave and the depth H of the water; the height h varying from place to place, approximately, in the inverse ratio of the square root of the depth H, viz., as $\frac{1}{\sqrt{H}}$.

This relation does not necessarily continue to obtain during the propagation of the oceanic wave inland up the estuary of a river The height reached by the fluvial wave depends, in a large measure, on the greater or less elevation of the oceanic wave which generates it opposite the mouth of the estuary.

The fluvial intumescence is the result of the united actions of an undulatory motion and the pouring in of sea water which takes place continuously during the flood, on account of the rise of the waters of the sea, due to the former cause, being more rapid than that of the waters of the stream.

The principal effects produced by all oscillatory motions are: 1st. The elevation of a portion of the waters in which they are produced above their mean level, 2nd. The simultaneous depression of adjoining portions below the said level. On the open sea the quantity of water elevated is sensibly equal to that depressed below the mean level, during the propagation of pendular waves of oscillation. (See diagram A.)

On account of the mixed or composite nature of fluvial waves, the ratio of the height to which the tidal intumescence becomes raised above the level of the tideless stream to the depression which takes place in the said level, is continually increasing as we proceed inward, and in the upper reaches of long estuaries, the tide water always remains at a higher elevation than the level of the tideless stream corresponding to the same fresh water discharge, whether at high or low tide.

Considering that the fresh water carried by the stream supplies a portion of the liquid required to satisfy the conditions of the undulatory motion, it is clear that while the discharge remains uniform the trough of the fluvial wave will be less depressed in reference to the level of the tideless stream, or more elevated per unit of increase in the amplitude of the oceanic wave, as these waves diminish in importance.

On the other hand, the rise of the summit of the fluvial wave per foot of increase in the amplitude of the oceanic wave must become notably greater, as the theoretical or astronomical importance or coefficient of amplitude diminishes. For, in any waterway where the flow takes place by virtue of the descent of the liquid particles from a higher

to a lower level, the velocity of the current varies, in general, approximately as the head of the square root lost, or fall, and if the area of the cross-section of the waterway remains sensibly constant, the volume of water carried through it also varies in the same ratio. In the case of fluvial waves, the volume of water poured into an estuary from the sea while the flood lasts at its mouth, is forced up to greater or less heights above the level of the tideless stream : according to the degree of convergence of the banks, the slope of the bed, the loss of hydraulic head caused by friction, sudden enlargements and contractions, etc. ; the total work performed by the inflowing stream being invariably equal to the energy supplied by the sea.

In the upper part of a long estuary, where the effect of the direct propagation of the pendular oscillation generated on the open ocean is small, the relations between the theoretical amplitude A of the said wave, and the height h of the fluvial intumescence above the level of the tideless stream, may be roughly represented by some such equation as $h^2 = n$ A, which is that of the common *parabola*.

From the remarks just made it appears that both the loci of the high and low water levels, as per diagrams Nos. XVI. to XXII., must necessarily be concave on their lower sides ; the degree of curvature of the low water locus is, however, in all probability quite small under any circumstances up to a very short distance of the axis of ordinates where the tidal amplitude is 0, at any rate too small to be determined with any degree of certainty, between the ordinates corresponding to the cœfficients of the greatest and least possible tides, viz. : 118 and 30.

Hence by assuming that the low water levels of all tides having theoretical cœfficients of amplitude below 30, if this was possible, would lie in the prolongation of the right line $\overline{I\ cd}$ which represents on diagrams XVI. to XXII., the general geometrical locus of the low tide levels actually observed when these are plotted after being corrected for variations in the fresh water discharge, in the order of the said theoretical or astronomical cœfficients of tidal importance, as above explained—the intersection I of the line $\overline{I\ cd}$ with the axis of the ordinates, will show the elevation of the tideless stream for the particular stage of the river considered, as nearly as the nature of the case permits.

The elevations of the tideless stream at the gauging station for the standard low river level of 21·50 feet above datum at Verchères and 27·54 feet at old lock No. 1, Lachine Canal, which corresponds to 16 feet depth on the lower sill of this lock, are approximately as per following table, No. X.

In this table are also indicated : the intermediate and total falls to Quebec and corresponding hydraulic inclinations, and the approximate average depths accumulated in the estuary below, or withdrawn from the same, above the low water lines of the highest and lowest possible tides, viz., those corresponding respectively to cœfficients 118 and 30.

TABLE X.

Total distance along axis of River.	Intermediate distance.	Gauging Stations.	Elevation of tideless stream in feet above datum with 16 feet depth on sill, lock No. 1, Lachine Canal.	Intermediate falls in feet.	Total fall in feet to Graving Dock.	Intermediate hydraulic inclinations in feet per mile.	Total hydraulic inclinations to Graving Dock, feet per mile.	Average elevation of low water level of neap tides of minimum amplitude corresponding to coefficient 30 with 16 feet water over sill, old lock No. 1, Lachine Canal, feet above datum.	Probable average depth of tide-water accumulated in (+) or withdrawn from (−) tideless estuary above or below low water line of tides of minimum amplitude in feet.	Average elevation of low water level of spring tides of maximum amplitude corresponding to coefficient 118 with 16 feet water over sill, old lock No. 1, Lachine Canal, ft. above datum.	Probable average depth of tide-water accumulated in (+) or withdrawn from (−) tideless stream above or below low water line of tides of maximum amplitude in feet.
·0	.....	Graving Dock	1·15	.....	.....	.....	.....	+ 0·628	− 0·522	− 0·893	− 2·043
13·5	13·5	St. Nicholas (Baker's wharf)	1·45	0·30	0·30	0·0222	0·0222	+ 1·104	− 0·346	+ 0·155	− 1·295
37·5	24·0	Platon (Hon. G. H. Joly de Lotbinière's wharf)	2·30	0·85	1·15	0·0354	0·0307	+ 2·519	+ 0·219	+ 3·519	+ 1·219
48·8	11·3	Grondines (Public wharf)	6·55	4·25	5·40	0·3761	0·1148	+ 6·888	+ 0·338	+ 8·486	+ 1·936
54·0	5·2	St. Jean des Chaillons (Levasseur's wharf) ...	8·70	2·15	7·55	0·4135	0·1398	+ 8·778	+ 0·078	+ 10·600	+ 1·900
61·8	7·8	Batiscan (Brunelle's wharf)	12·55	3·85	11·40	0·4936	0·1845	+ 12·887	+ 0·337	+ 14·311	+ 1·761
69·0	7·2	Champlain (Gagnon's wharf)	13·70	1·20	12·55	0·1666	0·1819	+ 13·984	+ 0·284	+ 15·376	+ 1·676
80·8	11·8	Three Rivers (Doucet's landing, G.T.R. wharf)	16·06	2·25	14·91	0·1907	0·1845	+ 16·310	+ 0·250	+ 17·640	+ 1·580
87·3	6·5	Port St. Francis (R. & O. Nav. Co.'s wharf).	16·16	0·10	15·01	0·0155	0·1720	+ 16·390	+ 0·230	+ 17·660	+ 1·500
118·0	30·7	Sorel (McCarthy's wharf).	18·85	2·75	17·70	0·0896	0·1500	+ 19·000	+ 0·150	+ 20·230	+ 1·380
133·0	15·0	Contrecœur (Public wharf).	19·85	1·00	18·70	0·0667	0·1406	+ 19·970	+ 0·120	+ 20·990	+ 1·140
141·0	8·0	Verchères (Public wharf).	21·42	1·57	20·27	0·1963	0·1438	+ 21·500	+ 0·080	+ 22·250	+ 0·830
160·0	19·0	Longueuil (Government wharf)	25·18	3·76	24·03	0·1979	0·1502	+ 25·200	+ 0·020	+ 25·600	+ 0·420
163·5	3·5	Montreal (foot of Lachine Canal)	27·54	2·38	26·41	0·6800	0·1615	+ 27·540	+ 0·000	+ 27·740	+ 0·200

DETERMINATION OF EXTREME AND OTHER CHARACTERISTIC HIGH AND LOW WATER LEVELS AT THE VARIOUS TIDE AND RIVER GAUGING STATIONS, ETC., BETWEEN QUEBEC AND MONTREAL.

We may, for the present purpose, assume that the comparatively small volume of water supplied by the affluents which enter the great St. Lawrence, below its junction with the north branch of the Ottawa at Bout de l'Ile, does not affect the water level of the river and estuary below, say Verchères, sufficiently at any time of the year to be worth taking into consideration.

Even the quantity of water which flows into the St. Lawrence from this branch of its greatest tributary, is so small, in comparison to the immense volume which passes down the principal stream—275,000 to over 400,000 cubic feet per second—that it cannot materially affect the level of the latter.

At any rate, no error of consequence can result from the supposition: that changes of level are generally taking place simultaneously in the two streams in the same direction, and that within the limits of a few feet, these variations bear to each other a nearly uniform or constant ratio. Thus, we are safe in assuming that not only extreme high and low; but also common high and low water occur, under ordinary circumstances, simultaneously at the foot of the Lachine Canal, Montreal, and at the gauging station which was intentionally established at a point a short distance below the influx of the northern branch of the Ottawa River into the St. Lawrence, viz., on the public wharf at the village of Verchères. It is believed that gaugings made at Verchères afford, on the whole, a better indication of the variations in the fresh water discharge through the St. Lawrence estuary, than gaugings made at the stations situated immediately above or below the said locality, because it is the highest point at which any small change of level that might be caused by the influx of the Ottawa at Bout de l'Ile is felt, while at the same time the influence of the tides can affect the height of the river only to an insignificant extent, in comparison to the fluctuations which may be produced by variations in the large volume of fresh water carried by the river.

EXTREME HIGH RIVER LEVEL.

The highest water observed since 1852, at Montreal, by the lock-masters of lock No. 1, at the foot of the Lachine Canal, after the St. Lawrence was clear of ice, that is to say, the greatest permanent swelling of the river caused by the waters from the Ottawa valley, or the northern waters, as they are termed, occurred on the 15th, 16th and 17th of May, 1876, when the depth on the lower sill of the said lock was, according to the water registers, 28 ft. 8 in. = 28·67 feet, each day at noon.

This depth of 28·67 feet on the sill of the old lock No. 1, corresponds to a water surface 40·21 feet above datum, if measured at the west side of the lock, and to 40·24 feet, if measured on its eastern side. The depth on the sill, registered May 15th and 16th, 1876, at lock No. 5, at the head of the Lachine Canal, viz., 17 ft. 3 in., is also the greatest on record since 1852; this depth of 17 ft. 3 in. corresponds to a water level 79·96 feet above datum in the upper entrance to the canal, immediately above the guard lock (No. 5). The mean depth registered at lock No. 1, during the high water season of 1888, between 19th and 26th May, viz., during the week when series of observations No. VII. was made at Verchères, is 24 ft. 4¾ in. = 24·39 feet, while the mean of the water level observed and registered at Verchères, during the same interval, is 31·50 feet above datum; the depths on the lock sill having varied between 24 ft. 8 in. and 24 ft. 0 in., and the elevation of the river at Verchères between 31·80 and 31·10. By taking the interval between 12th and 19th May, which corresponds to that of series of observations No. IV., when the St. Lawrence rose from 22 ft. 1 in. to 24 ft. 6 in. on the sill of lock No. 1, in connection with the interval between 27th May and 3rd June, which corresponds to that of series No. VIII., when the river fell from 24 ft. 6 in. to 22 ft. 8 in. at the lock, it is found that a mean depth of 23 ft. 4¾ in. = 23·39 feet, corresponds to a mean water surface 30·57 feet above datum at Verchères.

It would appear from the statement just made that a rise of 1 foot in the river at lock No. 1, from 23·39 to 24·39 over the sill, corresponds to a rise of the water at Verchères from elevation 30·57 ft. to elevation 31·50 ft., viz. : only 0·93 ft.

If, however, we take into consideration the aggregate rise which took place under special favourable conditions hereinafter described, in each one of the said localities from 3rd November, 1887, to 20th May, 1888, we find that a change of 1 foot at lock No. 1 corresponds, on a average, to one of $\frac{10·10}{8·41} = 1·2$ ft. at Verchères. I believe this coefficient (1·2) to be more nearly correct than 0·93 which may be materially vitiated owing to small tidal perturbations, local variations in the fresh water supply, etc.

Assuming, therefore, when the flow is permanent or nearly so, that the St. Lawrence rises at Verchères, 1·2 ft. for every foot of rise of the water at the lower end of the Lachine Canal between levels 24·39 ft. and 28·67 ft. above the sill of lock No. 1, it is found that this latter depth which denotes the highest water on record at Montreal during the season of navigation, corresponds to a river level 31·50 + (4·28 + 1·2) = 36·636, or say 36·60 ft. above datum at Verchères.

According, however, to the water register kept by Mr. Levi Larue, superintendent of the St. Ours Lock on the Richelieu River, who is in every sense a painstaking and reliable public officer, the water of the said river below his lock stood on the 15th and 16th of May, 1876, 22′ 2½″ over the lower mud sill and hence was 12·657 + 22·21 = 34·867 ft. above datum. Moreover, the fall of the Richelieu from the St. Ours Lock to the St. Lawrence at Sorel was 0·82 ft., according to actual measurements made in the spring of 1885, when the water above the lock was not very much higher than in 1876. Placing therefore this fall at 0·80, we find that at Sorel the highest water known to occur during the season of navigation, viz., that of 15th and 16th May, 1876, was 34·867 — 0·80 = 34·067 ft. above datum, and if we add to this height 2·25 ft. for the probable rise, Sorel to Verchères, the elevation of extreme high water at this place is found to be 36·317 or 36·32, which is all probably the more correct figure.

LOWEST NORMAL RIVER LEVEL.

I understand that since 1880, the Montreal Harbour Commissioners have adopted the low water level corresponding to a depth of 16·5 ft. on the sill of old lock 1, as a plane of reference for their soundings in their harbour and its vicinity ; but in my opinion the department should adopt as a basis for all furthur dredging operations between Quebec and Montreal, a water level corresponding to at most 16·0 ft. depth on the said sill. For, during the last nine or ten years the river fell several times to this level, and lower still, notably in November, 1879, and September, 1881, when it remained below the said level continuously for two weeks in each month ; moreover, on all Canadian rivers in general, the low water level tends to fall more and more as the country drained by them is being cleared of forests.

EXTREME LOW RIVER LEVEL.

The lowest water on record at Montreal was observed on the 8th and 9th of November, 1879, viz., two and three days after the moon had entered her last quarter, and on Thursday, 6th October, 1881, viz., 5½ days after she had passed into the last quarter, the depth on the sill of old lock No. 1 being in both cases only 15′ 5″ = 15·42 feet. On the 8th and 9th November, 1879, the water stood 9′ 6″ over the sill of lock No. 5, at the head of the Lachine Canal. The weather was fine at the time and the wind westerly ; in perfectly calm weather the depth on the lock sill last mentioned would probably not have exceeded 9′ 4″, which may be considered to indicate the lowest normal water of the St. Lawrence on record at Lachine. It is true the river fell to 9′ 1″ in November 1868, and to 8′ 10″ in November, 1871 ; but these depths show exceptional depressions of Lake St. Louis, caused by high easterly winds.

The easterly wind which was blowing during the greater part of the time between the 5th and 11th November, 1879, no doubt also kept the river, for some distance to

the eastward of Montreal, slightly lower than it would have stood if the weather had been perfectly calm, or if the wind had come from another direction ; but probably only to a small extent, for I was at the time engaged on a survey at Longueuil, on the beach along the south shore of the St. Lawrence, and, to my recollection, the breeze was never very strong, and sometimes barely perceptible. The principal causes of the unusual sinking of the water level were the great drought which prevailed during the latter part of the fall of 1879, and the diminished amplitudes of the tides.

On the 6th October, 1881, the depth on the sill of lock No. 5 was 9′ 7″, and at Sorel the elevation of the St. Lawrence was according to the measurements made at the foot of the St. Ours lock : (19·08 ft. — 0·33 ft.) = 18·75 ft. ; but the Montreal Harbour Commissioners' Sorel gauge register shows the river to have stood at a height of 19·05 ft. above datum, wind westerly. The gaugings were, in all probability, made at different hours of the day at Sorel and St. Ours.

By taking the mean of the depths of the water on the sill of lock No. 1, which obtained between 12th October and 10th November, 1887, a complete lunar month, and also the mean of the elevations of the river as determined from the gaugings made at Verchères during this lunar month, it is found that a depth of 16 ft. 5 in. = 16·42 ft. on the sill corresponds, in calm weather, to a water surface of 21·94 ft. above datum at Verchères. During the said lunar month the greatest depth recorded at lock No. 1 was 16′ 9″, and the least, 16′ 0″ ; while at Verchères the highest water observed stood 22·673 ft. over datum, and the lowest 21·573 ft.

During the space of time covered by series of observations Nos. I and IV, viz. : 19th to 25th October, and 3rd and 19th November, 1887, the average water levels between Montreal and Verchères, corresponding to the first interval, differed : at Verchères by 0·46 ft. : at Longueuil by 0·381 ft., and at the foot of the Lachine Canal; Montreal, by 0·42 ft., from the respective average levels corresponding to the second interval. If we allow that the same rates of variation obtain between the limits of 16′ 6″ and 15′ 5″ above the lock sill, as between the limits last stated, we find that :

1st. The Montreal Harbour Commissioners' ordinary low water, with 16·5 ft. depth on the sill of lock No. 1, corresponds, on an average, taking the tidal oscillations of a complete lunar month into account, to a water level : $21{\cdot}94 + \frac{(16{\cdot}50 - 16{\cdot}42) + 46}{42}$ = 22·03 ft., or say 22·0 ft. above datum at Verchères.

2nd. The low water now proposed for adoption by this department, with 16 ft. depth on the sill, to an average monthly level of $21{\cdot}94 - \frac{(16{\cdot}42 - 16{\cdot}00) \times 46}{42} = 21{\cdot}48$ ft., or say 21·50 at Verchères.

3rd. The extreme low water observed in November, 1879, with 15′ 5″ = 15·42 ft. on the sill, to a corresponding mean monthly level of $21{\cdot}94 - \frac{(16{\cdot}42 - 15{\cdot}42) \times 46}{42} =$ 20·85 ft. above datum at Verchères.

INFLUENCE OF TIDES ON WATER LEVELS OF ST. LAWRENCE ABOVE THREE RIVERS.

Thus far we have considered exclusively the fresh water fluctuations, it is now in order to investigate a little more closely than was hereinbefore attempted, the effects of the tides on the level of the water at each gauging station during various stages of the river.

Strictly speaking, the spring tides now and then influence the water level to the extent of usually one or two or three inches, even as far up stream as the foot of St. Mary's current, or St. Helen's Island, opposite the city of Montreal, and I have been informed by Mr. Louis Duval, an old respectable, observant citizen of Longueuil,

who has rendered valuable services of various kinds in connection with several river and harbour works which have been carried out during his lifetime in the vicinity of this town, including the new Government wharf, that some mornings he noticed, that the water had risen during the previous night as much as from 12 to 18 inches, as the result of the combined effects of high spring tides accompanied by stiff easterly winds. He says, moreover, that he also saw the water fall nearly as much, viz., some 12 inches in one night, about 'the time of quadrature' of the moon, when strong westerly winds' prevailed.

From Lake St. Peter up to Montreal the water level may be considered as being continually in a transitory state of equilibrium, similar to that which obtains on the lower or maritime portion of the St. Lawrence. On the stretch referred to, the river is either almost continuously raised or prevented from falling as rapidly as it otherwise would, by surplus tide water brought up by the waves of translation which are formed during series of gaining tides, or else it (the river) is lowered or prevented from rising as fast as it otherwise would, during series of losing tides, owing to some of the water being incorporated into outgoing, or return waves.

It may be said, however, that there is this difference between the two portions of the St. Lawrence in question, to wit: while, say from Port St. Francis, at the outlet of Lake St. Peter eastward, two distinct undulations are easily discernible every lunar day, and high and low water recur at sensibly regular intervals when the undulations are not too much disturbed by winds, etc.: from Port St. Francis to Montreal, the effect of each individual tide wave is, as a rule, too small to be plainly made out, except at high spring tides.

At Yamaska, Sorel and Contrecœur the effect produced on the water level by each individual tide, is distinctly noticeable during from two to three days before and after the tides reach their maximum amplitudes, especially during the low water season. I have already shown in the report I addressed you under date of 26th August, 1885, on the levelling operations carried out along the Richelieu, that one series of gaining tides may produce a rise of 1·0 foot or more, and a series of losing tides a fall of a foot in the water level at Sorel; the extent of the rise or fall depends, of course, primarily, on the importance of the astronomical tides which produce it; but also, in a great measure, on the winds which prevail at the time, and on the diurnal inequalities. Indeed, from Lake St. Peter to Montreal, changes of level caused by tidal fluctuations, winds and variations in the fresh water discharge, not to speak of the waves raised by steamships and tugs during the season of navigation, are so much intervolved, that it is not an easy matter, not to say impossible, to disassociate one kind of variations from another, and there appears to be no alternative but to consider them as a whole.

It will be seen from an inspection of the water lines shown on diagrams Nos. XI. and XV. at their correct elevations above datum, according to simultaneous observations made in 1887 and 1888 at the low and high water seasons, that at Three Rivers, Port St. Francis, Sorel, Contrecœur, Verchères and Longueuil the mean tide levels of the river vary on the whole in a corresponding manner, and when the flow of river water is nearly permanent, the ratio between the rise or fall at one place to the corresponding variation at another east or west of it, remains sensibly constant within a foot or two and more at any stage of the river whether high or low.

With a nearly uniform discharge of river water, the fall from Longueuil to any point above Sorel increases when the tides are losing, and decreases when the latter are gaining in importance, so that the declivity reaches its maximum value and the current is strongest, about the time of neaps, and the declivity is smallest and the current weakest about the time of spring tides. The main reason of this is, that more tide water is stored in the estuary at springs than at neaps; moreover, the fluctuations due to this cause are greater on Lake St. Peter than on adjoining stretches of river. As the declivity of an ordinary fresh water stream always increases when it is in a rising condition, the said slope must therefore increase on the St. Lawrence estuary as on all tideways in general, much more rapidly under such circumstances when the tides

are losing than when they are gaining and *vice versa*. It cannot be said, however, that the slope of the river surface between Lake St. Peter and Longueuil, which obtains at the time of extreme high water in May or June, is, on the whole, very different from the declivity at extreme low water in October or November, notwithstanding that the difference in the height of the water at these two stages is from 9 to 14 feet or more.

On the 20th of May, 1888, after the flow of the river had been as nearly permanent as the circumstances of the case admit of, for three or four days during which the summits of the tidal undulations had varied but little in elevation, as the waves entered Lake St. Peter, and their coefficients of amplitude varied only between 51 and 46—the water stood 35·50 ft. above datum at Longueuil; being exactly 10·10 ft. higher than on 3rd November, 1887, when similar conditions obtained not only as regards uniformity in the heights of the summits and the theoretical amplitudes of the tide waves of the three or four preceding days; but also as regards the comparative permanency of the flow during the same time.

Again, the elevation of the water at Sorel on the 20th May, 1888, was 29·55 ft., and on the 3rd November, 1887, 19·18 ft. above datum, hence the fall or slope of the river between Longueuil and Sorel was only 5·95 ft. at extreme high water in May, 1888, while it was 6·20 ft. at low water in November, 1887, that is to say the river rose at Sorel 0·25 ft. more during the high water season than at Longueuil, viz., 10·35 ft. instead of only 10·10 ft.

The elevations of the river at the five gauging stations established between Laprairie and Sorel, and also at locks Nos. 5 and 1, Lachine Canal, viz.: on 3rd November, 1887, and 20th May, 1888, together with the falls between the consecutive places, the total falls from Longueuil, etc., were found to be as shown in table XI. hereunder; the said river levels may be considered as representing approximately the mean semi-monthly elevations of the water in all instances where diminutive semi-diurnal variations caused by the tides are discernible, which is more especially the case at high springs.

TABLE XI.

Name of Gauging Station.	At Low Water, 3rd Nov., 1887.			At High Water, 20th May, 1888.			Total rise of water at each place from 3rd Nov., 1887, to 20th May, 1888.
	Elevation of water surface above datum.	Fall between each two consecutive stations.	Total fall from Longueuil.	Elevation of water surface above datum.	Fall between each two consecutive stations.	Total fall from Longueuil.	
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Lock No. 5, head of Lachine Canal	72·79		— 47·39	77·46		— 41·96	4·67
		34·03			36·42		
Laprairie	38·76		— 13·36	41·04		— 5·50	4·28
		11·03			4·90		
Lock No. 1, foot of Lachine Canal	27·73		— 2·33	36·14		— 0·64	8·41
		2·33			0·64		
Longueuil	25·40			35·50		0·00	10·10
		3·70			3·70		
Verchères	21·70		3·70	31·80		3·70	10·10
		1·60			1·20		
Contrecœur	20·10		5·30	30·60		4·90	10·50
		0·92			1·05		
Sorel	19·18		6·22	29·55		5·95	10·37

N.B.—The elevations at locks Nos. 1 and 5, Lachine Canal, are based on the entries made on the water registers by the lock-masters; the depths on the sills given

by them being respectively 10·1 ft. and 16·2 ft. for 3rd November, 1887, and 14·9 ft. and 24·7 ft. for 20th May, following.

These results go to show that Lake St. Peter with adjoining river stretches up to past Sorel and down to past Three Rivers, forms a sheet of water of such vast extent and so flat that its surface has to rise some 5½ feet and the whole river up to Longueuil with it, in order that the increased volume of water which comes down the St. Lawrence in the spring may make its way to the Gulf—otherwise, on account of the increase in the friction head generated when the stream is in a swollen state, the total declivity from Longueuil to Sorel would have been much greater, instead of being smaller at the high than at the low water season.

It has been shown that at Quebec the amplitudes of the tides are no longer directly proportional to the astronomical coefficients, in other words, that the unit of height is here a variable quantity, which generally turns out to be greater when based on a tide with a coefficient less than unity, than when based on a tide having a coefficient greater than 1. It is also clearly apparent from the tidal diagrams that as we ascend the estuary, and as the river passes to lower and lower stages this divergence accents itself more and more. Hence, on the contrary, by moving in a north-easterly, or down-stream direction along the estuary below Quebec, we must approach more and more towards a point of the Gulf or Atlantic coast, where the ratio between each theoretical and its corresponding actual coefficient of amplitude is as nearly uniform as the complex nature of the case permits.

Whether the importance of the tides varies on the eastern coast of North America absolutely according to the same laws as it does on the coast of France, for which in particular the tidal coefficient given in "L'Annuaire des Marées" are calculated, and the western coast of Europe generally, I am not prepared to affirm; but the resemblance of the main features of the high and low water curves based on the theoretical amplitudes shown in connection with the loci of the high and low water levels corrected for diurnal inequalities, of the eight continuous series of gaining and losing tides covering two complete lunar months, which were observed very closely October 12th to 10th November, 1887, and 5th May to 3rd June, 1888—is such as to warrant us in adopting as the best basis available for the determination of extreme and other typical high and low tide levels, the hypothesis that the tide waves on both sides of the Atlantic truly are contemporaneous and have the same relative importance. I have thought it advisable to establish first such typical mean high and low water levels of the estuary as are likely to obtain in normal conditions of weather, including atmospheric pressure: 1st at the time of spring tides having the greatest possible theoretical mean amplitude, viz.: that which corresponds to a coefficient of 118; 2nd at the time of neaps of least importance, the coefficient of which is about 30; leaving the effects of diurnal inequalities and of persistent high winds, to be dealt with separately.

During series No. I. of gaining tides, observed 12th to 18th October, 1887, the water level was raised about 0·75 feet at Sorel and only 0·45 feet at Longueuil. If we assume that the rise which took place at Longueuil was exclusively due to an increase in the fresh water discharge from above, the effect of series No. I. of gaining tides on Lake St. Peter is found to be a rise in the water level of $(0{\cdot}75 - 0{\cdot}45 \text{ feet}) = 0{\cdot}30$ feet. In this series of tides (No. I.) the astronomical coefficients varied as already stated, between 39 and 117, with an average value of 84·84.

During series of losing tides No. II., observed 18th to 25th October, 1887, and which also correspond to astronomical tides with coefficients decreasing from 117 to 39, but having an average value of only 77, the water fell at Sorel about 0·90 ft. and at Longueuil only about 0·30 ft.; probable effect of this series of tides in lowering the water level, say, 0·50 ft. Hence we may put approximately: $\frac{0{\cdot}30 + 0{\cdot}50}{2} = 0{\cdot}40$ ft. for mean change of level produced by series Nos. I. and II. of 13 gaining and 13 losing tides the average importance of which may be represented by an astronomical coefficient $= \frac{84{\cdot}84 + 77{\cdot}0}{2} = 80{\cdot}92$, or say 81.

As a gradual change of (117 — 39) = 78 in the theoretical coefficient of semi-amplitude of series of tides having a mean coefficient of importance = 81, may be considered to affect the water level around Sorel to the extent of nearly 0·40 ft. on an average, we may assume that with a series of tides of minimum importance, the coefficients of which may vary, say between 93 and 30, with a mean value of 65 or less, the water level would probably, at the same stage of the river, be further depressed from the level corresponding to the 39 tide, by about $\frac{39{\cdot}30 \times 0{\cdot}40}{78} = 0{\cdot}046$ on an average, or say 0·05 ft.

Now, at the beginning of series of tides No. I. and at the end of series No. II., when the astronomical tidal coefficient was 39, the river stood at Verchères at an average height of 21·95 nearly, and the mean elevation of the water at Sorel was 19·50; hence, with the minimum series of tides just described, the water at Sorel would have stood (19·50 — 0·05) = 19·45 ft. above datum. Moreover, at extreme low water, 20·85 ft. above datum at Verchères, the said minimum low water level would be (19·45 — 21·95 — 20·85) = 18·35 ft. above datum, and at the standard low water stage, 21·50 ft. above datum at Verchères, to which it is suggested all the soundings should be referred, the same minimum tide level would, at Sorel, be 19·45 — (21·95 — 21·50) = 19·00 ft. above datum.

As a matter of fact, the lowest water recorded in the Montreal Harbour Commissioners' Sorel water register for 1879 is 18 ft. 8 in. above the 0 at the lower end of their gauge, viz.: on the 10th of November. The elevation of this 0 was found, in 1885, to be about 0·05 ft., hence the height of 18 ft. 8 in. = 18·65 ft. indicates a water level 18·71 ft. above datum, viz.: 0·36 ft. higher than the computed extreme low water level; but then it must be borne in mind that the serial tidal amplitude, although small, was probably not an absolute minimum at the time in question. Again, considering that the height of the river was observed only once in 24 hours, the elevation of the water may have been and probably was, lower than 18·71 ft. either on the 9th or 10th of November. Moreover, the gauge board used was subdivided only into 3-inch spaces, and water levels could, consequently, not be read with precision; the gauge board may, at the time, also have been slightly too low in the water, in reference to the bench marks made on land, on account of the subsidence of the cribwork pier to which it was spiked or on account of having been shoved out of its proper place by a passing vessel and not put back again.

We can arrive at the extreme and standard low water and the extreme high water elevations at Laprairie, Longueuil and Contrecœur, with sufficient accuracy for practical purposes, by supposing, where more definite information is wanting, that the average rate of increase or decrease in the declivity between two consecutive places, per foot of rise or fall in the water at one or the other of these points, which obtained while the river rose from the level of 3rd November, 1887, to that of 20th May, 1888—or between any two other known stages of the river that might be better suited for the determination of the particular level sought—also hold good during the further lowering of the river down to standard and extreme low water and the further rising of the same up to extreme high water.

Table XII., which here follows, shows the extreme and standard low and extreme high water levels at the gauging stations from lock No. 5 to Sorel, which have been determined in the manner just described:—

TABLE XII.

Name of Gauging Station.	Elevation of highest known water during season of navigation.	Elevation of lowest known water during season of navigation.	Elevation of standard low water with 16 feet depth on sill lock 1, Lachine Canal.	Notes.
	Feet above datum.	Feet above datum.	Feet above datum.	
Lock No. 5, head of Lachine Canal	79·96	72·04	72·04	9′ 4″ + 62·71 ft. = 72·04 ft. in Nov., 1879. 17′ 3″ + 62·71 ft. = 79·96 ft. in May, 1879. Water surface at elevation 74·38 at lock 5 corresponds to mean summer level with 19·0 ft. depth on sill lock 1, 24·95 ft. above datum at Verchères, and 22·50 at Sorel.
Laprairie public wharf	43·23	38·39	38·40	28′ 8″ + 11·54 = 46·22 ft. in May, 1876. 15′ 5″ + 11·54 = 26·96 ft. in Nov., 1879.
Lock No. 1, foot of Lachine Canal	40·22	26·96	27·54	17′ 6″ on sill old lock No. 1 corresponds to river surface 23·25 ft. nearly above datum at Verchères.
Longueuil Government wharf	40·02	24·55	25·20	
Verchères public wharf	36·32	20·85	21·50	
Contrecœur public wharf	35·17	19·25	19·90	22′ 2½″ depth lower sill St. Ours lock, May 6, 1876, plus 12·657 minus 0·80 ft. fall to Sorel = 34·07 ft.
Sorel, McGarthy's wharf	34·07	18·35	19·00	Elevation 0 Mont. Hbr. Crs'. gauge at Sorel = + 0·05 ft.

As already remarked in connection with table of water levels XI. for 3rd November, 1887, and 20th May, 1888, the elevations of extreme high water here given for the stations between Longueuil and Sorel, where not only aggregate but also single effects of high springs are to some extent discernible, indicate respectively more nearly the position of the mean high tide levels of such springs above datum, than the heights of the corresponding maximum high tide levels which would be arrived at, if diurnal and weekly tidal inequalities and small local variations were also taken into account.

I may here bring to your notice a singular change in the general slope assumed by the river surface, which has been found to obtain during the low water season, along the south shore between Contrecœur village and a point some 2½ miles west of the wharf at this place, and about ¼ mile above Jos. Dansereau's stone house which stands at the junction of the post road as originally constructed, with a new portion of road opened on higher ground to prevent further damage by spring floods.

According to the series of simultaneous observations of the water level made between the points mentioned on the 29th of August, 1887, when the water stood on an average 23·10 feet above datum at Verchères and 17·5 feet over sill of lock No. 1 at Montreal, the fall on the said stretch was from elevation 22·58 ft. to elevation 21·50 ft. above datum, viz.: at the rate of 0·4320 per mile, while the general slope of the river for 5 miles above is $\frac{0{\cdot}44 \text{ ft.}}{5} = 0{\cdot}088$ ft., and for 5 miles below only $\frac{0{\cdot}35 \text{ ft.}}{5} = 0{\cdot}07$ ft. per mile.

The slope in question was also determined and a similar result arrived at, by using data derived from some accurate gaugings made at the Verchères and Contrecœur wharves during the latter part of August, 1888, in connection with the corresponding depths on the lower sills of lock No. 1, Lachine canal and the St. Ours lock, which are given in the lock-masters' registers; at the end of August, 1888, the elevation of the

river surface differed but four or five inches from the height it had reached the previous year on corresponding days in August.

Being apprehensive that, despite the numerous precautions taken to secure correct results, both as regards levelling and gauging operations, an error had been committed in some unaccountable way, for the field notes had all been closely examined and the computations checked and rechecked in vain, the continuous line of simultaneous double levellings run all along the south shore of the St. Lawrence was re-levelled in June, 1887, C. C.
from B. ⊖ M. in Jos. Dansereau's house to B. ⊖ M. on the Contrecœur church, and another CXXX CXXIX
series of simultaneous observations of the water level made on 21st June, 1889, when the river was at a height of 26·50 feet deep over sill of lock No. 1 instead of 21·50 feet and 17·30 feet respectively on the 29th August, 1887. The result of this work was to prove the accuracy of the original levelling operations in every particular; but the declivity was now found to be practically uniform above and below Contrecœur.

I have come to the conclusion, that the sudden drop in the river surface at low water, is caused by the long string of narrow islands and intervening shoals lying between the main or ship channel and the south shore, from a point say 2½ miles above Contrecœur village, for some 6 miles in length towards Sorel. These islands together with the intervening high middle grounds, broken only here and there by narrow tortuous channels, form an obstruction similar to a partly submerged dam which is sufficient to prevent the shore channel from attaining the same height as the ship channel; this channel is, at the lowest water in the fall, from 0·5 feet to 0·6 feet higher than the former, opposite the Contrecœur wharf.

It appears from the above remarks, that any gauging that may be necessary in connection with projected dredging operations in the ship channel opposite the parish of Contrecœur, should, during the low water season at least, be done on the northern side of the outlying islands or along the north shore of the St. Lawrence, in preference to the Contrecœur wharf or adjoining shore.

Proceeding down stream from Sorel through Lake St. Peter, the semi-diurnal oscillations continue to be very small, indeed at times so small, that they cannot be detected even as low down as Port St. Francis at the extreme eastern end of the lake, except by making extended series of accurate gaugings in calm weather with special apparatus.

The following results of some observations made about the times of the moon's quadratures and at the syzygies during the low water season of 1887 and high water season of 1888, at Port St. Francis and Doucet's Landing opposite Three Rivers, throw some light on the relative importance of the tides felt at these places, the diurnal inequalities, etc. :—

TABLE XIII.

Dates, positions, etc., of tides observed between Sorel and Three Rivers in 1887 and 1888, etc.	Theoretical tidal coefficients.	Average daily ranges.				Fall from Sorel in mean tide level.		Elevation of river at Verchères.	Remarks.
		At Port St. Francis.		At Three Rivers.		To Port St Francis.	To Three Rivers.		
		From	To	From	To	Feet.	Feet.	Feet above datum.	
Low water season of 1887.									
October 11 and 12, neaps at beginning of series of gaining tides No. I.	39 to 42	0·20	0·70	0·25	0·75	2·30	2·37	22·12	In October the evening tides have generally the greatest amplitudes.
October 18 and 19, springs at end of series of gaining tides No. I.	117 to 116	0·81	1·225	1·10	1·42	1·55	1·55	22·30	
High water season of 1888.									
May 19 and 20, neaps at beginning of series of gaining tides No. VII.	46 to 48	.....	.....	0·10	0·20	1·10	1·95	31·80	Range at Port St. Francis too small to be deduced from measurements made with ordinary gauging staff unprotected
May 26 and 27, springs at end of series of gaining tides No. VII.	107 to 106	0·20	0·40	0·47	0·70	0·98	1·75	31·10	In May the morning tides are the most important.

When the river is rising, while the tides are losing in importance, the declivity in the lake surface is, of course, greater than if the river had remained at a uniform level, or was also falling, and on the contrary, with gaining tides and a falling river, the surface slope is smaller than if the river remained at the same level or was in a rising state; all other things being equal in both cases respectively.

During the time simultaneous observations were made at Three Rivers, Port St. Francis, and Sorel, no coincidence of the nature thus described occurred, that could have the effect of increasing or decreasing in a notable manner, the declivity of the waters of Lake St. Peter.

On the 4th of May, 1888, with losing tides, having a coefficient of 44, and the river in a falling condition, the mean level of neaps was at Port St. Francis, lower than at Sorel, by 1·35 feet.

Again, on the 12th May following, when the tides were gaining and the river was rising, the mean level of springs having a coefficient of 82, was at Port St. Francis, below that at Sorel, only 1·15 feet.

We have seen that during series of gaining tides No. I., when the astronomical tidal coefficients fluctuated between 39 and 117, with an average value of 84·84, the water level was raised at Sorel, about (0·75 ft. – 0·45 ft.) = 0·30 ft. As the fall from Sorel to Three Rivers, a distance of over 36 miles along the axis or thalweg of the St. Lawrence, is on an average, less than 2 feet during the low water season and still smaller during the high water season, the effect of a permanent change in the fresh water discharge on the water level may be considered to be sensibly the same, in calm weather, at Sorel, Port St. Francis and Three Rivers. Hence we may take for granted that the effect of a series of gaining tides, such as No. I., on the water level at Port St.

Francis is also to raise it by (2·30 – 1·55 – 0·45) = 0·30 ft., and that the water at Three Rivers will be raised by (2·37 – 1·55 – 0·45) = 0·37 ft. under the same circumstances. Moreover, the probable lowering effects of series of losing tides No. II. may be placed at 0·50 foot at Port St. Francis, the same as at Sorel, and at 0·57 foot at Three Rivers, and the mean value of the effects of two series of tides such as Nos. I. and II., the average importance of which is indicated by coefficients 81, may be put equal to 0·40 foot for Port St. Francis, and 0·47 foot for Three Rivers. The average falls which obtain with such series of gaining and losing tides on the stretch of river under consideration, are, therefore, approximately as follows, when the river stands at a mean elevation of 21·95 feet above datum at Verchères, viz. :—

1. Between Sorel and Port St. Francis :
   (*a*) At neaps of.. 39, 2·30 + (0·40 – 0·30) = 2·40 feet ;
   (*b*) At springs of 117, 1·55 + (0·40 – 0·30) = 1·65 feet.
2. Between Sorel and Three Rivers :
   (*a*) At neaps of.. 39, 2·37 + (0·40 – 0·30) = 2·47 feet ;
   (*b*) At springs of 117, 1·55 + (0·40 – 0·30) = 1·65 feet.

Also, we may admit as before, that the further lowering of the water below the levels corresponding to the 39 tide just arrived at, which would obtain with a minimum series of tides having coefficients of, say, between 93 and 30, and of an average value of about 65, would be approximately 0·05 foot, both at Port St. Francis and Three Rivers, the same as at Sorel.

As the tide water has already been found to stand at a mean height of 18·35 feet at Sorel, at the time of extreme low water in the river 20·85 feet above datum at Verchères, and when the tide has a minimum amplitude corresponding to coefficient 30, therefore :—

(*a*) The minimum mean tide level is :
   1°. At Port St. Francis, 18·35 – 2·40 = 15·95 feet above datum ;
   2°. At Three Rivers.... 18·35 – 2·47 = 15·88 feet above datum.

(*b*) The standard mean tide level at normal lowest water in the river above is, in a similar manner, found to be nearly :
   1°. At Port St. Francis, 19·00 – 2·40 = 16·60 ;
   2°. At Three Rivers..... 19·00 – 2·47 = 16·53.

In order to obtain the average high tide levels corresponding to the above we have to add to the mean tide levels of 15·95 feet and 16·60 feet at Port St Francis: $\frac{0{\cdot}20 + 0{\cdot}70}{4}$, or say, more correctly, 0·24 foot, which gives 16·19 and 16·84 for the average high tide levels at the extreme low and standard low or lowest normal stages of the river respectively.

At Three Rivers, $\frac{0{\cdot}25 + 0{\cdot}75}{4 \text{ ft.}}$ = say 0·28 ft., has to be added to 15·88 ft. and 16·53 ft., which gives 16·16 ft. and 16·81 ft. for the average high tide levels, at the same respective stages of the river.

The low tide levels at the same stages are arrived at thus :

1°. At Port St. Francis :
   (*a*) Average low tide level corresponding to extreme low stage of river =
   $$15{\cdot}95 - \left\{\frac{0{\cdot}20 + 0{\cdot}70}{2} - 0{\cdot}24\right\} = 15{\cdot}74 \text{ ft.}$$
   (*b*) Average low tide level corresponding to standard low or lowest normal stage of river =
   $$16{\cdot}60 - \left\{\frac{0{\cdot}20 + 0{\cdot}70}{2} - 0{\cdot}24\right\} = 16{\cdot}39.$$

2°. At Three Rivers :
   (*a*) Average low tide level corresponding to extreme low stage of river =
   $$15{\cdot}88 - \left\{\frac{0{\cdot}25 + 0{\cdot}75}{2} - 0{\cdot}28\right\} = 15{\cdot}66.$$

(*b*) Average low tide level corresponding to standard low or lowest normal stage of river =

$$16\cdot53 - \left\{\frac{0\cdot25+0\cdot75}{2} - 0\cdot28\right\} = 16\cdot31.$$

By following a train of reasoning similar to that previously adopted herein for determining characteristic high and low and other tide and river levels, I have established for Port St. Francis and Three Rivers, chiefly by means of data to be found in the last table, as shown hereunder, the probable mean and high and low water levels of tides having amplitudes corresponding to the maximum astronomical coefficient 118 : (A) when the river is at the extreme high stage, 36·32 ft. above datum at Verchères and 34·07 ft. at Sorel : (B) when the river is at the standard low or lowest normal stage, 21·50 ft. above datum at Verchères and 19·0 ft. at Sorel ; the flow being supposed to be permanent, or nearly so in each case.

(A)

1. Decreased fall due to increase of amplitude corresponding to increase of 12 in theoretical tidal coefficient, from 106 to 118 :

(*a*) Sorel to Port St. Francis = $1\cdot10 - \left\{\frac{(1\cdot10-0\cdot98)(118-106)}{106-46} = 0\cdot024\right\} = 1\cdot080$ ft.

(*b*) Sorel to Three Rivers = $1\cdot95 - \left\{\frac{(1\cdot95-1\cdot75)(118-106)}{106-46} = 0\cdot040\right\} = 1\cdot91$ ft.

2. Fall as further modified by rising of river from 22·30 and 31·30 to 36·32 ft. above datum at Verchères :

(*a*) Sorel to Pt. St. Francis = $1\cdot54 - \left\{\frac{(1\cdot54-1\cdot080)(36\cdot32-22\cdot30)}{31\cdot30-22\cdot30} = 0\cdot72\right\} = 0\cdot82$ ft.

(*b*) Sorel to Three Rivers = $1\cdot54 + \left\{\frac{(1\cdot91-1\cdot54)(36\cdot32-22\cdot30)}{31\cdot30-22\cdot30} = 0\cdot580\right\} = 2\cdot12$ ft.

3. Hence in the extreme conditions mentioned, viz., with river discharge at a maximum and tide of greatest amplitude possible, the elevation of the mean tide level is :

(*a*) At Port St. Francis ..... 34·07 — 0·82 = 33·25 ft.

(*b*) At Three Rivers ..... 34·07 — 2·12 = 31·95 ft.

4. Now at Port St. Francis, the tidal intumescence is completely obliterated, even before the river has attained the extreme high stage above defined, for,

$$\left(\frac{0\cdot810 \text{ ft.} + 1\cdot225 \text{ ft.}}{2} = 1\cdot02\right) - \left(\frac{0\cdot22+0\cdot44}{2} = 0\cdot33\right) = 0\cdot69 \text{ and}$$

$$1\cdot02 - \left(\frac{0\cdot69\ (36\cdot32 - 22\cdot30)}{31\cdot10 - 22\cdot30} = 1\cdot07\right) = -0\cdot05.$$

But at Three Rivers, the tidal undulation is still felt ; the mean value of its amplitude being, however, reduced from $\frac{1\cdot10+1\cdot42}{2} = 1\cdot26$ ft. to :

$$1\cdot26 - \left\{\left(\frac{1\cdot26 - \frac{(0\cdot51+0\cdot77)(36\cdot32-22\cdot30)}{2}}{31\cdot10-22\cdot30}\right) = 0\cdot97\right\} = 0\cdot29 \text{ ft.}$$

Therefore, at Three Rivers, under the particular circumstances already described, mean low tide water stands 31·95 ft. — 0·14 ft. = 31·81 ft. above datum, and mean high tide water is ..... 31·95 ft. + 0·14 ft. = 32·09 ft. above datum.

(B)

1. Diminished fall due to increase of amplitude corresponding to increase of 2 in theoretical tidal coefficient from 116 to 118, is equal to, say 1·54 ft. between Sorel and Port St. Francis, and also 1·54 ft. between Sorel and Three Rivers.

2. Fall as further modified by lowering of river, from elevation 22·30 ft. to 21·50 ft. at Verchères :

(*a*) Sorel to Point St. Francis:

$$= 1{\cdot}54 + \left\{\frac{(1{\cdot}54 - 1{\cdot}080)\ (22{\cdot}3 - 21{\cdot}50)}{(31{\cdot}10 - 22{\cdot}30)} = 0{\cdot}04\right\} = 1{\cdot}58.$$

(*b*) Sorel to Three Rivers:

$$= 1{\cdot}54 - \left\{\frac{(1{\cdot}91 - 1{\cdot}54)\ (22{\cdot}30 - 21{\cdot}50)}{(31{\cdot}10 - 22{\cdot}30)} = 0{\cdot}03\right\} = 1{\cdot}51.$$

Hence in the case of springs of maximum importance corresponding to tidal coefficient 118, and with the river at the standard low stage when the water surface stands 21·50 ft. above datum at Verchères, we have for the elevation of the mean tide level:

At Port St. Francis..... 19·00 — 1·58 = 17·42 ft.
At Three Rivers ..... 19·00 — 1·51 = 17·49 ft.

Now at Port St. Francis, the mean height of the spring tide of maximum importance just referred to may be taken at $\frac{0{\cdot}81 + 1{\cdot}225}{2}$ or say 1·02 ft., and at Three Rivers at ..... $\frac{1{\cdot}10 + 1.42}{2} = 1{\cdot}26$ ft.

We have, therefore, for the mean elevation of low water:

At Port St. Francis ..... 17·42 — $\frac{1{\cdot}02}{2}$ = 16·91 ft.

At Three Rivers ..... 17·49 — $\frac{1{\cdot}26}{2}$ = 16·86 ft.

And for the mean elevation of high water:

At Port St. Francis ..... 17·42 + $\frac{1{\cdot}02}{2}$ = 17·98 ft.

At Three Rivers ..... 17·49 + $\frac{1{\cdot}26}{2}$ = 18·12 ft.

These four last results must, however, be further augmented, each by say 0·75 ft. and 0·80 ft. for Port St. Francis and Three Rivers respectively, on account of the increased general mean weekly elevation of the river surface produced by a series of tides of maximum average importance (85), as compared to the level that obtains with tides of minimum or of general average importance (70), as will hereinafter be explained.

TYPICAL TIDE WATER LEVELS BELOW CHAMPLAIN, ETC.

At the village of Champlain, on the north shore of the St. Lawrence, situated opposite the Gentilly shoal and basin, 15 miles east of Three Rivers, which is the next place below this city that was selected for a gauging station, the tidal intumescence is, as a rule, sufficiently well defined during the season of navigation to permit of its length, height and general character, including the respective periods of the flood and ebb, and the times of high and low water, being determined within comparatively narrow limits at neaps as well as at springs.

At this and all the other stations further down stream, the effects of the tidal and fluvial influences on the high and low water levels have been considered separately in the manner hereinafter described.

1. In place of the original approximate rectilinear loci, more accurate curvilinear loci of high and low tide levels were drawn in heavy dotted lines on the diagrams of tidal fluctuations prepared for all the stations below Champlain above referred to (see Ill. VI. to X. and XII. to XIV.), viz., so as to be, as closely as possible, in accord with the general features of the theoretical tide curves; due allowance being made, at the same

time, for changes of level produced by simultaneous variations in the fresh water discharge.

2. Seven additional diagrams (Ill. XVI. to XXII.), showing the high and low tide loci and corresponding elevations of the river surface at Verchères, were constructed for the gauging stations between Champlain and Quebec, on transparent leather section paper divided into inches and tenths; this paper being found to be more convenient than any other for taking off elevations from the first set of diagrams. Instead of being plotted in the order of the ranges of the corresponding tides, the high and low tide and fluvial levels have been laid down on these new diagrams in the order of the corresponding theoretical coefficients of tidal amplitude; these coefficients being represented by abscissas to a scale of $\frac{1}{10}$ inch per hundredth, and the elevations of the water to a scale of 2 feet per inch.

The whole of this preliminary work was undertaken with a view of representing graphically, the variations which take place in the high and low water loci of the eight series of gaining and losing tides observed in 1887-88, in reference to increases or decreases in the theoretical importance of the tides and in connection with changes of level that are caused simultaneously by variations in the fresh water discharge. As all tide levels are plotted in the order of the theoretical amplitudes, both gaining and losing series of tides appear on the diagram as affecting the elevation of the water in the same direction. In order, however, that the loci of the various series of water levels represented may be readily distinguished one from the other and compared, each pair or set of high and low water curves has been indicated by a particular kind of line. Thus, the loci of series of gaining tides Nos. I. and V., are shown by continuous full lines; those of series Nos. II. and VI. of losing tides, by small equidistant dots; those, of Nos. III. and VII. of gaining tides, by a succession of long dashes, and those of Nos. IV, and VIII. of losing tides, by dashes alternating with double dots.

Moreover, the curves showing the variable elevation of the water at high and low tide, according to gaugings made during the low water season in 1887, are shown in black, and the corresponding curves for the high water season of 1888 in red, while the loci of the river levels at Verchères, are in blue.

The disposition of the series of high and low water levels observed, side by side, in the order of the theoretical tidal coefficients, affords the advantage of showing at a glance, that apart from the general rise of the high and low water loci of series of gaining tides and the slope of the corresponding loci of losing tides, in proportion to their importance, and independently of the variations of level produced simultaneously in the estuary by fluctuations in the fluvial discharge, each series of high and low tide levels, taken as a whole, occupies moreover a higher or lower position according as the mean height of the fluvial intumescence during the week occupied by the said series, or we may say, approximately, according as the mean theoretical amplitude of the Atlantic wave, is greater or smaller.

The average mean tide, high and low water levels and amplitudes, together with the differences in height between series Nos. I. and III. of gaining, and series Nos. II. and IV. of losing, tides, respectively, which were actually obtained at each tide station between 12th October and 12th November, 1887, when the said series of tides were observed, are given in the following table, in connection with the corresponding average astronomical coefficients of amplitude, units of height and elevations of the river at Verchères:—

TABLE XIV.

Tide Stations.	Numbers of Series.	Tides in each Series, and Dates.	Actual Averages. Mean tide levels. Feet above datum.	High water levels. Feet above datum.	Low water levels. Feet above datum.	Differences of height between corresponding serial loci of High and Low water levels.	Amplitudes corrected for diurnal inequalities. Ft.	Elevations of river at Verchères. Feet above datum.	Mean astronomical coefficients of semi-amplitude.	Units of height corresponding to each Series. Ft.
Graving Dock.	I	14 gaining, Oct. 11 to Oct. 18.	7·534	15·089	0·127	H. W. Locus No. I 0·85 ft. above No. III and	14·963	22·01	81·57	9·172
	II	13 losing, Oct. 18 to Oct. 25..	7·286	14·238	0·202	H. W. Locus No. II 0·85 ft. above No. IV. Also	14·101	22·18	77·00	9·156
	III	15 gaining, Oct. 25 to Nov. 2.	6·568	13·334	–0·107	L. W. Locus No. I 0·25 ft. above No. III and	13·399	21·78	68·00	9·866
	IV	15 losing, Nov. 2 to Nov. 10 .	6·640	13·214	0·080	L. W. Locus No. II 0·25 ft. above No. IV.	13·128	21.80	65·21	10·063
		General average, 57 tides..	6·987	13·942	0·072		13·877	21·94	72·70	9·544
St. Nicholas.	I	14 gaining, Oct. 11 to Oct 18.	7·968	15·181	0·874	H. W. Locus No. I 0·80 ft. above No. III and	14·304	22·01	81·57	8·768
	II	13 losing, Oct. 18 to Oct. 25..	7·807	14·537	0·960	H. W. Locus No. II 0·80 ft. above No. IV. Also	13·619	22·18	77·00	8·843
	III	15 gaining, Oct. 25 to Nov. 2.	7·062	13·620	0·590	L. W. Locus No. I. 0·38 ft. above No. III. and	13·016	21·78	68·00	9·571
	IV	15 losing, Nov. 2 to Nov. 10..	7·144	13·523	0·739	L. W. Locus No. II. 0·30 ft. above No. IV.	12·785	21·80	65·21	9·803
		General average, 57 tides..	7·474	14·189	0·787		13·413	21·94	72·70	9·225
Pointe Platon.	I	14 gaining, Oct. 11 to Oct. 18.	9·775	16·050	3·556	H. W. Locus No. I 0·75 ft. above No. III. and	12·444	22·01	81·57	7·628
	II	13 losing, Oct. 18 to Oct. 25..	9·667	15·523	3·691	H. W. Locus No. II 0·75 ft. above No. IV.. Also	11·866	22·18	77·00	7·705
	III	15 gaining, Oct. 25 to Nov. 2.	8·941	14·770	3·209	L. W. Locus No. I 0·35 ft. above No. III and	11·553	21·78	68·00	8·495
	IV	15 losing, Nov. 2 to Nov. 10..	9·867	14·499	3·251	L. W. Locus No. II 0·35 ft. above No. IV.	11·237	21·80	65·21	8·616
		General average, 75 tides..	9·539	15·190	3·423		11·766	21·94	72·70	8·092

TABLE XIV.—*Continued.*

Tide Stations.	Numbers of Series.	Tides in each Series, and Dates.	Actual Averages. Mean tide levels. Feet above datum.	High water levels. Feet above datum.	Low water levels. Feet above datum.	Differences of height between corresponding serial loci of High and Low water levels.	Amplitudes corrected for diurnal inequalities. Ft.	Elevations of river at Verchères. Feet above datum.	Mean astronomical coefficients of semi-amplitude.	Units of height corresponding to each Series. Ft.
Grondines.	I	14 gaining, Oct. 11 to Oct. 18.	12·343	16·356	8·321	H. W. Locus No. I 0·70 ft. above No. III and H.W. Locus No. II 0·70 ft. above No. IV. Also L.W. Locus No. I 0·50 ft. above No. III and L.W. Locus No. II 0·50 ft. above No. IV.	7·946	22·01	81·57	4·870
	II	13 losing, Oct. 18 to Oct. 25..	12·351	15·965	8·638		7·352	22·18	77·00	4·709
	III	15 gaining, Oct. 25 to Nov. 2.	11·527	15·299	7·830		7·455	21·78	68·00	5·481
	IV	15 losing, Nov. 2 to Nov. 10..	11·405	15·042	7·814		7·241	21·80	65·21	5·552
		General average, 57 tides..	11·885	15·647	8·145		7·500	21·94	72·70	5·158
St. Jean Deschaillons.	I	14 gaining, Oct. 11 to Oct. 18.	13·561	16·455	10 653	H. W. Locus No. I 0·55 ft. above No. III and H. W. Locus No. II 0·55 ft. above No. IV. Also L. W. Locus No. I 0·40 ft. above No. III and L. W. Locus No. II 0·40 ft. above No. IV.	5·724	22·01	81·57	3·508
	II	13 losing, Oct. 18 to Oct. 25..	13·647	16·226	10·991		5·228	22·18	77·00	3·403
	III	15 gaining, Oct. 25 to Nov. 2.	12·779	15·476	10·140		5·337	21·78	68·00	3·925
	IV	15 losing, Nov. 2 to Nov. 10..	12·910	15·389	10·387		4·962	21·80	65·21	3·766
		General average, 57 tides..	13·201	15·866	10·536		5·333	21·94	72·70	3·649
Batiscan.	I	14 gaining, Oct. 11 to Oct. 18.	15·452	16·921	13·969	H. W. Locus No. I 0·48 ft. above No. III and H. W. Locus No. II 0.48 ft. above No. IV. Also L. W. Locus No. I 0·50 ft. above No. III and L. W. Locus No. II 0·50 ft. above No. IV.	2·881	22·01	81·57	1·766
	II	13 losing, Oct. 18 to Oct. 25..	15·656	16·873	14·372		2·500	22·18	77·00	1·623
	III	15 gaining, Oct. 25 to Nov. 2.	14·793	16·010	13·621		2·389	21·78	68·00	1·757
	IV	15 losing, Nov. 2 to Nov. 10..	14·782	15·948	13·590		2·376	21·80	65·21	1·821
		General average, 57 tides..	15·149	16·415	13·883		2·532	21·94	72·70	1·741

TABLE XIV.—*Continued.*

Tide Stations.	Numbers of Series.	Tides in each Series, and Dates.	Actual Averages. Mean tide levels. Feet above datum.	High water levels. Feet above datum.	Low water levels. Feet above datum.	Differences of height between corresponding serial loci of High and Low water levels.	Amplitudes corrected for diurnal inequalities.	Elevations of river at Verchères. Feet above datum.	Mean astronomical coefficients of semi-amplitude.	Units of height corresponding to each Series.
							Ft.			Ft.
Champlain.	I	14 gaining, Oct. 11 to Oct. 18.	16·314	17·478	15·206	H. W. Locus No. I 0·45 ft. above No. III and H. W. Locus No. II 0·45 ft. above No. IV. Also L. W. Locus No. I 0·38 ft. above No. III and L. W. Locus No. II 0·38 ft. above No. IV.	2·207	22·01	81·57	1·353
	II	*13 losing, Oct. 18 to Oct. 25.	16·573	17·474	15·605		1·882	22·18	77·00	1·222
	III	15 gaining, Oct. 25 to Nov. 2.	15·890	16·734	14·976		1·814	21·78	68·00	1·331
	IV	15 losing, Nov. 2 to Nov. 10.	15·594	16·440	14·754		1·678	21·80	65·21	1·252
		General average, 57 tides.	16·082	16·974	15·149		1·887	21·94	72·70	1·291

* These results for series No. II. are based on those obtained at Batiscan, the observations made at Champlain being incomplete.

The value of the unit of height based on the lowest neaps observed, viz.: 11th and 12th of October, for both of which the coefficient is 39, is found to be equal to $\frac{11{\cdot}090 + 10{\cdot}834}{39 \times 2 \times 2} = 14{\cdot}055$ feet, and that based on the highest or most important spring, observed 18th October, for which the coefficient is 117 to $\frac{17{\cdot}544}{1{\cdot}17 \times 2} = 7{\cdot}50$ feet; the first value being, therefore, nearly double the second.

If some one had attempted to determine the position of the high or that of low water level at the Graving Dock, for the morning tide of the 11th of October, at low neaps, from the average unit of height equal to, say, 9·75 feet, he would have found low water to stand: 0·41 × 9·75 feet = 4·00 feet below, and high water 4·00 feet above the mean tide level of that day. But according to actual observation, high water at 12·07 a.m., 11th October, was 6·765 feet above, and low water 5·69 feet below the mean tide level corrected for diurnal inequalities; the computed elevations are, therefore, respectively 2·76 and 1·69 feet in error.

Again, if corresponding determinations of high and low water levels had been made for the afternoon tide of the 18th October, at high springs, low and high water would have been found to stand respectively: 1·17 feet × 9·75 = 11·40 feet below and 11·40 feet above the correct mean tide levels, while in reality low water observed at 2·42 p.m. 18th of October, was but 10·72 feet — 2·066 feet = 8·65 feet below, and the high water immediately following 20·182 — 10·720 = 9·46 feet above the said mean tide level, the errors being respectively 2·75 and 1·94 feet.

Such computations would seldom prove of any practical utility at Quebec, on account of the position of the mean tide level being too unsettled and difficult to determine; they

serve here to show that even supposing the elevation of the said mean tide level to be accurately known, the errors that would be committed are, in the case of neaps, nearly 85 and 19 per cent, and in case of springs, 83 and 30 per cent greater than the errors which have been found to obtain in European seaports under the most unfavourable conditions of wind and weather, although during the whole time the observations were made and for several days previous, the weather was fair and no high winds were felt at Quebec and vicinity.

These large discrepancies appear to be chiefly due to the following causes: 1st. At spring tides, the whole body of water brought up the St. Lawrence estuary by the Atlantic wave has to be raised vertically several feet higher than at neap tides, and as a good portion of the energy of the fluvial undulation is expended in performing this work, the intumescence formed on the estuary must gain less rapidly in importance than the wave from the ocean which gives rise to it.

2nd. At neaps, the volume of tide water retained in the estuary—which may be looked upon as a very long narrow pond—is smaller than at springs, and the general level corresponding to any one whole phase of the undulations which are continuously being propagated up the St. Lawrence, is therefore lower than at springs and the importance or amplitude of the tides comparatively greater than the theoretical one, as represented by the coefficients in "L'Annuaire des Marées." That the volume of tide water which lodges in the estuary, increases with the gaining tides and diminishes when these are losing in importance, is shown in the most striking manner by diagrams Nos. IX., X., XIII. and XIV., which illustrate the movements of the tides at Grondines, St. Jean, Batiscan and Champlain, where the St. Lawrence falls to a lower level at neaps than at springs, while the fresh water discharge and river level at Verchères remain constant. Below Pointe Platon, the low water surface of the stream is generally at a higher level at neaps than at springs; but the filling and emptying of the estuary goes on according to the same law as above this locality, which is clearly shown by diagrams Nos. VI, VII., VIII., XII and. XIII., and also by the water levels entered in the last table. It is, moreover, not impossible that the interference of the wave passing through the Straits of Belle Isle with that entering the Gulf through Cabot Strait may contribute, in some measure, to the modification of the theoretical curve of amplitudes which indicates the variations due to astronomical causes, in the importance of the tide waves on the shores of the open Atlantic, and in the vertical position of the summits and troughs of these waves.

In view of the ascertained fact that the general elevation of each weekly series of gaining or losing tides varies with its mean amplitude, it follows that before the part of a change in the water level of the estuary, which is attributable to a corresponding variation in the fluvial discharge, can be correctly established by comparing the elevations of wave summits or troughs determined by the high stage loci of high and low tide levels, respectively, with the elevations of summits or troughs of undulations of equal theoretical importance, determined by corresponding loci for the low stage of the river, it will be necessary either: 1st. To refer both sets of loci to a series of tides, the mean amplitude of which corresponds to a standard theoretical coefficient having a fixed value, such as for instance: $\frac{81{\cdot}57 + 77{\cdot}00 + 68{\cdot}00 + 65{\cdot}21}{4}$ = say, 73 or, 2nd. To effect other corrections that may be found more advantageous for eliminating the difference of height in the said typical water lines, which arises from the inequality in the mean amplitudes of the weekly series of tides in question, or else: 3rd. To select for comparing purposes tides forming part of series having nearly equal mean coefficients of amplitude.

Moreover, it must be borne in mind that the springs which have a maximum theoretical amplitude corresponding to coefficient 118, belong to weekly series for which the mean coefficient of amplitude is, say, about 82, and the neaps of minimum importance corresponding to astronomical coefficient 30, form part of series the mean amplitude of which may be assumed to correspond to coefficient 65.

In series Nos. V. and VI. of high and low tide levels determined during the high water season of 1888, there occurs an interval of about 12 days between the 6th and 18th of May, embracing 24 tides with theoretical coefficients of from 49 to 75, during which period the river was continuously in a rising condition; its surface being raised 4·0 ft., viz.: from 27·50 ft. to 31·50 ft. above datum. During the first four days, viz.: from 6th to 10th May, the water rose gradually only 0·3 ft., and during the last four days, from 14th to 18th May, only 0·75 feet.

The observations and gaugings made during these two periods of 4 days are, on the whole, the best available for ascertaining by direct comparison, the variations in the high and low tide levels which result from an increased or diminished fluvial discharge corresponding to a given rise or fall of the river at Verchères, during the high stage of the Lower St. Lawrence in the spring of the year.

But even here, judging by the relative heights of the loci of series of wave summits and troughs Nos. VI. and VII., during the latter of which series the fresh water discharge was slowly decreasing instead of being on the increase, as during the previous series, the steady and comparatively rapid swelling of the river proper above Verchères, from 10th to 14th May, kept the level of the estuary abnormally high in the vicinity of Quebec between the 14th and 16th or 17th of May, say to the extent of from about 0·2 ft. at Pointe Platon to 0·5 ft. at the Graving Dock, especially at the time of low water. Hence, in order to determine the mean ratio which obtains when the flow is nearly permanent and the tide has an amplitude corresponding to astronomical coefficient 75, between the rise of an estuary at high or low tide caused by an increased fresh water discharge above a typical level corresponding to a standard high stage of the river, or the fall in the estuary below the typical level due to a decreased discharge, and the corresponding change in the fluvial level at Verchères, I have assumed that such standard river and typical high and low tide levels are situated respectively about midways between those of series Nos. VI. and VII. as plotted on the diagrams.

On account of the river falling only some 2¼ ft. at Verchères during the whole time occupied by series of gaugings Nos. VII. and VIII., the data afforded by these water measurements can evidently not be applied so advantageously to gain the object just described as the data derived from series Nos. V. and VI.

Still less is it to be expected that the ratio of the changes occurring in the high and low tide levels, to the variations which take place nearly simultaneously in the river levels at Verchères, can be deduced satisfactorily for the low water season, in a direct manner from the four series of observations Nos. I. to IV. made in the fall of 1887, considering that the variations in the fluvial discharge were naturally of much more limited extent than in the case of the high water series of tides Nos. VII. and VIII.

To compare some series of gaugings intermediate between the two monthly sets of gaining and losing series of tides, I. to IV. and V. to VIII., which correspond to the highest and to the lowest stages of the river—had such water measurements been made—with some of the low water series, I. to IV., would probably have been the most satisfactory way of determining the said low water ratios.

Under the circumstances, the best alternative course that would give results sufficiently accurate for the present purpose, appeared to be to establish:

1°. The ratios which the variations in the high and low water levels of a 49 tide, due to a fluctuation of the river at Verchères, between elevations 21·70 ft. and 27·50 ft., in passing from series No. IV. to series No. V., bear to the fluvial fluctuation of (27·50 ft. – 21·70 ft.) = 5·80 ft.

2°. The corresponding ratio for a tide of 75, while the river fluctuates at Verchères, between elevations 21·80 and 27·90 = 6·10 ft.

After, however, these computations were completed, with a view of checking, in a certain manner, the results arrived at, as just described and at the same time securing additional data that would show in a more satisfactory manner the nature of the combined effects of the fluvial and tidal waters on the level of the estuary, I also determined for every station below Champlain, the average variations which obtained in the high and low tide levels of the more extended series Nos. I., III., V. and VII., while

the river rose at Verchères: in the case of neaps of 46, from elevation 21·90 ft. to 31·60 ft. above datum, viz.: 9·7 ft.; and in the case of springs of 107, from elevation 22·10 ft. to 31·10 ft., viz.: 9·0 ft.

Finally, I concluded that, everything considered, the best course to follow was to take the mean of the two results obtained as above explained.

Let us now compute the values of these ratios *in extenso*, as just explained say for Grondines station, to give an example of the application of the method followed for all the other places.

On referring to diagram No. XIX it will be seen:

(*a.*) That during gaining weekly series of tides No. V in the spring of 1888 and the succeeding losing series No. VI, when the mean serial coefficients of amplitude were respectively 65·14 and 67·13:

1st. The high water level of a low neap tide corresponding to coefficient 49, rose at Grondines from 17·70 ft. above datum in series No. V, to 19·95 ft. in series No. VI, or 2·25 feet, while the rise of the river at Verchères was from elevation 27·60 feet to 31·60 feet = 4·0 feet. Deducting, say $(\frac{0\cdot79}{31})$ foot × ·02 = 0·10 foot from 2·25 feet, on account of the coefficient of mean amplitude in losing series No. VI being greater by (0·6713 — 0·6514) = 0·0199, than that of gaining series No. V, and denoting the ratio of the average rise or fall or variation, $V_{\cdot \text{H.W.}}$, in the high water level of a tide with a coefficient of $^{T}_{49,}$ at Grondines, to the corresponding variation, $V_{\cdot \text{R.}}$, of the river between elevations 27·60 feet and 31·60 feet, by:

$$\frac{V_{\cdot \text{H. W.},\overset{\text{T.}}{49}}}{V_{\cdot \text{R.},\left\{\begin{smallmatrix}27\cdot60\\ \text{to}\\ 31\cdot60\end{smallmatrix}\right\}}}$$

capitals being generally used in this and other similar expressions given hereafter, to indicate or refer to tide and river levels of the high water season, while corresponding river or tide levels which obtain during the low water season are represented by small letters, we have:

$$\frac{V_{\cdot \text{H.W.},\overset{\text{T.}}{49},}}{V_{\cdot \text{R.},\left\{\begin{smallmatrix}27\cdot60\\ \text{to}\\ 31\cdot60\end{smallmatrix}\right\}}} = \frac{(2\cdot25 - 0\cdot1) = 2\cdot15}{(31\cdot60 - 27\cdot60) = 4\cdot00} = 0\cdot538 \text{ ft.} \qquad (1)$$

2. The low water level rises, say from 13·20 ft. to 16·75 ft. above datum = 3·55 ft., whence we deduce for average rise or fall at Grondines due to each foot of corresponding change, after deducting $\left(\frac{0\cdot50}{0\cdot12}\right) \times 0\cdot02$, or say 0·09 from 3·55, owing to the inequality in the serial mean amplitudes:

$$\frac{V_{\cdot \text{L.W.},\overset{\text{T.}}{49},}}{V_{\cdot \text{R.},\left\{\begin{smallmatrix}27\cdot60\\ \text{to}\\ 31\cdot60\end{smallmatrix}\right\}}} = \frac{3\cdot46}{4\cdot00} = 0\cdot865 \text{ ft.} \qquad (2)$$

3. The amplitude is diminished from:

$$A._{\overset{\text{T.}}{49},(27\cdot60\text{ ft.})} \text{ to } A._{\overset{\text{T.}}{49},(27\cdot60)} - \left[V_{\cdot \text{H.W.},\overset{\text{T.}}{49},\left\{\begin{smallmatrix}27\cdot60\\ \text{to}\\ 31\cdot60\end{smallmatrix}\right\}} - V_{\cdot \text{L.W.}\overset{\text{T.}}{49},\left\{\begin{smallmatrix}27\cdot60\\ \text{to}\\ 31\cdot60\end{smallmatrix}\right\}}\right]$$

viz., from (17·70 − 13·20 = 4·50) to (19·95 − 16·76 = 3·20 ft., and to:

$$\frac{A._{\overset{\text{T.}}{49},(27\cdot60)} - \left[V_{\cdot \text{H.W.},\overset{\text{T.}}{49},\left\{\begin{smallmatrix}27\cdot60\\ \text{to}\\ 31\cdot68\end{smallmatrix}\right\}} - V_{\cdot \text{L.W.},\overset{\text{T.}}{49},\left\{\begin{smallmatrix}27\cdot60\\ \text{to}\\ 31\cdot60\end{smallmatrix}\right\}}\right]}{A._{\overset{\text{T.}}{49},(27\cdot60)}} = \frac{3\cdot20}{4\cdot50}, \qquad (3)$$

or 0·710 of its original value, where $A._{49,(27\cdot60\,ft.)}^{T.}$ denotes the tidal amplitude at Grondines during neaps of 49 when the river surface stands at a mean elevation of 27·60 ft. above datum at Verchères.

(*b.*) That when the Atlantic tides had an amplitude corresponding to coefficient 75 in series Nos. V and VI, with mean astronomical coefficients of 65·14 and 67·13 respectively, a rise of the river at Verchères from 27·80 ft. to 31·10 ft. = 3·30 feet above datum, caused :

1. The high water level at Grondines to rise from 19·35 ft. to 21·15 ft. = 1·80 ft. ; little or no correction being needed on account of the inequality of the serial mean amplitudes, whence :

$$\frac{V._{H.W.,75,}^{T.}}{V._{R.,\left\{\begin{smallmatrix}27\cdot80\\ to\\ 31\cdot10\end{smallmatrix}\right\}}} = \frac{1\cdot80}{3\cdot30} = 0\cdot545 \text{ ft.} \tag{4}$$

2. The low water level to rise from 13·90 to 16·70 = 2·80 ft., whence :

$$\frac{V._{L.W.,75}^{T.}}{V._{R.,\left\{\begin{smallmatrix}27\cdot80\\ to\\ 31\cdot10\end{smallmatrix}\right\}}} = \frac{2\cdot80}{3\cdot30} = 0\cdot848 \text{ ft.} \tag{5}$$

3. The amplitude $A._{75,\,(27\cdot80\,ft.)}^{T.}$ is thus reduced to :

$$A._{75,\,(27\cdot80\,ft.)}^{T.} - \left[V._{H.W.,75,\left\{\begin{smallmatrix}27\cdot80\\ to\\ 31\cdot10\end{smallmatrix}\right\}}^{T.} - V._{L.W.,75,\left\{\begin{smallmatrix}27\cdot80\\ to\\ 31\cdot10\end{smallmatrix}\right\}}^{T.} \right]$$

or from (19·35 — 13·95) = 5·45 ft., to (21·15 — 16·70) = 4·45 ft., viz. to :—

$$\frac{A._{75,\,(27\cdot80)}^{T.} - \left[V._{H.W.,75,\left\{\begin{smallmatrix}27\cdot80\\ to\\ 31\cdot10\end{smallmatrix}\right\}}^{T.} - V._{L.W.,75,}^{T.} \right]}{A._{75,\,(27\cdot80)}^{T.}} \tag{6}$$

or to $\frac{4\cdot45}{5\cdot45} = 0\cdot816$ of its original value.

(*c.*) That at neaps of 49 in series Nos. IV and V, having nearly equal theoretical coefficients of amplitude, viz. : 65·21 and 65·14, respectively ; and where, therefore, no correction is required on account of any difference that might exist in the mean importance of the said series of tides, we find that for a fluvial rise or fall at Verchères, between elevations 21·70 ft. and 27·60 ft. = 5·90 ft. :

1. The high water level at Grondines rises from 14·25 ft. to 17·70 ft., or falls from 17·70 feet to 14·25 = 3·45 ft., whence :

$$\frac{V._{H.W.,49,}^{T.}}{V._{R.,\left\{\begin{smallmatrix}21\cdot70\\ to\\ 27\cdot60\end{smallmatrix}\right\}}} = \frac{3\cdot45}{5\cdot90} = 0\cdot585 \text{ ft.} \tag{7}$$

2. The low water level is raised from 7·50 to 13·20 = 5·70 ft., or depressed as much, whence :

$$\frac{V._{L.W.,49,}^{T.}}{V._{R.,\left\{\begin{smallmatrix}21\cdot70\\ to\\ 27\cdot60\end{smallmatrix}\right\}}} = \frac{5\cdot70}{5\cdot90} = 0\cdot966 \text{ ft.} \tag{8}$$

3. The amplitude becomes, therefore, diminished from :

$$A._{49,\,(21\cdot70)\text{ to }}{}^{T.} A._{49,\,(21\cdot70)} - \left[V._{H.W.,49,}{}^{T.}\left\{\begin{matrix}21\cdot70\\ \text{to}\\ 27\cdot60\end{matrix}\right\} - V._{L.W.,49,}{}^{T.}\left\{\begin{matrix}21\cdot70\\ \text{to}\\ 27\cdot60\end{matrix}\right\} \right]$$

or from 6·75 to (17·70 – 13·20) = 4·50 ft., viz. to :

$$\frac{A._{49,\,(27\cdot60)}{}^{T.} - \left[V._{H.W.,49,}{}^{T.}\left\{\begin{matrix}21\cdot70\\ \text{to}\\ 27\cdot60\end{matrix}\right\} - V._{L.W.,49,}{}^{T.}\left\{\begin{matrix}21\cdot70\\ \text{to}\\ 27\cdot60\end{matrix}\right\} \right]}{A._{49,\,(27\cdot60)}{}^{T.}} \qquad (9)$$

or to $\frac{4\cdot50}{6\cdot75} = 0\cdot667$ of its first value.

(*d.*) That at springs of 75 in series Nos. IV. and V., for a rise of the river at Verchères from 21·70 to 27·80 = 6·10 ft. :

1. The high water level is elevated at Grondines from 15·35 ft. to 19·35 ft. = 4·00 feet, whence :

$$\frac{V._{H.W.,\,75,}{}^{T.}}{V._{R.,}\left\{\begin{matrix}21\cdot70\\ \text{to}\\ 27\cdot80\end{matrix}\right\}} = \frac{4\cdot00}{6\cdot10} = 0\cdot656. \qquad (10)$$

2. The low tide level is raised from 7·95 ft. to 13·90 ft. = 6·0 ft. above datum, whence :

$$\frac{V._{L.W.,\,75,}{}^{T.}}{V._{R.,}\left\{\begin{matrix}21\cdot70\\ \text{to}\\ 27\cdot80\end{matrix}\right\}} = \frac{6\cdot00}{6\cdot10} = 0\cdot983. \qquad (11)$$

3. The amplitudes are diminished from :

$$A._{75,\,(21\cdot70)}{}^{T.} \text{ to } A._{75,\,(21\cdot70),}{}^{T.} - \left[V._{H.W.,\,75,}{}^{T.}\left\{\begin{matrix}21\cdot70\\ \text{to}\\ 27\cdot80\end{matrix}\right\} - V._{L.W.,\,75,}{}^{T.}\left\{\begin{matrix}21\cdot70\\ \text{to}\\ 27\cdot80\end{matrix}\right\} \right]$$

or from 15·35 — 7·90 = 7·45 to 19·35 — 13·90 = 5·45 ft., viz. to :

$$\frac{A._{75,\,(21\cdot70)}{}^{T.} - \left[V._{H.W.,\,75,}{}^{T.}\left\{\begin{matrix}21\cdot70\\ \text{to}\\ 27\cdot80\end{matrix}\right\} - V._{L.W.,\,75,}{}^{T.}\left\{\begin{matrix}21\cdot70\\ \text{to}\\ 27\cdot80\end{matrix}\right\} \right]}{A._{75,\,(21\cdot70)}{}^{T.}} \qquad (12)$$

or $\frac{5\cdot54}{7\cdot45} = 0\cdot731$ of their first value.

(*e.*) That at neaps of importance, 46, in series Nos. III. and VI., the mean amplitude coefficients of which are 68·00 and 67·13, and where consequently the correction required when the mean serial amplitudes differ materially from each other may also be omitted, it is found that for a rise or a fall of the river at Verchères of 9·8 feet, between the elevations of 21·80 ft. and 31·60 ft. above datum :

1. The high water level becomes elevated or depressed at Grondines 5·35 ft., between the elevations of 14·60 ft. and 19·95 ft., whence :

$$\frac{V._{H.W.,\,46}{}^{T.}}{V._{R.,}\left\{\begin{matrix}21\cdot80\\ \text{to}\\ 31\cdot60\end{matrix}\right\}} = \frac{5\cdot35}{9\cdot80} = 0\cdot546 \text{ ft.} \qquad (13)$$

2. The low water level varies 9·00 ft., between the heights of 7·75 and 16·75 above datum, wherefore:

$$\frac{V._{\text{L.W.,}\ 46}^{\text{T.}}}{V._{\text{R.,}}\left\{\begin{matrix}21{\cdot}80\\ \text{to}\\ 31{\cdot}60\end{matrix}\right\}} = \frac{9{\cdot}00}{9{\cdot}80} = 0{\cdot}918 \text{ ft.} \qquad (14)$$

3. The amplitude becomes, therefore, diminished from:

$$A._{46,\,(21{\cdot}80)}^{\text{T.}} \text{ to } A._{46,\,(21{\cdot}30)}^{\text{T.}} - \left[V._{\text{H.W.,}46,}^{\text{T.}}\left\{\begin{matrix}21{\cdot}80\\ \text{to}\\ 31{\cdot}60\end{matrix}\right\} - V._{\text{L.W.,}46,}^{\text{T.}}\left\{\begin{matrix}21{\cdot}80\\ \text{to}\\ 31{\cdot}60\end{matrix}\right\}\right]$$

or from (14·60 — 7·75 = 6·85 ft.) to (19·95 — 16·75 = 3·20 ft.) viz., to:

$$\frac{A._{46,\,(21{\cdot}80)}^{\text{T.}} - \left[V._{\text{H.W.,}46,}^{\text{T.}}\left\{\begin{matrix}21{\cdot}80\\ \text{to}\\ 31{\cdot}60\end{matrix}\right\} - V._{\text{L.W.,}46,}^{\text{T.}}\left\{\begin{matrix}21{\cdot}80\\ \text{to}\\ 31{\cdot}60\end{matrix}\right\}\right]}{A._{46,\,(21{\cdot}80)}^{\text{T.}}} \qquad (15)$$

or $\frac{3{\cdot}20}{6{\cdot}80} = 0{\cdot}467$ of its first value.

(*f*) That at springs of 107 in series Nos. II. and VII., with weekly mean amplitudes corresponding to coefficients 77 and 78 respectively, it is found that for a rise of the river at Verchères from 22·50 to 31·00 ft. above datum = 8·5 ft.:

1. The high tide level is elevated at Grondines 5·40 ft., from the height of 17·25 ft. to 22·65 ft. above datum, whence:

$$\frac{V._{\text{H.W.,}\ 107}^{\text{T.}}}{V._{\text{R.,}}\left\{\begin{matrix}22{\cdot}50\\ \text{to}\\ 31{\cdot}30\end{matrix}\right\}} = \frac{5{\cdot}40}{8{\cdot}50} = 0.635 \text{ ft.} \qquad (16)$$

2. The low tide level is raised from 9·50 to 17·30 ft. above datum = 7·80 ft., whence:

$$\frac{V._{\text{L.W.,}\ 107}^{\text{T.}}}{V._{\text{R.,}}\left\{\begin{matrix}22{\cdot}50\\ \text{to}\\ 31{\cdot}00\end{matrix}\right\}} = \frac{7{\cdot}80}{8{\cdot}50} = 0{\cdot}918 \text{ ft.} \qquad (17)$$

3. The amplitude is diminished from:

$$A._{107,\,(22\ 50)}^{\text{T.}} \text{ to } A._{107,\,(22{\cdot}50)}^{\text{T.}} - \left[V._{\text{H.W.,}107,}^{\text{T.}}\left\{\begin{matrix}22{\cdot}50\\ \text{to}\\ 31{\cdot}00\end{matrix}\right\} - V._{\text{L.W.,}107,}^{\text{T.}}\left\{\begin{matrix}22{\cdot}50\\ \text{to}\\ 31{\cdot}00\end{matrix}\right\}\right]$$

or from (17·25 — 8·95 = 8·30) to (22·65 — 16·75 = 5·90) viz., to:

$$\frac{A._{107,\,(22{\cdot}50)}^{\text{T.}} - \left[V._{\text{H.W.,}\ 107,}^{\text{T.}}\left\{\begin{matrix}22{\cdot}50\\ \text{to}\\ 31{\cdot}00\end{matrix}\right\} - V._{\text{L.W.,}\ 107,}^{\text{T.}}\left\{\begin{matrix}22{\cdot}50\\ \text{to}\\ 31{\cdot}00\end{matrix}\right\}\right]}{A._{107,\,(22{\cdot}50)}^{\text{T.}}} \qquad (18)$$

and $\frac{5{\cdot}90}{8{\cdot}30} = 0{\cdot}694$ of its first value.

By means of the relations just determined we are enabled to establish the heights of extreme high and low and other characteristic spring and neap tide levels above datum at each tide station, as will now be done for Grondines.

(*a*.) At the high stage of the St. Lawrence, when the river surface is from 27·60 to 31·60 ft. above datum at Verchères, the average rate of change of ratio $\frac{V._{\text{H.W.}}}{V._{\text{R.}}}$ for

the high tide level per unit of tidal importance or theoretical amplitude, and for amplitudes corresponding to coefficients between 49 and 75, is, according to the above relations:

$$C_{\cdot H.W.,\left\{\substack{27\cdot60\\ \text{to}\\ 31\cdot60}\right\}} = \frac{\dfrac{V_{\cdot H.W.,\ 75}^{T.}}{V_{\cdot R.,\left\{\substack{27\cdot80\\ \text{to}\\ 31\cdot10}\right\}}} - \dfrac{V_{\cdot H.W.,\ 49}^{T.}}{V_{\cdot R.,\left\{\substack{27\cdot60\\ \text{to}\\ 31\cdot60}\right\}}}}{75 - 49} = \frac{0\cdot545 - 0\cdot538}{26} = +\,0\cdot00027. \qquad (19)$$

Hence the approximate value of $\dfrac{V_{\cdot H.W.}}{V_{\cdot R.}}$ at the highest springs and the lowest neaps possible, during the high water season when the river stands between 27·60 and 30·60 above datum at Verchères, are:

$$\frac{V_{\cdot H.W.,}}{V_{\cdot R.,\left\{\substack{27\cdot60\\ \text{to}\\ 31\cdot60}\right\}}} \text{ for } \begin{cases} {}^{T.}_{118} = 0\cdot545 + (118\text{–}75)\,(0\cdot00027) = 0\cdot5566. \\ {}^{T.}_{30} = 0\cdot538 - (49\text{–}30)\,(0\cdot00027) = 0\cdot5331. \end{cases} \qquad (20)$$

Now, by drawing a right line AB on diagram No. XIX., to indicate the general direction of the locus of high tide levels for the weekly series of gaining tides No. VII during which the St. Lawrence fell at Verchères only about 0·4 ft., while its mean elevation at this place was 31·20 ft., and producing this line upward past ordinate 118 and downwards to ordinate 30, the intersection of AB with the former ordinate is found to be at a height of 23·27 ft., and its intersection with the latter ordinate, 18·77 ft. above datum, so that we can put:

$$E._{\substack{H.W.\\ \text{for}\\ R.,(31\cdot20)}} \text{ for } \begin{cases} {}^{T.}_{118} = 23\cdot27 \text{ ft.} \\ {}^{T.}_{30} = 18\cdot77 \text{ ft.} \end{cases} \qquad (21)$$

The right line AB, shown on the diagram (No. XIX.), it will be noticed, does not strictly follow the average or general direction of the high tide levels or wave summits of series No. VII.; but has a slightly greater inclination to the horizon. This is due to my having applied an approximate correction, owing to the slight flattening of the high water locus corresponding to a perfectly uniform fluvial discharge which must have resulted from the continuous, though slow, falling off in the said discharge during the weekly series in question. The inclination given to AB is such that if a parallel was run through the intersection of loci Nos. VII. and VIII. it would cut off on its upper side about one-quarter of the angular space comprised between them; the reason being that during series No. VIII., for which the average astronomical coefficient of amplitude is nearly the same as for No. VII., viz.: 75·7, the river fell on the whole about three times as rapidly as during series No. VII.

If instead of being 31·20 ft. above datum at Verchères the river surface had stood at the greatest elevation on record, viz.: at 36·32, and if instead of 78 the mean serial coefficients of amplitude had been 82 and 65, the summit of the fluvial waves of maximum importance would have reached the following elevations, viz.:

$$E._{\substack{H.W.,\\ \text{for}\\ R.,(46\cdot32)}} \text{ for } \begin{cases} {}^{T.}_{118} = 23\cdot27 + (36\cdot32 - 31\cdot20)\,(0\cdot5566) + \left(\frac{\cdot70}{13}\right)(82\cdot78) = 26\cdot34 \text{ ft.} \\ {}^{T.}_{30} = 18\cdot77 + (36\cdot32 - 31.20)\,(0\cdot5331) - \left(\frac{\cdot70}{13}\right)(78\cdot65) = 20\cdot80 \text{ ft.} \end{cases} \qquad (22)$$

The elevation of 26·34 above datum indicates the probable extreme height to which spring tides of the maximum importance of 118 would rise at Grondines, at high water during the season of navigation, and 20·80 the lowest point to which neaps of the mini-

mum importance of 30 would fall, at low water when the river is at the extreme high stage of 36·32 ft. at Verchères; leaving out of consideration the effects of the tidal diurnal inequalities on the level of the estuary as well as those of persistent high winds, and taking for granted that such maximum and minimum tides may occur during the month of May. But according to the tables of tidal coefficients (centièmes) at the syzygies, which have been published annually in "La Connaissance des Temps" for the 19 years from 1870 to 1889, during which period the moon's nodes made a complete revolution, the tide of greatest importance that may be expected to occur during the month of May corresponds to a coefficient of 108 instead of 118.

Now, according to locus AB of high tide levels drawn on Ill. No. XIX, the elevation of high water of a 108 tide, with the river 31·20 ft. above datum, at Verchères, is at Grondines:

$$E_{\substack{\text{H.W., T. 108} \\ \text{for} \\ \text{R., (31·20)}}} = 22{\cdot}77 \text{ ft.} \qquad (23)$$

Hence, the greatest height to which springs can rise at Grondines, in May, or at the beginning of June, in the conditions just mentioned is:

$$E_{\substack{\text{H.W., T. 118,} \\ \text{for} \\ \text{R., (36·32)}}} = 22{\cdot}77 + \left\{0{\cdot}545 + (108 - 75)\,(+0{\cdot}00027)\right\}\left\{36{\cdot}32 - 31{\cdot}20\right\} = 25{\cdot}60 \text{ ft.} \qquad (24)$$

During the interval when the St. Lawrence fluctuated at Verchères, on an average, between $\frac{21{\cdot}70 + 21{\cdot}80}{2} = 21{\cdot}75$ ft., in weekly series of losing tides No. IV., with a mean importance of 65·21, and between $\frac{27{\cdot}50 + 27{\cdot}90}{2} = 27{\cdot}70$ ft., above datum, in series of gaining tides No. V. having very nearly the same mean importance as series No. IV., viz.: 65·14, and when, moreover, the astronomical coefficients of tidal amplitude varied between 49 and 75—the average change of the low tide level ratio, $\frac{V_{\cdot \text{L.W.,} \left\{\substack{\text{T.} \\ 49 \\ \text{to} \\ 75}\right\}}}{V_{\cdot \text{R.,} \left\{\substack{21{\cdot}70 \\ \text{to} \\ 27{\cdot}90}\right\}}}$ per unit of increase or decrease in the theoretical coefficient of amplitude was:

$$C_{\substack{\text{L.W.} \left\{\substack{\text{T.} \\ 75 \\ \text{to} \\ 49}\right\} \\ \text{or,} \\ l.w.}} = \frac{\dfrac{V_{\cdot \text{L.W., T. } 75}}{V_{\cdot \text{R.,} \left\{\substack{21{\cdot}70 \\ \text{to} \\ 27{\cdot}80}\right\}}} - \dfrac{V_{\cdot \text{L.W., T. } 49,}}{V_{\cdot \text{R.,} \left\{\substack{21{\cdot}70 \\ \text{to} \\ 27{\cdot}60}\right\}}}}{75 - 49} = \frac{0{\cdot}967 - 0{\cdot}966}{26} = 0{\cdot}00003 \qquad (25)$$

Assuming now that the said low tide level ratio continues to vary, approximately, at the same uniform rate of 0·00003 ft. for each unit of increase in the tidal coefficients, while these diminish from 49 to 30 and increase from 75 to 118, we have:

$$\frac{V_{\cdot l.w.}}{V'_{r.,(21{\cdot}50)}} \text{ for } \begin{cases} \text{T. } 30 & = 0{\cdot}966 - (49 - 30)\,(0{\cdot}00003) = 0{\cdot}9654 \\ \text{T. } 118 & = 0{\cdot}967 + (118 - 75)\,(0{\cdot}00003) = 0{\cdot}9683 \end{cases} \qquad (26)$$

where the expression $\frac{V_{\cdot l.w.}}{V_{\cdot r.,(21{\cdot}50)}}$ denotes, in general, the variation of the low tide level per foot of fluvial fluctuation, at Verchères, about the time the fresh water discharge is a minimum, and when those tides occur, which draw off the water of the estuary to the lowest possible level, in the locality under consideration, whether at maximum springs of 118, or at minimum neaps of 30.

Again, during the intervals when the St. Lawrence fluctuated at Verchères, on an average, between $\frac{21{\cdot}90 + 22{\cdot}20}{2} = 22{\cdot}05$ ft., in series No. I having a mean importance of 81·57, and $\frac{31{\cdot}60 + 31{\cdot}10}{2} = 31{\cdot}35$ ft. above datum, in series No. VII, the mean theoretical importance of which corresponds to coefficient 78, and when the astronomical coefficients of amplitude varied between 46 and 107, the mean change of the low tide level ratio, $\frac{V._{L.W.,\left\{\begin{smallmatrix}T.\\46\\to\\107\end{smallmatrix}\right\}}}{V._{R.,\left\{\begin{smallmatrix}21{\cdot}80\\to\\31{\cdot}60\end{smallmatrix}\right\}}}$ per unit of increase or decrease in the theoretical coefficient of amplitude, was:

$$C._{\substack{L.W.,\left\{\begin{smallmatrix}T.\\107\\to\\46\end{smallmatrix}\right\}\\to\\l.w.}} = \frac{\dfrac{V._{L.W.,\,\overset{T.}{107}}}{V._{R.,\left\{\begin{smallmatrix}22{\cdot}50\\to\\31{\cdot}00\end{smallmatrix}\right\}}} - \dfrac{V._{L.W.,\,\overset{T.}{46}}}{V._{R.,\left\{\begin{smallmatrix}21{\cdot}80\\to\\31{\cdot}60\end{smallmatrix}\right\}}}}{107 - 46} = \frac{0{\cdot}924 - 0{\cdot}918}{61} = +\,0{\cdot}00010 \qquad (27)$$

With the aid of this equation we arrive at:

$$\frac{V.''_{\,l.w.}}{V.''_{\,r.,(21{\cdot}50)}} \text{ for } \begin{cases} \overset{T.}{30} = 0{\cdot}918 - (46{\cdot}30)\,(0{\cdot}00010) = 0{\cdot}9160 \\ \overset{T.}{118} = 0{\cdot}924 - (118{\cdot}107)\,(0{\cdot}00010 = 0{\cdot}9250 \end{cases} \qquad (28)$$

Finally taking the mean of (26) and (28):

$$\frac{V._{l.w.}}{V._{r.,(21.50)}} \text{ for } \begin{cases} \overset{T.}{30} = 0{\cdot}9407 \\ \overset{T.}{118} = 0{\cdot}9466 \end{cases} \qquad (29)$$

is obtained.

If now we produce down to ordinate 30 and up to ordinate 118, the line $\overline{c\ d}$ drawn on diagram No. XIX., between ordinates 86 and 44, to indicate the general rate at which the low tide locus was lowered at Grondines, during series No. IV. of losing tides observed, while the river stood at an average elevation of 21·80 ft. at Verchères, without at any time having passed more than 0·2 ft. to either side of the said level and when the mean serial coefficient of tidal importance was as low as 65·21—we find by direct scale measurement of the diagram, that the elevations of low water of the tides of minimum and maximum amplitude, viz.: those corresponding to coefficients and ordinates 30 and 118 respectively, are:

$$E._{\substack{l.\,w.\\for\\R.,\,(21{\cdot}80)}} \text{ for } \begin{cases} \overset{T.}{30} = 7{\cdot}17 \text{ ft.} \\ \overset{T.}{158} = 8{\cdot}27 \text{ ft.} \end{cases}$$

But as the mean theoretical coefficient of weekly series of gaining or losing tides which comprise springs of maximum astronomical importance is about 82, instead of 65·21, we must, according to table XIV., add about 0·50 ft. to 8·27 ft., in order to arrive at the proper elevation of low water of the tide of maximum amplitude at Grondines, with river 21·80 ft. above datum at Verchères, whence:

$$E._{\substack{l.\,w.,\\R.,(21{\cdot}80)}} \text{ for } \begin{cases} \overset{T.}{30} = 7{\cdot}17 \text{ ft.} \\ \overset{T.}{118} = (8{\cdot}27 + 0{\cdot}50) = 8{\cdot}77 \text{ ft.} \end{cases} \qquad (30)$$

At the extreme low stage of the river, when the water is only 20·85 ft. above datum at Verchères, the elevations of the low water levels, or troughs of the said tidal undulations of minimum and maximum importance are, therefore :

$$\mathrm{E}_{\substack{l.\ w.,\\ \text{R.,(20·85)}}} \text{ for } \begin{cases} \text{T. } 30 & = 7{\cdot}17 - (21{\cdot}80 - 20{\cdot}85)\,(0{\cdot}9407) = 6{\cdot}277 \text{ ft.} \\ \text{T. } 118 & = 8{\cdot}77 - (21{\cdot}80 - 20{\cdot}85)\,(0{\cdot}9466) = 7{\cdot}861 \text{ ft.} \end{cases} \tag{31}$$

At the low stage of the river, 21·48 ft., or say 21·50 ft. above datum at Verchères, corresponding very nearly to 16·0 ft. on the sill of old lock No. 1, Lachine Canal, called standard low water in this report, and to which I have suggested all the soundings should be reduced, the heights of low water of the same tides of least and greatest amplitude are :

$$\mathrm{E}_{\substack{l.\ w.\\ \text{R.,(21·50)}}} \text{ for } \begin{cases} \text{T. } 30 & = 7{\cdot}17 - (21{\cdot}80 - 21{\cdot}50)\,(0{\cdot}9407) = 6{\cdot}888 \text{ ft.} \\ \text{T. } 118 & = 8{\cdot}77 - (21{\cdot}80 - 21{\cdot}50)\,(0{\cdot}9466) = 8{\cdot}486 \text{ ft.} \end{cases} \tag{32}$$

The lowest points to which the troughs of the fluvial waves of minimum and max imum importance can descend, when the river stands at the extreme high and highest known stage of 36·32 ft. above datum at Verchères, has been determined approximately as follows—always, as heretofore, independently of variations due to diurnal tidal inequalities and abnormal fluctuations caused by persistent high winds, etc.—and the mean coefficient of amplitude of the series of which the first mentioned tidal intumescence forms part, being assumed at 65 and the mean coefficient of the series of tides to which the other wave, viz., that of maximum amplitude belongs, at about 82.

During the two periods of the high water season included in series Nos. V and VI, for which the average coefficients of serial importance were, as already stated, 65·14 and 67·13, when the St. Lawrence stood between 27·60 and 31·60 ft. above datum at Verchères and the theoretical coefficients of tidal amplitude varied between 49 and 75—the mean change of ratio : $\dfrac{\mathrm{V}_{\text{L.W., T. 40 to 75}}}{\mathrm{V}_{\text{R., 27·60 to 31·60}}}$ for the low tide level, per unit of increase or decrease in the last mentioned coefficient, was :

$$\mathrm{C}_{\text{L.W., T. 49 to 75}} = \frac{\dfrac{\mathrm{V}_{\text{L.W., T. 75}}}{\mathrm{V}_{\text{R., 27·80 to 31·10}}} - \dfrac{\mathrm{V}_{\text{L.W., T. 49}}}{\mathrm{V}_{\text{R., 31·60 to 27·60}}}}{75 - 49} = \frac{0{\cdot}848 - 0{\cdot}865.}{26} = -0{\cdot}00065 \tag{33}$$

Hence :

$$\frac{\mathrm{V}_{\text{L.W.,}}}{\mathrm{V}_{\text{R. at 31·20}}} \text{ for } \begin{cases} \text{T. } 30 & = 0{\cdot}865 - (\ 49{\cdot}30)\,(-0{\cdot}00065 = 0{\cdot}87735 \\ \text{T. } 118 & = 0{\cdot}848 + (118{\cdot}75)\,(-0{\cdot}00065 = 0{\cdot}82000 \end{cases} \tag{34}$$

But by producing down to ordinate 30 and up to ordinate 118, the line C D drawn on diagram No. XIX. so as to indicate the general rise of the locus of the low tide levels of series of gaining tides No. VII. having a mean coefficient of amplitude equal to 78, when the river was at an average elevation of 31·20 ft. at Verchères, from which it had varied but 0·2 ft. either way in a whole week, while the tidal coefficients increased from 46 to 107, the whole as already set forth—we find, according to scale of measurements made on the diagram, that the low water levels of the tides of minimum and maximum amplitude are respectively : 16·07 and 16·88 ft. above datum, that is to say, we may put :

$$E_{\substack{L.W.,\\ R.,(31\cdot20)}} \text{ for } \begin{cases} \overset{T.}{30} = 16\cdot07 \text{ ft.} \\ \overset{T.}{118} = 16\cdot87 \text{ ft.} \end{cases} \qquad (35)$$

If, instead of standing 31·20 ft. above datum, the river surface had been at the extreme height of 36·32 ft at Verchères, and the coefficient of average serial amplitude 82 instead of 78, the elevations of the troughs of the said tides of minimum and maximum amplitude would have been at Grondines:

$$E_{\substack{L.W.,\\ R.,(36\cdot32)}} \text{ for } \begin{cases} \overset{T.}{30} = 16\cdot07 + (36\cdot32 - 31\cdot20)\ 0\cdot877 + \left(\frac{\cdot50}{12}\right)(82\cdot78) = 20\cdot73. \\ \overset{T.}{118} = 16\cdot87 + (36\cdot32 - 31\cdot20)\ 0\cdot820 + \left(\frac{\cdot50}{12}\right)(82\cdot78) = 21\cdot23. \end{cases} \qquad (36)$$

Finally, during the time when the St. Lawrence fluctuated at Verchères between 21·70 and 27·80 in series of tides Nos. IV and V, the mean theoretical coefficients of amplitude of which are nearly equal to each other, viz.: 65·21 and 65·14, the average rate of change of ratio $\frac{V_{\cdot\ H.W.,\ \overset{T.}{\left\{\substack{49\\ \text{to}\\ 75}\right\}}}}{V_{\cdot\ R.,\ \left\{\substack{21\cdot70\\ \text{to}\\ 27\cdot80}\right\}}}$ for the high tide level per unit of variation in the tidal coefficient, was at Grondines:

$$C_{\substack{H.W.,\ \overset{T.}{\left\{\substack{75\\ \text{to}\\ 75}\right\}}\\ \text{to}\\ h.w.\ \left\{\substack{75\\ \text{to}\\ 75}\right\}}} = \frac{\dfrac{V_{\cdot\ H.W.,\ 75,}^{T.}}{V_{\cdot\ R.,\ \left\{\substack{21\cdot70\\ \text{to}\\ 27\cdot80}\right\}}} - \dfrac{V_{\cdot\ H.W.,\ 49,}^{T.}}{V_{\cdot\ R.,\ \left\{\substack{21\cdot70\\ \text{to}\\ 27\cdot60}\right\}}}}{75 - 49} = \frac{0\cdot656 - 0\cdot585}{26} = 0\cdot00272. \qquad (37)$$

Whence we deduce, approximately, for values of ratio $\frac{V_{\cdot\ H.W.}}{V_{\cdot\ R.}}$ at the least neaps and the greatest possible springs, when the river surface stands between 21·70 and 27·80 ft. above datum at Verchères, and we may assume, also for all river levels down to elevation 21:

$$\frac{V'_{\cdot\ H.W.,}}{V'_{R.,(21\cdot50)}} \text{ for } \begin{cases} \overset{T.}{30} = 0\cdot585 - (49\cdot30)\,(0\cdot00272) = 0\cdot53332. \\ \overset{T.}{118} = 0\cdot656 - (118\cdot75)\,(0\cdot00272) = 0\cdot77296. \end{cases} \qquad (38)$$

Again, with river fluctuations at Verchères, between 21·80 and 31·60 during series Nos. III and IV, having also nearly equal mean theoretical coefficients of amplitude, viz.: 68·00 and 67·13, respectively, and where, consequently, no correction is required in this connection, we have for Grondines:

$$C_{\substack{H.W.,\ \overset{T.}{\left\{\substack{46\\ \text{to}\\ 107}\right\}}\\ \text{to}\\ h.w.,\ \left\{\substack{46\\ \text{to}\\ 107}\right\}}} = \frac{\dfrac{V_{\cdot\ W.H.,\ 107}^{T.}}{V_{\cdot\ R.,\ \left\{\substack{22\cdot60\\ \text{to}\\ 31\cdot10}\right\}}} - \dfrac{V_{\cdot\ H.W.,\ 46,}^{T.}}{V_{\cdot\ R.,\ \left\{\substack{21\cdot80\\ \text{to}\\ 31\cdot60}\right\}}}}{107 - 46} = \frac{0\cdot635 - 0\cdot546}{61} = 0\cdot00146. \qquad (39)$$

Hence we may put:

$$\frac{V''_{h.w.,}}{V''_{r.,(21\cdot50)}} \text{ for } \begin{cases} \overset{T.}{30,} = 0\cdot546 - (46-30)\,(0\cdot00146) = 0\cdot52264. \\ \overset{T.}{118,} = 0\cdot625 - (118-107)\,(0\cdot00146 = 0\cdot65106. \end{cases} \qquad (40)$$

Taking the arithmetical mean of :

$$\frac{V'_{H.W.}}{V'_{R.,(21\cdot50)}} \text{ and } \frac{V''_{h.w.,}}{V''_{r.,(21\cdot50)}}, \text{ we obtain :}$$

$$\frac{V_{h.w.}}{V_{r.,(21\cdot50)}} \text{ for } \begin{cases} \overset{T.}{30} = \dfrac{0\cdot53332 + 0\cdot52264}{2} = 0\cdot52798. \\ \overset{T.}{118} = \dfrac{0\cdot07296 + 0\cdot65106}{2} = 0\cdot71201. \end{cases} \tag{41}$$

By producing down to ordinate 30 and up to ordinate 118, the line $\overline{a\ b}$ drawn on diagram No. XIX. between ordinates 39 and 117 to indicate, in general, the locus of high tide levels at Grondines, during series of gaining and losing tides Nos. I and II while the water, stood at an average elevation of 21·10 ft. at Verchères, we find by actual scale measurement on the said diagram, that the elevations of high water of the neap tides of minimum amplitude and the springs of maximum amplitude are, under such circumstances :

$$E_{\substack{h.w. \\ \text{for} \\ R.,(22\cdot10)}} \text{ for } \begin{cases} \overset{T.}{30} = 13\cdot97 \text{ ft.} \\ \overset{T.}{118} = 17\cdot87 \text{ ft.} \end{cases} \tag{41½}$$

On account, however, of the mean theoretical coefficient of series of tides Nos. I. and II. being 79·27, while the minimum serial coefficient is only about 65, the level of 14·50 above datum does not strictly represent the lowest elevation which wave summits may reach at neaps when the river stands at elevation 22·10 at Verchères.

According to Table XIV., we have to substract 0·70 ft. from the said height of 14·50 to arrive at the proper elevation of the summit or high water of the tide wave of minimum amplitude at Grondines.

Hence :
$$E_{\substack{h.w., \\ R.,(22\cdot10)}} \text{ for } \begin{cases} \overset{T.}{30} = 13\cdot970 - 0\cdot700 = 13\cdot27 \text{ ft.} \\ \overset{T.}{118} = 17\cdot870 \text{ ft.} \end{cases} \tag{42}$$

At the standard low stage of the River St. Lawrence, when its surface is 21·50 ft. above datum at Verchères and 16·0 ft. over the lower sill of old lock No. 1, Lachine Canal, the elevations of the summits of these tides of minimum and maximum importance are found to be :

$$E_{\substack{h.w., \\ R.,(21\cdot50)}} \text{ for } \begin{cases} \overset{T.}{30} = 13\cdot270 - (22\cdot10 - 21\cdot50)\ (0\cdot52798) = 12\cdot953 \text{ ft.} \\ \overset{T.}{118} = 17\cdot870 - (22\cdot10 - 21\cdot50)\ (0\cdot71201) = 17\cdot443 \text{ ft.} \end{cases} \tag{43}$$

Relations between tidal and fluvial variations in the water level of the estuary, elevations of typical high and low tide levels, etc., corresponding to those established, as shown above in detail for Grondines, have been determined by following similar methods, for the other tide stations below Champlain; the results arrived at in each case are given hereunder in tabular form.

TABLE XV.

		Lévis Graving Dock.	St. Nicholas.	Point Platon	Grondines.	St. Jean des Chaillons.	Batiscan.	Champlain.	
(1)	$\frac{V_{H.W.,\ 49}^{T.}}{V_{R.,\ \binom{27\cdot60\ \text{to}}{31\cdot60}}}$	0·192	0·245	0·308	0·538	0 652	0·795	0·870	(1)
(2)	$\frac{V_{L.W.,\ 49}^{T.}}{V_{R.,\ \binom{27\cdot60\ \text{to}}{31\cdot60}}}$	0·265	0·300	0·550	0·865	0·870	0·905	0·947	(2)
(3)	$\frac{A_{49,\ (27\cdot60)}^{T.} - \left[V_{H.W.,\ 49,\ \binom{27\cdot60\ \text{to}}{31\cdot60}}^{T.} - V_{L.W.,\ 49,\ \binom{27\cdot60\ \text{to}}{31\cdot60}}^{T.}\right]}{A_{49,\ (27\cdot90)}^{T.}}$	0·975	0·980	0·897	0·710	0·672	0·633	0·612	(3)
(4)	$\frac{V_{H.W.,\ 75}^{T.}}{V_{R.,\ \binom{27\cdot80\ \text{to}}{31\cdot10}}}$	0·179	0·239	0·298	0·545	0·682	0·864	0·894	(4)
(5)	$\frac{V_{L.W.,\ 75}^{T.}}{V_{R.,\ \binom{27\cdot80\ \text{to}}{31\cdot10}}}$	0·298	0·343	0·597	0·848	0·909	0·939	0·955	(5)
(6)	$\frac{A_{75,\ (27\cdot60)}^{T.} - \left[V_{H.W.,\ 75,\ \binom{27\cdot60\ \text{to}}{31\cdot10}}^{T.} - V_{L.W.,\ 75,\ \binom{27\cdot80\ \text{to}}{31\cdot10}}^{T.}\right]}{A_{75,\ (27\cdot80)}^{T.}}$	0·971	0·973	0·911	0·816	0·786	0·833	0·826	(6

TABLE XV—*Continued.*

		Lévis Graving Dock.	St. Nicholas.	Point Platon	Grondines.	St. Jean des Chaillons.	Batiscan.	Champlain.	
(7)	$\frac{V_{H.W.,\ 49}^{T.}}{V_{R.,\left(\begin{smallmatrix}21\cdot70\\ to\\ 27\cdot60\end{smallmatrix}\right)}}$	0·246	0·364	0·432	0·585	0·712	0·898	0·932	(7)
(8)	$\frac{V_{L.W.,\ 49}^{T.}}{V_{R.,\left(\begin{smallmatrix}21\cdot70\\ to\\ 27\cdot60\end{smallmatrix}\right)}}$	0·263	0·373	0·635	0·966	1·042	1·059	1·060	(8)
(9)	$\frac{A_{T.\ 49,\ (27\cdot60)} - \left[V_{H.W.,\ 49,\left(\begin{smallmatrix}21\cdot70\\ to\\ 27\cdot60\end{smallmatrix}\right)}^{T.} - V_{H.W.,\ 49,\left(\begin{smallmatrix}21\cdot70\\ to\\ 27\cdot60\end{smallmatrix}\right)}^{T.}\right]}{A_{T.\ 49,\ (27\cdot60)}}$	0·991	0·995	0·887	0·667	0·589	0·558	0·516	(9)
(10)	$\frac{V_{H.W.,\ 75}^{T.}}{V_{R.,\left(\begin{smallmatrix}21\cdot70\\ to\\ 27\cdot80\end{smallmatrix}\right)}}$	0·262	0·377	0·606	0·656	0·721	0·861	0·918	(10)
(11)	$\frac{V_{L.W.,\ 75}^{T.}}{V_{R.,\left(\begin{smallmatrix}21\cdot70\\ to\\ 27\cdot60\end{smallmatrix}\right)}}$	0·295	0·442	0·680	0·967	1·016	1·033	1·049	(11)
(12)	$\frac{A_{T.\ 75,\ (21\cdot70)} - \left[V_{H.W.,\ 75,\left(\begin{smallmatrix}21\cdot70\\ to\\ 27\cdot80\end{smallmatrix}\right)}^{T.} - V_{L.W.,\ 75,\left(\begin{smallmatrix}21\cdot70\\ to\\ 27\cdot80\end{smallmatrix}\right)}^{T.}\right]}{A_{T.\ 75,\ (21\cdot70)}}$	0·986	0·970	0·962	0·745	0·664	0·588	0·589	(12)

(13)	$\frac{V_{H.W.,\ 46}^{T.}}{V_{R.,\ (21{\cdot}80\ \text{to}\ 31{\cdot}60)}}$	0·194	0·316	·357	0·546	0 709	0·867	0·923	(13)
(14)	$\frac{V_{L.W.,\ 46}^{T.}}{V_{R.,\ (21{\cdot}80\ \text{to}\ 31{\cdot}60)}}$	0·245	0·332	0·612	0·918	0·979	0·995	1·031	(14)
(15)	$\frac{A_{T.\ 46,\ (21{\cdot}80)} - \left[V_{H.W.,\ 46,\ (21{\cdot}80\ \text{to}\ 31{\cdot}60)}^{T.} - V_{L.W.,\ 46,\ (21{\cdot}80\ \text{to}\ 31{\cdot}60)}^{T.}\right]}{A_{T.\ 46,\ (21{\cdot}80)}}$	0·958	0·986	0·769	0·546	0·442	0·375	0·344	(15)
(16)	$\frac{V_{H.W.,\ 107}^{T.}}{V_{R.,\ (22{\cdot}50\ \text{to}\ 31{\cdot}00)}}$	0·224	0·341	0·600	0·635	0·712	0·794	0·882	(16)
(17)	$\frac{V_{L.W.,\ 107}^{T.}}{V_{R.,\ (22{\cdot}50\ \text{to}\ 31{\cdot}00)}}$	0·270	0·400	0·647	0·924	0·941	0·947	1·000	(17)
(18)	$\frac{A_{T.\ 107,\ (22{\cdot}50)} - \left[V_{H.W.,\ 107,\ (22{\cdot}50\ \text{to}\ 31{\cdot}00)}^{T.} - V_{L.W.,\ 107,\ (22{\cdot}50\ \text{to}\ 31{\cdot}00)}^{T.}\right]}{A_{T.\ 107,\ (22{\cdot}50)}}$	0·977	0·969	0·970	0·706	0·672	0·600	0·596	(18)
(19)	$C_{H.W.,\ (27{\cdot}60\ \text{to}\ 31{\cdot}60)} = \frac{\frac{V_{H.W.,\ 75}^{T.} -}{V_{R.,\ (27{\cdot}80\ \text{to}\ 31{\cdot}10)}} \quad \frac{V_{H.W.,\ 49}^{T.}}{V_{R.,\ (27{\cdot}60\ \text{to}\ 31{\cdot}60)}}}{75 - 49}$	— 0·00050	— 0·00023	— 0·00038	+ 0·00027	+ 0·00115	+ 0·00265	+ 0·00092	(19)

TABLE XV—*Continued.*

—	—	Lévis Graving Dock.	St. Nicholas.	Point Platon	Grondines.	St. Jean des Chaillons.	Batiscan.	Champlain.	
(20)	$\frac{V_{H.W.}}{V_{R.,(27{\cdot}60\text{ to }31{\cdot}60)}}$ for T. 30	0·20150	0·24940	0·31520	0·53310	0·63015	0·74465	0·85252	(20)
	for T. 118	0·15750	0·22910	0·28170	0·55660	0·73145	0·9779	0·93356	
(21)	$E_{H.W.\ R.,(31{\cdot}20)}$ for T. 30	12·40	13·75	15·85	18·77	20·13	23·40	24·30	(21)
	for T. 118	19·70	20·55	23·00	23·27	23·58	25·10	26·10	
(22)	$E_{H.W.\ R.,(36{\cdot}32)}$ for T. 30	12·59	14·22	16·72	20·80	22·81	26·73	28·22	(22)
	for T. 118	20·77	21·96	24·67	26·33	27·49	30·25	31·02	
(23)	$E_{H.W.,\ T.\ 108\ R.,(31{\cdot}20)}$	18·95	19·80	22·20	22·77	23·18	24·90	25·85	(23)
(24)	$E_{H.W.,\ T.\ 108\ R.,(36{\cdot}32)}$	20·28	20·98	22·64	25·60	26·87	29·77	30·58	(24)
(25)	$C_{L.W.\text{ or }l.w.\ (T.\ 75\text{ to }40)} = \frac{\frac{V_{L.W.,\ T.\ 75}}{V_{R.,(21{\cdot}70\text{ to }27{\cdot}80)}} - \frac{V_{L.W.,\ T.\ 49}}{V_{R.,(21{\cdot}70\text{ to }27{\cdot}60)}}}{75-49}$	+ 0·00123	+ 0·00265	+ 0·00173	+ 0·00003	— 0·00100	— 0·00100	— 0·00042	(25)
(26)	$\frac{V_{l.w.}}{V_{r.,(21{\cdot}50)}}$ for T. 30	0·23963	0·32265	0·60213	0·96540	1·01900	1·07800	1·06800	(26)
	for T. 118	0·34789	0·55595	0·75439	0 96830	0·93200	0·99000	1·03094	

(27)	$C_{\substack{\text{L. w.}\\ \text{to}\\ l.\ w.}}\left(\substack{\text{T.}\\ 107\\ \text{to}\\ 46}\right) = \dfrac{V_{\text{L. w., }\substack{\text{T.}\\ 107}} - V_{\text{L. w., }\substack{\text{T.}\\ 46}}}{V_{\text{R., }\left(\substack{22{\cdot}50\\ \text{to}\\ 31{\cdot}00}\right)} - V_{\text{R., }\left(\substack{21{\cdot}80\\ \text{to}\\ 31{\cdot}60}\right)}}$	+0·00041	+0·00111	+0·00057	+0·00010	−0·00062	−0·00079	−0·00051	(27)
(28)	$\dfrac{V_{\text{L. w., }\substack{\text{T.}\\ 30}}}{V_{r.,(21{\cdot}50)\ \text{for}\ \substack{\text{T.}\\ 118}}}$	0·23844	0·31424	0·60288	0·91610	0·98892	1·00764	1·03916	(28)
	$\dfrac{V_{\text{L. w., }\substack{\text{T.}\\ 30}}}{V_{r.,(21{\cdot}50)\ \text{for}\ \substack{\text{T.}\\ 118}}}$	0·27451	0·41221	0·65327	0·92510	0·93418	0·93831	0·99438	
(29)	$\dfrac{V_{\text{L. w., }\substack{\text{T.}\\ 30}}}{V_{r.,(21{\cdot}50)\ \text{for}\ \substack{\text{T.}\\ 118}}}$	0·23903	0·31849	0·60251	0·94070	1·00396	1·04282	1·05358	(29)
	$\dfrac{V_{\text{L. w., }\substack{\text{T.}\\ 30}}}{V_{r.,(21{\cdot}50)\ \text{for}\ \substack{\text{T.}\\ 118}}}$	0·31120	0·48403	0·70383	0·94660	0·93309	0·96415	1·01266	
(30)	$E_{l.\ w.,\ r.,(21{\cdot}80)\ \text{for}\ \substack{\text{T.}\\ 30}\ \text{to}\ \substack{\text{T.}\\ 118}}$	0·70	1·20	2·70	7·17	9·52	13·20	14·30	(30)
		−0·80	0·30	3·75	8·77	11·33	14·60	15·68	
(31)	$E_{l.\ w.,\ r.,(20{\cdot}85)\ \text{for}\ \substack{\text{T.}\\ 30}\ \text{to}\ \substack{\text{T.}\\ 118}}$	0·473	0·897	2·128	6·277	8·576	12·209	13·300	(31)
		−1·096	−0·240	3·081	7·861	10·376	13·684	14·718	
(32)	$E_{l.\ w.,\ r.,(21{\cdot}50)\ \text{for}\ \substack{\text{T.}\\ 30}\ \text{to}\ \substack{\text{T.}\\ 118}}$	0·628	1·104	2·519	6·888	9·228	12·887	13·984	(32)
		−0·893	0·155	3·519	8·486	11·028	14·311	15·376	
(33)	$C_{\text{L. w.}}\left(\substack{\text{T.}\\ 49\\ \text{to}\\ 76}\right) = \dfrac{V_{\text{L. w., }\substack{\text{T.}\\ 75}} - V_{\text{L. w., }\substack{\text{T.}\\ 49}}}{V_{\text{R., }\left(\substack{27{\cdot}80\\ \text{to}\\ 31{\cdot}10}\right)} - V_{\text{R., }\left(\substack{31{\cdot}60\\ \text{to}\\ 27{\cdot}60}\right)}}$	+0·00127	+0·00165	+0·00181	−0·00065	−0·00150	−0·00131	−0·00031	(33)
		0·24087	0·26865	0·51561	0·87735	0·89850	0·92989	0·95287	
(34)	$\dfrac{V_{\text{L. w.}}}{V_{\text{R. at (31·20)}}}$ for $\substack{\text{T.}\\ 30}$ to $\substack{\text{T.}\\ 118}$	0·35261	0·41395	0·67483	0·82065	0·84450	0·88267	0·95167	(34)

TABLE XV.—*Continued.*

		Lévis Graving Dock.	St. Nicholas.	Pointe Platon.	Grondines.	St. Jean des Chaillons.	Batiscan.	Champlain.	
(35)	$E_{\text{L. W. R., (31·20)}}$ for T. 30	2·70	4·10	8·00	16·07	18·63	22·45	23·85	(35)
	T. 118	1·90	3·90	9·50	16·87	19·03	23·05	24·40	
(36)	$E_{\text{L. W. R., (36·32)}}$ for T. 30	4·02	5·58	10·76	20·73	23·37	27 38	28·85	(36)
	T. 118	3·79	6·12	13·07	21·23	23·48	27·73	29·40	
(37)	$C_{\text{H. W. to } h.\,w.}\left(\begin{smallmatrix}\text{T.}\\75\\\text{to}\\49\end{smallmatrix}\right) = \dfrac{V_{\text{H. W., T. 75}} - V_{\text{H. W., T. 49}}}{V_{\text{R.,}\left(\begin{smallmatrix}21\cdot70\\\text{to}\\27\cdot80\end{smallmatrix}\right)} - V_{\text{R.,}\left(\begin{smallmatrix}21\cdot70\\\text{to}\\27\cdot60\end{smallmatrix}\right)}}{75-49}$	+0·00061	+0·00050	+0·00650	+0·00272	+0 00035	−0·00142	−0·00054	(37)
(38)	$\dfrac{V_{\text{H.W.}}}{V^1_{\text{R.,(21.50)}}}$ for T. 30	0·23441	0·35450	0·30850	0·53332	0·70535	0·92498	0·94226	(38)
	T. 118	0·28723	0·39850	0·88550	0·77296	0·73605	0·79994	0·90295	
(39)	$C_{\text{H.W., to } h.w.,}\left(\begin{smallmatrix}\text{T.}\\46\\\text{to}\\107\end{smallmatrix}\right) = \dfrac{V_{\text{H.W., T. 107}} - V_{\text{H.W., T. 46}}}{V_{\text{R.,}\left(\begin{smallmatrix}22.60\\\text{to}\\31.10\end{smallmatrix}\right)} - V_{\text{R.,}\left(\begin{smallmatrix}21.80\\\text{to}\\31.60\end{smallmatrix}\right)}}{107-46}$	+ 0·00050	+ 0·00041	+ 0·00398	+ 0·00146	+ 0·00005	− 0·00120	− 0·00672	(39)
(40)	$\dfrac{V''_{h.w.}}{V''_{r.,\,(21.50)}}$ for T. 30	0·18600	0·30944	0·29332	0·52264	0·70820	0·88972	0·93164	(40)
	T. 118	0·22950	0·34551	0·64378	0·65106	0·71255	0·78120	0·80808	

[1891]

(41)	$\frac{V_{h.w.,}}{V_{R.,(21.50)}}$ for T. 30		0·21020	0·33197	0·30091	0·52798	0·70895	0·90735	0·93595	(41)
	T. 118		0·25836	0 37200	0·76464	0·71201	0·72430	0·79057	0·85551	
(42)	$E_{h.w.,}$ for T. 30		10·40	10·80	12·45	13·27	13·78	14·77	15·35	(42)
	$E_{R.,(22.10)}$ for T. 118		17·45	17·55	17·80	17·87	18·03	18·45	18·90	
(43)	$E_{h.w.,}$ for T. 30		10·274	10·601	12·270	12·953	13·355	14·226	14·788	(43)
	$E_{R.,(21.50)}$ for T. 118		17·295	17·327	17·341	17·443	17·595	17·976	18·387	

8—10*

Notwithstanding the fact that the loci of the summits and troughs of a series of fluvial undulations occupy, as a rule, higher or lower positions, according as the average coefficient of amplitude corresponding to the said series is greater or smaller, yet in the cases of the Graving Dock, St. Nicholas and Pointe Platon—owing to exceptional perturbations in the normal successions of tide waves Nos. III. and IV.—the low water curves or loci of losing fluvial series No. IV., as approximately drawn on diagram Nos. XVI., XVII. and XVIII. come to occupy, on the whole, more elevated positions than the corresponding curves of gaining series No. III., although the tides forming this last series have a greater importance than those of No. IV., in the ratio of 68 to 65.

Again, during the high water season, the fluvial discharge, seldom if ever, remains uniform sufficiently long to permit of the St. Lawrence assuming a permanent or settled condition, all the way, say from Lake St. Peter or Verchères, to Quebec, which gives rise to many irregular fluctuations on various stretches of the upper portion of the estuary.

For these and other cognate reasons, it became necessary not only to substitute, as indicated in diagrams Nos. VI., VII., VIII., and XVI., XVII. and XVIII., for the original low water lines or loci of the three stations mentioned, viz.: those of the Graving Dock, St. Nicholas and Pointe Platon, amended ones more nearly in accord with the altered conditions of the estuary, when in a quasi permanent or settled state, over its whole length, as regards the effects of the fluvial discharge on the water level; but also to deviate slightly from loci actually determined in other cases, according to the particular circumstances under which these curves were obtained—the whole with a view of arriving at the above proper values of relations Nos. 8, 9, 11 and 12 with the estuary in the settled or permanent condition referred to and corresponding rational water levels.

The results given in the last table I believe to be as accurate as a single year's reliable high and low water gauging will permit of arriving at, there is no doubt, however, that more positive and precise data would be secured if complete series of tidal observations and simultaneous river gaugings, such as those made in 1887–88, were made for several years in succession.

As during the low water season, the fresh water discharge remains often nearly uniform for a week at a time or even longer, the relative positions of the high and low water levels which obtain every year at such time, will generally differ but little from those above determined, especially in calm weather and when the moon is near the equator; but the case is very different at the high water season or at any other time when the fluvial discharge varies rapidly. If the river is rising the slopes will, of course be, on the whole, steeper and when falling flatter, than that corresponding to a permanent flow; the height of the river at Verchères being the same in the three cases.

The figures in Table XV. indicate, as they should do, that proceeding from Champlain down stream:

1. The change of level which takes place in the estuary per foot of elevation or depression of the river at Verchères, decreases continuously until, at Quebec, it is reduced to from 0·18 ft. to 0·30 ft., according to the state of the tide.

2. The tidal amplitudes and ranges are affected less and less by the fresh water discharge; being reduced during a rise of 10 ft. in the river at Verchères, in round figures, by as much as 0·66 of their first values at Champlain and only by 0·04 at Quebec.

3. At high tide, the level of the water is invariably less affected by variations in the fresh water discharge, than at low tide.

4. The estuary may descend lower at neaps than at springs, as far down as say Ste. Croix, a point between Pointe Platon and St. Nicholas; thence eastward, at low water of springs of maximum importance, the estuary is always drawn down to a lower level than at neaps of minimum importance; the fluvial discharge and height of river at Verchères being supposed to be the same in both cases.

In order to determine the highest point to which the tide water is likely to rise, and the lowest to which it may fall, in ordinary weather, during the season of navigation, we have yet to take into consideration the effects produced in the estuary by the diurnal inequalities of the tide waves. These inequalities are, as well known, greatest along the sea-coast in the tides that are due to the attraction of the sun and moon when

the declination of the latter is a maximum, and the said inequalities disappear in those tides which are believed to be due to the attractions of the same heavenly bodies when the moon crosses the equator. It must be remembered the particular tides here referred to are felt at Quebec, in common with all others, forty-eight hours after the times when the said heavenly bodies occupied the positions to which they (the tides) correspond.

Some idea may be formed of the relative importance of the variations in the water level at the various tide stations due to this cause, by glancing over the following list of maximum inequalities in the high and low water levels, as observed and recorded during the low water season of 1887 and the high water season of 1888.

TABLE XVI.

Tide Stations.	Maximum diurnal tidal differences observed in high water levels.		Maximum diurnal tidal differences observed in low water levels.	
	At low stage of river in 1887. (Series II.)	At high stage of river in 1888. (Series VIII.)	At low stage of river in 1887. (Series II., III. and IV.)	At high stage of river in 1888. (Series V., VI. and VIII.)
	Feet.	Feet.	Feet.	Feet.
Lévis Graving Dock	4·356	3·340	1·450	1·540
Chaudière	4·040	3·260	1·410	1·400
St. Nicholas	3·910	3·140	1·380	1·370
Pointe Platon	3·605	2·989	1·035	0·995
Grondines	2·918	2·420	1·197	0·500
St. Jean des Chaillons	2·659	1·930	1·318	0·510
Batiscan	2·345	1·266	1·100	0·505
Champlain	2·268	0·960	1·150	0·550

The above differences do not, however, represent the true inequalities in the heights of the summits of tide waves of equal astronomical importance above, or the depths of the troughs of such undulations below a mean tide level situated at a sensibly constant elevation. They are alternately too large or too small, owing to (1) the variation in mean importance of every pair of consecutive tides, (2) the rise or fall of the mean tide level in passing from a series of gaining to one of losing tides, or *vice versa;* such differences are also often affected by local disturbances of the normal or regular fluctuations of the estuary, more especially the diurnal low water differences.

The maximum corresponding differences of height in high water and low water levels of series Nos. II. and VIII. of tides, observed in 1887 and 1888, may be assumed to have the following values, after being corrected so as to eliminate approximately, in each case, errors arising from the effects of decreasing or increasing astronomical tides on the general level of the St. Lawrence, and also for any small errors due to rapid fluctuations of the river at Verchères, and to local causes of disturbance of the normal level of the estuary.

TABLE XVII.

Tide Stations.	Corrected maximum diurnal lunar tidal inequalities in high water levels.		Corrected maximum diurnal lunar tidal inequalities in low water levels.	
	At low stage of river in October, 1887. (Series II.)	At high stage of river in May, 1889. (Series VIII.)	At low stage of river in October, 1887. (Series II.)	At high stage of river in May, 1888. (Series VIII.)
	Feet.	Feet.	Feet.	Feet.
Lévis Graving Dock	3·80	2·80	1·55	1·52
Chaudière	3·55	2·76	1·48	1·45
St. Nicholas	3·35	2·70	1·40	1·35
Pointe Platon	3·10	2·50	1·20	1·10
Grondines	2·50	2·10	0·90	0·65
St. Jean des Chaillons	2·20	1·65	0·80	0·55
Batiscan	1·95	1·00	0·73	0·45
Champlain	1·85	0·75	0·70	0·30

The greatest diurnal differences in the high and low tide levels were found to obtain generally from one day ahead of, to one to three days subsequent to the time when the moon's declination was a maximum.

Being apprehensive that the differences, as above corrected, might prove to be an excessive estimate of the probable normal maximum diurnal inequalities for ordinary high and low water seasons, viz., of the tidal inequalities disassociated from the effects of high winds at sea, sudden changes in the atmospheric pressure, and irregular local variations in the fresh water supply, I computed also the average of the differences which obtained every day at each station, during four consecutive series of gaining and losing tides, so as to take in a whole lunar month in each season.

This permitted of dispensing altogether with the corrections otherwise required as above described, as the excesses in the observed differences of height between the two wave summits and the two wave troughs of a tide day, respectively, over the corresponding tidal inequalities solely due to astronomical causes which arise from a varying mean tide level, the continuous gradual increase or decrease of the mean theoretical importance of the tides and changes in the fresh water discharge, may be considered to be about balanced by corresponding deficiencies; these average differences are as follows:—

TABLE XVIII.

Tide Stations.	Average diurnal differences observed in high water levels.		Average diurnal differences observed in low water levels.	
	At low stage of river during lunar month, Oct. 12 to Nov. 10, 1887.	At high stage of river during lunar month, May 5 to June 3, 1888.	At low stage of river during lunar month, Oct. 12 to Nov. 10, 1887.	At high stage of river during lunar month, May 5 to June 3, 1888.
	Feet.	Feet.	Feet.	Feet.
Lévis Graving Dock	1·637	1·701	0·460	0·426
Chaudière	1·416	1·642	0·455	0·362
St. Nicholas	1·290	1·581	0·440	0·346
Pointe Platon	1·234	1·546	0·403	0·237
Grondines	1·014	1·127	0·330	0·170
St. Jean des Chaillons	0·802	0·910	0·271	0·160
Batiscan	0·710	0·506	0·214	0·155
Champlain	0·649	0·390	0·312	0·150

It is evident from these figures that most of the amended maximum differences are much in excess of double the average observed ones, and, perhaps, rather on the large side than otherwise. But as these maximum inequalities obtained in the fall of 1887 and the spring of 1888 under apparently no extraordinary circumstances, it is not improbable that equally large differences may obtain in any year at the low and high stages of the river, respectively 21·50 and 36·32 ft. above datum at Verchères. I have, therefore, concluded, in order to be on the safe side, to place the water line for the reduction of soundings, lower at each station than the mean low tide level corresponding to the lowest neaps—or that of the highest springs where these descend below the neaps—by one-half the corresponding corrected maximum diurnal inequalities as above deduced from the low water gaugings of 1887, instead of only by a depth equal to the average diurnal inequality.

By substracting one-half the amended maximum low water inequalities from elevations: $E_{\underset{r.,\,(21\cdot50)}{\text{L.W.}}}$ for $\overset{\text{T.}}{30}$ and $E_{\underset{r.,\,(21\cdot50)}{\text{L.W.}}}$ for $\overset{\text{T.}}{118}$ of the mean low water levels at lowest neaps and highest springs with the river at 21·50 ft. above datum at Verchères, we find the lowest elevations: $e_{\underset{r.,\,(21.50)}{\text{L.W.}}}$ for $\overset{\text{T.}}{30}$ and $e_{\underset{r.,\,(21\cdot50)}{\text{L.W.}}}$ for $\overset{\text{T.}}{118}$ to which the estuary may descend at each station below Three Rivers, under the ordinary conditions of wind and weather described to be as follows:—

TABLE XIX.

	Lévis Graving Dock.	St. Nicholas.	Pointe Platon.	Grondines	St. Jean Deschaillons.	Batiscan.	Champlain.
	Feet above datum.	Feet above datum.	Feet above datum.	Feet above datum.	Feet above datum.	Feet above datum.	Feet above datum.
$e_{\text{L.W. for } r.,(21\cdot50)}$ $\overset{\text{T.}}{30}$ = ...	− 0·147	+0·404	1·919	6·438	8·828	12·522	13·634
$e_{\text{L.W. for } r.,(21\cdot50)}$ $\overset{\text{T.}}{118}$ = ...	− 1·668	−0·545	2·919	8·036	10·628	13·946	15·026

Taking the diurnal inequalities observed in 1887 and 1888 at the gauging stations above Three Rivers, as a basis of computation, the maximum diurnal inequalities in the elevations of the low tide levels during the low water season at the said stations have been estimated as shown hereunder, and the corresponding elevations of the lowest water at minimum neaps (30) and maximum springs (118), with the river surface 16·0 ft. over sill old lock No. 1, Lachine Canal, or 27·54 ft. above datum at the said lock in both cases, viz.:

$e_{\underset{r.,\,(21\cdot50)}{l.w.}}$ for $\overset{\text{T.}}{30}$ and $e_{\underset{r.,\,(21\cdot50)}{l.w.}}$ for $\overset{\text{T.}}{118}$ have also been approximately detcrmined. (See Table XX.)

TABLE XX.

Localities, etc.	Elevation of mean low water, based on the general river level that obtains with series of tides of average importance corresponding say to co-efficient (65).	Estimated excess of the mean weekly elevation of the river, produced by a series of tides of maximum mean importance (say 85) over the level that obtains with tides of average importance (65).	Estimated fall from mean low to minimum low water level, owing to diurnal and serial tidal inequalities.	Elevation of minimum low water at minimum neaps (30) and maximum springs (118).
	Feet above datum.	Feet.	Feet.	Feet above datum.
Three Rivers...$e_{l.w.\ (21\cdot50)}$ for T. 30 = ...	16·31	.....	$-\frac{0\cdot50}{2}$	=16·06
for T. 118 = ...	16·86	+0·80	$-\frac{0\cdot50}{2}$	=17·41
Port St. Francis. $e_{l.w.\ (21\cdot50)}$ for T. 30 = ...	16·39	.....	$-\frac{0\cdot44}{2}$	=16·17
for T. 118 = ...	16·91	+0·75	$-\frac{0\cdot44}{2}$	=17·44
Sorel .....$e_{l.w.\ (21\cdot50)}$ for T. 30 = ...	19·00	.....	$-\frac{0\cdot30}{2}$	=18·85
for T. 118 = ...	19·68	+0·55	$-\frac{0\cdot30}{2}$	=20·08
Contrecœur....$e_{l.w.\ (21\cdot50)}$ for T. 30 = ...	19·97	.....	$-\frac{0\cdot26}{2}$	=19·84
for T. 118 = ...	20·54	+0·45	$-\frac{0\cdot26}{2}$	=20·86
Verchères.....$e_{l.w.\ (21\cdot50)}$ for T. 30 = ...	21·50	.....	$-\frac{0\cdot16}{2}$	=21·42
for T. 118 = ...	21·90	+0·35	$-\frac{0\cdot16}{2}$	=22·17
Longueuil .....$e_{l.w.\ (21\cdot50)}$ for T. 30 = ...	25·20	.....	$-\frac{0\cdot04}{2}$	=25·18
for T. 118 = ...	25·40	+0·20	$-\frac{0\cdot04}{2}$	=25·58
*Montreal .....$e_{l.w.\ (21\cdot50)}$ for T. 30 = ...	27·54	.....	$-\frac{0\cdot00}{2}$	=27·54
for T. 118 = ...	27·64	+0·10	$-\frac{0\cdot02}{2}$	=27·73

* Foot of Lachine Canal.

The highest levels that can be counted on being reached at high water at the gauging stations for floating off vessels that are aground, etc.: and the lowest elevations to which the water must rise and below which, therefore, the bed of the estuary is never left uncovered at high tide, when the river is at the normal low stage, 21·50 ft. above datum at Verchères and 16·0 ft. nearly over the sill of old lock No. 1, Lachine Canal, are arrived at by adding one-half the corrected maximum high water diurnal inequality at each station,

as per table XVII., to the corresponding value of $E_{\substack{h.w. \\ r.,\ (21\cdot50)}}$ for $^{T.}_{118}$ as per (43) Table No. XV., and deducting the said simi-inequality from $E_{\substack{h.w. \\ r.,\ (21\cdot50)}}$ for $^{T.}_{30}$; the results being as follows :—

TABLE XXI.

	Lévis Graving Dock.	St. Nicholas.	Pointe Platon.	Grondines	St. Jean des Chaillons.	Batiscan.	Champlain.
	Feet above datum.	Feet above datum.	Feet above datum.	Feet above datum.	Feet above datum.	Feet above datum.	Feet above datum.
$E_{\substack{h.w. \\ r.(21\cdot50)}}$ for $^{T.}_{30}$ — semi-ineq = ..	8·374	8·926	10·720	11·703	12·255	13·251	13·863
$E_{\substack{h.w. \\ r.(21\cdot50)}}$ for $^{T.}_{118}$ + semi-ineq = ...	19·195	19·002	18·891	18·693	18·695	18·951	19·312

With a view of arriving at the absolute maximum and minimum elevations of the estuary, at high and low tide respectively, there remain yet to be determined the greatest possible deviations from the mean elevations of the normal low and high tide levels, which are due to diurnal inequalities in the tides, the effects of persistent high easterly and westerly winds and changes in the atmospheric pressure. These effects have to be considered jointly in connection with the diurnal tidal inequalities, there being no means, with the data available, as far as I can make out, for disassociating one kind of disturbance from the other, or either from the diurnal tidal inequalities which arise from the inclination of the plane of the moon's orbit to the celestial equator.

The following is a list of the greatest diurnal differences which obtained at Quebec under varying conditions in 1876 and 1882, according to the tide gauge registers which were kept under my direction during the said years :—

TABLE XXII.

Dates.	Elevations of consecutive high-tide levels.	Diurnal differences between high tide levels.	Elevations of consecutive low-tide levels.	Diurnal differences between low-tide levels.	Remarks.
1876.	Feet above datum.	Feet.	Feet above datum.	Feet.	
Feb. 25	10·90 16·10	5·20	−1·00 −4·80	3·80	Estuary depressed at Quebec to −4·80 ft., the lowest level on record, viz., one day previous to moon crossing equator, after three days of persistent heavy westerly gales; moon full February 25; maximum flood range of 20·90 ft. observed in 1876. Tidal importance corresponding to coefficient 81.
March 3	15·70 10·50	5·20	−0·90 −0·30	0·60	At quadrature, moon having entered second quarter February 3, viz., one day previous to her declination attaining a maximum. Westerly winds, February 2 to 4.
March 7	13·30 18·70	5·40	1·60 −1·30	2·90	After two days' high easterly winds. Moon three-quarters full, and about half-way back northward to equator. Maximum ebb observed in 1876 = 20·00 ft.
March 18-19	15·00 0·10	5·90	2·50 0·90	1·60	During north-westerly storm, about 1½ days after moon entered last quarter, her declination being 28° to 27° south, and near a maximum. Minimum flood range observed in 1876 = 8·10 ft.
March 20-21	11·20 16·50	5·30	0·10 3·90	3·80	During north-easterly storm within four days of new moon, and three days previous to her passage to the north of the equator. Declination 22° to 20° south. Minimum ebb range observed in 1876=7·30 ft.
March 22 33	14·60 12·20	2·50	2·80 −0·20	3·00	High westerly winds, March 22 and 23, after a succession of easterly gales. Moon's declination from 12° to 10° south. New moon, March 25.
March 30	18·10 13·40	4·70	0·80 −0·70	1·50	After two days' westerly winds; moon's north declination a maximum, March 31. First quarter ☽ April 1.
April 1	16.40 10·90	5·50	−0·70 0·70	1·40	Fine weather; ☽ April 1. Moon s north declination was a maximum on March 31.
1882.					
June 4	14·80 18·30	3·50	1·10 2·10	1·00	Three days after full moon, and two after moon's declination was a minimum; strong north-easterly wind blowing.
Nov. 1	16·60 12·00	4·60	1·40 0·30	1·10	Moon's declination a maximum, October 29; full moon, October 26. High westerly winds.
Nov. 13-14	18·10 12·70	5·40	2 20 0·00	2·20	North-easterly storm, November 11 to 14. New moon, November 10; her declination a maximum, November 13.
Nov. 25-26	18·55 14 40	4·15	1·20 −0·20	1·40	North-westerly gale; new moon, November 24; her declination a maximum, November 26.

It appears from the above list of large observed diurnal inequalities—1. That the difference of elevation which may obtain between two consecutive wave summits or troughs, on account of high winds blowing persistently up or down the estuary, changes in the atmospheric pressure and perturbations in the Atlantic waves, are of much

greater importance than those due to the varying attraction of the moon from morning to evening and *vice versa*, when she is at her greatest distance north or south of the equator, that is to say, when her declination is a maximum. 2. That the high tide levels are raised by easterly gales and depressed by westerly ones to a much greater extent than the low tide levels, the maximum daily difference which obtained while the former were blowing, being inclusive of tidal inequalities, 5·90 ft. and with the latter 3·80 ft.

It is true these, the greater of the total diurnal inequalities here referred to, were observed during the winter months of 1876 ; but we shall see presently that on 5th and 6th November, 1884, the summit of the fluvial wave was elevated even more above its normal height by a north-easterly storm than it was raised or depressed respectively by the most violent and persistent easterly or westerly winds experienced at Quebec, during the winter season of 1876. Furthermore, the trough of the fluvial undulation was also depressed considerably below its normal level on Wednesday, the 7th of November, 1877, yet not so much as on Friday, the 25th of February, 1876.

Being unable to deduce directly from the data available the diurnal inequalities which actually obtained in either the elevations of the high or those of the low water marks of the dates last mentioned, I estimated the effects of the storms, etc. ; on the normal high and low water levels, as explained hereunder.

On the 7th of September, 1881, I was informed by the late Woodford Pilkington, Esq., M.I.C.E., who was then resident engineer of the new Quebec Harbour improvements and Lévis Graving Dock, that the lowest water observed by him at Quebec occurred on Wednesday 7th November, 1877, when the estuary sank at low tide to 2 ft. 2 in., or say 2·18 ft. below the 0 of the Quebec Harbour Commissioners' gauge on the south-east side of their Pointe-à-Carcy wharf, which corresponds to an elevation of $(2{\cdot}18 + 0{\cdot}02) = 2{\cdot}20$ ft. below datum. This great depression of the St. Lawrence estuary was caused by a spring tide wave accompanied by fresh south-westerly winds, the importance of which corresponds to a theoretical tidal coefficient of 94, viz.: one day previous to the moon's S. declination reaching a maximum value equal to 27° 50′ 26″, and two days after new moon, while the river stood at Sorel about 20ft.-2in. over the zero of the Montreal Harbour Commissioners' gauge of the same place. This height of 20ft.-2in. corresponds to an elevation of $(20{\cdot}166 + 0{\cdot}05) = 20{\cdot}216$ ft, or say 20·2 ft. above datum, being $(20{\cdot}20 - 18{\cdot}35) = 1{\cdot}85$ ft. above the extreme low stage of the river when its surface stands 20·85 ft. above datum at Verchères and 15·5 ft. over the sill of lock No. 1 at the foot of the Lachine Canal, and $(20{\cdot}20 - 19{\cdot}00) = 1{\cdot}2$ ft. above the standard low water which corresponds to a river surface, 21·50 ft. above datum at Verchères and 16·0 ft. over the lock sill just mentioned.

As no tidal observations were made by Mr. Pilkington at night, the very low water level observed by him, Wednesday, 7th November, 1877, probably obtained, say at about 3.10 p.m. and the succeeding high water in the vicinity of 8 p.m. We know moreover, that in October and November the most important spring floods take place in the afternoon or evening, that is to say, in normal conditions as regards wind and weather, the estuary rises to a greater elevation in the evening at high water springs than it does in the forenoon. Under ordinary circumstances the elevation of the 8 o'clock p.m. high water would therefore have been greater than the elevation of the 7.30 a.m. high water on 7th November, 1877. Now the depth of the fluvial wave trough below the mean level of the estuary is always, in a measure, proportional to the height of the tidal intumescence which immediately precedes it above the same level, hence the elevation of the low water of 3.10 p.m. in question must have been greater than that of either of the adjacent low tide levels, viz. : by about 0·4 ft. or 0·5 ft. ; judging by the inequalities of some tides that were observed during October and November, 1887, when the weather was comparatively calm and the position of the moon, in reference to the equator, somewhat similar to that occupied by her, 7th November, 1877.

The elevation of one or the other of the low tide levels last mentioned, viz. : the lowest that obtained at new moon in November 1877, was therefore probably as low as $-(2{\cdot}2 + 0{\cdot}4) = -2{\cdot}6$ ft. if not lower ; the river surface being 20·2 ft. above datum at Sorel, and 22·7 ft. at Verchères.

Again, according to the approximate rectilinear locus a b of low tide levels shown on diagram No. XVI., the trough of a 94 tide descends to nearly—0·60 ft. with a fluvial discharge corresponding to an average water level of 21·80 at Verchères, and according to relation (17) page 132, a variation of 1 foot in this level at the ordinary low fall stage of the St. Lawrence, produces a corresponding change of about 0·27 ft. in the low tide level at Quebec. Hence, for a river level of 22·7 ft. at Verchères the elevation of the normal mean low water level of 7th November, 1877, at Quebec, is found to to be equal to : — (0·60 ft. — 0·24 ft.) = — 0·36 ft. ; and allowing 0·42 ft. for the diurnal lunar inequality, — 0·57 ft. is arrived at for the elevation of the deepest and — 0·15 ft. below datum for that of the shallowest trough of the waves propagated up the St. Lawrence past Quebec, on the date mentioned, whence the lowering of the estuary on this day at low tide, directly attributable to the prevalence of westerly winds, is deduced to be — (2·2 — 0·15) = 2·05 ft.

I am not in a position to determine in a similar manner, the effects of high winds on the low tide level of the estuary at the low stage of the river in the fall, at points above Quebec. I believe, however, we may assume, in the absence of more precise information and without risk of erring very much either way, that the total depression of the trough of the mean fluvial wave and the total elevation of the crest of the latter due to diurnal lunar tidal inequalities, high winds and changes in the pressure of the atmosphere combined, vary from one station to another, approximately in the same respective ratios, as the corrected maximum diurnal differences which have been deduced for the same stations, from the series of tidal observations made during the low water season of 1887 and during the high water season of 1888. (*See* Table XVII. of this report.)

Judging by several years of meteorological records I have examined, it does not appear unreasonable to suppose that westerly gales nearly as severe as that experienced in November, 1877, might prevail in the Lower St. Lawrence about the time of neaps as well as at the time of spring tides during the low water season. Hence, the same as for the locus of the lowest troughs of the undulations propagated up the St. Lawrence when the stream is in a normal state with a minimum discharge, the water line of absolute minimum elevation will obtain :

(*a.*) From Quebec up to a point beyond St. Nicholas and east of Pointe Platon, in the event of a spring tide corresponding to maximum theoretical coefficient 118 and accompanied by violent gales occurring, say towards the end of October (as in October, 1887), about two days after the moon's declination is a maximum ; the river proper being at the extreme low stage when the water surface is 20·85 ft. above datum at Verchères.

(*b.*) At all places to the westward of the point in the vicinity of Pointe Platon just referred to, in the event of a neap tide corresponding to minimum theoretical coefficient 30 and accompanied by heavy westerly gales, occurring also in the fall of the year, some two days after the moon's declination is a maximum ; the river being at the minimum elevation of 20·85 ft. at Verchères, which, as already stated, corresponds to elevation 18·35 ft. at Sorel, and to a depth of 15·4 ft. on the sill of old lock No. 1, foot of Lachine Canal.

The probable absolute minimum elevation $E_{\substack{\text{min. l.w.} \\ r.,\,(20.85)}}$ for $\nearrow \overset{\text{T.}}{30}$ and $\searrow \overset{\text{T}}{118}$ of the water level of the estuary at each station up to Three Rivers, corresponding to minimum neaps and maximum springs, has been computed on the above basis, as shown hereunder, with the aid of the elevations of mean low tide, for a mean fluvial level of 20·85 ft. at Verchères at neaps of 30 and springs 118 previously established, viz. :

$E_{\substack{l.w. \\ r.,\,(20.85)}}$ for $\nearrow \overset{\text{T.}}{30}$ and $\searrow \overset{\text{T.}}{118}$ as per relation No. (31) page 136 and by using the cor

rected maximum lunar diurnal inequalities contained in Table No. XVII. in connection with neaps as well as springs.

For determining the absolute minimum elevation at Three Rivers and stations to the westward, the data contained in Table XX. were directly utilized.

TABLE XXIII.

					Feet above datum.
Lévis Graving Dock.	E min. l. w. for r., (20·85)	T. 30	0·473	$-\frac{1·55}{2}+\frac{2·05\times1·55}{1·55}$	= − 2·357
		T. 118	−1·096	$-\frac{1·55}{2}+\frac{2·05\times1·55}{1·55}$	= − 3·929
St. Nicholas..	E min. l. w. for r., (20·85)	T. 30	0·897	$-\frac{1·40}{2}+\frac{2·05\times1·40}{1·55}$	= − 1·664
		T. 118	−0·240	$-\frac{1·40}{2}+\frac{2·05\times1·40}{1·55}$	= − 2·791
Pointe Platon.	E min. l. w. for r., (20·85)	T. 30	2·128	$-\frac{1·20}{2}+\frac{2·05\times1·20}{1·55}$	= − 0·059
		T. 118	3·081	$-\frac{1·20}{2}+\frac{2·05\times1·20}{1·55}$	= + 0·894
Grondines....	E min. l. w. for r., (20·85)	T. 30	6·277	$-\frac{0·90}{2}+\frac{2·05\times0·90}{1·55}$	= + 4·637
		T. 118	7·861	$-\frac{0·90}{2}+\frac{2·05\times0·90}{1·55}$	= + 6·221
St. Jean des Chaillons.	E min. l. w. for r., (20·85)	T. 30	8·575	$-\frac{0·80}{2}+\frac{2·05\times0·80}{1·55}$	= + 7·117
		T. 118	10·376	$-\frac{0·80}{2}+\frac{2·05\times0·80}{1·55}$	= + 8·917
Batiscan.....	E min. l. w. for r., (20·85)	T. 30	12·289	$-\frac{0·73}{2}+\frac{2·05\times0·73}{1·55}$	= + 10·878
		T. 118	13·684	$-\frac{0·73}{2}+\frac{2·05\times0·73}{1·55}$	= + 12·353
Champlain ...	E min. l. w. for r., (20·85)	T. 30	13·300	$-\frac{0·70}{2}+\frac{2·05\times0·70}{1·55}$	= + 12·025
		T. 118	14·718	$-\frac{0·70}{2}+\frac{2·05\times0·70}{1·55}$	= + 13·443
Doucet's Landing, Three Rivers.	E min. l. w. for r., (20·85)	T. 30	16·060	$-(21·50-20·85=0·65)+\frac{2·05\times0·50}{1·55}$	= + 14·749
		T. 118	17·410	$-(21·50-20·85=0·65)+\frac{2·05\times0·50}{1·55}$	= + 16·099
Port St. Francis.	E min. l. w. for r., (20·85)	T. 30	16·170	$-\frac{0·65+2·05\times0·44}{1·55}$	= + 14·938
		T. 118	17·440	$-\frac{0·65+2·05\times0·44}{1·55}$	= + 16·208
Sorel.....	E min. l. w. for r., (20·85)	T. 30	18·850	$-\frac{0·65+2·05\times0·30}{1·55}$	= + 17·803
		T. 118	20·080	$-\frac{0·65+2·05\times0·30}{1·55}$	= + 19·033
Coutrecœur...	E min. l. w. for r., (20·85)	T. 30	19·840	$-\frac{0·65+2·05\times0·26}{1·55}$	= + 18·846
		T. 118	24·860	$-\frac{0·65+2·05\times0·26}{1·55}$	= + 19·866

TABLE XXIII.—*Continued.*

						Feet above datum.
Verchères	E	min. l. w. for r., (20·85)	T. 30	= 21·420	$- \frac{0·65+2·05 \times 0·16}{1·55}$	= + 20·558
			T. 118	= 22·170	$- \frac{0·65+2·05 \times 0·16}{1·56}$	= + 21·308
Longueuil	E	min. l. w. for r., (20·85)	T. 30	= 25·180	$- \frac{0·65+2·05 \times 0·04}{1·55}$	= + 24·480
			T. 118	= 25·580	$- \frac{0·65+2·05 \times 0·04}{1·55}$	= + 24·880
Montreal, foot of Lachine Canal.	E	min. l. w. for r., (20·85)	T. 30	= 27·540	$- \frac{0·58+2·05 \times 0·00}{1·55}$	= + 26·960
			T. 118	= 27·740	$- \frac{0·58+2·05 \times 0·00}{1·55}$	= + 27·160

The highest tides that have ascended the St. Lawrence, within the recollection of the oldest inhabitants of Quebec city, are the evening tide of Wednesday, 5th November, 1884, and that of the following morning. These tides corresponded to the syzygy of 3rd November at full moon, when she was from 13° to 16° north of the equator; her declination being thus within 5½° to 2½° of its nearest maximum, viz.: 18° – 25′, which she reached on Thursday, 6th November, at about 11 a.m. Moreover, the evening tide of 5th November was the most important of the two tides in question, having for theoretical coefficient 108, and the depth on the sill of old lock No. 1, Lachine Canal, was 17·6 ft., which corresponds to a river level of 23·25 ft. nearly above datum at Verchères.

In telegraphic despatches dated Father Point and River du Loup (Fraserville), 5th November, and which were published in the "Quebec Morning Chronicle," 6th November, 1884, it is stated that this storm was considered to be the worst that visited the Lower St. Lawrence during the past 40 years, and that it caused much damage to both public and private property in that part of the Dominion. In the town of Rimouski and vicinity many houses, barns, stables and wharves were damaged; some buildings being driven out to sea with their contents. Total loss estimated at no less than from $25,000 to $30,000. (*See* Appendix No. 16, extracts from "Quebec Morning Chronicle" of 6th November, 1884.)

The following additional particulars appeared in the paper just named, on Friday, 7th November, 1884, under the heading of "The Great Storm."

"The tides were driven up the St. Lawrence estuary by a violent snow storm from "the eastward which lasted between two and three days, lashing the waves into fury. "The water in the river was raised several feet higher than during the high tides ex- "perienced in 1883; in fact it is generally conceded that such high tides have not been "seen at Quebec for half a century previously. Much damage was done to property in "the lower portions of the city and also some in surrounding villages.

"Dalhousie street was so much flooded that the traffic had to be carried on by skiffs, "and in some places the water came up to St. Peter street. Champlain and Finlay "market-places were both under water, and all the warehouses in the immediate vicinity "were more or less flooded.

"The St. Lawrence washed over all the wharves both on Dalhousie and St. An- "drew's streets and the St. Charles overflowed its banks; very considerably flooding "not only the village of Hedleyville; but also some of the low streets of St. Rochs.

"At Lévis a number af stores near the river were similarly flooded and a quantity "of property was swept from the wharves; a portion of the Intercolonial Ry. wharf "was also submerged and damaged."

"At South Quebec, it has been estimated that the evening tide of 5th November "surpassed by two feet the very high spring tides of 1883, which caused heavy damages "to the Grand Trunk Railway freight sheds, etc.

"Many steamers and schooners had to run into Cap Rouge for shelter; part of "this village was inundated, the water having, it is stated, risen four feet above ordinary "spring tide high water mark."

Some marks were pointed out to me by four different persons on Champlain and Finlay market-places, Quebec, and at St. Nicholas, indicating the highest levels reached by the tides in question.

These marks were all levelled to and their elevations calculated; but the results do not turn out to be as concordant as might be desired. The elevations range from 21·82 ft. at St. Nicholas up to 24·14 ft. above datum at Quebec, and it looks as if in some cases the morning high water mark of 6th November was indicated, and in others that of the preceding tide, viz.: the evening tide of 5th November.

In any case I think the elevation, 24·14 ft., of a point on the floor of Mr. Louis Bourget's grocery, on Finlay market square, at the corner of Laplace street, up to which, I was informed by Mr. J.-Bte. Caron, head clerk, the water rose in November, 1884; having been observed by himself through a knot hole in the flooring, may be accepted as a reliable and correct indication of the height actually reached by by the evening tide of 5th November, 1884.

According to the locus AB of the normal mean high water levels of series of gaining tides No. VII., observed at Quebec in the spring of 1888—while the river stood at an average height of 31·50 ft. above datum at Verchères—which is shown on diagram No. XVI., the elevation of the summit of a spring tide the importance of which corresponds to an astronomical coefficient of 108, is: 18·90 ft., and for a river level of 23·25 ft. at Verchères this wave summit would, under ordinary circumstances, stand: $18.90 - (31·50 - 23·25) \times 0·18$ = say, 17·40 ft. over datum.

As the moon passed from the southern to the northern hemisphere, at about 6·0 a.m., 31st October, the high water diurnal inequalities resulting from the difference between her action at the upper meridian passage and that at the lower passage, must have been comparatively small on 3rd November following, certainly less than the average value of 1·636 ft., made out for the low water season of 1887, probably not over 1·0 foot. If now we deduct 17·40 ft., the mean normal high water elevation of a 108 spring tide, with a river surface 23·25 ft. above datum at Verchères, from the actual height reached by the crest of the fluvial wave, Wednesday evening, diminished by one-half, such portion of the excess in the height of the said evening tide over that of either of the adjacent morning tides, as may be directly attributed to the diurnal variations in the action of the moon, viz.: 0·5 from 24·14 leaving 23·64 ft., we arrive at $6\frac{1}{4}$ ft. for the approximate elevation of the tide wave at Quebec by the violent north-easterly storm of 5th November, 1884.

The average depth on the lower sill of the St. Ours lock was 10·4 ft. on the 5th and 6th November, and the elevation of the water surface 23·06 ft. above datum; hence, if we allow 0·36 ft. for the fall of the Richelieu from the lock to Sorel, 22·70 ft. is arrived at for the elevation of the St. Lawrence at this town on Thursday, 6th November. On the other hand the depth on the sill of lock No. 1, Lachine Canal, at Montreal, was 17·6 ft., and the elevation of the water surface 29·04 ft., which corresponds, under ordinary circumstances, to a mean river level of 20·75 ft. nearly at Sorel, instead of 22·70 ft. This goes to show that the St. Lawrence was gradually raised at least to the extent of $22·70 - 20·75 = 1·95$ ft. at Sorel and vicinity, by the successive unusually high tides which obtained from about 2nd to 7th November, 1884.

We have seen that the greatest known effects of both westerly and easterly winds on the water level at Quebec during the season of navigation, obtained in the fall of the year, near the time of spring tides and when the river was comparatively low and the fresh water discharge small. Also, the summit of the fluvial wave invariably attains its greatest elevation in the entire maritime portion of the St. Lawrence, near the time of springs, and, as before stated, the ratio of the greatest rise in the high tide level of any place that can be caused by easterly winds, to the corresponding corrected maximum diurnal inequality due to the action of the moon, as given in Table XVII., may be assumed to be approximately the same for all tide stations above Quebec. In view, therefore, of the fact that, as far as known, the river level fluctuates at Verchères between the extreme limits of 20·85 and 36·32 ft. above datum, or 15·47 ft., and about $(15·47 \times 0·9) = 13·9$ ft. at Champlain and $(15·47 \times 0·2) = 3·1$ ft. at Quebec, while the proba-

ble maximum effects of the easterly storms at the same places, are on an average only, say: $\left(\frac{1{\cdot}85 + 0{\cdot}75}{3{\cdot}80 + 2{\cdot}80} \times 6{\cdot}25\right) = 1{\cdot}6$ ft. and $6\frac{1}{4}$ ft. respectively, where 1·85 and 0·75 and 3·80 and 2·80 represent the corrected maximum diurnal inequalities during the low and high water seasons at Champlain and Quebec respectively, as per Table No. XVII., it is evident that the estuary will attain its greatest elevation possible, in the event of a spring tide of the greatest amplitude possible in May or the beginning of June, viz.: one the theoretical coefficient of which is, for the reasons above stated, equal to 108, occurring within the time just mentioned, about two days after the moon's declination being a maximum and accompanied by a furious easterly wind, such as that experienced in November 1884; the river being at the same time swollen to the extreme high level of 36·32 ft. over datum at Verchères.

Assuming that the maximum lunar diurnal tidal inequalities coincide approximately with those entered in Table XVII. for the high water season of 1888, and taking relations Nos. (4), (19), (20), 23) and (24), pages 130 to 134, as a basis of computation, I have arrived, as follows, at the elevation $E_{\substack{\text{max. H.W.} \\ \text{R., (36·32)}}}$ of absolute maximum high water on the estuary of the St. Lawrence above Quebec: 1°. with the atmosphere in a normal state, 2°. with a low barometer and violent easterly storms.

TABLE XXIV.

Tide Gauging Stations.	Mean $E_{\substack{\text{T.} \\ \text{H.W.108,} \\ \text{R.,(36·32)}}}$ with atmosphere in a normal state.	Corrected maximum semi-diurnal inequality. — (*See* Table XVII.	$E_{\substack{\text{T.} \\ \text{max. H.W. 108,} \\ \text{R., (36·32)}}}$ with atmosphere in a normal state.	Rise caused by violent easterly storms.	$E_{\substack{\text{T.} \\ \text{max. H.W. 108,} \\ \text{R., (36·32)}}}$ with violent easterly storms and a low barometer.
	Feet above datum.	Feet.	Feet above datum.	Feet.	Feet above datum.
Lévis Graving Dock.	20·280 +	1·40	= 21·680 +	6·25	= 27·93
St. Nicholas.....	20·980 +	1·35	= 22·330 +	$\frac{6{\cdot}25 \times 2{\cdot}7}{2{\cdot}8}$	= 28·35
Pointe Platon.....	22·640 +	1·25	= 23·890 +	$\frac{6{\cdot}25 \times 2{\cdot}5}{2{\cdot}8}$	= 29·47
Grondines.....	25·600 +	1·05	= 26·650 +	$\frac{6{\cdot}25 \times 2{\cdot}1}{2{\cdot}8}$	= 31·34
St. Jean des Chaillons	26·866 +	0·825	= 27·691 +	$\frac{6{\cdot}25 \times 1{\cdot}65}{2{\cdot}8}$	= 31·37
Batiscan.....	29·770 +	0·500	= 30·270 +	$\frac{6{\cdot}25 \times 1{\cdot}0}{2{\cdot}8}$	= 32·50
Champlain.....	30·583 +	0·375	= 30·960 +	$\frac{6{\cdot}25 \times 0{\cdot}75}{2{\cdot}8}$	= 32·63

For Three Rivers and the gauging stations to the westward, the corresponding elevations of the highest possible water during the season of navigation as just defined, have been established as shown hereunder, viz.: upon the same principle as was adopted for determining: (*a*) the extreme high tide levels at Three Rivers and Port St. Francis

that would obtain if a spring tide, of the maximum importance of 118, occurred while the river stands at its highest known stage of 36·32 ft. at Verchères, (*b*) the extreme low water levels corresponding to a mean river level 20·85 ft. above datum at Verchères, with allowance for effect of persistent westerly winds at all the gauging stations between Three Rivers and Montreal.

Decreased fall due to increase of 2 in theoretical tidal coefficient from 106 to 108:

(*a*) Sorel to Port St. Francis $= 1{\cdot}10 - \left\{\frac{(1{\cdot}10 - 0{\cdot}98)\,(108 - 106)}{106 - 46} = 0{\cdot}004\right\} = 1{\cdot}096$ ft.

(*b*) Sorel to Three Rivers $= 1{\cdot}95 - \left\{\frac{(1{\cdot}95 - 1{\cdot}75)\,(108 - 106)}{106 - 46} = 0{\cdot}007\right\} = 1{\cdot}943$ ft.

Again, fall as further modified by swelling of river from 22·30 ft. and 31·30 ft. above datum to elevation 36·32 ft. at Verchères:

(*a*) Sorel to Port St. Francis $= 1{\cdot}54 - \left\{\frac{(1{\cdot}54 - 1{\cdot}096)(36{\cdot}32 - 22{\cdot}30)}{31{\cdot}30 - 22{\cdot}30} = 0{\cdot}69\right\} = 0{\cdot}85.$

(*b*) Sorel to Three Rivers $= 1{\cdot}54 + \left\{\frac{(1{\cdot}94 - 1{\cdot}54)\,(36{\cdot}32 - 22{\cdot}30)}{31{\cdot}30 - 22{\cdot}30} = 0{\cdot}62\right\} = 2{\cdot}16.$

Therefore, with the river proper at the highest possible stage, as far as known, and a tide the amplitude of which corresponds to astronomical coefficient 108, we have for the elevation of the mean tide level:

(*a*) At Port St. Francis: $34{\cdot}07 - 0{\cdot}85 = 33{\cdot}22$.
(*b*) At Three Rivers: $34{\cdot}07 - 2{\cdot}16 = 31{\cdot}91$.

Now, we have seen (page 121) that when the river is at its highest stage, the amplitude of the highest springs is reduced to 0·29 ft. at Three Rivers. Taking 0·28 ft. for the amplitude of a tide of 108, as against 0·29 ft. for one having an importance of 118, and assuming as heretofore, that the effect of the wind on the water level varies from place to place, approximately, in the same ratio as the corresponding diurnal inequalities, we find the elevation of the absolute maximum high tide level at Three Rivers to be:

$$E_{\substack{\text{max., H.W.,}\\ \text{R., (36·32)}}} = 31{\cdot}91 + \frac{0{\cdot}28}{2} + \frac{6{\cdot}25 \times 0{\cdot}50}{2{\cdot}80} = 33{\cdot}22 \text{ ft. above datum.}$$

and the corresponding low tide level:

$$E_{\substack{\text{max., L.W.,}\\ \text{R., (36·32)}}} = 31{\cdot}91 - \frac{0{\cdot}28}{2} + \frac{6{\cdot}25 \times 0{\cdot}50}{2{\cdot}80} = 32{\cdot}94 \text{ ft. above datum.}$$

In the vicinity of Port St. Francis, as already explained, the tidal intumescence becomes practically obliterated at the extreme high stage of the river under consideration; but the effects of the easterly storms continue to be appreciable, so that by using the estimated diurnal inequalities entered in Table XX, we can put approximately:

$E_{\text{max. H.W. R., (36·32)}}$

		Feet above datum.
At Port St. Francis	$= 33{\cdot}22 + \frac{6{\cdot}25 \times 0{\cdot}44}{2{\cdot}80} =$	34·20
At Sorel	$= 34{\cdot}07 + \frac{6{\cdot}25 \times 0{\cdot}30}{2{\cdot}80} =$	34·73
At Contrecoeur	$= 35{\cdot}17 + \frac{6{\cdot}25 \times 0{\cdot}26}{2{\cdot}80} =$	35·75
At Verchères	$= 36{\cdot}32 + \frac{6{\cdot}25 \times 0{\cdot}16}{2{\cdot}80} =$	36·68
At Longueuil	$= 40{\cdot}02 + \frac{6{\cdot}25 \times 0{\cdot}04}{2{\cdot}80} =$	40·11
At Montreal, foot of Lachine Canal	$= 40{\cdot}22 + \frac{6{\cdot}25 + 0{\cdot}02}{2{\cdot}80} =$	40·27

It must be noted, however, that the local effects of the storm between Quebec and Montreal have been left out of consideration ; in such localities as Ste. Croix Bay and Lake St. Peter, where the fetch is considerable, the rise of the high water curve going westward, would, no doubt, be somewhat greater than that indicated by the above elevations, as the river would be depressed more at the eastern end and raised more at the western end of the lake or bay.

THE WINTER AND SPRING FLOOD LEVELS, &C.

Occasionally, before the ice bridge at Quebec is sufficiently weakened by the rays of the sun and the currents, or broken up by winds, &c., to move away, and while the river is yet bedecked by an icy crust for miles to the westward of the ancient capital—when near the time of a syzygy, a high fluvial wave is driven up the estuary by a strong north-easterly gale—the tide water rises abnormally high opposite and in the vicinity of the said city, the same as during the open season, lifting the superincumbent ice crust above the top of the wharves, which become covered with ice and are submerged to the depth of several inches.

This happened notably on Sunday, the 30th of March, 1873, two days after new moon, when the morning tide, which had a theoretical importance corresponding to coefficient 1·12, reached an elevation of about 21·4 ft., above datum ; passing some 8 inches over the Finlay market square and flooding may cellars in various parts of lower town and St. Roch's. (*See* Appendix No. 16.)

On Friday, 8th May, 1874, viz., near the time of neap tides, the ice bridge at Quebec, which had been partly broken up directly opposite the city by some ferry steamers anxious to resume their regular service, departed suddenly *en bloc ;* the key at the narrow gorge immediately above the mouth of the River Chaudière, having given way under the pressure of the freshet waters from above.

As a result of this majestic raising of the ice blockade, many steamers and other vessels in winter quarters were either damaged, sunk or capsized by destructive ice jams and shoves. (*See* Appendix No. 18.)

No damage appears to have been done directly by the water, and there is no record of the departure of the ice bridge at Quebec, being attended by similar severe shoving and jamming of the ice in any other year.

In the year 1836 an unusually thick and solid ice bridge moved off, also only on the 8th of May ; but no damage was done to either vessels or wharf or other property. (*See* Appendix No. 17.)

Although considerable damage is sometimes done to public and private property during the season of navigation at Quebec, Lévis and surrounding parishes, by very high tides forced up the estuary past this city by north-easterly storms, late in the fall, as in November, 1884, or early in the spring, as in March, 1873, the losses resulting from the submersion of wharves, markets, streets, sewers, cellars, etc., by these extraordinary fluvial tide waves, cannot be compared to the disastrous consequences of the much-dreaded winter and spring floods which are experienced along one or more longer or shorter stretches of the St. Lawrence, and of some of its affluents, between the foot of the Lachine Rapids and the narrow gorge immediately above the Chaudière River, some 8 miles west of Quebec city.

It has been remarked by old inhabitants of parishes between Quebec and Montreal, which are injuriously affected by abnormal fluctuations of the river level, that from the beginning of the present century up to about 1850 or 1860 disastrous floods were comparatively of rare occurrence, but that since that time, as more and more of the bush lands in the valleys of the upper St. Lawrence and tributaries, and around the great lakes, came to be cleared and better drained, high and destructive floods were experienced at shorter and shorter intervals, until, within the last decade or so, no two or three years could pass by without a rise in the fluvial waters, and an inundation taking place in one locality or another between the said cities.

Whatever degree of importance one may feel inclined to attach to statements of this nature, in reference to the floods which occur at the time when the streams are

swollen by the melting snow and ice, I do not see how they can have any weight in the case of floods taking place in midwinter or at the taking of the ice.

These extraordinary and destructive accumulations of fresh water in particular parts of the bed of the St. Lawrence River and estuary during the winter and in the spring, variable in extent and as regards disastrous consequences, according to the manner of formation of the ice crust late in the fall, and the more or less effective blocking of the waterway at contracted points, around islands and over shoals, are caused : (1) during general and decided thaws, by sheets of ice detached by winds, etc., from the foreshores ; (2) in severe frosty weather, by frasis and anchor ice closely packed under the said upper icy crust, and (3) at the time of the débâcle, by jams or shoves of heavy cakes and fields of hummock ice.

The exceptionally great destruction of property of all kinds, and interruption of traffic caused by the very high floods of 1885 and 1886 in the lower portions of the city of Montreal and neighbouring towns and villages, led to the appointment by the Dominion Government, in June, 1886, of a Commission of Civil Engineers, who were instructed to inquire into the causes of the frequent recurrence of such disastrous inundations and to devise the best means of affording relief in the future. The Commissioners submitted, under date of 15th April, 1888 (*vide* No. 88159), a full report on their investigations, stating the conclusions arrived at by them, the outcome of which has been the construction of embankments or dykes of crib and earthworks along the river front at Montreal, and the erection of pump houses and installation of powerful pumps, etc., the whole with a view of affording protection to the low-lying portions of the city against further damage by flooding.

This report has been printed in *extenso* in the official report of the Honourable the Minister of Public Works for the fiscal year 1889-90.

Here follow, in chronological order, the heights above the mean level of the sea, of characteristic high river and other levels, that have been observed and recorded, or established at Montreal, from the earliest days of the foundation of the city up to the present time, together with explanations and particulars relative to the nature and duration of the floods and the winter and spring fluctuations of the St. Lawrence above Lake St. Peter, the whole, as far as could be made out by the Flood Commissioners of 1886, from an examination of old historical documents, files of newspapers and parliamentary and other official reports :—

TABLE XXV.

Year.	——	Elevation of river in feet above mean sea level.
1643.....	First great winter rise of St. Lawrence recorded in Montreal, viz.: at Christmas, when white men first wintered here under Maisonneuve, who was driven out of his cantonments by the rising stream.....	Unknown.
1791 or thereabouts ...	Water covered the whole of the lower part of St. Paul street.....	do
1791-1800...	Lower floors of Grey Nuns' Convent inundated to a great depth. Exact date not recorded.....	do
1809-1810...	Timber floated over Grey Nun street.....	do
1838.....	*Flood of 14 days' duration in January, 1838, described in *Montreal Gazette* as being the highest known since 1787. Also highest winter flood at Montreal, 1838 to 1887.....	52·12
1839-1840...	.....	49·62
1841.....	January flood.....	51·62
1848.....	Flood of five days' duration in January. River level of January greater than say.....	51·00
1858.....	January maximum river level.....	49·87
1860.....	March 11th—Lowest level to which river has risen at the departure of the ice, in 36 years, 1852 to 1887.....	41·04

*The term "flood" is applied by the Flood Commissioners of 1886-88, to all river levels exceeding 50·04 feet above the mean level of the sea, which is the elevation of the cut stone revetment wall along Commissioners' street, completed in 1841.

TABLE XXV.—*Continued.*

Year.	——	Elevation of river in feet above mean sea level.
1861.....	April flood water surface at noon; 3rd highest spring flood known	53·12
1865.....	April flood water surface at noon; 4th highest spring flood on record....	52·29
1869.....	April flood water surface at noon; 6th highest spring flood	51·96
1873.....	January 6th—Lowest level known at which ice took at Montreal during the shove and jam period.....	38·96
1873.....	April flood, 7th highest spring flood.....	50·04
1884.....	January.....	49·54
1884.....	April	48·96
1885.....	April flood, 5th highest spring flood	52·20
1886.....	January—Highest level reached by river at taking of ice in 35 years, 1852 to 1886.....	51·04
1886.....	April flood water surface, Sunday 18th at 10.50 a.m.; highest spring flood at Montreal in 35 years, 1852 to 1886.....	55·79
1887.....	April flood; 2nd highest spring flood at Montreal.....	54·66

From the report of the Flood Commission it appears:

1. That in 1886 the covering over of the St. Lawrence by an icy crust reaching from shore to shore, commenced in the vicinity of Nicolet, lower end of Lake St. Peter, on 4th December, viz.: about the time of spring tides, say at 10 a.m.

2. That the upward extension of this crust to Montreal is governed by the downward flow of ice, the supply of which is dependent on the weather, but not everywhere proportionate to it, because more is drawn under the crust or bridge where it is thin, and less where it is thick or the current weak.

3. That the river was completely frozen over from the lower end of Lake St. Peter to the foot of the Lachine rapids before an ice bridge commenced to form below this lake, which occurred on the 2nd of February at Pointe Platon, whence the bridge extended westward until a junction was effected, 12th February, with that at Nicolet and Port St. Francis, viz.: near the point where the ice first took, 4th December, 1886.

4. That in addition to the gradual rise of the water simultaneously with the increase in the "bordages," and as the stream becomes filled with floating ice, a special and temporary rise of fluctuation takes place in the river level as the ice bridge advances westward, and that within a short time after the ice has taken and the bridge is permanently established from point to point the water falls about 2 ft.

In the following table will be found the rate of progress of the ice bridge westward, and the variations of the winter and spring levels in reference to summer levels, according to the observations and measurements made under the direction of the Commissioners in connection with corresponding mean summer and winter elevations of the St. Lawrence above the mean level of the sea, surface declivities, etc.—as computed by myself.

The effects of the "taking of the ice in the River St. Lawrence during the winter of 1886–87" on the water levels, are described at length in Appendix No. 6 to the Flood Commissioners' Report, which is also contained in the printed Official Report of the Hon. the Minister of Public Works for the fiscal year 1889–90.

Locality.	Total distance from Nicolet, foot of Lake St. Peter, in statute miles.	Interval distance in statute miles.	1st. River at mean summer level corresponding to 19·0 ft. depth on sill, Old Lock 1, Lachine Canal, and 13·0 ft. depth on Lake St. Peter flats, with tides of average importance corresponding, say, to co-efficient 70.					2nd. Freezing over period, winter season of 1886-87.						3rd. Period of ice-bridge from Nicolet to Laprairie.					4th. Period of ice-bridge from Pointe Platon to Laprairie.					5th. Period of débâcle, spring of 1887.		Remarks.
			Mean elevation of river surface in feet above mean sea level datum.	Total fall in feet to or rise from Nicolet, at foot of Lake St. Peter.	Interval fall in feet.	Total surface declivity to or from Nicolet, at foot of Lake St. Peter, in feet per mile.	Interval surface declivity, in feet per mile.	—	Date, etc., of complete freezing over of waterway.	Elevation of river surface at taking of ice-bridge, in feet above mean sea level datum.	Total fall in feet to or from Nicolet, at foot of Lake St. Peter.	Interval fall in feet.	Total surface declivity to or from Nicolet in feet per mile.	Interval declivity in feet per mile.	Elevation of water surface, Jan. 17, 1887.	Total fall in feet to or rise from Nicolet, foot of Lake St. Peter, January 17, 1887.	Interval fall in feet.	Total surface declivity to or rate of rise from Nicolet, in feet per mile.	Interval declivity in feet per mile.	Elevation of water surface, March 27, 1887.	Total fall in feet to or rise from Nicolet, foot of Lake St. Peter, March 27, 1887.	Interval fall, March 27, 1887.	Total surface declivity, in feet per mile, March 27, 1887.	Interval surface declivity, in feet per mile, March 27, 1887.	Date, etc., of maximum spring flood level, 1887.	Maximum elevation of spring flood 1887, in feet above mean sea level datum.	
Lachine, Lock No. 5	83·0		74·10	53·50		0·645			Open all winter																	
									Elv. water, Dec. 4	74·04				74·13	54·53		0·657		73·88	49·38		0·595		Apr. 24 to 27	78·04	Highest water known, 79·96 feet above datum.
									do do 30	74·71															Lowest water known, 72·04 feet above datum at Lock No. 5.
		6·0			36·30		6·050		do Feb. 12	74·88						28·29					23·76				
Laprairie	77·0		17·80	17·20		0·223			December 30, 1886.	49·27	29·87		0·388	45·84	26·24		0·341		50·12	25·62		0·333		April 24..	56·89	*See*: Notes, etc., by M. Craig, Esq., Mayor of St. Lambert, relative to floods of 1887. Appendix No. 20.
		6·0			7·26		1·210					3·81	0·635			5·20		0·867			9·75		1·625			
Montreal, foot of Lachine Canal.	71·0		30·54	9·94		0·140			December 29, 1886.	45·46	26·06		0·367	40·64	21·04		0·296		40·37	15·87		0 224		April 23..	54·67	
		3·0			1·80		0·593					3·27	1·090			2·70		0·900			1·63		0·543			
Longueuil	68·0		28·74	8·14		0·120			December 29, 1886.	42·19	22·79		0·335	37·94	18·34		0·269		38·74	14·24		0·210		April 24..	51·93	*See*: Notes, etc., by L. E. Morin, Esq., Mayor of Longueuil, Ap. No. 20. Flood level taken above wharf at pump-house.
		3·5			0·75		0·215					5·09	1·454			4·26		1·217			2·09		0·597			
Longue Pointe	64·5		27·99	7·39		0·115			December 18, 1886.	37·10	17·70		0·274	33·68	14·08		0·218		36·65	12·15		0·188		April 28..	44·47	*See*: Notes, etc., by H. Lapointe, Esq., Mayor of Longue Pointe. Appendix No. 20.
		4·0			0·63		0·158					0·66	0·165			0·54		0·135			1·11		0·278			
Pointe aux Trembles	60·5		27·36	6·76		0·112			December 17, 1886.	36·44	17·04		0·281	33·14	13·54		0·224		35·54	11·04		0·182				
		3·5			0·92		0·263					1·07	0·306			1·22		0·349			1·54		0·440			
Varennes	57·0		26·44	5·84		0·103			December 16, 4.00 p.m.	35·37	15·97		0·280	31·92	12·32		0·216		34·00	9·50		0·167		April 25..	42·52	
		8·5			1·45		0·170					2·53	0·298								1·76		0·207			
Verchères	48·5		24·99	4·39		0·091			December 9, noon	32·84	13·44		0·277						32·24	7·74		0·160			40·85	Flood level taken near wharf.
		8·0			1·49		0·186														0·53		0·066			
Contrecœur	40·5		23·50	2·90		0·071										7·87		0·250	31·71	7·21		0·178			39·66	*See* notes, etc., by Mr. Duhamel, Mayor of Contrecœur, Appendix No. 20.
		6·4			0·41		0·064					8·62	0 375								2·40		0·375			
Lanoraie	34·1		23·09	2·49		0·073													29·31	4·81		0·141			36·78	Flood level taken 2½ miles below Lanoraie church.
		8·6			0·55		0·064														2·26		0·263			
Sorel	25·5		22·54	1·94		0·076			December 6, 8.00 a.m	24·22	4·82		0·189	24·05	4·45		0·175		27·05	2·55		0·100		April 24..	35·63	
		7·00																								
Stone Island, upper end of Lake St. Peter.	18·5		21·90	1·30	1·94	0·070	0·076		December 5, 4.00 p.m			4·82	0·189			4·45		0·175			2·55		0·100			35·52	Elevation of flood taken at Louiseville.
		18·5																								
Nicolet, lower end of Lake St. Peter.	0·00		20·60	0·00		0·000			December 4, say 10.00 a.m.	19·40	0·00		0·000	19·60	0·00		0·000		24·50			0·000			34·12	Flood level taken in Ernest Duval's house, Port St. Francis.
do do	0·00								February 12, 1887										24·40						34·12	
		9·50												19·50												
Three Rivers	9·5		20·50	Fall varies according to phase of fluvial tide wave.		Surface declivity varies according to phase of fluvial wave.		2nd ice-bridge formed from Pointe Platon to Nicolet.	February 12, 1887.	25·20	Fall varies with phase of fluvial wave. Surface declivity varies with phase of fluvial wave.				Fall varies with phase of fluvial wave.		Surface declivity varies with phase of fluvial wave.			Fall varies with phase of fluvial wave.		Surface declivity varies with phase of fluvial wave.	April 23..	33·60	Highest known flood, 36·30 feet above datum.
		19·00																								Lowest known water, 16·00 feet above datum at Three Rivers.
Batiscan	28·5								February 7, 1887.																31·53	Flood level taken at T. Laguerre's hotel, Batiscan.
		13·0																								
Grondines, head of Richelieu Rapids.	41·5								February 6, 1887.															April 24, 6 a.m.	24·52	*See*: Notes, etc., by Mayor O. Rivard, Appendix No. 20.
		6·5																								
Richelieu Light, foot of rapid.	48·0								February 5, 1887.																	Flood level taken above Grondines Point, on Aimé Dolbec's farm.
		5·0																								
Pointe Platon	53·0								February 4, 1887.																23·39	Flood level taken at Platon wharf.

It will be seen from a close inspection of the above figures, table XXVI. and those of tables XI. and XVIII. in connection with the diagram showing the Flood Commissions' winter gaugings of 1886–87 at their proper elevations above the mean level of the sea, which is submitted herewith (Ill. No. XXIII.)*, that while in summer and during the open season generally, the slope of the river between Montreal, Sorel and Nicolet is quite flat and very gradual, and remains nearly uniform within a range of several feet above and below the mean summer level: from the instant the stream commences to freeze over, up to the end of the débâcle, the conditions of flow are continually changing and the surface declivities anything but gradual or uniform, for any length of time.

The Flood Commissioners have established: 1. That in the early part of winter, frasis is packed in immense quantities—252,601,000 cubic yards to 476,212,000 cubic yards of water, between the Lachine Rapids and Varennes—more or less closely under the upper crust of solid or field ice. 2. That the unceasing variations in the hydraulic regimen of the stream, just referred to, arise from the tendency of the portions of this frasis which are most exposed to be displaced by the actions of the currents, to become distributed on the waterway in such a manner as to permit of the volume of water carried by the river in winter, passing out of the estuary with the least expenditure of energy and loss of head possible under the circumstances.

Thus, while during the formation of an ice bridge from Nicolet to Laprairie, 4th to 30th December, 1886, the resistance h to the passage of the winter discharge from Montreal to Nicolet was, at first, as great as the pressure exerted by a water column 26·06 ft. high: on the 17th of January, 1887, or 18 days after the complete freezing over of the river between the places first mentioned, h had been reduced to 21·04 ft. of water pressure.

Furthermore, 27th March, or 43 days after the complete closing up of the stream from Platon to Nicolet, viz: between 4th and 12th February, which produced a rise of over 5 ft. at the place last mentioned at the foot Lake St. Peter, h was only 15·87 ft. at Montreal; the head of resistance having thus been reduced by $\frac{26{\cdot}06 - 15{\cdot}87}{26{\cdot}06} = 0{\cdot}39$ of its first value.

Again, during the same space of time, 43 days, a corresponding reduction of $\left(\frac{4{\cdot}82 - 2{\cdot}55}{4{\cdot}82}\right) h = 0{\cdot}47\ h$ obtained at Sorel; and at Verchères one of $\frac{13{\cdot}44 - 7{\cdot}74}{13{\cdot}44} =$ 0·42 of the value of h at the taking of the ice at this place.

Although between the 2nd and 4th periods mentioned at the head of the last statement (No. XXVI), h was diminished by from 30 to 45 per cent or more, or say, on an average, 40 per cent of its value at the taking of the ice on 27th March, 1887, this resistance was still in excess of the head due to friction on the bed, etc., in the open stream down to Nicolet: 60 per cent at Montreal, 62 per cent, at Verchères and 24 per cent at Sorel. Were it not that on account of the freezing over of the estuary as far down as Quebec, its general or mean level is raised and the average cross section of the tidal stream considerably enlarged, as also that of the long stretch of river situated beyond the direct influence of the tides now under consideration, the said average increase of 40 per cent in the resistance h would not form more than one-fifth part of that due to the practical doubling of the wetted perimeter p, which is effected when either a natural or an artificial waterway, of very great width as compared to its depth, is covered over.

We know that in general, for a stretch of river on which the motion is uniform or nearly so, the following relation holds good, viz.:

$$h = \zeta \frac{lp}{F} \frac{v^2}{2g} = \zeta \frac{lp}{F} \left(\frac{Q^2}{\frac{F^2}{2g}} \right) = \zeta \frac{lp}{2g} \frac{Q^2}{F^3} \qquad (1)$$

* Ill. No. XXIII.—Reproduced ½ full size by lithography—to accompany Official Report of Minister of Public Works for fiscal year 1890–91.

where :

h, represents the resistance of friction, or the friction head,
ζ, a coefficient of friction variable with the velocity,
l, the length of the stretch of river considered,
p, the wetted perimeter,
v, the velocity, say in feet per second,
F, the area of the cross section of the stream, say in square feet,
g, the acceleration of gravity, which is taken at 32·02 ft. per second, on an average,
Q, the rate of discharge, say in cubic feet per second.

And when a large stream like the St. Lawrence is covered over by an ice crust, we may put with sufficient accuracy for present purposes :

$$h' = \zeta' \frac{2lp}{F'} \frac{v^2}{2g} = \zeta' \frac{2\,lp}{2g} \frac{Q'^2}{F'^3} \qquad (2)$$

Taking as a basis of computation, eight cross sections as uniformly distributed as practicable, along the stretch of river between Longueuil and Sorel, among those which were sounded in the winter of 1886–87 under the direction of the Montreal Flood Commission, viz. : $\overline{AB}$ at Longueuil with 98,000 square ft. of water ; $\overline{IJ}$ at a point midways between Longueuil and Longue Pointe, containing 99,000 square ft. ; $\overline{RZ}$ at Longue Pointe, 105,500 square ft. ; $\overline{CD}$, $\overline{IJ}$ at Pointe aux Trembles, 169,000 square ft. ; $\overline{CD}$ at Repentigny, 182,000 ; $\overline{EF}$, $\overline{HG}$ at Verchères, 163,000 ; $\overline{AB}$ at Lanoraie, 105,000, and $\overline{CD}$, $\overline{EF}$, $\overline{FG}$, $\overline{HI}$ at Sorel, containing 217,500 square ft. of water. (*See* Ill. No. XXVII.) I find the average areas of the clear waterway and of the frasis to have been as follows, between Longueuil and Sorel during the 1st and 4th periods, viz. :—

	Sq. ft.
1. Clear waterway with the river at mean summer level, corresponding to a depth of 19 ft. on the sill of lock No. 1, and, say, to 22·50 ft. per Montreal Harbour Commissioners' gauge at Sorel	119,000
2. Clear waterway, with river at level of 27th March, 1887	140,500
3. Frasis	29,000

Again, according to the measurement of the discharge of the St. Lawrence, which was made at Lanoraie, 2nd and 3rd November, 1886, viz. : about the time of neap tides, when, it is stated, there was 11 ft. 9 in. on the flats of Lake St. Peter, which corresponds to water level 20·75 ft. above zero of the Montreal Harbour Commissioners' Sorel gauge, and 20·80 ft. above datum : (1.) The area of the mean cross section was F = 115,000 sq. ft. (2.) The surface width b = 34·60 ft. (3.) The mean depth d = 33·25 ft. And (4.) The mean velocity $v_{r.,(28\cdot80)}$ = 2·7391 ft. per second, the mean velocity $v_{r.,(22.55)}$ of the river, at the mean summer level of, say, 22·55 ft. above datum at Sorel may be taken. approximately at : $v_{r.,(22\cdot55)} = v_{r.,(20\cdot80)} \left(1 + \frac{22\cdot55 - 20\cdot80}{2d}\right)$ = 2·8112 ft. per second for which ζ = 0·0795.

Also, from gaugings made during winter and summer, in connection with the projected Cedars Canal, at Cedars village—a point on the Cedar Rapids where the river is open all the year around for 5 miles on either side, and its elevation but little affected by irregular winter fluctuations of Lakes St. Francis and St. Louis, excepting those due to high winds—it appears that in winter the water does not fall much below its minimum elevation during the open season, and for a considerable part of the time stands at a higher level. Moreover, the depths on the sill of lock No. 14, at the head of the Beauharnois Canal, appear, on the whole, to afford a fair approximate indication of the open water fluctuations and corresponding discharges of the St. Lawrence in the locality in question.

Considering that the guard lock (No. 5) at the upper end of the Lachine Canal is also situated at the head of a stretch of river, with rapids several miles long that remain open the whole year round, it is presumed that the depths on the sill of this lock afford an equally fair approximate indication of the winter discharge of the St. Lawrence at Lachine

Now, the depth on the sill of lock No. 5 varied from 1st December, 1886, to 10th April, 1887, between 10′–7″ and 12′–7″; the averages for December, January, February, March being respectively: 11′–8″, 11′–7″, 11′–9″ and 11′–5″, and the general averages between the dates just mentioned, 11′–6″; moreover, between the 20th of March and the 6th of April, the depth varied only 3 in., viz., from 11′–0″ to 11′–3″, with an average of–11′1″. Also, according to measurements made by the lockmasters in July, 1888, at locks Nos. 1 and 5, the average depths were at the said locks, respectively, 19′–0″ and 11′–8″ nearly, so that we can assume that on 27th March, 1887, the discharge corresponded to a water level 7 to 8 inches, or say 1·0 ft., below the mean summer level.

But at the mean summer level of $(62{\cdot}71 + 11{\cdot}67) = 74{\cdot}38$ ft. above datum at lock No. 5, the mean depth of the River St. Lawrence at the head of the upper entrance of the Lachine Canal is, according to the plan of Lake St. Louis, etc., prepared by Mr. E. Lafleur, C.E,, in 1887, from actual survey: 17·95 ft., and we may use here for the determination of Q′, without risk of erring materially, the relation:

$$\frac{\dot{a} - a}{a} = \frac{\frac{3}{2}(Q' - Q)}{Q} \qquad (3)$$

where a denotes the depth at mean summer level and $\dot{a}$ the reduced depth which obtained 27th March, 1887, whence we deduce:

$$Q' = \frac{2\dot{a} + a}{3a} = \frac{2 \times 17{\cdot}35 + 17{\cdot}95}{3 \times 17{\cdot}95} Q = 0{\cdot}978\ Q, \text{ and } \frac{Q}{Q'} = 0.978.$$

Finally putting $\zeta' = \zeta = 0{\cdot}0795$, on account of the small difference between v' in summer, and v, March, 1887, substituting in equations (1) and (2) the numerical values of F, F′; ζ, ζ' and $\frac{Q}{Q'}$, just found for the symbols, we arrive at:

$$\frac{h'}{h} = \frac{\left\{\zeta' l 2 p Q'^2\right\}}{\left\{\zeta l p Q^2\right\}} \frac{\left\{2 g F^3\right\}}{\left\{2 g F'^3\right\}} = 2\,(0{\cdot}978)^2 \left(\frac{119{\cdot}000}{140{\cdot}500}\right)^3 = 1{\cdot}1623.$$

The ratio which actually obtained 27th March, 1887, on the reach from Longueuil to Sorel is, as per above Table XXVI.: $\frac{14{\cdot}24 - 2{\cdot}55}{8{\cdot}14 - 1{\cdot}94} = \frac{11{\cdot}69}{6{\cdot}20} = 1{\cdot}885$. Therefore, even at this late date (27th March) of the closed season, after the water had gone down at Longueuil from 42·19 ft. to 38·74 ft. above datum or 3·45 ft., and risen at Sorel from 24·22 to 27·05 = 2·83 ft., viz: so as to cause a diminution in the actual fall of 6·28 ft., there was still a head of back water of $(1{\cdot}885 - 1{\cdot}162) \times 6{\cdot}20 = 4{\cdot}48$ ft., directly attributable to the obstruction of the river bed by frasis; nay, a head probably exceeding 4·48 ft., for, no allowance whatever was made for covering the relative decrease in the volume of water flowing over the rapids at a fixed stage of the river when it is obstructed by ice.

Such being the case, after the natural distribution of the frasis in the waterway to the best advantage, as regards the flow of the water seaward, had been going on for a month and a half from the complete closing up of the river, 12th February, down to Platon and further, it can well be understood how even a moderately rapid increase in the volume of water carried by the St. Lawrence during winter, under ordinary circumstances, may be the sole cause (exclusive of ice jams) of a head being raised in the vicinity of Montreal city, sufficiently great for the swollen stream to flood the low-lying quarters of the said city, together with those of the neighbouring towns and villages, as well as some portions of the roads and fields on both shores, before a passage of the requisite discharging power can be worked through the stream, when surcharged with frasis, to permit of the free and regular outflow of the increased affluence of water.

TABLE XXVII.

FLOOD levels established between Lachine and Quebec, with notes relative to the damages done by the floods, the causes of the same, etc., the nature of the marks levelled to, etc., etc., the whole according to information obtained in the localities visited, from the municipal authorities and other sources.

NORTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Town of Lachine. Lock No. 5, head of Lachine Canal. (County of Jacques-Cartier).	173·5	.....	....	.....	.....	.....	Depth on lock-sill, measured every day at noon by lock-master. River open during the whole winter in 1886-87. Average depth on lock-sill from 28th December, 1886, when river became frozen over from shore to shore up to 10th April, 1887, when swelling of stream by spring freshets commenced; = 11'-7", which corresponds to an elevation of 74·30 ft. above datum.
Lot No. 4669, Parish of Montreal. Jos. Brault, owner.	165·3	.....	.....	....	57·93	58·26	Highest flood water of 1886 came to top of lower entrance steps, Jos. Brault's stone residence. Top of fence rail flush with highest water, April flood of 1887.
St. Henri pump-house.	163·9	.....	.....	.....	56·90	58·45	Marks in engine room pointed out by Alex. Baby, assistant to Alex. Fiset, engineer in charge of St. Henri water-works pumping machinery.
Lock No. 1, Lachine Canal. (City of Montreal).	161·5	52·29	48·96	52·20	55·79	54·67	Depth of water on lock-sill, measured regularly every day at noon by lock-master. Average depth on sill, 28th December, 1886, when river was completely frozen over, to 10th April, 1887, when swelling of stream by spring freshets commenced, = 2'9·8", which corresponds to an elevation of 41·21 ft. above datum.
Thibeaudeau Bros. & Co.'s store, Commissioners' street. (City of Montreal).	161·0	.....	.....	.....	55·96	55·39	Lines indicating highest flood levels of 1886 and 1887, painted in black on cut stone store front.
Longue Pointe..... (Co. of Hochelaga).	154·7	.....	.....	46·60	.....	45·03	Boat tied to verandah of H. Lapointe Esq., in 1885. Flood marks of 1885-87 on ground at foot of verandah, and at foot of tree pointed out by Mrs. Lapointe, (See notes, &c., by Mayor Lapointe, Appendix No. 20.)
Pointe aux Trembles. (Co. of Hochelaga).	151·0	.....	.....	.....	.....	.....	Mr. Achille Beaudry, Mayor of Pointe aux Trembles, called on Tuesday, 14th Aug., 1888, states that he gave instructions to Mr. Jeannotte, the clerk of the municipality, to make observations and marks asked for by department in April, 1887; but that Mr. Jeannotte had changed his place of residence without leaving any record of what he had done.
Repentigny..... (County of L'Assomption).	144·0	.....	.....	.....	42·92	....	1886. Flood mark on Secretary-treasurer F. X. O'Brien's shed on concession road to River L'Assomption. (See notes, &c., by M. O'Brien, Appendix No. 20.)
do	143·3	42 08	.....	42·29	42·66	.....	1886. Mark underside of entrance step, front of Mayor Eusèbe Juneau's store dwelling. Flood level of 1865 observed by Mr. Benjamin Rivet, who noted the height of the water in reference to the sash bars dividing the small panes of glass in his windows. Water remained high 7 to 8 days in 1885, and only about 5 to 6 in 1886. In the spring of 1885,

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

NORTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Repentigny—*(Con).*.	.....	.....	...	.....	.....	...	River L'Assomption was completely blocked by ice and its waters forced to discharge themselves laterally through gullies into the St. Lawrence; some houses were demolished, or rather came down on account of being undermined. Ice is often piled up very high in the spring opposite MM. Juneau and Rivet's houses, and these are occasionally threatened with destruction by ice shoves.
Lavaltrie..... (Co. of Joliette.)	130·8	..	.....	.....	*43·86 42·60	42·02	Flood marks made in 1886-87 by Denis Giguère, light-keeper, on trees near the Lavaltrie wharf. (See notes and observations respecting flood of 1887, etc., by Dr. Sin. Martineau, Mayor of Lavaltrie, Appendix No. 20.) *Water remained at elevation 43·86 only for a couple of hours; but for several days at about 42·60. Both Dr. Martineau and D. Giguere state that since the opening of the new south channel and the deposition of dredgings between the north and south channels and on the foreshores by the Montreal Harbour Commissioners, the ice is all drawn towards the south shore in the spring. The current strikes this south shore nearly at right angles and helps the piling up of ice on the battures. A proof that the whole of the water is drawn towards the said shore is, they state, that no slabs or chips or other mill refuse from Repentigny or the Ottawa River comes ashore in the vicinity of Lavaltrie, as previous to the opening of the second channel.
Lamoraie—lower end of parish. (Co. of Joliette.)	122·0	.....	.....	35·72	42·22	36·78	Flood levels pointed out by Mr. Louis Coderre, of Lanoraie—1885 mark, a high spot on ground in yard. In 1886, a mark was made with a knife on the jamb of a door in the wall between the main house and the kitchen annex; water remained some two days near this mark, which is 3·32 feet above the kitchen floor. 1887 mark, a spot on the ground at the foot of the entrance steps to the kitchen. Mr. Coderre says the flood of 1865 did not rise as high as that of 1886, opposite his land.
Lanoraie—mouth of River St. Joseph de Lanoraie. (Co. of Joliette.)	120·0	... ..	.....	36·47	39·08	36·47	Flood levels pointed out by Edward Valois, farmer, who had charge of Seigneur Bortwick Dauthré concession grist mill. In 1884 and 1887 water covered the top of a flat stone. Flood of 1886 rose up to top of third clapboard at base of mill, where water remained a day and a night. This flood was caused by an extensive ice jam, which blocked the waterway from above L. Coderre's farm to Antoine Trempe's farm, below which the river stood only 36·27 feet above datum; a shoal opposite

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

NORTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Lanoraie—mouth of River St. Joseph de Lanoraie.—*(Con.)*	.....	.....	.....	....	.....	.....	the mill helped to bring about an ice jam here. Mr. Antoine Trempe, 68 years old, owner of the first farm in the parish of Berthier going eastward, says he never saw ice piled up opposite his place as it was in 1885 and 1886. Batture ice got stuck in the fall at the head of "Ile aux Foin" and "Ile St. Ignace," whence it reached across to Sorel, and during winter the main channel, as well as the small northern channel, was blocked by drift ice. According to Mr. Trempe, the flood of 1865 was some 3·0 feet higher than those of 1885 and 1886; the former being caused by the blocking up of the Richelieu Rapid and high N.E. winds. Immediately below this farm the water fell suddenly in 1886, otherwise Berthierville would have suffered heavily.
Lanoraie Village....	124·5	.....	.....	....	.....	.....	Mayor Antoine Caisse called on Wednesday, 15th August. Mr. Caisse states he received no circular or letter from the department and made no flood marks, etc.
Berthierville ..... (County of Berthier.)	116·5	.....	... .	.....	34·57	.....	1886 flood reached top of entrance step, Grand Central Hotel, level indicated by Mr. Beaulne, the proprietor.
		36·37	.....	....	.....	35·54	Notch made on fence post by F. O. Lamarche, Esq., Mayor of Berthierville, at highest point reached by spring flood of 1887. (See notes, etc., by Mr. Lamarche, Appendix No. 20.) Flood of 1865 10″ higher than that of 1887; the highest point being reached by water, 12th April, Wednesday in holy week. Wind blew from the S.E. Tuesday evening, but turned to the northward on Wednesday morning, which cooled the atmosphere to such an extent as to cause fresh ice to take on the "battures"; wind then turned suddenly to the southward, and at 3 p.m. blew a hurricane. At 6 p.m. wind S.W., and at midnight again nearly due north. Battures of ice detached by this strong wind blocked up the river at Richelieu Rapid, causing an unprecedented sudden great rise in the water. The rise, however, fell rapidly, being already some 2 ft. lower on 13th than on 12th, and by the 18th of April the stream had again reached its ordinary summer level. Rev. Mr. Vincent Plinguet, vicaire forain and parish priest of Ile du Pas, has written a pamphlet giving a vivid description of the events of 1865, at the time of the great flood, when, it is stated, some 50 or more persons lost their lives by drowning in the islands at the head of Lake St. Peter and vicinity, and many dwellings, barns and stables were carried away, with all their contents,

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

NORTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Berthierville—*(Con.)*	.....	.....	.....	.....	.....	.....	horses, cattle, produce, etc. Appendix No. 91 contains copious extracts from Quebec, Sorel and Montreal papers, containing full accounts of this unprecedentedly disastrous and widespread inundation, and of the harrowing and heartrending scenes which accompanied the same, etc., viz. Extracts taken, 1st, from *L'Echo de Richelieu* and *La Gazette de Sorel*, as reproduced by *Le Canadien* (Quebec), 17th April, 1865; 2nd, from *La Minerve* (Montreal), of 11th, 12th, 13th, 15th, 17th, 18th and 21st April, 1865; 3rd, from the Quebec *Morning Chronicle* of 12th, 17th, 19th, 20th and 27th April, 1865. According to Mr. Sylvestre, M.P.P., the whole of the water passed in April, 1887, through the Ile du Pas channel, which was comparatively clear of ice, while the minor or south channel, and the Berthier, or north channel, were badly blocked up. Attempts were made, 16th and 17th Aug., to visit several of the islands at the head of Lake St. Peter, with a view of calling on Rev. Mr. Plante, and on L. Plante, Esq., Mayor of Ile du Pas, who resides on Ile Madame, 3½ miles east of parish church, but the weather was so bad, the wind so high, and the means of communication so uncertain, that the expedition had to be abandoned, as it became evident that it would take more time than I calculated could then be devoted to it.
St. Barthélemy..... Rang nord. (Lower end of Berthier, or north channel.) (Berthier County.)	109·5	36·85	.....	.....	36·22	35·54	On the 30th of April, 1887, water came up to under side of ash-pan on stove in Louis Gervais' house, east side of concession road leading to St. Barthélemy church. Water remained in Mr. Gervais' house for three or four days in May 1887. It flows into the dwelling every three or four years, and in 1886 it had not all left on the 10th of May.
Maskinongé ..... (Maskinongé Co.)	107·0	.....	.....	.....	.....	.....	Mayor Ovide Fleury called on Saturday, 18th August, 1888. Mark made by Mr. Fleury on a tree on his farm indicating flood level of 1887, about 4 miles from St. Lawrence. Elevation of this mark not established on account of large amount of extra levelling required along River Maskinongé, etc., which was not considered warranted by the circumstances.
Louiseville..... (Lower end of River du Loup en haut) (Maskinongé Co.)	100·5	.....	.....	.....	35·26	35·52	In compliance with departmental request of 26th April, 1887, Henry Mineau, Esq., banker, Mayor of Louiseville, made flood marks on bridge over Grande Rivière du Loup and on D. Caron's store house. Having found these marks to be rather far up from Lake St. Peter for establishing their elevations by means of the above lake level, Mr. Mineau advised me to

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

NORTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Louiseville—*(Con.)*..	.....	.....	....	.....	.....	.....	call on H. Vadeboncœur, who resides in last house going southward on west side of Grande Rivière du Loup and keeps a record of most of the high spring floods, &c. Flood levels of 1886 and 1887 marked by Mr. Honoré Chabrier dit Vadeboncœur at south-east corner of his barn. Mr. Vadeboncœur's dwelling, barn, shed and stable were carried away with all their contents by the great spring floods of 1865. Loss estimated at $2,500.
Yamachiche ..... (St. Maurice Co.)	94·0	.....	.....	.....	.....	.....	Yamachiche visited Monday, 20th August, and Mayor Th. Dufresne called on, but found that he had this day absented himself, not to return for a whole week. No one else able to point out satisfactorily the flood marks made by him (see his letter to Secretary Public Works, Appendix No. 20). Interviewed Mr. Olivier Lesieur, who acted for many years as agent of the Richelieu Company. Mr. Lesieur states that none of the floods of 1885, 1886 and 1887 proved disastrous at Yamachiche, but that the great flood of 1865, which was accompanied by high south-west wind, swept everything before it at lower Yamachiche. When an ice bridge is formed near Batiscan previous to the ice taking at or below the Richelieu Rapid, the parishes above are, to a great extent, saved from a destructive spring flood.
Pointe du Lac ..... (Upper end of parish.) (St. Maurice Co.)	89·5	38·46	.....	.....	... .	33·83	Flood mark of 1865 in Zéphirin Dupont's house, viz. : On small draught door in box stove. Flood level of 1887 pointed out by Onésime Dupont on crest of bank. Lake stated to have been lower in 1886 than in 1887, and to have remained very high some 10 days each year.
Pointe du Lac... ... (Lower end of parish, at Mayor Philippe Alarie's farm, 1½ to 2 miles below church.) (St. Maurice Co.)	86·7	39·16	....	. ...	.....	34·78	Mayor Ph. Alarie marked highest water level of 1887 on a tree. He stated that in the spring of 1886 the river did not rise quite as high as in 1887. Mr. Pierre Alarie, the father of the mayor, gives the following particulars relative to the great and destructive flood of April, 1865. On Tuesday evening, 11th April, the wind, which had been blowing from the southward during the day, turned round to the north-west, the weather becoming at the same time very cold. Early Wednesday morning the river was comparatively low, but the water rose so rapidly during a few hours in the forenoon that at about twelve o'clock it was 10 in. deep on a high ridge situated to the southward of Mr. Alarie's house, which depth was sufficient to permit of an empty "bateau" passing over freely. Early in the afternoon a south-west gale sprung

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

NORTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Pointe du Lac—*(Con.)*	.....	.....	.....	.....	.....	.....	up, and from 3.30 to 6.30 p.m. the wind blew with such force as to cause a further rise of from 2 to 2½ ft. in the St. Lawrence, the water having reached the under side of the stone sill of the door of Mr. Alarie's baking oven. The oven is still standing, and the elevation of its stone sill as well as that of the point on the ridge over which the boat passed have been established. The great flood of 1865 has been caused by a big ice jam near Grondines. The ice took in November, 1864, after a heavy fall of snow, and it is the opinion of many that the waterway was already partly obstructed by ice at Grondines in the fall, for the water stood very high in the early part of the winter. Mr. Madore Paquin, of Pointe du Lac, who keeps a register of all important events in the parish, puts down 12th April for the date of the highest water in 1865. He says, moreover, that in 1798 there was a flood nearly as high as that of 1865, viz.: Within 1 ft. of the height of the latter.
City of Three Rivers.	79·0	36·30	33·40	33·60	30·80	33·46	Flood levels of 1882-83, '84, '85, '86 and '87, observed under the supervision of Thos. Berlinguet, Esq., Engineer Three Rivers Harbour Commission, on a gauge spiked to the corporation wharf. When first put up in 1882, the zero of this gauge corresponded with the very low water originally observed by me 19th September, 1891, when the tides corresponded nearly to the action of the moon when in quadrature, and the river stood nearly 19·30 ft. above datum at Sorel and 15′ 10″ over sill of lock No. 1, Lachine Canal; but both wharf and gauge afterwards subsided about 0·6 ft., and in August, 1888, the said zero was found to be 16·0 ft. above datum. Elevations of April floods of 1882 and 1883 approximately 29·50 ft. and 32·00. ft. F. X. DeBellefeuille, Esq., President Three Rivers Harbour Commission, states that water rose twice on to his floor since 1865; in this last named year be believes at least 2 ft. higher than in 1887. In 1887, river remained near flood height during from 6 to 7 days. The highest point reached by the flood waters of 1865 marked by the late Auguste Martel, Esq., on a lamp post erected at the N.W. corner of De la Fosse and Fleuve streets. Flood level marks of several other years have been added on the same post by Mr. Félix Fleury, who has lived in Mr. Martel's house since 1871. Elevation of mark for 1873, 34·60 ft.; elevations of two marks for years not remembered by him, 34·12 and 33·49 ft. Further particulars relative to damage

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

NORTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
City of Three Rivers. *(Con.)*	.....	.....	.....	.....	.....	.....	done, etc., at Three Rivers and vicinity by the great flood of 1865, contained in Appendix No. 19.
Cap de la Magdeleine (Champlain Co.)	76·4	.....	.....	....	32·52	33·21	Flood mark of 1887, top of small hillock, said to have been covered by six inches water, by the Rev. Mr. Duguay. Highest spring water of 1886 stated to have been from 6 to 9 inches lower than that of 1887.
Champlain Village.. (Champlain Co.)	67·4	.....	.....	.....	.....	32·78	Highest flood water of 1887 marked April 24th, by Xavier Bourbeau, Esq., Mayor of Champlain, on root house built on slope of hill in rear of convent. (*See* the Mayor's letter to the Deputy Minister of Public Works, dated 28th April, 1887—Appen- No. 20.)
Champlain..... (Bridge on post road over Champlain River.) (Champlain Co.)	64·0	34·76	.....	31·76	.....	.....	Flood levels of 1865 and 1867 marked on N. W. corner of Alphonse Turcotte's former blacksmith's shop, standing on S.W. side of River Champlain. Flood mark for 1885, a spot on the ground covered by 3 inches of water, pointed out by Mr. Arthur Turcotte. Elevation reached by flood waters of 1867, 33·72 feet above datum. Mayor Bourbeau states there is little or no damage done by spring floods in the parish of Champlain ; the banks of the St. Lawrence being sufficiently high to prevent the lands from being overflowed.
Batiscan Village.... (Champlain Co)	59·5	34·73	.....	31·78	.....	31·53	Flood of 1885 rose nearly 9 inches over floor of residence of Jos. Marchildon, Esq., merchant and agent Richelieu and Ontario Navigation Compauy. Spring flood of 1887 reached top of floor in T. Laquerre's hotel, and in 1885 this floor was covered by 3 inches of water.
Ste. Anne la Pérade, one mile below parish church. (Champlain Co.)	55·0	33·51	31·51	.....	.....	.....	Four spring floods rose over floor of Mr. Théophile Lanouette's house (built in 1717) viz. : in 1865, 2′ 1½″ ; in 1868, 1′ 7½″ ; in 1873, 8½″ ; and 1884, 1½″. Elevation of flood level of 1868 33·01 ft. above datum. In 1865, water entered Mr. Lanouette's residence on Sunday, April 9th, and left it again on the following Wednesday. Mr. Ludger Jolin, Mayor of Ste. Anne la Pérade, called on 5th October, 1887. Flood level marked by him in the spring of 1887, considered to be too far up the River Ste. Anne to indicate correct water level of St. Lawrence.
Grondines, 1¼ mile above Grande Pointe des Grondines, 3¼ miles above the parish church. (Portneuf County.)	51·2	.....	.....	.....	.....	25·05	Flood level of 1887 marked by Mr. Aimé Dolbec on elm tree in his field, at request of Mayor Onésime Rivard, who was asked by Department to attend to this matter. (See his letter dated 25th April, 1887, Appendix No. 20.) Flood of 1873, which is the highest experienced in this locality after that of 1865, rose 8 to 9 inches over a stone or boulder pointed out by Mr. Dolbec having reached an elevation of

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

NORTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Grondines—*(Con.)*..	....	.....	.....	....	.....	....	33·53 ft. above datum. In the spring of 1873, Dr. Mayrand and M. G. Hardy rowed from Grondines Village to Ste. Anne la Pérade in a canoe, following the post road most of the way; they also passed through the window of the old church near the wharf at Grondines Village. In 1865, all the large trees along the river front of Mr. Dolbec's farm were mowed down by ice with the exception of two or three. It is stated that the flood of 1865 was higher at Ste. Anne and Upper Grondines than any other spring flood known in these localities, because ice got jammed and stuck fast above Grande Pointe at Grondines Village and vicinity. The spring flood waters rose higher in 1873 than in 1865, because they were retained by a jam at Pointe Platon. The inhabitants above Grande Pointe, Upper Grondines, have every year to be upon the alert at the time of the débâcle, for fear that the water of the St. Lawrence, forced out of its natural channel over the low lying ground on the north shore, might drown their cattle in the stables. When unusually high floods occur the cattle are taken to the upland, or rather on top of the hill which runs here parallel to the St. Lawrence, and kept there until the water has subsided sufficiently to bring them back to the stables; the cattle have had to remain out in the cold for as long as eight days, in 1873. The fences on the low lying lands have to be taken down every fall, otherwise they are carried away by the flood waters; these also cut up and wash away the earth in many places. Mark made by Mr. Joseph Guilbault, April 27th, 1888, at 10 a.m., indicating the highest water of the season on a small tree opposite Anse des Grondines and immediately above Grande Pointe des Grondines and the "Poivriers," two spurs of Grande Pointe. Elevation of this mark = 27·23 ft. Mr. Eugène Grondines, aged 64 years, a member of the numerous family after which this place has been named, relates that before his time, his father who died in 1888, 92 years old, and his uncle went one Sunday to the old church near the wharf in a canoe which they tied to the communion railing.
Grondines wharf.... (Portneuf County.)	47·0	.....	....	.....	.....	24·39	In April, 1873, Mr. E. Grondines measured the depth of water, when at its highest, over a stone at the door of the old mill, say ½ mile above the wharf, and found it to be 4·0 ft. Elevation of water corresponding to this depth = 33·89 ft.

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

NORTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Grondines wharf ... *(Con.)*	.. ..	.....	. ....	... .	.....	.....	Stakes planted by Treflé Arcand in 1887 and 1888, with top flush with highest water in the spring. In 1888, river reached its maximum elevation, viz.: 24·95 ft., 28th April, at about 6 a.m., and remained near this level all day. Ice commenced to move at Grondines in 1888, 27th April, at about 9 p.m.; but shortly stopped again when the channel became blocked up and remained so up to 29th, between 1 a.m. and 4 a.m. The waterway got chocked up with ice down to a point a short distance below the wharf, and ice shoved towards north shore after channel got blocked, rising on top of wharf 7 to 8 ft. in height. Ice piled up 20 ft. high, on shoal off wharf, where it remained for over a week. This is not the usual way the ice works opposite the wharf; generally it sticks at Grande Pointe des Grondines, where it partly dams the waterway before any move takes place opposite the wharf.
Deschambault, ¼ to ½ mile below parish church. (Portneuf County.)	39·7	. ....	....	.....	.....	22·22	River not very high in either the spring of 1887 or that of 1888. Elevation of highest water observed by Mr. O. Portelance in the spring of 1888 nearly the same as in 1887, viz.: 22·2 ft.; variations of river level appeared nearly as regular as in summer.
			28·34	.....	27·04	.....	Heights of spring floods of 1865, 1873 and 1886 pointed out by Mr. Jean Matte in his house, situated about ¼ mile below the wharf. Elevation of flood in 1873 = 27·94 ft. Mr. and Madame Matte state the water remained very high: in 1865 8 days, in 1873 5 days and in 1886 3 days. In 1865 the flood waters put out the fire in the stove.
Portneuf Village.... (Portneuf County.)	37·0	27·14	26·60	. ...	.....	.....	Highest spring flood levels of 1865 and 1884 pointed out by Madame Veuve Pierre N. Morissette and Onésime Poliquin in their houses. Elevations of corresponding marks nearly the same in both places. Flood of 1865 reached to top of knobs of chest of drawers in Mrs. Morissette's house and to centre of fire door of stove in Madame Poliquin's residence. Flood water of 1884 touched bottom of drawer in first house and took in half the foot of the stove in the second house mentioned. Water has risen several times in the spring up to underside of floor at Mrs. Morissette's and often enters her outhouse. Mayor Camille Poliquin called on 29th August, 1888. Mr. Poliquin says no mark was made by him at the highest spring level of the St. Lawrence in 1887, as requested by department, because ice was shoved up so much higher on land

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

NORTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Portneuf Village.... *(Con.)*	.....	.....	.....	....	.....	.....	than the water reached that he found it impossible to make a mark on a fixed object that would permit of determining satisfactorily the elevation of the water surface later on. Samuel Labranche, ferryman, says that in 1887 there was only thin or soft, snowy-like frasis in the channel, which did not affect the channel currents very much, either as regards strength or direction. It requires, he says, floating fields of upturned batture ice to cause a regular blockade accompanied by a flood.
Cap Santé..... (Portneuf County.)	33·0	....	.....	.....	.....	.....	Locality visited 30th August. No water marks made here, there being no damage done by spring floods; river banks high and steep. At F. Richard's tannery the water covered the road several times in the spring, forcing the vehicles to pass close to the base of the hill for a short distance above this establishment, but no damage was done either to buildings or any other property. Mr. Charles Falardeau and other observant inhabitants of the parish of Cap Santé state that generally an ice bridge is formed at the contracted part of the St. Lawrence, opposite the mouth of the River Chaudière, 8 miles above Quebec city, by reason of large fields of batture ice of considerable thickness which have become detached by north-easterly winds from foreshores above Cap Santé, pivoting around this cape and making their way unbroken towards the said narrow gauge where they block the waterway from shore to shore. It is believed that some ice breakers built on the chains of rocks at Cap Santé and vicinity would have the effect of breaking up the large fields of batture ice into small pieces, by which means the formation of a solid ice bridge 30 to 40 ft. thick or more at the Chaudière pass would be prevented. In such case not only would the St Lawrence above Quebec be opened to navigation a fortnight to three weeks earlier in the spring than at present, but the chief cause of the most disastrous of the spring floods would also be removed.
Pointe aux Trembles Village (en bas). (Portneuf County.)	21·6	.....	26·46	.....	...	.....	In the spring of 1884, highest water rose to within 0·3 feet of under side of stone lintel over chimney opening in Gaspard Béland's old house. Béland says ice was piled up high on Trembles shoal near the place of the red buoy, and there was a big jam in the river bed thence towards St. Nicholas; he does not remember ever having seen the water rise so high before. The river remained very high for about a week. Upper portion of Pointe aux

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, &c.

NORTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Pointe aux Trembles Village (en bas). *(Con.)*	.....	.....	.....	.....	.....	.....	Trembles wharf carried away by ice and water. Instead of making a mark at the highest flood level which obtained in April, 1887, Mayor Fortunat Belleau having placed a wrong construction on the request made by the department, instructed the Secretary-treasurer, Mr. Octave Delisle, to observe and register the elevation of the high water level of the estuary on the third day, after full moon following the last new moon, in May, 1887, about which time, it has been observed, the tide usually rises higher at Pointe aux Trembles than at any other time in the spring of the year, probably because the fresh water discharge of the St. Lawrence is then near a maximum. In accordance with this instruction, high water was observed by Mr. Delisle on Tuesday, the 7th of June. No unusual rise of the river observed at the débâcle of 1887, or that of 1888.
St. Augustin..... .. (Les Fonds.) (Portneuf County.)	15·8	26·21	25·40	.....	....	.....	In 1884 spring flood rose to within 3 inches of under side of second entrance step, and in 1865 to a point 0·7 feet below top of floor in Mr. George Juneau's house. In the former year the river commenced to submerge the grounds around this house on Monday morning 21st April, and receded on the following Saturday afternoon; having thus prevented free access to Mr. Juneau's premises from the roadway for about six days. Fifteen loads of stone, drift wood, etc., had to be carted away after the water subsided. In the year 1843 or 1844, when the late Geo. Juneau, sen., acquired his farm, the water also rose very high in the spring, and some damage was done by floods in several other years besides those specially mentioned. Mr. Philippe McCarthy, whose farm is adjacent to that of G. Juneau on the eastern side, says, that for the past thirty years or more, whenever a spring flood was experienced in this vicinity there was always a solid ice bridge at the "Sault," viz.: opposite the mouth of the River Chaudière. In 1865 the river kept up to or near flood level for about five days; as usual it was the solid key ice bridge at the "Sault" which caused the whole trouble. At the time of the débâcle, tremendous ice jams and shoves often take place, from a point one mile or so above Juneau's farm down past the site of the old church, 1½ miles below it; east of this point the jamming and upturning of ice diminishes gradually. Opposite Pierre Gagnon's house at the foot of the hill, on the road to Cap Rouge Village, the ice crust, although less

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

NORTH SHORE, RIVER ST. LAWRENCE—*Concluded.*

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
St. Augustin—*Con.*							broken up than further up stream, is yet generally so much disturbed as to prevent the opening of a good winter road to St. Nicholas on the south shore. It is stated that the flood of 1843-44 rose here higher, if anything than that of 1865. River not extraordinarily high here in 1884; at the débâcle, ice generally shoves towards the south shore.
Cap Rouge Village.. (Quebec County.)	9·2	.....	.....	.....	.....	.....	Mr. Joseph Daurais, an old resident of the place, says that the water never causes any damage here in the spring, when the river does not rise as high as during high tides in May, and in the fall of the year with north-easterly gales. Ice is broken up where it grounds, and also passes over some wharves, but water does not rise excessively high, at least it does not appear to have ever been stemmed back to any great extent, even when the ice bridge at the "Sault" is of very great thickness and the floating lumps of ice jammed in between the two shores, so as to partly block up the contracted waterway below Cap Rouge.
Quebec Harbour .... (Quebec West.)	0·0	.....	.....	.....	.....	.....	No inconvenience experienced here at any time from the rise of the estuary caused by the débâcle in the spring. Waterway always ample for the free passage of the whole of the ice and water from the Upper St. Lawrence, that has to find its way to the sea. On 11th May, 1874, considerable damage was, however, done, under exceptional circumstances, to shipping in winter quarters at Blais booms, Diamond harbour, &c. In the said year, contrary to the usual course of events, the ice from Lake St. Peter and other points on the upper portion of the St. Lawrence estuary, &c., made its way down stream before the ice bridge at Quebec, which was exceptionally thick and sound, became sufficiently weakened by tidal currents and the action of the sun, to be broken up by high spring tides and winds, in consequence of which heavy jamming and shoving took place in the localities mentioned, and elsewhere in Quebec Harbour, some of the floating masses of ice having to pass under the solid crust and others being forced on top of it and on to the foreshores. Damage done estimated at from ½ to 1 million dollars. (*See* extracts from Quebec "Morning Chronicle" and "Canadien," Appendix No. 18.) A somewhat similar débâcle occurred in the spring of 1836, when the river became completely free of ice at Quebec only about the 10th of May. No damage appears, however, to have resulted from this tardy breaking up of the ice bridge. (*See* extracts from Quebec "Mercury," May 5th and 10th, 1836, Appendix No. 17.)

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

SOUTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Parish of Laprairie, (Co. of Laprairie).							
River St. Régis—mouth of river near foot of Lachine Rapids, opposite Lot No. 629, Théophile Beauvais.	168	.....	.....	.....	61·01	58·84	Points on bank, west side St. Régis River, reached by flood waters in the spring of 1886 and that of 1887 levelled to.
Lot No. 619, Edouard Bourassa.	167·9	.....	.....	.....	61·10	59·00	Mrs. Edouard Bourassa pointed out a spot on the river bank opposite her house, up to which water reached in 1886. Flood level of 1887 stated to have been nearly 2·0 feet lower than that of 1886 level to.
Lot No. 617, Pierre Goyette.	167·8	.....	....	.....	58·28	....	Flood waters of 1886 rose to the top of floor in Mr. P. Goyette's residence.
Lot No. 606, Edmond Barbeau.	167·2	....	....	.....	57·82	.....	Mark made on stake by E. Barbeau, at highest level reached by spring flood of 1886.
Lot No. 555, Adolphe Ste. Marie.	166·3	.....	.....	.....	58·16	.....	Mark made by Adolphe Ste. Marie on his barn, at level of highest water, spring of 1886.
Lot No. 554, Judge Pagnuelo.	166·3	.....	....	....	58·02	56·32	Flood level of 1886 marked by the occupants of His Honor Judge Pagnuelo's cut stone residence, on wire gauze screen on cellar window, north-east side of house. Mark on the same screen left by water, after it receded in the spring of 1887, 1·7 feet below flood level of 1886.
Parish of Laprairie—Upper ice pier, south-west end.	166·0	.....	....	.....	.....	56·38 55·80	Elevation of flood mark made on ice pier in spring of 1887, by Dr. Brisson, at request of department = 55·80 ft. Elevation of flood mark of 1887 made on Joseph Lalumière's blacksmith shop, close to the ice pier = 56·38 ft. (*See* Dr. Brisson's letter, dated April 28, 1887, Appendix No. 20.)
Old St. Johns road, leading to Richelieu and Ontario Company's wharf.	165·8	.....	.....	57·60	58·21	56·89	Highest levels reached by spring floods of 1885, 1886 and 1887, marked with a knife on dado in bar of Montreal hotel, by the proprietor, Mr. Léandre Robert.
Lot No. 14, Xavier Perrat.	164·2	.....	.....	.....	57·04	.....	Flood of 1886 reached to the foot of a white stone, pointed out by Madame X. Perrat.
Lot No. 9, R. Perron	163·6	.....	.....	.....	56·84	.....	Spot on ground, pointed out by Mr. Perron, up to which spring flood rose in 1886, when at its highest.
Lot No. 1, Louis Roy.	163·3	.....	.....	.....	57·26	.....	Water mark made by Louis Roy, on a willow tree on his ground, in the spring of 1886.
Parish of Longueuil (Co. of Chambly.)							
Lot No. 269, Pierre Roy.	163·1	.....	.....	.....	57·69	.....	Yellow line painted by P. Roy, at highest flood level of 1886, at the south-west corner of his house.
Lot No. 265, Louis David.	162·9	....	....	.....	57·28	....	Flood levels of 1886, marked by L. David on his barn.
Lot No. 263, Moïse Trudeau.	162·5	.....	....	.....	.....	56·61	Height reached by spring flood of 1887 pointed out by M. Moise Trudeau, at the entrance steps to his house. This place is ½ mile above Victoria Bridge.

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

SOUTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Lot No. 256, Joseph Trudeau.	162·0	.....	.....	.....	56·87	55·27	Highest water of 1887 rose up to floor of veranda of Jos. Trudeau's house. In 1886 river was about 1·6 ft. higher than in 1887.
Lot No. 255, Grand Trunk Ry. Co.	161·8	.....	.....	.....	56·50	.....	Elevation of A. Irving's veranda floor, which was flush with water surface spring flood of 1886 = 56·50; water rose, however, to 56·88 ft. while the roadway was blocked up by ice. If opening left for post road in railway embankment was closed up, and the road raised and graded so as to permit of driving over the track, the properties on the north-east side of the Victoria Bridge, would in a measure be protected from damage by high floods. (*See* notes and observations by M. Grant, Esq., Mayor of St. Lambert, in letter, dated May 6, 1887, Appendix No. 20.)
Lot No. 162, Noël and Pierre Marcille (lower end of lot).	160·9	.....	.....	.....	55·73	.....	Flood of 1886 rose to a point a little above underside of sill of cellar window in stone outhouse, as pointed out by Noël Marcille, who says that in 1887 water came within 18 inches of height it reached in the spring of 1886.
Lot No. 161, Joseph Tiffin (lower end of lot).	160·3	.....	.....	.....	54·81	52·71	Highest flood level of 1886 observed by Mrs. John Thompson, and marked on window sash opposite second pane of glass above sill. Ice jams badly here, between St. Helen's Island and east or south shore. Mrs. Thompson's property much damaged. In 1887 mark left by spring flood water on bars of veranda railing in front of J. Thompson's stone house.
Pump-house, Longueuil water works (upper end).	158·7	.....	.....	50·43	50·89	51·93	Flood marks made in pump-house by Mr. Octave Poirier, assistant engineer of the Longueuil water-works. (*See* remarks, etc., by L. E. Morin, Esq., Mayor of Longueuil, in letter addressed to Deputy Minister of Public Works, under date of April 28, 1887, Appendix No. 20.) With very high spring floods, the front road between Longueuil and St. Lambert is sometimes so much obstructed and cut up by ice and water, as to be impassable for weeks. At the lower end of the town of Longueuil, ice has also often to be chopped, to make a passage for vehicles going to or coming from Boucherville.
Longueuil ..... Chas. Jalbert's shop on St. Charles st., between Rue St. Jean and Rue de l'Eglise.	158·4	.....	.....	.....	.....	51·58	Level reached by spring flood of 1887 pointed out by Mr. Charles Jalbert on the sash of his show window. Highest flood waters of 1886 said to have been about 2 ft. lower than those of 1887.
Terrapin hotel, west side Rue St. Charles	158·1	.....	.....	49·80	49·80	51·17	Height reached by spring floods in 1885 and 1886, at entrance steps to Terrapin hotel pointed out by T. Bourdon, Esq. In 1887 water rose up to first joint in brick work above floor of veranda in fron hotel.

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

SOUTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
North-west corner of St. Charles and Alexander streets.	158·0	.....	.....	.....	....	51·31	Mark made at highest flood level of 1887, by J.-Bte. Bouthilier, on the brick at south-east corner of his house.
North-west corner of St. Charles and Charlotte streets.	157·8	....	...	.....	.....	50·64	Mark make at the water surface of 1887 by Mr. E. Benoit in the cellar door of his store.
North-west corner of St. Charles and St. Antoine streets.	157·7	.....	.....	.....	49·09	50·03	Flood marks made in 1886 and 1887 on gate post by Mr. Pierre Patenaude.
At junction of St. Antoine street and Post Road.	157·7	... ...	....	.....	.....	50·00	In 1887 flood waters rose to underside of batten at base of clapboarding at north-east end of ex-Mayor Hurteau's residence.
Toll gate at lower end of town of Longueuil.	157·3	.....	... ..	48·98	46·89	48·98	Spring flood levels of 1885, 1886 and 1887 pointed out by Pierre Briard, toll-keeper, in the living room of the toll house. Water remained very high for 3 days in 1887.
Lot No. 27, Ant. Favreau.	156·2	.....	.....	.....	46·27	47·69	Flood levels of 1886 and 1887 pointed out by Ant. Favreau on steps at rear entrance.
Lot No. 17, Joseph Dagnault.	155·9	....	.....	47·35	45·39	45·39	Flood marks made in 1885, 1886 and 1887 by Joseph Dagnault on post close to north-east corner of his brick house.
Lot No. 10, George Charron.	155·2	. ....	.....	46·38	.....	.....	Level of ground taken in front of dwelling house at height reached by flood waters in the spring of 1885, as pointed out by Mr. G. Charron.
Lot No. 5, Louis Dubuque.	154·8	.....	.. ...	46·11	44·44	44·97	In 1885 flood waters were flush with top of second lowest entrance step of Mr. Dubuque's brick house, remaining near that level for about four days. In 1886 the river rose to batten around base of outhouse, but remained only about four hours at this elevation. In 1887 it came to a point on the ground, in front of the dwelling pointed out by Mr. Dubuque.
Parish of Boucherville. (Co. of Chambly.)							
Lot No. 4, Antoine Vinet.	154·2	. ...	.....	45·36	. ....	.....	Joint in brickwork of dwelling, up which water rose in spring of 1885, pointed out by Mr. A. Vinet.
Lot No. 43, Joseph Bourdon.	153·8	.....	... ..	44·87	.....	44·01	Top of one of the entrance steps of Mr. Bourdon's house, 3 inches under water in spring of 1885. In 1887, highest flood water flush with top of next lower step.
Lot No. 38, Toussaint Sicotte.	153·5	.. ...	.....	.....	45·21	45·08	Flood level of 1886 at top of sill around Mr. T. Sicotte's house, at base of clapboarding. Flood level of 1887 1 to 2 inches lower.
Racicot's hotel.. ...	152·6	. ....	.....	.....	45·30	.....	Flood level of spring of 1866, marked by Arthur Boucherville on the sign-post of Racicot's hotel, corner of St. Jean and Ste. Famille streets.
School-house of the Frères Viateurs.	152·4	.....	.. ...	.....	.....	43·36	Capping timber of protection work along river bank, in rear of the school-house of the Frères Viateurs, covered by six inches of water in the spring of 1887. This depth was measured by Brother Nadaud, and pointed out to me by him, in company with Dr. Demers, who was Mayor of Boucherville in 1887.

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

SOUTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river, above Quebec.	Maximum Elevations in feet above mean sea level of spring floods according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Corner of Ste. Famille and St. Charles sts.	152·4	.....	.....	.....	44·86	44·03	In 1886, height of water observed by Madame Veuve Chas. Guimont, on entrance steps of her house. In spring of 1887 water came to top of sidewalk. Water remained but two or three hours at each of these extreme high elevations. The valuable properties on the Boucherville islands suffer more than any others in this vicinity from the effects of high spring floods, barns being carried away with all their contents, trees torn down, etc., by the ice.
Corner of Ste. Catherine and Ste. Famille sts.	152·3	.....	.....	44·92	44·92	.....	Mrs. Chas. Senecal observed that in 1885 and 1886 the river rose to the top of the plank sidewalk at a point near the corner of Ste. Catherine and Ste. Famille sts.
Village of Varennes—west end. (Co. of Verchères).	147·8	.....	.....	.....	44·92	43·98	Highest flood level of 1886, pointed out by Mr. L. P. Decelles. Water rose suddenly one day, from 11 a.m. to 2 p.m., covering the floor of the former house of J. Bte. Bienvenue, and remained high for several days. Highest level of 1887, as pointed out by J. Bte. Bienvenue; river remained very high only a few hours.
Village of Varennes, (near wharf).	147·5	.....	.....	.....	.....	43·65	Flood level of 1887, marked by L. H. Massue, Esq., ex-M.P., on poplar tree in his garden.
Village of Varennes. (½-mile below wharf).	147·4	.....	.....	.....	43·36	43·27	Marks made by A. H. Bernard, Esq., on the fence of his garden.
Village of Varennes. (lower end).	147·2	.....	.....	43·45	43·79	.....	Height of spring flood level, pointed out by Madame DeMartigny. The water rose in 1862 to top of upper entrance step, viz.: to an elevation of 42·73 feet, being the highest since 1859; in 1885, close to underside of parlour floor; in 1886, three inches over this floor. In 1886, the highest water obtained, 20th April, from 12 o'clock till 2 p.m., and in 1885, 28th April at 5 a.m., remaining very high only an hour or two.
do ..	147·2	.....	.....	.....	43·65	.....	Water observed in spring of 1886 by Xavier Petit, who stated that it rose up to within two inches of the top of one of his entrance steps.
do ..	147·2	.....	.....	.....	43·79	.....	Mr. Joseph Poirier observed that in the spring of 1886 the river rose to a point close to the underside of a window-sill on his house.
do ..	147·1	.....	.....	.....	.....	42·28	Highest level reached by flood in 1887 on Mr. Bienvenue's house, pointed out by Mr. X. Petit.
do ..	147·1	.....	.....	.....	43·55	42·55	In the spring of 1886, water rose one inch over the oven of Mr. Joseph Cardin's stove, and in 1887 it only reached the fire door.
do ..	147·1	.....	.....	.....	43·02	42·62	Mr. Francis Robert observed that the spring flood of 1886 rose to top of floor, north side of a small bridge on roadway, and that of 1887 only to the underside of this floor.

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

SOUTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river, above Quebec.	Maximum Elevations in feet above mean sea level of spring floods according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Parish of Verchères. (Co. of Verchères). Lot No. 221, Elzéar Desmarais.	141·2	.....	.....	.....	44·41	41·42	Water rose in spring of 1887 to within 0·2 of the top of a large elm stump, pointed out by E. Desmarais. Highest flood water of spring of 1886, observed by Mr. E. Desmarais to stand at figure 7 of board gauge put up by him on a large ash tree, at request of Montreal Harbour Commissioners. River remained at this very high level, 44·41, only for about ½-hour.
At wharf, Verchères	138·9	.....	.....	42·37 42·51	42·85 42·88	40·85	Flood marks made by Clément Dupré in his windmill, viz., on a door frame. Flood marks in 1885-86-87 made with a knife by Mr. Timothé Desmarais on his carpenter shop. In 1862 river rose to within one foot of the highest spring level of 1885, viz., say to 41·51 feet. Old residents state that the floods of 1885-86 were the highest experienced here during the previous eighty years.
Lot No. 33, Telesphore Chagnon.	137·5	....	.....	42·49	42·87	.....	Flood marks made on a telegraph pole in a gully by Q. Chagnon.
Lot No. 20, J.-Bte. Moreau.	136·2	.....	....	.....	42 69	41·18	Mark made at highest flood level of 1886 by J.-Bte. Moreau, on a partition in his house, near the stove. Flood level of 1887 indicated on ground in front of his house.
Lot No. 18, Aimé Bouvier.	136·2	.....	.....	42·94	42·91	.....	In 1885 flood came up to top of veranda floor of Mr. A. Bouvier's house, and in 1886 the water rose to top of sill of the entrance door.
Lot No. 12A, Philippe Chicoine.	135·8	.....	.....	.....	42·02	40·80	High flood levels of 1886-87 marked by Mr. P. Chicoine on his barn door. In 1886 water rose suddenly and remained very high during from one-quarter to one-half day; in 1887 it rose and receded gradually.
Parish of Contrecœur (Co. of Verchères.) Lot No. 260, Joseph Dansereau.	134·1	....	.....	41·39	42·49	.....	Flood of 1885 rose to top of second entrance step, and that of 1886 up to landing or top of stoop, the whole as pointed out by Mr. J. Dansereau.
Lot No. 259, Avila Gervais.	134·0	....	.....	....	42·14	40·49	Flood level of 1886 pointed out approximately on ground by Mr. A. Gervais; in 1887 highest spring waters reached to the top of one of the entrance steps of his house.
Lot No. 239, Augustin Lanctot.	133·3	....	.....	.....	42·80	....	Flood waters of 1886 covered door steps of Mr. A. Lanctot's house.
Lot No. 229, J.-Bte. Gervais.	132·3	....	.....	.....	44·29	...	Highest flood level of 1886 at upper side of a step of Elzéar Lambert Boisjoli's house, N.W. angle, intersection of Post Road along south shore of St. Lawrence, with cross road to St. Denis.
Lot No. 223, Olivier Hubert.	132·0	....	....	41·87	.....	.....	Highest flood level of spring of 1885 marked by Mr. Hubert with an axe on a maple tree close to his house.
Contrecœur Village, 200 feet above wharf.	121·0	....	....	41·95	43·04	39·66	Flood marks made by Mr. Clément Chabot in and around his barn, pointed out by him at request of Mayor Duhamel. (*See* notes and observations by the Mayor, Appendix No. 20.) In 1885 water remained very high three days, in 1886 only three hours, and in 1887 one day.

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

SOUTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Contrecœur Village; on road leading to wharf.	131·0	. . .	. . . .	. . . . .	43·21	. . . . .	Spike driven into horse post by Montreal Harbour Commissioners' engineers, to indicate highest level reached by flood water in the spring of 1886.
Sorel . . . . . (Co. of Richelieu.)	116·0	36·59	34·90	35·67	36·00	35·84	Flood levels of 1865 and 1887, according to observations made by P. De Bellefeuille, Esq., harbour master of Sorel; in 1887 Mr. De Bellefeuille was asked by Mayor A. A. Taillon to make a flood mark, in compliance with request addressed him by the Department of Public Works. Flood level of 1885 as pointed out by the Messrs. McCarthy, in front of their office at St. Joseph de Sorel. Flood level of 1886 as observed for Montreal Harbour Commissioners, 20th April, at 10 p.m. In 1887 water remained at top height only for an hour or so.
Yamaska Lock . . . . . (Co. of Yamaska.)	108·2	. . . .	. . . . .	. . . . .	. . . . .	33·54	Nail driven at flood level of 1887, by C. E. Michaud, Esq., C.E., into small tree on west shore of Yamaska River, opposite the lock. Dr. R. Mignault, Mayor of Yamaska, states he made no mark as requested by the department at the end of April, 1887, because he was absent from home at the time.
St. François du Lac. (Co. of Yamaska.)	103·7	36·33	. . . . .	. . . . .	. . . .	35·66	Highest level reached by the flood waters in the spring of 1887, made by Mayor H. Crevier, on his barn, west side of River St. Francis, 2¼ miles below Abenakis Springs hotel, viz., in compliance with departmental request. Flood level of 1888 also pointed out by Mr. Crevier; elevation = 29·59 ft. Mayor Crevier stated that according to reports received from fishermen, the ice on Lake St. Peter was in 1887-88 only from 12 to 16 in. thick against 3·0 ft. generally; the absence of a flood in the spring of 1888 is partly ascribed to this circumstance. The main reasons of the ice having remained so thin appear to be as follows: 1st. The lake froze early and at a low stage of the water. 2nd. A short time after the ice took it was covered with a sufficient depth of snow to prevent the usual rapid thickening of the crust by frost. 3rd. There were no great thaws during the winter of 1887-88, and the snow was too deep to permit of the surface water passing through and becoming incorporated with the solid lake crust. Spring flood of 1865 rose 10 in. over parlour floor of Mr. François Varville's house.
La Baie du Fèbvre Village. (Co. of Yamaska.)	94·2	39·80	. . . . .	. . . . .	. . . . .	33·86	In 1865 the water was driven by a westerly storm to near the top of a box culvert on the post road opposite Jos. Duplessis' blacksmith shop, and in 1887 the lake reached to the foot of a gate post, which was pointed out by Mr. Duplessis.

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

SOUTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Nicolet..... (Ball's Mill, near mouth of River Nicolet.) (Co. of Nicolet.)	87·8	....	.. .	33·45	33·65	33·95	In the spring of 1887 the floor of Mayor G. Ball's office was 6 in. under water; in 1886 river rose 0·3 ft. less than in 1887, and in 1885 the water only came up to top of floor; the whole according to observations made by Mr. P. D. Poirier. Mr. Anselme Proulx, who resides a short distance to the eastward of Mr. Ball's mills, states that the highest water known here is that of 12th April, 1865, when the roadway was flooded to a depth of at least 12 ft. After the roadway was covered by 8 ft. of water, which put out the fire in Mr. Proulx s stove, a violent hurricane sprung up from the westward, which rolled up the waters to an additional height of 4 ft., raising, at the same time, swells sufficiently powerful to lift up the roof of his old stone house. Total loss suffered by Mr. Proulx estimated at $1,500.
Parish of Nicolet, (Port St. Francis.) (Co. of Nicolet.)	85·4	.....	. ..	.....	.....	34·12	In April, 1887, the river rose to the top of one of the steps of the flight leading up to the first floor of the house occupied by Mr. Ernest Duval, agent of the Richelieu and Ontario Navigation Company.
Parish of Ste. Angèle. (Village of Doucet's Landing.) (Co Nicolet.)	7·88	35·20	....	.....	. ...	33·44 33·53	Flood mark No. 1 (33·44), made in the spring of 1887, 1·14 ft. below top of fence post at north-west corner of Napoléon Lamothe's garden, by Joseph Désilets, Esq., Secretary-treasurer Ste. Angèle, viz.: at the request of Mayor Léon Denoncourt, and with a view of supplying the information called for by the Public Works Department. Mark No. 2 (33·53), nail on G. T. Ry. wharf, near outer switch, which was covered by 2 inches of water at time of spring flood in 1887. Flood level of 1865 pointed out approximately by Mr. Antoine Bourgeois, 80 years of age, who stated that the water stood 1½ ft. deep in the road opposite his house.
Parish of Bécancour. (Mouth of River Bécancour.) (Co. of Nicolet.)	73·3	35·71	....	. ...	....	32·55	The spring flood waters of 1887 rose up to hook or staple on Mayor Louis Masse's barn; this level observed at special request of Public Works Department. In 1865 water came up to centre of lower panes of glass in Zéphirin Champoux's front windows. Mr. Champoux states that in 1873 the river was only 15 inches lower than in 1865.
Gentilly Village, opposite new parish church. (Co. of Nicolet.)	65·4	37·01	.....	.....	.....	32·18	Spring flood level of 1887 observed by Mr. Louis Baril, near his house, at request of Mayor Marcil Toufville, with a view of furnishing information called for by the Public Works Department. Flood mark of 1865 on Pascal Poissant's house, 3·25 ft. above window sill, pointed out by Mr. Baril. Flood level of 1873 pointed out by Mr. Poissant.

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

SOUTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
St. Pierre les Becquets, opposite parish church. (Co. of Nicolet.)	58·4	.....	....	... .	..	32·70	Frs. Magny, boatman, was commissioned in the spring of 1887, by Dr. D. U. Archambault, Mayor of St. Pierre, to make a mark at the highest flood level on the steps leading from the post road to the beach, viz.: in response to the call made by the Public Works Department. This order was carried out, but the flight of steps was displaced before the mark could be connected with a bench mark, hence the river level here is only approximate.
St. Jean Deschaillons (Co. of Lotbinière.)	52·9	.....	....	.....	...	.....	Joseph Laliberté, Esq., Mayor of St. Jean Deschaillons, called on 26th October, 1887. Mr. Laliberté received letter from Public Works Department asking him to mark highest spring flood level in 1887, too late to be able to comply with this request; it having reached him only after the débâcle was all over. He pointed out, however, the highest level to which the spring flood rose in 1873; elevation of this water level =33·60 ft.
Leclercville Village. Parish of Ste. Emélie de Lotbinière. (Co. of Lotbinière.)	46·5	.....	.. ...	30·24	.....	24·92	Highest flood levels of 1873 and 1885 marked on wall in Hon. H. G. Joly de Lotbinière's office, by the agent in charge of his saw-mills, Mr. F. Perrot; elevation of water in 1873 = 33·30 ft. In the spring of 1885 the ice was prevented from coming down Grande Rivière du Chêne, by the St. Lawrence water, which backed up into the former stream and piled up the ice to such a great height that the bridge on the post road, then quite new, was lifted up and carried away; elevation of flood waters at bridge site, 34·25 ft. Opinions of old residents of Leclercville and Lotbinière appear to be divided as to whether an ice blockade in the vicinity of Pointe Platon, or one at the narrow pass above the mouth of the Rivière Chaudière causes the greatest rise in the river level and damage to property. The highest flood level known in this locality, as well as at St. Jean Deschaillons, Grondines and Lotbinière was that which obtained in 1873.
Lotbinière .. .... (Old church flats.) (Co. of Lotbinière.)	43·4	...	..	...	.....	... .	A mark was made by Laurent Beaudin, light keeper, at the request of Mayor Edouard Noël, on the Lotbinière lighthouse pier, to indicate the highest spring flood level of 1887, as asked by the Public Works Department in a circular addressed to Mr. Noël, in April, 1887. This mark appears to have been made too high, possibly at the surface of the ice instead of the water; its elevation above datum is 26·78 ft. In the spring of 1872 the water rose six inches over first step of flight leading up to Mr. Pierre Bernier's veranda, viz.: to an elevation of 33·94 ft. Notwithstanding

TABLE XXVII.—*Continued.*

FLOOD levels established between Lachine and Quebec, etc.

SOUTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum Elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
Lotbinière—*Con.*							that the water was very high in 1873, no damage was done; but a couple of years previous, when the river did not rise near so high, the ice damaged Mr. Bernier's blacksmith's shop, and shoved his house across from the north to the south side of the roadway. In 1873 the water covered the road for four to five days, and five buildings were flooded in this locality, some being badly damaged; other demolished. When the river is blocked a short distance above the Platon, the water is generally retained at a very high level at Lotbinière and vicinity during several days, because the large cakes and fields of ice which are shoved aground on to the foreshores at Portneuf, have to pivot through an angle of nearly 90° before they can make their way past Pointe Platon. When an ice bridge is formed at the "Sault," the channel of the Richelieu Rapid also generally freezes over opposite Lotbinière shortly after, so as to afford a safe crossing for vehicles. In years when the river remains open, an ice-boat ferry service is established between Lotbinière and Deschambault and Lachevrotière on the south shore. This service is here performed with much greater facility than at Quebec city, for the strong current keeps the drifting lumps of ice well apart, so as to afford a comparatively free passage across the channel.
Pointe Platon (Co. of Lotbinière).	35·6	.....	26·27	.....	.....	23·39	Flood marks made by Joseph Auger on Hon. H. G. Joly's boat house. Mr. Auger says that during the 20 years he lived at Platon, he never saw the water rise higher than in the spring of 1884; there was at that time no marked change in the river level at either ebb or flood during some eight days. The flood level of 1887 was marked by Mr. Auger at the special request of the Public Works Department.
Ste. Croix wharf (Co. of Lotbinière).	29·4	26·55	26·39	.....	.....	.....	In the spring of 1884 the floor of Captain F. Boisvert's verandah was covered by 1½ inches of water, and in 1865 Captain Boisvert states, the river stood about 3½ inches over this floor. (*See* Mayor F. Boisvert's reply to departmental circular of 26th April, 1887, Appendix No. 20).
St. Antoine, foot of Coté's hill, 2 miles below parish church	19·6	.....	26·34	.....	.....	.....	Flood level of 1884 marked on Isaac Daigle's boat house at the foot of Coté's hill. Mayor N. Dion, in compliance with request of Public Works Department, made a flood mark on the same boat house; but Mr. Dion was absent when St. Antoine was visited 19th October, 1887, and no one present could point out the mark. (*See* Mr. Dion's reply to departmental circular, Appendix No. 20).

TABLE XXVII.—*Concluded.*

FLOOD levels established between Lachine and Quebec, etc.

SOUTH SHORE, RIVER ST. LAWRENCE.

Locality.	Total distance in miles by river above Quebec.	Maximum elevations in feet above mean sea level of spring floods, according to local information.					Remarks.
		1865.	1884.	1885.	1886.	1887.	
St. Nicholas, Baker's wharf (County of Lévis).	11·3	. . . .	.....	.. ...	.....	.....	In the vicinity of St. Nicholas the river banks are high and steep, hence no inconvenience is felt from spring floods, nor have I succeeded in obtaining any positive information relative to the flood levels of this part of the St. Lawrence, notwithstanding that tremendous ice shoves and jams occasionally take place, as may be judged from the following: Capt. Angus Baker, whose residence stands on a high plateau directly opposite his wharf, related to me that in the spring of 1884, at the time of the débâcle, it happened one day that the ice was piled up to such an extraordinary height in front of the wharf, as to completely hide from his view, when standing close to the fence in front of his house, the hills which rise directly opposite the latter on the north shore of the St. Lawrence. Special measurements were made with the object of determining the minimum height above the river bed of an obstruction from 200 to 600 ft. outside of the wharf, that would hide the hills on the north shore when viewed from the spot pointed out by Capt. Baker. The result of the computations made in this connection is: that the ice must have been piled up in the spring of 1884, from 110 to 125 ft. or more in height above the bed of the river.

In addition to the tidal diagrams and illustrations already mentioned, I further submit herewith :

1° A profile of the River St. Lawrence between Quebec and Lachine, in one length (Ill. No. XXIV.); horizontal scale $\frac{1}{48000}$ or 4,000 ft per inch ; vertical scale $\frac{1}{192}$ or 16 ft. per inch. From Quebec to Montreal the axis of the ship channel has approximately been followed, thence to Lachine, the waters edge, along both the north and south shores.*

2° Two sets of typical local tide curves which obtain at the places where continuous series of tidal observations were made, plotted in chronological order and at their proper elevations above the mean level of the sea—together with two series of characteristic hourly instantaneous ebb and flood curves, extending from Quebec up to Lake St. Peter. In constructing the local curves, the times were laid down as abscisass to a scale of 1 inch per hour, and the heights of the water as ordinates to a scale of $\frac{1}{2}$ inch per foot. The horizontal scale adopted for the hourly instantaneous curves is 5 miles per inch and the vertical $\frac{1}{2}$ inch to the foot. (*See* Illustration No. XXV.)

PROFILE OF THE ST. LAWRENCE BETWEEN QUEBEC AND LACHINE.

Illustration XXIV.

On this profile several of the characteristic or typical flood and high and low water levels above determined and some instantaneous curves are laid down. The whole of the permanent and many of the temporary bench marks established on both sides of the river, are also indicated, together with the parishes, principal landing places, corrected establishments of the tide stations, etc., etc.

In constructing this longitudinal section of the river, the distances and depths were taken from the admiralty charts, cadastral and other maps obtained at the Quebec Crown Lands Department, plans of the river furnished by the Montreal Harbour Commissioners and other documents on record in the Public Works Department.

In reference to the depths, I have to state that there exists in many cases much uncertainty respecting the particular stage of the river, or kind of tide, to which the soundings given on the plans correspond. Under the circumstances, I have endeavoured, both as regards depths and distances, to make the best use possible of the official documents and other information available, which, I may intimate, is neither as complete or reliable as would be desirable.

The various high and low water levels and loci and instantaneous curves indicated on the profile, may be enumerated and described as follows ; commencing at the lowest, near the eastern end, viz. :—

(a) Approximate lowest possible water level during season of navigation, at lowest known stage of river proper 20·85 ft. above datum at Verchères, with persistent high westerly winds and corresponding to springs of maximum importance (118) up to Pointe aux Trembles *(en bas)*, or St. Croix, and to neaps of minimum importance (30), thence westward.

(b) Low water datum level proposed for the reduction of soundings, so as to indicate the minimum depths that may be safely counted upon for navigation purposes in the ship channel. This line represents, as already explained, the locus of the lowest possible troughs of tide waves, whether at springs or at neaps, with a fluvial discharge corresponding to the standard low mean river level of 21·50 ft. above datum at Verchères, and 16·0 ft. over mitre sill, foot of old lock No. 1, Lachine Canal ; the weather, inclusive of atmospheric pressure, being assumed to be in a normal condition.

* Profile of ship channel in one length lithographed $\frac{64}{100}$ of original size, to accompany Official Report of Hon. the Minister of Public Works for fiscal year 1890-91. Horizontal scale $\frac{1}{75000}$ or 6,250 ft. per inch ; vertical scale $\frac{1}{300}$ or 25 ft. per inch.

(c) The level which the St. Lawrence would assume, approximately, if the estuary was abstracted from the influence of the tides, with 16 ft. depth over the sill of old lock No. 1, corresponding to mean surface elevation 21·50 ft. at Verchères. In such case the total fall would be from Montreal, foot of Lachine Canal, to the Graving Dock at St. Joseph de Lévis, Quebec harbour, 27·54 ft. — 1·15 ft. = 26·39 ft. in a distance of 163¼ miles.

(d) Instantaneous curve, ordinary ebb, low water season (October, 1887), corresponding to half-tide level at St. Jean Deschaillons.

(e) Instantaneous curve, ordinary flood, low water season, corresponding to half-tide level at St. Jean Deschaillons.

These two instantaneous low water curves are for a tide having an astronomical coefficient of about 71, with the river level 22·0 ft. above datum at Verchères, and 16·5 ft. over the sill of old lock No. 1, Lachine Canal. They represent the mean of the longitudinal profiles presented by four waves having coefficients of 39, 117, 41 and 86.

(f) Instantaneous curve, ordinary ebb, high water season (May, 1888), corresponding to half-tide level at St. Jean Deschaillons.

(g) Instantaneous curve, ordinary flood, high water season ; corresponding to half-tide level at St. Jean Deschaillons.

These two instantaneous high water curves are for a tide having an astronomical coefficient of 70, with the river level 30 ft. above datum at Verchères, and 23·0 ft. over sill of old lock No. 1, Lachine Canal. They indicate the mean of the logitudinal profiles of four fluvial waves having coefficients of 44, 82, 46 and 107.

(h) Lowest water possible at high tide during season of navigation with river at lowest normal stage.

(i) Highest water possible at high tide during season of navigation, with river at lowest normal stage.

The first of the two water lines last described is the locus of the wave summit of a neap tide of minimum importance, with a theoretical amplitude corresponding to coefficient 30 ; and the second, the locus of the summit of a spring tide of maximum astronomical importance corresponding to coefficient 118 ; the river being in each case at the low normal stage when the water surface stands at elevation 21·50 ft. at Verchères, and 16 ft. over the sill of old lock No. 1, Lachine Canal.

(j) Highest water possible during season of navigation, with weather, including atmospheric pressure, in a normal state. This, as already explained, is the locus of the high tide levels of a spring tide having a theoretical amplitude of 108 (the highest possible in May), with the river at the highest known level, viz., 36·32 ft. over datum at Verchères.

(k) Highest water observed at Quebec and vicinity during the season of navigation, viz., 5th November, 1884, resulting from spring tides of a theoretical importance of 106, driven up by a north-easterly hurricane; the river being 17'-6" over sill old lock No. 1, Lachine Canal.

(l) Approximate locus of highest known levels reached by floods resulting from obstruction of waterway by ice or from wind pressure, or from both combined, from St. Augustin and St. Nicholas to Montreal and Lachine Rapids.

LOCAL AND INSTANTANEOUS TIDE CURVES.

Illustration No. XXV.

These curves correspond :

(a) To the spring tide of greatest importance, observed at the time of the year (autumn) when the oceanic waves are least disturbed by the fresh water discharge of the river, viz.: to the spring tide of 18th October, 1887, when the depth on the lower mitre sill of old lock No. 1, Lachine Canal, was 16·67 ft., and the astronomical tidal coefficient 117, or only 1 below its greatest possible value (118).

(b) To the least neap tide observed during the season (spring) when the regular propagation of the pendular oscillations generated in the open Atlantic, is interfered

with to the greatest possible extent by the large volume of drainage water carried by the River St. Lawrence, viz.: to the neap tide of 20th May, 1888, having a theoretical coefficient of 46, and with a depth of from 24·5 ft. to 24·6 ft., on the lower mitre sill of the lock just mentioned.

In all the local tide curves of places on the upper portion of the St. Lawrence which have been constructed, only one maximum obtains between the two consecutive low tide levels and one minimum between two consecutive high tide levels, nor do these curves appear to possess any features that might be considered singular or original in other respects, and that require to be specially noticed. The local curves serve to show, in a striking manner, the decreased duration of the floods and the correspondingly increased duration of the ebbs as we proceed up stream, which is the case on all estuaries; also, the extent to which the low water level may sink to the eastward of, say, Ste. Croix, and rise simultaneously to the westward of this place during series of gaining tides, or *vice versa*, when the tides are losing in importance, the diminished amplitudes of the high water season in comparison to those of the low water season.

Possibly some swellings and depressions in the local curves may be caused, here as along other sea coasts, by undulations having shorter periods than half a lunar day; but this can in any case be satisfactorily ascertained only at points on the lower St. Lawrence, where the regular propagation of the tidal oscillations is much less disturbed by the fresh water discharge and marked changes in the elevation and general conformation of the bed of the estuary than above Quebec city.

The hourly instantaneous curves indicate clearly the nature of the surface declivities of the St. Lawrence estuary, for typical phases of the fluvial intumescence which is generated by spring tides of very nearly absolute maximum astronomical importance when the river is at a very low stage, and also for corresponding phases of low astronomical neaps at the time the fresh water stream is most powerful.

On Admiraly Charts "No. 2830*a*—from Quebec to Pointe du Lac" (Ill.: XXVI.) and "No. 2830*b*—From Pointe du Lac to Lachine" (Ill. XXVII.), to both of which reference has already been made herein, the lines of geodetic levels run along the rivers Richelieu and St. Lawrence, inclusive of river crossings, check and loop lines, etc., are laid down and the positions of the bench marks indicated, all in red. Average scale of map No. 2830*a*, 10,325 ft. per inch, ditto of map No. 2830*b*, 10,423 ft. per inch nearly, shrinkage of paper taken into account in both instances. The most important results deduced from the complete monthly series of tidal observations and river gaugings which were made during the low water season of 1887, and the high water season of 1888 as well as the description and elevations of the more prominent bench marks, have been printed on the charts in tabular form, also in red. The axis of the ship channel and the elevations above the mean level of the sea of the low water datum level proposed for the reduction of soundings, so as to indicate the minimum depths that may be safely counted upon for navigation purposes in the said channel, are shown in blue.

Finally, a profile of the St. Lawrence ship channel between Quebec and Montreal, including, besides all the characteristic tide and river levels already enumerated, the approximate line to which the Admiralty soundings appear to have been reduced, and a profile of the navigable channel of the whole River Richelieu, from Rouse's Point, Lake Champlain, to Sorel, have been added on these charts to a horizontal scale of 30,000 ft. and a vertical scale of 40 ft. per inch, as also, reductions of the series of typical local and instantaneous hourly tide curves already described.*

*The charts, with additions above described, have been reproduced by lithography, each in two parts, having the same width as the Official Report and marked *a* and *b*; the plans of the rivers being enlarged uniformly to $\frac{1}{120000}$, which corresponds to a scale of 10,000 ft. per inch.

Illustration No. XXVI*a* comprises the plan of the River St. Lawrence, Quebec to Pointe du Lac, with corresponding profile of ship channel. On No. XXVI*b* are shown the local and instantaneous hourly tide curves, together with the chief results of the tidal observations and river gaugings of 1887-88, in tabular form.

No. XXVII*a* is a plan of the St. Lawrence, Pointe du Lac to Montreal and Lachine, with corresponding profile of ship channel, etc. No. XXVII*b* is a plan of the whole River Richelieu to the same scale as the St. Lawrence, viz.: 10,000 ft. per inch, with profile of navigable channel.

RATES OF RISE AND FALL OF TIDES, QUEBEC TO BATISCON.

According to the typical local tide curves constructed and the results of the series of continuous observations made in 1887-88 generally, the maximum rates of rise and fall of the tide water obtained at the gauging stations between Quebec and Batiscan, under ordinary conditions as regards wind and weather, at springs of maximum importance during the low water season of the year, viz. : as shown hereunder :—

TABLE XXVIII.

Gauging Stations.	Maximum rates of rise of flood.	Time after low water.	Maximum rates of fall of ebb.	Time after high water.
	Feet per hour.	H. M. H. M.	Feet per hour.	H. M. H. M.
Lévis Graving Dock	9·00	0·23 to 0·48	4·90	0·46 to 1·32
Chaudière	7·80	0·13 " 0·43	3·60	0·37 " 1·55
St. Nicholas	6·90	0·14 " 0·48	3·00	0·42 " 1·45
Pointe Platon	5·00	0·11 " 1·13	3·00	0·28 " 1·11
Grondines	3·60	1·11 " 2·11	2·10	0·33 " 1·07
St. Jean des Chaillons	2·80	1·03 " 2·24	1·60	0·20 " 0·57
Batiscan	2·00	1·04 " 1·41	0·80	0·08 " 0·42

In computing the typical mean rates of rise and fall which are entered in the following table (XXIX.), the portions of both the ebb and flood tide ranges corresponding to the stand within 0·05 ft. at high and low water, have been purposely eliminated throughout. This was done with a view of indicating, as closely as practicable, in connection with the above absolute maximum and minimum rates, the general nature of the hourly fluctuations, in the level of the estuary at the gauging stations during the high and low water seasons.

TABLE XXIX.

Gauging Stations.	Mean rates of rise of floods observed during the low water season of 1887, corresponding to :			Mean rates of fall of ebbs observed during the low water season of 1887, corresponding to :			Mean rates of rise of floods observed during the high water season of 1888, corresponding to :			Mean rates of fall of ebbs observed during the high water season of 1888, corresponding to :		
	Maximum spring ranges	Minimum neap ranges	Average ranges of a complete lunar month	Maximum spring ranges	Minimum neap ranges	Average ranges of a complete lunar month	Maximum spring ranges	Minimum neap ranges	Average ranges of a complete lunar month	Maximum spring ranges	Minimum neap ranges	Average ranges of a complete lunar month
	Feet per hr	Feet per hr	Feet per hr	Feet per hr	Feet per hr	Feet per hr	Feet per hr	Feet per hr	Feet per hr	Feet per hr	Feet per hr	Feet per hr
Lévis Graving Dock	4·20	2·02	2·91	2·36	1·42	1·92	4·18	2·15	3·01	2·20	1·39	1·84
Chaudière	3·85	1·99	2·87	2·29	1·49	1·89	4·04	2·11	2·90	2·18	1·38	1·80
St. Nicholas	4·00	2·03	2·85	2·20	1·50	1·87	3·72	2·08	2·80	2·08	1·36	1·77
Pointe Platon	3·43	2·13	2·65	1·79	1·31	1·56	3·66	2·04	2·79	1·60	0·90	1·27
Grondines	2·46	1·32	1·95	1·09	0·72	0·96	2·66	0·83	1·59	0·78	0·33	0·58
St. Jean Deschaillons	1·88	0·93	1·45	0·81	0·58	0·66	1·87	0·49	1·04	0·53	0·18	0·35
Batiscan	1·37	0·34	0·87	0·44	0·17	0·30	1·11	0·19	0·49	0·26	0·08	0·16

TABLE XXX.

Slope of St. Lawrence, corresponding to lowest normal tide and river levels between Quebec and Montreal.

No. of Reach.	Total distance above Graving Dock in miles.	Intermediate distances in statute miles.	Localities.	Surface declivity of stream in feet, corresponding to low water datum, proposed for minimum depth in ship channel.	Hydraulic inclination in feet per mile.
	0	.....	Graving dock, St. Joseph de Lévis.		
1°	.....	8¼	.....	0·010	0·00120
	8¼	.....	Lower end of narrow gorge on St. Lawrence, known under the name of "Le Sault," near mouth of River Chaudière.		
2°	.....	1	.....	0·360	0·36000
	9¼	.....	Basile's Hill (south shore). Upper end of narrow gorge known as "Le Sault."		
3°	.....	4¼	.....	0·755	0·17765
	13½	.....	Baker's wharf, St. Nicholas (south shore).		
4°	.....	2½	.....	0·875	0·35000
	16	.....	Point 1¼ mile below St. Augustin church (north shore).		
5°	.....	4	.....	0·840	0·21000
	20	.....	Pointe Aubin (south shore) or Fréchette's Island (north shore).		
6°	.....	17½	.....	0·749	0·04280
	37½	.....	Pointe Platon, Hon. Mr. Joly de Lotbinière's wharf.		
7°	.....	4½	.....	0·281	0·06244
	42	.....	Foot of Richelieu Rapid, opposite Deschambault wharf, ½ mile below Richelieu Island.		
8°	.....	2½	.....	3·760	1·50400
	44½	.....	Head of Richelieu Rapid, opposite Lotbinière church.		
9°	.....	4½	.....	0·450	0·10000
	49	.....	Grondines wharf (north shore).		
10°	.....	2½	.....	0·940	0·37600
	51½	.....	Grondines Point (north shore) and Cap Charles (south shore).		
11°	.....	2½	.....	1·474	0·58960
	54	.....	St. Jean Deschaillons wharf, Cap à la Roche.		
12°	.....	1½	.....	2·406	1·60400
	55½	.....	Head of Cap à la Roche rapid.		
13°	.....	6	.....	1·282	0·21367
	61½	.....	Batiscan (north shore), Brunelle's wharf.		
14°	.....	7¼	.....	1·108	0·15283
	68¾	.....	Champlain, Gagnon's wharf.		
15°	.....	8¼	.....	1·280	0·15515
	77	.....	Head of Provencher shoal.		
16°	.....	3¾	.....	1·160	0·30933
	80¾	.....	Grand Trunk Railway wharf, Doucet's Landing, south shore, opposite Three Rivers.		
17°	.....	6¼	.....	0·110	0·01466
	87	.....	Port St. Francis, lower end of Lake St. Peter.		
18°	.....	20¾	.....	1·610	0·07759
	107¾	.....	Mouth of River Yamaska, head of Lake St. Peter.		
19°	.....	9¾	.....	1·070	0·10974
	117½	.....	Sorel, mouth of River Richelieu.		
20°	.....	18	.....	2·170	0·12055
	135½	.....	Upper end of chain of islands along south shore, 3 miles above Contrecœur wharf.		
21°	.....	4¾	.....	0·400	0·08421
	140¼	.....	Verchères wharf.		
22°	.....	8½	.....	1·570	0·18471
	148¾	.....	Varennes wharf.		
23°	.....	5	.....	1·060	0·21200
	153¾	.....	Boucherville wharf.		
24°	.....	5½	.....	1·130	0·20545
	159¼	.....	Longueuil Government wharf.		
25°	.....	1¾	.....	0·680	0·38857

TABLE XXX.—*Con.*

Slope of St. Lawrence, corresponding to lowest normal tide and river levels between Quebec and Montreal.

No. of Reach.	Total distance above Graving Dock in miles.	Intermediate distances in statute miles.	Localities.	Surface declivity of stream in feet, corresponding to low water datum, proposed for minimum depth in ship channel.	Hydraulic inclination in feet per mile.
	161	.....	Foot of St. Mary's current, opposite Ile Ronde.		
26°	.....	$\frac{3}{8}$	.....	1·000	2·66667
	$161\frac{3}{8}$	.....	Head of St. Mary's current, opposite St. Helen's Island ferry landing.		
27°	.....	$1\frac{3}{8}$	.....	0·680	0·49455
	$162\frac{3}{4}$	.....	Foot of Lachine Canal.		
		$162\frac{3}{4}$	..... Totals.....	29·210	

Inward bound vessels for the port of Montreal, have to ascend portions of one or more, and possibly of the whole of the characteristic acclivities of the stream enumerated and described above in Table XXX., which obtain during the low water season between Quebec and Montreal.

According as the speed of the incoming ship exceeds or falls short of the rate of advance of the head of the flood, the incline which she has to ascend at any point is steeper or flatter than that indicated in the table. On the other hand, the benefit which a vessel going down the St. Lawrence derives at any point, as regards impulsion, from the slope of the stream is, during floods: smaller than that which would result from the corresponding declivity given in Table XXX.; diminishing as the speed of the ship increases, and during ebbs: larger than the tabular declivity; increasing with the speed of the ship.

TIDAL CURRENTS INDUCED BY FLUVIAL UNDULATIONS.

On the St. Lawrence, as in the tideway of every other large river flowing into the sea, the stream of ebb continues to make at any point P, for a short time, say $\frac{1}{4}$ to 1 hour, or more, after the hour of low water. During this space of time a portion of the liquid needed to insure the unbroken propagatian of the incoming fluvial intumescense caused by an oceanic tide wave, viz., over the part of the estuary lying below the point P, is derived from the drainage water carried by the river proper and the body of tide water accumulated in the estuary on the up stream side of the cross section corresponding to the said point.

At slack water of ebb, no more river or tide water from above is required, to satisfy the condition just mentioned of the continuous propagation of the fluvial undulation, which is thenceforth formed entirely by liquid drawn from the portion of the estuary on the down stream side of the cross section at P. After increasing gradually for some time, say from $\frac{3}{4}$ to 1 hour, or more, from the instant of slack water, the longitudinal translation of liquid particles in the fluvial undulation proper up the estuary, which constitutes the stream of flood, continues to take place in a comparatively uniform and steady manner for, say, from 1 to 3 hours. After this, the flood stream gradually loses in strength, and makes after high water during the ebbing of the tide, for just such a length of time as will, under the circumstances, ensure the continuous propagation of the ascending wave on the up stream side of P, with the least possible expenditure of energy.

At the instant of slack water of flood, the horizontal translation of liquid particles from the down stream to the up stream side of P is needed no more to satisfy the condition just mentioned of the formation of the incoming undulation, and the tide water remaining in the estuary commences to return seaward, constituting the stream of ebb. This stream assumes a velocity in accordance with the slope that establishes itself at every instant either between the summit of the tide wave and the sea, when, as is invariably the case in tideways of moderate length, one-half an undulation, at most, can find place therein at one time, or else between the wave crest and the head of the incoming flood, when the estuary is of such vast proportions, as in the case of the St. Lawrence, that the whole force of one tidal oscillation is expended previous to a second wave making its way up the river.

For an hour or two, or more, from slack water of flood, the outward current gradually gains in strength till the flow becomes comparatively steady and uniform, and thus the water continues to flow seaward for from 3 to 5 hours or more, when the stream of ebb diminishes in a sensible manner until it becomes perfectly slack again, a short time after low water. As already explained, the length of time which this stream, yet steady at dead low water, continues to obtain thereafter while the tide rises, is such; that the quantity of liquid required for the unbroken propagation of the fluvial wave on the down stream side of the point P, up to the instant of slackwater of ebb, may be supplied in the easiest way possible under the circumstances.

It is noteworthy that the direction followed by the tidal stream at any point P, cannot always be inferred from that of the surface slope of the water. In the portion of the estuary between Quebec and Batiscan, the stream of ebb continues, as well known, say 1 to 3 hours, or more, after low water, and while at Quebec the stream of flood already makes about 1 hour after low water; at Batiscan this stream practically ceases to be felt, nevertheless, at springs, during the low water season, the surface declivity of the river assumes, at every point along this stretch, a westerly or up stream direction, immediately after the tide reaches its lowest point. In the spring of the year, however, when the volume of drainage water, carried by the river proper, is very great, the surface slope of the tideway is, at low water of neaps, generally, if not always, in an easterly or down stream direction at points to the westward of Pointe Platon.

In the summer of 1882, while engaged on the hydrographic survey between Quebec and Cap à la Roche, which was commenced under my direction in 1881, I had velocities of tidal currents measured at several points in the ship channel between Pointe aux Trembles (*en bas*) and Pointe Platon. The measurements were made with Massey's patent log, at intervals of 5 minutes; the current meter being immersed now for 5 and again for 10 minutes at a time. The rise and fall of the tide was also ascertained simultaneously, with the aid of a tide staff anchored out in the river, beyond low water mark, in about 8 feet depth; the elevations of the water registered at intervals of from 1 to 6 minutes.

On Saturday, 26th August, 1882, when an easterly to south-easterly breeze of from 4 to 16 miles an hour was blowing, measurements were made continuously at a point in the ship channel 2½ miles below Pointe aux Trembles wharf, from 9·30 a.m. to 6 p.m., an interval which covered fully an entire flood tide of 4 hours and 55 minutes duration, and having a range of 11·10 ft., together with the first quarter of the succeeding ebb past slack water, and the last three quarters or so of the preceding ebb. Again, on the following Monday, 28th August, 1882, when there was little or no wind, a series of current measurements was made, embracing a complete ebb of 7 hours and 51 minutes duration, and having an amplitude of 14·0 ft., together with the first half or so of the succeeding flood, viz., past slack water.

On illustration No. XXVIII. are shown, at the proper elevation above the approximate mean sea level datum, local tide curves in blue and corresponding current curves in red, which are based on the observations and measurements made 26th and 28th August, 1882, above referred to. In constructing the current curves the times were represented by abscissas, one inch being allowed per hour, the same as the local tide curves, while the scale of the ordinates was fixed by the consideration that the differ-

ence in elevation of the slack water levels of ebb and flood would have to indicate the total distance passed over by the stream, in each case, between two consecutive instants of slack water.

TABLE XXXI.

Flood Stream.

Time, Saturday, 26th August, 1892.	Elevation of Water.	$+r$ Rate of rise of flood, $-r$ Rate of fall of ebb.	$+v$ Velocity of stream of flood, $-v$ Velocity of stream of ebb.	$\frac{v}{r}$	Remarks.
	Feet above datum.	Feet per hour.	Miles per hour.		
12·10 p.m...	4·35	—1·26	—3·5572	.....	
12·30 do ..	3·90	—1·20	—3·7696	.....	End of steady ebb stream.
12·50 do ..	3·70	0·00	—3·5615	.....	Dead low water.
1·15 do ..	4·10	2·28	—2·6911	.....	
2·00 do ..	6·47	2·76	—0·1391	.....	
2·17 do ..	7·33	3·03	0·0000	0·0000	Slack water of ebb.
2·30 do ..	7·99	2·40	0·3399	0·1416	Pleasant south-easterly breeze.
2·40 do ..	8·29	2·28	0·5141	0·2255	
2·50 do ..	8·75	2·88	1·2668	0·4398	
3·00 do ..	9·25	2·73	1·7577	0·6438	1·952 ft. per hour maximum velocity of flood stream.
3·15 do ..	9·86	2·58	1.9520	0·7566	
3·20 do ..	10·06	2·67	1·8912	0·7083	
3·40 do ..	11·00	2·64	1·9273	0·7300	
4·00 do ..	11 98	3·27	1·8158	0·5553	
4·20 do ..	13·03	2·55	1·6750	0·6569	
4·30 do ..	13·37	1·68	1·5920	0 9476	Wind easterly, 8 miles per hour.
4·40 do ..	13·59	1·38	1·5892	1·1516	
4·50 do ..	13·83	2·13	1·5167	0·7121	
5·00 do ..	14·30	2·01	1·2833	0·6409	
5·10 do ..	14·50	0·90	1·2252	1·3613	
5·20 do ..	14·60	0·90	0·9828	1·0920	
5·30 do ..	14·79	0 60	0·7742	1·2903	
5·45 do ..	14·80	0·00	0·2880	.....	Top high water.
5·50 do ..	14·80	—0·30	0·1960	.....	
6·16 do ..	14·38	—1·23	0·0000	.....	Slack water of flood. South-east wind, 16·8 miles per hour.
6·30 do ..	14·09	—1·29	—0·1841	.....	

Now the corresponding local flood and current curves for August 26, 1882, plotted in accordance with the above data (*See* illustration No. XXVIII.) are both, not only nearly straight; but also nearly parallel during the interval of 1h. 30m. between 3 p.m.—or 2 hours and 10 minutes after low tide—and 4.30 p.m., or one hour and 15 minutes within the succeeding high water. Hence, at Pointe aux Trembles (*en bas*) during the interval of flood just mentioned, or any corresponding interval; the value of the ratio $\frac{v_f}{r}$ between the rate of rise r of the flood, and the velocity v_f of the current, remains sensibly the same, and is nearly equal to the mean value of $\frac{v_f}{r}$, corresponding to the interval between slack water of ebb and the succeeding slack water of flood.

It will be seen, nevertheless, from an inspection of the results entered in table XXXI., that although the general parallelism of the corresponding flood tide and current curves indicates that v_f is on the whole directly proportioned to r: on 26th August, 1882, both the rate of rise r of the tide and the velocity v_f of the flood stream

oscillated incessantly within narrow limits about their average or continuous values, and it looks as if $\frac{v}{r}f$ and r varied, sometimes at least, in opposite directions. No doubt, some of these passing irregularities are due to errors of observation made in estimating the elevation of the water, as indicated by a plain tide staff anchored out in the river, and therefore unprotected from swells and the splash of waves. Some irregularities were also probably caused by the easterly breeze which was blowing at the time, others again by passing vessels, indeed, the water in the basin between St. Nicholas and Pointe Platon appeared to be almost continually in an unsettled state of equilibrium.

Mean value of $\frac{v}{r}f$, for the interval of 1h. 30m. from 3 p.m. to 4.30 p.m.=

$$\frac{1{\cdot}8319 \text{ miles p. hour}}{2.75 \text{ ft.}} = 0{\cdot}6661.$$

Mean value of $\frac{v}{r}f$ from slack water of flood, at 2h. 17m., viz.: 1h. 27m. after low water, to slack water of ebb at 6h. 16m. p.m., viz.: 31 minutes after high water, forming an interval of 3 hours and 59 minutes =

$$\frac{1{\cdot}1825 \text{ miles p. hour}}{1{\cdot}7699 \text{ feet per hour}} = 0{\cdot}6682.$$

TABLE XXXII.

Ebb Stream.

Time, Saturday, August 28, 1882.	Elevation of Water.	$-r$. Rate of fall of ebb. $+r$. Rate of rise of flood.	$-v$. Velocity of stream of ebb. $+v$. Velocity of stream of flood.	$\frac{v}{r}$.	Remarks.
	Feet above datum.	Feet per hour.	Miles per hour.		
A.M.					N.N.W. wind barely perceptible.
6.46	17·90	.....	.....	.....	Top high water.
7.15	17·57	−1·38	0·000	0·000	Slack water of flood.
7.45	16·39	−2·22	−0·7383	0·3326	
8.00	15·84	−2·40	−1·4339	0·5975	
8.30	14·64	−2·28	−2·7511	1·2066	Calm.
9.00	13·50	−2·37	−3·3685	1·4213	
10.00	11·45	−1·77	−4·1931	2·3690	
11.00	9·66	−1·50	−4·2321	2·8214	Sky overcast.
12.00	7·83	−1·83	−4·3541	2·3793	S.S. wind just perceptible.
P.M. 1.00	6·14	−1·92	−4·6892	2·4423	
2.00	4·58	−1·38	−4·4352	3·2139	
2.15	4·25	−1·26	−4·8273	3·8312	4·827 miles per hour, maximum velocity of ebb stream.
2.39	3·90	−0·00	−4·3704	S	Dead low water.
3.00	4·61	+3·66	−3·1115	.....	
3.15	5·56	+4·62	−1·9554	.....	Calm.
3.45	7·84	+3·90	0·0000	.....	Slack water of ebb.
4.00	8·54	+2·55	+0·2083	.....	Northerly wind, 2 miles per hour.
4.15	9·14	+2·82	+1·1410	.....	
4.45	10 86	+3·42	+2·4184	.....	Wind gone down.

Mean value of $\frac{v_e}{r}$ from 10 a.m. to 2.30 p.m.—an interval of 4h. 30m. during which the ebb stream remained nearly uniform:

$$= \frac{4{\cdot}4030 \text{ miles per hour}}{1{\cdot}6711 \text{ feet per hour}} = 2{\cdot}6348.$$

Mean value of $\frac{v_e}{r}$ from slack water of flood at 7.15 a.m., or 29 minutes after high water, to slack water of ebb at 3h. 45m., or 1h. 6m. after low water, forming an interval of 8h. 30m. $= \frac{3{\cdot}4860 \text{ miles per hour}}{1{\cdot}1447 \text{ feet per hour}} = 3{\cdot}0453.$

Information respecting the elevations of various points above mean sea level, etc. has already been furnished, upon application, to many engineers and other parties, among whom are the following gentlemen :—Revd. Professor A. K. Laflamme, Laval University ; Thos. Monro, Esq., E. H. Parent, Esq., St. Geo. Boswell, Esq., Thos. Berlinguet, Esq., and J. O. Mignault, Esq., Civil Engineers ; and Dr. L. Laberge, Medical Officer, Montreal, and it is desirable that all levels taken hereafter, for this or any other department of the public service, be referred to the mean sea level by connecting the same, whenever practicable, with one of the geodesic bench marks made under my direction.

As regards this department, a circular over your own signature addressed to the engineers under your control would evidently prove the best, if it is not the only way of attaining the object in view, viz. : the adoption of one and the same datum (the mean level of the sea) for all elevations determined, whether of the water or of the land.

In conclusion, I have again to bring under your notice the important services which have been rendered, both in the field and in the office, by Mr. Chas. Chaloner, as assistant engineer and draughtsman, and Mr. H. J. Friel as principal rodman, computing clerk, etc. I may add that in connection with the work, Mr. Alf. Dostaler has proved himself to be a competent, painstaking employee.

I have honour to be, sir,

Your obedient servant,

(Signed) R. STECKEL,

Engineer in charge.

PUBLIC WORKS, CANADA,

GEODETIC LEVELLING.

WATER LEVELS, RIVER ST. LAWRENCE,

BETWEEN

QUEBEC, MONTREAL AND LACHINE.

LIST OF ILLUSTRATIONS ACCOMPANYING REPORT ADDRESSED TO CHIEF ENGINEER, BY R. STECKEL, ENGINEER IN CHARGE OF LEVELLING AND GAUGING OPERATIONS, ETC., UNDER DATE OF 24TH NOVEMBER, 1891, INCLUDING REFERENCES TO COLOURS USED ON SAME.

REPORT

ON

WATER LEVELS, RIVER ST. LAWRENCE,

BETWEEN

QUEBEC, MONTREAL AND LACHINE

BY

R. STECKEL, CIVIL ENGINEER

24TH NOVEMBER, 1891.

List of accompanying illustrations and references to colours used on the same.

*I.—View of tide gauge, as put up for transportation.

*II.—Tide gauge in position for work.

*III.—Diagrams showing vertical movements of summits and troughs of tide waves for: 1°. Cumberland Basin, Bay of Fundy; 2°. Baie Verte, Gulf of St. Lawrence; 3°. Rimouski; 4°. Quebec City; 5°. Pointe Platon; 6°. Grondines; 7°. Sorel, high and low water levels, plotted as ordinates in the order of the ranges of tides; these being laid down as abscissas. Scale 5 ft. per inch.

*IV.—Diagrams showing discrepanecies between computed and observed times of high water, for the low water season of 1887, and the high water season of 1888, Lévis Graving Dock. Scale of abscissas, 40 hours per inch. Scale of ordinates, 20 minutes per inch.

*V.—Diagrams showing discrepancies between computed and observed times of high water, for the low water season of 1887 and the high water season of 1888, Batiscan. Scale of abscissas, 40 hours per inch. Scale of ordinates, 20 minutes per inch.

*VI., VII., VIII., *IX., X.—Diagrams showing fluctuations of high, low and mean tide levels at the Lévis Graving Dock, River Chaudière, St. Nicholas, Pointe Platon, Grondines, St. Jean des Chaillons, Batiscan and Champlain gauging stations, during the low water season of 1887. Scale of abscissas, 20 hours per inch. Scale of ordinates, 2 ft. per inch.

*XI.—Diagram showing tide and river water fluctuations during the low water season of 1887 at Doucet's Landing (opposite Three Rivers), Port St. Francis, Sorel, Contrecœur, Verchères and Longueuil. Scale of abscissas, 20 hours per inch. Scale of ordinates, 2 ft. per inch.

XII., XIII., *XIV.—Diagrams showing fluctuations of high, low and mean tide levels at the Lévis Graving Dock, River Chaudière, St. Nicholas, Pointe Platon, Grondines, St. Jean des Chaillons, Batiscan and Champlain gauging stations, during the high water season of 1888. Scale of abscissas, 20 hours per inch. Scale of ordinates, 2 ft. per inch.

*XV.—Diagram showing tide and river water fluctuations during the high water season of 1888, at Doucet's Landing, Port St. Francis, Sorel, Contrecœur, Verchères and Longueuil. Scale of abscissas, 20 hours per inch. Scale of ordinates, 2 ft., per inch.

* Lithographed full size to accompany Official Report of Minister of Public Works for fiscal year 1890-91.

XVI. to XXII.—Diagrams showing geometrical loci of amended high and low tide levels for the low and high water seasons, at the Lévis Graving Dock, St. Nicholas, Pointe Platon, Grondines, St. Jean Deschaillons, Batiscan and Champlain gauging stations ; also, loci of amended river levels at Verchères, as taken off diagrams Nos. VI to XV when plotted as ordinates in the order of the corresponding astronomical coefficients of tidal importance laid down as abscissas. Scale of abscissas, 10 hundreths (centièmes) per inch. Scale of ordinates, 2 ft. per inch.

**XXIII.—Diagram showing simultaneous gaugings made under the supervision of the Montreal Flood Commission at Laprairie, St. Lambert, Montreal, Hochelaga, Longue Pointe, Boucherville, Varennes and Sorel, December, 1886, to April, 1887, at their proper elevations above the mean sea level datum.

†XXIV.—Profile of the River St. Lawrence between Quebec and Lachine, in one length, on which are shown the loci of normal and extreme high and low tide levels at high and low stages of the river; instantaneous water lines, spring flood levels, etc. Also, the prominent bench marks, with their elevations and the principal results of the tide and river gauging operations of 1887-88, etc. Horizontal scale, $\frac{1}{48\,000}$, or 4·000 ft. per inch. Vertical scale, $\frac{1}{192}$, or 16 ft. per inch.

XXV.—Typical local tide curves at the eight gauging stations between Quebec and Three Rivers, for the low and high water seasons. Scales : abscissas, 1 inch per hour ; ordinates, or heights of water, $\frac{1}{2}$ inch per foot. Also, hourly instantaneous water lines, Quebec to Lake St. Peter, for the low and high water seasons. Horizontal scale, 5 miles per inch ; vertical, $\frac{1}{2}$ inch per foot.

‡XXVI.—Admiralty chart No. 2830*a*, River St. Lawrence, Quebec to Pointe du Lac. General scale, 10·335 ft. nearly. The following additions have been made, in red on this map, viz. : (1.) The main continuous line of geodetic levels run along the south shore of the St. Lawrence, together with all check and loop lines, cross-sections, etc., inclusive of river crossings which have been levelled in connection with the main line on both sides of the estuary. (2.) A profile of the ship channel, to a horizontal scale of 30,000 ft. per inch, and a vertical scale of 40 ft. per inch, on which are indicated, besides the characteristic tide levels at high and low stages of the river, the prominent bench marks and principal results of the tidal observations and river gaugings made in 1887-88, the same as on illustration No. XXIV—also, the approximate water line to which the Admiralty soundings appear to have been reduced. (3.) Series of typical local and instantaneous tide curves.

‡XXVII.—Admiralty chart No. 2830 *b*, River St. Lawrence, Pointe du Lac to Lachine Rapids. General scale, 10,335 ft. per inch nearly. Additions similar to those described for chart No. 2830 *a*, Illustration No. XXVI., made in red on this map, both in connection with the St. Lawrence and the River Richelieu, including a profile of the whole of the last named river, from Rouse's Point, on Lake Champlain (State of New York) down to Sorel.

*XXVIII.—Corresponding tide and current curves at a point in ship channel 2½ miles below wharf at Point aux Trembles *(en bas)*, according to observations made in 1882. Scales : Abscissas, 1 hour per inch ; ordinates, 2 ft. per inch.

** Lithographed one half full size.

† Profile reproduced by lithography $\frac{64}{100}$ of original size. Horizontal scale, $\frac{1}{75000}$, or 6250 ft. per inch ; vertical, $\frac{1}{300}$, or 25 ft. per inch.

‡ This chart reproduced by lithography in two parts, numbered XXVI*a*. and XXVI*b*. XXVI*a*. comprises the plan of the River St. Lawrence, Quebec to Pointe du Lac, to a scale of 10,000 ft. per inch, together with a profile of the corresponding portion of the ship channel : horizontal scale, 30,000 ft. per inch ; vertical, 40 ft. per inch. On XXVI*b*. are shown the local and hourly instantaneous tide curves, to which is added a table of the main results of the tidal observations and river gauging made in 1887-88.

‡ This chart also lithographed, inclusive of additions, in two parts, numbered XXVII*a* and XXVII*b*. XXVII*a*. comprises the plan of the River St. Lawrence to a scale of 10,000 ft. per inch, Pointe du Lac to Montreal and Lachine, together with a profile of the corresponding portion of the ship channel : horizontal scale, 30,000 ft. per inch ; vertical scale, 40 ft. per inch. XXVII*b*. is a plan of the whole River Richelieu, Sorel to Rouse's Point, to a scale of 10,000 ft. to an inch, with a profile of the navigable channel drawn to the scales just mentioned.

REFERENCES TO COLOURS USED ON ILLUSTRATIONS.

Black :—1. Plans of Rivers St. Lawrence and Richelieu, according to Admiralty charts, cadastral plans, Quebec Crown Lands Department, etc. 2. Local and instantaneous hourly tide curves for the low water season, as well as all other tide and river level fluctuations observed during the said season, excepting those at Verchères, which are indicated in ultramarine. 3. Loci of discrepancies between observed and computed times of high water, based on Brest times. Black is also used for general illustrating purposes, etc.

Burnt Sienna :—Local and instantaneous hourly tide curves for the high water season, as also all other tide and river level fluctuations observed during the said season, excepting the Verchères levels, which are shown in ultramarine.

Purple :—Tide and river level fluctuations during winter, or in the spring at the time of the débâcle, indicated by purple lines or black lines shaded in purple.

Ultramarine :—1. Verchères water levels during the high and low water seasons. 2. Standard low water level proposed for reduction of soundings. 3. Centre line of ship channel, together with mileage and elevations of water surface, also depths of water in same on profile.

Chinese blue :—1. Loci of discrepancies between observed and computed times of high water, based on London Bridge times. 2. Theoretical curves of summits and troughs of fluvial waves, and series of gaining and losing tides ; also shading of important water levels of season of navigation.

Scarlet :—1. Lines of levels and bench marks indicated on plans. 2. Amended geometrical loci of observed high and low water levels. 3. Loci of proposed provisional corrections of times of high water.

Jaqueminot lake :—Current curves and curve of atmospheric pressure or barometic heights.

Green :—Ground work of diagrams and profiles and ordinates, abscissas and plans or lines of reference in general.

ILLUSTRATION

MISSING

ILLUSTRATION

MISSING

ILL. III.

PUBLIC WORKS, CANADA.
WATER LEVELS RIVER ST. LAWRENCE.

Diagrams showing approximately vertical movements of summits and troughs of tide waves.

Scale: 5 Feet to 1 Inch.

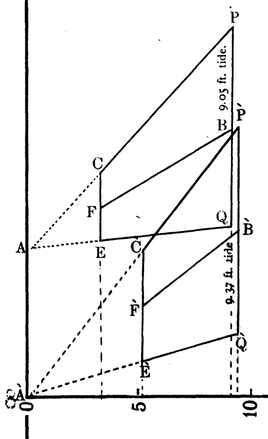
R. STECKEL,
Engineer in Charge.
See Report to Chief Engineer, dated November 24, 1891.

Ft.
Mean water level 26.5 above 0
Mont. H. Crs. gauge, Spring of 1882.

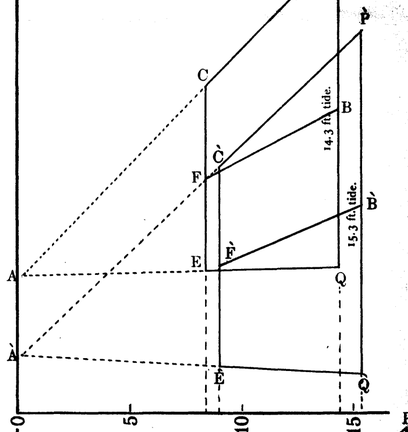
22.5 level of open river supposed to correspond approximately to mean winter discharge.

Mean water level 20.5 above zero.
fall of 1882.

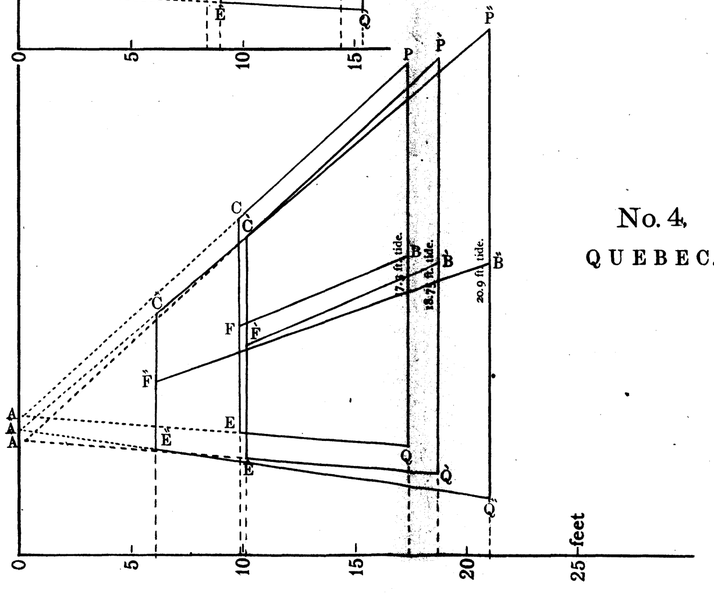
No. 7, SOREL.



No. 6, GRONDINES.



No. 5, POINTE PLATON.



No. 4, QUEBEC.

N.B.—The mean sea level, Gulf of St. Lawrence, as approximately determined by R. Steckel, in 1881-82, corresponds very nearly with the zero of the Montreal Harbour Commissioners' gauge at Sorel.

REFERENCES FOR DIAGRAMS NOS. 4, 5, 6.

AP, $\grave{A}\grave{P}$—Loci of high tide levels for river at mean elevations of 26.5 ft. and 20.5 ft. above o Mont. H. Crs. gauge at Sorel according to tidal observations and river gaugings made in 1882.

EQ, $\grave{E}\grave{Q}$—Loci of low tide levels for river at mean elevations of 26.5 ft. and 20.5 ft. at Sorel according to tidal observations and river gaugings made in 1882.

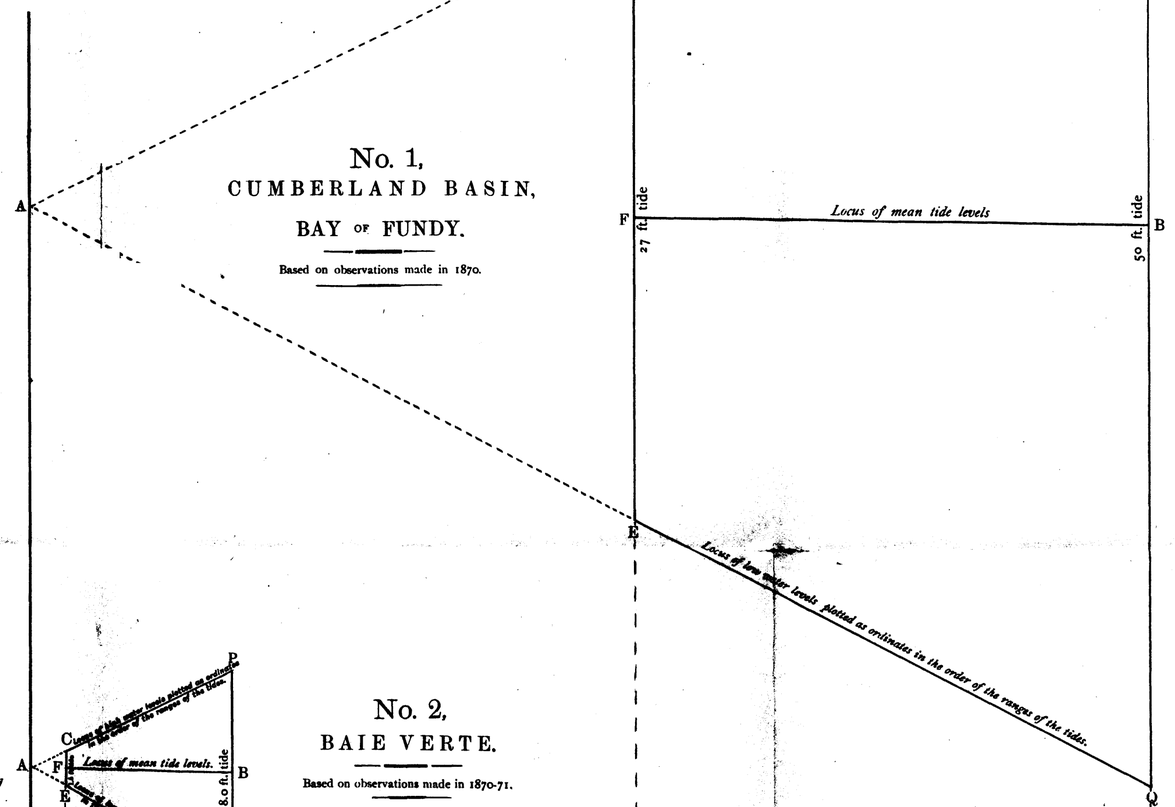
FB, $\grave{F}\grave{B}$—Loci of mean tide levels for river at mean elevations of 26.5 ft. and 20.5 ft. at Sorel according to tidal observations and river gaugings made in 1882.

$\grave{C}\grave{P}$, $\grave{E}\grave{Q}$ and $\grave{F}\grave{B}$ in No. 4 indicate corresponding loci for tides observed from 11th February to 26th April of 1876.

All high and low water levels plotted as ordinates in the order of the ranges of the corresponding tides, viz.: the ranges being used as abscissas.

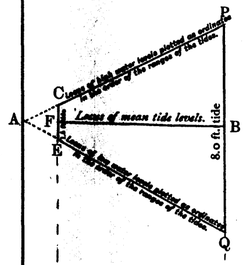
No. 1, CUMBERLAND BASIN, BAY OF FUNDY.

Based on observations made in 1870.



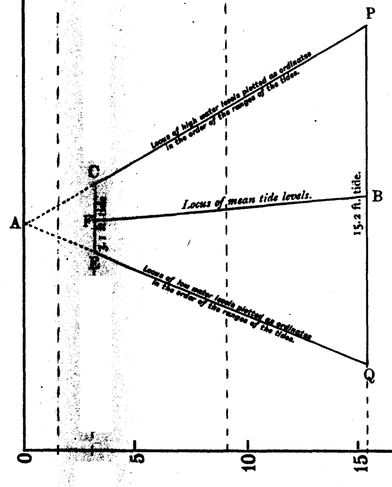
No. 2, BAIE VERTE.

Based on observations made in 1870-71.



No. 3, RIMOUSKI.

Based on observations made in 1870.



N.B.—The loci of the high, mean and low tide levels for Rimouski correspond to an average river level of about 23 ft. above o M. H. Crs. gauge at Sorel.

& Co., Lith., Ottawa.

Chas. Chaloner, del.

ILL. IV.

PUBLIC WORKS, CANADA.
H. F. PERLEY, Chief Engineer.

SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.
G. F. BAILLARGÉ, Deputy Minister.

R. STECKEL,
Engineer in Charge.
See Report to Chief Engineer, dated November 24, 1891.

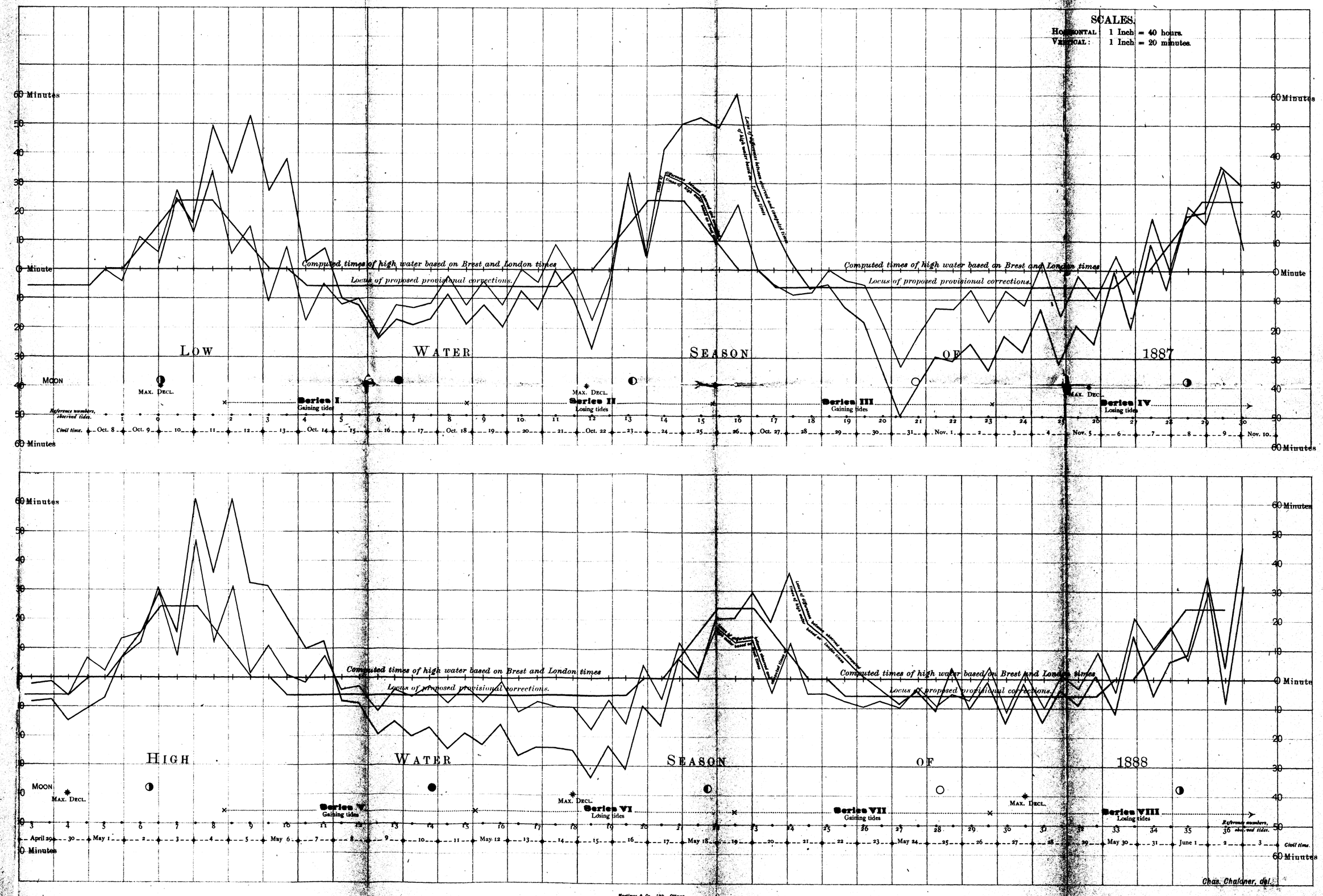
WATER LEVELS RIVER ST. LAWRENCE,
QUEBEC TO MONTREAL.

TIDAL FLUCTUATIONS.

Diagrams **showing discrepancies between computed and observed times of high water at**

GRAVING DOCK, QUEBEC.

SCALES.
HORIZONTAL: 1 Inch = 40 hours.
VERTICAL: 1 Inch = 20 minutes.



Chas. Chaloner, del.

Mortimer & Co., Lith., Ottawa.

ILL. V.

PUBLIC WORKS, CANADA

H. F. PERLEY, Chief Engineer.

SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.

G. F. BAILLARGÉ, Deputy Minister.

R. STECKEL,
Engineer in Charge.
See Report to Chief Engineer, dated November 24, 1891.

WATER LEVELS, RIVER ST. LAWRENCE,

QUEBEC TO MONTREAL.

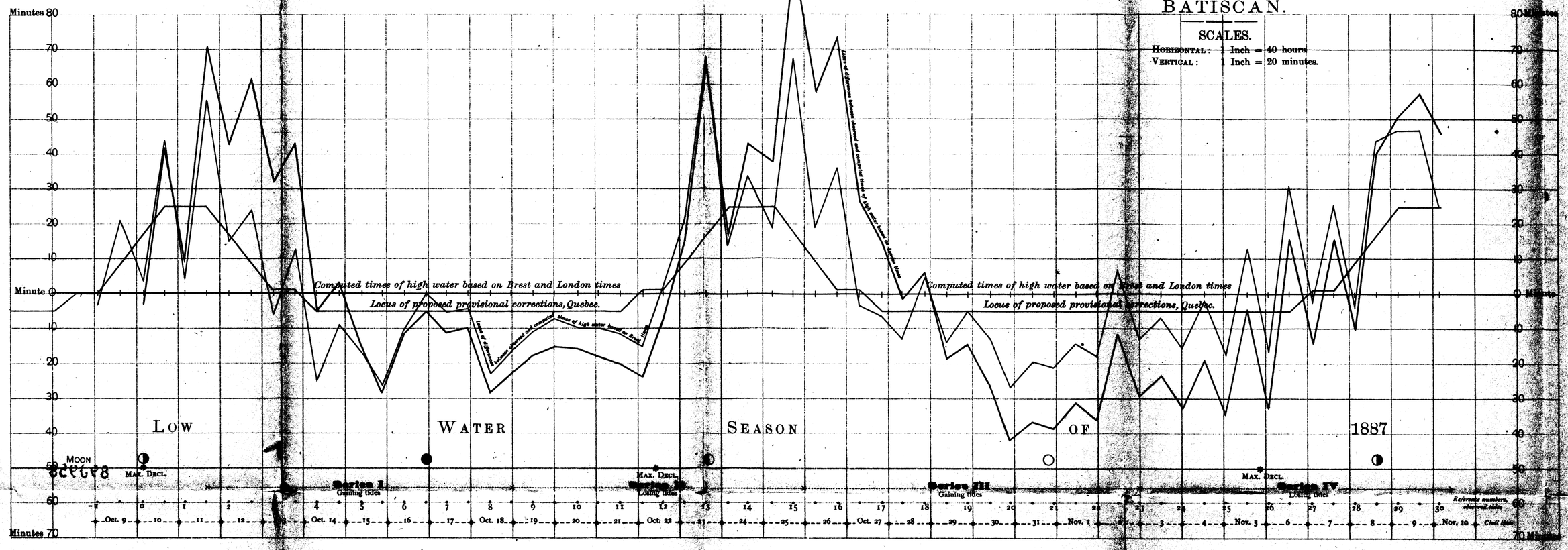
TIDAL FLUCTUATIONS.

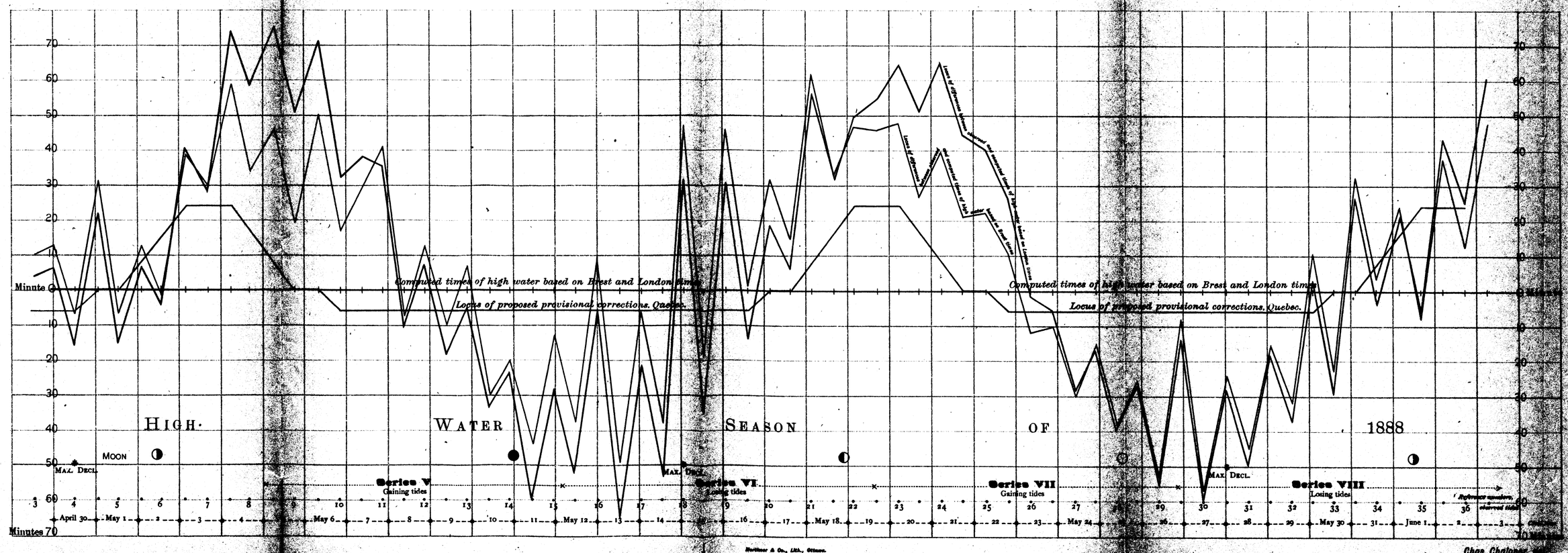
Diagrams **showing discrepancies between computed and observed times of high water at**

BATISCAN.

SCALES.

HORIZONTAL: 1 Inch = 40 hours.
VERTICAL: 1 Inch = 20 minutes.





Mortimer & Co., Lith., Ottawa.

Chas. Chalonet, Engr.

ILL. VI.

PUBLIC WORKS, CANADA.

H. F. PERLEY, Chief Engineer.

SIR H. L. LANGEVIN, C.

G. F. BAIL

REFERENCES.

Tide levels, as observed, connected thus.....

do corrected for diurnal inequalities—connected thus.....

do corrected approximately for diurnal inequalities and deviations in pressure of atmosphere from mean barometric height October 9th to November 10th, 1887, = 29.96 inches, connected thus.....

SERIES Nº. I

GAINING TIDES

CIVIL TIME 10 11 12 13 14 Oct 15 16 17 18

20 feet. 20 fee

15 ft. 15 ft.

10 ft. 10 ft.

5 ft. 5 ft.

HIGH TIDE LEVELS

MEAN TIDE LEVELS

LOW TIDE LEVELS

D D D1 D1 B1 B2 C C C1 C2

DATUM Approximate mean level of Atlantic Ocean, Gulf of St. Lawrence, established by R. Steckel, 1880-82. 0 feet.

Amended trough curve of observed fluvial undulations C corre

Theoretical locus of troughs of mean tidal oscillations due to

Tide Days, high water to high water 0 1 2 3 4 5 6 7 8

K.C.M.G., Minister of Public Works.

RGÉ, Deputy Minister.

WATER LEVELS --- RIVER ST. LAWRENCE,

QUEBEC TO MONTREAL.

TIDAL FLUCTUATIONS --- LOW WATER SEASON OF 1887,

AT THE

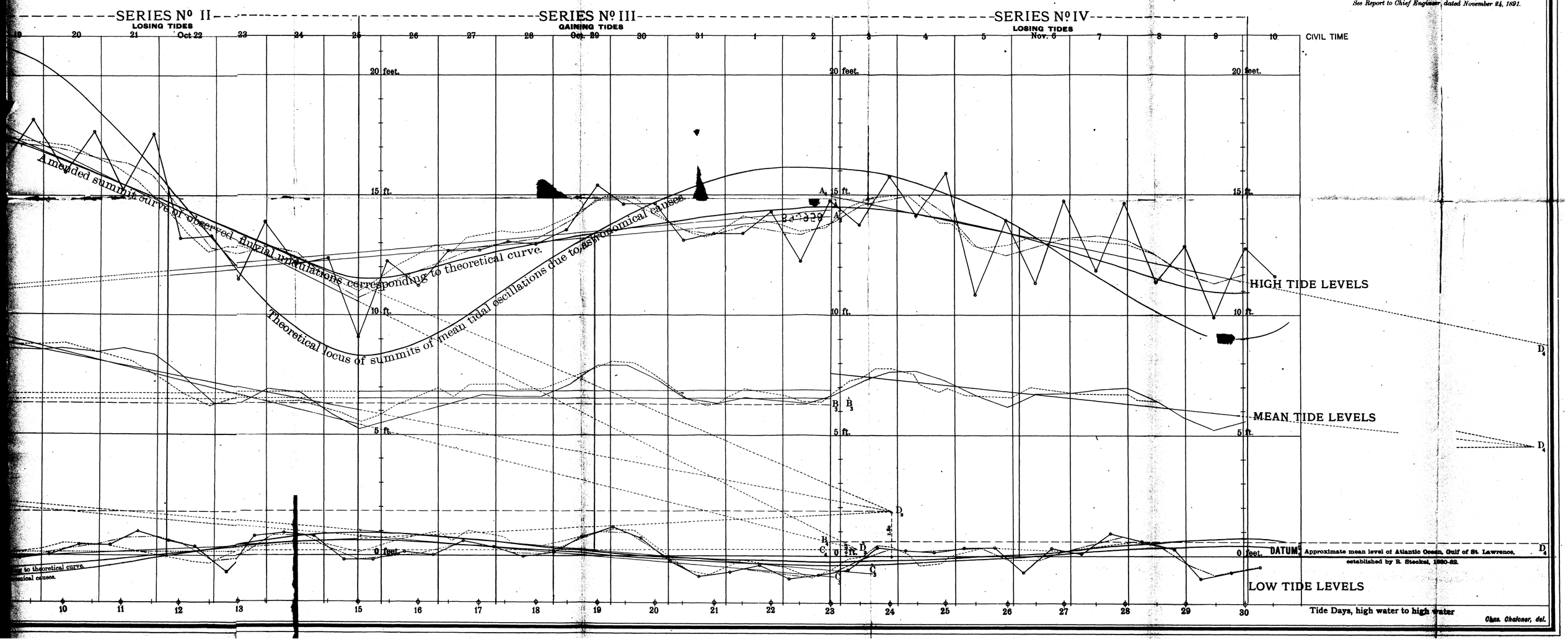
LEVIS GRAVING DOCK.

HIGH, LOW AND MEAN TIDE LEVELS.

Scale of Ordinates = 2 Feet per Inch.

Scale of Abscissas = 20 Hours per Inch.

R. STECKEL,
Engineer in Charge.
See Report to Chief Engineer, dated November 24, 1891.



ILL. IX.

PUBLIC WORKS, CANADA.

H. F. PERLEY, Chief Engineer.

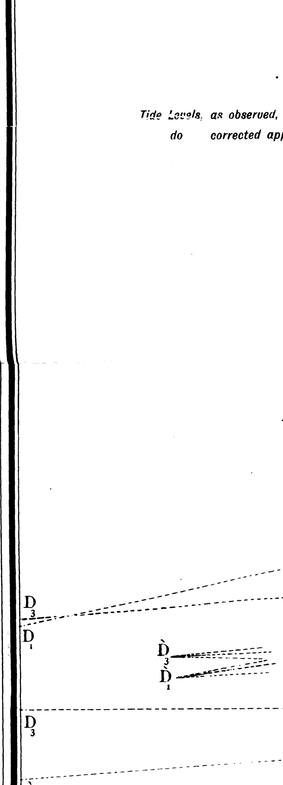
SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.

G. F. BAILLARGÉ, Deputy Minister.

REFERENCES.

Tide Levels, as observed, connected thus .....

do corrected approximately for diurnal inequalities connected thus ....



MEAN TIDE LEVELS.

LOW TIDE LEVELS.

SERIES Nº I
GAINING TIDES

SERIES Nº II
LOSING TIDES

CIVIL TIME 10 11 12 13 14 Oct. 15 16 17 18 19 20 21 Oct. 22 23 24

20 feet

15 ft

10 ft

5 ft

0 feet

Amended geometrical locus of summits of fluvial undulations.

Amended geometrical locus of troughs of fluvial undulations.

Tide Days, high water to high water 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

of Public Works.

ister.

WATER LEVELS---RIVER ST. LAWRENCE,

QUEBEC TO MONTREAL.

TIDAL FLUCTUATIONS---LOW WATER SEASON OF 1887,

AT

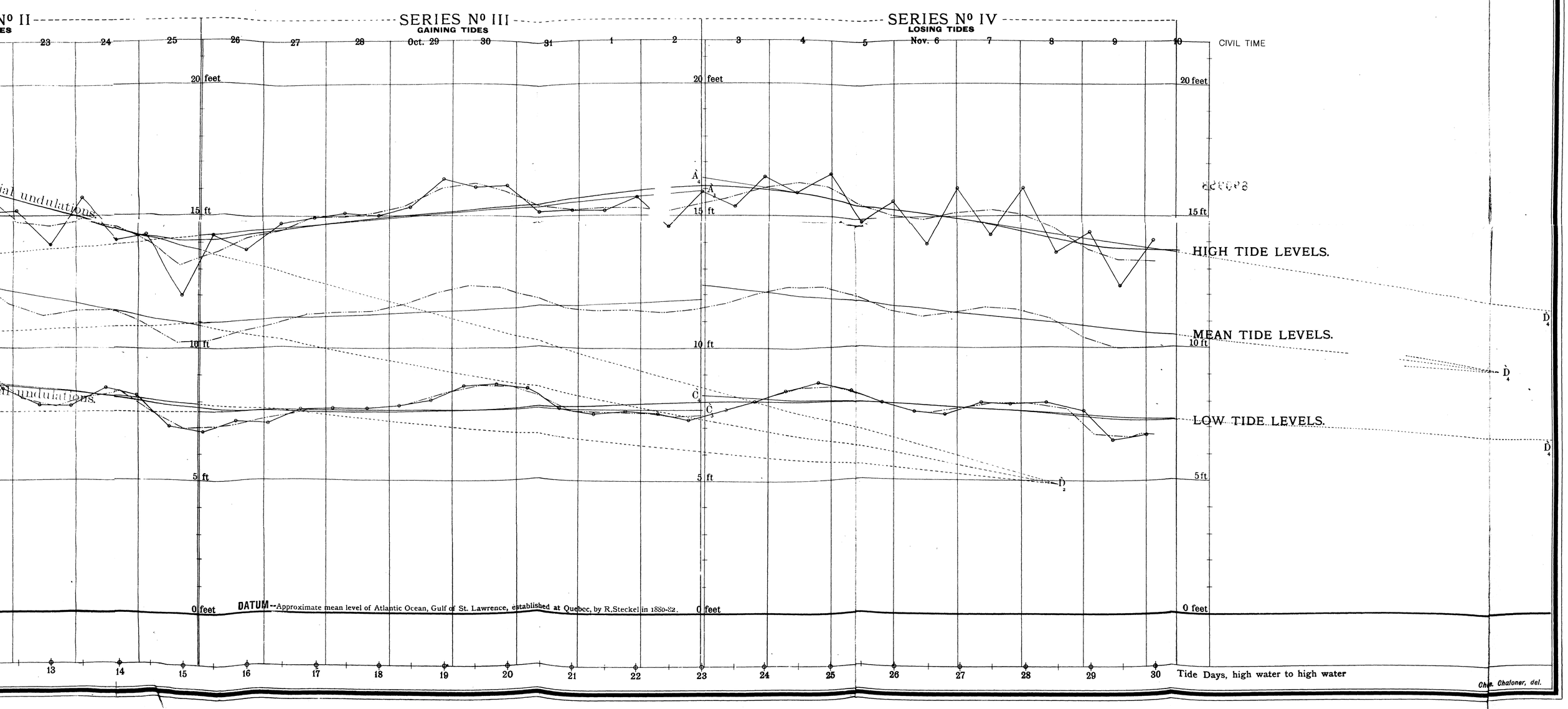
GRONDINES.

HIGH, LOW AND MEAN TIDE LEVELS.

Scale of Ordinates = 2 Feet per Inch.

Scale of Abscissas = 20 Hours per Inch.

R. STECKEL,
Engineer in Charge.
See Report to Chief Engineer, dated November 24 1891.



DATUM--Approximate mean level of Atlantic Ocean, Gulf of St. Lawrence, established at Quebec, by R.Steckel in 1880-82.

Chas. Chaloner, del.

ILL. XI.

PUBLIC WORKS, CANADA.

H. F. PERLEY, Chief Engineer.

SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.

G. F. BAILLARGE, Deputy Minister.

WATER LEVELS---RIVE

QUEBEC TO M

TIDE AND RIVER WATER FLUCTUATIO

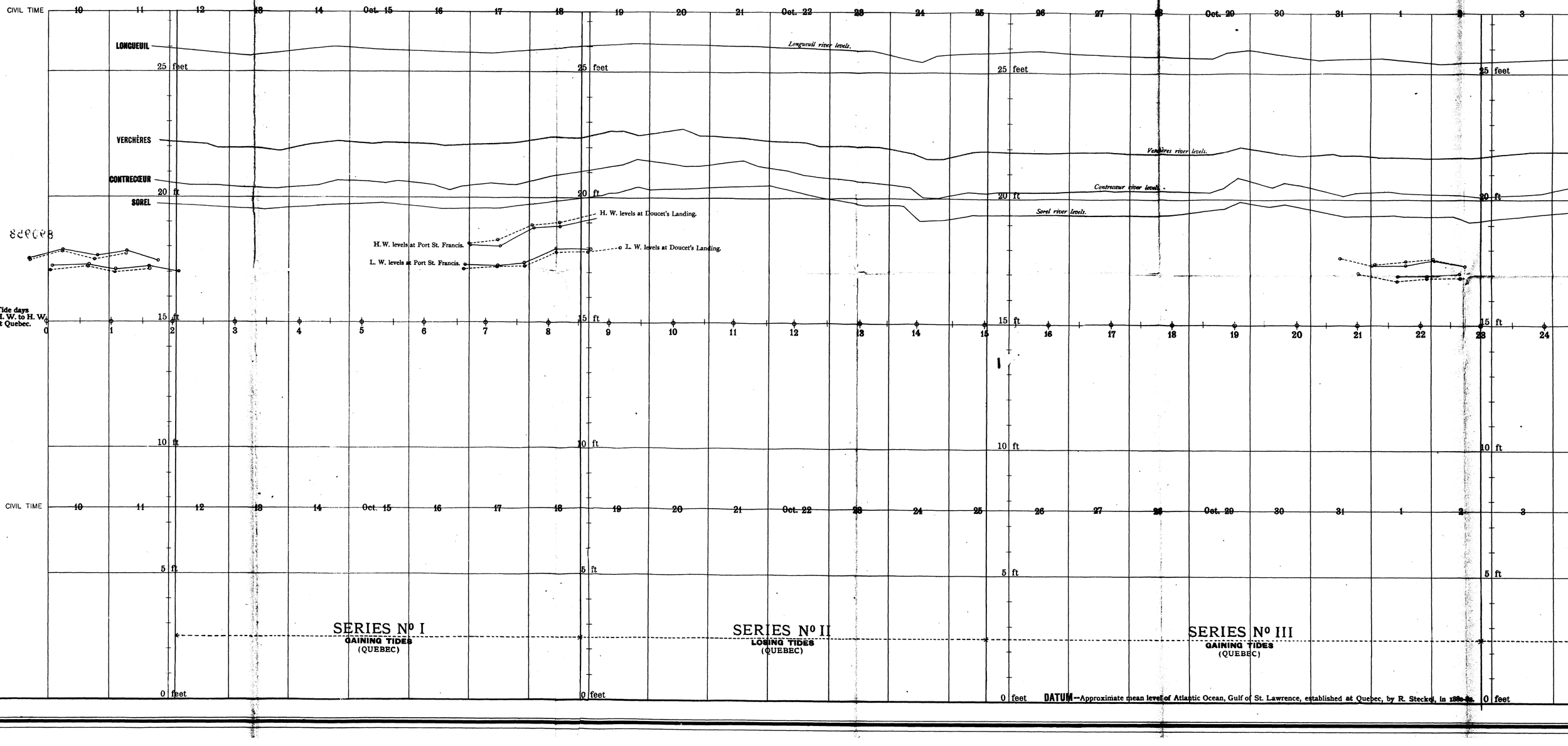
AT

DOUCET'S LANDING, PORT ST. FR

VERCHÈRES AND

Scale of Ordinates = 5

Scale of Abscissas = 20



DATUM--Approximate mean level of Atlantic Ocean, Gulf of St. Lawrence, established at Quebec, by R. Stecked, in 1880-81.

A.

SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.

G. F. BAILLARGÉ, Deputy Minister.

WATER LEVELS---RIVER ST. LAWRENCE,

QUEBEC TO MONTREAL.

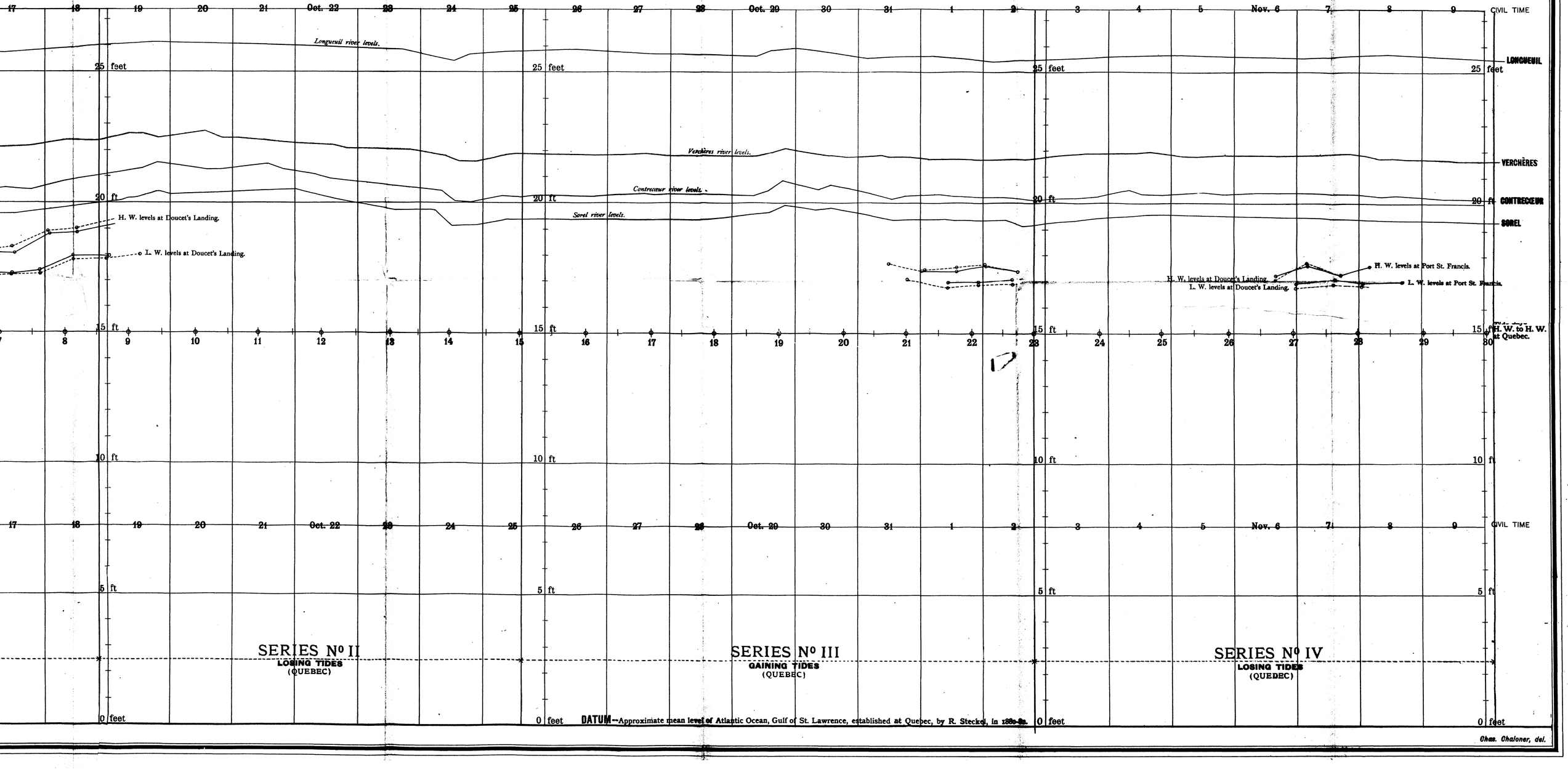
TIDE AND RIVER WATER FLUCTUATIONS LOW WATER SEASON OF 1887,

AT

DOUCET'S LANDING, PORT ST. FRANCIS, SOREL, CONTRECŒUR, VERCHÈRES AND LONGUEUIL.

Scale of Ordinates = 2 feet per Inch.
Scale of Abscissas = 20 Hours per Inch.

R. STECKEL,
Engineer in Charge.
See Report to Chief Engineer, dated November 24, 1891.



DATUM.--Approximate mean level of Atlantic Ocean, Gulf of St. Lawrence, established at Quebec, by R. Steckel, in 1880-81.

Chas. Chaloner, del.

ILL. XIV.

PUBLIC WORKS, CANADA.

H. F. PERLEY, Chief Engineer.

SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.

G. F. BAILLARGÉ, Deputy Minister.

REFERENCES.

Tide Levels, as observed, connected thus .....

do corrected approximately for diurnal inequalities connected thus ....

HIGH TIDE LEVELS.

MEAN TIDE LEVELS.

LOW TIDE LEVELS.

Amended geometrical locus of summits of fluvial undulations.

Amended geometrical locus of troughs of fluvial undulations.

25 feet

20 ft

15 ft

10 ft

5 ft

0 feet

CIVIL TIME 4 5 6 7 8 May 9 10 11 12 13 14 May 15 16 17 18 19 20 21 22

SERIES Nº V
GAINING TIDES

SERIES Nº VI
LOSING TIDES

SERIE
GAINI

DATUM—Approximate mean level of Atlantic Ocean, Gulf of St. Lawrence, established at Quebec, by R Steckel in 1880-82

Tide Days, high water to high water 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

N, C.B., K.C.M.G., Minister of Public Works.

ILLARGÉ, Deputy Minister.

WATER LEVELS---RIVER ST. LAWRENCE,

QUEBEC TO MONTREAL.

TIDAL FLUCTUATIONS HIGH WATER SEASON OF 1888,

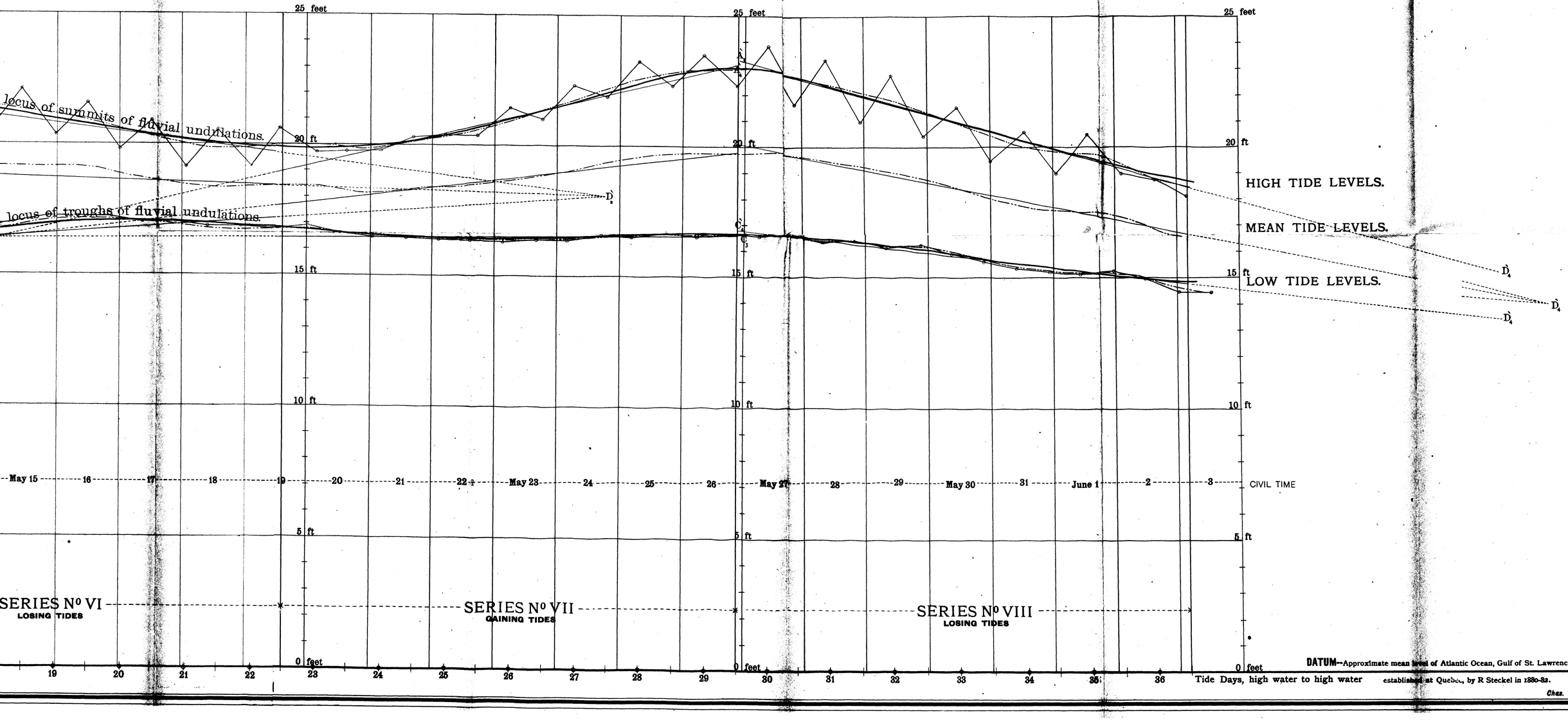
AT

GRONDINES.

HIGH, LOW AND MEAN TIDE LEVELS.

Scale of Ordinates = 2 feet per Inch.
Scale of Abscissas = 20 Hours per Inch.

R. STECKEL,
Engineer in Charge.
See Report of Chief Engineer, dated November 24 1891.



DATUM---Approximate mean level of Atlantic Ocean, Gulf of St. Lawrence, established at Quebec, by R Steckel in 1880-82.

Chas. Chaloner, del.

35 feet

LONGUEUIL

30 ft

VERCHÈRES

CONTRECŒUR

SOREL

25 ft

20 ft

15 ft

10 ft

Tide days H. W. to H. W. at Quebec.

5 ft

0 foot

Longueuil high water levels

Verchères high water levels

Contrecœur high water levels

Doucet's Landing levels.

Port St. Francis levels.

H. W. levels at Port St. Francis.

L. W. levels at Port St. Francis.

Sorel high water levels

H. W. levels at Doucet's Landing.

L. W. levels " "

CIVIL TIME

3 4 5 6 7 May 8 9 10 11 12 13 14 May 15 16 17 18 19 20 21 May 22 23

SERIES Nº V
GAINING TIDES
(QUEBEC)

9 10 11 12 13 14 15

SERIES Nº VI
LOSING TIDES
(QUEBEC)

16 17 18 19 20 21 22

SERIES Nº V
GAINING TIDES
(QUEBEC)

23 24 25 26

ILL. XV.

PUBLIC WORKS, CANADA.

H. F. PERLEY, Chief Engineer.

SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.

G. F. BAILLARGÉ, Deputy Minister.

DATUM--Approximate mean level of Atlantic Ocean, Gulf of St. Lawrence, established at Quebec, by R. Steckel, in 1880-82.

35 feet

30 ft

25 ft

20 ft

15 ft

10 ft

Longueuil high water levels

Verchères high water levels

Contrecœur high water levels

Sorel high water levels

Port St. Francis levels.

Doucet's Landing levels.

H. W. levels at Port St. Francis.
L. W. " " "

H. W. levels at Doucet's Landing.
L. W. " " "

LONGUEUIL

VERCHÈRES

CONTRECŒUR

SOREL

9 10 11 12 13 14 May 15 16 17 18 19 20 21 May 22 23 24 25 26 27 May 28 29 30 31 June 1 2 CIVIL TIME

13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 Tide days H. W. to H. W. at Quebec.

SERIES Nº VI
LOSING TIDES
(QUEBEC)

SERIES Nº VII
GAINING TIDES
(QUEBEC)

SERIES Nº VIII
LOSING TIDES
(QUEBEC)

5 ft

0 foot

SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.

G. F. BAILLARGÉ, Deputy Minister.

WATER LEVELS---RIVER ST. LAWRENCE,

QUEBEC TO MONTREAL.

TIDE AND RIVER WATER FLUCTUATIONS HIGH WATER SEASON OF 1888,

AT

DOUCET'S LANDING, PORT ST. FRANCIS, SOREL, CONTRECŒUR, VERCHÈRES AND LONGUEUIL.

HIGH, LOW AND MEAN TIDE LEVELS.

Scale of Ordinates = 2 feet per Inch.
Scale of Abscissas = 20 Hours per Inch.

R. STECKEL,
Engineer in Charge.
See Report to Chief Engineer, dated November 24 1891.

DATUM--Approximate mean level of Atlantic Ocean, Gulf of St. Lawrence, established at Quebec, by R. Steckel, in 1880-82.

Chas. Chaloner, del.

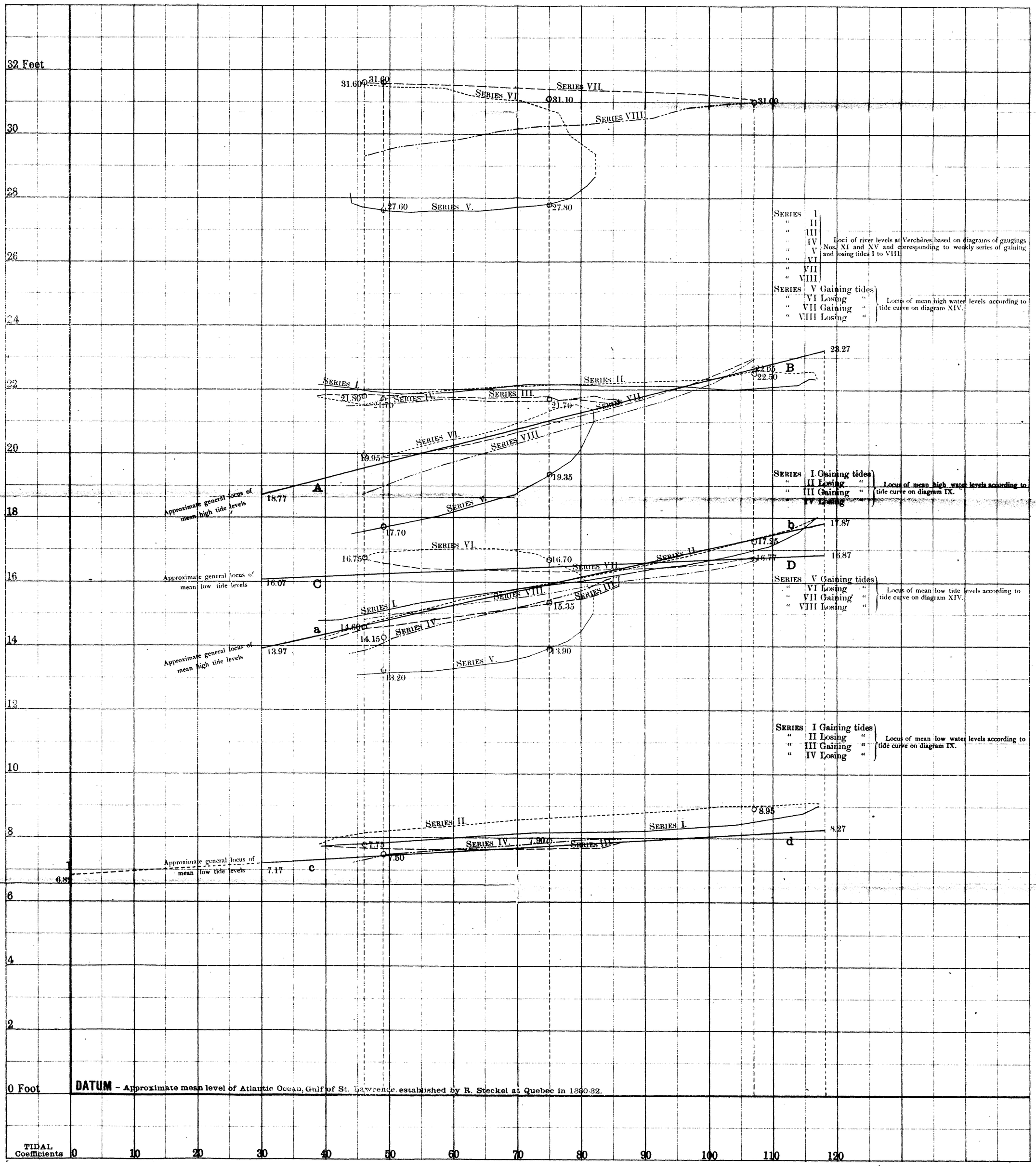
ILL. XIX.

PUBLIC WORKS, CANADA.

WATER LEVELS, RIVER ST. LAWRENCE
QUEBEC TO MONTREAL.

Loci of mean, high, and low tide levels, low water season of 1887 and high water season of 1888, as per diagrams Nos. IX and XIV, Grondines, and of Verchères river levels as per diagrams XI and XV—plotted in the order of corresponding astronomical coefficients of tidal importance.

R. STECKEL,
Engineer in charge,
See Report to Chief Engineer, dated November 24, 1891.



Chas. Chaloner, del.

H.L. No XXIII

PUBLIC WORKS, CANADA.
SIR H.L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.
G. F. HAILLARGE, Deputy Minister.
H. F. PERLEY, Chief Engineer.

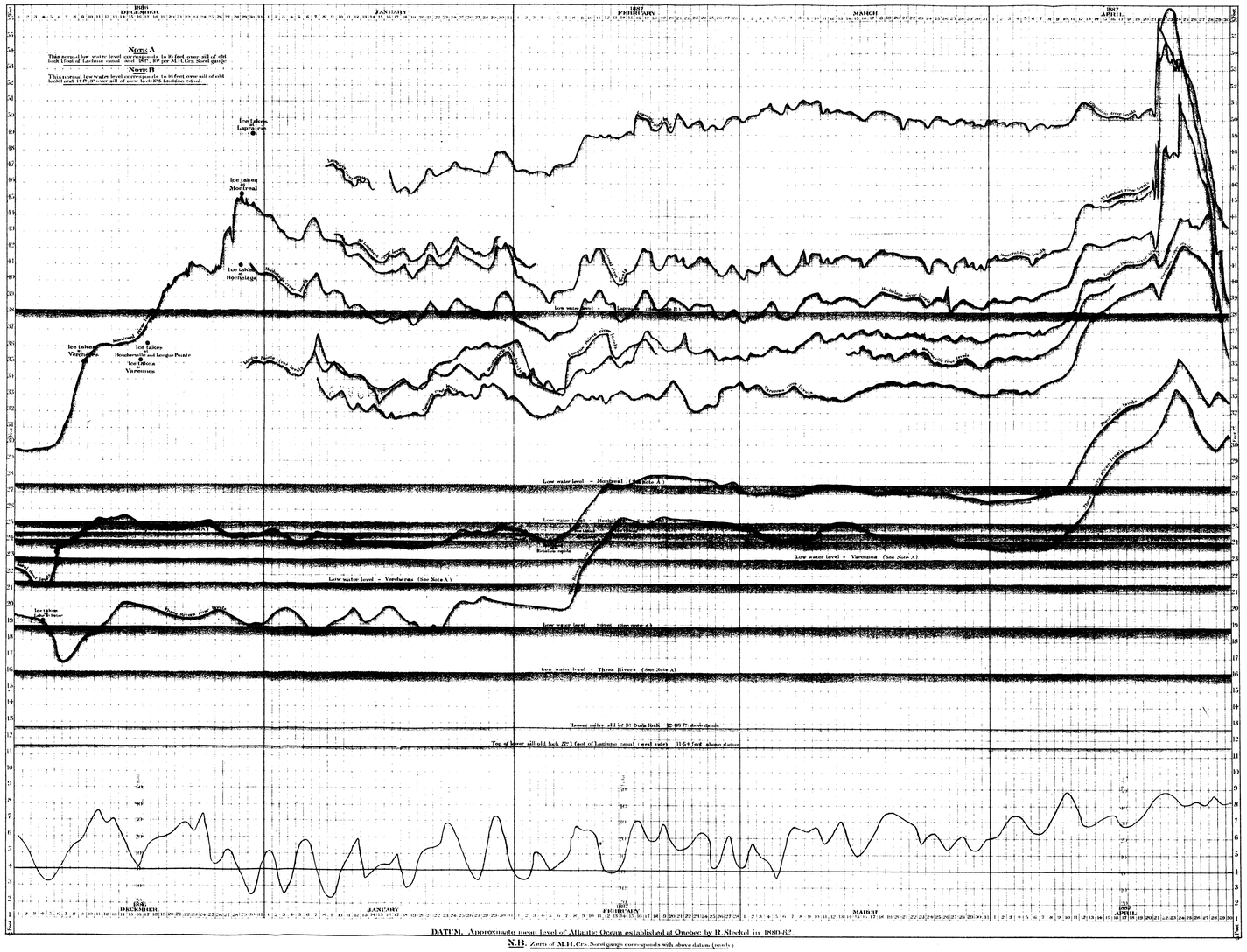
DIAGRAM

SHOWING SIMULTANEOUS GAUGING MADE UNDER THE SUPERVISION OF THE
MONTREAL FLOOD COMMISSION
DECEMBER 1886 to APRIL 1887.
BETWEEN
THREE RIVERS AND LAPRAIRIE,
ALL LEVELS BEING REFERRED TO THE MEAN LEVEL OF THE SEA
DETERMINED AT QUEBEC BY R. STECKEL IN 1880-82

SCALE OF ORDINATES: 4 FEET per INCH.
SCALE OF ABSCISSAS: 8 DAYS per INCH.

GEODETIC LEVELLING
RIVER ST LAWRENCE
QUEBEC TO MONTREAL
AND
LACHINE.

E. Parent
Engineer in Charge.
See Report to Chief Engineer dated November 24 1887



DATUM. Approximate mean level of Atlantic Ocean established at Quebec by R. Steckel in 1880-82.

N.B. Zero of M.H.Cra. Steel gauge corresponds with above datum (mean).

Chas. Chatauver lith

ILL. XXIV.

PUBLIC WORKS, CANADA.

SIR HECTOR LANGEVIN, C.B., K.C.M.G., Minister of Public Works.
G. F. BAILLARGÉ, Deputy Minister.
H. F. PERLEY, Chief Engineer.

GEODETIC LEVELLING.

WATER LEVELS--RIVER ST. LAWRENCE,

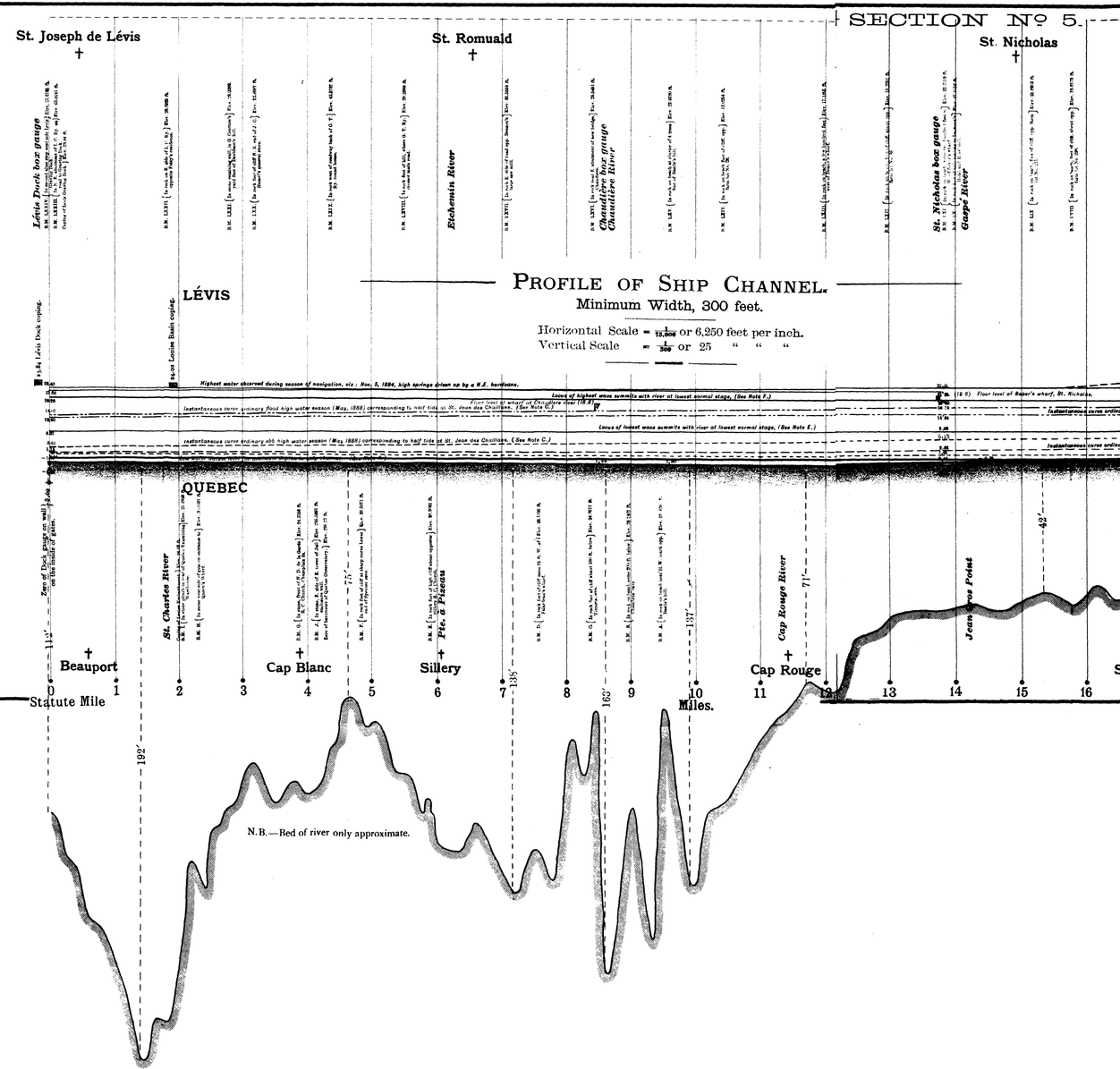
QUEBEC TO MONTREAL AND LACHINE.

R. STECKEL, Engineer in Charge.
See Report to Chief Engineer, dated Nov. 24th, 1891.

LOCALITIES ON SOUTH SHORE OF ST. LAWRENCE.

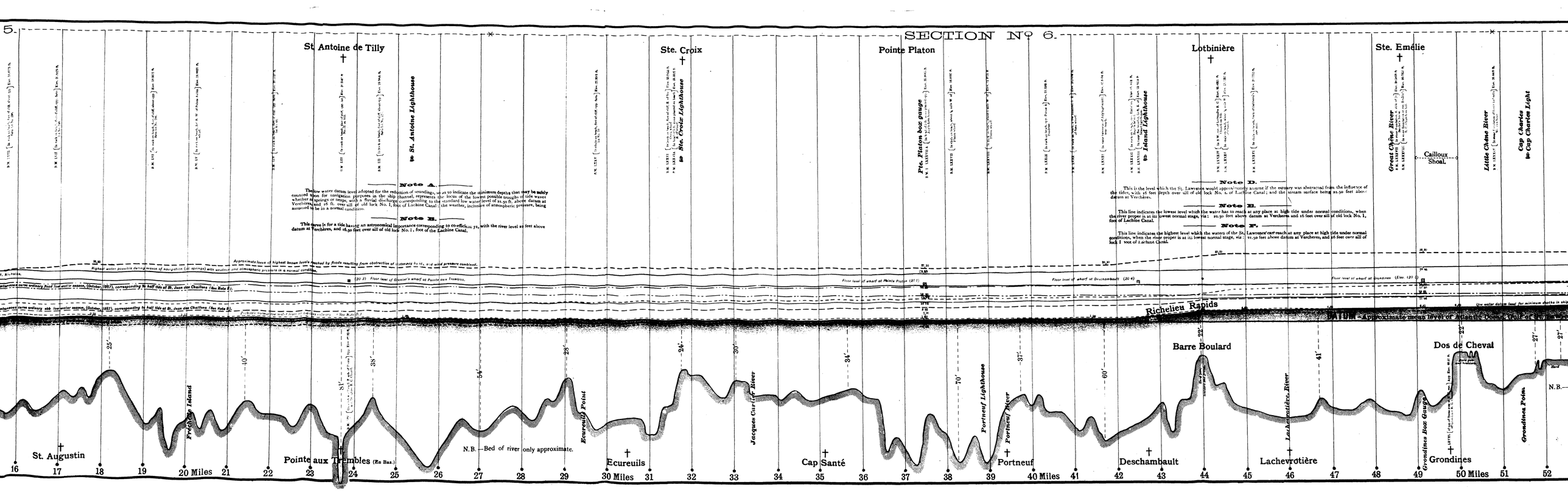
LOCALITIES ON NORTH SHORE OF ST. LAWRENCE.

SECTION Nº 5.



5.

SECTION No 6.



SECTION Nº 8.

SECTION Nº 7.

PROFILE OF SHIP CHANNEL.

Minimum Width, 300 feet.

Horizontal Scale = 1/12500 or 6,250 feet per inch.

Vertical Scale = 1/250 or 25 " " "

Note A.

The low water datum level adopted for the reduction of soundings, so as to indicate the minimum depths that may be safely counted upon for navigation purposes in the ship channel, represents the locus of the lowest possible troughs of tide waves whether at springs or neaps, with a fluvial discharge corresponding to the standard low waters level of 21.50 ft. above datum at Verchères, and 16 ft. over sill of old lock No. 1, foot of Lachine Canal; the weather, inclusive of atmospheric pressure, being assumed to be in a normal condition.

Note B.

This curve is for a tide having an astronomical importance corresponding to co-efficient 71, with the river level as feet above datum at Verchères, and 16.50 feet over sill of old lock No. 1, foot of the Lachine Canal.

St. Jean des Chaillons

St. Pierre les Becquets

Gentilly

Bécancour

Ste. Angèle

Port St. Fran

Cap Charles Light

St. Jean des Chaillons buoy astern

Cap Levrault

Gentilly River

Gentilly Shoal.

Provencher Shoal.

Bécancour River

Dupont Island

Bécancour Pt

Ste. Angèle board gauge

Godfrey River

Marguerite River

Port St. François Lighthouse

Port St. François board gauge

Approximate locus of highest known levels reached by floods resulting from obstruction of waterway by ice and wind pressure combined.

Highest water possible during season of navigation (at springs) with weather and atmospheric pressure in a normal condition.

(22 5) Floor level of Lavaisseur's wharf at St. Jean des Chaillons.

(24 5 Floor level of Brunelle's wharf at Batiscan.

(22.2). Floor level of Gagnon's wharf at Champlain.

(25.2) Floor level of Dupuis's sanding outside wharf.

(26 5)

minimum depths in ship channel. (See Note A.)

of St. Lawrence, established at Quebec by E. Steckel, 1880-82.

27' 27' 27' 26' 27' 27' 27' 35' 27' 32' 42' 27' 35' 27' 45' 80' 47' 27' 47' 20' 47' 67' 55' 60' 59' 45'

THREE RIVERS

N.B.—Bed of river only approximate.

N.B.—Bed of river only approximate.

St. Anne River

St. Anne Shoal.

Batiscan River

Batiscan box gauge on Brunelle's wharf

Ottonelle Point

Champlain River

Dupont Island

St. Maurice River

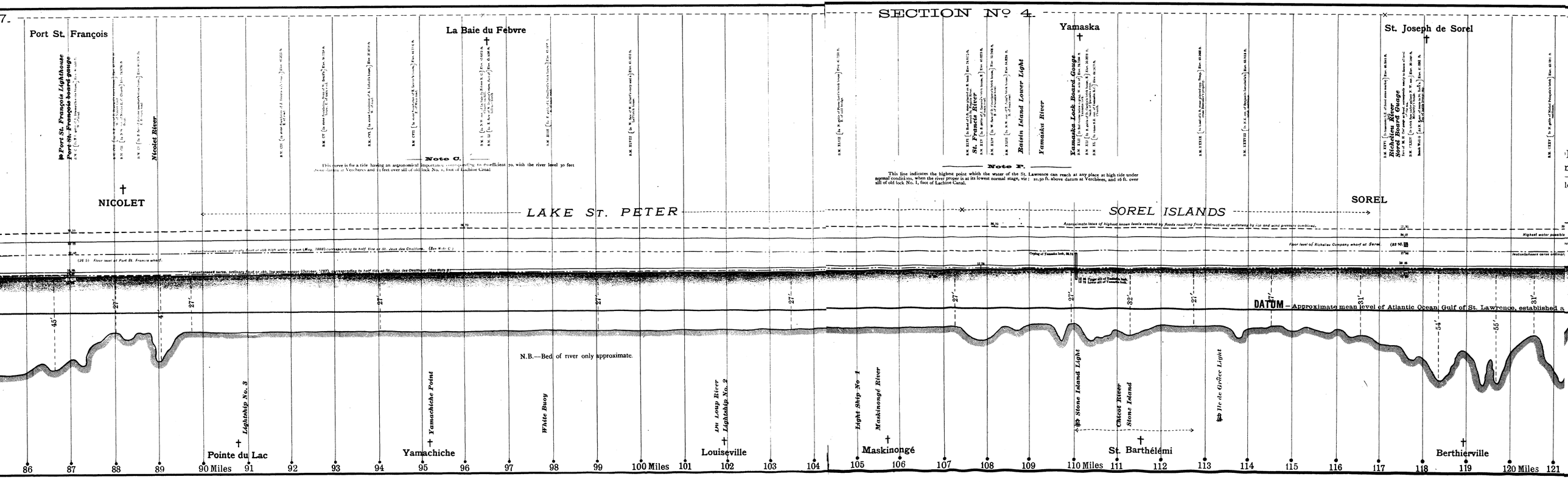
Ste. Anne la Pérade

Batiscan

Champlain

52 53 54 55 56 57 58 59 60 Miles 61 62 63 64 65 66 67 68 69 70 Miles 71 72 73 74 75 76 77 78 79 80 Miles 81 82 83 84 85 86 87

SECTION Nº 4.


Port St. François
Port St. François Lighthouse
Port St. François board gauge
Nicolet River
NICOLET
La Baie du Febvre
Note C.
This curve is for a tide having an astronomical importance corresponding to coefficient 70, with the river level 30 feet above datum at Verchères and 11 feet over sill of old lock No. 1, foot of Lachine Canal
LAKE ST. PETER
Yamaska
Yamaska Lock Board Gauge
St. Francis River
Raisin Island Lower Light
Yamaska River
Note F.
This line indicates the highest point which the water of the St. Lawrence can reach at any place at high tide under normal conditions, when the river proper is at its lowest normal stage, viz: 21.50 ft. above datum at Verchères, and 16 ft. over sill of old lock No. 1, foot of Lachine Canal.
SOREL ISLANDS
St. Joseph de Sorel
Richelieu River
Sorel Board Gauge
SOREL
Approximate lines of highest known levels reached by floods resulting from obstruction of waterway by ice and wind pressure combined.
Highest water possible
Floor level of Richelieu Company wharf at Sorel. (23.50)
Instantaneous water ordinary flood or ebb high water datum (May, 1888) corresponding to half tide at St. Jean des Chaillons. (See Note C.)
(26.5) Floor level at Port St. Francis wharf.
Instantaneous curve, ordinary flood or ebb, low water datum (October, 1887) corresponding to half tide at St. Jean des Chaillons. (See Note C.)
Coping of Yamaska lock, 36.75
Top of sill of Yamaska lock
Lower sill of Yamaska lock
DATUM — Approximate mean level of Atlantic Ocean, Gulf of St. Lawrence, established a
N.B.—Bed of river only approximate.
Lightship No. 3
Pointe du Lac
Yamachiche Point
Yamachiche
White Buoy
Du Loup River
Lightship No. 2
Louiseville
Light Ship No. 4
Maskinongé River
Maskinongé
Stone Island Light
Stone Island
Chicot River
St. Barthélémi
Ile de Grâce Light
Berthierville
Miles
Miles
Miles

SECTION Nº 9.

PROFILE OF SHIP CHANNEL.

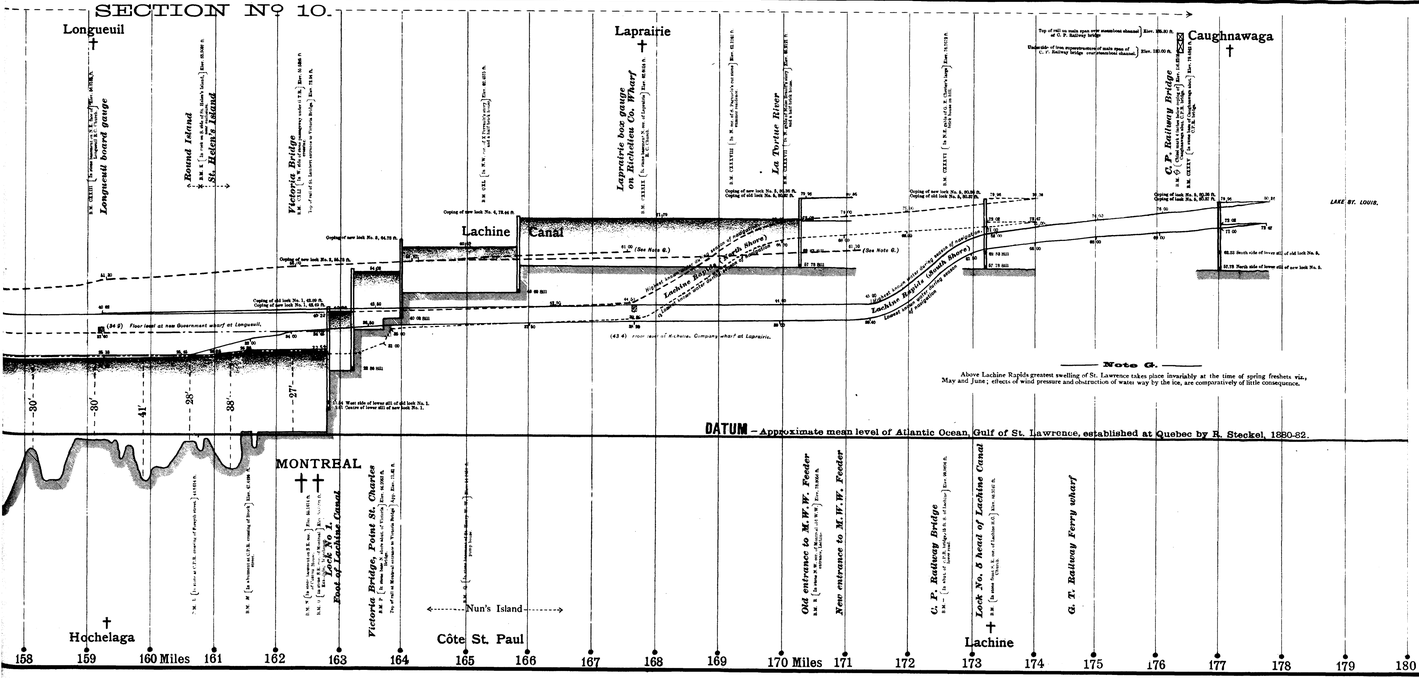
Minimum Width, 300 feet.

Horizontal Scale = $\frac{1}{12,000}$ or 6.250 feet per inch.
Vertical Scale = $\frac{1}{300}$ or 25 " " "

Note A.

The low water datum level adopted for the reduction of soundings, so as to indicate the minimum depths that may be safely depended upon for navigation purposes in the ship channel, represents the locus of the lowest possible troughs at springs, or neaps, with a fluvial discharge corresponding to the standard low water level of 21.50 ft. above datum at Verchères and 16 ft. over sill of old lock No. 1, foot of Lachine Canal; the weather and atmospheric pressure being assumed to be in a normal condition.

Contrecœur
Verchères
Varennes
Boucherville
Cap St. Michel
Contrecœur Board Gauge
Ile à l'Aigle
Highest water possible during season of navigation (at springs) with weather and atmospheric pressure in a normal condition.
Approximate lines of highest known floods reached by floods resulting from obstruction of waterway by ice and wind pressure combined.
Low water datum level for minimum depths in ship channel. (See Note A.)
Instantaneous zero ordinary flood or ebb high water season (May, 1888) corresponding to half tide at St. Jean des Chaillons. (See Note C.)
(31.) Floor level of Richelieu Company wharf at Contrecœur.
(32.6) Floor level of Richelieu Company wharf at Verchères.
(34.5) Floor level of Richelieu Company wharf at Varennes
(35.5) Floor level of Richelieu Company wharf at Boucherville.
Coping of St. Ours lock, 35.13 ft.
Established at Quebec by R. Steckel, 1880-82.
N.B.—Bed of river only approximate
N.B.—Bed of river only approximate.
Lavaltrie Light House
Lavaltrie Island
Plum Island
Ile Harteau
Ile Bottegarde
Ile Delorier
Ottawa River (Montreal Branch)
Rivière des Prairies
Boat de l'Ile, Montreal
Lower Light Ste. Thérèse Island
Ile aux Vaches
Longue Pointe Lunatic Asylum
Lanoraie
Lavaltrie
St. Sulpice
Répentigny
Pointe aux Trembles (en haut)
Longue Pointe
Miles 121 122 123 124 125 126 127 128 129 130 Miles 131 132 133 134 135 136 137 138 139 140 Miles 141 142 143 144 145 146 147 148 149 150 Miles 151 152 153 154 155 156 157 158



LOCALITIES ON SOUTH SHORE OF ST. LAWRENCE.

LOCALITIES ON NORTH SHORE OF ST. LAWRENCE.

ILL. XXIV.

PUBLIC WORKS, CANADA.

SIR HECTOR LANGEVIN, C.B., K.C.M.G., Minister of Public Works.
G. F. BAILLARGE, Deputy Minister.
H. F. PERLEY, Chief Engineer.

GEODETIC LEVELLING.

WATER LEVELS--RIVER ST. LAWRENCE,

QUEBEC TO MONTREAL AND LACHINE.

R. STECKEL, Engineer in Charge.
See Report to Chief Engineer, dated Nov. 24th, 1891.

Chas. Chaloner, del.

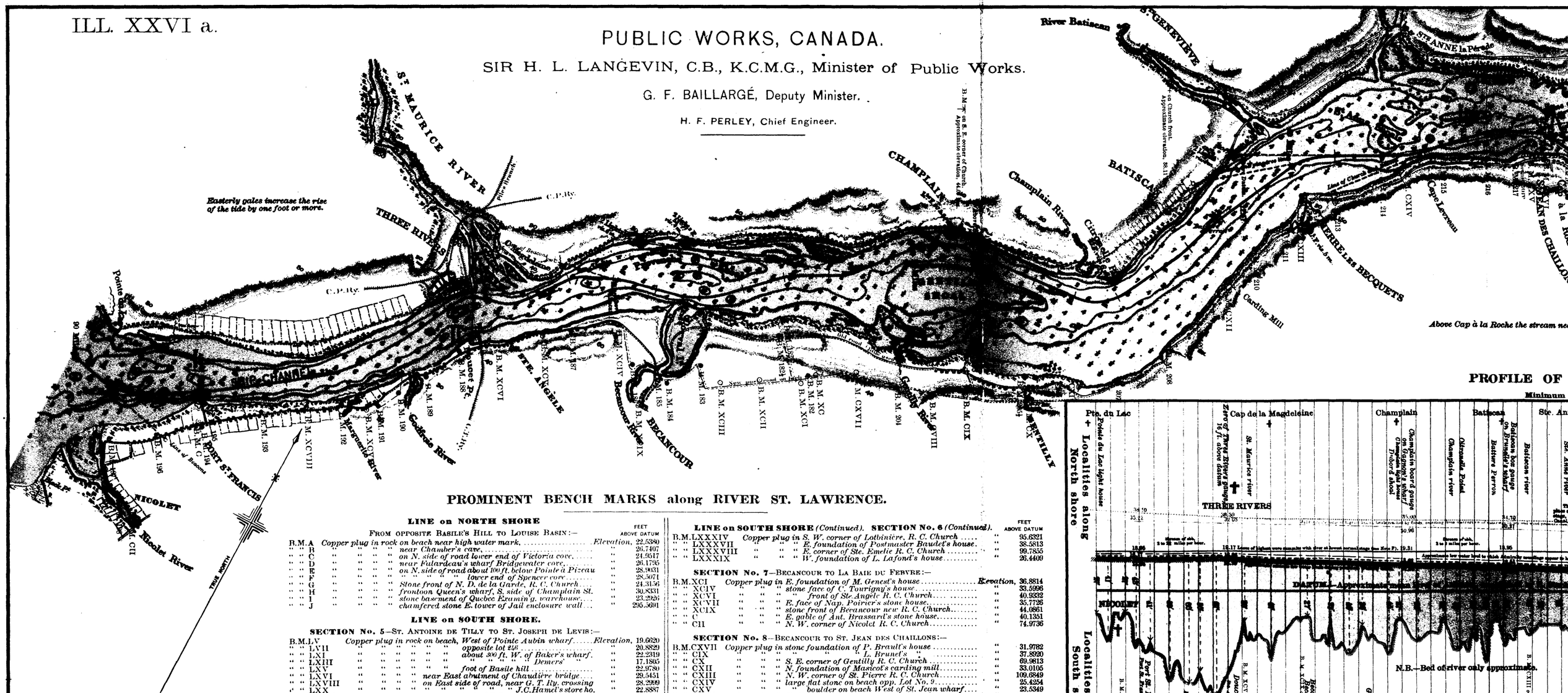
ILL. XXVI a.

PUBLIC WORKS, CANADA.

SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.

G. F. BAILLARGÉ, Deputy Minister.

H. F. PERLEY, Chief Engineer.



PROMINENT BENCH MARKS along RIVER ST. LAWRENCE.

LINE on NORTH SHORE

		FEET ABOVE DATUM
	FROM OPPOSITE BASILE'S HILL TO LOUISE BASIN:—	
B.M. A	*Copper plug in rock on beach near high water mark, Elevation,*	22.5380
" " B	" " " " *near Chamber's cave,* "	26.7407
" " C	" " " " *on N. side of road lower end of Victoria cove,* "	24.9517
" " D	" " " " *near Pidardeau's wharf Bridgewater cove,* "	26.1795
" " E	" " " " *on N. side of road about 100 ft. below Pointe à Pizeau* "	28.9031
" " F	" " " " " " " " *lower end of Spencer cove* "	28.5071
" " G	" " " " *Stone front of N. D. de la Garde, R. C. Church* "	24.3156
" " H	" " " " *frontoon Queen's wharf, S. side of Champlain St.* "	30.8331
" " I	" " " " *stone basement of Quebec Examing. warehouse,* "	23.2825
" " J	" " " " *chamfered stone E. tower of Jail enclosure wall* "	295.3691

LINE on SOUTH SHORE.

		FEET ABOVE DATUM
	SECTION No. 5—ST. ANTOINE DE TILLY TO ST. JOSEPH DE LEVIS:—	
B.M. LV	*Copper plug in rock on beach, West of Pointe Aubin wharf Elevation,*	19.6620
" " LVII	" " " " " " " *opposite lot 246* "	20.8829
" " LXI	" " " " " " " *about 300 ft. W. of Baker's wharf.* "	22.2319
" " LXIII	" " " " " " " " " " *Demers'* "	17.1805
" " LXV	" " " " " " " *foot of Basile hill* "	22.9780
" " LXVI	" " " " " " " *near East abutment of Chaudière bridge* "	29.5451
" " LXVIII	" " " " " " " *on East side of road, near G. T. Ry. crossing* "	28.2999
" " LXX	" " " " " " " " " " *J.C.Hamel's store ho.* "	22.8887
" " LXXII	" " " " " " " " " " *I.C.R. track, opp. Foizy's ho.* "	26.0925
" " LXXIV	" " " " *cut stone 2nd altar step, S.W. side of Graving Dock* "	21.6165
	SECTION No. 6—ST. ANTOINE DE TILLY TO ST. JEAN DES CHAILLONS:—	
B.M. LXXVIA	*Copper plug in 5 ft. stone, planted opposite Ste. Croix wharf, Elevation,*	25.1522
" " LXXVIIA	" " " " " " " *Joly's workshop* "	35.8665
" " LXXX	" " " " *rock on beach, near Joly's farm wharf* "	20.3498
" " LXXXIII	" " " " *large flat stone, some 15 ft. N. of Island lightho.* "	21.0159
B.M. LXXXIV	*Copper plug in S. W. corner of Lotbinière, R. C. Church* "	95.6321
" " LXXXVII	" " " " *E. foundation of Postmaster Baudet's house.* "	38.5813
" " LXXXVIII	" " " " *E. corner of Ste. Emelie R. C. Church* "	99.7855
" " LXXXIX	" " " " *W. foundation of L. Lafond's house* "	26.4409

LINE on SOUTH SHORE (Continued). SECTION No. 6 (Continued).

SECTION No. 7—BECANCOUR TO LA BAIE DU FEBVRE:—

		FEET ABOVE DATUM
B.M. XCI	*Copper plug in E. foundation of M. Genest's house Elevation,*	36.8814
" " XCIV	" " " " *stone face of C. Tourigny's house* "	33.5996
" " XCVI	" " " " " " *front of Ste Angele R. C. Church* "	40.9332
" " XCVII	" " " " *E. face of Nap. Poirier's stone house* "	35.7726
" " XCIX	" " " " *stone front of Becancour new R. C. Church* "	44.0861
" " C	" " " " *E. gable of Ant. Brassard's stone house* "	40.1351
" " CII	" " " " *N. W. corner of Nicolet R. C. Church* "	74.9736

SECTION No. 8—BECANCOUR TO ST. JEAN DES CHAILLONS:—

		FEET ABOVE DATUM
B.M. CXVII	*Copper plug in stone foundation of P. Brault's house* "	31.9782
" " CIX	" " " " " " " *L. Brunet's* "	37.8920
" " CX	" " " " *S. E. corner of Gentilly R. C. Church* "	69.9813
" " CXII	" " " " *N. foundation of Masicot's carding mill* "	33.0105
" " CXIII	" " " " *N. W. corner of St. Pierre R. C. Church* "	109.6849
" " CXIV	" " " " *large flat stone on beach opp. Lot No. 9* "	25.4254
" " CXV	" " " " " " *boulder on beach West of St. Jean wharf* "	23.5349
" " CXVI	" " " " *N. W. corner of St. Jean R. C. Church* "	160.0277

DATUM.

Approximate mean level of Atlantic, Gulf of St. Lawrence, determined by R. Steckel, at Quebec, 1880-82.

THE BURLAND LITH. CO. MONTREAL.

GEODETIC LEVELLING.
WATER LEVELS RIVER ST. LAWRENCE,
QUEBEC TO MONTREAL AND LACHINE.
R. STECKEL, Engineer in charge.
See Report to Chief Engineer dated Ottawa, Nov. 24, 1891.
N. B.—For profile of RIVER ST. LAWRENCE on larger scale, viz: Horizontal scale 1/75000 or 6250 feet per inch, Vertical " 1/300 or 25 " per inch, see ILL. XXIV. of accompanying report.
Flood Stream makes 50 minutes after L. W. and runs 4½ hrs.
Ebb Streams..........10..................H. W.............7½.....
Ebb Stream continues 1 hour after L. W.
Flood Stream.........½.............H.W.
Tide ebbs 7½ hrs. Flows 4½ hrs., but influenced by winds.
Ebb Stream makes at H. W. and runs 9 hrs.
Flood Stream makes up for about 2 hrs., but is scarcely felt at Neaps.
Continuous current measurements made at P. August 26th and 28th, 1882, covering an entire flood and an entire ebb. (See Illustration No. XXVIII.)
PORTNEUF
DESCHAMBAULT
GRONDINES
CAP SANTE
ECUREUIL
POINTE AUX TREMBLES
ST. AUGUSTIN
STE. CROIX
ST. NICHOLAS
ST. FOY
QUEBEC
BEAUPORT
LEVIS
Lake Calvaire
Cap Rouge
Cap Rouge River
River St. Charles
Chaudière R.
Grand Trunk Rail Road
E OF SHIP CHANNEL.
Horizontal Scale 1/360,000 or 30,000 feet per inch.
Vertical " 1/480 " 40 feet " "
Localities along North shore
Localities along South shore
PLAN OF RIVER ST. LAWRENCE, QUEBEC TO POINTE DU LAC,
According to Admiralty Chart No. 2830 a.
Natural Scale 1/120,000 = 10,000 feet per inch
0 10 20 30 40 50 thousand feet
F. Fixed, Fl. Flashing, Rev. Revolving, Lights.—B. Black, R. Red, W. White Buoys.—m. mud, r. rock, s. sand, st. stones.
Variation in 1886, increasing 2½ annually.
SOUNDINGS IN FATHOMS reduced to low water of ordinary Spring tides. Figures on the land show the height in feet above the river.
LINES of LEVELS and BENCH MARKS shown in red.
SHIP CHANNEL with mileage from Levis Graving Dock and elevations (above approximate mean sea level, determined by R. Steckel, at Quebec 1880 to 1888.) of the low water datum level, proposed for the reduction of soundings so as to indicate the minimum depths that may be safely counted on for navigation purposes in the ship channel—indicated in blue.
CHAS. CHALONER, DEL.

TIDES

		h.	m.		ft.		ft.
Quebec	H.W.F.&C.	VI	38	Springs rise	18	Neaps rise	13
Cap Rouge		VII	15		16		11
Frechette Island		VIII	0		14		9
Portneuf		VIII	30		14		9
Cap a la Roche	H.W.F.&C.	IX	30	Springs rise	6	Neaps rise	4
Champlain		IX	45		3		2
Three Rivers		XI	30		1		1
Pointe du Lac				Tide ends			

TIDES

Localities.	RIVER at low fall level. Mean luni-tidal intervals (corrected establishments). H.	M.	Corresponding monthly mean tidal amplitudes. FEET.	Maximum amplitudes of normal spring tides. FEET.	Maximum diurnal inequalities in tidal ranges. FEET.	RIVER at high spring level. Mean luni-tidal intervals (corrected establishments). H.	M.	Corresponding monthly mean tidal amplitudes. FEET.	Minimum amplitudes of normal neap tides. FEET.	Localities.
Quebec,	VI	24	13.85	18.20	4.35	VI	10	13.30	9.70	Quebec,
St. Nicholas,	VI	57	13.40	17 20	3.90	VI	52	12.75	9.65	St. Nicholas,
Pointe Platon,	VIII	6	11.75	13.80	3.60	VII	44	10.45	7.85	Pointe Platon,
Grondines,	VIII	41	7.50	8.95	2.90	VIII	28	4.75	2.70	Grondines,
St. Jean des Chaillons,	IX	2	5.30	6.55	2.75	VIII	58	3.00	1.50	St. Jean des Chaillons,
Batiscan,	IX	47	2.50	3.65	2.50	X	0	1.30	0.95	Batiscan,
Champlain,	X	26	1.90	3.00	2.25	X	26	0.95	0.45	Champlain.

ILL. XXVI b.

PUBLIC WORKS, CANADA.

H. F. PERLEY, Chief Engineer.

SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.

G. F. BAILLARGE, Deputy Minister.

GEODETIC LEVELLING.

WATER LEVELS RIVER ST. LAWRENCE,

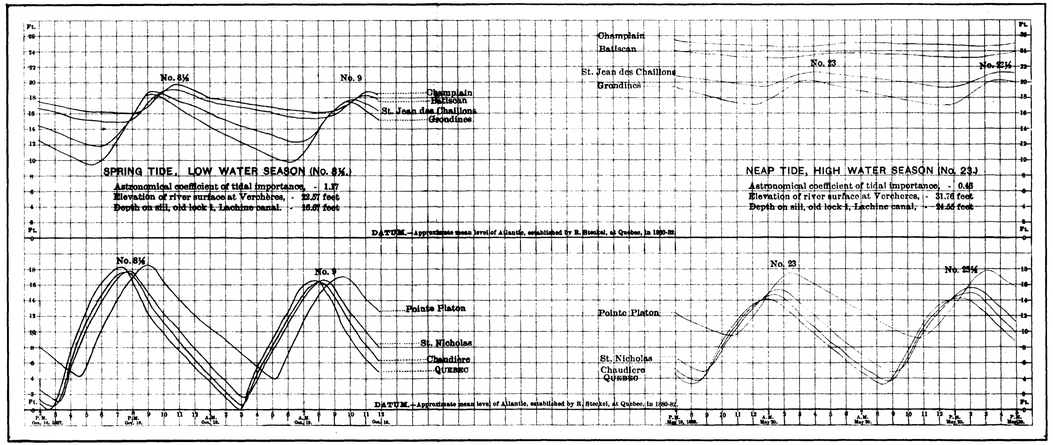
QUEBEC TO MONTREAL AND LACHINE.

R. STECKEL, Engineer in charge.

See Report to Chief Engineer dated Ottawa, Nov. 24, 1891.

TYPICAL LOCAL TIDE CURVES.

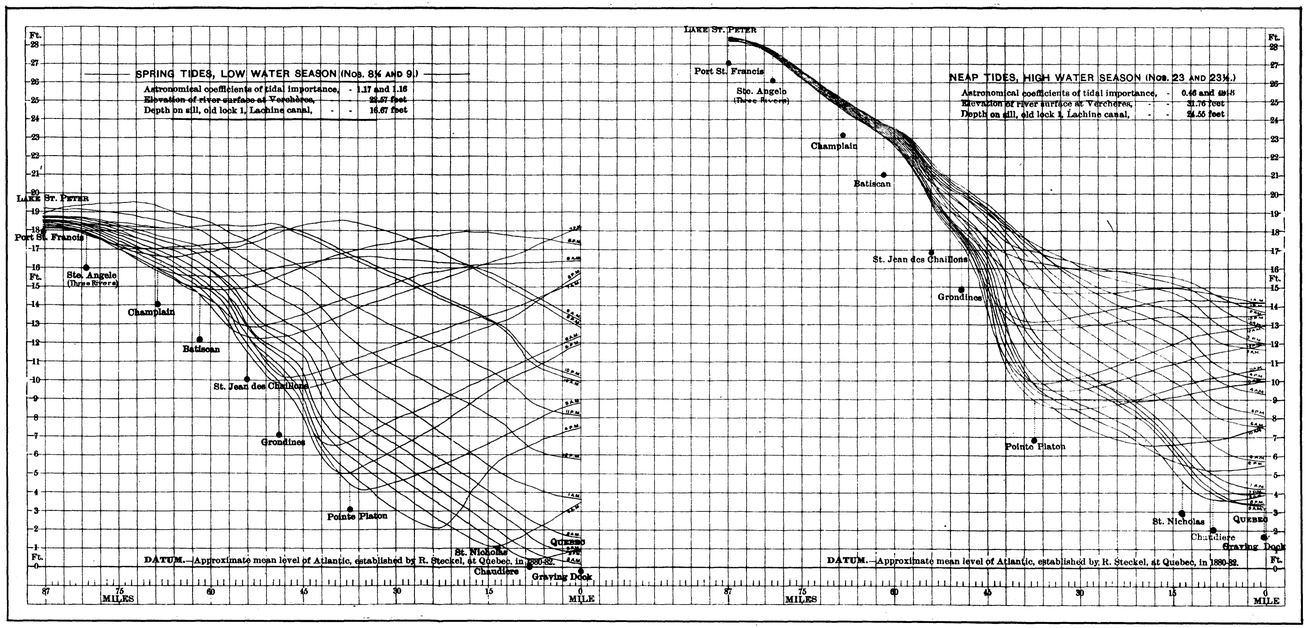
Scale of Ordinates, 12 feet per inch.
Scale of Abscissas, 6 hours per inch.



TYPICAL HOURLY INSTANTANEOUS TIDE CURVES.

QUEBEC TO LAKE ST. PETER.

Scale of distances, 15 miles per inch
Scale of heights, - 5 feet per inch



THE BURLAND LITH. CO. MONTREAL

RESULTS OF TIDAL OBSERVATIONS,

of 1887-88.

	QUEBEC Graving Dock.		ST. NICHOLAS.		POINTE PLATON.		GRONDINES.		ST. JEAN des CHAILLONS.		BATISCAN.		CHAMPLAIN.	
	Low water season	High water season	L.W. season	H.W. season	L.W. season	H.W. season	L.W. season	H.W. season	L.W. season	H.W. season	L.W. season	H.W. season	L.W. season	H.W. season
	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.
Mean observed luni-tidal interval for whole month (corrected establishm't.)	6.24	6.10	6.57	6.52	8. 6	7.44	8.41	8.28	9. 2	8.53	9.47	10. 0	10.26	10.26
Average luni-tidal interval observed on full and change days	6.40	6.33	7.20	7.88	8.29	8.10	9. 4	8.44	9.24	9. 3	10. 6	9.57	10.48	10.39
Corresponding monthly mean times of low water	6.32	6.21	7. 4	6.56	8.35	8.40	9.36	9.52	10. 7	10.27	11.24	11.14	12. 9	11.51
Maximum difference between observed time of high water and computed time based on London Bridge tide table contained in Nautical Almanac.	1. 1	1. 1	1. 0	.54	.58	.47	1. 8	.59	1.20	1. 4	1.38	1.16	1.41	1.29
Mean " " " " " "	.23	.17	.24	.19	.21	.18	.22	.22	.23	.23	.28	.36	.33	.29
Maximum duration of floods observed	5.39	5.18	5.46	5.20	5.23	4.40	5. 0	4. 2	4.39	3.58	4.38	4.38	5.15	4.38
Minimum " " " "	4.11	4.14	4.35	4.30	4. 1	3.20	3.32	3.12	3.25	3. 3	2.54	3. 0	2.40	2.43
Mean " " " "	4.59	4.45	5. 0	4.53	4.29	4. 4	4.14	3.35	4. 5	3.27	3.57	3.47	3.35	3.50
Maximum diurnal difference in observed duration of floods	1. 5	.52	.58	.25	.58	.48	.53	.26	.50	.23	1. 1	1. 2	1.50	1.24
Mean " " " " " "	.14	.14	.14	.11	.14	.16	.15	. 9	.19	. 9	.17	.19	.20	.20
Maximum duration of ebbs observed	8. 7	8.21	8. 9	8.20	8.26	9. 3	8.53	9.47	9.16	9.50	9.46	9.55	10. 0	10.13
Minimum " " " "	6.47	6.54	6.42	6.50	7. 5	7.40	7.24	8. 0	7.23	8.12	7.37	7. 7	7.20	7.20
Mean " " " "	7.27	7.40	7.26	7.32	7.47	8.22	8.12	8.50	8.21	8.58	8.49	8.37	8.47	8.45
Maximum diurnal difference in observed duration of ebbs	1. 8	.58	1.27	1.10	1.18	1. 8	1.23	1.22	1.53	1.22	2. 8	2.59	2. 0	2.20
Mean " " " " " "	.30	.28	.31	.35	.32	.37	.32	.49	.29	.47	.41	.59	.37	.49
Maximum observed priming of tides	.32	.26	.31	.25	.27	.35	.29	.25	.29	.26	.38	.43	1.15	.42
Maximum observed lagging of tides	.53	.29	.51	.40	.54	.35	.51	.29	.47	.25	1.39	.38	1.20	.52
Maximum diurnal inequalities in priming or lagging of tides	1.25	.28	1.22	1. 0	1.12	.30	1. 7	.22	.56	.29	1.30	1. 9	1.50	.57
Maximum duration of apparent stand at high water, within 0.05 foot	.31	.37	.36		.32	.34	.33	1. 0	.41	1.25	1.44	2.10	2. 0	2.30
Minimum " " " " " " " " " "	.13	.10	. 6		. 7	. 9	.20	.18	.16	.15	.17	.35	.16	.20
Mean " " " " " " " " " "	.22	.24	.19		.21	.21	.26	.32	.28	.37	.42	1.26	.45	1. 0
Maximum duration of apparent stand at low water, within 0.05 foot	.32	.36	.55		.26	.36	.35	1. 5	.56	1.14	1.30	2.25	2.50	2. 5
Minimum " " " " " " " " " "	.12	.11	. 4		.10	.10	.21	.32	.13	.20	. 2	.28	.15	.20
Mean " " " " " " " " " "	.19	.20	.18		.17	.22	.27	.45	.31	.49	.57	1.16	1.10	1. 4
General mean duration of apparent stand at high and low water, within 0.05 ft.	.20	.22	.20		.19	.22	.26	.38	.30	.43	.50	1.20	.53	1. 3
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Maximum flood range observed	18.915	17.775	17.590	16.700	15.128	13.825	9.684	7.310	7.655	5.130	4.383	2.617	3.800	1.980
Minimum " " "	9.351	10.126	9.550	9.680	8.990	7.030	4.972	2.190	3.540	1.200	.899	.430	.450	.140
Mean " " "	13.648	13.271	13.400	12.768	11.607	10.421	7.502	4.764	5.330	2.960	2.506	1.282	1.887	.960
Maximum ebb range observed	18.351	17.845	16.960	16.640	14.330	13.585	8.965	7.170	7.190	4.730	3.858	2.547	3.100	1.760
Minimum " " "	9.326	9.547	9.630	9.230	8.800	6.998	5.175	2.360	3.455	1.330	.700	.536	.800	.150
Mean " " "	13.816	13.246	13.380	12.748	11.711	10.434	7.496	4.874	5.291	2.940	2.477	1.286	1.866	.970
Maximum diurnal difference in high water levels	4.356	3.340	3.910	3.140	3.605	3.542	2.918	2.420	2.659	1.930	2.345	1.286	1.650	.980
Mean " " " " " "	1.637	1.681	1.290	1.609	1.267	1.546	.979	1.147	.787	.910	.709	.505	.662	.390
Maximum diurnal difference in low water levels	1.450	1.540	1.380	1.370	1.035	.995	1.197	.500	1.318	.510	1.109	.505	1.150	.550
Mean " " " " " "	.460	.412	.440	.352	.405	.237	.228	.170	.277	.160	.230	.157	.209	.150
Elevation of highest wave summit observed	18.397	20.184	17.890	20.969	18.670	23.051	18.340	23.827	18.494	24.360	18.746	25.948	19.253	26.989
Elevation of lowest wave trough observed	-1.321	.500	-.570	2.449	2.137	6.357	6.640	13.017	9.219	15.940	13.010	19.469	14.353	20.670
Mean elevation of summits and troughs of waves observed	6.998	8.946	7.488	10.353	9.306	13.696	11.900	17.883	13.204	19.895	15.465	22.594	16.067	23.740
General mean tide level (corrected for diurnal inequalities)	6.808	8.955	7.489	10.353	9.539	13.689	11.885	18.030	13.206	19.900	15.176	22.532	16.066	23.750

REMARKS.

During the low water season of 1887 observations were made continuously, from October 11th to November 11th, when the river stood at a mean elevation of 21.94 feet above datum at Verchères, and 16.40 feet over sill of old lock No. 1, foot of Lachine Canal, and during the high water season of 1888, from May 5th to June 3rd, when the river stood at a mean elevation of 29.91 feet above datum at Verchères, and 23 feet over said lock sill.

MEAN HEIGHTS OF BAROMETRICAL COLUMN REDUCED TO SEA LEVEL.
AND TO 0° CENT.= 32° FAHT.

QUEBEC (Graving Dock and Observatory).—Low water season of 1887, 30.020 inches—High water season, 29.946.
MONTREAL (McGill Observatory).— " " " " " 30.031 " " " " 29.931.

STRONGEST WINDS OBSERVED.

QUEBEC.—L. W. season of 1887, S. E. wind, 26 miles per hour.—H. W. season, N. W., 17 miles per hour.
MONTREAL. " " " " Westerly, 72 " " " " " S. W., 32 " " "

DIRECTIONS OF PREVALENT WINDS.

QUEBEC.—L. W. season of 1887, N. Westerly.—H. W. season N. Easterly.
MONTREAL. " " " " " " " " S. Westerly.

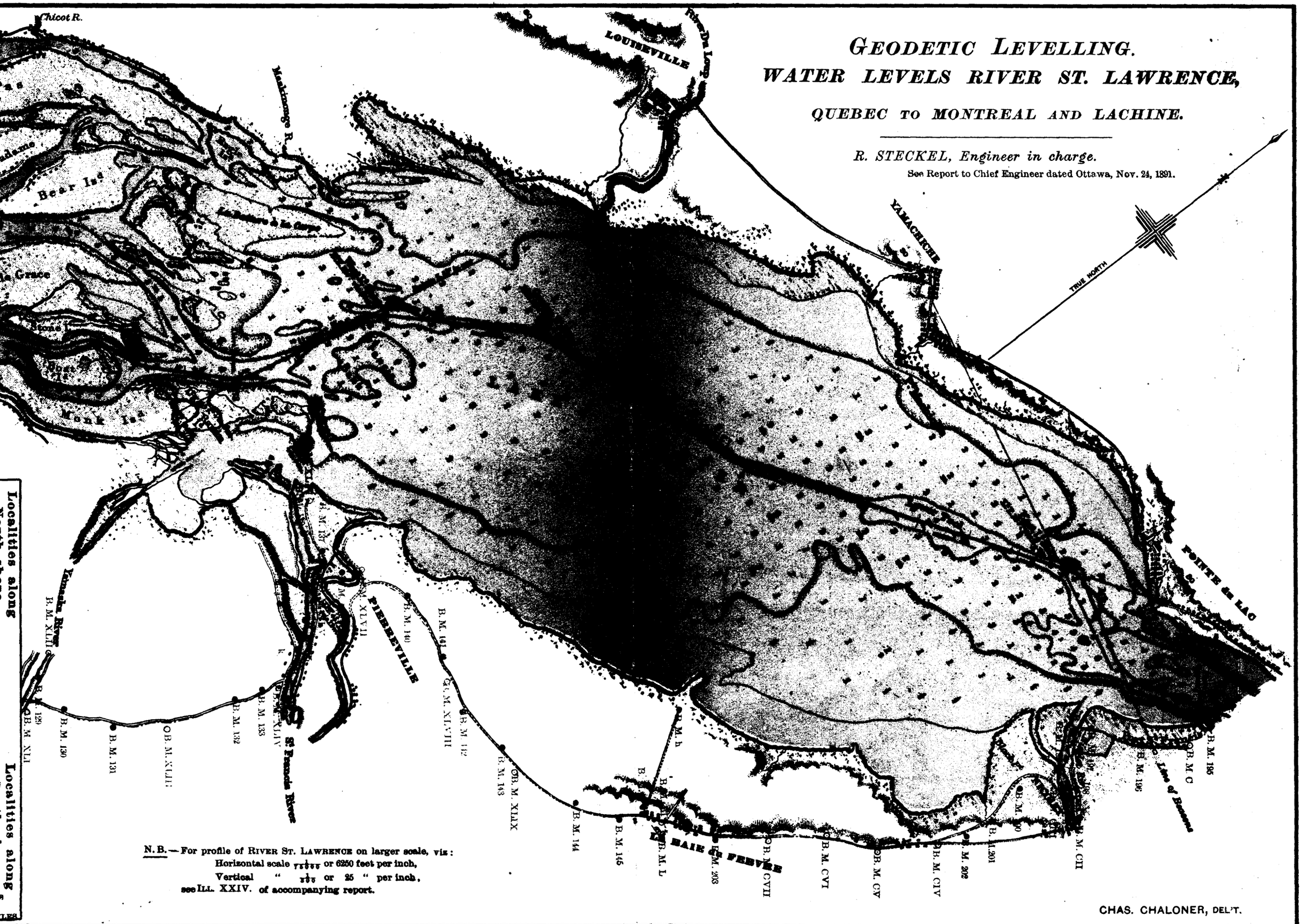
CHAS. CHALONER, DEL'T.


ILL. XXVIIa.
PLAN OF RIVER ST. LAWRENCE, POINTE DU LAC TO LACHINE,
According to Admiralty Chart No. 2830 b.
Natural Scale 1/120,000 = 10,000 feet per inch
0 5,000 10,000 20,000 30,000 40,000 50,000 English feet
F. Fixed, Fl. Flashing, Rev. Revolving, Lights.—B. Black, R. Red, W. White Buoys.—m. mud, r. rock, s. sand, st. stones.
Variation in 1886, increasing 3' annually.
SOUNDINGS IN FATHOMS reduced to the ordinary low water level of Summer. Figures on the land show the height in feet above the river.
NO TIDE.
LINES of LEVELS and BENCH MARKS shown in red.
SHIP CHANNEL with mileage from Levis Graving Dock and elevations (above approximate mean sea level, determined by R. Steckel, at Quebec. 1880 to 1882.) of the low water datum level, proposed for the reduction of soundings so as to indicate the minimum depths that may be safely counted on for navigation purposes in the ship channel—indicated in blue.
PUBLIC WORKS, CANADA.
SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.
G. F. BAILLARGÉ, Deputy Minister.
H. F. PERLEY, Chief Engineer.
MONTREAL ISLAND
MONTREAL
ILE JESUS
Ile Bouchard
BERTHIERVILLE
Ile St Ignace
LONGUEUIL
ST. LAMBERT
BOUCHERVILLE
Riv. Richelieu
(Sec. III. XXVIIb.)
PROMINENT BENCH MARKS along RIVER ST. LAWRENCE.
DATUM.—Approximate mean level of Atlantic, established by R. Steckel, at Quebec, 1880 to 1882.
PROFILE OF SHIP CHANNEL.
Minimum width, 300 feet.
Horizontal Scale, 1/360,000 or 30,000 feet per inch.
Vertical 1/480 40 feet
Localities along North shore
Localities along South shore
LAKE ST. LOUIS.
MONTREAL
LAKE ST. PETER
Note C.
Note A.
Lachine
Côte St. Paul
Hochelaga
Longue Pointe
Pte. aux Trembles
Répentigny
St. Sulpice
Lavaltrie
Lanoraie
Berthierville
St. Barthélémi
Maskinonge
Louiseville
Yamachiche
Pte. du Lac
Caughnawaga
Laprairie
St. Lambert
Longueuil
Boucherville
Varennes
Verchères
Contrecoeur
St. Joseph de Sorel
SOREL
Yamaska
La Baie du Febvre
Port St. Francis
STATUTE MILES
THE BURLAND LITH. CO. MONTREAL.

GEODETIC LEVELLING.
WATER LEVELS RIVER ST. LAWRENCE,
QUEBEC TO MONTREAL AND LACHINE.

R. STECKEL, Engineer in charge.

See Report to Chief Engineer dated Ottawa, Nov. 24, 1891.



N.B.—For profile of RIVER ST. LAWRENCE on larger scale, viz:
Horizontal scale $\frac{1}{75000}$ or 6250 feet per inch,
Vertical " $\frac{1}{500}$ or 25 " per inch,
see ILL. XXIV. of accompanying report.

CHAS. CHALONER, DEL'T.

Localities along North shore

Localities along

ILL. XXVII b.

PUBLIC WORKS, CANADA.

SIR H. L. LANGEVIN, C.B., K.C.M.G., Minister of Public Works.

G. F. BAILLARGÉ, Deputy Minister.

H. F. PERLEY, Chief Engineer.

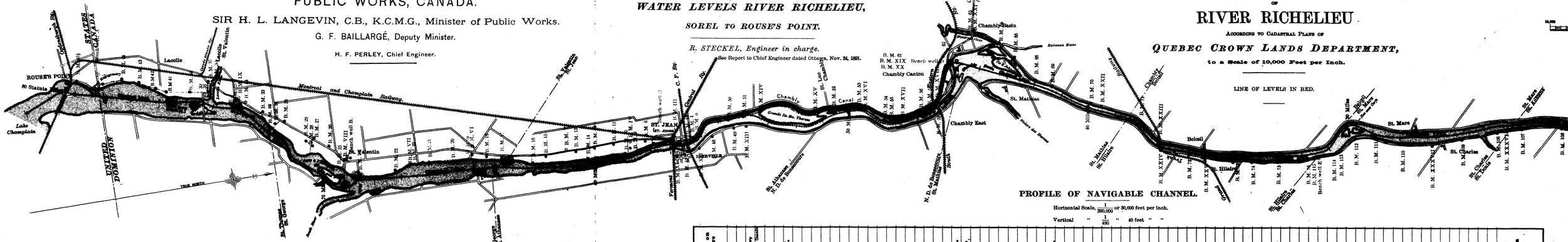
GEODETIC LEVELLING.

WATER LEVELS RIVER RICHELIEU,

SOREL TO ROUSE'S POINT.

R. STECKEL, Engineer in charge.

See Report to Chief Engineer dated Ottawa, Nov. 24, 1891.



PLAN
OF
RIVER RICHELIEU
ACCORDING TO CADASTRAL PLANS OF

QUEBEC CROWN LANDS DEPARTMENT,

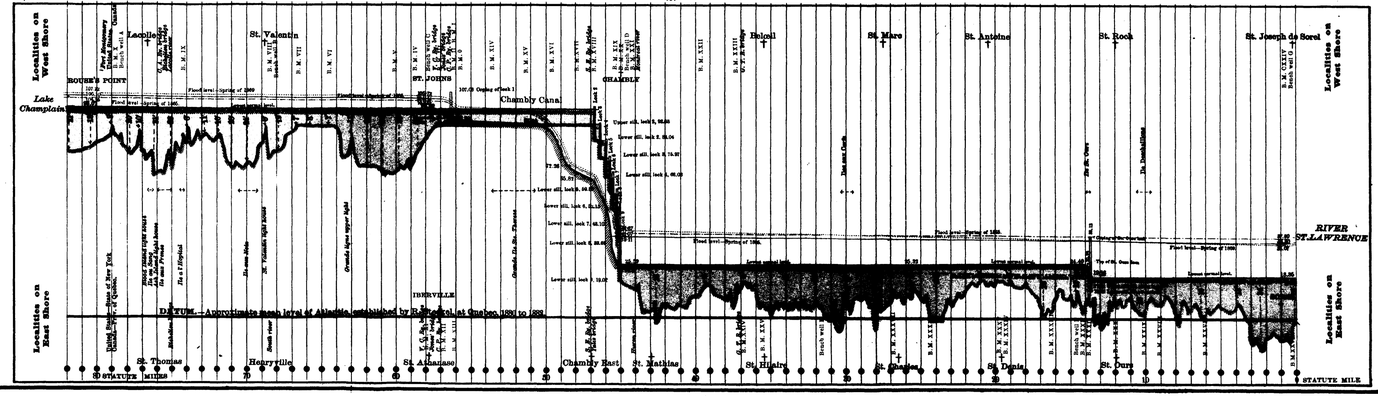
to a Scale of 10,000 Feet per Inch.

LINE OF LEVELS IN RED.

PROFILE OF NAVIGABLE CHANNEL.

Horizontal Scale, $\frac{1}{300,000}$ or 30,000 feet per inch.

Vertical " $\frac{1}{480}$ " 40 feet " "



PROMINENT BENCH MARKS along RIVER RICHELIEU.

		FEET ABOVE DATUM
SECTION No. 1—ST. JOHN'S TO ROUSE'S POINT:—		
B.M. O	Copper plug in large flat stone, East side of canal bank, opposite swing bridge, at Langelier's,	99.3382
" " I	" " N. E. corner of G. Nolin's brick house, opposite Lock 1,	112.4983
" " II	" " coping, upper end of Lock 1,	107.0838
" " III	" " stone front of Montgomery's house, N.W. corner of Lemoine and Champlain streets,	123.0341
" " IV	" " gable end of Moise Pinsonneault's house,	117.0812
" " V	" " N. E. gable of Mrs. Lord's stone house, Parish of St. John,	123.3138
" " VI	" " S.W. corner of Fra. Pinsonneault's house, Parish of St. Valentin,	133.8416
" " VII	" " stone planted in J. Bte. Bornais' field,	102.8436
" " VIII	" " S. E. corner stone foundation of Bouleau's hotel,	112.0939
" " IX	" " N. E. corner of William Vanvliet's house,	134.9616
" " X	" " stone planted a few feet from boundary line between Canada and the United States,	102.3867
Bench well A	Top of bronze cap of B. W. A planted in " " " " " "	100.0863
" " B	" " " " opposite Bissonnette's house, St. Valentin Village,	103.3134
" " C	" " inside St. John's barracks,	107.9667
CROSS SECTION—ST. JOHN'S TO IBERVILLE:—		
B.M. XI	Copper plug in S. W. corner of D. Prevette's brick store, cor. Napier and St. Ann Streets, Iberville,	110.5137
" " XII	" " " foundation of G. Thurdon's grist and carding mill,	100.5303
" " XIII	" " S. W. corner of D. Bawuais' house	101.4167
SECTION No. 2—ST. JOHN'S TO ST. HILAIRE:—		
B.M. XIV	Copper plug in stone planted at head of Grand St. Therese Island, Parish of St. John's,	100.4577
" " XV	" " " " foot " " "	99.8145
" " XVI	" " opposite L. Fortier's North line on brow of hill, Chambly,	103.1996
" " XVII	" " " " J. Collette's bridge, East side of Canal,	100.9147
" " XVIII	South abutment of S. E. Ry. bridge, Chambly,	86.3417

		FEET ABOVE DATUM
SECTION No. 2—ST. JOHN'S TO ST. HILAIRE—(Continued).		
B.M. XIX	Copper plug in stone lower face of Lock wall 7,	54.6123
" " XX	" " N. W. corner of Canal toll collector's office,	54.4085
" " XXI	" " N. E. corner of L. A. Lamourenx's stone house,	48.7347
" " XXII	" " E. Lamourenx's stone and a half brick house,	45.3993
" " XXIII	" " West stone abutment of G. T. Ry. bridge, Belœil,	53.9144
" " XXIV	" " East " " " " St. Hilaire,	50.3142
" " XXV	" " S.W. corner of St. Hilaire R. C. Church,	55.3564
Bench well D	Top of bronze cap of B. W. D planted on S. side of Lock 7,	54.2955
SECTION No. 3—SOREL TO ST. HILAIRE:—		
B.M. XXVI	Copper plug in stone basement S. E. corner of Sorel market hall,	46.3541
" " XXVII	" " North gable of F. Ethier's brick house, Sorel,	76.9899
" " XXVIII	" " " J. Dufault's " " St. Ours,	49.7199
" " XXIX	" " " L. Morin's " " "	56.0464
" " XXX	" " cap of plint, South side of St. Ours R. C. Church,	56.1744
" " XXXI	" " stone coping, East side and upper end of St. Ours Lock,	38.1183
" " XXXII	" " " iron abutment, W. st side of " " Island,	38.2978
" " XXXIII	" " North East gable of F. Plante's story and a half brick house, St. Ours,	54.1036
" " XXXIV	" " North West corner of St. Denis stone Convent wall,	55.3186
" " XXXV	" " North " " R. C. Church,	60.0041
" " XXXVI	" " " gable of T. Benoit's brick house, St. Charles,	47.3955
" " XXXVII	" " N. W. corner of St. Charles R. C. Church,	51.3150
Bench well K	Top of bronze cap of B. W. K. planted in line between St. Hilaire and St. Charles,	38.7079
" " L	" " " " " " cut of St. Ours Lock Island,	34.9452
" " G	" " " " " " " " G. " on N. E. corner of route to St. Ours, St. Joseph de Sorel,	37.3261

DATUM.

Approximate mean level of Atlantic Ocean, Gulf of St. Lawrence, established at Quebec, by R. Steckel, 1880 to 1882.

THE BURLAND LITH. CO. MONTREAL.

N. B.—For profile of RIVER RICHELIEU on larger scale, viz:
Horizontal scale $\frac{1}{10000}$ or 5000 feet per inch,
Vertical " $\frac{1}{800}$ or 25 " per inch,
see sheets Nos. IV., V. and VI., accompanying R. Steckel's Report to Chief Engineer, dated August 26, 1885.

SCALE

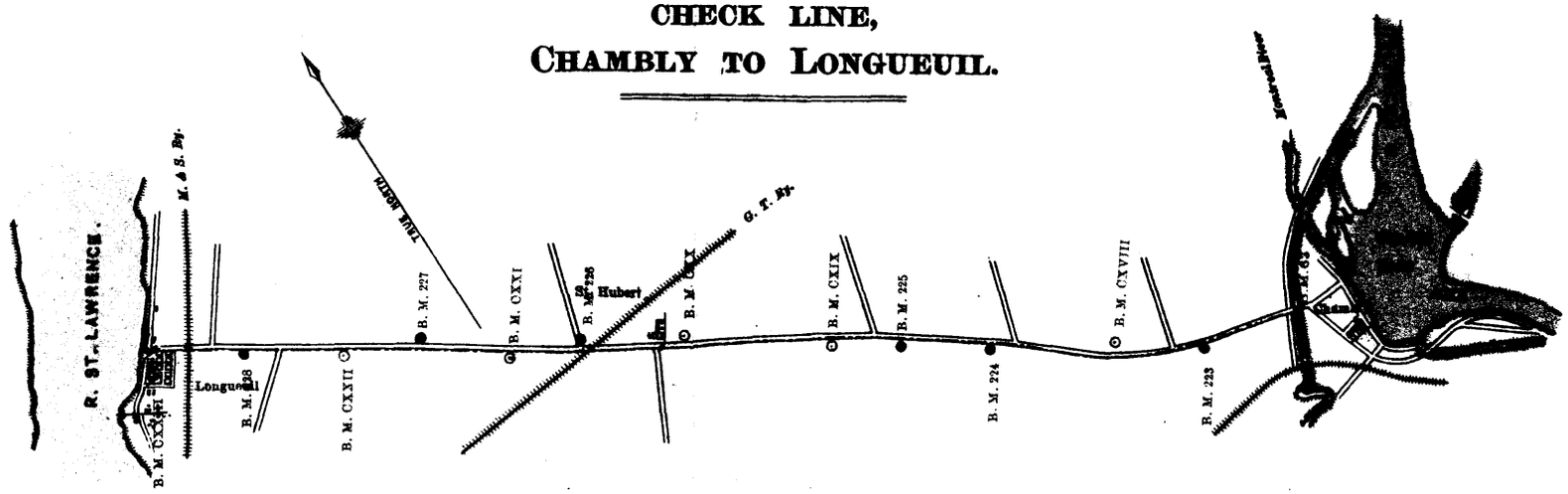
10,000 5,000 0 10,000 20,000 30,000 40,000 50,000 English feet

TRUE NORTH

St. Marc
St. Antoine
St. Antoine
St. Denis
St. Ours
St. Antoine
Belœil Roch
St. Roch
St. Ours
Ste. Victoire
St. Roch
St. Joseph
Ste. Victoire
St. Pierre
St. Joseph Branch

B. M. 107 B. M. 106 B. M. 105 B. M. 104 B. M. XXV B. M. XXVI B. M. 103 B. M. 102 B. M. 101 B. M. 100 B. M. 99 B. M. XXXIII B. M. 98 B. M. 97 B. M. 96 B. M. 96 St. Ours Lock and Dam B. M. 94 B. M. XXX B. M. XXIX B. M. XXVIII B. M. 91 B. M. 90 B. M. 89 B. M. 88 B. M. CXXVII B. M. 87 B. M. 86 B. M. XXVII B. M. 85 B. M. 84 B. M. 83 B. M. 82 B. M. 81 B. M. 80 B. M. 79 B. M. 78 B. M. 116 B. M. 115 B. M. XXVI B. M. CXXVI B. M. 233 B. M. 232 B. M. CXXV B. M. 231 B. M. 229

CHECK LINE, CHAMBLY TO LONGUEUIL.



PROMINENT BENCH MARKS ALONG CHECK LINE.

		FT. ABOVE DATUM.
B.M.CXVIII	Copper plug in S. E. gable of W. Daignault's stone house, North side of road, Chambly,	86.4815
" " CXIX	" " " stone foundation of J. B. E. Charon's stone house, W. side of road, St. Hubert,	83.3539
" " CXX	" " " " " A. Rocheleau's " " N. " " "	88.3992
B.M.CXXI	Copper plug in E. gable of H. Lamarre's stone house, South side of road, Longueuil,	107.9873
" " CXXII	" " " N. E. gable of P. Benoit's " " " " " "	100.9697
" " CXXIII	" " " N. E. corner of Longueuil R. C. Church,	56.8195

DATUM.—Approximate mean level of Atlantic, established by R. Steckel, at Quebec 1880 to 1882.

West Shore

East Shore

TE MILE

CHAS. CHALONER, DEL'T.

ILL. XXVIII.

PUBLIC WORKS, CANADA.

H. F. PERLEY, Chief Engineer.

SIR H. L. LANGEVIN, C. B., K. C. M. G., Minister of Public Works.

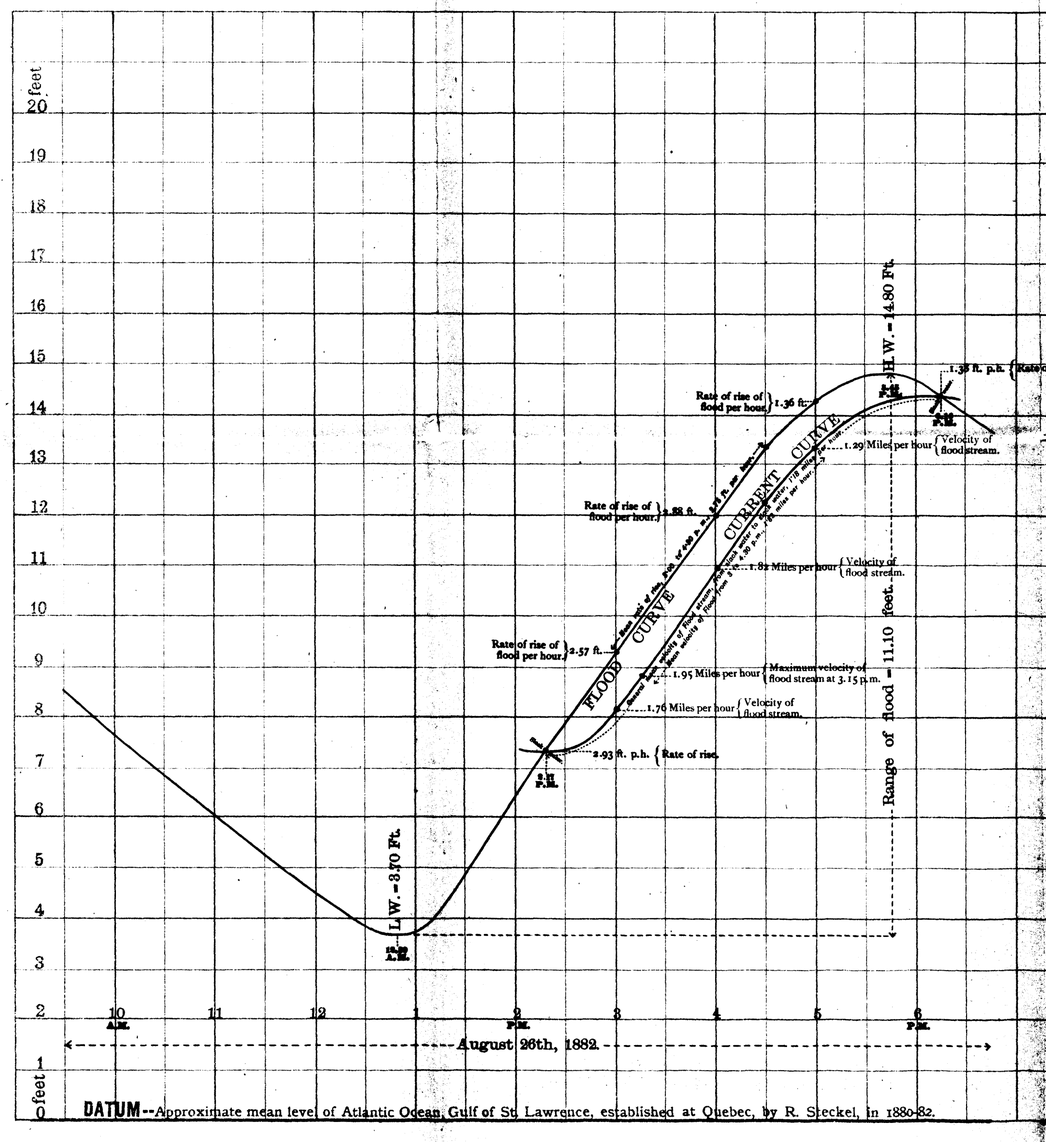
G. F. BAILLARGÉ, Deputy Minister.

WATER LEVELS, ST. LAWRENCE,

QUEBEC TO MONTREAL.

CORRESPONDING TIDE AND CURRENT CURVES AT A POINT IN SHIP CHANNEL 2½ MILES BELOW WHARF AT POINTE AUX TREMBLES (en bas), ACCORDING TO OBSERVATIONS MADE IN 1882.

R. STECKEL,
Engineer in Charge.
See Report to Chief Engineer, dated November 24 1891.



DATUM--Approximate mean level of Atlantic Ocean, Gulf of St. Lawrence, established at Quebec, by R. Steckel, in 1880-82.

N.B.—From August 25th to 28th, 1882, the river stood at Sorel 22·6 ft. above the zero of the Montreal Harbour Commissioners gauge, and hence was very nearly 22·5 ft. above datum.

Chas. Chaloner, del.

PUBLIC WORKS, CANADA,

GEODETIC LEVELLING.

WATER LEVELS, RIVER ST. LAWRENCE,

BETWEEN

QUEBEC, MONTREAL AND LACHINE.

LIST OF APPENDICES TO REPORT ADDRESSED TO CHIEF ENGINEER, BY R. STECKEL, ENGINEER IN CHARGE OF LEVELLING AND GAUGING OPERATIONS, ETC., UNDER DATE OF 24TH NOVEMBER, 1891.

REPORT

ON

WATER LEVELS, RIVER ST. LAWRENCE

BETWEEN

QUEBEC, MONTREAL AND LACHINE

BY

R. STECKEL, CIVIL ENGINEER

24TH NOVEMBER, 1891.

LIST OF APPENDICES.

*No. 1.—Computation tables, main line and cross sections, section No. 4, city of Sorel to village of La Baie du Febvre; 101 pages.

*No. 2.—Computation tables, main line and cross sections, section No. 5, from parish line between Ste. Croix and St. Antoine de Tilly to Lévis Graving Dock; 106 pages.

*No. 3.—Computation tables, loop line from Basile's Hill, south side of the St. Lawrence, *viâ* north shore to Couture's wharf, Lévis, inclusive of river crossings, together with a spur line to the Louise docks at Point à Carcy, and one from the church of Notre Dame de la Garde, Champlain street, Quebec, to the Quebec Observatory on the Cove Fields and to Martello Tower No. 2, near Grande Allée; 51 pages.

*No. 4.—Computation tables, main line and cross sections, etc., on both the north and south shores, section No. 6, from the division line between the parishes of St. Antoine de Tilly and Ste. Croix to Petite Rivière du Chêne, St. Jean des Chaillons; 132 pages.

*No. 5.—Computation tables, main line and cross sections, etc., on both sides of the river, section No. 7, from lower end parish of Bécancour to village of La Baie du Febvre; 132 pages.

N*o. 6.—Computation tables, main line and cross sections, check lines, etc., on north and south shores, section No. 8, from lower end of parish of Bécancour to Petite Rivière du Chêne, parish of St. Jean des Chaillons; 105 pages.

*No. 7.—Computation tables, main line and cross sections, etc., on both shores, section No. 9, from the city of Sorel to a point in the parish of Varennes, 2 miles below the parish church; 126 pages.

*No. 8.—Computation tables, main line and cross sections, etc., on the south side of the St. Lawrence, section No. 10, from the Canadian Pacific Railway bridge at Caughnawaga to a point in the parish of Varennes, 2 miles below the church; 170 pages.

* Not printed.

*No. 9.—Computation tables, section No. 10½—Loop line from balm of Gilead tree on south side of St. Lawrence, opposite lower end of St. Helen's Island, to first pier of new C. P. Ry. bridge, south side of river road, Montreal to Lachine, *viâ* north shore of river; from Brock street, Montreal, to Lachine C. P. Ry. bridge, inclusive of river crossings, extensions eastwardly from Brock street to Hochelaga sugar refinery, and cross sections, etc., levelled in connection with the said line; 126 pages.

*No. 10.—Computation tables, section No. 8½—Check line from Chambly Basin to Longueuil, including cross sections to water, etc.; 26 pages.

*No. 11.—Computation tables, 38 pages.—Beginning of proposed section No. 11, from abutment of C. P. Ry. bridge at Caughnawaga, south side of the St. Lawrence to Cedar Village, on the north shore of the river, inclusive of cross-sections to water, etc.; also connection of Canadian system of geodetic levels with B.M. of U. S. C. & G. Survey at Rouse's Point.

*No. 12.—Abstracts of cross-sections, etc., levelled on both sides of the St. Lawrence in connection with the main continuous line between St. Joseph de Lévis and the town of Lachine; 123 pages.

No. 13.—Sixteen tables of results deduced from tidal observations made in 1887-88 during high and low water stages of the River St. Lawrence: at the Graving Dock, Chaudière, St. Nicholas, Pointe Platon, Grondines, St. Jean des Chaillons, Batiscan and Champlain gauging stations, together with corresponding theoretical results based on data taken from the "Nautical Almanac," "L'Annuaire des Marées de France," etc.; 57 sheets $16\frac{1}{2}'' \times 21\frac{1}{2}''$.

No. 14.—Extract from a report dated 10th October, 1887, on fluctuation in the level of Lake Champlain and average height of its surface above the sea, by Assistant C. A. Schott, of the United States Coast and Geodetic Survey.

No. 15.—Progress report, R. Steckel, to Chief Engineer of Public Works, dated 9th December, 1886, on precision levelling carried out in 1885-86 with a view of establishing the heights of the finished copings of the graving dock at St. Joseph de Lévis and the Louise embankment and docks at Quebec, above the zero of the original standard tide gauge put up by the Quebec Harbour Commissioners at Point à Carcy.

No. 16.—Newspaper accounts showing the great damage done to shipping and other property in the maritime portion of the St. Lawrence by high spring tides driven up the estuary by north-easterly storms, in 1873 and 1884. From "Quebec Morning Chronicle" of 31st March, 1873, and 5th and 6th December, 1884.

No. 17.—Account of the gradual breaking up and moving off of an unusual thick and solid ice bridge, May 8 and 9, 1836, in Quebec harbour without causing any damage.

No. 18.—Newspaper accounts of the disastrous breaking up and moving away of the heavy ice bridge, in Quebec Harbour, 9th May, 1874. From the "Quebec Morning Chronicle," 9th of May, and "Le Canadien" of 11th of May, 1874.

No. 19.—Extracts from "La Minerve" (Montreal), "Le Canadien (Quebec), and the "Morning Chronicle" (Quebec), relative to the disastrous spring floods of 1861-65 and 1873 between Quebec and Montreal, showing the great destruction of property and loss of life caused by them, etc., etc., etc.

No. 20.—Notes and remarks relative to the débâcle and the flooding of the river banks on the St. Lawrence between Quebec and Montreal in the spring of 1887 by mayors, municipal officers, etc., of riparian parishes, in reply to circulars addressed them by the Department of Public Works, at the approach of spring in 1887.

No. 21.—Note A,—Approximate determination of mean level of Atlantic Ocean, at Quebec, by means of data afforded by tide and river gauge registers kept at points between Quebec and Montreal, 1878 to 1882, the Admiralty charts, etc.

* Not printed.

WATER LEVELS, ST. LAWRENCE,

BETWEEN

QUEBEC, MONTREAL AND LACHINE.

REPORT

BY R. STECKEL, CIVIL ENGINEER,

November 24, 1891.

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

LEVIS GRAVING DOCK, HARBOUR OF QUEBEC,

DURING A COMPLETE LUNAR MONTH OF THE LOW WATER SEASON OF 1887, VIZ., OCTOBER 8 TO NOVEMBER 9.

TABLE I.

FIRST WEEK'S SERIES OF GAINING TIDES, No. I.

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, Series of gaining tides No. I.

Gauge book reference numbers.	Series I. Gaining tides.	High and low waters observed each civil day.		Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming − or lagging + of tides.	Duration of apparent stand within 0·05 ft.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
				H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	Feet.
		Oct. 11	H.W.	1	8	P.M..	....	....	....	....	....	....	+ 27	.....	11·379	.....	.....	.....	.....
	¼	do 11	L.W.	7	58	P.M..	....	....	6	50	12	16	.....	24	1·899	.....	9·480	.....	.....
2		do 12	H.W.	1	24	A.M.	5	26	....	....	....	....	.....	24	13·500	11·601	.....	7·009	11·090
	¼	do 12	L.W.	9	5	A.M.	....	....	7	41	12	57	.....	23	1·029	.....	12·471	.....	.....
	½	do 12	H.W.	2	21	P.M..	5	16	....	....	....	....	+ 24	27	11·839	10·810	.....	6·835	11·697
	¾	do 12	L.W.	9	25	P.M..	....	....	7	4	12	17	.....	21	0·945	... .	10·894	.....	.....
3		do 13	H.W.	2	38	A.M.	5	13	....	....	....	....	.....	22	13·561	12·616	.....	6·751	12·366
	¼	do 13	L.W.	10	23	A.M.	....	....	7	45	12	58	.....	20	0·191	.....	13·370	.....	.....
	½	do 13	H.W.	3	36	P.M..	5	13	....	....	....	....	+ 15	23	12·777	12·586	.....	6·986	13·007
	¾	do 13	L.W.	10	32	P.M..	....	....	6	56	12	7	.....	20	0·775	.....	12·002	.....	.....
4		do 14	H.W.	3	43	A.M.	5	11	....	....	....	....	.....	21	14·846	14·071	.....	7·306	13·742
	¼	do 14	L.W.	11	26	A.M.	....	....	7	43	12	42	.....	17	0·095	.....	14·751	.....	.....
	½	do 14	H.W.	4	25	P.M..	4	59	....	....	....	....	+ 10	21	14·241	14·146	.....	7·515	14·455
	¾	do 14	L.W.	11	44	P.M..	...	....	7	19	12	18	.....	16	0·481	.....	13·760	.....	.....
5		do 15	H.W.	4	43	A.M.	4	59	....	....	....	....	.....	16	15·645	15·164	.....	7·621	14·961
	¼	do 15	L.W.	12	25	P.M..	....	....	7	41	12	27	.....	15	− 0·189	.....	15·834	.....	.....
	½	do 15	H.W.	5	11	P.M..	4	45	....	....	....	....	− 12	22	14·856	15·045	.....	7·176	15·489
	¾	do 16	L.W.	12	51	A.M.	....	....	7	40	12	11	.....	17	− 0·948	.....	15·804	.....	.....
6		do 16	H.W.	5	22	A.M.	4	32	....	....	....	....	.....	15	14·326 °	15·274	.....	6·847	15·964
	¼	do 16	L.W.	1	8	P.M..	....	....	7	46	12	31	.....	18	− 1·321	.....	15·647	.....	.....
	½	do 16	H.W.	5	53	P.M..	4	45	....	....	....	....	+ 3	16	15·808	17·129	.....	7·163	16·592
	¾	do 17	L.W.	1	46	A.M.	....	....	7	53	12	22	.....	17	− 0·944	.....	16·752	.....	.....
7		do 17	H.W.	6	15	A.M.	4	29	....	....	....	....	.....	25	15·895	16·839	.....	7·883	17·229
	¼	do 17	L.W.	1	53	P.M..	....	.. .	7	38	12	24	.....	14	− 0·518 °	.....	16·413	.....	.....
	½	do 17	H.W.	6	39	P.M..	4	46	...	....	....	....	+ 4	21	18·397 *	18·915	.....	8·683	17·664
	¾	do 18	L.W.	2	30	A.M.	....	..	7	51	12	30	.....	17	0·220	.....	18·177	..... *	..... *
8		do 18	H.W.	7	9	A.M.	4	39	....	....	....	....	.....	20	17·373	17·153	.....	8·987	17·688
	¼	do 18	L.W.	2	42	P.M..	....	....	7	33	12	12	.....	16 °	0·066	.....	17·307	.....	.....
	½	do 18	H.W.	7	21	P.M..	4	39	....	....	....	....	− 9	13	18·182	18·116	.....	8·720	17·544
Totals 14 tides			H.W.	66	40	}	....	68	52	105	20	174	12	+ 56	286	211·246	209·465	202·662	105·482	209·478
			L.W.	105	48	}								− 21	255	1·781				
Means do		14	H.W.	}	..	....	.....	4	55	7	31	12	27	+ 11	20	15·089	14·962	14·476	7·534	14·963
		14	L.W.	}										− 11	18	0·127				

N.B.—Maxima in whole lunar month indicated on Tables I, II, III and IV by a star, thus *, and minima by a circle, thus °.

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, Series of gaining tides No. 1.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*). Diurnal Inequalities. In duration of floods.	In duration of ebbs.	In semi tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals. H	M	Oscillations of float in hundredths of a foot.	Wind. Velocity miles per hour.	Direction.	Height of barometric column at sea level and for 0° cent or 32° Fah.	REMARKS.
Min.	Min.	Min.	Feet.	Feet.	Feet.	Feet.						Inches.	
....	....	....	.....	.....	.....	.....	..	..	....	.....	.....	.....	Longitude, Quebec Citadel = 71° 12' 35" =4h. 44m. 50s.
8	....	....	2·121	.....	·147	·256	..	..	....	5·080	N.W.	29·737	Longitude, Graving Dock = 71° 11' 30" =4h. 44m. 46s.=0·1978 of a day W. of Greenwich.
....	51	41	.....	0·870	.....	.....	6	9	....	2·000	N.W.	29·689	No. 2, tide of least importance in 1887, excepting two in September and one in April, for which coefficient=38 instead of 39; cloudy.
10	....	....	1·661	.....	·174	·607	..	..	1	8·590	N.W.	29·762	
....	37	40	.....	0·084	.....	.....	6	38	5	11·367	N.W.	29·779	Cloudy.....2½
3	....	....	1·722	.....	·084	·669	..	..	....	4·246	N.W.	29·853	do .....½
....	41	41	.....	0·754	.....	.....	6	28	....	4·549	S.W.	29·868	Sky overcast. 3
0	....	....	0·784	.....	·235	·641	..	..	....	1·026	S.W.	29·747	.....½
....	49	51	.....	0·584	.....	.....	6	58	....	2·705	N.W.	29·688	Rain. .....½
2	....	....	2·069	.....	·320	·735	..	..	....	3·631	N.W.	29·818	Cloudy; raining.....½
....	47	35	.....	0·680	.....	.....	6	38	1	2·655	N.W.	29·839	do 4
12	....	....	0·605	.....	·209	·713	..	..	....	10·250	N.W.	29·974	Clouding up.....½
....	24	24	.....	0 386	.....	.....	6	52	2	10·500	N.W.	29·979	Cloudy.....½
0	....	....	1·404	.....	·116	·496	..	..	5	11·757	N.W.	30·121	Sky overcast.....½
....	22	9	.....	0·670	.....	.....	6	43	....	4·580	N.W.	30·172	5
14	....	....	0·789	.....	·445	·538	..	..	3	9·858	W.	30·276	Clear weather; cold.....½
....	1	16	.....	0·759	.....	.....	6	42	3	5·685	W.N.W.	30·239	Clear sky .....½
13	....	....	0·530	.....	·329	·475	..	..	....	5·565	W.N.W.	30·231	Moon crosses equator Oct. 16; cloudy and cold.
....	6	20	.....	0·373	.....	.....	6	27	....	2·000	W.	30·260	Sky clear, bright. 6
13	....	....	1·482	.....	·316	·628	..	..	4	9·735	N.W.	30·050	Moon in perigee. Oct. 16, at 1 p.m.; clear.
....	7	9	.....	0·377	.....	.....	6	30	2	3·430	N.W.	30·082	New moon, Quebec, at 5.35 p.m., Oct. 16; clouding up.
16	....	....	0·087	.....	·720	·637	..	..	....	2·000	S.	30·113	.....½
....	15	2	.....	0·426	.....	.....	6	24	....	·800	W.	30·162	Cloudy sky.....7
17	....	....	2·502	.....	·800	·435	..	..	....	1·525	W.	30·101	do .....½
....	13	6	.....	0·738	.....	.....	6	20	2	4·352	N.E.	30·031	Sky clouded up... .....½
7	....	....	1·024	.....	·304	·024	..	..	10	4·000	E.	29·885	Moving clouds.....½
....	18	18	.....	0·154	.....	.....	6	21	....	·345	S.E.	29·760	Sky overcast.....8
0	....	....	0·809	.....	·267	·144	..	..	....	3·200	N.W.	29·868	Most important tide but one during 1887, viz.: evening tide of March 11, for which coefficient of semi-amplitude is 118 instead of 117. Getting colder, clear weather.
....	25	16	.....	0·235	.....	.....	6	5	....	2·500	N.W.	29·987	
115	356	328	17·589	7·090	4·466	6·998	91	15	....	139·931	.....	839·071	
8	25	23	1·256	0·506	0·319	0·499	6	31	...	4·998	.....	29·967	

APPENDIX 13.—Tidal Fluctuations. Lévis Graving Dock, series of gaining tides No. I.

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Gauge book reference numbers. Series I. Gaining tides.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon. Upper passage. H.	M.	Lower passage. H.	M.	Ages, &c. Days.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2).† H.	M.	Length of half tide day H. W. to H. W. H.	M.	Priming − or lagging + of tides. Min.	Lunitidal intervals. H.	M.	General coefficients of semi-amplitude from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old, together with proportional amplitudes and diurnal inequalities.* Co-efficients.	*Amplitudes. Feet.	Diurnal Difference. In amplitudes. Feet.	In semi-tide days. Min.
	.....	.....	.....	.....	.....	C		.....	.....	+ 34	.....	.....	.....	.....	.....	.....
½	.....	.....	.....	.....	.....	1	24	12	46	.....	.....	.....	.....	.....	0·00	.....
2	.....	.....	7	15	(1) (2) (3)	1 12	19 51	.....	.....	.....	6	4	39	7·42	.....	1
¼	.....	.....	.....	.....	.....	2	11	12	47	.....	.....	.....	.....	.....	0·57	.....
½	7	43	.....	.....	25·1	2 1	6 28	.....	.....	+ 40	6	23	42	7·99	.....	4
¾	.....	.....	.....	.....	.....	2	54	12	43	.....	.....	.....	.....	.....	0·95	.....
3	.....	.....	8	10	.....	2 2	49 11	.....	.....	.....	6	39	47	8·94	.....	4
¼	.....	.....	.....	.....	26·1	3	31	12	39	.....	.....	.....	.....	.....	1·34	.....
½	8	38	.....	.....	.....	3 2	28 58	.....	.....	+ 22	6	50	54	10·28	.....	6
¾	.....	.....	.....	.....	.....	4	7	12	33	.....	.....	.....	.....	.....	1·52	.....
4	.....	.....	9	5	.....	4 3	1 41	.....	.....	.....	6	56	62	11·80	.....	4
¼	.....	.....	.....	.....	27·1	4	31	12	29	.....	.....	.....	.....	.....	1·71	.....
½	9	33	.....	.....	.....	4 4	30 18	.....	.....	+ 5	6	57	71	13·51	.....	3
¾	.....	.....	.....	.....	.....	4	36	12	26	.....	.....	.....	.....	.....	1·71	.....
5	.....	.....	10	0	.....	4 4	56 54	.....	.....	.....	6	56	80	15·22	.....	1
¼	.....	.....	.....	.....	28·1	5	1	12	25	.....	.....	.....	.....	.....	1·72	.....
½	10	28	.....	.....	.....	5 5	21 23	.....	.....	− 2	6	53	89	16·94	.....	2
¾	.....	.....	.....	.....	.....	5	24	12	23	.....	.....	.....	.....	.....	1·52	.....
6	.....	.....	10	55	.....	5 5	44 45	.....	.....	.....	6	49	97	18·46	.....	1
¼	.....	.....	.....	.....	29·1	5	47	12	22	.....	.....	.....	.....	.....	1·33	.....
½	11	23	.....	.....	●	6 6	6 11	.....	.....	− 6	6	43	104	19·79	.....	0
¾	.....	.....	.....	.....	.....	6	9	12	22	.....	.....	.....	.....	.....	1·14	.....
7	.....	.....	11	51	.....	6 6	28 34	.....	.....	.....	6	37	110	20·93	.....	0
¼	.....	.....	.....	.....	0·8	6	30	12	22	.....	.....	.....	.....	.....	0·76	.....
½	.....	19	.....	.....	.....	6 6	50 56	.....	.....	− 7	6	31	114	21·69	.....	1
¾	.....	.....	.....	.....	.....	6	53	12	21	.....	.....	.....	.....	.....	0·38	.....
8	.....	.....	.....	48	.....	7 7	11 17	.....	.....	.....	6	23	116	22·07	.....	1
¼	.....	.....	.....	.....	1·8	7	15	12	22	.....	.....	.....	.....	.....	0·20	.....
½	1	16	.....	.....	.....	7 7	33 40	.....	.....	− 7	6	17	117	22·27	.....	1
Totals 14 tides	49 +24 =73	20 0 20	58 + 12 = 70	4 0 4	.....	68	22	175	0	+ 67 − 22 + 22 − 6	92	58	1142	217·31	14·85	29
Means 14 tides	10	29	10	1	.....	4	53	12	30		6	38	81·57	15·52	1·06	2

*The ratio of the mean of the observed amplitudes to the mean of the coefficients was taken as the basis of computation, viz.: say 19·03 ft. for 100.

†N.B.—The upper computed time of H.W. No. 1, entered in column C, is that found in the tide tables for the port of Quebec, which are issued every year by Archibald McCallum at his depot of nautical instruments and charts, 65 St. Peter street, Quebec. The second or time No. 2, is based on times of high water for the port of Brest France, taken from "L'Annuaire des Marées de France." The third or time No. 3, is based on the London Bridge times of H.W. contained in the Nautical Almanac.

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

LEVIS GRAVING DOCK, HARBOUR OF QUEBEC,

DURING A COMPLETE LUNAR MONTH OF THE LOW WATER SEASON OF 1887, VIZ., OCTOBER 8 TO NOVEMBER 9.

Maximum indicated by an asterisk, thus: * Minimum by a circle, thus: °

TABLE I.

WEEKLY SERIES OF LOSING TIDES, No. II.

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. II.

Gauge book reference numbers.	Series II. Losing tides.	High and low waters observed each civil day.		Time, Eastern Standard. H.	M.	A. M. or P. M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming − or lagging + of tides. Min.	Duration of apparent stand within 0·05 feet. Min.	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.
		Oct. 18	H.W.	7	21	P.M.	....	....	....	....	....	....	− 9	.....	18·182	.....	.....	.....	.....
	½	do 19	L.W.	3	19	A.M.	....	....	7	58	12	28	.....	16	− 0·169	.....	18·351	.....	.....
9		do 19	H.W.	7	49	A.M.	4	30	....	....	....	....	.....	27	a 16·234	16·403	.....	8·503	17·344
	½	do 19	L.W.	3	23	P.M.	....	....	7	33	12	14	.....	16	c − 0·169	.....	16·403	.....	.....
	½	do 19	H.W.	8	4	P.M.	4	41	....	....	....	....	− 2	19	e 18·052	18·221	.....	8·464	17·167
	½	do 20	L.W.	4	5	A.M.	....	....	8	1	12	34	.....	14	d − 0·069	.....	18·121	.....	.....
10		do 20	H.W.	8	38	A.M.	4	33	....	...	....	....	.....	18	b 15·855	15·924	.....	8·488	16·696
	½	do 20	L.W.	4	2	P.M.	....	....	7	24	12	16	.....	19	0·350	.....	15·505	.....	.....
	½	do 20	H.W.	8	54	P.M.	4	52	....	....	....	....	+ 2	15	17·583	17·233	.....	8·435	16·195
	½	do 21	L.W.	4	50	A.M.	....	....	7	56	12	36	.....	15	0·325	.....	17·258	.....	.....
11		do 21	H.W.	9	30	A.M.	4	40	....	....	....	....	.....	19	15·110	14·785	.....	8·465	15·691
	½	do 21	L.W.	4	52	P.M.	....	....	7	22	12	12	.....	12	0·915	.....	14·195	.....	.....
	½	do 21	H.W.	9	42	P.M.	4	50	....	....	....	....	− 32	16	17·443	16·528	.....	8·281	14·978
	½	do 22	L.W.	5	37	A.M.	....	....	7	55	12	6	.....	21	0·670	.....	16·773	.....	.....
12		do 22	H.W.	9	48	A.M.	4	11	....	....	....	....	.....	18	13·087	12·417	.....	7·330	13,748
	½	do 22	L.W.	5	12	P.M.	....	....	7	24	12	40	....	21	0·241	.....	12·846	.....	.....
	½	do 22	H.W.	10	28	P.M.	5	16	....	....	....	....	+ 53	23	13·197	12·956	.....	6·220	12·998
	½	do 23	L.W.	6	35	A.M.	....	....	8	7	13	3	.....	19	− 0·800	.....	13·997	.....	.....
13		do 23	H.W.	11	31	A.M.	4	56	....	....	....	....	.....	20	11·394	12·194	....	6·186	12·521
	½	do 23	L.W.	6	30	P.M.	....	....	6	59	11	59	.....	18	0·650	.....	10·744	.....	.....
	½	do 24	H.W.	11	30	P.M.	5	00	....	....	....	....	+ 14	25	13·800	13·150	.....	6·740	12·031
	½	do 24	L.W.	7	20	A.M.	....	....	7	50	13	5	.....	17	0·800	.....	13·000	.....	.....
14		do 24	H.W.	12	35	P.M.	5	15	....	....	....	....	.....	27	12·029	11·229	.....	6·647	11·778
	½	do 24	L.W.	7	42	P.M.	....	....	7	7	12	38	.....	16	0·717	.....	11·312	.....	.....
	½	do 25	H.W.	1	13	A.M.	5	31	....	....	....	....	+ 25	25	12·288	11·571	.....	5·800	11·212
	½	do 25	L.W.	8	48	A.M.	....	....	7	35	12	37	.....	23	− 0·329	.....	12·617	.....	.....
15		do 25	H.W.	1	50	P.M.	5	2	....	....	....	....	.....	31	9·022	9·351	.....	5·158	10·949
	½	do 25	L.W.	8	44	P.M.	....	....	6	54	12	33	.....	18	− 0·304	.....	9·326	.....	.....
Tot'ls 13½ tides			H.W.	111	32	....	65	17	106	5	175	1	+ 94	283	185·094	181·962	200·448	94·717	183·308
			L.W.	80	59	....							− 34	245	2·828				
Means do	13		H.W.	..	..	....	5	1	7	35	12	30	+ 24	22	14·238	13·997	14·318	7·286	14·101
	14		L.W.	..	..	....							− 17	18	0·202				

a, c. e, d, b.—Corrected mean tide level No. 9½ $= \frac{a+b}{8} + \frac{c+d+e.}{4}$ *Corrected amplitude No. 9½ $= \frac{a+b}{4} + \frac{e-(c+d)}{2}$

Maxima in whole lunar month indicated on Tables I, II, III and IV by a star, thus *, and minima by a circle, thus °.

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. II.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*). Diurnal Inequalities. In duration of floods.	In duration of ebbs.	In semi tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals. H	M	Oscillations of float in hundredths of a foot.	Wind. Velocity miles per hour.	Direction.	Height of barometric column, at sea-level and for 0° cent. or 32° Fah.	REMARKS.
Min.	Min.	Min.	Feet.	Feet.	Feet.	Feet.						Inches.	
....	....	..	.....	.....	.....	.....			....	.....	.....	.....	.....
9	....	....	1·948	.....	.....	.....			....	·935	E.	28·910	Fair, clear weather.....½
....	25	14	.....	0·000	·217	·200	6	5	....	1·256	N.W.	30·080	do 9
11	....	....	1·818	.....	.....	.....			....	·653	N.W.	30·117	.....½
....	28	20	.....	0·100	·039	·177	5	49	....	·504	N.E.	30·073	Clear, cold weather... .....½
8	....	....	2·197	.....	.....	.....			....	1·300	N.E.	30·123	Freezing hard.....½
....	28	18	.....	0·419	·024	·471	5	54	....	1·254	N.	30·106	Clear and bright.....10
19	....	....	1·728	.....	.....	.....			2	1·590	E.	29·930	.....½
....	32	20	.....	0·025	·053	·501	5	41	...	4·130	N.E.	29·903	Clear weather.....½
12	...	....	2·473	.....	.....	.....			5	2·500	N.E.	29·817	.....½
....	34	24	.....	0·590	·030	·504	5	49	2	3·287	E.	29·595	Rain 11
10	....	....	2·333	.....	.....	.....			5	1·336	N.E.	29·392	Raining hard, cold. .....½
....	33	6	.....	0·245	·184	·713	5	33	1	1·570	N.E	29·241	Raining.....½
39	....	....	4.356	.....	.....	.....			15	6·380	N.W.	29·435	Moon's S declination a maximum=20° 8'. Max. inequality observed in high water levels=4·356 feet. Cold wind.
....	31	34	.....	0.429	·851	1·230	5	12	6	3·910	N.W.	29·367	Cloudy and cold. 12
65	....	....	0·110	.....	.....	.....			6	15·000	N.W.	29·683	Maximum inequality in priming and lagging of tides observed=—32 + 53. Cold.
....	43	23	.....	1·041	1·110	0·750	5	25	4	16·500	N.W.	29·875	Sky overcast, very cold.....½
20	....	....	1·803	.....	.....	.....			4	15·400	N.W.	30·100	do .....½
....	68	64	.....	1·450	·034	·477	6	1	2	7·200	N.W.	30·222	Maximum inequality observed in low water levels=14·50. Cloudy and cold.
4	....	....	2·406	.....	.....	.....			....	·621	N.W.	30·090	.....½
....	51	66	.....	0·150	·554	·490	5	34	1	3·800	N.E.	29·500	Moon's first quarter, Quebec, Oct. 23rd from 0·46 P.M.
15	....	....	1·771	.....	.....	.....			6	3·560	N.E.	29·520	Heavy rain.....½
....	43	27	.....	0·083	·93	·253	6	14	1	6·320	N.W.	29·614	Getting colder.....14
16	....	....	0 259	.....	.....	.....			6	15·440	N.W.	29·919	Cloudy and cold.....½
....	28	1	.....	1·046	·847	·566	6	28	3	10·000	N.W.	30·113	Very cold, freezing hard.....½
29	....	....	3·266	.....	.....	.....			3	15·850	N.W.	30·180	Fine, clear weather.....½
....	41	4	.....	0·025	·642	·263	6	41	....	3·000	N.W.	30·195	15
37	....	....	3·176	.....	.....	.....			2	3·570	N.W.	30·119	Cold, cloudy weather.....½
294	485	321	29·644	5·603	4·678	6·595	76	26	....	149·360	.....	806·299	.....
21	37	25	2.117	0·431	0·359	0·507	5	53	...	5·334	.....	29·863	.....

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. II.

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Gauge book reference numbers.	Series II. Losing tides.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon. Upper passage. H.	Upper passage. M.	Lower passage. H.	Lower passage. M.	Ages, &c. Days.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)† H.	H. M.	Length of half tide day H.W. to H.W. H.	M.	Priming — or lagging + of tides. Min.	Lunitidal intervals. H.	M.	General coefficients of semi-amplitude from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old, together with proportional amplitudes and diurnal inequalities.* Co-efficients.	*Amplitudes. Feet.	Diurnal Differences In amplitudes. Feet.	Diurnal Differences In semi-tide days. Min.
.....	.....	.....	.....	.....	.....	.....	C	.....	.....	.....	— 7	.....	.....	.....	.....	.....	.....
	½	.....	.....	.....	.....	.....	.....	.....	12	21	.....	.....	.....	.....	.....	·20	.....
9		.....	.....	1	45	(1)	7	37	.....	.....	.....	6	9	116	22·07	.....	1
		.....	.....	.....	.....	(2)	7	54	.....	.....	.....	.....	.....	.....	.....	.....	.....
		.....	.....	.....	.....	(3)	8	2	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¼	.....	.....	.....	.....	2·8	.....	.....	12	22	.....	.....	.....	.....	.....	·57	.....
		.....	.....	.....	.....	.....	7	58	.....	.....	.....	.....	.....	.....	.....	.....	.....
	½	2	15	.....	.....	.....	8	16	.....	.....	— 6	6	1	113	21·50	.....	0
		.....	.....	.....	.....	.....	8	24	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¾	.....	.....	.....	.....	.....	.....	.....	12	22	.....	.....	.....	.....	.....	·95	.....
		.....	.....	.....	.....	.....	8	21	.....	.....	.....	.....	.....	.....	.....	.....	.....
10		.....	.....	2	44	.....	8	38	.....	.....	.....	5	54	108	20·55	.....	1
		.....	.....	.....	.....	.....	8	45	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¼	.....	.....	.....	.....	3·8	.....	.....	12	21	.....	.....	.....	.....	.....	1·33	.....
		.....	.....	.....	.....	.....	8	43	.....	.....	.....	.....	.....	.....	.....	.....	.....
	½	3	13	.....	.....	.....	8	59	.....	.....	— 7	5	46	101	19·22	.....	1
		.....	.....	.....	.....	.....	9	8	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¾	.....	.....	.....	.....	.....	.....	.....	12	22	.....	.....	.....	.....	.....	1·33	.....
		.....	.....	.....	.....	.....	9	5	.....	.....	.....	.....	.....	.....	.....	.....	.....
11		.....	.....	3	41	.....	9	21	.....	.....	.....	5	40	94	17·89	.....	0
		.....	.....	.....	.....	.....	9	30	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¼	.....	.....	.....	.....	4·8	.....	.....	12	22	.....	.....	.....	.....	.....	1·52	.....
		.....	.....	.....	.....	.....	9	28	.....	.....	.....	.....	.....	.....	.....	.....	.....
	½	4	9	.....	.....	.....	9	43	.....	.....	— 5	5	34	86	16·37	.....	1
		.....	.....	.....	.....	.....	9	52	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¾	.....	.....	.....	.....	.....	.....	.....	12	23	.....	.....	.....	.....	.....	1·72	.....
		.....	.....	.....	.....	.....	9	50	.....	.....	.....	.....	.....	.....	.....	.....	.....
12		.....	.....	4	36	.....	10	6	.....	.....	.....	5	30	77	14·65	.....	2
		.....	.....	.....	.....	.....	10	15	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¼	.....	.....	.....	.....	5·8	.....	.....	12	25	.....	.....	.....	.....	.....	1·71	.....
		.....	.....	.....	.....	.....	10	14	.....	.....	.....	.....	.....	.....	.....	.....	.....
	½	5	3	.....	.....	.....	10	31	.....	.....	+ 2	5	28	68	12·94	.....	2
		.....	.....	.....	.....	.....	10	37	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¾	.....	.....	.....	.....	.....	.....	.....	12	27	.....	.....	.....	.....	.....	1·52	.....
		.....	.....	.....	.....	.....	10	39	.....	.....	.....	.....	.....	.....	.....	.....	.....
13		.....	.....	5	30	.....	10	58	.....	.....	.....	5	28	60	11·42	.....	3
		.....	.....	.....	.....	.....	11	1	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¼	.....	.....	.....	.....	6·8	.....	.....	12	30	.....	.....	.....	.....	.....	1·52	.....
		.....	.....	.....	.....	.....	11	6	.....	.....	.....	.....	.....	.....	.....	.....	.....
	½	5	56	.....	.....	●	11	28	.....	.....	+ 14	5	32	52	9·90	.....	4
		.....	.....	.....	.....	.....	11	26	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¾	.....	.....	.....	.....	.....	.....	.....	12	34	.....	.....	.....	.....	.....	1·15	.....
		.....	.....	.....	.....	.....	11	36	.....	.....	.....	.....	.....	.....	.....	.....	.....
14		.....	.....	6	21	.....	12	2	.....	.....	.....	5	41	46	8·75	.....	6
		.....	.....	.....	.....	.....	11	53	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¼	.....	.....	.....	.....	7·8	.....	.....	12	40	.....	.....	.....	.....	.....	·95	.....
		.....	.....	.....	.....	.....	12	47	.....	.....	.....	.....	.....	.....	.....	.....	.....
	½	6	45	.....	.....	.....	12	42	.....	.....	+ 34	5	57	41	7·80	.....	4
		.....	.....	.....	.....	.....	12	23	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¾	.....	.....	.....	.....	.....	.....	.....	12	44	.....	.....	.....	.....	.....	·38	.....
		.....	.....	.....	.....	.....	1	29	.....	.....	.....	.....	.....	.....	.....	.....	.....
15		.....	.....	7	9	.....	1	26	.....	.....	.....	6	17	39	7·42	.....	3
		.....	.....	.....	.....	.....	12	57	.....	.....	.....	.....	.....	.....	.....	.....	.....
	¼	.....	.....	.....	.....	8·8	.....	.....	12	47	.....	.....	.....	.....	.....	·19	.....
Totals 13¼ tides		27	21	31	46	.....	122 + 12 =134	4 0 4	174	40	+ 50 — 18	74	57	1,001	190·48	15·04	28
Means 13¼ tides		4	34	4	32	.....	10	19	12	29	+ 17 — 6	5	46	77	14·65	1·07	.2

*The ratio of the mean of the observed amplitudes to the mean of the coefficients being taken as the basis of computation, viz.: say 19·03 ft.=100.

†N.B.—The upper computed time of H.W. No. 1, entered in column C, is that found in the tide tables for the port of Quebec, which are issued every year by Archibald McCallum at his depot of nautical instruments and charts, 65 St. Peter street, Quebec. The second or time No. 2, is based on times of high water for the port of Brest, France, taken from "L'Annuaire des Marées de France." The third or time No, 3, is based on the London Bridge times of H.W. contained in the Nautical Almanac.

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

LEVIS GRAVING DOCK, HARBOUR OF QUEBEC,

DURING A COMPLETE LUNAR MONTH OF THE LOW WATER SEASON OF 1887, VIZ., OCTOBER 8 TO NOVEMBER 9.

Maximum indicated by an asterisk, thus: * Minimum by a circle, thus °

TABLE I.

WEEKLY SERIES OF GAINING TIDES, No. III.

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of gaining tides No. III.

Gauge book reference numbers.	Series III. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming — or lagging + of tides.	Duration of apparent stand within 0·05 ft.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
			H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	Feet.
		Oct. 25 L.W.	8	44	P.M..	....	....	....	....	....	....	+ 25	.....	— 0·304	.....	.....	.....	.....
	½	do 26 H.W.	2	23	A.M.	5	39	....	....	....	....	+ 37	25	12·198	12·502	.....	5·510	11·275
	¾	do 26 L.W.	9	59	A.M.	....	....	7	36	12	54	.....	19	0·050	.....	12·148	.....	.....
16		do 26 H.W.	3	17	P.M..	5	18	....	....	....	....	.....	27	11·174	11·124	.....	5·880	11·801
	¼	do 26 L.W.	10	15	P.M..	....	....	6	58	12	14	.....	19	— 0·089	.....	11·263	.....	.....
	½	do 27 H.W.	3	31	A.M.	5	16	....	....	....	....	— 10	24	12·578	12·667	.....	6·212	12·047
	¾	do 27 L.W.	10	43	A.M.	....	....	7	12	12	26	.....	21	0·470	.....	12·108	.....	.....
17		do 27 H.W.	3	57	P.M..	5	14	....	....	....	....	.....	26	12·618	12·148	.....	6·545	12·360
	¼	do 27 L.W.	11	12	P.M..	....	....	7	15	12	23	.....	19	0·260	.....	12·358	.....	.....
	½	do 28 H.W.	4	20	A.M.	5	8	....	....	....	...	— 3	25	13·087	12·827	.....	6·487	12·858
	¾	do 28 L.W.	11	42	A.M.	....	....	7	22	12	24	.....	19	— 0·144	.....	13·231	.....	.....
18		do 28 H.W.	4	44	P.M..	5	2	....	....	....	....	.....	18	12·873	13·017	.....	6·504	13·132
	¼	do 28 L.W.	12	5	A.M.	....	....	7	21	12	29	.....	15	0·021	.....	12·852	.....	.....
	½	do 29 H.W.	5	13	A.M.	5	8	....	....	....	....	6	28	13·452	13·431	.....	7·051	13·427
	¾	do 29 L.W.	12	6	A.M.	....	....	6	53	12	15	.....	18	0·655	.....	12·797	.....	.....
19		do 29 H.W.	5	28	P.M..	5	22	....	....	....	....	.....	23	15·285	14·630	.....	7·776	13·747
	¼	do 30 L.W.	12	40	A.M.	....	....	7	12	12	16	.....	19	1·150	.....	14·135	.....	.....
	½	do 30 H.W.	5	44	A.M.	5	4	....	....	....	....	— 30	21	14·576	13·426	.....	7·812	13·875
	¾	do 30 L.W.	12	55	P.M..	....	....	7	11	12	4	.....	19	0·600	.....	13·976	.....	.....
20		do 30 H.W.	5	48	P.M..	4	53	....	....	...	....	.....	20	14·566	13·966	.....	7·178	14·047
	¼	do 31 L.W.	1	26	A.M.	....	....	7	38	12	1	.....	15	— 0·289	.....	14·855	.....	.....
	½	do 31 H.W.	5	49	A.M.	4	23	....	....	....	....	— 23	22	13·101	13·390	.....	6·446	14·164
	¾	do 31 L.W.	1	32	P.M..	....	....	7	43	12	26	.....	19	— 0·983	.....	14·084	.....	.....
21		do 31 H.W.	6	15	P.M..	4	43	....	....	....	....	.....	20	13·347	14·330	.....	6·194	14·196
	¼	Nov. 1 L.W.	1	54	A.M.	....	....	7	39	12	25	.....	14	— 0·819	.....	14·166	.....	.....
	½	do 1 H.W.	6	40	A.M.	4	46	....	....	....	....	— 11	25	13·367	14·186	.....	6·465	14·253
	¾	do 1 L.W.	2	6	P.M..	....	....	7	26	12	14	.....	17	— 0·504	.....	13·871	.....	.....
22		do 1 H.W.	6	54	P.M..	4	48	....	....	....	....	.....	18	14·286	14·790	.....	6·369	14·310
	¼	do 2 L.W.	2	38	A.M.	....	....	7	44	12	21	.....	17	— 1·068	.....	15·354	.....	.....
	½	do 2 H.W.	7	15	A.M.	4	37	....	....	....	....	— 25	23	12·159	13·227	.....	6·162	14·313
	¾	do 2 L.W.	2	37	P.M..	....	....	7	22	12	4	.....	19	— 0·919	.....	13·078	.....	.....
23		do 2 H.W.	7	19	P.M..	4	42	....	....	....	....	.....	21	14·672	15·591	.....	6·509	14·589
Total 15½ tides		H.W.	84	37	....	80	3	110	32	184	56	+ 37	366	213·339	215·252	200·276	105·100	214·394
		L.W.	115	50	....							—108	269	— 1·609				
Means do	16	H.W.	..	..	.....	5	0	7	22	12	20	+ 37	23	13·334	13·453	13·351	6·568	13·399
	15	L.W.										— 15	18	— 0·107				

N.B.—Maxima in whole diurnal month indicated on Tables I, II, III and IV by a star, thus *, and minima by a circle, thus °.

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of gaining tides No. III.

Direct Results of Tidal Observations—(*Continued*). Diurnal Inequalities. In duration of floods.	In duration of ebbs.	In semi tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Wind. Velocity miles per hour.	Direction.	Height of barometric column at sea level and for 0° cent or 32° Fah.	Remarks.
Min.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M.				Inches.	
....	....	....	.....	.....	.....	.....	....	....	....	.....	.....	.....	.....
....	42	21	.....	·354	·352	·326	6	51	2	4·270	N.W.	30·515	Fine, clear frosty weather..... ....½
21	....	....	1·024	.....	.....	.....	....	....	3	5·080	N.W.	30·618	Fine weather..... .....¾
....	38	40	.....	·139	·370	·526	7	23	....	2·450	N.W.	30·547	Clear, bright 16
2	....	....	1·404	.....	.....	.....	....	....	2	2·000	N.	30·618	....½
....	14	12	.....	·559	·332	·246	7	15	2	2·750	N.	30·201	Hard frost.....½
2	....	....	·040	.....	.....	.....	....	...	4	2·750	N.E.	30·458	.....¾
....	3	3	.....	·210	·333	·313	7	19	....	2·650	N.E.	30·405	Milder weather.....17
6	....	....	·469	.....	.....	.....	....	....	....	2·630	N.	30·365	Fine and clear.....½
....	7	1	.....	·404	·058	·498	7	21	....	2·000	N.W.	30·402	do .....½
6	....	...	·214	.....	....	.....	....	....	....	·950	N.W.	30·234	Clouding up .....¾
....	1	5	.....	·165	·017	·274	7	24	....	2·350	S.W.	30·184	18
6	....	....	·579	.....	.....	.....	....	...	....	1·501	W.	30·179	Cloudy.....½
....	28	14	.....	·634	·547	·295	7	32	....	1·583	W.	30·079	Fine, clear weather.....½
14	....	....	1·833	.....	.....	.....	....	....	4	9·442	S.E.	29·978	Moon crosses equator Oct. 29th; cloudy, appearance of rain.
....	19	1	.....	·495	·725	·320	7	26	5	2·440	S.E.	30·048	Moon in apogee, Oct. 29th, at 6 p.m. Snowing hard; strong gusts of wind.
18	....	....	·709	.....	.....	.....	....	....	20	26·231	S.E.	30·150	Blinding snow storm.....½
....	1	12	.....	·550	·036	·128	7	21	3	6 276	S.E.	30·233	Gusts of wind; cold.....½
11	....	....	·010	.....	.....	.....	....	....	....	1·094	S.W.	30·076	Fine.....¾
....	27	3	.....	·889	·634	·172	7	4	....	5·258	N.W.	30·096	Bright and clear sky.....20
30	....	....	1·465	.....	.....	.....	....	....	2	16·894	N.W.	30·000	Getting cloudy.....½
..	5	25	.....	·694	·732	·117	6	44	2	10·935	N.W.	29·900	Snow squall.....½
20	....	...	·246	.....	.....	.....	....	....	2	8·442	N.W.	29·826	Cold and cloudy.....¾
....	4	1	.....	·164	·252	·032	6	49	1	5·703	N.W.	29·918	Full moon, Quebec, Oct. 31st, at 4h. 31m. p.m.; cloudy.
3	....	....	·020	.....	.....	.....	....	....	15	2·951	N.W.	30·193	Fine moonlight night.....½
....	13	11	.....	·315	·271	·057	6	52	....	3·117	N.W.	30·247	Cold, clear day .....½
2	....	....	·919	.....	.....	.....	....	....	1	4·594	N.W.	30·227	Cold and clear weather.....¾
....	18	7	.....	·564	·096	·057	6	44	1	3·056	N.W.	30·191	Bright, cold day..... 22
11	....	....	2·127	.....	.....	.....	....	....	....	2·390	N.W.	30·106	.....½
....	22	17	.....	·149	·207	·003	6	42	....	6·328	N.W.	30·003	Clear sky; cold ....½
5	....	....	2·513	.....	.....	.....	....	....	....	3·749	N.W.	29·871	Sky clouded up; cold.....½
....	26	22	.....	·261	347	·276	6	23	....	2·546	N.W.	29·932	Sky overcast.....23
157	268	195	13·572	6·546	5·309	3·640	113	10	....	144·420	.....	935·800	.....
10	17	12	0·905	0·409	0·331	0·227	7	4	....	4·659	.....	30·187	.....

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of gaining tides No. III.

Gauge book reference numbers, Series III. Gaining tides.	RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES." Eastern standard civil times of meridian passage immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2). †		Length of half tide day H. W. to H. W.		Priming − or lagging + of tides.	Lunitidal intervals		General coefficients of semi-amplitude from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old, together with proportional amplitudes and diurnal inequalities.* See foot notes, tables I, II.			
	Upper passage.		Lower passage.		Ages, &c.								Co-efficients.	*Amplitudes.	Diurnal Difference.	
															In amplitudes.	In semi-tide days.
	H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		Feet.	Feet.	Min.
.....	.....	.....	.....	.....	.....	C	.....	.....	.....	+ 34	.....	.....	.....	.....	.....	.....
					(1)	2	14									*
½	7	32	.....	.....	(2)	2	13	.....	.....	+ 38	6	41	40	7·61	.....	6
					(3)	1	34									
¾	.....	.....	.....	.....	9·8	.....	.....	12	41	.....	.....	.....	.....	.....	·38	.....
						2	54									
16	.....	.....	7	54	.....	2	54	.....	.....	.....	7	0	42	7·99	.....	4
						2	16									
¼	.....	.....	.....	.....	.....	.....	.....	12	37	.....	.....	.....	.....	.....	·76	.....
						3	30									
½	8	16	.....	.....	.....	3	31	.....	.....	+ 18	7	15	46	8·75	.....	6
						3	1									
¾	.....	.....	.....	.....	10·8	.....	.....	12	31	.....	.....	.....	.....	.....	·96	.....
						4	3									
17	.....	.....	8	38	.....	4	2	.....	.....	.....	7	24	51	9·71	.....	4
						3	41									
¼	.....	.....	.....	.....	.....	.....	.....	12	27	.....	.....	.....	.....	.....	·95	.....
						4	31									
½	8	59	.....	.....	.....	4	29	.....	.....	+ 0	7	30	56	10·66	.....	4
						4	17									
¾	.....	.....	.....	.....	11·8	.....	.....	12	23	.....	.....	.....	.....	.....	·95	.....
						4	31				*					
18	.....	.....	9	20	.....	4	52	.....	.....	.....	7	32	61	11·66	.....	2
						4	50									
¼	.....	.....	.....	.....	.....	.....	.....	12	21	.....	.....	.....	.....	.....	·76	.....
						4	54									
½	9	41	.....	.....	.....	5	13	.....	.....	− 10	7	32	65	12·37	.....	2
						5	18									
¾	.....	.....	.....	.....	12·8	.....	.....	12	19	.....	.....	.....	.....	.....	·95	.....
						5	15									
19	.....	.....	10	2	.....	5	32	.....	.....	.....	7	30	70	13·32	.....	2
						5	41									
¼	.....	.....	.....	.....	.....	.....	.....	12	17	.....	.....	.....	.....	.....	·76	.....
						5	34									
½	10	23	.....	.....	.....	5	49	.....	.....	− 16	7	26	74	14·08	.....	0
						6	2									
¾	.....	.....	.....	.....	13·8	.....	.....	12	17	.....	.....	.....	.....	.....	·56	.....
						5	52									
20	.....	.....	10	44	.....	6	6	.....	.....	.....	7	22	77	14·64	.....	1
						6	21									
¼	.....	.....	.....	.....	.....	.....	.....	12	16	.....	.....	.....	.....	.....	·58	.....
						6	7									
½	11	5	.....	.....	.....	6	22	.....	.....	− 19	7	17	80	15·22	.....	1
						6	39									
¾	.....	.....	.....	.....	14·8	.....	.....	12	15	.....	.....	.....	.....	.....	·57	.....
						6	23									
21	.....	.....	11	26	○	6	37	.....	.....	.....	7	11	83	15·79	.....	1
						6	54									
¼	.....	.....	.....	.....	.....	.....	.....	12	16	.....	.....	.....	.....	.....	·39	.....
						6	38				*					
½	11	48	.....	.....	.....	6	53	.....	.....	− 20	7	5	85	16·18	.....	2
						7	10									
¾	.....	.....	.....	.....	15·8	.....	.....	12	14	.....	.....	.....	.....	.....	·19	.....
						6	53									
22	.....	.....	.....	10	.....	7	7	.....	.....	.....	6	57	86	16·37	.....	1
						7	25									
¼	.....	.....	.....	.....	.....	.....	.....	12	15	.....	.....	.....	.....	.....	·00	.....
						7	7									
½	.....	33	.....	.....	.....	7	22	.....	.....	− 20	6	49	86	16·37	.....	0
						7	40									
¾	.....	.....	.....	.....	16·8	.....	.....	12	15	.....	.....	.....	.....	.....	·00	.....
						7	21									
23	.....	.....	.....	56	.....	7	37	.....	.....	.....	6	41	86	16·37	.....	0
						7	54									
Total 14 tides	68	17	59	10	.....	86	39	185	24	+ 56 ..... − 85	115	12	1088	207·04	876	36
	+ 12	0	+ 24	0												
	= 80	17	= 83	10												
Mean 14 tides	10	2	10	6	.....	5	25	12	22	+ 19 ..... − 17	7	12	68	12·57	55	2

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

LEVIS GRAVING DOCK, HARBOUR OF QUEBEC,

DURING A COMPLETE LUNAR MONTH OF THE LOW WATER SEASON OF 1887, VIZ., OCTOBER 8 TO NOVEMBER 9.

Maximum indicated by an asterisk, thus * Minimum by a circle, thus °

TABLE I.

WEEKLY SERIES OF LOSING TIDES, No. IV.

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. IV.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers	Series IV. Losing tides.	High and low waters observed each civil day.		Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming − or lagging + of tides.	Duration of apparent stand within 0·05 ft.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
				H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	Feet.
		Nov. 2	H.W.	7	19	P.M.	....	....	....	....	....	....	− 25	....	14·672	.....	.....	.....	.....
	¼	do 3	L.W.	3	7	A.M.	....	....	7	48	12	26	.....	17	− 0·658	.....	15·330	.....	.....
	½	do 3	H.W.	7	45	A.M.	4	38	....	....	...	....	− 13	23	13·708	14·366	.....	7·138	14·614
	¾	do 3	L.W.	2	59	P.M.	....	....	7	14	12	11	.....	14	0·321	.....	13·387	.....	.....
24		do 3	H.W.	7	56	P.M.	4	57	....	....	....	....	.....	22	15·695	15·374	.....	7·531	14·530
	¼	do 4	L.W.	3	37	A.M.	....	....	7	41	12	29	.....	15	0·211	.....	15·484	.....	.....
	½	do 4	H.W.	8	25	A.M.	4	48	....	....	...	....	− 23	22	14·087	13·876	.....	7 783	14·300
	¾	do 4	L.W.	3	28	P.M.	....	....	7	3	11	58	.....	21	1·049	.....	13·038	.....	.....
25		do 4	H.W.	8	23	P.M.	4	55	....	....	....	....	.....	21	15 875	14·826	.....	7·656	13·993
	¼	do 5	L.W.	4	14	A.M.	....	....	7	51	12	30	.....	22	0·271	.....	15·604	.....	.....
	½	do 5	H.W.	8	53	A.M.	4	39	....	....	....	....	− 10	18	12·778	12·507	.....	7·066	13·542
	¾	do 5	L.W.	3	52	P.M.	....	....	6	59	12	10	.....	32	0·320	.....	12·458	.....	.....
26		do 5	H.W.	9	3	P.M.	5	11	....	....	....	....	.....	18	13·917	13·597	.....	6·378	13·174
	¼	do 6	L.W.	4	41	A.M.	....	....	7	38	12	41	.....	24	− 0·738	.....	14·655	.....	.....
	½	do 6	H.W.	9	44	A.M.	5	3	....	....	....	....	− 11	20	11·250	11·988	.....	6·157	12·982
	¾	do 6	L.W.	4	31	P.M.	....	....	6	47	11	58	.....	18	0·320	.....	10·930	.....	.....
27		do 6	H.W.	9	42	P.M.	5	11	....	....	....	....	.....	21	14 677	14·357	.....	6·644	12·928
	¼	do 7	L.W.	5	33	A.M.	....	....	7	51	12	47	.....	17	0·041	.....	14·636	.....	.....
	½	do 7	H.W.	10	29	A.M.	4	56	....	....	..	....	+ 3	27	11·829	11·788	.....	6·848	12·775
	¾	do 7	L.W.	5	19	P.M.	....	....	6	50	12	6	.....	18	0·880	.....	10·949	.....	.....
28		do 7	H.W.	10	35	P.M.	5	16	....	....	....	....	.....	20	14·607	13·727	.....	6·897	12·374
	¼	do 8	L.W.	6	19	A.M.	....	....	7	44	12	49	.....	22	0·540	.....	14·067	.....	.....
	½	do 8	H.W.	11	24	A.M.	5	5	....	....	....	....	+ 35	21	11·295	10·755	.....	6·454	12·089
	¾	do 8	L.W.	6	32	P.M.	....	....	7	8	12	36	.....	21	0·280	.....	11·015	.....	.....
29		do 9	H.W.	12	0	P.M.	5	28	....	....	....	....	.....	22	12·800	12·520	.....	5·659	12·029
	¼	do 9	L.W.	7	40	A.M.	....	....	7	40	12	45	.....	18	− 0·990	.....	13·790	.....	.....
	½	do 9	H.W.	12	45	P.M.	5	5	....	....	....	....	+ 10	20	9·800	10·790	.....	5·205	12·130
	¾	do 9	L.W.	8	5	P.M.	....	....	7	20	12	15	.....	19	− 0·730	.....	10·530	.....	.....
30		do 10	H.W.	1	0	A.M.	4	55	....	....	....	....	.....	20	12·680	13·410	.....	5·553	12·336
.....	.....	.....	.....	.....	.....	.....	.....	.....	7	30	12	55	.....	18	.....	.....	13·180	.....	.....
	¼	Nov. 10	L.W.	8	30	A.M.	....	....	....	....	....	....	.....	.....	− 0·500	.....	.....	.....	.....
Totals 14 tides			H.W.	128	4	....	70	7	111	4	186	36	+ 48	295	184·998	183·881	199·053	92·969	183·796
			L.W.	69	57								− 57	296	1·117				
Means do 14			H.W.	..	....	.....	5	1	7	24	12	26	+ 16	21	13·214	13·134	13·270	6·640	13·128
			L.W.										− 14	20	·080				
Grand totals 57 tides.....			H.W.	..	....	.....	284	19	433	1	720	44	+ 235	1230	794·677	790·560	802·441	398·268	790·976
			L.W.										−220	1075	4·117				
Grand means 57 tides.....			H.W.	..	....	.....	4	59	7	28	12	26	+ 18	22	13·942	13·869	13·835	6·987	13·877
			L.W.										− 15	19	·072				

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. IV.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*). Diurnal Inequalities. In duration of floods.	In duration of ebbs.	In semi tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Wind.		Height of barometric column at sea level and for 0° cent or 32° Fah.	REMARKS.
Min.	Min.	Min.	Feet.	Feet	Feet.	Feet.	H.	M.		Velocity miles per hour.	Direction.	Inches.	
....	....	....	....	....	....	....	....	....	....	....	....	....	....
4	....	....	·964	....	·629	·025	....	....	....	2·710	W.	30·131	Milder temperature..... ....½
....	34	15	....	·979	....	....	6	26	....	5·008	N.W.	30·046	Sky overcast; turning colder.....½
19	....	....	1·987	....	·393	·084	....	....	7	3·038	E.	30·245	do .....¾
....	27	18	....	·110	....	....	6	13	....	2·599	N.E.	30·036	do 24
9	....	....	1·608	....	·252	·230	....	....	10	3·253	N.E.	29·929	do milder.....½
....	38	31	....	·838	....	....	6	18	....	4·351	N.E.	29·491	do ....½
7	....	....	1·788	....	·127	·307	....	....	3	8·651	N.E.	29·482	Cold; raining hard.....¾
....	48	32	....	·778	....	....	5	51	3	15·994	N.W.	29·705	Cloudy; turning colder 25
16	....	....	3·097	....	·590	·451	....	....	25	21·792	N.W.	29·802	Cold, piercing wind; freezing hard...½
....	52	20	....	·049	....	....	5	55	4	20·442	N.W.	29·965	Clear, cold day..... .....½
32	....	....	1·139	....	·688	·368	....	....	30	20·138	N.W.	30·036	Moon's N declination a maximum=20° 39'. Temperature+14° Fahrenheit.
....	39	31	....	1·058	....	....	5	39	....	5·413	N.W.	30·134	Sky overcast; milder.....26
8	....	....	2·667	....	·221	·192	....	....	....	·622	N.W.	30·291	Snow flurries; much milder.....½
....	51	43	....	1·058	....	....	5	54	....	1·972	S.E.	30·135	Sky overcast.....½
8	....	....	3·427	....	·487	·054	....	....	....	·697	N.E.	30·054	Cloudy but mild..... ....½
....	64	49	....	·279	....	....	5	26	....	2·878	N.E.	29·938	Cloudy.....27
15	....	....	2·848	....	·204	·153	....	....	....	1·617	N.E.	29·834	Fine day; not very cold.....½
....	61	41	....	·839	....	....	5	47	....	8·522	W.	29·759	Clear and bright.....½
20	....	....	2·778	....	·049	·401	....	....	....	·356	W.	29·762	Clouding up somewhat.....¾
....	54	43	....	·340	....	....	5	27	....	·935	W.	29·756	Clear weather.....28
11	....	....	3·312	....	·443	·285	....	....	1	16·351	N.W.	29·708	Moon's last quarter, Quebec, from 0·02 p.m., Nov. 8th; cloudy.
...	36	13	....	·260	....	....	5	49	4	17·069	N.W.	29·932	Cloudy.....½
23	....	....	1·505	....	·795	·060	....	....	12	15·000	N.W.	30·050	Cloudy weather.....¾
....	32	9	....	1·270	....	....	5	59	3	8·000	S.W.	30·302	Fine day 29
23	....	...	3·000	....	·454	·101	....	....	6	5·000	S.W.	30·368	Fine and bright day.....½
....	20	30	....	·260	....	....	6	17	2	3·000	S.W.	30·272	Clear weather.....½
10	....	....	2·880	....	·348	·206	....	....	3	2·000	S.W.	30·235	do .....¾
....	10	40	....	·230	....	....	6	6	....	2·000	N.E.	30·075	Clouding up..... 30
30	....	....	1·080	....	....	....	....	....	2	4·000	N.E.	29·807	Cloudy; snow.....½
....	....	....	....	....	....	....	....	....	....	....	....	....	....
235	566	415	34·080	8·348	5·680	2·917	83	7	....	203·408	....	869·280	....
15	40	30	2·272	·596	·405	·208	5	56	...	7·014	....	29·975	....
801	1675	1259	94·885	27·587	20·133	20·150	364	38	....	637·119	....	3450·450	....
15	29	22	1·637	0·484	0·353	0·353	6	24	....	5·540	....	30·004	....

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. IV.

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Gauge book reference numbers. Series IV. Losing tides.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon. Upper passage. H.	M.	Lower passage. H.	M.	Ages, &c. Days.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2).† H.	M.	Length of half tide day H. W. to H. W. H.	M.	Priming − or lagging + of tides. Min.	Lunitidal intervals H.	M.	General coefficients of semi-amplitude from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old, together with proportional amplitudes and diurnal inequalities.* See foot notes, tables I, II. Co-efficients.	*Amplitudes. Feet.	Diurnal Difference. In amplitudes. Feet.	In semi-tide days. Min.
.....	.....	.....	.....	.....	.....	..C.....		.....		− 20	.....		.....	.....	.....	.....
½	.....	.....	.....	.....	(1)	7	38	12	15	.....	.....		.....	.....	.....	.....
½	1	19	.....	.....	(2)	7	52	.....	.....	− 19	6	33	86	16·37	.....	1
¾	.....	.....	.....	.....	(3) 17·8	8	8	12	16	.....	.....		.....	.....	38	.....
24	.....	.....	1	43	.....	7	53	.....	.....	.....	6	25	84	15·99	.....	1
¼	.....	.....	.....	.....	.....	8	8	12	15	.. ..	.....		.....	.....	39	.....
½	2	7	.....	.....	.....	8	9	.....	.....	− 19	6	16	82	15·60	.....	1
¾	.....	.....	.....	.....	18·8	8	23	12	16	.....	.....		.....	.....	38	.....
25	.....	.....	2	32	.....	8	25	.....	.....	.....	6	7	80	15·22	.....	0
¼	.....	.....	.....	.....	.....	8	39	12	16	.....	.....		.....	.....	76	.....
½	2	58	.....	.....	.....	8	42	.....	.....	− 16	5	57	76	14·46	.....	2
¾	.....	.....	.....	.....	19·8	9	12	12	18	.....	.....		.....	.....	57	.....
26	.....	.....	3	24	.....	8	58	.....	.....	.....	5	49	73	13·89	.....	1
¼	.....	.....	.....	.....	.....	9	13	12	17	.....	.....		.....	.....	76	.....
½	3	50	.....	.....	.....	9	29	.....	.....	− 13	5	40	69	13·13	.....	3
¾	.....	.....	.....	.....	20·8	9	15	12	20	.....	.....		.....	.....	95	.....
27	.....	.....	4	16	.....	9	30	.....	.....	.....	5	34	64	12·18	.....	1
¼	.....	.....	.....	.....	.....	9	45	12	21	.....	.....		.....	.....	95	.....
½	4	42	.....	.....	.....	9	54	.....	.....	− 5	5	29	59	11·23	.....	3
¾	.....	.....	.....	.....	21·8	10	11	12	24	.....	.....		.....	.....	76	.....
28	.....	.....	5	8	.....	10	20	.....	.....	.....	5	27	55	10·47	.....	3
¼	.....	.....	.....	.....	.....	10	18	12	27	.....	.....		.....	.....	96	.....
½	5	35	.....	.....	22·8	10	35	.....	.....	+ 9	5	27	50	9·51	.....	5
¾	.....	.....	.....	.....	◑	10	41	12	32	.....	.....		.....	.....	57	.....
29	.....	.....	6	1	.....	10	43	.....	.....	.....	5	33	47	8·94	.....	4
¼	.....	.....	.....	.....	23·8	11	2	12	36	.....	.....		.....	.....	0	.....
½	6	28	.....	.....	.....	11	5	.....	.....	+ 28	5	42	44	8·37	.....	6
¾	.....	.....	.....	.....	.....	11	10	12	42	.....	.....		.....	.....	38	.....
30	.....	.....	6	54	.....	11	34	.....	.....	.....	5	58	44	8·37	.....	1
.....	.....	.....	.....	.....	24·8	11	30	12	43	.....	.....		.....	.....	.....	.....
¼	.....	.....	.....	.....	.....	11	43	.....	.....	.....	.....		.....	.....	.....	.....
Total 14 tides	26	59	29	58	.....	138	54	185	58	+ 37 − 72 + 18 ..... − 14	81	57	913	173·73	7·81	32
Mean 14 tides	3	51	4	17	.....	9	55	12	24		5	51	65·21	12·27	60	2
Gra'd to's 57 tides	171 + 36 =207	57 0 57	178 + 36 214	58 0 58		415 + 12 =427	59 0 59	721	2	+ 210 ..... −197 + 19 ..... − 12	365	4	41·44	888·56	46·46	2·05
Gra'd m'n 57 tides	7	26	7	25	.....	7	31	12	26		6	24	72·70	15·59	82	2

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

AT

*CHAUDIERE, ST. NICHOLAS, PLATON, &c.

DURING THE LUNAR MONTH OF THE LOW WATER SEASON OF 1887, OCTOBER 9th TO NOVEMBER 8th.

TABLES II, III AND IV.

WEEKLY SERIES OF GAINING AND LOSING TIDES Nos. I, II, III, IV.

* Chaudière fluctuations are incomplete.

APPENDIX 13.

TABLE VII.—Tidal Fluctuations at Chaudière during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series I. Gaining tides.	High and low waters observed each civil day.		Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming − or lagging + of tides Min.	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	Diurnal Inequalities. In duration of floods. Min.	In duration of ebbs. Min.	In semi tides days. Min.
¼	Oct. 11	H.W	* 1	25	P.M.	..	..	..	..	..	..	+ 37	....	11·725	.....	.....	.....	.....	..	..	...
¾	do 11	L.W.	8	16	P.M.	..	..	6	51	12	27	....	25	1·975	.....	9·750	.....	.....	..	..	...
2	do 12	H.W	1	52	A.M.	5	36	..	..	..	..	+ 31	17	13·635	11·660	.....	7·159	11·238	..	34	27
¼	do 12	L.W.	9	17	A.M.	..	..	7	25	12	54	...	21	1·105	.....	12·530	.....	.....	7	..	...
¾	do 12	H.W	2	46	P.M.	5	29	..	..	..	..	....	26	12·115	11·010	.....	6·959	11·798	..	38	37
¾	do 12	L.W.	9	33	P.M.	..	..	6	47	12	17	....	35	1·015	.....	11·100	.....	.....	1	..	...
3	do 13	H.W	3	3	A.M.	5	30	..	..	..	..	+ 17	24	13·565	12·550	.....	6·857	12 383	..	45	33
¼	do 13	L.W.	10	35	A.M.	..	..	7	32	12	50	....	18	0 315	.....	13·250	.....	.....	12	..	...
¼	do 13	H.W	3	53	P.M.	5	18	..	..	..	..	....	22	12·945	12·630	.....	7·084	12·938	..	37	40
¾	do 13	L.W.	10	45	P.M.	..	..	6	55	12	10	....	17	0·915	.....	12·030	.....	.....	3	..	...
4	do 14	H.W	4	0	A.M.	5	15	..	..	..	..	+ 5	25	14·755	13·840	.....	7·369	13·598	..	48	35
¼	do 14	L.W.	11	43	A.M.	..	..	7	43	12	45	..	17	0·225	.....	14·530	.....	.....	13	..	...
¾	do 14	H.W	4	45	P.M.	5	2	..	..	..	..	....	21	14·215	13·990	.....	7·543	14·263	..	26	27
¾	do 15	L.W.	12	2	A.M.	..	..	7	17	12	18	....	14	0 595	.....	13·620	.....	.....	1	..	...
5	do 15	H.W	5	3	A.M.	5	1	..	..	..	..	— 6	20	15·515	14·920	.....	7·636	14·733	..	20	8
¼	do 15	L.W.	12	40	P.M.	..	..	7	37	12	26	....	17	−0·055	.....	15·570	.....	.....	12	..	...
¾	do 15	H.W	5	29	P.M.	4	49	..	..	..	..	....	19	14·765	14·820	.....	7·208	15·276	..	66	73
¾	do 16	L.W.	+ 1	3	A.M.	..	..	6	31	11	13	....	17	−0·805	.....	15·570	.....	.....	7	..	...
6	do 16	H.W	5	45	A.M.	4	42	..	..	..	..	— 64	6	14·335	15·140	.....	6·864	15·758	..	71	80
¼	do 16	L.W.	‡ 1	27	P.M.	..	..	7	42	12	33	..	13	−1·225	.....	15·560	.....	.....	9	..	...
¾	do 16	H.W	§ 6	18	P.M.	4	51	..	..	..	..	....	14	15·535	16·760	.....	7·148	16·238	..	5	11
¾	do 17	L.W.	1	55	A.M.	..	..	7	37	12	22	....	25	−0·715	.....	16·250	.....	.....	6	..	...
7	do 17	H.W	6	40	A.M.	4	45	..	..	..	..	— 5	18	15·665	16·380	.....	7·841	16·655	..	7	1
¼	do 17	L.W.	2	10	P.M.	..	..	7	30	12	23	....	16	−0·255	.....	15·920	.....	.....	8	..	...
¾	do 17	H.W	7	3	P.M.	4	53	..	..	..	..	....	10	17·815	18·070	.....	8·604	16·988	..	10	1
¾	do 18	L.W.	2	43	A.M.	..	..	7	40	12	22	....	14	0·475	.....	17·340	.....	.....	11	..	...
8	do 18	H.W	7	25	A.M.	4	42	..	..	..	..	— 25	19	17·095	16·620	.....	8·916	17·062	..	17	19
¼	do 18	L.W.	‖ 2	58	P.M.	..	..	7	23	12	3	..	16	0·295	.....	16·800	.....	.....	2	..	...
½	do 18	H.W	7	38	P.M.	4	40	..	..	..	..	....	14	17·785	17·490	.....	8·689	17·007	..	32	33
Totals 14 tides ...		H.W	71	40								+ 53	255	209·740							
			97	7		70	33	102	30	173	3	....	..	.....	205·880	199·820	105·877	205·935	92	456	425
		L.W.	12	0								—100	265	3·860							
		=	109	7																	
1 Means do 14		H.W	...	..	...	5	2	7	19	12	22	+ 18	18	14·981	14·706	14·273	7·563	14·709	7	33	30
		L.W.										— 25	19	0·276							
Grand totals 57 tides.		H.W											1118	789·012							
		L.W.	...	..	...	..	..	..	..	..	..	....	1097	8·923	.....	.....	399·759	777·598	..	..	...
Grand means 57 tides.		H.W											19	13·842							
		L.W.	...	..	...	..	..	..	..	..	..	....	19	0·157	.....	.....	7·013	13 642	..	..	...

* Longitude, mouth river Chaudière = 71° 17′ = 4h. 45m. 8s. = 0·1980 of a day west of Greenwich.
† Moon crosses equator, Oct. 16. ‡ Moon in perigee, Oct. 16, at 1 p.m. § New moon (Que.) 5.35 p.m., Oc 16.
‖ Most important tide but one during 1887, viz., evening tide of March 11, for which coefficient of s_2 mi- amplitude is 118.

APPENDIX 13.

TABLE II.—Tidal Fluctuations at Chaudière during the Low water season of 1887, viz., from quadrature October 9th, to quadrature November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).							RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."													
Diurnal Inequalities.							Eastern standard civil times of meridian passages immediately preceding observed high waters, with correspondingages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: No. 2.		Length of half tide day H.W. to H.W.		Priming — or lagging + of tides.	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series I. Gaining tides. Gauge book reference numbers.
In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.									
Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.		
....	2·80	....	....	....	....	....	....	....	....	....	....	....	....	....	....	+34	....	....	....	¼
1·910	....	....	....	....	....	....	....	....	....	....	....	....	....	12	46	....	....	....	....	¼
....	8·70	....	....	6	36	....	....	....	7	16	....	1	40	....	....	....	6	24	39	¼ 2
1·520	....	2·00	5·60	....	....	4	....	....	....	....	....	....	....	12	47	....	....	....	....	¼
....	0·90	....	....	7	3	15	7	43	....	....	25·1	2	27	....	....	+40	6	44	42	¼
1·450	....	1·02	5·85	....	....	....	....	....	....	....	....	....	....	12	43	....	....	....	....	¼
....	7·00	....	....	6	52	....	....	....	8	11	....	3	10	....	....	....	6	59	47	¼ 3
6·20	....	2·27	5·55	....	....	....	....	....	....	....	....	....	....	12	39	....	....	....	....	¼
....	6·00	....	....	7	15	....	8	38	....	....	....	3	49	....	....	+22	7	11	54	¼
1·810	....	2·85	6·60	....	....	....	....	....	....	....	26·1	....	....	12	33	....	....	....	....	¼
....	6·90	....	....	6	54	7	....	....	9	6	....	4	22	....	....	....	7	16	62	¼ 4
5·40	....	1·74	6·65	....	....	7	....	....	....	....	....	....	....	12	29	....	....	....	....	¼
....	3·70	....	....	7	12	5	9	33	....	....	....	4	51	....	....	+ 5	7	18	71	¼
1·300	....	0·93	4·70	....	....	....	....	....	....	....	27·1	....	....	12	26	....	....	....	....	¼
....	6·50	....	....	7	3	4	....	....	10	0	....	5	17	....	....	....	7	17	80	¼ 5
7·50	....	4·28	5·43	....	....	7	....	....	....	....	....	....	....	12	25	....	....	....	....	¼
....	7·50	....	....	7	1	....	10	28	....	....	....	5	42	....	....	— 2	7	14	89	¼
4·30	....	3·44	4·82	....	....	7	....	....	....	....	28·1	....	....	12	23	....	....	....	....	¼
....	4·20	....	....	6	49	15	....	....	10	56	....	6	5	....	....	....	7	9	97	¼ 6
1·200	....	2·84	4·80	....	....	15	....	....	....	....	....	....	....	12	22	....	....	....	....	¼
....	5·10	....	....	6	54	5	11	24	....	....	....	6	27	....	....	— 6	7	3	104	¼
1·30	....	6·93	4·17	....	....	....	....	....	....	....	29·1	....	....	12	22	....	....	....	....	¼
....	4·60	....	....	6	48	....	....	....	11	52	....	6	49	....	....	....	6	57	110	¼ 7
2·150	....	7·63	3·33	....	....	4	....	....	....	....	....	....	....	12	22	....	....	....	....	¼
....	7·30	....	....	6	43	20	....	20	....	....	....	7	11	....	....	— 7	6	51	114	¼
7·20	....	3·12	0·74	....	....	....	....	....	....	....	0·8	....	....	12	21	....	....	....	....	¼
....	1·80	....	....	6	37	3	....	....	....	48	....	7	32	....	....	....	6	44	116	¼ 8
6·90	....	2·27	0·55	....	....	4	....	....	....	....	....	....	....	15	22	....	....	....	....	¼
....	....	....	....	6	21	3	1	17	....	....	1·8	7	54	....	....	— 7	6	37	117	½
							49	23	58	9						+67				
15·220	7·300	4·132	....	96	8	....	+24	0	+12	0	....	73	16	175	0	....	97	44	1142	¶
			5·879				=73	23	=70	9						—22				
1·087	0·521	0·318	0·452	6	52	....	10	29	10	1	....	5	14	12	30	+22 .... — 6	6	59	81·57	
80·712	28·404	....	....	367	65	....	....	....	....	....	....	....	....	....	....	....	....	....	4144	
1·415	0·498	....	....	6	45	....	....	....	....	....	....	....	....	....	....	....	....	....	72·70	

¶ Only 27 tides observed at river Chaudière in 1887. Results here given for complete lunar month arrived at by assuming that they are in general directly proportional to corresponding results entered in table I. for the Graving Dock station.

APPENDIX 13.

TABLE III.—Tidal Fluctuations at St. Nicholas during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series I. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H. W. to H. W.		Priming—or lagging + of tides.	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	Diurnal Inequalities.		
		H.	M	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.	In duration of floods. Min	In duration of ebbs. Min	In semi tide days. Min
½	Oct. 11 H. W	+ 1	37	P.M.	..	..	..	..	..	..	+36	....	12·03	...	...	.....	.....	...	....	....
¼	do 11 L. W.	8	33	P.M.	..	..	6	56	12	29	....	21	2·40	.....	° 9·63	.....	.....	22	....	....
2	do 12 H. W	2	6	A.M.	5	33	..	..	..	..	..	32	13·86	11·46	.....	7·53	11·04	....	38	25
¼	do 12 L. W.	9	40	A.M.	..	..	7	34	12	54	...	10	1·62	.....	12·24	.....	.....	13	....	....
¼	do 12 H. W	3	0	P.M.	5	20	..	..	..	..	+19	14	12·43	10·81	.....	7·36	11·58	....	29	39
¼	do 12 L. W.	10	5	P.M.	..	..	7	5	12	15	..	28	1·51	.....	10·92	.....	.....	10	....	....
3	do 13 H. W	3	15	A.M.	5	10	..	..	..	..	..	23	13·87	12·36	.....	7·28	12·12	....	35	40
¼	do 13 L. W.	10	55	A.M.	..	..	7	40	12	55	..	20	0·93	.....	12·94	.....	.....	5	....	....
¼	do 13 H. W	4	10	P.M.	5	15	..	..	..	..	+32	26	13·19	12·26	.....	7·52	12·67	....	40	28
¼	do 13 L. W.	11	10	P.M.	..	..	7	0	12	27	..	19	1·44	.....	11·75	.....	.....	12	....	....
4	do 14 H. W	4	37	A.M.	5	27	..	..	..	..	....	18	15·15	13·71	.....	7·82	13·35	....	25	4
¼	do 14 L. W.	12	2	P.M.	..	..	7	25	12	23	....	16	0·84	.....	14·31	.....	.....	29	....	....
¼	do 14 H. W	5	0	P.M.	4	58	..	..	..	..	—12	18	14·45	13·61	.....	7·98	13·90	....	8	8
¾	do 15 L. W.	12	17	A.M.	..	..	7	17	12	15	..	18	1·22	.....	13·23	.....	.....	° 0	....	....
5	do 15 H. W	5	15	A.M.	4	58	..	..	..	..	....	22	15·68	14·46	....	8·06	14·27	....	23	8
¼	do 15 L. W.	12	55	P.M.	..	..	7	40	12	23	...	18	0·63	.....	15·05	.....	.....	15	....	....
¼	do 15 H. W ‡	5	38	P.M.	4	43	..	..	..	..	—10	20	14·99	14·36	.....	7·67	14·83	....	2	6
¾	do 16 L. W.	1	20	A.M.	..	..	7	42	12	17	...	8	— 0·12	.....	15·11	.....	.....	8	....	....
6	do 16 H. W §	5	55	A.M.	°	4	35	..	..	..	....	15	14·66	14·78	.....	7·32	15·35	....	6	18
¼	do 16 L. W.	1	43	P.M.	..	..	7	48	12	35	...	10	—°0·57	.....	15·23	.....	.....	12	....	....
¼	do 16 H. W	6	30	P.M.	4	47	..	..	..	..	+ 9	20	15·67	16·24	.....	7·51	15·81	....	4	11
¾	do 17 L. W.	2	14	A.M.	..	..	7	44	12	24	...	14	— 0·21	.....	15.88	.....	.....	7	....	....
7	do 17 H. W	6	54	A.M.	4	40	..	..	..	..	....	21	15·68	15·89	.....	8·10	16·18	....	10	8
¼	do 17 L. W.	2	28	P.M.	..	..	7	34	12	16	..	15	0·30	.....	15·38	.....	.....	2	....	....
¾	do 17 H. W	7	10	P.M.	4	42	..	..	..	..	— 9	25	*17·89	*17·59	.....	8·97	*16·41	....	16	9
¾	do 18 L. W.	3	0	A.M.	..	..	7	50	12	25	...	14	1·23	.....	16·66	.....	.....	7	....	....
8	do 18 H. W	7	35	A.M.	4	35	..	..	..	..	....	21	17·21	15·98	.....	* 9·33	16·40	....	13	8
¼	do 18 L. W.	3	12	P.M.	..	..	7	37	12	17	...	14	1·02	.....	16·19	.....	.....	5	....	....
¾	do 18 H. W ¶	7	52	P.M.	4	40	..	..	..	..	+ 0	23	17·81	16·79	...	9·11	16·34	...	21	16
Totals tides....	14 H. W	74	57		..	69	23	104	52	174	15	+60	298	212·54	.....	200·30	194·52	111·56	200·25	147	270	228
		101	34																	
	L. W.	+12	0									—31	225	12·24						
		113	34																	
	14 H. W											+15	21	15·181						
Means do		...	...	.....	4	57	7	29	12	27				.....		14·31	13·89	7·968	14·304	11	19	16
	14 L. W.											—10	16	0·874						

N.B.—Maxima in whole lunar month indicated by a star, thus: *, and minima by a circle, thus: °.
† Longitude, St. Nicholas gauge = 71° 23′ 0″ = 4h. 45m. 32s. = 0·1983 of a day west of Greenwich.
‡ Moon crosses equator, Oct. 16. § Moon in perigee, Oct. 16. | New moon, Quebec, at 5.35 p.m., Oct. 16.
¶ Most important tide but one during 1887, viz., evening tide of March 11, for which coefficient of semi-amplitude is 118.

APPENDIX 13.

TABLE III.—Tidal Fluctuations at St. Nicholas during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).							RESULT BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."													
Diurnal Inequalities.							Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding gages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: No. 2.		Length of half tide day H.W. to H.W.		Priming — or lagging + of tides.	Lunitidal intervals.		Generalcoefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series I. Gaining tides. Gauge book reference numbers.
In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.									
Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.		
....	..	....	....	....	..	....	..	..	..	..	....	....	..	....	..	+34	..	..	....	
....	21	....	....	....	..	....	..	..	..	..	....	....	..	....	..	....	..	..	....	$\frac{1}{4}$
1·83	....	15	27	....	..	....	..	..	..	..	....	....	..	12	46	....	..	..	....	$\frac{1}{2}$
....	78	....	....	6	50	....	..	..	7	16	....	1	52	....	..	....	6	36	....	2
1·43	....	17	54	....	..	....	..	..	..	..	....	....	..	* 12	47	....	..	..	° 39	$\frac{1}{4}$
....	11	....	....	7	16	....	7	44	....	..	25·1	2	39	....	..	*+40	6	55	° 42	$\frac{1}{2}$
1·44	....	08	54	....	..	....	..	..	..	..	....	....	..	12	43	....	..	..	....	$\frac{3}{4}$
....	58	....	....	7	4	..	..	..	8	11	...	3	22	....	..	....	7	11	47	3
68	..	24	55	....	..	....	..	..	..	..	....	....	..	12	39	....	..	..	....	$\frac{1}{4}$
....	51	....	....	7	31	....	8	39	....	..	26·1	4	1	....	..	+22	7	22	54	$\frac{1}{2}$
1·96	..	30	68	....	..	....	..	..	..	..	....	....	..	12	33	....	..	..	....	$\frac{3}{4}$
....	60	....	....	7	31	....	..	..	9	6	...	4	34	....	..	....	7	28	62	4
70	..	16	55	....	..	....	..	..	..	..	....	....	..	12	29	....	..	..	....	$\frac{1}{4}$
....	38	....	....	7	26	....	9	34	....	..	27·1	5	3	....	..	+ 5	7	29	71	$\frac{1}{2}$
1·23	....	08	37	....	..	....	..	..	..	..	....	....	..	12	26	....	..	..	....	$\frac{3}{4}$
....	59	....	....	7	14	....	..	..	10	1	...	5	29	....	..	....	7	28	80	5
69	....	39	56	....	..	....	..	..	..	..	....	....	..	12	25	....	..	..	....	$\frac{1}{4}$
....	75	....	....	7	9	....	10	29	....	..	28·1	5	54	....	..	° -2	7	25	89	$\frac{1}{2}$
33	....	35	52	....	..	....	..	..	..	..	....	....	..	12	23	....	..	..	....	$\frac{3}{4}$
....	45	....	....	6	59	....	..	..	10	56	●	6	17	....	..	....	7	21	97	6
1·01	....	19	46	....	..	....	..	..	..	..	....	....	..	12	22	....	..	..	....	$\frac{1}{4}$
....	36	....	....	7	6	....	11	24	....	..	29·1	6	39	....	..	— 6	7	15	104	$\frac{1}{2}$
0·01	....	59	37	....	..	....	..	..	..	..	....	....	..	12	22	....	..	..	....	$\frac{3}{4}$
....	51	....	....	7	2	....	..	..	11	52	...	7	1	....	..	....	7	9	110	7
2·21	....	87	23	....	..	....	..	..	..	..	....	....	..	12	22	....	..	..	....	$\frac{1}{4}$
....	93	....	....	6	50	..	12	20	..	..	0·8	7	23	....	..	— 7	7	3	114	$\frac{1}{2}$
68	....	36	° 01	....	..	....	..	..	..	..	....	....	..	12	21	....	..	..	....	$\frac{3}{4}$
....	21	....	....	6	46	....	..	..	12	49	...	7	44	....	..	....	6	55	116	8
60	....	22	06	....	..	....	..	..	..	..	....	....	..	12	22	....	..	..	....	$\frac{1}{4}$
..	....	....	....	6	35	..	1	17	....	..	1·8	8	6	....	..	— 7	6	49	* 117	$\frac{1}{2}$
14·80	6·97	4·15	5·71	99	19	...	61 +12 =73	27 0 27	70	11	....	76	4	175	0	+67 ... −22	100	26	11 42	
1·057	·497	·297	·408	7	6	....	10	30	10	1	....	5	26	12	30	+22 — 6	7	10	81·57	

APPENDIX 13.

TABLE III.—Tidal Fluctuations at St. Nicholas during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series II.	Losing tides.	High and low waters observed each civil day.		Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides Min.	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	Diurnal Inequalities In duration of floods. Min	Diurnal Inequalities In duration of ebbs. Min
½		Oct. 18	H.W	7	52	P.M.	..	..	..	..	..	..	..	....	17·81	..	.....	.....	.....	...	....
¾		do 19	L.W.	3	50	A.M.	....		7	58	12	33	....	11	0·85	.....	*16·96	.....	.....	5	...
9		do 19	H.W	8	25	A.M.	°4	35	....		....		.....	19	16·29	15·44	.....	8·92	16·20	....	28
¼		do 19	L.W.	3	55	P.M.	....		7	30	12	16	....	* 55	0·78	.....	15·51	.....	.....	11	....
¾		do 19	H.W	8	41	P.M.	4	46	....		....		+ 1	20	17·68	16·90	.....	8·99	16·23	....	25
¼		do 20	L.W.	4	36	A.M.	....		7	55	12	35	.....	16	0·96	.....	16·72	.....	.....	6	....
10		do 20	H.W	9	16	A.M.	4	40	....		....		....	9	16·74	15·78	.....	9·13	16·00	..	36
¼		do 20	L.W.	4	35	P.M.	....		7	19	12	10	.....	8	1·29	.....	15·45	.....	.....	11	....
¾		do 20	H.W	9	26	P.M.	4	51	....		....		+ 2	25	17·37	16·08	.....	8·99	15·44	...	35
¼		do 21	L.W.	5	20	A.M.	....		7	54	12	42	.....	17	1·25	.....	16·12	.....	.....	3	....
11		do 21	H.W	10	8	A.M.	4	48	....		....		....	24	15·35	14·10	.....	8·99	14·73	....	52
¼		do 21	L.W.	5	10	P.M.	....		7	2	12	4	.....	15	2·01	.....	13·34	.....	.....	14	....
¾		do 21	H.W	† 10	12	P.M.	5	2	....		....		—* 31	19	17·35	15·34	.....	8·82	14·11	....	56
¼		do 22	L.W.	‡ 6	10	A.M.	....		7	58	12	15	.....	13	1·51	.....	15·84	.....	.....	45	....
12		do 22	H.W	10	27	A.M.	4	17	....		....		.....	10	13·44	11·93	.....	7·81	13·21	..	37
¼		do 22	L.W.	5	48	P.M.	....		7	21	12	26	.....	20	0·90	.....	12·54	.....	.....	* 58	....
¾		do 22	H.W	11	3	P.M.	5	15	....		....		+* 51	35	13·41	12·51	.....	6·69	12·72	....	48
¼		do 23	L.W.	7	12	A.M.	....		* 8	9	*13	15	.....	30	— 0·24	.....	13·65	.....	.....	9	....
13		do 23	H.W	§ 12	18	P.M.	5	6	....		....		.....	24	11·93	12·17	.....	6·63	12·40	....	* 87
¼		do 23	L.W.	7	0	P.M.	....		° 6	42	°11	50	.....	16	1·09	.....	10·84	.....	.....	2	....
¾		do 24	H.W	12	8	A.M.	5	8	....		....		+ 7	14	14·05	12·96	.....	7·26	11·96	....	65
¼		do 24	L.W.	7	55	A.M.	....		7	47	13	7	.....	20	1·47	.....	12·58	.....	.....	12	....
14		do 24	H.W	1	15	P.M.	5	20	....		....		.....	18	12·91	11·44	.....	7·25	11·80	....	44
¼		do 24	L.W.	8	18	P.M.	....		7	3	12	10	.....	25	1·24	.....	11·67	.....	.....	13	....
¾		do 25	H.W	1	25	A.M.	5	7	....		....		+ 25	20	12·71	11·47	.....	6·37	11·30	....	58
¼		do 25	L.W.	9	26	A.M.	....		8	1	13	5	.....	22	0·20	.....	12·51	.....	.....	3	....
15		do 25	H.W	2	30	P.M.	5	4	....		....		.....	26	9·75	° 9·55	.....	° 5·64	°10·95	..	77
¼		do 25	L.W.	9	14	P.M.	....		6	44	12	10	.....	22	0·12	.....	° 9·63	.....	.....	42	....
				107	14																
Totals tides....	13½	H.W	+ 12	0									+ 86	263	188·98						
			= 119	14		63	59	105	23	174	38	....				175·67	193·36	101·49	177·05	234	648
		L.W.	88	29									— 31	293	13·43						
	13	H W											+ 17	20	14·537						
Means	do		..	..	..	4	55	7	32	12	28	....	..		..	13·51	13·81	7·807	13·619	17	50
	14	L.W.											— 31	21	0·960						

N.B.—Maxima in whole lunar month indicated by a star, thus: *, and minima by a circle, thus: °.
† Moon's S. declination a maximum = 20°—8'. ‡ Diurnal maximum inequality observed in high water levels = 3·91 feet. § Moon's first quarter, Quebec, Oct. 23, from 0·46 p.m.

APPENDIX 13.

TABLE III.—Tidal Fluctuations at St. Nicholas during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).								RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."																					
Diurnal Inequalities.					Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2).		Length of half tide day H. W. to H. W.		Priming + or lagging — of tides		Lunitidal intervals.		General coefficients of semi-amplitude from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series II. Losing tides. Gauge book reference numbers.	
In semi tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.				Upper passage.		Lower passage.		Ages, etc.																
Min	Feet.	Ft.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.										
....	....	17	....	....	..	..	....	..	....	..	..	..	....	....	....	....	— 7	....	....	....	....	....	....	....	....	....	....	....	....
....	1·52	....	19	14	..	....	....	..	....	..	....	..	....	....	12	21	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	07	....	....	6	39	....	..	....	1	46	....	8	27	....	..	..	6	41	116	....	....	....	....	....	....	....	....	9
17	1·39	....	07	03	..	....	....	..	....	..	....	2·8	....	....	12	22	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	18	....	....	6	26	....	2	15	..	....	....	8	42	....	..	— 6	6	34	113	....	....	....	....	....	....	....	....	....
19	·94	....	14	23	..	....	....	..	....	..	....	..	....	....	12	22	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	33	....	....	6	32	....	..	....	2	44	....	9	11	....	..	....	6	27	108	....	....	....	....	....	....	....	....	10
25	·63	....	14	56	..	....	....	..	....	..	....	3·8	....	....	12	21	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	04	....	....	6	13	....	3	13	..	....	....	9	32	....	..	— 7	6	19	101	....	....	....	....	....	....	....	....	....
32	2·02	....	° 00	71	..	....	....	..	....	..	....	....	....	....	12	22	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	76	....	....	6	27	....	..	....	3	41	....	9	54	....	..	....	6	13	94	....	....	....	....	....	....	....	....	11
38	2·00	....	17	62	..	....	....	..	....	..	....	4·8	....	....	12	22	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	50	....	....	6	3	....	4	9	..	....	....	10	16	....	..	— 5	6	7	86	....	....	....	....	....	....	....	....	....
11	* 3·91	....	1·01	* ·90	..	....	....	..	....	..	....	....	....	....	12	23	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	61	....	....	°5	50	....	..	....	4	37	....	10	39	....	..	....	6	2	77	....	....	....	....	....	....	....	....	12
11	·03	....	* 1·12	49	..	....	....	..	....	..	....	5·8	....	....	12	25	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	1·14	....	....	5	59	....	5	4	..	....	....	11	4	....	..	+ 2	6	0	68	....	....	....	....	....	....	....	....	....
49	1·48	....	·06	32	..	....	....	..	....	..	....	....	....	....	12	27	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	1·33	....	....	6	47	....	..	....	5	31	O	11	31	....	..	....	6	0	60	....	....	....	....	....	....	....	....	13
85	2·12	....	·63	44	..	....	....	..	....	..	....	6·8	....	....	12	30	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	38	....	....	6	12	....	5	56	..	....	....	12	1	....	..	+ 14	6	5	52	....	....	....	....	....	....	....	....	....
77	1·14	....	·01	16	..	....	....	..	....	..	....	....	....	....	12	34	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	23	....	....	6	54	* 25	..	....	6	21	....	12	35	....	..	....	6	14	46	....	....	....	....	....	....	....	....	14
57	·20	....	·88	50	..	....	....	..	....	..	....	7·8	....	....	12	40	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	1·04	....	....	6	39	....	6	46	..	....	....	1	15	....	..	+ 34	6	29	41	....	....	....	....	....	....	....	....	....
55	2·96	....	·73	35	..	....	....	..	....	..	....	....	....	....	12	44	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	08	....	....	7	21	....	..	....	7	9	....	1	59	....	..	....	6	50	39	....	....	....	....	....	....	....	....	15
55	2·46	....	·29	16	..	....	....	..	....	..	....	8·8	....	....	12	47	....	....	....	....	....	....	....	....	....	....	....	....	....
													117	13			+ 50												
531	22·80	6·86	5·44	5·61	84	2	....	27	23	31	49	.. .	+ 24	0	174	40	.....	82	1	1001									
													= 141	13			— 18												
																	+ 17												
41	1·63	0·49	0·380	0·400	6	28	....	4	34	4	32	...	10	52	12	29	.....	6	19	77·00									
																	— 6												

APPENDIX 13.

TABLE III.—Tidal Fluctuations at St. Nicholas during the Low water season of 1887, viz. :—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers.	Series III.	Gaining tides.	High and low waters observed each civil day.		Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides Min	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	Diurnal Inequalities: In duration of floods. Min.	Diurnal Inequalities: In duration of ebbs. Min.
	1/4	Oct. 25	L.W.		9	14	P.M.	..	..	..	..	..	..	+25	....	....	....	....	....	....	....	....
	2	....	....		....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
		do 26	H.W		3	0	A.M.	*5	46	..	..	..	..	+ 5	21	12·21	12·09	....	5·93	11·11	....	49
	3/4	do 26	L.W.		10	33	A.M.	..	..	7	33	12	45	....	24	0·62	....	11·59	....	....	34	....
16		do 26	H.W		3	45	P.M.	5	12	..	..	..	..	....	20	11·74	11·12	....	6·35	11·61	....	30
	1/4	do 26	L.W.		10	48	P.M.	..	..	7	3	12	23	....	20	0·48	....	11·26	....	....	8	....
	2/4	do 27	H.W		4	8	A.M.	5	20	..	..	..	..	+°0	29	12·95	12·47	....	6·73	11·88	....	12
	3/4	do 27	L.W.		11	23	A.M.	..	..	7	15	12	27	..	16	1·09	....	11·86	....	....	8	....
17		do 27	H.W		4	35	P.M.	5	12	..	..	..	..	....	28	13·05	11·96	....	7·08	12·13	....	2
	1/4	do 27	L.W.		11	48	P.M.	..	..	7	13	12	15	....	18	0·93	....	12·12	....	....	10	....
	2/4	do 28	H.W		4	50	A.M.	5	2	..	..	..	..	— 8	19	13·50	12·57	....	7·04	12·59	..	14
	3/4	do 28	L.W.		12	17	P.M.	..	..	7	27	12	27	....	12	0·56	....	12·94	....	....	2	....
18		do 28	H.W		5	17	P.M.	5	0	..	..	..	..	....	23	13·26	12·70	....	7·07	12·76	....	10
	1/4	do 29	L.W.	‡	12	34	A.M.	..	..	7	17	12	21	....	21	0·81	....	12·45	....	....	4	....
	2/4	do 29	H.W	§	5	38	A.M.	5	4	..	..	..	..	—14	19	13·78	12·97	....	7·58	12·94	..	18
	3/4	do 29	L.W.		12	37	P.M.	..	..	6	59	12	15	..	18	1·40	....	12·38	....	....	12	....
19		do 29	H.W		5	53	P.M.	5	16	..	..	..	..	....	24	15·37	13·97	....	8·28	13·14	....	18
	1/4	do 30	L.W.		1	10	A.M.	..	..	7	17	12	21	....	18	2·03	....	13·34	....	....	12	....
	2/4	do 30	H.W		6	14	A.M.	5	4	..	..	..	..	—13	20	14·91	12·88	....	8·34	13·26	....	° 1
	3/4	do 30	L.W.		1	30	P.M.	..	..	7	16	12	16	....	8	1·37	....	13·54	....	....	14	....
20		do 30	H.W	†	6	20	P.M.	4	50	..	..	..	..	.... °	6	14·68	13·31	....	7·54	13·71	..	16
	1/4	do 31	L.W.		1	52	A.M.	..	..	7	32	12	15	....	10	— 0·01	....	14·69	....	....	7	....
	2/4	do 31	H.W		6	35	A.M.	4	43	..	..	..	..	—10	24	13·30	13·31	....	6·80	13·88	....	3
	3/4	do 31	L.W.		2	10	P.M.	..	..	7	35	12	25	....	18	— 0·26	....	13·56	....	....	7	....
21		do 31	H.W	¶	7	0	P.M.	4	50	..	..	..	..	....	22	13·68	13·94	....	6·72	13·72	....	13
	1/4	Nov. 1	L.W.		2	22	A.M.	..	..	7	22	12	15	....	17	— 0·03	....	13·71	....	....	3	....
	2/4	do 1	H.W		7	15	A.M.	4	53	..	..	..	..	—21	26	13·66	13·69	....	7·00	13·75	....	1
	3/4	do 1	L.W.		2	36	P.M.	..	..	7	21	12	14	....	17	0·27	....	13·39	....	....	° 0	....
22		do 1	H.W		7	29	P.M.	4	53	..	..	..	..	....	23	14·46	14·19	....	6·90	13·79	....	19
	1/4	do 2	L.W.		3	9	A.M.	..	..	7	40	12	26	....	16	— 0·26	....	14·72	....	....	7	....
	2/4	do 2	H.W		7	55	A.M.	4	46	..	..	..	..	—19	22	12·60	12·86	....	6·70	13·82	....	35
	3/4	do 2	L.W.		3	0	P.M.	..	..	7	5	12	5	....	15	— 0·15	....	12·75	....	....	14	....
23		do 2	H.W		8	0	P.M.	5	0	..	..	..	..	.. .	27	14·77	14·92	....	6·94	14·17	....	36
Totals	15½		H.W		93	54								+ 5	353	217·92						
tides					99	49	....	80	51	109	55	185	10	....	....	....	208·95	194·30	113·00	208·26	142	277
			L.W.	+	24	0								—85	248	8·85						
				=	123	49																
	16		H.W											+ 2	22	13·62						
Means	do				....	....	....	5	3	7	20	12	21	....	....	.....	13·06	12·95	7·062	13·016	9	17
	15		L.W.											—14	17	0·59						

N.B.—Maxima in whole lunar month indicated by a star, thus : *, and minima by a circle, thus : °.
‡ Moon crosses equator equator Oct. 29th. § Moon in apogee Oct. 29th at 6.0 p.m.
† Maximum inequality observed in low water levels=1·38 feet.
¶ Full moon, Quebec, Oct. 31st, at 4.31 p.m.

APPENDIX 13.

TABLE III.—Tidal Fluctuations at St. Nicholas during the Low water season of 1887, viz :—from quadrature, October 9th, to quadrature, November 8th.

Direct Results of Tidal Observations—(*Continued.*) Diurnal Inequalities. In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Results based on data from Nautical Almanac and "L'Annuaire des Marees." Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon. Upper passage.		Lower passage.		Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times. No. 2		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitude from "l'Annuaire des Marés," corresponding to observed tides assumed to be 48 hours old.	Series III. Gaining tides. Gauge book reference numbers.
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		
																	+ 34				
		·50			7	27		7	33				2	46			+ 38	7	13	40	¼ ½ ¾
35	·47		·42	·50								9·8			12	41					
		·14			7	50				7	55		3	27				7	32	42	16
22	1·21		·38	·27											12	37					
		·61			7	51		8	17				4	4			+ 18	7	47	46	¼ ½ ¾
4	·10		·35	·25								10·8			12	31					
		·16			7	56				8	39		4	35				7	56	51	17
12	·45		·04	·46											12	27					
		·37			7	50		9	0				5	2			+° 00	8	2	56	¼ ½ ¾
12	·24		·03	·17								11·8			12	23					
		·25			* 7	56				9	21		5	25				* 8	4	61	18
6	·52		·51	·18											12	21					
		·59			7	56		9	42				5	46			— 10	8	4	65	¼ ½ ¾
6	·59		·70	·20								12·8			12	19					
		·63			7	50				10	3		6	5				8	2	70	19
6	·46		·06	·12											12	17					
		·66			7	50		10	24				6	22			— 16	7	58	74	¼ ½ ¾
5	·23		·80	·45								13·8			12	17					
		* 1·38			7	35				10	45		6	39				7	54	77	20
° 1	1·38		·74	·17											12	16					
		·25			7	29		11	6				6	55			— 19	7	49	80	¼ ½ ¾
10	·38		·08	·16			10					14·8			12	15					
		·23			7	33				11	27	○	7	10				7	43	83	21
10	·02		·28	·03											12	16					
		·30			7	26		11	49				7	26			—* 20	7	37	85	¼ ½ ¾
1	·80		·10	·04								15·8			° 12	14					
		·53			7	18					11		7	40				7	29	86	22
12	1·86		·20	·03											12	15					
		·11			7	21		12	34				7	55			— 20	7	21	86	¼ ½ ¾
21	2·17		·24	·35								16·8			12	15					
					7	4					56		8	10				7	14	86	23
163	10·88	6·71	4·93	3·38	122	12	....	80	25	59 +24 =83	17 0 17	....	95	27	185	24	+ 56 — 85	123	45	1088	
11	0·725	0·447	0·329	0·225	7	38	...	10	3	10	25	....	5	58	12	22	+ 19 — 17	7	44	68·00	

APPENDIX 13.

TABLE III.—Tidal Fluctuations at St. Nicholas during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series IV. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	Diurnal Inequalities	
																		In duration of floods.	In duration of ebbs.
		H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min	Min
	Nov. 2 H.W	8	0	P.M.							— 19		14·77						
	do 3 L.W.	3	41	A.M.			7	41	12	25		18	—0·15		14·92			16	
	do 3 H.W	8	25	A.M.	4	44					— 28	11	13·94	14·09		7·26	14·64		36
	do 3 L.W.	3	30	P.M.			7	5	11	57		15	0·02		13·92			8	
24	do 3 H.W	8	22	P.M.	4	52						23	15·67	15·65		7·86	14·63		34
	do 4 L.W.	4	1	A.M.			7	39	12	43		10	1·07		14·60			12	
	do 4 H.W	9	5	A.M.	5	4					— 9	20	15·39	14·32		8·34	14·47		44
	do 4 L.W.	4	0	P.M.			6	55	11	58		20	1·12		14·27			1	
25	do 4 H.W	9	3	P.M.	5	3						11	15·84	14·72		8·13	13·89		44
	do 5 L.W.	4	42	A.M.			7	39	12	24		20	1·24		14·60			18	
	do 5 H.W	9	27	A.M.	4	45					— 23	23	13·23	11·99		7·57	13·07		36
	do 5 L.W.	4	30	P.M.			7	3	12	3		14	0·82		12·41			15	
26	do 5 H.W	9	30	P.M.	5	0					*	36	14·13	13·31		7·08	12·49		42
	do 6 L.W.	5	15	A.M.			7	45	12	40		23	0·84		13·29			5	
	do 6 H.W	10	10	A.M.	4	55					— 3	19	11·80	10·96		7·01	12·24		55
	do 6 L.W.	5	0	P.M.			6	50	12	7		14	0·94		10·86			22	
27	do 6 H.W	10	17	P.M.	5	17						26	14·77	13·83		7·15	12·56		61
	do 7 L.W.	6	8	A.M.			7	51	12	43		° 4	0·80		13·97			25	
	do 7 H.W	11	0	A.M.	4	52					— 2	25	12·38	11·58		7·38	12·43		64
	do 7 L.W.	5	47	P.M.			6	47	12	5		15	1·52		10·86			26	
28	do 7 H.W	11	5	P.M.	5	18						23	14·81	13·29		7·41	12·12		65
	do 8 L.W.	6	57	A.M.			7	52	12	53		18	1·18		13·63			17	
	do 8 H.W	11	58	A.M.	5	1					+ 50	28	11·88	10·70		7·03	11·74		45
	do 8 L.W.	7	5	P.M.			7	7	12	47		21	1·12		10·76			39	
29	do 9 H.W	12	45	A.M.	5	40						20	13·00	11·88		6·23	11·49		16
	do 9 L.W.	8	8	A.M.			7	23	12	30		19	—0·15		13·15			33	
	do 9 H.W	1	15	P.M.	5	7					—° 1	25	10·04	10·19		5·65	11·47		2
	do 9 L.W.	8	40	P.M.			7	25	12	19		19	—0·02		10·06			13	
30	do 10 H.W	1	34	A.M.	4	54						25	12·44	12·46		5·91	11·75		7
							7	32	12	53		20			12·30			27	
	do 10 L.W.	9	6	A.M.									0·14						
	H.W.	+ 12	0								+ 50	315	189·32						
Totals 14 tides..		= 135	56		70	32	110	34	186	27				178·97	193·60	100·01	178·99	277	551
	L.W.	77	24								— 66	250	10·35						
14	H.W.										+ 50	21	13·523						
Means do					5	3	7	23	12	26				12·78	12·91	7·144	12·785	19	39
14	L.W.										— 11	18	0·739						
	H.W.										+ 201	1229	808·76						
Grand totals 57 tides.					284	45	430	44	720	30				763·89	775·78	426·06	764·55	800	1746
	L.W.										— 213	1016	44·87						
57	H.W.										+ 17	19	14·189						
Grand means do					5	0	7	26	12	25				13·40	13·38	7·474	13·413	14	31
57	L.W.										— 13	18	0·787						

N.B.—Maxima in whole lunar month indicated by a star thus: *, and minima by a circle, thus: °.

APPENDIX 13.

TABLE III.—Tidal Fluctuations at St. Nicholas during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).								RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."																
Diurnal Inequalities.								Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times. (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides								
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.			Lunitidal intervals.		General coefficients of semi-amplitudes from "L'Annuaire des Marées, corresponding to observed tides assumed to be 48 hours old.	Series IV. Losing tides. Gauge book reference numbers.	
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.					
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	— 20	...	...	...	...	...	...	
...	...	° 00	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
...	83	...	32	34	...	...	...	...	...	...	...	...	...	...	12	15	...	...	...	...	...	...	...	
28	...	17	...	...	7	5	...	1	20	...	...	...	8	25	...	...	— 19	7	5	86	...	...	...	
...	1·73	...	60	01	...	...	...	...	...	...	...	17·8	...	...	12	16	...	...	...	...	...	...	...	
46	...	1·05	...	...	6	38	...	...	...	1	44	...	8	41	...	...	...	6	57	84	...	...	...	**24**
...	28	...	48	16	...	...	...	...	...	...	...	...	...	...	12	15	...	...	...	...	...	...	...	
45	...	05	...	...	6	57	...	2	8	...	...	...	8	56	...	...	— 19	6	48	82	...	...	...	
...	45	...	21	58	...	...	...	...	...	...	...	18·8	...	...	12	16	...	...	...	...	...	...	...	
26	...	12	...	...	6	30	...	...	...	2	33	...	9	12	...	...	...	6	39	80	...	...	...	**25**
...	2·61	...	56	82	...	...	...	...	...	...	...	...	...	...	12	16	...	...	...	...	...	...	...	
21	...	42	...	...	6	28	16	2	59	...	...	...	9	28	...	...	— 16	6	29	76	...	...	...	
...	90	...	49	58	...	...	...	...	...	...	...	19·8	...	...	12	18	...	...	...	† ...	...	...	...	
37	...	02	...	...	6	6	...	...	...	3	24	...	9	46	...	...	...	6	22	73	...	...	...	**26**
...	2·33	...	07	25	...	...	...	...	...	...	...	...	...	...	12	17	...	...	...	...	...	...	...	
33	...	10	...	...	6	20	...	3	50	...	...	...	10	3	...	...	— 13	6	13	69	...	...	...	
...	2·97	...	14	32	...	...	...	...	...	...	...	20·8	...	...	12	20	...	...	...	...	...	...	...	
36	...	14	...	...	6	1	...	...	...	4	16	...	10	23	...	...	...	6	7	64	...	...	...	**27**
...	2·39	...	23	13	...	...	...	...	...	...	...	...	...	...	12	21	...	...	...	...	...	...	...	
38	...	72	...	...	6	17	...	4	43	...	...	...	10	44	...	...	— 5	6	1	59	...	...	...	
...	2·43	...	03	31	...	...	...	...	...	...	...	21·8	...	...	12	24	...	...	...	...	...	...	...	
48	...	34	...	...	5	56	...	...	...	5	9	...	11	8	...	...	...	° 5	59	55	...	...	...	**28**
...	2·93	...	38	38	...	...	...	...	...	...	...	...	...	...	12	27	...	...	...	...	...	...	...	
6	...	06	...	...	6	22	...	5	36	...	...	☌	11	35	...	...	+ 9	5	59	‡ 50	...	...	...	
...	1·12	...	80	25	...	...	...	...	...	...	...	22·8	...	...	12	32	...	...	...	...	...	...	...	
17	...	1·27	...	...	6	43	...	...	...	6	2	...	12	7	...	...	...	6	5	47	...	...	...	**29**
...	2·96	...	58	02	...	...	...	...	...	...	...	...	...	...	12	36	...	...	...	...	...	...	...	
11	...	13	...	...	6	46	...	6	29	...	...	23·8	12	43	...	...	+ 28	6	14	44	...	...	...	
...	2·40	...	26	28	...	...	...	...	...	...	...	...	...	...	12	42	...	...	...	...	...	...	...	
34	...	16	...	...	6	39	...	...	...	6	55	...	1	25	...	...	...	6	30	44	...	...	...	**30**
...	13	...	...	...	...	...	...	...	...	...	...	24·8	...	...	12	43	...	...	...	...	...	...	...	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	‡
426	26·46	4·75	5·15	4·43	90	48	....	27	5	30	3	....	+ 134 12 — 146	36 0 36	185	58	+ 37 ... — 72	89	28	913				
30	1·764	0·316	0·367	0·316	6	29	....	3	52	4	18	...	10	28	12	24	+ 18 ... — 14	6	23	65·21				
1348	74·94	25·34	19·67	19·13	396	21	....	208	20	215	20	...	459	20	721	2	+210 ... —197	395	40	4144				
24	1·29	·44	·34	·34	6	57	....	7	26	7	26	...	8	4	12	26	+ 19 ... — 12	6	56	72·70				

† Moon's N. declination a maximum = 20°—39'. ‡ Moon's last quarter, Quebec, from 0·02 p.m., Nov. 8th.

APPENDIX 13.

TABLE IV.—Tidal Fluctuations at Pointe Platon during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series I. Gaining tides.	High and low waters observed each civil day.		Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	Diurnal Inequalities. In duration of floods.	Diurnal Inequalities. In duration of ebbs.
			H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min	Min.
	Oct. 11	H.W	† 2	44	P.M.	...	...	...	...	...	...	+28	....	13·332	...	...	...	...	...	.....
	.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
½	do 11	L.W.	10	7	P.M.	...	...	7	23	12	23	....	20	4·216	.....	9·116	...	...	...	.....
2	do 12	H.W	3	7	A.M.	5	0	...	...	...	...	....	23	14·961	10·745	...	9·043	10·300	....	37
½	do 12	L.W.	11	7	A.M.	...	...	8	0	12	55	....	19	3·570	.....	11·391	.....	.....	5	.....
½	do 12	H.W	4	2	P.M.	4	55	...	...	...	...	+31	21	13·517	9·947	...	8·908	10·678	..	35
½	do 12	L.W.	11	27	P.M.	...	...	7	25	12	26	..	19	3·567	...	9·950	.....	.....	6	.....
3	do 13	H.W	4	28	A.M.	5	1	...	...	...	...	....	24	14·992	11·425	.....	8·978	10·981	....	39
½	do 13	L.W.	12	32	P.M.	...	...	8	4	12	51	....	20	3·407	.....	11·585	.....	.....	14	....
½	do 13	H.W	5	19	P.M.	4	47	...	...	...	...	+12	27	14·372	10·965	...	9·219	11·331	....	44
½	do 14	L.W.	12	39	A.M.	...	...	7	20	12	11	....	18	3·702	.....	10·670	.....	.....	4	.....
4	do 14	H.W	5	30	A.M.	4	51	...	...	...	...	....	22	15·807	12·105	.....	9·442	11·800	....	51
½	do 14	L.W.	1	41	P.M.	...	...	8	11	12	42	..	17	3·382	.....	12·425	.....	.....	20	....
½	do 14	H.W	6	12	P.M.	4	31	...	...	...	...	+12	20	15·382	12·000	...	9·585	12·217	....	41
½	do 15	L.W.	1	42	A.M.	...	...	7	30	12	20	....	22	3·570	...	11·812	.....	.....	19	.....
5	do 15	H.W	6	32	A.M.	4	50	...	...	...	...	....	17	16·200	12·630	...	9·704	12·437	....	18
½	do 15	L.W.	2	20	P.M.	...	...	7	48	12	20	....	18	3·400	.....	12·800	.....	.....	18	.....
½	do 15	H.W	6	52	P.M.	4	32	...	...	...	...	— 5	17	15·907	12·507	...	9·545	12·663	..	13
½	do 16	L.W.	‡ 2	53	A.M.	...	...	8	1	12	25	..	14	3·027	.....	12·880	.....	.....	8	.....
6	do 16	H.W	7	17	A.M.	4	24	...	...	...	...	....	21	15·492	12·465	.....	9·339	13·002	....	5
½	do 16	L.W.	‖ 3	13	P.M.	...	...	7	56	12	25	..	12	2·647	.....	12·845	.....	.....	5	....
½	do 16	H.W	§ 7	42	P.M.	4	29	...	...	...	...	+ 5	18	16·467	13·820	...	9·572	13·363	....	°1
½	do 17	L.W.	3	39	A.M.	...	...	7	57	12	30	....	13	3·132	.....	13·335	.....	.....	4	.....
7	do 17	H.W	8	12	A.M.	4	33	...	...	...	...	....	19	16·587	13·455	.....	10·207	13·741	....	15
½	do 17	L.W.	3	54	P.M.	...	...	7	42	12	18	....	11	3·542	.....	13·045	.....	.....	3	.....
½	do 17	H.W	¶ 8	30	P.M.	4	36	...	...	...	...	—18	16	*18·670	*15·128	...	10·956	*14·019	....	8
½	do 18	L.W.	4	20	A.M.	...	...	7	50	12	14	....	15	4·350	.....	*14·320	.....	.....	12	.....
8	do 18	H.W	8	44	A.M.	4	24	...	...	...	...	....	20	17·932	13·582	...	*11·274	13·926	....	7
½	do 18	L.W.	** 4	41	P.M.	...	...	7	57	12	24	....	14	4·272	.....	13·660	.....	.....	.....	.....
½	do 18	H.W	9	8	P.M.	4	27	...	...	...	...	+ 2	19	18·412	14·140	.....	11·085	13·766	3	13
Totals 14 tides. ..		H.W		91	35							+62	284	224·698						
				86	15	....	65	20	109	4	174	24	....	...	174·914	169·834	136·857	174·244	121	327
		L.W.	+	36	0							—23	232	49·784						
			=	122	15															
	14	H.W										+12	20	16·050						
Means do						...	...	...		4	40	7	47	12	27	...	...	...	12·494	12·131	9·775	12·444	9	23
14		L.W.										—12	17	3·556						

N.B.—Maxima in whole lunar month indicated by a star, thus: *, and minima by a circle thus: °.

† Longitude, Pointe Platon = 71° 51′ = 4h. 47m. 24s. = 0·1966 of a day west of Greenwich.

‡ Moon crosses equator, Oct. 16th. § Moon in perigee, Oct. 16th, at 1h. 0m. p.m.

‖ New moon, Quebec, at 5.35 p.m., Oct. 16th. ¶ River very rough owing to north-easterly gale, was washing over gauge and prevented accurate readings being made.

** Most important tide but one during 1887, viz.: evening tide of March 11th, for which coefficient of semi-amplitude is 118.

APPENDIX 13.

TABLE IV.—Tidal Fluctuations at Pointe Platon during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).									RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."													
Diurnal Inequalities.									Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times. (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series I. Gaining tides. Gauge book reference numbers.
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.		Upper passage.		Lower passage.		Ages, etc.									
Min	Feet.	Feet.	Feet.	Feet.	H.	M.			H.	M.	H.	M.	Days.	H.	M.	H.	M	Min.	H.	M.		
....	....	....	....	....	....	....	....		....	....	....	....	....	....	....	....	....	+ 34	....	....	....	
....	....	029	....	....	....	....	....		....	....	....	....	....	....	....	....	....	....	....	....	....	
....	1·629	....	....	....	....	....	....		....	....	....	....	....	....	....	12	46	....	....	....	....	
32	....	646	....	....	7	49	....		....	....	7	18	....	3	1	....	....	....	7	43	° 39	2
....	1·444	....	135	378	....	....	....		....	....	....	....	....	....	....	* 12	47	....	....	....	....	
29	....	003	....	....	8	16	....		7	46	....	....	25·1	3	48	....	....	+*4⁰	8	2	42	
....	1·475	....	070	303	....	....	....		....	....	....	....	....	....	....	12	43	....	....	....	....	
25	....	160	....	....	8	15	....		....	....	8	13	....	4	31	....	....	....	8	18	47	3
....	620	....	241	350	....	....	....		....	....	....	....	....	....	....	12	39	....	....	....	....	
40	....	295	....	....	8	38	....		8	41	....	....	26·1	5	10	....	....	+ 2²	8	29	54	
....	1·435	....	223	469	....	....	....		....	....	....	....	....	....	....	12	33	....	....	....	....	
31	....	320	....	....	8	22	6		....	....	9	8	....	5	43	....	....	....	8	35	62	4
....	425	....	143	417	....	....	4		....	....	....	....	27·1	....	....	12	29	....	....	....	....	
22	....	188	....	....	8	36	....		9	36	....	....	....	6	12	....	....	+ 5	8	36	71	
....	818	....	119	220	....	....	....		....	....	....	....	....	....	....	12	26	....	....	....	....	
0	....	170	....	....	8	29	....		....	....	10	3	....	6	38	....	....	....	8	35	80	5
....	293	....	159	226	....	....	....		....	....	....	....	28·1	....	....	12	25	....	....	....	....	
5	....	373	....	....	8	21	....		10	31	....	....	....	7	3	....	....	—° 2	8	32	89	
....	415	....	206	339	....	....	....		....	....	....	....	....	....	....	12	23	....	....	....	....	
0	....	380	....	....	8	18	3		....	....	10	59	....	7	26	....	....	....	8	27	97	6
....	975	....	233	361	....	....	12		....	....	....	....	29·1	....	....	12	22	....	....	....	....	
5	....	485	....	....	8	16	....		11	26	....	....	●	7	48	....	....	— 6	8	22	104	
....	120	....	635	478	....	....	....		....	....	....	....	....	....	....	12	22	....	....	....	....	
12	....	410	....	....	8	18	....		....	....	11	54	....	8	10	....	....	....	8	16	110	7
....	2·083	....	749	278	....	....	....		....	....	....	....	0·8	....	....	12	22	....	....	....	....	
4	....	808	....	....	8	8	....		....	22	....	....	....	8	32	....	....	— 7	8	10	114	
....	738	....	318	093	....	....	....		....	....	....	....	....	....	....	12	21	....	....	....	....	
10	....	078	....	....	7	53	....		....	....	....	51	....	8	53	....	....	....	8	2	116	8
....	480	....	189	160	....	....	....		....	....	....	....	1·8	....	....	12	22	....	....	....	....	
5	....	....	....	....	7	49	....		1	19	....	....	....	9	15	....	....	— 7	7	56	*117	
									49	41	58	26						+ 67				
220	12·950	4·345	3·420	4·072	115	28	....		+24	+ 0	12	0	....	92	10	175	0	....	116	3	1142	
									=73	=41	70	26						— 22				
																		+ 22				
16	0·925	0·310	0·263	0·313	8	15	....		10	32	10	4	....	6	35	12	30	....	8	17	81·57	
																		— 6				

APPENDIX 13.

TABLE IV.—Tidal Fluctuations at Pointe Platon during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers. Series II. Losing tides.		High and low waters observed each civil day.		Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
				H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.
	Oct. 18	H.W		9	8	P.M.	...	...	...	...	...	...	+ 2	...	18·412	.....	.....	.....	.....
	...	...		...	...		...	...	...	...	...	...	...	...	...	...	...	...	...
¾	do 19	L.W.		5	18	A.M.	...	...	8	10	12	28	...	13	4·130	.....	14·282	.....	.....
9	do 19	H.W		9	36	A.M.	4	18	...	...	...	...	.....	20	17·112	12·982	.....	10·932	13·632
¼	do 19	L.W.		5	24	P.M.	...	...	7	48	12	16	....	25	4·102	.....	13·010	.....	.....
½	do 19	H.W		9	52	P.M.	4	28	...	...	...	...	— ° 3	21	18·357	14·255	.....	10·947	13·500
¾	do 20	L.W.		6	1	A.M.	...	...	8	9	12	31	....	14	4·292	.....	14·065	.....	.....
10	do 20	H.W		10	23	A.M.	4	22	...	...	...	...	...	15	16·962	12·670	.....	10·999	13·229
¼	do 20	L.W.		6	1	P.M.	...	...	7	38	12	8	.....	12	4 477	.....	12·485	.....	.....
½	do 20	H.W		10	31	P.M.	4	30	...	...	...	...	— 4	18	18·170	13·693	.....	10·956	13·034
¾	do 21	L.W.		6	51	A.M.	...	...	8	20	12	38	.....	16	4·400	.....	13·770	.....	.....
11	do 21	H.W		11	9	A.M.	4	18	...	...	...	...	...	14	16·587	12·187	.....	11·023	12·678
¼	do 21	L.W.		6	45	P.M.	...	...	7	36	12	10	.....	21	4·967	.....	11·620	.....	.....
½	do 21	H.W	†	11	19	P.M.	4	34	...	...	...	...	— 18	25	18·102	13·135	.....	10·765	12·115
¾	do 22	L.W.	‡	7	40	A.M.	...	...	8	21	12	22	...	17	4·447	.....	13·655	.....	.....
12	do 22	H.W	§	11	41	A.M.	°4	1	...	...	...	...	...	15	14·497	10·050	.....	9·678	11·496
¼	do 22	L.W.		7	18	P.M	...	...	7	37	12	36	....	11	3·412	.....	11·085	.....	.....
½	do 23	H.W		12	17	A.M.	4	59	...	...	...	...	+ * 54	18	14·607	11·195	.....	8·586	11·303
¾	do 23	L.W.		8	43	A.M.	...	...	* 8	26	* 13	8	....	16	2·457	.....	12·150	.....	.....
13	do 23	H.W	‖	1	25	P.M.	4	42	...	...	...	...	...	21	13·237	10·780	.....	8·512	11·209
¼	do 23	L.W.		8	33	P.M.	...	...	7	8	11	59	....	14	3·357	...	9·880	.....	.....
½	do 24	H.W		1	24	A.M.	4	51	...	...	...	...	+ ° 0 °	7	15·382	12·025	.....	9·014	10·790
¾	do 24	L.W.		9	28	A.M.	...	...	8	4	12	51	.....	24	3·882	.....	11·500	.....	.....
14	do 24	H.W		2	15	P.M.	4	47	...	...	...	...	.....	16	13·637	9·755	.....	8·846	10·562
¼	do 24	L.W.		9	52	P.M.	...	...	7	37	12	25	....	26	3·247	.....	10·390	.....	.....
½	do 25	H.W		2	40	A.M.	4	48	...	...	...	...	+ 25	18	13·847	10·600	.....	7·982	10·350
¾	do 25	L.W.		11	0	A.M.	...	...	8	20	12	50	.....	15	2·367	.....	11·480	.....	.....
15	do 25	H.W		3	30	P.M.	4	30	...	...	...	...	.....	* 27	11·297	° 8·930	.....	° 7·431	10·358
¼	do 25	L.W.		10	48	P.M.	...	...	7	18	12	35	...	21	° 2·137	....	9·160	.....	.....
				98	2														
			+	12	0														
Totals tides	14	H.W	=	122	2		...	59	8	110	32	174	57	+ 79	235	201·794	.....	152·257	168·532	125·671	154·256
		L.W.		109	42									— 25	245	51·676					
	13	H.W												+ 26	18	15·523					
Means do	14	L.W.		....	..	....	4	33	7	54	12	30	.....	— 8	18	3·691	.....	11·712	12·038	9·667	11·866

N.B.—Maxima in whole lunar month indicated by a star, thus: *, and minima by a circle, thus: °.
†Maximum diurnal inequality observed in high water levels=3·605 ft.
‡Moon's S. declination a maximum=20° 8'.
§Maximum diurnal inequality observed in low water levels=1·035 ft.
‖Moon's first quarter, (Quebec,) Oct. 23rd, from 0.46 p.m.

APPENDIX 13.

TABLE IV.—Tidal Fluctuations at Pointe Platon during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).										RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."													
Diurnal Inequalities.							Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Mares," corresponding to observed tides assumed to be 48 hours old.	Series II. Losing tides. Gauge book reference numbers.
In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.				Upper passage.		Lower passage.		Ages, etc.									
Min.	Min.	Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.		
...	...	...	...	142	...	...	...	...	...	...	...	...	...	...	...	...	...	...	— 7	...	...	...	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	1·300	*1·153	134	...	...	...	...	...	...	...	...	...	...	...	12	21	...	...	...	...	
...	22	18	...	028	...	...	7	48	...	...	...	1	48	...	9	36	...	...	...	7	48	116	9
10	...	...	1·245	...	015	132	...	...	...	...	...	...	...	2·8	...	...	12	22	...	...	...	...	
...	21	15	...	190	...	...	7	35	...	2	17	...	...	...	9	58	...	...	— 6	7	41	113	
6	...	...	1·395	...	052	271	...	...	...	...	...	...	...	...	...	...	12	22	...	...	...	...	
...	31	23	...	815	...	...	7	37	4	...	...	2	46	...	10	20	...	...	...	7	34	108	10
8	...	...	1·208	...	043	195	...	...	4	...	...	...	...	3·8	...	...	12	21	...	...	...	...	
...	42	30	...	077	...	...	7	16	9	3	15	...	...	...	10	41	...	...	7	7	26	101	
12	...	...	1·583	...	067	356	...	...	9	...	...	...	...	...	...	...	12	22	...	...	...	...	
...	44	28	...	567	...	...	7	26	1	...	...	3	43	...	11	3	...	...	...	7	20	94	11
16	...	...	1 515	...	258	563	...	...	12	...	...	...	...	4·8	...	...	12	22	...	...	...	...	
...	45	12	...	520	...	...	7	7	5	4	12	...	...	...	11	25	...	...	— 5	7	13	86	
33	...	...	*3·605	...	1·087	*·619	...	...	6	...	...	...	...	...	...	...	12	23	...	...	...	...	
...	44	14	...	*1·035	...	...	°7	2	3	...	...	4	39	...	11	48	...	...	...	7	9	77	12
*58	...	...	110	...	1·092	193	...	...	3	...	...	...	...	5·8	...	...	12	25	...	...	...	...	
...	49	* 92	...	955	...	...	7	11	...	5	6	...	...	...	12	13	...	...	+ 2	7	7	68	
17	...	...	1·370	...	074	094	...	...	2	...	...	...	...	...	...	...	12	27	...	...	...	...	
...	*78	69	...	900	...	...	7	52	0	...	...	5	33	○ 6·8	12	40	...	...	...	7	7	60	13
9	...	...	2·145	...	502	419	...	...	2	...	...	...	...	...	...	...	12	30	...	...	...	...	
...	56	52	...	525	...	...	7	25	* 60	5	59	...	...	...	1	10	...	...	+14	7	11	52	
4	...	...	745	...	168	228	...	...	14	...	...	...	...	...	...	...	12	34	...	...	...	...	
...	27	26	...	635	...	...	7	52	...	...	...	6	23	...	1	44	...	...	...	7	21	46	14
° 1	...	...	210	...	864	212	...	...	14	...	...	...	...	7·8	...	...	12	40	...	...	...	...	
...	43	25	...	880	...	...	7	52	...	6	48	...	...	...	2	24	...	...	+34	7	36	41	
18	...	...	2·550	...	551	° 008	...	...	...	...	...	...	...	...	...	...	12	44	...	...	...	...	
...	62	52	...	230	...	...	8	18	...	...	...	7	12	...	3	8	...	...	...	7	56	39	15
47	...	...	2·703	...	363	261	...	...	1	...	...	...	...	8·8	...	...	12	47	...	...	...	...	
															108	10							
															+48	0			+50				
248	644	696	21·684	7·499	6·289	3·685	98	21	....	27	37	32	4		=156	10	174	40	...	96	29	1001	
																			—18				
																			+17				
18	50	53	1·549	0·536	0·449	0·263	7	34	....	4	36	4	35	...	12	1	12	29	....	7	25	77·00	
																			— 6				

APPENDIX 13.

TABLE IV.—Tidal Fluctuations at Pointe Platon during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series III. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
		H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.
‡	Oct. 25 L.W.	10	48	P.M.							+25		2·137				
‡	Oct. 26 H.W	4	5	A.M.	5	17					+35	19	14·000	11·863		7·794	10·619
‡	do 26 L.W.	12	3	P.M.			7	58	12	50		21	2·832		11·168		
16	do 26 H.W	4	55	P.M.	4	52						28	13·117	10·285		8·227	10·771
‡	do 27 L.W.	12	23	A.M.			7	28	12	19		20	2·852		10·265		
‡	do 27 H.W	5	14	A.M.	4	51					— 6*	32	14·217	11·365		8·578	10·801
‡	do 27 L.W.	12	53	P.M.			7	39	12	25		20	3·502		10·715		
17	do 27 H.W	5	39	P.M.	4	46						22	14·362	10·860		8·933	10·961
‡	do 28 L.W.	1	20	A.M.			7	41	12	25		17	3·402		10·960		
‡	do 28 H.W	6	4	A.M.	4	44					+ 6	20	14·712	11·310		8·943	11·263
‡	do 28 L.W.	1	50	P.M.			7	46	12	31		17	3·222		11·490		
18	do 28 H.W	6	35	P.M.	4	45						21	14·512	11·290		8·979	11·383
‡	do 29 L.W.	2	8	A.M.			7	33	12	13		19	3·352		11·160		
‡	do 29 H.W	6	48	A.M.	4	40					— 19	23	14·942	11·590		9·434	11·494
‡	do 29 L.W. †	2	10	P.M.			7	22	12	18		13	4·022		10·920		
9	do 29 H.W ‡	7	6	P.M.	4	56						20	16·327	12·305		10·063	11·621
‡	do 30 L.W.	2	50	A.M.			7	44	12	16		16	4·482		11·845		
‡	do 30 H.W	7	22	A.M.	4	32					— 25	18	15·897	11·415		10·122	11·721
‡	do 30 L.W.	3	2	P.M.			7	40	12	9		18	4·040		11·857		
20	do 30 H.W	7	31	P.M.	4	29						19	15·807	11·767		9·595	11·788
‡	do 31 L.W.	3	30	A.M.			7	59	12	20		17	3·362		12·445		
‡	do 31 H.W	7	51	A.M.	4	21					— 10	22	14·442	11·080		8·891	11·876
‡	do 31 L.W.	3	40	P.M.			7	49	12	20		15	2·542		11·900		
21	do 31 H.W §	8	11	P.M.	4	31						20	14·622	12·080		8·591	11·996
‡	Nov. 1 L.W.	3	57	A.M.			7	46	12	20		17	2·642		11·980		
‡	do 1 H.W	8	31	A.M.	4	34					— 20	22	14·667	12·025		8·779	12·079
‡	do 1 L.W.	4	6	P.M.			7	35	12	10		15	2·837		11·830		
22	do 1 H.W	8	41	P.M.	4	35						20	15·317	12·480		8·735	12·070
‡	do 2 L.W.	4	38	A.M.			7	57	12	22		15	2·562		12·755		
‡	do 2 H.W	9	3	A.M.	4	25					— 17	24	13·777	11·215		8·569	12·100
‡	do 2 L.W.	4	31	P.M.			7	28	12	11		14	2·477		11·300		
23	do 2 H.W	9	14	P.M.	4	43						20	15·607	13·130		8·822	12·310
Totals 15½ tides....	H.W	112	59								+41	350	236·325				
		75	1	+48 0	75	1	115	25	185	9				186·060	172·590	143·055	184·853
	L.W.	= 123	1								— 97	254	48·128				
Means do	16 H.W				4	41	7	42	12	21	+20	22	14·770				
	15 L.W.										— 16	17	3·209	11·629	11·506	8·941	11·553

N.B.—Maxima in whole lunar month indicated by a star, thus*: and minima by a circle, thus °:
† Moon crosses equator, Oct. 29th.
‡ Moon in apogee, Oct. 29th, at 6h. 0m. p.m.
§ Full moon (Quebec) Oct. 31st, at 4h. 31m. p.m.

APPENDIX 13.

Table IV.—Tidal Fluctuations at Pointe Platon during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Direct Results of Tidal Observations—(Continued).										Results based on data from Nautical Almanac and "L'Annuaire des Marées."														
Diurnal Inequalities.										Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.														
In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series III. Gaining tides.	Gauge book reference numbers.
Min.	Min.	Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.			
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+34	...	...	...	¼	
...	40	15	...	·695	...	...	8	30	...	7	35	...	...		3	55	...	...	+38	8	20	40	½	
25	...	...	·883	...	·433	·152	...	...	...	...	...	...	...	9·8	...	...	12	41	...	...	...	...	¾	
...	30	31	...	°·020	...	...	8	58	...	...	...	7	57	...	4	36	...	...	...	8	39	42		16
1	...	...	1·100	...	·351	·030	...	...	5	...	...	...	...	...	...	...	12	37	...	...	...	...	¼	
...	11	6	...	·650	...	...	8	55	...	8	19	...	...	...	5	13	...	...	+18	8	54	46	½	
5	...	...	145	...	·355	·160	...	...	25	...	...	...	...	10·8	...	...	12	31	...	...	...	...	¾	
...	2	0	...	·100	...	...	8	58	...	...	...	8	41	...	5	44	...	...	...	9	3	51		17
2	...	...	·350	...	°·010	·302	...	...	...	...	...	...	...	...	...	...	12	27	...	...	...	...	¼	
...	5	6	...	·180	...	...	9	2	...	9	2	...	...	...	6	11	...	...	+ 0	9	9	56	½	
1	...	...	·200	...	·036	·120	...	...	...	...	...	...	...	11·8	...	...	12	23	...	...	...	...	¾	
...	13	18	...	·130	...	...	* 9	12	...	...	...	9	23	...	6	34	...	...	...	* 9	11	61		18
5	...	...	·430	...	·455	·111	...	...	...	...	...	...	...	...	...	...	12	21	...	...	...	...	¼	
...	11	5	...	·670	...	...	9	4	...	9	44	...	...	...	6	55	...	...	—10	9	11	65	½	
16	...	...	1·385	...	·629	·12.	...	...	...	...	...	...	...	12·8	...	...	12	19	...	...	...	...	¾	
...	22	2	...	·460	...	...	9	1	...	...	...	10	5	...	7	14	...	...	...	9	9	70		19
24	...	...	·430	...	·059	·100	...	...	...	...	...	...	...	...	...	...	12	17	...	...	...	...	¼	
...	4	7	...	·442	...	...	8	56	...	10	26	...	...	...	7	31	...	...	−16	9	5	74	½	
17	...	...	·090	...	·527	·067	...	...	...	...	...	...	...	13·8	...	...	12	17	...	...	...	...	¾	
...	19	11	...	·678	...	...	8	44	...	...	...	10	47	...	7	48	...	...	...	9	1	77		20
8	...	...	1·365	...	·704	·088	...	...	13	...	...	...	...	...	...	...	12	16	...	...	...	...	¼	
...	10	0	...	820	...	...	8	43	...	11	8	...	...	...	8	4	...	...	−19	8	56	80	½	
10	...	...	·180	...	·300	·120	...	...	...	...	...	...	...	14·8	...	...	12	15	...	...	...	...	¾	
...	3	0	...	·100	...	...	8	42	2	...	...	11	29	⊙	8	19	...	...	...	8	50	83		21
3	...	...	°·045	...	·188	·083	...	...	5	...	...	...	...	...	...	...	12	16	...	...	...	...	¼	
...	11	10	...	·195	...	...	8	40	...	11	51	...	...	...	8	35	...	...	*20	8	44	85	½	
1	...	...	·650	...	·044	·009	...	...	...	...	...	...	...	15·8	...	...	°12	14	...	...	...	...	¾	
...	22	12	...	·725	...	...	8	28	...	...	...	...	13	...	8	49	...	...	...	8	36	86		22
10	...	...	1·540	...	·166	·030	...	...	...	...	...	...	...	...	...	...	1	15	...	...	...	...	¼	
...	29	11	...	·085	...	...	8	27	...	...	36	...	...	...	9	4	...	...	−20	8	28	86	½	
18	...	...	1·830	...	·253	·210	...	...	...	...	...	...	...	16·8	...	...	1	15	...	...	...	...	¾	
...	22	13	...	...	...	...	8	15	...	...	...	...	59	...	9	19	...	...	...	8	20	86		23
146	254	147	10·623	5·950	4·510	1·709	140	35	....	68 +12 =80	41 0 41	59·34 +24· 0 =83·4		....	113	51	185	24	+56 ... −85	141	36	1088		
10	16	9	0·708	0·397	0·301	0·114	8	47	....	10	5	10·27		....	7	7	12	22	+19 ... −17	8	51	68·00		

APPENDIX 13.

TABLE IV.—Tidal Fluctuations at Pointe Platon during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers, Series IV. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Direct Results of Tidal Observations, &c.														
					Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.
		H.	M	A.M. or P.M.	H.	M	H.	M	H.	M	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min
	Nov. 2 H.W	9	14	P.M.	...	...	...	...	...	...	— 17	....	15·607	....	.....	.....	.....	....
		...	...	.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...
¼	Nov. 3 L.W.	5	4	A.M.	...	...	7	50	12	23	...	13	2·857	.....	12·750	.....	.....	10
¾	do 3 H.W	9	37	A.M.	4	33	...	...	...	...	—*27	24	14·917	12·060	.....	9·340	12·280	...
¾	do 3 L.W.	4	58	P.M.	...	...	7	21	12	0	....	14	3·542	....	11·375	....	....	6
24	do 3 H.W	9	37	P.M.	4	39	...	...	...	...	....	20	16 477	12·935	....	9·780	12·125	....
¼	do 4 L.W.	5	36	A.M.	...	...	7	59	12	35	....	15	3·892	....	12·585	....	....	3
¾	do 4 H.W	10	12	A.M.	4	36	...	...	...	...	— 21	18	15·497	11·605	.....	10·022	11·961	....
¾	do 4 L.W.	5	29	P.M.	...	...	7	17	°11	54	....	19	4·192	....	11·305	....	....	1
25	do 4 H.W	10	6	P.M.	4	37	...	...	...	...	....	20	16·542	12·350	.....	9·783	11·832	....
¼	do 5 L.W.	6	19	A.M.	...	...	8	13	12	39	....	°10	3·542	.....	13·600	.....	.....	11
¾	do 5 H.W	10	45	A.M.	4	26	...	...	...	...	— 8	17	14·217	10·675	.....	9·199	11·635	....
¾	do 5 L.W.	6	4	P.M.	...	...	7	19	12	3	....	21	3·222	.....	10·995	.....	.....	18
26	do 5 H.W	10	48	P.M.	4	44	...	...	...	...	....	30	15·092	11·870	.....	8·661	11·438	....
¼	do 6 L.W.	6	50	A.M.	...	...	8	2	12	37	....	16	2·672	.....	12·420	.....	.....	9
¾	do 6 H.W	11	25	A.M.	4	35	...	...	...	...	— 7	23	13·097	10·425	.....	8·565	11·356	....
¾	do 6 L.W.	6	30	P.M.	...	...	° 7	5	12	6	....	16	3·102	.....	9·995	.....	.....	26
27	do 6 H.W	11	31	P.M.	5	1	...	...	...	...	....	22	15·687	12·585	.....	8·855	11·318	....
¼	do 7 L.W.	7	38	A.M.	...	...	8	7	12	41	....	19	3·292	.....	12·395	.....	.....	27
¾	do 7 H.W	12	12	P.M.	4	34	...	...	...	...	+ 2	24	13·587	10·295	.....	9·044	11·195	....
¾	do 7 L.W.	7	23	P.M.	...	...	7	11	12	11	....	20	3·602	.....	9·985	.....	.....	26
28	do 8 H.W	12	23	A.M.	5	0	...	...	...	...	....	26	15·707	12·105	.....	8·993	10·973	....
¼	do 8 L.W.	8	30	A.M.	...	...	8	7	12	40	....	17	3·412	.....	12·295	.....	.....	27
¾	do 8 H.W	1	3	P.M.	4	33	...	...	...	...	+ 42	25	12·917	9·505	.....	8·572	10·601	....
¾	do 8 L.W.	8	32	P.M.	...	...	7	29	12	52	....	17	3·132	.....	9·785	.....	.....	50
29	do 9 H.W	1	55	A.M.	*5	23	...	...	...	...	....	22	13·950	10·818	.....	7·910	10·338	....
¼	do 9 L.W.	9	45	A.M.	...	...	7	50	12	25	....	20	2·350	.....	11·600	.....	.....	48
¾	do 9 H.W	2	20	P.M.	4	35	...	...	...	...	— 10	18	11·500	9·150	.....	7·607	10·163	....
¾	do 9 L.W.	10	15	P.M.	...	...	7	55	12	15	....	19	2·700	.....	° 8·800	.....	.....	15
30	do 10 H.W	2	35	A.M.	4	20	...	...	...	...	....	21	13·800	11·100	.....	7·807	°10·113	....
	.....	...	...	.....	...	...	8	10	12	40	....	23	.....	....	11·000	.....	.....	16
¼	Nov10 L.W.	10	45	A.M.	...	...	...	...	...	...	....	....	2·800	.....	.....	.....	.....	....
	H.W	116	29	+24·0							+ 44	310	202·987					
	Totals 14 tides.	=140	29	.....	65	36	115	55	186	1	.....	.....	.....	157·478	170·285	138·138	157·318	293
	L.W.	98	53								— 73	259	45·509					
	14 H.W										+ 22	22	14·499					
	Means do	...	..	.....	4	41	7	44	12	24	.....	.....	.....	11·248	11·352	9·867	11·237	20
	14 L.W.										— 16	17	3·251					
	H.W										+226	1179	865·804					
	Grand totals 57 tides.....	...	..	.....	265	5	450	56	722	21	.....	.....	.....	670·709	681·241	543·720	670·651	808
	L.W.										—218	990	195·097					
	57 H.W										+ 20	21	15·190					
	Grand means do	.....	..	.....	4	29	7	47	12	30	.....	.....	.....	11·767	11·746	9·539	11·766	14
	57 L.W.										— 13	17	3·423					

N.B.—Maxima in whole lunar month indicated by a star, thus *: and minima by a circle, thus °:

APPENDIX 13.

Table IV.—Tidal Fluctuations at Pointe Platon during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Direct Results of Tidal Observations—*Continued.* Diurnal Inequalities. In duration of ebbs.	Diurnal Inequalities. In semi-tide days.	Diurnal Inequalities. In high water levels.	Diurnal Inequalities. In low water levels.	Diurnal Inequalities. In mean tide levels.	Diurnal Inequalities. In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Results based on data from Nautical Almanac and "L'Annuaire des Marées." Eastern standard civil times of meridian passages immediately preceding observed high waters with corresponding ages and phases of the moon. Upper passage.		Lower passage.		Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series IV. Losing tides. Gauge book reference numbers.
Min	Min	Feet.	Feet.	Feet.	Feet.	H.	M		H.	M	H.	M	Days.	H.	M	H.	M	Min.	H.	M		
																		— 20				
			·380																			
		·690		·518	·030											12	15					¼
31	23		·685			8	15	4	1	22				9	34			— 19	8	12	86	½
		1·560		·440	·345								17·8			12	16					¾
38	35		·350			7	51	10			1	46		9	50				8	4	84	24
		·980		·242	·164			20								12	15					¼
42	81		·300			8	2	10	2	10				10	5			— 19	7	55	82	½
		1·045		·239	·129			43					18·8			12	16					¾
56	45		·650			7	31	5			2	35		10	21				7	46	80	25
		2·325		·584	·197			32								12	16					¼
54	36		·320			7	44	3	3	1				10	37			— 16	7	36	76	½
		·875		·538	·207								19·8			12	18				†	¾
43	34		·550			7	22				3	26		10	55				7	29	73	26
		1·995		·096	·072			3								12	17					¼
57	31		·430			7	33		3	52				11	12			— 13	7	20	69	½
		2·590		·290	·038			6					20·8			12	20					¾
62	35		.190			7	12				4	19		11	32				7	13	64	27
		2·100		·811	·123											12	21					¼
56	30		·310			7	27		4	45				11	53			— 5	7	8	59	½
		2·120		·051	·222								21·8			12	24					¾
56	29		·190			7	12				5	11		12	17				°7	6	55	28
		2·790		·421	·372			6								12	27				‡	¼
38	12		·280			7	25	50	5	38			○	12	44			+ 9	7	6	50	½
		1·033		·662	·263			8					22·8			12	32					¾
21	7		·782			7	51				6	4		1	16				7	12	47	29
		2·450		·303	·175								23·8			12	36					¼
5	10		·350			7	49		6	31				1	52			+ 28	7	21	44	½
		2·300		·200	·050											12	42					¾
15	25		·100			7	38				6	57		2	34				7	37	44	30
		1·450											24·8			12	43					
																						¼
574	433	26·303	5·867	5·395	2·387	106	52	....	27	19	30	18	....	126 + 36 =162	42 0 42	185	58	+ 37 .... — 72	105	5	913	
41	32	1·754	0·391	0·385	0·171	7	38	....	3	54	4	20	....	11	37	12	24	+ 18 .... — 14	7	30	65·21	
1799	1496	71·560	23·661	19·614	11·853	461	16	....	209	18	216	22	....	524	53	721	2	+210 ... —197	459	13	4144	
32	27	1·234	0·408	0·350	0·212	8	6	....	7	29	7	28	....	9	13	12	26	+ 19 .... — 12	8	3	72·70	

† Moon's N. declination a maximum=20° 39′. ‡ Moon's last quarter, Quebec, from 0h. 02m. p.m., Nov. 8th.

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

GRONDINES, ST. JEAN DES CHAILLONS AND BATISCAN.

DURING A COMPLETE LUNAR MONTH OF THE LOW WATER SEASON OF 1887, VIZ., OCTOBER 8 TO NOVEMBER 9.

TABLES V, VI AND VII.

WEEKLY SERIES OF GAINING AND LOSING TIDES, Nos. I, II, III, IV.

APPENDIX 13.

TABLE V.—Tidal Fluctuations at Grondines during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers. Series I. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
		H.	M	A.M. or P.M.	H.	M	H.	M	H.	M	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.
½	Oct. 11 H.W †	3	2	P.M.	..	..	..	..	..	..	+49	....	14·0700	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	do 11 L.W.	11	10	P.M.	..	..	8	8	12	58	....	26	8·0200	.....	6·0500	.....	.....
	do 12 H.W	3	40	A.M.	4	30	..	..	..	..	....	30	15·4400	7·4200	.....	11·4345	6·7490
½	do 12 L.W.	12	19	P.M.	..	..	8	39	12	57	..	32	8·0999	.....	7·3401	.....	.....
	do 12 H.W	4	37	P.M.	4	18	..	..	..	..	+32	30	14·2859	6·1860	.....	11·4128	6·9158
	do 13 L.W.	12	37	A.M.	..	..	7	35	12	25	....	27	7·8099	.....	6·4760	.....	.....
3	do 13 H.W	5	2	A.M.	4	25	..	..	..	..	....	32	15·4710	7·6611	.....	11·4726	7·1756
½	do 13 L.W.	1	31	P.M.	..	..	8	29	12	49	....	26	7·9599	.....	7·5111	.....	.....
	do 13 H.W	5	51	P.M.	4	20	..	..	..	..	+14	30	15·0139	7·0540	.....	11·7084	7·3770
	do 14 L.W.	1	43	A.M.	..	..	7	52	12	15	....	30	8·0799	.....	6·9340	.....	.....
4	do 14 H.W	6	6	A.M.	4	23	..	..	..	..	....	28	16·0889	8·0090	.....	11·8978	7·6958
½	do 14 L.W.	2	35	P.M.	..	..	8	29	12	40	....	25	8·0199	.....	8·0690	.....	.....
	do 14 H.W	6	46	P.M.	4	11	..	..	..	..	+10	27	15·7909	7·7710	.....	12·1242	7·9205
	do 15 L.W.	2	47	A.M.	..	..	8	1	12	20	...	27	8·3079	.....	7·4830	.....	.....
5	do 15 H.W	7	6	A.M.	4	19	..	..	..	..	....	24	16·6669	8·3590	.....	12·3714	7·9590
	do 15 L.W.	3	27	P.M.	..	..	8	21	12	22	....	25	8·4759	.....	8·1910	.....	.....
½	do 15 H.W	7	28	P.M.	4	1	..	..	..	..	— 3	27	16·2789	7·8030	.....	12·3328	7·9418
	do 16 L.W. ‡	3	52	A.M.	..	..	8	24	12	25	..	32	8·2479	.....	8·0310	.....	.....
6	do 16 H.W	7	53	A.M.	4	1	..	..	..	..	....	26	15·9899	7·7420	.....	12·1664	8·1350
½	do 16 L.W. §	4	10	P.M.	..	..	8	17	12	27	....	24	7·9499	.....	8·0400	.....	.....
	do 16 H.W	8	20	P.M.	4	10	..	..	..	..	+ 1	°20	16·6769	8·7270	.....	12·3083	8·4388
	do 17 L.W.	4	38	A.M.	..	..	8	18	12	24	....	24	8·2279	.....	8·4490	.....	.....
7	do 17 H.W.	8	44	A.M.	4	6	..	..	..	..	....	24	16·7669	8·5390	.....	12·7451	8·7255
½	do 17 L.W.	4	47	P.M.	..	..	8	3	12	18	....	22	8·5369	.....	8·2300	.....	.....
	do 17 H.W	9	2	P.M.	4	15	..	..	..	..	—15	20	18·2209	*9·6840	.....	13·3833	*8·8148
	do 18 L.W.	5	25	A.M.	..	..	8	23	12	17	....	22	9·4149	.....	8·8060	.....	.....
8	do 18 H.W	9	19	A.M.	3	54	..	..	..	..	....	23	17·9539	8·5390	.....	13·7485	8·7373
½	do 18 L.W. ¶	5	37	P.M.	..	..	8	18	12	24	— 2	23	9·3449	.....	8·6090	.....	.....
	do 18 H.W	9	43	P.M.	4	6	..	..	..	..	...	26	*18·3399	8·9950	.....	13·6896	8·6595
	H.W.	99	37								+57	367	228·9848				
Totals 14 tides.		76	38	+24·0	58	59	115	17	174	41	.....	.....	.....	112·4891	108·2192	172·7957	111·2454
	L.W.	= 100	38								—20	365	116·4957				MIM
	14 H.W.										+14	26	16·3561				MIM
Means	do ..	.....	.....	.....	4	15	8	14	12	29	.....	.....	.....	8·0349	7·7299	12·3426	7·9461
	14 L.W.										— 7	26	8·3211				MIM

N.B.—Maxima in whole lunar month indicated by a star, thus * : and minima by a circle, thus ° :
† Longitude, Grondines wharf = 72° 2′ west = 4h. 48m. 8s. = 0·2001 of a day west of Greenwich.
‡ Moon crosses equator, Oct. 16th.
§ Moon in perigee, Oct. 16th, at 1h. 0m. p.m.
‖ New moon, Quebec, at 5h. 35m. p.m., Oct. 16th.
¶ Most important tide during 1887, viz.: evening tide of March 11th, for which coefficient of semi-amplitude is 118.

APPENDIX 13.

TABLE V.—Tidal Fluctuations at Grondines during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).											RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."																				
Diurnal Inequalities.											Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.						Eastern standard civil times of high water at Quebec, based on Breet times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series I. Gaining tides. Gauge book reference numbers.	
In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.		Upper passage.		Lower passage.		Ages, etc.														
Min.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M			H.	M	H.	M	Days.		H.	M	H.	M	Min	H.	M						
...	...	...	...	3659	.....	.....	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	+34	...	...	.....	½	
...	...	...	...	.....	.....	.....	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	...	...	...	.....		
...	...	...	1 3700	.....	.....	.....	...	...	...	...	...	...	...	...	...	...	.....	...	12	46	...	...	...	.....	¾	
...	31	1	.....	0799	.....	.....	8	21	...	...	...	...	7	19	...	...	3	36	...	...	...	8	17	°39	1	2
12	...	...	1 1541	...	0217	1668	...	...	...	...	...	...	...	...	...	...	...	...	*12	47	...	...	...	.....	1¼	
...	64	32	.....	2900	.....	.....	8	51	2		7	46	...	...	25	1	4	23	...	...	+*40	8	37	42	1½	
7	...	...	1 1851	...	0598	2598	...	...	...	...	...	...	...	...	...	...	...	...	12	43	...	...	...	.....	1¾	
...	54	24	.....	1500	.....	.....	8	48	2		...	...	8	14	...	...	5	6	...	...	...	8	52	47	2	3
5	...	...	4571	...	2358	2014	...	...	...	...	...	...	...	...	26	1	...	...	12	39	...	...	...	.....	2¼	
...	37	34	.....	1200	.....	.....	9	10	...	...	8	41	...	...	...	...	5	45	...	...	+22	9	4	54	2½	
3	...	...	1 0.50	...	1894	3188	...	...	...	...	...	...	...	...	...	...	...	...	12	33	...	...	...	.....	2¾	
...	37	25	.....	0600	.....	.....	8	57	...	...	...	...	9	9	...	...	6	18	...	...	...	9	9	62	3	4
12	...	...	2980	...	2264	2247	...	...	...	...	...	...	...	...	27	1	...	...	12	29	...	...	...	.....	3¼	
...	28	20	.....	2880	.....	.....	9	10	...	...	9	36	...	...	...	...	6	47	...	...	+ 5	9	11	71	3½	
8	...	...	8760	...	2472	0385	...	...	...	...	...	...	...	...	...	...	...	...	12	26	...	...	...	.....	3¾	
...	20	2	.....	1680	.....	.....	9	3	...	...	...	...	10	3	...	...	7	13	...	...	...	9	10	80	4	5
18	...	...	3880	...	0386	0172	...	...	...	...	...	...	...	...	28	1	...	...	12	25	...	...	...	.....	4¼	
...	3	3	.....	2280	.....	.....	8	57	2		10	31	...	...	...	...	7	38	...	...	—°2	9	7	89	4½	
0	...	...	2890	...	1664	1932	...	...	...	...	...	...	...	...	...	...	...	...	12	23	...	...	...	.....	4¾	
...	7	2	.....	2980	.....	.....	8	54	4		...	...	10	59	...	...	8	1	...	...	...	9	2	97	5	6
9	...	...	6870	...	1419	3038	...	...	...	...	...	...	...	...	29	1	...	...	12	22	...	...	...	.....	5¼	
...	1	3	.....	2780	.....	.....	8	53	...		11	27	...	...	●		8	23	...	...	— 6	8	56	104	5½	
4	...	...	0900	...	4368	2867	...	...	...	...	...	...	...	...	...	...	...	...	12	22	...	...	...	.....	5¾	
...	15	6	.....	3090	.....	.....	8	49	...	...	...	...	11	55	...	...	8	45	...	...	...	8	50	110	6	7
9	...	...	1 4540	...	6382	0893	...	...	...	...	...	...	...	...	0	8	...	...	12	22	...	...	...	.....	6¼	
...	20	1	.....	8780	.....	.....	8	39	10		12	23	...	...	...	...	9	7	...	...	— 7	8	44	114	6½	
21	...	...	2670	...	3652	0775	...	...	...	...	...	...	...	...	...	...	...	...	12	21	...	...	...	.....	6¾	
...	5	7	.....	0700	.....	.....	8	28	...	...	...	...	12	51	...	...	9	28	...	...	...	8	37	116	7	8
12	...	...	3860	...	0589	0778	...	...	...	...	...	...	...	...	1	8	...	...	12	22	...	...	...	.....	7¼	
...	16	0	.....	...	.....	.....	8	23	...	...	1	20	...	...	...	...	9	50	...	...	— 7	8	30	*117	7½	
120	338	160	9 9763	3 5828	2 8263	2 2555	123	23	....		61 +12 =73	44 0 44	70	30	....		100	20	175	0	+67 ... —22 +22	124	6	1142		
9	24	11	0 7126	0 2559	0 2174	0 1735	8	49	....		10	32	10	5	....		7	10	12	30	.... — 6	8	52	81·57		

APPENDIX 13.

TABLE V.—Tidal Fluctuations at Grondines during the Low water season of 1887, viz. :—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series II. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming − or lagging + of tides. Min	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min.	In duration of ebbs. Min.
½	Oct. 18 H.W	9	43	P.M.	..	..	..	..	..	..	− 2	...	18·3399	.....	.....	.....	...	...	...
¼	.....	...	...	...	...	...	...	...	...	...	...	...	.....	.....	.....	.....	...	...	...
¾	Oct. 19 L.W.	6	17	A.M.	..	..	8	34	12	24	....	27	9·2749	.....	*8·9650	.....	.....	16	...
9	do 19 H.W	10	7	A.M.	3	50	...	...	...	...	...	25	17·4439	8·0690	.....	13·6072	8·5646	...	19
¼	do 19 L.W.	6	22	P.M.	..	..	8	15	12	19	..	26	9·2749	.....	8·1690	.....	.....	14	...
¾	do 19 H.W	10	27	P.M.	4	4	...	...	...	...	+ °0	23	18·3304	9·0555	.....	13·6034	8·488 0	...	25
¼	do 20 L.W.	7	6	A.M.	..	..	8	40	12	31	..	28	9·4439	.....	8·8865	.....	.....	13	...
10	do 20 H.W	10	57	A.M.	3	51	...	...	...	...	..	24	17·2849	7·8410	.....	13·6123	8·3459	...	35
¼	do 20 L.W.	7	2	P.M.	..	..	8	5	12	15	...	25	9·4349	.....	7·8500	.....	.....	19	...
¾	do 20 H.W	11	12	P.M.	4	10	...	...	...	...	+ 0	24	18·2409	8·8060	.....	13·6085	8·1693	...	35
¼	do 21 L.W.	7	52	A.M.	..	..	8	40	12	30	....	30	9·6129	.....	8·6280	.....	.....	15	...
11	do 21 H.W	11	47	A.M.	°3	55	...	...	...	...	....	25	17·0059	7·3930	.....	*13·6244	7·9436	...	41
¼	do 21 L.W.	7	46	P.M.	..	..	7	59	12	10	...	26	9·6929	.....	7·3130	.....	.....	16	...
¾	do 21 H.W	†11	57	P.M.	4	11	...	...	...	...	−16	28	18·1309	8·4380	.....	13·3990	7·4423	...	53
¼	do 22 L.W.	8	49	A.M.	..	..	8	52	12	24	....	30	9·6629	.....	8·4680	.....	.....	39	...
12	do 22 H.W	12	21	P.M.	3	32	...	...	...	...	..	26	15·2129	5·5500	.....	12·5071	6·8855	...	46
¼	do 22 L.W.	8	27	P.M.	..	..	8	6	12	31	...	34	8·4659	.....	6·7470	.....	.....	*53	...
¾	do 23 H.W	12	52	A.M.	4	25	...	...	...	...	*+51	30	15·2429	6·7770	.....	11·5011	6·8663	...	47
¼	do 23 L.W.	9	45	A.M.	..	..	*8	53	*13	10	..	*35	7·6699	.....	7·5730	.....	.....	8	...
13	do 23 H.W	‡ 2	2	P.M.	4	17	...	...	...	...	....	25	14·0379	6·3680	.....	11·2561	7·0225	...	*83
¼	do 23 L.W.	9	32	P.M.	..	..	7	30	12	0	....	24	7·8199	.....	6·2180	.....	.....	13	...
¾	do 24 H.W	2	2	A.M.	4	30	...	...	...	...	+10	25	15·7509	7·9310	.....	11·5761	6·7563	...	70
¼	do 24 L.W.	10	42	−.M.	..	..	8	40	13	0	....	28	8·5759	.....	7·1750	.....	.....	10	...
14	do 24 H.W	3	2	P.M.	4	20	...	...	...	...	....	29	14·2769	5·7010	.....	11·4591	6·4833	...	40
¼	do 24 L.W.	11	2	P.M.	..	..	8	0	12	14	....	35	7·8599	.....	6·4170	.....	.....	6	...
¾	do 25 H.W	3	16	A.M.	4	14	...	...	...	...	+30	28	14·4959	6·6360	.....	10·6662	6·3495	...	53
¼	do 25 L.W.	12	9	P.M.	..	..	8	53	13	6	...	29	7·1229	.....	7·3730	.....	.....	1	...
15	do 25 H.W	4	22	P.M.	4	13	...	...	...	...	....	33	12·0949	°4·9720	.....	10·1472	°6·2514	...	83
¼	do 26 L.W.	11	52	A.M.	..	..	7	30	12	20	....	27	6·9200	.....	°5·1749	.....	.....	37	..
	H.W	106	23								+91	345	207·5492						
Totals 13½ tides		...	...	...	53	32	116	37	174	54	.....	.....	.....	93·5375	104·9574	160·5677	95·5669	260	630
	L.W.	124	43								−16	404	120·9317						
	13 H.W										+18	29	15·9653						•
Means do	14 L.W.	...	...	.....	4	7	8	20	12	29	.....	...	.....	7·1952	7·4969	12·3514	7·3513	19	48
											−16	27	8·6380						

N.B.—Maxima in whole lunar month indicated by a star, thus : *, and minima by a circle, thus : °.
†Moon's S. declination a maximum = 20° 8′ maximum diurnal inequality observed in high water levels = 2·918 ft. ; maximum diurnal inequality observed in low water levels = 1·197 feet.
‡Moon's first quarter (Quebec), Oct. 23rd, from 0h. 46m., p.m.

APPENDIX 13.

TABLE V.—Tidal Fluctuations at Grondines during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued.*)

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Diurnal Inequalities.									Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.																
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.L.		Priming—or lagging + of tides	Lunitidal intervals.			General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series II. Losing tides. Gauge book reference numbers.
Min.	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.		
...	....	....	.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	− 7	....	....	....		½
...	....	0300	.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....		
...	8960	.....	0824	0949	....	....	....	....	....	....	....	....	....	....	12	21	....	....	....	....		¾
5	.....	1000	.....	.....	8	18	....	....	....	1	49	....	10	11	....	....	....	8	22	116		9
...	8865	.....	0038	0766	....	....	....	....	....	....	....	2·8	....	....	12	22	....	....	....	....		¼
12	.....	1690	.....	.....	8	8	....	2	18	....	....	....	10	33	....	....	− 6	8	15	113		½
..	1·0455	.....	0089	1421	....	....	....	....	....	....	....	....	....	....	12	22	....	....	....	....		¾
16	.....	° 0090	.....	.....	8	10	5	....	....	2	47	....	10	55	....	....	....	8	8	108		10
...	9560	.....	0038	1766	....	....	2	....	....	....	....	3·8	....	....	12	21	....	....	....	....		¼
15	.....	1780	.....	.....	7	57	5	3	15	....	....	....	11	7	....	....	− 7	7	52	101		½
...	1·2350	.....	0159	2263	....	....	2	....	....	....	....	....	....	....	12	22	....	....	....	....		¾
20	.....	0800	.....	.....	8	3	5	....	....	3	44	....	11	38	....	....	....	7	54	94		11
...	1·1250	.....	2254	5007	....	....	....	....	....	....	....	4·8	....	....	12	22	....	....	....	....		¼
14	.....	0300	.....	.....	7	45	3	4	12	....	....	....	12	0	....	....	− 5	7	48	86		½
...	*2·9180	.....	8919	*·5568	....	....	....	....	....	....	....	....	....	....	12	23	....	....	....	....		¾
7	.....	*1·1970	.....	.....	° 7	41	10	....	....	4	40	....	12	23	....	....	....	7	43	77		12
...	° 0300	.....	1·0060	0192	....	....	....	....	....	....	....	5·8	....	....	12	25	....	....	....	....		¼
39	.....	7960	.....	.....	7	46	3	5	6	....	....	....	12	48	....	....	+ 2	7	42	68		½
...	1·2050	.....	2450	1562	....	....	....	....	....	....	....	....	....	....	12	27	....	....	....	....		¾
*70	.....	1500	.....	.....	8	29	....	....	....	5	33	●	1	15	....	....	....	7	42	60		13
...	1·7130	.....	3200	2662	....	....	....	....	....	....	....	6·8	....	....	12	30	....	....	....	....		¼
60	.....	7560	.....	.....	8	3	14	5	59	....	....	....	1	45	....	....	+14	7	46	52		½
...	1·4740	.....	1170	2740	....	....	3	....	....	....	....	....	....	....	12	34	....	....	....	....		¾
46	.....	7160	.....	.....	8	38	10	....	....	6	24	....	2	19	....	....	....	7	55	46		14
...	2190	.....	7929	1328	....	....	....	....	....	....	....	7·8	....	....	12	40	....	....	....	....		¼
52	.....	7370	.....	.....	8	28	....	6	48	....	....	....	3	0	....	....	+34	8	12	41		½
...	2·4010	.....	5190	0981	....	....	....	....	....	....	....	....	....	....	12	44	....	....	....	....		¾
46	.....	2029	.....	.....	9	10	....	....	....	7	12	....	3	43	....	....	....	8	31	39		15
...	2·3110	.....	2503	3215	....	....	....	....	....	....	....	8·8	....	....	12	47	....	....	....	....		¼
													103	37	....	....	+50					
													+ 60	0								
402	18·4150	5 1509	4·4823	3·0420	106	36	....	27	38	32	9	....	=163	37	174	40	....	103	50	1001		
																	−18					
																	+17					
31	1·3154	0·3679	0·3202	0·2173	8	12	....	4	36	4	36	....	12	35	12	29	....	7	59	77·00		
																	− 6					

APPENDIX 13.

TABLE V.—Tidal Fluctuations at Grondines during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers. Series III. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.
		H.	M	A.M. or P.M.	H.	M	H.	M	H.	M	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min
¼	Oct. 26 L.W.	12	42	A.M.	..	..	..	..	..	..	+30	....	6·9200	.....	.....	....	....	...
¼	do 26 H.W	4	42	A.M.	4	50	..	..	..	..	+17	31	14·4059	7·4859	.....	10·3975	6·5729	...
¾	do 26 L.W.	1	9	P.M.	..	..	8	27	12	47	....	35	7·3019	.....	7·1040	.....	.....	30
16	do 26 H.W	5	29	P.M.	4	20	..	..	..	..	....	29	13·8289	6·5270	.....	10·7246	6·9853	....
¼	do 27 L.W.	1	22	A.M.	..	..	7	53	12	23	..	24	7·1619	.....	6·6670	.....	.....	10
½	do 27 H.W	5	52	A.M.	4	30	..	..	..	..	— 2	28	14·8049	7·6430	.....	11·0209	7·1498	...
¾	do 27 L.W.	1	57	P.M.	..	..	8	5	12	25	...	27	7·7299	.....	7·0750	.....	.....	10
17	do 27 H.W	6	17	P.M.	4	20	..	..	..	..	....	26	14·9439	7·2140	.....	11·3669	7·2240	....
¼	do 28 L.W.	2	20	A.M.	..	..	8	3	12	23	....	26	7·7799	.....	7·1640	.....	.....	° 0
½	do 28 H.W	6	40	A.M.	4	20	..	..	..	..	+ 3	27	15·2229	7·4430	.....	11·4467	7·3435	....
¾	do 28 L.W.	2	50	P.M.	..	..	8	10	12	30	....	28	7·7699	.....	7·4530	.....	.....	0
18	do 28 H.W	7	10	P.M.	4	20	..	..	..	..	....	28	15·0839	7·3140	.....	11·5055	7·3913	....
¼	do 29 L.W.	3	11	A.M.	..	..	8	1	12	17	....	30	7·8499	.....	7·2340	.....	.....	4
½	do 29 H.W	7	27	A.M.	4	16	..	..	..	..	—19	27	15·4139	7·5640	.....	11·7872	7·5855	....
¾	do 29 L.W. †	3	11	P.M.	..	..	7	44	12	14	....	23	8·1389	.....	7·2750	.....	.....	14
19	do 29 H.W ‡	7	41	P.M.	4	30	..	..	..	..	..	23	16·4079	8·2690	.....	12·2448	7·7248	....
¼	do 30 L.W.	3	52	A.M.	..	..	8	11	12	15	....	25	8·6259	.....	7·7820	.....	.....	26
½	do 30 H.W	7	36	A.M.	4	4	..	..	..	..	—*29	26	16·1989	7·5730	.....	12·4648	7·6178	....
¾	do 30 L.W.	4	1	P.M.	..	..	8	5	12	6	....	29	8·6859	.....	7·5130	.....	.....	3
20	do 30 H.W	8	2	P.M.	4	1	..	..	..	..	....	26	16·2889	7·6030	.....	12·2954	7·4190	....
¼	do 31 L.W.	4	27	A.M.	..	..	8	25	12	21	....	27	8·4859	.....	7·8030	.....	.....	15
½	do 31 H.W	8	23	A.M.	3	56	..	..	..	..	—10	24	15·2429	6·7570	.....	11·8137	7·4115	....
¾	do 31 L.W.	4	33	P.M.	..	..	8	10	12	19	....	24	7·7299	.....	7·5130	.....	.....	13
21	do 31 H.W §	8	42	P.M.	4	9	..	..	..	..	..	21	15·3029	7·5730	.....	11·4504	7·6500	....
¼	Nov. 1 L.W.	4	53	A.M.	..	..	8	11	12	25	..	24	7·5209	.....	7·7820	.....	.....	5
½	do 1 H.W	9	7	A.M.	4	14	..	..	..	..	—15	26	15·2529	7·7320	.....	11·5014	7·8020	....
¾	do 1 L.W.	5	2	P.M.	..	..	7	55	12	10	....	24	7·6799	.....	7·5730	.....	.....	1
22	do 1 H.W	9	17	P.M.	4	15	..	..	..	..	....	25	15·8009	8·1210	.....	11·5037	7·7275	....
¼	do 2 L.W.	5	37	A.M.	..	..	8	20	12	16	....	26	7·5999	.....	8·2010	.....	.....	19
½	do 2 H.W	9	33	A.M.	3	56	..	..	..	..	—20	31	14·6149	7·0150	.....	11·3715	7·7523	....
¾	do 2 L.W.	5	27	P.M.	..	..	7	54	12	14	....	23	7·3909	.....	7·2240	.....	.....	24
23	do 2 H.W	9	47	P.M.	4	20	..	..	..	..	..	25	15·9599	8·5690	.....	11·5298	7·9288	....
	.....	...	..	....	..	..	..	..	..	..	...	...	.....	.....	.....	.....	.....	...
	H.W.	122	5								+20	423	244·7814					
	Totals 15½ tides.	53	52	+36	68	21	121	34	185	5	....	....	.....	120·4029	111·3630	184·4248	119·2860	174
	L.W.	=89	52								—95	395	117·4515					
	16 H.W.										+10	26	15·2988					
	Means do ..	....	..	....	4	16	8	6	12	20	....	....	.....	7·5252	7·4242	11·5266	7·4554	12
	15 L.W.										—16	26	7·8301					

N.B.—Maximum in whole lunar month indicated by a star, thus *: and minima by a circle, thus °:
†Moon crosses equator, Oct. 29th.
‡Moon in apogee, Oct. 29th, at 6h. 0m. p.m.
§Full moon, (Quebec) Oct. 31st, at 4h. 31m. p.m.

APPENDIX 13.

TABLE V.—Tidal Fluctuations at Grondines during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).										RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRES DES MARÉES."																					
Diurnal Inequalities.										Eastern standard civil times of meridian passages immediately preceding observed high waters, with correspondingages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H. W. to H. W.		Priming – or lagging + of tides			Lunitidal intervals.			General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series III. Gaining tides. Gauge book reference numbers.
In duration of ebbs.		In semi-tide days.		In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.																	
Min.		Min.		Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.			H.	M.						
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	34	...	...	...	...	...	...	...	...	¼
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
57	27	...	...	3819	...	...	...	9	7	...	7	35	...	...	...	4	30	...	...	+	38	8	55	40	...	...	...	...	...	½
...	...	5770	...	...	...	3271	4124	...	...	...	...	...	...	...	9 8	...	...	12	41	...	...	...	...	...	...	...	...	...	...	...
34	24	...	...	1400	...	...	...	9	32	...	...	...	7	57	...	5	11	...	...	...	...	9	14	42	...	...	...	...	...	**16**
...	...	9760	...	...	...	2963	1645	...	...	...	...	...	...	...	...	...	...	12	37	...	...	...	...	...	...	...	...	...	...	¼
12	2	...	...	5680	...	...	...	9	33	10	8	19	...	...	...	5	48	...	...	+	18	9	29	46	...	...	...	...	...	½
...	...	1390	...	...	...	3460	0742	...	...	...	...	...	...	...	10 8	...	...	12	31	...	...	...	...	...	...	...	...	...	...	...
2	2	...	...	0500	...	...	...	9	36	...	...	...	8	41	...	6	19	...	...	...	...	9	38	51	...	...	...	...	...	**17**
...	...	2790	...	...	...	0798	1195	...	...	...	...	...	...	...	...	...	...	12	27	...	...	...	...	...	...	...	...	...	...	¼
7	7	...	...	0100	...	...	...	9	38	...	9	2	...	...	...	6	46	...	...	+	0	9	44	56	...	...	...	...	...	½
...	...	1390	...	...	...	0588	0478	...	...	...	...	...	...	...	11 8	...	...	12	23	...	...	...	...	...	...	...	...	...	...	...
9	13	...	...	0800	...	...	...	*9	47	...	...	...	9	23	...	7	9	...	...	...	...	9	46	61	...	...	...	...	...	**18**
...	...	3300	...	...	...	2817	1942	...	...	...	...	...	...	...	...	...	...	12	21	...	...	...	...	...	...	...	...	...	...	...
17	3	...	...	2890	...	...	...	9	43	...	9	44	...	...	...	7	30	...	...	–	10	*9	56	65	...	...	...	...	...	¼
...	...	9940	...	...	...	4576	1393	...	...	...	...	...	...	...	12 8	...	...	12	19	...	...	...	...	...	...	...	...	...	...	...
23	3	...	...	4870	...	...	...	9	36	10	...	...	10	5	...	7	49	...	...	...	...	9	44	70	...	...	...	...	...	**19**
...	...	2090	...	...	...	2200	1070	...	...	...	...	...	...	...	...	...	...	12	17	...	...	...	...	...	...	...	...	...	...	¼
2	5	...	...	0600	...	...	...	9	30	...	10	26	...	...	...	8	6	...	...	–	16	9	40	74	...	...	...	...	...	½
...	...	0900	...	...	...	1694	1988	...	...	...	...	...	...	...	13 8	...	...	12	17	...	...	...	...	...	...	...	...	...	...	...
20	15	...	...	2000	...	...	...	9	15	4	...	...	10	47	...	8	23	...	...	...	...	9	36	77	...	...	...	...	...	**20**
...	...	1 0460	...	...	...	4817	° 0075	...	...	...	...	...	...	...	...	...	...	12	16	...	...	...	...	...	...	...	...	...	...	¼
15	2	...	...	7560	...	...	...	9	15	...	11	8	...	...	...	8	39	...	...	–	19	9	31	80	...	...	...	...	...	½
...	...	0600	...	...	...	3633	2385	...	...	...	...	...	...	...	14 8	...	...	12	15	...	...	...	...	...	...	...	...	...	...	...
° 1	6	...	...	2090	...	...	...	9	13	...	...	...	11	29	⊙	8	54	...	...	...	...	9	25	83	...	...	...	...	...	**21**
...	...	0500	...	...	...	0510	1520	...	...	...	...	...	...	...	...	...	...	12	16	...	...	...	...	...	...	...	...	...	...	¼
16	15	...	...	1590	...	...	...	9	16	...	11	51	...	...	...	9	10	...	...	—	*20	9	19	85	...	...	...	...	...	½
...	...	5480	...	...	°	0023	0745	...	...	...	...	...	...	...	15 8	...	...	°12	14	...	...	...	...	...	...	...	...	...	...	...
25	6	...	...	0800	...	...	...	9	4	...	...	...	12	13	...	9	24	...	...	...	...	9	11	86	...	...	...	...	...	**22**
...	...	1 1860	...	...	...	1322	0248	...	...	...	...	...	...	...	...	...	...	12	15	...	...	...	...	...	...	...	...	...	...	¼
26	2	...	...	2090	...	...	...	8	57	...	12	36	...	...	...	9	39	...	...	–	20	9	3	86	...	...	...	...	...	½
...	...	1 3450	...	...	...	1583	1765	...	...	...	...	...	...	...	16 8	...	...	12	15	...	...	...	...	...	...	...	...	...	...	...
21	12	...	...	...	...	...	...	8	48	...	...	...	12	59	...	9	54	...	...	...	...	8	55	86	...	...	...	...	...	**23**
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12	15	...	...	...	...	...	...	...	...	...	...	...
287	144	7	9680	3	6789	3	4255	2	1315	149	50	....	80	41	....	83	34	....	123	11	197	39	+ 56 — 85 + 19 — 17	150	56	1088			
18	9	0	5312	0	2453	0	2284	0	1421	9	22	....	10	5	10	27	....	7	42	12	21	....		9	26	68	00			

APPENDIX 13.

TABLE V.—Tidal Fluctuations at Grondines during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers. Series IV. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of flood. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides. Min.	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min.
23	Nov. 2 H.W	9	47	P.M.							− 20		15·9599					
¼	Nov. 3 L.W.	6	2	A.M.			8	15	12	26		23	7·7399		8·2200			9
½	do 3 H.W	10	13	A.M.	4	11					− 19	26	15·4419	7·7020		11·8998	7·9508	
¾	do 3 L.W.	5	58	P.M.			7	45	12	5		25	8·1089		7·3330			9
24	do 3 H.W	10	18	P.M.	4	20						24	16·6569	8·5480		12·2384	7·9010	
¼	do 4 L.W.	6	31	A.M.			8	13	12	30		26	8·4669		8·1900			3
½	do 4 H.W	10	48	A.M.	4	17					− 25	25	15·9999	7·5330		12·4674	7·7320	
¾	do 4 L.W.	6	26	P.M.			7	38	° 11	55		22	8·7359		7·2640			0
25	do 4 H.W	10	43	P.M.	4	17						26	16·6769	7·9410		12·3241	7·5055	
¼	do 5 L.W.	7	22	A.M.			8	39	12	39		26	8·4069		8·2700			17
½	do 5 H.W	11	22	A.M.	4	0					− 10	26	14·9539	6·5470		11·8599	7·3930	
¾	do 5 L.W.	† 7	8	P.M.			7	46	12	1		26	7·9199		7·0340			15
26	do 5 H.W	11	23	P.M.	4	15						26	15·6409	7·7210		11·4042	7·2885	
¼	do 6 L.W.	7	52	A.M.			8	29	12	45		31	7·5999		8·0410			1
½	do 6 H.W	12	8	P.M.	4	16					−° 1	27	13·9579	6·3580		11·2209	7·3710	
¾	do 6 L.W.	7	32	P.M.			° 7	24	12	4		° 21	7·4709		6·4870			24
27	do 7 H.W	12	12	A.M.	4	40						21	16·0689	8·5980		11·4202	7·4005	
¼	do 7 L.W.	8	43	A.M.			8	31	12	31		25	7·9689		8·1000			40
½	do 7 H.W	12	43	P.M.	4	0					− 4	31	14·3859	6·4170		11·5886	7·2883	
¾	do 7 L.W.	8	22	P.M.			7	39	12	15		23	7·9199		6·4660			36
28	do 8 H.W	12	58	A.M.	4	36						26	16·0899	8·1700		11·5028	7·1068	
¼	do 8 L.W.	‡ 9	28	A.M.			8	30	12	40		24	7·9789		8·1110			26
½	do 8 H.W	1	38	P.M.	4	10					+ 42	28	13·6589	5·6800		11·1432	6·6374	
¾	do 8 L.W.	9	30	P.M.			7	52	12	52		27	7·6700		5·9889			50
29	do 9 H.W	2	30	A.M.	* 5	0						22	14·4400	6·7700		10·4536	6·5972	
¼	do 9 L.W.	10	40	A.M.			8	10	12	20		25	° 6·6400		7·8000			50
½	do 9 H.W	2	50	P.M.	4	10					− 10	27	12·4700	5·8200		°10·0438	6·6775	
¾	do 9 L.W.	11	10	P.M.			8	20	12	20		26	6·7700		5·7000			10
30	do 10 H.W	3	10	A.M.	4	0						21	14·1500	7·3800		10·1088	6·5275	
							8	30	12	30		24			7·2300			0
¼	do 10 L.W.	11	40	A.M.									6·9200					
	H.W.	124	56								+ 42	356	210·5919					
	Totals 14 tides..				60	12	121	41	185	53				101·1950	110·2349	159·6757	101·3770	290
	L.W.	112	44								− 69	374	109·3969					
	14 H.W.										+ 42	25	15·0423					
	Means do				4	18	8	7	12	24				7·2282	7·3490	11·4054	7·2412	19
	14 L.W										− 11	25	7·8141					
	Grd. totals H.W.										+210	1491	891·9003					
	57 tides.				241	4	475	9	720	33				427·6245	434·7745	677·4639	427·4753	844
	L.W.										−200	1538	464·2758					
	57 H.W.										+ 18	26	15·6474					
	Grd. means do				4	14	8	12	12	26				7·5022	7·4961	11·8853	7·4996	15
	57 L.W.										− 13	27	8·1452					

N.B.—Maxima in whole lunar month indicated by a star, thus: *, and minima by a circle, thus: °.

APPENDIX 13.

TABLE V.—Tidal Fluctuations at Grondines during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued.*)

Diurnal Inequalities.

In duration of ebbs.	In semi tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.
Min	Min	Feet.	Feet.	Feet.	Feet.	H.	M.	
..	....	.....	3490	.....	.....	...	...	..
..	....	.....	.....	.....	.....	...	...	..
....	....	5180	.....	3700	0220	...	...	..
30	21	.....	3690	.....	.....	8	51	..
....	....	1·2150	.....	3386	0498	...	...	..
28	25	.....	3580	.....	.....	8	32	10
....	....	6570	.....	2290	1690	...	...	..
35	35	.....	2690	.....	.....	8	38	..
....	....	6770	.....	1433	2265	...	...	..
61	44	.....	3290	.....	.....	8	8	3
....	....	1·7230	.....	4642	1125	...	...	3
53	38	.....	4870	.....	.....	8	21	3
..	....	6870	.....	4557	1045	...	...	..
43	44	.....	3200	.....	.....	7	56	..
....	....	1·6830	.....	1833	0825	...	...	..
65	41	.....	1290	.....	.....	8	15	..
....	....	2·1110	.....	1993	0295	...	...	..
67	27	.....	4980	.....	.....	7	53	..
....	....	1·6830	.....	1684	1122	...	...	..
52	16	.....	0490	.....	.....	7	58	..
....	....	1·7040	.....	0858	1815	...	...	..
51	25	.....	0590	.....	.....	7	47	..
....	....	2·4310	.....	3596	4694	...	...	..
38	12	.....	3089	.....	.....	8	0	..
....	....	7811	.....	6896	0402	...	...	..
18	32	.....	0300	.....	.....	8	26	..
....	....	1·9700	.....	4098	0803	...	...	..
10	0	.....	1300	.....	.....	8	19	..
....	....	1·6800	.....	0650	1500	...	...	..
10	10	.....	1500	.....	.....	8	13	..
....	....	.....	9000	.....	.....	...	...	..
....	....	.....	.....	.....	.....	...	...	..
561	370	20·4201	3·8349	4·1616	1·8299	115	17	..
40	26	1·3613	0·2557	·2973	0·1307	8	14	.
1816	1076	56·7794	16·2475	14·9533	9·2589	495	6	..
32	19	0·9789	0·2801	0·2670	0·1653	8	41	..

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.

Upper passage.		Lower passage.		Ages, etc.
H.	M.	H.	M.	Days.
1	22	..	..	....
..	..	..	..	17·8
..	..	1	46	....
2	10	..	..	....
..	..	..	..	18·8
..	..	2	35	....
..	..	..	..	....
3	53	..	..	....
..	..	..	..	20·8
..	..	4	19	....
4	45	..	..	....
..	..	..	..	21·8
..	..	5	11	....
5	38	..	..	0
..	..	..	..	22·8
..	..	6	4	....
6	31	..	..	....
..	..	..	..	23·8
..	..	6	57	....
..	..	..	..	24·8
..	..	..	..	....
27	20	30	19	....
209	23	216	32	....
7	29	7	28	....

Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H. W. to H. W.		Priming + or lagging − of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series IV. Gauge book reference numbers.
H.	M.	H.	M.	Min.	H.	M.	Losing tides.	
....	....	....	....	− 20	....	....	....	23
....	....	....	....	....	....	....	....	
....	....	....	....	....	....	....	....	
10	9	....	....	− 19	8	47	86	
....	....	12	16	....	....	....	....	
10	25	....	....	....	8	39	84	
....	....	12	15	....	....	....	....	24
10	40	....	....	− 19	8	30	82	
....	....	12	16	....	....	....	....	
10	56	....	....	....	8	21	80	
....	....	12	16	....	....	....	....	25
11	12	....	....	− 16	8	11	76	
....	....	12	18	....	....	....	....	
11	30	....	....	....	8	3	73	
....	....	12	17	....	....	....	....	26
11	47	....	....	− 13	7	54	69	
....	....	12	20	....	....	....	....	
12	7	....	....	....	7	48	64	
....	....	12	21	....	....	....	....	27
12	28	....	....	− 5	7	43	59	
....	....	12	24	....	....	....	....	
12	52	....	....	....	7	41	55	
....	....	12	27	....	....	....	....	28
1	19	....	....	+ 9	7	41	50	
....	....	12	32	....	....	....	....	
51	....	....	....	....	7	47	47	
....	....	12	36	....	....	....	....	29
2	29	....	....	+ 28	7	56	44	
....	....	12	42	....	....	....	....	
3	9	....	....	....	8	12	44	
....	....	12	43	....	....	....	....	30
....	....	....	....	....	....	....	....	
122 + 48 = 170	52 0 52	173	43	+ 37 .... − 72	113	13	913	
12	12	12	25	+ 18 .... − 14	8	5	65·21	
558	0	721	2	+ 210 .... − 197	492	5	4144	
9	47	12	26	+ 19 .... − 12	8	38	72·70	

†Moon's N. declination at maximum = 20° 39'. ‡Moon's last quarter (Quebec) from 0h. 2m. p.m. Nov. 8.

TABLE VI.—Tidal Fluctuations at St. Jean des Chaillons during the Low water season of 1887, viz.:—from quadrature of Oct. 9th to quadrature of Nov. 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series I. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lugging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitude corrected for diurnal inequalities.
		H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.
	Oct. 11 H. W †	3	32	P.M.	...	...	...	...	...	...	+ 27	...	14·3390	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	Oct. 11 L.W.	11	43	P.M.	...	...	8	11	12	26	...	28	10·3633	...	3·9757	...	...
	do 12 H. W	3	58	A.M.	4	15	...	...	...	...	...	30	15·6352	5·2719	...	12·7067	4·6518
	do 12 L.W.	12	52	P.M.	...	...	8	54	12	58	...	40	10·3983	...	5·2369	...	...
	do 12 H. W	4	56	P.M.	4	4	...	...	...	...	+ 31	35	14·5211	4·1228	...	12·7307	4·7050
	do 13 L.W.	1	30	A.M.	...	...	8	34	12	23	...	30	10·3582	...	4·1629	...	...
3	do 13 H. W	5	19	A.M.	3	49	...	...	...	...	...	37	15·6552	5·2970	...	12·8026	4·9185
	do 13 L.W.	1	57	P.M.	...	...	8	38	12	51	...	38	10·3284	...	5·3268	...	...
	do 13 H. W	6	10	P.M.	4	13	...	...	...	...	+ 21	30	15·2155	4·8871	...	12·9431	5·2494
	do 14 L.W.	2	18	A.M.	...	...	8	8	12	20	...	31	10·3084	...	4·9071	...	...
4	do 14 H. W	6	30	A.M.	4	12	...	...	...	...	...	28	16·1849	5·8765	...	13·1143	5·5267
	do 14 L.W.	3	5	P.M	...	...	8	35	12	41	...	32	10·3934	...	5·7915	...	...
	do 14 H. W	7	11	P.M.	4	6	...	...	...	...	+ 9	38	15·9252	5·5318	...	13·3273	5·7129
	do 15 L.W.	3	21	A.M.	...	...	8	10	12	18	...	26	10·5482	...	5·3770	...	...
5	do 15 H. W	7	29	A.M.	4	8	...	...	...	...	...	25	16·6996	6·1514	...	13·5677	5·7391
	do 15 L.W.	3	56	P.M.	...	...	8	27	12	20	...	35	10·8482	...	5·8514	...	...
	do 15 H. W	7	49	P.M.	3	53	...	...	...	...	− 4	21	16·4248	5·5766	...	13·5957	5·5950
	do 16 L.W. ‡	4	34	A.M.	...	...	8	45	12	26	...	24	10·7482	...	5·6766	...	...
6	do 16 H. W	8	15	A.M.	3	41	...	...	...	...	...	20	16·0235	5·2753	...	13·5050	5·5832
	do 16 L.W. §	4	34	P.M.	...	...	8	19	12	30	...	33	10·6785	...	5·3450	...	...
	do 16 H. W	8	45	P.M.	4	11	...	...	...	...	+° 0	23	16·7146	6·0361	...	13·5644	5·9922
	do 17 L.W.	5	15	A.M.	...	...	8	30	12	20	...	16	10·4582	...	6·2564	...	...
7	do 17 H. W	9	5	A.M.	3	50	...	...	...	...	...	22	16·7896	6·3314	...	13·9225	6·5487
	do 17 L.W.	5	16	P.M.	...	...	8	11	12	32	...	25	10·8382	...	5·9514	...	...
	do 17 H. W	9	37	P.M.	4	21	...	...	...	...	− 7	°16	*18·4936	*7·6554	...	14·4930	*6·8444
	do 18 L.W.	5	50	A.M.	...	...	8	13	12	11	...	20	11·3035	...	*7·1901	...	...
8	do 18 H. W	9	48	A.M.	3	58	...	...	...	...	...	22	17·8840	6·5805	...	14·7760	6·6807
	do 18 L.W. ¶	6	09	P.M.	...	...	8	21	12	31	...	27	11·5676	...	6·3164	...	...
	do 18 H. W	10	19	P.M.	4	10	...	...	...	...	+ 12	27	18·2037	6·6361	...	*14·8088	6·3924
	H. W.	105	11								+ 73	374	230·3705				
		72	20	+12·0	56	51	117	56	174	47	...	...	...	81·2299	77·3652	189·8578	80·1400
Totals	14 tides	84	20								− 11	405	149·1406				
	L. W																
	14 H. W.										+ 15	27	16·4550				
Means	do ...	...	...	...	4	3	8	26	12	29				5·8021	5·5261	13·5613	5·7243
	14 L. W.										− 5	29	10·6529				

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °
†Longitude St. Jean des Chaillons wharf = 72° 7″ = 4h. 48m. 28s. = 0·2004 of a day west of Greenwich.
‡Moon crosses equator Oct. 16th.
§Moon in perigee Oct. 16th at 1h. 0m. p.m.
‖New moon (Quebec) at 5.35 p.m., Oct. 16th.
¶ Most important tide but one during 1887, viz.: evening tide of March 11th, for which coefficient of semi-amplitude is 118.

TABLE VI.—Tidal Fluctuations at St. Jean des Chaillons during the Low water season of 1887, viz.:—from quadrature of Oct. 9th to quadrature of Nov. 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued.*)

Diurnal Inequalities.

In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.
Min.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M.	
...	...	...	....	2449	....	....	...	...	....
...	...	...	1 2962	....	....	....	...	...	2
...	43	32	....	0350	....	....	8	39	....
11	...	...	1 1141	....	0240	0532	...	...	....
...	20	35	....	0401	....	....	9	9	....
15	...	...	1 1341	....	0719	2135	...	...	....
...	4	28	....	0298	....	....	9	5	....
24	...	...	4397	....	1405	3309	...	...	....
...	30	31	....	0200	....	....	9	28	....
1	...	...	9694	....	1712	2773	...	...	....
...	27	21	....	0850	....	....	9	21	....
6	...	...	2597	....	2130	1862	...	...	2
...	25	23	....	1548	....	....	9	34	3
8	...	...	7744	....	2404	0262	...	...	1
...	17	2	....	3000	....	....	9	25	..
15	...	...	2748	....	0280	1441	...	...	1
...	18	20	....	1000	....	....	9	17	2
12	...	...	4013	....	0907	0118	...	...	....
...	26	4	....	0697	....	....	9	15	....
56	...	...	6911	....	0594	4090	...	...	....
...	11	10	....	2203	....	....	9	18	....
21	...	...	.0750	....	3581	5565	...	...	....
...	19	12	....	3800	....	....	9	10	....
31	...	...	1 7040	....	5705	2957	...	...	....
...	2	21	....	4653	....	....	9	14	....
23	...	...	6096	....	2830	1637	...	...	....
...	8	20	....	2641	....	....	8	56	....
12	...	...	3197	....	0328	2883	...	...	....
...	10	0	....	....	....	....	8	59	....
235	260	259	10 0631	2 4090	2 2835	2 9564	128	50	...
18	19	19	7188	1721	1757	2274	9	12	....

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and places of the moon.

Upper passage		Lower passage		Ages, etc.
H.	M.	H.	M.	Days.
...	...	...	...	....
...	...	...	...	....
...	...	7	19	....
...	...	...	...	....
7	47	...	...	25 1
...	...	...	...	....
...	...	8	14	....
...	...	...	...	26 1
8	42	...	...	....
...	...	9	9	....
...	...	...	...	27 1
9	37	...	...	....
...	...	10	4	....
...	...	...	...	28 1
10	32	...	...	....
...	...	11	0	....
11	27	...	...	●
...	...	11	55	....
12	23	...	...	....
...	...	12	52	....
1	20	...	...	1 8
61	48	70	33	....
+12	0			
=73	48			
10	33	10	5	

Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H. W. to H. W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series I. Gaining tides. Gauge book reference numbers.
H.	M.	H.	M.	Min	H.	M.		
...	...	...	...	+34	...	...	....	
...	...	...	...	....	...	...	....	
...	...	12	46	....	...	...	....	
3	57	*12	47	....	8	38	°39	2
...	...	...	...	....	...	...	....	
4	44	...	...	*+40	8	57	42	
...	...	12	43	....	...	...	....	
5	27	...	...	....	9	13	47	3
...	...	12	39	....	...	...	....	
6	6	...	...	+22	9	24	54	
...	...	12	33	....	...	...	....	
6	39	...	...	....	9	30	62	4
...	...	12	29	....	...	...	....	
7	8	...	...	+ 5	9	31	71	
...	...	12	26	....	...	...	....	
7	34	...	...	....	9	30	80	5
...	...	12	25	....	...	...	....	
7	59	...	...	—°2	9	27	89	
...	...	12	23	....	...	...	....	
8	22	...	...	.	9	22	97	6
...	...	12	22	....	...	...	....	
8	44	...	...	— 6	9	17	104	
...	...	12	22	....	...	...	....	
9	6	...	...	....	9	11	110	7
...	...	12	22	....	...	...	....	
9	28	...	...	— 7	9	5	114	
...	...	12	21	....	...	...	....	
9	49	...	...	....	8	57	116	8
...	...	12	22	....	...	...	....	
10	11	...	...	— 7	8	51	*117	
105	14	175	0	+67	128	25	1142	
				—22				
7	31	12	30	+22	9	12	81·57	
				— 6				

APPENDIX 13.

TABLE VI.—Tidal Fluctuations at St. Jean des Chaillons during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers. Series II. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.
		H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min.
	Oct. 18 H.W	10	19	P.M.	...	...	...	...	...	...	+ 12	...	18·2037	.....	.....	.....	.....	...
	...	...	...	...	...	...	...	...	...	...	...	...	.....	.....	.....	.....	.....	...
¾	Oct. 19 L.W.	6	50	A.M.	...	...	8	31	12	21	...	36	11·6576	.....	6·5461	.....	.....	20
9	do 19 H.W	10	40	A.M.	3	50	...	...	...	...	...	25	17·7285	6·0709	.....	14·7889	6·3417	...
¼	do 19 L.W.	6	50	P.M.	...	...	8	10	12	10	...	27	11·5785	.....	6·1500	.....	.....	20
¾	do 19 H.W	11	0	P.M.	4	10	...	...	...	...	— 23	26	18·1785	6·6000	.....	14·7527	6·2193	...
¼	do 20 L.W.	7	38	A.M.	...	...	8	38	12	17	...	31	11·7076	.....	6·4709	.....	.....	31
10	do 20 H.W	11	17	A.M.	3	39	...	...	...	...	...	25	17·3641	5·6565	.....	14·7301	6·0950	...
¼	do 20 L.W.	7	29	P.M.	...	...	8	12	12	24	...	31	11·6576	.....	5·7065	.....	.....	33
¾	do 20 H.W	11	41	P.M.	4	12	...	...	...	...	+ °0	22	18·2037	6·5461	.....	14·7345	6·0039	...
¼	do 21 L.W.	8	25	A.M.	...	...	8	44	12	26	.....	24	11·8076	.....	6·3961	.....	.....	30
11	do 21 H.W	12	7	P.M.	3	42	...	...	...	...	.....	20	17·1743	5·3667	.....	14 7648	5·8384	...
¼	do 21 L.W.	8	16	P.M.	...	...	8	9	12	9	.....	29	11·8836	.....	5·2907	.....	.....	18
¾	do 22 H.W	† 12	16	A.M.	4	0	...	...	...	...	— 12	25	18·1837	6 3001	.....	14·5987	5·3363	...
¼	do 22 L.W.	‡ 9	20	A.M.	...	...	9	4	12	29	...	35	11·9774	.....	6·2063	.....	.....	35
12	do 22 H.W	12	45	P.M.	°3	25	...	...	...	...	.....	20	15·5252	3·5478	.....	13·8454	4·7405	...
¼	do 22 L.W.	9	2	P.M.	...	...	8	17	12	32	.....	38	10·9730	.....	4·5522	.....	.....	*50
¾	do 23 H.W	1	17	A.M.	4	15	...	...	...	...	+ 44	31	15·6285	4·6555	.....	12·9464	4·6763	...
¼	do 23 L.W.	10	19	A.M.	...	...	9	2	13	2	.....	34	10·2435	.....	5·3850	.....	.....	5
13	do 23 H.W	§ 2	29	P.M.	4	10	...	...	...	...	.....	37	14·3560	4·1125	.....	12·6512	4·8604	...
¼	do 23 L.W.	10	0	P.M.	...	...	7	31	°11	51	...	42	10·1985	.....	4·1575	.....	.....	10
¾	do 24 H.W	2	20	A.M.	4	20	...	...	...	...	— 2	25	15·9852	5·7867	.....	12·9244	4·6523	...
¼	do 24 L.W.	11	1	A.M.	...	...	8	41	12	57	....	*56	10·9980	.....	4·9872	.....	.....	4
14	do 24 H.W	3	17	P.M.	4	16	...	...	...	...	.....	26	14·6758	3·6778	.....	12·8239	4·3711	...
¼	do 24 L.W.	11	28	P.M.	...	...	8	11	12	1	...	34	10·2785	.....	4·3973	.....	.....	26
¾	do 25 H.W	3	18	A.M.	3	50	...	...	...	...	+*47	36	14 7008	4·4223	.....	12·1551	4·3428	...
¼	do 25 L.W.	12	34	P.M.	...	...	*9	16	*13	36	.....	44	9·6888	.....	5·0120	.....	.....	30
15	do 25 H.W	4	54	P.M.	4	20	...	...	...	...	.....	35	13·2285	°3·5397	.....	°11·6974	4·4869	...
¼	do 26 L.W.	12	17	A.M.	...	...	°7	23	12	21	....	37	° 9·2191	.....	4·0094	.....	.....	18
		99	21	+12·0														
	H.W.	=111	21								+ 91	353	210·9328					
Totals 13½ tides.		.....	...	.....	52	9	117	49	174	36	.....	.....	.....	66·2826	75·2672	177·4135	67·9649	330
	L.W.	131	29								— 37	498	153·8693					
	13 H.W.										÷ 30	27	16·2256					
Means	do ..	...	...	.....	4	1	8	25	12	28	.....	.....	.....	5·0987	5·3762	13·6472	5·2281	24
	14 L.W.										— 12	36	10·9907					

N.B.—Maximum in whole lunar month indicated by a star, thus: * and maxima by a circle, thus: °
† Maximum diurnal inequality observed in high water levels=2·659 feet.
‡ Moon's S. declination a maximum=20° 8′.
§ Moon's first quarter (Quebec), Oct. 23rd, from 0h. 46m. p.m.

APPENDIX 13.

TABLE VI.—Tidal Fluctuations at St. Jean des Chaillons during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).										RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."																	
Diurnal Inequalities.										Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.						Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series II. Losing tides. Gauge book reference numbers.	
In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.		Upper passage.		Lower passage.		Ages, etc.											
Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M		H.	M	H.	M	Days.			H.	M	H.	M	Min	H.	M		
....	....	.....	0900	.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	— 7	....	....	.....		
....	....	.....	.....	.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	.....		
....	....	4752	.....	0199	0507	....	....	....	....	....	....	....	....	....	....	....	....	12	21	....	....	....	.....		
21	21	.....	0791	.....	.....	8	51	....	....	....	1	49	....	....	10	32	....	....	....	8	43	116		9	
....	....	4500	.....	0362	1224	....	....	....	....	....	....	....	2·8	....	....	....	12	22	....	....	....	.....			
28	7	.....	1291	.....	.....	8	42	....	2	18	....	....	....	....	10	54	....	....	— 6	8	36	113			
....	....	8144	.....	0226	1243	....	....	....	....	....	....	....	....	....	....	....	12	22	....	....	....	.....			
26	7	.....	0500	.....	.....	8	30	....	....	....	2	47	....	....	11	17	....	....	....	8	30	108		10	
....	....	8396	.....	0044	0911	....	....	....	....	....	....	....	3·8	....	....	....	12	21	....	....	....	.....			
32	2	.....	1500	.....	.....	8	25	....	3	16	....	....	....	....	11	37	....	....	— 7	8	21	101			
....	....	1·0294	.....	0303	1655	....	....	....	....	....	....	....	....	....	....	....	12	22	....	....	....	.....			
35	17	.....	0760	.....	.....	8	23	....	....	....	3	44	....	....	11	59	....	....	....	8	15	94		11	
....	....	1·0094	.....	1661	5021	....	....	....	....	....	....	....	4·8	....	....	....	12	22	....	....	....	.....			
55	20	.....	0938	.....	.....	*8	3	*4	4	13	....	....	....	....	12	21	....	....	— 5	8	8	86			
....	....	*2·6585	.....	7533	5958	....	....	4	....	....	....	....	....	....	....	....	12	23	....	....	....	.....			
47	3	.....	1·0044	.....	.....	8	5	4	....	....	4	40	....	....	12	24	....	....	....	8	4	77		12	
....	....	1033	.....	*8990	0642	....	....	....	....	....	....	....	5·8	....	....	....	12	25	....	....	....	.....			
45	30	.....	7295	.....	.....	8	10	....	5	7	....	....	....	....	1	9	....	....	+ 2	8	2	68			
....	....	1·2725	.....	2952	1841	....	....	....	....	....	....	....	....	....	....	....	12	27	....	....	....	.....			
91	71	.....	0450	.....	.....	8	55	....	....	....	5	34	◐	....	1	36	....	....	....	8	2	60		13	
....	....	1·6292	.....	2732	2081	....	....	....	....	....	....	....	6·8	....	....	....	12	30	....	....	....	.....			
70	66	.....	7995	.....	.....	8	20	....	6	0	....	....	....	....	2	6	....	....	+14	8	6	52			
....	....	1·3094	.....	1005	2812	....	....	....	....	....	....	....	....	....	....	....	12	34	....	....	....	.....			
30	56	.....	7195	.....	.....	8	53	....	....	....	6	24	....	....	2	40	....	....	....	8	16	46		14	
....	....	0250	.....	6688	0283	....	....	....	....	....	....	....	7 8	....	....	....	12	40	....	....	....	.....			
65	*95	.....	5897	.....	.....	8	29	....	6	49	....	....	....	....	3	20	....	....	+34	8	31	41			
....	....	1·4723	.....	4577	1441	....	....	....	....	....	....	....	....	....	....	....	12	44	....	....	....	.....			
*113	75	.....	4697	.....	.....	9	41	....	....	....	7	13	....	....	4	4	....	....	....	8	51	39		15	
....	....	1·3773	.....	0825	2149	....	....	....	....	....	....	....	8·8	....	....	....	12	47	....	....	....	.....			
658	470	14·4655	5·0253	3·8097	2·7768	111	27	....	27	43	32	11	....	....	96 + 72 =168	19 0 19	174	40	+50 .... −18 +17 .... − 6	108	25	1001			
51	36	1·0333	3590	·2721	·1983	8	34	...	4	37	4	36	....	....	12	57	12	29		8	20	77·00			

APPENDIX 13.

TABLE VI.—Tidal Fluctuations at St. Jean des Chaillons during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers. Series III. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of flood.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming – or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of submits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.	In duration of ebbs.
		H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min.	Min.
	Oct. 26 L.W.	12	17	A.M.	...	...	...	...	...	...	+47	....	9·2191	..	.....	.. ...	... ...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	do 26 H.W	4	55	A.M.	4	38	...	...	...	...	+21	35	14·6058	5·3867	.....	11·7799	4·7018	...	57
	do 26 L.W.	1	35	P.M.	...	...	8	40	12	50	....	37	9·6388	.....	4·9670	.....	.....	28	...
16	do 26 H.W	5	45	P.M.	4	10	...	...	...	...	...	33	14·0832	4·4444	.....	12·0236	4·8445	...	42
	do 27 L.W.	1	43	A.M.	...	...	7	58	12	23	...	37	9·5638	.....	4·5194	.....	.....	15	...
	do 27 H.W	6	8	A.M.	4	25	...	...	...	...	— 2	29	15·0108	5·4470	.....	12·3126	4·9928	...	19
	do 27 L.W.	2	25	P.M.	...	...	8	17	12	25	...	40	10·0685	.....	4·9423	.....	.....	17	...
17	do 27 H.W	6	33	P.M.	4	8	...	...	...	...	...	28	15·1311	5·0626	.....	12·6322	5·0674	...	5
	do 28 L.W.	2	45	A.M.	...	...	8	12	12	21	...	47	10·1285	...	5·0026	.....	.....	1	...
	do 28 H.W	6	54	A.M.	4	9	...	...	...	...	—°1	27	15·3905	5·2620	.....	12·7265	5·1410	...	3
	do 28 L.W.	3	9	P.M.	...	...	8	15	12	28	....	39	10·1835	.....	5·2070	.....	.....	4	...
18	do 28 H.W	7	22	P.M.	4	13	...	...	...	...	...	37	15·2758	5·0923	.....	12·7895	5·1873	...	11
	do 29 L.W.	3	26	A.M.	...	...	8	4	12	16	..	40	10·2082	...	5·0676	.....	.....	1	...
	do 29 H.W	7	38	A.M.	4	12	...	...	...	...	—10	30	15·5905	5·3823	.....	12·9282	5·5795	...	10
	do 29 L.W.	† 3	52	P.M.	...	...	8	14	12	24	...	25	10·0685	.....	5·5220	.....	.....	2	...
19	do 29 H.W	‡ 8	2	P.M.	4	10	...	...	...	...	...	28	16·4149	6·3464	.....	13·1636	6·1403	...	°0
	do 30 L.W.	4	16	A.M.	...	...	8	14	12	11	....	22	10·1185	.....	6·2964	.....	.....	13	...
	do 30 H.W	8	13	A.M.	3	57	...	...	...	...	—27	30	16·5149	6·3964	.....	13·4828	5·9792	...	8
	do 30 L.W.	4	35	P.M.	...	...	8	22	12	12	....	25	10·8679	.....	5·6470	.....	.....	7	...
20	do 30 H.W	8	25	P.M.	3	50	...	...	...	...	....	24	16·4450	5·5771	.....	13·5590	5·3122	...	1
	do 31 L.W.	4	46	A.M.	...	...	8	21	12	22	..	24	10·9379	.....	5·5071	.....	.....	11	...
	do 31 H.W	8	47	A.M.	4	1	...	...	...	...	—15	30	15·4555	4·5176	.....	13·1554	5·0948	...	2
	do 31 L.W.	5	10	P.M.	...	...	8	23	12	13	.....	32	10·2782	.....	5·1773	....	.....	11	...
21	do 31 H.W	§ 9	0	P.M.	3	50	...	...	...	...	...	27	15·4554	5·1772	.....	12·7995	5·3019	...	3
	Nov. 1 L.W.	5	26	A.M.	...	...	8	26	12	12	...	50	10·0188	.....	5·4366	.....	.....	4	...
	do 1 H.W	9	12	A.M.	3	46	...	...	...	...	—18	27	15·4253	5·4165	.....	12·7982	5·5242	...	6
	do 1 L.W.	5	32	P.M.	...	...	8	20	12	20	....	26	10·0534	....	5·3819	.....	.....	14	...
22	do 1 H.W	9	32	P.M.	4	0	...	...	...	...	...	25	15·9152	5·8618	.....	12·8069	5·4619	...	31
	do 2 L.W.	6	23	A.M.	...	...	8	51	12	21	..	23	10·0986	.....	5·8166	.....	.....	25	...
	do 2 H.W	9	58	A.M.	3	35	...	...	...	...	—13	26	14·8858	4·7872	.....	12·7033	5·4393	...	55
	do 2 L.W.	5	54	P.M.	...	...	7	56	12	16	....	31	9·8688	.....	5·0170	.....	.....	45	...
23	do 2 H.W	10	14	P.M.	4	20	...	...	...	...	....	30	16·0052	6·1364	.....	12·8045	5·6267	...	16
	H.W.	126	38								+21	466	247·6149						
Totals 15½ tides.					65	24	124	33	185	14	.....	.....	.....	86·2939	79·5078	204·4657	85·3948	198	269
	L.W.	60	57								—86	498	152·1019						
	16 H.W.										+21	29	15·4759						
Means	do				4	5	8	18	12	21	.....	.....	.....	5·3934	5·3005	12·7791	5·3372	13	17
	15 L.W.										—12	33	10·1401						

N.B.—Maxima in whole lunar month indicated by a star, thus: *, and minima by a circle, thus: °.
†Moon crosses equator, Oct. 29th. ‡Moon apogee, Oct. 29th at 6h. 0m. p.m. §Full moon (Quebec) Oct. 31st at 4h. 31m. p.m.

APPENDIX 13.

TABLE VI.—Tidal Fluctuations at St. Jean des Chaillons during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RELULTS OF TIDAL OBSERVATIONS—(*Continued.*)									RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."															
Diurnal Inequalities.									Eastern standard civil times of meridian passages immediately preceding high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming + or lagging—of tides		Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series III. Gaining tides. Gauge book reference numbers.
In semi tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitadal intervals.		Oscillations of float in hundredths of a foot.		Upper passage.		Lower passage.		Ages, etc.										
Min	Feet.	Feet.	Feet.	Feet.	H.	M.			H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.		H.	M.		
....	.....	.....	.....	.....	...	...	...		...	...	...	...	...	...	...	...	...	+ 34		...	...	...	
....	.....	.....	.....	.....	...	...	...		...	...	...	...	...	...	...	...	...	.....		...	...	...	
29	.....	4197	.....	.....	9	19	...		7	36	...	...	...	4	51	...	...	+ 38		9	15	40	
....	5226	.....	2437	1427	...	...	...		....	...	...	...	9 8	...	...	12	41	.....		...	...	...	
27	.....	0750	.....	.....	9	47	...		...	...	7	58	....	5	32	...	...	.....		9	34	42	16
....	9276	.....	2890	1483	...	...	...		...	...	...	...	...	...	...	12	37	.....		...	...	...	
2	.....	5047	.....	.....	9	48	1		8	20	...	...	...	6	9	...	...	+ 18		9	49	46	
....	1203	.....	3196	0746	...	...	...		...	...	...	...	10 8	...	...	12	31	.....		...	...	...	
4	.....	0600	.....	.....	9	51	...		...	...	8	42	....	6	40	...	...	.....		9	58	51	17
....	2594	.....	0943	0736	...	...	...		...	...	...	...	...	...	...	12	27	.....		...	...	...	
7	.....	0550	.....	.....	9	51	...		9	3	...	...	...	7	7	...	...	+° 0		10	4	56	
....	1147	.....	0630	0463	...	...	...		...	...	...	...	11 8	...	...	12	23	.....		...	...	...	
12	.....	0247	.....	..... *	9	58	...		...	...	9	24	....	7	30	...	...	.....		*10	6	61	18
....	3147	.....	1387	3922	...	...	...		...	...	...	...	...	...	...	12	21	.....		...	...	...	
8	.....	1397	.....	.....	9	53	...		9	45	...	...	...	7	51	...	...	— 10		10	6	65	
....	8244	.....	2354	5608	...	...	...		...	...	...	...	12 8	...	...	12	19	.....		...	...	...	
13	.....	0500	.....	.....	9	56	1		...	...	10	6	....	8	10	...	...	.....		10	4	70	19
....	1000	.....	3192	1611	...	...	...		...	...	...	...	...	...	...	12	17	.....		...	...	...	
1	.....	7494	.....	.....	9	46	..		10	27	...	...	...	8	27	...	...	— 16		10	0	74	
....	0699	.....	0762 *	6670	...	...	...		...	...	...	...	13 8	...	...	12	17	.....		...	...	...	
10	.....	0700	.....	.....	9	37	1		...	...	10	48	....	8	44	...	...	.....		9	56	77	20
....	9895	.....	4036	2174	...	...	...		...	...	...	...	...	...	...	12	16	.....		...	...	...	
9	.....	6597	.....	.....	9	38	....		11	9	...	...	...	9	0	...	...	— 19		9	51	80	
....	° 0001	.....	3559	3071	...	...	...		...	...	...	...	14 8	...	...	12	15	.....		...	...	...	
1	.....	2594	.....	.....	9	30	..		...	...	11	30	○	9	15	...	...	.....		9	45	83	21
..	0201	.....	° 0013	2223	...	...	...		...	...	...	...	...	...	...	12	16	.....		...	...	...	
8	.....	0346	.....	.....	9	20	....		11	52	...	...	...	9	31	...	...	—*20		9	39	85	
....	4799	.....	0087	0623	...	...	...		...	...	...	...	15 8	...	...	°12	14	.....		...	...	...	
1	.....	0452	.....	.....	9	18	....		...	...	12	14	....	9	45	...	...	.....		9	31	86	22
...	1·0294	.....	1036	0226	...	...	...		...	...	...	...	...	...	...	12	15	.....		...	...	...	
5	.....	2298	.....	.....	9	21	....		12	37	...	...	...	10	0	...	...	— 20		9	23	86	
...	1·1194	.....	1012	1874	...	...	...		...	...	...	...	16 8	...	...	12	15	.....		...	...	...	
2	.....	.....	.....	.....	9	14	....		...	...	1	0	...	10	15	...	...	.....		9	15	86	23
											71	42						+ 56					
139	6·8920	3·3769	2·7534	3·2857	154	7	....		80	49	+12	0	....	128	47	185	24	.....		156	16	1088	
											=83	42						— 85					
																		+ 19					
9	·4595	·2251	·1836	·2190	9	38	...		10	6	10	28	....	8	3	12	22	.....		9	46	68·00	
																		— 17					

APPENDIX 13.

TABLE VI.—Tidal Fluctations at St. Jean des Chaillons during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series IV. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of halt tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides Min.	Duration of apparent stand within 0·05 ft. Min	Elevation of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min.
	Nov 2 H.W	10	14	P.M.	....	..	....	..	....	..	− 13	....	16·0052	.. ....	.....	.....	.....	.
	.....	..	..	.....	....	..	....	..	....	..	.....	....	.....	.....	.....	.....	.....	...
¼	Nov 3 L.W.	6	26	A.M.	....	..	8	12	12	14	....	25	10·1135	.....	5·8917	.....	.....	18
¾	do 3 H.W	10	28	A.M.	4	2	....	..	....	..	− 26	34	15·5752	5·4617	.....	13·0917	5·7217	..
¾	do 3 L.W.	6	25	P.M.	....	..	7	57	12	10	....	34	10·3482	.....	5·2270	.....	.....	11
24	do 3 H.W	10	38	P.M.	4	13	....	..	....	..	....	28	16·6546	6·3064	.....	13·3852	5·7469	....
¼	do 4 L.W.	7	7	A.M.	....	..	8	29	12	28	....	35	10·6752	.....	5·9794	.....	.....	14
¾	do 4 H.W	11	6	A.M.	3	59	....	..	....	..	− 23	20	16·1499	5·4747	.....	13·5895	5·7055	....
¾	do 4 L.W.	7	6	P.M.	....	..	8	0	11	59	....	21	10·7982	.....	5·3517	.....	.....	° 0
25	do 4 H.W	11	5	P.M.	3	59	....	..	....	..	....	34	16·8146	6·0164	.....	13·5172	5·4179	....
¼	do 5 L.W.	7	26	A.M.	....	..	8	21	12	38	....	° 13	10·8182	.....	5·9964	.....	.....	18
¾	do 5 H.W	11	43	A.M.	4	17	....	..	....	..	+ 12	31	15·1255	4·3073	.....	13·1317	5·1069	....
¾	do 5 L.W.	7	42	P.M.	....	..	7	59	12	24	....	28	10·3384	.....	4·7871	.....	.....	8
26	do 6 H.W	12	7	A.M.	+ 4	25	....	..	....	..	....	19	15·6752	5·3368	.....	12·6364	5·0856	....
¼	do 6 L.W.	8	16	A.M.	....	..	8	9	12	17	....	18	9·8488	.....	5·8264	.....	.....	17
¾	do 6 H.W	12	24	P.M.	4	8	....	..	....	..	* − 29	30	14·2411	4·3923	.....	12·4591	5·2305	....
¾	do 6 L.W.	8	3	P.M.	....	..	7	39	12	4	....	25	9·8388	.....	4·4023	.....	.....	17
27	do 7 H.W	12	28	A.M.	4	25	....	..	....	..	....	31	16·1399	6·3011	.....	12·6814	5·2105	....
¼	do 7 L.W.	9	13	A.M.	....	..	8	45	12	36	....	42	10·3135	.....	5·8264	.....	.....	34
¾	do 7 H.W	1	4	P.M.	3	51	....	..	....	..	+ 6	34	14·6258	4·3123	.....	12·8326	5·1281	....
¾	do 7 L.W.	8	54	P.M.	....	..	7	50	12	20	....	33	10·2235	.....	4·4023	.....	.....	39
28	do 8 H.W	1	24	A.M.	4	30	....	..	....	..	....	22	16·1949	5·9714	.....	12·7632	4·9647	....
¼	do 8 L.W.	10	10	A.M.	‡	..	8	46	12	36	....	32	10·3382	.....	5·8567	.....	.....	40
¾	do 8 H.W	2	0	P.M.	3	50	....	..	....	..	+ 6	34	13·9664	3·6282	.....	12·3522	4·7074	....
¾	do 8 L.W.	10	11	P.M.	....	..	8	11	12	20	....	23	9·6588	.....	4·3076	.....	.....	49
29	do 9 H.W	2	50	A.M.	§*4	39	....	..	....	..	* 41	14·6958	5·0370	.....	12·4346	4·2339	....
¼	do 9 L.W.	11	10	A.M.	....	..	8	20	12	34	....	26	10·9765	.....	3·7193	.....	.....	25
¾	do 9 H.W	3	24	P.M.	4	14	....	..	....	..	+ ·5	31	14·8485	3·8720	.....	12·9169	3·7308	....
¾	do 10 L.W.	11	52	A.M.	....	..	8	28	12	21	....	22	11·1265	.....	3·7220	.....	.....	21
30	do 10 H.W	3	45	A.M.	3	53	....	..	....	..	....	25	14·7365	3·6100	.....	12·9421	3·4766	....
	.....	..	..	.....	....	..	8	25	12	5	....	32	.....	.....	° 3·4553	.....	.....	15
¼	do 10 L.W.	12	10	P.M.	....	..	....	..	....	..	.....	....	11·2812	.....	.....	.....	.....	....
	H.W.	106	26	+24							+ 29	414	215·4439					
	Tot'ls 14 tides = L.W.	120	1	...	58	25	123	31	185	6	− 78	409	145·4163	70·0276	74·7516	180·7338	69·4670	316
	14 H.W										+ 13	30	15·3889					
	Means do	...	..	...	4	10	8	14	12	20	.....	.....	.....	5·0020	4·9834	12·9096	4·9619	21
	14 L.W										− 26	27	10·3869					
	Grd. totals H.W										+ 214	1607	904·3621					
	57 tides.....	...	..	.....	232	49	483	49	720	24	.....	.....	.....	303·8340	306·8918	752·4708	303·9667	1079
	L.W.										− 212	1810	600·5281					
	57 H.W										+ 16	28	15·8660					
	Grd. means do	...	..	....	4	5	8	21	12	25	.....	.....	.....	5·3304	5·2912	13·2012	5·3327	19
	57 L.W.										− 14	31	10·5356					

N.B.—Maxima in whole lunar month indicated by a star, thus : *, and minima by a circle, thus : °.
§Maximum diurnal inequality observed in low water levels = 1·318.

APPENDIX 13.

TABLE VI.—Tidal Fluctations at St. Jean des Chaillons during the Low water season of 1887, viz. :—from quadrature, October 9th, to qnadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—*Continued.*

Diurnal Inequalities.

In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.	Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon. Upper passage.	Lower passage.	Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)	Length of half tide day H. W. to H. W.	Priming—or lagging + of tides	Lunitidal intervals.	General coefficients of semi-amplitudes from "Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series IV. Losing tides. Gauge book reference numbers.
Min	Min	Feet.	Feet.	Feet.	Feet.	H. M.		H. M.	H. M.	Days.	H. M.	H. H.	Min.	H. M.		
													− 20			
			2447													
		4300		2872	0950							12 15				
15	4		2347			9 05		1 23			10 30		− 19	9 7	86	
		1·0794		2935	0252					17·8		12 16				
32	18		3270			8 51			1 47		10 46			8 59	84	24
		5047		2043	0414							12 15				
29	29		1230			8 55		2 11			11 1		− 19	8 50	82	
		6647		0723	2876		1			18·8		12 16				
21	39		0200			8 29	2		2 36		11 17			8 41	80	25
		1·6891		3855	3110		1					12 16				
22	14		4798			8 41	1	3 2			11 33		− 16	8 31	76	
		5497		4953	0213		1			19·8		12 18				
10	7		4896			8 40			3 27		11 51			8 24	73	26
		1·4341		1773	1449							12 17				
30	13		0100			8 31		3 53			12 8		− 13	8 15	69	
		1·8988		2223	0200					20·8		12 20				
66	32		4747			8 8			4 20		12 28			8 8	64	27
		1·5141		1512	0824							12 21				
55	16		0900			8 18		4 46			12 49		− 5	8 3	59	
		1·5691		0694	1634					21·8		12 24				
56	16		1147			8 12			5 12		1 13			8 1	55	28
		2·2285		4110	2573		3			◑		12 27				
35	16		6794			8 21		5 39			1 40		+ 9	8 1	50	
		7294		0824	4735					22·8		12 32				
9	44		*1·3177			8 45	1		6 5		2 12			8 7	47	29
		1527		4823	5031							12 36				
8	13		1500			8 52		6 32		23·8	2 48		+ 28	8 16	44	
		1120		0252	2·542							12 42				
3	16		1547			8 47			6 58		3 30			8 32	44	30
		5365								24·8		12 43				
											115 46		+ 37			
											+ 60 0					
391	277	15·0928	4·9100	3·3692	2·6803	120 35		27 26	30 25		=175 46	185 58		117 55	913	
													− 72			
													+ 18			
28	20	1·0062	·3273	·2407	·1915	8 37		3 55	4 21		12 33	12 24		8 25	65·21	
													− 14			
													+210			
1578	1145	46·5134	15·7212	12·2158	11·6992	514 59		209 46	216 51		578 6	721 2		511 29	4144	
													−197			
													+ 19			
29	20	·8019	·2711	·2181	·2089	9 2		7 30	7 29		10 9	12 26		8 58	72·70	
													− 12			

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

†Moon's N. declination a maximum = 20° 39'. ‡Moon's last quarter (Quebec), from 0h. 02m., p.m. November 8th.

APPENDIX 13.

TABLE VII.—Tidal Fluctuations at Batiscan during the Low water season of 1887, viz.:—from quadrature of October 9th to quadrature of November 8th.

DIRECT OF RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series I. Gaining tides.	High and low waters observed each civil day.		Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to L.W.		Priming — or lagging + of tides.	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
			H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.
												+45						
	Oct. 12..	L. W.	1	2	A.M.	..	..	8	9	12	5	..	79	13·657	..	1·570	..	..
2	do 12..	H. W.	4	58	A.M.	3	56	..	..	..	..	..	25	16·142	2·485	..	14·693	2·004
	do 12..	L. W.	2	6	P.M.	..	..	9	8	12	56	..	28	13·726	..	2·416	..	..
	do 12..	H. W.	5	54	P.M.	3	48	..	..	..	..	+19	40	15·268	1·542	..	14·675	2·067
	do 13..	L. W.	2	0	A.M.	..	..	8	6	12	13	..	85	13·557	..	1·711	..	..
3	do 13..	H. W.	6	7	A.M.	4	7	..	..	..	..	..	52	16·152	2·595	..	14·731	2·197
	do 13..	L. W.	3	10	P.M.	..	..	9	3	12	58	..	65	13·706	..	2·446	..	..
	do 13..	H. W.	7	5	P.M.	3	55	..	..	..	..	+ 3	31	15·744	2·038	..	14·870	2·417
	do 14..	L. W.	3	13	A.M.	..	..	8	8	11	55	..	62	13·616	..	2·128	..	..
4	do 14..	H. W.	7	0	A.M.	3	47	..	..	..	..	..	39	16 669	3·053	..	15·014	2·717
	do 14..	L. W.	4	9	P.M.	..	..	9	9	12	45	..	69	13·696	..	2·973	..	..
	do 14..	H. W.	7	45	P.M.	3	36	..	..	..	..	+13	33	16·410	2·714	..	15·225	2·888
	do 15..	L. W.	4	25	A.M.	..	..	8	40	12	18	..	62	13·866	..	2·544	..	..
5	do 15..	H. W.	8	3	A.M.	3	38	..	..	..	..	..	26	17·186	3·320	..	15·454	2·927
	do 15..	L. W.	5	7	P.M.	..	..	9	4	12	15	..	62	14·114	..	3·072	..	..
	do 15..	H. W.	8	18	P.M.	3	11	..	..	..	..	+ 5	47	16·887	2·773	..	15·503	2·758
	do 16..	L. W.	5	43	A.M.	..	..	9	25	12	40	..	57	14·134	..	2·753	..	..
6	do 16..	H. W.	8	58	A.M.	3	15	..	..	..	..	..	19	16·569	2·435	..	15 401	2·714
	do 16..	L. W.	6	0	P.M.	..	..	9	2	12	32	..	62	13·954	..	2·615	..	..
	do 16..	H. W.	9	30	P.M.	3	30	..	..	..	..	—°1	26	17·006	3·052	..	15·473	2·998
	do 17..	L. W.	6	25	A.M.	..	..	8	55	12	17	..	62	13·994	..	3·012	..	..
7	do 17..	H. W.	9	47	A.M.	3	22	..	..	..	..	..	27	17·305	3·311	..	15·795	3·472
	do 17..	L. W.	6	22	P.M.	..	..	8	35	12	23	..	61	14·124	..	3·181	..	..
	do 17..	H. W.	10	10	P.M.	3	48	..	..	..	..	—23	20	18·507	*4·383	..	16·293	3·742
	do 18..	L. W.	6	47	A.M.	..	..	8	37	12	4	..	42	14·720	..	3·787	..	..
8	do 18..	H. W.	10	14	A.M.	3	27	..	..	..	..	..	26	18·338	3·618	..	16·592	*3·763
	do 18..	L. W.	7	16	P.M.	..	..	9	2	12	31	..	59	14·700	..	3·638	..	..
	do 18..	H. W.	10	45	P.M.	3	29	..	..	..	..	+ 4	25	18·707	4·007	..	16·608	3·667
		H.W.	114	34								+44	441	236·890				
Totals 14 tides...		L.W.	63	45	+24	50	49	123	3	173	52	..	855	195·564	41·326	37·846	216·327	40·331
			87	45								—24						
		14 H.W.										+ 9	32	16·921				
Means	do ...	14 L.W.	....	....	....	3	38	8	47	12	25	....	61	13·969	2·952	2·703	15·452	2·881
												—12						

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °
The zero of the gauge was taken to be 25·055ft. above datum instead of 25·0646ft. as per abstract of results

a Longitude—Batiscan, Brunell's wharf = 72° 15′ 0″ = 4h. 49m. 0s. = 0·2007 of a day west of Greenwich.
b Gentle N.W. wind. Fine weather.
c North-westerly breeze. Clear and cold.
d North-westerly breeze. Cloudy and cold.
e North-westerly breeze. Cloudy and cold. Fresh S.W. breeze. Dropping rain.
f Stiff S.W. breeze. Sky overcast.
g Light S.W. wind. Cold rain.
h S.W. wind. Rain.
i S.W. wind, hardly perceptible. Cloudy.
j N.W. wind, just perceptible. Sky overcast. Cold.
k Fresh N.W. breeze. Clouded sky.
l Gentle N.W. wind.

APPENDIX 13.

TABLE VII.—Tidal Fluctuations at Batiscan during the Low water season of 1887, viz.:—from quadrature of October 9th to quadrature of November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).

Diurnal Inequalities.

In duration of floods	In duration of ebbs	In semi-tide days.	In high water levels	In low water levels.	In mean tide levels	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high wsters, with corresponding ages and phases of the moon. Upper passage.		Lower passage.		Ages, etc,	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to L.W.		Priming — or lagging + of tides.	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series I. Gaining tides. Gauge book reference numbers.
Min.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.		
			915														12	46	+34				
	59	51		069			9	38	1			7	20		4	42				9	22	39	2
	8		874		018	063			3								*12	47					
	62	43		169			10	7		7	47			25·1	5	29			*+40	9	42	42	
19			884		056	130			8								12	43					
	57	45		149			9	52	5			8	15		6	12				9	57	47	3
12			408		139	220			1					26·1			12	39					
	55	63		090			10	23		8	42				6	51			+22	10	9	54	
8			925		144	300											12	33					
	61	50		080			9	50	5			9	10		7	24				10	14	62	4
11			259		211	171								27·1			12	29					
	29	27		170			10	8		9	37				7	53			+ 5	10	16	71	
2			776		229	039											12	26					
	24	3		248			9	59	1			10	4		8	19				10	15	80	5
27			299		049	169			3					28·1			12	25					
	21	25		020			9	46	3	10	32				8	44			—°2	10	12	89	
4			318		102	044											12	23					
	23	8		180			9	58	7			11	0		9	7				10	7	97	6
15			437		072	284								29·1			12	22					
	17	15		040			10	2		11	28			●	9	29			— 6	10	1	104	
8			299		322	474											12	22					
	20	6		130			9	51				11	56		9	51				9	55	110	7
26			1·202		498	270								0·8			12	22					
	2	19		596			9	46		12	24				10	13			— 7	9	49	114	
21			169		299	021											12	21					
	25	27		020			9	22				12	52		10	34				9	42	116	8
2			369		016	096								1·8			12	22					
	14	8		149			9	24		1	21				10	56			— 7	9	35	*117	
										61	51								+67				
										+12	0												
163	469	390	8·134	2·110	2·155	2·281	138	6		=73	51	70	37		115	44	175	0		139	16	1142	
																			—22				
																			+22				
13	34	28	0·581	0·151	0·166	0·176	9	52		10	33	10	5		8	16	12	30	— 6	9	57	81·57	

n Feeble N.W. wind. Fine clear weather.
o Feeble N.W. wind. Fine clear weather.
p Fresh S.W. breeze.
q S.W. wind.
r Moon crosses equator Oct. 16th.
s Stiff S.W. breeze. Clear and cold.
t Moon in perigee, Oct. 15th, at 1 p.m. Strong S.W. wind.
u Wind going down. Appearance of rain. New moon (Quebec) at 5.35 p.m., Oct. 16th.
v Fresh N.E. breeze. Rain at midnight.
v Feeble S.W. wind. Fine.
w S.W. wind, just perceptible. Fine day.
x Gentle N.E. breeze. Clouding up; appearance of rain.
z S.W. wind. Weather clearing up.
aa Wind changes from S. to N.W. Fresh breeze blowing.
bb N.W. breeze, just perceptible. Fine clear weather.
cc Most important tide but one during 1887, viz.: evening tide of March 11th, for which coefficient of semi-amplitude is 118. N.W. wind; fine.

APPENDIX 13.

TABLE VII.—Tidal Fluctuations at Batiscan during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series II.	Losing tides.	High and low waters observed each civil day.		Time, Eastern Standard. H.	M	A.M. or P.M.	Duration of floods. H.	M	Duration of ebbs. H.	M	Length of half tide day H.W. to H.W. H.	M	Priming − or lagging + of tides Min.	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min.	In duration of ebbs. Min.
½	Oct. 18	H.W		10	41	P.M.							+ 4		18·707						
	Oct. 19	L.W.	*a*	8	1	A.M.			9	16	12	23		59	14·849		*3·858			22	
9	do 19	H.W	*b*	11	8	A.M.	3	7						23	18·010	3 161		16·595	3·531		26
¼	do 19	L.W.	*c*	7	58	P.M.			8	50	12	25		57	14·810		3·200			28	
¾	do 19	H.W	*d*	11	33	P.M.	3	35					− 5	30	18·716	3·906		16·600	3·492		22
¼	do 20	L.W.	*e*	8	45	A.M.			9	12	12	20		50	14·898		3·818			27	
10	do 20	H.W	*f*	11	53	A.M.	3	8						25	17·940	3·042		16·602	3·467		29
¼	do 20	L.W.	*g*	8	36	P.M.			8	43	12	21		29	14·839		3·101			30	
¾	do 21	H.W	*h*	12	14	A.M.	3	38					− 9	27	*18·746	3·907		16·606	3·374		23
¼	do 21	L.W.	*i*	9	20	A.M.			9	6	12	20		41	14·998		3·748			24	
11	do 21	H.W	*j*	12	34	P.M.	3	14						26	17·736	2·738		*16·610	3·213		30
¼	do 21	L.W.	*k*	9	10	P.M.			8	36	12	18		53	15·008		2·728			28	
¾	do 22	H.W	*l*	12	52	A.M.	3	42					+ 8	29	18·647	3·639		16·458	2·750		70
¼	do 22	L.W.	*m*	10	38	A.M.			*9	46	12	40		64	15·158		3·489			48	
12	do 22	H.W	*n*	1	32	P.M.	2	54						58	16·392	1·144		15·793	2·076		43
¼	do 22	L.W.	*o*	10	35	P.M.			9	3	12	44		51	14·352		1·950			47	
¾	do 23	H.W	*p*	2	16	A.M.	3	41					+ *69	71	16·072	1·720		15·017	1·798		31
¼	do 23	L.W.	*q*	11	50	A.M.			9	34	13	15		69	13·885		2·187			°0	
13	do 23	H.W	*r*	3	31	P.M.	3	41						90	15·218	1·333		14·782	2·005		107
¼	do 23	L.W.	*s*	11	18	P.M.			7	47	°11	35		31	13·672		1·546			7	
¾	do 24	H.W	*t*	3	6	A.M.	3	48					− 21	°17	16·629	2·957		15·109	1·907		52
¼	do 24	L.W.	*u*	11	45	A.M.			8	39	12	54		68	14·640		1·989			27	
14	do 24	H.W	*v*	4	0	P.M.	4	15						20	15·774	1·134		15·033	1·696		21
¼	do 25	L.W.		1	0	A.M.			9	0	12	25		68	13·731		2·043			50	
¾	do 25	H.W	*w*	4	25	A.M.	3	25					+ 68	73	15·347	1·616		14·358	1·627		45
¼	do 25	L.W.	*x*	2	10	P.M.			9	45	*13	33		82	13·358		1·989			23	
15	do 25	H.W	*y*	5	58	P.M.	3	48						*104	14·214	0·856		°13·969	1·569		*128
½	do 26	L.W.	*z*	1	35	A.M.			°7	37	11	58		47	°13·010		°1·204			33	
		H.W.		97	2	+12·0															
				=109	2								+ 145	593	219·351						
Totals	13½ tides			112	41	+36·0	45	56	124	54	175	11					31·158	36·850	203·532	32·505	394	627
		L.W.		=148	41								− 35	769	201·208						
	13	H.W.											+ 48	46	16·873						
Means	do			....	..	.....	3	32	8	55	12	31				2·396	2·632	15·656	2·500	28	48
	14	L.W.											− 12	55	14·372						

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °

a. Easterly wind, hardly perceptible, fine. *b*. Fine, clear weather.
c. N.W. wind just perceptible; fine and bright. *d*. N.W. wind; clear, cold weather.
e. Ordinary N.E. breeze; cold and clear. *f*. Fresh N.E. breeze; fine day.
g. Fresh N.E. breeze; fine day. *h*. Fresh N.E. breeze; fair. *i*. Fresh N.E breeze; rain.
j. N.E. wind; cold rain. *k*. Gentle S.W. breeze; fair weather.
l. Stiff S.W. breeze; sky overcast. Moon's S. declination a maximum = 20° 8′.
m. Maximum diurnal inequality observed in high water levels = 2·345 feet. N.W. wind; fair; cold.

APPENDIX 13.

TABLE VII.—Tidal Fluctuations at Batiscan during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Diurnal Inequalities.									Eastern standard civil times of meridian passages immediately preceding observed high waters, with correspondingages and phases of the moon.													
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2).		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series II. Losing tides. Gauge book reference numbers.
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.		
....	.....	.....	.....	.....	...	...	...	...	...	...	...	...	.....	...	...	...	— 7	...	...	.....	½
....	.....	149	.....	.....	...	...	...	...	...	...	...	...	.....	...	...	...	...	...	...	.....	½
....	697	.....	013	136	...	...	...	...	...	...	...	...	.....	...	12	21	...	...	...	.....	¾
2	.....	039	.....	.....	9	18	...	...	...	1	50	...	11	17	...	...	...	9	27	116	9
...	706	.....	005	039	...	...	...	...	...	...	...	2	8	...	12	22	...	...	...	.....	¼
5	.....	088	.....	.....	9	14	...	2	19	...	...	...	11	39	...	...	— 6	9	20	113	¼
....	776	.....	002	025	...	...	...	...	...	...	...	...	.....	...	12	22	...	...	...	.....	¾
1	.....	059	.....	.....	9	5	...	...	...	2	48	...	12	1	...	...	...	9	13	108	10
...	806	.....	004	093	...	...	...	...	...	...	...	3	8	...	12	21	...	...	...	.....	¼
1	.....	159	.....	.....	8	48	...	3	16	...	...	...	12	22	...	...	— 7	9	6	101	¼
...	1·010	.....	004	161	...	...	...	...	...	...	...	...	.....	...	12	22	...	...	...	.....	¾
2	.....	010	.....	.....	8	49	...	...	...	3	45	...	12	44	...	...	...	8	59	94	11
...	911	.....	152	463	...	...	...	...	...	...	...	4	8	...	12	22	...	...	...	.....	¼
22	.....	150	.....	.....	8	39	...	4	13	...	...	...	1	6	...	...	— 5	8	53	86	¼
....	*2·345	.....	665	*674	...	...	...	...	...	...	...	...	.....	...	12	23	...	...	...	.....	¾
4	.....	806	.....	.....	8	51	...	...	...	4	41	...	1	29	...	...	...	8	48	77	12
...	230	.....	*776	278	...	...	...	...	...	...	...	5	8	...	12	25	...	...	...	.....	¼
31	.....	467	.....	.....	9	9	...	5	7	...	...	...	1	54	...	...	+ 2	8	47	68	¼
....	854	.....	235	207	...	...	...	...	...	...	...	...	.....	...	12	27	...	...	...	.....	¾
*100	.....	213	.....	.....	9	57	...	...	...	5	34	◑	2	21	...	...	...	8	47	60	13
...	1·411	.....	327	098	...	...	...	...	...	...	...	6	8	...	12	30	...	...	...	.....	¼
79	.....	*968	.....	.....	9	6	...	6	0	...	...	...	2	51	...	...	+14	8	51	52	¼
....	855	.....	076	211	...	...	*25	...	...	...	...	...	.....	...	12	34	...	...	...	.....	¾
29	.....	909	.....	.....	9	35	...	...	...	6	25	...	3	25	...	...	...	9	0	46	14
....	427	.....	675	069	...	...	5	...	...	...	...	7	8	...	12	40	...	...	...	.....	¼
68	.....	373	.....	.....	9	36	...	6	49	...	...	...	4	5	...	...	+34	9	16	41	¼
....	1·133	.....	389	058	...	...	...	...	...	...	...	...	.....	...	12	44	...	...	...	.....	¾
95	.....	348	.....	.....	10	45	...	...	...	7	13	...	4	49	...	...	...	9	36	39	15
....	1·024	.....	038	197	...	...	...	...	...	...	...	8	8	...	12	47	...	...	...	.....	¼
													+ 82	3			+50				
													+ 96	0							
439	13·185	4·738	3·361	2·709	121	2	...	27	44	32	16	...	= 178	3	174	40	...	118	3	1001	
																	—18				
																	+17				
34	0·942	0·338	0·240	0·194	9	19	...	4	37	4	37	..	13	42	12	29	...	9	5	77·00	
																	— 6				

n. Strong N.W. wind; cloudy and cold. *o.* N.W. breeze; cold.
p. Gentle N.W. breeze; freezing hard; fine. *q.* S.W. wind; fair.
r. Moon's first quarter (Quebec) Oct. 23rd, from 0h. 46m. p.m.; cloudy.
s. Stiff N.E. breeze; snowing hard. *t.* N.E. breeze; raining. *u.* High S.W. wind or gale; rain.
v. S.W. wind, going down. *w.* Moderate S.W. breeze; clear and frosty.
x. N.W. breeze; foggy at intervals. *y.* Light N.W. breeze; bright and cold.
z. Gentle N.W. breeze; clear and cold.

APPENDIX 13.

Table VII.—Tidal Fluctuations at Batiscan during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers. Series III. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides.	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods	In duration of ebbs.
		H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min	Min
‡	Oct. 26 L.W.	4	35	A.M.	..	..	..	..	..	..	+ 68	....	13·010	..	.....	...	....	.....	.....
‡	do 26 H.W *a*	5	56	A.M.	4	21	..	..	..	..	+ 6	69	15·238	2·228	.....	14·007	1·766	....	77
‡	do 26 L.W. *b*	2	50	P.M.	..	..	8	54	12	58	.....	82	13·238	.....	2·000	.....	.....	17	...
16	do 26 H.W *c*	6	54	P.M.	4	4	..	..	..	..	.....	73	14·869	1·631	.....	14·166	1·964	....	48
‡	do 27 L.W. *d*	3	0	A.M.	..	..	8	6	11	58	.....	60	13 130	....	1·739	.....	.....	12	...
‡	do 27 H.W *e*	6	52	A.M.	3	52	..	..	..	..	— 24	43	15·615	2·485	.....	14·377	2·157	....	45
‡	do 27 L.W. *f*	3	43	P.M.	..	..	8	51	12	28	. . *	90	13·467	.....	2·148	.....	.....	15	....
17	do 27 H.W *g*	7	20	P.M.	3	37	..	..	..	..	.....	47	15·724	2·257	....	14·630	2·245	....	5
‡	do 28 L.W. *h*	4	6	A.M.	..	..	8	46	12	20	. .	71	13·547	....	2·177	.....	.....	3	....
‡	do 28 H.W *i*	7	40	A.M.	3	34	..	..	..	..	+ 10	38	15·943	2·396	....	14·715	2·277	....	17
‡	do 28 L.W. *j*	4	43	P.M.	..	..	9	3	12	40	.....	85	13·607	.....	2·336	.....	.....	3	....
18	do 28 H.W *k*	8	20	P.M.	3	37	..	..	..	..	.....	55	15·804	2·197	.....	14·759	2·304	....	32
‡	do 29 L.W. *l*	4	51	A.M.	..	..	8	31	12	3	.....	63	13·607	....	2·197	.....	.....	5	....
‡	do 29 H.W *m*	8	23	A.M.	3	32	..	..	..	..	— 19	48	16·092	2·485	.....	14·888	2·692	....	24
‡	do 29 L.W. *n*	5	18	P.M.	..	..	8	55	12	28	.....	32	13·477	.....	2·615	.....	.....	1	...
19	do 29 H.W *o*	8	51	P.M.	3	33	..	..	..	..	.....	26	16·946	3·469	....	15·211	2·988	....	19
‡	do 30 L.W. *p*	5	27	A.M.	..	..	8	36	12	9	.....	54	13·955	....	2·991	.....	.....	0	....
‡	do 30 H.W *q*	9	0	A.M.	3	33	..	..	..	..	—*38	35	16·833	2·878	.....	15·477	2·795	....	2
20	do 30 L.W. *r*	5	38	P.M.	..	..	8	38	12	3	.....	62	14·204	....	2·629	.....	.....	8	....
20	do 30 H.W *s*	9	3	P.M.	3	25	..	..	..	..	.....	37	16·887	2·683	....	15·441	2·414	....	29
‡	do 31 L.W. *t*	6	10	A.M.	..	..	9	7	12	23	.....	72	14.263	....	2·624	.....	.....	9	....
‡	do 31 H.W	9	26	A.M.	3	16	..	..	..	..	— 13	50	15·982	1·719	....	15·120	2·152	....	7
‡	do 31 L.W. *u*	6	26	P.M.	..	..	9	0	12	14	.....	70	13·825	.....	2·157	.....	.....	2	....
21	do 31 H.W *v*	9	40	P.M.	3	14	..	..	..	..	.....	60	15·933	2·108	.....	14·796	2·298	....	2
‡	Nov. 1 L.W. *w*	6	38	A.M.	..	..	8	58	12	23	.....	52	13·468	.....	2·465	.....	.....	11	....
‡	do 1 H.W	10	3	A.M.	3	25	..	..	..	..	— 17	41	15·932	2·464	.....	14·782	2·530	....	° 1
‡	do 1 L.W. *x*	7	0	P.M.	..	..	8	57	12	10	.....	67	13·567	.....	2·365	.....	.....	12	....
22	do 1 H.W *y*	10	13	P.M.	3	13	..	..	..	..	.....	33	16·390	2·823	.....	14·806	2·467	...	11
‡	do 2 L.W. *z*	7	21	A.M.	..	..	9	8	12	40	.....	64	13·577	.....	2·813	.....	.....	19	...
‡	do 2 H.W *aa*	10	53	A.M.	3	32	..	..	..	..	— 15	70	15·445	1.868	....	14·714	2·473	....	45
‡	do 2 L.W. *bb*	7	16	P.M.	..	..	8	23	11	55	. .	40	13·378	....	2·067	.....	.....	0	....
23	do 2 H.W *cc*	10	48	P.M.	3	32	..	..	..	..	.....	30	16·524	3·146	.....	14·794	2·703	...	36
	H.W.	139	22								+ 16	755	256·157						
Totals	15½ tides.	86	27	...	57	20	131	53	184	52	.....	.....	.....	38·837	35·323	236·683	38·225	117	400
	L.W.										—126	964	204·310						
	16 H.W.										+ 8	47	16·010						
Means	do				3	35	8	48	12	19	.....	.....	.....	2·427	2·355	14·793	2·389	8	25
	15 L.W.										— 21	64	13·621						

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °

a N.W. wind, just perceptible. Fine, clear, frosty weather.
b S.W. wind do do
c do do do
d Stiff N.E. breeze. Clear and cold.
e do Hard frost.
N.E. wind just perceptible. Fine, clear, but milder weather.
g N.E. wind. Fine.
h N.E. wind. Fine and bright.
i N.E. wind, hardly perceptible.
j S.W. wind, just perceptible. Fine and mild.
k do do Cloudy, mild.
l Feeble S.W. wind. Sky overcast, appearance of rain.
m Feeble N. wind. Commencing to rain.
n Northerly breeze. Cold. Snow flurries. Moon crosses equator, Oct. 29th.

APPENDIX 13.

TABLE VII.—Tidal Fluctuations at Batiscan during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Diurnal Inequalities. In semi duration.	In high water levels	In low water levels	In mean tide levels	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon. Upper passage.		Lower passage.		Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming + or lagging — of tides.	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series III. Losing tides. Gauge book reference numbers.
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		
....	.	.....	..	.....	...	..	....	...	..	...	..	...	..	...	...	..	+ 34	...	..	.....	¼
60	.....	228	.....	.....	10	20	....	7	36	...	..	...	5	36	...	..	+ 38	10	0	40	¼
...	369	.....	159	198	...	..	.....	...	..	...	..	9·8	...	..	12	41	.....	...	..	.....	¼
60	.....	108	.....	.....	*10	56	....	...	..	7	58	....	6	17	...	..	.....	10	19	42	**16**
....	746	.....	211	193	...	..	.....	...	..	...	..	...	...	..	12	37	.....	...	..	.....	¼
30	.....	337	.....	.....	10	32	....	8	20	...	..	...	6	54	...	..	+ 18	10	34	46	¼
...	109	.....	253	088	...	..	.....	...	..	...	..	10·8	...	..	12	31	.....	...	..	.....	¼
8	.....	080	.....	.....	10	38	....	...	..	8	42	....	7	25	...	..	.....	10	43	51	**17**
....	219	.....	085	032	...	..	.....	...	..	...	..	...	...	..	12	27	.....	...	..	.....	¼
20	.....	060	.....	.....	10	37	....	9	3	...	..	...	7	52	...	..	+ 0	10	49	56	¼
...	139	.....	044	027	...	..	.....	...	..	...	..	11·8	...	..	12	23	.....	...	..	.....	¼
37	.....	000	.....	.....	10	56	....	...	..	9	24	..	8	15	...	..	.....	* 10	51	61	**18**
....	288	.....	129	388	...	..	.....	...	..	...	..	...	...	..	12	21	.....	...	..	.....	¼
25	.....	130	.....	.....	10	38	..	9	45	...	..	...	8	36	...	..	— 10	10	49	65	¼
....	854	.....	323	296	...	..	.....	...	..	...	..	12·8	...	..	12	19	.....	...	..	.....	¼
19	.....	478	.....	.....	10	45	....	...	..	10	6	...	8	55	...	..	.....	10	45	70	**19**
....	113	.....	266	193	...	..	.....	...	..	...	..	...	...	..	12	17	.....	...	..	.....	¼
6	.....	249	.....	.....	10	33	....	10	27	...	..	...	9	12	...	..	— 16	10	41	74	¼
...	054	.....	036	381	...	..	.....	...	..	...	..	13·8	...	..	12	17	.....	...	..	.....	¼
20	.....	059	.....	.....	10	15	7	...	..	10	48	....	9	29	...	..	.....	10	36	77	**20**
....	905	.....	321	262	...	..	.....	...	..	...	..	...	...	..	12	16	.....	...	..	.....	¼
9	.....	438	.....	.....	10	17	....	11	9	...	..	...	9	45	...	..	— 19	10	30	80	¼
....	049	.....	324	146	...	..	1	...	..	...	..	14·8	...	..	12	15	.....	...	..	.....	¼
9	.....	357	.....	.....	10	10	....	...	..	11	30	○	10	0	...	..	.....	10	24	83	**21**
...	001	.....	014	232	...	..	.....	...	..	...	..	...	...	..	12	16	.....	...	..	.....	¼
13	.....	099	.....	.....	10	11	....	11	52	...	..	...	10	16	...	..	—*20	10	16	85	¼
....	458	.....	024	063	...	..	.....	...	..	...	..	15·8	...	..	°	12	14	.....	...	..	¼
30	.....	010	.....	.....	9	59	....	...	..	12	14	....	10	30	...	..	.....	10	8	86	**22**
....	945	.....	092	006	...	..	2	...	..	...	..	...	...	..	12	15	.....	...	..	.....	¼
45	.....	199	.....	.....	10	16	2	12	37	...	..	...	10	45	...	..	— 20	10	0	86	¼
....	1 079	..	080	230	...	..	3	...	..	...	..	16·8	...	..	12	15	.....	...	..	.....	¼
26	..	..	..	..	9	40	....	...	..	1	0	....	11	0	...	..	.....	...	..	86	**23**
417	6·328	2·832	2·361	2·735	166	51	...	80	49	71 +12 =83	42 0 42	...	140	47	185	24	+ 56 ... — 85	168	16	1082	
26	·422	·189	·157	·182	10	26	....	10	6	10	28	...	8	48	12	22	+ 19 ..... — 17	10	31	68·00	

o Northerly breeze. Cold. Snowing. Moon in apogee, Oct. 29th at 6h. 0m. p.m.
p Gentle N. breeze. Sky clearing up.
q do Fine clear, cold.
r S.W. breeze.
s Stiff S.W. breeze.
t Ordinary S.W. breeze.
u Moderate S.W. breeze. Cloudy, but mild.
v Full moon (Quebec) Oct. 31st, at 4h. 31m. p.m. N. breeze clear and cold.
w N. breeze, just perceptible. Bright and cold.
x S.W. wind, clear hard frost.
y do diminishing. Fine.
z do getting stronger.
aa High S.W. wind. Clouding up.
bb S.W. wind, hardly perceptible. Sky overcast, mild.
cc N. wind, hardly perceptible. Sky overcast, mild.

APPENDIX 13.

TABLE VII.—Tidal Fluctuations at Batiscan during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers. Series IV. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.
		H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.
	Nov. 2 H.W	10	48	P.M.	...	....	....	....	...	....	− 15	....	16·524	.....	....	.....
	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
¼	Nov. 3 L.W.	7	47	A.M.	...	....	8	59	12	21	.....	63	13·507	.....	3·017	.....
¾	do 3 H.W	11	9	A.M.	3	22	...	...	...	...	− 22	57	16·092	2·585	.....	15·018
¾	do 3 L.W.	7	31	P.M.	..	....	8	22	12	7	..	54	13·607	.....	2·485	....
24	do 3 H.W	11	6	P.M.	3	45	...	...	...	...	.....	26	17·206	3·599	....	15·271
¼	do 4 L.W.	8	20	A.M.	...	....	9	4	12	29	.....	56	13·905	.....	3·301	.....
¾	do 4 H.W	11	45	A.M.	3	25	..	...	...	...	− 21	31	16·639	2·734	.....	15·463
¾	do 4 L.W.	8	12	P.M.	...	....	8	27	12	0	. ...	60	14·064	.....	2·575	.....
25	do 4 H.W	11	45	P.M.	3	33	...	...	...	...	.....	35	17·285	3·221	.....	15·372
¼	do 5 L.W.	9	4	A.M.	...	....	9	19	12	47	.....	46	13·964	.....	3·321	.....
¾	do 5 H.W	12	32	P.M.	3	28	...	...	...	...	− 15	45	15·709	1 745	.....	15·030
¾	do 5 L.W.	8	52	P.M.	...	....	8	20	11	48	.....	63	13·656	.. ...	2·053	.....
26	do 6 H.W	12	20	A.M.	3	28	...	...	...	...	.....	32	16·300	2·644	.....	14·706
¼	do 6 L.W.	9	52	A.M.	...	....	9	32	13	5	..	63	13·517	.....	2·783	.....
¾	do 6 H.W	1	25	P.M.	3	33	...	...	...	...	°+ 2	63	14·998	1·481	.....	14·582
¾	do 6 L.W.	9	11	P.M.	...	....	7	46	11	47	....	51	13·308	.....	1·690	.....
27	do 7 H.W	1	12	A.M.	4	1	....	....	....	....	.....	30	16·704	3·396	....	14·706
¼	do 7 L.W.	10	42	A.M.	...	....	9	30	12	48	.....	4	13·647	....	3·057	.....
¾	do 7 H.W	2	0	P.M.	3	18	...	...	...	...	− 7	59	15·327	1·680	....	14·808
¾	do 7 L.W.	10	2	P.M.	...	....	8	2	11	55	.... °	2	13·547	.....	1·780	.....
28	do 8 H.W	1	55	A.M.	3	53	...	...	...	...	. ...	32	16·718	3·171	....	14·743
¼	do 8 L.W.	11	33	A.M.	...	....	9	38	13	15	.....	55	13·607	.....	3·111	.....
¾	do 8 H.W	3	10	P.M.	3	37	...	...	...	...	+ 60	33	14·869	1·262	....	14·434
¾	do 8 L.W.	11	7	P.M.	...	....	7	57	12	35	. ..	70	13·210	.....	1·659	.....
29	do 9 H.W	3	45	A.M.	* 4	38	...	...	...	...	.....	56	15·380	2·170	....	14·199
¼	do 9 L.W.	12	30	P.M.	...	....	8	45	12	35		29	13·270	.....	2·110	.....
¾	do 9 H.W	4	20	P.M.	3	50	...	...	...	...	+ 25	47	15·000	1·730	.....	14·234
¾	do 10 L.W.	1	20	A.M.	...	....	9	0	12	40	.. .	56	13·450	.....	1·550	.....
30	do 10 H.W	5	0	A.M.	3	40	...	...	...	...	.....	60	15·050	°1·600	.....	14·386
	... ...	...	...	...	...	....	8	50	12	20	..	38	...	.....	1·430	.....
	.. ..	...	...	...	...	...	...	...	...	...	...	...	13·620	...	...	.....
	H.W	93	34	+24							+ 87	606	223·277	.		
		= 117	34	....	51	31	131	31	186	32	.....	...	.....	33·018	35·922	206·952
Totals 14 tides.		126	3	+12												
	L.W.	= 138	3								− 65	710	190·259			
	14 H.W.										+ 29	43	15·948			
Means	do	.....	..	....	3	41	8	45	12	26	. .	...	.....	2·358	2·395	14·782
	14 L.W.										− 16	47	13·590			
Grd. totals	H.W.										+ 292	2395	935·675			
57 tides	.....	.....	..	....	205	36	511	21	720	27	. .	....	.....	144·334	145·941	863·494
	L.W.										− 250	3298	791·341			
	57 H.W.										+ 22	42	16·415			
Grd. means	do	....	..	....	3	37	8	49	12	25	.....	....	.....	2·532	2·516	15·149
	57 L.W.										− 16	57	13·883			

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °

The (°) zero of the gauge was taken to be 25·055 ft. above datum, instead of 25·0646ft. as per Abstract of Results.

APPENDIX 13.

TABLE VII.—Tidal Fluctuations at Batiscan during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.—(*Continued.*)

Mean amplitudes corrected for diurnal inequalities.	Diurnal Inequalities.							Remarks.
	In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	
Feet.	Min	Min	Min	Feet.	Feet.	Feet.	Feet.	
					129			
	10			432		224	219	Light N. breeze; cloudy. 1
2·922		37	14		100			Feeble northerly breeze 3
	23			1·114		253	108	Sky overcast; light N.E. wind; appearance of rain or snow. 1
3·030		42	22		298			Stiff N.E. breeze; appearance of rain or snow 24
	20			567		192	073	Commencing to rain at 8.45 a.m. 1
2·957		37	29		159			3
	8			646		091	241	Moderate N.W. breeze; clear, cold weather 3
2·716		52	47		100			do do fine, freezing hard 25
	5			1·576		342	275	Fresh N.W. breeze; fine, bright and cold 1
2·441		59	59		308			do clear, cold weather 3
	0			591		324	201	†N.W. breeze gone down considerably. 1
2·240		72	77		139			Feeble N.W. breeze; snowing. 26
	5			1·302		124	097	do do 1
2·337		106	78		209			do do 3
	28			1·706		124	118	3
2·455		104	61		339			N.E. wind, hardly perceptible; fine, moderate N.E. wind. 27
	43			1·377		102	033	N. wind do do 1
2·422		88	53		100			do do fine and mild 3
	35			1·391		063	091	Ordinary S.W. breeze. 3
2·331		96	80		060			Stiff S.W. breeze; mild 28
	16			1·849		309	281	‡Stiff N.W. breeze; clear and cold 1
2·050		101	40		397			Moderate N.W. breeze 1
	* 61			511		235	133	do do 3
1·917		48	0		060			§Gentle S.W. wind; clear and bright 29
	48			380		035	169	Gentle S.W. wind; clear weather 1
1·748		15	15		180			3
	10			050		152	045	Calm, clear and bright. 3
1·703		10	20		170			Moderate N.E. breeze; cloudy, snowing 30
	0			803				
33·269	312	867	595	14·295	2·748	2·572	2·084	
2·376	21	62	43	·953	·183	·184	·149	
144·330	986	2363	1841	41·942	12·428	10·449	9·809	
2·532	17	41	32	·723	·214	·187	·175	

†Moon's N. declination a maximum = 20° 39′. ‡Moon's last quarter (Quebec) from 0h. 02m., p.m., Nov. 8th §Maximum inequality observed in low water levels = 1·100 feet.

APPENDIX 13.

TABLE VII.—(*Concluded*)—Tidal Fluctuations at Batiscan during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers. Series IV. Losing tides.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."												
				Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times. (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.
				Upper passage.		Lower passage.		Ages, etc.								
	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.	
	....	....	....	....	....	....	....	.....	.....	.....	....	....	− 20	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	15	.....	.....	.....	.....
	9	46	....	1	23	....	....	.....	11	15	....	....	− 19	9	52	86
	.....	.....	.....	.....	.....	.....	.....	17·8	.....	.....	12	16	.....	.....	.....	.....
24	9	29	3	....	....	1	47	.....	11	31	....	....	.....	9	44	84
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	15	.....	.....	.....	.....
	9	34	....	2	11	....	....	.....	11	46	....	....	− 19	9	35	82
	.....	.....	.....	.....	.....	.....	.....	18·8	.....	.....	12	16	.....	.....	.....	.....
25	9	9	....	....	....	2	36	.....	12	2	....	....	.....	9	26	80
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	16	.....	.....	.....	.....
	9	30	...	3	2	.....	.....	.....	12	15	....	....	− 16	9	16	76
	.....	.....	.....	.....	.....	.....	.....	19·8	.....	.....	12	18	.....	.....	.....	.....
26	8	52	....	....	....	3	28	.....	12	36	....	....	.....	9	8	73
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	17	.....	.....	.....	.....
	9	31	...	3	54	.....	.....	.....	12	53	....	....	− 13	8	59	69
	.....	.....	.....	.....	.....	.....	.....	20·8	.....	.....	12	20	.....	.....	.....	.....
27	8	52	....	....	....	4	20	.....	1	13	....	....	.....	8	53	64
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	21	.....	.....	.....	.....
	9	14	....	4	46	.....	.....	.....	1	34	....	....	− 5	8	48	59
	.....	.....	1	.....	.....	.....	.....	21·8	.....	.....	12	24	.....	.....	.....	.....
28	8	43	4	....	....	5	12	.....	1	55	....	....	.....	8	46	55
	.....	.....	4	.....	.....	.....	.....	◑	.....	.....	12	27	.....	.....	.....	.....
	9	31	3	5	39	.....	.....	.....	2	25	....	....	+ 9	8	46	50
	.....	.....	.....	.....	.....	.....	.....	22·8	.....	.....	12	32	.....	.....	.....	.....
29	9	40	...	....	....	6	5	.....	2	57	....	....	.....	8	52	47
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	36	.....	.....	.....	.....
	9	48	...	6	32	....	....	.....	3	33	....	....	+ 28	9	1	44
	.....	.....	.....	.....	.....	.....	.....	23·8	.....	.....	12	42	.....	.....	.....	.....
30	10	2	....	....	....	6	58	.....	4	15	....	....	.....	9	17	44
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	43	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals 14 tides.	131	41	....	27	27	30	26	.....	+ 102	16	185	58	+ 37	128	23	913
									+ 84	0			.....			
									= 186	16			− 72			
Means 14 tides.	9	24	...	3	55	4	21	.....	13	18	12	24	+ 19	9	10	65·21
													− 14			
Grand totals 57 tides.	557	40	....	209	51	217	1	.....	620	50	721	2	+ 210	553	58	4114
													.....			
													− 197			
Grand means 57 tides.	9	47	....	7	30	7	29	.....	10	54	12	26	+ 19	9	43	72·70
													.....			
													− 12			

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

AT

CHAMPLAIN,

DURING THE LUNAR MONTH OF THE LOW WATER SEASON OF 1887, OCTOBER 9 TO NOVEMBER 8.

TABLE VIII.

WEEKLY SERIES OF GAINING TIDES Nos. I. and III.
" " LOSING " No. IV.

APPENDIX 13.

TABLE VIII.—Tidal Fluctuations at Champlain during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers. Series I. Gaining tides.		High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.	In duration of ebbs.
			H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min	Min
½	Oct. 11	H.W.	† 4	50	P.M.	...	...	...	...	...	...	+ 10	70	15·853	...	.....	.....	.....	.....	.....
...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	.....	.....	.....	.....	.....	.....
¾	Oct. 12	L.W.	2	30	A.M.	...	...	9	40	12	40	.....	.....	15·053	...	°0·800	.....	.....	.....	.....
2	do 12	H.W	5	30	A.M.	3	0	...	...	...	...	.....	.....	16·855	1·802	.....	15·553	1·552	...	° 0
¼	do 12	L.W.	3	10	P.M.	...	...	9	40	12	50	.....	.....	14·500	...	2·355	.....	.....	10	...
¾	do 12	H.W	6	20	P.M.	3	10	...	...	...	...	+ 10	...	15·753	1·253	...	15·428	1·802	...	40
*2	do 13	L.W.	3	20	A.M.	...	...	9	0	12	10	.....	.....	14·553	...	1·200	.....	.....	° 0	...
3	do 13	H.W	‡ 6	30	A.M.	3	10	...	...	...	...	...	...	16·953	2·400	.....	15·790	1·325	....	10
¼	do 13	L.W.	3	40	P.M.	...	...	9	10	13	0	.....	.....	15·703	.....	1·250	.....	.....	40	...
¾	do 13	H.W	7	30	P.M.	3	50	...	...	...	...	+ ° 0	...	16·153	°0·450	.....	16·034	1·213	...	0
*3	do 14	L.W.	4	40	A.M.	...	...	9	10	11	50	.....	.....	15·153	...	1·000	.....	.....	70	...
4	do 14	H.W	7	20	A.M.	2	40	...	...	...	...	.....	.....	17·303	2·150	...	15·916	1·875	.....	50
¼	do 14	L.W.	5	20	P.M.	...	...	*10	0	12	50	.....	.....	14·803	...	2·500	.....	.....	10	...
¾	do 14	H.W	8	10	P.M.	2	50	...	...	...	...	+ 30	...	16·653	1·850	.....	16·060	2·113	...	10
*3	do 15	L.W.	6	0	A.M.	...	...	9	50	12	30	.....	.....	15·203	.....	1·450	.....	.....	10	...
5	do 15	H.W	8	40	A.M.	2	40	...	...	...	...	.....	.....	17·853	2·650	.....	16·378	2·000	...	30
¼	do 15	L.W.	6	0	P.M.	...	...	9	20	12	0	.....	.....	15 553	.....	2·300	.....	.....	0	.....
¾	do 15	H.W	8	40	P.M.	2	40	...	...	...	...	+ 10	.....	17·153	1·600	.....	16·428	1·750	....	40
*3	do 16	L.W.	§ 6	40	A.M.	...	...	10	0	13	0	.....	.....	15·553	.....	1·600	.....	.....	20	...
6	do 16	H.W	9	40	A.M.	3	0	...	...	...	...	.....	.....	17·053	1·500	.....	16·316	2·025	....	60
¼	do 16	L.W.	6	40	P.M.	...	...	9	0	12	10	....	25	15·053	...	2·000	.....	.....	10	...
¾	do 16	H.W	¶ 9	55	P.M.	3	10	...	...	...	...	— 15	27	18 053	3·000	...	16·428	2·700	....	5
*3	do 17	L.W.	6	50	A.M.	...	...	8	55	12	25	....	90	15·103	...	2·950	.....	.....	20	...
7	do 17	H.W	10	20	A.M.	3	30	...	...	...	...	....	36	17 953	2·850	.....	16 641	3·125	....	45
¼	do 17	L.W.	8	0	P.M.	...	...	9	40	12	20	....	41	15·053	.....	2·900	.....	.....	50	...
¾	do 17	H.W	10	40	P.M.	2	40	...	...	...	...	— 30	35	18·853	*3·800	...	17·016	*3·225	...	50
*3	do 18	L.W.	7	30	A.M.	...	...	8	50	12	0	....	40	15·753	.....	*3·100	.....	.....	30	...
8	do 18	H.W	10	40	A.M.	3	10	...	...	...	...	.....	25	18·853	3·100	.....	17·378	3·150	....	30
¼	do 18	L.W.	‡ 8	0	P.M.	...	...	9	20	12	20	.....	44	15·853	.....	3·000	.....	.....	10	....
½	do 18	H.W	11	0	P.M.	3	0	...	...	...	...	+ 12	40	*19·253	3·400	.....	*17·434	3·037	...	....
		H.W.	120	55								+ 62	163	244·694						
Totals	14 tides					42	30	121	35	174	5	.....	.....	.....	31·805	28·405	228·800	30 892	280	370
		L.W.	78	20								— 45	240	212·889						
	14	H.W.										+ 12	33	17 478						
Means	do		....	.....	.....	3	22	8	41	12	26	.....	.....	.....	2·272	2·029	16·343	2·207	22	28
	14	L.W.										— 23	48	15·206						

N.B.—Only a few of series of losing tides No. II. observed at Champlain.
Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °.
† Longitude—Gagnon's wharf, Champlain, 72° 20′=4h. 49m. 20s. =0 2009 of a day west of Greenwich.
‡ Maximum diurnal inequality observed in low water levels =1·150 feet.

APPENDIX 13.

TABLE VIII.—Tidal Fluctuations at Champlain during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued.*)									RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."													
Diurnal Inequalities.									Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.													
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series I. Gaining tides. Gauge book reference numbers.
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.		
...	.....	.....	.....	.....	...	..	...	...	..	...	..	...	...	..	...	..	+ 34	...	..	.....	½
...	.....	100	.....	.....	...	..	...	...	..	...	..	...	...	..	...	..	.....	...	..	.....	
...	1·002	.....	.....	.....	...	..	...	...	..	...	..	...	...	..	12	46	.....	...	..	.....	¾
10	.....	553	.....	.....	10	10	...	...	..	7	20	..	5	21	...	..	.....	10	1	° 39	2
...	1·102	.....	125	250	...	..	...	...	..	...	..	...	...	..	* 12	47	.....	...	..	.....	1
40	.....	053	.....	.....	10	32	...	7	48	...	..	25·1	6	7	...	..	+*40	10	19	42	1¼
...	1·200	.....	362	477	...	..	...	...	..	...	..	...	...	..	12	43	.....	...	..	.....	1½
50	.....	*1·150	.....	.....	10	15	...	...	..	8	15	....	6	50	...	..	.....	10	35	47	3
...	800	.....	244	112	...	..	...	...	..	...	..	...	...	..	12	39	.....	...	..	.....	1¾
30	.....	550	.....	.....	10	47	...	8	43	...	..	26·1	7	29	...	..	+ 22	10	46	54	2
...	1·150	.....	118	662	...	..	...	...	..	...	..	...	...	..	12	33	.....	...	..	.....	2¼
60	.....	350	.....	.....	10	10	...	...	..	9	10	....	8	2	...	..	.....	10	52	62	4
...	650	.....	144	238	...	..	...	...	..	...	..	...	...	..	12	29	.....	...	..	.....	2½
20	.....	400	.....	.....	10	32	...	9	38	...	..	27·1	8	31	...	..	+ 5	10	53	71	2¾
...	1·200	.....	318	113	...	..	...	...	..	...	..	...	...	..	12	26	.....	...	..	.....	3
30	.....	350	.....	.....	10	35	...	...	..	10	5	..	8	57	...	..	.....	10	52	80	5
...	700	.....	050	250	...	..	...	...	..	...	..	...	...	..	12	25	.....	...	..	.....	1
60	.....	000	.....	.....	10	7	...	10	33	...	..	28·1	9	22	...	..	— ° 2	10	49	89	1¼
...	100	.....	112	275	...	..	...	...	..	...	..	...	...	..	12	23	.....	...	..	.....	1½
10	.....	500	.....	.....	10	39	...	...	..	11	1	....	9	45	...	..	.....	10	44	97	6
...	1·000	.....	112	675	...	..	...	...	..	...	..	...	...	..	12	22	.....	...	..	.....	1¾
15	.....	050	.....	.....	10	27	...	11	28	...	..	29·1	10	7	...	..	— 6	10	39	104	2
...	100	.....	213	425	...	..	...	...	..	...	..	●	...	..	12	22	.....	...	..	.....	2¼
5	.....	050	.....	.....	10	24	...	...	..	11	56	..	10	29	...	..	.....	10	33	110	7
...	900	.....	375	100	...	..	...	...	..	...	..	...	...	..	12	22	.....	...	..	.....	1
20	.....	700	.....	.....	10	16	...	12	24	...	..	0·8	10	51	...	..	— 7	10	27	114	1¼
...	000	.....	362	075	...	..	...	...	..	...	..	...	...	..	12	21	.....	...	..	.....	1½
20	.....	100	.....	.....	9	47	...	...	..	12	53	....	11	12	...	..	.....	10	19	116	8
...	400	.....	056	113	...	..	...	...	..	...	..	...	...	..	12	22	.....	...	..	.....	1¾
...	.....	.....	.....	.....	9	39	...	1	21	...	..	1·8	11	34	...	..	— 7	10	13	* 117	2
370	10·304	4·906	2·591	3·765	144	20	...	61 +12 =73	55 0 55	70	40	....	124	37	175	0	+ 67 ..... — 22	148	2	1142	
28	·736	351	·199	·290	10	17	....	10	33	10	6	....	8	54	12	30	+ 22 ..... — 6	10	34	81·57	

§ Moon crosses equator, October 16th. Moon in perigee, October 16th, at 1h. 0m. p.m.
¶ New moon (Quebec) at 5h. 35m. p.m. October 16th. ♆ Most important tide but one during 1887, viz.: evening tide of March 11th, for which coefficient of semi-amplitude is 118.

APPENDIX 13.

TABLE VIII.—Tidal Fluctuations at Champlain during the Low water season of 1887, viz.:—from quadrature of October 9th to quadrature of November 8th.

Gauge book references numbers. Series III. Gaining tides.		High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
			H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.
	Oct.	26.. H. W.	6	40	A.M.	..	..	..	..	..	..	+ 21	36	15·953	0·900	....	.....	....
	do	26.. L. W.	6	30	P.M.	..	..	8	50	13	0	..	40	14·453	....	1·500	....	....
16	do	26.. H. W.	7	40	P.M.		10	..	..	..	..	..	....	15·828	1·375	....	15·197	1·188
	do	27.. L. W.	3	40	A.M.	..	..	8	0	12	6	....	..	14·753	....	1·075	....	....
	do	27.. H. W.	7	46	A.M.	4	6	..	..	..	..	— 10	...	15·553	0·800	....	15·294	1·156
	do	27.. L. W.	4	10	P.M.	..	..	8	24	12	34	....	....	14·678	....	0·875	....	....
17	do	27.. H. W.	8	20	P.M.	4	10	..	..	..	..	..	....	16·553	1·875	..	15·503	1·626
	do	28.. L. W.	4	40	A.M.	..	..	8	20	12	20	....	....	14·703	....	1·850	....	....
	do	28.. H. W.	8	40	A.M.	4	0	..	..	..	..	+ 50	....	16·603	1·900	....	15·675	2·044
	do	28.. L. W.	5	10	P.M.	..	..	*8	30	*13	20	....	....	14·603	....	2·000	....	....
18	do	28.. H. W.	9	0	P.M.	4	50	..	..	..	..	....	....	17·028	2·425	....	15·762	2·193
	do	29.. L. W.	5	20	A.M.	..	..	8	20	12	20	....	....	14·728	....	2·300	....	....
	do	29.. H. W.	9	20	A.M.	4	0	..	..	..	..	—° 5	....	16·778	2·020	....	15·794	2·131
	do	29.. L. W. †	5	30	P.M.	..	..	8	10	12	25	....	....	14·728	....	2·050	....	....
19	do	29.. H. W. ‡	9	45	P.M.	4	15	..	..	..	..	....	25	16·853	2·125	....	15·972	2·212
	do	30 L. W.	5	10	A.M.	..	..	7	25	11	45	....	20	15·003	....	1·850	....	....
	do	30.. H. W.	9	30	A.M.	4	20	..	..	..	..	+ 0	32	17·828	2·825	....	16·409	2·363
	do	30.. L. W.	5	20	P.M.	..	..	7	50	13	5	...	°15	15·453	....	2·375	....	....
20	do	30.. H. W.	10	35	P.M.	* 5	15	..	..	..	..	....	20	17·853	2·400	....	16·624	2·469
	do	31.. L. W.	7	0	A.M.	..	..	8	25	11	50	....	19	15·328	....	2·525	....	....
	do	31.. H. W.	10	25	A.M.	3	25	..	..	..	..	— 45	°16	17·903	2·575	..	16·410	2·287
	do	31.. L. W.	6	30	P.M.	..	..	8	5	12	15	....	*170	15·203	....	2·700	....	....
21	do	31.. H. W. §	10	40	P.M.	4	10	..	..	..	..	....	*120	16·553	1·350	....	16·153	1·475
	Nov.	1.. L. W.	8	0	A.M.	..	..	9	20	12	10	..	45	15·628	....	0·925	....	....
	do	1.. H. W.	10	50	A.M.	2	50	..	..	..	..	— 60	38	16·553	0·925	....	16·122	°0·863
	do	1.. L. W.	7	30	P.M.	..	..	8	40	11	40	....	120	15·753	....	0·800	....	....
22	do	1.. H. W.	10	30	P.M.	3	0	..	..	..	..	....	75	16·553	0·800	..	15·978	1·425
	do	2.. L. W.	8	10	A.M.	..	..	9	40	12	50	....	146	14·778	....	1·775	....	....
	do	2.. H. W.	11	20	A.M.	3	10	..	..	..	..	+ 10	25	17·103	2·325	....	15·785	1·938
	do	2.. L. W.	8	20	P.M.	..	..	9	0	12	10	....	110	14·853	....	2·250	....	....
23	do	2.. H. W.	11	30	P.M.	3	10	....	....	..	..	....	30	16·253	1·400	....	15·672	1·838
		H. W.	152	31								+ 81	457	267·748				
Totals	15½	tides ...	....	..	...	60	31	127	55	185	50	.....	....	.....	28·050	26·850	238·350	27·208
		L. W.	88	0								— 120	685	224·645				
		16 H. W.										+ 20	46	16·734				
Means	do	....	...	..	....	4	2	8	32	12	23	.....	....	.....	1·753	1·790	15·890	1·814
		15 L. W.										— 30	98	14·976				

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °
† Moon crosses equator, October 29th.
‡ Moon in apogee, October 29th, at 6.0 p.m.
§ Full moon (Quebec), October 13th, at 4.31 p.m.

APPENDIX 13.

TABLE VIII.—Tidal Fluctuations at Champlain during the Low water season of 1887, viz.:—from quadrature of October 9th to quadrature of November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).											BESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."															
Diurnal Inequalities.											Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H. W. to H. W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "L'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series III. Gaining tides. Gauge book reference numbers.
In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage		Lower passage		Ages, etc.											
Min.	Min	Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.			
...	....	..		600	. ...	.....	11	3	....	7	37	....	..	....	6	14	....	..	+38	10	37	40		
...	....	..	125	....	....	.. .	....	..	....	..	..	....	..	9·8	....	..	12	41	....	....	..	....		
...	50	54	....	300	...	...	11	41	....	..	..	7	59	..	6	55	....	..	....	10	56	42		16
4	....	....	275	..	097	032	....	..	....	..	..	....	..	....	....	..	12	37	....	....	..	....		
...	24	28	....	075	....	....	11	25	...	8	21	....	..	....	7	32	....	..	+18	11	11	46		
4	....	....	1·000	....	209	470	....	..	....	..	..	....	..	10·8	....	..	12	31	....	....	..	....		
...	4	14	....	025	....	....	11	37	...	..	..	8	43	....	8	3	....	..	....	11	20	51		17
10	....	....	050	....	172	418	....	..	....	..	..	....	..	....	....	..	12	27	....	....	..	....		
...	10	60	....	100	..	....	11	36	....	9	4	....	..	....	8	30	....	..	+ 0	11	26	56		
50	....	....	425	....	087	149	....	..	....	..	..	....	..	11·8	....	..	12	23	....	....	..	....		
...	10	60	....	125	....	....	11	35	....	..	..	9	25	....	8	53	....	..	....	*11	28	61		18
50	....	....	250	..	032	062	....	..	....	..	..	....	..	....	....	..	12	21	....	....	..	....		
...	10	5	....	°000	....	....	11	34	...	9	46	....	..	....	9	14	....	..	—10	11	28	65		
15	....	....	075	....	178	081	....	..	....	..	..	....	..	12·8	....	..	12	19	....	....	..	....		
...	15	40	....	275	....	....	11	38	....	..	..	10	7	....	9	33	....	..	....	11	26	70		19
5	....	....	975	..	* 437	151	....	..	....	..	..	....	..	....	....	..	12	17	....	....	..	....		
...	25	80	....	450	....	....	11	2	....	10	28	....	..	....	9	50	....	..	—16	11	22	74		
55	....	....	025	....	215	106	....	..	....	..	..	....	..	13·8	....	..	12	17	....	....	..	....		
...	35	75	....	125	....	....	*11	46	....	..	..	10	49	....	10	7	....	..	....	11	18	77		20
*110	....	....	050	....	214	182	....	..	....	..	..	....	..	....	....	..	12	16	....	....	..	....		
...	20	25	....	125	....	....	11	15	...	11	10	....	..	....	10	23	....	..	—19	11	13	80		
45	....	....	1·350	..	257	* 812	....	..	....	..	..	....	..	14·8	....	..	12	15	....	....	..	....		
...	75	*145	....	425	....	....	11	9	....	..	..	11	31	○	10	38	....	..	....	11	7	83		21
80	....	....	000	....	031	612	....	..	....	..	..	....	..	....	....	..	12	16	....	....	..	....		
...	40	30	....	125	....	....	10	57	....	11	53	....	..	....	10	54	....	..	-*20	11	1	85		
10	....	....	000	..	144	562	....	..	....	..	..	....	..	15·8	....	..	°12	14	....	....	..	....		
...	60	70	....	975	....	....	11	15	....	..	..	12	15	....	11	8	....	..	.. .	10	53	86		22
10	....	....	550	..	193	513	....	..	....	..	..	....	..	....	....	..	12	15	....	....	..	....		
...	40	40	....	075	....	....	10	42	...	12	38	....	..	....	11	23	....	..	—20	10	45	86		
° 0	....	....	850	....	113	100	....	..	....	..	..	....	..	16·8	....	..	12	15	....	....	..	....		
...	0	15	....	....	... ..	....	10	29	...	..	..	1	1	....	11	38	....	..	...	10	37	86		23
448	418	741	6·000	3·800	4·148	4·250	179	44	...	80	57	71 =83	50 50	+12	150	55	185	24	+56 .... --85 +19 .... —17	178	8	1088		
32	28	49	·400	·253	·296	·304	11	14	....	10	7	10	29	....	9	26	12	22	....	11	8	68·00		

APPENDIX 13.

TABLE VIII.—Tidal Fluctuations at Champlain during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

Gauge book reference numbers. Series IV. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Direct Results of Tidal Observations, &c.																
					Duration of floods.		Duration of ebbs.		Length of half tide-day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.	In duration of ebbs.
		H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min	Min
											+ 10								
¼	Nov 3 L.W.	8	30	A.M.			9	0	11	55		45	14·653		1·600			15	
¾	do 3 H.W.	11	25	A.M.	2	55					— 20	47	16·753	2·100		15·672	1·962		20
¼	do 3 L.W.	8	45	P.M.			9	20	12	35		77	14·728		2·025			20	
24	do 4 H.W.	12	0	A.M.	3	15						39	16·853	2·125		15·903	2·050		21
¼	do 4 L.W.	8	59	A.M.			8	59	12	5		36	15·028		1·825			9	
¾	do 4 H.W.	12	5	P.M.	3	6					— 10	35	17·253	2·225		16·072	1·963		46
¼	do 4 L.W.	9	50	P.M.			9	45	12	35		47	15·153		2·100			16	
25	do 5 H.W.	12	40	A.M.	2	50						40	16·853	1·700		15·985	1·763		15
¼	do 5 L.W.	10	10	A.M.			9	30	12	25			15·053		1·800			5	
¾	do 5 H.W. †	1	5	P.M.	2	55					+ 35		16·503	1·450		15·809	1·565		5
¼	do 5 L.W.	10	40	P.M.			9	35	13	0			14·998		1·505			30	
26	do 6 H.W.	2	5	A.M.	3	25							16·503	1·505		15·561	1·465		75
¼	do 6 L.W.	10	25	A.M.			8	20	°11	35			14·653		1·850			10	
¾	do 6 H.W.	1	40	P.M.	3	15					—*75		15·653	1·000		15·448	1·662		30
¼	do 6 L.W.	10	30	P.M.			8	50	12	0			14·578		1·075			5	
27	do 7 H.W.	1	40	A.M.	3	10							17·303	2·725		15·638	1·843		30
¼	do 7 L.W.	11	0	A.M.			9	20	13	0		80	14·853		2·450			30	
¼	do 7 H.W.	2	40	P.M.	3	40					+ 20	60	15·978	1·125		15·709	1·837		60
¾	do 7 L.W.	11	0	P.M.			8	20	12	10		70	14·728		1·250			10	
28	do 8 H.W.	2	50	A.M.	3	50						80	17·253	2·525		15·656	1·781		51
¼	do 8 L.W.	12	1	P.M.			9	11	13	10		73	14·803		2·450			9	
¾	do 8 H.W.	4	0	P.M.	3	59					+ 20	60	15·703	0·900		15·398	1·544		111
¼	do 8 L.W.	11	20	P.M.			°7	20	12	0		90	14·453		1·250			41	
29	do 9 H.W.	4	0	A.M.	4	40						65	16·028	1·575		15·171	1·536		*120
¼	do 9 L.W.	1	20	P.M.			9	20	13	5		70	°14·353		1·675			55	
¾	do 9 H.W.	5	5	P.M.	3	45					+*80	40	16·000	1·647		15·165	1·448		35
¼	do 10 L.W.	3	0	A.M.			9	55	13	5		58	14·528		1·472			35	
30	do 10 H.W.	6	10	A.M.	3	10						65	15·528	1·000		°15·128	1·074		75
							8	40	12	0		42			0·875			10	
¼	do 10 L.W.	2	50	P.M.									14·653						
Totals 14 tides	H.W. { =103	79	25	+24 0	47	55	135	25	186	40	+155	531	230·164	23·602	25·202	218·315	23·493	30	694
	H.W. {	25																	
	L.W. { =139	127	30	+12 0							—105	688	206·562						
	L.W. {	30																	
Means	14 H.W. do 14 L.W.				3	25	9	2	12	27	+ 39 — 35	53 63	16·440 14·754	1·686	1·680	15·594	1·678	20	50
G'd t'ls 43½ tides	H.W.				150	56	384	55	546	35	+298	1151	742·606	83·457	80·457	685·465	81·593	1028	1482
	L.W.										—270	1613	644·096						
G'd means	44 H.W. do 43 L.W.				3	31	8	45	12	25	+ 23 — 30	46 65	16·877 14·979	1·897	1·829	15·941	1·898	24	35
Grand means based on results of Batiscan.	H.W. L.W.				3	35	8	47	12	25	+ 34 — 24	48 69	16·974 15·149	1·869	1·857	16·091	1·887	30	35

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °
† Moon's N. declination a maximum = 20° 39′.

APPENDIX 13.

TABLE VIII.—Tidal Fluctuations at Champlain during the Low water season of 1887, viz.:—from quadrature, October 9th, to quadrature, November 8th.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Diurnal Inequalities.								Eastern standard civil times of meridian passages immediately preceding observed high waters, with correspondingages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H. W. to H. W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series IV. Losing tides. Gauge book reference numbers.
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.									
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		
....	.....	.....	.....	.....	...	...	....	...	...	...	...	....	...	...	...	...	— 20	...	...	.....	.....
..	.....	200	.....	.....	...	...	....	...	...	...	...	....	...	...	...	...	...	...	...	.....	.....
...	500	....	° 000	124	...	...	....	...	...	...	...	....	...	...	12	15	...	10	29	86	‡
20	.....	075	.....	.....	10	1	....	1	24	...	...	....	11	53	...	...	— 19	...	...	.....	.....
...	100	.....	231	088	...	...	....	...	...	...	...	17·8	...	...	12	16	...	10	21	84	‡
30	.....	300	.....	.....	10	12	....	...	...	1	48	....	12	9	...	...	...	...	...	.....	24
....	400	....	169	087	...	...	....	...	...	...	...	....	...	...	12	15	...	10	12	82	‡
30	.....	125	.....	.....	9	53	....	2	12	...	...	....	12	24	...	...	— 19	...	...	.....	.....
...	400	.....	087	200	...	...	....	...	...	...	...	18·8	...	...	12	16	...	10	3	80	‡
10	.....	100	.....	.....	10	3	....	...	...	2	37	....	12	40	...	...	...	...	...	.....	25
....	350	....	176	198	...	...	....	...	...	...	...	....	...	...	12	16	...	9	53	76	‡
35	.....	055	.....	.....	10	2	....	3	3	...	...	....	12	56	...	...	— 16	...	...	.....	.....
...	° 000	.....	248	100	...	...	....	...	...	...	...	19·8	...	...	12	18	...	9	46	73	‡
85	.....	345	.....	.....	10	37	....	...	...	3	28	....	1	14	...	...	...	...	...	.....	26
...	850	....	113	197	...	...	....	...	...	...	...	....	...	...	12	17	...	9	37	69	‡
25	.....	075	.....	.....	9	46	....	3	54	...	...	....	1	31	...	...	— 13	...	...	.....	.....
....	*1 650	....	190	181	...	...	....	...	...	...	...	20·8	...	...	12	20	...	9	30	64	‡
60	.....	275	.....	.....	° 9	19	....	...	...	4	21	....	1	51	...	...	...	...	...	.....	27
...	1 325	.....	071	° 006	...	...	....	...	...	...	...	....	...	...	12	21	...	9	25	59	‡
50	.....	125	.....	.....	9	53	....	4	47	...	...	....	2	12	...	...	— 5	...	...	.....	.....
....	1 275	....	053	056	...	...	....	...	...	...	...	21·8	...	...	12	24	...	° 9	23	55	‡
60	.....	075	.....	.....	9	37	....	...	...	5	13	....	2	36	...	...	...	...	...	.....	28
....	1 550	.....	258	237	...	...	....	...	...	...	...	....	...	...	12	27	...	9	23	50	‡
70	.....	350	.....	.....	10	20	....	5	40	...	...	◑	3	3	...	...	+ 9	...	...	.....	.....
...	325	.....	227	008	...	...	....	...	...	...	...	22·8	...	...	12	32	...	9	29	47	‡
65	.....	100	.....	.....	9	54	....	...	...	6	6	....	3	35	...	...	...	...	...	.....	29
...	028	....	006	088	...	...	....	...	...	...	...	....	...	...	12	36	...	9	38	44	‡
0	.....	175	.....	.....	10	32	....	6	33	...	...	....	4	11	...	...	+ 28	...	...	.....	.....
...	472	....	037	374	...	...	....	...	...	...	...	23·8	...	...	12	42	...	9	54	44	‡
65	.....	125	.....	.....	11	11	....	...	...	6	59	....	4	53	...	...	...	...	...	.....	30
....	075	....	200	176	...	...	....	...	...	...	...	24·8	...	...	12	43	...	...	...	.....	.....
....	.....	.....	.....	.....	...	...	....	...	...	...	...	....	...	...	...	...	...	...	...	.....	‡
605	9·300	2·500	2·066	2·120	141	20	....	27	33	30	32	....	87 +108 195	8 0 8	185	58	+ 37 ..... — 72	137	3	913	
43	0·620	0·167	0·138	0·141	10	6	....	3	56	4	22	....	13	56	12	24	+ 19 ..... — 14	9	47	65·21	
1716	25·604	11·206	8·805	10·135	465	24	....	182	25	185	2	....	470	40	546	22	+ 160 ..... — 179	463	13	3143	
41	0·582	0·255	0·210	0·241	10	35	....	8	18	8	25	....	10	42	12	25	+ 20 ..... — 13	10	32	71·43	
40	0·649	0·316	0 233	0·254	10	26	....	7	30	7	29	....	11	33	12	26	+ 19 ..... — 12	10	22	72·70	

‡ Maximum diurnal inequality observed in high water levels = 1·650 feet.
§ Moon's last quarter (Quebec), from 0h. 2m. p.m., November 8th.

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

LEVIS GRAVING DOCK, HARBOUR OF QUEBEC,

DURING A COMPLETE LUNAR MONTH OF THE HIGH WATER SEASON OF 1888, VIZ., MAY 2 TO JUNE 1.

TABLE IX.

WEEKLY SERIES OF GAINING TIDES, No. V.

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of gaining tides No. V.

Gauge book reference numbers.	Series V. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H. W. to H. W.		Priming − or lagging + of tides.	Duration of apparent stand within 0·05 ft.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
			H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	Feet.
		May 4 L.W.	9	8	P.M..	....	....	7	43	13	1	.....	32	1·570	.....	.....	.....	.....
		....	...	...	.....	....	....	...	...	...	...	.....	.....	... ...	.....	.....	.....	.....
		May 5 H.W.	2	25	A.M.	5	17	...	...	.....	...	+ 22	31	12·417	10·847	.....	7·557	11·014
		do 5 L.W.	9	19	A.M.	....	....	6	54	12	11	.....	29	2·530	.....	9·887	.....	.....
9		do 5 H.W.	2	36	P.M.	5	17	....	....	.	....	.....	29	*a* 13·871	11·341	.....	7·795	11·155
	¼	do 5 L.W.	10	5	P.M..	....	....	7	29	12	47	.....	21	*c* 1·905	.....	11·966	.....	.....
	½	do 6 H.W.	3	23	A.M.	5	18	....	....	....	....	+ 19	31	*e* 13·339	11·429	.....	† 7·738	‡11·561
	¾	do 6 L.W.	10	33	A.M.	....	....	7	10	12	22	.....	20	*d* 2·070	.... ..	11·264	.....	.. ...
10		do 6 H.W.	3	45	P.M..	5	12	....	....	....	....	.....	31	*b* 13·417	11·347	.....	7·608	11·711
	¼	do 6 L.W.	11	7	P.M..	....	....	7	22	12	25	.....	18	1·435	.....	11·982	.....	.....
	½	do 7 H.W.	4	10	A.M.	5	3	....	...	....	....	+ 9	28	13·686	12·251	.....	7·515	12·396
	¾	do 7 L.W.	11	36	A.M.	....	....	7	26	12	34	.....	22	1·200	.....	12·486	.....	.....
11		do 7 H.W.	4	44	P.M..	5	8	....	....	....	....	.....	27	14·066	12·866	.....	7·736	12·772
	¼	do 7 L.W.	11	59	P.M..	....	....	7	15	12	10	.....	17	1·500	.....	12·566	.....	.....
	½	do 8 H.W.	4	54	A.M.	4	55	....	....	....	....	− 19	37	14·671	13·171	.....	7·794	13·018
	¾	do 8 L.W.	12	29	P.M..	....	....	7	35	12	21	.....	18	1·070	.....	13·601	.....	.....
12		do 8 H.W.	5	15	P.M..	4	46	....	....	....	....	.....	29	13·806	12·736	.....	7·742	13·174
	¼	do 9 L.W.	12	39	A.M.	....	....	7	24	12	10	. ....	17	1·240	.....	12·566	.....	.....
	½	do 9 H.W.	5	25	A.M.	4	46	....	....	....	....	− 15	25	15·036	13·796	.....	7·833	13·460
	¾	do 9 L.W.	1	9	P.M..	...	...	7	44	12	25	.....	20	0·966	.....	14·070	.....	.....
13		do 9 H.W.	5	50	P.M..	4	41	....	....	....	...	.....	26	14·376	13·410	.....	7·886	14·306
	¼	do 10 L.W.	1	18	A.M.	....	...	7	28	12	14	.....	16	°0·500	.....	13·876	.....	.....
	½	do 10 H.W.	6	4	A.M.	4	46	....	....	....	....	− 16	26	16·370	15·870	.....	8·999	14·459
	¾	do 10 L.W.	1	40	P.M..	....	....	7	36	12	20	.....	19	2·040	.....	14·330	.....	.....
14		do 10 H.W.	6	24	P.M..	4	44	....	....	...	....	.....	23	15·800	13·760	.....	9·345	14·010
	¼	do 11 L.W.	1	41	A.M.	....	....	7	17	12	9	.....	17	2·640	.....	13·160	.....	.....
	½	do 11 H.W.	6	33	A.M.	4	52	....	....	....	....	− 19	18	17·430	14·790	.....	9·433	14·016
	¾	do 11 L.W.	2	26	P.M..	....	....	7	53	12	22	.....	16	2·210	.....	15·220	.....	.....
15		do 11 H.W.	6	55	P.M..	4	29	....	....	....	....	.....	24	15·106	12·896	.....	9·230	13·960
	¼	do 12 L.W.	2	22	A.M.	....	....	7	27	12	10	.....	20	..... 2·290	.....	12·816	.....	.....
Totals 14 tides		H.W.	68	23	....	69	14	104	0	172	40	+ 50	385	203·386	180·510	179·790	113·711	180·952
		L.W.	100	23								− 69	270	21·306				
Means		14 H.W.	..	....	.....	4	57	7	26	12	20	+ 17	28	14·528	12·894	12·842	8·122	12·925
		do 14 L.W.										− 17	19	1·638				

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °

†Corrected mean tide level No. $9\frac{1}{2} = \frac{a+b}{8} + \frac{c+d+e}{4}$ ‡Corrected amplitude No. $9\frac{1}{2} = \frac{a+b}{4} + \frac{e-(c+d)}{2}$

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of gaining tides No. V.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*). Diurnal Inequalities. In duration of floods. Min.	In duration of ebbs. Min.	In semi-tide days. Min.	In high water levels. Feet.	In low water levels. Feet.	In mean tide levels. Feet.	In amplitudes. Feet.	Lunitidal intervals. H	M	Oscillations of float in hundredths of a foot.	Wind. Velocity miles per hour.	Direction.	Height of barometric column at sea level and for 0° cent or 32° Fah. Inches.	REMARKS.
....	....	....	.....	.....	.....	.....	..	..	...	2·731	N.E.	30·177	Longitude, Graving Dock = 71° 11′ 30″
....	....	....	.....	.....	.....	.....	..	..	...	.....	.....	.....	=4h. 44m. 46s. =0·1978 of a day W. of Greenwich.
....	50	50	.....	0·960	.....	.....	6	48	....	4·250	N.E.	30·138	Cloudy, fair.
0	....	....	1·454	.....	·238	·141	..	..	4	5·511	N.E.	30·096	Sky overcast
....	35	36	.....	0·625	.....	.....	6	37	4	6·898	N.E.	30·064	Raining.
1	....	....	0·537	.....	·057	·346	..	..	...	·546	N.	30·077	Clearing up
....	19	25	.....	0·165	.....	.....	7	2	....	6·057	N.W.	30·047	Clouds breaking
6	....	....	0·083	.....	·130	·210	..	..	...	8·807	N.W.	30·022	Sky becoming clearer.
....	12	3	.....	0·635	.....	.....	7	3	4	8·795	N.W.	30·021	Cloudy; commencing to rain
9	....	....	0·269	.....	·093	·685	..	..	...	5·807	N.W.	30·028	Sky overcast
....	4	9	.....	0·235	.....	.....	7	7	2	5·545	N.W.	30·058	Cloudy and cold.
5	....	....	0·380	.....	·221	·376	..	..	4	16·966	N.W.	30·091	Moon crosees the equator; cloudy and cold.
....	11	24	.....	0·300	.....	.....	7	20	....	11·386	N.W.	30·107	Beautiful bright day
13	....	....	0·605	.....	·058	·246	..	..	...	9·568	N.W.	30·195	Fine clear weather
....	20	11	.....	0·430	.....	.....	7	9	....	7·000	N.W.	30·251	Fine bright morning.
9	....	....	0·865	.....	·052	·156	..	..	2	8·886	S.W.	30·020	Clear weather, fine
....	11	11	.....	0·170	.....	.....	7	9	....	3·386	S.W.	30·084	Beautifully bright and clear.
0	....	....	1·230	.....	·091	·286	..	..	...	4·671	S.W.	30·020	Clear weather.
....	20	15	.....	0·274	.....	.....	7	0	2	8·000	W.	29·875	.....
5	....	....	0·660	.....	·053	·846	..	..	1	7·091	W.	29·861	Clear weather
....	15	11	.....	0·466	.....	.....	7	2	....	5·490	N.W.	29·864	Moon in apogee, May 9th, at 8 p.m.
5	....	....	1·994	.....	·613	·153	..	..	...	6·057	N.W.	29·923	Fine clear weather
....	8	6	.....	1·540	.....	.....	6	55	2	9·545	S,E.	29·982	Maximum diurnal inequality in low water levels observed, 1·540 feet. Bright morning.
2	....	....	0·570	.....	·846	·449	..	..	10	10·227	N.E.	29·980	Raining heavily
....	19	11	.....	0·600	.....	.....	6	53	4	11·955	N.E.	29·989	New moon (Quebec) May 10, at 8h. 24m. p.m. Clearing up.
8	....	....	1·630	.....	·088	·006	..	..	2	12·708	N.E.	30·050	Clear weather.
..	36	13	.....	0·430	.....	.....	6	40	1	10 977	N.E.	30·098	Cloudy.
23	....	....	2·324	.....	·203	·056	..	..	25	9·000	N.E.	30·079	.....
....	26	12	.....	0·080	.....	.....	6	40	3	10·545	N.E.	30·080	Fine clear day
14	....	....	2·094	.....	.....	.....	..	..	2	4·114	N.E.	30·030	.....
100	286	237	14·695	6·910	2·743	3·956	97	25	....	219·788	.....	840·130	
7	20	17	1·050	·494	·211	·304	6	58	....	7·850	.....	30·005	

APPENDIX 13.—Tidal Fluctuations. Lévis Graving Dock, series of gaining tides No. V.

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Gauge book reference numbers. Series V. Gaining tides.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2).†		Length of half tide day H. W. to H. W.		Priming − or lagging + of tides.	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old, together with proportional amplitudes and diurnal inequalities.*			
	Upper passage.		Lower passage.		Ages, &c.								Co-efficients.	*Amplitudes.	Diurnal Difference.	
															In amplitudes.	In semi-tide days.
	H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		Feet.	Feet.	Min.
½							C.	12	42							
					23·3	2	13									
½			7	37		1	54			+ 33	6	17	44	8·18		
						1	24									
¾								12	41						27	
						2	53									
9	7	59			24·3	2	35				6	36	46	8·45		4
						2	3									
¼								12	37						66	
						3	28									
½			8	21		3	12			+ 19	6	51	49	9·11		5
						2	51									
¾					25·3			12	32						74	
						3	59									
10	8	42				3	44				7	2	53	9·85		5
						3	25									
¼								12	27						75	
						4	28									
½			9	3		4	11			+ 2	7	8	57	10·60		2
						4	0									
¾					26·3			12	25						74	
						4	31									
11	9	24				4	36				7	12	61	11·34		3
						4	31									
¼								12	22						75	
						4	52									
½			9	45		4	58			− 8	7	13	65	12·09		2
						5	0									
¾					27·3			12	20						74	
						5	18									
12	10	6				5	18				7	12	69	12·83		2
						5	24									
¼								12	18						56	
						5	33									
½			10	25		5	36			− 14	7	11	72	13·39		0
						5	45									
¾					28·3			12	18						56	
						5	52									
13	10	48				5	54				7	6	75	13·95		2
						6	5									
¼								12	16						56	
						6	9									
½			11	9		6	10			− 17	7	1	78	14·51		1
						6	24									
¾					29·3			12	17						37	
						6	26									
14	11	31			●	6	27				6	56	80	14·88		2
						6	41									
¼								12	15						18	
						6	42									
½			11	53		6	42			− 19	6	49	81	15·06		1
						6	58									
¾					0·6			12	16						19	
						6	56									
15	12	15				6	58				6	43	82	15·25		1
						7	14									
¼								12	15							
Totals 14 tides.	58	45	68	13		68	15	173	19	+ 54 − 58	97	17	912	169·49	7·07	30
Means 14 tides.	8	24	9	45		4	53	12	23	+ 18 − 15	6	57	65·14	12·11	·54	2

*The ratio of the mean of the observed amplitudes to the mean of the coefficients being taken as the basis of computation, or say 18·6 ft. = 100.

†N.B.—The upper computed time of H.W. No. 1, entered in column C, is that found in the tide tables for the port of Quebec, which are issued every year by Archibald McCallum at his depot of nautical instruments and charts, 65 St. Peter street, Quebec. The second or time No. 2, is based on times of high water for the port of Brest, France, taken from "L'Annuaire des Marées de France." The third or time No. 3, is based on the London Bridge times of H.W. contained in the Nautical Almanac.

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

LEVIS GRAVING DOCK, HARBOUR OF QUEBEC,

DURING A COMPLETE LUNAR MONTH OF THE HIGH WATER SEASON OF 1888, VIZ., MAY 2 TO JUNE 1.

TABLE IX.

WEEKLY SERIES OF LOSING TIDES, No. VI.

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. VI.

Gauge book reference numbers.	Series VI. Losing tides.	DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.																
		High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming − or lagging + of tides.	Duration of apparent stand within 0·05 ft.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
			H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	Feet.
	½	May 12 L.W.	2	22	A.M.	....	....	....	....	....	....	— 19	.....	2·200	.....	.....	.....	.....
		....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	½	May 12 H.W.	7	5	A.M.	4	43	....	....	....	....	— 17	21	17·200	14·910	.....	9·283	13·968
	¾	do 12 L.W.	2	48	P.M.	....	....	7	43	12	23	.....	25	2·309	.....	14·891	.....	.....
16		do 12 H.W.	7	28	P.M.	4	40	....	....	....	....	.....	° 10	15·564	13·255	.....	9·597	13·936
	¼	do 13 L.W.	2	45	A.M.	....	....	7	17	12	5	.....	17	2·949	.....	12·615	.....	.....
	½	do 13 H.W.	7	33	A.M.	4	48	....	....	....	....	— *26	20	17·934	14·985	.....	9·746	13·855
	¾	do 13 L.W.	3	30	P.M.	....	....	7	57	12	19	.....	19	2·689	.....	15·245	.....	.....
17		do 13 H.W.	7	52	P.M.	4	22	....	....	....	....	.....	23	15·265	12·576	.....	9·874	13·556
	¼	do 14 L.W.	3	8	A.M.	....	....	7	16	12	14	.....	23	3·503	.....	11·762	.....	.....
	½	do 14 H.W.	8	6	A.M.	4	58	....	....	....	....	— 20	19	18·144	14·641	.....	9·934	13·306
	¾	do 14 L.W.	4	1	P.M.	....	....	7	55	12	16	.....	19	3·059	.....	15·085	.....	.....
18		do 14 H.W.	8	22	P.M.	4	21	....	....	....	....	.....	26	14·795	11·736	.....	9·664	13·060
	¼	do 15 L.W.	3	56	A.M.	....	....	7	34	12	8	.....	° 11	3·209	.....	11·586	.....	.....
	½	do 15 H.W.	8	30	A.M.	4	34	....	....	....	....	— 14	23	17·044	13·835	.....	9·527	12·705
	¾	do 15 L.W.	4	29	P.M.	....	....	7	59	12	28	.....	19	3·139	.....	13·905	.....	.....
19		do 15 H.W.	8	58	P.M.	4	29	....	....	....	....	.....	25	14·635	11·496	.....	9·478	12·423
	¼	do 16 L.W.	4	25	A.M.	....	....	7	29	12	10	.....	25	3·393	.....	11·242	.....	.....
	½	do 16 H.W.	9	8	A.M.	4	43	....	....	....	....	— 1	25	16·444	13·051	.....	9·197	12·206
	¾	do 16 L.W.	5	12	P.M.	....	....	8	4	12	39	.....	20	2·794	.....	13·650	.....	.....
20		do 16 H.W.	9	47	P.M.	4	35	....	....	....	....	.....	24	13·675	10·881	.....	8·926	11·850
	¼	do 17 L.W.	5	2	A.M.	....	....	7	15	12	11	.....	* 36	3·209	.....	10·466	.....	.....
	½	do 17 H.W.	9	58	A.M.	4	56	....	....	....	....	+ 4	27	15·614	12·405	.....	8·654	11·511
	¾	do 17 L.W.	5	56	P.M.	....	....	7	58	12	43	.....	35	2·589	.....	13·025	.....	.....
21		do 17 H.W.	10	41	P.M.	4	45	....	....	....	....	.....	26	12·735	10·146	.....	8·440	11·238
	¼	do 18 L.W.	5	53	A.M.	....	....	7	12	12	15	.....	27	3·054	.....	9·681	.....	.....
	½	do 18 H.W.	10	56	A.M.	5	3	....	....	....	....	+ 12	19	15·155	12·101	.....	8·437	11·081
	¾	do 18 L.W.	6	43	P.M.	....	....	7	47	12	47	.....	16	2·739	.....	12·416	.....	.....
22		do 18 H.W.	11	43	P.M.	5	0	....	....	....	....	.....	24	12·865	° 10·126	.....	8·520	10·984
	¼	do 19 L.W.	6	53	A.M.	....	....	7	10	12	28	.....	23	3·318	.....	° 9·547	.....	.....
	½	do 19 H.W.	12	11	P.M.	5	18	....	....	....	....	+ 17	24	15·165	11·847	.....	8·782	11·016
Totals 15 tides		H.W.	138	18	.....	71	15	106	34	173	6	+; 33	336	232·234	.....	.....	.....	.....
		L.W.	64	41	.....							— 78	315	41·953	187·991	175·116	138·059	186·695
Means	15 do	H.W.	....	....	.....	4	45	7	37	12	22	+ 11	22	15·482	12·533	12·508	9·204	12·446
	14	L.W.										— 16	23	2·996				

N.B.—Maxima in whole lunar month indicated by a star, thus; * and minima by a circle, thus: °

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. VI.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*). Diurnal Inequalities. In duration of floods.	In duration of ebbs.	In semi tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Wind. Velocity miles per hour.	Direction.	Height of barometric column at sea level and for 0° cent or 32° Fah.	REMARKS.
Min.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M.				Inches.	
....	....	....	....	....	....	....	....	....	....	....	....	....	.... ½
....	....	....	....	....	·053	·008	....	....	....	....	....	....	....
....	16	....	....	·019	....	....	6	27	2	5·875	N.E.	29·967	Fair, clear .... ½
3	....	13	1·636	....	·314	·032	....	....	3	6·136	E.	29·891	Raining hard .... ¾
....	26	....	....	·640	....	....	6	27	2	6·386	E.	29·823	Raining very heavily 16
8	....	18	2·370	....	·149	·081	....	....	1	6·591	E.	29·859	Rain ended at 4.0 a.m .... ¼
....	40	....	....	·260	....	....	6	8	2	5·181	S.E.	29·860	Raining quite heavily .... ½
26	....	14	2·669	....	·128	·299	....	....	1	3·057	S.E.	29·900	Heavy rain continues .... ¾
....	41	....	....	·814	....	....	6	3	....	1·807	E.	29·910	Still raining 17
36	....	5	2·879	....	·060	·250	....	....	20	7·068	E.	29·884	Rain continues .... ¼
....	39	....	....	·444	....	....	5	53	4	11·670	E.	29·859	do do .... ½
37	....	2	*3 349	....	·270	·246	....	....	5	8·295	N.E.	29·936	Maximum diurnal inequality in high water levels observed = 3·340 ft. Sky clearing up. ¾
....	21	....	....	·150	....	....	5	44	4	7·613	N.E.	29·956	Moons N. declination a maximum = 21° 8'. Cloudy. 18
13	....	8	2·249	....	·137	355	....	..	3	7·693	N.E.	29·958	Sky overcast. Commencing to rain .... ¼
....	25	....	....	·070	....	....	5	27	2	4·398	N.E.	29·951	Raining .... ½
5	....	20	2·409	....	·049	·282	....	....	2	4·424	N.E.	29·898	Rain continues .... ¾
....	32	....	....	·254	....	....	5	29	....	2·273	N.E.	29·868	do do 18
13	....	18	1·809	....	·281	·217	....	....	....	·909	S.W.	29·827	Cloudy .... ¼
....	37	....	....	·599	....	....	5	14	....	1·898	W.	29·800	Weather clearing up .... ½
8	....	29	2·769	....	·271	·356	....	....	....	7·159	W.	29·775	Clear, fair .... ¾
....	49	....	....	·415	....	....	5	27	....	4·761	W.	29·812	Clouding up 20
21	....	28	1·939	....	·272	·339	....	....	....	6·500	S.W.	29·854	Cloudy .... ¼
....	43	....	....	·620	....	....	5	13	....	9·375	N.W.	29·871	Fair .... ½
11	....	8	2·879	....	·214	·273	....	....	25	12·250	N.W.	29·911	Fine clear weather .... ¾
....	*46	....	....	·465	....	....	5	30	....	9·318	N.W.	29·959	do do 21
42	....	12	2·420	....	·003	·157	....	....	....	8 181	N.W.	29·959	Fine bright morning .... ¼
....	35	....	....	·315	....	....	5	20	2	11·470	N.	29·922	Fine and bright .... ½
3	....	32	2·290	....	·083	·097	....	....	....	1·841	N.E.	29·906	Moon's first quarter, May 18th, at Quebec, from 6h. 5m. p.m. Clear ¾
....	37	....	....	·579	....	....	5	41	....	2 163	N.E.	29·921	and fine. 22
18	....	19	2·300	....	·262	·032	....	....	5	6·886	N.E.	29·935	Cloudy .... ¼
....	....	....	....	....	....	....	5	44	1	9 023	N.E.	29·920	Rain commenced at 11.40 a,m. .... ½
244	487	226	33·967	5·644	2·546	3·024	85	47	....	180	·201	....	866·892
17	35	16	2·426	0·403	0·170	0·202	5	43	....	6	·214	....	29·893

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. VI.

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Gauge book reference numbers. Series VI. Losing tides.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2).†		Length of half tide day H. W. to H. W.		Priming — or lagging + of tides.	Lunitidal intervals		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old, together with proportional amplitudes and diurnal inequalities.*			
	Upper passage.		Lower passage.		Ages, &c.								Co-efficients.	*Amplitudes.	Diurnal Difference.	
															In amplitudes.	In semi-tide days.
	H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		Feet.	Feet.	Min.
½										— 19						
						7	12									
½			12	38		7	13			— 19	6	35	82	15·25		1
						7	28									
¾					1·6			12	16						·00	
						7	28									
16	1	1				7	29				6	28	82	15·25		1
						7	44									
¼								12	15						·19	
						7	44									
½			1	25		7	44			— 19	6	19	81	15·06		1
						8	0									
¾					2·6			12	16						·18	
						8	0									
17	1	49				8	0				9	11	80	14·88		0
						8	16									
¼								12	16						·38	
						8	15									
½			2	13	3·6	8	16			— 18	6	3	78	14·50		0
						8	32									
¾								12	16						·37	
						8	33									
18	2	38				8	32				5	54	76	14·13		0
						8	47									
¼								12	16						·56	
						8	49									
½			3	3	4·6	8	48			— 16	5	45	73	13·57		2
						9	5									
¾								12	18						·55	
						9	7									
19	3	29				9	6				5	37	70	13·02		0
						9	21									
¼								12	18						·75	
						9	24									
½			3	54	5·6	9	24			— 13	5	30	66	12·27		1
						9	39									
¾								12	19						·74	
						9	42									
20	4	20				9	43				5	23	62	11·53		3
						9	56									
¼								12	22						·75	
						10	2									
½			4	45	6·6	10	5			— 4	5	20	58	10·78		2
						10	14									
¾								12	24						·74	
						10	24									
21	5	11				10	29				5	18	54	10·04		2
						10	34									
¼								12	26						·56	
						10	50									
½			5	36	7·6	10	55			+ 6	5	19	51	9·48		4
						10	56									
¾								12	30						·56	
						11	18									
22	6	2				11	25				5	23	48	8·92		4
						11	22									
¼								12	34						·39	·?
						11	48									
½			6	27	8·6	11	59			+ 22	5	32	46	8·53		4
						11	50									
Totals	24	30	28	1		139	8	172	46	+ 28	86	37	1007	187·21	6·72	25
										— 89						
Totals	3	30	3	30		9	17	12	20	+ 14	5	46	67·13	12·48	·45	2
										— 15						

* The ratio of the mean of the observed amplitudes to the mean of the coefficients being taken as the basis of computation, or say 186 ft.=100.

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

LEVIS GRAVING DOCK, HARBOUR OF QUEBEC,

DURING A COMPLETE LUNAR MONTH OF THE HIGH WATER SEASON OF 1888, VIZ., MAY 2nd TO JUNE 1st.

TABLE IX.

WEEKLY SERIES OF GAINING TIDES, No. VII.

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of gaining tides No. VII.

Gauge book reference numbers.	Gaining tides.	Series VII.	High and low waters observed each civil day.		Time, Eastern Standard.				Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming — or lagging + of tides.	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
					H.	M.	A. M. or P. M.		H.	M.	H.	M.	H.	M.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	Feet.
.....			May 19	H.W.	12	11	P.M.		...	....	....	....	....	....	+ 17	.....	15·165	.....	.....	.....	.....
.....			.....	.....	....	.....	.....		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
		¾	May 19	L.W.	7	52	P.M.		...	....	7	41	12	39	.....	23	3·229	.....	11·936	.....	.....
23			do 20	H.W.	12	50	A.M.		4	58	...	...	...	...	.....	33	13·965	10·736	.....	8·688	11·188
		¼	do 20	L.W.	8	23	A.M.		...	....	7	33	12	22	.....	18	2·959	.....	11·006	.....	.....
		½	do 20	H.W.	1	12	P.M.		4	49	...	...	...	...	+ 26	24	14·035	11·076	.....	8·294	11·431
		¾	do 20	L.W.	9	4	P.M.		...	....	7	52	12	54	.....	22	2·199	.....	11·836	.....	.....
24			do 21	H.W.	2	6	A.M.		5	2	...	...	...	...	.....	33	14·005	11·806	.....	8·294	11·845
		¼	do 21	L.W.	9	35	A.M.		...	....	7	29	12	22	.....	25	2·544	.....	11·461	.....	.....
		½	do 21	H.W.	2	28	P.M.		4	53	...	...	...	...	+ 6	26	14·820	12·276	.....	8·517	12·286
		¾	do 21	L.W.	10	1	P.M.		...	....	7	33	12	34	.....	27	2·204	.....	12·616	.....	.....
25			do 22	H.W.	3	2	A.M.		5	1	...	...	...	...	.....	29	14·995	12 791	.....	8·495	12·907
		¼	do 22	L.W.	10	53	A.M.		...	....	7	51	12	28	.....	19	1·879	.....	13·116	.....	.....
		½	do 22	H.W.	3	30	P.M.		4	37	...	...	...	...	+ 4	29	14·985	13·106	.....	8·617	13·552
		¾	do 22	L.W.	11	11	P.M.		...	....	7	41	12	26	.....	19	1·804	.....	13·181	.....	.....
26			do 23	H.W.	3	56	A.M.		4	45	...	...	...	...	.....	26	16·609	14·805	.....	8·904	14·287
		¼	do 23	L.W.	11	52	A.M.		...	....	7	56	12	28	.....	16	1·719	.....	14·890	.....	.....
		½	do 23	H.W.	4	24	P.M.		4	32	...	...	...	...	°+ 1	26	15·989	14·270	.....	9·228	14·807
		¾	do 24	L.W.	12	6	A.M.		...	....	7	42	12	23	.....	14	1·929	.....	14·060	.....	.....
27			do 24	H.W.	4	47	A.M.		4	41	...	...	...	...	.....	23	17·939	•16 010	.....	9·594	15·281
		¼	do 24	L.W.	12	50	P.M.		...	....	8	3	12	31	.....	20	1·979	.....	15·960	.....	.....
		½	do 24	H.W.	5	18	P.M.		4	28	...	...	...	...	— 2	21	17·074	15·095	.....	9·947	15·686
		¾	do 25	L.W.	1	3	A.M.		...	....	7	45	12	17	.....	17	2·229	.....	14·845	.....	.....
28			do 25	H.W.	5	35	A.M.		4	32	...	...	...	...	.....	18	19·073	16·844	.....	10·168	16·009
		¼	do 25	L.W.	1	48	P.M.		...	....	8	13	12	29	.....	19	2·099	.....	16·974	.....	.....
		½	do 25	H.W.	6	4	P.M.		4	16	...	...	...	...	°— 0	26	17·474	15·375	.....	10·308	16·208
		¾	do 26	L.W.	1	56	A.M.		...	....	7	52	12	21	.....	21	2·309	.....	15·165	.....	.....
29			do 26	H.W.	6	25	A.M.		4	29	...	...	...	...	.....	20	19·628	17·319	.....	10·364	16·359
		¼	do 26	L.W.	2	41	P.M.		..	....	8	16	12	34	.....	14	2·059	.....	17·569	.....	.....
		½	do 26	H.W.	6	59	P.M.		4	18	...	...	...	...	— 7	20	17·444	15·385	.....	10·454	*16·441
Totals 14 tides				H.W.	68	36	}	....	65	21	109	27	174	48	+ 37	354	228·035	196·894	194·615	129·872	198·287
				L.W.	111	15	}								.....	.....	.....				
															— 9	274	31·141				
Means	14			H.W.	}				4	40	7	49	12	29	+ 9	25	16·288	14·064	13·901	9·277	14·163
	do 14			L.W.	}										— 3	20	2·224				

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus °

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of gaining tides No. VII.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).

Diurnal Inequalities. In duration of floods. Min.	In duration of ebbs. Min.	In semi-tide days. Min.	In high water levels. Feet.	In low water levels. Feet.	In mean tide levels. Feet.	In amplitudes. Feet.	Lunitidal intervals. H	M	Oscillations of float in hundredths of a foot.	Wind. Velocity miles per hour.	Direction.	Height of barometric column, at sea level and for 0° cent. or 32° Fah. Inches.	REMARKS.
....	....	....	....	....	....	....				.....	.....		.....
....	31	....	.....	·089	.....	.....				.....	.....		.....
20	....	11	1·200	.....	·094	·172	..	..	3	5·455	N.E.	29·908	Sky clearing up..... ¾
....	18	....	.....	·270	.....	.....	5	57	....	3·398	N.W.	29·934	do 23
9	....	17	·070	.....	·394	·243	..	..	....	10·307	N.W.	29·991	Clouds forming ..... ¼
...	19	..	.....	·760	.....	.....	5	54	1	6·659	N.W.	29·985	Sun showers..... ½
47	....	32	·030	.....	·000	·414	..	..	....	8·045	N.W.	30·063	Clear weather..... ¾
...	23	....	.....	·345	.....	.....	6	22	....	5·807	N.W.	30·083	Fair..... 24
9	....	32	·815	.....	·223	·441	..	..	2	9·318	N.W.	30·108	Fine clear weather..... ¼
....	4	....	.....	·340	.....	.....	6	18	....	1·012	N.W.	30·098	Beautiful day..... ½
52	....	12	·175	.....	·022	·621	..	..	....	1·273	N.W.	30·174	Moon after crossing equator; fine night. ¾
....	18	....	.....	·325	.....	.....	6	26	....	4·273	N.W.	30·218	Perfectly clear sky..... 25
24	....	6	·010	.....	·122	·645	..	..	....	3·057	N.W.	30·236	Fine; clouds here and there..... ¼
....	10	....	.....	·075	.....	.....	6	28	....	4·136	S.W.	30·148	Fine day; scattering clouds ..... ½
8	....	2	1·624	.....	·287	·735	..	..	....	2·375	S.W.	30·103	Fair; sky getting cloudy ..... ¾
....	15	....	.....	·085	.....	.....	6	27	....	·909	N.E.	30·085	do cloudy 26
13	....	2	·620	.....	·324	·520	..	..	....	7·943	S.W.	30·021	Clear sky..... ¼
....	14	....	.....	·210	.....	.....	6	27	....	5·170	S.W.	29·986	Rather close and hot..... ½
9	....	5	1·950	.....	·366	·474	..	..	2	6·955	N.E.	30·042	Fine and bright..... ¾
....	21	....	.....	·050	.....	.....	6	22	..	6·364	E.	30·062	Very fine morning..... 27
13	....	8	·865	.....	·353	·405	..	..	5	7·818	N.E.	30·034	Moon in perigee, May 24th, at 2 p.m.; fine. ¼
...	18	....	.....	·250	.....	.....	6	25	2	4·716	N.E.	29·993	Fine and bright..... ½
4	...	14	1·999	....	·221	·323	..	..	4	9·545	N.E.	29·995	do clear weather..... ¾
....	28	....	.....	·130	.....	.....	6	12	4	6·534	N.E.	30·006	Full moon (Quebec) May 25th, at 8h. 28m., p.m.; fine day.
16	....	12	1·599	.....	·140	·199	..	..	4	9·068	N.E.	30·004	Fair,..... ¼
....	21	....	.....	·210	.....	.....	6	11	3	10·273	N.E.	30·002	Fine day; sky clear of clouds..... ½
13	....	8	2·154	.....	·056	·151	..	..	10	7·216	N.E.	30·021	Fine clear night..... ¾
....	24	....	.....	·250	.....	.....	6	2	1	5·602	N.E.	30·035	Clear sky; fine..... 29
11	....	13	2·184	.....	·090	·082	..	..	....	3·807	N.E.	29·922	Fair.....
....	....	....	.....	.....	.....	.....	6	5	2	8·841	N.E.	29·906	Clouding up.....
248	264	174	15·295	3·389	2·692	5·425	87	36	....	165·876	.....	841·163	.....
18	19	12	1·092	0·242	0·192	0·387	6	15	....	5·924	.....	30·042	.....

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of gaining tides No. VII.

Gauge book reference numbers. Series VII.	Gaining tides.	RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."															
		Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2).†		Length of half tide day H. W. to H. W.		Priming − or lagging + of tides.	Lunitidal intervals		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old, together with proportional amplitudes and diurnal inequalities.*			
		Upper passage.		Lower passage.		Ages, &c.								Co-efficients.	*Amplitudes.	Diurnal Differences	
																In amplitudes.	In semi-tide days.
		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		Feet.	Feet.	Min.
	½							C.			+ 22						
	¾								12	38						·02	
23		6	53				12	58				5	44	46	8·55		2
							12	37									
	¼						12	20	12	40						·37	
	½			7	18	9·6	1	37									
							1	17			+ 29	5	59	48	8·92		1
	¾						12	53	12	39						·54	
24		7	44				2	16				6	12	51	9·46		2
							1	56									
	¼						1	30	12	37						·93	
	½			8	10	10·6	2	50									
							2	33			+ 21	6	23	56	10·39		3
	¾						2	9	12	34						1·14	
25		8	36				3	23				6	31	62	11·53		3
							3	7									
	¼					11·6	2	48	12	31						1·30	
	½			9	2		3	55									
							3	38			+ 9	6	36	69	12·83		3
	¾						3	22	12	28						1·30	
26		9	29				4	24				6	37	76	14·13		2
							4	6									
	¼					12·6	3	55	12	26						1·27	
	½			9	57		4	31									
							4	32			°+ 1	6	35	83	15·40		1
	¾						4	27	12	25						1·15	
27		10	25				4	50				6	32	89	16·55		1
							4	57									
	¼					13·6	4	56	12	24						1·12	
	½			10	53		5	4									
							5	21			°− 2	6	28	95	17·67		0
	¾						5	22	12	24						·89	
28		11	23			O	5	38				6	22	100	18·56		0
							5	45									
	¼					14·6	5	46	12	24						·78	
	½			11	53		6	3									
							6	9			− 3	6	16	104	19·34		1
	¾						6	0	12	23						·37	
29			23				6	28				6	9	106	19·71		0
							6	32									
	¼					15·6	6	35	12	23						·19	
	½				54		6	51						*	*		
							6	55			− 3	6	1	107	19·90		1
							7	0									
Totals 14 tides.		66	53	70	7	.....	69 +156 =225	25 0 25	174	56	+ 60 ..... − 8	88	25	1092	203·94	11·37	20
Means 14 tides.		9	33	10	1	.....	16	6	12	30	+ 13 ..... − 3	6	19	78·00	14·57	·81	1

*The ratio of the mean of the observed amplitudes to the mean of the coefficients being taken as the basis of computation, or say 18·6 ft.=1·00.

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

LEVIS GRAVING DOCK, HARBOUR OF QUEBEC,

DURING A COMPLETE LUNAR MONTH OF THE HIGH WATER SEASON OF 1888, VIZ., MAY 2 TO JUNE 1.

TABLE IX.

WEEKLY SERIES OF LOSING TIDES, No. VIII.

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. VIII.

Gauge book reference numbers	Series VIII. Losing tides.	High and low waters observed each civil day.		Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming − or lagging + of tides.	Duration of apparent stand within 0·05 ft.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
				H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	Feet.
	½	May 26	H.W.	6	59	P.M.	....	....	....	....	....	....	− 7	.....	17·444	.....	....	.....	.....
	¾	May 27	L.W.	2	36	A.M.	....	....	7	37	12	9	.....	17	2·409	.....	*15·035	.....	.....
30		do 27	H.W.	7	8	A.M.	4	32	....	....	....	....	.....	19	20·184	17·775	.....	10·529	16·311
	¼	do 27	L.W.	3	29	P.M.	....	....	8	21	12	36	.....	15	2·339	.....	17·845	.....	.....
	½	do 27	H.W.	7	44	P.M.	4	15	....	....	....	....	− 2	20	16·926	14·587	.....	10·344	15·961
	¾	do 28	L.W.	3	21	A.M.	....	....	7	37	12	12	.....	16	2·389	.....	14·537	.....	.....
31		do 28	H.W.	7	56	A.M.	4	35	....	....	....	....	.....	18	19·263	16·874	.....	10·016	15·655
	¼	do 28	L.W.	4	17	P.M.	....	....	8	21	12	35	.....	17	1·989	.....	17·274	.....	.....
	½	do 28	H.W.	8	31	P.M.	4	14	....	....	....	....	+ 4	19	15·924	13·935	.....	9·780	15·312
	¾	do 29	L.W.	4	8	A.M.	....	....	7	37	12	19	.....	16	2·259	.....	13·665	.....	.....
32		do 29	H.W.	8	50	A.M.	4	42	....	....	....	....	.....	19	18·633	16·374	.....	9·656	14·990
	¼	do 29	L.W.	5	6	P.M.	....	....	8	16	12	35	.....	19	2·064	.....	16·569	.....	.....
	½	do 29	H.W.	9	25	P.M.	4	19	....	....	....	....	− 5	12	15·414	13·350	.....	9·420	14·542
	¾	do 30	L.W.	5	20	A.M.	....	....	7	55	12	10	.....	13	2·234	.....	13·180	.....	.....
33		do 30	H.W.	9	35	A.M.	4	15	....	....	....	....	.....	20	17·304	15·070	.....	9·020	14·148
	¼	do 30	L.W.	5	53	P.M.	....	....	8	18	12	52	.....	15	1·659	.....	15·645	.....	.....
	½	do 30	H.W.	10	27	P.M.	4	34	....	....	....	....	+ 7	20	14·355	12·696	.....	8·824	13·425
	¾	do 31	L.W.	5	47	A.M.	....	....	7	20	12	5	.....	23	2·564	.....	11·791	.....	.....
34		do 31	H.W.	10	32	A.M.	4	45	....	....	....	....	.....	23	16·132	13·568	.....	8·640	12·852
	¼	do 31	L.W.	6	36	P.M.	....	....	8	4	12	45	.....	20	1·864	.....	14·268	.....	.....
	½	do 31	H.W.	11	17	P.M.	4	41	....	....	....	....	+ 14	29	13·645	11·781	.....	8·704	12·355
	¾	June 1	L.W.	6	35	A.M.	....	....	7	18	12	19	.....	17	3·189	.....	10·456	.....	.....
35		do 1	H.W.	11	36	A.M.	5	1	....	....	....	....	.....	28	16·104	12·915	.....	8·965	12·006
	¼	do 1	L.W.	7	28	P.M.	....	....	7	52	12	54	.....	18	2·734	.....	13·370	.....	.....
	½	do 2	H.W.	12	30	A.M.	5	2	....	....	....	....	+ 1	29	14·020	11·286	.....	8·781	11·507
	¾	do 2	L.W.	7	44	A.M.	....	....	7	14	11°	57	.....	23	3·323	.....	10·697	.....	.....
36		do 2	H.W.	12	27	P.M.	4	43	....	....	....	....	.....	22	13·995	10·672	.....	8·188	11·156
	¼	do 2	L.W.	8	26	P.M.	....	....	7	59	13*	12	.....	21	1·899	.....	12·096	.....	.....
	½	do 3	H.W.	1	39	A.M.	5	13	....	....	....	....	+ 29*	34	13·057	11·158	.....	7·908	10·752°
	¾	June 3	L.W.	8	46	A.M.	....	....	7	7	12	7	.....	21	.....	.....	10·308	.....	.....
															2·749				
Totals 14 tides			H.W.	129	37	....	64	51	116	56	186	47	+ 55	312	224·956	192·041	206·736	128·775	190·972
			L.W.	85	32								− 7	269	32·915				
Means do 14 15			H.W.	....	....	.....	4	38	7	48	12	27	+ 11	22	16·068	13·718	13·782	9·198	13·641
			L.W.										− 3	18	2·351				
Grand totals 57 tides			H.W.	....	....	.....	270	41	436	57	707	21	+175	1366	888·611	757·436	756·257	510·417	756·906
			L.W.										−163	1181	127·315				
Grand means 57 tides			H.W.	....	....	.....	4	45	7	40	12	25	+ 12	24	15·590	13·288	13·268	8·955	13·279
			L.W.										− 12	20	2·233				

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. VIII.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*). Diurnal Inequalities. In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Wind.		Height of barometric column at sea level and for 0° cent or 32° Fah.	REMARKS.
Min.	Min.	Min.	Feet.	Feet	Feet.	Feet.	H.	M.		Velocity, miles per hour.	Direction.	Inches.	
....	....	....	....	....	....	....	....	....	....	....	....	....	.... ½
....	39	....	....	·350	....	....	....	....	....	....	....	....	....
14	....	25	2·740	.....	·075	·131	....	....	10	7·807	N.E.	29·895	Cloudy ¾
....	44	....	.....	·070	.....	.....	5	43	....	5·341	N.E.	29·924	Commencing to rain. 30
17	....	27	3·258	.....	·185	·349	....	....	....	4·750	N.E.	29·891	Raining ½
....	44	....	.....	·050	.....	.....	5	49	1	5·636	N.E.	29·913	Moon's S. declination a maximum=21° 41'. Rain continues.
20	....	24	2·337	.....	·328	·306	....	....	....	3·420	N.E.	29·912	Rain stopped at 9.0 p.m.; cloudy. ¾
....	44	....	.....	·400	.....	.....	5	31	....	2·511	N.E.	29·907	Rain; cloudy 31
21	....	23	3·339	.....	·236	·343	....	....	10	6·307	N.E.	29·885	do ½
....	44	....	.....	·270	.....	.....	5	37	....	2·239	N.E.	29·890	Rain continues; sky overcast. ½
28	....	16	2·709	.....	·124	·322	....	....	10	5·216	N.E.	29·870	Rain. ¾
....	39	....	.....	·195	.....	.....	5	27	1	3·136	S.W.	29·693	Raining still 32
23	....	16	3·219	.....	·236	·448	....	....	1	4·205	S.W.	29·716	Fine, bright, warm afternoon. ½
....	21	....	.....	·170	.....	.....	5	34	....	·875	S.W.	29·761	Fine, clear weather. ½
4	....	25	1·890	.....	·400	·394	....	....	....	2·318	S.W.	29·803	Fine morning. ¾
....	23	....	.....	·575	.....	.....	5	17	....	3·898	W.	29·781	Clear, bright, sunny day. 33
19	....	42	2·949	.....	·196	·723	....	....	10	7·045	W.	29·754	Squalls of W. wind ½
....	58	....	.....	·905	.....	.....	5	43	....	2·023	W.	29·803	Clear, fine night. ½
11	....	47	1·777	.....	·184	·573	....	....	....	1·705	E.	29·923	Cloudy and cool. ¾
....	16	....	.....	·700	.....	.....	5	23	....	2·511	N.E.	29·936	Fair. 34
4	....	40	2·487	.....	·064	·497	....	....	....	2·102	N.E.	29·807	Cloudy ½
....	46	....	.....	1·325	.....	.....	5	45	....	2·511	N.E.	29·779	Rain commenced at 11 p.m. ½
0	....	26	2·459	.....	·261	·349	....	....	6	7·989	N.E.	29·598	Moon's last quarter, June 1st, at Quebec, from 7h. 53m. a.m.; pouring rain.
....	34	....	.....	·455	.....	.....	5	40	6	6·250	S.W.	29·586	Clearing up 35
1	....	35	2·084	.....	·184	·499	....	....	....	2·693	S.	29·621	do ½
....	38	....	.....	·589	.....	.....	6	12	....	2·180	S.	29·688	Sky becoming cloudy ½
19	....	57	·025	.....	·593	·351	....	....	....	2·466	N.E.	29·804	Cloudy, mist and rain ¾
....	45	....	.....	1·424	.....	.....	5	46	....	1·443	N.E.	29·809	Sky clearing up; fair. 36
30	...	75	·938	.. ..	·280	·404	....	..	...	5·330	N.E.	29·808	Cloudy ½
....	52	...	.. ...	·850	...	.....	6	37	....	2·977	N.E.	29·806	Rain; sky overcast ½
13		65	·803	....	·280	·404	....	....	....	1·648	W.	29·807	....
....	....	....	.....	.....	.....	.....	....	....	....	....	....	....	Rain continues ¾
224	587	543	33·014	8·328	3·626	6·093	80	4	....	108·532	.....	865·370	....
15	39	36	2·201	·555	·242	·406	5	43	....	3·743	.....	29·840	....
816	1624	1180	96·971	24·271	11·807	18·498	350	52	....	667·128	.....	3413·555	....
14	28	21	1·701	·426	·204	·325	6	10	....	5·888	.....	29·943	....

APPENDIX 13.—Tidal Fluctuations, Lévis Graving Dock, series of losing tides No. VIII.

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Gauge book reference numbers.	Series VIII. Losing tides.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)†		Length of half tide day H.W. to H.W.		Priming — or lagging + of tides.	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old, together with proportional amplitudes and diurnal inequalities.*			
		Upper passage.		Lower passage.		Ages, &c.								Co-efficients.	*Amplitudes.	Diurnal Differences	
																In amplitudes.	In semi-tide days.
		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		Feet.	Feet.	Min.
	½	.....	.....	.....	.....	.....	...C...		.....	.....	— 3	.....	.....	.....	.....	.....	.....
	¾	.....	.....	.....	.....	.....	.....		12	24	.....	.....	.....	.....	.....	·19	.....
30		1	25	.....	.....	.....	7	14			.....	5	54	106	19·71	.....	1
	¼	.....	.....	.....	.....	16·6	7	19	12	23	.....	.....	.....	.....	.....	·37	.....
	½	.....	.....	1	55	.....	7	23	.....	.....	— 3	5	47	104	19·34	.....	1
	¾	.....	.....	.....	.....	.....	7	39	12	24	.....	.....	.....	.....	.....	·56	.....
31		2	25	.....	.....	17·6	7	42			.....	5	41	101	18·78	.....	0
	¼	.....	.....	.....	.....	.....	7	46	12	24	.....	.....	.....	.....	.....	·93	.....
	½	.....	.....	2	54	.....	8	2	.....	.....	— 3	5	36	96	17·85	.....	1
	¾	.....	.....	.....	.....	.....	8	6	12	23	.....	.....	.....	.....	.....	·93	.....
32		3	23	.....	.....	18·6	8	11			.....	5	30	91	16·92	.....	0
	¼	.....	.....	.....	.....	.....	8	27	12	23	.....	.....	.....	.....	.....	1·11	.....
	½	.....	.....	3	51	.....	8	30	.....	.....	— 3	5	25	85	15·81	.....	1
	¾	.....	.....	.....	.....	.....	8	34	12	24	.....	.....	.....	.....	.....	1·12	.....
33		4	18	.....	.....	19·6	8	52			.....	5	22	79	14·69	.....	2
	¼	.....	.....	.....	.....	.....	8	53	12	26	.....	.....	.....	.....	.....	1·30	.....
	½	.....	.....	4	44	.....	8	59	.....	.....	+ 2	5	22	72	13·39	.....	0
	¾	.....	.....	.....	.....	.....	9	15	12	26	.....	.....	.....	.....	.....	1·12	.....
34		5	9	.....	.....	20·6	9	16			.....	5	23	66	12·27	.....	1
	¼	.....	.....	.....	.....	.....	9	24	12	27	.....	.....	.....	.....	.....	1·11	.....
	½	.....	.....	5	32	.....	9	40	.....	.....	+ 7	5	27	60	11·16	.....	3
	¾	.....	.....	.....	.....	◑	9	47	12	30	.....	.....	.....	.....	.....	·93	.....
35		5	56	.....	.....	21·6	10	4			.....	5	33	55	10·23	.....	2
	¼	.....	.....	.....	.....	.....	10	6	12	32	.....	.....	.....	.....	.....	·75	.....
	½	.....	.....	6	18	.....	10	12	.....	.....	+ 17	5	43	51	9·48	.....	3
	¾	.....	.....	.....	.....	.....	10	29	12	35	.....	.....	.....	.....	.....	·56	.....
36		6	41	.....	.....	22·6	10	32			.....	5	55	48	8·92	.....	4
	¼	.....	.....	.....	.....	.....	10	38	12	31	.....	.....	.....	.....	.....	·39	.....
	½	.....	.....	7	2	.....	10	55	.....	.....	+ 10	6	5	46	8·53	.....	.....
	¾	.....	.....	.....	.....	23·6	11	1	12	29	.....	.....	.....	.....	.....	.....	.....
Total 14 tides		29	17	32	16	.....	128	16	186	41	+ 36 ..... — 9	78	43	1060	197·8	1137	19
							+12	0									
							=140	16									
Mean 14 tides		4	11	4	37	.....	10	1	12	27	+ 9 ..... — 3	5	37	75·71	14·8	·81	1
Gra'd t'ls 57 tides		179	25	198	37	.....	573	4	707	42	+ 178 ..... —164	351	2	4071	757·72	3653	94
Gra'd m'n 57 tides		6	24	6	51	.....	10	3	12	25	+ 14 ..... — 10	6	10	77·42	13·29	·65	2

* The ratio of the mean of the observed amplitudes to the mean of the coefficients being taken as the basis of computation, or say 1·86 ft=100.

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

*CHAUDIERE, ST. NICHOLAS, POINTE PLATON,

DURING A COMPLETE LUNAR MONTH OF THE HIGH WATER SEASON OF 1888, VIZ., MAY 2 TO JUNE 1.

TABLES X, XI AND XII.

WEEKLY SERIES OF GAINING AND LOSING TIDES Nos. V, V, VI, VII, VIII.

*Chaudière fluctuations incomplete.

APPENDIX 13.

TABLE X.—Tidal Fluctuations at Chaudière during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series V. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides Min	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min.	In duration of ebbs. Min.
	May 4 L.W. †	9	25	P.M.	..	..	7	37	12	52	....	25	1·913	.....	.....	.....	.....	.....	.....
	May 5 H.W	2	42	A.M.	5	17	..	..	..	..	+19	23	13·073	11·160	.....	8·040	11·305	....	47
	do 5 L.W.	9	32	A.M.	..	..	6	50	12	15	....	29	2·863	.....	10·210	.....	.....	8	...
9	do 5 H.W	2	57	P.M.	5	25	..	..	..	..	....	13	14·503	11·640	.....	8·281	11·458	....	43
	do 5 L.W.	10	30	P.M.	..	..	7	33	12	48	....	25	2·243	.....	12·260	.....	.....	10	...
	do 6 H.W	3	45	A.M.	5	15	..	..	..	..	+17	24	13·963	11·720	.....	8·212	11·828	...	24
	do 6 L.W.	10	54	A.M.	..	..	7	9	12	19	....	20	2·353	.....	11·610	.....	.....	5	...
10	do 6 H.W	4	4	P.M.	5	10	..	..	..	..	....	17	14·073	11·720	.....	8·053	12·060	....	19
	do 6 L.W.	11	32	P.M.	..	..	7	28	12	38	....	20	1·693	.....	12·380	.....	.....	0	...
	do 7 H.W	4	42	A.M.	5	10	..	..	..	..	+ 9	24	14·223	12·530	.....	7·932	12·708	....	16
	do 7 L.W. ‡	11	54	A.M.	..	..	7	12	12	21	....	22	1·463	.....	12·760	.....	.....	1	...
11	do 7 H.W	5	3	P.M.	5	9	..	..	..	..	....	21	14·623	13·160	.....	8·148	13·030	...	3
	do 8 L.W.	12	18	A.M.	..	..	7	15	12	14	....	18	1·803	.....	12·820	.....	.....	10	...
	do 8 H.W	5	17	A.M.	4	59	..	..	..	..	—11	15	15·183	13·380	.....	8·212	13·257	....	16
	do 8 L.W.	12	48	P.M.	..	..	7	31	12	25	....	16	1·363	.....	13·820	.....	.....	5	...
12	do 8 H.W	5	42	P.M.	4	54	..	..	..	..	....	19	14·373	13·101	.....	8·152	13·428	....	13
	do 9 L.W.	1	0	A.M.	..	..	7	18	12	5	....	11	1·513	.....	12·860	.....	.....	7	...
	do 9 H.W	5	47	A.M.	4	47	..	..	..	..	—10	29	15·533	14·020	.....	8·228	13·700	....	25
	do 9 L.W.	1	30	P.M.	..	..	7	43	12	35	....	17	1·243	.....	14·290	.....	.....	5	...
13	do 9 H.W §	6	22	P.M.	4	52	..	..	..	..	...	21	14·873	13·630	.....	8·549	13·953	....	30
	do 10 L.W.	1	35	A.M.	..	..	7	13	12	8	....	12	1·903	.....	12·970	.....	.....	3	...
	do 10 H.W	6	30	A.M.	4	55	..	..	..	..	—19	23	16·823	14·920	.....	9·179	14·073	....	20
	do 10 L.W.	2	3	P.M.	..	..	7	33	12	23	....	14	2·383	.....	14·440	.....	.....	5	...
14	do 10 H.W	6	53	P.M.	4	50	..	..	..	..	....	18	16·343	13·960	.....	9·766	14·175	...	28
	do 11 L.W.	1	58	A.M.	..	..	7	5	12	9	....	13	2·973	.....	13·370	.....	.....	14	...
	do 11 H.W	7	2	A.M.	5	4	..	..	..	..	—18	16	17·903	14·930	.....	9·870	14·145	....	38
	do 11 L.W.	2	45	P.M.	..	..	7	43	12	23	...	20	2·623	.....	15·280	.....	.....	24	...
15	do 11 H.W	7	25	P.M.	4	40	..	..	..	..	....	23	15·623	13·000	.....	9·670	14·120	....	40
	do 12 L.W.	2	28	A.M.	..	..	7	3	12	25	....	24	.....	.....	13·000	.....	.....	42	...
	.....	...	...	.....	...	...	...	...	...	...	...	...	2·623	.....	.....	.....	.....	...	...
	H.W.	74	11								+45	286	211·112						
Totals 14 tides	.....	.....	.....	....	70	27	102	36	173	8	.....	.....	.....	182·780	182·070	120·292	183·240	139	362
	L.W.	92	47								—58	261	26·419						
	L.W.	+ 12	9																
	L.W.	=104	47																
	14 H.W.										+15	20	15·080						
Means	do	.....	.....	....	5	2	7	20	12	22	..	.....	.....	13·056	13·005	8·592	13·089	10	23
	14 L.W.										—15	19	2·032						

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °
† Longitude, mouth of River Chaudière = 71° 17′ = 4h. 45m. 8s. = 0·1980 of a day west of Greenwich.

APPENDIX 13.

TABLE X.—Tidal Fluctuations at Chaudière during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).								RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."													
Diurnal Inequalities.								Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.				
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.									
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M	Days.	H.	M.	H.	M.	Min	H.	M.	General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series V. Gaining tides. Gauge book reference numbers.
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12	42	....	....	....	....	
....	....	....	....	....	....	....	....	....	....	....	....	23·3	....	....	....	....	....	....	....	....	
39	....	950	....	....	7	5	....	....	....	7	37	....	2	16	....	....	+33	6	39	44	
....	1·430	....	241	153	....	....	....	....	....	....	....	....	....	....	12	41	....	....	....	....	
33	....	620	....	....	6	58	....	7	59	....	....	....	2	57	....	....	....	6	58	46	9
....	540	....	069	370	....	....	....	....	....	....	....	24·3	....	....	12	37	....	....	....	....	
29	....	110	....	....	7	24	....	....	....	8	21	....	3	34	....	....	+19	7	13	49	
....	110	....	159	232	....	....	....	....	....	....	....	....	....	....	12	32	....	....	....	....	
19	....	660	....	....	7	22	....	8	42	....	....	....	4	6	....	....	....	7	24	53	10
....	150	....	121	648	....	....	2	....	....	....	....	25·3	....	....	12	27	....	....	....	....	
17	....	230	....	....	7	38	....	....	....	9	4	....	4	33	....	....	+ 2	7	29	57	
....	400	....	216	322	....	....	....	....	....	....	....	....	....	....	12	25	....	....	....	....	
7	....	340	....	....	7	39	....	9	24	....	....	....	4	58	....	....	....	7	34	61	11
....	560	....	064	227	....	....	3	....	....	....	....	26·3	....	....	12	22	....	....	....	....	
11	....	440	....	....	7	32	....	....	....	9	45	....	5	20	....	....	— 8	7	35	65	
....	810	....	060	171	....	....	....	....	....	....	....	....	....	....	12	20	....	....	....	....	
20	....	150	....	....	7	36	....	10	6	....	....	....	5	40	....	....	....	7	34	69	12
....	1·160	....	076	272	....	....	3	....	....	....	....	27·3	....	....	12	18	....	....	....	....	
25	....	270	....	....	7	21	....	....	....	10	26	....	5	58	....	....	—14	7	32	72	
....	660	....	321	253	....	....	....	....	....	....	....	....	....	....	12	18	....	....	....	....	
22	....	660	....	....	7	34	....	10	48	....	....	....	6	16	....	....	....	7	28	75	13
....	1·950	....	630	120	....	....	5	....	....	....	....	28·3	....	....	12	16	....	....	....	....	
15	....	480	....	....	7	21	....	....	....	11	9	....	6	32	....	....	—17	7	23	78	
....	480	....	587	102	....	....	4	....	....	....	....	....	....	....	12	17	....	....	....	....	
14	....	590	....	....	7	22	....	11	31	....	....	●	6	49	....	....	....	7	18	80	14
....	1·560	....	104	030	....	....	5	....	....	....	....	29·3	....	....	12	15	....	....	....	....	
14	....	350	....	....	7	9	....	....	....	11	53	....	7	4	....	....	—19	7	11	81	
....	2·280	....	200	025	....	....	3	....	....	....	....	....	....	....	12	16	....	....	....	....	
2	....	000	....	....	7	10	....	....	15	....	....	....	7	20	....	....	....	7	5	82	15
....	2·100	....	....	....	....	....	3	....	....	....	....	0·6	....	....	12	15	....	....	....	....	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	
267	14·190	5·850	2·848	2·925	103	11	...	58	45	68	15	....	73	23	173	19	+54 .... —58	102	23	912	
19	1·014	0·418	0·219	0·225	7	22	...	8	24	9	45	....	5	15	12	23	+18 .... —15	7	19	65·14	

‡ Moon crosses the equator.
New moon (Quebec) May 10th, at 8h. 24m. p.m.

§ Moon in apogee, May 9th, at 8h. 0m. p.m.

APPENDIX 13.

TABLE XI.—Tidal Fluctuations at St. Nicholas during the High water seaaon of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

Gauge book reference numbers. Series V. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides.	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.	In duration of ebbs.
		H.	M	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min.	Min.
¼	May 4 L.W.	9	50	P.M.	...	...	7	50	13	0	..	20	2·8392	.... ..	11·8200	... ...	.....	...	...
¼	do 5 H.W	3	0	A.M.	5	10	...	...	...	...	+25	26	13·6092	10·7700	.....	°8·7342	10·9400	...	50
¼	do 5 L.W.	10	0	A.M.	...	...	7	0	12	15	....	....	3·6892	.....	9·9200	.....	.....	5	...
9	do 5 H.W	3	15	P.M.	5	15	...	...	...	...	....	....	14·9392	11·2500	.....	8·9742	11·0400	...	30
¼	do 5 L.W.	10	45	P.M.	...	...	7	30	12	40	....	....	3·2192	.....	11·7200	.....	.....	5	...
¼	do 6 H.W	3	55	A.M.	5	10	...	...	...	...	+10	....	14·4892	11·2700	.....	8·9417	11·3550	...	10
¼	do 6 L.W.	11	15	A.M.	...	...	7	20	12	20	....	....	3·3092	.....	11·1800	.....	.....	10	...
10	do 6 H.W	4	15	P.M.	5	0	...	...	...	...	...	....	14·5592	11·2500	.....	8·7955	11·6025	...	10
¼	do 7 L.W.	11	45	P.M.	...	...	7	30	12	40	....	....	2·6792	.....	11·8800	.....	.....	10	...
¼	do 7 H.W	4	55	A.M.	5	10	...	...	...	...	+ 5	....	14·7792	12·1000	.....	8.6892	12·2300	...	15
¼	do 7 L.W.	12	10	P.M.	...	...	7	15	12	15	....	....	2·4692	.....	12·3100	.....	.....	10	...
11	do 7 H.W	5	10	P.M.	5	0	...	...	...	...	...	....	15·0992	12·6300	.....	8·8892	12·4700	...	°5
¼	do 8 L.W.	12	30	A.M.	...	...	7	20	12	15	....	....	2·8392	.....	12·2600	.....	.....	5	...
¼	do 8 H.W	5	25	A.M.	4	55	...	...	...	...	−10	....	15·5192	12·6800	.....	8·9530	12·6075	...	15
¼	do 8 L.W.	1	0	P.M.	...	...	7	35	12	25	....	....	2·4592	.....	13·0600	.....	.....	5	...
12	do 8 H.W	5	50	P.M.	4	50	...	...	...	...	...	....	14·8892	12·4300	.....	8·9355	12·7725	...	15
¼	do 9 L.W.	1	10	A.M.	...	...	7	20	12	10	....	....	2·6392	.....	12·2500	.....	.....	°0	...
¼	do 9 H.W	6	0	A.M.	4	50	...	...	...	...	−10	....	15·9892	13·3500	.....	9·0555	13·0225	...	25
¼	do 9 L.W.	1	45	P.M.	...	...	7	45	12	30	....	....	°2·4492	.....	13·5400	.....	.....	5	...
13	do 9 H.W	6	30	P.M.	4	45	...	...	...	...	...	....	15·3992	12·9500	.....	9·3867	13·2350	...	30
¼	do 10 L.W.	1	45	A.M.	...	...	7	15	12	10	....	....	3·0892	.....	12·3100	.....	.....	10	...
¼	do 10 H.W	6	40	A.M.	4	55	...	...	...	...	−20	....	17·2292	14·1400	.....	10·0167	13·3050	...	20
¼	do 10 L.W.	2	15	P.M.	...	...	7	35	12	20	....	....	3·6392	.....	13·5900	.....	.....	10	...
14	do 10 H.W	7	0	P.M.	4	45	...	...	...	...	....	20	16·8192	13·1800	.....	10·5967	13·3850	...	25
¼	do 11 L.W.	2	10	A.M.	...	...	7	10	12	0	....	10	4·1692	.....	12·6500	.....	.....	5	...
¼	do 11 H.W	7	0	A.M.	4	50	...	...	...	...	10	14	18·2892	14·1200	.....	10·7167	13·3750	...	50
¼	do 11 L.W.	3	0	P.M.	...	...	8	0	12	40	..	12	3·8892	.....	14·4000	.....	.....	10	...
15	do 11 H.W	7	40	P.M.	4	40	...	...	...	...	...	14	16·2192	12·3300	.....	10·5680	13·3275	...	50
¼	do 12 L.W.	2	50	A.M.	...	...	°7	10	12	0	....	15	....	..	12·3000	.....	.....	10	...
	.....	...	...	...	...	...	...	...	...	...	...	...	3·9192	....	...	...	...	...	...
Totals 14 tides..	H.W	76	35								−40	74	217·8288						
					69	15	103	45	172	40	...	...	...	174·4500	173·3700	131·2528	174·6675	100	350
	L.W.	84	20	+24							−50	57	40·5396						
	=	108	20																
Means do 14	H.W				4	57	7	25	12	20	+13	19	15·5592	12·4008	12·3836	9·3752	12·4763	7	25
	L.W.										−13	14	3·1184						

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °.

APPENDIX 13.

TABLE XI.—Tidal Fluctuations at St. Nicholas during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).

RESULT BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Diurnal Inequalities.								Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding gages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: No. 2.	Length of half tide day H. W. to H. W.		Priming — or lagging + of tides.	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series V. Gaining tides. Gauge book reference numbers.
In semi tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.								
Min.	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.	
...	.....	.....	.....	.....	...	...	...	...	...	...	...	23·3	.....		12	42	...	...		+	¼
...	.....	.....	.....	.....	...	...	...	...	...	...	...	...	.....		...	...	...	...	...	...	...
45	.....	8500	.....	.....	7	23	1	..	...	7	37	...	2	36	...	...	+33	6	59	° 44	½
...	1·3300	.....	2400	1000	..	..	1	...	...	...	...	...	.....		*12	41	...	...	...	...	¾
25	.....	4700	.....	.....	7	15	...	8	0	...	...	24·3	3	17	...	...	...	7	17	46	9
...	4500	.....	0325	3150	..	..	...	...	...	...	...	...	.....		12	37	...	...	...	...	¼
20	.....	0900	.....	.....	7	34	...	...	...	8	21	...	3	54	...	...	−19	7	33	49	½
...	0700	.....	1462	2475	..	..	...	...	...	...	...	...	.....		12	32	...	...	...	...	¾
20	.....	6300	.....	.....	7	32	..	8	43	..	...	25·3	4	26	...	...	...	7	43	53	10
...	2200	.....	1063	6275	..	..	...	...	...	...	...	...	.....		12	27	...	...	...	...	¼
25	.....	2100	.....	.....	* 7	51	...	...	...	9	4	....	4	53	...	...	+ 2	7	49	57	½
...	3200	..	2000	2400	..	..	...	...	...	...	...	...	.....		12	25	...	...	...	...	¾
° 0	.....	3700	.....	.....	7	45	...	9	25	..	..	26·3	5	18	...	...	...	7	53	61	11
...	4200	.....	0638	1375	..	..	...	...	...	...	...	...	.....		12	22	...	...	...	...	¼
10	.....	3800	.....	.....	7	39	...	...	...	9	46	..	5	40	...	...	− 8	* 7	54	65	½
...	6300	.....	0175	1650	..	..	...	...	...	...	...	...	.....		12	20	...	...	...	...	¾
15	.....	1800	.....	.....	7	43	...	10	7	..	...	27·3	6	0	...	...	...	7	53	69	12
...	1·1000	.....	1200	2500	..	..	...	...	...	...	...	...	.....		12	18	...	...	...	...	¼
20	.....	1900	.....	.....	7	34	...	...	...	10	26	....	6	18	...	...	−14	7	52	72	½
...	5900	.....	3312	2125	..	..	...	...	...	...	...	...	.....		12	18	...	...	...	...	¾
20	.....	6400	.....	.....	7	41	...	10	49	..	...	28·3	6	36	...	...	...	7	47	§ 75	13
...	1·8300	.....	* 6300	0700	..	..	...	...	...	...	...	...	.....		12	16	...	...	...	...	¼
10	.....	5500	.....	.....	7	30	...	...	...	11	10	....	6	52	...	...	−17	7	42	78	½
...	4100	.....	5800	0800	..	..	15	...	...	...	...	...	.....		12	17	...	...	...	...	¾
20	.....	5300	.....	.....	7	29	1	11	31	..	...	29·3	7	9	...	...	...	7	38	80	14
...	1·4700	.....	1200	° 0100	..	..	12	...	...	...	...	...	.....		12	15	...	...	...	...	¼
40	.....	2800	.....	.....	7	7	5	...	...	11	53	...	7	24	...	...	*-19	7	31	81	½
...	2·0700	.....	1487	0475	..	..	12	...	...	...	...	...	.....		12	16	...	...	...	...	¾
40	.....	0300	.....	.....	7	24	...	...	...	16	...	0·6	7	40	...	...	...	7	24	82	15
...	1·9800	...	1400	0100	..	..	15	...	...	...	...	...	.....		° 12	15	...	...	...	...	¼
..	.....	...	...	.....	...	...	...	...	...	...	...	...	.....		...	...	...	...	...	...	...
310	12·8900	5·4000	2·8762	2·5125	105	27	....	58	51	68	17	...	78	3	173	19	+54 ... −58	106	55	912	
22	·9207	·3857	·2054	·1795	7	32	....	8	24	9	45	....	5	35	12	23	+18 ... −15	7	38	65·14	

† Longitude, St. Nicholas gauge=71° 23', 4h. 45m. 32s.=0·1983 of a day west of Greenwich.
‡ Moon crosses the equator. § Moon in apogee, May 9th=at 8h. 0m. p.m. ‖ New moon (Quebec) at 8h. 24m. p.m.

APPENDIX 13.

TABLE XI.—Tidal Fluctuations at St. Nicholas during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

Gauge book reference numbers. Series VI. Losing tides.		High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H. W. to H. W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	Diurnal Inequalities	
			H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.	In duration of floods. Min	In duration of ebbs. Min
												− 10		3·9192						
		May 12	H.W	7	40	A.M.	4	50				− 20	17	18·1992	14·2800		10·7080	13·3375		
		do 12	L.W.	3	20	P.M.			7	40	12	30	9	4·1592		14·0400			00	
16		do 12	H.W	8	10	A.M.	4	50					− 22	16·8892	12·7300		11·1405	13·2525		40
		do 13	L.W.	3	10	A.M.			7	0	°11	55		4·8692		12·0200			5	
		do 13	H.W	8	5	A.M.	4	55					− *25	19·0892	14·2200		11.3805	13·1025		55
		do 13	L.W.	4	0	P.M.			7	55	12	30		4·7892		14·3000			20	
17		do 13	H.W	8	35	P.M.	4	35						16·6592	11·8700		11 3119	13·1346		30
		do 14	L.W.	4	0	A.M.			7	25	12	25		4·7000		11·9592			* 25	
		do 14	H.W	† 9	0	A.M.	5	0					− 15	19·1092	14·4092			12·8496		° 5
		do 14	L.W.	4	30	P.M.			7	30	12	10	− 20	5·1892		13·9200	11·3694		20	
18		do 14	H.W	9	10	P.M.	4	40						16·2992	11·1100			12.3275		20
		do 15	L.W.	4	20	A.M.			7	10	12	0		5·1292		11·1700	11·3230		10	
		do 15	H.W	9	10	A.M.	4	50					− 20	18 2392	13·1100			12·0100		40
		do 15	L.W.	5	0	P.M.			7	50	12	30		5·1492		13·0900	11·1442		10	
19		do 15	H.W	9	40	P.M.	4	40						15·8192	10·6700			11 7625		30
		do 16	L.W.	5	0	A.M.			7	20	12	20		5·1692		10·6500	11·0405		20	
		do 16	H.W	10	0	A.M.	5	0					+ 10	17·8092	12·6400			11·6600		30
		do 16	L.W.	5	50	P.M.			7	50	12	40		4 6692		13·1400	10·7492		10	
20		do 16	H.W	10	40	P.M.	4	50						14·8792	10·2100			11·3875		50
		do 17	L.W.	5	40	A.M.			7	0	12	5		4·8192		10·0600	10·4380		15	
		do 17	H.W	10	45	A.M.	5	5					+ 5	16·9592	12·1400			11·1475		55
		do 17	L.W.	6	40	P.M.			7	55	12	50		4·2492		2·7100	10·1080		10	
21		do 17	H.W	11	35	P.M.	4	55						13·9292	°9·6800			10·9200		65
		do 18	L.W.	6	25	A.M.			° 6	50	12	0		4·5792		9·3500	9·8742		15	
		do 18	H.W	11	35	P.M.	5	10					+ 5	16·5192	11·9400			10·8200		65
		do 18	L.W.	‡ 7	30	P.M.			7	55	12	55		4·2992		12·2200	9·8492		10	
22		do 19	H.W	12	30	A.M.	5	0						14 0692	9·7700			10·7275		55
		do 19	L.W.	7	30	A.M.			7	0	12	20		4·8392		°9·2300	9·9330		20	
		do 19	H.W	12	50	P.M.	*5	20					+ 10	16·5292	11·6900			°10·7025		40
																	10·2155			
		H.W.	149	25									+ 30	39	250·9980					
		Totals 15 tides.				73	40	104	20	173	10					180·4692	157·8592	160·5851	179·1417	190	590
		L.W.	72	55								− 80	9	70·5288						
		15 H.W.										+ 8	19	16·7332						
		Means do				4	55	7	27	12	22				12·0313	11·2757	10·7057	11·9428	14	42
		14 L.W.										− 20	9	4·7017						

N.B.—Maxima in whole lunar month indicated by a star thus : * and minima by a circle thus : °
† Moon's N. declination a maximum.
‡ Moon's first quarter (Quebec) May 18th, from 6h. 5m. p.m.

APPENDIX 13.

TABLE XI.—Tidal Fluctuations at St. Nicholas during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).								RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."													
Diurnal Inequalities.								Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times. (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marés, corresponding to observed tides assumed to be 48 hours old.	Series VI. Losing tides. Gauge book reference numbers.
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.									
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		
...	.....	..	.....	.....	.....		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	− 19	.....	.....	.....	
...	.....	.....	.....	.....	.....		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
...	.....	.....	.....	.....	.....		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
...	1·3100	·2400	.....	.....	7	2	3	.....	.....	.....	38	.....	7	55	.....	.....	+ *19	7	17	82	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
35	.....	.....	·4325	·0850	.....		15	.....	.....	.....	.....	1·6	.....	.....	12	16	.....	.....	.....	.....	**16**
...	2·2000	·7100	.....	.....	7	9	.....	1	1	.....	.....	.....	8	11	.....	.....	.....	7	10	82	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
35	.....	.....	·2400	·1500	.....		.....	.....	.....	.....	.....	.....	.....	.....	°12	15	.....	.....	.....	.....	
...	2·4300	·0800	.....	.....	6	40	.....	.....	.....	.....	1 25	.....	8	26	.....	.....	− 19	7	1	81	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
5	.....	.....	·0686	·0321	.....		.....	.....	.....	.....	.....	2·6	.....	.....	12	16	.....	.....	.....	.....	**17**
...	2·4500	·0892	.....	.....	6	45	.....	1	50	.....	.....	.....	8	42	.....	.....	.....	6	52	80	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
15	.....	.....	·0575	·2850	.....		.....	.....	.....	.....	.....	.....	.....	.....	12	16	.....	.....	.....	.....	
...	2·8100	·4992	.....	.....	6	46	.....	.....	.....	.....	2 14	.....	8	58	.....	.....	− 18	6	44	78	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
10	.....	.....	·0464	·5221	.....		15	.....	.....	.....	.....	3·6	.....	.....	12	16	.....	.....	.....	.....	**18**
...	1·9400	·0600	.....	.....	6	31	.....	2	39	.....	.....	.....	9	14	.....	.....	.....	6	35	76	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
30	.....	.....	·1788	·3175	.....		.....	.....	.....	.....	.....	.....	.....	.....	12	16	.....	.....	.....	.....	
...	2·4200	·0200	.....	.....	6	6	.....	.....	.....	.....	3 4	.....	9	30	.....	.....	− 16	6	26	73	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
10	.....	.....	·1037	·2475	.....		.....	.....	.....	.....	.....	4·6	.....	.....	12	18	.....	.....	.....	.....	**19**
...	1·9900	·0200	.....	.....	6	11	.....	3	29	.....	.....	.....	9	48	.....	.....	.....	6	19	70	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
20	.....	.....	·2913	·1025	.....		.....	.....	.....	.....	.....	.....	.....	.....	12	18	.....	.....	.....	.....	
...	2·9300	·5000	.....	.....	6	5	.....	.....	.....	.....	3 55	.....	10	6	.....	.....	− 13	6	11	66	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
35	.....	.....	·3112	·2725	.....		.....	.....	.....	.....	.....	5 6	.....	.....	12	19	.....	.....	.....	.....	**20**
...	2·0800	·1500	.....	.....	6	20	.....	4	20	.....	.....	.....	10	25	.....	.....	.....	6	5	62	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
45	.....	.....	·3300	·2400	.....		.....	.....	.....	.....	.....	.....	.....	.....	12	22	.....	.....	.....	.....	
...	3·0300	·5700	.....	.....	5	59	.....	.....	.....	.....	4 46	.....	10	47	.....	.....	− 4	6	1	58	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
50	.....	.....	·2338	·2275	.....		.....	.....	.....	.....	.....	6·6	.....	.....	12	24	.....	.....	.....	.....	**21**
...	2·5900	·3300	.....	.....	6	23	.....	5	12	.....	.....	.....	11	11	.....	.....	.....	5	59	54	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
55	.....	.....	·0250	·1000	.....		.....	.....	.....	.....	.....	.....	.....	.....	12	26	.....	.....	.....	.....	
...	2·4500	·2800	.....	.....	5	58	.....	.....	.....	.....	5 37	7 6	11	37	.....	.....	+ 6	6	0	51	$\frac{1}{2}\frac{2}{3}\frac{3}{4}$
35	.....	.....	·0838	·0925	.....		.....	.....	.....	.....	.....	●	.....	.....	12	30	.....	.....	.....	.....	**22**
...	2·4600	·5400	.....	.....	6	27	.....	6	3	.....	.....	.....	12	7	.....	.....	.....	6	4	48	$\frac{1}{2}$
20	.....	.....	·2825	·0250	.....		.....	.....	.....	.....	.....	.....	.....	.....	12	34	.....	.....	.....	.....	
...	.....	.....	.....	.....	6	22	.....	.....	.....	6	28	8·6	12	41	.....	.....	+ 22	6	13	46	
400	33 0900	4·0784	2·6851	2·6992	96	44	..	24	34	40	7	....	149	38	172	46	+ 28	96	57	1007	
										+ 80	·0					.....				
										=124	·7					− 89				
29	2·3636	·2913	·1918	·1928	6	27	....	3	31	15	31	....	9	59	12	20	+ 14	6	28	67·13	
																	.....				
																	− 15				

APPENDIX 13.

TABLE XI.—Tidal Fluctuations at St. Nicholas during the High water season of 1888, viz. :—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series III. Gaining tides.		High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides Min	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	Diurnal Inequalities: In duration of floods. Min.	In duration of ebbs. Min.
												+10		16·5292						
½	May 19	L.W.	8	30	P.M.			7	40	12	40			4·8892		11·6400			20	
23	do 20	H.W	1	30	A.M.	5	0						13	15·1392	10·2500		10·1055	10·8525		10
½	do 20	L.W.	9	0	A.M.			7	30	12	50		20	4·4692		10·6700			20	
½	do 20	H.W	2	20	P.M.	*5	20					+*40	23	15·3192	10·8500		9·7030	11·1675		10
½	do 20	L.W.	9	40	P.M.			7	20	12	40		13	3·7692		11·5500			0	
24	do 21	H.W	3	0	A.M.	5	20						23	15·3692	11·6000		9·7380	11·6075		10
½	do 21	L.W.	10	10	A.M.			7	10	12	10			4·0992		11·2700			20	
½	do 21	H.W	3	10	P.M.	5	0					—°0		16·1092	12·0100		9·9267	12·0850		35
½	do 21	L.W.	10	55	P.M.			7	45	12	40			3·6692		12·4400			5	
25	do 22	H.W	3	50	A.M.	4	55							16·2892	12·6200		9·9180	12·6175		°5
½	do 22	L.W.	11	30	A.M.			7	40	12	25			3·5492		12·7400			10	
½	do 22	H.W	4	15	P.M.	4	45					— 5		16·2192	12·6700		10·0655	13·1225		5
½	do 22	L.W.	11	50	P.M.			7	35	12	20			3·4592		12·7600			0	
26	do 23	H.W	4	35	A.M.	4	45							17·7792	14·3200		10·3542	13·7800		20
½	do 23	L.W.	12	30	P.M.			7	55	12	35			3·4692		14·3100			5	
½	do 23	H.W	5	10	P.M.	4	40					+ 5		17·1992	13·7300		10·6942	14·1800		25
½	do 24	L.W.	12	40	A.M.			7	30	12	20			3·7392		13·4600			10	
27	do 24	H.W	5	30	A.M.	4	50							18·9592	15·2200		11·0692	14·5100		20
½	do 24	L.W.	1	20	P.M.			7	50	12	30			3·8892		15·0700			10	
½	do 24	H.W	6	0	P.M.	4	40					—10		18·1792	14·2900		11·4030	14·8375		20
½	do 25	L.W.	1	30	A.M.			7	30	12	10			4·0792		14·1000			0	
28	do 25	H.W	6	10	A.M.	4	40							19·9692	15·8900		11·6167	15·1150		40
½	do 25	L.W.	2	20	P.M.			8	10	10	40		17	4·0392		15·9300			10	
½	do 25	H.W	6	50	P.M.	°4	30					+10	15	18·5792	14·5400		11·7535	15·2325		40
½	do 26	L.W.	2	20	A.M.			7	30	12	20		14	4·2392		14·3400			20	
29	do 26	H.W	7	10	A.M.	4	50						14	20·3592	16·1200		11·8030	15·2975		30
½	do 26	L.W.	3	10	P.M.			8	0	12	30		16	4·0692		16·2900			20	
½	do 26	H.W	7	40	P.M.	4	30					—10	14	18·5092	14·4400		11·8780	°15·4175		30
		H.W.	67	10	+12=							+55	126	243·9788						
Totals	14 tides..		79	10	.	67	45	107	5	174	50						188·5500	186·5700	150·0285	189·8225	150	300
		L.W.	107	25	+ 12							—25	76	55·4288						
			=119	25																
		14 H.W.										+18	18	17·4271						
Means		do ..				4	50	7	39	12	29	..					13·4679	13·3265	10·7163	13·5588	11	21
		14 L.W.										— 6	15	3·9592						

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus °

APPENDIX 13.

TABLE XI.—Tidal Fluctuations at St. Nicholas during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued.*)								RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MAREES."													
Diurnal Inequalities.					Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times (No. 2).		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series III. Gaining tides. Gauge book reference numbers.
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.				Upper passage.		Lower passage.		Ages, etc.									
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		
....	....	0·0500	....	....	....	....	....	....	....	....	....	....	....	....	....	....	+22	....	....	....	....
....	1·3900	....	1·1100	1·1500	....	....	....	....	....	....	....	....	....	....	12	38	....	....	....	....	....
10	....	0·4200	....	....	6	37	....	6	53	....	....	....	1	19	....	....	....	6	26	46	23
....	0·1800	....	0·4025	0·3150	....	....	....	....	....	....	....	....	....	....	12	40	....	....	....	....	....
10	....	0·7000	....	....	7	1	12	....	....	7	19	9·6	1	59	....	....	+29	6	40	48	....
....	0·5000	....	0·0350	0·4400	....	....	8	....	....	....	....	....	....	....	12	39	....	....	....	....	....
30	....	0·3300	....	....	7	16	5	7	44	....	....	....	2	38	....	....	....	6	54	51	24
....	0·7400	....	0·1887	0·4775	....	....	....	....	....	....	....	....	....	....	12	37	....	....	....	....	....
30	....	0·4300	....	....	7	0	....	....	....	8	10	10·6	3	15	....	....	+21	7	5	56	....
....	0·1800	....	0·0087	0·5325	....	....	....	....	....	....	....	....	....	....	12	34	....	....	†	....	....
15	....	0·1200	....	....	7	14	....	8	36	....	....	....	3	49	....	....	....	7	13	62	25
....	0·7000	....	0·1475	0·5050	....	....	....	....	....	....	....	....	....	....	12	31	....	....	....	....	....
5	....	0·0900	....	....	7	12	....	....	....	9	3	11·6	4	20	....	....	+ 9	7	17	69	....
....	1·5600	....	0·2887	* 0·6575	....	....	....	....	....	....	....	....	....	....	12	28	....	....	....	....	....
15	....	° 0·0100	....	....	7	5	....	9	30	....	....	....	4	48	....	....	....	7	18	76	26
....	0·5800	....	0·3400	0·4000	....	....	....	....	....	....	....	....	....	....	12	26	....	....	....	....	....
15	....	0·2700	....	....	7	13	....	....	....	9	57	12·6	5	14	....	....	+°1	7	17	83	....
....	1·7600	....	0·3750	0·3300	....	....	....	....	....	....	....	....	....	....	12	25	....	....	‡	....	....
10	....	0·1500	....	....	7	5	....	10	25	....	....	....	5	39	....	....	....	7	14	89	27
....	0·7800	....	0·3338	0·3275	....	....	....	....	....	....	....	....	....	....	12	24	....	....	....	....	....
20	....	0·1900	....	....	7	6	....	....	....	10	54	13·6	6	3	....	....	— 2	7	9	97	....
....	1·7900	....	0·2137	0·2775	....	....	....	....	....	....	....	○	....	....	12	24	....	....	....	....	....
30	....	0·0400	....	....	6	46	10	11	24	....	....	....	6	27	....	....	....	7	3	§ 100	28
....	1·3900	....	0·1368	0·1175	....	....	15	....	....	....	....	....	....	....	12	24	....	....	....	....	....
20	....	0·2000	....	....	6	57	5	....	....	11	53	14·6	6	51	....	....	— 3	6	58	104	....
....	1·7800	....	0·0495	0·0650	....	....	....	....	....	....	....	....	....	....	12	23	....	....	....	....	....
10	....	0·1700	....	....	6	46	15	....	24	....	....	....	7	14	....	....	....	6	50	106	29
....	1·8500	....	0·0750	0·1200	....	....	15	....	....	....	....	....	....	....	12	23	....	....	....	....	....
20	....	....	....	....	6	46	....	....	....	....	54	15·6	7	37	....	....	— 3	6	43	*107	....
240	15·1800	3·1700	2·7049	4·7150	98	4	....	66	56	70	10	....	67	13	174	56	+60	98	7	1092	
													+168	0			— 8				
													=235	13							
17	1·0843	0·2264	0·1932	0·3368	7	0	..	9	34	10	1	....	16	48	12	30	+15	7	1	78·00	
																	— 3				

†Moon after crossing equator. ‡Moon in perigee, May 24th, at 2h. 0m. p.m.
§Full moon (Quebec) May 25th, at 8h. 40m. a.m.

APPENDIX 13.

TABLE XI.—Tidal Fluctuations at St. Nicholas during the High water season of 1888, viz.:—from quadrature, May 2nd. to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series VIII. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides Min.	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min.
											— 10							
‡	May 27 L.W.	3	10	A.M.			7	30	12	10		12	4·2692		14·2400			10
30	do 27 H.W.	7	50	A.M.	4	40						12	*20·9692	*16·7000		*11·9517	15·3050	
‡	do 27 L.W.	4	0	P.M.			8	10	12	45		14	4·3292		*16·6400			5
‡	do 27 H.W †	8	35	P.M.	4	35					— 0		17·9692	13·6400		11·8367	14·8450	
‡	do 28 L.W.	4	0	A.M.			7	25	12	5			4·4992		13·4700			5
31	do 28 H.W	8	40	A.M.	4	40							20·1292	15·6300		11·5092	14·5900	
‡	do 28 L.W. ‡	5	0	P.M.			* 8	20	12	50			3·9292		16·2000			10
‡	do 28 H.W	9	30	P.M.	° 4	30					— 0		16·9892	13·0600		11·1805	14·4625	
‡	do 29 L.W.	4	45	A.M.			7	15	12	0			3·9692		13·0200			15
32	do 29 H.W	9	30	A.M.	4	45							19·5392	15·5700		11·0230	14·2575	
‡	do 29 L.W.	5	45	P.M.			8	15	12	50			3·8192		15·7200			10
‡	do 29 H.W	10	20	P.M	4	35					— 0		16·5392	12·7200		10·8205	13·8325	
‡	do 30 L.W.	5	30	A.M.			7	10	12	0			3·9892		12·5500			15
33	do 30 H.W	10	20	A.M.	4	50							18·3292	14·3400		10·4470	13·6175	
‡	do 30 L.W.	6	30	P.M.			8	10	12	50			3·2892		15·0400			10
‡	do 30 H.W	11	10	P.M.	4	40					+ ° 0		15·8292	12·5400		10·2257	13·1621	
‡	do 31 L.W.	6	20	A.M.			7	10	12	0			4·0000		11·8292			10
34	do 31 H.W	11	10	A.M.	4	50							17·2392	13·2392		10·0107	12·5721	
‡	do 31 L.W.	7	10	P.M.			8	0	*13	0			3·4492		13·7900			10
‡	do 31 H.W	12	10	A.M.	5	0					+ 20	20	14·8792	11·4300		10·0167	12·0750	
‡	June 1 L.W.	§ 7	0	A.M.			° 6	50	12	10		10	4·5092		10·3700			20
35	do 1 H.W	12	20	P.M.	* 5	20						23	17·2192	12·7100		10·2830	11·7775	
‡	do 1 L.W.	8	10	P.M.			7	50	12	50		22	4·2792		12·9400			20
‡	do 2 H.W	1	10	A.M.	5	0					+ 10	22	15·3692	11·0900		10·1305	11·3125	
‡	do 2 L.W.	8	20	A.M.			7	10	12	10			4·6692		10·7000			0
36	do 2 H.W	1	20	P.M.	5	0							15·1892	10·5200		9·5142	11·0600	
‡	do 2 L.W.	9	0	P.M.			7	40	13	0			3·2992		11·8900			20
‡	do 3 H.W	2	20	A.M.	5	20					+ 30		14·4292	11·1300		9·2255	11·1325	
							7	10	12	20					10·4100			10
‡	do 3 L.W.	9	30	A.M.									4·0192					
	H.W.										+ 60	77	240·0188					
Totals 14 tides..	L.W. =	116	25	+24	67	45	114	5	187	0	— 0	44	56·2996	184·3192	198·8092	148·1749	184·0017	170
		140	25															
		94	10															
	14 H.W.										+ 15	19	17·1871					
Means	do				4	50	7	36	12	28				13·1657	13·2539	10·5840	13·1430	12
	15 L.W.										— 0	15	4·0214					
Grd. totals	H.W.										+185	76	953·4244					
57 tides					278	25	429	15	707	40				727·7884	716·6084	590·0473	727·6334	610
	L.W.										—155	56	222·7968					
	57 H.W.										+ 13	19	16·7267					
Grd. means	do				4	53	7	32	12	25				12·7682	12·5721	10·3516	12·7655	11
	57 L.W.										— 10	14	3·9087					

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °

†Moon's S. declination a maximum = 21° 41′.

‡Maximum diurnal inequality in high water levels observed = 3·1400 feet.

APPENDIX 13.

TABLE XI.—Tidal Fluctuations at St. Nicholas during the High water season of 1888, viz.:—from quadrature May 2nd, to quadrature June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).									RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."													
Diurnal Inequalities.									Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: No. 2.		Length of half tide day H.W. to H.W.		Priming — or lagging + of tides.					
In duration of ebbs.	In semi-tides days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.			Lunitidal intervals.		General coefficients of semi-amplitudes from "Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old	Series VIII. Losing tides. Gauge book reference numbers.
Min	Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		
			2000															— 3				
		2·4600		0737	1125											12	24					
40	35		0600			6	25		1	25				8	1				6	36	106	30
		3·0000		1150	4600			12					16·6			12	23					
45	40		1700			6	39				1	56		8	24			— 3	6	28	104	
		2·1600		3275	2550			10								12	24					
55	45		5700			6	14		2	26				8	48				6	22	101	31
		*3·1400		3287	1275			10					17·6			12	24					
65	50		0400			6	35				2	55		9	12			— 3	6	17	96	
		2·5500		1575	2050			10								12	23					
60	50		1500			6	6		3	24				9	35				6	11	91	32
		3·0000		2025	4250								18·6			12	23					
65	50		1700			6	28				3	52		9	58			— 3	6	6	85	
		1·7900		3735	2150											12	24					
60	50		7000			6	2		4	18				10	22				6	4	79	33
		2·5000		2213	4554								19·6			12	26					
60	50		7108			6	26				4	44		10	48			+ 2	6	4	72	
		1·4100		2150	5900											12	26					
50	* 60		5508			6	1		5	9				11	14				6	5	66	34
		2·3600		0060	4971								20·6			12	27					
* 70	50		1·0600			6	37				5	33		11	41			+ 7	6	8	60	
		2·3400		2663	2975			* 15								12	30					
60	40		2300			6	23		5	57			○	12	11				6	14	55	35
		1·8500		1525	4650								21·6			12	32					
40	40		3900			6	51				6	19		12	43			+ 17	6	24	51	
		1800		6163	2525											12	35					
30	50		*1·3700			6	39		6	41				1	18				6	37	48	36
		7600		2887	0725								22·6			12	31					
30	40		7200			7	17				7	3		1	49			+ 10	6	46	46	
		6900											23·6			12	29					
730	650	30·1900	7·0916	3 3445	4·4300	90	43		29	20	32	22		126	4	186	41	+ 36	88	22	1060	
														+ 24	0			— 9				
														=150	4							
52	46	2·0127	·4728	·2389	·3164	6	29		4	11	4	38		10	43	12	27	+ 9	6	19	75·78	
																		— 3				
1970	1600	91·3500	19·7400	11·4107	14·3567	390	58		179	41	294	56		612	58	707	42	+178	390	21	4071	
																		—164				
35	27	1·5851	·3463	·2038	·2564	6	51		6	25	10	10		10	45	12	25	+ 14	6	51	71·42	
																		— 10				

§Moon's last quarter (Quebec) June 1st, from 7h. 35m. a.m.
Maximum diurnal inequality in low water levels observed = 1·370 feet.

APPENDIX 13.

TABLE XII.—Tidal Fluctuations at Pointe Platon during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series V. Gaining tides.				High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging+of tides Min.	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.
	May	4	L.W.	†	11	23	P.M.			8	33	12	50			6·6908				
¼	do	5	H.W		3	40	A.M.	4	17					+ 55	23	14·5868	7·8960		°11·2122	8·5168
½	do	5	L.W.		11	20	A.M.			°7	40	12	15		28	7·2168		7·3700		
9	do	5	H.W		3	55	P.M.	4	35						25	17·0118	9·7950		11·6625	9·1613
¼	do	6	L.W.		12	25	A.M.			8	30	*13	10		25	6·9468		10·0650		
½	do	6	H.W		5	5	A.M.	*4	40					*+35	24	16·3618	9·4150		11·7316	9·6355
¾	do	6	L.W.		1	3	P.M.			7	58	12	15		32	6·8808		9·4810		
10	do	6	H.W		5	20	P.M.	4	17						15	16·4618	9·5810		11·5779	9·7880
¼	do	7	L.W.		1	32	A.M.			8	12	12	20		30	6·4868		9·9750		
½	do	7	H.W		5	40	A.M.	4	8					+ 5	28	16·6018	10·1150		11·5475	10·2513
¾	do	7	L.W.	‡	1	58	P.M.			8	18	12	35		20	°6·3568		10·2450		
11	do	7	H.W		6	15	P.M.	4	17						23	17·0268	10·6700		11·8097	10·5118
¼	do	8	L.W.		2	18	A.M.			8	3	12	13		22	6·7508		10·2760		
½	do	8	H.W		6	28	A.M.	4	10					— 19	18	17·6068	10·8560		11·9783	10·6095
¾	do	8	L.W.		2	48	P.M.			8	20	12	18		22	6·5964		11·0104		
12	do	8	H.W		6	46	P.M.	3	58						30	16·8918	10·2954		11·9992	10·6852
¼	do	9	L.W.		2	53	A.M.			8	7	12	17		25	6·7168		10·1750		
½	do	9	H.W		7	3	A.M.	4	10					— 8	22	17·9768	11·2600		12·1437	10·8738
¾	do	9	L.W.		3	27	P.M.			8	24	12	25		20	6·6968		11·2800		
13	do	9	H.W	§	7	28	P.M.	4	1						15	17·4768	10·7800		12·5193	11·1150
¼	do	10	L.W.		3	25	A.M.			7	57	12	17		18	7·2268		10·2500		
½	do	10	H.W		7	45	A.M.	4	20					— 13	20	19·3768	12·1500		13·2030	11·2625
¾	do	10	L.W.		4	2	P.M.			8	17	12	20		20	7·9168		11·4600		
14	do	10	H.W		8	5	P.M.	4	3						20	19·1068	11·1900		13·8062	11·3838
¼	do	11	L.W.		3	55	A.M.			7	50	12	0		23	8·3118		10·7950		
½	do	11	H.W		8	5	A.M.	4	10					— 20	20	20·4018	12·0900		13·9506	11·3475
¾	do	11	L.W.		4	30	P.M.			8	25	12	30		22	8·2418		12·1600		
15	do	11	H.W		8	35	P.M.	4	5						30	18·5868	10·3450		13·8968	11·2400
¼	do	12	L.W.		4	32	A.M.			7	57	12	7		20			10·2750		
																8·3118				
			H.W.		90	10								+ 55	313	245·4752				
Totals, 14 tides.								59	11	113	58	173	2				146·4384	144·8174	173·0385	146·3820
			L.W.		60	8	+48							— 60	327	92·3460				
				=	108	8														
			14 H.W.											+ 18	22	17·5339				
Means		do						4	14	8	8	12	21				10·4599	10·3441	12·3599	10·4559
			14 L.W.											— 15	23	7·1035				

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °

† Longitude Pointe Platon=71° 51′=4h. 47m. 24sec.=0·1996 of a day west of Greenwich.

‡ Moon crosses the equator.

§ Moon in apogee, May 9th, at 8 p.m.
New moon (Quebec), May 10th, at 8.24 p.m.

APPENDIX 13.

TABLE XII.—Tidal Fluctuations at Pointe Platon during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).											RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."														
Diurnal Inequalities.							Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon				Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2)		Length of half tide day H. W. to H. W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series V. Gaining tides. Gauge book reference numbers.
In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.				Upper passage.		Lower passage.		Ages, etc.										
Min.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.		
...	...	...	...	...	...	...	...	...	...	...	...	...	...	23·3	...	...	12	42	...	...	...	...	...
...	53	35	...	5260	...	...	8	1	9	...	...	7	39	....	3	28	...	...	*+33	7	49	° 44	¼
18	...	...	2·4250	...	4503	*·6445	...	...	2	...	...	...	...	....	...	...	*12	41	...	...	...	...	¼
...	50	*55	...	2700	...	...	7	53	...	8	2	...	...	24·3	4	9	...	...	...	8	7	46	9
5	...	...	6500	...	0691	·4742	...	...	...	...	...	...	...	....	...	...	12	37	...	...	...	...	¼
...	32	55	...	0660	...	...	8	42	...	...	...	8	23	....	4	46	...	...	+19	8	23	49	¼
23	...	...	1000	...	1537	·1525	...	...	...	...	...	...	...	....	...	...	12	32	...	...	...	...	¼
...	14	5	...	3940	...	...	8	35	1	8	45	...	..	25·3	5	18	...	...	...	8	33	53	10
9	...	...	1400	...	0304	·4633	...	...	...	...	...	...	...	....	...	...	12	27	...	...	...	...	¼
...	6	15	...	1300	...	...	8	34	...	...	...	9	6	....	5	45	...	...	+ 2	8	39	57	¼
9	...	...	4250	...	2622	·2605	...	...	...	...	...	...	...	....	...	...	12	25	...	...	...	...	¼
...	15	22	...	3940	...	...	8	48	..	9	27	...	..	26·3	6	10	...	...	....	8	43	61	11
7	...	...	5800	...	1686	·0977	...	...	...	...	...	...	...	....	...	...	12	22	...	...	...	...	¼
...	17	5	...	1544	...	...	8	40	...	...	...	9	48	....	6	32	...	...	- 8	*8	44	65	¼
12	...	...	7150	...	0209	·0757	...	...	...	...	...	...	...	....	...	...	12	20	...	...	...	...	¼
...	13	° 1	...	1204	...	...	8	37	...	10	9	...	..	27·3	6	52	...	...	....	8	43	69	12
12	...	...	1·0850	...	1445	·1886	...	...	...	...	...	...	...	....	...	...	12	18	...	...	...	...	¼
...	17	8	...	° 0200	...	...	8	35	...	...	...	10	28	....	7	10	...	...	—14	8	42	72	¼
9	...	...	5000	...	3756	·2412	...	...	...	...	...	...	...	....	...	...	12	18	...	...	...	...	¼
...	27	8	...	5300	...	...	8	38	2	10	50	...	..	28·3	7	28	...	...	....	8	38	75	13
19	...	...	1·9000	...	* 6837	·1475	...	...	...	...	...	...	...	....	...	...	12	16	...	...	...	...	¼
...	20	3	...	6900	...	...	8	33	2	...	...	11	12	....	7	44	...	...	—17	8	32	78	¼
17	...	...	2700	...	6032	·1213	...	...	3	...	...	...	...	29·3	...	...	12	17	...	...	...	...	¼
...	27	20	...	3950	...	...	8	32	3	11	33	...	..	●	8	1	...	...	....	8	28	80	14
7	...	...	1·2950	...	1444	·0363	...	...	2	...	...	...	...	....	...	...	°12	15	...	...	...	...	¼
...	35	30	...	0700	...	...	8	10	*40	...	...	11	55	..	8	16	...	...	*-19	8	21	81	¼
5	...	...	1·8150	...	0538	·1075	...	...	1	...	...	...	...	....	...	...	12	16	...	...	...	...	¼
...	28	23	...	0700	...	...	8	17	2	...	18	...	..	0·6	8	32	...	...	....	8	14	82	15
5	...	...	1·9050	...	2063	·0275	...	...	2	...	...	...	...	....	...	...	12	15	...	...	...	...	¼
157	354	285	13·8050	3·8298	3·3667	3·0383	118	35	....	71	4	68	31	....	90	11	173	19	+54 ... —58	118	36	912	
11	22	20	·9861	·2736	·2405	·2170	8	28	....	10	9	9	47	...	6	27	12	23	+18 .. —15	8	28	65·14	

APPENDIX 13.

TABLE XII.—Tidal Fluctuations at Pointe Platon during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series VI. Losing tides.		High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.
			H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min.
	May 12	L.W.	4	32	A.M.							—20		8·3118					
¼	do 12	H.W.	8	42	A.M.	4	10					—15	22	20·4918	12·1800		14·1030	11·2125	
½	do 12	L.W.	5	12	P.M.			8	30	12	28		23	8·6818		11·8100			12
16	do 12	H.W.	9	10	P.M.	3	58						16	19·2668	10·5850		14·5018	11·1600	
¼	do 13	L.W.	4	59	A.M.			7	49	°11	55		21	9·1618		10·1050			8
½	do 13	H.W.	9	5	A.M.	4	6					* 35	20	21·3018	12·1400		14·7211	10·9484	
½	do 13	L.W.	5	45	P.M.			8	40	12	20		24	9·3318		11·9700			26
17	do 13	H.W.	9	25	P.M.	3	40						30	18·9105	9·5787		14·8632	10·7359	
¼	do 14	L.W.	5	25	A.M.			8	0	12	8		20	9·6590		9·2515			28
½	do 14	H.W.	9	33	A.M.	4	8					—30	25	21·8025	12·1435		14·9682	10·4515	
½	do 14	L.W.	6	25	P.M.			8	52	12	12		28	9·8260		11·9765			*48
18	do 14	H.W.	9	45	P.M.	°3	20						25	18·2605	8·4345		14·7094	10·0968	
¼	do 15	L.W.	6	0	A.M.			8	15	12	20		17	9·4960		8·7645			45
½	do 15	H.W.	10	5	A.M.	4	5					— 8	33	20·7075	11·2115		14·5695	9·8040	
½	do 15	L.W.	6	55	P.M.			8	50	12	22		23	9·8390		10·8685			33
19	do 15	H.W.	10	27	P.M.	3	32						11	18·2105	8·3715		14·4794	9·5108	
¼	do 16	L.W.	6	42	A.M.			8	15	12	8		22	9·6090		8·6015			21
½	do 16	H.W.	10	35	A.M.	3	53					+ 5	19	19·8105	10·2015		14·2166	9·3853	
½	do 16	L.W.	7	37	P.M.			9	2	12	47		24	9·4390		10·3715			8
20	do 16	H.W.	11	22	P.M.	3	45						°9	17·8055	8·3665		13·9585	9·2390	
¼	do 17	L.W.	7	17	A.M.			7	55	12	15		17	9·2390		8·5665			35
½	do 17	H.W.	11	37	A.M.	4	20					+13	25	18·8905	9·6515		13·5381	8·7671	
½	do 17	L.W.	8	25	P.M.			8	48	12	48		26	9·0700		9·8205			20
21	do 18	H.W.	12	25	A.M.	4	0						21	16·1000	°7·0300		13·2047	8·4004	
¼	do 18	L.W.	8	10	A.M.			7	45	12	12		20	8·9390		7·1610			27
½	do 18	H.W.	12	37	P.M.	4	27					—°0	12	18·5290	9·5900		13·1444	8·3598	
½	do 18	L.W.	9	20	P.M.			8	43	12	38		35	8·9900		9·5390			32
22	do 19	H.W.	1	15	A.M.	3	55						21	16·1390	7·1490		13·1969	°8·2578	
¼	do 19	L.W.	9	15	A.M.			8	0	12	10		24	9·1400		°6·9930			15
½	do 19	H.W.	1	25	P.M.	4	10					+20	20	18·4960	9·3500		13·3766	8·3373	
		H.W.	137 =161	28 28	+ 24							+38	309	284·7224					
Totals 15 tides..						59	29	117	24	172	43				145·9832	135·7990	211·5515	144·6666	358
		L.W.	97	27								—88	332	138·7392					
	15	H.W.										+13	21	18·9815					
Means	do	..				3	58	8	23	12	20				9·7322	9·6999	14·1034	9·6444	26
	14	L.W.										—18	24	9·2493					

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °

† From 6.30 p.m., May 13, to 1.0 p.m., May 21, observations made with ordinary tide staffs, pending arrival of new gauge from Quebec to replace that taken by rafts, etc.

APPENDIX 13.

TABLE XII.—Tidal Fluctuations at Pointe Platon during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).									RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."																			
Diurnal Inequalities.									Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides										
In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.			Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Mares," corresponding to observed tides assumed to be 48 hours old.	Series VI. Losing tides. Gauge book reference numbers.
									H.	M.	H.	M.																
Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.			H.	M.	H.	M.	Min	H.	M.						
																				—19								
33	21	.....	3700	.....	.....	8	2	4	.....	.....	.....	40	.....			8	47	.....	.....	*-19	8	7	82					
.....	.....	1·2250	.....	3987	0525	.....	.....	3	.....	.....	.....	.....	1·6			.....	.....	12	16	.....	.....	.....	.....					
41	33	.....	4800	.....	.....	8	7	2	1	3	.....	.....	.....			9	3	.....	.....	.....	8	0	82					16
.....	.....	2·0350	.....	2193	2116	.....	.....	9	.....	.....	.....	.....	.....			.....	.....	12	15	.....	.....	.....	.....					
51	25	.....	1700	.....	.....	7	38	2	.....	.....	1	27	.....			9	18	.....	.....	—19	7	51	81					
.....	.....	2·3913	.....	1421	2125	.....	.....	.....	.....	.....	.....	.....	2·6			.....	.....	12	16	.....	.....	.....	.....					
40	12	.....	3272	.....	.....	7	34	..	1	51	.....	.....	.....			9	34	.....	.....	.....	7	43	80					17
.....	.....	2·8920	.....	1050	2844	.....	.....	.....	.....	.....	.....	.....	.....			.....	.....	12	16	.....	.....	.....	.....					
52	4	.....	1670	.....	.....	7	17	..	.....	.....	2	16	.....			9	50	.....	.....	—18	7	34	78					
.....	.....	*3·5420	.....	2588	3547	.....	.....	.....	.....	.....	.....	.....	3·6			.....	.....	12	16	.....	.....	.....	.....					
37	8	.....	3300	.....	.....	7	4	..	2	41	.....	.....	.....			10	6	.....	.....	.....	7	25	76					18
.....	.....	2·4470	.....	1399	2928	.....	.....	.....	.....	.....	.....	.....	.....			.....	.....	12	16	.....	.....	.....	.....					
35	2	.....	3430	.....	.....	6	59	..	.....	.....	3	6	.....			10	22	.....	.....	—16	7	16	73					
.....	.....	2·4970	.....	0901	2932	.....	.....	.....	.....	.....	.....	.....	4·6			.....	.....	12	18	.....	.....	.....	.....					
35	14	.....	2300	.....	.....	6	56	..	3	31	.....	.....	.....			10	40	.....	.....	.....	7	9	70					19
.....	.....	1·6000	.....	2628	1255	.....	.....	.....	.....	.....	.....	.....	.....			.....	.....	12	18	.....	.....	.....	.....					
47	39	.....	1700	.....	.....	§6	38	..	.....	.....	3	57	.....			10	58	.....	.....	—13	7	1	66					
.....	.....	2·0050	.....	2581	1463	.....	.....	.....	.....	.....	.....	.....	5·6			.....	.....	12	19	.....	.....	.....	.....					
67	32	.....	2000	.....	.....	7	0	..	4	22	.....	.....	.....			11	17	.....	.....	.....	6	55	62					20
.....	.....	1·0850	.....	4204	4719	.....	.....	.....	.....	.....	.....	.....	.....			.....	.....	12	22	.....	.....	.....	.....					
53	33	.....	1690	.....	.....	6	49	..	.....	.....	4	48	.....			11	39	.....	.....	— 4	6	51	58					
.....	.....	2·7905	.....	3334	3667	.....	.....	.....	.....	.....	.....	.....	6·6			.....	.....	12	24	.....	.....	.....	.....					
63	36	.....	1310	.....	.....	7	11	..	5	14	.....	.....	.....			12	3	.....	.....	.....	§6	49	54					21
.....	.....	2·4290	.....	0603	0406	.....	.....	.....	.....	.....	.....	.....	.....			.....	.....	12	26	.....	.....	.....	.....					
58	26	.....	0510	.....	.....	6	58	..	.....	.....	5	39	◑			12	29	.....	.....	+ 6	6	50	51					
.....	.....	2·3900	.....	0525	1020	.....	.....	.....	.....	.....	.....	.....	7·6			.....	.....	12	30	.....	.....	.....	.....					
43	28	.....	1560	.....	.....	7	11	..	6	4	.....	.....	.....			..	59	.....	.....	.....	6	55	48					22
.....	.....	2·3570	.....	1797	0795	.....	.....	.....	.....	.....	.....	.....	.....			.....	.....	12	34	.....	.....	.....	.....					
55	50	.....	.....	.....	.....	6	55	..	.....	.....	6	30	.			1	33	.....	.....	+22	7	3	46					
											40	23				138	38											
											+84	0				+ 24	0			+28								
710	363	31·6858	3·2942	2·9211	3·0342	108	19	..	24	46	=124	23	....			=162	38	172	46	....	109	29	1007					
																				—89								
																				+14								
47	24	2·2633	·2353	·2087	·2171	7	13	..	3	32	15	33	....			10	51	12	20	....	7	18	67·13					
																				—15								

‡ Maximum diurnal inequality in high water levels according to observations with plain tide staff (not very accurate).

§ Moon's north declination a maximum=21° 8′.

‖ Moon's first quarter (Quebec), May 18th, from 6h. 5m. p.m.

APPENDIX 13.

TABLE XII.—Tidal Fluctuations at Pointe Platon during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series VII. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M	A.M. or P.M.	Duration of floods. H.	M	Duration of ebbs. H.	M	Length of half tide day H.W. to H.W. H.	M	Priming—or lagging+ of tides Min	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min.
	May 19 H.W	1	25	P.M.							+20		18·4960					
¾	do 19 L.W.	10	20	P.M.			8	55	13	0	....	22	9·2700		9·2260			5
23	do 20 H.W	2	25	A.M.	4	5					....	*34	17·0500	7·7800		13·2631	8·4170	
¼	do 20 L.W.	10	37	A.M.			8	12	12	30	...	10	8·8390		8·2110			13
½	do 20 H.W	2	55	P.M.	4	18					+30	27	17·2900	8·4510		12·9311	8·5630	
¾	do 20 L.W. †	11	32	P.M.			8	37	12	50	..	20	8·4600		8·8300			5
24	do 21 H.W	3	45	A.M.	4	13					....	22	17·2200	8·7600		13·0312	8·9634	
¼	do 21 L.W.	11	55	A.M.			8	10	12	20	..	24	8·6390		8·5810			3
½	do 21 H.W	4	5	P.M.	4	10					+ 8	29	18·3214	9·6824		13·3555	9·5161	
¾	do 22 L.W. ‡	12	39	A.M.			8	34	12	38	...	*36	8·5560		9·7654			6
25	do 22 H.W	4	43	A.M.	4	4					...	21	18·5914	10·0354		13·5276	9·9827	
¼	do 22 L.W.	1	15	P.M.			8	32	12	29	....	23	8·5164		10·0750			7
½	do 22 H.W	5	12	P.M.	3	57					—°0	23	18·5714	10·0550		13·7245	10·4663	
¾	do 23 L.W.	1	30	A.M.			8	18	12	21	....	25	8·4664		10·1050			6
26	do 23 H.W	5	33	A.M.	4	3					....	20	20·0964	11·6300		14·0565	11·0450	
¼	do 23 L.W.	2	13	P.M.			8	40	12	33	....	25	8·6014		11·4950			10
½	do 23 H.W	6	6	P.M.	3	53					— 0	18	19·5514	10·9500		14·4083	11·4488	
¾	do 24 L.W.	2	24	A.M.			8	18	12	17	....	24	8·7664		10·7850			6
27	do 24 H.W	6	23	A.M.	3	59					....	17	21·3314	12·5650		14·8010	11·8243	
¼	do 24 L.W. §	3	8	P.M.			8	45	12	34	....	17	9·0114		12·3200			10
½	do 24 H.W	6	57	P.M.	3	49					— 0	23	20·6384	11·6270		15·1355	12·1690	
¾	do 25 L.W.	3	15	A.M.			8	18	12	16	...	21	9·0904		11·5480			9
28	do 25 H.W	7	13	A.M.	3	58					...	18	22·2714	13·1810		15·3937	12·3865	
¼	do 25 L.W.	4	2	P.M.			8	49	12	40	....	22	9·3104		12·9610			7
½	do 25 H.W	7	53	P.M.	3	51					+°1	11	21·1664	11·8560		15·5357	12·5545	
¾	do 26 L.W.	4	4	A.M.			8	11	12	11	..	17	9·2064		11·9600			9
29	do 26 H.W	8	4	A.M.	4	0					...	19	22·6474	13·4410		15·5656	12·5683	
¼	do 26 L.W.	4	55	P.M.			8	51	12	34	....	23	9·3564		13·2910			17
½	do 26 H.W	8	38	P.M.	3	43					+ 1	21	20·9374	11·5810		15·5925	*12·6020	
	. . .																	
	H.W.	79	52								+40	303	275·6844					
Totals	14 tides				56	3	119	10	175	13	....			151·5948	149·1534	200·3218	152·5069	113
	L.W.	83	49	+48							— 0	309	124·0896					
		131	49															
	14 H.W.										+10	22	19·6917					
Means	do ..	....	..	....	4	0	8	31	12	31	....	..	..	10·8282	10·6538	14·3087	10·8934	8
	14 L.W.										— 0	22	8·8635					

N.B.—Maxima in whole lunar month indicated by a star, thus *: and minima by a circle, thus °:
†From 6h. 30m. p.m., May 13th, to 1h. 0m., May 21st, observations made with ordinary tide staffs pending arrival of new box gauge ordered from Quebec to replace that broken by rafts and steamboat.

APPENDIX 13.

TABLE XII.—Tidal Fluctuations at Pointe Platon during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).									RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."															
Diurnal Inequalities.									Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.						Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H. W. to H. W		Priming—or lagging + of tides	Lunitidal intervals		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series VII. Gaining tides. Gauge book reference numbers.
In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.											
Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.		H.	M.	H.	M.	Min	H.	M.		
...	...	1·4460	·1240	..	.....	...	...	....	...	...	...	...	....		.....	...	...	...	+22	...	...	.....	
...	...	.....	.....	.....	.....	...	...	....	...	...	...	...	....		.....	...	...	...	...	...	...	.....	
43	30	.....	.....	·1135	·0797	...	...	....	...	...	...	...	....		.....	...	12	38	....	7	16	46	‡ ‖ 23
...	...	·2400	·4310	.....	.....	7	30	....	6	55	...	...	....		2	11	...	...	....	...	...	.....	‡
25	20	.....	.....	·3320	·1460	...	...	....	...	...	...	...	9·6		.....	...	12	40	....	7	30	48	‡ §
...	...	·0700	·3790	.....	.....	7	34	....	...	...	7	21	....		2	52	...	...	+29	...	...	.....	‡ §
27	30	.....	.....	·1001	·4004	...	...	....	...	...	...	...	....		.....	...	12	39	....	7	44	51	‡ § 24
...	...	1·1014	·1790	.....	.....	7	59	....	7	46	...	...	....		3	31	...	...	....	...	...	.....	‡ §
24	18	.....	.....	·3243	·5527	...	...	....	...	...	...	...	10·6		.....	...	12	37	....	7	55	56	‡ §
...	...	·2700	°·0830	.....	.....	7	53	....	...	...	8	12	....		4	7	...	...	+21	...	...	.....	‡ §
2	9	.....	.....	·1721	·4666	...	...	....	...	...	...	...	....		.....	...	12	34	..	8	3	62	‡ § 25
...	...	°·0200	·0396	.....	.....	8	5	....	8	38	...	...	....		4	41	...	...	..	...	...	.....	‡ §
14	8	.....	.....	·1969	·4836	...	...	....	...	...	...	...	11·6		.....	...	12	31	....	8	7	69	‡ §
...	...	1·5250	·0500	.....	.....	8	7	....	...	...	9	5	....		5	12	...	...	+ 9	...	...	.....	‡ §
22	12	.....	.....	·3320	·5787	...	...	....	...	...	...	...	....		.....	...	12	28	....	8	8	76	‡ § 26
...	...	·5450	·1350	.....	.....	8	1	....	9	32	...	...	....		5	40	...	...	....	...	...	.....	‡ §
22	16	.....	.....	·3518	·4038	...	...	....	...	...	...	...	12·6		.....	...	12	26	....	8	7	83	‡ §
...	...	1·7800	·1650	.....	.....	8	7	....	...	...	9	59	....		6	6	...	...	+°1	...	...	.....	‡ §
27	17	.....	.....	·3927	·3755	...	...	....	...	...	...	...	....		.....	...	12	25	...	8	4	89	‡ § 27
...	...	·6930	·2450	.....	.....	7	56	....	10	27	...	...	....		6	31	...	...	..	...	...	.....	‡ §
27	18	.....	.....	·3345	·3447	...	...	2	...	...	...	...	13·6		.....	...	12	24	....	7	59	95	‡ §
...	...	1·6330	·0790	.....	.....	8	1	1	...	...	10	56	....		6	55	...	...	—°2	...	...	.....	‡ §
31	24	.....	.....	·2582	·2175	...	...	2	...	...	...	...	....		.....	...	12	24	....	7	53	100	‡ § 25
...	...	1·1050	·2200	.....	.....	7	47	1	11	26	...	...	⊙		7	19	...	...	....	...	...	.....	‡ §
38	29	.....	.....	·1420	·1680	...	...	....	...	...	...	...	14·6		.....	...	12	24	....	7	48	104	‡ §
...	...	1·4810	·1040	.....	.....	7	58	1	...	...	11	55	....		7	43	...	...	— 3	...	...	.....	‡ §
40	23	.....	.....	·0299	°·0138	...	...	8	...	...	...	...	....		.....	...	12	23	...	7	40	106	‡ § 29
...	...	1·7100	·1500	.....	.....	7	38	..	...	26	...	...	....		8	6	...	...	..	...	...	.....	‡ §
40	17	.....	.....	·0269	·0337	...	...	3	...	...	...	...	15·6		.....	...	12	23	...	7	33	*107	‡ §
...	...	.....	.....	.....	.....	7	42	..	...	...	...	56	....		8	29	...	...	— 3	...	...	.....	
382	271	13·6194	2·3836	3·1069	4·2647	110	18	....	67	10	70	24	....		79	21	174	56	+60	109	47	1092	
															+168	0			— 8				
															=247	21							
27	19	·9728	·1703	·2219	·3046	7	53	....	9	36	10	3	....		17	40	12	30	+15	7	51	78·00	
																			— 3				

‡ Moon after crossing equator.
§ Moon in perigee, May 24th, at 2h. 0m. p.m.
‖ Full moon (Quebec), May 25th, at 8h. 40m. a.m.

APPENDIX 13.

TABLE XII.—Tidal Fluctuations at Pointe Platon during the High water season of 1888, viz., from quadrature May 2nd, to quadrature June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series VIII. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides. Min.	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min.	In duration of ebbs. Min.
	May 26 H.W	8	38	P.M.	3	43	...	...	...	...	+ 1	....	20·9374	....	.....	.....	.....	...	...
¼	do 27 L.W.	4	49	A.M.	...	...	8	11	12	17	...	18	9·2264	.....	11·7110	.....	.....	23	...
30	do 27 H.W	8	55	A.M.	4	6	...	...	...	...	...	25	*23·0514	*13·8250	.....	*15·6060	12·5190	...	39
½	do 27 L.W.	5	45	P.M.	...	...	8	50	12	38	.....	22	9·4664	.....	*13·5850	.....	.....	18	...
¾	do 27 H.W	† 9	33	P.M.	3	48	...	...	...	...	— 2	13	20·4214	10·9550	.....	15·4539	12·2948	...	50
1	do 28 L.W.	5	33	A.M.	...	...	8	0	12	10	...	15	9·1464	.....	11·2750	.....	.....	22	...
31	do 28 H.W	9	43	A.M.	4	10	...	...	...	...	...	11	22·5107	13·3643	.....	15·1838	12·1147	...	54
¼	do 28 L.W.	‡ 6	37	P.M.	...	...	8	54	12	37	.....	16	9·1064	.....	13·4043	.....	.....	27	...
½	do 28 H.W	10	20	P.M.	3	43	...	...	...	...	— 5	21	19·5214	10·4150	.....	14·9107	11·8386	...	47
¾	do 29 L.W.	6	27	A.M.	...	...	8	7	12	8	....	11	8·8764	.....	10·6450	.....	.....	18	...
32	do 29 H.W	10	28	A.M.	4	1	...	...	...	...	...	18	21·7664	12·8900	.....	14·6502	11·6575	...	54
¼	do 29 L.W.	7	29	P.M.	...	...	9	1	12	45	.....	19	8·7664	.....	13·0000	.....	.....	17	...
½	do 29 H.W	11	13	P.M.	3	44	...	...	...	...	— 3	33	18·8614	10·0950	.....	14·3452	11·3035	...	62
¾	do 30 L.W.	7	12	A.M.	...	...	7	59	12	2	.....	21	8·6204	.....	10·2410	.....	.....	19	...
33	do 30 H.W	11	15	A.M.	4	3	...	...	...	...	...	20	20·4984	11·8780	.....	13·9029	10·9990	...	64
¼	do 30 L.W.	8	18	P.M.	...	...	* 9	3	12	55	....	24	8·1864	.....	12·3120	.....	.....	11	...
½	do 31 H.W	12	10	A.M.	3	52	...	...	...	...	+ 7	21	17·7514	9·5650	.....	13·5486	10·6143	...	* 68
¾	do 31 L.W.	8	5	A.M.	...	...	7	55	12	2	.....	23	8·2964	.....	9·4550	.....	.....	15	...
34	do 31 H.W	12	12	P.M.	4	7	...	...	...	...	.....	19	19·4214	11·1250	.....	13·3095	10·2913	...	56
¼	do 31 L.W.	9	3	P.M.	...	...	8	51	12	53	...	25	8·0314	.....	11·3900	.....	.....	5	...
½	June 1 H.W	1	5	A.M.	4	2	...	...	...	...	+ 15	16	17·2264	9·1950	.....	13·2914	10·0300	...	63
¾	do 1 L.W.	§ 8	53	A.M.	...	...	7	48	12	12	.....	22	8·5214	.....	8·7050	.....	.....	22	...
35	do 1 H.W	1	17	P.M.	4	24	...	...	...	...	.....	28	19·3514	10·8300	.....	13·3890	9·8550	...	55
¼	do 1 L.W.	10	0	P.M.	...	...	8	43	12	47	.....	17	8·4014	.....	10·9500	.....	.....	20	...
½	do 2 H.W	2	4	A.M.	4	4	...	...	...	...	+ 8	25	17·3364	8·9350	.....	13.1027	9·4375	...	39
¾	do 2 L.W.	10	8	A.M.	...	...	8	4	12	11	.....	25	8·3664	.....	8·9700	.....	.....	3	...
36	do 2 H.W	2	15	P.M.	4	7	...	...	...	...	.....	21	17·2614	8·8950	.....	12·4658	9·1938	...	35
¼	do 2 L.W	10	54	P.M.	...	...	8	39	12	58	.....	24	7·3714	.....	9·8900	.....	.....	12	...
½	do 3 H.W	3	13	A.M.	4	19	...	...	...	...	+ 24	23	16·3914	9·0200	.....	12·1650	9·2530	...	39
					...	...	8	0	12	16	.....	23	.....	.....	.....	.....	.....	...	...
¾	do 3 L.W.	11	13	A.M.	...	...	...	...	...	...	.....	...	7·7054	....	.....	.....	.....	...	...
	H.W.	105	43	+24							+ 54	294	271·3709						
Totals	14 tides =	129	43	....	56	30	126	5	186	51	.....	.....	.....	150·9873	155·5333	195·3247	151·4020	232	725
	L.W.	120	26								— 10	305	120·3836						
	14 H.W.										+ 14	21	19·3836						
Means	do ..	...	..	....	4	2	8	24	12	27	.....	...	.....	10·7848	11·1095	13·9518	10·8144	17	52
	15 L.W.										— 3	20	8·5988						
	H.W.										+187	1219	1077·2529						
Grand totals	57	...	..	....	231	13	476	37	707	49	.....	.....	.....	595·0037	585·3031	780·2365	594·9575	860	2171
tides.	L.W.										—158	1273	475·5584						
	57 H.W.										+ 13	21	18·8991						
Grand means	do	...	..	....	4	4	8	22	12	25	.....	...	.....	10·4387	10·4518	13·6884	10·4378	16	37
	57 L.W.										— 8	22	8·3431						

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °

† Moon's S. declination a maximum = 21° 41′.

‡ Maximum diurnal inequality in high water levels observed with box gauge = 2·989 ft.

APPENDIX 13.

TABLE XII.—Tide Fluctuatians at Pointe Platon during the High water season of 1888, viz., from quadrature May 2nd, to quadrature June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).									RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."													
Diurnal Inequalities.								Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times. (No. 2).	Length of half-tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series VIII. Losing tides. Gauge book reference numbers.
In semi-tide days.	In high waters.	In low water levels.	In mean tide level.	In amplitudes.	Lunitidal intervals.			Upper passage.		Lower passage.		Ages, etc.										
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.			
....	.....	1300	.....	.....	...	...		...	...	...	...	...	...	...	...	...	— 3	...	...	.....		
....	2·1140	.....	·0135	·0830	...	...	1	...	...	...	...	...	...	...	12	24	.....	...	...	.....		
21	.....	2400	.....	.....	7	28	20	1	27	...	...	1·66	8	53	...	...	.....	7	26	106		30
....	2·6300	.....	1521	2242	...	...	3	...	...	...	...	...	...	...	12	23	.....	...	...	.....		
28	.....	3200	.....	.....	7	35	3	...	...	1	58	....	9	16	...	...	— 3	7	18	104		
....	2·0893	.....	2701	1801	...	...	3	...	...	...	...	...	...	...	12	24	.....	...	...	.....		
27	.....	0400	.....	.....	7	15	5	2	28	...	...	...	9	40	...	...	.....	7	12	101		31
....	2·9893	.....	2731	2761	...	...	3	...	...	...	...	17·6	...	...	12	24	.....	...	...	.....		
29	.....	2300	.....	.....	7	23	1	...	...	2	57	....	10	4	...	...	— 3	7	7	96		
....	2·2450	.....	2605	1811	...	...	...	...	...	...	...	...	...	...	12	23	.....	...	...	.....		
37	.....	1100	.....	.....	7	2	...	3	26	...	...	...	10	27	...	...	.....	7	1	91		32
....	2·9050	.....	3050	3540	...	...	...	...	...	...	...	18·6	...	...	12	23	.....	...	...	.....		
43	.....	1460	.....	.....	7	20	...	...	...	3	53	....	10	50	...	...	— 3	6	57	85		
....	1·6370	.....	4423	3045	...	...	...	...	...	...	...	...	...	...	12	24	.....	...	...	.....		
53	.....	4340	.....	.....	6	55	...	4	20	...	...	....	11	14	...	...	.....	6	54	79		33
....	2·7470	.....	3543	3847	...	...	...	...	...	...	...	19·6	...	...	12	26	.....	...	...	.....		
53	.....	1100	.....	.....	7	24	...	...	...	4	46	....	11	40	...	...	+ 2	6	54	72		
....	1·6700	.....	2391	3230	...	...	...	...	...	...	...	...	...	...	12	26	.....	...	...	.....		
51	.....	2650	.....	.....	7	1	...	5	11	...	...	....	12	6	...	...	.....	6	55	66		34
....	2·1950	.....	0181	2613	...	...	...	...	...	...	...	20·6	...	...	12	27	.....	...	...	.....		
41	.....	4900	.....	.....	7	30	3	...	...	5	35	....	12	33	...	...	+ 7	6	58	60		
....	2·1250	.....	0976	1750	...	...	5	...	...	...	...	...	...	...	12	30	.....	...	...	.....		
35	.....	1200	.....	.....	7	19	3	5	58	...	...	◐ 21·6	1	3	...	...	.....	7	5	55		35
....	2·0150	.....	2863	4175	...	...	...	...	...	...	...	...	...	...	12	32	.....	...	...	.....		
36	.....	0350	.....	.....	7	43	...	...	...	6	21	....	1	35	...	...	+ 17	7	14	51		
....	0·750	.....	6369	2437	...	...	...	...	...	...	...	...	...	...	12	35	.....	...	...	.....		
47	.....	*·9950	.....	.....	7	32	...	6	43	...	...	22·6	2	10	...	...	.....	7	27	48		36
....	·8700	.....	3008	0592	...	...	...	...	...	...	...	...	...	...	12	31	.....	...	...	.....		
42	.....	3340	.....	.....	8	9	...	...	...	7	4	....	2	41	...	...	+ 10	7	37	46		
....	7300	.....	.....	.....	...	...	...	...	...	...	...	23·6	...	...	12	29	.....	...	...	.....		
543	29·0366	3·9990	3·6497	3.4674	103	36	...	29	33	32	34	....	114	12	186	41	+ 36	100	5	1060		
													+48	0			.....					
													=162	12			— 9					
39	1·9358	·2666	·2606	.2477	7	24	...	4	13	4	39	....	11	35	12	27	+ 9 ..... — 3	7	9	75·71		
1462	88·1468	13·5066	13·0444	13·8046	440	48	...	192	33	211	52	....	662	22	707	42	+178	437	57	4071		
																	.....					
																	—164					
26	1·5464	·2370	·2329	·2465	7	52	...	6	53	7	19	....	11	37	12	25	+ 14 ..... — 10	7	41	71·42		

§ Moon's last quarter (Quebec) June 1st from 7h. 53m. p.m.
* Maximum diurnal inequality observed in low water levels=0·995 feet.

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

GRONDINES, ST. JEAN DES CHAILLONS AND BATISCAN,

DURING A COMPLETE LUNAR MONTH OF THE HIGH WATER SEASON OF 1888, VIZ., MAY 2, TO JUNE 1.

TABLES XIII, XIV AND XV.

WEEKLY SERIES OF GAINING AND LOSING TIDES Nos. V, VI, VII AND VIII.

APPENDIX 13.

TABLE XIII.—Tidal Fluctuations at Grondines during the High water season of 1887, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series V. (Gaining tides.		High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides Min	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min.	In duration of ebbs. Min
	May 5	L.W.	+12	53	A.M.			9	10	12	59			13·3474						
													47							
¼	do 5	H.W.	4	42	A.M.	3	49					+22	36	17·1974	3·8500		15·4950	4·3350		52
½	do 5	L.W.	1	0	P.M.			8	18	12	13		45	13·3074		3·8900			6	
9	do 5	H.W.	4	55	P.M.	3	55						36	18·2074	4·9000		15·5812	4·5075		42
¼	do 6	L.W.	1	55	A.M.			9	0	12	47		47	13·3474		4·8600			8	
½	do 6	H.W.	5	42	A.M.	3	47					+15	34	17·7274	4·3800		15·5912	4·5175		22
¾	do 6	L.W.	2	20	P.M.			8	38	12	18		46	13·3174		4·4100			7	
10	do 6	H.W.	6	0	P.M.	3	40						34	17·7374	4·4200		15·4800	4·5650		12
¼	do 7	L.W.	2	50	A.M.			8	50	12	38		47	13·0574		4·6800			8	
½	do 7	H.W.	6	38	A.M.	3	48					+12	30	17·8074	4·7500		°15·4575	4·8400		8
¾	do 7	L.W.	‡ 3	20	P.M.			8	42	12	24		41	13·0174		4·7909			6	
11	do 7	H.W.	7	2	P.M.	3	42						31	18·1574	5·1400		15·6887	5·0225		12
¼	do 8	L.W.	3	32	A.M.			8	30	12	14		49	13·3374		4·8200			2	
½	do 8	H.W.	7	16	A.M.	3	44					—°0	21	18·6774	5·3400		15·9012	5·0275		17
¾	do 8	L.W.	4	3	P.M.			8	47	12	26		41	13·4374		5·2400			5	
12	do 8	H.W.	7	42	P.M.	3	39						31	18·1474	4·7100		16·0000	5·0150		21
¼	do 9	L.W.	4	8	A.M.			8	26	12	5		40	13·5474		4·6000			°0	
½	do 9	H.W.	7	47	A.M.	3	39					—22	28	19·0574	5·5100		16·1725	5·1200		27
¾	do 9	L.W.	4	40	P.M.			8	53	12	23		38	13·6774		5·3800			9	
13	do 9	H.W.	§ 8	10	P.M.	3	30						29	18·6674	4·9900		16·4722	5·3095		32
¼	do 10	L.W.	4	31	A.M.			8	21	12	1		37	13·9574		4·7100			10	
½	do 10	H.W.	8	11	A.M.	3	40					—13	33	20·1154	6·1580		16·9670	5·6190		29
¾	do 10	L.W.	5	1	P.M.			8	56	12	36		39	14·3574		5·7580			6	
14	do 10	H.W.	8	47	P.M.	3	46						30	20·2074	5·8500		17·4844	5·9038		40
¼	do 11	L.W.	4	57	A.M.			8	10	11	49		35	14·7074		5·5000			7	
½	do 11	H.W.	8	36	A.M.	3	39					—20	29	21·2144	6·5070		17·7279	5·8310		56
¾	do 11	L.W.	5	42	P.M.			9	6	12	41		35	14·9174		6·2970			4	
15	do 11	H.W.	9	17	P.M.	3	35						28	19·9374	5·0200		17·7927	5·6805		56
¼	do 12	L.W.	5	27	A.M.			8	10	11	50		33			4·9500			5	
														14·9874						
		H.W.	100	45								+49	430	262·8586						
Totals	14 tides..		53	26	+24	51	53	120	41	172	25				71·5250	69·8850	227·8015	71·2938	83	426
		L.W.	=77	26								—55	620	191·3336						
	14	H.W.										+16	31	18·7756						
Means	do					3	42	8	37	12	19				5·1089	4·9918	16·2715	5·0924	6	30
	14	L.W.										—13	41	13·6667						

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °
†Longitude Grondines wharf = 72° 2′ = 4h. 48m. 8s. = 0·2001 of a day west of Greenwich.
‡Moon crosses the equator.
§Moon in apogee, May 9th, at 8 p.m.
New moon (Quebec) May 10th, at 8h. 24m. p.m.

APPENDIX 13.

TABLE XIII.—Tidal Fluctuations at Grondines during the High water season of 1887, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued.*)

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Diurnal Inequalities. In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon. Upper passage.		Lower passage.		Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times. (No. 2.)		Length of half tide day H. W. to H. W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series V. Gaining tides. Gauge book reference numbers.
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		
												23·3			12	42					
46		0400			9	2				7	40		4	12			+ 33	8	32	44	
	1·0100		0862	1725											*12	41					
34		0400			8	53		8	2			24·3	4	53				8	51	46	9
	4800		0100	0100											12	37					
29		0300			9	18				8	24		5	30			+ 19	9	6	49	
	0100		1212	0475											12	32					
20		2600			9	15		8	45			25·3	6	2				9	17	53	10
	0700		0125	2750											12	27					
14		0400			9	31				9	7		6	29			+ 2	9	22	57	
	3500		2312	1825											12	25					
10		3200			* 9	34		9	28			26·3	6	54				9	26	61	11
	5200		2125	0050											12	22					
12		1000			9	28				9	48		7	16			— 8	* 9	28	65	
	5300		0988	0125											12	20					
21		1100			9	33		10	9			27·3	7	36				9	27	69	12
	9100		1725	1050											12	18					
18		1300			9	17				10	30		7	54			— 14	9	24	72	
	3900		2997	1895											12	18					
22		2800			9	19		10	51			28·3	8	12				9	21	75	13
	1·4480		4948	3095											12	16					
35		4000			8	58				11	13		8	28			— 17	9	15	78	
	0920		* 5174	2848			3					●			12	17					
47		3500			9	13	3	11	34			29·3	8	45				9	11	80	14
	1·0070		2435	0728			2								12	15					
52		2100			8	40	2			11	56		9	0			— 19	9	4	81	
	1·2770		0648	1505			3								12	16					
51		0700			8	59	5	0	18			0·6	9	16				8	58	82	15
	1·5050		2195	0310			3								12	15					
411	9·5990	2·3800	2·7846	1·8481	129	0		71	7	68	38		100	27	173	19	+ 54	128	42	912	
																	— 58				
29	·6856	·1700	·1989	·1320	9	13		10	9	9	48		7	11	12	23	+ 18	9	12	65·14	
																	— 15				

APPENDIX 13.

TABLE XIII.—Tidal Fluctuations at Grondines during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series VI. Gaining tides.	High and low waters observed each civil day.			Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevation of summits and troughs of fluvial tide waves	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.
				H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min.
	May	12	L.W.	5	27	A.M.							— 20		14·9874					
¼	do	12	H.W	9	7	A.M.	3	40					—*25	20	21·4424	6·4550		18·0122	5·6195	
¾	do	12	L.W.	6	12	P.M.			9	5	12	35		33	15·3874		6·0550			10
16	do	12	H.W	† 9	42	P.M.	3	30						29	20·5254	5·1380		18·4117	5·3484	
¼	do	13	L.W.	5	58	A.M.			8	16	11	55		30	15·8874		4·6380			9
¾	do	13	H.W	9	37	A.M.	3	39					— 15	27	22·2500	6·3626		18·7513	5·2478	
¾	do	13	L.W.	6	49	P.M.			9	12	12	40		44	16·3674		5·8826			11
17	do	13	H.W	10	17	P.M.	3	28						32	20·4754	4·1080		18·9739	5·0328	
¼	do	14	L.W.	6	19	A.M.			8	2	11	55		48	16·5474		3·9280			25
¾	do	14	H.W	10	12	A.M.	3	53					— 9	30	22·7600	6·2126		19·1566	4·9483	
¾	do	14	L.W.	7	24	P.M.			9	12	12	46		35	16·8174		5·9426			19
18	do	14	H.W	‡ 10	58	P.M.	3	34						33	20·5274	3·7100		19·1728	4·5907	
¼	do	15	L.W.	7	5	A.M.			8	7	11	48		40	16·9374		3·5900			7
¾	do	15	H.W	10	46	A.M.	3	41					— 14	29	22·0574	5·1200		19·1672	4·1893	
¾	do	15	L.W.	8	5	P.M.			9	19	12	48		50	17·2074		4·8500			12
19	do	15	H.W	11	34	P.M.	3	29						39	20·4054	3·1980		19·1476	3·9378	
¼	do	16	L.W.	7	50	A.M.			8	16	11	54		51	17·1474		3·2580			9
¾	do	16	H.W	11	28	A.M.	3	38					— 3	31	21·6024	4·4550		19·0147	3·6945	
¾	do	16	L.W.	8	57	P.M.			9	29	12	53		54	17·1874		4·4150			14
20	do	17	H.W	12	21	A.M.	3	24						36	19·8374	2·6500		18·8144	3·4738	
¼	do	17	L.W.	8	32	A.M.			8	11	12	1		55	16·9674		2·8700			*26
¾	do	17	H.W	12	22	P.M.	3	50					+ 17	35	20·9274	3·9600		18·5862	3·2475	
¾	do	17	L.W.	9	47	P.M.			9	25	13	6		60	16·9574		3·9700			9
21	do	18	H.W	1	28	A.M.	3	41					*	60	19·1474	°2·1900		18·4112	3·0775	
¼	do	18	L.W.	9	32	A.M.			8	4	11	54		64	16·7874		°2·3600			9
¾	do	18	H.W	1	22	P.M.	3	50					+ 7	36	20·5774	3·7900		18·3300	°3·0750	
¾	do	18	L.W.	§ 10	42	P.M.			9	20	13	3		* 65	16·7974		3·7800			7
22	do	19	H.W	2	25	A.M.	3	43						55	19·1674	2·3700		18·3225	3·1400	
¼	do	19	L.W.	10	25	A.M.			° 8	0	12	2		50	16·7074		2·4600			19
¾	do	19	H.W	2	27	P.M.	*4	2					+ 10	39	20·7574	3·9500		18·4237	3·2525	
		H.W.		126	6	+24														
Totals	15 tides			=150	6								+ 34	531	312·3612					
		15	L.W.	113	37		55	2	121	58	173	20				63·6692	57·9992	280·6960	61·9054	186
													— 66	679	248·6910					
		H.W.											+ 12	35	20·8241					
Means		do					3	40	8	43	12	23				4·2446	4·1428	18·7131	4·1271	13
		14	L.W.										— 13	49	16·5794					

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus °

APPENDIX 13.

TABLE XIII.—Tidal Fluctuations at Grondines during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).									RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."														
Diurnal Inequalities.									Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times (No. 2).		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series VI. Gaining tides. Gauge book reference numbers.
In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillation of float in hundredths of a foot	Upper passage.		Lower passage.		Ages, etc.										
Min	Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.			H.	M.	H.	M.	Min.	H.	M.		
																				— 19				
55	45		4000			8	26	5				41				9	31			—*19	8	50		82	
		9170		3995	3011			3					1·6					12	16						
49	40		*5000			8	38	3	1	4						9	47				8	43	†	82	16
		1·7246		3396	1006			1										°12	15						
56	45		4800			8	9				1	28				1	02			— 19	8	34		81	
		1·7746		2226	2150								2·6					12	16						
70	45		1800			8	25		1	52						10	18				8	26		80	17
		2·2846		1827	0845													12	16						
70	51		2700			7	55				2	17				10	34			— 18	8	17		78	
		2·2326		0162	3576			2					3·6					12	16						
55	58		1200			8	17	3	2	41						10	50				8	9	‡	76	18
		1·5300		0056	4014													12	16						
72	60		2700			7	39				3	7				11	6			— 16	7	59		73	
		1·6520		0196	2515								4·6					12	18						
63	54		0600			8	2		3	32						11	24				7	52		70	19
		1·1970		1329	2433													12	18						
73	59		0400			°7	30				3	58				11	42			— 13	7	44		66	
		1·7650		2003	2207								5·6					12	19						
78	52		2200			7	58		4	23						12	1				7	38		62	20
		1·0900		2282	2263													12	22						
74	65		0100			7	33				4	49				12	23			— 4	7	34		58	
		1·7800		1750	1700								6·6					12	24						
81	*72		1700			8	14		5	14						12	47				7	33		54	21
		1·4300		0812	° 0025													12	26						
76	69		0100			7	42				5	40	◐			1	13			+ 6	7	33		51	
		1·4100		0075	0650								7·6					12	30				§		
80	61		0900			8	20		6	5						1	43				7	38		48	22
		1·4900		1012	1125			5										12	34						
80	56					7	56	3			6	31	8·6			2	17			+ 22	7	46		46	
																				+ 28					
1032	832	22·2774	2·8200	2·1121	2·7520	120	44		24	51	40	31				137	38	172	46		120	16		1007	
											+ 84	0				+36	0			— 89					
											=124	31				173	38								
																				+ 14					
69	55	1·5912	2014	1509	1966	8	3		3	33	15	34				11	35	12	20		8	1		67·13	
																				— 15					

†Maximum diurnal inequality in high water levels observed = 0·500.
‡ Moon's N. declination a maximum 21·°8'. § Moon's first quarter (Quebec) May 18th, from 6-5 p.m.

APPENDIX 13.

TABLE XIII.—Tidal Fluctuations at Grondines during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series VII. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.
		H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min
	May 19 H.W.	2	27	P.M.	...	...	...	...	...	...	+10	...	20·6574	...	...	...	...	...
¾	May 19 L.W.	11	47	P.M.	...	...	9	20	12	58	...	59	16·8874	...	3·7700	...	3·2050	24
23	do 20 H.W.	3	25	A.M.	3	38	...	...	...	...	..	40	19·7174	2·8300	...	18·3600	...	...
¼	do 20 L.W.	12	12	P.M.	...	...	8	47	12	30	...	57	16·6274	...	3·0900	...	3·2073	5
½	do 20 H.W.	3	55	P.M.	3	43	...	...	...	...	+21	38	19·7574	3·1300	...	18·1412	...	...
¾	do 21 L.W.	12	57	A.M.	...	...	9	2	12	41	...	60	16·4474	...	3·3100	...	3·4345	4
24	do 21 H.W.	4	36	A.M.	3	39	...	...	...	...	...	38	19·7474	3·3000	...	18·1597	...	...
¼	do 21 L.W.	1	12	P.M.	...	...	8	36	12	19	...	56	16·4374	...	3·3100	...	3·7485	4
½	do 21 H.W.	4	55	P.M.	3	43	...	...	...	...	+ 7	40	20·2554	3·8180	...	18·2867	...	...
¾	do 22 L.W.	1	57	A.M.	...	...	9	2	12	38	...	54	16·3874	...	3·8680	...	3·9780	7
25	do 22 H.W.	5	33	A.M.	3	36	...	...	...	...	...	31	20·3854	3·9980	...	18·3565	...	...
¼	do 22 L.W.	2	30	P.M.	...	...	8	57	12	29	...	52	16·3474	...	4·0380	...	4·3098	4
½	do 22 H.W.	6	2	P.M.	3	32	...	...	...	...	— 5	33	20·3554	4·0080	...	18·4773	...	...
¾	do 23 L.W.	2	45	A.M.	...	...	8	43	12	16	...	41	16·2974	...	4·0580	...	4·7313	1
26	do 23 H.W.	6	18	A.M.	3	33	...	...	...	...	...	28	21·4324	5·1350	...	18·6930	...	...
¼	do 23 L.W.	3	27	P.M.	...	...	9	9	12	34	...	41	16·3574	...	5·0750	...	5·0823	8
½	do 23 H.W.	6	52	P.M.	3	25	...	...	...	...	+ °0	28	21·0144	4·6570	...	18·8935	...	...
¾	do 24 L.W.	3	33	A.M.	...	...	8	41	12	16	...	39	16·3474	...	4·6670	...	5·4080	10
27	do 24 H.W.	7	8	A.M.	3	35	...	...	...	...	...	32	22·2774	5·9300	...	19·1515	...	...
¼	do 24 L.W.	4	15	P.M.	...	...	9	7	12	30	...	39	16·5474	...	5·7300	...	5·7600	12
½	do 24 H.W.	7	38	P.M.	3	23	...	...	...	...	—16	27	21·8524	5·3050	...	19·4124	...	...
¾	do 25 L.W.	4	17	A.M.	...	...	8	39	12	4	...	36	16·5174	...	5·3350	...	6·0388	2
28	do 25 H.W.	7	42	A.M.	3	25	...	...	...	...	...	23	23·1874	6·6700	...	19 6119	...	...
¼	do 25 L.W.	5	7	P.M.	...	...	9	25	12	40	...	35	16·6674	...	6·5200	...	6·2300	10
½	do 25 H.W.	8	22	P.M.	3	15	...	...	...	...	— 5	°18	22·2974	5·6300	...	19·7075	...	...
¾	do 26 L.W.	5	8	A.M.	...	...	8	46	12	5	...	°32	16·5174	...	5·7800	...	6·2800	4
29	do 26 H.W.	8	27	A.M.	3	19	...	...	...	...	...	20	23·5074	6·9900	...	19·7275	...	...
¼	do 26 L.W.	6	0	P.M.	...	...	9	33	12	46	..	35	16·6574	...	6·8500	...	*6·3250	6
½	do 26 H.W.	9	13	P.M.	3	13	...	...	...	...	— 5	21	22·1574	5·5000	...	*20·0256	...	...
	H.W.	90	6								+28	417	297·9446					
Totals	14 tides	...	...	...	48	59	125	47	174	46	...	...	...	66·9010	65·4010	265·0043	67·7385	101
	L.W.	77	7	+24							—31	636	231·0436					
		101	7															
	14 H.W.										+ 9	30	21·2818					
Means	do ...	...	...	...	3	30	8	59	12	29	...	...	...	4·7787	4·6715	18·9289	4·8385	7
	14 L.W.										— 8	45	16·5031					

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °

† Moon after crossing the equator.

‡ Moon in perigee, May 24th, at 2.0 p.m.

§ Full moon (Quebec), May 25th, at 8.40 a.m.

APPENDIX 13.

TABLE XIII.—Tidal Fluctuations at Grondines during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).										RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."											
Diurnal Inequalities.										Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H. W. to H. W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series VII. Gaining tides. Gauge book reference numbers.
In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.		Upper passage.		Lower passage.		Ages, etc.										
Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.		Days.	H.	M.	H.	M.	Min	H.	M.		
																			+22				
			1800																				
		9400		0637	0475												12	38					½
33	28		2600			8	29		6	56					2	55				7	59	46	23
		0400		2188	0023						7	21		9·6			12	40					¼
15	11		1800			8	34								3	35			+29	8	14	48	½
		° 0100		0185	2272												12	39					¾
26	22		0100			8	49		7	47					4	14				8	27	51	24
		5080		1270	3140									10·6			12	37					¼
26	19		0500			8	42				8	13			4	51			+21	8	38	56	½
		1300		0698	2295												12	34					¾
°5	°9		0400			8	54		8	39					5	25				8	46	62	25
		0300		1208	3318									11·6			12	31					¼
14	13		0500			8	57				9	5			5	56			+ 9	8	51	69	½
		1·0770		2157	4215												12	28					¾
26	18		0600			8	46		9	32					6	24				8	52	76	26
		4180		2005	3510									12·6			12	26					¼
28	18		0100			8	52				10	0			6	50			+°1	8	50	83	½
		1·2630		2580	3257			2									12	25					¾
26	14		2000			8	40	6	10	28					7	15				8	47	89	27
		4250		2609	3520									13·6			12	24					¼
28	26		0300			8	41	5			10	57			7	39			—°2	8	42	95	½
		1·3350		1995	2788												12	24					¾
46	36		1500			8	16		11	26				⊙	8	3				8	37	100	28
		8900		0956	1912			3						14·6			12	24					¼
39	35		1500			8	26	*10			11	56			8	27			— 3	8	31	104	½
		1·2100		0200	0500												12	23					¾
47	41		1400			8	1	10		26				15·6	8	50				8	24	106	29
		1·3500		2981	0450												12	23					¾
52	47					8	16							57	9	13			— 3	8	16	*107	½
																			+60				
411	337	9·6260	1·5100	2·1669	3·1675	120	23		67	14	70	·29			89	37	174	56		119	54	1092	
															+168	0			— 8				
															—257	37							
																			+15				
29	24	·6876	·1079	·1548	·2263	8	36		9	36	10	4			18	24	12	30		8	34	78·00	
																			— 3				

APPENDIX 13.

TABLE XIII.—Tidal Fluctuations at Grondines during the High water season of 1888, viz., from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series VIII. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides Min.	Duration of apparent stand within 0·05 ft. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min.
	May 26 H.W.	9	13	P.M.							− 5		22·1574					
¾	do 27 L.W.	5	54	A.M.			8	41	11	59		37	16·5174		5·6400			5
30	do 27 H.W.	9	12	A.M.	3	18						27	*23·8274	*7·3100		19·7206	6·2663	
¼	do 27 L.W.	6	48	P.M.			9	36	12	50		36	16·6574		*7·1700			4
½	do 27 H.W.	†10	2	P.M.	3	14					− 4	27	21·6024	4·9450		19·5412	6·0875	
¾	do 28 L.W.	6	33	A.M.			8	31	11	56		37	16·3374		5·2650			11
31	do 28 H.W.	9	58	A.M.	3	25						26	23·3074	6·9700		19·3275	5·9100	
¼	do 28 L.W.	7	43	P.M.			9	45	13	0		40	16·4074		6·9000			10
½	do 28 H.W.	10	58	P.M.	3	15					+ 5	27	20·9124	4·5050		19·1287	5·6825	
¾	do 29 L.W.	7	23	A.M.			8	25	11	55		39	16·1674		4·7450			15
32	do 29 H.W.	10	53	A.M.	3	30						27	22·7474	6·5800		18·9256	5·5163	
¼	do 29 L.W.	‡ 8	40	P.M.			*9	47	12	59		42	16·1674		6·5800			18
½	do 29 H.W.	11	52	P.M.	° 3	12					+ 9	30	20·3274	4·1600		18·6318	5·2188	
¾	do 30 L.W.	8	22	A.M.			8	30	12	0		45	15·8774		4·4500			18
33	do 30 H.W.	11	52	A.M.	3	30						26	21·5624	5·6850		18·2424	4·9700	
¼	do 30 L.W.	9	30	P.M.			9	38	13	1		44	15·6374		5·9250			7
½	do 31 H.W.	12	53	A.M.	3	23					+ 10	29	19·4574	3·8200		17·8802	4·7653	
¾	do 31 L.W.	9	15	A.M.			8	22	11	59		44	15·3574		4·1000			14
34	do 31 H.W.	12	52	P.M.	3	37						28	20·5744	5·2170		17·5892	4·6035	
¼	do 31 L.W.	10	22	P.M.			9	30	13	1		42	15·2174		5·3570			6
½	June 1 H.W.	1	53	A.M.	3	31					+ 8	44	18·9574	3·7400		17·4755	4·5460	
¾	do 1 L.W.	§10	7	A.M.			8	14	11	57		44	15·1874		3·7700			12
35	do 1 H.W.	1	50	P.M.	3	43						30	20·5044	5·3170		17·4717	4·4985	
¼	do 1 L.W.	11	20	P.M.			9	30	*13	8		43	15·2574		5·2470			5
½	do 2 H.W.	2	58	A.M.	3	38					+ 22	34	18·9174	3·6600		17·1946	4·1843	
¾	do 2 L.W.	11	30	A.M.			8	32	12	4		51	14·9474		3·9700			6
36	do 2 H.W.	3	2	P.M.	3	32						37	18·8074	3·8600		16·6825	3·7600	
¼	do 3 L.W.	12	17	A.M.			9	15	13	6		55	14·4574		4·3500			19
½	do 3 H.W.	4	8	A.M.	3	51					* + 29	37	18·1174	3·6600		16·4212	3·9675	
							8	26	12	13		53			3·7000			4
¾	June 3 L.W.	12	34	P.M.									14·4174					
	H.W.	114	23								+ 83	429	289·6226					
Totals 14 tides..	L.W.	138	18		48	39	134	42	187	8				69·4290	77·1690	254·2327	69·9765	154
											− 4	652	220·1936					
	14 H.W.										+ 14	31	20·6873					
Means	do				3	29	8	59	12	29				4·9592	5·1446	18·1595	4·9983	10
	15 L.W.										− 4	43	15·7281					
Grd. totals	H.W.										+ 194	1807	1162·7870					
57 tides					204	33	503	8	707	39				271·5242	270·4542	1027·7345	270·9142	524
	57 L.W.										− 156	2587	891·2618					
Grd. means	do										+ 14	32	20·3998					
57	L.W.				3	35	8	50	12	25				4·7636	4·7449	18·0304	4·7528	9
											− 10	45	15·6362					

N.B.—Maxima in whole lunar month indicated by a star, thus : * and minima by a circle, thus : °

APPENDIX 13.

TABLE XIII.—Tidal Fluctations at Grondines during the High water season of 1888, viz., from quadrature, May 2nd, to quadrature. June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS.—*Continued.*

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Diurnal Inequalities. In duration of ebbs.	Diurnal Inequalities. In semi-tide days.	Diurnal Inequalities. In high water levels.	Diurnal Inequalities. In low water levels.	Diurnal Inequalities. In mean tide levels.	Diurnal Inequalities. In amplitudes.	Lunitidal intervals.	Oscillations of float in hundreths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phrases of the moon. Upper passage.	Lower passage.	Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times. (No. 2.)	Length of half tide day H.W. to H.W.	Priming—or lagging + of tides	Lunitidal intervals.	General coefficients of semi-amplitudes from "Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series VIII. Losing tides, Gauge book reference numbers.
Min	Min	Feet.	Feet.	Feet.	Feet.	H. M.		H. M.	H. M.	Days.	H. M.	H. M.	Min.	H. M.		
			1400										− 3			
		1·6700		3050	0587							12 24				
55	51		1400			7 44	6	1 28			9 37			8 9	106	30
		2·2250		1794	1788		3			16·6		12 23				
65	54		3200			8 4	5		1 58		10 0		− 3	8 2	104	
		1·7050		2137	1775		3					12 24				
74	64		0700			7 30	* 10	2 28			10 24			7 56	101	31
		2·3950		1988	2275		3			17·6		12 24				
80	65		2400			8 0	6		2 58		10 48		− 3	7 50	96	
		1·8350		2031	1662							12 23				
* 82	64		·0000			7 27		3 26			11 11			7 45	91	32
		*2·4200		2938	2975					18·6		12 23				
77	59		2900			7 58			3 54		11 34		− 3	7 40	85	
		1·2350		3894	2488							12 24				
68	61		2400			7 31		4 21			11 58			7 37	79	33
		2·1050		3622	2047					19·6		12 26				
76	62		2·800			8 6			4 47		12 24		+ 2	7 37	72	
		1·1170		2910	1618							12 26				
68	62		1400			7 40		5 12			12 50			7 38	66	34
		1·6170		1137	0575					20·6		12 27				
76	64		0300			8 17			5 36		1 17		+ 7	7 41	60	
		1·5470		0038	0475							12 30				
76	71		0700			7 51		5 59		◑	1 47			7 48	55	35
		1·5870		2771	3142					21·6		12 32				
58	64		3100			8 36			6 22		2 19		+ 17	7 57	51	
		1100		5121	* 4243							12 35				
43	62		4900			8 18		6 44		22·6	2 54			8 10	48	36
		6900		2613	2075							12 31				
49	53		0400			9 3			7 5		3 25		+ 10	8 20	46	
		4600								23·6		12 29				
											112 28		+ 36			
											+ 60 0					
947	856	22·7180	2·8000	3·6044	2·7725	112 5		29 38	32 40			186 41		110 10	1060	
											=172 28		− 9			
													+ 9			
67	61	1·5145	·1867	·2575	·1980	8 0		4 14	4 40		12 19	12 27		7 52	75·71	
													− 3			
													+178			
2816	2436	64·2204	9·5100	10·6680	10·5401	482 12		192 50	296 18		704 10	707 42		479 2	4071	
													−164			
													+ 14			
49	42	1·1267	·1698	·1905	·1882	8 28		6 53	10 13		12 21	12 25		8 24	71·42	
													− 10			

†Moon's S. declination a maximum = 21° 41'. ‡Maximum diurnal inequality observed in high water levels = 1·318. §Moon's last quarter (Quebec), June 1st, from 7h. 35m. a.m.

APPENDIX 13.

TABLE XIV.—Tidal Fluctuations at St. Jean des Chaillons during High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers.	Series V.	Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides Min.	Duration of apparent stand within 0·05 feet. Min	Elevation of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min	In duration of ebbs. Min
			May 5 L.W.	† 1	15	A.M.			9	3	12	55		70	16·45						
	¼	do 5	H.W.	5	7	A.M.	3	52					+10	50	18.54	2·09*		17·61	2·53		43
	½	do 5	L.W.	1	27	P.M.			8	20	12	5		64	16 24		2·30			7	
9		do 5	H.W.	5	12	P.M.	3	45						40	19 20	2·96		17·60	2·68		50
	¼	do 6	L.W.	2	22	A.M.			9	12	12	53		52	16·27		2·93			2	
	½	do 6	H.W.	6	5	A.M.	3	43					*+25	50	18·78	2·51		17·54	2·66		31
	¾	do 6	L.W.	2	44	P.M.			8	39	12	22		54	16·15		2·63			° 0	
10		do 6	H.W.	6	27	P.M.	3	43						43	18·73	2·58		17·40	2·70		11
	¼	do 7	L.W.	3	17	A.M.			8	50	12	27		54	15·95		2·78			6	
	½	do 7	H.W.	6	54	A.M.	3	37					+ 4	38	18·76	2·81		°17·38	2·88		2
	¾	do 7	L.W.	‡ 3	42	P.M.			8	48	12	27		47	°15·94		2·82			2	
11		do 7	H.W.	7	21	P.M.	3	39						36	19·03	3·09		17·54	2·03		° 1
	¼	do 8	L.W.	4	8	A.M.			8	47	12	16		49	16·10		2·93			10	
	½	do 8	H.W.	7	37	A.M.	3	29					−14	33	19·41	3·31		17·68	3·10		10
	¾	do 8	L.W.	4	34	P.M.			8	57	12	20		36	16·15		3·26			6	
12		do 8	H.W.	7	57	P.M.	3	23						37	19·06	2·91		17·50	2·62		22
	¼	do 9	L.W.	4	32	A.M.			8	35	12	10		33	16·23		2·83			12	
	½	do 9	H.W.	8	7	A.M.	3	35					−11	26	17·73	1·50		17·41	2·21		30
	¾	do 9	L.W.	5	12	P.M.			9	5	12	29		36	16·38		1·35	.....		11	
13		do 9	H.W.	§ 8	36	P.M.	3	24						32	19·51	3·13		17·95	2·91		35
	¼	do 10	L.W.	5	6	A.M.			8	30	12	9		42	16·61		2·90			15	
	½	do 10	H.W.	8	45	A.M.	3	39					*−26	31	20·85	4·24		18·63	3·72		25
	¾	do 10	L.W.	5	40	P.M.			8	55	12	15		39	16·93		3·92			19	
14		do 10	H.W.	9	0	P.M.	3	20						23	20·73	3·80		19·06	3·92		18
	¼	do 11	L.W.	5	37	A.M.			8	37	12	5		52	17·27		3·46			8	
	½	do 11	H.W.	9	5	A.M.	3	28					−13	29	21·75	4·48		19·32	3·83		40
	¾	do 11	L.W.	6	22	P.M.			9	17	12	32		46	17·55		4·20			13	
15		do 11	H.W.	9	37	P.M.	3	15						23	20·72	3·17		19·44	3·73		42
	¼	do 12	L.W.	6	12	A.M.			8	35	11	58		48			3·12			8	
															17·60						
Totals	14	H.W. tides.		105	50		49	52	123	5	172	28	+39	491	272·80	42 58	41·43	252·06	42·52	119	360
		L.W.		60	55								−64	722	231·37						
Means	14	H.W. do					3	34	8	48	12	19	+13	35	19·49	3·04	2·96	18·00	3·04	9	26
	14	L.W.											−16	48	16·53						

N.B.—Maxima in whole lunar month indicated by a star, thus: *, and minima by a circle, thus: °.
†Longitude St. Jean Wharf, 72·7′ 4h., 48m., 28sec.=0·2004 of a day west of Greenwich.
‡Moon crosses the equator.

APPENDIX 13.

TABLE XIV.—Tidal Fluctuations at St. Jean des Chaillons during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued.*)								RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."																
Diurnal Inequalities.								Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times. No.2.		Length of half tide day H.W. to H.W.		Priming—or lagging—of tides	Lunitidal intervals.		General coefficient of semi-amplitude from "L'Annuaire des Marés," corresponding to observed tides assumed to be 48 hours old.	Series III. Gaining tides. Gauge book reference numbers.
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.												
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		
															12	42					
50		21			9	27	10			7	40	23·3	4	37			*+33	8	57	°44	
	66		8·01	15											*12	41					
48		03			9	9	9	8	3				5	18				9	15	46	0
	42		06	02								24·3			12	37					
31		12			9	41				8	24		5	55			+19	9	31	49	
	05		14	04											12	32					
05		20			9	41		8	46				6	27				9	41	53	10
	°03		02	18								25·3			12	27					
0		01			9	47	4			9	7		6	54			+ 2	9	47	57	
	27		16	15			1								12	25					
11		16			*9	53	1	9	28				7	19				9	51	61	11
	38		14	07								26·3			12	22					
4		05			9	48				9	49		7	41			— 8	*9	52	65	
	35		18	48											12	20					
10		08			9	47		10	10				8	1				9	51	69	12
	1·33		09	41								27·3			12	18					
19		15			9	38				10	29		8	19			—14	9	50	72	
	1·78		54	70											12	18					
20		23			9	45		10	51				8	37				9	46	75	13
	1·34		*68	81			5					28·3			12	16					
6		32			9	32	15			11	13		8	53			—17	9	40	78	
	12		43	20			20								12	17					
10		34			9	26	15	11	34			●	9	10				9	36	80	14
	1·02		26	09			20					29·3			12	15					
27		28			9	9	9			11	56		9	25			—19	9	29	81	
	1·03		12	10			20								12	16					
34		05			9	18	20		19			0·6	9	41				9	22	82	15
	1·29		24	02			15								12	15					
275	10·07	2·23	3·07	3·42	134	1		71	11	68	38		106	17	173	19	+54	134	28	912	
																	—58				
20	·72	·16	·22	·25	9	34		10	10	9	48		7	36	12	23	+18	9	36	65·14	
																	—15				

§Moon in apogee May 9th, at 8h. 0m., p.m.
New moon (Quebec) May 10th, at 8h. 24m., p.m.

APPENDIX 13.

TABLE XIV.—Tidal Fluctuations at St. Jean des Chaillons during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

Gauge book reference numbers. Series VI. Losing tides.	High and low water observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevation of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.	In duration of ebbs.
		H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min	Min
	May12 L.W.	6	12	A.M.	...	...	...	...	...	...	—13	....	17·60	...	.....	...	.....	...	....
½	May12 H.W	9	35	A.M.	3	23	...	...	...	...	—18	25	22·01	4·41	..	19·68	3·71	....	34
	do 12 L.W.	6	44	P.M.	...	...	9	9	12	34	...	48	18·05	...	3·96	...	...	2	....
16	do 12 H.W	10	9	P.M.	3	25	...	...	...	...	....	28	21·36	3·31	.	20·09	3·62	...	41
½	do 13 L.W.	6	37	A.M.	...	...	8	28	11	51	....	49	18·50	.....	2·86	...	.....	2	....
	do 13 H.W	10	0	A.M.	3	23	...	...	...	...	—12	23	22·84	4·34	..	20·45	3·39	...	64
	do 13 L.W. †	7	32	P.M.	...	...	9	32	12	47	....	44	19·01	....	3·83	...	.....	8	....
17	do 13 H.W	10	47	P.M.	3	15	...	...	...	...	....	33	21·55	2·54	.....	20·72	3·23	....	77
½	do 14 L.W.	7	2	A.M.	...	...	8	15	°11	48	....	45	19·20	...	2·35	...	.....	18	....
	do 14 H.W	10	35	A.M.	3	33	...	...	...	...	—18	26	23·36	4·16	.....	20·87	3·22	...	79
	do 14 L.W.	8	9	P.M.	.....	...	9	34	12	44	....	45	19·33	...	4·03	...	.....	*23	....
18	do 14 H.W ‡	11	19	P.M.	3	10	...	...	...	...	....	44	21·63	2·30	..	20·97	2·89	....	63
½	do 15 L.W.	7	50	A.M.	.....	...	8	31	11	58	...	26	19·72	...	1·91	...	.....	17	....
	do 15 H.W	11	17	A.M.	3	27	...	...	...	...	+ °1	37	23·01	3·29	.....	21·12	2·52	....	52
	do 15 L.W.	8	40	P.M.	.....	...	9	23	12	53	....	41	19·98	.....	3·03	...	.....	3	....
19	do 16 H.W	12	10	A.M.	3	30	...	...	...	...	....	45	21·84	1·86	.....	21·17	2·38	....	69
½	do 16 L.W.	8	24	A.M.	.....	...	8	14	11	50	..	48	19·98	...	1·86	...	.....	6	....
	do 16 H.W	12	0	A.M.	3	36	...	...	...	...	—11	36	22·74	2·76	..	21·11	2·20	...	76
	do 16 L.W.	9	30	P.M.	.....	...	9	30	12	49	....	60	20·03	...	2·71	...	.....	17	....
20	do 17 H.W	12	49	A.M.	3	19	...	...	...	...	....	50	21·48	1·45	.....	20·96	2·05	....	65
½	do 17 L.W.	9	14	A.M.	.....	...	8	25	11	59	....	56	19·84	.....	1·64	...	.....	15	....
	do 17 H.W	12	48	P.M.	3	34	...	...	...	...	+18	36	22·23	2·39	.....	20·80	1·91	....	69
	do 17 L.W.	10	22	P.M.	.....	...	9	34	*13	9	....	55	19·83	.....	2·40	...	.....	1	....
21	do 18 H.W	1	57	A.M.	3	35	...	...	...	...	....	*85	21·03	°1·20	.....	20·67	1·80	..	79
½	do 18 L.W.	10	12	A.M.	.....	...	8	15	11	58	....	72	19·70	...	°1·33	...	.....	8	....
	do 18 H.W	1	55	P.M.	3	43	...	...	...	...	+ 9	54	21·95	2·25	..	20·59	°1·78	....	66
	do 18 L.W. §	11	16	P.M.	...	...	9	21	13	1	..	*74	19·71	.....	2·24	...	.....	3	....
22	do 19 H.W	2	56	A.M.	3	40	...	...	...	...	....	73	21·00	1·29	.....	20·58	1·84	....	69
½	do 19 L.W.	11	8	A.M.	.....	...	°8	12	12	10	....	40	19·59	...	1·41	...	.....	18	....
	do 19 H.W	3	6	P.M.	*3	58	....	...	...	...	+12	50	21·99	2·40	.....	20·63	1·93	....	58
	H.W.	133	23								+40	645	330·02						
Totals 15 tides..		...	...	..	52	31	124	23	173	31	...	...		39·95	35·56	310·41	38·47	141	961
	L.W.	122	40								—59	703	290·07						
	15 H.W.										+10	43	22·00						
Means	do	...	.	....	3	30	8	53	12	24	..	....	.....	2·66	2·54	20·69	2·57	10	64
	14 L.W.										—15	50	19·34						

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °
† Maximum diurnal inequality observed in low water levels 0·51.

APPENDIX 13.

TABLE XIV.—Tidal Fluctuations at St. Jean des Chaillons during the High water season of 1888, viz. :—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).									RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."															
Diurnal Inequalities.					Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high water, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times : (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "L'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series VI. Losing tides. Gauge book reference numbers.
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.				Upper passage.		Lower passage.		Ages, etc.												
Min.	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.					
																	—19							
36		45			8	54	10					41		9	56		*-19	9	15	82				
	65		41	09			6					1 6				12	16							
43		45			9	5	10	1	4					10	12			9	8	82				16
	1 48		36	23			3									12	15							
56		*51			8	32				1	28			10	27		—19	8	59	81				
	1 29		27	16								2 6				12	16							
59		19			8	55		1	52					10	43			8	51	80				17
	1 81		15	01												12	16							
56		13			8	18	12			2	17			10	59		—18	8	42	78				
	1 73		10	33			*22					3 6				12	16							
46		39			8	37	18	2	42					11	15			8	33	76				18
	1 38		15	37			2									12	16							
55		26			8	10				3	7			11	31		—16	8	24	73				
	1 17		05	14								4 6				12	18							
63		‡00			8	38		3	32					11	49			8	17	70				19
	90		06	18												12	18							
59		05			8	2				3	58			12	7		—13	8	9	66				
	1 26		15	15								5 6				12	19							
50		19			8	26		4	23					12	26			8	3	62				20
	75		16	14												12	22							
70		01			7	59				4	49			12	48		— 4	7	59	58				
	1 20		13	11								6 6				12	24							
71		13			8	42		5	15					1	12			7	57	54				21
	92		08	02												12	26							
63		01			8	15				5	40			1	38		+ 6	7	58	51				
	95		01	06								7 6				12	30							
51		12			8	51	2	6	5					2	8			8	3	48				22
	99		05	09												12	34							
42					8	35				6	31	8 6		2	42		+22	8	11	46				
										40	31			131	53		+28							
820	16 48	2 89	2 13	2 08	127	59		24	53	+ 84	0		+	48	0	172	46	126	29	1007				
										124	31			179	53		—89							
																	+14							
55	1 18	·21	·15	·15	8	32		3	33	15	34			12	0	12	20	8	26	67 13				
																	—15							

‡ Moon's north declination a maximum =21° 8'.
§ Moon's first quarter (Quebec), May 18th, from 6h. 5m. p.m.

APPENDIX 13.

TABLE XIV.—Tidal Fluctuations at St. Jean des Chaillons during the High water season of 1888, viz.:—from quadrature of May 2nd to quadrature of June 1st.

Gauge book reference numbers. Series VII. Gaining tides.				DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.																
			High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
				H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.
	May	19..	H.W.	3	3	P.M.	....	..	....	..	....	..	+12	....	....	....	....	....	....
	do	20..	L.W.	12	16	A.M.	....	..	9	10	12	52	....	63	19·72	....	227	....	1·87
23	do	20..	H.W.	3	58	A.M.	3	42	....	..	....	..	....	51	21·35	1·63	....	20·96	....
	do	20..	L.W.	12	31	P.M.	....	..	8	33	12	23	....	71	19·53	....	1·82	....	1·88
	do	20..	H.W.	4	21	P.M.	3	50	....	..	....	..	+23	62	21·32	1·79	....	20·38	....
	do	21..	L.W.	1	33	A.M.	....	..	9	12	12	50	....	71	19·35	....	1·97	....	2·03
24	do	21..	H.W.	5	11	A.M.	3	38	....	..	....	..	....	44	21·28	1·93	....	20·36	....
	do	21..	L.W.	1	53	P.M.	....	..	8	42	12	11	....	52	19·33	....	1·95	....	2·24
	do	21..	H.W.	5	22	P.M.	3	29	....	..	....	..	°—2	41	21·60	2·27	....	20·42	....
	do	22..	L.W. †	2	31	A.M.	....	..	9	9	12	37	....	61	19·27	....	2·33	....	2·39
25	do	22..	H.W.	5	59	A.M.	3	28	....	..	....	..	....	34	21·67	2·40	....	20·45	....
	do	22..	L.W.	3	0	P.M.	....	..	9	1	12	25	....	54	19·24	....	2·43	....	2·62
	do	22..	H.W.	6	24	P.M.	3	24	....	..	....	..	— 3	37	21·62	2·38	....	20·51	....
	do	23..	L.W.	3	16	A.M.	....	..	8	52	12	22	....	52	19·16	....	2·46	....	2·92
26	do	23..	H.W.	6	46	A.M.	3	30	....	..	....	..	....	33	22·36	3·20	....	20·64	....
	do	23..	L.W.	3	59	P.M.	....	..	9	13	12	30	....	48	19·21	....	3·15	....	3·20
	do	23..	H.W.	7	16	P.M.	3	17	....	..	....	..	— 6	39	22·04	2·83	....	20·79	....
	do	24..	L.W.	4	7	A.M.	....	..	8	51	12	16	....	°20	19·17	....	2·87	....	3·49
27	do	24..	H.W.	7	32	A.M.	3	25	....	..	....	..	....	28	23·11	3·94	....	21·00	....
	do	24..	L.W. ‡	4	52	P.M.	....	..	9	20	12	30	....	52	19·33	....	3·78	....	3·76
	do	24..	H.W.	8	2	P.M.	3	10	....	..	....	..	—15	23	22·71	3·38	....	21·19	....
	do	25..	L.W.	4	44	A.M.	....	..	8	42	12	5	....	42	19·29	....	3·42	....	3·96
28	do	25..	H.W. §	8	7	A.M.	3	23	....	..	....	..	....	22	23·73	4·44	....	21·32	....
	do	25..	L.W.	5	38	P.M.	....	..	9	31	12	42	....	34	19·40	....	4·33	....	4·13
	do	25..	H.W.	8	49	P.M.	3	11	....	..	....	..	— 6	17	23·04	3·64	....	21·37	....
	do	26..	L.W.	5	45	A.M.	....	..	8	56	12	4	....	29	19·26	....	3·78	....	4·18
29	do	26..	H.W	8	53	A.M.	3	8	....	..	....	..	°15	24·04	4·78	....	....	21·41	....
	do	26..	L.W.	6	35	P.M.	....	..	9	42	12	45	....	38	19·39	....	4·65	....	*4·22
	do	26..	H.W.	9	38	P.M.	°3	3	....	..	....	..	— 5	27	22·86	3·47	....	*21·42	....
Totals, 14 tides'			H.W.	96	18	....	47	38	126	54	174	32	+23	473	312·73	42·08	41·21	292·22	42·89
			L.W.	72	40	+12							—37	687	270·65				
				=84	40														
Means	do	14	H.W.	....	..	....	3	24	9	4	12	28	+23	34	22·34	3·01	2·95	20·87	3·06
	do	14	L.W.	....	..	....							— 6	49	19·33				

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °
† Moon after crossing equator.
‡ Moon in perigee, May 24th, at 2 p.m.
§ Full moon, May 25th, at 8.40 a.m.

APPENDIX 13.

TABLE XIV.—Tidal Fluctuations at St. Jean des Chaillons during the High water season of 1888, viz.:—from quadrature of May 2nd to quadrature of June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS —(*Continued*)											RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."														
Diurnal Inequalities.											Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.													
In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.		Upper passage.		Lower passage.		Ages, etc.		Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2)		Length of half tide day H. W. to H. W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "L'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Gauge book reference numbers, Series VII. Gaining tides.
Min.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M.			H.	M.	H.	M.	Days.		H.	M.	H.	M.	Min	H.	M.		
...	...	...	...	13	...	...	...	...	...		...	...	...	...	...		...	...	...	...	+22	...	...	...	
16	...	...	64	...	33	06	...	...	...		...	...	...	...	...		...	...	12	38	...	...	...	...	
...	37	29	...	19	...	...	9	2	...		6	56	...	...	...		3	20	...	...	...	8	24	46	23
8	...	...	03	...	58	01	...	...	...		...	...	...	...	9	6	...	...	12	40	...	...	...	...	
...	39	27	...	18	...	...	8	59	3		...	...	7	22	...		4	0	...	...	+29	8	38	48	
12	...	...	04	...	02	15	...	...	...		...	...	...	...	...		...	...	12	39	...	...	...	...	
...	30	39	...	02	...	...	9	24	10		7	47	...	...	...		4	39	...	...	...	8	52	51	24
9	...	...	32	...	06	21	...	...	...		...	...	...	...	10	6	...	...	12	37	...	...	...	...	
...	27	26	...	06	...	...	9	9	...		...	...	8	13	...		5	16	...	...	+21	9	3	56	
1	...	...	07	...	03	15	...	...	...		...	...	...	...	...		...	...	12	34	...	...	...	...	
...	8	12	...	03	...	...	9	20	...		8	39	...	...	...		5	50	...	...	...	9	11	62	25
4	...	...	05	...	06	23	...	...	...		...	...	...	...	11	6	...	...	12	31	...	...	...	...	
...	9	3	...	08	...	...	9	18	...		...	...	9	6	...		6	21	...	...	+ 9	9	15	69	
6	...	...	26	...	13	30	...	...	...		...	...	...	...	...		...	...	12	28	...	...	...	...	
...	21	8	...	05	...	...	9	13	...		9	33	...	...	...		6	49	...	...	...	9	16	76	26
13	...	...	32	...	15	28	...	...	...		...	...	...	...	12	6	...	...	12	26	...	...	...	...	
...	22	14	...	01	...	...	9	16	...		...	...	10	0	...		7	15	...	...	°+1	9	15	83	
8	...	...	1·07	...	21	29	...	...	6		...	...	...	...	...		...	...	12	25	...	...	...	...	
...	29	14	...	16	...	...	9	4	6		10	28	...	...	...		7	40	...	...	...	9	12	89	27
15	...	...	40	...	19	27	...	...	...		...	...	...	...	13	6	...	...	12	24	...	...	...	...	
...	38	25	...	04	...	...	9	5	7		...	...	10	57	...		8	4	...	...	—°2	9	7	95	
13	...	...	1·02	...	13	20	...	...	...		...	...	...	...	...		...	...	12	24	...	...	...	...	
...	49	37	...	11	...	...	8	40	...		11	27	...	...	○		8	28	...	...	...	9	1	100	28
12	...	...	69	...	05	17	...	...	7		...	...	...	...	14	6	...	...	12	24	...	...	...	...	
...	35	38	...	14	...	...	8	53	12		...	...	11	56	...		8	52	...	...	— 3	8	56	104	
3	...	...	1·00	...	04	05	...	...	6		...	...	...	...	...		...	...	12	23	...	...	...	...	
...	46	41	...	13	...	...	8	26	2		...	27	...	...	...		9	15	...	...	...	8	48	106	29
5	...	...	1·18	...	01	04	...	...	...		...	...	...	...	15	6	...	...	12	23	...	...	...	...	
...	55	45	...	...	...	...	8	41	2		...	...	...	57	...		9	38	...	...	— 3	8	41	*107	
125	445	358	7·09	1·36	1·99	2·41	126	30	....		67	17	70	31	....		95 27 + 168 0 = 263 27		174	56	+60 .... — 8	125	39	1092	
9	32	26	·51	·10	·14	·17	9	2	....		9	37	10	4	....		18	49	12	30	+15 .... — 3	8	59	78·00	

APPENDIX 13.

TABLE XIV.—Tidal Fluctuations at St. Jean des Chaillons during the High water season of 1888, viz., from quadrature May 2nd, to quadrature June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series VIII. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides Min.	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min	In duration of ebbs. Min
	May 26 H.W	9	38	P.M.							− 5		22·86						
¾	May 27 L.W.	6	25	A.M.			8	47	12	0		44	19·23		3·63			10	
30	do 27 H.W	9	38	A.M.	3	13						19 *	24·36 *	5·13		21·40	4·22		56
¼	do 27 L.W.	7	21	P.M.			9	43	12	48		35	19·35		5·01			8	
½	do 27 H.W †	10	26	P.M.	3	5					− 4	32	22·44	3·09		21·24	4·08		58
¾	do 28 L.W.	7	11	A.M.			8	45	12	0		33	19·06		3·38			10	
31	do 28 H.W	10	26	A.M.	3	15						20	23·88	4·82		21·07	3·93		63
¼	do 28 L.W. ‡	8	14	P.M.			9	48	12	58		58	19·15		* 4·73			5	
½	do 28 H.W	11	24	P.M.	3	10					+ 6	30	21·93	2·78		20·90	3·72		73
¾	do 29 L.W.	7	59	A.M.			8	35	11	58		46	18·95		2·98			13	
32	do 29 H.W	11	22	A.M.	3	23						21	23·32	4·37		20·72	3·57		74
¼	do 29 L.W.	9	11	P.M.			9	49	13	0		45	18·91		4·41			12	
½	do 29 H.W	12	22	A.M.	3	11					+ 5	26	21·43	2·52		20·44	3·35		74
¾	do 30 L.W.	8	57	A.M.			8	35	11	55		45	18·63		2·80			9	
33	do 30 H.W	12	17	P.M.	3	20						30	22·28	3·65		20·09	3·14		75
¼	do 30 L.W.	10	7	P.M.			* 9	50	13	5		39	18·40		3·88			5	
½	do 31 H.W	1	22	A.M.	3	15					+ 8	42	20·60	2·20		19·73	2·98		* 82
¾	do 31 L.W.	9	50	A.M.			8	28	11	53		46	18·09		2·51			10	
34	do 31 H.W	1	15	P.M.	3	25						34	21·40	3·31		19·46	2·64		74
¼	do 31 L.W.	10	57	P.M.			9	42	12	57		46	17·98		3·42			10	
½	June 1 H.W	2	12	A.M.	3	15					+ 12	56	20·10	2·12		19·34	2·79		69
¾	do 1 L.W. §	10	45	A.M.			8	33	12	5		56	17·91		2·19			17	
35	do 1 H.W	2	17	P.M.	3	32						37	21·32	3·41		19·32	3·77		63
¼	do 1 L.W.	11	53	P.M.			9	36	13	0		42	17·93		3·39			8	
½	do 2 H.W	3	17	A.M.	3	24					+ 20	43	20·10	2·17		19·07	2·60		50
¾	do 2 L.W.	12	3	A.M.			8	46	12	10		58	17·62		2·48			0	
36	do 2 H.W	3	27	P.M.	3	24						42	19·95	2·33		18·52	2·43		39
¼	do 3 L.W.	12	52	A.M.			9	25	13	5		57	17·23		2·72			16	
½	do 3 H.W	4	32	A.M.	3	40					+ 25	42	19·41	2·18		18·40	2·42		57
							8	28	12	10		53			2·27			2	
¾	do 3 L.W.	1	0	P.M.									17·14						
	H.W.	96	17	+24							+ 76	474	302·52						
Totals 14 tides					46	32	136	50	187	4				44·08	49·80	279·70	45·64	135	907
		=120	17																
	L.W.	134	45	+12							− 4	703	258·44						
		=146	45																
	14 H.W.										+ 13	34	21·61						
Means	do				3	19	9	7	12	29				3·15	3·32	19·98	3·26	9	65
	15 L.W.										− 3	47	18·46						
	H.W.										+178	2083	1218·07						
Grand totals 57 tides.					196	33	511	12	707	35				168·69	168·00	1134·39	169·52	520	2673
	L.W.										−158	2815	1050·53						
	57 H.W.										+ 13	37	21·37						
Grand means do					3	27	8	58	12	25				2·96	2·94	19·90	2·98	9	47
	57 L.W.										− 11	49	18·43						

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °
† Monn's S. declination a maximum = 21° 41'.

APPENDIX 13.

TABLE XIV.—Tidal Fluctuations at St. Jean des Chaillons during the High water season of 1888, viz., from quadrature May 2nd, to quadrature June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued.*)								RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."												
Diurnal inequalities.								Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.												
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times. No. 2.		Length of half tide day H. W. to H. W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series VIII. Losing tides. Gauge book reference numbers.
Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.	
....	....	.16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	— 3	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	1·50	....	·02	·00	....	....	....	....	....	....	....	....	....	....	12	24	....	....	....	....
48	....	·12	....	....	8	10	3	1	28	....	....	....	10	2	....	....	....	8	34	106
....	1·92	....	·16	·14	....	....	5	....	....	....	....	16·6	....	....	12	23	....	....	....	....
48	....	·29	....	....	8	27	7	....	....	1	59	....	10	25	....	....	— 3	8	26	104
....	1·44	....	·17	·15	....	....	2	....	....	....	....	....	....	....	12	24	....	....	....	....
58	....	·09	....	....	7	57	8	2	29	....	....	....	10	49	....	....	....	8	20	101
....	* 1·95	....	·17	·21	....	....	5	....	....	....	....	17·6	....	....	12	24	....	....	....	....
60	....	·20	....	....	8	26	15	....	....	2	58	....	11	13	....	....	— 3	8	15	96
....	1·39	....	·18	·15	....	....	1	....	....	....	....	....	....	....	12	23	....	....	....	....
62	....	·04	....	....	° 7	55	1	3	27	....	....	....	11	36	....	....	....	8	9	91
....	1·89	....	·28	·22	....	....	....	....	....	....	....	18·6	....	....	12	23	....	....	....	....
65	....	·28	....	....	8	28	....	....	....	3	54	....	11	59	....	....	— 3	8	5	85
....	·85	....	·35	·21	....	....	....	....	....	....	....	....	....	....	12	24	....	....	....	....
70	....	·23	....	....	7	56	....	4	21	....	....	....	12	23	....	....	....	8	2	79
....	1·68	....	·36	·16	....	....	....	....	....	....	....	19·6	....	....	12	26	....	....	....	....
* 72	....	·31	....	....	8	35	....	....	....	4	47	....	12	49	....	....	+ 2	8	2	72
....	·80	....	·27	·34	....	....	....	....	....	....	....	....	....	....	12	26	....	....	....	....
64	....	·11	....	....	8	3	....	5	12	....	....	....	1	15	....	....	....	8	3	66
....	1·30	....	·12	·15	....	....	....	....	....	....	....	20·6	....	....	12	27	....	....	....	....
52	....	·07	....	....	8	36	10	....	....	5	36	....	1	42	....	....	+ 7	8	6	60
....	1·22	....	·02	·98	....	....	....	....	....	....	....	....	....	....	12	30	....	....	....	....
55	....	·02	....	....	8	18	....	5	59	....	....	....	2	12	....	....	....	8	13	55
....	1·22	....	·25	* 1·17	....	....	....	....	....	....	....	21·6	....	....	12	32	....	....	....	....
55	....	·31	....	....	8	55	....	....	....	6	22	....	2	44	....	....	+ 17	8	22	51
....	·15	....	·55	·17	....	....	....	....	....	....	....	22·6	....	....	12	35	....	....	....	....
55	....	·39	....	....	8	43	....	6	44	....	....	....	3	19	....	....	....	8	35	48
....	·54	....	·12	·01	....	....	....	....	....	....	....	....	....	....	12	31	....	....	....	....
55	....	·09	....	....	9	27	....	....	....	7	5	23·6	3	50	....	....	+ 10	8	45	46
....	·24	....	....	....	....	....	....	....	....	....	....	....	....	....	12	29	....	....	....	....
814	18·09	2·71	3·02	4·06	117	56	....	29	40	32	41	....	106	28	186	41	+ 36	115	57	1060
													+ 72	0			....			
													=178	18			— 9			
58	1·20	·18	·22	·29	8	25	....	4	14	4	40	....	12	44	12	27	+ 9	8	17	75·71
																	....			
																	— 3			
2267	51·73	9·19	10·21	11·97	506	26	....	193	1	296	21	....	727	55	707	42	+ 178	502	33	4071
																	....			
																	— 164			
40	·91	·16	·18	·21	8	53	....	6	51	7	19	....	12	46	12	25	+ 14	8	49	71·42
																	....			
																	— 10			

‡ Maximum diurnal inequality in high water levels observed = 1·93 ft.
§ Moon's last quarter (Quebec) June 1st, from 7h. 58m. a.m.

APPENDIX 13.

TABLE XV.—Tidal Fluctuations at Batiscan during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

Gauge book reference numbers. Series V. Gaining tides.		High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming − or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.
			H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min
	¼	May 5 L.W.	*a* 2	29	A.M.	..	..	8	52	12	54	....	81	19·8175	....	....	....	....	....
	½	May 5 H.W.	*b* 6	31	A.M.	4	2	..	..	..	..	+ 18	97	20·5585	7410	....	20·2393	1·0135	....
	¾	do 5 L.W.	*c* 2	34	P.M.	..	..	8	3	12	14	....	68	19·6475	....	9110	....	....	9
9		do 5 H.W.	*d* 6	45	P.M.	4	11	..	..	..	..	....	107	20·8885	1·2410	....	20·2151	1·1070	....
	¼	do 6 L.W.	*e* 3	21	A.M.	..	..	8	36	13	8	....	77	19·6755	....	1·2130	....	....	21
	½	do 6 H.W.	*f* 7	53	A.M.	4	32	..	..	..	..	+ 17	122	20·7385	1·0630	....	20·1654	1·1068	....
	¾	do 6 L.W.	*g* 3	54	P.M.	..	..	8	1	11	59	....	75	19·5485	....	1·1900	....	....	34
10		do 6 H.W.	*h* 7	52	P.M.	3	58	..	..	..	..	....	100	20·5095	9610	....	20·0364	1·0558	....
	¼	do 7 L.W.	*i* 4	18	A.M.	..	..	8	26	12	37	....	95	19·4685	....	1·0410	....	....	13
	½	do 7 H.W.	*j* 8	29	A.M.	4	11	..	..	..	..	+ 16	107	20·4995	1·0310	....	°20·0063	1·0755	....
	¾	do 7 L.W.	*k* 4	33	P.M.	..	..	8	4	12	29	....	*145	°19·4685	....	1·0310	....	....	14
11		do 7 H.W.	*l* 8	58	P.M.	4	25	..	..	..	..	....	106	20·6285	1·1600	....	20·0848	1·1525	....
	¼	do 8 L.W.	*m* 5	1	A.M.	..	..	8	3	11	43	....	75	19·5485	....	1·0800	....	....	45
	½	do 8 H.W.	*n* 8	41	A.M.	3	40	..	..	..	..	− 26	84	20·8875	1·3390	....	20·1943	1·2025	....
	¾	do 8 L.W.	*o* 5	27	P.M.	..	..	8	46	12	41	....	75	19·6375	....	1·2500	....	....	15
12		do 8 H.W.	*p* 9	22	P.M.	3	55	..	..	..	..	....	77	20·7785	1·1410	....	20·2911	1·2370	....
	¼	do 9 L.W.	*q* 5	25	A.M.	..	..	8	3	11	55	....	60	19·7075	....	1·0710	....	....	3
	½	do 9 H.W.	*r* 9	17	A.M.	3	52	..	..	..	..	− 21	86	21·1935	1·4860	....	20·4353	1·2885	....
	¾	do 9 L.W.	*s* 5	55	P.M.	..	..	8	38	12	34	....	63	19·8755	....	1·3180	....	....	4
13		do 9 H.W.	*t* 9	51	P.M.	3	56	..	..	..	..	....	95	21·1545	1·2790	....	20·6579	1·4148	....
	¼	do 10 L.W.	*u* 5	58	A.M.	..	..	8	7	11	40	....	°28	20·0255	....	1·1290	....	....	23
	½	do 10 H.W.	*v* 9	31	A.M.	3	33	..	..	..	..	−*43	77	21·9585	1·9330	....	20·9645	1·6010	....
	¾	do 10 L.W.	*w* 6	25	P.M.	..	..	8	54	12	27	....	71	20·3025	....	1·6560	....	....	°0
14		do 10 H.W.	*x* 9	58	P.M.	3	33	..	..	..	..	....	82	21·9985	1·6960	....	21·3185	1·7260	....
	¼	do 11 L.W.	*y* 6	16	A.M.	..	..	8	18	11	51	....	62	20·6085	....	1·3900	....	....	0
	½	do 11 H.W.	*z* 9	49	A.M.	3	33	..	..	..	..	− 12	68	22·7705	2·1620	....	21·6069	1·6788	....
	¾	do 11 L.W.	*aa* 7	4	P.M.	..	..	9	15	12	47	....	74	20·9265	....	1·8440	....	....	1
15		do 11 H.W.	*bb* 10	36	P.M.	3	32	..	..	..	..	....	80	22·2455	1·3190	....	21·7701	1·6482	....
	¼	do 12 L.W.	*cc* 6	54	A.M.	..	..	8	18	11	50	....	60	....	....	1·2800	....	....	0
			....	....	....	....	....	....	....	....	....	....	....	20·9655	....	....	....	....	....
		H.W.	123	33								+ 51	1288	296·8100					
Totals	14 tides		....	....	....	54	53	117	32	171	55	....	....	....	18·5520	17·4040	287·9859	8·3079	182
		L.W.	73	5								−102	1109	278·2580					
		14 H.W.										+ 17	92	21·2007					
Means		do ..	....	....	....	3	55	8	24	12	17	....	....	....	1·3251	1·2431	20·5704	1·3077	13
		14 L.W.										− 26	74	19·8756					

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °

a Longitude, Batiscan, Brunelle's wharf=72° 15′=4h. 49m. 0s.=0·2007 of a day west of Greenwich.
b Stiff N.E. breeze; sky overcast; appearance of rain. *c* Light N.E. breeze; rain.
d N.E. breeze; rain continues. *e* Sky clouded. *f* Fine, clear weather.
g Cloudy; N.E. wind, hardly perceptible. *h* Feeble S.W. breeze; cloudy.
i Fine, bright, cool weather. *j* Gusts of N.E. wind; fair.
k Moon crosses the equator; wind, N.W.; cool. *l* Fair. *m* Fine, bright morning.
n Very light S. wind. *o* Gentle S.W. breeze; fine, clear sky; warm.

APPENDIX 13.

TABLE XV.—Tidal Fluctuations at Batiscan during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).									RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."																
Diurnal Inequalities.									Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides		Lunitidal intervals.		General coefficients of semi-amplitudes from "L'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series V. (Gaining tides. (Gauge book reference numbers.
In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.	Oscillations of float in hundredths of a foot.	Upper passage.		Lower passage.		Ages, etc.													
Min.	Min.	Feet.	Feet.	Feet.	Feet.	H. M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		
												23·3									
49	40		1700			10 50				7	41			5	44				+*33	10	3	°44	
		3300		0242	0935											*12	41						
33	54		0280			10 42		8	3			24·3		6	25					10	22	46	9
		1500		0497	°0002											12	37						
35	69		1270			11 28				8	25			7	2				+ 19	10	37	49	
		2290		1290	0510											12	32						
25	38		0800			11 6		8	46			25·3		7	34					10	48	53	10
		°0100		0301	0197											12	27						
22	8		°0000			11 21				9	8			8	1				+ 2	10	53	57	
		1290		0785	0770											12	25						
°1	46		0800			*11 30		9	28			26·3		8	26					10	58	61	11
		2590		1095	0500											12	22						
43	58		0890			10 52				9	49			8	48				— 8	*10	59	65	
		1090		0968	0345											12	20						
43	46		0700			11 12		10	10			27·3		9	8					10	58	69	12
		4150		1442	0515											12	18						
30	34		1680			10 46				10	31			9	26				— 14	10	55	72	
		0390		2226	1263											12	18						
26	49		1500			10 59		10	52			28·3		9	44					10	52	75	13
		8040		3066	1862											12	16						
47	47		2770			10 18				11	13			10	0				— 17	10	47	78	
		0400		3540	1250		4									12	17						
36	36		3060			10 23		11	35			●		10	17					10	42	80	14
		7720		2884	0472		7					29·3				°12	15						
57	56		3180			9 52				11	57			10	32				— 19	10	35	81	
		5250		1632	0306		5									12	16						
57	57		0390			10 17	6		19			0·6		10	48					10	29	82	15
		8700		2538	0026		6									12	15						
504	638	4 6810	1 9020	2 2506		8953	151	36	71	13	68	44		121	55	160	96	+ 54		149	58	912	
																			— 58				
36	46	3344	1359	1608		0640	10	50	10	10	9	49		8	43	11	50	+ 18		10	43	65·14	
																			— 15				

p S.W. breeze, very feeble; fine, clear sky; warm. *q* N. wind, very feeble; fine weather.
r Light S.W. breeze; fine, clear weather. *s* Light S.W. breeze; fine, clear weather; warm.
t Light S.W. breeze; fine, clear weather; warm. Moon in apogee, May 9th, at 8.0 p.m.
u Brisk N.E. breeze; sky overcast. *v* Strong N.E. wind; rain. *w* N.E. wind; cloudy; fair.
x Very strong N.E. breeze; cloudy. New moon (Quebec), May 10th, at 8.24 p.m.
y Sky overcast; fair; high N.E. wind. *z* Strong N.E. breeze; fine and bright.
aa Brisk N.E. breeze; sky overcast; appearance of rain.
bb Brisk N.E. breeze; fine, clear weather. *cc* High N.E. wind; rain.

APPENDIX 13.

TABLE XV.—Tidal Fluctuations at Batiscan during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

Gauge book reference numbers. Series VI. Losing tides.		High and low waters observed each civil day.		Time, Eastern Standard			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming — or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.
				H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min
	‡	May 12	L.W.	6	54	A.M.	...	...	...	...	...	...	−12	...	...	...	...	...	...	...
															20·9655					
	‡	May 12	H.W	10	26	A.M.	3	32	...	...	...	...	+ 3	50	23·1155	2·1500	...	22·0239	1·6508	...
	‡	do 12	L.W.	7	27	P.M.	...	...	9	1	13	3	...	58	21·4315	...	1·6840	...	...	30
16		do 13	H.W	11	29	P.M.	4	2	...	...	...	...	...	65	22·9205	1·4890	...	22·4588	1·5661	...
	‡	do 13	L.W.	7	45	A.M.	...	...	8	16	11	16	...	67	21·9200	...	1·0005	...	...	* 62
	‡	do 13	H.W	10	45	A.M.	° 3	0	...	...	...	...	−34	67	24·0105	2·0905	...	22·8752	1·4469	...
	‡	do 13	L.W.	8	7	P.M.	...	...	9	22	13	0	...	60	22·3835	...	1·6270	...	...	38
17		do 14	H.W	11	45	P.M.	3	38	...	...	...	...	...	79	23·4530	1·0695	...	23·1647	1·4053	...
	‡	do 14	L.W.	7	58	A.M.	...	...	8	13	11	44	...	45	22·5405	...	0·9125	...	...	33
	‡	do 14	H.W	11	29	A.M.	3	31	...	...	...	...	+35	73	24·5525	2·0120	...	23·3465	1·4519	...
	‡	do 14	L.W.	8	38	P.M.	...	...	9	09	13	41	...	84	22·7005	...	1·8520	...	...	21
18		do 15	H.W	1	10	A.M.	4	32	...	...	...	...	...	110	23·7315	1·0310	...	23·5682	1·2315	...
	‡	do 15	L.W.	8	17	A.M.	...	...	° 7	7	° 11	10	...	85	23·2055	...	° 0·5206	...	...	29
	‡	do 15	H.W	12	20	P.M.	4	3	...	...	...	...	−17	64	24·7225	1·5170	...	23·8302	1·0313	...
	‡	do 15	L.W.	9	33	P.M.	...	...	9	13	*13	23	...	76	23·4235	...	1·2990	...	...	7
19		do 16	H.W	1	43	A.M.	4	10	...	...	...	...	...	107	24·2065	0·7830	...	23·9565	1·0660	...
	‡	do 16	L.W.	8	55	A.M.	...	...	7	12	11	33	...	61	23·4835	...	0·7230	...	...	11
	‡	do 16	H.W	1	16	P.M.	4	21	...	...	...	...	−27	102	24·7025	1·3190	...	*23·9824	0·8898	...
	‡	do 16	L.W.	10	27	P.M.	...	...	9	11	12	50	...	88	23·5915	...	1·1110	...	...	42
20		do 17	H.W	2	6	A.M.	3	39	...	...	...	...	...	113	24·0975	0·5060	...	23·9292	0·8233	...
	‡	do 17	L.W.	9	47	A.M.	...	...	7	41	12	5	...	90	23·4435	...	0·6540	...	...	45
	‡	do 17	H.W	2	11	P.M.	4	24	...	...	...	...	+26	90	24·4655	1·0220	...	23·8375	0·7800	...
	‡	do 17	L.W.	11	17	P.M.	...	...	9	6	13	11	...	95	23·4515	...	1·0140	...	...	19
21		do 18	H.W	‡ 3	22	A.M.	4	5	...	...	...	...	...	111	23·8815	° 0·4300	...	23·7570	° 0·7380	...
	‡	do 18	L.W.	10	52	A.M.	...	...	7	30	11	57	...	70	23·3245	...	0·5570	...	...	22
	‡	do 18	H.W	3	19	P.M.	4	27	...	...	...	...	− 9	87	24·2755	0·9510	...	23·6755	0·7410	...
	‡	do 18	L.W.	12	26	P.M.	...	...	9	7	12	44	...	105	23·2855	...	0·9900	...	...	50
22		do 19	H.W	4	3	A.M.	3	37	...	...	...	...	...	93	23·7515	0·4660	...	23·6157	0·7905	...
	‡	do 19	L.W.	11	58	A.M.	...	...	7	55	12	33	...	103	23·1555	...	0·5960	...	...	61
	‡	do 19	H.W	4	36	P.M.	* 4	38	...	...	...	...	+23	86	24·2655	1·1100	...	23·6362	0·8167	...
			H.W.	92	0	60							+87	1297	360·1520					
				152	0															
Totals 15 tides							59	39	118		3	174	10				17·9460	14·5460	351·6575	16·4291	470
			L.W.	133	27								−87	1087	342·3060					
			15 H.W.										+21	86	24·0101					
Means			do				3	59	8	26	12	26				1·1964	1·0390	23·4438	1·0953	34
			14 L.W.										−22	78	22·8204					

N.B.—Maxima in whole lunar month indicated by a star, thus: * Minima by a circle, thus: °
† Moon's N. declination a maximum 21° 8'. Maximum diurnal inequality observed in low water levels = 0·505. ‡Moon's first quarter (Quebec), May 18th, from 6h. 5m., p.m.

APPENDIX 13.

TABLE XV.—Tidal Fluctuations at Batiscan during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS.—*Continued.*										RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."													
Diurnal Inequalities.						Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times. (No. 2.)		Length of half tide day H.W. to H.W.		Priming – or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series VI. Losing tides. Gauge book reference numbers.
In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.				Upper passage.		Lower passage.		Ages, etc.									
Min	Min	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.		
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	−19	....	....	....	
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	
43	73	....	0·4660	....	....	9	44	....	....	....	....	42	....	11	3	....	....	*−19	10	21	82	
....	....	0·1950	....	*0·4349	0·0847	....	....	5	....	....	....	....	1·6	....	....	12	16	....	....	....	....	
45	107	....	0·4885	....	....	10	24	4	1	5	....	....	....	11	19	....	....	....	10	14	82	16
....	....	1·0900	....	0·4164	0·1192	....	....	....	....	....	....	....	....	....	....	°12	15	....	....	....	....	
66	104	....	0·4635	....	....	9	16	3	....	....	....	1	29	....	....	11	34	....	*−19	10	5	81	
....	....	0·5575	....	0·2895	0·0416	....	....	5	....	....	....	....	2·6	....	....	12	16	....	....	....	....	
69	36	....	0·1570	....	....	9	52	6	1	53	....	....	....	11	50	....	....	....	9	57	80	17
....	....	1·0995	....	0·1818	0·0466	....	....	7	....	....	....	....	....	....	....	12	16	....	....	....	....	
56	77	....	0·1600	....	....	9	11	7	....	....	....	2	18	....	....	12	6	....	−18	9	48	78	
....	....	0·8210	....	0·2217	*0·2204	....	....	7	....	....	....	....	3·6	....	....	12	16	....	....	....	....	
122	*151	....	*0·5050	....	....	10	28	2	2	42	....	....	....	12	22	....	....	....	9	40	76	18
....	....	0·9910	....	0·2620	0·2002	....	....	....	....	....	....	....	....	....	....	12	16	....	....	....	....	
126	133	....	0·2180	....	....	9	12	....	....	....	....	3	08	....	....	12	38	....	−16	9	30	73	
....	....	0·5160	....	0·1263	0·0347	....	....	....	....	....	....	....	4·6	....	....	12	18	....	....	....	....	
121	110	....	0·0600	....	....	10	10	....	3	33	....	....	....	12	56	....	....	....	9	23	70	19
....	....	0·4960	....	0 0259	0·1762	....	....	....	....	....	....	....	....	....	....	12	18	....	....	....	....	
*179	77	....	0·1080	....	....	9	18	....	....	....	....	3	58	....	....	1	14	....	−13	9	16	66	
....	....	0·6050	....	0·0532	0·0665	....	....	....	....	....	....	....	5·6	....	....	12	19	....	....	....	....	
90	45	....	0·1480	....	....	9	42	....	4	24	....	....	....	1	33	....	....	....	9	9	62	20
....	....	0·3680	....	0·0917	0·0433	....	....	....	....	....	....	....	....	....	....	12	22	....	....	....	....	
85	66	....	0·0080	....	....	9	21	....	....	....	....	4	50	....	....	1	55	....	− 4	9	5	58	
....	....	0·5840	....	0·0805	0·0420	....	....	....	....	....	....	....	6·6	....	....	12	24	....	....	....	....	
96	74	....	0·1270	....	....	10	7	....	5	15	....	....	....	2	19	....	....	....	9	4	54	21
....	....	5·3940	....	0·0815	0·0030	....	....	....	....	....	....	....	....	....	....	12	26	....	....	....	....	
97	47	....	0·0390	....	....	9	38	....	....	....	....	5	41	....	....	2	45	....	+ 6	9	4	51	
....	....	0·5240	....	0·0598	0·0495	....	....	....	....	....	....	....	7·6	....	....	12	30	....	....	....	....	
72	11	....	0·1300	....	....	9	57	....	6	6	....	....	....	3	15	....	....	....	9	9	48	22
....	....	0·5140	....	0·0205	0·0262	....	....	....	....	....	....	....	....	....	....	12	34	....	....	....	....	
49	7	....	....	....	....	10	04	....	....	....	....	6	32	8·6	3	49	....	....	+22	9	17	46	
																		+28				
1316	1118	8·7550	3·0780	2·3457	1·1541	146	24	....	24	58	40	38	....	112	38	172	46	....	143	2	1007	
											+ 84	0		+ 84	0			−89				
											=124	38		=196	38							
																		+14				
88	75	0·6254	0·2199	0·1676	0·0824	9	46	....	3	34	15	35	....	13	7	12	20	....	9	32	67·13	
																		−15				

a. High N.E. wind; rain. *b.* N.E breeze; rainy weather. *c.* Gentle N.E. breeze; rain. *d.* Feeble N.E. wind. *e.* N.E. wind with rain. *f.* N.E. breeze with showers of rain. *g.* High N.E. wind; heavy rain. *h.* High N.E. wind; sky overcast. *i.* High N.E. wind; wet weather. *j.* N.E. breeze, accompanied by rain. *k.* Gentle S.W. breeze; fair. *l.* N.W. wind; fine. *m.* Light S.W. wind; fine day. *n.* S.W. wind just perceptible; fine. *o.* Gentle N.W. breeze. *p.* Gentle N.W. wind; clear bright sky. *q.* Light N.W. breeze; fine clear weather. *r.* Fresh N.W. breeze; fine clear weather. *s.* Feeble S. breeze; wet weather. *t.* N.E. breeze; showers of rain.

APPENDIX 13.

TABLE XV.—Tidal Fluctuations at Batiscan during the High water season of 1888, viz.:—from quadrature of May 2nd to quadrature of June 1st.

Gauge book reference numbers. Series VII. Gaining tides.			High and low waters observed each civil day.	Time, Eastern Standard.			Direct Results of Tidal Observations, &c.													
							Duration of floods.		Duration of ebbs.		Length of half tide day H. W. to H. W.		Priming—or lagging + of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
				H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min.	Feet.	Feet.	Feet	Feet.	Feet.
	½	May 19	H.W	4	36	P.M.	*a*						+23		24·2655				
	½	do 20	L.W.	1	20	A.M.	*b*		8	44	12	40		117	23·3000		0·9655		
23		do 20	H.W	5	16	A.M.	*c*	3	56					112	23·8955	0·5955		23·5949	0·7442
	½	do 20	L.W.	1	29	P.M.			8	13	12	19		140	23·1455		0·7500		
	½	do 20	H.W	5	35	P.M.	*d*	4	6				+21	*130	23·8115	0·6660		23·4403	0·7445
	½	do 21	L.W.	2	5	A.M.	*e*		8	30	12	52		109	22·9905		0·8210		
24		do 21	H.W	6	27	A.M.	*f*	4	22					115	23·7315	0·7410		23·3685	0·8160
	½	do 21	L.W.	2	32	P.M.	*g*		8	5	12	18		92	22·9305		0·8010		
	½	do 21	H.W	6	45	P.M.	*h*	4	13				+3	125	23·8315	0·9010		23·3435	0·9160
	½	do 22	L.W.	3	20	A.M.	*i*		8	35	12	35		70	22·8405		0·9910		
25		do 22	H.W	7	20	A.M.	*j*	4	0					105	23·8115	0·9710		23·3135	0·9760
	½	do 22	L.W.	3	49	P.M.	*j*		8	29	12	20		65	22·8105		1·0010		
	½	do 22	H.W	7	40	P.M.	*k*	3	51				−25	90	23·7515	0·9410		23·3165	1·0720
	½	do 23	L.W.	3	58	A.M.	*l*		8	18	12	5		88	22·7505		1·0010		
26		do 23	H.W	7	45	A.M.	*m*	3	47					77	24·0955	1·3450		23·3571	1·2030
	½	do 23	L.W.	4	51	P.M.	*n*		9	6	12	28		60	22·7605		1·3350		
	½	do 23	H.W	8	13	P.M.	*o*	3	22				−17	91	23·8915	1·1310		23·3919	1·3728
	½	do 24	L.W.	4	29	A.M.	*c*		8	16	12	5		53	22·6505		1·2410		
27		do 24	H.W	8	18	A.M.	*p*	3	49					62	24·4345	1·7840		23·4861	1·5210
	½	do 24	L.W.	5	38	P.M.	*q*		9	20	12	39		62	22·8005		1·6340		
	½	do 24	H.W	8	57	P.M.	*r*	3	19				−11	67	24·2255	1·4250		23·5950	1·6490
	½	do 25	L.W.	5	39	A.M.	*s*		8	42	12	0		58	22·7405		1·4850		
28		do 25	H.W	8	57	A.M.	*t*	3	18					76	24·7925	2·0520		23·6648	1·7148
	½	do 25	L.W.	6	24	P.M.	*t*		9	27	12	38		57	22·8405		1·9520		
	½	do 25	H.W	9	35	P.M.	*t*	3	11				−17	64	24·3455	1·5050		23·6905	1·8606
	½	do 26	L.W.	6	13	A.M.	*t*		8	38	11	55		73	22·6800		1·6655		
29		do 26	H.W	9	30	A.M.	*u*	3	17					52	25·0000	2·3200		23·6740	1·9175
	½	do 26	L.W.	7	15	P.M.	*v*		9	45	13	8		56	22·7505		2·2495		
	½	do 26	H.W	10	38	P.M.	*r*	3	23				− 7	101	24·1855	1·4350		23·6725	1·9641
			H.W.	110	56								+24	1267	337·8035				
Totals		14 tides		59	2	+24	51	54	122	8	174	2				17·8125	17·8925	328·9091	18·4715
			L.W.	=83	2								−77	1100	319·9910				
		14	H.W.										+12	91	24·1288				
Means		do					3	42	8	43	12	26				1·2723	1·2780	23·4935	1·3194
		14	L.W.										−16	79	22·8565				

N.B.—Maxima in whole lunar month indicated by a star, thus : * and minima by a circle, thus : °

a Gentle S.W.b reeze ; fine. *b* N.W. wind just perceptible ; bright cold weather. *c* N.W. breeze.
d Very light S.W. wind ; fine. *e* N. breeze ; sky clear and bright. *f* Gentle N. breeze ; bright day.
g Gentle N. breeze; fine clear weather. *h* Gentle N. breeze ; fine clear weather; moon after crossing equator.
i Gentle N. breeze ; clear bright sky. *j* Light S.W. wind ; fine. *k* Nearly dead calm ; fine and bright.

APPENDIX 13.

TABLE XV.—Tidal Fluctuations at Batiscan during the High water season of 1888, viz.:—from quadrature of May 2nd to quadrature of June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).										RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."														
Diurnal Inequalities.							Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.				Eastern standard civil time of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.W.		Priming—or lagging + of tides		Lunitidal intervals.		General coefficients of semi-amplitudes from "Annuaire des Marées," corresponding to observed tides assumed to be hours old.	Series VII. Gauming tides. Gauge book reference numbers.
In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.				Upper passage.		Lower passage.		Ages, etc.										
Min.	Min.	Min.	Feet.	Feet.	Feet.	Feet.	H.	M.		H.	M.	H.	M.	Days	H.	M.	H.	M.	Min.		H.	M.		
...	...	...	...	0·1455	...	...	...	...	...	...	...	...	...	...	...	...	12	38	+ 22	...	...	...	...	½
42	...	0	3700	...	0·0413	0·0725	10	19	...	6	57	...	...	...	...	...	...	...	...	...	9	30	46	½
...	31	21	...	0·1545	...	...	...	...	...	...	...	...	...	9·6	4	27	12	40	...	...	...	...	...	**23**
10	...	0	0840	...	0·1546	0·0003	10	13	2	...	...	7	22	...	...	...	...	...	+ 29	...	9	45	48	½
...	17	33	...	0·1550	...	...	...	...	...	...	...	...	...	...	5	7	12	39	...	...	...	...	...	½
16	...	0	0800	...	0·0718	0·0715	10	39	...	7	48	...	...	...	...	...	...	...	...	...	9	58	51	½
...	25	34	...	0·0600	...	...	...	...	...	...	...	...	...	10·6	5	46	12	37	...	...	...	...	...	**24**
99	...	0	1000	...	0·0250	0·1000	10	31	...	...	...	8	14	...	...	...	...	...	+ 21	10	9	56	...	½
...	30	17	...	0·0900	...	...	...	...	...	...	...	...	...	...	6	23	12	34	...	...	...	...	...	½
13	...	0	0200	...	0·0300	0·0600	10	40	...	8	40	...	...	...	...	...	...	...	...	10	17	62	...	½
...	6	15	...	0·0300	...	...	...	...	...	...	...	...	...	11·6	6	57	12	31	...	...	...	...	...	**25**
9	...	0	0600	...	0·0030	0·0960	10	34	...	...	...	9	6	...	...	...	...	...	+ 9	10	22	69	...	½
...	21	25	...	0·0600	...	...	...	...	...	...	...	...	...	...	7	28	12	28	...	...	...	...	...	½
4	...	0	3440	...	0·0406	0·1310	10	12	...	9	33	...	...	...	...	...	...	...	...	10	23	76	...	½
...	58	33	...	0·0100	...	...	...	...	...	...	...	...	...	12·6	7	56	12	26	...	...	...	...	...	**26**
25	...	0	2040	...	0·0348	0·1698	10	12	2	...	...	10	1	...	...	...	...	...	+ 1	10	21	83	...	½
...	50	23	...	0·1100	...	...	...	...	2	...	...	...	...	...	8	22	12	25	...	...	...	...	...	½
27	...	0	5430	...	0·0942	0·1482	9	49	...	10	29	...	...	...	...	...	...	...	...	10	18	89	...	½
...	64	34	...	0·1500	...	...	...	...	...	...	...	...	...	13·6	8	47	12	24	...	...	...	...	...	**27**
30	...	0	2090	...	0·1089	0·1280	9	59	...	...	...	10	58	...	...	...	...	...	— 2	10	13	95	...	½
...	38	39	...	0·0600	...	...	...	...	...	...	...	...	...	...	9	11	12	24	...	...	...	...	...	½
1	...	0	5670	...	0·0698	0·0658	9	30	...	11	27	...	...	○	...	...	...	...	...	10	8	100	...	½
...	45	38	...	0·1000	...	...	...	...	2	...	...	...	...	14·6	9	35	12	24	...	...	...	...	...	**28**
7	...	0	4470	...	0·0257	0·0458	9	38	...	...	...	11	57	...	...	...	...	...	— 3	10	2	104	...	½
...	49	43	...	0·1605	...	...	...	...	3	...	...	...	...	...	9	59	12	23	...	...	...	...	...	½
6	...	0	6545	...	0·0165	0·0569	9	3	3	...	27	...	...	...	...	...	...	...	...	9	55	106	...	½
...	67	73	...	0·0705	...	...	...	...	1	...	...	...	...	15·6	10	22	12	23	...	...	...	...	...	**29**
6	...	0	8145	...	0·0015	0·0466	9	40	1	...	...	...	58	...	...	...	...	...	— 3	9	47	*107	...	½
...	74	93	...	...	...	...	...	...	...	...	...	...	...	...	10	45	...	...	...	...	...	...	...	½
205	575	521	4·4970	1·3550	0·7177	1·1924	140	59	...	67	21	70	36	...	111	5	174	56	+ 60	141	8	1092		
															+168	0			— 8					
															=279	5								
15	41	37	0·3212	0·0968	0·0513	0·0852	10	4	...	9	37	10	5		19	56	12	30	+ 15	10	5	78·00		
																			— 3					

l Very feeble N.E. breeze; fair. *m* Very feeble S.W. breeze; fine. *n* Very light N.E. wind; clear sky.
o N.E. breeze; fair. *p* N.E. breeze; fair; moon in perigee, May 24th, at 2 p.m.
q Gentle N.E. breeze; fine and bright. *r* N.E. wind hardly perceptible; fine clear sky.
s N.E. wind hardly perceptible; fine clear sky; full moon (Quebec), May 25th, at 8.40 a.m.
t N.E. breeze; fair. *u* Fresh N.E. breeze; fair. *v* Stiff N.E. breeze; fair.

APPENDIX 13.

TABLE XV.—Tidal Fluctuations at Batiscan during High water season of 1888, viz.: —from quadrature, May 2nd, to quadrature, June 1st.

Gauge book reference numbers.	Series VIII. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming −or lagging +of tides Min.	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.
		M'y 26 H. w	10	38	P.M.	....	....	....	....	....	..	−7	....	24·1855	.... ..	..... .	... ..
		... ...	...	...	...	....	....	....	....	....	..	...	....	.....	.... ..	..... .	... ..
	¾	M'y 27 L. w	7	9	A.M.	....	....	8	31	11	35	....	62	22·6305	.....	1·5550	.....
30		do 27 H. w	10	13	A.M.	3	4	....	....	..	..	.....	° 35	*25·2475	*2·6170	.... ..	23·6655
	¼	do 27 L. w	8	8	P.M.	....	....	* 9	55	12	56	....	50	22·7005	.....	*2·5470	.....
	¾	do 27 H. w	11	9	P.M.	3	1	....	....	..	..	+9	57	23·9815	1·2810	.....	23·5510
	¾	do 28 L. w	7	53	A.M.	....	....	8	44	12	3	....	62	22·4725	.....	1·5090	.....
31		do 28 H. w	11	12	A.M.	3	19	....	....	..	..	.....	45	24·8512	2·3787	.....	23·4217
	¼	do 28 L. w	8	58	P.M.	....	....	9	46	12	55	....	56	22·5415	.....	2·3097	.....
	¾	do 29 H. w	12	7	A.M.	3	9	....	....	..	..	+10	69	23·6615	1·1200	.... ..	23·3167
	¼	do 29 L. w	8	32	A.M.	....	....	8	25	12	5	....	55	22·4205	.....	1·2410	.....
32		do 29 H. w	12	12	P.M.	3	40	....	....	..	..	.....	56	24·4355	2·0150	.....	23·1658
	¼	do 29 L. w	9	50	P.M.	....	....	9	38	13	6	....	62	22·3335	.....	2·1020	.....
	¾	do 30 H. w	1	18	A.M.	3	28	....	....	..	..	+ 6	87	23·2855	0·9520	.....	22·9382
	¾	do 30 L. w	9	38	A.M.	....	....	8	20	11	50	..	43	22·0755	.....	1·2100	.....
33		do 30 H. w	1	8	P.M.	3	30	....	....	..	..	.....	38	23·6815	1·6060	.....	22·6494
	¼	do 30 L. w	10	57	P.M.	....	....	9	49	13	22	....	53	21·8775	.....	1·8040	.....
	¾	do 31 H. w	2	30	A.M.	3	33	....	....	..	..	+28	78	22·6405	0·7630	.....	22·3585
	¾	do 31 L. w	10	32	A.M.	....	....	8	2	11	56	....	61	21·5815	.....	1·0590	.....
34		do 31 H. w	2	26	P.M.	3	54	....	....	..	..	.....	83	22·9875	1·4060	.....	22·1684
	¼	do 31 L. w	11	51	P.M.	....	....	9	25	12	48	°	80	21·6615	.....	1·3260	.....
	¼	June 1 H. w	3	14	A.M.	3	23	....	....	..	..	−4	110	22·2455	0·5840	.....	22·0882
	¾	do 1 L. w	11	22	A.M.	....	....	8	8	11	58	....	75	21·3715	.....	0·8740	....
35		do 1 H. w	3	12	P.M.	3	50	....	....	..	..	.....	107	22·9205	1·5490	.....	21·9493
	¼	do 2 L. w	12	49	A.M.	....	....	9	37	13	18	....	78	21·3245	.....	1·5960	.....
	¾	do 2 H. w	4	30	A.M.	3	41	....	....	..	..	*+38	93	22·1155	0·7910	.....	21·7314
	¾	do 2 L. w	12	51	P.M.	....	....	8	21	12	10	....	92	21·0555	.....	1·0600	.....
36		do 2 H. w	4	40	P.M.	3	49	....	....	..	..	.....	87	21·9395	0·8840	.....	21·4026
	¼	do 3 L. w	1	43	A.M.	....	..	9	3	13	6	....	89	20·7685	.....	1·1710	.....
	½	do 3 H. w	5	46	A.M.	4	3	....	..	..	..	+33	93	21·5785	0·8100	.....	21·1976
		... ...	...	...	...	....	..	8	7	12	17	....	93	.....	.....	0·9200	.....
	¾	June 3 L. w	1	53	P.M.	....	....	....	....	..	..	.....	...	20·6585	.....	.....	... ..
Totals 14 tides		H.W. 85—37+24 =109—37				49	24	133	51	187	25	+124	1038	325·5717	18·7567	22·2837	315·6043
		L.W. 134— 6+24 =158— 6										— 4	1011	306·8150			
Means		14 H.W. do				3	32	8	55	12	30	+21	74	23·2551	1·3398	1·4856	22·5432
		15 L.W.										— 4	67	21·9154			
Grand totals 57 tides		H.W.				215	50	491	34	707	32	+286	4890	1320·3372	73·0672	72·1262	1284.1568
		L.W.										−270	4307	1247·3700			
Grand means		57 H.W. do				3	47	8	37	12	25	+ 19	86	23·1638	1·2819	1·2654	22·5291
		57 L.W.										— 18	76	21·8837			

N. B.—Maxima in whole lunar month indicated by a star, thus: * ; and minima by a circle, thus: °.

APPENDIX 13.

TABLE XV.—Tidal Fluctuations at Batiscan during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.—*Con.*

Mean amplitudes corrected for diurnal inequalities.	Diurnal Inequalities.							REMARKS.
	In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	
Feet.	Min	Min.	Min.	Feet.	Feet.	Feet.	Feet.	
...	...	...	...	...	...	...	...	...
...	...	...	...	...	0·1200	...	...	...
...	19	...	...	1·0620	...	0·0070	0·0359	Feeble N.E. wind with rain
*2·6000	...	84	81	...	0·0700	...	...	Maximum diurnal inequality in high water levels observed = 1·266. N.E. breeze, fair
...	3	...	...	*1·2660	...	0·1145	0·0711	Moon S. declination a max. = 21°41′ N.E. breeze.
1·9289	...	71	53	...	0·2280	...	...	...
...	18	...	...	0·8697	...	0·1293	0·0995	...
1·8294	...	62	52	...	0·0690	...	...	N.E. breeze
...	10	...	...	1·1897	...	0·1050	0·1580	Gentle N.E. breeze, rain.
1·6714	...	81	50	...	0·1210	...	...	...
...	31	...	...	0·7740	...	0·1509	0·0939	Stiff S.W. breeze, rain.
1·5775	...	73	61	...	0·0870	...	...	do do fair
...	12	...	...	1·1500	...	0·2276	0·1100	Gentle do do
1·4675	...	78	76	...	0·2580	...	...	Very feeble S.W. breeze—fine clear weather
...	2	...	...	0·3960	...	0·2888	0·1217	Light N.W. breeze do
1·3458	...	89	92	...	0·1980	...	...	S.W. breeze do
...	3	...	...	1·0410	...	0·2909	0·0878	Gentle N.W. breeze—fine
1·2580	...	107	86	...	0·2960	...	...	Maximum diurnal inequality observed in low water levels=0·296 ft. Gentle S.W. breeze, fine.
...	21	...	...	0·3470	...	0·1901	0·1642	Feeble N.E. breeze—fine
1·0938	...	83	52	...	0·0800	...	...	Very light N.E. breeze—fine
...	31	...	...	0·7420	...	0·0802	0·0105	S. breeze—raining weather.
1·0833	...	77	50	...	0·2900	...	...	N.E. breeze—rain.
...	27	...	...	0·6750	...	0·1389	0·1192	Feeble N.E. wind, sky overcast. Moon's last quarter (Quebec) June 1st from 7.53 a.m.
1·2025	...	89	80	...	0·0470	...	...	Sky overcast—feeble N.E. wind.
...	9	...	...	0·8050	...	0·2179	0·1197	Light N. breeze
1·0828	...	76	68	...	0·2690	...	...	Feeble N.E. breeze—fine
...	8	...	...	0·1760	...	0·3288	0·1015	Light N.W. breeze—fine
0·9813	...	42	56	...	0·2870	...	...	...
...	14	...	...	0·3610	...	0·2050	0·0133	Feeble N. breeze—light rain
0·9680	...	56	49	...	0·1100	...	...	do rain
...	7	...	...	0·0510	...	...	...	Light N.W. wind—fine.
...	...	...	...	...	...	...	...	...
19·4902	215	1068	906	10·9054	2·5300	2·4749	1·3063	...
1·3921	14	76	71	0·7270	0·1687	0·1768	0·0933	...
72·6987	1072	3463	3183	28·8384	8·8650	7·7889	4·5481	...
1·2754	19	59	56	0·5059	0·1555	0·1391	0·0812	...

APPENDIX 13.

TABLE XV.—Tidal Fluctuations at Batiscan during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Gauge book reference numbers.	Series VIII. Losing tides.	Lunitidal intervals.		Oscillations of float in hundredths of a foot.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times. (No. 2).		Length of half tide day H. W. to H. W.		Priming + or lagging − of tides	Lunitidal intervals.		General coefficients of semi-amplitude from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.
					Upper passage.		Lower. passage.		Ages, etc.								
		H.	M.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M	
														− 3			
												12	24				
	¾	8	44		1	29									9	40	106
30				2			1	59	16·6	11	9	12	23				
	1	9	10											− 3	9	33	104
	¼									11	32	12	24				
	½	8	43		2	29									9	27	101
31				3			2	59	17·6	11	56	12	24				
	¼	9	8	3										− 3	9	21	96
	½									12	20	12	23				
	¾	8	45	*15	3	27									9	16	91
32				3			3	55	18·6	12	43	12	23				
	1	9	23	1										− 3	9	11	85
	¼			3						1	6	12	24				
	½	8	46		4	22									9	8	79
33				3			4	48	19·6	1	30	12	26				
	¼	9	42											+ 2	9	8	72
	½									1	56	12	26				
	¾	9	13		5	13									9	9	66
34							5	37	20·6	2	22	12	27				
	¼	9	37											+	9	12	60
	½			2						2	49	12	30				
	¾	9	12		6	0									9	19	55
35							6	23	21·6	3	19	12	32				
	¼	10	7											+17	9	28	51
	½	9	55		6	45			22·6	3	51	12	35		9	41	48
36							7	6		4	26	12	31				
	¼	10	40											+10	9	51	46
	½								23·6	4	57	12	29				
	¾																
		131	5		29	45	32	47		85	56	186	41	+36	131	24	1060
										+108	0			− 9			
										=193	56						
		9	22		4	15	4	41		13	51	12	27	+ 9	9	22	75·71
														− 3			
		570	4		193	17	297	5		431	34	707	42	+178	565	32	4071
										+360	0			−164			
										=791	34			+ 14			
		10	0		6	54	10	25		13	53	12	25	− 10	9	55	71·42

APPENDIX 13.

TIDAL FLUCTUATIONS, ETC.,

CHAMPLAIN.

DURING A COMPLETE LUNAR MONTH OF THE HIGH WATER SEASON OF 1888, VIZ., MAY 2, TO JUNE 1.

TABLE XVI.

WEEKLY SERIES OF GAINING AND LOSING TIDES, Nos. V, VI, VII, AND VIII.

APPENDIX 13.

TABLE XVI.—Tidal Fluctuations at Champlain during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series V. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H.W. to H.W. H.	M.	Priming—or lagging + of tides Min	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min
	May 5 L.W.	+ 3	0	A.M.	....	....	9	0	13	10	....	....	21·07	....	....	....	....	....
	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
‡	May 5 H.W	7	10	A.M.	4	10	....	....	....	....	+11	°20	21·90	83	....	21·48	94	....
	do 5 L.W.	3	20	P.M.	....	....	8	10	11	51	....	90	20·95	....	95	....	....	29
9	do 5 H.W	7	1	P.M.	3	41	....	....	....	....	....	65	21·91	96	....	21·40	92	....
‡	do 6 L.W.	4	23	A.M.	....	....	9	22	12	54	....	°20	20·94	....	97	....	....	9
‡	do 6 H.W	7	55	A.M.	3	32	....	....	....	....	+ 1	42	21·70	76	....	21·27	85	....
	do 6 L.W.	4	23	P.M.	....	....	8	28	11	57	....	75	20·77	....	93	....	....	3
10	do 6 H.W	7	52	P.M.	3	29	....	....	....	....	....	65	21·47	70	....	21·14	82	....
‡	do 7 L.W.	4	45	A.M.	....	....	8	53	12	41	....	40	°20·67	....	80	....	....	19
‡	do 7 H.W	8	33	A.M.	3	48	....	....	....	....	+16	45	21·52	85	....	°21·11	85	....
	do 7 L.W.	‡ 4	55	P.M.	....	....	8	22	12	25	....	75	20·70	....	82	....	....	15
11	do 7 H.W	8	58	P.M.	4	3	....	....	....	....	....	45	21·60	90	....	21·20	89	....
‡	do 8 L.W.	5	30	A.M.	....	....	8	32	12	9	....	41	20·80	....	80	....	....	26
‡	do 8 H.W	9	7	A.M.	3	37	....	....	....	....	—°0	60	21·84	1·04	....	21·30	93	....
	do 8 L.W.	6	18	P.M.	....	....	9	11	12	41	....	40	20·87	....	97	....	....	7
12	do 8 H.W	9	48	P.M.	3	30	....	....	....	....	....	65	21·74	87	....	21·39	97	....
‡	do 9 L.W.	6	33	A.M.	....	....	8	45	11	47	....	40	20·94	....	80	....	....	28
‡	do 9 H.W	9	35	A.M.	3	2	....	....	....	....	—31	30	22·14	1·20	....	21·53	1·01	....
	do 9 L.W.	6	58	P.M.	....	....	9	23	12	32	....	47	21·10	....	1·04	....	....	7
13	do 9 H.W	§ 10	7	P.M.	3	9	....	....	....	....	....	74	22·10	1·00	....	21·75	1·16	....
‡	do 10 L.W.	6	43	A.M.	....	....	8	36	12	43	....	50	21·22	....	88	....	....	58
‡	do 10 H.W	10	50	A.M.	4	7	....	....	....	....	— 7	42	22·94	1·72	....	22·13	1·29	....
	do 10 L.W.	6	40	P.M.	....	....	7	50	12	0	....	27	21·75	....	1·19	....	....	3
14	do 10 H.W	10	50	P.M.	4	10	....	....	....	....	....	40	23·08	1·33	....	22·55	1·34	....
‡	do 11 L.W.	7	30	A.M.	....	....	8	40	12	0	....	83	22·00	....	1·08	....	....	50
‡	do 11 H.W	10	50	A.M.	3	20	....	....	....	....	—20	61	23·73	1·73	....	22·80	1·36	....
	do 11 L.W.	7	30	P.M.	....	....	8	40	12	30	....	55	22·22	....	1·51	....	....	30
15	do 11 H.W	11	20	P.M.	3	50	....	....	....	....	....	82	23·35	1·13	....	22·97	1·31	....
‡	do 12 L.W.	7	40	A.M.	....	....	8	20	11	40	....	60	....	....	95	....	....	30
	....	....	....	....	....	....	....	....	....	....	....	....	22·40	....	....	....	....	....
Totals 14 tides.	H.W.	129	56		51	28	121	12	171	50	+28	736	311·02	15·02	13·69	304·02	14·64	314
	L.W.	83	8								—58	743	296·00					
Means 14 tides.	H.W.	....	....	....	3	41	8	39	12	16	+ 9	53	22·22	1·07	0·97	21·72	1·05	22
	L.W.										—15	53	21·14					

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus °:
† Longitude, Gagnon's wharf, Champlain—72° 20′—4h. 49m. 20s. 0·2009 of a day west of Greenwich.
‡ Moon crosses the equator.
§ Moon in apogee, May 9th, at 8h. 0m. p.m.
| New moon (Quebec), May 10th, at 8.24 p.m.

APPENDIX 13.

TABLE XVI.—Tidal Fluctuations at Champlain during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).													RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."									
Diurnal Inequalities.								Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.					Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2)		Length of half tide day H.W. to H.W.							
In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Upper passage.		Lower passage.		Ages, etc.					Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series V. Gauging tides. Gauge book reference numbers.
Min	Min	Ft.	Ft.	Ft.	Ft.	H.	M.	H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		
												23·3									
50	79	0·01	0·12			11	29			7	41		6	10			+*33	10	29	°44	
		0·01		08	02										*12	41					
72	63		0·01			10	58	8	3			24·3	6	51				10	48	46	9
		0·21		13	07										12	37					
54	57		0·17			11	30			8	25		7	28			+ 19	11	3	49	
		0·23		13	03										12	32					
25	44		0·10			11	5	8	47			25·3	8	0				11	13	53	10
		0·05		03	03										12	27					
31	16		0·03			11	25			9	8		8	27			+ 2	11	19	57	
		0·08		09	04										12	25					
10	16		0·10			11	29	9	29			26·3	8	52				11	23	61	11
		0·24		10	04										12	22					
39	32		0·07			11	17			9	50		9	14			— 8	*11	24	65	
		0·10		09	04										12	20					
26	54		0·07			*11	38	10	10			27·3	9	34				*11	24	69	12
		0·40		14	04										12	18					
38	45		0·16			11	4			10	31		9	52			— 14	11	21	72	
		0·04		22	15										12	18					
47	11		0·12			11	15	10	52			28·3	10	10				11	18	75	13
		0·84		38	13										12	16					
46	43		0·53			11	36			11	14		10	26			— 17	11	12	78	
		0·14	*	42	05										12	17					
50	°0		0·25			11	15	11	35			29·3	10	43				11	8	80	14
		0·65		25	02										°12	15					
°0	30		0·22			10	53			11	57		10	58			—*19	11	1	81	
		0·38		17	05										12	16					
20	50		0·18			11	0	12	20			0·6	11	14				10	54	82	15
		0·70		25	03										12	15					
508	540	4·07	2·13	2·48	0·74	157	54	71	16	68	46		127	59	173	19	+ 54	155	57	912	
																	— 58				
36	39	·29	0·15	0·17	0·06	11	17	10	11	9	49		9	9	12	23	+ 18	11	8	65·14	
																	— 15				

APPENDIX 13.

TABLE XVI.—Tidal Fluctuations at Champlain during the High water season of 1888, viz. :—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS, &c.

Gauge book reference numbers. Series VI.	Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard. H.	M.	A.M. or P.M.	Duration of floods. H.	M.	Duration of ebbs. H.	M.	Length of half tide day H. W. to H. W. H.	M.	Priming—or lagging + of tides Min	Duration of apparent stand within 0·05 feet. Min	Elevations of summits and troughs of fluvial tide waves. Feet.	Ranges of floods. Feet.	Ranges of ebbs. Feet.	Mean tide levels corrected for diurnal inequalities. Feet.	Mean amplitudes corrected for diurnal inequalities. Feet.	In duration of floods. Min.	In duration of ebbs. Min.
		May 2 L.W.	7	40	A.M.							−20								
														22·40						
½		May 2 H.W.	11	0	A.M.	3	20					−23	35	24·05	1·65		23·22	1·28		20
¾		do 12 L.W.	7	40	P.M.			8	40	12	47		118	22·75		1·30			47	
16		do 12 H.W.	11	47	P.M.	4	7						53	23·99	1·24		23·62	1·24		22
¼		do 13 L.W.	8	5	A.M.			8	18	11	48		50	23·25		·74			37	
½		do 13 H.W.	†11	35	A.M.	3	30					* 42	28	24·92	1·67		24·07	1·09		15
¾		do 13 L.W.	8	8	P.M.			8	33	12	20		38	23·80		1·12			17	
17		do 14 H.W.	11	55	P.M.	3	47						76	24·60	·80		24·37	1·06		15
¼		do 14 L.W.	8	43	A.M.			8	48	11	53		25	23·87		·73			42	
½		do 14 H.W.	11	48	A.M.	3	5					−22	37	25·43	1·56		25·64	1·04		64
¾		do 14 L.W.	9	40	P.M.			9	52	12	35		30	24·36		1·07			22	
18		do 15 H.W.	‡12	23	A.M.	° 2	43						27	25·12	76		24·97	·86		30
¼		do 15 L.W.	9	45	A.M.			9	22	12	42		35	24·71		·41			37	
½		do 15 H.W.	1	5	P.M.	3	20					+17	23	25·87	1·16		25·19	·81		55
¾		do 15 L.W.	9	32	P.M.			8	27	12	25		56	24·85		1·02			38	
19		do 16 H.W.	1	30	A.M.	3	58						64	25·50	·65		25·27	·85		27
¼		do 16 L.W.	9	30	A.M.			8	0	12	8		45	24·87		·63			10	
½		do 16 H.W.	1	38	P.M.	4	8					− 2	95	25·77	·90		25·29	·74		72
¾		do 16 L.W.	10	50	P.M.			9	12	12	40		80	24·97		·80			40	
20		do 17 H.W.	2	18	A.M.	3	28						75	25·61	·64		*25·31	·70		67
¼		do 17 L.W.	10	23	A.M.			8	5	12	27	+ 5	77	24·93		·68			54	
½		do 17 H.W.	2	45	P.M.	4	22						97	25·62	·69		25·20	·63		85
¾		do 17 L.W.	12	15	A.M.			9	30	12	28		72	24·83		·79			*84	
21		do 18 H.W.	3	13	A.M.	2	58						75	25·17	·34		25·07	·58		70
¼		do 18 L.W.	11	33	A.M.			8	20	12	20		50	24·73		·44			62	
½		do 18 H.W.	3	33	P.M.	4	0					− 5	45	25·47	·74		24·97	·53		72
¾		do 19 L.W.	§ 1	5	A.M.			9	32	12	25		45	24·67		·80			67	
22		do 19 H.W.	3	58	A.M.	2	53						50	24·81	° ·14		24·91	° ·48		37
¼		do 19 L.W.	12	53	P.M.			8	55	12	52		60	24·66		° ·15			64	
½		do 19 H.W.	4	50	P.M.	3	57					*+52	40	25·47	·81		24·96	·52		15
		H.W.	95	18								+74	820	377·40						
Totals 15 tides.						55	36	121	34	173	50				13·75	10·68	371·06	12·41	621	666
		L.W.	130	2	+12							−94	781	363·65						
			142	2																
		15 H.W.										+25	55	25·16						
Means		do				3	42	8	41	12	25				0·92	0·76	24·74	0·83	44	44
		14 L.W.										−19	56	24·24						

N.B.—Maxima in whole lunar month indicated by a star, thus : *, and minima by a circle, thus : °.
†Maximum diurnal inequality in low water levels – observed = 0·55 ft.
‡Moon's N. declination a maximum = 21° 8′.
§Moon's first quarter (Quebec), May 18th, from 6h. 05m., p.m.

APPENDIX 13.

TABLE XVI.—Tidal Fluctuations at Champlain during the High water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued.*)							RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."													
Diurnal Inequalities.							Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.													
In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Upper passage.		Lower passage.		Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)		Length of half tide day H.W. to H.L.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series VI. Losing tides. (Gauge book reference numbers.
Min.	Feet.	Feet.	Feet.	Feet.	H.		H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min	H.	M.		
																-19				
67		0·35			10	18			12	42		11	29			* 19	10	47	82	
	0·06		0·40	0·04							1·6			12	16					
59		0·50			10	41	1	6				11	45				10	39	82	16
	0·93		0·45	0·15										12	15					
32		* 0·55			10	6			1	29		12	0			* 19	10	31	81	
	0·32		0·30	0·03							2·6			12	16					
27		0·07			10	2	1	53				12	16				10	23	80	17
	0·83		0·27	0·02										12	16					
42		0·49		*	9	30			2	18		12	32			-18	10	14	78	
	0·31		0·33	0·18							3·6			12	16					
7		0·35			9	40	2	43				12	48				10	5	76	18
	0·75		0·22	0·05										12	16					
17		0·14			9	57			3	8		1	4			-16	9	56	73	
	0·37		0·08	0·04							4·6			12	18					
17		0·02			9	57	3	33				1	22				9	49	70	19
	0·27		0·02	0·11										12	18					
32		0·10			9	39			3	59		1	40			-13	9	41	66	
	0·16		0·02	0·04							5·6			12	19					
13		0·04			9	54	4	24				1	59				9	35	62	20
	0·01		0·11	0·07										12	22					
1		0·10			9	55			4	50		2	21			- 4	9	31	58	
	0·45		0·13	0·05							6·6			12	24					
8		0·10			9	58	5	15				2	45				9	30	54	21
	0·30		0·10	0·05										12	26					
5		0·06			9	52			5	41		3	11			+ 6	9	30	51	
	0·66		0·06	0·05							7·6			12	30					
27		0·01			9	52	6	6				3	41				9	35	48	22
	0·66		0·05	0·04										12	34					
2					10	18			6	32	8·6	4	15			+22	9	43	46	
																+28				
356	6·08	2·88	2·54	0·92	149	39	25	0	40	39	...	95	8	172	46	...	149	29	1007	
									84	0		108	0			-89				
									124	39		203	8							
																+14				
24	0·43	0·21	0·18	0·07	9	59	3	34	15	35	..	13	33	12	20	...	9	58	67·13	
																-15				

APPENDIX 13.

TABLE XVI.—Tidal Fluctuations at Champlain during the Low water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

Gauge book reference numbers. Series VII. Gaining tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Direct Results of Tidal Observations, &c.															
					Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming + or lagging − of tides	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.	In duration of floods.
		H.	M	A.M. or P.M.	H.	M	H.	M	H.	M	Min	Min	Feet.	Feet.	Feet.	Feet.	Feet.	Min
	May 19 H.W	4	50	P.M.							+ *52		25·47					
	do 20 L.W.	2	0	A.M.			9	10	12	50		100	24·73		74			17
23	do 20 H.W	5	40	A.M.	3	40						100	25·10	37		24·92	51	
	do 20 L.W.	2	20	P.M.			8	40	12	30		41	24·60		59			10
	do 20 H.W	6	10	P.M.	3	50					2	120	25·00	40		24·75	50	
	do 21 L.W.	2	10	A.M.			8	0	12	18		52	24·40		60			28
24	do 21 H.W	6	28	A.M.	4	18						85	24·90	50		24·66	58	
	do 21 L.W.	3	10	P.M.			8	42	12	25		40	24·33		57			35
	do 21 H.W	6	53	P.M.	3	43					+ 15	45	24·97	64		24·59	71	
	do 22 L.W.	3	35	A.M.			8	42	12	40		45	24·15		82			15
25	do 22 H.W	7	33	A.M.	3	58						50	24·95	80		24·55	78	
	do 22 L.W.	4	18	P.M.			8	45	12	32		50	24·17		78			41
	do 22 H.W	8	5	P.M.	3	47					+ 0	70	24·87	70		24·59	82	
	do 23 L.W.	4	37	A.M.			8	32	12	18		65	24·13		74			1
26	do 23 H.W	8	23	A.M.	3	46						23	25·20	1·07		24·62	96	
	do 23 L.W.	5	13	P.M.			8	50	12	50		75	24·13		1·07			14
	do 23 H.W	9	13	P.M.	4	0					5	50	25·10	97		24·68	1·07	
	do 24 L.W.	5	58	A.M.			8	45	11	55		45	24·16		94			10
27	do 24 H.W	9	8	A.M.	3	10						25	25·45	29		24·75	1·13	
	do 24 L.W. ‡	6	0	P.M.			8	52	12	22		96	24·20		1·25			40
	do 24 H.W	9	30	P.M.	3	30					28	54	25·25	1·05		24·79	1·24	
	do 25 L.W.	6	20	A.M.			8	50	12	0		80	24·13		1·12			20
28	do 25 H.W §	9	30	A.M.	3	10						60	25·65	1·52		24·80	1·32	
	do 25 L.W.	7	0	P.M.			9	30	12	40		55	24·15		1·50			° 0
	do 25 H.W	10	10	P.M.	3	10					30	60	25·30	1·15		24·82	* 1·43	
	do 26 L.W.	6	40	A.M.			8	30	11	40		80	24·07		1·23			0
29	do 26 H.W	9	50	A.M.	3	10						70	25·81	1·74		24·83	1·39	
	do 26 L.W.	7	30	P.M.			9	40	13	20		*125	24·20		1·61			30
	do 26 H.W	11	10	P.M.	3	40					+ 10	60	25·17	97		24·82	1·40	
Totals 14 tides..	H.W.	117	43		50	52	123	28	174	20	− 65	872	352·72	12·17	13·47	346·17	13·84	231
	L.W.	66	51								+ 25	949	339·55					
Means	14 H.W.				3	38	8	49	12	27	− 16	80	25·19	0·87	9·96	24·73	0·99	17
	do 14 L.W.										+ 8	68	24·25					

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °
† Moon after crossing equator.
‡ Moon in perigee, May 25th, at 2 p.m.
§ Full moon (Quebec), May 24th, at 8.40 a.m.

APPENDIX 13.

TABLE XVI.—Tidal Fluctuations at Champlain during the Low water season of 1888, viz.:—from quadrature, May 2nd, to quadrature, June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Diurnal Inequalities.																								
In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.	Lunitidal intervals.		Eastern standard civil times of meridian passages immediately preceding observed high waters, with correspondingages and phases of the moon. Upper passage.		Lower passage.		Ages, etc.	Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)	Length of half tide day H.W. to H.W.		Priming—or lagging + of tides	Lunitidal intervals.		General coefficients of semi-amplitudes from "L'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Series VII. Gaining tides. Gauge book reference numbers.	
Min.	Min.	Feet.	Feet.	Feet.	Feet	H.	M.	H.	M.	H.	M.	Days.	H.	M.	H.	M.	Min.	H.	M.		
																	+ 22				
			0·07																		
		0·37		·04	·01			6 57							12	38					
30	20		0·13			10	43					9·6	4	53				9	56	46	**23**
		0·10		·17	·01					7 23					12	40					
40	12		0·20			10	47						5	33			+ 29	10	10	48	
		0·10		·09	·08			7 48							12	39					
42	7		0·07			10	40					10·6	6	12				10	24	51	**24**
		0·07		·07	·13					8 14					12	37					
0	15		0·18			10	39						6	49			+ 21	10	35	56	
		0 02		·04	·07			8 40							12	34					
3	8		0·02			10	53					11·6	7	23				10	43	62	**25**
		0·08		·04	·04					9 07					12	31					
13	14		0·04			10	58						7	54			+ 9	10	47	69	
		0·33		·03	·14			9 34							12	28					
18	32		0·00			10	49					12·6	8	22				10	48	76	**26**
		0·10		·06	·11					10 1					12	26					
5	5		0·03			11	12						8	48			+ 1	10	47	83	
		0·35		·07	·06			10 29							12	25					
7	33		0·04			10	39					13·6	9	13				10	44	89	**27**
		0·20		·04	·11					10 58					12	24					
2	22		0·07			10	32						9	37			— 2	10	39	95	
		0·40		·01	·08			11 27							12	24					
40	40		0·02			10	3					(·)	10	1				10	34	100	**28**
		0·35		·02	·11					11 57		14·6			12	24					
60	60		0·08			10	13						10	25			— 3	10	28	104	
		0·51		·01	·04			12 28							12	23					
70	100		0·13			9	22					15·6	10	48				10	20	106	**29**
		0·64		·01	·01					12 58					12	23					
80	100					10	12						11	11			+ 3	10	13	*107	
																	— 5				
410	468	3·62	1·08	0·70	1·00	147	42	67	23	70	38		117	9	174	56		147	8	1092	
													+168	0			+ 63				
													=285	9							
29	33	0·26	0·08	0·05	0·07	10	33	9	38	10	5		20	22	12	30		10	31	78·00	
																	+ 12				
																	— 2				

APPENDIX 13.

TABLE XVI.—Tidal Fluctuations at Champlain during High water season of 1888, viz., from quadrature of May 2nd to quadrature of June 1st.

Gauge book reference numbers. Series VIII. Losing tides.	High and low waters observed each civil day.	Time, Eastern Standard.			Duration of floods.		Duration of ebbs.		Length of half tide day H.W. to H.W.		Priming – or lagging + of tides.	Duration of apparent stand within 0·05 feet.	Elevations of summits and troughs of fluvial tide waves.	Ranges of floods.	Ranges of ebbs.	Mean tide levels corrected for diurnal inequalities.	Mean amplitudes corrected for diurnal inequalities.
		H.	M.	A.M. or P.M.	H.	M.	H.	M.	H.	M.	Min.	Min	Feet.	Feet.	Feet.	Feet.	Feet.
	May 26 H. W.	11	10	P.M.							+ 10						
													25·17				
‡	do 27 L. W.	7	30	A.M.			8	20	11	40		80	24·04		1·13		
30	do 27 H. W.	10	50	A.M.	3	20						40	*25·92	*1·88		24·80	1·39
‡	do 27 L. W.	8	23	P.M.			9	33	*13	25		105	24·16		*1·76		
‡	do 28 H. W.	† 12	15	A.M.	3	52					+ 3	30	24·96	80		24·71	1·34
‡	do 28 L. W.	8	15	A.M.			8	0	11	28		90	23·93		1·03		
31	do 28 H. W.	11	43	A.M.	3	28						40	25·69	1·76		24·61	1·32
‡	do 28 L. W.	‡ 9	23	P.M.			9	40	12	52		65	23·98		1·71		
‡	do 29 H. W.	12	35	A.M.	3	12					+ 12	45	24·73	75		24·52	1·19
‡	do 29 L. W.	9	15	A.M.			8	40	12	10		45	23·86		87		
32	do 29 H. W.	12	45	P.M.	3	30						44	25·29	1·43		24·34	1·16
‡	do 29 L. W.	10	58	P.M.			*10	13	13	8		75	23·66		1·63		
‡	do 30 H. W.	1	53	A.M.	2	55					+ 12	80	24·38	72		24·12	1·11
‡	do 30 L. W.	10	35	A.M.			8	42	11	54		55	23·46		92		
33	do 30 H. W.	1	47	P.M.	3	12						65	24·63	1·17		23·87	·99
‡	do 30 L. W.	11	53	P.M.			10	6	13	6		90	23·28		1·35		
‡	do 31 H. W.	2	53	A.M.	3	0					+ 28	75	23·80	·52		23·61	·91
‡	do 31 L. W.	11	5	A.M.			8	12	12	12		63	23·02		78		
34	do 31 H. W.	3	5	P.M.	4	0						80	24·00	·98		23·37	·87
‡	June 1 L. W.	12	30	P.M.			9	25	13	15		60	22·85		1·15		
‡	do 1 H. W.	4	20	A.M.	3	50					+ 5	*150	23·38	·53		23·25	·84
‡	do 1 L. W.	§ 11	40	A.M.			°7	20	11	40		110	22·82		·56		
35	do 1 H. W.	4	0	P.M.	4	20						80	23·93	1·11		23·20	·85
‡	do 2 L. W.	1	40	A.M.			9	40	12	38		70	22·72		1·21		
‡	do 2 H. W.	4	38	A.M.	2	58					+ 18	100	23·23	51		22·96	·78
‡	do 2 L. W.	1	15	P.M.			8	37	12	30		90	22·42		·81		
36	do 2 H. W.	5	8	P.M.	3	53						90	23·02	·60		22·67	·67
‡	do 3 L. W.	1	45	A.M.			8	37	13	15		100	22·25		·77		
‡	do 3 H. W.	6	23	A.M.	*4	38					+ 32	60	22·72	·47		22·47	·62
							7	50	12	7		95			·65		
‡	do 4 L. W.	2	13	P.M.									22·07				
	H. W.	94	15								+110	979	339·68				
Totals	14 tides.	118	20	+ 24	50	8	132	55	187	20				13·23	16·33	332·50	14·04
	L. W.	=142	20								— 0	1193	326·45				
	14 H. W.										+ 16	70	24·26				
Means	do				3	35	8	52	12	29				0·95	1·09	23·75	1·00
	15 L. W.										— 0	79	23·32				
	H. W.										+237	3407	1380·82				
Grand totals	57				208	4	499	9	707	20				54·17	54·17	1353·75	54·93
tides.	L. W.										—217	3666	1325·65				
	57 H. W.										+ 15	60	24·22				
Grand means	do				3	39	8	45	12	25				0·95	0·95	23·75	0·96
	57 L. W.										— 17	64	23·26				

DIRECT RESULTS OF TIDAL OBSERVATIONS, &C.

N.B.—Maxima in whole lunar month indicated by a star, thus: * and minima by a circle, thus: °
† Moon's S. declination a maximum = 21° 41′.
‡ Maximum diurnal inequality in high water levels observed = 0·96 ft.

APPENDIX 13.

TABLE XVI.—Tidal Fluctuations at Champlain during High water season of 1888, viz., from quadrature of May 2nd to quadrature of June 1st.

DIRECT RESULTS OF TIDAL OBSERVATIONS—(*Continued*).

RESULTS BASED ON DATA FROM NAUTICAL ALMANAC AND "L'ANNUAIRE DES MARÉES."

Diurnal Inequalities.							Lunitidal intervals.	Eastern standard civil times of meridian passages immediately preceding observed high waters, with corresponding ages and phases of the moon.			Eastern standard civil times of high water at Quebec, based on Brest times: (No. 2.)	Length of half tide day H. W. to H. W.	Priming—or lagging + of tides	Lunitidal intervals.	General coefficients of semi-amplitude from "l'Annuaire des Marées," corresponding to observed tides assumed to be 48 hours old.	Gauge book reference numbers. Series VIII. Losing tides.
In duration of floods.	In duration of ebbs.	In semi-tide days.	In high water levels.	In low water levels.	In mean tide levels.	In amplitudes.		Upper passage.	Lower passage.	Ages, etc.						
Min	Min	Min	Feet.	Feet.	Feet.	Feet.	H. M	H. M	H. M.	Days.	H. M.	H. M.	Min.	H. M		
...	...	...	...	...	...	...	...	...	...	...	...	...	+ 3	...	...	...
...	...	...	...	16	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	75	...	02	°01	...	...	...	...	...	12 24	...	...	...	...
...	73	105	...	12	...	...	9 21	1 29	...	...	11 35	...	...	9 59	106	30
32	...	...	* 96	...	09	05	...	...	...	16·6	...	12 23	...	...	...	...
...	93	*117	...	23	...	...	10 16	...	1 59	...	11 58	...	— 3	9 59	104	...
24	...	...	73	...	10	02	...	...	...	...	...	12 24	...	...	...	...
...	100	84	...	05	...	...	9 13	2 30	...	...	12 22	...	...	9 52	101	31
16	...	...	96	...	09	13	...	...	...	17·6	...	12 24	...	...	...	...
...	60	42	...	12	...	...	9 36	...	2 59	...	12 46	...	— 3	9 47	96	...
18	...	...	56	...	18	03	...	...	...	...	...	12 23	...	...	...	...
...	93	58	...	20	...	...	9 17	3 28	...	...	1 9	...	...	9 41	91	32
35	...	...	91	...	22	05	...	...	...	18·6	...	12 23	...	...	...	...
...	91	74	...	20	...	...	9 58	...	3 55	...	1 32	...	— 3	9 37	85	...
17	...	...	25	...	25	12	...	...	...	...	...	12 24	...	...	...	...
...	84	72	...	18	...	...	9 25	4 22	...	...	1 56	...	...	9 34	79	33
12	...	...	83	...	26	68	...	...	...	19·6	...	12 26	...	...	...	...
...	114	54	...	26	...	...	10 5	...	4 48	...	2 22	...	+ 2	9 34	72	...
60	...	...	20	...	24	04	...	...	...	...	...	12 26	...	...	...	...
...	73	63	...	17	...	...	9 52	5 13	...	...	2 48	...	...	9 35	66	34
10	...	...	62	...	12	03	...	...	...	20·6	...	12 27	...	...	...	...
...	125	95	...	03	...	...	10 43	...	5 37	...	3 15	...	+ 7	9 38	60	...
30	...	...	55	...	05	01	...	...	...	...	...	12 30	...	...	...	...
...	*140	58	...	10	...	...	10 0	6 0	...	◑	3 45	...	...	9 45	55	35
82	...	...	70	...	24	07	...	...	...	21·6	...	12 32	...	...	...	...
...	63	8	...	30	...	...	10 15	...	6 23	...	4 17	...	+ 17	9 54	51	...
55	...	...	21	...	29	11	...	...	...	...	...	12 35	...	...	...	...
...	°0	45	...	17	...	...	10 23	6 45	...	...	4 52	...	...	10 7	48	36
45	...	...	30	...	20	05	...	...	...	22·6	...	12 31	...	...	...	...
...	47	68	...	18	...	...	11 17	...	7 6	...	5 23	...	+ 10	10 17	46	...
21	...	...	05	...	...	...	...	...	...	...	...	12 29	...	...	...	...
...	...	...	...	...	...	...	...	...	...	23·6	...	...	...	...	...	...
477	1156	943	8·58	2·47	2·35	0·80	139 41	29 47	32 47	....	80 0 +120 0 =200 0	186 41	+ 36 — 9	137 19	1060	
32	83	67	0·57	0·16	0·17	0·06	9 59	4 15	4 41	.. .	14 17	12 27	+ 9 — 3	9 49	75·71	
1729	2816	2415	22·35	8·56	8·07	3·46	594 56	193 26	296 50	...	816 16	707 42	+178 —164	589 53	4071	
30	49	42	0·39	0·15	0·14	0·06	10 26	6 55	10 14	....	14 19	12 25	+ 14 — 10	10 21	71·42	

§ Moon's last quarter (Quebec) June 1st, from 7h. 53m. a.m.

‖ Maximum diurnal inequality in low water levels observed = 0·30 ft.

APPENDIX No. 14.

REPORT ON WATER LEVELS, RIVER ST. LAWRENCE, BETWEEN QUEBEC, MONTREAL AND LACHINE, BY R. STECKEL, CIVIL ENGINEER, 24TH NOVEMBER, 1891.

EXTRACT FROM A REPORT

DATED 10TH OCTOBER, 1887, ON

FLUCTUATIONS IN THE LEVEL OF LAKE CHAMPLAIN

AND AVERAGE

HEIGHT OF ITS SURFACE ABOVE THE SEA,

BY

ASSISTANT C. A. SCHOTT,

of the United States Coast and Geodetic Survey.

EXTRACT FROM A REPORT

DATED 10th OCTOBER, 1887, ON

FLUCTUATIONS IN THE LEVEL OF LAKE CHAMPLAIN

AND AVERAGE

HEIGHT OF ITS SURFACE ABOVE THE SEA,

BY

ASSISTANT C. A. SCHOTT,

of the United States Coast and Geodetic Survey.

* * * * * * * *

THE ABSOLUTE HEIGHT OF THE LAKE ABOVE THE OCEAN.

The absolute height of Lake Champlain when in an average state, as measured by the water gauge at Fort Montgomery between 1871 and 1882, may now be closely approximated. The following data are available for this purpose. Bench mark on grist mill at Greenbush, opposite Albany, N.Y., above half tide or average level of the ocean 4·489 m. or 14·73 ft.

This result depends on tidal observations in New York harbor, made by the Coast Survey at Governor's Island, between 1852 and 1879 inclusive (comprising therefore one and a half revolutions of the moon's nodes), and on spirit levelling along the eastern side of the Hudson River by J. B. Vose in 1857-8* and resumed by O. H. Tittman in 1887.

This same bench mark was the starting point (level) for the determination of the heights of the great lakes.—Prof. Paper's C. of Eng. No. 24, p. 608.

In 1882, Asst. Tittman resumed the levelling operations for the connection of Albany with the lake; the line started from Albany at lock No. 1 of the Erie Canal, the height of which he had determined in 1877, viz.; mitre sill at south-east gate of lock above mean sea level, 1·873 m. or 6·145 ft. He then followed the tow-path of the Champlain Canal to Whitehall, N.Y., and thence carried the line along the track of the Deleware and Hudson Canal Co.'s R. R., as far as Putnam Station. There a water gauge and mark was established and connected with others placed at Port Henry, Plattsburg, Burlington and Rouse's Point. He makes bench mark No. 40, cut in the R. R. culvet at Putnam, to be 32·536 m. above bench mark at lock No. 1, the absolute height of No. 40 is therefore 30·663 m. and the zero of his water gauge 30·048 m., the latter being 0·615 m. below this mark. Simultaneous observations were made by means of these gauges of the stage of the lake surface for 15 consecutive days, 4th to 19th November, at the hours 8 a.m., noon and 5 p.m.

The zero of each gauge was referred to a permanent bench-mark established near it. These gauges were each 4 ft. long and graduated from top downward.

We have: mean water level, 4th to 18th November, 1882, corresponds to reading 0·995 m. on the Putnam gauge, this mean level therefore is 29·053 m. above the ocean and corresponds to the reading 0·843 m. of the Rouse's Point gauge.

*The zero of gauge at Governor's Island was transferred to mark on Hudson River, foot of 18th street, New York City, by water level.

This places the zero of the Rouse's Point gauge 29·896 m. above the ocean, and since the *Rouse's Point bench-mark* on Chapman's block, north side, is 3·649 m. above it, the latter is 33·545 m. or 110·06 feet above *the mean sea level*. This mark has been proposed for an international bench-mark for the connection of the American and Canadian spirit levels in this region.

According to Asst. Tittman, the Chapman block bench-mark is 1·350 m. above the level of the heel of loophole of Bastion A, Fort Montgomery which is also known as the hydrographic bench-mark of the fort, and this hydrographic mark is 2·925 m. above the U.S. Engineer's bench-mark which is the level of base course of scarp wall of bastion *B ; the latter is therefore 29·270 m. above the mean sea level.

The zero of the Engineer's water gauge being one and a half foot below this mark and the average readings of the water level between 1871 and 1882 (*vide* preceding table) being 2·64 feet, we have, finally, the height of the average lake level above the mean sea level 29·618 m. or 97·17 ft.

Pending spirit levelling between the Putnam and the Rouse's Point marks and further observations of the lake level for a series of years, this result may be accepted as a close approximation to the true value. I estimate its probable error or uncertainty at about 0.3 feet (exclusive of uncertainty due to secular change.)

We can now also determine the height above the ocean (meantide) of the level of reference adopted on the Coast Survey charts of the lake ; this level has reference to a gauge and mark at Plattsburg, and computation shows that the chart plan very nearly corresponded to the zero of the Engineers' gauge at Fort Montgomery (was about 0·02 m. above it) ; this plan of references consequently is very nearly 28·93 or 94·6 ft. above the mean level of the Atlantic, and is also 0·78 m. or 2·56 ft. below the average level of the lake, period 1871 1882. * * * *

B. M. AT ROUSE'S POINT, N.Y., O. H. TITTMAN, 1882.

The water gauge was nailed against the dock opposite Chapman's block at Rouse's Point. The bench-mark is a cross and circle ⊕ cut with a chisel into the stone water sill of Chapman's block on the north side of the building and about 15 ft. from the north-east corner, as shown on the sketch sent with the extract. This B. M. was connected with the hydrographic bench-mark at Fort Montgomery. The hydrographic bench is the heel of the loop-hole of Bastion A. The B. M. at Rouse's Point is 3·6487 m. above zero of gauge.

FORT MONTGOMERY.

The zero of water levels at Fort Montgomery is $1\frac{5}{10}$ ft. below top of base course of scarp wall, at the left re-entrant angle of Bastion B., at the outer end of the lake postern.

*This same level is designated by Assistant Tittman "water sill level at the fort."

APPENDIX No. 15.

REPORT OF WATER LEVELS, RIVER ST. LAWRENCE, BETWEEN QUEBEC, MONTREAL AND LACHINE, BY R. SEECKEL, CIVIL ENGINEER, 24TH NOVEMBER, 1881.

PROGRESS REPORT,

R. STECKEL

TO

CHIEF ENGINEER OF PUBLIC WORKS,

9TH DECEMBER, 1886,

ON PRECISION LEVELLING CARRIED OUT IN 1885-86, WITH A VIEW OF ESTABLISHING THE HEIGHTS OF THE FINISHED COPINGS OF THE GRAVING DOCK AT ST. JOSEPH DE LÉVIS AND THE LOUISE EMBANKMENT, AT QUEBEC, ABOVE THE ZERO OF THE ORIGINAL STANDARD TIDE-GAUGE PUT UP BY THE QUEBEC HARBOUR COMMISSIONERS AT POINTE À CARCY.

GEODETIC LEVELLING, RIVER ST. LAWRENCE.

PROGRESS REPORT.

DEPARTMENT OF PUBLIC WORKS,
OTTAWA, 9th December, 1886.

H. F. PERLEY, Esq., Chief Engineer.

SIR,—To comply with instructions received from you, I now beg to submit the fol lowing progress report on the geodetic levelling which has been carried on under my charge since 1885, referring more particularly to the operations performed with a view of establishing the actual heights of the finished copings of the Lévis Graving Dock and Louise Embankment at Quebec, above the 0 of the original standard gauge of the Quebec Harbour Commissioners.

The gauge here referred to is that put up by Mr. Simmons, a former engineer of the Quebec Harbour Commissioners, on the south side of their Pointe à Carcy wharf, several years previous to the letting of the extensive harbour works now in course of construction at Quebec and Lévis.

The correct determination of the relative elevation of the points mentioned, obviously involved the connecting of a series of levels taken on the north shore, with another series run along the south shore of the St. Lawrence, which river is from $\frac{3}{4}$ to 1 mile wide opposite the City of Quebec. This connection could be effected: 1° By measuring simultaneously, on a calm day, the heights of at least two fixed points directly opposite each other on the river shore, above the water surface while quite smooth and in a perfect state of equilibrium, say at high or low tide, or about the time of slack water, or else: 2° by sighting in very clear weather the whole way across the river to targets put up on firm ground at suitable places near high water mark; care being taken to place the instrument sufficiently high over the water for the line of collimation to clear the densest of the vapors which continually emanate therefrom, and further, to make the pointings only when the portion of the atmosphere traversed, would be quite free of smoke from steamboat or factory chimneys or other sources.

These modes of carrying the levels across the comparatively wide estuary of the St. Lawrence, it is easily seen, are both attended with difficulties and each has its drawbacks. Having but one geodetic level at my disposal in 1885, I concluded, that all things considered, it would be best to take advantage of the complete covering of the river surface in winter, by a crust of ice several feet thick, over which, though it be incessantly rising or falling with the tide, the levels can be satisfactorily carried from shore to shore in one sight; there being in such case no vapors to interfere with the free passage of the luminous rays through the atmosphere, necessitating objectionable corrections for excessive refraction, etc.

Moreover, in order to reduce the chances of making errors of pointing, etc., to a minimum, I further decided, with your approval, to effect the crossing on the contracted part of the St. Lawrence tide-way between the mouth of the Chaudière River and Cap Rouge, some seven miles west of the River St. Charles, where the distance between the high water marks on opposite shores is less than one-half mile, and where the winter road kept open every year across the ice, affords an easy and rapid means of communication from one shore to the other.

This course necessitated the levelling of seven miles on the north shore down to the Louise Dock, in a direction nearly parallel to that of the projected continuous line to be run on the south shore of the St. Lawrence.

During the last days of March, 1885, I made several attempts to level westward along the north shore from a bench-mark (B) made at the base of the cliff, near Chamber's Cove, above Victoria Cove, to another bench (A) made on the rock, near the point selected for sighting across the ice, to the foot of Basile's Hill. Owing, however, to persistent unfavourable weather for nearly a whole week, and the time at my disposal for this work being unavoidably limited, I had to leave Quebec after having succeeded in completing, on the 3rd April, only one set of observations, viz., that from the north to the south side of the tide-way.

The atmosphere was quite clear and calm, while the observations just referred to, were made, and the distance from level on north shore to rod on south shore was measured twice on the ice with a correct tape line ; being found to be 2,852 ft.

As to refraction, I adopted the value of the coefficient n given by the celebrated Russian astronomer Strüve, for valleys, viz., 0·085 ft. instead of that used for general geodetic levelling purposes (0·0625 ft.), so that the correction applied for curvature and refraction to the reading across the river was calculated by the formula :—

$n = \frac{d^2}{2r}(1 - 0{\cdot}17) = \frac{{\cdot}83d^2}{41{\cdot}794{\cdot}000} = 0{\cdot}000{\cdot}000{\cdot}020\ d^2$ instead of $0{\cdot}000{\cdot}000{\cdot}021\ d^2$ in feet, where r denotes the radius of the great circle of the earth in the plane in which the observations are made, and d the distance, level to rod in feet.

The results of the computations made in connection with the winter operations of 1885, went to show that the coping of the Louise embankment stands 24·038 ft. above the 0 of the Quebec Harbour Commissioners' old gauge, south side of Pointe à Carcy wharf and the coping of the Graving Dock, Lévis, with top at a mean height of 24·14 ft. above the same zero, or say 0·1 ft. higher than that at Quebec.

Now, besides the heights of the bench-marks, copings, gauges, etc.; the elevations of the high and low water surfaces of some flowing and ebbing tides had also been established in 1885 at several points on both sides of the estuary, from the Lévis Graving Dock westward up to Basile's Hill.

Upon examining the geometrical loci of the summits and troughs of the fluvial tide waves thus determined, I found that all these curves pointed to the existence of a greater rise in the stream at high and low tide going from the Quebec Harbour Commissioners' Pointe à Carcy wharf to the Graving Dock at St. Joseph de Lévis, than that which was shown to have taken place from Victoria Cove, opposite the narrow gorge through which the outflowing streams of tide and drainage water rushes with great force, to the said wharf at Pointe à Carcy. I was aware, of course, that being unprovided with special boxed-in gauging apparatuses with pointers and verniers, and owing to the swells raised by steamships and other craft, etc., it could not be expected that the observed elevations of the water surface would be absolutely correct, still, as a rise however small in the water level in the locality referred to, could not well be accounted for, I became apprehensive, lest the connection of the regular permanent bench-mark (LXV.) on the south shore, near high water mark, with the turning point established here on solid ground for use in levelling across the river, was imperfectly made, on account of the operations having had to be done on soft snow and ice across a gully or bay wherein the tide might have been at work unnoticed.

Under the circumstances I considered it prudent to suggest, as you are aware, the desirability of checking the results of the winter crossing by means of simultaneous observations from both shores, with two good instruments placed as nearly as practicable, so that their lines of collimation would traverse the same strata of air, when sighting across the water. With your sanction, a second geodetic or precision level was ordered from Messrs. Fauth & Co., and in July last the levels were successfully crossed over the St. Lawrence at two points, viz., at Basile's Hill and at the Queen's wharf, opposite Quebec city.

The close agreement of the results afforded by these crossings in connection with the land levelling leaves now no room for doubting the accuracy of both the field operations and office computations performed ; the figures will prove more convincing than any words I might venture to add in their support.

In the annexed abstracts of results the elevations are all referred to the approximate mean level of the Atlantic Ocean, as determined by me at Quebec in 1882, taking as a basis the tidal observations made at this port under my directions in 1876, 1880 and 1881, this datum* is 9·76 ft. below the mean tide level adopted by the Royal Engineers in 1864 for their contoured plan of Quebec and environs.

It may not be out of place to bring to your notice, in this connection, the propriety of having put up in a permanent manner at least one self-registering tide gauge, of approved construction, on the Atlantic coast, and another on the Pacific coast, with the main object in view of making accurate determinations of the mean level of the sea in Canadian waters. The cost of attending regularly to these gauges, if properly located, would be comparatively small.

There are at present in the United States four permanent tide stations, viz., two on the Atlantic and two on the Pacific coast, besides many temporary ones where self-registering apparatus are used.

Pending the establishment of similar stations on Canadian territory, our system of geodetic levels should be connected with that of the United States C. and G. Survey, at one or more convenient points, in which case the mean sea level as deduced from the tidal observations made at the North Haven station in Maine, or the Sandy Hook, N.Y., station, could be adopted as a plane of reference in lieu of the approximate sea level now used temporarily as the best available rational datum. By referring to the abstracts appended hereto, it will be seen that the land operations performed between the Louise embankment at Quebec and the Lévis Graving Dock afford the following results when taken in connection with the crossing made in July, 1886, at the contracted part of the river, opposite Basile's Hill, viz. :—

	Elevation above * datum.	Elevation above 0 of Q. H. C. gauge, south side Pointe à Carcy wharf.
	Feet.	Feet.
1. Top of coping Louise embankment, near junction with timber breakwater	26 0177	24·038
2. 0 of Quebec Harbour Commissioners gauge, north side of Pointe à Carcy wharf	8·0585	10·038
3. Lower stone step of rear entrance to Quebec Custom House, found in 1877·78 to be 22·73 ft. above 0 of south side gauge	24·6531	22·674
4. Coping of Graving Dock, Lévis, mean between elevations of north and south ends	25·8357	23·856
5. 0 of gauge at Graving Dock, 11th Oct., 1885	0·6389	1·341
6. Nail driven by Kinipie & Morris into elm tree on north-east side of dock, 1875	24·7161	22·737
Fluvial tide wave, 12th October, 1885.		
1. Summit of high water, 9 a.m.—		
(a.) At Graving Dock, Lévis	15·779	
(b.) At Quebec Harbour Commissioners' gauge, south side Pointe à Carcy wharf	15·929	
(c.) Rocketts upper wharf, Victoria Cove	15·848	
2. Bottom of trough at dead low water, about 4.20 p.m.—		
(a.) At Graving Dock	2·289	
(b.) Pointe à Carcy	2·404	
(c.) Victoria Cove	2·248	
3. Summit at Harbour Works, about 9.05 p.m.—		
(a.) At Graving Dock	17·589	
(b.) At Pointe à Carcy	17·704	
(c.) Victoria Cove	17·348	

* The datum plane here referred to is 2 ft. below that subsequently adopted for reasons set forth at length in Note A, Appendix No. 21 to this Report.

These elevations of the high and low water levels of the incoming and outgoing tide waves, indicate that at these extreme stages of the river, there was a rise of from 0·08 ft. to 0·36 ft. in the surface from Victoria Cove to Pointe à Carcy and thence to the Graving Dock, a fall instead of a rise as per winter crossing.

The following are the mean and probable errors by which the results of the 18·53 miles of land levelling performed between the Louise embankment and the Graving Dock, are effected as found by actual computation, viz. :—

	Feet.
1. Mean error for whole distance	0·0373
2. Probable error for whole distance	0·0252
3. Mean error per mile	0·0086
4. Probable error per mile	0·0058

It will be seen by referring to pages 5½, 6, 16 and 17 of the Appendix, that by applying in all the computations the usual corrections for curvature, refraction and irregularity of collars, instead of assuming that the corrections required for the back-sights are exactly compensated for by those of the fore-sight, or *vice versa*, which is truly the case for simultaneous observations made in opposite directions at equal altitudes the difference which obtains is for the upper crossing at Basile's Hill but 0·0019 feet and for the lower crossing at Queen's Wharf only 0·0037 feet.

I may here remark that after the river crossing were completed, the irregularities of the collars as well as the mean value of a division of the micrometer head, were carefully determined for the new level (No. 2) and found to correspond respectively to 0·014 micrometer division and 2·22 seconds, the inequality of the collars was also tested anew for level No. 1 and found to correspond to + 1·1 micrometer division.

By crossing directly from B. M on the Queen's store on Champlain St., Quebec, to B. M. at the foot of Couture's Hill, Lévis, and proceeding to the Graving Dock the mean elevation of the coping of the latter is found to be 25·8365 ft. ; or only 0·0008 ft. greater than that obtained by connecting B. M. with the crossing at Basile's Hill along the north shore and coming down on the south shore to the dock.

Moreover, the maximum variation of the difference of level between the outside plates on the opposite shores derived from a single set of corrected observations, from the mean results of the four sets with corrections omitted is 0·0342 ft. for the upper or Basile's Hill crossing and 0·0497 ft. for the lower or Queen's wharf crossing (see pages 5½, 6, 16 and 17, Appendix).

In the short season of 1885, August to October, besides connecting the Basile's Hill crossing with the Louise embankment, Quebec, the proposed continuous line of levellings along the St. Lawrence was run on the south shore from the Lévis Graving Dock up to Pointe Platon; section No. 5 being levelled going eastward from St. Antoine to St. Joseph de Lévis, and 12 miles of section No. 6 run from St. Antoine westwardly. The total distance levelled over in 1885 was 51·35 miles, the computations have all been performed for this distance, and the season's work proven to come up to the generally accepted standard of accuracy.

In 1886, the gaps which remained in the continuous line between Pointe Platon and La Baie have been filled in by the completion of two and a-half intermediate sections, viz. : the upper half of section No. 6 westwardly from Pointe Platon to St. Jean des Chaillons, section No. 7 westwardly from Bécancour to La Baie du Fèbvre and section No. 8 eastwardly from Bécancour to St. Jean des Chaillons, so that the continuous levelling on the south shore is now completed up to a point about 4 miles west of Sorel.

In addition to the observations just referred to, levels have also been taken from Chambly to Longueuil, on the post road, with a view of connecting the system along the Richelieu with that proposed to be carried out along the St. Lawrence, for verification purposes.

The total distance levelled over, July to November, 1886, is about 80 miles ; besides the levelling operations that have been performed, the elevations of the river surfaces at various stages have also been observed at several places and recorded.

The office computations required in connection with the field work done in 1886 are now being proceeded with in the usual manner.

I have the honour to be, sir,

Your obedient servant,

(Signed) R. STECKEL.

APPENDIX No. 16.

REPORT ON WATER LEVELS, RIVER ST. LAWRENCE, BETWEEN QUEBEC, MONTREAL AND LACHINE, BY R. STECKEL, CIVIL ENGINEER, 24TH NOVEMBER, 1891.

ACCOUNTS

SHOWING THE

GREAT DAMAGE DONE TO SHIPPING

AND OTHER PROPERTY IN THE

MARITIME PORTION OF THE ST. LAWRENCE

BY

HIGH SPRING TIDES

DRIVEN UP THE ESTUARY BY NORTH-EASTERLY STORMS IN 1873 AND 1884.

From the Quebec Morning Chronicle of 31*st March*, 1873, *and 5th and 6th November*, 1884.

QUEBEC, 31st March, 1873.

HIGH TIDES.

Yesterday morning under the influence of the spring tides, the river rose to an extraordinary height, overflowing the wharves and flooding the cellars of the houses in the lower portion of the city.

The ice was lifted above the level of the wharves and 8 inches of water covered the Finlay market. In St. Paul street and St. Roch's the effect of the tide was severely felt by residents whose cellars have become wells.

Some idea of the height of the tide and the extent of the overflow may be formed when we state: that the cellars of Messrs. Lemesurier & Brouard, St. Joseph street, corner of Grant, are three feet deep in water.

The ice bridge was somewhat shaken by the combined influence of the tide and the high wind of the previous night and a large portion of it carried away, between the Island and Indian Point.

We understand that a considerable amount of damage has been done on the south shore.

FATHER POINT, 5th November, 1884.

A fearful snow and wind storm from the east has been raging since midnight yesterday all along the coast. The wind averages 70 miles per hour, the sea is tremendous and has crossed the highways and inundated the fields of all parishes along the coast here. The lighthouse and telegraph office is now completely surrounded by the raging waves and the roads are all undermined.

The watch-house, etc., here, and several buildings near here and at Rimouski have been carried away, besides fences, &c. Great numbers of people have vacated the buildings at Rimouski, and much uneasiness is felt for to-night's tide if the storm does not go down. The Intercolonial Ry. track and roadway is washed away between Rimouski and Bic. No lives are lost so far as is known yet.

8.50 p.m.—The signal and telegraph offices have now been abandoned, the station men having to take to the boats.

The greatest storm that has ever visited this vicinity for 40 years is now playing havoc with everything.

RIMOUSKI, 5th November, 1884.

The high water swollen by a north-east gale, has worked terrible havoc in this town this afternoon.

Many houses, barns, stables and wharves are damaged and driven to the sea with their contents. Damages about $25,000.

The spring tides, which are usually very high at this season of the year, visited this place last night and to-day, and helped by a raging snow storm and high north-east wind have swollen tremendously and the sea which is now running is the heaviest that has visited this city for years. The whole town of Rimouski is inundated and forms a part of the sea itself. A large number of houses, barns and stables, as also various wharves, about 15 to 18 in number, have been carried away with their contents. So far as heard, no lives have been lost. Part of the I.C.R. track is inundated and trains are retarded. People are leaving their houses in boats. The cattle have been turned loose and have taken to the interior of the country. Several stores where goods were placed have become almost worthless. Further fears are entertained for the next high tide. The loss so far is estimated at between $25,000 to$30,000.

RIVIÈRE DU LOUP (EN BAS), 5th November, 1884.

There has been a snow storm raging here since last night and it still continues with heavy winds from the north-east. The sea is sweeping over the wharf and has carried off a lot of lumber there was on it. It also has swept away the store where the telegraph office was. The kitchen of a house belonging to L. T. Pinze, freight agent, at the wharf, and the main part of the building, is not expected to stand another tide.

There was also a heavy washout on the I. C. R., some three miles out of Bic, this evening, extending 100 ft. long by 15 to 20 ft. deep. Trains are unable to transfer to-night.

QUEBEC, 7th November, 1884.

THE GREAT STORM.

The great storm of the last few days appears to have now entirely passed away from the Lower St. Lawrence, but not without leaving death and destruction in its path.

In the immediate vicinity of the city, the disasters arising from the storm have been chiefly confined to the damage and loss of property.

In the city, the principal sufferers are the merchants of the Lower Town whose stores face the river front. Both yesterday morning and the previous night, the high tides, increased by the violence of the easterly gales, raised the water of the river several feet higher than during the high tides of the last year. In fact, it is generally conceded that such high tides have not been seen here for half a century previously. Dalhousie street was so much flooded that the traffic was carried on by skiffs, and for a time passengers were taken on and off the ferry steamers in small boats, at a cost of ten cents each. Subsequently the ferry service had to be suspended for the space of a couple of hours, owing to the impossibility af landing passengers at all upon either side of the river.

In some places the water came up to Peter street. Champlain and Finlay market-places were both below water, and all the warehouses in the immediate vicinity were more or less flooded.

In the basement of the large new store of Messrs. Thibaudeau Bros. & Co., the water was three or four feet deep, and several bales of cotton and other goods were somewhat seriously damaged. The same thing occurred, though to a less extent, at the warehouse of Messrs. Hamel & Co.

In some of the grocery stores near the river the brooms and other articles were floating around in the water.

The largest sufferers were probably the flour and fish dealers, their stores for the most part, being nearer the river than any others. Messrs. Archer, Leduc & Co. and Nazaire Turcotte suffered in this manner, the largest sufferers in Dalhousie street being probably Mr. Carrier, who had a quantity of flour in bags damaged. Messrs. Renaud & Co. and other merchants having stores on St. Paul and St. Andrew streets, suffered in a similar manner. The river washed over all the wharves both on Dalhousie and St. Andrew streets. A quantity of cordwood was swept away, and some forty barrels of herrings had disappeared from Convey's wharf when the tide subsided.

At Lévis, a number of stores near the river were similarly flooded, and a quantity of property was swept from the wharves. A portion of the new Intercolonial Railway track was also submerged and some damage to it, is reported.

The St. Charles River overflowed its banks very considerably, flooding not only the village of Hedleyville, but also some of the low streets of St. Roch's.

CAP ROUGE, 6th November, 1884.

The steamer "Champion," with five schooners in tow bound for Quebec, put in here for shelter last night. One of her tow was cast adrift from her anchorage. The steamers "Etoile" and "St. Louis," both market steamers, with about 200 passengers on board, had also to seek shelter here, as a most violent hurricane was blowing. The tide rose about four feet above the usual spring tide mark, accompanied by a mild cyclone and snow storm, which lashed the waves into fury. Part of the village was inundated while the tide remained, but afterwards receded. Damage light. Two feet of snow this morning. Sleighing is excellent and the weather cold.

SOUTH QUEBEC, 6th November, 1884.

The high tides of last night surpassed those of last spring by two feet. It will be remembered that heavy losses were incurred last spring at this point, but they served as a warning, and the Grand Trunk built their sheds much further back. They, therefore, escaped a repetition of previous disasters.

APPENDIX No. 17.

REPORT ON WATER LEVELS, RIVER ST. LAWRENCE, BETWEEN QUEBEC, MONTREAL AND LACHINE BY R. STECKEL, CIVIL ENGINEER, 24TH NOVEMBER, 1891.

THE ACCOUNT

OF A GRADUAL BREAKING UP AND MOVING OFF OF AN UNUSUALLY THICK AND SOLID ICE BRIDGE, MAY 8 AND 9, 1836, IN QUEBEC HARBOUR WITHOUT CAUSING ANY DAMAGE.

(*From the Quebec "Mercury" of 5th and 10th May, 1836.*)

QUEBEC, Thursday, 5th May, 1836.

The ice bridge still stands firm in all its ample dimensions, having resisted the high tides and easterly gales of Monday and Tuesday yesterday it was crossed with heavy loads. The master carpenter of the Royal Engineers, had the curiosity to bore the ice in several spots, and ascertained its depth by means of a long pole with a crow foot projecting at a right angle from the lower end which, catching in the under surface of the ice, as it was drawn back, enabled him accurately to ascertain, the thickness.

The result of the experiment showed, near the lower town market, 18 feet thickness; at a distance further from the shore, 17 feet, and still further out on the spot, where the hut was erected, the same depth.

Two feet of the lower surface, in all these soundings, was found to be soft, and offered but very little resistance to the gauging hook; proving, that notwithstanding the low temperature of the water, the under tow has been considerable, as also the action of current, in destroying the accumulated masses of ice which have this year formed the ice bridge. From the usual thickness of the ice and coldness of the water flowing from the upper portion of the river, this operation cannot proceed rapidly, and we fear that another week may elapse before the channel is open.

QUEBEC, Tuesday, 10th May, 1836.

The ice bridge has at length almost entirely disappeared, though large masses still adhere to the shore, and will probably, not entirely be got rid of till the spring tides renew.

Notwithstanding the ice had moved so much as completely to break the road, numerous foot passengers came across on Saturday, and some were seen traversing the broken and pathless plain as late as sunset; by the frequent changes they were observed to make in their line of march, it was clear they met with difficulties if not with danger. No accident, however, is known to have occurred, nor has the breaking up of the ice, formidable as was its thickness, been attended by any mischief to quays, wharves, etc. The ice bridge at the Chaudière gave way with the high tide, about noon on Sunday, but the ice on the battures still remained. A steamboat from Montreal may probably arrive to-morrow, but is expected certainly on Thursday. Boats from Three Rivers and above have this day arrived with fresh fish, the first evidence of the navigation being actually open. The ice in the channel between the Island of Orleans and north shore gave way last night.

APPENDIX No. 18.

REPORT ON WATER LEVELS, RIVER ST. LAWRENCE, BETWEEN QUEBEC, MONTREAL AND LACHINE BY R. STECKEL, CIVIL ENGINEER, 24TH NOVEMBER, 1891.

ACCOUNTS

OF THE

DISASTROUS BREAKING UP

AND MOVING AWAY OF THE

HEAVY ICE BRIDGE IN QUEBEC HARBOUR

29th MAY, 1874.

From the Quebec "Morning Chronicle" of the same date, and "Le Canadien" of 11th May, 1874.

FROM THE "MORNING CHRONICLE," QUEBEC, 9TH MAY, 1874.

BREAKING UP OF ICE BRIDGE.

At twenty-five minutes past three o'clock yesterday the ice bridge concluded to leave and moved off accordingly in a very majestic manner with the tide. The steamers "Rescue" and "Prince Edward," both belonging to the St. Lawrence Tow Boat Company, had been working since Wednesday in trying to clear a channel across the river, and but a small strip of ice, not wider than the length of the "Rescue," remained to be cut through, when further efforts to separate the floating mass became unnecessary as it commenced to move off. The "Prince Edward" at once made the best of her way to the wharf at Lévis, where she took shelter below it; the "Rescue" also managed to get clear of the field of drifting ice, by putting on steam and making directly for Indian Cove.

As soon as it become known that the ice was on the move, the crowds that had been watching the steamers all day from Durham Terrace and from the wharves, received a vast accession to their number. The good folks in the Lower Town, where business has been at a stand-still on account of the unusual delay in the opening of navigation, became wild with excitement and everywhere people might have been seen talking the matter over excitedly, or taking gigantic strides riverward to feast their eyes on the long wished for sight.

Picking up our hats and becoming suddenly oblivious to the importunities of our devil for copy or complimentary tickets to see the Black Crook or something, we rush frantically down to the river and presently find ourselves on the wharf in the very midst of an enthusiastic multitude.

And surely enough, there the whole field of ice extending from shore to shore, and reaching away up and down the river as far as the eye could see, is moving off steadily and with irresistible power. The peculiar noise caused by the grinding action of the different pieces upon each other becomes louder and louder as the jam becomes greater; but nothing stops the drifting mass and very soon the blue open water appears in the direction of New Liverpool, and an hour afterwards, the last of the ice halts with the turning tide before the Citadel. But the satisfaction felt at the raising of the ice blockade and the opening of navigation, is damped by the record of the wholesale disasters to shipping which has taken place. Such a destruction of property caused by the moving ice in the vicinity of the harbour is, we believe, quite unparalleled.

The scene of the havoc is at Blais Booms, and a visit to the place at once convinced us that the most disheartening rumours that had reached us were not exaggerated. Ocean steamers, propellers, river craft, tugs, side-wheel steamboats, and all, manner of vessels are either damaged, sunk, capsized, or broken up.

The fine iron sea-going steamer, the Napoleon III, is a complete wreck; one of her sides is jammed against the corner of the pier at which she was moored and stove in, and the others have been completely smashed by the ice. Her deck is lifted up, and the coal bunkers, which are full, are moved upwards through it; the bulwark and railing on the port side, the side smashed by the ice, has fallen outwards, and the engine house is a complete wreck. She is the property of the Dominion Government.

Below the wreck of the Napoleon III., lies a sunken propeller over which the ice has piled up to a great height, her upper works and broken funnel being alone visible at high tide.

The *Druid*, another Government steamer, also of iron, is considerably injured, and lies over on her side. The steamboat Castor, is sunk and a complete wreck. The steamer Georgia, belonging to the Gulf Ports Company, is also sunk, having had her side crushed in by the ice. The steamboat Rescue, belonging to Mr. Dinning, has, like the two last, gone to the bottom, and is partly broken up. The steamboat Hector is much injured and was not expected to float through the night. The St. Lawrence Tow-Boat Company's tug, the Napoleon, is also broken up. Several vessels, including the Mersey, Shannon, the Norwegian ship Harold Haarfager, and others laying at Dinning's, were

either carried away or more or less damaged. The steamer Miramichi, has suffered considerably.

Among the steamboats which have been more or less damaged are the Canada, Secret, Providence, Conqueror, and Bellechase, and several schooners, one of which, the Hermine had taken in a cargo. There are many other craft lying further up which have also suffered, and some other damage, such as carrying away booms, etc., has been done. It is impossible to make any approximative estimate of the value of the property destroyed, but it will considerably exceed a million of dollars.

The Gulf Ports Company are insured, but the loss will fall heavily on the owners of the steamboats, and other river craft.

In 1836, the ice bridge moved off on the 8th May as it did this year. The Rescue returned last night and will commence running to-day on the ferry to the Grand Trunk station at Lévis. Capt. Moore deserves great credit for the manner in which he handled her during the time she was engaged in breaking up the ice bridge. The Prince Edward will also commence her regular trips as ferry boat to-day.

"LE CANADIEN," QUEBEC, MONDAY, 11TH MAY, 1874.

THE ICE SHOVING AND ITS GREAT DISASTERS.

The ice bridge which generally leaves the river in a very quiet way, has moved away this year, in causing disaster valued at many thousand dollars. These damages, it is said, are due to the unusual thickness and soundness of the ice.

Friday, 8th May, day of the shoving, the steamers "Prince Edward" and "Rescue," were working, as previously, to break through the ice, at about the middle of the river, so to cause a channel to be formed from shore to shore, when at 3.20 p.m., the bridge losing its hold at the "Key" commenced to move down.

The "Prince Edward" had reached her wharf some time before, but the "Rescue" was taken amidst the floating mass, and carried down by it. She succeeded to get out of her serious position somewhere at a little distance from the Island of Orleans and steamed to Indian Cove. Mr. Wagner and his men, are said, to have also contributed to accelerate the departure of the ice by their sawing through at many places.

But the ice bridge, offended, if we may say so, at being torn to pieces by the steamers and sawers, and driven away when it was not yet ready to leave us, took vengeance during its shoving, and indeed it was only with too much success.

In Blais' Booms, at Cap Blanc, had wintered a hundred vessels of all kinds and sizes; steamers, barques, schooners, boats, &c. All were near one another. The ice took a direction towards these booms with a dreadful strength and rapidity, jamming all these vessels one upon one another, some of which were crushed, upset and sunk.

The beautiful iron steamer, the "Napoleon III," belonging to the Government, which was in the first row, was pushed against the angle of a pier to which it was moored, crushed and nearly cut in two. She is full of water. Her engine was broken. The "Druid," another government iron steamer was slightly damaged.

The "Georgia" of the Gulf Steamers Company had one of her sides broken through and sank. She is split open from stern to stern, and has holes of some twelve feet in her hull.

The "Castor" crushed and sunk.

The "Rescue," "Canada," "Beaver" of the Royal, have also been crushed and sank

The "Rival" is greatly damaged as well as the "Shannon," and the "Conqueror," the "Miramichi," "Secret," "Providence," "Bellechasse," and the "Hector" were also more or less damaged.

The Norwegian ship "Harold Haarfager" and others which were moored at Dinning's wharf have been carried away, and more or less damaged.

Many schooners have also suffered ; two of these had already been loaded with provisions for Gaspé, they were torn to pieces and they sank. They were owned by Captains Berthelot and Kennedy.

Piers and portions of wharf have been torn away. Nothing resisted to the ice where it struck. At many places ice is piled in large-sized cakes and covers partly the vessels which it broke. The Gulf Steamers Company has insurances ; but the loss is very considerable for other owners of steamers, schooners, &c., who had none or very little insurance. Some people estimate the damages at more than half a-million dollars.

APPENDIX No. 19.

REPORT ON WATER LEVELS RIVER ST. LAWRENCE BETWEEN QUEBEC, MONTREAL AND LACHINE, BY R. STECKEL, CIVIL ENGINEER, 24TH NOVEMBER, 1891.

EXTRACTS

FROM

"LA MINERVE" (MONTREAL)

"LE CANADIEN" (QUEBEC)

AND THE

"QUEBEC MORNING CHRONICLE"

RELATIVE

TO THE

DISASTROUS SPRING FLOODS

OF

1861, 1865, 1873,

BETWEEN QUEBEC AND MONTREAL,

Showing the great destruction of property and loss of life caused by them, etc.

"LA MINERVE," MONTREAL, 16TH APRIL, 1861.

FLOOD IN MONTREAL.

Fire.

A quarter of the city is flooded since 7 o'clock, Sunday.

The ice from the lakes is accumulated between Victoria Bridge and Ste. Hélène's Island, and the waters, prevented from passing through their ordinary channel have overflowed. The whole of Griffintown and part of St. Joseph and St. Antoine suburbs are inundated. Distress is at its highest pitch. The authorities, the mayor, Mr. Coursol, superintendent of police, &c., are up since very early yesterday morning; help is distributed to the greatest sufferers. All boats have been put in requisition. The whole of Commissioners street is covered with a depth of water varying from 2 to 3½ feet. The cellars of stores facing the harbour are flooded and the doors of many of the stores have been broken by the ice. The Montreal College, it is said, has been shut. The Grey Nuns have been forced to leave the lower floor of their convent on account of the water. The gas works have suffered so much that it will be impossible to have them working before many days.

The village of Laprairie and the low part of Longueuil village are also under water.

And, as if all the elements had decided our ruin, a sudden fire broke out during the flood and the doleful voice of the tocsin was heard. It was destroying the offices and the vaults of the inspection office for lye; its cause being unknown.

We notify the public that the boatmen are under the immediate direction of the police, and that their services must be given gratitutiously to the sufferers by the flood. The City Council held an extra meeting yesterday morning, and a Relief Committee has been appointed, which at once began to meet the most pressing wants. Losses are estimated now at more than one million dollars, affecting grain as well as other goods of all kinds.

At the moment of going to press, the level of the water tends to a decrease.

"LA MINERVE," MONTREAL, 18TH APRIL, 1861.

THE FLOOD.

The water has decreased to the top of the wharves.

Some streets of Griffintown are yet under water; but if the water goes on decreasing, during night the flood will be over and nothing but its disasters will be seen. We cannot say at this moment the amount of the loss suffered by people in Griffintown, St. Joseph and College streets, &c., and by merchants on St. Paul and Commissioners streets.

We learn that the disasters caused by this flood have been considerable in Laprairie, Longueuil and Boucherville. A large number of cattle were drowned and many houses have been badly damaged by the ice in the villages of Laprairie and Longueuil. We have to regret many serious accidents: A young child has disappeared from his parents' home since Monday, and has not yet been found; a boat containing five persons upset and three of them, Carmichael, his daughter and one Ryan, were drowned; the corpses have not yet been found.

The greatest sufferers will probably be the numerous flour and grain merchants of Commissioners street and those in the neighborhood of St. Ann's Market.

To complete our misfortune, a heavy snow fall, helped by a north-east wind, came over the city in the early part of the night of Tuesday. An idea of the sufferings in Griffintown can be formed when it will be known that the people are living in attics without any fire, exposed to the cold and to all inclemencies of weather. A friend who has visited the place relates that the distress is great. On the spots freed from water the walls of houses are soaked with the same, as well as their floors. Firewood piled in

many places has been carried away by the stream, and difficulties are yet experienced to reach certain portions where the flood still makes terrible ravages.

In some places the streets are impassable, and in some others circulation on foot is made through a depth of two to three feet of water.

"LE CANADIEN," QUEBEC, 12TH APRIL, 1865.

OPENING OF NAVIGATION.

The lower part of the ice covering Lake St. Peter began to shove yesterday afternoon and caused a rise of more than six feet in the level of the river at Three Rivers. Half of that city is under water; damages are heavy. Turcotte's Wharf has been carried away, and Farmer's Hotel, as well as other houses, have been seriously damaged.

At Cap-Rouge, the ice is yet many feet thick.

Opposite Quebec, the ice bridge is still firm, and teams, as well as people on foot are seen crossing over it continuously.

Above Montreal, and on Lake Champlain, navigation is opened and steamers have begun their regular trips.

"LE CANADIEN," QUEBEC, MONDAY, 17TH APRIL, 1865.

GREAT FLOOD—MORE THAN FIFTY LIVES LOST—CATTLE LOST—HOUSES, BARNS, &C., DESTROYED, &C., &C.

The following details are from "l'Echo du Richelieu" and the "Gazette de Sorel."

SOREL, Thursday, noon, 13th April.

Since a few days the water has reached a height which caused fear for the properties situated on the Chanal du Moine and the adjoining islands. Everywhere the fields were submerged and the farmers could get an entrance to their houses only by the use of canoes; the greater number of families had lodged in the garrets of their houses, patiently awaiting there the end of their misfortune; cattle were moved to the lofts of barns, a great part of which had already been destroyed by the flood which was threatening every day and with the first strong wind, to ruin them all. This day, alas! was not long in coming. Yesterday noon a strong wind from the south began to blow with such violence that many persons in the city feared for their buildings. Some sailing boats anchored at the mouth of the Richelieu River began to drift rapidly down the St. Lawrence under the action of the wind, which seemed to spare nothing. These vessels, however, resisted; one of them only, lost her masts, and the tremendous waves would have filled her had it not been for two young men left in charge of her, who succeeded to hold her upon her anchor till relief was given them, which was very opportune. Besides a few other small accidents, more or less serious, such as loss of wood, of sheds, &c., we have no mishap to deplore in our city.

But what was more to fear, were the probable sufferings the people of Ile de Grâce, Ile aux Ours and of the "Chenal du Moine" were exposed to endure during this frightful storm.

In fact, towards 10 o'clock last night news reached the city, by the crew of the propeller "Bell," under Captain Chas. Armstrong, whose devotedness was very great, during the storm ever increasing in impetuosity, that houses and barns on the islands and along the Chenal du Moine were being carried away. Immediately, Mr. Sincennes ordered two vessels of the Richelieu Company to be rigged and to leave for the relief of the inhabitants, some of whom, it was said, had been drowned and some others had lost all their properties. At about midnight, the steamer "Terrebonne" under the command of the experienced Captain Roy, proceeded at full steam to the island. It reached Ile de Grâce, where the "Cygne" had reached during the day, and which had on board a great number of persons having escaped the danger of the storm.

At 2 o'clock this morning, "l'Etoile" under the active Captain Malhiot was steaming towards Chenal du Moine in order to help, if it was yet possible, the unfortunate flooded *habitants* of that district. The "Terrebonne" came back here this morning at 10 o'clock, with a distress flag flying at her stern mast and having on board some forty survivors from Ile de Grâce and Ile aux Ours.

The news brought was of the most alarming nature; all the houses, or nearly so, had been carried away; twenty or twenty-five persons, partly women and children, had found a watery grave. The barns, containing cattle, the houses, &c., of the farmers, were no more to be seen. A few minutes later "l'Etoile" reached here with 150 people or more on board, from the Chenal du Moine. Nothing was more heartrending! their misery was the greatest; scarcely were they clothed! The great number were bareheaded and barefooted.

The city is in the highest state of excitement! the clergy, the city council, His Honour Judge Loranger, Mr. Sincennes, and the leading citizens of Sorel are busily engaged giving a shelter to these poor people. At this moment, the great number are lodged at the City Hall; many are receiving the hospitality of particulars.

The approaches to the wharf of the Richelieu Company are incumbered since the morning.

The number of the victims of the flood, now here, is about 250 to 300. One child only has been brought here in a state of death; no other dead body has yet been recovered.

Very nice courageous acts are related of persons, who during the circumstances, have employed all their means for the rescue of these unfortunates.

LATEST NEWS.

2 p.m.

A meeting of the citizens called by His Honour the Mayor, R. H. Kittson, Esq., was held this forenoon at the Court House; every one present has shown a great liberality; in the space of a few minutes the subscriptions for the relief of the flooded people reached $1,600. This amount shows the zeal of our leading citizens, and one will not be astonished when it'll be known that the Messrs. McCarthy have personally given $250; Mr. Sincennes, $150; Hon. Judge Loranger, $100; Richelieu Company, $50; Hon. David Armstrong, Mr. M. C. L. Armstrong, $60; Dr. L. U. Turcotte, $100; James Morgan, $50; W. Lunan, $50; A. N. Gouin, $50; P. R. Chevalier, $50; W. Buttery, $50; Eugène Bruneau, $40; and many others who handsomely did credit to our population. Subscriptions are yet given actively and liberally.

In the Chenal du Moine, no lives were lost; the number of buildings, houses and barns, carried away is from 60 to 70; out of which 24 are houses. One farmer named Millet, lost 13 buildings. It is impossible to tell exactly the number of cattle lost, but it is very large. On Isle de Grâce, 19 or 20 people perished. One Peloquin, lost 4 children, and he himself owes his life to his rescuers. One Ethier, of Ile de Grâce, saw his wife, his sister-in-law and two of his children drown under his eyes. Another, Joseph Lavallée, of Ile de Grace, had taken hold of a branch of a tree, with his wife and 4 or 6 of his children, where he stood during 16 hours at the mercy of the waves; he saw one of his children perish, his wife die at his side, and yet he was strong enough to wait with the balance of his family till he was relieved.

The city is yet in a state of excitement. The water recedes visibly. Let us hope that the adjoining parishes that have not so severely suffered by this terrible calamity will join the population of Sorel to provide, as much as possible, to the wants of these unfortunate compatriots.

Berthier.—The news coming from the "Petit Nord" is alarming; everywhere the buildings have nearly completely disappeared. 17 lives, it is said, have been lost, at Ile du Pads.

6.30 p.m.

The "Terrebonne" is coming back from a second trip to the Islands; her distress flag is yet flying. She brings back two corpses: the body of the wife of Joseph Lavallée (above mentioned) and the one of a young child; also a great number of cattle.

Oh! May God give us courage and protect us during these misfortunes.

During the storm the "Cygne" could scarcely hold herself on her anchor, Captain Labelle and 2 men resolutely took a canoe and were rowing towards the direction whence shouts came to from people in danger of drowning. But their frail craft was resisting with difficulty the storm, the waves were filling it; they reached some trees where they had a shelter. There, they found a young girl, who by one hand, was holding the branch of a tree, and maintaining herself above the water by means of a wash-tub which she had used for reaching the tree. At the sight of the canoe nearing her, she threw herself in, but this additional weight was nearly upsetting the canoe which was nearly three quarters filled with water, when the young girl took a resolute hold of the wash-tub and during the time the men were keeping the canoe next to the trees, she succeeded in emptying it. At a little distance further, another young girl, with 2 young children in her arms, was standing in a tree cracking under the repeated lashes of a violent wind.

After 3 hours terrible pangs, these men succeeded in rejoining the "Cygne." Besides Capt. Laforce, who then risked his steamer, to save the wrecked people, and Capt. Labelle, whose heroism we mentioned above, it is stated that Mr. J. B. Lavallée, of Sorel, who was on board the steamer, exhibited during all that time a courage proof against everything and a great presence of mind; without the co-operation and the experience of this courageous man, it is probable, that we would have to deplore the the loss of the "Cygne," and consequently that of many lives.

The passengers of other steamers, during the same night and during the day, yesterday, picked up numerous wrecked people, men, women and children, whom they brought to Sorel, half dead by anguish and misery.

One Lavallée *alias* Blache, had seen his house crushed by the waves and he had taken to a canoe, with his wife and five children. A few minutes later, the canoe was crushed against the trees. The poor mother took hold of the branches of a tree, and her husband succeeded in reaching another tree, with his five children. He stood there, one child under each arm, and the other three near by, during sixteen hours. His wife, exhausted by hardship, was drowned in his presence and one of his children died in his arms. When they were relieved, the children were benumbed by cold; but as soon as their father was in the canoe he paddled courageously towards the steamer. The corpse of his wife was recovered yesterday.

Will you have something more thrilling? Read! A woman was in bed on the verge of confinement. The husband seeing that the storm was threatening his house, asked his wife to have the courage of getting up so as to reach the canoe. She answered him: "Save yourself with the children, if you can; as for me, I see it is impossible; but we will meet again in the other world." And while she was speaking the house fell down and all were thrown in the water! This is no romance. It is naked truth. These events have happened the day before yesterday. But we have said enough.

We read in the second edition of the "Union Nationale" of Saturday:

"We have obtained some more details on the flood which further increase the frightful picture of its disasters, which we have extracted from the 'Gazette de Sorel.'"

The Rev. M. Plinguet, arriving from Ile du Pads, this morning, brought the sad news that 17 persons have perished on that Island, whereas 25 perished on Ile de Grâce and Ile aux Ours. It may be that a greater number have lost their lives; we are not sure yet of having ascertained the whole extent of hecatombs.

All the houses, barns, &c., from the division road of St. Cuthbert down to the Common of Maskinongé, on a length and a breadth of about 5 leagues, have been blown down, carried away and destroyed.

A letter from Ile du Pads, of 13th April, 1865, contains the following:

"The water was 6 inches higher than the day before. We cannot form an idea of the spectacle presented by this flood; water has never been so high since 67 years. Towards 2 p.m. yesterday blew a furious wind, which lasted till night, keeping steadily at its height for some 3 or 4 hours. The wind was so strong that in my stone house, which is very solid, we continuously felt the floor shaking under our feet. The waves

outside of the river banks were tremendous ; they struck with such a force against every obstruction that they were flying over the buildings ; above the surface of this vast stretch of water the atmosphere had the appearance of being filled with drifting snow (poudrerie) as in winter.

" I learn at this moment, 8 a.m., that three houses, at Ilè du Pads, were blown down by the wind and carried away with all their contents ; also 17 lives were lost."

Mr. Belcourt hands us the following letter from Three Rivers, dated 14th April.

" I assure you that the 12th April, 1865, will be engraved forever in the memory of the Trifluvians and of the inhabitants of the adjoining parishes. In fact, I have never seen such a frightful spectacle as that witnessed in the afternoon.

" The water was extraordinarily high and the ice from the lake was moving down, when commenced a gale from the south-west which broke down fences, vessels, houses, barns, &c. with a terrible rapidity. The losses are immense here ; not less than 15 houses have been destroyed, wholly or partially, without taking into account the sheds, stables, &c. And the worst of it is, that the poorer class is partly affected. The water has caused damages specially on St. Philip and St. George streets, and the ice on Notre Dame street, near the little bridge. The house of Seymour, belonging once to Gilmour, has been crushed with all the furniture, and three other houses this side of it have had their fronts torn so much that furniture was drifting out. The river was covered with poles, posts, boards, bedsteads, commodes, carts, bark canoes, and even whole buildings. And the most terrible is that we have to register two lives lost : In the outskirts of the city, F. Dufresne, and one of his sons, were drowned in a small scow. The eldest of his sons escaped. I think some lives were also lost in the country. It is related that one Syrenne was drowned at Bécancour, and according to rumour, a whole house with the family in, in the same parish, has been carried away. At Yamachiche, at " la Pointe au Sable," and on the south of the river, opposite Three Rivers, a great number of buildings have been carried away, some with the cattle in. I am just imformed that at Yamachiche, no less than fifty buildings of all kinds have been demolished ; it is stated that a lady lost her house, barn, and even her cattle. I believe that when all the damages caused by these three elements which have struck upon our district will be all known, the losses will be incalculable.

" Yesterday, I went all around town, and I assure you that it is very painful to see everything disturbed ; everywhere we meet but poles, boards, furniture, and doorsteps hanging around; a whole house floated off and grounded into the street where Proulx lives ; another house was carried through the street where Thivierge lives and grounded on the Hay Market square.

" The body of F. Dufresne has not yet been found ; that of his son has been recovered ; as the water is receding quickly, hopes of finding the father's body are entertained.

" A small steamboat left here for Sorel, yesterday ; the lake seems to be clear of ice."

Minor News.—Friday, 14th April, in the afternoon, a portion of the ice bridge opposite the town broke and moved down with the tide ; but a large floe of ice, from above, opposite the Grand Trunk Station, a few moments later, came down on this side and grounded in front of Finlay Market and took the place of the drifting ice in such a way that a new bridge was formed opposite the city, over which people on foot were seen crossing to Levis as late as noon, when it disappeared with the ebb ; but what is most singular, during the afternoon of the following day, another floe of large dimensions closed the river at the same place, forming a third bridge over which circulation between the two shores was renewed, though with danger. Towards 5 p.m., at the time when the boatmen were yet afraid to cross over this improvised bridge without their boats, an intrepid Irish woman, not to say imprudent, left the Grand Trunk Station, and daringly proceeded to come alone over to this shore, amidst imminent danger and frequent open spaces here and there, and when the floating pieces of ice could separate and move off downward. Happily, Ellen Wall (such was her name) did so well that she got without hindrance to Finlay Market, where a large

crowd having assembled to look at the end of this act of temerity, applauded the child of the Green Erin. A man, wishing probably to follow Ellen Wall's example, left from this side towards Levis, but the ice shoved before he could reach his destination, and he was carried down to a considerable distance ; he was rescued by men in a canoe.

19th April. A painful rumour, says "l'Union Nationale" of yesterday, was circulating the day before yesterday, that not less than 80 persons had been drowned during the flood in the Grand Nord, Parish of St. Cuthbert. We have yet no positive data, but such a large number of houses have been removed, that we fear the chapter of misfortunes will be increased by new hecatombs.

In St. Therese Island, opposite Varennes, two houses were crushed by ice ; one, in stone, was the property of the Estate of the late Mde. Joseph Laporte, and the other belonged to L. A. Robitaille, Esq. ; the tenants have nearly lost all their furniture and grain.

The wind caused yet more extended damages all along the river. The water has eaten away the shores in a dreadful manner and part of the wharves are demolished.

A letter from *Varennes* says : "We see but demolished barns. Five of these are totally wrecked. The good sisters of "l'Hospice de Lajemmerais" have experienced a terrible mishap. Every one knows that the pecuniary means of these holy nuns to do good are very limited. Some years ago they had a chapel built up with brick, in the rear of the principal body of the hospital, in order to strengthen this building and to facilitate pious exercises. The gale swept the whole chapel away. The roofs were found two arpents further."

Mr. Hyacinthe Desrochers, of 'Ile Ste. Therese,' was very near being killed ; the roof of his barn fell upon him and he was pulled from under the ruins half dead. One of his shoulders is broken and his neck nearly so. He suffers greatly from pains in the stomach. Dr. Painchaud has been called to attend him.

"LA MINERVE," MONTREAL, 11TH APRIL, 1865.

THE RIVER.

Sunday morning, the few arpents of *bordage* ice, opposite the town, have been removed by the stream and the water begins to recede from over the wharves, but they are yet covered by large piles of ice.

The "Iron Duke" and the "Fashion" steamed Sunday as far as the foot of St. Mary's Current and are yet anchored at this place.

It will be hard for the ferry to begin its operations before the end of the week, on account of the obstructions by the ice. On the Longueuil side the ice piles extend from the bottom of the river to many feet above the surface of the water.

Five or six schooners whose winter quarters were in the Boucherville Islands have arrived at the Canal.

The news received from the district below is all of the same nature. The place, most affected, is, we believe, the Island opposite the Village of Boucherville. On Tuesday last, the ice carried away two barns and one house belonging to Mde Vve. Quintal, of Boucherville, and also another barn. One man, named Lesperance, was in this house with some fifteen children when the ice was nearing the place. He quickly passed the children through a window and deposited them in a boat ; at the instant, he was placing the last child in the boat, a cake of ice carried away the shutters and one minute later the house was removed. This island is not at a great distance from the shore of Boucherville, and as all the doings of the inhabitants could be seen from this shore, a large crowd gathered to witness the scene.

It is said that the ice shoves opposite St. Sulpice have formed a wall reaching the height of the telegraph posts.

The river is cleared as far down as Lanoraie, but the ice between Lavaltrie wharf and the Island opposite, is yet solid, so that steamboats will not be able to call there for some time.

Sunday, canoes were yet used for circulating in the streets of Berthier; this unfortunate village is now flooded since a fortnight. According to the latest news, the water which was near reaching the Church of Ile du Pads threatens to invade the whole of this Island.

In the Chenal du Moine, the water covers the land as far as the eye can reach. The ice upset one house and one barn, and we have not ascertained if any other loss has taken place. The poor inhabitants are forced to leave their premises or to use scaffolding for remaining in.

Canoes are fastened at people's doors and everyone rushes at them when the ice becomes threatening.

The flood was seriously felt at Sorel and the houses on the bank of the river have been inundated.

The "Journal de Quebec" of Saturday says:

Notwithstanding all what is said, the ice bridge opposite Quebec, is yet solid. Yesterday, a chain weighing more than 2,500 lbs. has been taken over the river in a sleigh drawn by three horses, one in front of the other, from the Grand Trank Landing, without any accident happening.

"LA MINERVE," MONTREAL, 12TH APRIL, 1865.

FLOOD AT THREE RIVERS.

9th April, 11 a.m.—The outskirts of the city are flooded and a great part of our unfortunate town presents a painful appearance. The poor sufferers are without fire, nor bed, nor bread. The whole of St. Philips ward is flooded and the water, on Notre Dame Street, reaches the store of Mr. Houliston. The boatmen give us a remembrance of Venice during Carnival. The water is stated to stand higher than during the great flood of 1843.

The ice of the lake is yet solid; but if it comes down during this high state of the river, we fear immense disasters.

11th April, 3 p.m.—At two o'clock sheets of ice began to pass down; they are thought to be coming from the lake; water rose 6 inches since last night.

A shed, on Turcotte's wharf, has been torn into pieces and carried by ice.

It is thought the ice will cause terrible damage; half of the town is under water and we cannot ascertain the extent of the distress existing everywhere.

THE NAVIGATION.

Navigation is long to open. The day before yesterday the steamboat "John Brown" came in the harbour, and yesterday, the "Richelieu" arrived.

The steamboat "Richelieu" came from Lachine, through the rapids, yesterday afternoon and entered into the Canal Basin.

This nice boat has been bought during the winter by the Trinity Board of Montreal, and given to the charge of Capt. Cotté, superintendent of pilots; she will be used for the buoys services and the general direction of the lighthouses between Quebec and Montreal.

Yesterday water rose many inches and covers again the wharves. This slight rising caused the ice grounded on these wharves, to flow away.

At the foot of the current, canoe men have organized a regular line of crossing.

Our telegraph correspondent from Three Rivers, gives us, to-day, some news and we call the attention of our readers to our special despatches.

The Richelieu Company has been good enough to hand us the following letter from Three Rivers, received yesterday morning.

THREE RIVERS, 10th April, 1865.

Since my last letter, water has not receded; on the contrary its rise has been alarming. The ice breakers on Molson's Wharf are covered by 2 or 3 feet of water.

The Farmers' Hotel is all surrounded by water. If the lake ice moves down, we fear every house on the edge of the river will be crushed and even carried away. In

short, all the low part of the city is under water, this means about half of the city and it forms the places of residence of the poorer class ; so that you may judge of the existing misery. We are happy to see the corporation and charitable people, doing their utmost, to help the unfortunates. It is thought, that in many places, water rose by 8 feet, at least, and at this hour, it is yet rising. It is related that the ice is yet very solid below.

I regret that I am not able to keep you posted by telegraph, on the disasters the ice will cause here, because the wire has been carried away at la Point du Lac.

When I was finishing this letter, I received a despatch from the agent of the Richelieu Company, at Batiscan, Mr. Marchildon ; he says the ice has moved down as far as Grondines and that Batiscan is extraordinarily flooded and that everywhere they are surrounded by water.

At Quebec, the bridge is of a distressing firmness.

The "Canadien" of the 10th says :

"Saturday, two horses drawing three very large pieces of square timber crossed the bridge and reached Lévis without accident. Last night, about 6 o'clock, a boat from Island of Orleans, carrying five men, has been seen reaching the lower edge of the bridge.

"This boat which was of large dimensions, was drawn on the ice and taken without any mishap, by the men, to the Finlay Market.

This morning, summer as well as winter vehicles cross over the bridge with as much safety as ever.

"LA MINERVE," MONTREAL, 13TH APRIL, 1865.

THE SEASON.

Yesterday was characterized by a furious gale which deprived the spring of its gentle features.

The wind blew the hats off the heads of people ; roofs of houses were thrown down ; in Griffintown, it helped in drying the floors on account of houses being ventilated by the roofs.

The large warehouse, on Pointe à Callières, Commissioners street, belonging to Mr. Logan and occupied by M. T. Marc. Bryson, had 15 to 20 ft. of its roofing removed ; one large stone chimney was blown down ; two soldiers, members of the band of the 60th, that were passing at the foot of said building were very much frightened.

Another gentleman, student-at-law, was very near being struck by a sash detached from the second floor of a house on Beaver Hall. The wind did some good to the harbour ; it removed nearly all the ice piles. And we have only to regret that the wharves are yet under water and no steamboat can be snubbed.

We learn that the two steamboats that were anchored yesterday opposite Hochelaga, dragged their anchors. Damages are feared.

We hope the end of our narration of disaster along the river is at hand. The only fact that we have to register concerns Ile Bouchard : A barn in the loft of which cattle had taken refuge having collapsed, two horses and four cows were killed. A little further down the river the waters carried away a portion of some islands, and swept away barns, ice-breakers, shrubs and large trees.

We do not expect a steamboat from Sorel before 2 to 3 days.

The Richelieu company has been good enough to communicate to us the following details concerning Three Rivers and its neighbourhood.

THREE RIVERS, 11th April, 1865.

Since yesterday, water continued to rise till about 10 o'clock in the morning, when it began to fall a little. Ice floats about in small quantities since this morning. This is generally believed to be the beginning of the shove of the ice from the lake. The inhabitants say that the water has never been so high since 60 years. To give you an idea of its height I have only to tell you that it would be possible to take a canoe on Notre

Dame street and proceed to Yamachiche, by following the Post road, a distance of 5 leagues. I learn that Mr. Marchildon is much afraid that his wharf will be carried away ; this will be a great loss for him. No serious accident has yet been recorded in the city ; one was registered, but it had no fatal results. This morning an old man fell over his canoe on one of the streets, but he got off with a cold bath which is very disagreeable at this time.

By the last news we learn that the ice is jammed at Grondines and Cap à la Roche.

If the ice of the lake has moved down yesterday, as we believe, helped by the strong wind that prevailed here, we cannot form an idea of the disasters the shove must have caused. We are in dread that, on account of the height of the water, the houses situated on the wharves at Three Rivers, may be swept away. Nevertheless, at the instant of going to press we have not received any dispatch from this place. We are inclined to believe that the ice bridge opposite Quebec, must have been badly shaken yesterday, by the first tide of April, if indeed, it has not disappeared.

The citizens of Sorel have opened subscription lists to come to the assistance of the unfortunate, wretched people of Chenal du Moine and adjoining islands.

At Quebec, vehicles were seen crossing over the bridge yesterday.

The farmers take advantage of the advanced state of the season, and sowing is being done, everywhere.

"LA MINERVE," MONTREAL, 15TH APRIL, 1865.

GREAT FLOOD AT SOREL—BERTHIER AND THREE RIVERS—50 PERSONS DROWNED—500 VICTIMS OF THE FLOOD.

We have to record a frightful disaster on the islands of Sorel. Providence has taken us through hard trials, for the misfortune experienced by a portion of our compatriots, is truly a national calamity. Since a few days, our columns contain sorrowful narratives of the destruction caused by the flood. Alas ! we were far from believing that these different catastrophes were only the prelude of unheard mishaps. At this moment the city of Sorel and its neighbourhood, are in mourning ; death has made some victims in hundreds of families and ruined whole homesteads.

Our daily reports have kept our readers posted on the distress caused by the flood at Sorel and in the islands. We have seen how the inhabitants of the Islands Du Pads, Du Moine, De Grâce, De Madame, &c., have been held in captivity. Monday and Tuesday the water rose so much that the people fled to the second floors of their houses and could not come out. Wood and fire were wanting and a single board separating them from the water, was not sufficient to preserve them against an unbearable cold.

Bread became scarce ; victuals were decreasing by degrees, and in a short time these unfortunate, isolated people, deprived of all resources, had only to contemplate the abyss under their feet, a threatening heaven over their heads and famine amongst them ; death was everywhere. A fearful scene of desolation was slowly approaching.

Wednesday, threatening clouds were gathering on the horizon. Shortly afterwards the gale, which carried consternation all over the country, reached with a greater violence the most unfortunate of these people. In our quiet houses, each roaring of the storm caused each of us to tremble, nevertheless, we had the knowledge of a sure asylum, in case of mishaps, alas ! it was not so for other compatriots already reduced to despair.

The gale began by raising the waves into fury, and in a few moments tremendous waves had been formed, which lashed with impetuosity through the rooms of first floors of houses. We would have wished to never have to relate the sequel of this terrible drama. Nature, in one of those great convulsions, never to be painted, displayed around her the cortege of terror. The victims that a watery grave was to receive suffered at first all the pangs of fright. These miserable exiles already tormented by hunger and cold felt the most violent moral sufferings. They were losing their energy with the

strength of their bodies. Each cracking of their houses resounded terribly in their souls, for the last efforts of their retreat, were like the voice of a solemn warning.

These moments of supreme anxiety were not, however, of long duration; fears were to be succeeded by the most terrible of all realities. Roofs were scattered on the waves; barns soon were demolished, and the cattle kept on scaffolds raised in the lofts were precipitated in the water and drowned.

It is difficult to hold back the irresistible emotion which takes possession of our heart at the idea of the most awful catastrophe that ever visited this country. Thousands of compatriots, some friends, some relations perhaps, have passed without transition from wealth to the most abject poverty. Alas! they have not only lost their goods, but their families, or they have died themselves. Yes, they sank under an errand wave. The land they had fecundated by their sweats is to-day the bed of an abyss, the saddest of all graves. How can we describe the painful scene of the gale breaking the foundations of houses and precipitating the inmates into furious waves. Here is a father forgetting himself for saving his wife, and who disappears under the water when he believes to have hold of her, the anchor of his family; there is a mother breathing her last breath and calling the names of her children; here is a child, weak, being without any support, who is crushed by wrecks before being in possession of his watery grave.

Such was, however, the spectacle to be seen Wednesday last, amongst the Islands of Sorel. In some hours 50 victims were violently withdrawn from this world; 2000 persons could, from one second to another, have the same fate.

* * * * * *

Here follows an account of the lives lost and damages done to properties, according to "la Gazette de Sorel." It is believed 50 lives in all were lost.

ILE DE GRACE.

Joseph Lavallée's wife and one child; Louis Cardin's wife and three children; Pierre Ethier's wife, three children and his sister-in-law; four children of Pierre Peloquin; two children of Ignace Lavallée; his wife has been rescued in a dying state. One child of Paul Cardin.

With the exception of three, all the houses of the Island have been thrown down by the wind and the waves, and most of the cattle perished; also nearly the whole of the grain, etc., destroyed.

ILE AUX OURS.

Ignace Bergeron, Pierre St-Martin, Frs. St Martin, Pierre Bergeron and Pierre Plante have lost their houses, barns, grain, cattle, &c. It is supposed that Pierre Plante is drowned because he has not been seen since.

ILE MADAME.

Bruneau Ethier, Bélonie Cournoyer, Joseph Cardin and Athanase Cardin lost their houses, barns, cattle and grain. Bruneau Ethier has 1,000 bushels of oats in his barns. The other inhabitants of these islands have more or less suffered; no details are yet at hand.

CHENAL DU MOINE.

Seventy-one houses, barns, &c., have been swept by the gale. A large number of cattle have perished and a great quantity of grain and furniture has been destroyed, but no life lost. The inhabitants deserted their homes at the beginning of the storm and succeeded in reaching the woods in canoes.

ILE DU PAS.

Seventeen buildings, houses and barns, are said to have been carried away, but we do not know if this is the correct figure. Two scows filled with people have been driven as far as the lake. No victuals were on board. But we have no reason of dreading that they have been wrecked.

THE STORM OF WEDNESDAY.

The storm of Wednesday is changed into a veritable disaster, not only in Montreal but everywhere over the country. In Montreal, the principal accidents are the following. Broken trees were first noticed; one of them is lying on St. Francois Xavier Street, opposite the store of Benning and Barsalou.

A great number of trees shared the same fate on Sherbrooke Street, St. Lawrence Street and Viger Square; the quantity of trees broken on the mountain is incalculable.

Fences and hedges of all kinds have been thrown down in thousands of places. In many instances cattle took to their heels. On Wellington Street especially, opposite Mulligan's Hotel, a fence is destroyed.

More than one street lamp was put into pieces, one amongst them, at the corner of Notre Dame and St. Sulpice Streets. Some fifteen to twenty houses had part of their tin roof torn away.

At the foot of the current, the roof of a shed, full of grain, has been carried away. The body of the building, the property of Mr. Lynch, was damaged to the extent of $300 as per estimation. On Fullum street, a brick house and a shed, property of one Louis Gauthier, have been upset at about the same time.

The Molson Distillery has been strongly shaken; some stone from the upper part having fallen.

A portion of the stables belonging to Mr. Morgan came down.

The conservatory of Viger Garden, according to one of our confreres, was very nearly being blown down by the wind, and its preservation was due to the efforts of Mr. Valtimet and his men who succeeded in propping it up. Some of its panes of glass however, were broken, and the side most exposed, was bent and distorted so much that the glazing is shaking, all the putty having been loosened. At different times, this side of the conservatory was swinging to and fro 5 or 6 inches out of the perpendicular.

One house which is being constructed on St. Lawrence Street, property of Mr. Miron, was blown down while four men were at work on it; one of them, the contractor, named Vaillancourt, received such wounds as to have to be taken to the Hotel Dieu. Fears are entertained for his recovery.

A shed, previously occupied by Mr. Taylor, St. Lawrence Street, fell down, burying two men who were not hurt.

At the corner of Lagauchetiere and Berry Streets, the cut granite gable of a house belonging to Mr. Betournay, was thrown down, and one block of stone of 5 feet, fell down from another house in progress, close to a labourer mixing mortar.

A wooden house, at Mile End, near the toll-gate, was totally upset. The same thing happened to another house on St. Dominique Street, the property of Mr. Paquette.

On the street going to the burial ground, a falling brick house was near killing a passer by. On Common Street the roof of the store of Mr. Grengan came down and missed two soldiers.

At the Gas Works a large building has fallen, wounding many persons, one of whom seriously. At Point St. Charles the action of the wind was also felt; some of the freight sheds lost their roofs. On St. Catherine Street a child had his arm broken and the face deeply cut by some falling boards coming from the lumber pile at the back of the new school for the Brothers, which the Seminary is constructing at the corner of St. Catharine, and St. Denis. A lady was also wounded.

On Sherbrooke Street a young servant girl in the service of M. McIntosh, was near being struck by a large piece of iron detached from the house.

The slender spire of the steeple of the English Cathedral was subjected to oscillations of 20 to 30 degrees, but without accident, happily.

The "Iron Duke" and the "Fashion" were driven from their anchorage; the "Iron Duke," broken in many places, was diverted on shoals, it is related. She is filled up with water, and the "Fashion" has gone to her rescue with a steam pump.

Towards two o'clock the tow boat "John Brown" steamed down in the midst of the Boucherville Islands to tow up barges that wintered there. Her captain, foreseeing the storm, remained there. Shortly after the barges were violently thrown

upon the island, and the tow boat had to get them away the next day. One of them, the "Derrick," sank. The ice has totally disappeared from the tops of wharves, but the water seems to have played havoc on them, for pieces of flooring are seen floating at many points above the water which is yet over them.

The gale was not less fatal in the country, as shown by the following letter :—

SHERRINGTON, 12th April, 1865.

MR. EDITOR,—Our poor parish has just been cruelly tried by Divine Providence. The humble temple the generosity of our people had raised to the Lord has been torn into pieces by a violent gale.

This afternoon, at about five o'clock, the faithful that were in the Church, heard a strange noise. Through the windows they could see the roof of the building going down piece by piece. At a few feet further were lying the capping and the bricks of the chimney belonging to the parsonage. On the other side were about 50 feet of the wrecked roof of our modest temple which was yet unfinished. The burial ground was covered with debris; many precious tombstones were crushed down. All these damages resulted from a north-west gale. If the wind was now turning to the north-east we have no doubt that the losses would be far greater. The remainder of the roof would certainly be blown off. Then all would be over for our ceiling, already broken at two places. We can estimate the loss at $120.00. This sum is very large for our poor parish. We hope that Providence will not continue this trial and that we will receive grace. It is so painful to see the fruit of many years savings suddenly destroyed. But against supreme law there is no resistance. H. A. P.

The wind blew down one of the steeples of the church at Ste. Thérèse, which falling on the roof, passed through it. It is related the roof of the church at Ste. Athanase has been removed; but we are not sure of the fact.

Portion of the roof of the church, at Ste. Scholastique, has been torn; fears, during a certain time, were entertained that the steeple would fall; but happily, it stands on a very solid framing. One piece of timber, 30 feet long, has been torn from the roof and blown in the air with an incredible rapidity.

During nearly five minutes only boards and shingles were to be seen over the church. Many sheds have been blown down. The walls of a brick house, the property of Mr. Fortin, N. P., receded many inches.

It is said, that in the parish, no less than forty barns have been damaged, some nearly completely blown down. In the adjoining localities a large number of barns and other buildings suffered alike.

The Zion Church, Toronto, and the Catholic Church, at Cornwall, lost their steeples.

At St. Martin, the bridge of MM. Delisle & Verret, called the "Bridge of la Barre à Plouffe" lost abont 100 feet of its covering. Some pieces according to spectators, being thrown 21 and 30 feet.

In most of the country places, barns or houses were blown to pieces. At Pointe aux-Trembles, no less than six barns were completely broken down and many others damaged. At Longue-Pointe, two barns fell down, along the coast.

At Repentigny many houses lost their roofs. Mr. Cushing had just paid 80 to 100 men for rescuing his lumber which the ice had carried amongst the islands, when the wind forced it again in the river. One house, owned by Beauchamp, has been crushed.

At Verchères about 10 barns are down and five in Ile Bouchard.

The wind and the water, on the north side of the river, have had such action on its banks that they are eaten away some 20 to 30 feet at many places. The oldest farmers say there never was such a gale.

At Lanoraie, the shed of Mr. Champagne is down. The house of M. Latour is so much undermined that it may fall at any moment.

It is feared that between Berthier and Maskinongé great disasters have taken place. In the village of Berthier mention is made of only two or three buildings being carried

away. In the "Petit" as well as in the "Grand Nord" all the houses are said to have been carried away.

At Sorel, anchored vessels were sent adrift; a shed was upset in the dock-yard of MM. McCarthy; timber belonging to these gentlemen and others floated out into the St. Lawrence; the vessels of the Richelieu Company had great difficulties in keeping anchored in the harbour. Two or three large barges laden with wood were seen on the river resisting with difficulty to the wind.

A schooner which had wintered next to Ile Bouchard, had been loaded with firewood at Lavaltrie, and was sailing towards Montreal when she met the first touch of the gale at Repentigny; she anchored, but soon after her chain broke when she drifted down with great rapidity. Probably she came to a stand still only on arriving at the Berthier Islands.

We read in the "Courrier de St. Hyacinthe": Since Wednesday, the wind blows with an extraordinary violence. Many disasters are mentioned as having taken place during the day and night of Wednesday. A great number of trees were blown down in the adjoining bushes, the hand ball building at the college and many fences were demolished. The wind was so violent that poles of fences were thrown in the air.

FLOOD AND NAVIGATION.

Friday morning there was no more ice on the wharves, but a certain quantity remained on the revetment wall.

Water and ice, this year, caused incalculable damages. A man named Perrault was drowned at St. Sulpice. The bank of the river at this place is very steep and the water rose extraordinarily high, having reached a height of 8 to 10 ft. on the shore. The unfortunate Perrault, last Sunday—Palm Sunday—went for a pail of water; the bank settled under his weight and he was precipitated in the river. Efforts were made to rescue him by means of a seine, but vainly; the harpoon was unsuceessfully used; he had been buried under the fallen debris.

A letter from Sorel, dated 11th April, says:—

Water rose again 2 inches since last night. From all parts we hear but narratives of accidents and distress reigns everywhere. Yesterday a collection was taken for the relief of the poor in Berthier. The wealthiest had had no bread since a week. This morning, the principal citizens of Sorel took 300 loaves, some pork, &c., to Berthier; they crossed the river on the steamboat "Rivière du Loup;" this was the trial trip of the new boat which will be used for the transport of travellers from the port of Rivière du Loup up to the mouth of the lake where the "Columbia" calls.

An idea can be formed of the elevation of the water when it will be known that entrance was effected in the Berthier church, by means of a canoe. There is no use of telling that all stores were closed and the inhabitants are in the greatest consternation.

The same persons went with the same steamer to the relief of the poor flooded people of the Chenal du Moine. Many houses have been carried away by water; others have been removed by the stream.

Well merited thanks are due to the Richelieu Company for their eagerness to put a vessel at the disposal of charitable people from Sorel in order to relieve the sufferers.

From Ste. Anne de la Pérade, a letter dated 10th says:—

"Thanks to the piers built in the river to favor the formation of an ice bridge opposite Quebec, for the greatest accommodation of that city's people and farmers around Quebec, we are favoured with a flood such as we have never had according to the memory of our oldest inhabitants.

We are literally floating. Half of the population lives in the attics of their houses; the other half have deserted their places which threaten to fall down. Cattle have been placed in the lofts of stables; some have been located on high grounds, exposed to all inclemencies; some even were drowned.

Many buildings, such as barns, stables, sheds, &c., are floating in the fields. The magnificent bridge of Ste. Anne, runs great risks of being broken; the bridge at Batiscan has been totally removed by the ice. These two bridges, the shortest having not less than 1,500 ft. in length, are almost indispensible and their loss would be an immense calamity for the public.

Happilly, no human lives lost are to be recorded, but God only knows how we will get out of this ordeal. And to say that these disasters will be yearly repeated as long as the piers will be useful to the formation of an early ice bridge opposite Quebec.

Finally, a letter from Three Rivers announces that the ice of the lake has shoved during the storm of Wednesday. We could not receive details before this hour on account of the telegraph wires being broken everywhere.

"THREE RIVERS, 12th Aprll, 1865.

"It is 2 o'clock, p.m.; the ice has been floating down in varying quantities since yesterday. At this hour, it passes abundantly. Yesterday afternoon the ice broke into the front of the office of the Richelieu Company and into the shed on Molson's wharf. The small shed on Turcotte's wharf was also crushed and part of it, as well as its roof, were carried away.

"The Messrs. Ward & Baptist have lost a great quantity of logs during the night, the booms having broken."

"THREE RIVERS, 13th April, 1865.

Ice moved down all day, specially during the whole afternoon, under the action of a strong south-west wind. In the city, on the west side, many houses have been pulled down. Happily they had been deserted some days before, by their owners and tenants. The telegraph wire has not yet been repaired. I think the whole ice has passed. The city is in a total distress; everything is upside down. On each side of the river a great number of houses were demolished.

During the gale, a respectable inhabitant of our *banlieue* accompanied by his two sons ventured to go to his barns for looking after his cattle. Their small scow upset and they were thrown in the water. The father and the youngest son were drowned. The other son escaped a watery grave with great difficulty. It may not be the only accident to record.

THREE RIVERS, 13th April, 1865.

2 p.m.—The ice of the lake moved down yesterday. Water was very high and the wind very strong. Happily we had rain this morning; it broke the ice. Nevertheless the shoving caused great damage. Nothing was so sinister as the appearance of wrecks carried by the ice; there were parts of houses, fences, barns, uprooted trees, &c. The Farmers Hotel was very near being cut down. Seymour's house on Notre Dame Street was struck and demolished; the furniture, &c., are lost. In the *banlieue*, Mr. François Dufresne and one of his sons were drowned yesterday afternoon, while trying to save some goods off their farm. It is related that another young man was also drowned.

At Ste. Anne, according to rumour, many houses are damaged, cattle are lost, &c. On the south, the cars cannot circulate; the ice lying on the track near Godfroy river.

The Montreal and Quebec mails have not yet arrived; they are 36 hours late. Four houses, on the south, are being carried away towards the gulf.

It is said the house of Hon. M. Malhiot at Pointe du Lac, was crushed down. Telegraph wires are broken. Fences, it is related, have all disappeared, both on the north and south shores, for a space of 10 leagues.

Water lowered 30 inches, but it is yet very high. The steamboat "Ste-Anne" left this morning for Sorel.

TABLE OF FLOOD LEVELS.

The following table shows the gradual rise of the water during the flood at Montreal. The figures represent the number of feet above the ordinary level of the river :

—	Hour.	Feet.	—	Hour.	Feet.
Jacques Cartier Square	9.00 a.m.	19·13	Jacques Cartier Square	4·55 p.m.	20·24
do	9.06 a.m.	19·83	do	4.55 p.m.	20·24
do	3.00 p.m.	20·57	Longueuil Crossing	3.45 p.m.	15·83
do	4.45 p.m.	20·81	do	4.10 p.m.	15·74
do	4.50 p.m.	21·23	do	4.40 p.m.	16·12

—	Hour.	Elevation.	—	Hour.	Elevation.
Jacques Cartier Square	3.00 p.m.	20·57	Foot of Colborne St	3.35 p.m.	16·95
Foot of Montcalm St.	3.20 p.m.	19·41	Longueuil Crossing	3.45 p.m.	15·83
do Voltigeur St.	3.25 p.m.	18·86	Military Wharf, Hochelaga	3.57 p.m.	13 53
do Monarque St.	4.05 p.m.	18·49	Ruisseau Migeon	4.04 p.m.	13·09
do Colborne St	3.00 p.m.	19·50			

COMPARISON of the levels of the water, in 1861 and 1865.

—	1861.	1865.	—	1861.	1865.
	Feet.	Feet.		Feet.	Feet.
St. Peter River	25·00		Longueuil Crossing	20·49	16·12
Above Victoria Bridge	24·00		Hochelaga Wharf	19·93	13·53
Below do	23·48		Ruisseau Migeon	15·85	13·07
Grant & Hall Mills	23 42	22·76	do (Migeon and Sauvageau)	15·85	13·09
Jacques Cartier Square	22·80	21·23			

"LA MINERVE," MONTREAL, 17TH APRIL, 1865.

THE FLOODED PEOPLE—HELP FROM THE GOVERNMENT.

QUEBEC, 15th April.

The City of Quebec has learned with a deep regret of the misfortunes caused by the flood. The Government will not be idle and as soon as it is provided with sure data concerning the loss suffered it will help the sufferers.

The steamboat "Arctic" began this morning its trips between Quebec and Levis.

QUEBEC, 15th April.

Two miles only of the ice have gone ; the ice is still solid at Cap Rouge. I believe it will resist till the next spring tide which will be only in 12 days from now.

THREE RIVERS, 15th April.

Water decreased 6 feet. Sixty buildings are said to have been carried away at Yamachiche.

NEW LOSSES.

THREE RIVERS, 15th April, 1865.

Sufferings are great in this city. Mr. Frederic Dufresne and his son, aged 18, were drowned on Wednesday. It is said Mrs. Gingras, of Bécancour, and her family composed of six children, have been buried under the wreck of their house. Numerous accidents are related as having taken place at Bécancour, Gentilly, Berthier, Yamachiche and Pointe du Lac. In the low part of the city, 16 to 18 houses have been damaged. Furniture has been broken.

The lumber merchants who had logs in the St. Maurice Channel have greatly suffered. A woman and six children have been rescued from a drifting raft on the river. They had run two leagues.

OTHER DETAILS ON THE FLOOD—HUMAN LIVES LOST—ABOUT THREE THOUSAND CATTLE PERISHED.

THREE RIVERS, 15th April, 1865.

The operator at Berthier telegraphed to Three Rivers, on the 14th:

I have not been able to work since the 6th. Water rose to the top of my table. Yesterday it began to recede.

Nothing is heard but news of people being drowned, and houses and barns carried away.

At Chenal du Moine, three miles east of Sorel, 200 persons were rescued by the Richelieu Company.

At l'Ile de Grace, twenty persons were drowned.

At l'Ile du Pads, seventeen persons were drowned.

At Grand Nord, six miles eastward, nine houses only are standing. Hundreds of barns have been removed. No life lost. Immense number of cattle drowned. Many houses, in the village, blown down by the wind. All have suffered some kind of loss. A large quantity of grain was lost.

Everywhere we hear "This one is dead; that one is dying."

Sixty buildings carried away at Yamachiche.

THREE RIVERS, 15, 6 p.m.

Water continues to fall.

I learn that Yamachiche is cruelly tried. Sixty buildings having been thrown down.

The M. M. Proulx, of Nicolet suffered greatly. Captain Duval, of Port St. Francois, suffered losses estimated at from $3,000 to $4,000.

The house of M. Malhiot, at Pointe du Lac, has not been damaged.

At Three Rivers, six drowned women and children were found.

Another Despatch.

BERTHIER, 15th April, P. M.
(*Via* Three Rivers.)

Water continues to go down; immense damages have been caused during these last three days; houses broken up, barns carried away, &c. Over 60 people are supposed to have been drowned.

At l'Ile à l'Aigle, two families composed of 17 persons, were drowned.

The loss of cattle is estimated at about 3,000 head.

PUBLIC MEETING.

As will be seen by the Proclamation of His Honour the Mayor, a great meeting of the citizens of Montreal will be held this afternoon at 3 o'clock, for the adoption of the best means to come to the assistance of the inundated people. This demonstration, due to the initiative of Mr. Justice Coursol, MM. Lamère, McNaughton and some other citizens, will certainly attain the end for which it was called.

We learned with pleasure Saturday night, that Hon. Justice Loranger, who was one of the first to render assistance to the flooded people of the Islands and of the Chenal du Moine, will perhaps arrive here in time, to-day, to attend the meeting.

There is no use inviting Montrealers to be present at such a meeting; their well-known charity could not be deficient on such a sorrowful occasion.

"L'Etoile," which left only yesterday morning, Sunday, had on board provisions that some charitable persons were already sending to the scene of the disasters.

We learn that M. Perreault, member for Richelieu, has taken an active part in all the measures taken in the interests of his constituents; he himself opened a subscription list and has succeeded, it is said, in collecting a large amount.

THE FLOOD AT SOREL.

We have learned with much pleasure from Mr. Sincennes, that before his departure from Sorel, a Committee had been appointed to ascertain as exactly as possible the extent of the damages resulting from the flood in order to relieve each one according to his loss. We must call the public attention to the fact that last Friday Mr. Sincennes has placed "l'Etoile" at the disposition of the destitute inundated people and that he has come to Montreal for calling on public charity.

"LA MINERVE," MONTREAL, 18TH APRIL, 1865.

QUEBEC, 17th April.

On Saturday and Sunday some 4 inches of snow covered the ground The ice bridge from the Harbour to the Chaudiere and the St. Charles has moved away during the flood. This flood has considerably damaged the telegraph posts on the north shore. All the houses, for a length of 6 miles, near Maskinonge, have been carried away. A schooner left for Bic to-day. The calling of a public meeting for the relief of the sufferers is talked of.

Wrecks of Houses Carried on the Shoving Ice.

Thursday or Friday, a wardrobe or *commode*, and a trunk filled with clothes of some value were found in the lower part of the parish of Contrecoeur; besides some nice dresses, they contained nine or ten dollars in silver, a gold chain and some rings.

Public Meeting in Favour of Sufferers.

The public meeting called by His Honour the Mayor for the adoption of proper measures for the relief of those who suffered by the flood, at Berthier and Sorel, took place yesterday at 3 p.m.; it was numerous and composed of citizens of standing, such as the Hon. MM. Quesnel, McGee, Chauveau, Ryan, DeBeaujeu, the Hon. Justices Loranger and Coursol, M. Redpath, president of the Board of Trade, M. C. S. Cherrier, M. Sincennes, president Richelieu Company, M. Lamère, general agent of same Company, M. Perreault, M.P.P. for Richelieu, and many other notables of Montreal.

His Honour the Mayor was requested to preside at the meeting and M. M. L. N. Duvernay and Stevenson asked to act as secretaries.

His Honour having read the petition which he had received and the answer he had given to same, explained in a few words the object of the meeting, which was to render assistance to the people who suffered losses by the flood. Hon. M. Quesnel then spoke on the gravity and importance of the disaster and of the urgency of adopting remedial measures; he proposed the following resolution, seconded by Hon. T. D'Arcy McGee:—

"That this meeting regretting the calamity which has caused the death of so many persons and the loss of so much property belonging to inhabitants residing in the neighbourhood of Sorel and at Berthier, and sympathizing with the sufferers of such calamity, desire to adopt without delay, measures to relieve all those that require help, by means of voluntary contribution."

Hon. M. McGee, having seconded the motion, called to remembrance the fact that Montreal had also suffered damages by the flood, and that the inhabitants, better than others, could form an idea of the calamity which had brought mourning and desolation to such a large portion of the population of Richelieu District. He eloquently painted sorrows of those families so cruelly afflicted who, in the space of a few hours, have lost not only their wealth, their homes, but also one or more members of their household. He concluded by a warm appeal to the charity of all those present, and suggested that a subscription list be opened at once and that every one be called to contribute his share to the relief of those victims.

Hon. Justice Loranger being called to speak, said that he remembered having received the same request from Montreal, in many circumstances, and that his contribution had always been ready, but that, under the present circumstances, he had particular motives in addressing the meeting. The narrative of the flood and its ravages are to be found on papers and in the mouth of everybody, he said ; no one has not been moved by the recital of such terrible disasters. A committee had been appointed at once at Sorel, to render to these poor victims, whose losses are deplored by every one, the help required. It has been ascertained that 500 persons are to-day totally ruined and have no hope of assistance other than that from the charity of the public.

The Hon. Justice then began a recital of this horrible disaster ; he had seen all the facts he was to mention, or he had heard them related by the actors themselves or by those that took part in them,

For a considerable time back the rise of water excited fears of mishap ; never had the river been so high. Suddenly a report reached Sorel that all the neighbouring islands were under water and the Sorel people went to those islands to assist those exposed to all the horrors of famine. No presumption could be had of what the disaster was to be. All was covered by water. Everywhere was water, 10 or 11 feet high, around buildings whose first floors were flooded. Cattle had been transferred to the upper floors of barns and stables.

Nevertheless, every one was confident and believed all danger over the moment the ice had disappeared. They were looking only for bread, and when they had received some, these poor people believed they had nothing else to wish for.

"LA MINERVE," MONTREAL, 20TH APRIL, 1865.

FLOOD—200 HOUSES PULLED DOWN AT BÉCANCOUR—LIFE LOST.

Last Wednesday while the gale was raging through the islands opposite Sorel and making so many victims, the inhabitants of Bécancour were also experiencing a terrible trial. Suddenly, at about 3 p.m., the river overflowed its banks and the water spread all over the country. The road along the river was under a depth of water, of 12 to 15 feet. The inhabitants surprised in their houses had hardly time to fly to upper floors. The ice pushed by a strong wind, crushed every thing it met. More than 200 buildings, barns and houses, have been carried away. Happily that men succeeded in rescuing people living in the most exposed places and bringing them by canoes to high places inland ; had they not succeeded we would have many more deaths to record.

Nevertheless, a young child called Serene has been buried in the waves while his older brother escaped by jumping on a cake of ice whence he was rescued. A man named Dubois was at work in his barn, at the beginning of the ice shove, but the water rose so rapidly that he had to escape by a hole made in the roof and was received by four men paddling a canoe. Hardly was he in the canoe that an enormous piece of ice struck the barn and crushed it down.

A lady called Gingras embarked in a canoe with her seven children, the eldest of whom was only 15 years of age. The canoe had drifted for two leagues amidst lumps of ice and wrecks of all kinds, when it struck against an obstruction at the bottom of the river ; the shock being so violent as to throw Mrs. Gingras in the water. She was

near disappearing when her daughter caught hold of her hair and succeeded in bringing her in the canoe which was kept in equilibrum by the other children. Men came to their rescue and saved them from a sure death.

The water and the ice have caused great damage. The houses and other buildings which resisted to the shove are greatly damaged. The losses to the inhabitants are immense. Two sheds belonging to one Mrs. Beauchamp have been carried away with hardware, groceries, and 200 cords of firewood. Water rose 4 feet inside of her private house and to a height of 6 feet in her store. Her furniture is no more good and her groceries having remained for a long time in the water are nearly all useless.

A letter from Maskinongé, says :

" During the débâcle of the ice on the lake, Wednesday last, 12th instant, the water of the river Maskinongé driven by a strong south-west wind invaded the fields, houses and other buildings. Many houses were destroyed and other buildings more or less damaged. Happily no life was lost. The losses of hay and other fodders were heavy. A good number of cattle, horses, beefs, cows and sheep have been drowned and carried away."

" LA MINERVE," MONTREAL, 21st APRIL, 1865.

FLOOD AND DISASTER.

The " Messager de Joliette " says :

" At Lanoraie, the gale has made terrible ravages, although no loss of life is to be recorded. Eight houses owned by Messrs. Laliberté, Ducharme, Champagne, Caron, Pagé, and by a widow, Mrs. Caisse, and a blacksmith shop belonging to Mr. Didace Lippé have been carried away by the waves. A shed of Mr. Louis Champagne's is also down. It is affirmed that this gentleman will be forced to take down his house to rebuild it elsewhere. Circulation on foot is no longer possible in front of the house owned by Notary Latour, and the ground under the south-west corner of the same house is undermined for at least 10 feet in depth. At many places, over a distance of 6 or 8 miles, the road next the river has been worn away over its whole breadth. The house mentioned as the one of Mr. Champagne is not his residence next the railway station."

" L'Ere Nouvelle " of Three Rivers, says :

" When the gale was raging most violently, the waves dashed with fury against the buildings, and in less than one hour the vast sea was covered with wrecked houses, barns, sheds and furniture passing between cakes of ice, to the great despair of their owners, some of whom risked their lives in endeavouring to save these articles. Nevertheless notwithstanding the formidable appearance of the storm which seemed to destroy all the portions of the town under water, there were only some ten houses and some barns thrown down and carried away."

" LA MINERVE," MONTREAL, 14TH APRIL, 1873.

THE ICE BREAKING UP.

The ice bridge opposite the city, moved somewhat during the night of Saturday to Sunday. We believe this first move of the ice is due to the actual breaking of the ice in Lake St. Louis.

The winter road to St. Lambert, has moved to below Bonsecours market. The frequent rains we have had lately contributed greatly to the shove.

News from Sorel, says the ice is shoving greatly at that place. In every part of the country the moving ice causes disasters. Since 15 years, the level of rivulets has never been so high and nevertheless the water continues to rise. The ice has piled up opposite Laprairie Village and we learn that pieces of ice are piled near the La Saline Hotel.

As it will be seen by our despatches contained in other columns, the damages done by the flood are great at Terrebonne and Sault au Récollet.

"LA MINERVE," MONTREAL, 15TH APRIL, 1873.

At every hour, at every instant, the progress of the shove is watched. The water continues to rise and last night it stood nearly 2 ft. high in most of the cellars of the stores of St. Paul Street, between McGill and St. Peter Streets. Some cellars on Commissioners Street are also flooded. At many places the ice has moved on top of the revetment wall on Commissioners Street, and nevertheless it is only the beginning.

If we go through Point St. Charles, we notice that the inhabitants are very uneasy and do not know what will be the end of what is called the "*débâcle.*" The water in certain parts of that suburb, especially on the south side of Wellington Street, is 4 to 5 ft. high.

Above Victoria Bridge, the ice pilings reach 25 ft. in height. The ice packs are seen all around Ste. Helène Island and some of the pine trees which are its ornaments, in summer, have been crushed. Old inhabitants say they never saw the like.

At Longueuil, fears are entertained the same as on this side; people are preparing for the flood. Two men yesterday crossed the bridge to St. Lambert, but it is said they have incurred great risks and that they would not repeat the same imprudent act.

"LA MINERVE," MONTREAL, 18TH APRIL, 1873.

The ice bridge has shoved down a little during the night of Wednesday to Thursday, especially on the St. Lambert side; on the south side of Ste. Helène Island, the ice has piled at several places, to a height of 50 ft., forming mountains.

Many guns mounted on their carriages and used for firing practice have been pulled down.

Water rose rapidly since 10 o'clock the night before last. Yesterday morning, Commissioners Street was flooded, partly, between St. Jean Baptiste Street and Bonsecours market.

The warehouse "Ottawa and Rideau" and the coal yard of the Intercolonial, on McGill Street are flooded, as well as St. Paul Street at the corner of St. Peters Street, and a great portion of Pointe St. Charles including the plot of land known as "St. Patricks Fields." Cellars in Griffintown are flooded; last night Chaboillez Square appeared like a small lake. Portion of St. David Street has been changed into a rivulet.

At Point St. Charles many inhabitants use canoes for going out of their houses.

Lands situated on the Lachine road are covered by 3 to 4 feet of water. The ground floor of St. Anne's Market is full of water. The winter road to Longueuil is totally broken up and enormous pieces of ice have got stuck fast near the cotton factory, at Hochelaga.

At four yesterday morning the steamer "Richelieu," of the Richelieu Company, left Sorel for St. Hilaire. The passengers arrived here by the noon train.

"LA MINERVE," MONTREAL, 19TH APRIL, 1873.

The water which is now at the level of top of the revetment wall, seems to be stationary. Since 4 p.m. yesterday, Commissioners Street is dry, though some pools of water are yet seen in some places.

It is related that some time yesterday the Village of Laprairie was totally flooded and that great damages were caused by ice; it is even said that many houses were torn down. M. Lanctot, hotel keeper, seems to be the greatest sufferer of all these accidents.

"LA MINERVE," MONTREAL, 21ST APRIL, 1873.

Water has reached an extraordinary level; it stands over all the wharves and threatens to invade the offices and sheds of the Richelieu Company, the highest on the shore,

to which access is now had by boards resting on blocks. Our rich harbour has at last been entirely cleared of its winter obstruction—the ice bridge. At the first shove of the ice heavy chains which tied to shore some rafts of square timber were broken as threads, and the rafts moved down a distance of fifteen arpents. One crib even followed the ice in the river. All the remainder were saved. This was the only accident due to the breaking up of the ice.

"LA MINERVE," MONTREAL, 23RD APRIL, 1873.

A large quantity of ice lying on the shore at St. Lambert, moved away yesterday. At Longue Pointe the breaking up of the ice is far advanced, and a channel is opened as far as beyond Verennes.

The water is falling slowly.

(Morning Chronicle, Quebec, 12th April, 1865.)

INUNDATION AT STE. ANNE.

A correspondent writes us as follows: from Ste. Anné de la Pérade, under date of Sunday:—

"We are flooded. The water was never so high here as it is at the present moment. There is a foot of water in the lower part of the house in which I at present reside, although it is built in the highest part of the parish. I have been obliged to take my horses out of the stable. To day we went to church in canoes. It is feared that the water will rise still higher, inasmuch as the ice is not moving. All the fields in rear of the village are flooded as far as the woods. Fears are entertained for our bridge, inasmuch as the ice is jammed against it. It is said here that Batiscan bridge has been carried away, and that a number of small craft, in winter quarters at the mouth of the river, have been damaged. Our own parish presents a sad spectacle. Its whole extent is inundated as far as the church.

The Montreal "Evening Telegraph" of 12th April, 1865, says:—

The flood still continues with little abatement, and although the water is not so high as in 1861, the area of the submerged district is very large, extending from the river to Bonaventure Street, including the whole of Ste. Ann's, part of St. Antoine, West, Centre and East wards. The amount of suffering occasioned by it is very great, and quite beyond the means of the national and other benevolent societies to alleviate.

(Morning Chronicle, Quebec, 13th April, 1865.)

THE ICE PIER.

A correspondent of the "Journal," writing from Ste. Anne de la Pérade, in reference to the flood at that place, already referred to in our columns, says:—

"Thanks to the piers constructed in the river to favour the formation of an ice bridge for the accommodation of the citizens or persons residing in the environs of the city, we are now in a "jam," the like of which was never seen before within the memory of man.

"There is but one outcry here, a protest against the piers and those who caused them to be constructed."

(Morning Chronicle, Quebec, 15th April, 1865.)

THE RIVER.

By the latest intelligence received we learn that the ice that broke up in the upper part of the river has got jammed at Grondines.

The damage done to Mr. Cushing's mill at Repentigny, by the recent break up of the ice, is estimated at $200.

(Morning Chronicle, Quebec, 19th April, 1865.)

The ice has done much damage at Bécancour and Gentilly, while full details of the disaster at Pointe du Lac, have not yet reached us. In the lower part of Three Rivers there are fifteen houses more or less injured by the ice, and in many instances the furniture has been either carried away or else broken to pieces. The high water has also caused loss to several lumber merchants who wintered saw-logs and timber in booms in the east channel of the St. Maurice. The flood rose above the piers to which the Government booms are usually attached, and the ice floated over them carrying off most of the timber and logs wintered there. In a similar way the water in the west channel of the St. Maurice rose so high, being backed up by the St. Lawrence, that the ice floated over the piers belonging to Mr. Ward's sawmill, and when the gale of Wednesday rose, the entire sheet of ice from the mills to the bridge was carried out half way across the river, bearing with it, the booms which had been strung along inshore in the fall for safety, as well as boats, schooners, etc. Fortunately there was no current in the St. Maurice, and by dint of hard labour and considerable expense all the property will be saved. A gentleman who had occasion to pass through Belle Rivière, St. Eustache, St. Martin, informs us that he counted no less than 32 barns and 4 dwelling houses unroofed during the gale, also that the covering of the bridge of Barre à Plouffe was to the extent of about 150 yards blown into the river.

One of the incidents of the disaster at the Island of Sorel is thus described: "One child of twelve months old had been taken off a roof by Capt. Labelle and was supposed to be dead, but by constant rubbing when on board by the crew of the boat, he was brought to life. One young woman, thinly dressed, dripping wet, with long hair dishevelled, hanging over her face and shoulders, with large black eyes rolling, presented a picture of despair, she looked as if bereft of reason. One very old man and a number of women and children were driven away in an open boat towards the lake; fortunately they found refuge in a covered bateau, which was itself driven into the woods. The husband of one of these women caught hold of some boards, was carried in another direction into the woods and passed twelve hours in that situation. One man left his house to go to the barn to feed his cattle; a few minutes after he saw his house fall. His wife and three children were drowned.

The following additional sad tidings come from Isle du Pads: Three houses were knocked down, and, with their contents, were carried away by the force of the wind and water. Seventeen persons were lost, namely, the wife of Oliver Berard and four daughters; widow (Gilbert Brisset and her children) Jos. Boucher and his wife, and the wife of another Jos. Boucher. Besides these victims, two other persons, the wife of Louis Deay and his daughter were carried away by the flood, but they were subsequently rescued and it is hoped that they will recover. Sixty buildings have been destroyed at Yamachiche. At a place called Grand Nord, six miles below the Isle du Pads, there are only nine dwelling houses standing. Every barn and outbuilding has been carried away. The number of cattle drowned is immense. The Messrs. Proulx at Yamachiche have suffered very heavily. Captain Duval's loss at Port St. François will reach $4,000. At Isle de l'Aigle two families, numbering seventeen persons, were drowned on Friday night.

A frail craft on which there were seven persons, a mother and six children, were picked up below Berthier by one of the steamers. They were terribly exhausted, having drifted down some six miles with the current. The total number of deaths is stated by those who have visited the inundated district at fifty or thereabouts, and the destruction of the other sufferers who escaped with their lives is in many instances extreme.

The number of cattle drowned is estimated at three thousand head at least.

(Morning Chronicle, Quebec, 20th April, 1865.)

The following extract of a letter from Nicolet, under date of Monday last, has been communicated to us for publication:—

"Great damage done here by the water, ice and wind. The buildings on the property belonging to Mr. Gleason suffered great damage. A large dwelling house was all smashed with the exception of the frame which was left standing.

"The barns, stables and other outbuildings, to the number of nine or ten, were either thrown down and carried away by the water or smashed to pieces. All the fences are gone and trees torn out by the roots. Mr. Michael Finlay, the tenant of the said property, has suffered great loss, having lost all the grain to the amount of 300 bushels, also 1,500 bundles of fodder. All the farm implements have been carried away ; not an article left. Mr. Roy, of Nicolet, has also had his barns destroyed and his house considerably damaged. Mr. Boudreault has likewise suffered heavily, his house having been destroyed. Mr. G. Beaubien and other residents have suffered more or less."

(Morning Chronicle, Quebec, 27th April, 1865.)

Some additional details have been received of the loss of life and property at various points on both banks of the River St. Lawrence, by the recent flood storm. The bodies of nineteen of the victims, belonging to the de Grace and Isle du Pads, have been picked up along the shores. The greater number of these are women and children. The loss of property in the parish of Nicolet is estimated at $12,400. The loss at Bécancour is much more extensive than was at first supposed, about three-fourths of the whole surface of the parish being flooded. Fully two hundred buildings in this locality have been carried away, and the loss of cattle, grain and produce generally is immense. At Lanoraie, which it was thought at first had escaped the dreadful visitation, eight dwelling houses and a number of outbuildings were carried away, but there was no loss of life.

APPENDIX No. 20.

REPORT ON WATER LEVELS, RIVER ST. LAWRENCE, BETWEEN QUEBEC, MONTREAL AND LACHINE, BY R. STECKEL, CIVIL ENGINEER, 24TH NOVEMBER, 1891.

NOTES AND REMARKS

RELATIVE TO THE

DÉBÂCLE AND THE FLOODING OF THE BANKS

ON THE

RIVER ST. LAWRENCE

BETWEEN

QUEBEC, MONTREAL AND LACHINE

IN THE

SPRING OF 1887.

Replies of mayors, municipal officers, etc., of riparian parishes to circulars sent by the Department of Public Works at the approach of spring in 1887.

LAPRAIRIE, 23rd April, 1887.

G. F. BAILLAIRGÉ, ESQ.,
Deputy Minister of Public Works,
Ottawa.

SIR,—I have the honour to acknowledge the receipt of your communication dated the 20th, by which you ask me to observe the shoving of the ice and generally all other particulars relating to the débâcle on the St. Lawrence.

The following day I commenced my observations and I hope before long to be able to present you with a complete report, not only of my own personal observations but also of those of Rev. Mr. Bourgeault, the parish priest, who has noticed with particular attention the movements of the flood, as well as those of citizens of good standing of this village.

I have also followed the instructions contained in the dispatch of Mr. A. Gobeil, dated the 26th instant. The highest level reached by the water is marked on the breakwater. So that you need not fear, dear sir, that the information will be deficient, but rather, a superabundance of data.

Warmly thanking you for the interest you display in favour of La Prairie. I remain with much consideration

Your obedient servant,
(Signed) T. A. BRISSON.

LONGUEUIL, 28th April, 1887.

G. F. BAILLAIRGÉ, ESQ.,
Deputy Minister of Public Works,
Ottawa.

SIR,—In answer to your request dated the 20th instant asking for information concerning the progress of the ice shove and the flood this year, at Longueuil, I have the honour to submit the following observations:

From April the 18th to 21st, the water stood nearly at a uniform level, viz.: even with the foot of the streets ending at the bank of the river without, however, flooding the said streets.

In the morning of the 22nd at 6.15 the ice shoved with great effect along the bank, from the government land, at the west end of the city, causing the formation all along the bank of a wall measuring on an average 24 feet in height, breaking the house and barn situated on the government land; carrying away one corner of the house belonging to the South-Eastern Railway Company; destroying part of the property of Mr. Smardon, near the river, on the street opposite the convent of the "Sœurs Jésus-Marie" and causing further damages of less importance. At the same time water reached the foot of St. Charles Street in the west end of the city, rising about 3 feet, but it fell almost immediately to within 1 foot of its level prior to the shove.

In the afternoon of the 22nd, at 5 o'clock, water rose very slowly. At 5 p.m. I paid a visit to the waterworks, and it was noticed that the water was only a few inches below the fires. I then went by boat to the ruins of the government farm house to have a good view of the situation.

On the Montreal and Hochelaga side, and behind Ste. Hélène Island, I could see but mountains of ice following a line nearly direct from the South-Eastern Railway to the cotton factory of Mr. Hudon. Below this point, the ice seemed not to have moved, except along the bank of the river and along the city front as above referred to. I found the situation to be so threatening that I ordered the men in charge of the waterworks to take every possible measures to prevent the fires being put out, but not to remain on the premises during the night for fear of the works being washed away by ice that could be driven against the building during that period. From 5 to 6 p.m. the water rose more particularly in the west end of the city, and we noted that it was not so much the swelling of the St. Lawrence itself, as the waters running down from St. Lambert which flooded our streets. At 8 o'clock, water rising slowly in the east end of

the city. The ice seemed jammed and securely anchored to the bottom of the river where the Montreal Harbour Commission have deposited the dredgings of the said harbour during the past few years, and more particularly from the Princess Royal Avenue down towards Boucherville.

23rd April, 6.30 a.m. Thermometer 48°. South-east wind. The water rose about 1 foot during the night and covers a part of St. Charles Street, but does not reach the fires of the boiler in the waterworks. Ice does not seem to have moved during the night.

Noon. Temperature 55°, south wind. Threatening rain. No rise in the water, which is at the level of this morning. Ice opposite town has not moved. I learn by telephone that in Montreal the water has fallen 6 inches.

5 p.m. Heavy rain. No change in the condition of ice since noon. I learn by telegraph from Pointe-Claire that the ice of Lake St. Louis was yet solid at 2 this p.m.

8 p.m. Water has risen a little since 5 o'clock, which is due as much to rain as to the ice. The stretch of the river between Victoria Bridge and Laprairie which was free of ice this morning has been refilled for the second time since yesterday. The rain has changed the rivulets into torrents.

24th April, 6 a.m. Temperature 40°. Water rose 4 inches in the west end of the city and 10 inches in the east end. No noticeable change in the state of ice.

9 a.m. No particular observation. Water has only 1 inch more to rise to reach the fires at the waterworks.

Noon. No change to be noted.

1 p.m. I learn by telephone from Pointe Claire that the ice began to move. We expect a shove here at about 6 p.m.

3.40 p.m. Beginning of the débâcle. The ice at the back of St. Helène Island, south shore, descends towards the north, but once at the centre of the river, flows towards north-east as far as opposite the Catholic church of Longueuil and thence directly to the east till it grounds on the bottom covered by the dredgings deposited by the Harbour Commissioners.

For one hour the water rose very rapidly and reached from 18 to 19 inches above the highest water of 1885, which was the highest flood observed in Longueuil, that of 1886 having reached a level 1 ft. lower.

From 3.40 to 4.30 water rose at least three feet.

5.20 p.m. Water fell 6 inches. The ice shove is stopped, but we expect there will be another move at about 8. Seen from the steeple of the church the part of the river between Victoria Bridge and Laprairie seems to be free of ice.

The engines at the waterworks are not working. The ice has not moved at the eastern end of the town. It seems as if the ice shoved further down on the south shore probably because the Montreal Harbour Commission has not placed any obstructions to the free course of the ice on that side of the river.

6 p.m. Water stationary. Ice not moving. Thermometer showed little or no change to-day, not having risen above 42°. This morning we had 40° at 6 o'clock, now we have 40½° at 7 p.m.

Since one hour, water has again fallen by 6 inches. No change in the ice.

25th April, 6 a.m. Temperature 32°. During the night the water fell some inches. It stands about 1 foot lower than the highest level reached yesterday at 4.30. It rose a little between 8 o'clock and midnight, for this reason the three decreases of height I point out, viz.: that at 5.20 p.m., that at 7 p.m. yesterday and that of this morning, I find a fall of only 1 foot. No change in the ice on the Longueuil side. The key or centre of resistence seems to be in the eastern end of Longueuil towards Boucherville.

9 a.m. A dispatch from Pointe Claire says the ice of Lake St. Louis is coming down in one field. No change to be noticed here in the ice.

1 p.m. No change.

26th April, 7 a.m. During last night water fell about 12 inches. No change in the ice.

Noon. Water decreases very slowly in height.

6 p.m. Water level decreased about 1 foot in the preceeding 12 hours. No change in the ice. I have given orders for marking the highest elevation reached by water, from the waterworks to the lower part of the town, so as to refer to these marks when required.

27th April, 6 a.m. Thermometor 36°. No motion of the ice and no change to be noted.

Water level decreased sufficiently to permit the working of the pumps of the waterworks this morning.

Noon. During the last 18 hours water fell 1 foot. We begin to realize the extent of the losses suffered which are greater than at first supposed.

The habitants on the north of St. Charles Street are totally demoralized. The exasperation against the Montreal Harbour Commission is at its height and the calling of an indignation meeting is talked of as also the sending of delegates to make representations to the Federal Government, with a view of obtaining justice from the said Commission who seem inclined to sneer at every one, notwithstanding that it is evident the Commission is responsible for the present state of things by its perseverence in filling up the channels below this town.

28th April, 6 a.m. Thermometor 33°. No change in ice. Water is still falling. The eye cannot ascertain the opening of a channel within the range it can reach.

6 p.m. Channel opened on the Hochelaga side and ice moving down, but at the east end of the town, towards Boucherville, it moves very little if any. This is a very excellent opportunity for the Engineer of the Montreal Harbour Commission to come and admire his work. The year 1887 will be memorable for Longueuil when the flood question will come up.

I have the honour to be, Sir,
Your devoted servant,
(Signed) L. E. MORIN,
Mayor of Longueuil.

LONGUE POINTE, 22nd May, 1887.

SIR,—In answer to your request concerning informations in relation to the flood and the débâcle, I have to say that the ice shoved between Hochelaga and Longue Pointe on the 22nd April; the water was excessively high at the beginning of the shove; on the 24th the ice moved anew from Longue Pointe to the end of Charron Island; the water decreased in height during these few days; for a third time, on the 27th, the ice moved, and between 4 or 5 o'clock on the afternoon of the 29th the river was entirely clear.

I believe we were exempted from a flood at Longue Pointe only on account of the ice having begun to move below this place. As regards the height reached by the water, it did not rise as high as during the floods of 1885 and 1886.

(Signed) HORMIDAS LAPOINTE.

REPENTIGNY, 5th May, 1887.

SIR,—I am directed by the Mayor of this place to transmit to you the following informations concerning the flood at Repentigny.

This year it is impossible for us to tell you exactly the greatest height through which the river rose on the 24th April 1887 (at its maximum) because we have not observed the height of the water last summer when it was low. However, we can say that we believe the water reached a point 20 ft. above the lowest water. The point it reached this year was 20 inches lower than that of last year.

Since 3 years, the water covers the two-thirds of the Post Road for a depth of 1 to 6 ft.

The débâcle began at 4 a.m. Wednesday, the 27th April, and was very slow; 4 days before the river was clear of ice opposite this parish. As everywhere else, the water rose and fell a few inches in one hour, &c., &c.; but it remained high during a shorter time this year than last.

The flood of this spring lasted from the 20th April to the 1st of May.

I have the honour to be, Sir, your obedient servant,

(Signed) F. X. O'BRIEN,
Secretary-Treasurer of the M.C.P.R.

G. F. BAILLAIRGÉ, ESQ.,
Deputy Minister of Public Works,
Ottawa.

CONTRECŒUR POST OFFICE, 30th April, 1887.

The Mayor of Contrecœur, Jos. Duhamel, has the honour of answering to a circular of the Deputy Minister of Public Works, dated the 20th April, as follows:

The river reached its highest level at noon of the 25th and stood 2½ feet below its highest level of 1886. The absence of a water gauge prevents us from giving a more precise figure. After many moves, the ice made a decided downward move on the 28th at noon, and continued to descend thereafter. On the 29th, the Northern Channel seemed free of ice.

The breaking up of the ice opposite our place is always slow and difficult on account of the narrow passage in front of Lanoraie.

It is said the river is free at Verchères. Large quantities of ice are yet kept back here by the islands, and a strong north-east wind.

(Signed) JOS. DUHAMEL, Mayor.

LAVALTRIE, 5th May, 1887.

SIR,—I have the honour to transmit herewith my notes and observations concerning the breaking up of the ice and the flood of this spring at Lavaltrie.

I considered that I should supplement these notes with certain remarks, which being in accordance with others, will, I hope, help the Government not only in finding the remedy, but also to apply the said remedy to our sufferings. Let us have the proper confidence in engineers, for the most part strangers, who know very little of our great river; but specially let us listen to the testimony of old Canadians able to supply informations based upon their own experience, and which are worth a great deal more, I think, than the reports of those engineers made at the cost of millions of dollars.

I have the honour to be, Sir, your obedient servant,

(Signed) SIM. MARTINEAU, M.D., Mayor.

G. F. BAILLAIRGÉ, ESQ.,
Deputy Minister of Public Works,
Ottawa.

NOTES AND OBSERVATIONS ON THE DÉBACLE AND THE FLOOD AT LAVALTRIE, 1887.

Friday, 22nd April. The water which up to date has risen slowly, is yet 8 ft. below its highest point of last spring, 1886.

Saturday, 23rd April, 6 a.m. Water rose 2 ft. since yesterday. This morning a shove of the ice took place; ice moved for about 200 ft. and broke the shed of the Richelieu Company.

Sunday, 24th April, 6 p.m. To-day, water rose 6 inches. Three feet more required to reach the level of last year.

Monday, 25th April, 3 p.m. Water sank 2 inches since yesterday.

Tuesday, 26th April, 4 p.m. Water fell 8 inches since yesterday. Ice yet solid.

Wednesday 27th, 8 p.m. Water is again sinking a little. Ice began to move last night and is still piled up at several places on the banks; many fences broken and carried away.

Thursday 28th, 9 a.m. Ice shoves again and breaks up here and there. Water descends slowly.

28th April, 6 p.m. At various intervals to-day, the ice went down and broke up, we began to notice a few open spaces here and there.

Remark. The rise of the water is explained by the ice choking the narrow part of the river in front of Lanoraie. This jamming of the ice at Lanoraie, in 1869 and 1886, after the departure of the ice from opposite our place, caused the water to reach here its highest level; it could not flow through the choked channel. Sometimes, however, the jamming takes place amongst the Islands of Sorel, instead of at Lanoraie, and which equally causes a flood at Lavaltrie, such was the case in 1865 and 1885.

29th April, 6 a.m. This morning the channel is nearly clear of ice, although ice is yet solidly attached to the shoals, on each bank. Since yesterday, water fell 1½ ft. and the action of the wind is the only cause that can now detach these grounded cakes of ice.

Remark. It is proper to state that since a few years, the Montreal Harbour Commission has caused a new channel to be dredged across the flat shoals, on the south side of the old channel. This new channel, according to the opinion of competent men, corroborated by the testimony of an experienced pilot, living here, is one of the most active causes of the flood, and I am of the same opinion. At any rate it is worthy of note that this channel is opened since only three or four years, and that during each one of these years, we have experienced a disastrous flood.

This opinion is based upon two principal reasons: 1st. The level of the shoals has been considerably raised by the deposition of a large quantity of dredgings here and there.

The dredging operations have caused these shoals to dry at low water, whereas they were never seen above water before. Whence: a first obstruction, easy to understand, opposed the descent of the ice. 2nd. This new channel has completely changed the natural course of the river which followed the old channel in a straight direction towards Lanoraie. Now the water has to turn nearly at an acute angle up stream to go into the new channel which is deeper than the old one, where the banks are nearly dry at low water, which gives the channel the appearance of a canal. The water goes through that channel as through a rapid, for a distance of 3 miles, and strikes in a perpendicular direction on the banks at Contrecœur. In thus striking the shore, this stream is broken up and reflected so as to return northward, stemming back the surrounding waters on each side. Whence the dangerous whirlpool complained of by pilots and which causes the ice to ground on the adjoining foreshores and thus obstructs the river bed more and more; the original current being no longer there to clear it.

Nothing surprising then, if we have floods, and we will have many more of them in the future, because, these are undeniable facts which everybody can ascertain and the consequence of which can only be more and more disastrous floods.

29th April, 6 p.m. Strong north-east wind. Water rose one foot since morning. The fields of ice, grounded on the shoals, are broken up by the action of the tide.

30th April. Moderate wind; hardly any ice left. The water continues to fall steadily, the flood is over.

Remark. The highest level was reached here by the water on the 24th April. It stood 3 ft. below the level of last year, and one foot below the level of 1885; in 1869, the flood reached about the same level as this year.

As far back as our people can remember, the highest flood observed here was that of 1886.

1st May, 1887. Opening of navigation.

(Signed) SIM. MARTINEAU, M.D., Mayor.

Lavaltrie, 1st May, 1887.

BERTHIER EN HAUT, 3rd May, 1887.

G. F. BAILLAIRGÉ, ESQ.,
Deputy Minister Public Works,
Ottawa.

SIR,—In answer to your request addressed to me asking for information concerning the breaking up of the ice at Berthier, I supply you with the following notes.

The débâble occurred on the River St. Lawrence, opposite this place, on the 29th April. The greatest rise of the water took place on the evening of the 24th, when it reached an elevation of 16½ ft. above its ordinary summer level; the low part of the town became flooded on or about the 15th April, and the whole town on the 24th. Late in the evening of that day, the water became stationary, and remained so all night and during the forenoon of the 25th, after which it began to fall quite rapidly, and during the whole of the 25th, and since last night, it recedes slowly enough—the low part of the town is yet somewhat flooded. The water rose very rapidly during the night of the 23rd to the 24th, and during this last day.

According to many observations, there is a difference of 10 inches or thereabouts between the level of the water in 1865 and this year's, noting that the flood of 1865 is stated to have been the highest by the oldest habitants; and that the flood of 1887 comes next as regards elevation.

I remain, Sir, yours, &c.,
(Signed) F. O. LAMARCHE,
Mayor of Berthierville.

ST.-FRANÇOIS DU LAC, 4th May, 1887.

G. F. BAILLAIRGÉ, ESQ.,
Deputy Minister of Public Works.

SIR—,The following is my answer to your request:

On the 29th April, lake St. Peter and the river were cleared of ice.

The flood commenced on the 14th of that month and the water has not yet altogether gone down.

This year the water rose 4 ft. higher than last, and I have marked its highest level of this year on a house, as I was requested.

(Signed) H. CREVRIER, Mayor.

ST.-FRANÇOIS DU LAC, 18th May, 1887.

SIR,—In reply to your letter of May the 12th, asking me to give you the date of the breaking up of the ice on River St-François du Lac, I have much pleasure to be able to inform you that it took place on the 27th and 28th April; water was nearly 2 ft. higher than during other springs.

It commenced to fall on the 26th, and now, is at its normal height.

I have not asked for information from the Mayor of St. Thomas, because this gentleman lives in the concessions, and I think he has not heard of this question of flood.

Your most humble servant,
HENRI CREVRIER, Mayor.

G. F. BAILLAIRGÉ, ESQ.

YAMACHICHE, 28th April, 1887.

Mr. A. GOBEIL,
Secretary of Public Works,
Ottawa.

SIR,—I received your telegram and in answer thereto, beg to state, that I acted according to your request in marking the highest level reached by the water this spring.

Yours truly,
(Signed) THOMAS DUFRESNE, Mayor.

CHAMPLAIN, 28th April, 1887.

G. F. BAILLAIRGÉ, ESQ.,
Deputy Minister of Public Works,
Ottawa.

I have received your letter of the 20th instant, asking for information relative to the highest water and the breaking up of the ice.

The water rose 18½ ft. above the summer level of the lowest tides. The dèbâcle began in the afternoon of the 20th, and the ice continued to move every day until Sunday morning the 24th, when the water began to fall, and since then it fell 5½ ft.

I remain, your most humble servant,
(Signed) XAVIER BOURBEAU, Mayor.

GRONDINES, 25th April, 1887.

G. F. BAILLARGÉ, ESQ.,
Deputy Minister of Public Works.

SIR,—Ice broke up here on the 24th inst., at 6 a.m. ; we had no flood ; water rose about 8 ft. during a few hours only.

I have the honour to be, Sir, your humble servant,
(Signed) ONÉSIME RIVARD, Mayor.

ST. ANTOINE, 15th May, 1887.

SIR,—At different times, I went to the river to note the highest level reached by the water ; and it is in April that it rose most. I have marked its level on a shed, ¾ of a league below the church.

(Signed) N. DION, Mayor.

STE. CROIX, 27th April, 1887.

MR. A. GOBEIL.

In reply to your telegram of yesterday, I have to ask you if I am to observe all the highest spring tides, or only those that will rise most and no others. An answer is requested.

Yours truly,
CAPT. FERD. BOISVERT, Mayor.

No. 76890.

ST. LAMBERT, 5th May, 1887.

To the Deputy Minister of Public Works, Ottawa.

DEAR SIR,—In conformity to your request, I herewith submit the following facts in relation to the recent flood and its results on this side of the river.

A shove took place on the 20th day of April, about 3 o'clock in the afternoon, and a large quantity of ice shoved up on Moffatt's Island, this turned the course of the shove, crowding it towards the St. Lambert shore, causing considerable damage to the river bank, by removing large quantities of soil therefrom. The water rose slowly until about noon of that date, and at this time it reached the height of about 23 feet above summer level.

On the morning of the 22nd it commenced to recede slowly.

The water at its highest stage measured from 2 to 6 feet above the road, and in some parts it shoved the ice up to a height of from 15 to 20 feet and quite close to a large dwelling house. Had the ice gone a little further it would have been wrecked,

and in other parts large boulders have been deposited in the middle of the road. The ice has this year, as it did during the flood of last year, removed a large part of the river bank, below the long wharf, formerly used by the G. T. RR., but of no use now ; the road has now become so narrow in consequence of the removal of so much of the river bank, that it is dangerous to public travel, the road being in some places only about 15 feet wide, and two teams can hardly pass with safety.

It is to be hoped that the Government will take measures to remove this wharf. It would furnish excellent material for the improvements so much needed on the St. Lambert shore.

The shove took place on the afternoon of the 24th, at this time the bulk of the ice left here and the water lowered some, but owing to the clamming of the ice gorge below Longueuil the water continued even with and the lower parts several feet above, the road, until the 27th, when it left the road altogether.

I think with many others that the Harbour Commissioners have committed a grave mistake in causing the dredgings of the harbour to be dumped in the river, below Longueuil, thus causing shallows for the great mass of ice to ground on, and prevent the free flow of the water.

In conclusion I would say, that these floods are causing great loss of property and the people's time, besides the untold miseries and suffering brought upon the inhabitants of the flooded districts. We hope that such measures may be adopted as will hereafter put a stop to these inundations.

Respectfully yours,
(Sgd.) M. CRAIG,
Mayor of St. Lambert.

No. 76665.

HARBOUR MASTER'S OFFICE,
MONTREAL, 2nd May, 1887.

DEAR SIR,—I am in receipt of your note of the 21st ult., and send you by mail, a copy of our annual report, in which you will find statement of the opening and closing of navigation from 1877 to 1886, as well as other information that you may find interesting.

Believe me, yours very truly,
(Sgd.) THOMAS HOWARD,
Harbour Master.

G. F. BAILLAIRGÉ, Esq.,
Ottawa.

APPENDIX No. 21.

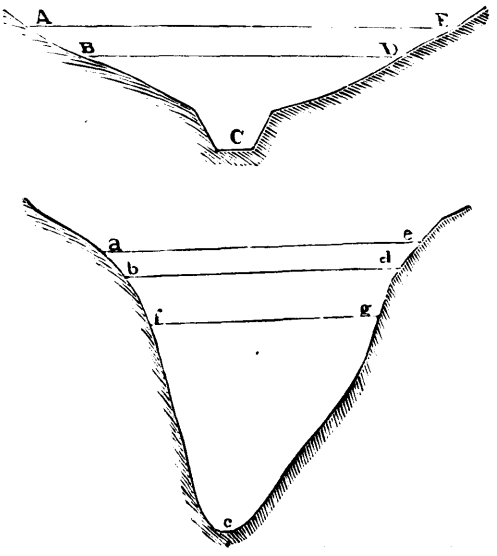
REPORT ON WATER LEVELS, RIVER ST. LAWRENCE, BETWEEN QUEBEC, MONTREAL AND LACHINE, BY R. STECKEL, CIVIL ENGINEER, 24TH NOVEMBER, 1891.

NOTE A.

APPROXIMATE DETERMINATION OF MEAN LEVEL OF ATLANTIC OCEAN, AT QUEBEC, BY MEANS OF DATA AFFORDED BY TIDE AND RIVER GAUGE REGISTERS KEPT AT VARIOUS PLACES BETWEEN QUEBEC AND MONTREAL, 1878 TO 1882; THE ADMIRALTY CHARTS, ETC., ETC.

NOTE A.

APPROXIMATE DETERMINATION OF POSITION OF MEAN LEVEL OF ATLANTIC OCEAN AT QUEBEC, BY MEANS OF DATA AFFORDED BY TIDE AND RIVER GAUGE REGISTERS KEPT, 1878 TO 1882, ETC.



1st. Let A B C D E A be a cross section of Lake St. Peter, or at any other point of the River St. Lawrence, where it is free from regular tidal fluctuations, or practically so, in comparison to the variations of level due to changes in the fresh water discharge, and where the elevation of the bottom of the thalweg is near a maximum and the bed would be completely uncovered if the stream ran dry at any time; the surfaces A E and B D corresponding; respectively, to river levels 26·6 ft. and 20 ft. above 0, per Montreal Harbour Commissioners' gauge at Sorel.

2nd. *a b c d e a*, a cross section of the St. Lawrence estuary—such as it would be, if the Atlantic Ocean; being abstracted from the combined influences of the sun and moon, was tideless—at a point where the depth of the back water from the sea at its mean level is great in comparison to the total depth of the stream of drainage and tide water which makes its way to the gulf; the surfaces *a e* and *b d* also corresponding to the river levels at Sorel just described.

Again, let us put:

F_1, for area of waterway A B C D E A,
F, " " B C D B,
F'_1, " " *a b c d e a*,
F', " " *b c d b*,
p_1, for wetted perimeter A B C D E,
p, " " B C D,

C_1, velocity in waterway A B C D E,
C, " " B C D B,
c_1, " " $a\ b\ c\ d\ e$,
c' " " $b\ c\ d\ b$,
Q_1, volume of water passing through area A B C D E A = F_1, in the unit of time,
Q, " " " B C D B = F, in the unit of time,
Q'_1, " " " $a\ b\ c\ d\ e\ a$ = F'_1,
Q', " " " $b\ c\ d\ b$ = F'.

Neglecting to take into account the comparatively small quantities of water supplied by the affluents of the St. Lawrence, between the cross sections selected and above described, viz., A B C D E A and $a\ b\ c\ d\ e\ a$, we may consider the volumes which flow through the same in the unit of time to be sensibly equal to each other and admit that:

$$Q'_1 = Q_1 \text{ and } Q' = Q \qquad (1)$$

But although not invariably true within narrow limits, still it is probable that on the same river bed the velocity C varies, in general, nearly as $\sqrt{\frac{F}{P}}$ whence we may put:

$$\frac{C_1}{C} = \sqrt{\frac{F}{P_1}} \times \sqrt{\frac{P}{F}} \qquad (2)$$

As each one of the volumes (Q, Q_1) is evidently equal to the product of the area (F, F_1) by the velocity (C, C'_1), we have also:

$$\frac{Q_1}{Q} = \frac{F_1\ C_1}{F\ C} \qquad (3)$$

and

$$\frac{c'_1}{c} = \frac{Q_1}{F_1} \div \frac{Q'}{F'} = \frac{Q_1\ F'}{Q'\ F_1} \qquad (4)$$

because, in general, the velocity (c'_1, c') is equal to the discharge ($Q'_1 = Q_1$, $Q' = Q$) divided by the area (F'_1, F') of the waterway. Furthermore, the following relations hold good, viz.:

$$Q_1 = (F_1 - F)\,c_1 + Fc + F\,(c_1 - c) = (\acute{F}_1 - \acute{F})\,c'_1 + \acute{F}c' + \acute{F}\,(c'_1 - c'),$$

$$Q = Fc = \acute{F}c'$$

$$Q_1 - Q = (F_1 - F)\,c_1 + F\,(c_1 - c) = (\acute{F}_1 - \acute{F})\,c'_1 + \acute{F}\,(c'_1 - c') \qquad (5)$$

On account of the ever increasing mass of the body of back water from the Atlantic Ocean, which has to be put in motion by the fresh water stream flowing through the estuary, the velocities c' and c'_1 in the waterways $b\ c\ d\ b$ and $a\ b\ c\ d\ e\ a$, become diminished more and more as we proceed down stream towards the Gulf of St. Lawrence, and the ratios $\frac{c'_1}{c}$ correspondingly increased, in comparison to those that would obtain, if the river was flowing freely over its bed above the mean level of the sea, when no resistance caused by back water would be met with.

With the aid of transverse profiles (see A, B, C on plan attached to this appendix*) of the river bed, constructed with soundings and other data taken from the Admiralty charts, together with diagrams, (such as Nos. 2 to 8, Ill. No. III.,) showing the geometrical loci of the flood and ebb high and low water levels of the estuary, when these levels are plotted as ordinates with the ranges of the tides taken as abscissas,—for various stages of Lake St. Peter and the river above; etc,—the areas F, F_1, and ratios $\frac{c_1}{c}$ have been computed, approximately at least, as shown on appendices I., II., III. and IV. to this note, for the waterways A B C D E A and B C D B of the fresh water stream proper, which are beyond the upper limit of tidal influence, viz.: on

Lake St. Peter and at a point one-quarter mile above Lanoraie, where the elevation of the bottom of the thalweg appears to be near a maximum. Moreover, the areas $\acute{F}$, $\grave{F}_1$, and ratios $\frac{c'_1}{c'}$, for the waterways at the tide stations at the foot of St. James Street, Quebec, Victoria Cove, Pointe au Trembles, Pointe Platon, Grondines, etc., can also be calculated, hence F, F_1, $\frac{c'}{c}$, $\grave{F}$, F and $\frac{c'_1}{c'}$ may be considered as being known quantities.

Now, when the water falls at Sorel from a level of 26·6 ft. to a level 20 above 0 of the Montreal Harbour Commissioners gauge, viz: 6·6 it is found (*vide* appendices I., II., III., IV.) that the velocity c_1, is decreased from 15 to 20 per cent, according as we take cross section A taken near Lanoraie, or one or the other of the cross sections, B or C, of Lake St. Peter, shown on the accompanying plan, as a basis of computation, that is to say: $(c_1 - c)$ becomes equal to: from $0{\cdot}15\ c_1$ to $0{\cdot}20\ c_1$.

Again, at the foot of St. James street, and at Victoria Cove—at both of which places the depth is considerable and the effect of the back water on the fresh water stream very great—the velocity c'_1 is decreased for the same change of level at Sorel from 26·6 to 20·0: by the quantity $\frac{Q\,F_1'}{Q_1\,F'}$;

(*a.*) Adopting section A as a basis of computation, we find:

1°. At foot of St. James Street, Quebec Harbour:

$$\frac{Q\,\acute{F}_1}{Q_1\,\acute{F}} = \frac{1 \times 405{,}470}{1{\cdot}64 \times 400{,}400} = 0{\cdot}618 \qquad \text{and}$$

$$(c'_1 - c') = (1 - 0{\cdot}618)\ c'_1 = 8{\cdot}382\ c'_1$$

2. At Victoria Cove, Quebec Harbour:

$$\frac{Q\,F'_1}{Q_1\,F'} = \frac{1 \times 177{,}400}{1{\cdot}64 \times 171{,}500} = 0{\cdot}631, \qquad \text{and}$$

$$(c'_1 - c') = (1 - 0{\cdot}631)\ c'_1 = 0{\cdot}369\ c'_1$$

(*b.*) Taking section C as basis, we have—

1°. At foot of St. James Street, Quebec Harbour:

$$\frac{Q\,\grave{F}_1}{Q_1\,F'} = \frac{1 \times 405{,}470}{2{\cdot}22 \times 400{,}400} = 0{\cdot}456, \qquad \text{and}$$

$$(c'_1 - c') = (1 - 0{\cdot}456)\ c'_1 = 0{\cdot}544\ c'_1$$

2°. At Victoria Cove:

$$\frac{Q\,\grave{F}_1}{Q_1\,F'} = \frac{1 \times 177{,}400}{2{\cdot}22 \times 171{,}500} = 0{\cdot}466 \qquad \text{and}$$

$$(c'_1 - c') = (1 - 0{\cdot}466)\ c'_1 = 0{\cdot}534\ c',$$

Now, if Lake St. Peter was to run dry: F'_1, c and c' would be $= 0$ and the expressions $(c_1 - c)$, $(c'_1 - c')$, instead of having the values just determined, would become equal to $1c$ and $1c'$, respectively.

In the absence of anything more definite, let us assume that in order that c', $(c'_1 - c')$ may gradually disappear, the tideless estuary must continue to be depressed at each of the tide stations at the same average rate, in reference to loss of velocity,

as it descends from the level corresponding to a river surface 26·6 ft. above the 0 of the Sorel gauge to one only 20·0 ft. above this 0, in which case we can put :

$$D' : d' :: 1 \frac{c_1' - c'}{c_1'}$$

whence :

$$D^1 = \left(\frac{d'}{\frac{c_1' - c'}{c'}} \right) \qquad (6)$$

where d' represents the lowering of the water at a tide gauging station, which corresponds to the lowering of the river proper at Sorel by 6·6 ft. viz : from 26·6 ft. to 20 ft. on the gauge just mentioned, and D' the depression caused at the same station by the lowering of the Sorel river level from 26·6 ft. to about 8·0 ft. above 0 on the same gauge, when Lake St. Peter would be nearly dry, which depression is equivalent to 14 ft. at the foot of St. James Street, and 2·4 ft. at Victoria Cove.

Substituting in equation (6) the numerical value for the symbols d' and $\frac{c_1' - c'}{c_1'}$ we obtain :—

1°. For foot of St. James Street, Quebec Harbour :

(*a*) Taking cross section A as a basis :

$D'_1 = \frac{1 \cdot 4}{0 \cdot 382} = 3 \cdot 66$ ft. below level of tideless estuary 21 · 9 ft. below 0 of St. James Street gauge of 1882, which level corresponds to river surface 20 ft. above 0, per Sorel gauge.

Depth δ_1 of mean sea level, below level of tideless estuary just described, corresponding to river surface 20 ft. above 0 of Sorel gauge = (3·66 — 1·4) = 2·3 ft.

(*b*.) Adopting cross section C as a basis of computation :

$D'_2 = \frac{1 \cdot 4}{0 \cdot 544} = 2 \cdot 58$ ft and $\delta_2 = (2 \cdot 58 - 1 \cdot 4) =$ say 1·2 ft.

2°. For Victoria Cove, Quebec Harbour,

(*a*.) Adopting cross section A :

$D'_3 = \frac{2 \cdot 4}{0 \cdot 369} = 6 \cdot 5$ ft. below level of tideless estuary corresponding to river level 20 above 0, per Sorel gauge.

Depth δ_3 of mean sea level, below level of tideless estuary just described = (6·5 — 2·4) = 4·1 ft.

(*b*.) Adopting cross section C as the basis of computation :

$D'_4 = \frac{2 \cdot 4}{0 \cdot 534} = 4 \cdot 50$ ft. and $\delta_4 = (4 \cdot 5 - 2 \cdot 4) = 2 \cdot 1$ ft.

No computations based on cross section B were made, because the data derived from this section were nearly the same as those obtained by using section C.

The lowest of the mean sea levels thus roughly determined in both places, are evidently those based on cross section A, and the highest those based on cross section C.

If we assume the surface of the tideless estuary to be about level between St. James Street and Victoria Cove, and take the mean of the lowest sea levels just determined, $\frac{(21 \cdot 9 + 2 \cdot 03) + (21 \cdot 9 + 4 \cdot 1)}{2} = 25 \cdot 1$ ft. is found for the average depth of the mean sea level below the 0 of the St. James Street gauge of 1882.

But if we suppose that a fall of 0·15 ft. obtains in the tideless stream between the places mentioned, and take the mean of the results which raise the sea level to the greatest height, we find : $\left(\frac{(21 \cdot 9 + 1 \cdot 2) + (21 \cdot 9 + 2 \cdot 1)}{2} \right) - 0 \cdot 15 = 23 \cdot 40$ ft., for the corresponding probable depth of the mean sea level below the 0 of the St. James Street gauge of 1882.

It appears probable, for the following reasons, that the plane 23·4 ft. below the 0 of the St. James Street gauge of 1882, will be found to coincide more nearly with the actual mean level of the Atlantic Ocean, than the datum plane above established, which is 25·1 below the said 0.

1°. On account of the great width of the Lake St. Peter, the value of the relation $\frac{c_1}{c} = \sqrt{\frac{F_1}{P_1}} \times \sqrt{\frac{P}{F}}$ for cross section C, is less liable to be vitiated by errors in soundings, etc., than the value of the corresponding relation for cross section A.

2°. The data derived from two cross sections (B and C) which have been constructed with the aid of soundings obtained from two different sources, are nearly identical.

3°. Because a mean sea level (b), closely agreeing with that based on a cross section of the tideless estuary at Quebec and one of Lake St. Peter, is also deduced from the following considerations.

The whole declivity in the surface of the tideless estuary may be considered to be due solely to the friction generated by the fresh or drainage water, in passing over the bed of the river, and on any stretch of this estuary between Quebec and the Gulf of St. Lawrence, the area of the longitudinal section taken along its axis, as well as that of any cross section, may be assumed to remain practically invariable for all discharges from 0 to 450·000 cubic feet per second. Hence the total friction head h_f must, in general, be nearly directly proportional to the product of the square of the volicity v by the coefficient of resistance of friction c_f and also the product of the square of the discharge Q by the same coefficient c_f.

That is to say, if h_{f_1} and h_{f_2} represent the friction heads geneted with discharges Q_1, Q_2, corresponding, respectively, to depths of 17·1 ft. and 22·9 ft. over mitre sill of lock No. 1, Lachine Canal, and water levels 26·58 and 20·68 above the 0 of the Montreal Harbour Commissioners gauge at Sorel, and c_{f_1}, c_{f_2}, the mean coefficients of friction corresponding to the velocities V_1, V_2, which obtain in each case, we must have nearly:

$$h_{f_1} : h_{f_2} :: Q^2_{1c_{f1}} : Q^2_{2c_{f2}}, \text{ and also, } h_{f_1} : \left(h_{f_2} - h_{f_1}\right) :: Q^2_{1c_{f1}} : \left[Q^2_{2c_{f2}} - Q^2_{1c_{f1}}\right]$$

$$\text{whence } h_{f_1} = \frac{\left[h_{f_2} - h_{f_1}\right] Q^2_{1c_{f1}}}{Q^2_{2c_{f2}} - Q^2_{1c_{f1}}}$$

Now it appears from diagrams of high and low water loci, similar to Nos. 2 to 8 constructed for high and low stages of the River St. Lawrence in 1881–82, that for a fall in the river level from 26·58 ft. to 20·68 ft. above the 0 of Montreal-Harbour Commissioners' gauge at Sorel, the variation in the friction head was at Quebec about 1·2, that is to say, we have: $h_{f_2} - h_{f_1} = 1{\cdot}2$ ft. nearly.

Again, from data taken from the report made by the late Thos. Guerin, Esq. civil engineer, under date of 12th March, 1883, in relation to the proposed hydraulic works in the harbour of Montreal known as the "Shearer scheme" (*See* printed Report of Minister of Public Works for the fiscal year 1882-83, Appendix No. 10, page 124), I have deduced the following:—

(*a.*) Between 25th May and 6th June, 1882, when the river stood at a mean elevation of 26·58 ft. per Montreal Harbour Commissioners' Sorel gauge, the mean depth of water on the sill of lock No. 1, Lachine Canal, was 22·9 ft.

(*b.*) Between 6th November and 5th December, 1882, when the river stood at a mean height of 20·68 ft. per Sorel gauge, the mean depth of water on the same lock sill, was 17·1 ft.

Average fall of river from average high water in spring, to average low water in autumn, equal to 5·9 ft. at Sorel, and 5·8 ft. at Montreal, foot of Lachine Canal.

Discharge Q'_2 computed by Mr. Guerin for high river level of 6th June, when water stood 2·75 ft. over 0 at Sorel and 23·5 ft. over sill, old lock, No. 1, at Montreal = 431·733 ft. cube per second.

Discharge Q'_1, as computed by Mr. Guerin for low water level of 24th November, 1882, with river at 21·1 at Sorel, and 17·5 ft. on sill lock No. 1, at Montreal = 281·581 ft. cube per second.

Mean depth d'_2 of channels, north and south sides of St. Helen's Island, 6th June, 1882, $= \frac{84 \cdot 019^{\text{sq. ft.}}_{38}}{4 \cdot 949^{50}} = 16 \cdot 97$ ft.

Mean depth d'_1 of same channels, 24th November, 1882 $= \frac{59 \cdot 550^{\text{sq. ft.}}}{4 \cdot 350} = 13 \cdot 69$ ft.

Discharges Q_2 and Q_1 corresponding to river levels, respectively, 22·9 ft. and 17·1 ft. above the lock sill, instead of 23·5 and 17·5, have been arrived at as follows:—

Mean depth d'_2 for 22·9 ft. on lock sill = say: 16·07 ft.

Mean depth d'_1 for 17·1 ft. on lock sill = say: 13·09 ft.

The decrease in volumes of discharges, as determined by Weisbach's approximate formula, are:

$$\frac{Q_1 - Q'_1}{Q_1} = \frac{3}{2}\left(\frac{d_1 - d'_1}{d'_1}\right) = \frac{3}{2}\left(\frac{0 \cdot 60}{13 \cdot 69}\right) = 0 \cdot 0657, \text{ whence:}$$

$$Q'_1 = 281{,}581 - (0 \cdot 0657)(281{,}581) = 263{,}081 \text{ cubic ft., and}$$

$$\frac{Q_2 - Q'_2}{Q'_2} = \frac{3}{2}\left(\frac{d_2 - d'_2}{d'_2}\right) = \frac{3}{2}\left(\frac{0 \cdot 90}{16 \cdot 97}\right) = 0 \cdot 0795, \text{ whence:}$$

$$Q'_2 = 431{,}733 - (0 \cdot 0795)(431{,}733) = 397{,}410 \text{ cubic ft.}$$

By applying the same formula to the determination of the discharge Q_3, corresponding to 23·5 ft. depth on sill of lock No. 1, by means of the discharge computed by Mr. Guerin for a depth of 17·5 ft., and the increased dimensions of the waterway which obtained when the river was 6·0 ft. higher, it is found that

$$Q_3 = 281{,}581 + (0 \cdot 3595 \times 281{,}581) = 382{,}809 \text{ cubic ft.,}$$

instead of 431·733 cubic ft. per second, the discrepancy being 48·924 ft. cube—due to variation in width of waterway, etc.

By assuming that the error varies in an approximate manner directly as the increase of depth in each case, we have

$$\text{Error for } \{(d_2 - d'_2) = 0 \cdot 9 \text{ ft.}\} = \frac{48 \cdot 924 \times 09}{6 \cdot 0} = 7339, \text{ and}$$

$$\text{Error for } \{(d_1 - d'_1) = 0 \cdot 6 \text{ ft.}\} = \frac{48 \cdot 924 \times 06}{6 \cdot 0} = 4892.$$

Q_2 thus becomes: 397,410 − 7339 = 390,071, and Q_1 becomes: 263,081 − 4892 = 258,189, or in round numbers, we may put:

$Q_2 = 390{,}000$ ft. cube, and

$Q_1 = 260{,}000$ ft. cube.

There remains to be determined the value of c_{f_1} and c_{f_2}, or, strictly speaking only their relative or proportional values for velocities which bear to each other the ratio of 39 to 26, or 3 to 2.

At Quebec the area a''_2 of the tideless estuary is, for river surface 26·58 ft. above 0 of Montreal Harbour Commissioners' gauge at Sorel, approximately: 405·000 sq. ft., whence, velocity v''_2 corresponding to discharge Q_2 is deduced to be 0·963 ft. per second, and v''_1 corresponding to discharge Q_1, 0·642 ft. nearly.

According to J. Neville's hydraulic tables, coefficients and formulæ, page 229, the coefficients of resistance for friction in pipes corresponding to these velocities are to each other nearly as 0·009133 to 0·008117, and for large rivers the coefficients of resistance for velocities within narrow limits, bear to each other ratios not materially different from

those which obtain for pipes under the same conditions. But by taking in the whole estuary below Quebec down to the Gulf, the mean velocities would be, of course, much smaller than those just mentioned, and for smaller velocities of the same relative values, the coefficients c_f increase more rapidly than the velocities decrease; but according to what precise law this decrease takes place is not definitely known. The smallest velocity for which a coefficient is given by Neville is 0·1 ft. per second; its value being 0·017159.

If we suppose, judging by the soundings, etc., on the Admiralty Charts, etc., that the average velocities corresponding to discharges Q_1 and Q_2 are 0·2 and 0·3 ft. per second between Quebec and the Gulf, which is, in each case, say between $\frac{1}{4}$ and $\frac{1}{3}$ of the velocity that would obtain in the vicinity of Quebec city, the coefficients c_{f_1} and c_{f_2} become : 0·013186 and 0·011427.

By substituting in equation (×) the numerical values just determined for the symbols, we find, having divided each discharge by 10,000 before squaring :

$$h_{f_1} = \frac{1{\cdot}2 \times 67{\cdot}6 \times 0{\cdot}013186}{152{\cdot}1 \times 0{\cdot}011427 - 67{\cdot}6 \times 0{\cdot}013186} = 1{\cdot}27 \text{ ft.}$$

That is to say with a discharge Q_1 of 260,000 cubic ft. per second, the level of the estuary abstracted from the influence of the tides would stand opposite Quebec city 1·27 ft. above the mean level of the Atlantic Ocean in the Gulf of St. Lawrence, a result which agrees tolerably well with 1·2 ft., the value arrived at for δ_2, the depth of the mean sea level below level of tideless estuary at Quebec corresponding to river surface 20 ft. above the 0 of the Montreal Harbour Commissioners' gauge at Sorel.

R. STECKEL.

APPENDIX I TO NOTE A.

COMPARISON of River levels at Contrecœur, Lavaltrie and Sorel, extracted from gauge registers kept under the supervision of the Montreal Harbour Commissioners.—(John Kennedy, Chief Engineer.)

Dates.	Contrecœur and Lavaltrie.			Sorel.			Difference.	Average difference in each year.	Maximum deviation from average in each year.
	Maximum	Minimum	Average	Maximum	Minimum	Average			
1878.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.
Nov. 18-23	23·5	22·2	22·5	23·3	22·0	22·3	0·2	3·5	0·15
do 25-30	24·0	23·5	23·8	23·6	23·3	23·3	0·5		
1879.									
Sept. 16-30	25·7	25·2	25·4	21·0	20·1	20·6	4·8	4·9	0·1
Oct. 1-25	25·3	24·3	24·8	20·3	19·3	19·9	4·9		
do 26-31	24·5	24·0	24·2	19·5	18·8	19·2	5·0		
Nov. 1-7	24·3	23·8	24·1	19·5	18·9	19·3	4·8		
1880.									
May 3-6	32·3	32·0	32·2	26·7	26·4	26·5	5·7	5·6	0·3
July 26-31	27·4	26·5	27·0	21·7	21·2	21·6	5·4		
Oct. 1-4	25·5	25·2	25·4	20·3	19·5	19·8	5·6		
do 13-30	26·4	25·2	25·6	20·6	19·7	20·1	5·5		
Nov. 1-11	27·2	26·3	26·8	21·8	20·1	20·9	5·9		
do 12-22	28·5	27·3	28·1	23·0	21·2	22·4	5·7		
1881.									
April 25-30	29·2	27·7	28·4	23·6	22·3	22·8	5·6	5·8	0·3
May 1-12	30·5	29·5	29·7	24·7	23·6	23·9	5·8		
do 13-14	31·3	31·3	31·3	25·8	25·4	25·6	5·7		
do 18-21	33·7	33·0	33·4	27·5	27·1	27·3	6·1		
do 23-30	32·5	30·7	31·6	26·3	24·8	25·6	6·0		
June 1-7	30·3	29·0	29·7	24·5	23·0	23·8	5·9		
Oct. 11-31	25·4	24·6	25·1	19·8	18·9	19·3	5·8		
Nov. 1-25	25·7	24·9	25·3	20·0	19·2	19·6	5·7		

The above shows that for the years 1880-81, during which the observations registered were most numerous, extending over, we may say, the whole season of navigation, the water fell about 0·3 ft. more at Lavaltrie than at Sorel—or what is probably more correct, the water was raised 0·3 ft. more at Sorel by the tides, than at Lavaltrie and Contrecœur. This difference, it will be noticed, has been taken into account in calculating the area of the waterway at Lanoraie (A) corresponding to a river level 26·6 ft. above 0 at Sorel; the fall of the St. Lawrence from 26·6 to 19·3 ft. = 7·3 ft. at Sorel, being taken at 7·7 ft. at Lanoraie.

APPENDIX II TO NOTE A.

COMPUTATION of area F, etc., for waterway at a point 1¼ miles west of Lanoraie, where elevation of bottom of thalweg is near a maximum according to soundings given on Admiralty Chart No. 2779 of St. Lawrence above Quebec.

Distances North to South shore with 10·3 ft. on Lake St. Peter Flats.	Intermediate distances.	Average depths of sections for 10·3 on flats, Lake St. Peter.	Areas, of Sections.	Data for establishing approximate position of mean sea level.
ft. ft.	ft.	ft.	sq. ft.	
0 ....to....30	30	½	15	
30.... " ...400	370	9/2	3700	
400.... " ...900	500	41/2	10250	
900 ... " ..1500	600	27/2	8100	
1500.... " ..1830	330	19/2	3135	
1830.... " ..2570	740	34/2	12580	
2570.... " ..3170	600	43/2	12900	
3170.... " ..3770	600	45/2	13500	
3770.... " ..4570	800	35/2	14000	
4570.... " ..5770	1200	38/2	22800	
5770.... " ..6270	500	26/2	6500	
6270 ... " ..6400	100	½	50	
Total area for 10·3 ft. water on flats corresponding to water surface at 19·3 ft. above 0, Sorel gauge.			107530	Mean depth for 10·3 on flats. $\frac{107530}{6400}=16.8$ feet.
For waterway at 11 ft. level add :				
North side— Feet.		Area, Sq. feet.		
$10\times\frac{7}{2}=$		35		Wetted perimeter for 11 ft. water on flats. $p=$ say 6·400 feet.
South side— Feet.				
$15\times\frac{7}{2}=$		52·5		
$6370\times\cdot7=$		4459·		
			4546	
Total area F, for 11 ft. water on flats corresponding to water surface at 20 ft. above 0, Sorel gauge.			112076	Mean depth for 11 ft. on flats. $=\frac{112045}{6395}=17\cdot52$ feet.
				7·3 ft. fall at Sorel = 7·7 ft. at Lanoraie.
North side— Feet.		Area, Sq. feet.		Wetted perimeter for 17·6 ft. of water on flats. $p=$ say 6570 feet.
$70\times\frac{7\cdot7}{2}=$		269·8		Velocity ratio according to formula (2). $\frac{c'}{c}=\sqrt{\frac{157233\times6400}{112076\times6570}}=1\cdot16915$
South side— Feet.				
$100\cdot\times\frac{7\cdot7}{2}=$		385·0		
$63\cdot70\times7\cdot7=$		49049·0		
			49703	Discharge ratio according to formula (3). $\frac{Q'^1}{Q}=\frac{F^1 c^1}{F c}=1\cdot64057$; $\frac{c.\ Q'^1}{c.\ Q}=1\cdot40321$
Add area for 10·3 ft. level as above			107530	
Total area F, for 17·6 ft. water on flats corresponding to water surface at 26·6 ft. above 0, Sorel gauge			157233	Mean depth for 17·6 on flats. $=\frac{157\cdot233}{6540}=24\cdot04$ feet.

APPENDIX III TO NOTE A.

COMPUTATION of area F, etc., for waterway across flats at Lake St. Peter, viz., where elevation of bottom is near a maximum according to ice soundings given on Montreal Harbour Commissioners chart, dated 1855.

Distances North to South with 11 ft. on Lake St. Peter Flats.	Intermediate distances.	Average depths of sections for 11 feet on flats, Lake St. Peter.	Area, Square Feet.	Data for establishing approximately position of mean sea level.
ft. ft.	ft.	ft.	sq. ft.	
0. ..to...2300	2300 ×	$2\frac{5}{8}$	5720	
2300.... " ..5500	3200	$\frac{1}{3}$	20800	
5500.... " ..8900	3400	$\frac{17}{2}$	28900	
8900.... " .11400	2500	9	22500	
11400.... " .12600	1200	$\frac{19}{2}$	11400	
12600.... " .14000	1400	$\frac{21}{2}$	14700	
14000.... " .15360	1360	$2\frac{3}{8}$	15664	
15360.... " .15690	330	25	8250	Ship channel deepened to 25 feet at ordinary summer water.
15690.... " .18000	2310	15	26565	
18000.... " .19200	1200	$2\frac{1}{2}$	14760	
19200.... " .20200	1000	$\frac{25}{2}$	12500	
20200.... " .23700	3500	12	42000	
23700.... " .24700	1000	$\frac{23}{2}$	11500	
24700.... " .29000	4300	11	47300	
29000.... " .29500	500	$\frac{21}{2}$	5250	
29500.... " .30200	700	$\frac{19}{2}$	6650	
30200.... " .31200	1000	$\frac{17}{2}$	8500	Wetted perimeter for 11 ft. of water on flats. p = say 35040 ft.
31200.... " .32000	800	$\frac{14}{2}$	5600	
32000.... " .32800	800	$\frac{11}{2}$	4400	
32800 .... " .35000	2200	$\frac{5}{2}$	5500	Mean depth for 11 ft. on flats. $= \frac{318489}{35000} = 9 \cdot 1$ ft.
Total area F, for 11 feet water on flats corresponding to water surface at 20 feet above 0, Sorel gauge.			318489	
Add: For area F of waterway with lake surface 26·6 feet above Sorel gauge.				Wetted perimeter for 17·6 ft. of water on flats. p_1 = say 40650 ft.
Add: North shore— Feet.		Area, Sq. feet.		
$1600 \times \frac{6 \cdot 6}{2} =$		5280		Velocity ratio according to formula (2). $\frac{C_1}{C} = \sqrt{\frac{568,000 \times 35040}{318,500 \times 40650}} = 1 \cdot 23985$
South shore— $4000 \times \frac{6 \cdot 6}{2} =$		13200		Discharge ratio according to formula (3). $\frac{Q_1}{Q} - \frac{F_1 c_1}{F.c} = 2 \cdot 21111$
Centre— $35000 \times 6 \cdot 6 =$		231000		$\frac{c\,Q_1}{c.\,Q} = 1 \cdot 78336$
			249480	
Total area F, for 17.6 feet water on flats corresponding to water surface at 26·6 feet above 0, Sorel gauge.			567969	Mean depth for 17·6 ft. on flats. $= \frac{567969}{40\,600} = 13 \cdot 99$ feet.

APPENDIX IV. TO NOTE A.

COMPUTATION of Area F, etc., for waterway across flats of Lake St. Peter, viz.: when elevation of bottom is near a maximum according to soundings given on Admiralty chart No. 2781 of the lake, dated 1859.

North to South.		Distance in feet for 10·3 ft. on Lake St. Peter flats.	Average depth in feet for 10·3 ft. on Lake St. Peter flats.	Area, Square Feet.	Data for establishing approximately, position of Mean Sea Level, etc.
1400	3000	1600	2	= 3200	
3000	5470	2470	6	= 14820	
5470	7000	1530	8	= 12240	
7000	8500	1500	8½	= 12750	
8500	13780	5280	9	= 47520	
13780	15000	1220	9½	= 11590	
15300	15700	700	10	= 7000	
15700	16100	400	24	= 9600	Ship channel deepened to 24 ft. at ordinary low summer water.
16100	16500	400	10	= 4000	
16500	17100	600	9½	= 5700	
17100	18300	1200	10	= 12000	
18300	28150	9850	11	= 108350	
28150	29350	1200	10	= 12000	
29350	30380	1030	8½	= 8755	
30380	31450	1070	7	= 7490	
31450	33930	2480	6	= 14880	
33930	34830	900	5½	= 4950	
34830	35730	900	4½	= 4050	
35730	37100	1370	2	= 2740	
Total area for 10·3 ft. water on flats corresponding to water surface at 19·3 ft. above 0, Sorel gauge.				303635	
For waterway—with 11 ft. depth on flats, add:					Wetted perimeter for 11 ft. water on flats. P = say 36160 ft.
North side— Ft. $180 \times \frac{7}{2}$ =				63·	
South side— $250 \times \frac{7}{2}$ =				87·5	
37100 — 1400 = 35·700 × 7 =				24990·	
				25140·5	
Total area F for 11 ft. water on flats corresponding to water surface at 20 ft. above 0, Sorel gauge.				328775·5	Mean depth for 11 ft. on flats. $= \frac{328775 \cdot 5}{36130} = 9 \cdot 1$ ft.
					Wetted perimeter of water on flats. P_1 = say 39760 ft.
North side— Ft. $1650 \times \frac{7 \cdot 3}{2}$ =				60225·	
South side— $2380 \times \frac{7 \cdot 3}{2}$ =				8687·0	
35700 × 7·3 =				260610·0	
				275319·5	Velocity ratio according to formula (2). $\frac{C_1}{C} \sqrt{\frac{578950 \times 3616}{328800 \times 39760}} = 1 \cdot 26400$
Add area for 10·3 ft. level as above				303635·0	Discharge ratio according to formula (3). $\frac{Q_1}{Q} = \frac{F_1 c_1}{Fc} = 2 \cdot 22564$
					$\frac{c. Q_1}{c_1 Q} = 1 \cdot 76080$
Total area F for 17·6 ft. water on flats, corresponding to water surface at 26·6 ft. above 0, Sorel gauge.				578954·5	Mean depth for W.S. 26·6 ft. above 0, Sorel gauge, or 17·6 on flats. = 14·57 ft.

INDEX.

INDEX—*Continued.*

INDEX—*Concluded.*

DOMINION OF CANADA

ANNUAL REPORT

OF THE

DEPARTMENT OF RAILWAYS AND CANALS

FOR THE PAST

FISCAL YEAR FROM 1st JULY, 1890, TO 30th JUNE, 1891

SUBMITTED IN ACCORDANCE WITH THE PROVISIONS OF THE REVISED STATUTE OF CANADA, CHAPTER 37, SECTION 28

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST EXCELLENT MAJESTY.
1892

[No. 9—1891.] *Price* 20 *cents.*

To His Excellency the Lord Stanley of Preston, P.C., G.C.B., &c., &c.,

Governor General of Canada, &c., &c.

MAY IT PLEASE YOUR EXCELLENCY:

The undersigned has the honour to present to Your Excellency the Annual Report of the Department of Railways and Canals of the Dominion of Canada, for the past fiscal year from the 1st of July, 1890, to the 30th of June, 1891.

All of which is respectfully submitted,

JOHN HAGGART,

Minister of Railways and Canals.

OTTAWA, 31st December, 1891.

CONTENTS OF REPORT.

RAILWAYS.

GOVERNMENT ACTION AS TO SUBSIDIZED LINES—*Continued.*

GOVERNMENT ACTION AS TO SUBSIDIZED LINES—*Concluded.*

CANALS.

MAPS.

(BETWEEN REPORT AND APPENDICES.)

1. General map of the Dominion.
2. Nova Scotia, Cape Breton, Prince Edward Island and part of New Brunswick.
3. New Brunswick and parts of Maine and Quebec.
4. do do taking in Montreal.
5. Eastern Ontario and part of Quebec.
6. Western Ontario
7. North of Lake Superior.
8. Lake Superior to Manitoba.
9. Manitoba and Assiniboia.
10. Assiniboia and Saskatchewan.
11. Assiniboia and Alberta to the Rocky Mountains.
12. British Columbia.

DIAGRAM.

River St. Lawrence Canals.

APPENDICES.

CANALS.

MONTREAL DIVISION.

E. H. PARENT, Superintending Engineer.

ST. LAWRENCE DISTRICTS.

T. S. RUBIDGE, Superintending Engineer.

WELLAND CANAL.

W. G. THOMPSON, M. Inst. C. E.

REPORT.

1890-91.

To the Hon. JOHN HAGGART,
Minister of Railways and Canals.

SIR,—I have the honour to submit the Annual Report of the Department of Railways and Canals for the fiscal year ended 30th June, 1891.

The annual reports of the engineers, together with general and special reports from superintendents, both of railways and canals, and from other officers of the Department, are given in Appendices.

Attached hereto (Appendices Nos. 1, 2 and 3) will be found statements showing the amounts expended during the past fiscal year in construction, repairs and maintenance of the several works under the department; also statements showing total expenditure on each canal since its construction, on each of the Government railways, and on the Canadian Pacific Railway so far as the Government is concerned; also a statement showing the payments made, year by year, to subsidized railways, with the aggregates of such payments.

RAILWAYS.

The present report deals with those railways of the Dominion directly controlled by the Federal Government, and others towards the construction of which subsidies have been authorized.*

There is prepared by this department, and laid before Parliament annually, a special statistical report, embodying returns made by Canadian railway companies, as required by statute. This report gives information as to railroad operations in Canada, including the Government roads.

The following general facts gathered from this compilation, being returns made for the fiscal year ended on the 30th of June, 1890, the last issued, will be of interest.

* It should be observed that while the usual reports furnished by the superintending officers, and to be found in the appendices hereto, deal with the fiscal year only, the Chief Engineer of Government Railways has reported dealing with certain matters under his charge up to the 11th of November, 1891, and the General Report contains information on points of interest relating to subsidized lines of railway up to the end of December, 1891.

The number of railways, including the Government roads, in actual operation (embracing under one head all amalgamated lines), was 54. The number of miles of railway completed was 14,004 (besides 1,679 miles of sidings), of which 13,339 were laid with steel rails. There were 13,256 miles of railway in actual operation. The paid up capital amounted to $786,447,811. The gross earnings of all these railways amounted to $46,843,826, and their working expenses to $32,913,350, leaving the amount of the net earnings $13,930,476. The number of passengers carried was 12,821,262, and 20,787,469 tons of freight were conveyed over these roads. The total number of miles run by trains was 41,849,329.

CANADIAN TRANSCONTINENTAL RAILWAY COMMUNICATION.

Halifax or St. John to Montreal.

The routes available between Halifax and Montreal are four in number; in all of which the Intercolonial is used, either in whole or in part, as follows: (The names adopted are those of the dominating roads):—

Intercolonial Railway Route—

	Miles.	
By Intercolonial Railway to Point Lévis	675	
Grand Trunk Railway to Montreal	173	
		848

(Or by ferry across the St. Lawrence to Quebec, thence by North Shore Railway, C.P.R., also 173 miles).

Canadian Pacific Railway Route—

	Miles.	
By Intercolonial Railway to St. John, N.B	275	
New Brunswick Railway and Maine Central Railway to Mattawamkeag	146	
Canadian Pacific Railway to Montreal	334	
		755

Grand Trunk Railway Route—

	Miles.	
By Intercolonial Railway to St. John, N.B	275	
New Brunswick Railway	90	
Maine Central Railway	224	
Total up to Danville Junction	589	
By Grand Trunk Railway to Montreal	270	
		859

Témiscouata Railway Route—

	Miles.	
By Intercolonial Railway to St. John	275	
New Brunswick Railway to Edmundston	170	
Témiscouata Railway to Rivière du Loup	81	
Intercolonial Railway to Lévis	115	
Grand Trunk Railway to Montreal	173	
		814

MONTREAL TO THE PACIFIC COAST.

CANADIAN PACIFIC RAILWAY.

NOTE.—A somewhat detailed statement of the Government transactions with this company will be found in the Annual Report of this Department for the year 1887.

Trunk Line.

		Miles.
Quebec to St. Martin's Junction (13 miles north of Montreal)		159
Montreal (at the head of Atlantic Ocean navigation) to St. Martin's Junction		13
St. Martin's Junction to Callander		331
For this portion the Company were subsidized direct by the Govt. under their contract. — Callander to Port Arthur	649	
Port Arthur to Red River (opposite Winnipeg)	428	
Red River to Savona's Ferry	1,257	
Savona's Ferry to the waters of the Pacific Ocean at Port Moody	213	
		2,547
Port Moody to Vancouver on Burrard Inlet		15
Total, Montreal to Vancouver, Burrard Inlet		2,906

This railway was opened for through traffic on the 28th of June, 1886.

By the Act 51 Vic., c. 32, approval and ratification were given to a certain agreement dated the 18th of April, 1888, provisionally made between the Government and the company, whereby the restrictions contained in Article 15 of the original agreement for the construction of the road, barring the Dominion Parliament for twenty years from authorizing the construction of railways south of the Canadian Pacific Railway from any point at or near that road, except those running south-west, were removed. By this agreement the Government undertook to guarantee the payment of interest at 3½ per cent on an issue of the company's bonds to the extent of fifteen million dollars, running for a term not exceeding fifty years; the unsold lands of the company's subsidy, estimated at nearly fifteen million acres, to form the security for such bonds. The arrangements contemplated by this agreement are being carried out by the Department of Finance. A deed of mortgage in favour of special trustees, one of whom is the Minister of Finance, has been executed under date the 2nd of June, 1888, having previously been approved by an Order in Council of the 1st of that month, being a mortgage of the said unsold lands of the company's subsidy, amounting to 14,934,238 acres, and constitutes the said security.

By the Act passed last session, 54–55 Vic., ch. 11, respecting the North Shore section of the Canadian Pacific Railway, authority was given, subject to certain provisions, for the cancellation of the mortgage bonds of the North Shore Railway, which, to the value of $1,108,626, had been purchased by the Government for the sum of $970,000 (part of a sum of $1,500,000 voted by Parliament in the years 1884 and 1885 to secure to the port of Quebec free access for the trains and traffic of the Canadian Pacific Railway) and for discharging that company from all liability in respect of such bonds. The conditions under which this action might be taken were, as stated in the Act, that the

company should execute a deed of agreement binding itself to complete and provide, with all due diligence, the following works and improvements, namely :—

"Rolling stock, including sleeping cars, day coaches, baggage, mail and express cars, locomotives and freight cars, of a standard equal to that used on other portions of the company's railway system, involving an outlay of about three hundred and fifty thousand dollars.

"Improvements over the whole line between St. Martin's Junction and the city of Quebec, of such a character as to bring that section up to the highest standard of the other Canadian Pacific sections, including additional accommodation for passengers at nearly every station, and increased space for the handling of freight, the lengthening of platforms and sidings, the furnishing of new sidings for the development of stone, lumber and other traffic, the substitution of iron for wooden bridges on the line of the North Shore Railway, and the construction of the following specific works, that is to say :—

(1.) In the City of Quebec :

(*a.*) One grain elevator ;

(*b.*) One flour shed ;

(*c.*) Such local improvements and facilities as are necessary for the handling of the traffic of that city ;

(2.) In Three Rivers :

(*a.*) One grain elevator ;

(*b.*) Improvements over the loop line ;

(*c.*) Improvements on the Piles Branch ;

"The said improvements over the whole line involving an outlay of about three hundred thousand dollars, in addition to the said outlay on rolling stock ;

"The whole to be completed to the satisfaction of the Minister of Railways and Canals."

In pursuance of this Act, and on application by the company, an Order in Council was passed on the 14th of December, 1891, reciting the facts of the case, and approving of the execution of a draft agreement, by which the company binds itself to carry out the improvements called for by the Act, expending the moneys thereon as follows :—

"At least two hundred thousand dollars ($200,000) during the year ending on the first day of April, A.D. 1893, an aggregate of at least three hundred and fifty thousand dollars ($350,000) to the end of the year ending on the first day of April, A.D. 1894, and an aggregate of at least five hundred thousand dollars ($500,000) to the end of the year ending on the first day of April, A.D. 1895, and an aggregate of at least six hundred and fifty thousand dollars ($650,000) to the end of the year ending on the first day of April, A.D. 1896, subject to such extension in respect of any repairs or renewals for which the necessity has not arisen as may be granted by His Excellency the Governor in Council."

On the 22nd of December, 1891, the agreement so authorized was duly signed.

In the agreement dated the 20th of November, 1886, and executed under an Order in Council of the 2nd of that month, which constituted the basis of the final settlement of matters between the Government and the company prior to the transfer of the road

to them, a special provision was inserted, in view of dispute as to the condition in which the work in British Columbia executed by the Government should be handed over; the company accepted the same, "subject to the adjustment and correction by the Government of any defects or deficiencies in the construction thereof, if any, according to the specifications and conditions of the contracts therefor, except in so far as the same were modified by the Government prior to 21st October, 1880." *

For the determination of the questions covered by the foregoing, a special arbitration was authorized by an Order in Council of the 5th January, 1888. The arbitrators have now made their award, and it was furnished to the Government in October, 1891, the amount fixed thereby as payable by the Government to the company being $579,255, the amount claimed by the company having been $12,000,000. This award, in effect, represents the value of work which the arbitrators find the Government should have performed on the sections of the road in British Columbia constructed by it. The amount so awarded is to be expended under the supervision of an officer of the Government, for the improvement of the railway, in certain specified directions.

There remain still to be dealt with by the arbitrator two unimportant claims in respect of steel rails.

It should be noted that for the year ended on the 30th June, 1891, the company had under traffic 5,564 miles of railway, and that its gross receipts were $18,672,174.

GOVERNMENT RAILWAYS IN OPERATION.

During the past fiscal year certain new railway works built by the Government were operated for traffic, and by a special Act, 54 Vic., ch. 50, were, together with the "Eastern Extension" section, embodied in the Intercolonial system. These additions were as follows:—

Oxford Junction to Brown's Point Junction and Pugwash, 72½ miles, opened on the 15th of July, 1890; and the Cape Breton Railway, of which the portion from Point Tupper to Grand Narrows, 46 miles, was put under traffic on the 1st of January, 1891, and the portion from Grand Narrows to Sydney and North Sydney, and connection with the International Coal Company's Railway at Sydney, 52½ miles, was opened on the 24th of November, 1890.

The several lines maintained by the Government during the past fiscal year, ended the 30th June, 1891, were:

		Miles.
The Intercolonial	1,142	
do wharf branches	12½	
		1,154½
Windsor Branch (maintained only)		32
Prince Edward Island Railway		211
Total mileage length		1,397½

The through ocean mail line from Point Lévis, opposite Quebec, to Halifax, is 675 miles in length.

* The date of the company's contract.

Details respecting these railways and their operations will be found in Appendix No. 4, containing reports from the Chief Engineer and General Manager, and from the Chief Superintendents and other officials of these roads.

The general revenue accounts for 1890–91 show the following as the financial position of these roads for the past fiscal year and the average mileage:—

	Average mileage of the year.	Working expenses.	Earnings.	Profit	Loss.
		$ cts.	$ cts.	$ cts.	$ cts.
Intercolonial, including the Eastern Extension and the Cape Breton Railway	1,094	3,662,341 94	2,977,395 38		684,946 56
Windsor Branch (earnings, one-third of entire receipts; expenditure on maintenance)	32	28,931 71	30,235 13	1,303 42	
Prince Edward Island	211	257,990 08	174,258 05		83,732 03
				1,303 42	768,678 59
					1,303 42
Total average mileage	1,337		Net loss		767,375 17

INTERCOLONIAL RAILWAY.

The Intercolonial Railway touches six Atlantic Ocean ports, namely Pointe du Chêne, Pictou, Halifax, St. John, Sydney and North Sydney. The following list shows its through lines and branches, in sequence—commencing from the west. Connection is made with the Grand Trunk Railway at Chaudière Junction and with the Canadian Pacific Railway at Quebec (by ferry from Lévis).

The total length of the road (including wharf and freight branches) is 1,154½ miles.

	Miles.
Chaudière Junction to Lévis	8
Lévis to St. Charles Junction	14
Chaudière Junction to St. Charles Junction	17
St. Charles Junction to Dalhousie Junction	299
Dalhousie Junction to Dalhousie (Dalhousie Branch)	7
Dalhousie Junction to Derby Junction	101
Derby Junction to Indiantown (Indiantown Branch)	14
Derby Junction to Moncton	75
Moncton to ST. JOHN	89
Moncton to Painsec Junction	7
Painsec Junction to Pointe du Chêne (Shediac Branch)	11

		Miles.
Painsec Junction to Oxford Junction		71
Oxford Junction to Pugwash Junction	Oxford and Pictou Branch.	15
Pugwash Junction to Pugwash		5
Pugwash Junction to Brown's Point.		52
Brown's Point to Pictou		2
Oxford Junction to Truro		46
Truro to Richmond		61
Richmond to Dartmouth (Dartmouth Branch)		5
Richmond to HALIFAX		1
Truro to Stellarton Junction		41
Stellarton Junction to Brown's Point		12
Stellarton to New Glasgow		2
New Glasgow to Pictou Landing		8
New Glasgow to Port Mulgrave		80
Ferry to Point Tupper		1
Point Tupper to North Sydney Junction		79
North Sydney Junction to NORTH SYDNEY		5
North Sydney Junction to SYDNEY		13

Wharf and Freight Branches.

	Miles.
Rimouski to wharf	2
Newcastle, N.B., to deep water wharf	2
Dorchester to shipping wharf	1
Sackville to shipping wharf	0·5
Stewiacke to wharf	1
Rivière du Loup town to wharf	4
Courtney Bay to wharf	1
Branch to Halifax cotton factory	1
	12·5

The following are the through distances :—

		Miles.
Lévis (opposite Quebec) *viâ* St. Joseph & St. Charles Junction (14 miles) to Halifax		675
do do do	St. John.	578
do *via* Truro	to Sydney	827
	North Sydney	820

NOTE.—At Lévis, passengers make connection with the Canadian Pacific Railway and with the Grand Trunk Railway. Freight is carried direct along the old main line between Chaudière Junction and St. Charles Junction (17 miles), instead of round by Lévis to St. Charles Junction, a total distance of 24 miles.

Traffic connection is made with other railways, as follows :—

At Lévis	with the	Canadian Pacific Ry.
Lévis	do	Grand Trunk Ry.
Lévis	do	Quebec Central Ry.
Chaudière Junction	do	Grand Trunk Ry.
St. Henri	do	Quebec Central Ry.
Rivière du Loup	do	Temiscouata Ry.

Metapediac	with the	Baie des Chaleurs Ry.
Gloucester Junction	do	Caraquet Ry.
Indiantown	do	Canada Eastern Ry.
Chatham Junction	do	Canada Eastern Ry.
Kent Junction	do	Kent Northern Ry.
Salisbury	do	Salisbury and Harvey Ry.
Petitcodiac	do	Elgin, Havelock Ry.
Norton	do	Central Ry. of New Brunswick.
Hampton	do	Central Ry. of New Brunswick.
St. John	do	Canadian Pacific Ry.
Buctouche Junction	do	Buctouche and Moncton Ry.
Sackville	do	New Brunswick & Prince Edward Ry.
Maccan	do	Joggins Ry.
Spring Hill Junction	do	Cumberland Coal & Ry. Co.
Salt Springs Junction	do	Spring Hill and Oxford Ry.
Windsor Junction	do	Windsor and Annapolis Ry.
Ferona Junction	do	New Glasgow Iron, Coal and Ry. Co.
Sydney	do	International Coal Company's Ry.

Capital Account.

The expenditure charged to Capital Account for the year ended 30th June, 1891, is as follows:—

The total cost of road and equipment on 30th June, 1890, was			$46,908,233 81
The additions during the year were as follows:—			
Increased accommodation at Moncton	$10,608 73		
do do St. John	4,355 17		
Dartmouth Branch	413 94		
Indiantown Branch	402 63		
St. Charles Branch	12,033 49		
Rolling stock and heating cars by steam from the locomotive	50,083 44		
Construction of a "Y" at Truro	1,500 00		
Old construction	531 94		
		(a)	79,929 34
		(b)	$46,988,163 15

To this must be added the total cost, chargeable to "capital," of the railway works now amalgamated under the Act of last session, namely:—

Oxford and New Glasgow	$1,776,446 91	
Eastern Extension Railway	1,321,986 89	
Cape Breton Railway	3,541,194 23	
		6,639,628 03
Total cost, chargeable to "capital," up to the 30th of June, 1891		$53,627,791 18

(a) Explanations of these several expenditures will be found on page 37 of the appendices.
(b) See note on page 13 of the appendices.

Revenue Account.

The gross expenditure for the year was	$ 3,662,341 94
The earnings were	2,977,395 38
Excess of expenditure over earnings	$ 684,946 56

Compared with the previous year, the earnings were as follows :—

	1889-90. (Including the Eastern Extension Ry.)	1890-91. (Including the Eastern Extension Railway, the Oxford and New Glasgow, and the Cape Breton Railways.)	
Passenger Traffic—			
Intercolonial	$ 854,794 31		
Eastern Extension Ry.	40,300 22		
	$ 895,094 53	$ 962,316 88	Increase, $67,222 35
Freight Traffic—			
Intercolonial	$ 1,926,927 14		
Eastern Extension Ry.	37,719 72		
	$ 1,964,646 86	$1,854,629 88	Decrease, 110,016 98
Mails and Sundries—			
Intercolonial	$ 146,359 47		
Eastern Extension Ry.	6,639 01		
	$ 152,998 48	$ 160,448 62	Increase, 7,450 14
Gross Earnings—			
Intercolonial	$ 2,928,080 92		
Eastern Extension Ry.	84,658 95		
	$ 3,012,739 87	$2,977,395 38	Decrease, 35,344 47

The number of passengers carried compares with the previous year as follows :—

1890–91		1,298,304
1889–90—Intercolonial	1,170,249	
Eastern Extension	48,984	
		1,219,233
Increase		79,071

The quantity of freight carried compares with the previous year as follows :—

	Tons.
1889–90—Intercolonial and Eastern Extension	1,368,819
1890–91	1,304,534
Decrease	64,285

The value of stores, including fuel and steel rails, in hand at the end of the fiscal year 1890–91, was $933,436.20. Of this amount, old material to the value of $106,283.84 was for sale.

In the subjoined reports of the Chief Engineer of Government Railways, the Chief Superintendent of the Intercolonial Railway, the Accountant of the railway and the head officers of the several departments which compose it, will be found statistical and other detailed information with respect to the railway.

The following will show certain of the more important features of its operation:—

	Miles.
The average mileage of the year was	1,094
The number of miles run by engines	6,080,791
do do trains	5,027,791
do do cars	56,492,801
The gross expenditure, including car mileage (payments for Intercolonial cars hauled on other roads, $23,708.81) was	$ 3,662,341 94

The gross earnings of the year amounted to $2,977,395 38.

Of this, the percentages earned by the several classes of traffic were as follows:—

Passenger traffic percentage	32·32
Freight do do	62·29
Mails and sundries	5·39
	100

The expenses as per mile run by engines amounted to	60·23 cts.
do do trains do	72·84 do
do per mile of railway amounted to	$3,347 66

The large addition to the mileage of the road, placed under operation during the past fiscal year, though adding considerably to the total cost of the year, is necessarily to be regarded as a means of developing the country adjacent to it, and of encouraging trade, rather than as an immediate source of increased revenue. The new sections of railway have, however, been successfully operated, and have proved to be of value as an accommodation to the public, for which object they were constructed.

The coal traffic over the line does not tend to expand, there having been a decrease of about 20,000 tons each year since 1887, when the maximum quantity so far carried, 192,022 tons, was reached. The quantity transported during the last fiscal year from the Nova Scotia collieries westward to Chaudière Junction was 137,472 tons.

Compared with the traffic of the previous year, the following are the results in specific features (the year 1889-90, including the Eastern Extension Railway). The number of passengers carried was 1,298,304, an increase of 79,071. Of barrels of flour there were carried 1,013,129, a decrease of 102,921 ; of grain, 2,890,921 bushels, an increase of 280,719 ; of lumber, 184,138,324 feet, a decrease of 25,766,741 ; of live stock, 95,529 head, an increase of 8,758.

The very satisfactory system of heating cars by means of steam supplied from the locomotive has been further extended during the year. The minimizing of risk from fire

in the event of an accident is one, and not the least, of the advantages attached to this mode of heating. The same observation applies to the use of electricity for the purposes of light, and the system of electrical lighting has been applied on the through express trains of the railway.

The adoption of the Westinghouse air brakes on freight cars and engines is regarded as of great importance for the avoidance of the risks to which employés are exposed, specially in winter, in using the ordinary hand brake, worked from the top of the car; 616 freight cars and 57 engines are accordingly being fitted with this brake.

The first serious accident that has taken place on the line has to be regretfully recorded, the express train from Halifax to Montreal having, on the 18th December, 1890, been derailed at St. Joseph, near Lévis. The accident, which appears to have been due to purely natural causes, resulted, unhappily, in the death of five persons and in the injury of others. The use of steam as a means of heating in place of stoves obviated further loss of life and injury through fire.

The railway and all the works connected with it were efficiently maintained throughout the year. Full details of repairs, renewals and other works executed will be found in the appendices.

The Cape Breton section suffered damage through the prevalence of heavy wind storms, and a considerable amount of repair was required. This section, though operated, had not, therefore, in November last, been handed over to the traffic department.

The Oxford and New Glasgow section has been successfully operated during the year. It has been well and substantially built, the bridges being of steel, resting on masonry.

Windsor Branch.

This road is 32 miles in length. It extends from Windsor Junction, on the Intercolonial Railway, to Windsor.

The arrangement whereby the Windsor and Annapolis Railway Company operate this line still continues. The company pay all charges in connection with the working of the traffic, two-thirds of the gross earnings being allowed them for such purpose; the Government taking the remaining one-third, and assuming all costs of maintenance of the road and works.

The agreement, dated the 21st September, 1871, as to traffic arrangements and running powers over the trunk line between Windsor Junction and Halifax, and the use of the Windsor Branch, contained the following provision as to time of enjoyment, and renewal of same.

"21. This agreement shall take effect on the first day of January, 1872, and continue for 21 years, and be then renewed on the same conditions, or such other conditions as may be mutually agreed to."

All charges for superintendence and supervision of maintenance of works are borne by the Intercolonial Railway, whose chief officer performs the duty.

The earnings and expenditure for the year ended the 30th June, 1891, were as follows:—

Earnings accruing to the Government (one-third of the gross earnings)	$ 30,235 13
Expenditure for maintenance of way and works	28,931 71
Government profit	$ 1,303 42

Government earnings, in comparison with those of the previous year:—

1890-91	$ 30,235 13
1889-90	30,162 46
Increase	$ 72 67

Expenditure in comparison with that of the previous year:—

1890-91	$ 28,931 71
1889-90	18,982 82
Increase	$ 9,948 89

The increase in the expenditure is due to the construction of a new steel bridge of 7 spans over the River Jordan, to replace a wooden trestle structure, to the relaying with steel rails of a part of the road, and to the improvement of the water supply.

Eastern Extension Railway.

This section of railway is eighty miles long, extending from the Intercolonial Railway at New Glasgow to Port Mulgrave, on the Strait of Canso, thence connecting with Cape Breton by means of a ferry.

This line, with its equipment, was, on the 9th January, 1884, purchased by the Dominion Government from the Government of the Province of Nova Scotia, together with rights possessed by that Government in the Pictou Branch between Truro and Pictou; also, the ferry built for the passage of the Strait of Canso.

By the Act passed last session, 54 Vic., chap. 50, this section, which had previously been worked by a staff under direction of the chief officers of the Intercolonial Railway, the accounts being, however, kept separate, was amalgamated with the Intercolonial Railway system; and the accounts have, accordingly, during the past fiscal year, been made part of the accounts of that road.

Oxford and New Glasgow Section.

Under authority of a vote of Parliament, passed in 1882, this line of railway has been built between two points on the Intercolonial system, namely, the Oxford station of that railway and Brown's Point on its Pictou Town Branch, the length being 67·60 miles. In addition, a branch from it, 4·75 miles long, extends from Pugwash Junction to Pugwash Harbour, making a total of 72·35 miles. The line passes close to the towns of Oxford, Pugwash, Wallace, Tatamagouche and River John. The road being sufficiently completed on the 15th of July, 1890, to be operated for public traffic, it was opened on that day.

Under an Act passed last session, 54-55 Vic., ch. 50, it has been made part of the Intercolonial Railway.

Carleton Branch Railway.

This road extends from Fairville, where it joins the line of the New Brunswick Railway Company, to Carleton, on the south side of the harbour of St. John, N.B., a distance of $3\frac{68}{100}$ miles.

By the Act 54-55 Vic., chap. 15, authority was given for the sale of this railway to the corporation of the city of St. John for the sum of $40,000, and under date the 20th of May, 1891, an Order in Council was passed authorizing the completion of the arrangements for the transfer. The road will be leased to the Canadian Pacific Railway Company for a term of 999 years.

Cape Breton Railway.

Under authorization of Parliament, given by the Act 49 Vic., ch. 14 (1886), a line of railway has been built by the Government in the Island of Cape Breton, extending from Point Tupper, on the Strait of Canso (opposite the terminus of the Eastern Extension Railway at Port Mulgrave, on the mainland) for a distance of 78 miles, to a point near Leitche's Creek, from which two extensions branch, one, 5 miles long, running to North Sydney, and the other, 13·75 miles long, into the town of Sydney. A connecting line, 1·25 miles long, gives communication with the International Coal Company's Railway beyond Sydney, thus bringing that important industry into direct line with the Intercolonial Railway system. The total length of the road, including the bridge over the Grand Narrows, is $98\frac{1}{2}$ miles.

About 50 miles, the eastern section of Grand Narrows, was put under traffic on the 24th of November, 1890, and the remaining section, west of Grand Narrows, was opened for traffic on the 1st of January, 1891.

Under the Act 54-55 Vic., ch. 50, it is made part of the Intercolonial Railway.

Communication across the Strait of Canso is made by means of a ferry between Point Tupper and Port Mulgrave.

Digby and Annapolis Railway.

This link of the Western Counties Railway, forming part of that line, was completed by the Government and handed over, but not transferred, to the company for operation on the 27th of July, 1891. By means of it, and of an arrangement made with the Windsor and Annapolis Railway Company, through communication can now be had between Yarmouth and Halifax without change of cars. The final estimate for the work has not yet been issued, but the expenditure up to the 30th June, 1891, was $588,659.38.

The construction of this section by the Government has been carried on under the authority of the special Act 52 Vic., chap. 8 (1889), an appropriation of $500,000 contingently granted by the Act 50-51 Vic., chap. 25, as a subsidy, having by such special Act been made available, and funds for further payments having been provided by special

votes. The cost over and above the $500,000 granted is a liability of the company towards the Government. The section has not, up to the 31st of December, 1891, been transferred to the company.

Further information on this matter will be found in the statements in this report respecting subsidized railways under the head of "Western Counties Railway Company."

PRINCE EDWARD ISLAND RAILWAY.

Length of Line.

	Miles.	
Souris to Tignish	168	
Mount Stewart to Georgetown	24	
Charlottetown to Royalty Junction	5	
Emerald Junction to Cape Traverse	13	
Alberton to Cascumpec Wharf	1	
		211

This railway was first opened for traffic on the 12th of May, 1875.

Capital Account.

No addition has been made to the expenditure on Capital Account during the past fiscal year, and the total cost of the road and equipment chargeable to Capital Account at the close of the fiscal year 1890-91 remains the same as at the close of 1889-90, namely $3,741,780 89

Revenue Account.

The working expenses and receipts for the year ended 30th of June, 1891, were :—

Gross expenditure	$ 257,990 08
Gross earnings	174,258 05
Excess of expenditure over earnings	$ 83,732 03

The gross earnings, compared with those of the previous year, were :—

1890–91	$ 174,258 05
1889–90	160,971 78
Increase	13,286 27

The gross expenditure, compared with that of the previous year, was :—

1889–90	$ 266,485 85
1890–91	257,990 08
Decrease	$ 8,495 77

The engine mileage was :—

	Miles.
1890–91	335,202
1889–90	315,943
Increase	19,259

The train mileage was :—

1890–91	272,475
1889–90	252,573
Increase	19,902

The car mileage was :—

1890–91	1,420,428
1889–90	1,316,355
Increase	104,073

The value of the stores on hand on the 30th June, 1891, including general stores, fuel, rails and old material, was $142,107.41.

The number of passengers carried was 145,508, an increase over the previous year of 7,409 ; and 59,511 tons of freight were carried, being an increase of 7,907 tons.

New works to the total value of $12,086.54 were executed, and extensive repairs and improvements were made to the Summerside wharf, damaged by severe storms.

Communication between the Prince Edward Island Railway and the Intercolonial is afforded in summer by steamer between Summerside and Point du Chêne and between Charlottetown and Pictou, and between Georgetown and Pictou, and in winter by the specially-built steamer "Stanley" between Georgetown and Pictou, and between Charlottetown and Pictou ; there is, also, further provision made for communication by ice-boats from Cape Traverse. These cross the Strait to Cape Tormentine, on the mainland, a distance of about 9 miles. Here, by the line of the New Brunswick and Prince Edward Railway, about 40 miles in length, connection is made with the Intercolonial Railway at Sackville. This winter service is conducted by the Marine Department, the mails being taken to and met at Cape Traverse by, if necessary, special trains.

GOVERNMENT ACTION AS TO SUBSIDIZED LINES.

NOTE.—The numbers within brackets after the title of the company refer to the list of railways subsidized by Parliament. Appendix 18, p. 164.

With regard to the several lines of railway subsidized by the Dominion, the following represents the action taken and the progress made in so far as the Dominion Government is concerned ; only those lines and companies being mentioned as to which definite steps, other than merely preliminary, have been taken towards securing the subsidy. Information has been brought down to the 31st of December, 1891.

Since the system of subsidy of railway enterprise was commenced, the following are the sums paid over, namely:—

For the fiscal year	1883-84,	ended on June 30,	1884	$ 208,000 00
do	1884-85	do	1885	403,245 00
do	1885-86	do	1886	2,171,249 00
do	1886-87	do	1887	1,406,533 00
do	1887-88	do	1888	1,027,041 92
do	1888-89	do	1889	846,721 83
do	1889-90	do	1890	1,491,595 72
do	1890-91	do	1891	1,079,105 87
				$8,633,492 34
Add to the above for the six months that have elapsed since, namely, from the 30th of June, 1891, to the 31st December, 1891				555,678 00
Total payments to the 31st December, 1891				$9,189,170 34

The Canadian Pacific Railway is not included in the above, nor is the subsidy to the Canada Central, nor that to the Quebec Government for the line from Ottawa to Quebec, nor advances made on mortgage to the St. John Bridge Company, to the Albert Railway Company, and to the Fredericton and St. Mary's Bridge Company, nor the annual subsidy to the Atlantic and North-West Railway Company payable for 20 years (included in last year's list).

The total number of companies to whom payments have been made on subsidy account up to the 31st of December, 1891 (with the above exceptions), is 61.

The following pages show, in alphabetical sequence, the position of those companies whose dealings with the Government is respect of subsidies are not yet closed. Reports of previous years give information as to companies whose subsidies have been earned and paid prior to the 1st of July, 1890.

A tabulated statement of payments will be found in Appendix 3, page 20.

Albert Southern Railway Company.

(See Nos. 36 and 157.)

By the Act 47 Vic., chap. 8 (1884), a subsidy not exceeding $51,200 was authorised towards the construction of a line from Hopewell (now called Albert) to Alma, N.B.

Under the authority of an Order in Council of the 8th of May, 1885, a contract for this work, namely, from Albert to the mouth of Salmon River, in the parish of Alma, was made with the Albert Southern Railway Company on the 23rd of that month, the line to be completed by the 1st of July, 1887. By an Order in Council of the 4th of April, 1887, the company were permitted to change their location, a route *vid* Derry's Corner being adopted.

The balance of the subsidy, $31,771.43, unpaid in 1889, lapsed, but was revived by the Act 52 Vic., ch. 3.

During the fiscal year 1890-91 the sum of $10,684.37 was paid, making the total payments to the end of the fiscal year $31,500. Since that date there has been paid a further sum of $15,600, making the total payments up to the 31st of December, 1891 $47,100.

Baie Des Chaleurs Railway Company.

(See Nos. 6, 42 and 158.)

This company was incorporated by the Provincial Act 45 Vic., ch. 53.

The Dominion Act 47 Vic., ch. 8, authorized the expenditure of $300,000 (revoted in the year 1885) for the construction of a branch of the Intercolonial Railway, to extend for a distance of 20 miles eastward, from Metapediac towards Paspebiac.

Tenders for the work were received, but none of them coming within the limit of expenditure authorized by Parliament, an offer made by the Baie des Chaleurs Railway Company to build and operate this section as a part of their own road from Metapediac to Paspebiac for the amount, was accepted by an Order in Council of the 18th September, 1885, and a provisional contract was entered into with them on the 7th of November, the section to be finished by the 1st of July, 1888, plans being furnished and the work supervised by the Department.

By the Act 46 Vic., ch. 25 (1883) a subsidy had been authorized in favour of this company towards the construction of their said road; the limit fixed by the Act being $3,200 a mile, for 100 miles, or a total of $320,000.

Provision, however, having been made, as above stated, for the building of the first 20 miles of this distance, the contract entered into with the company, also on the 7th of November, 1885, as authorized by an Order in Council, also dated the 18th of September, for the work under this subsidy, dealt with the construction of the last 80 miles only. It contained a clause under which, subject to authorization from Parliament to that end, the portion, namely, $3,200 a mile, applicable to the first 20-mile section of the road under the 100 mile subsidy of 1883, should be transferred to the second 20-mile section as an additional subsidy therefor, making the grant for such section $6,400 a mile.

To this arrangement approval of Parliament was given, the two agreements above mentioned being ratified and confirmed by the special Act 49 Vic., ch. 17; the date for the completion of the road being fixed by the Act as the 1st of December, 1888, in place of the 25th of May, 1887, as contemplated by their agreement.

By the Railway Subsidy Act of 1889, 52 Vic., ch. 3, the balance, $244,500, remaining unpaid of the subsidy mentioned in the Act 49 Vic., ch, 17, was granted to the company.

By authority of the same Act the subsidy applicable to the 30 miles between the 70th and the 100th mile was transferred to the section between the 40th and the 70th, making the grant for this section also $6,400 a mile. The company undertake to construct the section from the 70th to the 100th mile without subsidy, and have deposited bonds to the value of £83,000 stg. as security to that effect.

For subsidy purposes the time for completion was extended by an Order in Council of the 14th of June, 1888, to the 1st of January, 1890.

Under date the 1st of June, 1891, an Order in Council was passed approving of the location of the section between the 60th and the 80th miles, and under date the 26th of October, 1891, a copy was furnished to the Department of a contract made by the company for the construction of this section of road.

By the Act passed last session, 54–55 Vic., ch. 97 (1891), the company was declared to be a corporation under the Parliament of Canada, and the time for completion of its railway was extended for charter purposes, namely, up to Paspebiac, to the 30th of September, 1893, and up to Gaspé Basin to the 30th of September, 1895.

The following shows the position of this subsidy :—

Original subsidy, granted in 1883, $3,200 per mile, for 100 miles	$320,000	
Special vote, 1885	300,000	
		$620,000

Actual present position :

Miles.		
0 to 20	—20 miles (special vote)	$300,000
20 do 40	—20 $6,400 per mile	128,000
40 do 70	—30 $6,400 do	192,000
70 do 100	—30 Nil	
		$620,000
Total payments up to the close of the fiscal year 1889–90 covering the distance, 60 miles, up to the River Grand Cascapedia		524,175
Balance		$ 95,825

No further payments have been made up to the 31st of December, 1891.

Beauharnois Junction Railway Company.

(See No. 102.)

By the Railway Subsidy Act, 50–51 Vic., ch. 25, the grant of a subsidy not exceeding $96,000 was authorized in favour of the Beauharnois Junction Railway Company from St. Martin towards St. Anicet, the estimated distance being 30 miles.

On the 21st November, 1887, and under the authority of Orders in Council of the 1st of October and 2nd of November, a contract for the work was made with the company, namely, from St. Martin to Valleyfield, towards St. Anicet, the road to be completed by the 1st of December, 1888. By the Order first named, approval was also given to the location of the road from its junction with the Montreal and Champlain Junction Railway, at St. Martins, to Valleyfield, $19\frac{69}{100}$ miles. Up to the close of the fiscal year 1889–90 the total payments amounted to $58,900. No further payment has been made up to the 31st of December, 1891.

Brockville, Westport and Sault Ste. Marie Railway Company.

(See Nos. 48, 181, 193 and 240.)

By the Act 48–49 Vic., chap. 59 (1885), aid was granted to an extent not exceeding $128,000 towards the construction of the portion between Brockville and Westport, about 40 miles, of the line of the Brockville, Westport and Sault Ste. Marie Railway.

Under the authority of an Order in Council of the 28th of April, 1886, a contract was made with the company on the 16th of July, 1886, the subsidized road to be finished by the 1st of August, 1889.

Under an Order in Council of the 26th November, 1888, the sum of $45,000 was paid. The balance of the subsidy lapsed on the 1st of August, 1889, but was re-voted by the Act 53 Vic., ch. 2 (1890).

By the Act 53 Vic., ch. 2 (1890), the grant of a subsidy to the extent of $64,000 was authorized for 20 miles of railway from Newboro' towards Palmer's Rapids. For this subsidy there was substituted last session, by the Act 54-55 Vic., ch. 8, one for the same amount, and for the same distance, 20 miles, but from a point "at or near Newboro' towards Palmer's Rapids," payment to be made on completion of each section of the railway as follows:—from at or near Newboro' to Westport, 4 miles, and from Westport towards Palmer's Rapids, 16 miles.

During the past fiscal year payment has been made to the extent of $47,400, and since that date $12,800 on the 4-mile section between Newboro' and Westport, making the total up to the 31st of December, 1891, $105,200.

Brantford, Waterloo and Lake Erie Railway Company.

(See No. 104.)

By the Act 50-51 Vic., ch. 24, authority was given for the grant of a subsidy of $57,600 to the above company for 18 miles of their railway from Brantford to Hagersville or Waterford, or some intermediate point on the Canada Southern Railway.

Under an Order in Council of the 4th of August, 1888, a contract was made with the company, on the 31st, for a line from Brantford to Waterford, the work to be completed by the 1st of August, 1891. An Order of the same date approved of the location, the actual distance being 16¾ miles. During the fiscal year the sum of $16,190 was paid, making the total payments up to the 31st December, 1891, $52,810.

Buctouche and Moncton Railway Company.

(See Nos. 65 and 101.)

By the Act 49 Vic., chap. 10 (1886), assistance was authorized for the construction of a railway about 30 miles long, to connect Buctouche, N.B., with the Intercolonial Railway at or near Moncton, the subsidy not to exceed $96,000.

By the Act 50–51 Vic., chap. 24, an additional subsidy of $6,400 was granted for 2 miles additional, the distance between the points named actually being 32 miles, making the total subsidy $102,400.

Under an Order in Council of the 10th September, 1886, an agreement, dated the 14th of that month, was entered into with the Buctouche and Moncton Railway Company for the execution of this work. During the fiscal year there was paid the sum of $1,600.43, making the total payments up to the 31st of December, 1891, $67,020.

Canada Atlantic Railway Company.

(See Nos. 60, 80 and 132.)

By the Acts 48–49 Vic., ch. 59 and 49 Vic., ch. 10, the Canada Atlantic Railway Company were subsidized to the extent not exceeding $134,400 for a line from Clark's Island, in the St. Lawrence, opposite Valleyfield, through Lacolle to the Internationa boundary, about 50 miles; also from the present Ottawa terminus to the Chaudière Falls; and under the authority of Orders in Council, dated the 17th of September, 1885,

and 1st of July, 1886, contracts have been made with the company for the work in question. The date for full completion was extended by an Order in Council of the 17th of November, 1888, to the 1st of August, 1890. Under date the 4th of December, 1888, the company applied for the inspection of the Chaudière section.

Upon due inspection, payments were made, under Orders in Council, to the extent of $102,355.20; the work done and so paid for comprising the whole portion between Clark's Island and Lacolle, a distance of 43·18 miles; also the section, 3 miles, between the terminus at Ottawa and the Chaudière Falls, on the River Ottawa, leaving a balance of $32,044.80 to cover work yet remaining to be done. This balance, however, lapsed on the 1st of August, 1890.

By the Act 50–51 Vic., ch. 24, the grant of a subsidy not exceeding $180,000 was authorized for a bridge across the River St. Lawrence at Coteau Landing on the line of this railway.

The Canada Atlantic Railway Company possess powers under the Acts 35 Vic., ch. 83, and 42 Vic., ch. 57, to build this bridge, subject to the approval of the Governor General in Council, and upon Proclamation in the *Canada Gazette* showing such approval. The company having submitted satisfactory plans of the proposed work and site, these were approved by Orders in Council of the 23rd February, 1887, and 26th of November, 1888; and a proclamation was published in the *Canada Gazette* of the 10th of December, 1888, accordingly.

An agreement, dated the 5th of December, 1888, was entered into with the company for the construction of the said bridge, a low-level structure with a swing, on certain conditions, specifications and descriptions approved by an Order in Council of the 12th of that month, with a view to their obtaining the subsidy authorized by the Act 50–51 Vic., ch. 24, above mentioned.

A supplementary agreement, framed in the interests of navigation and of the public, for the operation of the swing to be built in this bridge, has been approved by Orders in Council of the 29th of December, 1888, and 9th of January, 1889, and will be held as part and parcel of the main agreement for the construction of the bridge. It requires the maintenance of a signal service at a point about one mile above the bridge, and the observance of such rules and regulations as are considered necessary for the protection of traffic down the navigable channel of the river.

The main features of the bridge are as follows: From the north shore to Giroux Island, five spans, one 154 feet clear opening; two swing spans each 160 feet clear, and two trusses each 165 feet. From Giroux Island to Round Island, 11 spans, each 186½ feet clear opening. From Round Island to Clark's Island, four spans, each of 213 feet clear opening, all the above being the width of the openings at summer water level. The total length of the bridging to be executed, including the spans, is about 4,100 feet. The superstructure is of iron-rivetted lattice work, the width 16 feet clear inside the end posts, and the minimum height 32 feet, the rail level being 20 feet above minimum summer water level. The estimated cost of the superstructure, including the swing, is $470,000.

During the fiscal year the sum of $30,188 was paid, making the total payment of $180,000, the full amount granted for this bridge.

Central Railway Company of New Brunswick.

(See Nos. 40, 143, 156 and 205.)

By the Act of 1884, 47 Vic., chap. 8, a subsidy not exceeding $128,000 was granted in aid of the construction of about 40 miles of the Central Railway, from the head of Grand Lake to a point on the Intercolonial Railway between Sussex and St. John, N.B.

Under the authority of an Order in Council of the 5th of June, 1886, a contract was made with the Central Railway Company, on the 7th July, 1886, for a line from Salmon River, at the head of Grand Lake, to Norton, on the Intercolonial Railway, the work to be completed by the 1st of July, 1888. Certain work had been executed, but the contract obligations had not been carried out, and no portion of the subsidy was paid. The subsidy lapsed, but was revived by the Subsidy Act 52 Vic., ch. 3 (1889). In November, 1889, the company applied for inspection of the road as a completed work, but no portion of the subsidy was paid.

On the 1st of December, 1890, a new contract was made with the company for this work under the Subsidy Act of 1889, the limit of subsidy being $128,000; this contract covering also a subsidy for 4½ miles, the limit of which was $14,400, authorized by the Act 53 Vic., ch. 2, making a total subsidy of $142,400; the total length of road subsidized being 44½ miles. The date for completion was fixed as the 1st of December, 1891. During the past fiscal year there was paid the sum of $75,639, no further payments have been made up to the 31st of December, 1891.

By the Act 51 Vic., ch. 3, a grant as a subsidy to this company was authorized of certain used iron rails to the value of $83,612.54, loaned to the St. Martin's and Upham Railway Company (which railway has been acquired by the Central Railway Company; the sale being approved by an Order in Council of the 15th of November, 1887), the condition of the grant being that such rails should first be replaced by new steel rails. The new steel rails were substituted, and an Order in Council of the 18th of October, 1889, authorized the transfer of the old rails to the company.

Chignecto Marine Transport Company.

(See No. 5.)

On the 3rd of February, 1882, this company (which received incorporation the same year, by Act 45 Vic., chap. 76) made a proposal to the Government for the construction of a line of railway for the transport of ships overland across the Isthmus of Chignecto from Tidnish, on Baie Verte, in the Gulf of St. Lawrence, to a point at or near the mouth of the River La Planche, in the Bay of Fundy, and by the Act 45 Vic., ch. 55, authority was given for the grant of a subsidy of $150,000 a year, for 25 years, in aid of the work.

No definite action was, however, taken until the 6th of October, 1885, when an Order in Council was passed authorizing entry into agreement with the company, subject to the approval of Parliament, and such agreement was executed on the 4th of March, 1886. Under its terms, the subsidy payable is to be $170,602 a year for 20 years, or such portion thereof as may be required to bring the net earnings to 7 per cent per annum on the authorized share and bond capital of the company, $5,500,000, and to be granted only during the satisfactory performance of the services contemplated, such

services comprising the raising, transport and lowering of vessels of 1,000 tons burden, registered, with full cargo. Should the earnings exceed 7 per cent per annum, one-half of such surplus is to be paid to the Government until repayment of the whole amount received by said company under their subsidy.

By a special Act, 49 Vic., ch. 18 (1886), this agreement was confirmed and ratified.

By a further special Act, 51 Vic., ch. 4 (1888), the time for the completion of the work, for subsidy purposes, was extended to the 1st of July, 1890, with, if required, a further extension for 24 months, but under penalty.

The company duly submitted plans, and these have been approved by Order in Council. As reported last year, good progress was being made, and it was expected that the works would have been completed early in 1892. They have been, however, suspended for a time, owing, it is understood, to financial causes.

By the special Act passed last session, 54-55 Vic., ch. 12, the date for completion for subsidy purposes has been extended to the 1st of July, 1893, the penal clauses in this regard contained in the Act 51 Vic., ch. 4, being repealed.

Columbia and Kootenay Railway and Navigation Company.

(Leased to the Canadian Pacific Railway Company.)

(See No. 222.)

This company was incorporated by an Act of the Province of British Columbia, but its proposed works were, by the Dominion Act 53 Vic., ch. 87 (1890), declared to be for the general advantage of Canada.

It has powers to construct a railway from the outlet of Kootenay Lake, B.C., through the Selkirk Range, to a point on the Columbia River near to the point of junction of the Rivers Kootenay and Columbia; also to operate a line of steamers in this connection. Power was also given for the leasing of the said works to the Canadian Pacific Railway Company, the lease to be first sanctioned by the Governor in Council.

By the Subsidy Act of 1890, 53 Vic., ch. 2, a subsidy, limited to $112,000, was authorized for the 35 miles of railway above described, and under date the 8th of October, 1890, the company were admitted to contract for this work, the date for completion being fixed as the 1st of December, 1891.

By an Order in Council of the 20th of August, 1890, sanction has been given to the lease of this railway for a term of 999 years to the Canadian Pacific Railway Company, who thereby undertake the construction of the road.

No portion of the subsidy was paid during the fiscal year, but the road being practically completed, there has been paid since that date the sum of $82,400, this being the total amount paid up to the 31st of December, 1891. The actual distance is 27¾ miles.

Cornwallis Valley Railway Company.

(See Nos. 128 and 168.)

By the Act 50–51 Vic., ch. 24 (1887), the grant of a subsidy to this company to the extent of $41,600 was authorized for 13 miles of their railway from Kentville to Kingsport.

Under an Order in Council of the 29th of March, 1888, they were admitted to contract on the 28th of May, the road to be completed by the 1st of October, 1889.

By the Act 52 Vic., ch. 3, an additional subsidy for one mile, $3,200, was authorized, and a contract, under date the 30th of September, 1889, has been entered into for the building of such extra mile to the harbour of Kingsport. The time for the completion of the whole work has been extended to the 1st of October, 1890.

During the fiscal year the sum of $42,670 was paid, and subsequently a further sum of $2,130, making a total of $44,800 up to the 31st of December, 1891.

Cumberland Railway and Coal Company.

(See No. 124.)

By the Act 50-51 Vic., ch. 24 (1887), the grant to this company of subsidy to the extent of $44,800 was authorized for 14 miles of their railway, from a point on the Spring Hill and Parrsboro' Railway, near Spring Hill, to a point on the Oxford and New Glasgow Railway, near Oxford.

The company having applied, they were admitted to contract on the 12th of April, 1888, under an Order in Council of the 12th March, the work to be completed by the 1st August, 1891. During the fiscal year the sum of $10,450 was paid to this company, making the total payments up to the 31st of December, 1891, $39,850.

Drummond County Railway Company.

(See Nos. 99, 175 and 214.)

By the Railway Subsidy Act of 1887, 50-51 Vic., ch. 24, the grant of aid to an extent not exceeding $96,000 was authorized to the Drummond County Railway Company for 30 miles of their railway from Drummondville towards Nicolet, Que.

Under the authority of an Order in Council of the 12th of November, 1887, a contract was made with the company on the 1st of December, 1887, covering a line from the South Eastern Railway, at the village of Drummondville, to the south-west branch of the River Nicolet; the road to be completed by the 1st of August, 1891.

On the 2nd of May, 1889, the company were admitted to contract for the balance, 17½ miles, of the 30 miles subsidized.

By the Subsidy Act of 1889, 52 Vic., ch. 3, this company were further subsidized for 4½ miles from the end of the line already subsidized to Ball's wharf, on the River St. Lawrence, to the extent $14,400, and were admitted to contract on the 21st of January, 1890.

By the Subsidy Act 53 Vic., ch. 2 (1890), authority was given for the grant of a subsidy, the limit of which was $76,800, for 24 miles of the railway of the company from Drummondville to Ste. Rosalie. Under date 2nd of February, 1891, the company were admitted to contract for this work.

During the fiscal year there was paid to the company the sum of $136,000, and subsequently the further sum of $5,105, making the total payments up to the 31st of December, 1891, $182,405.

Elgin, Petitcodiac and Havelock Railway Company.

(See Nos. 15 and 144.)

By the Act 51 Vic., ch 3 (1888), certain used iron rails from the Intercolonial Railway, valued at $44,252.82, which had been loaned to the Elgin Branch Railway, now part of the line of the above named company, were changed from a loan to a subsidy for that company, on condition that they should first be replaced on the track with new steel rails.

Such new rails having been laid, covering a distance of 14 miles, the transfer of the whole quantity of old rails to the company has been made under Orders in Council, the last dated 3rd of September, 1890.

(*Note.*—A previous subsidy of $38,400 had been earned by, and paid to, this company in 1885-86).

Great Eastern Railway Company.

(See Nos. 88, 114, 174, 213 and 235.)

By the Act 49 Vic., ch. 10, authority was given for the grant of a subsidy to an extent not exceeding $32,000, on an estimated distance of 10 miles, towards the construction of a line from Yamaska to the River St. Francis, Que.; and the Great Eastern Railway Company having applied, a contract was made with them on the 12th of October, 1886, under the authority of an Order in Council of the 9th of that month, the time of completion being fixed as the 1st of October, 1887.

The road having been completed and inspected, the whole of the subsidy due for its actual distance, 6 miles, namely, $19,200, was paid under an Order in Council of the 27th of March, 1887.

By the Act 50–51 Vic., ch. 24, authority was given for the grant of a subsidy to the company to an extent not exceeding $96,000 for 30 miles of their railway from the River St. Francis to the Arthabaska (Grand Trunk) Railway at St. Grégoire, and under an Order in Council an agreement was entered into with them for the work, the date being 16th March, 1888. During the past fiscal year the sum of $16,300 was paid from this subsidy of $96,000, for 6·66 miles from the east bank of the River Nicolet to the Grand Trunk Railway at St. Grégoire.

By the Act 52 Vic., cap. 3, a subsidy was authorized to the extent of $64,000 for a further distance of 20 miles from St. Grégoire. No contract has yet been signed for this work.

By the Act 53 Vic., ch. 2 (1890), a subsidy of 15 per cent on the value of two bridges, one over the River Nicolet, the other over the River St. Francis, not exceeding $37,500, was authorized. On the 20th of June, 1891, a contract was entered into with the company for the work. Nothing was paid out of the subsidy during the past fiscal year, but there has since been paid the sum of $4,845 for work on the Nicolet bridge.

By the subsidy Act of last session, 54–55 Vic., ch. 8, there was revoted the balance unpaid, $79,700, of the subsidy granted by the Act 50–51 Vic., ch. 26, which had lapsed.

Great Northern Railway Company.

(See Nos. 33, 37, 72, 79, 154, 215 and 231.)

By the Act 47 Vic., ch. 8 (1884), a subsidy not exceeding $32,000 was granted to this company for the construction of a line from St. Jérôme to New Glasgow, Que. ; the estimated length being 10 miles.

Under the authority of an Order in Council of the 3rd February, 1885, a contract for the work was entered into with the company on the 14th of that month, the road to be completed by the 1st of July, 1885.

The line was duly completed and inspected. Under an Order in Council of the 2nd of March, 1885, payment was made therefor, namely, for 7·84 miles, $25,088.

By the Act 49 Vic., ch. 10 (1886), a subsidy not exceeding $57,600 was authorized for a line from New Glasgow to Montcalm, a distance of about 18 miles. The Great Northern Railway Company having applied for it, it was granted to them by an Order in Council of the 18th July, 1887, which also approved of the location. The contract was made on the 19th of August, 1887, the road to be completed by the 1st of August, 1890. During the fiscal year the sum of $20,000 was paid on the first 10-mile section from New Glasgow towards Montcalm.

By the Act 49 Vic., ch. 10, a subsidy not exceeding $22,400 was granted for a line from St. Andrews to Lachute, Que., 7 miles. For this subsidy the above named company applied, but no contract was made. The same subsidy was again voted by the Act of 1889, 52 Vic., ch. 3, and under date the 8th of October, 1890, a contract was entered into with them for the work, calling for completion by the 1st of August, 1891. No portion of this subsidy was paid up to the 31st of December, 1891, but the work was practically completed.

By the Act 53 Vic., ch. 2 (1890), the grant of a subsidy for a line from Montcalm to the Canadian Pacific Railway between Joliette and St. Félix de Valois was authorized.

By the Act 54–55 Vic., ch. 8 (1891), the unpaid balance, $28,100, of the subsidy granted in 1886 was revoted, and during the fiscal year the sum of $9,500 was paid, making the total payments for the section from New Glasgow to Montcalm $29,500 up to the 3rd of December, 1891, and the total payments to the companies $54,588.

Guelph Junction Railway Company.

(See No. 105.)

By the Subsidy Act of 1887, 50-51 Vic., ch. 24, authority was given for the grant of a subsidy not exceeding $51,200 to the Guelph Junction Railway Company for 16 miles of their railway, from its junction with the Canadian Pacific Railway to the town of Guelph, Ont.

Under date the 1st October, 1887, an Order in Council authorized entry into contract, and such contract was signed on the 5th of November, the date fixed for the completion of the road being the 1st January, 1889.

By the Subsidy Act, 53 Vic., ch. 2 (1890), a subsidy not exceeding $48,000 was granted to this company for 15 miles of their railway from at or near Montreal to the Canadian Pacific Railway between Joliette and St. Félix de Valois. No contract has yet been made.

The location plans for the road, 15¼ miles, subsidized in 1887, having been approved and the work inspected, payment was made of the sum of $46,000 under an Order in Council dated the 21st of December, 1888; the sum of $2,800 being withheld for work remaining to be done.

By the Act 50-51 Vic., ch. 59, the company were empowered to extend their rail way to a point on Lake Huron near Goderich.

By this special Act, 54-55 Vic., ch. 73, the lease of this road to the Canadian Pacific Railway Company was approved and ratified. No further payment has been made up to 31st December, 1891.

Hereford Railway Company (formerly Hereford Branch Railway Company.)

(See Nos. 73 and 179.)

By the Act 49 Vic., ch. 10 (1886), authority was given for the grant of a subsidy to the extent of $108,800 for a railway from Hereford to the International Railway, in the Township of Eaton, an estimated distance of 34 miles.

The Hereford Branch Railway Company having applied, an Order in Council of the 30th December, 1887, authorized entry into contract with them for the work, and a contract was made accordingly, dated the 31st March, 1888.

By the subsidy Act of 1889, 52 Vic., ch. 3, a subsidy of $48,000 was authorized for a line from Cookshire to Dudswell, on the Quebec Central Railway, 15 miles, and the company were admitted to contract on the 3rd of August, 1889. The whole of the road has been built, and up to the close of the fiscal year 1889-90 the company had been paid $155,200 out of their total subsidies, $156,800, the difference, $1,600, representing some minor work remaining to be finished. No further payment has been made to the 3rd of December, 1891.

On the 4th of October, 1890, the company were allowed, after inspection, to open their road for public traffic from Dudswell Junction to the international boundary, 48·43 miles.

By an Order in Council of the 12th of June, 1890, sanction was given to the purchase of the Dominion Lime Company's railway by this company, in conformity with the Act 51 Vic., ch. 81.

Irondale, Bancroft and Ottawa Railway Company.

(See Nos. 24 and 159.)

By the Act 47 Vic., ch. 8 (1884), the Irondale, Bancroft and Ottawa Railway Company were subsidized, to an extent not exceeding $160,000, for a line, about 50 miles long, to connect the Victoria Branch of the Midland Railway with the village of Bancroft.

With the sanction of an Order in Council of the 10th July, 1886, a contract was made with the company on the 19th August, 1886.

Under the authority of an Order in Council of the 14th of February, 1887, $15,000 has been paid. The unpaid balance of subsidy, $145,000, which had lapsed, was revoted by the Act 52 Vic., ch. 3 (1889). No further payment of subsidy has been made up to the 31st of December, 1891. Under an Order in Council of the 3rd of August, 1891, the time for completion has been extended to the 1st of August, 1893.

Joggins Railway Company.

(See Nos. 76 and 100.)

By the Act 49 Vic., ch. 18 (1886), authority was given for the grant of aid to an extent not exceeding $38,400, towards the construction of a railway, the estimated length of which is 12 miles, from a point at or near McCann station, on the Intercolonial Railway, to the Joggins, on Cumberland Basin, N.S.

The Joggins Railway Company having applied for this subsidy, and the application being satisfactory, a contract was made with them on the 30th of November, 1886, under the authority of an Order in Council of the 5th of October, the line to be completed by the 1st of November, 1887.

A further subsidy to this company, not exceeding $4,000, having been authorized by the Act 50–51 Vic., chap. 24 (1887), towards the construction of an extension of the line, 1¼ mile long, to the wharves on Cumberland Basin, a contract was made with them for the work on the 13th of October, 1887.

During the fiscal year the company were paid the sum of $1,600, making the total payments up to the 31st of December, 1891, $37,500.

Lake Temiscamingue Colonization Railway Company.

(See Nos. 55, 84, 119, 122, 169 and 216.)

By the Act 48-49 Vic., ch. 59, a subsidy was authorized in aid of the construction of a line of railway from Long Sault to the foot of Lake Temiscamingue, surmounting certain rapids on the River Ottawa. The limit of the amount was $25,600, covering a total distance of 8 miles. A contract was entered into on the 25th of November, 1885, for the construction of 6 miles, to be completed by the 1st of January, 1887.

In conformity with an express provision to that effect in clause 2 of the Act 49 Vic., ch. 10, letters patent were issued under an Order in Council of the 20th of July, 1886, published in the *Canada Gazette* of the 24th, granting a charter for the construction of this railway to the "Lake Temiscamingue Colonization Railway Company."

By the Subsidy Act 49 Vic., ch. 10, a further subsidy of $6,000 was authorized for the building of wharves and landing stages in connection with this line. This was subsequently cancelled, and by the Act 50-51 Vic., ch. 24 (1887), the definition of portions of the road to which the preceding Acts had granted subsidies was corrected, the amount of the subsidy, however, remaining the same, namely, a total of $31,600.

By the Act 50-51 Vic., ch. 24, the grant of a subsidy to the extent of $33,600 was authorized for 10½ miles of this company's line from Long Sault to Lake Kippewa. The contract for this subsidy was entered into on the 27th of June, 1888.

By the Act 52 Vic., ch. 3 (1889), a subsidy was authorized not exceeding $48,000 for 15 miles, from Mattawa station, C.P.R., towards the Long Sault, or *vice versa*.

By the Act 53 Vic., ch. 2 (1890), a subsidy was authorized, not exceeding $64,000 for 20 miles from the northern end of the line subsidized by 52 Vic., ch. 3.

During the fiscal year 1888-89 the sum of $26,360 was paid, making a total of $52,760 paid to this company. No further payment has been made up to the 31st of December, 1891.

By the special Act 54-55 Vic., ch. 94 (1891), the company was empowered to convey or lease their road to the Canadian Pacific Railway Campany, and also to extend the railway to the head of Lake Temiscamingue; the company's works to be completed by the 10th of July, 1896.

Minudie Railway Company.

(See No. 121.)

By the Act 50–51 Vic., ch. 24 (1887), authority was given for the grant of a subsidy to the extent of $17,600 to the above company for 5½ miles of their railway, from its junction with the Joggins Railway, near the River Hébert railway bridge to the village of Minudie, Nova Scotia.

Under authority of an Order in Council of the 10th of February a contract, dated the 26th of March, 1888, has been made with the company for this work, which was to be completed by the 1st of March, 1889.

Up to the 31st of December, 1891, no portion of the subsidy has been paid.

Montreal and Champlain Junction Railway Company.

(See Nos. 51, 125 and 136.)

By the Act 48–49 Vic., ch. 59, a subsidy was authorized to be granted to this company for a line from Brosseau's to Dundee, not exceeding $30,000. The work was completed and the subsidy was paid in the year 1885–86.

By the Act 50–51 Vic., ch. 24, a further subsidy, not exceeding $64,000, was authorized to be granted to this company, and the contract was signed on the 25th of January, 1888, for a line from Fort Covington to Massena Springs.

By the Act 51 Vic., ch. 3, a further subsidy of $9,600 was authorized for 3 miles additional, making a total of $73,600. Nothing has been paid to the company during the past fiscal year, and the total payments up to the 31st of December, 1891, amount to $88,500.

Montreal and Lake Maskinongé Railway Company.

(See Nos. 74 and 212.)

By the Act 49 Vic., ch. 10 (1886), the grant of a subsidy of $32,000 for a railway from St. Félix to Lake Maskinongé, Que., was authorized, and application being made by the Montreal and Lake Maskinongé Railway Company, an Order in Council of the 1st of October, 1887, accepted them as contractors, and an agreement was entered into accordingly on the 29th September, covering the distance between St. Félix and St. Gabriel de Brandon, near Lake Maskinongé. The distance being greater than that

subsidized, a further grant for 3½ miles, $10,200, was made by the Subsidy Act 53 Vic., ch. 2 (1890). During the fiscal year payment has been made of $1,500, making the total payments up to the 31st of December, 1891, $41,280; the railway for the whole distance, 12·90 miles, being completed.

Montreal and Sorel Railway Company.

(See Nos. 47 and 210.)

By the Act 48-49 Vic., ch. 59, a subsidy not exceeding $72,000 was authorized to be granted to this company for a line from St. Lambert to Sorel. Under an Order in Council of the 2nd of October, 1885, a contract was made with the company on the 14th, and under the authority of Orders in Council, the last dated the 10th of November, 1886, payments have been made, amounting in all to $69,922, the road, 44·67 miles long, having been completed, with the exception of a small quantity of work, to secure the finishing of which $1,550 was retained. No further payment was made, and the said balance lapsed on the 1st of August, 1889.

By the Act 53 Vic., ch. 2 (1890), the sum of $40,000 was granted for the repair of this road. The work was undertaken by the Great Eastern Railway Company, and is being carried out under requirements laid down by this Department, and the inspection of its engineers. During the past fiscal year there was paid from this subsidy the sum of $17,116.07, making the total payments on that account, up the 31st December, $23,835.57, and the total payments to the company $93,757.57.

Montreal and Western Railway Company.

(See Nos. 78 and 206.)

By the Subsidy Act of 1886, 49 Vic., ch. 10, authority was given for the grant of a subsidy in lieu of previous subsidies to the Montreal and Western Railway Company for 70 miles of their railway from St. Jérôme north-westerly towards Le Désert, Que., the amount being $5,151 per mile, not exceeding in the whole $361,270.

For this subsidy another for the same amount was substituted by the Act 53 Vic., ch. 2 (1890), special authority being given for payment in named sections less than 10 miles in length.

Under authorization of an Order in Council dated the 4th of June, 1888, a contract was made with the company for the work on the 6th. During the past fiscal year there was paid to the company the sum of $76,143, and subsequently the further sum of $32,253, making the total payments up to the 31st of December, 1891, $108,396. These payments apply to the distance between St. Jérôme and Ste. Adèle, 18 miles, which is completed and open for traffic.

Montreal and Ottawa Railway Company.

(Formerly the Vaudreuil and Prescott Railway Company.)

(Name changed by 53 Vic., ch. 58.)

(See Nos. 97, 186 and 237.)

By the Railway Subsidy Act of 1887, 50-51 Victoria, ch. 24, the grant of a subsidy to the above company was authorized for 30 miles of their railway from Vaudreuil towards Hawkesbury, the extent of such subsidy being $96,000.

A contract was made with the company on the 11th of February, 1889, for the distance named, starting from the Grand Trunk Railway at Vaudreuil. The date for completion is fixed as the 1st of August, 1891.

The company, on the 4th of October, 1890, were authorized to open the portion of their road between Vaudreuil and Rigaud, 16 miles, for public traffic.

By the Act 53 Vic., ch. 2 (1890), a subsidy for a further distance of 30 miles towards Ottawa, $96,000, was authorized. A draft contract covering this subsidy was approved by an Order in Council on the 21st of September, 1891, but has not yet been signed.

By the Act 54-55 Vic., ch. 8 (1891), the unpaid balance, $46,040, of the subsidy granted in 1887, was revoted. During the fiscal year there was paid the sum of $49,960; nothing further has been paid up to the 31st of December, 1891.

Napanee, Tamworth and Quebec Railway Company.

(Name changed to the **Kingston, Napanee and Western Railway Company** *by the Act 53 Vic., ch. 62.)*

(See Nos. 13, 27, 57, 94, 107 and 166.)

In 1883 Parliament authorized a subsidy of $89,600 to this company, covering their road from Napanee to Tamworth.

A contract, dated 31st December, 1883, was entered into with the company for this work, and upon completion, inspection and approval of the road this subsidy was all paid under Orders in Council, the last dated the 28th of July, 1884.

In the session of that year Parliament authorized the grant of a further subsidy, not exceeding $3,200 a mile, or a total of $70,406, for an extension of this company's road from Tamworth to Bogart and Bridgewater. In 1885, however, in substitution for this subsidy, Parliament authorized the grant to the company of a subsidy of $70,000 for a line "from Tamworth towards Bogart and Bridgewater, 16 miles." This, again, was cancelled by the Act 49 Vic., ch. 10 (1886), a subsidy of $70,000 being granted to the company for 18 miles of their railway from Tamworth to Tweed.

By the Act 50-51 Vic., ch. 24 (1887), a further subsidy to this company, not exceeding $12,800, was authorized for 4 miles of their road to Tweed.

Under date of the 25th July, 1888, an Order in Council authorized entry into contract, and approved the location plans from Tamworth to Tweed, 20 miles. The contract was signed on the 31st of July, 1888, covering both subsidies. The road is to be completed by the 1st of August, 1890.

By the Act 52 Vic., ch. 3 (1889), the grant of a further subsidy to this company was authorized for 7 miles of their railway from Yarker to Harrowsmith, and also a grant to a company for 3 miles of railway from Harrowsmith to Sydenham, the total being $32,000. Under date the 4th of September, 1889, the company were admitted to contract for 3 miles, to be completed by the 1st of August, 1893, and, under date the 26th of December, for the distance of 6¾ miles, from a point near Yarker to or near Harrowsmith, to be completed by the 1st of August, 1891.

The total subsidies available under the contracts covering the distance between Tamworth and Tweed, Yarker, Harrowsmith and Sydenham, amount to $114,800. Under date the 30th of November, 1889, the company were allowed to open for traffic between Tamworth and Tweed, and between Yarker and Harrowsmith.

During the fiscal year payments were made to the extent of $7,600, making the total payments on these contracts $103,344, the full amount applicable; the total subsidies paid to the company being $192,944.

Northern and Pacific Junction Railway—Gravenhurst to Callander.

(See Nos. 1, 16, 160 and 188.)

For the purpose of affording to the Province of Ontario the advantage of direct railway communication with the North-West, it was necessary that a road should be built connecting the Canadian Pacific Railway with the existing railways of Ontario, and such a line was subsidized by the Acts of 1882 and 1883 to the extent of $12,000 a mile, for the distance of 110 miles, or a total of $1,320,000. It extends southwards from the Canadian Pacific Railway at Nipissing Junction, east of Lake Nipissing, to the village of Gravenhurst, a distance of 111¼ miles, there connecting with the railway system of Ontario. Under the authority of an Order in Council dated the 10th of April, 1884, a contract was entered into on the 12th of April, 1884, with the Northern and Pacific Junction Railway Company (formerly the Northern, North-Western and Sault Ste. Marie Railway Company), for the construction of this line, the same to be completed by the 1st May, 1886.

Connection was made from north to south in January, 1886, a through train running on the 27th of that month.

Up to the 31st of December, 1886, the total payments aggregated $1,284,400, leaving the sum of $35,600 to cover certain incomplete work. This balance lapsed, but was revoted in 1889 (52 Vic., ch. 3), being, however, set down as $35,000 only. The whole of the work being completed, this amount was paid to the company, under an Order in Council of the 6th of July, 1889, leaving $600 due.

By the Act 53 Vic., ch. 2 (1890), this sum of $600 was voted, and was paid during the past fiscal year, thus closing the matter.

Nova Scotia Central Railway Company.

(See Nos. 129 and 135.)

By the Subsidy Act of 1887, 50–51 Vic., ch. 24, the Nova Scotia Central Railway Company were subsidized for 34 miles of their railway, to an extent not exceeding $108,800. Under an Order in Council of the 16th September, 1887, the company were admitted to contract on the 17th of October, 1887, the work to be executed being a line of railway from Lunenburg, on the east coast of Nova Scotia, westward, to a point in the district of New Germany, together with a spur, about ¾ mile long, to Bridgewater railway wharf, the whole to be completed by the 31st of December, 1889.

By the Act 51 Vic., ch. 3 (1888), the grant of a further subsidy, not exceeding $147,200, was authorized for 46 miles of the company's railway, and under an Order in Council of the 9th October, 1888, a contract, dated the 15th of October, 1888, was

executed, covering a line of railway 39½ miles, starting from a point 33½ miles from Lunenburg, and running to Middleton, on the Windsor and Annapolis Railway; the work to be completed by the 31st of December, 1890.

During the fiscal year payments were made to the extent of $3,300, and subsequently a further sum of $8,300, bringing the total payments to this company up to the sum of $230,700 at date, 31st December, 1891, covering the distance from Lunenburg to Middleton and the spur to Bridgewater, a total of 73½ miles. No further payments have been made up to the 31st December, 1891.

Ontario and Pacific Railway Company.

(See Nos. 31, 115 and 150.)

By the Act 47 Vic., ch. 8 (1884), the grant of a subsidy to the Ontario and Pacific Railway Company was authorized, namely, to the extent of $262,400, on an estimated distance of 82 miles, for a line from Cornwall to Perth, and on the 27th of July, 1886, a contract was made with the company, under the authority of an Order in Council of the first day of that month, for the construction of such line, *viâ* Newington, Chrysler, Manotic and Franktown, the road to be completed by the 1st July, 1888. This subsidy lapsed on the 1st of July, 1888.

By the Act 50-51 Vic., chap. 24, a further subsidy of $19,200 for a further distance of 6 miles was granted.

By the Act 52 Vic., chap. 3 (1889), a subsidy not exceeding $172,400 was authorized to this company for a line from Cornwall to Ottawa, but no contract has yet been entered into for the work.

No portion of these subsidies has been paid up to the 31st of December, 1891.

Ontario and Quebec Railway Company.

(See West Ontario Pacific Railway Company.)

Orford Mountain Railway Company.

(See No. 228.)

By the Subsidy Act 53 Vic., ch. 2, the grant of a subsidy limited to $99,200 was authorized in favour of the above company, for 31 miles of their railway between Eastman and Kingsbury, Que., and on the 16th of December, 1891, the company were admitted to contract for the work for a distance of 10 miles, namely, from Eastman to Lawrenceville; the road for this distance to be completed by the 1st of December, 1893.

The work was completed, but no portion of the subsidy has been paid up to the 31st of December, 1891.

Ottawa and Gatineau Valley Railway Company.

(See Nos. 8, 26, 58 and 151.)

By the Act 48-49 Vic., chap. 59 (1885), the grant of a subsidy to this company was authorized (in lieu of subsidies granted in previous years), namely, for a line of

railway from Hull station towards the village of Le Desert, 62 miles, the amount being $320,000. This subsidy having lapsed, it was re-voted by the Act 52 Vic., chap. 3 (1889).

Under authority of an Order in Council of the 10th of July, 1889, a contract with the company for the work in question, 62 miles, was signed on the 19th of August, the date for completion being fixed as the 1st of August, 1893.

The location plans of the first 50 miles have been approved.

During the fiscal year $87,582 was paid to the company, and subsequently the further sum of $35,720, making the total payments up to the 31st December, 1891, $123,302. This applies to the first 20 miles, the opening of which for traffic was sanctioned on the 28th of that month.

Oshawa Railway and Navigation Company.

(Name changed to "The Oshawa Railway Company," 54-55 Vic., ch. 91.)

(See Nos. 112 and 233.)

By the Act 50-51 Vic., ch. 24 (1887), the grant of a subsidy to the extent of $22,400 was authorized for seven miles of this company's railway, extending from Port Oshawa towards Raglan; they were admitted to contract on the 20th July, 1889. This subsidy was renewed by the Act 54-55 Vic., ch. 8. No portion of the subsidy had been paid up to the 31st of December, 1891.

By the special Act 54-55 Vic., ch. 91, the corporate powers of the company were revived, and its name was changed as above.

Parry Sound Colonization Railway Company.

(See No. 153.)

By the Subsidy Act of 1889, 52 Vic., ch. 3, authority was given for the grant of a subsidy to this company, not exceeding $128,000 for 40 miles of railway from the village of Parry Sound to the village of Sundridge, or some other point on the line of the Northern and Pacific Junction Railway.

On the 21st of July, 1890, the company was admitted to contract accordingly, the line to run from the village of Parry Sound through the townships of Foley, Christie, Monteith, McMurrick and Perry, joining the line of the Northern and Pacific Junction Railway at Scotia, or a point about two miles from Elmsdale station. The date for completion has been extended to the 1st of November, 1892. The location of the first 30 miles has been approved by an Order in Council of the 11th of July, 1890.

No payment on subsidy account was made during the fiscal year; but, subsequently, there has been paid the sum of $30,400, this being the total paid up to the 31st of December, 1891.

Port Arthur, Duluth and Western Railway Company.

(Formerly the "Thunder Bay Colonization Railway Company.")

(See Nos. 139 and 195.)

This company was originally incorporated as the "Thunder Bay Colonization Rail-

way Company." It was declared to be a body corporate under its present name by the Dominion Act 51 Vic., ch. 84, which authorized it to receive all grants voted to the previous company.

By the Subsidy Act, 51 Vic., ch. 3 (1888), the grant of a subsidy to the extent of $271,200 was authorized in favour of the above company, for 84¾ miles of their railway from Port Arthur towards Gun Flint Lake, a point on the international boundary line; this being in place of subsidies previously granted for the construction of a railway from Murillo station to Crooked Lake.

A contract was entered into with the company on the 24th of December, 1889. The location of the entire line has been approved. During the fiscal year payment was made to the extent of $87,000, and, subsequently, the further sum of $70,075, making the total payments up to the 31st of December, 1891, $157,075.

By the Act 53 Vic., ch. 2 (1890), a subsidy limited to $16,000 was authorized for a branch, 5 miles long, to the Kakabeka Falls.

Pontiac and Renfrew Railway Company.

(See No. 163.)

By the Act 52 Vic., chap. 3 (1889), the grant of a subsidy to the above company of $19,200 was authorized for 6 miles of their railway, and under date the 2nd of August, 1889, they were admitted to contract, the line to be from the Bristol iron mines to the Pontiac Pacific Junction Railway, in Onslow. During the fiscal year the sum of $3,800 was paid from this subsidy, completing the payment of the full subsidy, $13,600, applicable to the actual length, 4½ miles, of this road.

Pontiac Pacific Junction Railway Company.

(See Nos. 25, 137 and 211.)

This line was subsidized by Parliament in 1884 to the extent of $3,200 a mile, not exceeding $272,000.

Under authority of an Order in Council dated the 12th of December, 1884, a contract, dated the 22nd of that month, was made with this company for the building of the line subsidized, namely, from Aylmer, Que., to Pembroke, crossing the River Ottawa at a point "not east of Lapasse," the first twenty-seven miles to be completed by the 1st September, 1885 (extended to 15th of December by Order in Council of the 13th of August, 1885), the second twenty-seven miles by the 1st of July, 1886, and the whole road, estimated at 85 miles west of Aylmer, by the 1st of July, 1887.

Up to the close of the fiscal year 1887-88 a total of $174,828, for a distance of 71 miles from Aylmer, had been paid out of the full subsidy, $272,000. No further payment has been made since that date up to the 31st of December, 1891.

The road is open for public traffic from Aylmer to Coulonge, 59 miles.

By the Act 51 Vic., ch. 3 (1888), a subsidy to this company of $31,500 was authorized for the bridging of the River Ottawa at Culbute; also a subsidy of $9,600 for 3

miles of their railway from a point 3 miles east of Pembroke to Pembroke, provided that the entire work subsidized on this railway be completed within four years from the 22nd of May, 1888. No contract has been entered into for the work contemplated by this Act up to the 31st of December, 1889.

By the 5th clause of the Act 52 Vic., ch. 3, it was specially provided that the several subsidies in aid of this railway should be extended to the 22nd of May, 1892.

By the Act 53 Vic., ch. 2 (1890), a subsidy limited to $24,000 was authorized for 7½ miles of this railway, between Hull and Aylmer.

By the Act 53 Vic., ch. 68 (1890), the time for completion of the railway to the town of Pembroke, and of the bridge over the River Ottawa, at or near the city of Ottawa, which the company were empowered to construct by the Act 45 Vic., ch. 69, was extended to the 22nd of May, 1892. The same Act gave the company power to extend their line from the said bridge to the canal basin in the city of Ottawa.

The Act 53 Vic., ch. 69 (1890), gave to this company power to purchase from the Canadian Pacific Railway Company the section between Hull and Aylmer, or any part thereof.

Quebec Central Railway Company.

(See Nos. 22, 142 and 219.)

This company was subsidized in 1884 to the extent of $211,200, in aid of the construction of 66 miles of their railway from Beauce Junction to the international boundary.

Under the authority of an Order in Council, dated the 2nd of August, 1884, a contract was made with the company on that date for the construction of a line from Beauce Junction on their trunk line, thence up the valley of the River Chaudière to the frontier, the line to be completed by the 2nd of February, 1888.

The location of the first 23 miles was approved of by an Order in Council of the 8th of May, 1885. The amount of the subsidy paid up to the end of the fiscal year 1885-86, under an Order in Council of the 14th of August, 1885, was $60,342, covering 15½ miles of road inspected, starting from Beauce Junction.

In lieu of the balance of this subsidy, which lapsed on the 1st of July, 1888, authority was given by the Act 51 Vic., ch. 3 (1888), for the grant of a subsidy to this company of $21,191.54 a year, for 20 years, equivalent to a cash grant of $288,000 for a line of railway from St. Francis station to a point on the Atlantic and North-West Railway, near Moose River, 90 miles. No contract was made for this work.

By the Act 53 Vic., ch. 2 (1890), in lieu of the subsidy so granted, the company may receive the same amount for a similar term of years, or a guarantee of interest on bonds for a like sum, for 90 miles of their railway from St. Francis station on their line to a point on the Atlantic and North Western Railway near Moose River, or from a point on their line between the Chaudière River and Tring station to a point on the International Railway at or near Lake Megantic, the first annual payment to be made

at the end of twelve months from the date of the certificate of completion. A draft contract was prepared, but has not yet been entered into, for this subsidy, and no further payments have been made up to the 31st of December, 1891.

Quebec and Lake St. John Railway Company.

(See Nos. 2, 14, 49, 82, 126, 140, 177, 220 and 232.)

By the Subsidy Act of 1882 a subsidy of $384,000 was granted for a line from St. Raymond to Lake St. John. By the Act of 1883 the Quebec and Lake St. John Railway Company, engaged in the work of constructing this line, were permitted to receive a further subsidy of $80,000. By the Act of 1885 a subsidy of $96,000 was authorized for a line extending from the point of their junction with the North Shore Railway (4 miles from Quebec) up to St. Raymond (36 miles from Quebec), conditionally upon the construction of their line to a point 50 miles north of St. Raymond, and by the Act of 1886 a subsidy was authorized, not exceeding $186,295, for the portion, 95 miles, extending from the point 50 miles north of St. Raymond to Lake St. John.

By the Act 50-51 Vic., ch. 24 (1887), an additional subsidy not exceeding $28,800 was authorized for a distance of 9 miles, the distance which previous subsidies granted were short of covering from the city of Quebec to Lake St. John. By this Act authority was given for payment up to the 23rd of June, 1888 (under the usual conditions) of balances available from the subsidies granted in 1882 and 1883. The aggregate of the subsidies granted to this company for the whole distance from Quebec to Lake St. John is $775,095, the number of miles subsidized being 186.

An agreement was duly entered into on the 4th of September, 1883, in respect of the two subsidies first named, under which this line was to be completed by the 25th of May, 1887, the portion up to Lake Edward to be completed by the 31st of December, 1885, and on the 10th of February, 1886, an agreement was signed covering the third subsidy, namely, that of 1885. For the subsidies granted in 1886 and 1887 no further contracts are required, these subsidies being applicable to works embraced in the previous contracts.

The road is in operation up to Roberval, on Lake St. John, 190 miles from Quebec.

By the Act 51 Vic., ch. 3, a subsidy to the extent of $96,000, previously granted to the Saguenay and Lake St. John Railway Company for 30 miles of their railway from Lake St. John towards Chicoutimi, was transferred to this company, and under authority of an Order in Council of the 17th of November, 1888, a contract was made with them on the 5th of December for this work, which starts from Chambord Junction, near Lake St. John, on their main line; the work to be completed by the 1st of August, 1890. The location for these 30 miles has been approved by an Order in Council of the 17th of November, 1888.

By the Act 52 Vic., ch. 3 (1889), a further subsidy of $64,000 was granted for an additional 20 miles, making the total subsidy for this branch $160,000.

By the Act 53 Vic., ch. 2 (1890), a subsidy to this company, to an extent not exceeding $30,000, was authorized for a railway bridge over the River St. Charles; also a subsidy, limited to $38,400, for 12 miles of railway from Lorette *viâ* Charlesbourg to

Quebec. Under date the 2nd of December, 1890, both these subsidies were covered by one contract, the work to be completed by the 1st of October, 1891.

By the Act 54–55 Vic., ch. 8, there was expressly voted the difference, $5,250, between the $30,000 mentioned in the above subsidy for the St. Charles bridge and the amount actually paid the company.

During the fiscal year there has been paid the sum of $70,350, making the total payments up to the 30th of June, 1891, for both main line and branches, $818,705. Since that date there has been paid the further sum of $5,250, making the total payments to the company up to the 31st of December, 1891, $823,955.

Quebec, Montmorency and Charlevoix Railway Company.

(See No. 164.)

By the Subsidy Act 52 Vic., ch. 3 (1889), the grant of a subsidy to the extent of $96,000 to the above company was authorized, for 30 miles of their railway, from the east bank of the River St. Charles to or near to Cape Tourmente, Que.

A contract was entered into with the company on the 14th of November, 1889, for this work, from Hedleyville to St. Joachim.

During the fiscal year 1889–90 the sum of $65,600 was paid from this subsidy, the distance covered being 20½ miles, viz.: from Quebec (the east side of the River St. Charles) to Ste. Anne. No further payments have been made up to the 31st of December, 1891.

Shuswap and Okanagon Railway Company.

(See No. 167.)

This company was incorporated by the Act 49 Vic., ch. 82 (1886), for the construction of a line of railway from a point on the Canadian Pacific Railway, at Sicamous Narrows, B.C., running up the left bank of the Shuswap River to a point near the north end of Lake Okanagon.

By 51 Vic., ch. 88 (1888), this Act was amended, and the company were allowed two years to commence and five to complete their main line.

By the Subsidy Act of 1889 a subsidy to the extent of $163,200 was authorized for the said railway, the estimated distance being 51 miles.

The contract for this work was signed on the 11th of February, 1890, the date for completion being fixed as the 4th May, 1893. Plans showing the location of the line for the whole distance, 51 miles, have been approved. The road is practically completed, the actual distance being 50·79 miles. In December, 1891, a final inspection of the road was asked for.

No portion of the subsidy was paid during the fiscal year. Subsequently, however, the sum of $65,010 has been paid up to the 31st December, 1891.

By the special Act 54–55 Vic., ch. 72 (1891), an agreement for the lease of the road to the Canadian Pacific Railway Company, when completed, for a term of 25 years, was approved and ratified, and powers were given to extend the line to a point on the international boundary at or near Lake Osooyos.

St. Catharines and Niagara Central Railway Company.

(See Nos. 96 and 176.)

By the Act 50–51 Vic., ch. 24 (1887), the grant of a subsidy to the extent of $38,400 to the above company was authorized for 12 miles of their railway from St. Catharines to the bridge over the River Niagara.

The company were admitted to contract on the 5th March, 1888, under an Order in Council of the 12th April, the location being approved by an Order of the same date.

On the 20th of December, 1888, the road having been built and inspected, the company were permitted to open it for traffic. The sum of $26,640 was paid to the company in the fiscal year 1888–89.

By the Act 52 Vic., ch. 3 (1889), a subsidy for 20 miles of this road was authorized, limited to $64,000, and on the 1st August, 1890, the contract was signed, the extension being from their present terminus at St. Catharines towards Hamilton.

During the fiscal year the sum of $11,760 was paid to this company, covering the distance, 12 miles, between St. Catharines and Niagara River. No further payments have been made up to 31st December, 1891.

The payments made to this company aggregate $38,400.

St. Clair Frontier Tunnel Company.

(See No. 162.)

In the year 1884 a company, "The St. Clair Frontier Tunnel Company," was incorporated by the Dominion Act 47 Vic., ch. 82, for the purpose of building a tunnel for railway passage under the River St. Clair, from a point in or near the town of Sarnia, Ontario, to the city of Port Huron, Michigan, U.S., the Act providing that the plans of the tunnel and its works should be approved by the Governor in Council prior to commencement.

Plans of this work were submitted by the company and approved by an Order in Council dated the 24th of November, 1886, which also approved of the site. Certain changes were subsequently found necessary, and amended plans were approved by an Order in Council dated the 7th of October, 1889.

This work gives connection between the Grand Trunk Railway and the Chicago and Grand Trunk Railway.

By the Subsidy Act, 52 Vic., ch. 3 (1889), a subsidy to the extent of 15 per cent of the value of the work, but not exceeding $375,000, was authorized.

Under authority of an Order in Council dated the 2nd of October, 1889, a contract was entered into with the company on the 30th of that month for the work in question, which was to be completed by the 1st of August, 1893.

The tunnel proper was formed throughout by the 30th of August, 1890, the shields from either end meeting at that day. On the 15th of October, 1891, the company

notified the Department that the work was completed and ready for inspection and traffic.

During the fiscal year the company were paid the sum of $143,400, and subsequently a further sum of $39,270, making a total of $316,400 paid up to the 31st of December, 1891.

The following memoranda, furnished by the company, will show the main features of the work as completed:—

Length of tunnel from face of portal to edge of water, Canadian side of river, 1,982 feet; tunnel under river, 2,310 feet; tunnel under dry ground, American side, 1,734 feet; total length of tunnel, from face to face of portals, 6,026 feet. Length of open approach, Canadian side, 3,061 feet; length of open approach, American side, 2,466 feet; total length of tunnel works, 11,553. Gradient from east end of Canadian approach falls towards the west at the rate of 105·6 feet per mile for a distance of 4,983 feet; it therefore extends into the tunnel 1,922 feet. Thence the gradient rises towards the west, 1 in 1,000, for 1,708 feet. Thence the gradient rises to the west end of the American approach 2,862 feet. Of this last mentioned gradient there are in the tunnel 2,396 feet.

The tunnel is circular, and is lined throughout with cast iron. The outside diameter of this lining is 21 feet; the inside diameter is 19 feet 10 inches. The iron lining consists of a shell, 2 inches thick, strengthened by inside flanges 5 inches deep, and varying in thickness from 2 to 3 inches. Vertically, these flanges are about 13 inches apart, and horizontally 4 feet 8 inches. The segments are fastened together by $\frac{7}{8}$-inch steel bolts, about $4\frac{1}{2}$ inches apart, centre to centre.

The portals are built of rock-faced ashlar, the courses being exceptionally heavy.

While the tunnel proper is only single track, the approaches are double track, the two tracks being connected outside of and near the portals. The slopes of the approaches are terraced to an inclination of 3 horizontal to 1 vertical. Very heavy retaining walls are built at the bottom of the slopes wherever the cutting exceeds 20 feet in depth.

The permanent way consists of steel rails, 100 pounds per yard, laid upon white oak ties in the open cuttings, and upon creosoted southern pine in the tunnel. The cross ties in the tunnel rest upon four longitudinal stringers, to which each second tie is secured by a $\frac{3}{4}$-inch steel bolt. Creosoted guard timbers, 10 inches by 12 inches, are bolted to the cross ties, near the outside of the rail in the tunnel, but not in the approaches.

The inside of the tunnel is practically dry, as the leakage does not exceed twenty-five gallons per minute. Two Worthington duplex pumps, with a capacity of 250 gallons per minute each, are provided for the drainage of the tunnel, but they only work occasionally and one at a time. Compressed air, instead of steam, is used for driving them.

At the Canadian portal steam pumps, having a capacity of 4,000 imperial gallons per minute, are used for removing rain or surface water from the open approach. These of course only work occasionally during storms or when the snow is melting. A similar arrangement has been made at the American portal for removing the water from the west approach. At neither end of the tunnel is any surface water allowed to enter.

The greatest depth of water over the tunnel is $40\frac{1}{2}$ feet. The minimum depth of clay and gravel between the bottom of the river and the outside of the iron lining is 15

feet; the distance from the bottom of the iron lining to the highest point of rock underlying the clay is 10·4 feet.

The traffic is worked through the tunnel by decapod engines weighing 195,000 pounds, and carried on a wheel base of 18½ feet.

St. John Valley and Rivière du Loup Railway Company.

(See Nos. 90, 118 and 225.)

By the Act 49 Vic., chap. 10 (1886), a subsidy of $70,400 was authorized for 22 miles of railway from Fredericton to Prince William, New Brunswick, and by the Act 50–51 Vic., chap. 24, a subsidy of $70,400 was authorized, in favour of the St. John Valley and Rivière du Loup Railway Company, for 22 miles of railway from Prince William towards Woodstock.

The company having applied for both subsidies, they were admitted to contract on the 26th June, 1888, under an Order in Council of the 21st May, the time for completion being fixed as the 31st July, 1890. This covers both subsidies, aggregating $140,800. The location plans were approved by an Order in Council of the 23rd May, 1888, covering the distances, 44 miles, from Fredericton to Woodstock.

By the Act 53 Vic., chap. 2 (1890), both the above subsidies were, in effect, revoted.

Up to the 31st December, 1891, no payments have been made.

Stewiacke Valley and Lansdowne Railway Company.

(See Nos. 87 and 232.)

By the Act 49 Vic., chap. 18 (1886), a subsidy was authorized for a railway from a point on the Intercolonial Railway through the Stewiacke valley, affording communication with the Iron Mines, Spring Side, Upper Stewiacke and Musquodoboit settlements, 25 miles, the extent of aid not exceeding $80,000. The Stewiacke valley and Lansdowne Railway Company having applied for this subsidy, a contract was made with them on the 17th of December, 1886, the line to be completed by the 1st of December, 1889.

By the Act 53 Vic., ch. 2 (1890), the above subsidy was in effect revoted, and the old contract having been cancelled, a new contract with this company was entered into on the 30th of August, 1890. Completion is called for by the 1st September, 1892.

By the Act 52 Vic., ch. 3 (1889), a subsidy was granted for a railway from Truro or a point between Truro and Stewiacke to Newport or Windsor, 49 miles, the limit being $156,800. A contract was made with this company on the 30th of August, 1890, for the work, the line to run from Brockville station, on the Intercolonial, to Newport station, on the Windsor Branch Railway; the line to be completed by the 1st of September, 1893.

The location plans have been approved for this distance.

No portion of any of the above subsidies has been paid up to the 31st of December, 1891.

St. Lawrence and Adirondack Railway Company.

(See No. 218.)

By the Subsidy Act 53 Vic., ch. 2 (1890), a subsidy not exceeding $57,600 was granted to the above company for 18 miles of their railway from Valleyfield to Huntingdon, on the Montreal and Champlain Junction Railway.

On the 29th of April, 1891, a contract was entered into with the company for this work, the time for completion being fixed as the 1st of July, 1893.

In December, 1891, the road was inspected and reported as complete—the actual distance being 12·58 miles. Up to the close of that month the subsidy had not been paid.

This road connects the Canada Atlantic Railway at Valleyfield with the Montreal and Champlain Junction Railway at Huntingdon.

St. Lawrence, Lower Laurentian and Saguenay Railway Company.

(Name changed to "The Lower Laurentian Railway Company" by Provincial Act 51-52 Vic., ch. 108, 1888.)

(See Nos. 38, 59, 117 and 234.)

By the Act 48–49 Vic., chap. 49 (1885), a bulk sum subsidy of $217,600 was granted for a line of railway from the Grand Piles, on the River St. Maurice, Que., to a point of junction with the Lake St. John Railway (being in lieu of a subsidy of the previous year).

By the Act 50-51 Vic., chap. 24, this subsidy was repeated in favour of the company named below.

The St. Lawrence, Lower Laurentian and Saguenay Railway Company having applied for this subsidy, and being approved, a contract was entered into with them on the 20th of February, 1886, under authority of an Order in Council of the 6th of that month, which also approved of the location plans, the said location being subsequently amended under an Order in Council of the 25th of August, 1887.

During the past fiscal year there has been paid the sum of $32,000, making the total payments up to the 31st December, 1891, $124,816.

By the Subsidy Act of 1891, 54–55 Vic., ch. 8, the unpaid balance, $92,784, of the company's subsidy, was revoted.

Nothing further was paid up to the 31st of December, 1891, but the road was inspected in that month, and authority was given by Order in Council, at its close, to pay $91,784, the road being completed. The distance from Grand Piles to the Rivière à Pierre station of the Quebec and Lake St. John Railway is nearly 39 miles.

Témiscouata Railway Company—Rivière du Loup to Edmundston.

(See Nos. 3, 62, 127, 141 and 226.)

Towards the construction of a line from Rivière du Loup or Rivière Ouelle, or from some point between them, to Edmundston, Parliament, in 1882, voted a subsidy of $240,000, and by the Act 48–49 Vic., ch. 58, a further subsidy, not exceeding $258,000, was voted for the same work, making a total subsidy of $498,000.

Under express provisions of this Act a charter was granted by Orders in Council of the 3rd and 7th of October, 1885, to certain persons constituting "The Témiscouata Railway Company," their object being to build the said road, and such charter, being published in the *Canada Gazette* of the 10th of that month, has force and effect as if an Act of Parliament. This charter was subsequently confirmed and amended by the special Act 50–51 Vic., ch. 71 (1887). Under the said charter the company have power to construct a road from the Intercolonial Railway at Rivière du Loup to Edmundston. On the 21st June, 1886, a contract was duly entered into with the company for the work subsidized, the whole to be completed by the 1st of August, 1889. The location of the road, 80½ miles *viâ* Lake Témiscouata and the River Madawaska, was approved of by an Order in Council of the 30th of September, 1886.

On the 22nd November, 1888, the company were permitted to open the road for traffic.

By the Act 51 Vic., ch. 3 (1888) a subsidy of $100,000 was granted to this company for 20 miles of their branch railway from Edmundston towards the River St. Francis, in lieu of a subsidy granted the previous year.

The company having applied to be admitted to contract, authority was given by an Order in Council passed on the 31st of December, 1888, which also approved of the location; and the contract was signed on the 22nd January, 1889.

By the Act of 1890, 53 Vic., ch. 2, a subsidy to the limit of $51,200 was authorized for a further distance of 16 miles. A contract under this subsidy was made with the company on the 20th of October, 1891, covering the distance, 12 miles, between Clair's siding and Connor's station. The branch up to this point, 31¾ miles, has been completed.

During the fiscal year payments have been made to the extent of $82,770, and subsequently a further sum of $54,830 has been paid, making the total payments up to the 31st of December, 1891, $624,800.

Tobique Valley Railway Company.

(See Nos. 130, 227 and 235.)

By the Act 50–51 Vic., ch. 24 (1887), authority was given for the grant of a subsidy of the extent of $89,600 for 14 miles of the railway of the above company from Perth Centre station, on the New Brunswick Railway, towards Plaister Rock Island, in lieu of a subsidy previously granted. A contract was made with the company for the work on the 4th of September, 1888. By the Act 54–55 Vic., ch. 8 (1891) this subsidy was in effect revoted, having lapsed.

By the Act 53 Vic., ch. 2 (1890), a subsidy limited to $35,200 was authorized for a further distance of 11 miles.

The first section of 14 miles was completed in December, 1891.

No portion of the subsidy was paid during the fiscal year, but subsequently there was paid up to the 31st of December, 1891, the sum of $58,890.

Thousand Islands Railway Company.

(See No. 182.)

By the Subsidy Act 52 Vic., ch. 3 (1889), the grant of a subsidy to the extent of $54,400 to the above company, for 4 miles of their railway from a point near the River St. Lawrence, in the village of Gananoque Junction, on the Grand Trunk Railway, and for thirteen miles of their railway from Gananoque Junction to a point of junction with the Brockville, Westport and Sault Ste. Marie Railway, was authorized.

A contract was made with the company for this work on the 24th of October, 1889, the 4-mile section to be built by the 1st of July, 1890, and the 13-mile section by the 1st of August, 1893. Under an Order in Council of the 10th of December, 1889, $10,400 has been paid for the section, 3¼ miles, from Gananoque to the Grand Trunk Railway, completed. No further payment has been made up to the 31st of December, 1891.

Vaudreuil and Prescott Railway Company.

(See *Montreal and Ottawa Railway Company.*)

Waterloo Junction Railway Company.

(See No. 187.)

By the Subsidy Act 53 Vic., ch. 2 (1890), a subsidy not exceeding $35,200 was granted to this company for 11 miles of their railway from Waterloo to Elmira.

Under date the 17th of February, 1891, a contract was made with the company for the work in question; the date for completion being fixed as the 1st of November, 1891.

No payments were made during the fiscal year, but subsequently there was paid the sum of $32,800, the road being completed. The actual distance is 10¼ miles.

Western Counties Railway Company.

By the Act 50–51 Vic., ch. 25 (1887), assented to on the 23rd of June, 1887, confirmation was given to an agreement made by the Government with the Western Counties Railway Company on the 31st of January, 1887, contingent on such confirmation, the agreement itself being thereby, in some respects, modified, as expressed in a subsidiary agreement. Under the provisions of the said Act and agreements, covenants have been entered into which may be summarized as follows:—

The company agreed to withdraw a suit pending against the Crown in respect of the Windsor Branch Railway, releasing the Government from all claims, and also releasing to the Government all right and title to the branch. They also undertook to build and complete the railway between Annapolis and Digby, N.S., and to complete, equip and put in first-class order the whole of the line from Yarmouth to Annapolis; also to settle all liens on their property, and their indebtedness. In order to the fulfilment of the above, they undertook to deposit with the Government the total proceeds of the sale of their debentures, &c., the issue of which was limited to $4,200,000. The Government, on its side, in consideration of these premises, undertook to pay to the company the sum of $500,000, this amount to be credited to the company and added to the proceeds of the sale of the debentures, which proceeds the Government agree to hold

for the purpose, the whole to be applied, under certificate of the Government Chief Engineer and Order in Council, to the payment of interest on the debentures, &c., to be issued, to the building and completion of the railway above mentioned, and to the satisfaction of the company's existing obligations; the balance, if any, to be paid to the company. The dates to which the company were bound, as modified by terms of the Act, were as follows:—

Work to be commenced by the 13th of July, 1887, and the railway between Annapolis and Digby to be completed by the 12th of September, 1888, the company to complete to the satisfaction of the Government, by the 12th of September, 1887, all arrangements for the settlement of its indebtedness. Provision was made also for the completion of the line between Annapolis and Digby by the Government, at its option, from the funds in its hands, in the event of failure on the part of the company to make commencement of work, to progress with the same, or to satisfy the Government as to the arrangement of the settlement of its indebtedness by the dates so fixed.

The company did not make deposit of money; nor did they take any practical steps to carry out the work contemplated. Under these circumstances, and in view of representations urging that the Government should itself undertake the work, a survey was made of the country between Digby and Annapolis, under instructions given in October, 1888.

By the special Act 52 Vic., ch. 8 (1889), authority was given for the construction of this link of railway out of the appropriation of $500,000 granted by the Act 50–51 Vic., ch. 25. The work was, accordingly, taken in hand by the Department of Railways, and was completed, and the company placed in possession for operating purposes on the 27th of July, 1891.

West Ontario Pacific Railway Company.

(Leased to the Ontario and Quebec Railway Company—C.P.R.)

(See Nos. 66 and 189.)

By the Act 49 Vic., chap. 10 (1886), the grant of a subsidy not exceeding $3,200 a mile, nor in the whole $256,000, was authorized in aid of the construction of a railway from Ingersoll *viâ* London, to Chatham, Ont., the estimated distance being 80 miles.

Application being made by the West Ontario Pacific Railway Company for the said subsidy, qualified by a request for permission to construct a road from Woodstock to London, in place of from Ingersoll, and it appearing that in view of the greater distance of the line proposed by them from any other existing railway it would be of more service to the country than the route actually subsidized, they were permitted, by an Order in Council of the 8th of September, 1886, to enter into contract for the road suggested between Woodstock and London, 27 miles, subject, however, to approval by Parliament. This conditional contract was signed on the 2nd of November, 1886, the road to be completed by the 1st of November, 1887.

The company, however, actually constructed a portion of their railway, the location of which was duly approved, from London eastwards to a point near Ingersoll, 19 miles, from which connection may be made with both Ingersoll and Woodstock. The work being completed, the subsidy earned was paid.

In the session of 1887 an Act, 50-51 Vic., chap. 62, was passed, authorizing the lease to the Ontario and Quebec Railway Company of such part of the line of the West Ontario Pacific Railway Company and of the branch thereof then under construction, from the line of the Ontario and Quebec Railway near Woodstock, *vid* London, to the River St. Clair; the Act further authorized the substitution of the said point of junction of the two railways for the point between Ingersoll and St. Thomas, previously fixed as the point of junction. This lease has been approved by an Order in Council dated the 15th of October, 1887.

Under an Order in Council dated the 25th of August, 1888, an agreement dated the 4th of September, 1889, was made with the Ontario and Quebec Railway Company (Canadian Pacific Railway), direct, for the construction of the line between London and Chatham by the 1st of August, 1890, the estimated distance for subsidy purposes being 65 miles.

By the Act 53 Vic., ch. 2 (1890), in lieu of the subsidy granted by the Act 49 Vic., ch. 10, for a subsidy from Ingersoll *vid* London to Chatham, a subsidy limited to $256,000 was granted for a railway from Woodstock *vid* London to Chatham, 80 miles, being, practically, a re-vote, with a change of the terminus.

During the past fiscal year the sum of $6,000 was paid, making a total of $256,000, the whole amount of the subsidies granted, all the work being completed.

Woodstock and Centreville Railway Company.

(See Nos. 131 and 203.)

By the Act 50-51 Vic., ch. 24 (1887), the grant of a subsidy to the extent of $64,000 was authorized for a railway from Woodstock towards Centreville, 20 miles.

The above railway company having applied and being approved, a contract was made with them on the 6th of May, 1889, for the distance named, the line to start from Upper Woodstock station, on the New Brunswick Railway, the work to be completed by the 1st October, 1890.

By the Act 53 Vic., ch. 2 (1890), a subsidy limited to $19,200 was authorized for a further distance of 6 miles to the international boundary.

No portion of the company's subsidy has been paid up to the 31st of December, 1891.

LAND SUBSIDIES.

The following companies have been aided by subsidies in land, duly authorized by Parliament and granted by the Department of the Interior:—

They are enumerated here because the engineering details have been dealt with by this department, the certificate of whose officer is required prior to handing over to the company concerned any part of the subsidy. (The numbers given refer to the special "land subsidies" list, Appendix 17.)

Alberta and Athabasca Railway Company.

(See No. 10.)

(Name changed by 52 Vic., ch. 65, to the "North Western Railway Company of Canada," which see.)

Alberta Railway and Coal Company.

(See Nos. 13 and 25.)

This company was incorporated in 1889 by the Act 52 Vic., ch. 50 (amended by the Act 53 Vic., ch. 85), for the construction of a railway from a point on the North Western Coal and Navigation Company's line, at or near Lethbridge, southerly, to the international boundary line; the Act giving them powers to acquire, by purchase or lease, the railway property and assets of that company.

On the 1st of January, 1890, they did so acquire, by lease, the said railway.

By the Land Subsidy Act, 52 Vic., ch. 4, as amended by the Act 53 Vic., ch. 3, the grant of 6,400 acres per mile was authorized in favour of this company for the distance, set down as about 50 miles, from Lethbridge to the international boundary.

The road has been built and inspected, and under date of the 8th of December, 1890, the company were authorized to open it for public traffic, the distance being 64·62 miles.

Under authority of the Act 53 Vic., ch. 85, this company has obtained a transfer, by way of lease, of the North Western Coal and Navigation Company's line.

Brandon and South-Western Railway Company.

(See No. 19.)

By an Order in Council dated the 23rd of November, 1889, but subject to the approval of Parliament, and contingent on their obtaining an Act of incorporation from the Dominion, this company has been granted a subsidy of 6,400 acres per mile in aid of a railway from a point in Township 1, in either Range 23 or 24, west of the 1st Principal Meridian, to Deloraine, Manitoba, about 17 miles. This subsidy was confirmed by the Act 53 Vic., ch. 4. The company was incorporated under a provincial Act, but received a Dominion charter by the Act 53 Vic., ch. 86 (1890), and under said Order in Council the subsidized section was to be completed and running by the 1st of May, 1891. The company have submitted location plans and profiles for approval.

Calgary and Edmonton Railway Company.

(See Nos. 230 and 21.)

This company was incorporated by the Act 53 Vic., ch. 84 (1890), for the construction of a railway from the Canadian Pacific Railway at Calgary northward to Edmonton, and southward to the international boundary, also northerly to Peace River.

By the Act 53 Vic., ch. 5, authority was given for entry into a contract with this company for the conveyance of men, supplies, materials, and mails, for 20 years; a payment to be made annually of the sum of $80,000 therefor, computation to be made from the date of the completion of the road between Calgary and a point on the North Saskatchewan River near Edmonton. The Act further gave power to the company to lease the said railway to the Canadian Pacific Railway Company.

On the 21st of June, 1890, a contract for transport service was made, accordingly, with the Government, this contract calling for completion of the first 100 miles by the 1st of November, 1891, and of the whole road by the 1st of November, 1893.

By the Land Subsidy Act of 1890, 53 Vic., ch. 4, a grant of land to the extent of 6,400 acres per mile was made for the line from Calgary north to Edmonton, about 190 miles, and also for a line south from Calgary to the international boundary, about 150 miles.

On the 26th of December, 1890, the company entered into a definite contract for the work of constructing, under this subsidy, both the northern line to Edmonton and the southern line to the boundary, the dates for completion being as follows :—

From Calgary northward, 100 miles, by the 1st of November, 1891 ; the balance to Edmonton within two years thereafter.

From Calgary southward, 50 miles, by the 1st of November, 1892, and to a point on the Old Man's River, by the 1st of November, 1893 ; the balance to the international boundary by a date to be fixed by the Governor in Council.

At the close of the calendar year the track was laid for a distance of 93·78 miles north from Calgary up to the south bank of the Red Deer River ; and on the 10th of August, 1891, the whole road from Calgary to Edmonton, 192 miles, was officially reported as fit to be opened for public traffic.

On the 7th of December, 1891, the first 50 miles southward from Calgary was officially reported as fit to be opened for public traffic.

An agreement has been entered into for the lease of this railway to the Canadian Pacific Railway Company.

Canadian Pacific Railway Company.

(See Nos. 17, 18 and 29.)

By an Order in Council of the 18th of May, 1889, but subject to approval by Parliament, a grant of lands, to the extent of 6,400 acres per mile, in favour of the Canadian Pacific Railway Company, was authorized in aid of the construction of a branch from a point at or near Brandon, on their main line, south-westerly to or near Township 3, Range 27, west of the 1st Principal Meridian, and thence westerly, a total distance of 100 miles—this they term their "Souris Branch ;" also, for a line, 25 miles, running from such point in Township 3 easterly to Deloraine, the western terminus of the existing line of the Manitoba South-Western Colonization Railway, making in all 125 miles subsidized, and the total grant 800,000 acres. A further Order of the 18th of June, 1889, authorized the conveyance of the subsidy on completion of each 20-mile section.

By the Land Subsidy Act 53 Vic., ch. 4, this grant was confirmed.

By the Land Subsidy Act of 1891, 54–55 Vic., ch. 10, a subsidy of 6,400 acres per mile, for a further distance of about 60 miles, to La Roche Percée, was granted.

The company duly filed plans showing the location of this branch from Kemnay, a station on their main line, 8 miles west of Brandon, to Melita, in Township 3, Range 26, west ; and from Melita east to Deloraine. On the 30th of January, 1891, the portion between Kemnay and Airdrie was officially reported to be fit for traffic, and on the 26th of October, 1891, the company asked for inspection between Hartney and Melita.

By an Order in Council of the 14th of June, 1889, but also subject to approval by Parliament, the grant of a subsidy to the Canadian Pacific Railway Company of land to the extent of 6,400 acres per mile was authorized for a branch starting from a point on the above mentioned south-westerly or "Souris" branch, and running to Glenboro', the length of railway so subsidized being stated to be about 60 miles, the subsidy to be conveyed on the completion of each 20-mile section. This is known as the Glenboro' extension of the Souris Branch.

By the Land Subsidy Act, 53 Vic., ch. 4, this grant was confirmed.

On the 26th October, 1891, the company applied for inspection of the extension from Glenboro' to Nesbitt, this latter being 131 miles from Winnipeg, this road, for 27 miles, constituting the company's "South-Western Branch;" and at the close of the calendar year the whole distance from Nesbitt to Winnipeg was under traffic. It should be observed that the portion of their road between Winnipeg and Glenboro' was formerly the Manitoba and South-Western Colonization Railway, of which the Canadian Pacific Company became lessees.

Great North-West Central Railway Company.

(See No. 7.)

The construction of a line of railway to extend from Brandon, on the Canadian Pacific Railway, to Battleford, in the provisional district of Saskatchewan, a distance of about 450 miles, was contemplated by the North-West Central Railway Company (formerly the Souris and Rocky Mountain Railway Company); and under an Order in Council of the 29th of July, 1885, the privilege of purchasing land at the rate of $1.06 per acre, to the extent of 6,400 acres per mile, previously accorded, was converted into a free grant of such land (subject to a charge of 10 cents per acre for survey), the grant being contingent on the due completion of their work in stated sections.

This concession did not result in the construction of any section of the road; and difficulties arising, and other applications being put forward for the work, the Act 49 Vic., ch. 11 (1886), granting aid to the extent of 6,400 acres per mile for the same, was made applicable either to the company named or to such other company as might undertake the construction of the road. The Great North-West Central Railway Company was incorporated by an Order in Council of the 22nd of July, 1889, in conformity with the provisions of the Act; a second Order, of the 3rd of August, amending such charter, and the whole being confirmed and ratified by the Act 51 Vic., ch. 85 (1888). A section of such charter giving running powers to the Canadian Pacific Railway was repealed by 52 Vic., ch. 67 (1889).

By an Order in Council, also of the 22nd July, 1886, the subsidy referred to was granted to this company, the contract itself being signed on the 12th of September, 1887. Under an Order in Council of the 1st of July, 1889, the contract time for completion was extended as follows:—

By the	1st of	December,	1889,	50 miles.
do	30th	do	1890,	100 do
do	do	do	1891,	150 do
do	do	do	1892,	150 do
				450 miles.

A further Order in Council of the 16th of November, 1889, extended to the 31st of May, 1890, the time for the completion of the first 50 miles; and on the 3rd of September, 1890, an Order in Council was passed accepting this section as completed.

By an Order in Council, dated the 7th of December, 1891, extension of time has been accorded—subject to the condition that the first 50 miles would be effectively operated and maintained on and after the 15th of that month, as follows: 100 miles from the end of the first 50 miles by the 30th November, 1892, and 300 miles further (or whatever distance may be required to complete the road to Battleford) by the 30th November, 1893.

The company reported the first 50 miles as having been opened for traffic on the 16th of December.

Lac Seul Railway Company.

(See No. 20.)

Under date the 13th November, 1889, there was granted to the above company by an Order in Council, subject to the approval of Parliament, a subsidy in land to the extent of 6,400 acres per mile, towards the construction of a railway from a point near Shelley station, on the Canadian Pacific Railway, to a point near Mud Lake, on the Winnipeg River, about 18 miles; the road to be completed by the 1st November, 1891.

This grant was confirmed by the Land Subsidy Act, 53 Vic., chap. 4 (1890.)

No further action appears to have been taken.

Manitoba and North-Western Railway Company.

(See Nos. 4 and 6.)

By the Act 48-49 Vic., ch. 60, authority was given for the grant of aid for a line from Portage la Prairie to the crossing of the south branch of the River Saskatchewan, 20 miles from Prince Albert, about 430 miles, 6,400 acres per mile.

A grant was made to the company by Order in Council of the 4th October, 1884, cancelling previous Orders. The time for completion was fixed by Order in Council of the 6th of May, 1885, as at the rate of 50 miles a year.

The location and grades having been duly approved, an inspection made of the company's road showed that up to the 1st December, 1885, they had built and equipped 131 miles of road.

By the Act 49 Vic., chap. 11, 1886, authority was given for the grant of aid for a branch of this railway from a point on the main line at or near Todburn to the River Assiniboine, near Shellmouth, about 26 miles, 6,400 acres per mile.

This grant was made to the company by Order in Council of the 24th of May, 1886. Under Orders in Council of the 10th and 21st September, 1886, the line was permitted to start from Binscarth, the Order first named approving the location to Russell, up to which point the road has been built. This branch, 11½ miles long, is in operation.

By the Act 55 Vic., ch. 78 (1890), relative to this railway, the company were bound to complete 17 miles in the calendar year 1890, and 20 miles a year thereafter.

Plans of location for the distance between the 206th and 256th mile from Portage la Prairie were approved by an Order in Council of the 27th January, 1890.

At the present date, the 31st of December, 1891, the main line is in operation for traffic purposes from Portage la Prairie to Yorkton, 223 miles, permission to open the line from Saltcoats to Yorkton, 17½ miles, for traffic, having been given, after inspection, on the 18th December.

Manitoba and South-Eastern Railway Company.

This company was subsidized in lands by the Act 53 Vic. ch. 4 (1890) for a line from Winnipeg southerly or south-easterly to a point on the west side of the Lake of the Woods, about 110 miles. They have submitted plans of location of the first 27 miles.

Manitoba and South-Western Colonization Railway Company.

(Leased to the Canadian Pacific Railway Company.)

(See Nos. 3, 27 and 28.)

By 48-49 Vic., cap. 60 (1885), authority was given for the grant of aid for a line from Winnipeg to Whitewater Lake, about 150 miles, 6,400 acres per mile.

The charter of the company, granted by Act 42 Vic., ch. 66 (1879), empowered them to build a line from Winnipeg to Rock Lake, near the west boundary of the province, the line to be completed in five years, namely, by the 15th May, 1884.

By the Act 43 Vic., ch. 53 (1880), they were permitted to extend the line up to the Souris coal fields.

By the Act 47 Vic., ch. 73 (1884), the company were allowed to lease their line to the Canadian Pacific Railway Company, the time for the completion of the railway being extended three years beyond the period fixed by their charter, namely, to the 15th of May, 1887.

By an Order in Council of the 4th of October, 1884, the company were subsidized to the extent of 6,400 acres per mile for the whole distance, about 152 miles, from Winnipeg to Whitewater Lake, equal to 972,800 acres, the line for this distance to be completed by the 1st of October, 1885. Location has been approved as follows:—

By an Order in Council of the 3rd November, 1881—from Aikins street, Winnipeg, to Section 18, Township 7, Range 4, W., about 52 miles. This is to a point about 4 miles south from what is now known as Elm Creek.

By an Order in Council of the 1st April, 1885—from Section 29, Township 8, Range 4, the point now known as Elm Creek, running west on a tangent to Section 31, Township 7, Range 9. This is the northern branch to the westward.

By an Order in Council of the 10th of September, 1885—from Section 29, Township 8, Range 4, passing through Carman and Manitou and the south shore of Whitewater Lake, thence to the western boundary of Manitoba, between Ranges 29 and 30. This is the southern branch.

An Order in Council of the 6th April, 1885, modified the grant of the Order in Council of the 4th October, 1884, so as to make it applicable to a change in the location of the road, and to the following sections:—

	Miles.
1. From Township 7, Range 4 (the portion from Winnipeg to Township 7, Range 6, about 50 miles, being already completed to Manitou)	110
2. From Manitou to Whitewater Lake.....	
3. From Township 8, Range 4, to Township 8, Range 9.....	20
	130

The Order also apportioned the 972,800 acres equally amongst these 130 miles =7,483·84 acres per mile.

An Order in Council of the 11th September, 1885, extended the time for completion to the 6th April, 1886.

An Order in Council of the 5th April, 1886, after report by the Chief Engineer of Railways as to inspection, showing completion of 100 miles, authorized the conveyance of 748,384 acres to the Manitoba South-Western Railway Company.

By an Order in Council of 15th November, 1886, it was decided to apply to certain further extensions completed, namely, on the south branch, from Boisevain west 21 miles, on the north branch, from Holland west 20 miles, the reserve for section No. 1, made under the Order of the 6th April, 1885. The remainder was to be kept as a subsidy for said section No. 1, from Township 7, Range 4, to Manitou, the construction of which was deferred, the Canadian Pacific Railway Company, the lessees of the road, having already communication with Manitou from Winnipeg by their southern line. In August, 1885, however, the company filed plans of the extension from Elm Creek to Carman, part of the said section No. 1.

By an Order in Council of the 6th March, 1887, the location of the northern of the two limbs has been approved for a total distance of 60 miles from Elm Creek to Section 10, Township 7, Range 14.

After further inspection and report by the Government Chief Engineer, showing the railway fit for traffic for a further total distance of 60 miles, an Order in Council was passed on the 19th of March, 1887, authorizing conveyance of the lands representing the subsidy for this distance. The line is in operation from Winnipeg to Glenboro' (northern limb), 105 miles ; also on the southern limb as far as Deloraine, a point 100 miles west from Manitou and 202 miles from Winnipeg.

By the Land Subsidy Act of 1891, 54-55 Vic., ch. 10, an additional subsidy of 6,400 acres per mile was granted for 62 miles over and above the subsidy for 150 miles granted by the Act of 1885, making the total subsidy for 212 miles, the distance constructed and in operation.

By the same Act a land subsidy of 6,400 acres per mile was granted for the branch from Carman to Barnsley, about 6¼ miles.

It should be observed that the Canadian Pacific Railway Company, the lessees of this road, have obtained by Orders in Council, and grant by Parliament, subsidies in land for branches which are practically extensions of both the northern line from Glenboro' and the southern line from Deloraine. These subsidies are dealt with under the heading " Canadian Pacific Railway Company."

Medicine Hat Railway and Coal Company.

(See No. 12.)

By the Act 50-51 Vic., chap. 23 (1887), authority was given for the grant to the above company of Dominion lands to the extent of 6,400 acres per mile for a railway from a point at or near Medicine Hat, on the line of the Canadian Pacific Railway, to the coal field in or near Townships Nos. 12 and 13, Range 6, west of the 4th Principal Meridian, a distance of about 8 miles.

By an Order in Council of the 6th of July, 1887, the grant was made to the company accordingly, it being provided that the road should be completed and in operation by the 31st December, 1888.

By an Order in Council of the 24th of January, 1889, approval was given to a draft of a formal contract with the company, and an extension of time to the 2nd of June, 1890, was granted for completion of the road. A contract was signed on the 14th of February, 1889, for this work.

By the special Act 54-55 Vic., ch. 79 (1891), the charter of the company was revived and its powers were extended.

North-Western Coal and Navigation Company.

(See Nos. 2, 9 and 13.)

By 48-49 Vic., ch. 60 (1885), aid was granted to this company for a line from Medicine Hat to the coal banks on the Belly River, about 110 miles, 3,800 acres per mile. This was amended by 50-51 Vic., ch. 22—the extent of land being increased to 3,840 acres per mile.

By an Order in Council of the 16th March, 1885, approval was given to the location of the company's line, and on inspection, in October, 1885, of the road from Dunmore station, on the Canadian Pacific Railway, to Lethbridge, 109 miles, an Order in Council of the 19th of October, 1885, accepted the road as completed.

It should be observed that by the Land Subsidy Act of 1889 a grant of 6,400 acres per mile for 50 miles, the distance between Lethbridge and the international boundary, was made under the name of this company. An Order in Council of the 14th of October, 1889, corrected the grant, as being intended for the "Alberta Railway and Coal Company," and the Act 53 Vic., ch. 3, made the necessary rectification.

By the Land Subsidy Act 53 Vic., ch. 4 (1890), a grant of 3,840 acres per mile for the distance between Lethbridge and the Crow's Nest Pass, about 100 miles, was authorized in favour of the North-Western Coal and Navigation Company, and an Order in Council of the 25th June, 1890, provided that on the completion of the first 50 miles from Lethbridge (by the 1st August, 1892) the lands applicable to this distance should be conveyed; conveyance to be made on the completion of each 10-mile section for the remainder of the distance (to be completed by the 1st of December, 1894.)

On the 25th June, 1890, a definite contract was made with this department by the company for the work between Lethbridge and Crow's Nest Pass, the dates for completion being those named above.

By the Act 53 Vic., ch. 85 (1890), powers were given for the lease of this railway to the Alberta Railway and Coal Company, and on the 1st of January, 1890, the railway property and assets were transferred, accordingly, by lease.

North-Western Railway Company of Canada.

(Formerly the Alberta and Athabasca Railway Company.)

(See No. 15.)

By an Order in Council dated the 21st of May, 1887, a grant of land was made, subject to the approval of Parliament, to the Alberta and Athabasca Railway Company (the name of which was changed, as above, by the Act 52 Vic., ch. 65) from some point on the Bow River or Canadian Pacific Railway at or between Calgary and Crow Foot Creek, running northerly to a point on the River Athabasca, and crossing the North Saskatchewan at a point near the town plot of Edmonton, a distance of 300 miles, the subsidy being at the rate of 6,400 acres per mile. The first 50 miles, commencing at the southern terminus, were to be completed by the 20th July, 1888, 100 miles in each of the two years following, and the whole road by the 20th of July, 1891.

By the Act 50-51 Vic., ch. 23, the above grant was confirmed.

By the Land Subsidy Act of 1889 (52 Vic., ch. 4), a subsidy was authorized in favour of the North-Western Railway Company of Canada to the extent of 10,000 acres per mile, for a railway from Calgary, on the Canadian Pacific Railway, northerly to a point on the North Saskatchewan River, at or near Edmonton, a distance of about 210 miles ; also to the extent of 10,000 acres per mile for a railway from Calgary southerly to Lethbridge, a distance of about 120 miles.

The Act 52 Vic., ch. 65 (1889), by which the change of name was authorized, gave power for further railway construction. This Act called for completion of 100 miles northwards from the Canadian Pacific Railway towards Edmonton by the 1st of December, 1890, and the remainder to Edmonton by the first December, 1891 ; also of the line south to Lethbridge or to a point on the international boundary by the 1st of December, 1892.

Qu'Appelle, Long Lake and Saskatchewan Railroad and Steamboat Company.

(See Nos. 185, 5 and 11.)

By the Act 48–49 Vic., ch. 60, authority was given for the grant to this company of aid for a line from a point near Regina to the navigable waters of Long Lake, 6,400 acres per mile.

On the 13th December, 1884, an Order in Council was passed granting to this company the above subsidy.

The location of the road from Regina to the navigable waters of Long Lake, a distance of about 23 miles, was approved by an Order in Council of the 25th of September, 1886.

On inspection of the road, made in May, 1886, it was found completed and in running order for a distance of 20·10 miles.

By the Act 50–51 Vic., ch. 23, authority was given for the grant to this company of a subsidy of 6,400 acres per mile for an extension of their line from a point near the

northern terminus of the completed portion of the line near Long Lake to a point near the elbow of the North Saskatchewan River, with branches to Prince Albert and Battleford, about 325 miles.

On the 20th of June, 1887, an Order in Council was passed granting this subsidy, the company to construct and have running the first 50 miles of the distance by the 20th of July, 1888, the portion up to the crossing of the South Saskatchewan within the following year, and the whole road by the 25th of May, 1891. This Order was subsequently cancelled.

By the special Act, 52 Vic., ch. 5 (1889), authority was given as follows :—

"In order to enable the Qu'Appelle, Long Lake and Saskatchewan Railroad and Steamboat Company to complete their railway from Regina to some point on the South Saskatchewan River, at or near Saskatoon, and thence northward to Prince Albert, the Governor in Council may enter into a contract with such company for the transport of men, supplies, materials and mails, for twenty years, and may pay for such services, during the said term, eighty thousand dollars per annum, in manner following, that is to say :—the sum of fifty thousand dollars to be paid annually on the construction of the railway to a point at or near Saskatoon, such payment to be computed from the date of the completion of the railway to such point; and the remaining thirty thousand dollars annually on the extension of the railway to Prince Albert, such payment to be computed from the date of such last mentioned completion : Provided, that if the second portion of the said railway is not built and operated to Prince Albert within two years after the completion of the railway to the South Saskatchewan, as aforesaid, the payment of fifty thousand dollars shall cease until the whole railway is finished to Prince Albert."

By an Order in Council of the 26th of June, 1889, approval was given to a draft of an agreement with the company in respect of transport service on completion of the road to Saskatoon. This agreement was signed on the 5th of August, 1889. By it the company were bound to complete the road to a point on the River Saskatchewan, near Saskatoon, by the 1st of November, 1890, and to Prince Albert within two years afterwards.

By the Act 53 Vic., ch. 8 (1890), there was confirmed a certain agreement made on the 7th of August, 1889, between this company and the Canadian Pacific Railway Company, for the possession, control and operation by the latter company of the railway from Regina to Prince Albert, the transfer to be effective up to the 6th of February, 1896, with the option of the final acquisition of the road at that date.

The road has been completed up to Prince Albert, the total distance from Regina being 247·91 miles.

Under an Order in Council dated the 18th of December, 1890, the 1st of July, 1890, has been fixed as the date for the computation of the transport service payment for the distance between Regina and Saskatoon ; the 12th of October, 1890, being the date fixed for the computation of payment for the portion from Saskatoon to Prince Albert.

The payments are made by the Department of Finance.

Red Deer Valley Railway and Coal Company.

(See Nos. 14 and 26.)

This company was incorporated by the Act 52 Vic., ch. 52, for the construction of a railway from a point near Calgary, N.W.T., to a point on the Red Deer River, in Township 32, Range 21, west of the 4th Principal Meridian, the route being defined; also from a point at or near Cheadle station, on the Canadian Pacific Railway, northerly to a point of junction with the line from Calgary, in or near Township 26, Range 25, west of the 4th Principal Meridian, with other branches indicated.

On the 28th of November, 1888, an Order in Council authorized the grant, subject to approval by Parliament, of a subsidy in land to the extent of 6,400 acres per mile for the line from Cheadle station to a point in or near Township 29, Range 23, west of the 4th Meridian, a distance of about 55 miles. This was confirmed by the Land Subsidy Act, 52 Vic., ch. 4 (1889).

By the Act 54-55 Vic., ch. 9, the above subsidy was cancelled, and in lieu thereof there was granted a subsidy, not exceeding 6,400 acres per mile, for the company's railway from Calgary to a point in or near Township 29, Range 23, west of the 4th Meridian, a distance of about 55 miles.

Winnipeg and Hudson's Bay Railway and Steamship Company.

(See No. 1, and special Act 54-55 Vic., ch. 81.)

By 47 Vic., cap. 25, clause 7 (1884), authority was given for the grant of aid for a line from some point on the Canadian Pacific Railway to Hudson's Bay, viz., for each mile in Manitoba 6,400 acres, and in the North-West Territories 12,800 acres.

In the year 1880, by Act 43 Vic., ch. 59, there was incorporated the "Winnipeg and Hudson's Bay Railway and Steamship Company," with powers for the construction of a line from Winnipeg to or near Port Nelson, Hudson's Bay.

In 1884 this Act was amended (by chapter 70), and the company were authorized to commence their line either from Winnipeg or from some point between Selkirk and Portage la Prairie, extending to Port Nelson and Churchill, or some other point on Hudson's Bay; also to construct a branch from any point on their main line to the Canadian Pacific Railway, west of Lake Winnipegoosis, construction to be carried on at the rate of at least 50 miles a year.

By the same Act, a previous Act authorizing the amalgamation of this company with the Nelson Valley Railway and Transportation Company was repealed, and authorization was giving for the winding up of the company last named and the transfer to the Winnipeg and Hudson's Bay Company of all its property and interests.

By an Act passed in 1886 (49 Vic., ch. 73) the date for completion was fixed as the 2nd of June, 1890.

By an Order in Council of the 11th of May, 1885, all previous Orders in this connection were cancelled, and there was granted to the Winnipeg and Hudson's Bay Railway and Steamship Company a subsidy in land, as follows:—

	Acres.
Division A.—From the Canadian Pacific Railway to the northern boundary of Manitoba—estimated distance, 225 miles.....	1,440,000
Division B.—From the boundary to the terminus near the mouth of the Nelson River, Hudson's Bay—estimated distance, 425 miles.	5,440,000
Division C.—The Branch, from a point on the main line, near the northern extremity of Lake Winnipeg, to intersection with the Manitoba and North-Western Railway—estimated distance not to exceed 250 miles (grant to be subject to approval by Parliament).....	1,600,000

The time for completion was fixed by this Order as 50 miles on division A or B by the 19th of April, 1887, and 50 miles a year thereafter until completion of main line; but if the main line was not completed by the 11th of May, 1890, they were to forfeit their right to a grant for their branch line, which must itself be completed by the 11th May, 1893.

In April, 1888, the Chief Engineer of Government Railways reported, showing that 40 miles of road were completed, with the exception of certain station buildings, &c.

By an Order in Council dated the 16th of September, 1891, the dates for the completion of the company's road have been extended as follows:—

From the end of the 40 miles already built to a point on the south shore of the River Saskatchewan, near the western end of Cedar Lake, or between Cedar Lake and Grand Rapids, a distance of about 250 miles, by the 21st of June, 1894 (the limit allowed by their charter as amended by 53 Vic., ch. 80). This Order in Council approved of the draft of a definite agreement to be made with the company for the work, and this agreement was duly signed on the 18th of September, 1891.

By the special Act 54-55 Vic., ch. 81, the entry into a contract with this company was authorized for the conveyance of men, supplies, materials and mails over the portion of this line between Winnipeg and the River Saskatchewan, for an annual payment of $80,000 a year for 20 years, under authority of an Order in Council dated the 16th of September, 1891. An agreement was made with the company accordingly on the 18th of September, 1891.

Wood Mountain and Qu'Appelle Railway Company.

(See No. 8.)

By the Act 49 Vic., ch. 11 (1886), the grant of aid was authorized for a railway from a point in Township 4, Range 30, west of the 2nd Meridian, passing through Fort Qu'Appelle, to the Manitoba and North-Western Railway, about 240 miles, 6,400 acres per mile.

A grant was made to the company by Order in Council of the 24th May, 1886, for the portion between Fort Qu'Appelle and the Canadian Pacific Railway, to be completed by the 1st November, 1887, and 50 miles a year thereafter.

This Order was amended by an Order of the 7th of July, 1887, the company being allowed one year from the 1st of January, 1887, for the completion of the first 50-mile section (after completion by the 1st of November, 1887, of the portion between the

Canadian Pacific Railway and Fort Qu'Appelle), the rate of construction to be 50 miles each year, subsequently, until completion of the road.

By a further amending Order in Council of the 22nd of November, 1887, the company were granted an extension of time for the completion of the portion between Fort Qu'Appelle and the Canadian Pacific Railway, namely, up to the 31st of July, 1888 : 100 miles of the road to be completed and in operation by the 31st of December, 1888, as required by the preceding Order.

By the special Act 52 Vic., ch. 66 (1889), the section of a previous Act giving this company power to construct a railway on the route above indicated was repealed, and they were empowered to construct a line from a point on the international boundary line, at or near Range 16, west of the 2nd Principal Meridian, in a northerly direction by Qu'Appelle station to Fort Qu'Appelle, thence in a north-easterly direction to a point at or near the north-west corner of Lake Winnipegoosis ; the portion between the point of intersection with the Canadian Pacific Railway and Fort Qu'Appelle to be completed by the 1st August, 1890, and the whole road by the 16th of April, 1896.

By the Land Subsidy Act of 1889, 52 Vic., ch. 4, the subsidy provided by the Act 49 Vic., ch. 11, was made available for this new line.

By the Act 53 Vic., ch. 83 (1890), the statutory time for the construction of the portion of this railway between the Canadian Pacific Railway and Fort Qu'Appelle was extended to the 1st of August, 1892—the balance of the road to be completed at the rate of 50 miles a year thereafter.

THE RAILWAY COMMITTEE OF THE PRIVY COUNCIL.

The Minister of Railways being Chairman of the Railway Committee of the Honourable the Privy Council, on which certain extensive duties are imposed by the Railway Act of 1888, it seems proper that a brief record should here be made of the several cases heard before this committee during the year, and the decisions arrived at.

The following cases have been before the Railway Committee of the Privy Council, from January to December, 1891 :—

Expropriation of additional land for station purposes on the city front, Toronto, by the Ontario and Quebec Railway Company.—Pending.

Protection at a crossing of a highway in the township of Sandwich West by the Canada Southern Railway.—Protection ordered.

Location of Brantford, Waterloo and Lake Erie Railway along Kerr and York streets, in the city of Brantford.—Approved.

Crossings at rail level by the Don branch of the Ontario and Quebec Railway of certain streets in the city of Toronto.—Consideration postponed at the request of the parties.

Protection of streets in the city of Sherbrooke crossed by the Grand Trunk and Canadian Pacific Railways.—Protection ordered at King and Belvidere streets, subject to the approval of His Excellency in Council.

Crossing at rail level by the Drummond County Railway of the Great Eastern Railway near the town of Nicolet.—Pending.

Overhead instead of level crossing by a street in the village of Magog, of the Atlantic and North-West Railway.—Overhead crossing ordered.

Subway under Grand Trunk and Canadian Pacific Railways on Keele street north, town of Toronto Junction.—Authorized.

Protection at Weston road and St. Clair avenue crossings of the Grand Trunk and Canadian Pacific Railways in town of Toronto Junction.—No order issued.

Opening of a crossing of the Grand Trunk Railway at Ingersoll on Wonham street.—Pending.

Protection at street crossings of the St. John Bridge and Railway Extension Company's line of railway at St. John, N.B.—Protection by means of a flag-man ordered at the Portland street crossing.

Crossing by the Toronto Belt Line Railway of the Canadian Pacific Railway in the city of Toronto near the Don.—Authority given for the issue of an Order approving, on certain details with respect to the plans being attended to by the Toronto Belt Line Company.

Protection at crossings by certain streets in the city of Toronto of the Grand Trunk and Canadian Pacific Railways; and the extension of Royce avenue across the Grand Trunk Railway.—Pending.

Crossing at rail level by the Drummond County Railway of the South Eastern Railway at Drummondville.—Pending.

Branch railway from the Blackwall station of the Grand Trunk Railway to connect with the St. Clair tunnel.—Approved.

Change in location of the Grand Trunk Railway between Brighton and Colborne.—Authorized.

Bridge carrying continuation of King and Queen streets across the Canadian Pacific, Toronto Belt Line and Don River, Toronto. Application from the city for approval of.—Pending.

Change of location of the Salisbury and Harvey Railway at Sayres quarry.—Authorized.

Crossing at rail level by the Atlantic and North-West and Lake Champlain and St. Lawrence Junction Railways of the Montreal, Portland and Boston Railway near the Farnham station.—Authorized.

Location of the Montreal and Western Railway along certain public highways in the parishes of St. Sauveur, Ste. Adèle and Ste. Agathe, in the county of Terrebonne, Que., and the diversion of the public highway at certain points.—Authorized.

Protection at street crossings of the Canadian Pacific Railway in the city of Vancouver.—Ordered to stand.

Complaint that an overhead crossing by the Atlantic and North-West Railway, of Galt street, in the city of Sherbrooke, was not properly constructed, so as to meet the requirements of street traffic.—Change ordered.

Dispute between the city of Sherbrooke and the Canadian Pacific Railway Company in respect to the construction of a bridge carrying the Waterloo and Magog Railway over Galt street, in the city of Sherbrooke.—Discharged.

Crossing at rail level by the Eastern Development Company's railway of the Cape Breton Railway. Application for reconsideration of refusal to allow a crossing at grade, and for a crossing to be allowed at a different point from that at first proposed.—Referred to the Government chief engineer for decision after examination of new plans.

Plan and site of bridge of Quebec and Lake St. John Railway across the Metabechouan River.—Approved.

Crossing at rail level by the Port Arthur and Neebing Electric Street Railway of the Port Arthur, Duluth and Western Railway, on the Fort William road.—Authorized.

Branch line of the Grand Trunk Railway, in the township of Ascot, county of Sherbrooke, to connect that road with the Eustis mines; and level crossing of the Massawippi Valley Railway by the said branch.—Approved.

Location of Grand Junction Railway along Sackville street, in the town of Guelph.—Authorized.

Crossings at rail level by the Ottawa Electric Street Railway of the Canada Atlantic Railway, on Bank and Broad streets, in the city of Ottawa.—Approved.

Public road crossing of the Grand Trunk Railway near the village of Brompton Falls.—Authorized.

Crossing at rail level by the St. Lawrence and Adirondack Railway of the Grand Trunk Railway at Huntingdon.—Approved.

Application from the Port Arthur, Duluth and Western Railway Company for a change in the order of the Committee of the 8th May, 1891, so as to provide for gates to be placed at the point of crossing of that railway by the Port Arthur and Neebing Electric Street Railway, or otherwise for the removal of the crossing to another place.—Not granted.

Substitution of a swing for a fixed bridge carrying the Grand Trunk (Midland) Railway across the Fenelon River, connecting Cameron and Sturgeon Lakes, in the Province of Ontario.—Swing bridge ordered to be provided on or before the 1st April, 1892.

The Grand Trunk Railway Company have since made a suggestion that, instead of building another bridge with a swing at this point, it might be preferable to deviate their road, crossing the river at another place where a swing would not be required, and the matter, in the meantime, is being dealt with by the Department of Railways and Canals.

Crossing at rail level by the Ottawa Electric Street Railway of the Canadian Pacific Railway near St. Patrick's street bridge, in the city of Ottawa.—Approved.

Change of location of the Quebec Central Railway at its junction with the Tring and Megantic branch.—Approved.

Crossing at rail level by the Drummond County Railway of the South Eastern Railway at Drummondville.—Approved.

Protection at crossing at rail level by the Canada Southern Railway of the London and Port Stanley Branch of the Grand Trunk Railway at St. Thomas.—Interlocking switch and signalling apparatus, with derails, ordered to be provided.

Crossing at rail level by the Vancouver Electric Street Railway of the Canadian Pacific Railway on Granville street, Vancouver.—Approved.

Protection at certain street crossings of the Grand Trunk Railway in St. Henri, a suburb of Montreal.—Under consideration.

Crossing at rail level by the Toronto Belt Line Railway of the Canadian Pacific Railway at the Lambton station.—Approved.

Application from the Ontario Express and Transportation Company, Limited, having for its object the obtaining of certain express facilities on the Grand Trunk Railway system.—Not granted.

Culvert under Central Vermont Railway and ditch through lands of same—As to whether the railway company, or the municipality of the county of Iberville, shall bear the cost of enlargement.—Stands for decision.

Protection at crossing by the Ottawa Electric Street Railway of the Canada Atlantic Railway on Broad street, in the city of Ottawa.—Semaphore ordered.

RAILWAY LEGISLATION OF THE SESSION OF PARLIAMENT

54-55 Victoria, 1891.

CHAP.

8 An Act to authorize the granting of subsidies in aid of the construction of lines of railway therein mentioned.

9 An Act further to amend the Act fifty-second Victoria, chapter four, intituled "An Act to authorize the granting of subsidies in land to certain railway companies."

10 An Act to authorize the granting of subsidies in land to certain railway companies.

77 Alberta Railway and Coal Company, Act to amend the Acts relating to the.

61 Atikokan Iron Range Railway Company, an Act to incorporate the.

97 Baie des Chaleurs Railway Company, an Act respecting the.

85 Berlin and Canadian Pacific Junction Railway Company, an Act respecting the.

64 Brighton, Warkworth and Norwood Railway Company, an Act to incorporate the.

59 Buffalo Lake and Battleford Railway, Coal and Iron Company, an Act to incorporate the.

57 Burrard Inlet and Westminster Valley Railway Company, an Act to incorporate the.

70 Canadian Pacific Railway Company, an Act respecting the.

71 Canadian Pacific Railway Act, 1889, an Act further to amend the.

11 Canadian Pacific Railway, an Act respecting the north shore section of the.

15 Carleton, City of Saint John, Branch Railway, an Act to authorize the sale of the.

89 Central Counties Railway Company, an Act respecting the.

CHAP.

62 Chatsworth, Georgian Bay and Lake Huron Railway Company, an Act to incorporate the.

12 Chignecto Marine Transport Railway Company (Limited), an Act to amend the Acts respecting the granting of a subsidy to the.

90 Cobourg, Northumberland and Pacific Railway Company, an Act to revive and amend the Act to incorporate the.

84 Collingwood and Bay of Quinté Railway Company, an Act to amend the Act to incorporate the.

98 Great Eastern Railway Company, an Act further to amend an Act to incorporate the.

80 Great North West Central Railway Company, an Act to correct a clerical error in the Act fifty-third Victoria, chapter eighty-one, intituled "An Act respecting the."

69 Grand Trunk Railway Company of Canada, an Act respecting the.

73 Guelph Junction Railway Company and the Canadian Pacific Railway Company, an Act to confirm a lease made between the, and for other purposes.

50 Intercolonial Railway, an Act respecting the.

66 Kingston and Pontiac Railway Company, an Act to incorporate the.

95 Kingston, Smith's Falls and Ottawa Railway Company, an Act respecting the.

88 Lake Erie, Essex and Detroit River Railway Company, an Act respecting the, and to change the name thereof to "The Lake Erie and Detroit River Railway Company."

94 Lake Temiscamingue Colonization Railway Company, an Act respecting the.

60 Manitoba and Assiniboia Grand Junction Railway Company, an Act to incorporate the.

79 Medicine Hat Railway and Coal Company, an Act to revive and amend the Act respecting the.

69 Montreal and Atlantic Railway Company, an Act to incorporate the, and for other purposes.

96 Montreal and Ottawa Railway Company, an Act respecting the.

99 New Brunswick Railway Company, an Act to amend the Act respecting the.

74 New Brunswick Railway Company and the Canadian Pacific Railway Company, an Act to confirm an Indenture between the.

82 Ontario and Rainy River Railway Company, an Act respecting the.

91 Oshawa Railway and Navigation Company, an Act to revive and amend the Act to incorporate the, and to change the name thereof to "The Oshawa Railway Company."

93 Ottawa and Parry Sound Railway Company, and the Ottawa Arnprior and Renfrew Railway Company, an Act amalgamating the, under the name of "The Ottawa, Arnprior and Parry Sound Railway Company."

63 Peterborough, Sudbury and Sault Ste. Marie Railway Company, an Act to incorporate the.

51 "Railway Act," an Act to amend the.

76 Red Deer Valley Railway and Coal Company, an Act to revive and amend the Act to incorporate the.

102 River St. Clair Railway Bridge and Tunnel Company, an Act respecting the.

CHAP.
58 Rocky Mountain Railway and Coal Company, an Act to incorporate the.
100 Salisbury and Harvey Railway Company, an Act respecting the.
78 Saskatchewan Railway and Mining Company, an Act respecting the.
92 South Ontario Pacific Railway, an Act respecting the.
83 South Western Railway Company, an Act respecting the.
87 St. Catherines and Niagara Central Railway Company, an Act respecting the.
72 Shuswap and Okanagon Railway Company and the Canadian Pacific Railway Company, an Act to confirm an agreement between the, and to grant further powers to the Shuswap and Okanagon Railway Company.
86 Toronto, Hamilton and Buffalo Railway Company, an Act respecting the.
75 Victoria, Saanich and New Westminster Railway Company, an Act respecting the.
101 Victoria and North American Railway Company, an Act to enable the, to run a ferry between Becher Bay, in British Columbia, and a point on the Straits of Fuca within the United States of America.
81 Winnipeg and Hudson's Bay Railway Company, an Act respecting the.

CANALS.

The canal systems of the Dominion, under Government control, in connection with lakes and navigable rivers, are as follows:—

1. The River St. Lawrence and lakes.
2. The Richelieu navigation, from the St. Lawrence to Lake Champlain.
3. The River Ottawa.
4. The Rideau navigation, from Ottawa to Kingston.
5. The Trent navigation.
6. St. Peter's Canal, Bras d'Or Lake, Nova Scotia.

The collection of the revenue derivable from the canals of the Dominion, formerly in the hands of the Department of Inland Revenue, was assumed by this Department, under an Order in Council of the 4th of June, 1889, as authorized by the Act 52 Victoria, chapter 19. Details relating to this branch will be found in the appendix. (App. 20, p. 209.)

The following statement shows the amount accrued on each canal for canal revenue proper and hydraulic rents, &c., during the fiscal year ended the 30th of June, 1891.

Name of Canal.	Tolls.	Wharfage and Storage.	Fines and Damages.	Other Receipts.	Hydraulic Rents, &c.	Total.
	$ cts.	$ cts.	$ cts	$ cts.	$ cts.	$ cts.
Welland	187,331 56	.....	1,153 38	101 59	3,766 72	192,353 25
St. Lawrence	62,272 77	4,677 21	417 05	12,552 45	24,970 98	104,890 46
Chambly	20,180 24	.....	6 75	.....	70 00	20,256 99
Ottawa	47,140 75	.....	.....	8 00	25 00	47,173 75
Rideau	5,954 99	12 20	6 00	179 78	731 15	6,884 12
Trent valley	681 11	.....	.....	50 00	236 00	967 11
St. Peter's	1,528 85	.....	.....	177 91	.....	1,706 76
Murray	672 86	.....	38 16	.....	.....	711 02
	325,763 13	4,689 41	1,621 34	13,069 73	29,799 85	374,943 46

RIVER ST. LAWRENCE AND LAKES.

The River St. Lawrence, with the system of canals established on its course above Montreal, and the Lakes Ontario, Erie, St. Clair, Huron and Superior, with connecting canals, affords a course of water communication extending from the Straits of Belle Isle to Port Arthur, at the head of Lake Superior, a distance of 2,260 statute miles. The distance to Duluth is 2,384 miles. (A table giving the intermediate distances will be found in Appendix No. 12, p. 143.)

The difference in level between the point on the St. Lawrence near to Three Rivers, where tidal influence ceases, and Lake Superior, is about 600 feet.

The Dominion canals, constructed between Montreal and Lake Erie, are the Lachine, Beauharnois, Cornwall, Farran's Point, Rapide Plat, Galops and Welland. Their aggregate length is 70½ miles; total lockage (or height directly overcome by locks) is 533¼ feet; number of locks, 53.

Communication between Lakes Huron and Superior is obtained by means of the Sault Ste. Marie Canal, situated on the United States side of the river.

This canal is a little over a mile in length, with a bottom width of 100 feet, and has one lock, the dimensions being:—length 515 feet, width 80 feet, gate openings 60 feet wide, with 16 feet of water on the sills, and a lift of about 18 feet. By it there is afforded a 16 feet navigation between the two lakes.*

* From the report of the Chief of Engineers, U. S. army, dated the 23rd of September, 1891, for the fiscal year ended the 30th June, 1891, it appears that the construction of the proposed new and larger lock is in progress, taking the site occupied by the two old locks built in 1855, the canal itself being deepened to correspond, so as to give a navigable depth of 20 feet. The dimensions of the new lock will be—length 800 feet between gates, width 100 feet throughout, with 21 feet of water on the sills, with a single lift, approximating 18 feet. The estimated cost of this new lock and work of canal deepening is set down at $4,738,865. For this work an appropriation of $250,000 was made by Congress in August, 1886. The total expenditure up to the 30th of June, 1891, was $587,676.74. On the 1st of July, 1891, there was an unexpended balance of appropriations amounting to $2,187,335.44. For the fiscal year ending on the 30th June, 1893, an additional sum of $2,000,000 can, it is stated, be profitably expended, in view of the importance of completing the work at the earliest possible date, the enormous traffic being now dependent on a single lock.

From the same report and its appendices it appears that during the fiscal year ended the 30th of June, 1891, the canal now in operation was closed on the 3rd December, 1890, and opened on the 27th April, 1891, being open for 221 days; that 9,541 vessels, etc., passed through, carrying 8,338,981 tons of freight and 26,226 passengers, the number of lockages being 4,614. The cost of operation and care of the canal during the fiscal year 1890-91 was $45,417.66, which includes in repairs $13,046.29.

A special report deals with the operation of the canal during the *season of navigation* of the calendar year 1890. From this it appears that during that season the canal was open for 228 days, that 10,557 vessels passed through in 4,970 lockages, carrying 9,041,213 tons of freight and 24,856 passengers, the total value of the freight being $102,214,948.70.

The total number of registered craft using the canal during the season was 598, of which 369 were steam and 229 sailing vessels. The largest single cargo carried by a steamer was 2,946 tons, and the largest by any vessel was 3,021 tons, carried by a barge. There were 90 steamers carrying 2,000 tons and upwards, and 21 sail vessels carrying 2,000 tons and upwards.

The total amount of freight paid was $9,472,214.90; the total mile-tons (the number of miles run multiplied by the freight tonnage) was 7,207,299,415; the cost per mile per ton was 1·3 mills. The average distance freight was carried was 797·2 miles. The principal items of freight were as follows:—Wheat, 16,217,370 bushels; corn, 1,870,406 bushels; flour, 3,239,104 barrels; coal, 2,176,925 tons; iron ore, 4,774,768 tons (the ton is the net ton of 2,000 lbs.) The report states that the average cost of transportation per ton per mile, including terminal charges, was, for the year 1890, 1·3 mills, as against 1·5 mills in the years 1889 and 1888, and as against 2·3 mills in the year 1887.

Compared with the previous season of 1889, there was an increase in all classes of freight except wheat, grain other than wheat, pig iron, and silver ore and bullion, in which items there was a slight decrease.

The total valuation of all the vessels using the canal in the season of 1890 is set down at $29,635,500, against a total valuation in 1887 of $19,773,950.

This canal is free of toll.

In connection with the enlargement of this canal there has been undertaken, and is in progress, the work of improving the southern channel of the river below the falls, known as the Hay Lake channel in American waters. It is proposed to make a channel of 300 feet wide and of a navigable depth of 20 feet. The improved route will leave the present navigable channel of the river at a point, Sugar Island rapids, about 2½

Steps have been taken by the Dominion Government for the construction of a lock and canal on the Canadian side, a general description of which will be found further on in the present report, page 88.

The following is a brief summary of the chief points in connection with the scheme of canal enlargement on the through line of navigation between tide water and Lake Superior now being carried on.

The general enlargement scheme comprises locks of the following dimensions:—Length, 270 feet between the gates; width, 45 feet; with a navigable depth of 14 feet of water over the sills.

Lachine Canal.—On the Lachine Canal the foundations of the permanent structures were put down to the full depth for vessels drawing 14 feet, but about $6\frac{1}{2}$ miles of the canal itself has yet to be lowered 2 feet to obtain this depth. The bottom is chiefly rock.

Lake St. Louis.—For about four miles above the head of the Lachine Canal, Lake St. Louis is obstructed by numerous shoals, consisting principally of hard material, the removal of which is necessary to form a channel suitable to the enlarged 14 feet navigation.

Soulanges Canal.—Between Lakes St. Louis and St. Francis there is a rise of about 83 feet in the river, which is at present surmounted by the Beauharnois Canal, on the south shore of the St. Lawrence. The enlarged scale canal (the Soulanges) will be built on the north shore of the river.

Lake St. Francis.—In Lake St. Francis the obstructions to a 14 feet navigation are of minor importance, and are found chiefly near its upper or western end, where there are some shoals to be removed.

Cornwall Canal.—The works of the Cornwall Canal are all under contract. The two lower locks, &c., were completed in 1882. The four other locks, weirs, &c., are now nearly finished. The canal for about half its length has been excavated to the requisite depth.

Farran's Point Canal.—Nothing has been done towards the enlargement of the canal at Farran's Point, but the necessary surveys have been completed.

Rapide Plat Canal.—At the Rapide Plat the guard lock is finished and in use; the works remaining to be done to complete the enlargement have been recently placed under contract.

Between the Cornwall Canal and the Galops Canal the river reaches require to be deepened or improved at certain points.

Galops Canal.—The Galops Canal is $7\frac{5}{8}$ miles in length; it is composed of two, originally separate, canals, the Iroquois 3 miles long, and the Galops $2\frac{1}{4}$ miles long, which were afterwards united, it being found that there was not a sufficient depth of water in the Iroquois Canal without the supply from the head water so afforded.

---

miles below the canal; will pass through these into Hay; Lake then by way of Middle Neebish; rejoining the present navigable channel at the foot of Sugar Island; saving a distance of 11 miles (16 miles in place of 27), and giving a route which can be so marked by lights as to be navigable at night, an advantage which is not to be afforded by the present channel, except by the use of many lights. The estimated cost of the work is set down in the report of the U. S. engineers, quoted, at $2,659,115. The total expenditure up to the 30th June, 1891, amounted to $828,823.08.

The rapids thereby avoided are the Iroquois, the Cardinal and the Galops. Of these, the Iroquois and the Cardinal are very strong currents rather than rapids.

This canal is being enlarged for a distance of about 4,000 feet from the upper entrance to a point below the Galops Rapids, where a new lock will give access from the river. With the exception of preliminary surveys, nothing has yet been done towards the enlargement of the remainder of the canal.

From the upper entrance of this canal to the Prescott reach, a distance of about three miles, the present circuitous and, in parts, shallow channel lies across what is known as "Flat Rock" shoal, and runs through American waters. The improvement and utilization of the north or Canadian channel of the river is a part of the general scheme of enlargement.

Welland Canal.—The enlargement of this canal is completed.

Sault Ste. Marie Canal.—Work has been commenced on the Sault Ste. Marie Canal, which will be of much larger dimensions than any of the others.

In consequence of representations made in Parliament last session, the plans on which this work was being built have been modified. The dimensions of the lock, as modified, will be as follows:—Length, 900 feet; width, 60 feet; depth of water on the sills, 21 feet (the same as the new American lock under construction.)

By the changes made in the plans, a straight entrance and exit will be afforded to and from the lock chamber. This lock will accommodate at the same time one lake vessel 320 feet long, and two of the Welland Canal type, 255 feet long.

LACHINE CANAL.

	Old Line.	New Line.
Length of canal	8½ statute miles.	8½ statute miles.
Number of locks	5	5
Dimensions of locks	200 feet by 45 feet.	270 feet by 45 feet.
Total rise, or lockage	45 "	45 "
Depth of water on sills { at two locks	16 "	18 "
Depth of water on sills { at three locks	9 "	14 "
Mean width of new canal		150 "

The depth of the canal between locks is at present adapted to vessels of only 12 feet draught.

The canal now consists of one channel, with two distinct systems of locks, the old and the enlarged. There are two entrances at each end.

This canal extends from the city of Montreal to the town of Lachine, overcoming the St. Louis Rapids, the first of the series of rapids which bars the ascent of the River St. Lawrence. They are 986 miles distant from the Straits of Belle Isle.

The scheme for the enlargement of this, in common with the other canals of the St. Lawrence, contemplated the affording a navigable depth of 14 feet throughout. The improvement immediately in view, however, was only intended to furnish a navigable depth of 12 feet in the canal proper, and accordingly, on the following reaches, namely, between Lachine and Côte St. Paul, Côte St. Paul and St. Gabriel, and between

St. Gabriel and Wellington Basin, the channel has been adapted to navigation by vessels of 12 feet draught only. All permanent works on the canal, such as locks, bridges, side walls and culverts, have been built to afford a navigable depth of 14 feet. Through Lake St. Louis down to the Lachine Canal—a distance of about 15 miles—the existing channel, which is wide and deep, would be available for about 11 miles. Over the lower four miles, however, the channel will require to be deepened and widened at a number of places. Some experimental dredging has been carried on in order to determine the nature of the material to be removed, and the best way of dealing with it.

The canal was closed on the 29th of November, 1890, and opened on the 28th of April, 1891.

There were no accidents during the year, nor was navigation interrupted. The water was maintained at a good height on all the levels, both for navigation and for manufacturing purposes.

The report of the Superintending Engineer gives details of the repairs and new works executed, and shows generally the condition of the canal. (App. 5, p. 99.)

BEAUHARNOIS CANAL.

Length of canal	11¼ statute miles.
Number of locks	9
Dimensions of locks	200 feet by 45 feet.
Total rise or lockage	82½ feet.
Depth of water on sills	9 "
Breadth of canal at bottom	80 "
Breadth of canal at water surface	120 "

This canal commences on the south side of the St. Lawrence, 15¼ miles from the head of the Lachine Canal. It connects Lakes St. Louis and St. Francis, and passes the three rapids known, respectively, as the Cascades, the Cedars and the Coteau.

The canal was closed on the 30th of November, 1890, and was re-opened for traffic on the 24th of April, 1891.

No accident or interruption to navigation occurred during the year.

Details of repairs will be found in Appendix 5, p. 101.

CORNWALL CANAL.

Length of canal	11½ statute miles.
Number of locks	6
Dimensions of locks (four)	200 feet by 55 feet.
" of two lower entrance locks	270 by 45.
Total rise or lockage	48 feet.
Depth of water on sills	9 "
" " at the two lower entrance locks	14 "
Breadth of canal at bottom (except at three culverts)	* 100 "
Breadth of canal at water surface	150 "

*NOTE.—Though the bottom breadth is, as stated, 100 feet, it must be observed that this is the bottom breadth of the old, or 9 feet navigation canal.

From the head of the Beauharnois to the foot of the Cornwall Canal there is a stretch through Lake St. Francis of 32¾ miles, which is navigable for vessels of the size at present in use.

The Cornwall Canal extends past the Long Sault Rapids.

This canal was closed on the 4th of December, 1890, and re-opened on the 4th of May, 1891.

The works for the enlargement of this canal were carried on throughout the season of navigation, all possible measures being taken to avoid hindrance to traffic.

An unusually low level of water in the St. Lawrence affected the water supply in the canal.

NEW WORKS.

The two locks at the new lower entrance (taking the place of three on the old line) were completed in 1882. Their dimensions are those of the general enlargement scheme, namely : length, 270 feet ; breadth, 45 feet ; depth of water, 14 feet. The basin between these two locks is 825 feet long.

The four locks still to be dealt with are all nearly completed, together with the supply weirs and bridges ; also the work of deepening and enlarging the prism of the canal.

The works in progress are described in detail in the appendices to the present report. (See Appendix 6, page 115.)

A statement of the highest and lowest water on this canal from the year 1849 will be found in Appendix 6, page 128.

WILLIAMSBURGH CANALS.

The Farran's Point, Rapide Plat, and Galops Canals are collectively known as the Williamsburgh Canals.

These canals were closed on the 4th of December, 1890, and re-opened on the 21st of April, 1891.

They have been well maintained through the season, and no delays to navigation have occurred.

Tables showing the highest and lowest water on the lock sills of these canals from the year 1849 will be found on page 123. (See Appendix 6.)

FARRAN'S POINT CANAL.

Length of canal	¾ mile.
Number of locks	1
Dimensions of lock	200 feet by 45 feet.
Total rise, or lockage	4 feet.
Depth of water on sills at ordinary water level.	9 "
Breadth of canal at bottom	50 "
Breadth of canal on water surface	90 "

From the head of the Cornwall Canal to the foot of Farran's Point Canal the distance on the River St. Lawrence is 5 miles. The latter canal enables vessels ascending the river to avoid, if necessary, the Farran's Point Rapid. Descending vessels run the rapid with ease and safety.

No steps have been taken for the enlargement of this canal, but surveys have been made during the past year with this object.

RAPIDE PLAT CANAL.

Length of canal	4 miles.
Number of locks	2
Dimensions of locks	200 feet by 45 feet.
Total rise, or lockage	11½ feet.
Depth of water on sills	9 "
Breadth of canal at bottom	50 "
Breadth of canal at surface of water	90 "

From the head of Farran's Point Canal to the foot of Rapide Plat Canal there is a navigable stretch of 10½ miles. This canal was formed to enable vessels ascending the river to pass the rapid at that place. Descending vessels run the rapid safely.

New Works.

The enlargement of this canal in conformity with the proportions of the general scheme is in progress. The works consist of the enlargement of the channel way above and for some distance below the present guard-lock at the head of the canal, and the construction of a new guard-lock and a supply weir in connection with the old lock. The bottom of the channel, for a distance of about 1,000 feet below, and out into deep water, above the lock, about 700 feet, has been excavated to an extent sufficient to afford a navigable depth of 14 feet. The new lock was completed in 1888, and is in operation; the other works in that connection are also finished. Contracts for the enlargement of the remaining portion of the canal, including the lock at the lower outlet, were entered into in the month of January, 1891. (See Appendix 6, page 120.)

GALOPS CANAL.

Length of canal	7⅝ miles.
Number of locks	3
Dimensions of locks	200 feet by 45 feet.
Total rise, or lockage	15½ feet.
Depth of water on sills	9 "
Breadth of canal at bottom	50 "
Breadth of canal at surface of water	90 "

From the head of Rapide Plat Canal to Iroquois, at the foot of the Galops Canal, the St. Lawrence is navigable for 4½ miles. This canal enables vessels to overcome the rapids at Pointe aux Iroquois, Point Cardinal and the Galops.

NEW WORKS.

The works for the widening and deepening of the upper entrance, and for the construction of a lift-lock from the river below the Galops Rapids, about 4,000 feet from the upper entrance, together with a guard-lock and supply weir to the canal adjacent to that point were placed under contract in November, 1888. The guard-lock is completed, and the other works are in progress. It is proposed that by the use of this new lift lock vessels of light draught qualified to stem the current of the Iroquois and Cardinal Rapids should dispense with about 7 miles of canal passage, traversing only the 4,000 feet between the lock and the upper entrance in order to pass the Galops Rapids. The late Chief Engineer, who designed this lock, did so with the idea of affording a route which should relieve much of the traffic of the canal.

No steps have, so far, been taken towards the enlargement of the 7 miles of the canal east of this lock, beyond the preliminary surveys.

In the river opposite the canal a new channel has been excavated through the Galops Rapids. The intention of the Department was to afford a safe passage at a low stage of the river water (9 feet on the mitre sills of the lock at the upper entrance of the old Galops Canal) for vessels drawing 14 feet. It was considered advisable to allow a clear margin of 3 feet below the keel of a vessel of this draught, the depth to be, consequently, 17 feet. The engineer in charge of this work reports the depth of this channel to be sufficient for the passage of vessels drawing 14 feet at the low stage of water (9 feet on the sills of the upper entrance lock). At a few points, however, there is less than 17 feet of water.

The removal of material at these points, whether rock *in situ* or debris accumulated subsequently to the close of the contractor's operations, will be effected in the forthcoming season.

The channel so improved is about 3,300 feet in length and 200 feet wide.

To fully carry out the design, some minor work will be necessary in order to obviate certain cross currents, the action of which required to be ascertained by actual experience after the excavation of the channel.

Further, it is advisable that the course of the channel be indicated by buoys, instead, as at present, by ranges only.

MURRAY CANAL.

Length between eastern and western pier heads	5⅙ miles.
Breadth at bottom	80 feet.
Depth below lowest known lake level	11 "

No locks.

This canal extends through the Isthmus of Murray, giving connection westward between the head waters of the Bay of Quinté and Lake Ontario, and thus enabling vessels to avoid the open lake navigation.

The works on this canal comprise a cut through the isthmus 4¼ miles long, and improvements in the way of dredging and other work to the entrance channels at either

end, covering a total distance of 9½ miles in all. There are no locks. The canal is crossed by four swing bridges.

Its western terminus is near the village of Brighton, in the harbour of Presqu'Ile, from which point to Port Dalhousie, the entrance of the Welland Canal, the distance is less than 120 miles.

The canal is 80 feet wide at the bottom, the depth being, at low water, 12½ feet.

The new entrance from the lake to Presqu'Ile harbour has a width varying from 1,000 outside the main light to 200 feet at the entrance to the channel. The maximum depth at the entrance is 16 feet at low water.

The canal was closed on the 27th of November, 1890, and reopened on the 16th of April, 1891.

The low stage of water in Lake Ontario did not prevent the satisfactory maintenance of navigation through this canal. (App. 6, p. 123.)

WELLAND CANAL.

Main Line, from Port Dalhousie, Lake Ontario, to Port Colborne, Lake Erie.

	Old Line.	Enlarged or New Line.
Length of canal	27½ miles.	26¾ miles.
Pairs of guard-gates (formerly 3)		2
Number of locks { lift	26	lift 25
Number of locks { guard	1	guard 1
Dimensions	1 lock 200 x 45 1 " 200 x 45 1 (tidal) 230 x 45 24 locks 150 x 26½	270 feet x 45 feet.
Total rise, or lockage	326¾ feet.	326¾ feet.
Depth of water on sills	10¼ "	14 "

Welland River Branches.

Length of Canal—Port Robinson Cut to River Welland	2,622	feet.
" From the canal at Welland to the river, *viâ* lock at aqueduct	300	"
" Chippawa Cut to River Niagara	1,020	"

Number of locks—One at aqueduct and one at Port Robinson	2
Dimensions of locks	150 by 26½ feet.
Total lockage from the canal at Welland down to River Welland	10 feet.
Depth of water on sills	9 " 10 inches.

GRAND RIVER FEEDER.

Length of canal	21 miles.
Number of locks	2
Dimensions of locks	1 of 150 by 26½ feet. 1 of 200 by 45 "
Total rise, or lockage	7 to 8 feet.
Depth of water on sills	9 feet.

PORT MAITLAND BRANCH.

Length of canal	1¾ miles.
Number of locks	1
Dimensions of locks	185 by 45 feet.
Total rise or lockage	7½ feet.
Depth of water on sills	11 "

The Welland Canal has two entrances from Lake Ontario, at Port Dalhousie one for the old, the other for the new canal.

From Port Dalhousie to Allanburgh, 11¾ miles, there are now two distinct lines of canals in operation, the old line and the enlarged or new line.

From Allanburgh to Port Colborne, a distance of 15 miles, there is only one channel, the old canal having been enlarged.

The canal was opened in 1883 for vessels drawing 12 feet of water, and in May, 1887, for vessels drawing 14 feet.

The canal was closed to navigation on the 5th December, 1890, and reopened on the 20th April, 1891.

On the 1st of September, 1890, the steam barge "T. D. Stunson" ran into and carried away the head gates of lock No. 18, the two foot gates being also carried away, The consequent interruption to navigation lasted for 46 hours.

On the 18th of the same month the head gates of this lock were again carried away by the steam barge "Samoa," causing an interruption for 16 hours to the traffic on the canal.

The work of removing sand accumulation in the channel at the Port Dalhousie entrance of the canal has been carried on under contract.

Tables will be found on page 133 showing the highest and lowest depth of water at the new entrance locks at Port Dalhousie and at Port Colborne, for each month throughout the past fiscal year. The water level was lower during the past than in the previous year.

Details as to repairs executed will be found in the appendix. (See Appendix 7, p. 131.)

From the head of the Welland Canal there is deep water navigation through Lake Erie, the Detroit River, Lake St. Clair, the St. Clair River, Lake Huron and the River St. Mary to within a short distance of the Sault Canal, a distance of about 394 miles. From the Sault to Port Arthur the distance, through Lake Superior to Port Arthur, is 266 miles and to Duluth 390 miles.

SAULT STE. MARIE CANAL.

This canal is being constructed through St. Mary's Island, on the north side of the rapids of the River St. Mary, and, with that river, will give communication between Lakes Huron and Superior.

At ordinary stages of the river water there is a difference of 18 feet in the levels of the water above and below this island. The length of the canal across the island is 3,500 feet. A considerable amount of excavation is required to form channels of approach both at the upper and at the lower entrances. The total length of this canal and its approaches will be about 18,100 feet.

For contract purposes, the work was divided into three sections, and contracts were entered into as follows:—For the lower entrance, pier work and beacon, on the 30th of January, 1889; for the upper entrance, pier work and beacon, on the 26th of March, 1889, and for the canal and lift-lock on the 20th of November, 1888.

The scheme as covered by these contracts contemplated a lock chamber 600 feet long and 85 feet wide, with a depth of water on the sills of 16¼ feet at the lowest known water level; the width of the gate entrances to the lock to be 60 feet. This lock was designed to pass two vessels at one lockage.

The plans were subsequently modified, in view of strong representations made urging that more extensive accommodation should be afforded, and the dimensions of the lock chamber were increased to 650 feet in length, 100 feet in width, the gate width remaining at 60 feet, and to a depth on the sills at extreme low water of 19 feet. This lock would accommodate four vessels, two abreast, but the gates being narrower than the chamber, a certain amount of delay would be necessary in order to get vessels into and out of the straight course for lockage.

A discussion which took place in Parliament last session on this point has led to a further modification, and under date the 24th of December, 1891, the following dimensions have been adopted by Order in Council:—Length of chamber, 900 feet; width of chamber, 60 feet; gate width, 60 feet; depth of water on the sills, 19 feet at the lowest recorded water level. This depth, though calculated on a different basis (extreme low instead of "mean" water level), is intended to be the equivalent of the depth, 21 feet, of the new American lock now under construction.

By the scheme as so modified accommodation will be afforded to three vessels lying in the lock one behind the other, one of the lake type 320 feet long, and two of the Welland Canal type 255 feet long, with ready means of entrance and exit on a course through the gates and lock straight with the line of the canal.

The canal proper will have a width at low water level of 152 feet, and a bottom width of 145 feet. The depth will be made suitable to navigation at mean water level by vessels drawing 20 feet.

The gates will be worked either by hydraulic power or by electricity.

The works, including both those for the lock and the canal, also the entrance channels at both ends, are in progress. Details of these works will be found in the appendices.

(See App. 10, p. 140). *

MONTREAL, OTTAWA AND KINGSTON.

This route extends from the harbour of Montreal to the port of Kingston, passing through the Lachine Canal, the navigation section of the lower River Ottawa, and the Ottawa River Canal, to the city of Ottawa; thence by the River Rideau and the Rideau Canal to Kingston, on Lake Ontario—a total distance of 245⅝ miles.

After leaving the Lachine Canal the works constructed to overcome difficulties of navigation are:—

The St. Anne's Lock;
Carillon Canal;
Grenville Canal;
Rideau Canal;
} Ottawa River canals.

The total lockage (not including that of the Lachine Canal) is 509 feet—(345 rise, 164 fall)—and the number of locks is 55.

The following table exhibits the intermediate distances from Montreal harbour:—

Sections of Navigation.	Intermediate Distance.	Total Distance from Montreal.
	Miles.	Miles.
The Lachine Canal	8½	
From Lachine to Ste. Anne's Lock	15	23½
Ste. Anne's Lock and Piers	⅛	23⅝
From Ste. Anne's Lock to Carillon Canal	27	50⅝
The Carillon Canal	¾	51⅜
From Carillon Canal to Grenville Canal	6¼	57⅝
The Grenville Canal	¾	63⅜
From the Grenville Canal to entrance Rideau navigation	56	119⅜
Rideau navigation, ending at Kingston	126¼	245⅝

STE. ANNE'S LOCK.

	Old Lock.	New Lock.
Length of canal	⅛ mile	⅛ mile.
Number of locks	1	1
Dimensions of lock	190x45 feet.	200x45 feet.
Total rise, or lockage	3 feet.	3 feet.
Depth of water on sills	6 "	9 "

* For information respecting the new American canal, see page 29 of the present Report.

This work, with guide piers above and below, surmounts the Ste. Anne's Rapids between Ile Perrot and the head of the island of Montreal, at the outlet of that portion of the Ottawa River which forms the Lake of Two Mountains, 23½ miles from Montreal harbour.

This lock was closed to navigation on the 25th November, 1890, and re-opened on the 25th April, 1891.

Navigation has been conducted without interruption during the year.

The work of strengthening the old Grand Trunk Railway pier at this point has been carried out.

Both the old and the new locks are available. (App. 5, p. 106)

THE CARILLON CANAL.

Length of canal	¾ mile.
Number of locks	2
Dimensions of locks	200 by 45 feet.
Total rise, or lockage	16 feet.
Depth of water on sills	9 "
Breadth of canal at bottom	100 "
Breadth of canal at water surface	110 "

This canal overcomes the Carillon Rapids.

From Ste. Anne's Lock to the foot of the Carillon Canal there is a navigable stretch of 27 miles, through the Lake of Two Mountains and the River Ottawa.

The canal was closed on the 29th of November, 1890, and re-opened on the 23rd of April, 1891. (*See* App. 5, p. 107.)

By the construction of the Carillon dam the water at that point is raised 9 feet. Above this point, for a distance of nearly seven miles, as far as the foot of the Grenville Canal, the level of the river has been raised, and navigation continues up to that canal.

GRENVILLE CANAL.

Length of canal	5¾ miles.
Number of locks	5
Dimensions of locks	200 by 45 feet.
Total rise, or lockage	43¾ feet.
Depth of water on sills	9 "
Breadth of canal at bottom	40 to 50 feet.
Breadth of canal at surface of water	50 to 80 "

From the head of the Carillon Canal to the foot of the Grenville Canal there is a navigable stretch of 5½ miles.

This canal, by which the Long Sault Rapids are avoided, is about 56 miles below the city of Ottawa.

The canal was closed on the 29th of November, 1890, and reopened on the 23rd of April, 1891. (See App. 5, p. 107).

UPPER OTTAWA RIVER.

CULBUTE LOCKS AND DAMS.

Number of locks	2
Dimensions of locks	200 by 45 feet
Total rise, or lockage	18 to 20 "
Depth of water on sills	5 "
Aggregate length of dams	625 "

From the Grenville Canal to the city of Ottawa, a distance of about 56 miles, the river is navigable. Beyond the city, for a distance of 107 miles, to L'Islet or Culbute, continuous navigation is rendered impracticable by the undermentioned rapids :—

The Chaudière, the DesChênes, the Chats, the Chenaux, the Portage du Fort and the Grand Calumet.

The Culbute works, situated at L'Islet, surmount the Culbute and L'Islet Rapids on the north channel of the Ottawa.

These works comprise two locks and three continuous dams, all built of wood. The dams reduce the rapids to smooth water, enabling the river to be navigated from the head of the locks to Des Joachims, a distance of 37 miles.

There is a navigation route of 80 miles, with a minimum depth of 7 feet at extreme low water, between Des Joachims and Bryson ; making a total above and below Culbute of 117 miles.

In view of the fact that the locks on this canal were built of wood, and are much decayed, and that in order to make these works permanently effective considerable cost would be entailed, while, on the other hand, the traffic is of but insignificant extent, the presence of railway facilities having greatly lessened the anticipated usefulness of the work, it has been decided to abandon the idea of maintaining the water at an abnormal height, and an Order in Council was passed on the 24th October, 1889, to the effect that the river should be allowed to resume its natural level, one which, save at special seasons, admits of navigation. The dams have not yet been removed. (See Appendix 5, p. 103.)

RIDEAU NAVIGATION.

The Rideau system connects the River Ottawa, at the city of Ottawa, with the eastern end of Lake Ontario, at Kingston.

Length of navigable waters	126¼ miles.
Number of locks going from Ottawa to Kingston.	35 ascending 14 descending.

Total lockage	446¼	282¼ rise and 164 fall. at high water.
Dimensions of locks		134 by 33 feet.
Depth of water on sills, 5 feet; navigable depth through the several reaches		4½ feet.
Breadth of canal reaches at bottom		60 " in earth.
		54 " in rock.
Breadth at surface of water		80 " in earth.

Perth Branch.

Length of canal	6 miles.
Number of locks	2
Dimensions of locks	134 feet by 32 feet.
Total rise or lockage	26 "
Depth of water on sills	5 feet 6 inches.
Length of dam	200 feet.
Breadth of canal at bottom	40 "
Breadth of canal at surface of water	40 " in rock.
	64 " in clay.

This branch of the Rideau Canal affords communication between Beveridge's Bay, on Lake Rideau, and the town of Perth.

By an Order in Council dated the 27th of September, 1890, it was declared to be a part of the Rideau Canal.

The summit level of this system is at upper Lake Rideau, but several of the descending reaches are also supplied by waters which have been made tributary to them. The following description gives the sources of supply :—

From the summit, the route towards Ottawa follows the River Rideau, and that towards Kingston follows the River Cataraqui. The supply of water for the canal is derived from the reserves given in detail below.

These may be divided into three systems, viz. :—

1. The summit level, supplied by the Wolfe Lake system ; 2. The eastern descending level to Ottawa, supplied by the River Tay system, discharging into Lake Rideau ; 3. The south-west descending level to Kingston, supplied by the Mud Lake system, formerly known as the Devil Lake system, discharging into Lake Opinicon.

Lake Opinicon receives the waters of Buck Lake and Rock Lake.

All these waters on the descending level, supplemented by those of Lake Loughboro', flow into Cranberry Lake, which, discharging through Round Tail outlet, forms the River Cataraqui. This river, rendered navigable by dams at various points, affords a line of navigation to Kingston.

The navigation stopped at Ottawa on the 29th, and at Kingston Mills on the 26th of November, 1890, and recommenced at Ottawa on the 28th of April, and at Kingston Mills on the 1st of May, 1891.

The full depth of water required for navigation was maintained on both the ascending and descending reaches.

There was no interruption to navigation.

Details of repairs and other works will be found in the appendices. (See Appendix 8, p. 135.)

For table of distances of stations between Ottawa and Kingston, see Appendix 13, p. 144.

RICHELIEU AND LAKE CHAMPLAIN.

This system, commencing at Sorel, at the confluence of the rivers St. Lawrence and Richelieu, 46 miles below Montreal, extends along the River Richelieu, through the St. Ours Lock to the basin of Chambly, thence by the Chambly Canal to St. Johns and the River Richelieu to Lake Champlain. The distance from Sorel to the boundary line is 81 miles.

At Whitehall, the southern end of Lake Champlain, the Champlain Canal is entered, and connection is obtained with the River Hudson, by which the city of New York is directly reached. From the boundary line to New York the distance is 330 miles.

The following table shows the distance between Sorel and New York :—

Sections of Navigation.	Intermediate Distances in Miles.	Total Distances.
Sorel to St. Ours Lock	14	14
St. Ours Lock to Chambly Canal	32	46
Chambly Canal	12	58
Chambly Canal to boundary line	23	81
Boundary line to Champlain Canal	111	192
Champlain Canal to junction with Erie Canal	66	258
Erie Canal from junction to Albany	7	265
Albany to New York	146	411

ST. OURS LOCK AND DAM.

Length	$\frac{1}{8}$ mile.
Number of locks	1
Dimensions of lock	200 feet by 45 feet.
Total rise, or lockage	5 "
Depth of water on sills	7 " at low water.
Length of dam in eastern channel	300 "
" " western channel	690 "

At St. Ours, fourteen miles from Sorel, the River Richelieu is divided by a small island into two channels. The St. Ours Lock is the eastern channel.

There is a navigable depth of 7 feet between St. Ours Lock and Chambly Basin, a distance of thirty-two miles.

Navigation closed on the 28th of November, 1890, and re-opened on the 8th of May, 1891.

The operations of the season were conducted without either accident or delay. (See Appendix 5, p. 104.)

This lock was constructed in 1849, and has for some years been in bad condition. The works necessary to its repair, which, in order to avoid hindrance to navigation, had to be executed in winter, were resumed in November, 1890, and were completed in May, 1891. (See Appendix 5, p. 105.)

CHAMBLY CANAL.

Length of canal	12	miles.	
Number of locks	9		
Dimensions of locks :—			
Guard Lock, No. 1, at St. Johns	122	feet	From 22½ to 24 feet wide.
Lift " " 2	124	"	
" " " 3, 4, 5, 6	118	"	
" " " 7, 8, 9 combined	125	"	
Total rise, or lockage	74	"	
Depth of water on sills	7	"	
Breadth of canal at bottom	36	"	
" " surface of water	60	"	

This canal succeeds the 32 miles of navigable water between St. Ours Lock and Chambly Basin. This canal overcomes the rapids between Chambly and St. Johns.

The canal was closed to navigation on the 24th of November, 1890, and was re-opened on the 4th of May, 1891.

The upper entrance at St. Johns is now lighted by electricity. No accident occurred and navigation was uninterrupted.

A description of the several works of repair and improvement executed during the year will be found in the appendices. These include the deepening and widening of parts of the canal and of the harbour of St. Johns. (See Appendix 5, p. 102.)

TRENT RIVER NAVIGATION.

The term "Trent River Navigation" is applied to a series of water stretches, which do not, however, form a connected system of navigation, and which, in their present condition, are efficient only for local use.

The series is composed of a chain of lakes and rivers, extending from Trenton, at the mouth of the River Trent, on the Bay of Quinté, Lake Ontario, to Lake Huron.

Many years ago the utilizing of these waters for the purpose of through water communication between Lake Huron and Lake Ontario was projected.

The course in contemplation was as follows:—

Through the River Trent, Rice Lake, the River Otonabee and Lakes Clear, Buckhorn, Chemong, Pigeon, Sturgeon and Cameron to Lake Balsam, the summit water, about 165 miles from Trenton; from Lake Balsam by a canal and the River Talbot to Lake Simcoe; thence by the River Severn to Georgian Bay, Lake Huron, the total distance being about 235 miles.

The execution of this scheme, commenced in 1837, was subsequently deferred. By certain works, however, below specified, sections of these waters were made practicable for navigation and for the passage of timber. A branch of the main route, extending from Sturgeon Lake south, affords communication with the town of Lindsay, and through Lake Scugog to Port Perry, a distance of 190 miles from Trenton.

The following table gives the distance of navigable and unnavigable reaches:—

	Navigable Miles.	Unnavigable Miles.
From Trenton, Bay of Quinté, to Nine Mile Rapids....		9
" Nine Mile Rapids to Percy Landing.....	19½	
" Percy Landing to Heeley's Fall dam.		14¼
" Heeley's Fall dam to Peterboro'.....	51¾	
" Peterboro to Lakefield.....		9¼
" Lakefield to a point across Balsam Lake	61	
	132¼	32¾
Total distance, Bay of Quinté to Balsam Lake.....		165
From Sturgeon Point on Sturgeon Lake, 48¾ miles from Lakefield, the branch through the town of Lindsay to Port Perry at the head of Lake Scugog.....		27½

The following is a list of the works:—

MAIN LINE FROM TRENTON TO BALSAM LAKE.

	Distance from Trenton in miles.
Chisholm's Rapids.	
The work here consists of a canal and lock, a dam and slide..	15½
Percy Landing.	
A retaining boom for saw logs.—Controlled by Dept. of Public Works.....	28½
Campbellford.	
Guide booms.—Controlled by Dept. of Public Works.....	34¾
Middle Falls.	
The works consist of 2 dams and slide.—Controlled by Dept. of Public Works.....	37¾
Crow Bay.	
A retaining boom.—Controlled by Dept. of Public Works...	38

	Distance from Trenton in miles.
Heeley's Falls.	
A dam and slide.—Controlled by Dept. of Public Works....	42¾
Lakefield.	
The works consist of a dam and wharf.....	103½
Katchawannoe Lake.	
A boom, 4 miles in length, separating navigable and timber channels—(under control Dept. of Public Works).	
Crook's Rapids, Hastings.	
The works consist of 1 lock, 1 dam and slide for timber.....	56½
Whitlas' Rapids.	
The works, situated below Peterboro', consist of a lock, dam and canal.....	92⅞
Peterboro'.	
The works consist of 3 piers and 1 boom.....	94
Young's Point.	
One lock (a Provincial Government work) and dam.....	108½
Burleigh.	
Timber slides, 3 dams, 2 locks (new).....	118
Lovesick Rapids.	
One lock and 4 dams.....	119½
Buckhorn Rapids.	
There is a dam at this point, which is important as keeping up the level of the water of the lake west of it, as far as Bobcaygeon, including Lakes Pigeon, Buckhorn (Ball) and Chemong, 1 lock, 1 slide.....	125
Bobcaygeon.	
There are 2 dams here, with canal, lock and slide. These dams retain the waters of the reach as far as Fenelon Falls and Lindsay lock.....	140¾
Fenelon Falls.	
A large dam, slide and booms, 2 combined locks (new).....	154¾
Rosedale.	
A lock, maintained by the Ontario Government, giving entrance from Cameron's Lake to Balsam Lake.....	162¾

BRANCH FROM STURGEON LAKE TO LAKE SCUGOG.

Lindsay.

One lock, rebuilt by the Government of the Province of Ontario in 1879. Its dimensions are 134 x 33 feet, with 5 feet of water on the sills 161¼

The navigation is, by this work, extended to Port Perry, Lake Scugog 190

The water on the several reaches was maintained at a good height, there being between 5 feet 6 inches and 6 feet of water on the sills till near the close of navigation.

The depth of water on all the stretches was satisfactory throughout the season.

Navigation ceased on the 24th November, 1890, and reopened on the 20th of April, 1891.

The new works completed for the improvement of the Trent Valley navigation are at the following places :—Canals, with locks and bridges, at Burleigh Rapids, Buckhorn Rapids and Fenelon Falls ; also dams at Lakefield and Young's Point. By these works there is afforded communication between Lakefield, 9½ miles from Peterboro', and Balsam Lake, the headwaters of the system ; opening up a total of about 160 miles of direct and lateral navigation.

At Lakefield, 9½ miles from Peterboro', the new dam, at the head of the Nine Mile Rapids of the River Otonabee, which maintains navigation on Lake Katchiwannoe up to Young's Point, was completed during the fiscal year 1886-87.

At Young's Point, 5 miles from Lakefield, the new dam between Late Katchiwannoe and Clear Lake controls the water level through Clear and Stony Lakes up to the foot of the Burleigh Canal. The lock here, it should be observed, is controlled by the Provincial Government.

At Burleigh Rapids, 10 miles from Young's Point, a canal, about 2¼ miles in length, passes the Burleigh and Lovesick Rapids, and gives communication between Stony Lake and Deer Bay ; it comprises three lift-locks and certain dams.

At Buckhorn Rapids, 7 miles from Burleigh Rapids, a canal of about one-fourth of a mile long has been constructed, having one lift-lock.

At Bobcaygeon, 15¾ miles from Buckhorn Rapids, the new dam, 553 feet long, takes the place of two old ones. By this work the water level is controlled up to Fenelon Falls.

At Fenelon Falls, 15 miles from Bobcaygeon, a canal about one-third of a mile in length, with two lift-locks, was constructed in 1885, connecting Sturgeon Lake with Cameron Lake. The channel above the falls was improved during the year by the removal of rock obstructions.

In all the above named works the locks are of the following dimensions :—

Length	134 feet.
Breadth	33 "
Depth of water on the mitre sills	5 "

Details of the several repairs executed will be found in the appendices.

(App. 9, p. 138.)

COMMISSION ON THE TRENT NAVIGATION.

In view of the interest taken in the scheme for connecting the waters of the Bay of Quinté, Lake Ontario, with those of Georgian Bay, Lake Huron, it was thought advisable that the matter should receive investigation, and accordingly an Order in Council was passed on the 8th of October, 1887, authorizing the appointment of a Commission of Enquiry to examine and report on the question of the expediency of extending the Trent Valley navigation. The commission was constituted accordingly.

Under date the 17th of December, 1890, the Commissioners made a report, embodying the results of their investigations.

ST. PETER'S CANAL, CAPE BRETON.

Length of canal	About 2,400 feet.
Breadth at water line	55 feet.
Lock	One tidal lock, 4 pairs of gates.
Dimensions	200 feet by 48 feet.
Depth of water on sills	18 " at lowest water.
Depth through canal	19 "
Extreme rise and fall of tide in St. Peter's Bay	4 "

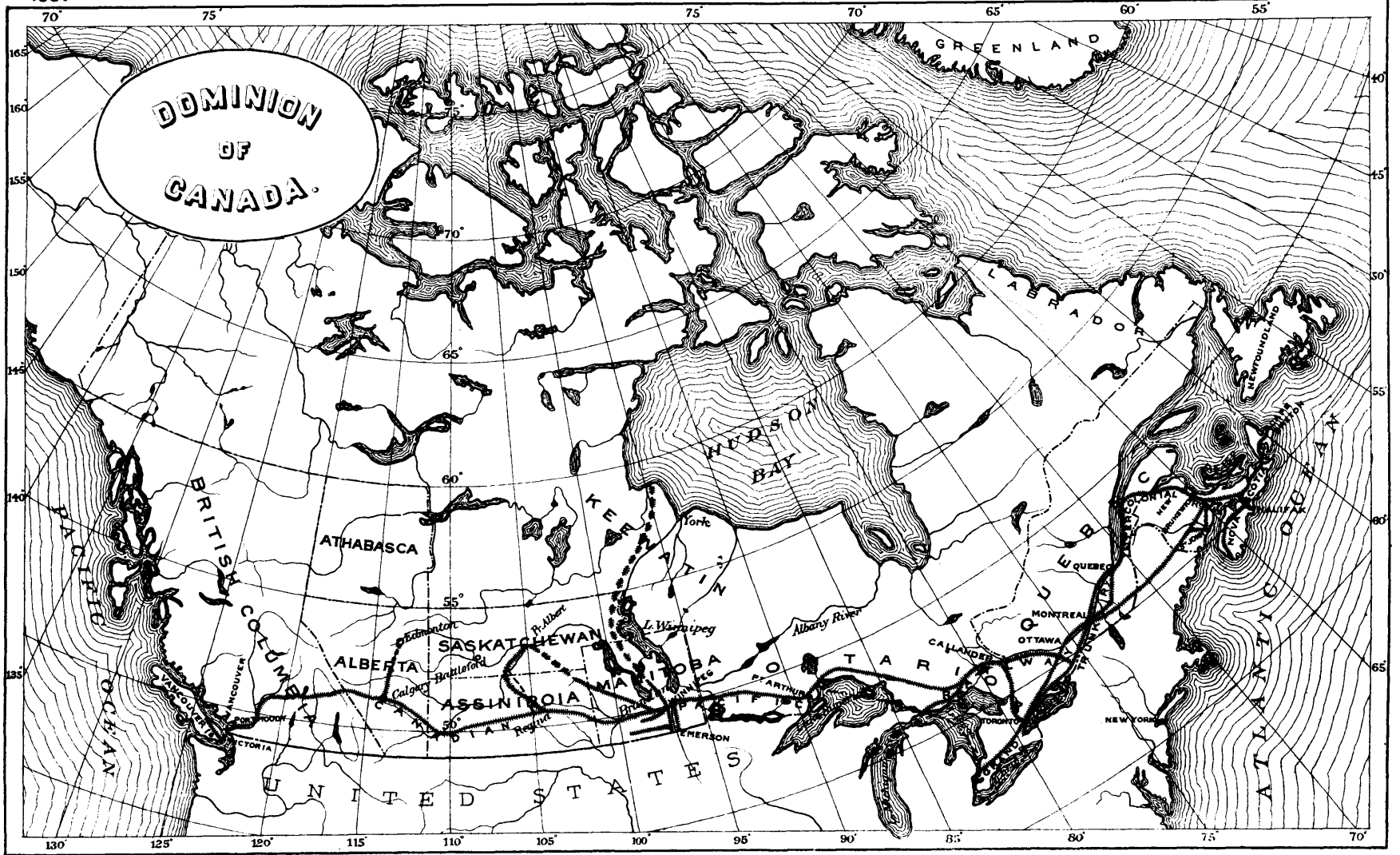
This canal connects St. Peter's Bay, on the southern side of Cape Breton, Nova Scotia, with the Bras d'Or Lakes. It crosses an isthmus half a mile in width, and gives access from the Atlantic.

Navigation was closed on the 24th of December, 1890, and re-opened on the 22nd of April, 1891.

Certain repairs and improvements are being carried out, which are described in the appendices. (App. 11, p. 142).

I have the honour to be, Sir,
Your obedient servant,
T. TRUDEAU,
Deputy of the Minister of Railways and Canals.

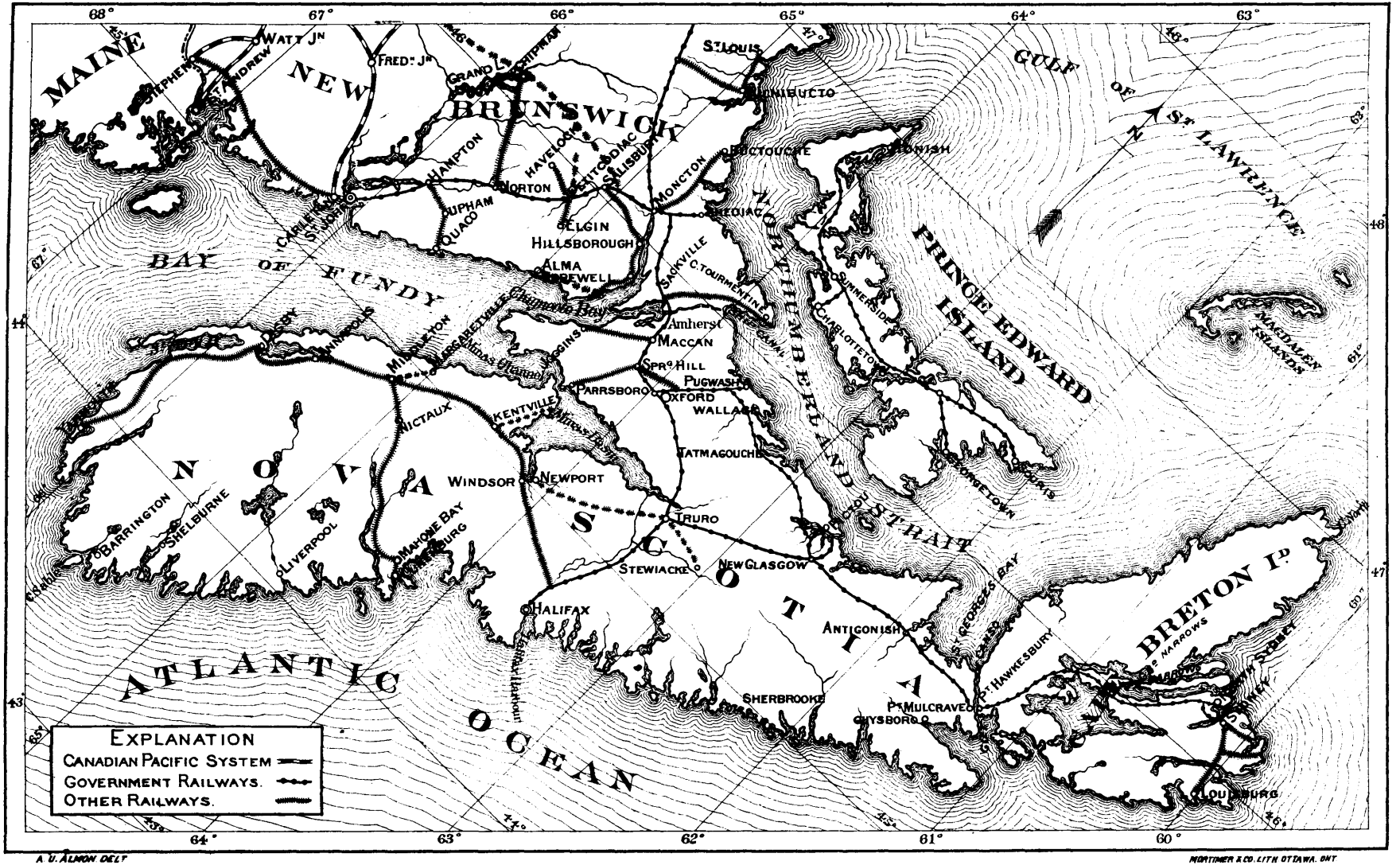
31st December, 1891.



MORTIMER & CO. LITH. OTTAWA ONT.

1891

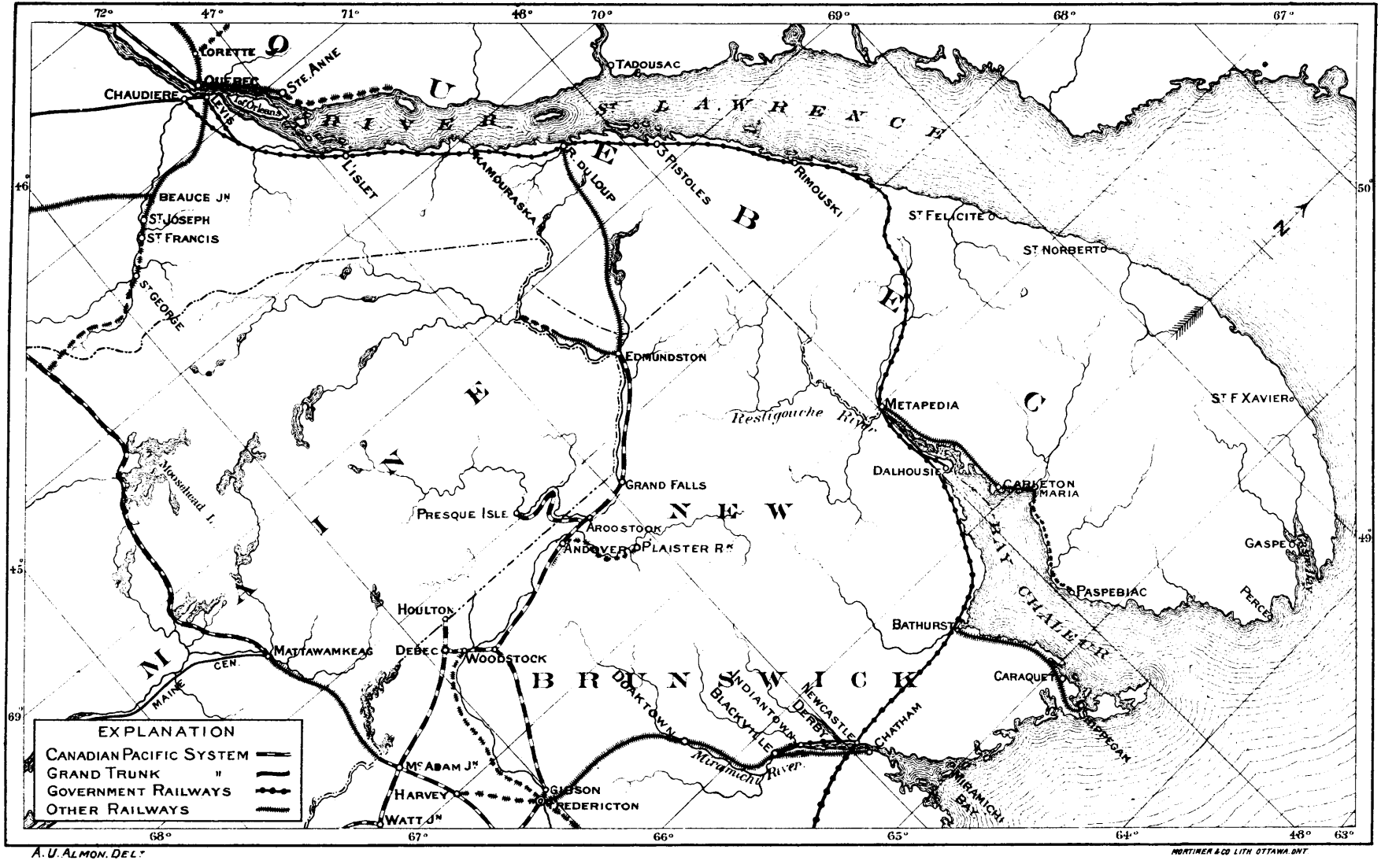
No 2.



A. U. Allaron Delt

Mortimer & Co. Lith Ottawa. Ont

1891 No. 3.

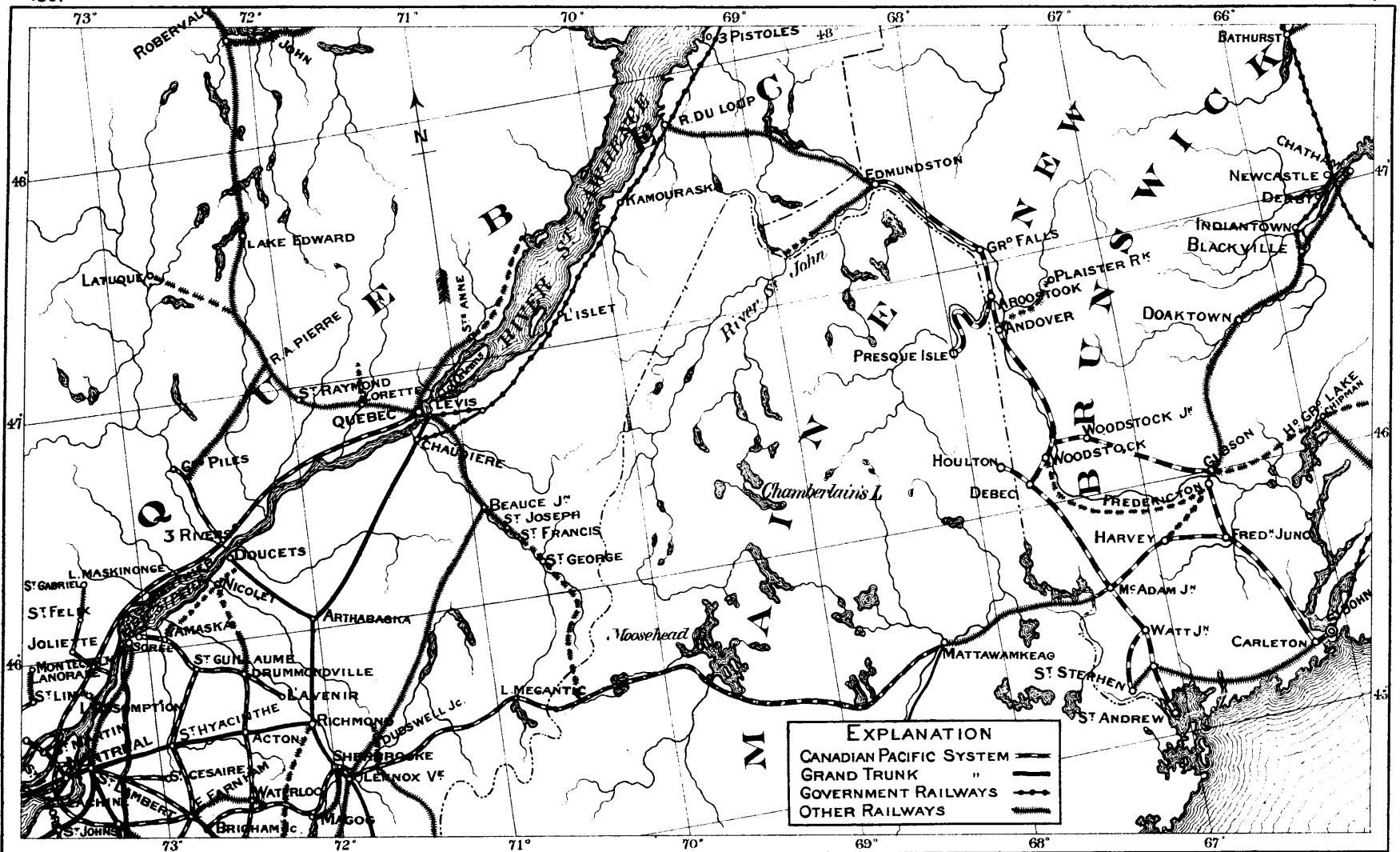


A. U. ALMON. DEL.

MORTIMER & CO. LITH. OTTAWA. ONT.

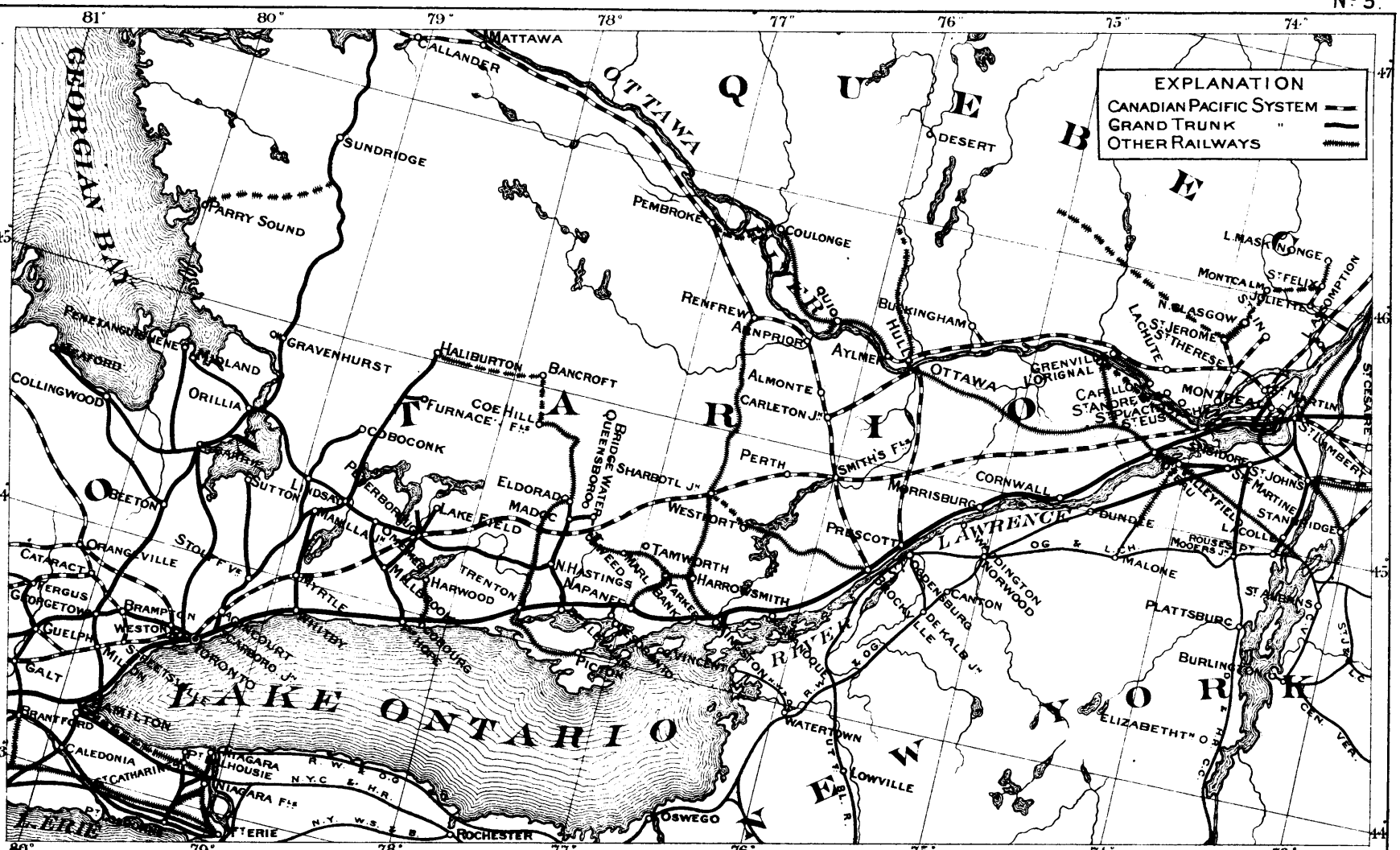
1891

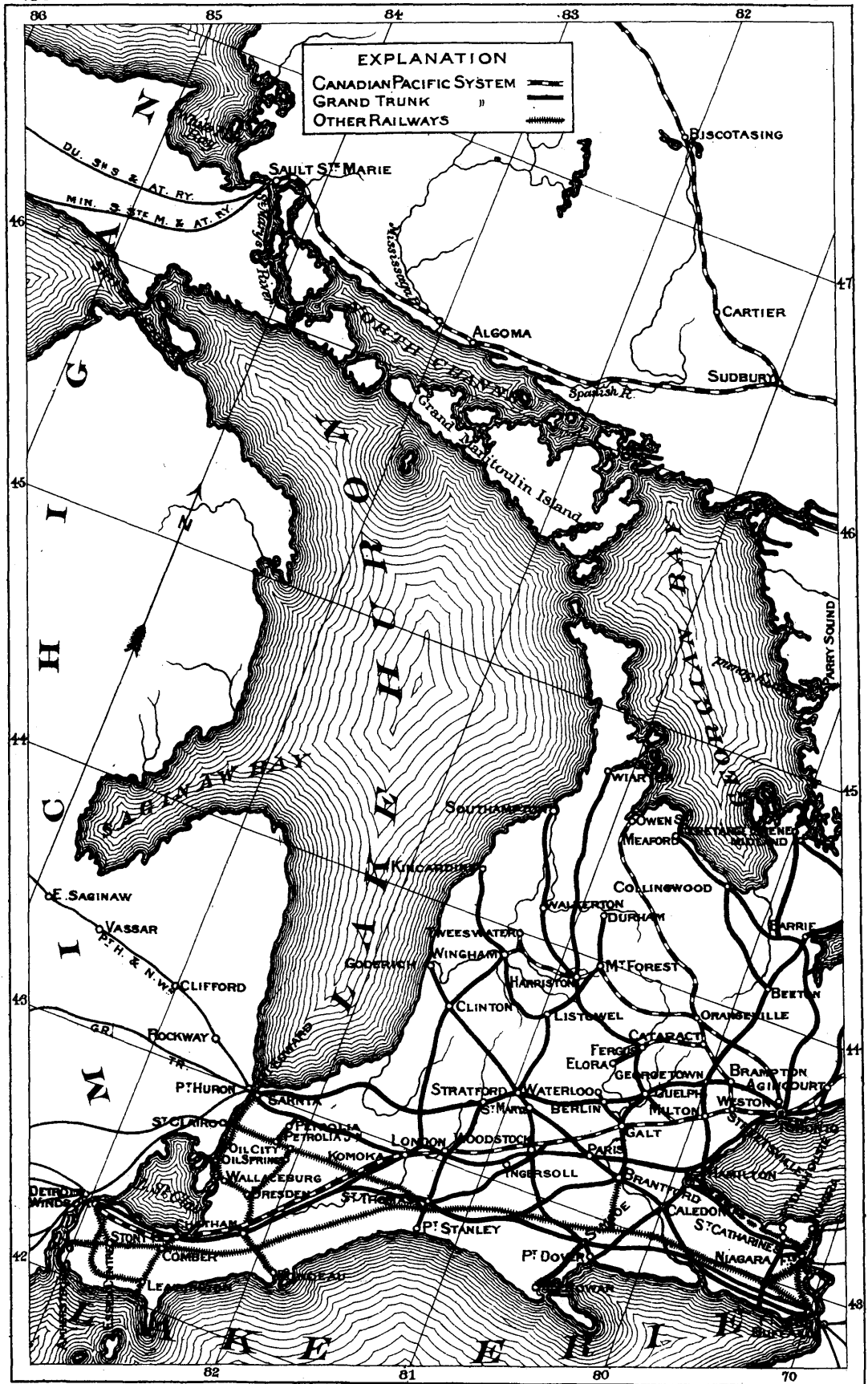
No 4



A. U. ALMON. DEL^r

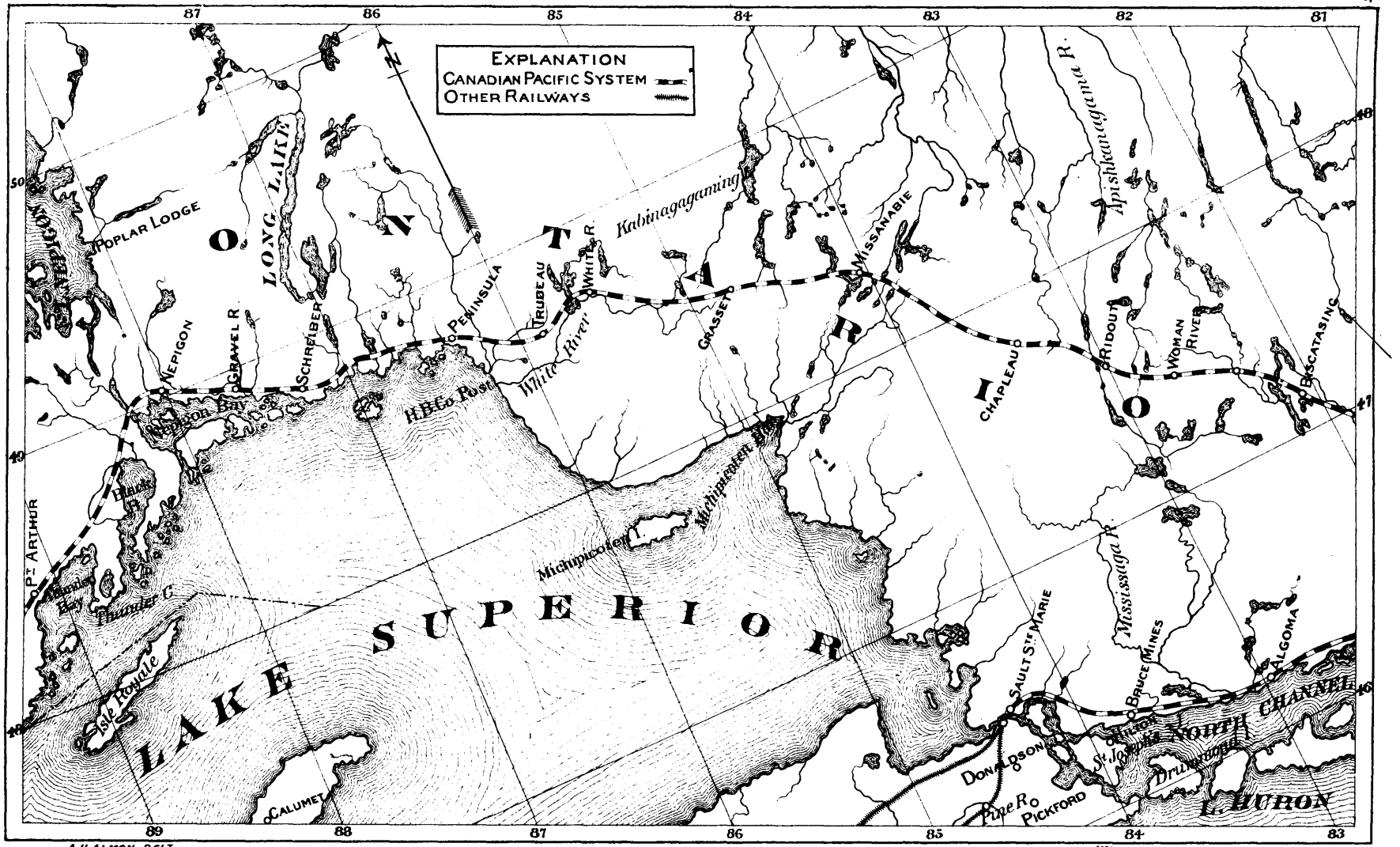
MORTIMER & CO. LITH. OTTAWA. ONT.


EXPLANATION
CANADIAN PACIFIC SYSTEM
GRAND TRUNK "
OTHER RAILWAYS
LAKE ONTARIO
L. ERIE
GEORGIAN BAY
OTTAWA
QUEBEC
ONTARIO
NEW YORK
MATTAWA
CALLANDER
SUNDRIDGE
PARRY SOUND
PENETANGUISHENE
MIDLAND
GRAVENHURST
HALIBURTON
BANCROFT
COLLINGWOOD
ORILLIA
BARRIE
COE HILL
FURNACE Falls
BOBCAYGEON
PETERBORO'
LINDSAY
OMEMEE
MILLBROOK
BETHANY
PORT HOPE
COBOURG
PICTON
TRENTON
HARWOOD
CAMPBELLFORD
MADOC
ELDORADO
LAKE FIELD
QUEENSBORO
BRIDGE WATER
SHARBOT L.
TAMWORTH
N. HASTINGS
NAPANEE
HARROWSMITH
WESTPORT
PERTH
SMITH'S Falls
ALMONTE
CARLETON J.
RENFREW
ARNPRIOR
PEMBROKE
COULONGE
AYLMER
BUCKINGHAM
HULL
DESERT
L. MASKINONGE
MONTCALM
ST. FELIX
ST. JULIETTE
ST. GABRIEL
N. LASGOW
ST. JEROME
LACHUTE
ST. THERESE
GRENVILLE
L'ORIGNAL
CARILLON
STANDREWS
PLACID
ST. EUS
MONTREAL
ST. MARTIN
ST. CESAIRE
ST. JOHNS
ST. MARTINE
STANBRIDGE
LACOLLE
ROUSES PT.
MOOERS J.
MALONE
PLATTSBURG
ST. ALBANS
BURLINGTON
CEN. VER.
ST. J. & L. C.
CORNWALL
MORRISBURG
DUNDEE
LANCASTER
LAWRENCE
PRESCOTT
BROCKVILLE
ODENSBURG
DE KALB J.
CANTON
NORWOOD
OGDENSBURG & L. CH.
RICHELIEU & O. NAV. CO.
RICHELIEU & O. NAV. CO.
WATERTOWN
LOWVILLE
ELIZABETHTN
O. & L. CH. R.
N. Y. C. & H. R.
N. Y. W. S. & B.
R. W. & O.
T. H. & B.
G. T. R.
C. P. R.
ORANGEVILLE
CATARACT
GEORGETOWN
BRAMPTON
GUELPH
GALT
MILTON
BRANTFORD
CALEDONIA
ST. CATHARINES
NIAGARA Falls
NIAGARA
ST. DAVIDS
QUEENSTON
TORONTO
TORONTO J.
WESTON
MILTON
STREETSVILLE
MIMICO
LORNE PARK
WHITBY
OSHAWA
PORT PERRY
LINDSAY
STOUFFVILLE
MARKHAM
UNIONVILLE
PORT DALHOUSIE
WELLAND
PORT COLBORNE
BUFFALO
ROCHESTER
OSWEGO
STERIE
PORT ROWAN
PORT DOVER
PORT STANLEY
A. U. ALMON, DEL.
MORTIMER & CO. LITH. OTTAWA ONT.



A.U. ALMON DELT

MORTIMER & CO. LITH. OTTAWA ONT.

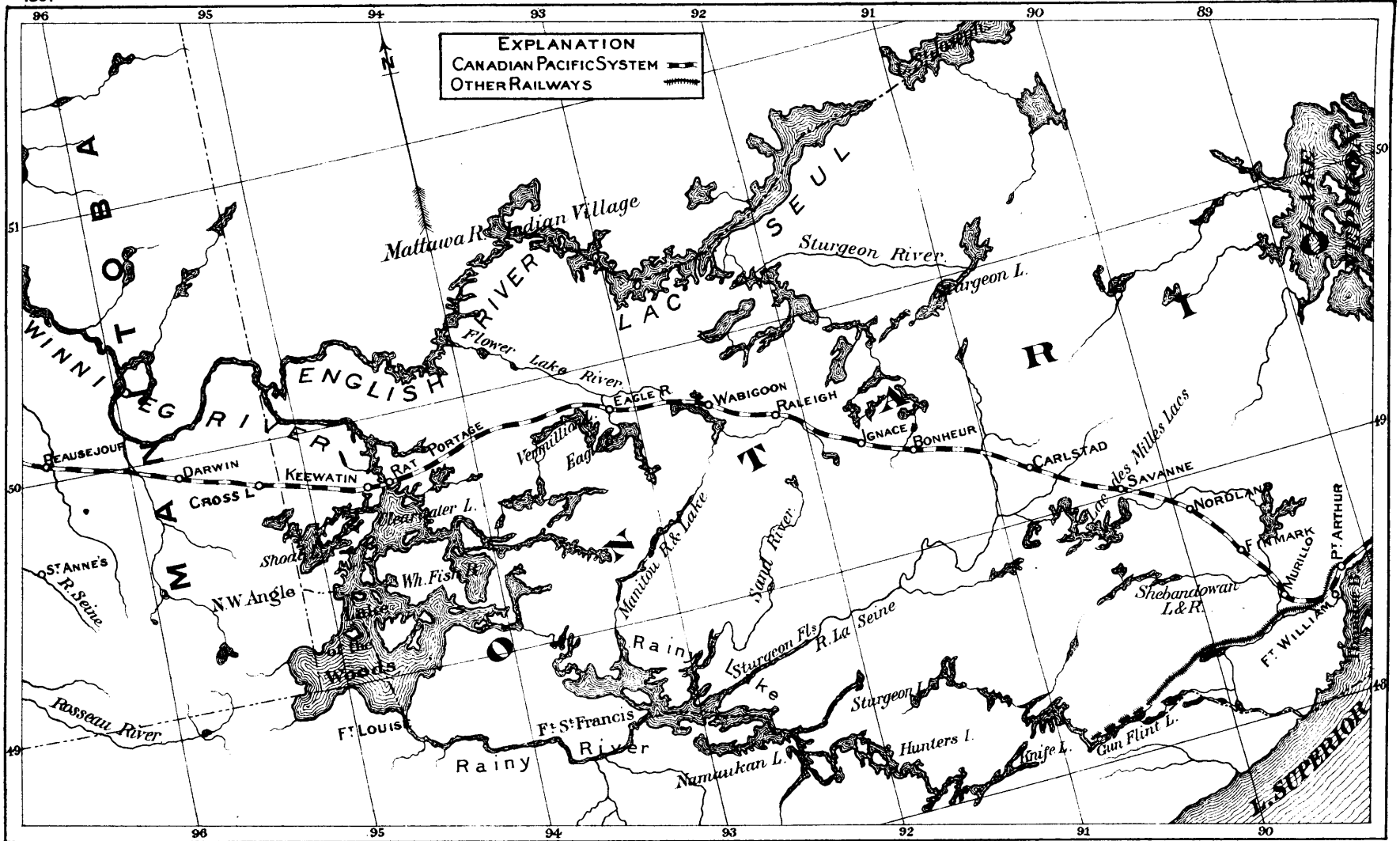


A.U. ALMON. DEL.

MORTIMER & CO. LITH. OTTAWA, ONT.

1891

No 8.

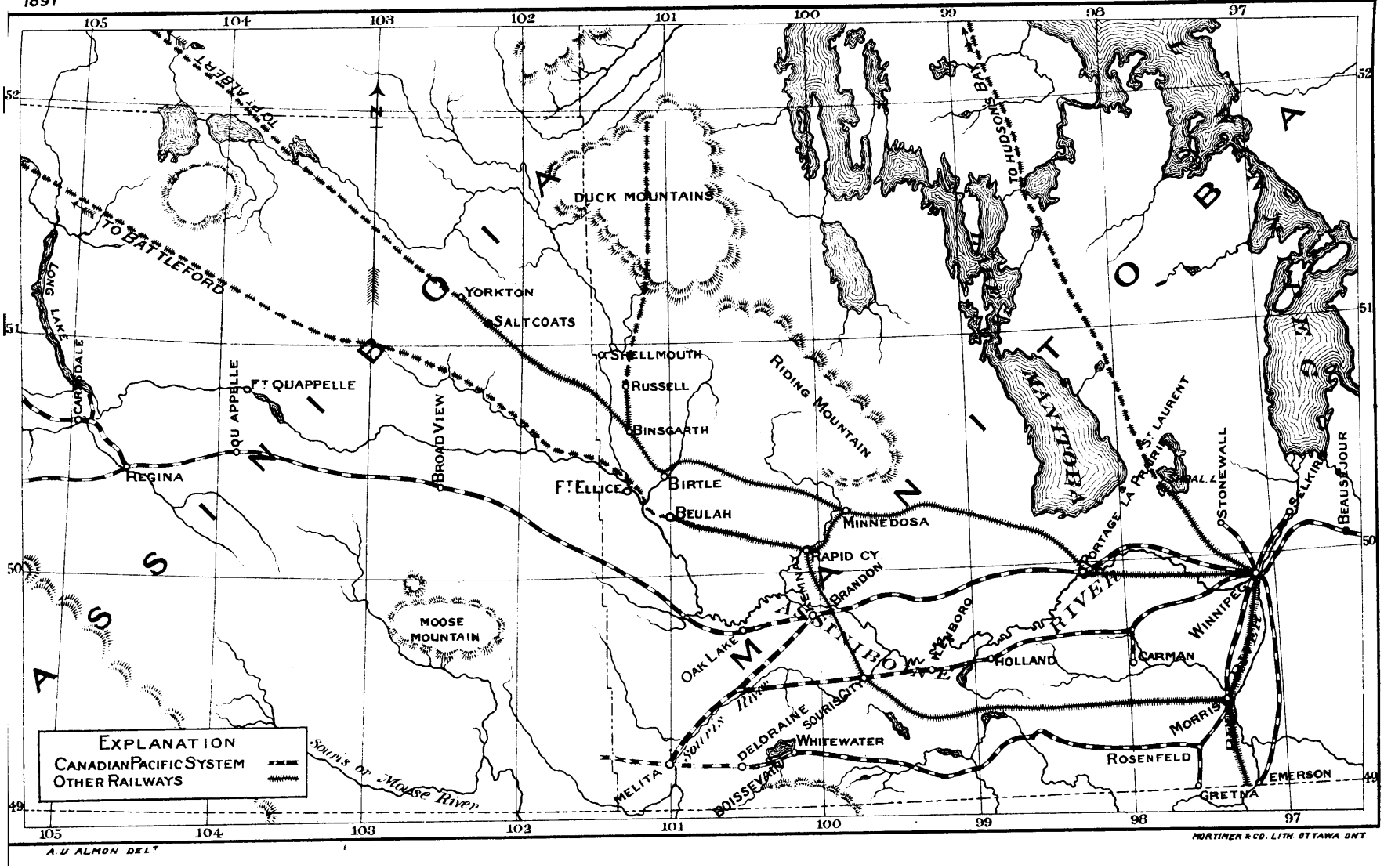


A.U. ALMON. DEL.

MORTIMER & CO. LITH. OTTAWA. ONT.

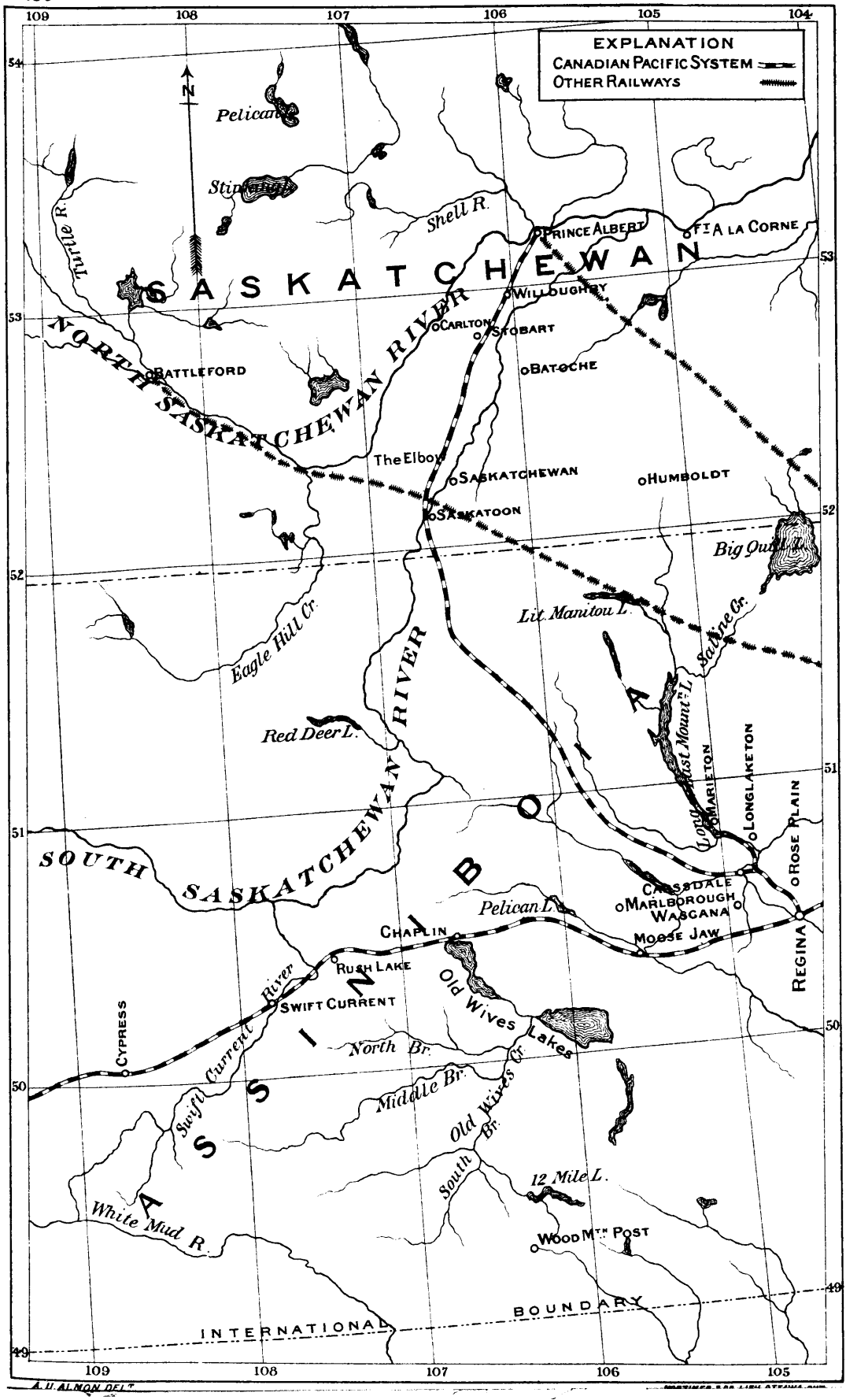
1891

No 9

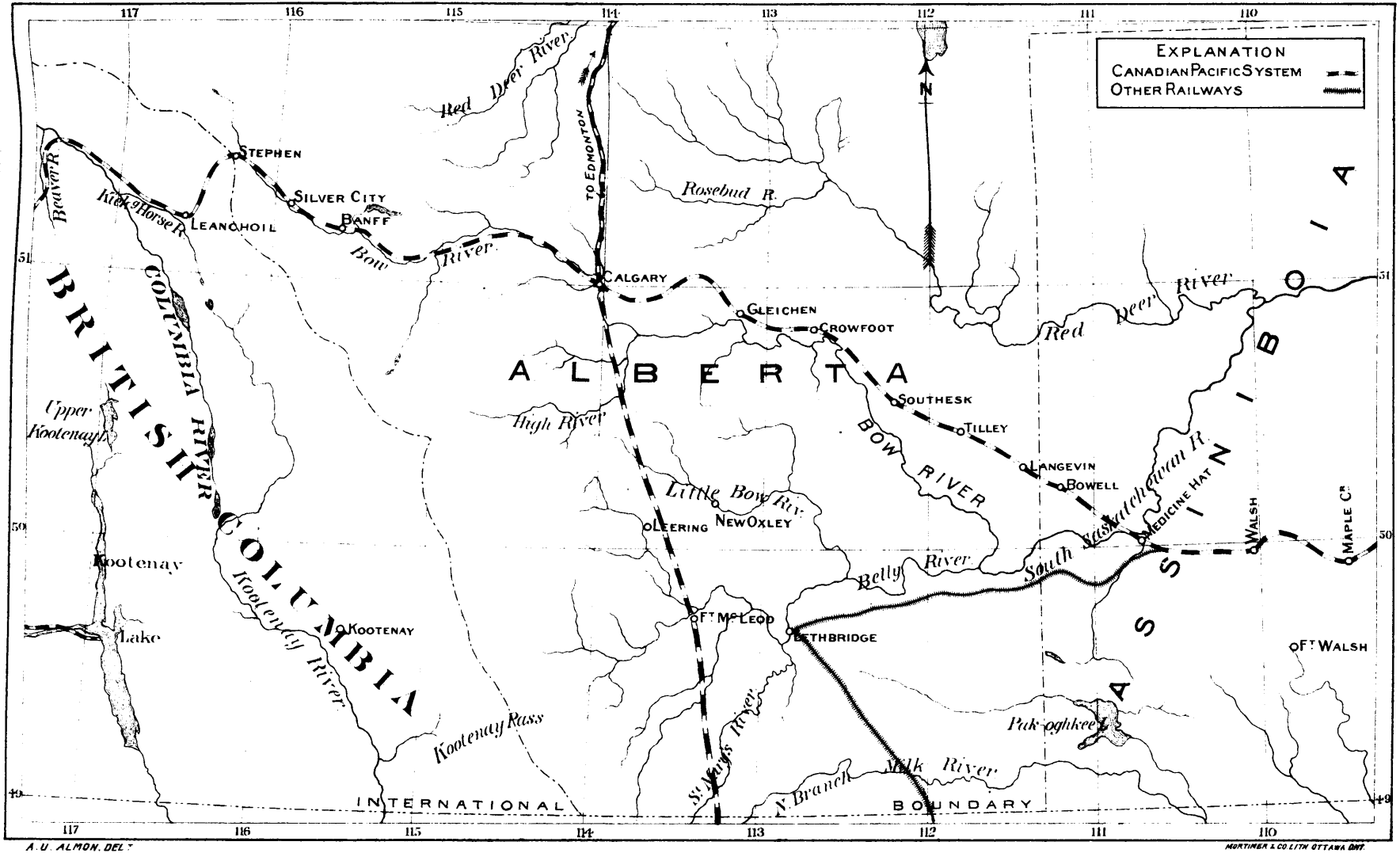


A.U ALMON DEL.T

MORTIMER & CO. LITH OTTAWA ONT.

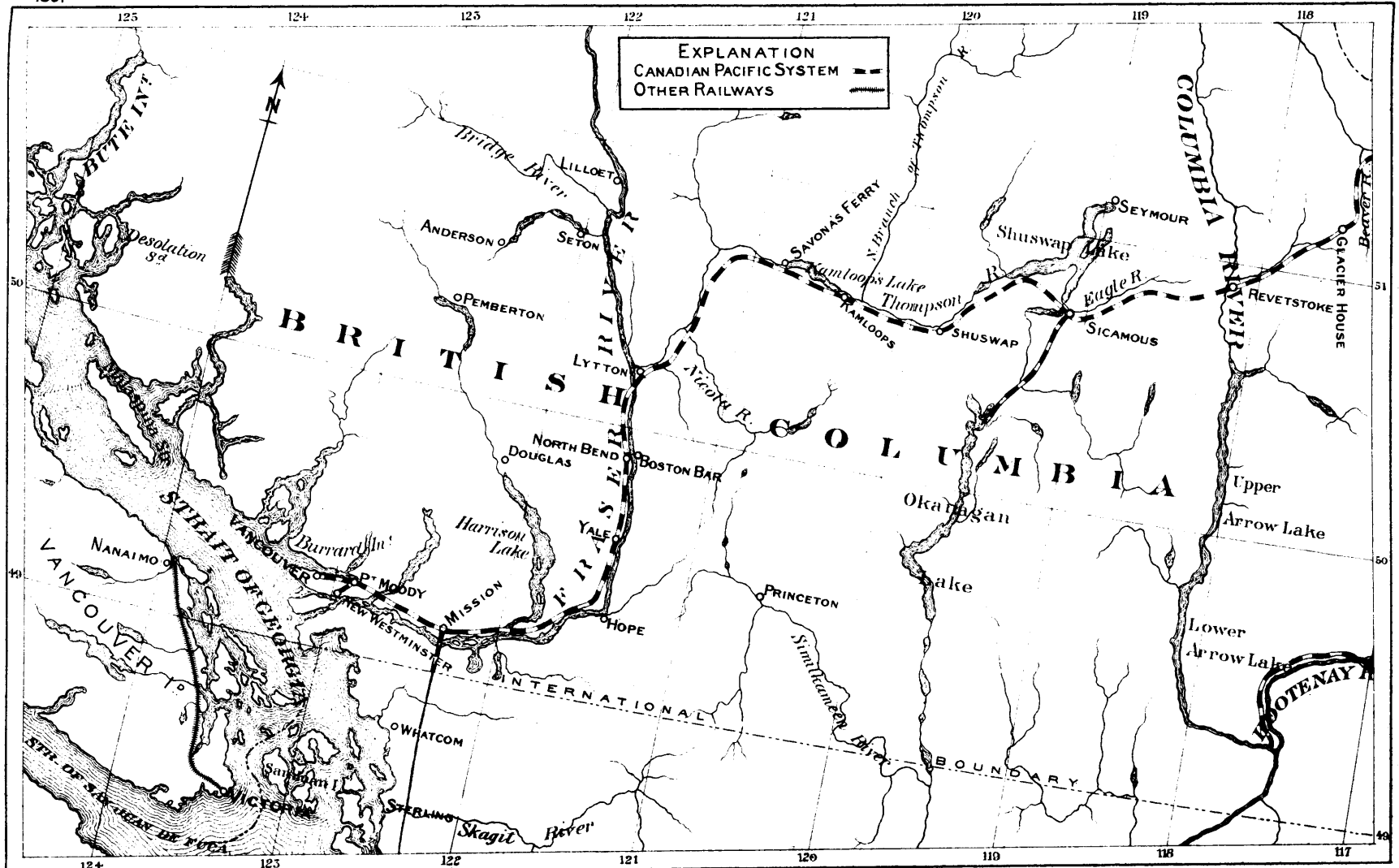

EXPLANATION
CANADIAN PACIFIC SYSTEM
OTHER RAILWAYS
N
SASKATCHEWAN
NORTH SASKATCHEWAN RIVER
SOUTH SASKATCHEWAN RIVER
ASSINIBOIA
Pelican L.
Stipendiary
Turtle R.
Shell R.
PRINCE ALBERT
Ft A LA CORNE
WILLOUGHBY
CARLTON
STOBART
BATTLEFORD
BATOCHE
The Elbow
SASKATCHEWAN
HUMBOLDT
SASKATOON
Big Quill L.
Lit. Manitou L.
Eagle Hill Cr.
Red Deer L.
Salt Mount'n L.
Saline Cr.
MARIETON
LONGLAKETON
ROSE PLAIN
CASSDALE
MARLBOROUGH
WASCANA
REGINA
Pelican L.
CHAPLIN
MOOSE JAW
RUSH LAKE
SWIFT CURRENT
CYPRESS
River
Swift Current
Old Wives Lakes
North Br.
Middle Br.
Old Wives Cr.
South Br.
12 Mile L.
White Mud R.
WOOD MTN POST
INTERNATIONAL BOUNDARY
109
108
107
106
105
104
54
53
52
51
50
49

A. H. ALMON DEL.



A. U. ALMON, DEL.

MORTIMER & CO. LITH. OTTAWA ONT.



A.U ALMON. DEL.

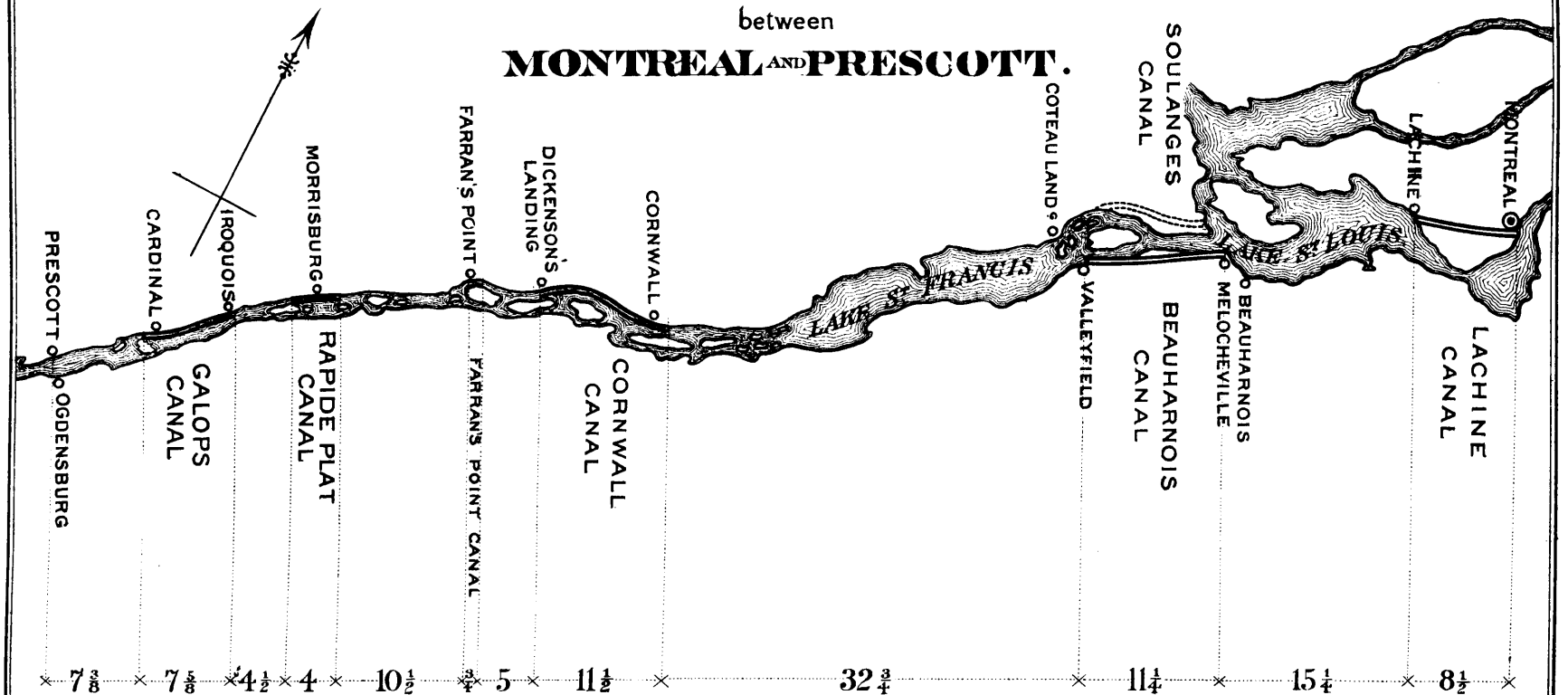
MORTIMER & CO. LITH. OTTAWA. ONT.

DIAGRAM

Shewing the Canals on the *St LAWRENCE RIVER.*

between

MONTREAL AND PRESCOTT.



Total Canal Navigation	43 5/8	*Miles*
" *River* "	75 3/8	"
" *Prescott to Montreal*	119	"

NORTHER & CO. LITH. OTTAWA, ONT.

APPENDIX No. 1.

STATEMENT showing the amount expended by the Department of Railways and Canals, Dominion of Canada, during the Fiscal Year ended 30th June, 1891.

Name of Work.	Construction.	Repairs.	Staff and Maintenance.
CANALS.	$ cts.	$ cts.	$ cts.
Beauharnois—Income	17,085 68	12,537 39	18,886 86
Carillon and Grenville—Income	4,395 25	10,796 68	21,230 22
Chambly—Income	43,344 41	11,399 93	19,204 76
Cornwall	599,001 85	9,830 05	16,077 72
do —Income	1,459 98		
Culbute	2,183 15	499 91	745 25
do —Income	9,122 05		
Lachine	217 53	36,292 98	50,721 69
do Income	16,155 75		
Murray	61,260 49	173 53	5,137 03
Rideau—Income	20,967 25	21,537 56	34,641 98
St. Anne's—Income	8,173 69	1,503 56	2,505 69
St. Lawrence	35,137 25		
St. Ours—Income	21,696 74	4,460 16	2,011 08
St. Peter's	972 65	312 02	3,255 30
do —Income	510 53		
Sault Ste. Marie	325,336 33		
Tay	17,114 78		
Trent	9,826 49	4,888 98	3,803 66
do —Income	3,164 81		
Welland	24,707 11	82,548 30	107,662 33
do deepening	8,422 65		
do land and damages	3,241 27		
do floating bridge—Income	43 73		
do culvert at Stromness—Income	2 72		
do swing bridge over Feeder do	2 73		
do Port Dalhousie pier do	15,951 80		
do extension to raceway do	1,917 00		
do Shoal Bay, above old Lock 2—Income	1,849 75		
Williamsburgh	230,670 60	7,987 40	8,678 25
Surveys—Income	9,882 87		
General dredging—Income	1,080 44	1,638 50	
Miscellaneous works not otherwise provided for—Income	2,310 00		
do gratuities as voted	3,652 00		
do staff			1,683 93
Dredge vessel, Rideau, working		1,621 28	
Sunday labour			10,566 15
Salaries and contingencies, canal officers			41,412 19
Total on Canals	1,500,861 33	208,028 23	348,224 39
RAILWAYS.			
Pacific	37,367 00		
Intercolonial	79,929 34		3,662,341 94
do Eastern Extension	3,255 40		
do Windsor Branch			28,931 71
Annapolis and Digby	196,869 36		
Cape Breton	521,441 62		
Oxford and New Glasgow	220,886 39		
Montreal and European Short Line	124,568 23		
Surveys—Income	14,888 56		
Statistics do	1,425 85		
Subsidies	1,079,105 87		
Prince Edward Island			257,990 08
Total on Railways	2,279,737 62		3,949,263 73
Total on Railways and Canals	3,780,598 95	208,028 23	4,297,488 12

Total amount expended $8,286,115 30

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

APPENDIX No. 2.

STATEMENTS showing the amounts expended on Construction, Renewals, Ordinary Repairs and Working Staff of the Canals of the Dominion of Canada, up to the 30th June, 1891.

ST. PETER'S CANAL.

	Year ending 30th June.	Capital.	Renewals Chargeable to Income.	Staff.	Repairs.
		$ cts.	$ cts.	$ cts.	$ cts.
Government expenditure prior to Confederation	....	156,523 32	.....	.....	.....
do since do do ..	1868	21,519 72	.....	.....	.....
do do do ..	1869	70,719 80	.....	.....	.....
do do do ..	1870	.....	46,193 57	.....	.....
do do do ..	1871	.....	.....	225 36	555 78
do do do ..	1872	.....	.....	280 00	6,122 07
do do do ..	1873	.....	.....	343 32	6,539 58
do do do ..	1874	.....	.....	725 93	1,558 57
do do do ..	1875	20 97	.....	560 00	889 35
do do do ..	1876	11,125 00	.....	641 55	.....
do do do ..	1877	63,330 18	.....	600 00	17 45
do do do ..	1878	26,511 51	.....	600 00	.....
do do do ..	1879	107,337 75	.....	631 50	.....
do do do ..	1880	80,120 54	.....	400 00	.....
do do do ..	1881	69,434 76	.....	959 58	.....
do do do ..	1882	484 00	.....	1,920 54	200 63
do do do ..	1883	.....	.....	2,089 19	232 42
do do do ..	1884	2,471 40	.....	2,601 47	367 85
do do do ..	1885	16,820 15	.....	1,929 11	183 11
do do do ..	1886	2,316 85	.....	2,360 67	297 81
do do do ..	1887	1,087 75	750 00	2,777 13	343 23
do do do ..	1888	.....	.....	3,217 77	1,588 40
do do do ..	1889	.....	500 00	3,085 29	353 38
do do do ..	1890	.....	.....	3,110 15	255 34
do do do ..	1891	972 65	510 53	3,255 30	312 02
Total	....	630,796 35	47,954 10	32,313 86	19,816 99

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

STATEMENTS showing the amounts expended on Construction, Renewals, &c.—*Con.*

BAIE VERTE CANAL—SURVEY.

	Year ending 30th June.	Capital.	Income.
		$ cts.	$ cts.
Government expenditure prior to Confederation			
do since do	1868		
do do do	1869		
do do do	1870		
do do do	1871		17,929 34
do do do	1872		6,399 41
do do do	1873		14,943 83
do do do	1874		4,018 90
do do do	1875		443 00
do do do	1876		110 75
do do do	1877		22 30
do do do	1878		
do do do	1879		
do do do	1880		
do do do	1881		520 00
do do do	1882		
do do do	1883		
do do do	1884		
do do do	1885		
do do do	1886		
do do do	1887		
do do do	1888		
do do do	1889		
do do do	1890		
do do do	1891		
Total			44,387 53

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

STATEMENTS showing the amounts expended on Construction, Renewals, &c.—*Con.*

LACHINE CANAL.

——	Year ending 30th June.	Capital.	Renewals Chargeable to Income.	Staff.	Repairs.
		$ cts.	$ cts.	$ cts.	$ cts.
Expenditure by Imperial Government		40,000 00			
Government expenditure prior to Confederation		2,547,532 85			
do since do do	1868		1,852 70	13,742 05	10,431 51
do do do do	1869	2,000 00		14,209 02	12,085 84
do do do do	1870			15,834 49	13,302 39
do do do do	1871		12,231 40	17,478 52	15,093 25
do do do do	1872	36,708 15		16,076 93	12,334 69
do do do do	1873	7,824 28	35,158 21	23,601 03	34,300 60
do do do do	1874	158,618 35		25,811 07	22,828 66
do do do do	1875	197,420 52		28,592 01	30,057 34
do do do do	1876	327,769 39		33,797 73	29,103 65
do do do do	1877	1,439,375 73		33,148 86	19,824 33
do do do do	1878	1,484,619 63		39,062 97	13,646 41
do do do do	1879	958,053 30		42,338 84	12,400 78
do do do do	1880	369,566 74		38,950 90	10,223 62
do do do do	1881	292,165 51		39,027 99	19,888 33
do do do do	1882	252,821 33	2,978 66	41,158 90	17,116 46
do do do do	1883	396,496 96	1,859 68	45,554 91	18,199 59
do do do do	1884	188,266 18		48,624 51	19,683 24
do do do do	1885	111,215 23		49,004 85	20,199 78
do do do do	1886	210,509 42		50,969 10	19,199 18
do do do do	1887	28,772 52	12,981 59	53,113 97	22,567 81
do do do do	1888	19,414 34	7,996 38	52,229 61	19,999 64
do do do do	1889	76,032 96	972 71	54,110 67	22,957 71
do do do do	1890	7,448 03	8,238 46	53,114 34	22,999 38
do do do do	1891	217 53	16,555 75	50,721 69	36,292 98
		9,152,848 95	100,425 54	800,274 96	474,737 17

BEAUHARNOIS CANAL.

Government expenditure prior to Confederation		1,611,424 11			
do since do do	1868		63,193 75	9,349 99	6,216 98
do do do do	1869		55 00	9,626 99	6,498 57
do do do do	1870		27 50	10,117 57	6,384 81
do do do do	1871			12,316 53	5,722 36
do do do do	1872		27 50	11,792 46	15,733 38
do do do do	1873		5,122 50	12,210 73	9,882 06
do do do do	1874		26 00	15,392 51	10,990 56
do do do do	1875		36 00	14,399 32	12,253 01
do do do do	1876			14,465 86	17,170 83
do do do do	1877			14,377 63	15,207 36
do do do do	1878			14,383 37	9,861 05
do do do do	1879			15,015 86	10,370 71
do do do do	1880	266 15		15,362 61	8,997 34
do do do do	1881			17,659 93	10,770 67
do do do do	1882			18,804 53	20,813 86
do do do do	1883		6,727 44	18,287 77	15,826 71
do do do do	1884		3,277 98	19,107 38	16,232 61
do do do do	1885		7,999 79	18,960 40	14,637 70
do do do do	1886		8,491 80	19,228 90	14,356 00
do do do do	1887		3,633 57	18,867 45	14,999 88
do do do do	1888		14,411 97	19,325 05	14,285 98
do do do do	1889		10,993 52	20,019 11	14,982 54
do do do do	1890			19,847 42	14,999 20
do do do do	1891		17,085 68	18,886 86	12,537 39
		1,611,690 26	141,110 00	377,806 23	299,731 56

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

STATEMENTS showing the amounts expended on Construction, Renewals, &c.-- *Continued*.

CORNWALL CANAL.

——	Year ending 30th June.	Capital.	Renewals Chargeable to Income.	Staff.	Repairs.
		$ cts.	$ cts.	$ cts.	$ cts.
Government expenditure prior to Confederation		1,933,152 69			
do since do do	1868		2,786 00	11,244 47	3,774 18
do do do do	1869	10,692 04		10,347 91	3,859 14
do do do do	1870		17,780 05	10,368 16	7,145 42
do do do do	1871		7 50	11,848 39	8,891 61
do do do do	1872		10,000 21	10,594 30	8,163 70
do do do do	1873		1,011 75	13,042 25	12,467 65
do do do do	1874			13,405 20	7,610 70
do do do do	1875	1,780 00		13,351 91	7,097 34
do do do do	1876			13,320 61	6,423 67
do do do do	1877	49,211 37		13,375 70	6,440 54
do do do do	1878	145,015 45		13,825 50	4,935 21
do do do do	1879	143,092 05		13,817 96	4,983 15
do do do do	1880	109,454 95		14,440 33	9,735 76
do do do do	1881	53,948 14		15,173 60	5,524 10
do do do do	1882	44,587 61		15,052 20	6,634 62
do do do do	1883	21,728 93		18,283 67	8,361 71
do do do do	1884	23,018 13		18,475 48	9,007 73
do do do do	1885	62,034 90	16,298 96	15,988 96	12,368 51
do do do do	1886	57,820 83	6,960 95	15,994 80	11,832 83
do do do do	1887	46,966 43		17,520 54	12,100 29
do do do do	1888	67,945 74		16,938 54	13,942 64
do do do do	1889	163,993 85		17,890 55	58,205 26
do do do do	1890	365,038 01	2,000 00	17,063 49	12,758 18
do do do do	1891	599,001 85	1,459 98	16,077 72	9,830 05
		3,898,482 97	58,305 40	347,442 24	252,093 99

WILLIAMSBURG CANALS.

Government expenditure prior to Confederation		1,320,655 54			
do since do do	1868			5,745 97	6,442 41
do do do do	1869			5,769 81	5,670 88
do do do do	1870			5,573 13	6,546 16
do do do do	1871			6,382 17	5,308 41
do do do do	1872		1,077 00	5,542 94	3,230 07
do do do do	1873			6,424 49	7,347 75
do do do do	1874			6,857 19	7,395 92
do do do do	1875			6,547 62	4,110 29
do do do do	1876			7,418 39	11,690 98
do do do do	1877			7,388 08	10,053 61
do do do do	1878			7,430 11	4,449 78
do do do do	1879			7,517 20	3,549 71
do do do do	1880			7,590 15	3,999 77
do do do do	1881			7,572 35	5,020 73
do do do do	1882			7,589 44	7,447 69
do do do do	1883	13 19		7,423 48	7,299 39
do do do do	1884	2,473 44		7,757 04	7,349 37
do do do do	1885	103,237 12		7,696 67	8,198 03
do do do do	1886	149,835 71		7,671 54	7,847 05
do do do do	1887	115,853 00		7,635 54	7,904 76
do do do do	1888	70,128 29	1,613 67	7,646 79	8,190 13
do do do do	1889	59,867 26		7,485 28	8,794 61
do do do do	1890	139,078 37		8,954 53	8,191 69
do do do do	1891	230,670 60		8,678 25	7,987 40
		2,191,812 52	2,690 67	172,298 16	164,026 59

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

STATEMENTS showing the amounts expended on Construction, Renewals, &c.—*Continued.*

ST. LAWRENCE RIVER AND CANALS, SURVEYS, &c.

——	Year ending 30th June.	Chargeable to Capital.	Chargeable to Income.
		$ cts.	$ cts.
Government expenditure prior to Confederation		18,442 85	98,378 46
do since do	1868		
do do do	1869		
do do do	1870		
do do do	1871		
do do do	1872		
do do do	1873	33,241 69	
do do do	1874	26,541 30	
do do do	1875	20,611 36	
do do do	1876	50,215 47	
do do do	1877	47,377 31	
do do do	1878	5,570 46	
do do do	1879	9,265 77	
do do do	1880	9,214 56	
do do do	1881	6,927 96	
do do do	1882	28,933 45	
do do do	1883	44,874 31	
do do do	1884	89,846 03	
do do do	1885	115,110 17	
do do do	1886	116,051 73	
do do do	1887	74,437 31	
do do do	1888	56,482 85	
do do do	1889	18,493 92	
do do do	1890	23,979 91	
do do do	1891	35,137 25	
		830,755 66	98,378 46

WELLAND CANAL.

——	Year ending 30th June.	Capital.	Renewals Chargeable to Income.	Staff.	Repairs.
		$ cts.	$ cts.	$ cts.	$ cts.
Imperial Government		222,220 00			
Government expenditure prior to Confederation		7,416,019 83			
do since do	1868	12,097 84		37,679 05	38,852 96
do do do	1869	43,486 36		39,060 61	50,773 03
do do do	1870		22,173 72	40,340 45	65,009 19
do do do	1871		48,569 10	42,383 33	53,381 02
do do do	1872	53,680 32	6,022 44	37,085 37	50,276 90
do do do	1873	82,282 20	47,876 27	45,382 99	66,550 73
do do do	1874	746,420 61		50,966 48	103,666 99
do do do	1875	1,047,119 91		52,595 00	88,539 99
do do do	1876	1,569,478 19	700 00	57,623 31	81,376 12
do do do	1877	2,199,962 61		59,963 47	49,783 93
do do do	1878	2,138,392 99		60,138 59	66,393 53
do do do	1879	1,552,697 41		59,942 23	56,755 57
do do do	1880	1,252,924 75		63,198 10	76,535 25
do do do	1881	1,242,943 37	6,593 19	56,398 04	69,249 53
do do do	1882	603,402 17	13,664 80	74,641 51	84,374 97
do do do	1883	549,433 29	5,979 03	109,207 21	72,707 62
do do do	1884	432,336 21		113,276 87	90,926 97
do do do	1885	463,505 38	6,150 21	112,670 00	91,534 66
do do do	1886	215,380 75	1,359 00	111,660 22	69,507 48
do do do	1887	1,071,073 87	3,828 67	109,371 69	77,440 80
do do do	1888	429,720 94	10,740 86	110,806 01	86,518 97
do do do	1889	225,910 21	43,803 80	113,587 05	77,547 77
do do do	1890	117,633 22	51,648 28	109,202 02	72,686 19
do do do	1891	36,371 03	19,767 73	107,662 63	82,548 30
		23,724,493 46	288,877 10	1,774,842 23	1,722,938 47

DEPT. OF RAILWAYS AND CANALS, OTTAWA, Dec. 31, 1891. LEONARD SHANNON, *Accountant.*

STATEMENTS showing the amounts expended on Construction, Renewals, &c.—*Continued.*

STE. ANNE'S LOCK AND CANAL.

——	Year ending 30th June.	Capital.	Renewals Chargeable to Income.	Staff.	Repairs.
		$ cts.	$ cts.	$ cts.	$ cts.
Government expenditure prior to Confederation		134,456 51			
do since do do	1868			778 16	432 47
do do do do	1869			1,062 96	1,873 51
do do do do	1870			1,136 54	1,280 36
do do do do	1871			1,285 84	1,539 02
do do do do	1872		1,939 46	1,106 80	1,393 63
do do do do	1873		540 11	2,199 64	1,264 40
do do do do	1874	12,753 27		2,614 90	7,208 63
do do do do	1875	32,627 71		1,859 20	4,506 68
do do do do	1876	24,935 85		1,952 14	4,033 72
do do do do	1877	30,003 08		1,982 65	1,756 93
do do do do	1878	14,618 85		2,057 32	541 95
do do do do	1879	22,113 02		2,202 03	3,259 70
do do do do	1880	3,054 68		2,152 57	1,704 71
do do do do	1881	69,042 76		2,553 02	3,257 92
do do do do	1882	193,158 36		2,611 30	2,343 99
do do do do	1883	172,959 95		2,569 86	3,448 83
do do do do	1884	142,006 25		2,775 32	2,725 49
do do do do	1885	93,679 57		2,618 60	4,042 04
do do do do	1886	129,681 67		2,611 90	5,803 01
do do do do	1887	45,276 08	6,054 10	2,537 41	1,499 96
do do do do	1888	18,910 55	1,372 59	2,505 61	1,380 75
do do do do	1889	24,786 33		2,569 22	1,730 79
do do do do	1890	6,151 14		2,571 04	1,525 51
do do do do	1891		8,173 69	2,505 69	1,503 56
		1,170,215 63	18,079 95	50,819 72	60,057 56

CARILLON AND GRENVILLE CANALS.

Government expenditure prior to Confederation		63,053 64			
do since do do	1868		19,817 22	6,301 88	8,911 28
do do do do	1869			6,549 38	10,157 42
do do do do	1870		4,167 96	6,617 81	9,852 09
do do do do	1871		23,119 37	8,676 90	8,218 24
do do do do	1872	165,257 28		8,324 51	17,235 31
do do do do	1873	133,199 10	3,051 38	10,068 28	8,781 50
do do do do	1874	245,258 38		10,710 88	10,605 82
do do do do	1875	339,864 76		10,378 57	18,520 44
do do do do	1876	326,203 16		10,764 38	11,475 96
do do do do	1877	245,738 04		11,050 27	10,304 06
do do do do	1878	22,676 20		11,401 30	5,082 72
do do do do	1879	243,141 24		11,501 22	7,629 98
do do do do	1880	281,514 27		11,959 14	7,625 54
do do do do	1881	336,707 53		13,059 18	8,076 91
do do do do	1882	433,084 39		14,387 49	7,582 68
do do do do	1883	433,575 10		17,479 58	8,310 02
do do do do	1884	399,267 16		17,393 91	7,918 42
do do do do	1885	157,187 72		19,702 30	10,429 26
do do do do	1886	104,973 24	75 00	20,597 82	9,303 31
do do do do	1887	20,747 11		20,011 36	10,554 41
do do do do	1888	38,996 29		21,531 12	10,036 62
do do do do	1889	298 17		22,098 88	10,135 66
do do do do	1890	17 58	4,526 61	15,896 16	7,582 38
do do do do	1891		4,395 25	21,230 22	10,796 68
		3,990,760 36	59,152 79	327,692 54	235,126 71

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

STATEMENTS showing the amounts expended on Construction, Renewals, &c.—*Continued.*

CULBUTE LOCK AND DAM.

——	Year ending 30th June.	Capital.	Renewals Chargeable to Income.	Staff.	Repairs.
		$ cts.	$ cts.	$ cts.	$ cts.
Government expenditure since Confederation..	1868				
do do do ..	1869				
do do do ..	1870				
do do do ..	1871				
do do do ..	1872				
do do do ..	1873		835 53		
do do do ..	1874		38,388 99		
do do do ..	1875	63,659 29			
do do do ..	1876	76,842 44			
do do do ..	1877	56,081 87			
do do do ..	1878	5,933 53			
do do do ..	1879	20,694 19			
do do do ..	1880	16,688 20		202 50	259 31
do do do ..	1881	4,721 62		962 85	
do do do ..	1882	29,567 15		790 00	162 33
do do do ..	1883	14,249 60		695 00	288 99
do do do ..	1884	8,151 16		733 50	
do do do ..	1885	19,071 76		730 00	572 75
do do do ..	1886	26,385 27		730 00	2,396 14
do do do ..	1887	7,760 88		730 00	967 33
do do do ..	1888	7,573 99		739 50	730 60
do do do ..	1889	17,112 01		1,050 00	116 53
do do do ..	1890	2,818 35		747 83	
do do do ..	1891	2,183 15	9,122 05	745 25	499 91
		379,494 46	48,346 57	8,856 43	5,993 89

RIDEAU CANAL.

Imperial Government		3,911,701 47			
Government expenditure prior to Confederation		153,062 60			
do since do ..	1868		7,298 12	18,597 28	16,475 21
do do do ..	1869			19,250 71	13,140 77
do do do ..	1870		13 16	20,022 37	19,469 33
do do do ..	1871		11,732 98	22,814 58	18,120 52
do do do ..	1872		4,967 50	22,139 48	14,005 32
do do do ..	1873		18,070 97	22,841 51	26,074 49
do do do ..	1874		5,793 16	26,815 44	22,957 40
do do do ..	1875	9,310 85		26,553 37	19,699 81
do do do ..	1876	2,163 96		26,430 77	14,428 25
do do do ..	1877	214 11		25,959 56	14,198 18
do do do ..	1878			26,651 51	11,034 22
do do do ..	1879	7,703 88		26,042 52	7,134 55
do do do ..	1880			26,463 88	11,434 05
do do do ..	1881		133 50	26,024 71	8,627 00
do do do ..	1882			26,915 29	13,860 28
do do do ..	1883		70 65	27,322 81	23,524 84
do do do ..	1884		4,597 50	26,938 95	19,245 02
do do do ..	1885		2,098 76	26,971 32	18,189 55
do do do ..	1886		550 00	27,045 95	35,648 04
do do do ..	1887		20,823 96	29,440 46	18,565 34
do do do ..	1888		18,889 48	33,458 83	25,478 87
do do do ..	1889		6,665 22	33,801 77	18,106 36
do do do ..	1890		21,124 10	34,270 57	18,025 21
do do do ..	1891		20,967 25	34,641 98	21,537 56
		4,084,156 87	143,796 31	637,215 62	428,980 17

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

LEONARD SHANNON,
Accountant.

STATEMENTS showing the amounts expended on Construction, Renewals, &c.—*Continued.*

ST. OURS LOCK.

——	Year ending 30th June.	Capital.	Renewals Chargeable to Income.	Staff.	Repairs.
		$ cts.	$ cts.	$ cts.	$ cts.
Government expenditure prior to Confederation		121,537 65			
do since do do	1868			1,532 75	753 74
do do do do	1869			1,755 15	1,399 18
do do do do	1870			1,458 09	1,006 22
do do do do	1871			1,414 48	1,210 98
do do do do	1872			1,565 80	1,263 19
do do do do	1873			2,076 50	1,575 10
do do do do	1874			2,219 13	2,363 42
do do do do	1875			1,362 22	1,245 69
do do do do	1876			1,403 92	1,601 71
do do do do	1877			1,533 40	750 80
do do do do	1878			1,556 65	283 77
do do do do	1879			1,581 55	456 07
do do do do	1880			1,614 01	705 54
do do do do	1881			1,741 97	1,299 77
do do do do	1882			2,002 71	1,902 41
do do do do	1883		17,230 32	2,361 65	2,188 08
do do do do	1884		5,279 17	2,315 37	1,494 99
do do do do	1885		4,700 64	2,271 57	3,652 63
do do do do	1886			2,311 70	4,143 47
do do do do	1887			2,175 37	5,864 78
do do do do	1888			2,216 04	2,801 17
do do do do	1889		17,964 45	2,421 14	2,002 63
do do do do	1890		24,571 96	2,138 40	1,935 44
do do do do	1891		21,696 74	2,011 08	4,460 16
		121,537 65	91,443 28	45,040 65	46,360 94

CHAMBLY CANAL.

Government expenditure prior to Confederation		634,711 76			
do since do do	1868			8,312 90	9,355 70
do do do do	1869			8,437 22	13,120 97
do do do do	1870			8,934 41	20,180 73
do do do do	1871		2,839 85	10,214 71	22,426 33
do do do do	1872		1,906 40	9,628 50	22,327 99
do do do do	1873		759 00	10,390 44	11,789 27
do do do do	1874		2,810 00	11,675 67	16,427 19
do do do do	1875	2,415 00		12,201 99	16,306 91
do do do do	1876			10,593 14	13,273 56
do do do do	1877	80 00		10,281 78	10,111 32
do do do do	1878			10,413 99	6,022 96
do do do do	1879			11,301 53	8,809 77
do do do do	1880			11,516 22	12,377 74
do do do do	1881			13,950 47	20,705 17
do do do do	1882		31,796 41	16,686 78	16,843 60
do do do do	1883		21,332 36	15,904 38	15,182 24
do do do do	1884		41,640 77	18,448 85	12,003 34
do do do do	1885		21,049 23	18,378 55	13,046 95
do do do do	1886		14,547 27	19,501 28	11,999 77
do do do do	1887		17,911 17	19,053 62	20,071 37
do do do do	1888		65,536 64	20,073 60	11,823 74
do do do do	1889		51,437 87	19,679 22	19,392 18
do do do do	1890		23,221 48	19,655 38	14,399 93
do do do do	1891		43,344 41	19,204 76	11,399 93
		637,206 76	340,132 86	334,439 39	349,398 66

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

LEONARD SHANNON,
Accountant.

STATEMENTS showing the amounts expended on Construction, Renewals, &c.—*Continued.*

MURRAY CANAL.

	Year ending 30th June.	Capital.	Renewals Chargeable to Income.	Staff.	Repairs.
		$ cts.	$ cts.	$ cts.	$ cts.
Government expenditure prior to Confederation					
do since do do	1868		400 00		
do do do do	1869				
do do do do	1870				
do do do do	1871				
do do do do	1872				
do do do do	1873				
do do do do	1874				
do do do do	1875				
do do do do	1876				
do do do do	1877				
do do do do	1878				
do do do do	1879				
do do do do	1880				
do do do do	1881				
do do do do	1882	7,135 63			
do do do do	1883	84,071 68			
do do do do	1884	118,187 43			
do do do do	1885	148,902 66			
do do do do	1886	179,704 52			
do do do do	1887	142,563 66			
do do do do	1888	146,754 37			
do do do do	1889	215,326 46			
do do do do	1890	106,760 35		494 31	
do do do do	1891	61,260 49		5,137 03	173 53
		1,210,667 25	400 00	5,631 34	173 53

TRENT CANAL.

Government expenditure prior to Confederation		309,371 31			
do since do do	1868				
do do do do	1869				
do do do do	1870				
do do do do	1871				
do do do do	1872				
do do do do	1873				
do do do do	1874				
do do do do	1875				
do do do do	1876				
do do do do	1877				
do do do do	1878				
do do do do	1879				
do do do do	1880	561 50		1,188 92	3,568 89
do do do do	1881			2,489 93	2,233 50
do do do do	1882		5,836 51	2,011 92	8,115 50
do do do do	1883	40,767 16	9,303 66	2,235 50	3,047 42
do do do do	1884	120,393 91	6,198 57	2,208 64	5,264 35
do do do do	1885	121,382 84		3,303 87	4,653 50
do do do do	1886	75,103 30		1,639 75	5,917 88
do do do do	1887	179,541 63		1,938 08	6,008 88
do do do do	1888	114,879 35		1,770 29	5,151 42
do do do do	1889	47,592 13	29,677 92	3,242 05	5,935 94
do do do do	1890	58,644 50	11,522 65	3,450 99	730 55
do do do do	1891	9,826 49	3,164 81	3,803 66	4,888 98
		1,078,064 12	65,704 12	29,283 60	55,516 81

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

LEONARD SHANNON,
Accountant.

STATEMENTS showing the amounts expended on Construction, Renewals, &c.—*Continued.*

TAY CANAL.

——	Year ending 30th June.	Capital.	Renewals Chargeable to Income.	Staff.	Repairs.
		$ cts.	$ cts.	$ cts.	$ cts.
Government expenditure since Confederation..	1868				
do do do ..	1869				
do do do ..	1870				
do do do ..	1871				
do do do ..	1872				
do do do ..	1873				
do do do ..	1874				
do do do ..	1875				
do do do ..	1876				
do do do ..	1877				
do do do ..	1878				
do do do ..	1879				
do do do ..	1880				
do do do ..	1881				
do do do ..	1882		748 65		
do do do ..	1883	4,831 80			
do do do ..	1884	50,878 12			
do do do ..	1885	92,473 97			
do do do ..	1886	65,561 51			
do do do ..	1887	49,617 92			
do do do ..	1888	54,166 57			
do do do ..	1889	89,486 18			
do do do ..	1890	22,226 23			
do do do ..	1891	17,114 78		*	*
		446,357 08	748 65		

SAULT STE. MARIE CANAL.

Government expenditure since Confederation..	1868				
do do do ..	1869				
do do do ..	1870				
do do do ..	1871				
do do do ..	1872		949 35		
do do do ..	1873				
do do do ..	1874				
do do do ..	1875				
do do do ..	1876				
do do do ..	1877				
do do do ..	1878				
do do do ..	1879				
do do do ..	1880				
do do do ..	1881				
do do do ..	1882				
do do do ..	1883				
do do do ..	1884				
do do do ..	1885				
do do do ..	1886				
do do do ..	1887				
do do do ..	1888	8,145 06			
do do do ..	1889	34,018 95			
do do do ..	1890	176,568 55			
do do do ..	1891	325,336 33			
		544,068 89	949 35		

* Staff and Repairs included in Rideau Canal.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

LEONARD SHANNON,
Accountant.

RECAPITULATION—EXPENDITURE ON CANALS.

——	Year ending June 30.	Capital.	Income.	Staff.	Repairs.
		$ cts.	$ cts.	$ cts.	$ cts.
Government expenditure prior to Confederation, including Imperial Government	....	20,593,866 13	98,378 46	.....	....
Government expenditure since Confederation..	1868	33,617 56	95,347 79	113,084 50	101,646 44
do do ..	1869	126,898 20	55 00	116,069 76	118,579 31
do do ..	1870	.....	90,355 96	120,403 02	150,176 70
do do ..	1871	.....	116,429 54	135,040 81	140,467 52
do do ..	1872	255,645 75	33,289 27	124,137 09	152,086 25
do do ..	1873	256,547 27	127,369 55	148,581 18	186,573 13
do do ..	1874	1,189,591 91	51,037 05	167,194 40	213,613 86
do do ..	1875	1,714,830 37	479 00	168,401 21	203,226 85
do do ..	1876	2,388,733 46	810 75	178,411 80	190,578 45
do do ..	1877	4,131,374 30	22 30	179,661 40	138,448 51
do do ..	1878	3,843,338 62	.....	187,521 31	122,251 60
do do ..	1879	3,064,098 61	.....	191,892 44	115,349 99
do do ..	1880	2,123,366 34	....	195,039 33	147,167 52
do do ..	1881	2,075,891 65	7,246 69	197,573 62	154,653 63
do do ..	1882	1,593,174 09	55,025 03	224,572 61	187,399 02
do do ..	1883	1,763,001 97	62,503 14	269,415 01	178,617 86
do do ..	1884	1,577,295 42	60,993 99	280,657 29	192,219 38
do do ..	1885	1,504,621 47	58,297 59	280,226 20	201,708 47
do do ..	1886	1,333,324 80	31,984 02	282,323 63	198,251 97
do do ..	1887	1,783,698 16	65,983 06	285,172 62	198,888 84
do do ..	1888	1,033,118 34	120,561 59	292,458 76	201,928 93
do do ..	1889	972,918 43	162,015 49	301,040 23	240,261 36
do do ..	1890	1,026,364 24	146,853 54	290,516 63	176,089 00
do do ..	1891	1,318,092 15	165,843 87	294,562 12	204,768 45
		55,703,409 24	1,550,882 68	5,023,956 97	4,114,953 04

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

INTERCOLONIAL RAILWAY

(Including amounts paid to Nova Scotia Railway and European and North American Railway, N.B.)

——	Year.	Construction.	Working Expenses, including Windsor Branch Railway.
		$ cts.	$ cts.
Expenditure prior to Confederation	....	10,766,725 54	.....
do since do	1868	483,353 65	359,961 08
do do do	1869	282,615 18	387,548 47
do do do	1870	1,729,381 49	445,208 75
do do do	1871	2,916,782 13	442,993 31
do do do	1872	5,131,141 51	595,076 22
do do do	1873	5,201,450 37	1,011,892 60
do do do	1874	3,614,898 81	1,847,175 24
do do do	1875	3,426,099 55	1,532,589 62
do do do	1876	1,108,321 59	1,277,197 79
do do do	1877	1,318,352 19	1,661,673 55
do do do	1878	408,816 74	1,811,273 56
do do do	1879	226,639 19	2,010,183 22
do do do	1880	2,048,014 60	1,607,956 70
do do do	1881	608,732 80	1,780,353 53
do do do	1882	585,568 79	2,080,592 37
do do do	1883	1,616,632 96	2,383,477 20
do do do	1884	1,405,377 52	2,366,719 95
do do do	1885	1,195,363 08	2,460,229 87
do do do	1886	544,958 17	2,508,473 10
do do do	1887	823,070 86	2,854,158 91
do do do	1888	742,203 09	3,300,481 94
do do do	1889	655,228 13	3,174,785 19
do do do	1890	365,246 48	3,500,455 80
do do do	1891	79,929 34	3,691,273 65
		*47,284,903 76	45,091,731 62

* Including $296,872.90 charged to "Consolidated Fund."

Total cost of construction as above ..... $ 47,284,903 76

Less amounts transferred from Capital to Consolidated Fund as follows:—

	Nova Scotia Ry.	European and North American Ry.	
1868	$ 16,800 99	$ 11,302 89	
1870	34,403 45	1,749 21	
1871	50,405 69		
1873	106,899 59	75,311 08	
	$ 208,509 72	$ 83,363 18	
		208,509 72	
			296,872 90

Agreeing with Balance Sheet, Public Accounts, 1890-91, page xiv ..... $ 46,988,030 86

Total cost of road and equipment chargeable to Capital Account as per Chief Engineer's Report, page 34 ..... 46,988,163 15

Difference to be adjusted before next report ..... $ 132 29

LEONARD SHANNON,

Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

EASTERN EXTENSION RAILWAY.

	Year.	Capital.	Working Expenses.
		$ cts.	$ cts.
Government expenditure prior to Confederation			
do since do	1868		
do do do	1869		
do do do	1870		
do do do	1871		
do do do	1872		
do do do	1873		
do do do	1874		
do do do	1875		
do do do	1876		
do do do	1877		
do do do	1878		
do do do	1879		
do do do	1880		
do do do	1881		
do do do	1882		
do do do	1883		
do do do	1884	1,284,311 97	10,033 77
do do do	1885	2,055 92	78,273 65
do do do	1886	183 79	94,756 06
do do do	1887		94,254 04
do do do	1888		90,954 73
do do do	1889	34,235 73	90,719 04
do do do	1890		79,102 77
do do do	1891	3,255 40	*
		1,324,042 81	538,094 06

* Included in Intercolonial Railway working expenses.

CARLETON BRANCH RAILWAY.

Government expenditure prior to Confederation			
do since do	1868		
do do do	1869		
do do do	1870		
do do do	1871		
do do do	1872		
do do do	1873		
do do do	1874		
do do do	1875		
do do do	1876		
do do do	1877		
do do do	1878		
do do do	1879		
do do do	1880		
do do do	1881		
do do do	1882		
do do do	1883		
do do do	1884		
do do do	1885		
do do do	1886	85,610 69	
do do do	1887	2,299 62	
do do do	1888	500 17	
do do do	1889		
do do do	1890		
do do do	1891		
		88,410 48	

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

CAPE BRETON RAILWAY.

——	Year.	Capital.	Working Expenses.
		$ cts.	$ cts.
Government expenditure prior to Confederation	1868		
do since do	1869		
do do do	1870		
do do do	1871		
do do do	1872		
do do do	1873		
do do do	1874		
do do do	1875		
do do do	1876		
do do do	1877		
do do do	1878		
do do do	1879		
do do do	1880		
do do do	1881		
do do do	1882		
do do do	1883		
do do do	1884		
do do do	1885		
do do do	1886		
do do do	1887	76,501 89	
do do do	1888	689,450 50	
do do do	1889	1,083,276 60	
do do do	1890	1,170,523 62	
do do do	1891	521,441 62	
		3,541,194 23	

OXFORD AND NEW GLASGOW RAILWAY.

Government expenditure prior to Confederation	1868		
do since do	1869		
do do do	1870		
do do do	1871		
do do do	1872		
do do do	1873		
do do do	1874		
do do do	1875		
do do do	1876		
do do do	1877		
do do do	1878		
do do do	1879		
do do do	1880		
do do do	1881		
do do do	1882		
do do do	1883		
do do do	1884		
do do do	1885		
do do do	1886		
do do do	1887		
do do do	1888	280,932 35	
do do do	1889	840,553 57	
do do do	1890	434,074 60	
do do do	1891	220,886 39	
		1,776,446 91	

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

MONTREAL AND EUROPEAN SHORT LINE RAILWAY.

	Year.	Construction.	Working Expenses.
		$ cts.	$ cts.
Government expenditure prior to Confederation			
do since do do	1868		
do do do	1869		
do do do	1870		
do do do	1871		
do do do	1872		
do do do	1873		
do do do	1874		
do do do	1875		
do do do	1876		
do do do	1877		
do do do	1878		
do do do	1879		
do do do	1880		
do do do	1881		
do do do	1882		
do do do	1833		
do do do	1884		
do do do	1885	49,587 45	
do do do	1886	135,214 38	
do do do	1887	24,157 32	
do do do	1888	397 35	
do do do	1889		
do do do	1890		
do do do	1891	124,568 23	
		333,924 73	

PRINCE EDWARD ISLAND RAILWAY.

Government expenditure prior to Confederation		3,114,735 11	
do since do	1874		750 00
do do do	1875	46,086 63	49,344 62
do do do	1876	42,546 10	219,930 43
do do do	1877	200,000 00	228,595 25
do do do	1878	6,551 86	221,599 49
do do do	1879	40,129 05	223,313 12
do do do	1880	16,539 82	164,640 55
do do do	1881		203,122 88
do do do	1882	402 03	228,259 97
do do do	1883	57,186 02	252,808 41
do do do	1884	130,663 38	236,428 13
do do do	1885	76,956 56	211,207 01
do do do	1886	4,668 33	216,744 34
do do do	1887	5,800 00	204,237 45
do do do	1888		229,639 95
do do do	1889		247,559 44
do do do	1890		266,485 85
do do do	1891		257,990 08
		3,742,264 89	3,662,656 97

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

CANADIAN PACIFIC RAILWAY.

——	Year.	Construction, including Subsidy of $25,000,000.	Working Expenses.
		$ cts.	$ cts.
Government expenditure prior to Confederation			
do since do	1868		
do do do	1869		
do do do	1870		
do do do	1871	30,148 32	
do do do	1872	489,428 16	
do do do	1873	561,818 44	
do do do	1874	310,224 88	
do do do	1875	1,546,241 67	
do do do	1876	3,346,567 06	
do do do	1877	1,691,149 97	
do do do	1878	2,228,373 13	
do do do	1879	2,240,285 47	
do do do	1880	4,044,522 72	78,892 01
do do do	1881	4,968,503 93	236,944 98
do do do	1882	(1) 4,589,075 79	1,786 20
do do do	1883	(2) 10,033,800 04	266 09
do do do	1884	(3) 11,192,722 02	327 02
do do do	1885	(4) 9,900,281 53	
do do do	1886	(5) 3,672,584 81	
do do do	1887	(6) 915,057 49	
do do do	1888	52,098 65	
do do do	1889	86,716 07	
do do do	1890	40,980 54	
do do do	1891	37,367 00	
		* 61,977,947 69	318,216 30

* Agrees with Public Accounts balance sheet, 1890-91, page xiv.

(1)	Including	$ 2,210,000 00	on account subsidy
(2)	do	5,323,076 60	do
(3)	do	7,254,208 27	do
(4)	do	6,862,201 00	do
(5)	do	2,890,427 00	do
(6)	do	460,087 13	do
		$25,000,000 00	

LEONARD SHANNON,
Accountant

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

ANNAPOLIS AND DIGBY RAILWAY.

——	Year.	Capital.	Working Expenses.
		$ cts.	$ cts.
Government expenditure prior to Confederation			
do since do	1868		
do do do	1869		
do do do	1870		
do do do	1871		
do do do	1872		
do do do	1873		
do do do	1874		
do do do	1875		
do do do	1876		
do do do	1877		
do do do	1878		
do do do	1879		
do do do	1880		
do do do	1881		
do do do	1882		
do do do	1883		
do do do	1884		
do do do	1885		
do do do	1886		
do do do	1887		
do do do	1888		
do do do	1889	9,847 27	
do do do	1890	381,942 75	
do do do	1891	196,869 36	
		588,659 38	

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

RECAPITULATION—RAILWAYS.

——	Year.	Construction.	Working Expenses.
		$ cts.	$ cts.
Government expenditure prior to Confederation		13,881,460 65	
do since do	1868	483,353 65	359,961 08
do do do	1869	282,615 18	387,548 47
do do do	1870	1,729,381 49	445,208 75
do do do	1871	2,946,930 45	442,993 31
do do do	1872	5,620,569 67	595,076 22
do do do	1873	5,763,268 81	1,011,892 60
do do do	1874	3,925,123 69	1,847,925 24
do do do	1875	5,018,427 85	1,581,934 24
do do do	1876	4,497,434 75	1,497,128 22
do do do	1877	3,209,502 16	1,890,268 80
do do do	1878	2,643,741 73	2,032,873 05
do do do	1879	2,507,053 71	2,233,496 34
do do do	1880	6,109,077 14	1,851,489 26
do do do	1881	5,577,236 73	2,220,421 39
do do do	1882	5,175,046 61	2,310,638 54
do do do	1883	11,707,619 02	2,636,551 70
do do do	1884	14,013,074 89	2,613,508 87
do do do	1885	11,224,244 54	2,749,710 53
do do do	1886	4,443,220 17	2,819,973 50
do do do	1887	1,846,887 18	3,152,650 40
do do do	1888	1,765,582 11	3,621,076 62
do do do	1889	2,709,857 37	3,513,063 67
do do do	1890	2,392,767 99	3,846,044 42
do do do	1891	1,184,317 34	3,949,263 73
		120,657,794 88	49,610,698 95

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 31st December, 1891.

APPENDIX No. 3.

STATEMENT showing Subsidies voted for Railways as to which contracts have been entered into and payments made, up to 30th June, 1891.

Subsidies Voted.				Railways.	Payments.								Total to June 30, 1891.
Authority.			Amount.		1883-84.	1884-85.	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.	1890-91.	
			$ cts.		$	$	$	$	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
46 Vic., cap.	25		156,800 00	International Ry., Quebec	144,000				8,960 00		3,840 00		156,800 00
53 do	2												
45 do	14		384,000 00	Quebec and Lake St. John Ry., Quebec	32,000	37,027	186,745	202,219	232,013 00	19,911 00	38,440 00	70,350 00	818,705 00
46 do	25		80,000 00										
48-9 do	59		96,000 00										
49 do	10		186,295 00										
50-1 do	24		28,800 00										
51 do	3		96,000 00										
46 do	25		89,600 00	Napanee, Tamworth & Quebec Ry., Ontario	32,000	57,600					95,744 00	7,600 00	192,944 00
49 do	10		70,000 00										
50-1 do	24		12,800 00										
52 do	3		32,000 00										
47 do	8		272,000 00	Pontiac Pacific Junc. Ry., Que.		49,090	41,000	60,580	24,158 00				174,828 00
46 do	25		115,200 00	Caraquet Ry., N.B.		32,000	76,800	61,200	40,050 00	13,950 00			224,000 00
47 do	8		76,800 00										
50-1 do	24		32,000 00										
47 do	8		32,000 00	Great Northern Ry., Quebec		25,088					20,000 00	9,500 00	54,588 00
49 do	10		57,600 00										
52 do	3		22,400 00										
47 do	8		48,000 00	Kingston & Pembroke Ry., Ont.		48,000							48,000 00
45 do	14		660,000 00	Northern & Pacific Junction Ry., Ontario		154,440	1,051,590	78,370			35,000 00	600 00	1,320,000 00
46 do	26		660,000 00										
53 do	2												
47 do	8		128,000 00	Nothern & Western Ry., N.B.			128,000	18,200	159,400 00	6,300 00	100 00		312,000 00
48-9 do	59		19,200 00										
49 do	10		32,000 00										
48-9 do	59		140,800 00										
47 do	8		60,342 00	Quebec Central Ry., Quebec			60,342						60,342 00
51 do	3												
53 do	2		288,000 00										
48-9 do	59		72,000 00	Montrea and Sorel Ry., Que.			64,972	4,950			6,719 50	17,116 07	93,757 57
53 do	2		40,000 00										

48-9	do	59	30,000 00	Montreal and Champlain Junction Railway, Que.			30,000		16,400 00	36,700 00	5,400 00		88,500 00
50-1	do	24	64,000 00										
51	do	3	9,600 00										
46	do	25	38,400 00	Elgin, Petitcodiac and Havelock Railway, N.B.			38,400						38,400 00
47	do	8	22,400 00	St. Louis & Richibucto Ry., N.B			22,400						22,400 00
48-9	do	59	96,000 00	Canada Atlantic Ry., Ont			48,480	44,384		9,491 20	149,812 00	30,188 00	282,355 20
49	do	10	38,400 00										
50-1	do	24	180,000 00										
47	do	6	750,000 00	Esquimalt & Nanaimo Ry., B.C			422,520	327,480					750,000 00
47	do	8	96,000 00	Erie and Huron Railway, Ont.				96,000					96,000 00
46	do	25	320,000 00	Baie des Chaleurs Ry., Que.				250,000	50,300 00	75,200 00	148,675 00		524,175 00
47	do	8	300,000 00										
52	do	3											
48-9	do	59	118,400 00	New Brunswick & P.E. Ry., N.B				97,440	16,000 00				113,440 00
50-1	do	24	217,600 00	St. Lawrence, Lower Laurentian and Saguenay Railway, Que.				64,430	28,383 00			32,003 00	124,816 00
49	do	10	11,200 00	L'Assomption Railway, Quebec.				11,200					11,200 00
49	do	10	32,000 00	Great Eastern Railway, Que				19,200				16,300 00	35,500 00
50-1	do	24	96,000 00										
47	do	8	160,000 00	Irondale, Bancroft and Ottawa Railway, Ontario				15,000					15,000 00
52	do	3											
49	do	10	96,000 00	Buctouche and Moncton Railway, N.B.				40,480	20,573 57		4,366 00	1,600 43	67,020 00
50-1	do	24	6,400 00										
47	do	8	51,200 00	Albert Southern Railway, N.B.				1,000	18,428 57	1,387 06		10,684 37	31,500 00
52	do	3											
48-9	do	59	65,200 00	Lake Temiscamingue Colonization Railway, Quebec				14,400	3,000 00	9,000 00	26,360 00		52,760 00
50-1	do	24											
49	do	10	38,400 00	Joggins Railway, N.S.					26,138 78		9,761 22	1,600 00	37,500 00
50-1	do	24	4,000 00										
45	do	14	240,000 00	Temiscouata Railway, N. B. and Quebec					249,684 00	163,216 00	74,309 00	82,770 00	569,970 00
48-9	do	58	258,000 00										
51	do	3	100,000 00										
48-9	do	59	44,800 00	Leamington and St. Clair Railway, Ontario					32,000 00	19,200 00			51,200 00
50-1	do	24	6,400 00										
49	do	10	16,000 00	Toronto, Grey & Bruce Ry., Ont.					14,656 00				14,656 00
50-1	do	24	22,400 00	Dominion Lime Co., Quebec					11,840 00	3,520 00			15,360 00
49	do	10	256,000 00	West Ontario Pacific Ry., and Ontario and Quebec Ry.					60,000 00	800 00	189,200 00	6,000 00	256,000 00
53	do	2											
50-1	do	24	96,000 00	Drummond County Ry., Que.					15,057 00	13,815 00	12,428 00	136,000 00	177,300 00
52	do	3	14,400 00										
53	do	2	76,800 00										
48-9	do	59	128,000 00	Brockville, Westport and Sault Ste. Marie Railway, Ont.						45,000 00		47,400 00	92,400 00
53	do	2											
49	do	10	32,000 00	Montreal and Lake Maskinongé Railway, Quebec						19,700 00	20,080 00	1,500 00	41,280 00
53	do	2	10,200 00										
50-1	do	24	54,400 00	South Norfolk Railway, Ont.						54,400 00			54,400 00
50-1	do	24	51,200 00	Guelph Junction Railway, Ont.						46,000 00			46,000 00
48-9	do	59	22,400 00	Belleville and North Hastings Railway, Ontario						21,888 00			21,888 00
49	do	10											

Subsidies Voted.			Railways.	Payments.								Total to June 30, 1891.
Authority.		Amount.		1883-84	1884-85.	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.	1890-91.	
		$ cts.		$	$	$	$	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
45 Vic., cap.	10	108,800 00	Hereford Railway, Quebec. .						63,900 00	91,300 00		155,200 00
52 do	3	48,000 00										
50-1 do	24	118,400 00	Lake Erie, Essex and Detroit River Railway, Ontario						106,500 00	11,900 00		118,400 00
50-1 do	24	96,000 00	Beauharnois Junction Ry., Que.						54,650 00	4,250 00		58,900 00
50-1 do	24	38,400 00	St. Catharines and Niagara Central Railway, Ontario						26,640 00		11,760 00	38,400 00
52 do	3	64,000 00										
52 do	3	30,000 00	Fredericton and St. Mary's Ry. Bridge Co., N.B.						30,000 00			30,000 00
50-1 do	24	9,600 00	Harvey Branch Ry. Co., N.B.						5,553 57			5,553 57
50-1 do	24	108,800 00	Nova Scotia Central Railway Co., N.S.							219,100 00	3,300 00	222,400 00
51 do	3	147,200 00										
50-1 do	24	44,800 00	Cumberland Ry. & Coal Co., N.S							29,400 00	10,450 00	39,850 00
52 do	3	19,200 00	Pontiac & Renfrew Ry. Co., Ont.							9,800 00	3,800 00	13,600 00
52 do	3	54,400 00	Thousand Islands Ry. Co., Ont.							10,400 00		10,400 00
52 do	3	96,000 00	Quebec, Montmorency & Charlevoix Railway, Quebec.							65,600 00		65,600 00
52 do	3	375,000 00	St. Clair Frontier Tunnel Co., Ontario							173,000 00	143,400 00	316,400 00
50-1 do	24	57,600 00	Brantford, Waterloo and Lake Erie Railway, Ontario.							36,620 00	16,190 00	52,810 00
51 do	3	287,200 00	Port Arthur, Duluth and Western Railway, Ontario.								87,000 00	87,000 00
53 do	2											
50-1 do	24	192,000 00	Montreal and Ottawa Railway, Ontario								49,960 00	49,960 00
53 do	2											
50-1 do	24	44,800 00	Cornwallis Valley Ry., N.S...								42,670 00	42,670 00
52 do	3											
52 do	3	320,000 00	Ottawa and Gatineau Valley Railway, Quebec.								87,582 00	87,582 00
52 do	3	142,400 00	Central Railway, N.B.								75,639 00	75,639 00
53 do	2											
53 do	2	361,270 00	Montreal and Western Ry., Que.								76,143 00	76,143 00
				208,000	403,245	2,171,249	1,406,533	1,027,041 92	846,721 83	1,491,595 72	1,079,105 87	8,633,492 34

This return does not include the following :—
1. The Canada Central Railway. 2. The Canadian Pacific Railway—main line. 3. The Atlantic and North-Western Railway.

LEONARD SHANNON,
Accountant.

DEPARTMENT OF RAILWAYS AND CANALS, OTTAWA, 31st December, 1891.

[1891]

APPENDIX No. 4.

DEPARTMENT OF RAILWAYS AND CANALS,
OFFICE OF THE CHIEF ENGINEER AND GENERAL MANAGER,
OTTAWA, 11th November, 1891.

SIR,—I have the honour to submit to you my annual report in connection with the construction of the following railways:—The Canadian Pacific Railway, the Cape Breton Railway, the Oxford and New Glasgow Railway, the Digby and Annapolis Railway, and also the subsidized railways, both to the 30th June, 1891, and to the present date.

CANADIAN PACIFIC RAILWAY.

The arbitrators appointed to adjudicate upon the claim made upon the Government by the Canadian Pacific Railway Company in connection with the construction of the section of railway built by the Government between Savona's Ferry and Port Moody, amounting to about $12,000,000, have made their award, which amounts to $579,255, which, I presume, closes this part of the case. The arbitrators, however, have still two small matters of dispute to settle between the Government and the company—one relating to steel rails in temporary tracks, etc., along the Pembina branch, amounting to $57,481.71, to which the company claim to be entitled free of charge, and the other being a claim arising out of the transfer, under agreement, of a surplus of 3,185 tons of steel rails remaining on the line between Port Arthur and Cross Lake, at the date of the transfer of this section by the Government to the company, the latter alleging that the value placed on these rails by the Government was excessive. So soon as the award is paid, and the two small claims just described are settled, the Government account for construction will be closed, with the exception of a number of land claims.

I should state that the amount of the award is to be expended under the supervision of a Government officer, whose duty it will be to see that the work covered by the award be well and faithfully carried out. Had this work been originally executed by the contractor he would have been paid for it at his contract schedule prices for the several classes of work, inasmuch as his contract was an item schedule one; this being the work which the arbitrators have called upon the Government to execute, the latter is involved in no actual loss, inasmuch as the arbitrators, as I understand the matter, have merely decided that the Government had left undone work amounting to the value of $579,255, which was necessary to complete the road up to the standard called for by their contract with the company.

As stated in my last report, dated 9th October, 1890, this railway was opened for traffic across the continent on the 28th June, 1886, with a length of road in operation of 4,274 miles. The gross earnings for the first twelve months were $10,650,254. On the 30th June, 1891, with a mileage under traffic of 5,564 miles, the gross earnings for the year then closed amounted to $18,672,174, showing a marvellous development in those five years. The future prospects of the line are still more encouraging, and its usefulness in the development of the trade of the country is everywhere felt.

CAPE BRETON RAILWAY.

The total length constructed of the Cape Breton Railway, including branch lines, is 98½ miles. Since my last report, 9th October, 1890, the road, though not thoroughly completed, was put under traffic as follows:—Point Tupper to Grand Narrows on 1st January, 1891; Grand Narrows to Sydney and North Sydney, 24th November, 1890.

It was operated throughout the winter, with some difficulty, owing to the slides which took place from time to time from the stiff clay slopes of the cuttings and the slipping away of the embankments; upon the opening of spring, well-manned construction trains were set to work to remove the material which had slid down from the slopes, to complete the filling of embankments, the ballasting and other work. This work had been prosecuted throughout the season under the supervision of Mr. Hiram Donkin, the District Superintendent of the traffic department. Owing to the unforeseen heavy settlement in some of the embankments, and the damage done to the works by gales of wind and heavy wind storms which have prevailed during the season, much more has had to be done than was calculated upon, and at this date all is not in complete order; but Mr. Donkin informs me that in two or three weeks, or sooner, it will be ready for transfer to the traffic department.

Upon this road there are several large steel structures, the most important being the bridge over the "Grand Narrows" of the Bras d'Or Lakes. It is 1,720 feet in length, and is composed of six spans, each of 242 feet, and a swing span of 245 feet, all resting on massive masonry piers and abutments, the piers being in a depth of 75 feet of water. This is a very fine piece of workmanship, carried through to completion in a most satisfactory manner by the contractors, Messrs. Reid and Isbester. The other structures referred to are steel trestles of some magnitude, being of great height and considerable length. The whole of the structures, including culverts, are of the most durable and substantial character, and the road is first-class in every respect.

Expenditure up to 30th June, 1891.....	$3,541,194	23
do from 30th June to 31st Oct., 1891.....	58,278	77
	$3,599,473	00

OXFORD AND NEW GLASGOW RAILWAY.

This road is 72½ miles in length, including the Pugwash branch. Although not actually completed, it was put under traffic on the 15th July, 1890, and has since been in successful operation. The works of construction are completed, with the exception of three water stations. Two first-class passenger cars are also still required. Great difficulty has been experienced in obtaining a water supply at Pugwash and Wallace stations, and even yet this has not been done with complete success, though drill holes have been sunk into the rock at these two points several hundred feet below the bottom of the wells. At any day, however, a supply may be reached. The two first-class cars are under contract with Messrs. James Harris & Co., of St. John, N.B., and will be ready for delivery very shortly. The road is in good running order, and is built in a very substantial and durable manner, the superstructures of the bridges being of steel, and resting on solid masonry, and the culverts of masonry and double-strength vitrified clay culvert pipes.

Expenditure up to 30th June, 1891.....	$1,776,446	91
do from 30th June to 31st Oct., 1891.....	16,695	80
	$1,793,142	71

DIGBY AND ANNAPOLIS RAILWAY.

This section of railway is 20 miles in length. It extends from Digby to Annapolis, and is familiarly known as the "Missing Link." It is a section of the Western Counties Railway, which took possession of it on its completion by Government on the 27th July, 1891, and which has since operated it successfully. I believe it has not only proved to be a great boon to the travelling public and to commercial men, but to the Western Counties Railway Company also, which has made an arrangement with the Windsor and Annapolis Railway Company under which passengers run through from

Yarmouth to Halifax without change of cars. The final estimate in favour of Messrs. O'Neil & Campbell, the contractors for the construction of this road, has not yet been issued, but will be complete in a few days.

Expenditure up to 30th June, 1891	$588,659 38
do from 30th June to 31st Oct., 1891	12,925 43
	$601,584 81

RAILWAYS SUBSIDIZED IN CASH, RAILS OR LAND.

LIST of Railways receiving a Cash Subsidy per mile, in a lump sum, or 15 per cent on cost of tunnel or bridge: showing the amount of subsidy granted to each, amounts paid up to 30th June, 1890, during the year ended 30th June, 1891, and during the three months ended 30th September, 1891, respectively; also, the total amount paid up to the last named date.

Name of Railway.	Estimated Length in Miles.	Subsidy Granted.	Subsidy Paid to 30th June, 1890.	Subsidy paid during the year ended 30th June, 1891.	Subsidy Paid during the three months ended 30th September, 1891.	Total Subsidy Paid up to 30th September, 1891.
		$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Albert Southern	16	51,200 00	20,815 63	10,684 37	11,800 00	43,300 00
Amherstburg and Lake Shore	20	64,000 00	.....	.....	.....	.....
Baie des Chaleurs	70	620,000 00	524,175 00	.....	.....	524,175 00
Beauharnois Junction	30	96,000 00	58,900 00	.....	.....	58,900 00
Belleville and Lake Nipissing	30	96,000 00	.....	.....	.....	.....
Belleville and North Hastings	7	22,400 00	21,888 00	.....	.....	21,888 00
Brantford, Waterloo and Lake Erie	18	57,600 00	36,620 00	16,190 00	.....	52,810 00
Brockville, Westport and Sault Ste. Marie	60	192,000 00	45,000 00	47,400 00	.....	92,400 00
Buctouche and Moncton	32	102,400 00	65,419 57	1,600 43	.....	67,020 00
Canada Atlantic	53 and bridge	314,400 00	252,167 20	30,188 00	.....	282,355 20
Canada Central	120	1,525,250 00	1,525,250 00	.....	.....	1,525,250 00
Canadian Pacific	2,005	25,000,000 00	25,000,000 00	.....	.....	25,000,000 00
Canadian Pacific Extension	160	1,500,000 00	.....	.....	.....	.....
Cap Rouge and St. Lawrence	12	38,400 00	.....	.....	.....	.....
For a line from Cape Tormentine towards Murray Bay	20	64,000 00	.....	.....	.....	.....
Caraquet	67	224,000 00	224,000 00	.....	.....	224,000 00
Central of New Brunswick	44½	142,400 00	.....	75,639 00	.....	75,639 00
Cobourg, Northumberland and Pacific	30	96,000 00	.....	.....	.....	.....
Cornwallis Valley	14	44,800 00	.....	42,670 00	.....	42,670 00
Columbia and Kootenay	35	112,000 00	.....	.....	.....	.....
Cumberland	14	44,800 00	29,400 00	10,450 00	.....	39,850 00
Dominion Lime Company	6	22,400 00	15,360 00	.....	.....	15,360 00
Drummond County	58½	187,200 00	41,300 00	136,000 00	5,105 00	182,405 00
Elgin, Petitcodiac & Havelock	12	38,400 00	38,400 00	.....	.....	38,400 00
Erie and Huron	52	166,400 00	96,000 00	.....	.....	96,000 00
Esquimalt and Nanaimo	71	750,000 00	750,000 00	.....	.....	750,000 00
For a line from Fredericton to the N. B. Ry. *viâ* Oromocto and Gagetown	30	96,000 00	.....	.....	.....	.....
Fredericton and St. Mary's Ry. Bridge Company	1¼	30,000 00	30,000 00	.....	.....	30,000 00
Grand Trunk, Georgian Bay and Lake Erie	15	48,000 00	.....	.....	.....	.....
Great Eastern	60	229,500 00	19,200 00	16,300 00	4,845 00	40,345 00
Great Northern	50	160,000 00	45,088 00	9,500 00	.....	54,588 00
Guelph Junction	16	51,200 00	46,000 00	.....	.....	46,000 00

RAILWAYS SUBSIDIZED IN CASH, RAILS OR LAND—*Continued.*

List of Railways receiving a Cash Subsidy per mile, &c., up to 30th June, 1890.

Name of Railway.	Estimated Length in Miles.	Subsidy Granted.	Subsidy Paid to 30th June, 1890.	Subsidy Paid during the Year ended 30th June, 1891.	Subsidy Paid during the three months ended 30th September, 1891.	Total Subsidy Paid up to 30th September, 1891.
		$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Harvey Branch	3	9,600 00	5,554 00			5,554 00
Hereford	49	156,800 00	155,200 00			155,200 00
International	49	156,800 00	156,800 00			156,800 00
Inverness and Richmond	50	50,000 00				
Irondale, Bancroft and Ottawa	50	160,000 00	15,000 00			15,000 00
Joggins	18½	58,400 00	35,900 00	1,600 00		37,500 00
Kingston and Pembroke	15	48,000 00	48,000 00			48,000 00
For a line from Lachine Bank to Rivière des Prairies	15	48,000 00				
L'Assomption	3½	11,200 00	11,200 00			11,200 00
Lake Erie, Essex and Detroit River	77	278,400 00	118,400 00			118,400 00
Lake Temiscamingue Colon	53½	177,200 00	52,760 00			52,760 00
Leamington and St. Clair	15	51,200 00	51,200 00			51,200 00
Massawippi Valley	10	32,000 00				
Massawippi Junction	15	48,000 00				
Maskinongé and Nipissing	30	96,000 00				
Montreal and Sorel	45	112,000 00	76,641 50	17,116 07		93,757 57
Montreal and Champlain Jun.	63	103,600 00	88,500 00			88,500 00
Montreal & Lake Maskinongé	13½	42,200 00	39,780 00	1,500 00		41,280 00
Montreal and Western	70	361,270 00		76,143 00		76,143 00
Napanee, Tamworth & Quebec	60	204,400 00	185,344 00	7,600 00		192,944 00
New Brunswick and Prince Edward	37	118,400 00	113,400 00			312,000 00
Northern and Western of N.B.	100	320,000 00	312,000 00			1,320,000 00
Northern and Pacific Junction	110	1,320,000 00	1,319,400 00	600 00		222,400 00
Nova Scotia Central	80	256,000 00	219,100 00	3,300 00		
Ontario and Pacific	53	172,400 00				
Orford Mountain	31	79,200 00				
Ottawa and Gatineau Valley	62	320,000 00		87,582 00		87,582 00
Ottawa and Parry Sound	52	166,400 00				
For a line from Ottawa to Morrisburg	52	166,400 00				
Oshawa Ry. & Navigation Co.	7	22,400 00				
Parry Sound Colonization	40	128,000 00			30,400 00	30,400 00
Pontiac Pacific Junction	95½	337,100 00	174,828 00			174,828 00
Pontiac and Renfrew	6	19,200 00	9,800 00	3,800 00		13,600 00
Port Arthur, Duluth and Western	89⅜	287,200 00		87,000 00	31,250 00	118,250 00
Quebec Central	105	348,342 00	60,342 00			60,342 00
Quebec and Lake St. John	248	1,003,495 00	748,355 00	70,350 00	9,600 00	828,305 00
Quebec, Montmorency and Charlevoix	30	96,000 00	65,600 00			65,600 00
South Norfolk	17	54,400 00				54,400 00
South Ontario Pacific	49	158,400 00				
For a line from Shelburne towards Annapolis	75	240,000 00				
Sicamous, on C.P.R., to near Lake Okanagan	51	163,200 00			65,010 00	65,010 00
St. Catharines and Niagara Central	46	147,200 00	26,640 00	11,760 00		38,400 00
St. Lawrence, Lower Laurentian and Saguenay	40	217,600 00	92,813 00	32,003 00		124,816 00
For a line from St. Césaire to St. Paul	5	16,000 00				
St. Louis, Richibucto and Buctouche	7	22,400 00	22,400 00			22,400 00

RAILWAYS SUBSIDIZED IN CASH, RAILS OR LAND—*Continued.*

LIST of Railways receiving a Cash Subsidy per mile, &c., up to 30th June, 1891.

Name of Railway.	Estimated Length in Miles.	Subsidy Granted.	Subsidy Paid to 30th June, 1890.	Subsidy Paid during the year ended 30th June, 1891.	Subsidy Paid during the three months ended 30th June, 1891.	Total Subsidy Paid up to 30th September, 1891.
		$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
St John Valley and Rivière du Loup	44	140,800 00	...	...	...	...
St. Lawrence and Adirondac	18	57,600 00	...	...	...	...
St. Stephen and Milltown	3½	11,200 00	...	...	...	...
St. Clair Frontier Tunnel	2	375,000 00	173,000 00	143,400 00	...	316,400 00
Stewiacke Valley and Lansdowne	25	80,000 00	...	...	...	...
For a line from Summerside to Richmond	3	9,600 00	...	...	...	...
Temiscouata	119	649,200 00	487,200 00	82,770 00	...	569,970 00
Thousand Isles	17	54,400 00	10,400 00	...	...	10,400 00
Tobique Valley	25	124,800 00	...	...	...	...
Toronto, Grey and Bruce	5	16,000 00	14,656 00	...	...	14,656 00
For a line from Truro to Newport	49	156,800 00	...	...	...	...
Vaudreuil and Prescott	60	192,000 00	...	49,960 00	...	49,960 00
West Ontario Pacific	80	256,000 00	250,000 00	6,000 00	...	256,000 00
Waterloo Junction	11	35,200 00	...	...	...	...
Western Counties	20	500,000 00	391,790 02	196,869 36	799 00	589,458 38
Woodstock and Centreville	6	19,200 00	Part lapsed.	...	...	...
Totals		43,273,357 00	34,471,426 92	1,275,975 23	158,809 00	35,906,211 15

It will be observed the above table includes the Canada Central Railway, the North Shore Railway, the Esquimalt and Nanaimo Railway and the Canadian Pacific Railway.

List of Railways receiving cash subsidies of fixed sums per annum for a series of years :—

Name of Railway.	Terms of Subsidy.
Atlantic and North-West	Subsidy not to exceed $250,000 per annum for 20 years.
Chignecto Marine Transport	do do 170,602 do do
Kingston, Smith's Falls and Ottawa	do do 12,534 do do

Amount paid annually to the Province of Quebec as interest upon subsidy granted to Quebec, Montreal, Ottawa and Occidental Railway ; 5 per cent. on $2,394,000—$119,700.

The railway subsidized from Montreal to St. Andrews, St. John and Halifax, to the amount of $250,000 per annum for twenty years, and contracted for by the Atlantic and North-West Railway Company, was divided into three sections, as follows :—

(1.) Montreal to Sherbrooke, 108 miles.

(2.) Internationul Boundary to Mattawamkeag, 144 miles.

(3.) Harvey to Salisbury, 115 miles.

The two first-named sections are completed and under traffic, entitling the company to receive the sum of $186,600 per annum for twenty years.

On the Chignecto Marine Transport Railway the works which it was expected would be completed by January next have been suspended owing, I believe, to difficulties met with on the London money market.

Cost of Railway Lines built by the Dominion Government and transferred to the Canadian Pacific Railway Company up to 30th June, 1891	$30,338,366 26
From 30th June to 31st October, 1891	62,548 35
Total to 31st October, 1891	$30,400,914 61

Cost of Dominion Government Railways to 30th June and 31st October, 1891.

	Cost up to 30th June, 1891.	Expended from 30th June to 31st Oct., 1891.	Total cost to 31st Oct., 1891.
	$ cts.	$ cts.	$ cts.
Intercolonial Railway	46,988,163 15	31,031 93	47,019,195 08
Eastern Extension Railway	1,321,986 89	46 30	1,322,033 19
Cape Breton Railway	3,541,194 23	58,278 77	3,599,473 00
Oxford and New Glasgow Railway	1,776,446 91	16,695 80	1,793,142 71
Prince Edward Island Railway	3,741,780 89	450 47	3,742,231 36
Total	57,369,572 07	106,503 27	57,476,074 74

List of Railways to which grant of Subsidies in Old Rails to the value appearing opposite their respective names has been authorized by Parliament.

Name of Railway.	Value of old Iron Rails Granted as Subsidy.	Remarks.
	$ cts.	
Albert	14,665 45	
Central of New Brunswick	83,612 54	Earned and transferred.
Chatham Branch	24,439 84	do do
Elgin, Petitcodiac and Havelock	44,252 82	do do
Kent Northern	58,334 27	
Halifax Cotton Company	4,335 00	
Steel Company of Canada	11,964 66	

List of Railways to which grants of Land Subsidies have been authorized by Parliament.

Name of Railway.	Miles.	Acres Granted.	Remarks.
Alberta Railway and Coal Co	50	320,000	
Alberta and Athabaska Railway Co	300	1,920,000	
Brandon and South-Western Railway Co	17	108,800	
Calgary and Edmonton Railway Co	340	2,176,000	
Canadian Pacific Railway Co	2,245	26,568,000	2,005 miles completed and in operation.
Esquimalt and Nanaimo Railway Co	78	1,900,000	Completed and in operation.
Great North-West Central Railway Co	450	2,880,000	50 miles constructed.
Lake Manitoba Railway and Canal Co	142	902,000	
Lake Seul Railway Co	18	115,200	
Manitoba and South-Western Railway Co	456	2,918,400	250 miles completed and in operation.
Manitoba South-Western Colonization Railway Co	218¼	1,396,800	
Manitoba and South-Western Railway Co	100	704,000	
Medicine Hat Railway and Coal Co	8	51,200	
North-Western Railway Co. of Canada	330	3,300,000	
North-Western Coal and Navigation Co	210	1,091,100	109 miles constructed and in operation.
Qu'Appelle, Long Lake and Saskatchewan	348⅓	2,229,333	248 miles constructed.
Red Deer Valley Railway and Coal Co	55	352,000	
Winnipeg and Hudson Bay Railway Co	No distance named.	.....	6,400 acres per mile in Manitoba, and 12,800 in North-West Territories. 40 miles constructed.
Wood Mountain and Qu'Appelle Railway Co	240	1,536,000	

Name changed by 52 Vic., cap. 65, to the North-Western Railway Company of Canada.

I am not in possession of the information necessary to enable me to state the position of the land subsidies as regards the quantities of land conveyed to the companies.

I have the honour to be, Sir,

Your obedient servant,

(Signed) COLLINGWOOD SCHREIBER,

Chief Engineer and Gen. Manager.

A. P. Bradley, Esq.,

Secretary, Dept. Railways and Canals.

APPENDIX No. 4.

REPORT OF CHIEF ENGINEER ON GOVERNMENT RAILWAYS IN OPERATION.

DEPARTMENT OF RAILWAYS AND CANALS,
OFFICE OF THE CHIEF ENGINEER AND GENERAL MANAGER,
OTTAWA, 18th November, 1891.

SIR,—I have the honour to submit to you my annual report in connection with the operation of the Government railways for the year ended 30th June, 1891, accompanied by the reports of the Chief Superintendent, Chief Engineer and Mechanical Superintendent of the Intercolonial Railway, and also that of the Superintendent and Mechanical Superintendent of the Prince Edward Island Railway, together with statements of accounts prepared by the accountants of these roads.

Table showing the length of the Government railways in operation on the 30th of June, 1891 :—

INTERCOLONIAL RAILWAY.

	Miles.	
Chaudière Junction to Halifax	678	
Moncton to St. John	89	
Truro to Sydney	217	
Oxford Junction to Pictou	70	
Chaudière Junction to Lévis	8	
Lévis to St. Charles Junction *viâ* Harlaka	14	
Dalhousie Junction to Dalhousie	7	
Derby Junction to Indiantown	14	
Panisec Junction to Pointe du Chene	11	
Pugwash Junction to Pugwash	5	
Stellarton Junction to Brown's Point Junction	12	
New Glasgow to Pictou Landing	7	
Richmond to Dartmouth	5	
Total miles showing a regular train service		1,142

FREIGHT BRANCHES.

		Miles.	
Rivière du Loup, Wharf Branch		4	
Rimouski	do	2	
Dorchester	do	1	
Newcastle	do	2	
Sackville	do	½	
Stewiacke	do	1	
Courtney Bay	do	1	
Halifax Cotton Factory	do	1	
		—	12½
Total length of Intercolonial Railway			1,154½

WINDSOR BRANCH.

Windsor Junction to Windsor	32

PRINCE EDWARD ISLAND RAILWAY.

	Miles.	
Souris to Tignish	168	
Mount Stewart to Georgetown	24	
Charlottetown to Royalty Junction	5	
Emerald Junction to Cape Traverse	13	
Alberton to Cascumpec Wharf	1	
	---	211
Total length of Government railways		1,397½

The result of the year's operations of the Government railways may be stated as follows:—

Name of Railway.	Average Mileage operated for the Year.	—	Amount	Profit.	Loss.
			$ cts.	$ cts.	$ cts.
Intercolonial Railway, including E. E. Ry. & C. B. Ry.	1,094	Earnings	2,977,395 38		
		Working expenses.	3,662,341 94	.....	684,946 56
Windsor Branch Ry	32	Earnings	30,235 13		
		Working expenses.	28,931 71	1,303 42	
Prince Edward Island Ry.	211	Earnings	174,258 05		
		Working expenses.	257,990 08	.....	83,732 03
					768,678 59
					1,303 42
Total average miles	1,337		Net loss	.....	767,375 17

The above statement does not show a satisfactory state of things as regards the net results, but the increased service, and the additional mileage of railway put in operation during the year, have been a great accommodation to the travelling public, an immense convenience to the localities traversed by new lines, and of great service in facilitating trade.

INTERCOLONIAL RAILWAY.

(Including the Eastern Extension and Cape Breton Railway.)

Since the date of my last Annual Report an Act of Parliament was passed consolidating the lines operated by the Government on the mainland, under the name and style of "The Intercolonial Railway," with a total length of 1,154½ miles. The sections composing this mileage are given at the commencement of this report. The new road opened for traffic during the year is as follows:—

Oxford Junction to Brown's Point Junction and Pugwash, 72½ miles, opened on the 15th July, 1890.

Point Tupper to Grand Narrows, C.B., 46 miles, put under traffic on 1st January, 1891; Grand Narrows to Sidney and North Sidney, with loop connecting with the International Coal Company's railway at Sidney, 52½ miles, opened for traffic on the 24th November, 1890.

The total length of additional road placed under traffic during the year was therefore 170 miles.

The full development of the traffic on these new portions must necessarily take some time, but the business done so far has been fully equal to my expectations, and the summer tourist travel on the Cape Breton section looked most encouraging. The scenery throughout the island is very beautiful especially along the shores of the Bras d'Or Lakes, and the air is fresh and health-restoring. This is well known to travellers, these lakes having for years been frequented by foreign tourists.

I regret that I have to record a serious accident which befell the through express train going west on the 18th December last, at St. Joseph, about 1½ miles east of Lévis station, resulting in the loss of the lives of several passengers, and in injury to a number of others. This is the first really serious accident which has occurred on the Intercolonial Railway. Had the cars been heated by stoves the loss of life might have been much greater, as all the passenger cars rolled down an embankment on their sides. The train being heated by steam from the locomotive, no fire occurred.

The system of heating passenger trains by steam from the locomotive continues to give satisfactory results. There are now 56 engines and 165 cars fitted up for heating in this manner. The lighting of the cars by electricity is another safeguard against fire in case of collision or when overturned. This method of lighting, though very expensive, costing about twelve times as much as oil lighting, has been introduced upon the through express trains, 82 cars being fitted up for it.

With a view of guarding the employés from accident, the Westinghouse air brake is being applied to the freight cars and the Westinghouse air driver brake to the engines, 616 freight cars and 57 engines being fitted with these brakes—but the first advantage to be derived from the use of these air brakes cannot be realized until all freight cars running over the road are furnished with them; and this means, not only the cars of the Intercolonial Railway, but also those of other roads interchanging cars with it; for, so long as trains are partly made up of cars fitted with the hand brake the brakemen will have to mount on the top of them, a proceeding admittedly dangerous in this cold climate.

The yard and freight shed accommodation at Halifax is still inadequate to the proper despatch of business. An appropriation of $150,000 has been granted towards the increase of this accommodation, but no further progress has been made in the direction of providing it.

The following is a statement of the quantity and classes of rolling stock purchased on capital account up to 30th June, 1891, including that of the Eastern Extension and Cape Breton Railways:—

	Engines.	Passenger Car Stock.					Conductors' Vans.	Box and Cattle Cars.	Platform Cars.	Coal Cars of three several kinds.	Snow Ploughs.	Wing Ploughs.	Flangers.	Rotary Steam Ploughs.
		1st Class Sleeping and Parlour.	1st Class.	2nd Class Sleeping.	2nd Class.	Baggage and Mail.								
	202	15	87	6	95	24	99	2071	2123	895	44	10	21	2
										513				
	....	5	....	....	....	39	...	103	...	801	...	...	....	....
		20				63		2174		2209				

In addition to the 202 engines, there are 4 still in use, which have been replaced with 4 new ones, at cost of revenue.

The following is a statement of the quantity and classes of rolling stock which has been rebuilt during the year at cost of revenue to maintain the stock :—

	Engines.	Passenger Car Stock.					Conductors' Vans.	Box and Cattle Cars.	Platform Cars.	Coal Cars of three several kinds.	Snow Ploughs.	Wing Ploughs.	Flangers.	Rotary Steam Ploughs.
		1st Class Sleeping and Parlour.	1st Class.	2nd Class Sleeping.	2nd Class.	Baggage and Mail.								
	....	.....	3	1	....	3	2	4 7	14	5 7	1	....	1	
								11		12				

The following table shows the gross earnings, the tonnage of freight and number of passengers carried each year since the 1st July, 1876, when the roadway was first opened as a through line, including the traffic of the Eastern Extension and Cape Breton Railways :—

Year.	Average Miles in Operation.	Gross Earnings.	Tons of Freight Carried.	No. of Passengers Carried.
		$ cts.		
1876-77	714	1,154,445 33	421,327	613,420
1877-78	714	1,378,946 78	522,710	618,957
1878-79	714	1,294,009 69	510,861	640,101
1879-80	829	1,506,298 48	561,924	581,483
1880-81	840	1,760,393 92	725,577	631,245
1881-82	840	2,079,262 66	838,956	779,994
1882-83	840	2,370,910 10	970,961	878,600
1883-84	887	2,384,414 92	1,009,237	944,636
1884-85	941	2,441,203 66	989,936	957,228
1885-86	946	2,450,093 88	1,023,788	932,880
1886-87	966	2,660,116 93	1,143,020	982,784
1887-88	971	2,983,336 05	1,288,823	1,040,163
1888-89	971	2,967,801 00	1,218,877	1,136,272
1889-90	971	3,012,739 87	1,368,819	1,219,233
1890-91	1,094	2,977,395 38	1,304,534	1,298,304

The following table shows the number of tons of coal carried over the Intercolonial Railway from the Nova Scotia collieries to Chaudière Junction and points west thereof, in each calendar year since the commencement of the trade in 1879.

Year.	Tons.	Year.	Tons.
1879..	570	1885..	165,791
1880..	10,246	1886..	175,512
1881..	30,629	1887..	192,022
1882..	35,089	1888..	173,730
1883..	54,891	1889..	157,407
1884..	112,898	1890..	137.472

There were 1,792 tons of 67-lb. steel rails laid in the track during the year, to replace the 56-lb. rails lifted.

CAPITAL ACCOUNT.

Total cost of road and equipment to 30th June, 1890		$46,908,233 81
Add expenditure on Intercolonial Railway during the year :—		
Increased accommodation at Moncton.	$10,608 73	
do do St. John...	4,355 17	
St. Charles' Branch	12,033 49	
Indiantown do	402 63	
Dartmouth do	413 94	
Y at Truro	1,500 00	
Rolling stock	50,083 44	
Original construction	531 94	
		79,929 34
Add cost of following roads :—		
Oxford and New Glasgow	$1,776,446 91	
Cape Breton	3,541,194 23	
Eastern Extension	1,321,986 89	
		6,639,628 03
Total cost up to 30th June, 1891		$53,627,791 18

The cost of construction and equipment may be classified as follows :—

Road	$46,108,685 51
Rolling stock	7,519,105 67
Total	$53,627,791 18

Both road and rolling stock have been well maintained, and are in very efficient condition.

WINDSOR BRANCH.

The Windsor and Annapolis Railway Company continue to work the traffic of the road—the Government maintaining the way and works as heretofore—the former receiving two-thirds and the latter one-third of the gross earnings. The way and works have been well maintained, a considerable sum having been expended in renewing 4 miles of rails (the new rails being 56-lb. steel and the old ones iron rails of the same weight), and the replacing of seven spans of a wooden bridge over the Jordan River by seven spans of steel. The road is in efficient running condition.

The result of the arrangement for the year was :—

One-third of the gross earnings received by Government	$30,235 13
Cost of maintenance of way and works	28,931 71
Net profit	$ 1,303 42

In future years the gross earnings of the Windsor Branch should show a considerable increase over those of past years, inasmuch as there is now through connection between Halifax and Yarmouth, which should be the means of developing the trade between Halifax and the western section of Nova Scotia.

PRINCE EDWARD ISLAND RAILWAY.

No work on Capital Account having been executed during the year, the figures remain as on the 30th June, 1890 :—

Cost of road	$3,283,051 89
Cost of rolling stock	458,729 00
Total cost to 30th June, 1891	$3,741,780 89

The rolling stock provided on Capital Account, and representing the sum of $458,729 as above, consists of—

Engines.	Passenger Car Stock.				Box Cars.	Platform Cars.	Conductors' Vans.	Pay Cars.	Snow Ploughs	Flangers
	1st Class Cars.	2nd Class Cars.	Baggage and Smoking Cars	Official Cars.						
21	17	15	3	1	175	125	3	1	8	9

Statement of rolling stock rebuilt during the year:—Four platform cars.

Revenue Account.

The traffic of the year under consideration exceeds that of the preceding year, both as to volume and receipts, the latter being more by a few thousand dollars. There is, however, only a slight advance on that of 1888–89.

The earnings and working expenses were as follows:—

Earnings	$174,258 05
Working expenses	257,990 08
Net loss	$ 83,732 03

The following table shows the gross earnings, the tonnage of freight and number of passengers carried during each year since 30th June, 1875, when the railway was opened for traffic.

Year.	Miles in Operation.	Gross Earnings.	Tons Freight Carried.	No. of Passengers Carried.
		$ cts.		
1875-76	199	118,860 96	28,358	93,964
1876-77	199	130,664 92	41,039	93,478
1877-78	199	135,899 60	38,923	111,428
1878-79	199	125,855 99	38,668	105,046
1879-80	199	113,851 11	37,208	90,533
1880-81	199	131,131 43	45,336	102,937
1881-82	199	137,267 54	48,315	118,436
1882-83	199	146,170 42	51,920	117,162
1883-84	199	144,504 12	51,841	118,988
1884-85	210	158,588 06	57,346	130,423
1885-86	210	155,584 36	57,913	120,374
1886-87	210	155,303 37	53,589	130,067
1887-88	210	158,363 62	59,603	131,246
1888-89	210	171,369 56	55,682	152,780
1889-90	210	160,971 78	51,604	133,099
1890 91	210	174,258 05	59,511	145,508

During the year four wooden bridges have been replaced by steel superstructures resting on masonry abutments, and only a few wooden bridges now remain on the road, which it is proposed to replace by steel so soon as they require rebuilding. The length of road laid with 50-lb. steel rails is 85 miles, leaving 125 miles of 40-lb. iron rails, which have been in service 18 years, and begin to show signs of wear. It will therefore be necessary to continue year by year, until the whole line is steeled, using the best of the old iron rails lifted each year for repair.

The necessary repairs to way and works have been made, and the rolling stock is in good condition.

I do not look for any very brisk business during the next year, as the potato crop in the island is said to be a failure, while the wheat crop is unusually large. The result of this will be that very few potatoes will be moved, and that the flour will be produced at the mills throughout the island, instead of coming across the Straits either to Summerside or Charlottetown. Little distribution will, therefore, be necessary.

I regret to say that, owing to failing health, the Hon. Benjamin Davies, Paymaster and Travelling Auditor, is incapacitated for duty, and is, at his request, about to be placed on the retired list.

I have the honour to be, Sir,

Your obedient servant,

COLLINGWOOD SCHREIBER,

Chief Engineer and General Manager.

The Secretary, Department of Railways and Canals,
Ottawa.

INTERCOLONIAL RAILWAY.

OFFICE OF THE CHIEF SUPERINTENDENT,

MONCTON, N.B., 13th November, 1891.

SIR,—I have the honour to submit the following report on the working of the Intercolonial Railway during the fiscal year which ended 30th June, 1891.

I enclose the reports of the Chief Engineer and the Mechanical Superintendent, and the following statements prepared by the Chief Accountant and Treasurer:—

No. 1. Capital account.
" 2. Revenue account.
" 3. Locomotive power.
" 4. Car expenses.
" 5. Maintenance of way and works.
" 6. Station expenses.
" 7. General charges.
" 8. General stores account.
" 9. General balance.
" 10. Comparative statement of averages.

On the 12th July, 1890, the accounts of the Eastern Extension Railway, which had heretofore been kept separate, were, with the exception of the capital account, merged in the similar accounts of the Intercolonial Railway.

The mileage of the Eastern Extension Railway—80 miles—has, therefore, to be added to that of the Intercolonial Railway.

On the 15th July, 1890, the Oxford and New Glasgow Railway, extending from Oxford Junction to Pugwash and Brown's Point—72 miles—was opened for traffic.

On the 24th November, 1890, the portion of the Cape Breton Railway, extending from Sydney and North Sydney to Grand Narrows—50 miles—was opened for traffic, and on the 1st January, 1891, the balance of the Cape Breton Railway, extending from Grand Narrows to Point Tupper—46 miles—was opened for traffic.

The above additions increase the mileage of the Intercolonial Railway from 894 miles, included in last year's report, to 1,142 miles.

CAPITAL ACCOUNT.

The total cost of road and equipment on 30th June, 1890, was		$ 46,908,233 81
The additions during the year are as follows :—		
Construction of a Y at Truro	$ 1,500 00	
Increased accommodation, Moncton	10,608 73	
do do St. John	4,355 17	
Dartmouth Branch	413 94	
Indian Town Branch	402 63	
St. Charles Branch	12,033 49	
Rolling stock	50,083 44	
Construction	531 94	
		79,929
Total cost of road and equipment on 30th June, 1891		$ 46,988,163 1

The Y at Truro was completed during the year, and the amount charged to is a balance which was due for the completion of a bridge.

Increased Accommodation, Moncton.—This consists of a balance which was due for the erecting shop and the engine house which were completed during the year, and the cost of an extension of the freight shed.

Increased Accommodation, St. John.—This is a payment made to the Water Commissioners, St. John, under a judgment of the Exchequer Court, and some legal expenses in connection with the case.

Dartmouth Branch.—This is for legal expenses in connection with land claims.

Indian Town Branch.—This is a payment for land and for legal expenses.

St. Charles Branch.—This consists of payments for land, for interest, for legal services and for witness fees.

The charge for rolling stock consists of the cost of three additional parlor cars ; also the cost of applying steam-heating apparatus to 20 locomotives and 47 passenger train cars ; also the cost of applying air brakes to 136 freight cars.

The heating of passenger cars by steam from the locomotive continues to give satisfaction. There are now 57 locomotives and 149 cars fitted.

The total number of freight cars fitted with the Westinghouse automatic air brake is 600.

REVENUE ACCOUNT.

The expenditure and earnings for the year compare as follows :—		
Expenditure	$3,662,341 94	
Earnings	2,977,395 38	
		$ 684,946 56

In the comparisons which follow, both in regard to revenue and expenditure, it should be borne in mind that in addition to the Eastern Extension Railway—80 miles in length—there were on an averge 120 miles more railway in operation during this year than during the previous year.

The gross earnings compare as follows with those of the previous year :—		
In 1889-90—Intercolonial	$2,928,080 92	
Eastern Extension	84,658 95	
	$3,012,739 87	
In 1890-91	2,977,395 38	
		$ 35,344 48

The earnings from passenger traffic compare as follows:—

In 1890-91		$ 962,316 88
In 1889-90—Intercolonial	$ 854,794 31	
Eastern Extension	40,300 22	
		895,094 53
		$ 66,222 35

The number of passengers carried compared as follows with the previous year:—

In 1890-91		1,298,304
In 1889-90—Intercolonial	1,170,249	
Eastern Extension	48,984	
		1,219,233
		79,071

The earnings from freight traffic compare as follows:—

In 1889-90—Intercolonial	$ 1,926,927 14	
Eastern Extension	37,719 72	
		$ 1,964,646 86
In 1890-91		1,854,629 88
		$ 110,016 98

The earnings for mails and sundries compare as follows:—

In 1890-91		$ 160,448 62
In 1889-90—Intercolonial	$ 146,359 47	
Eastern Extension	6,639 07	
		152,998 54
		$ 7,450 08

The weight of freight carried compares as follows:—

	Tons.
In 1889-90—Intercolonial and Eastern Extension	1,368,819
In 1890-91 do do	1,304,534
	64,285

The following is a comparative statement of a few of the chief articles of freight, showing the quantity carried in this and in the previous year:—

Articles.	1889-90, Intercolonial Railway and Eastern Extension.	1890-91.	Increase.	Decrease.
Barrels of flour	1,116,050	1,013,129		102,921
Bushels grain	2,610,202	2,890,921	280,719	
Lumber, in feet	209,905,065	184,138,324		25,766,741
Head of live stock	86,771	95,529	8,758	
Other goods, in tons	926,514	899,724		26,790

The quantity of coal carried from the mines in Nova Scotia to the Upper Provinces compares as follows with the preceding year (during the twelve months ended 31st December):—

	Tons.	Tons.
1889	.....	157,407
1890—*Viâ* Chaudière Junction and Quebec.	137,335	
Viâ St. John	137	137,472
		19,935

WORKING EXPENSES.

The working expenses compare as follows with the previous year:—

In 1890–91	$3,662,341 94
In 1889–90—Intercolonial and Eastern Extension	3,560,575 74
	$ 101,766 20

They compare with last year as follows:—

Per mile run by engines—

	Cents.
1890-91	60·23
1889-90	59·32

Per mile run by trains—

1890-91	72·84
1889-90	70·76

Per mile of railway—

1889-90	$3,666 90
1890-91	3,347 66

The necessary repairs were made to the permanent way and structures, and all the works of the railway were maintained in a state of efficiency.

The number of new ties put into the track was 215,086; 170 miles of track were re-ballasted, 16 miles of track were relaid with heavier steel rails, weighing 67 lbs. to the yard, and 2 miles of new sidings were constructed at various places.

The bridge over the Rivière du Loup was replaced with a new steel bridge at a cost of $23,900, and the bridges at Murphy's, near Antigonish, and over Barney's River were also renewed with steel instead of wood.

Four bridges were strengthened by lateral bracing.

Fifty-two bridges were provided with new and improved floors and iron guard rails.

Fifteen small wooden bridges of ten to twenty span each were replaced by iron bridges, and one iron overhead bridge was erected in place of a wooden one.

The fences received necessary repairs, and 102 miles of new fences were built.

In addition to the repairs of snow fences, 84,000 lineal feet of snow fences were rebuilt.

The snow sheds received necessary repairs, and 1,440 lineal feet of snow sheds were rebuilt.

The buildings on all parts of the line were repaired, and several new ones were erected.

Thirteen semaphore signals were erected at various stations.

The wharves received necessary repairs, and a large amount of dredging was done at several of them.

The rolling stock received necessary repairs, and is in good order.

Four new and powerful locomotives for freight traffic were purchased, and charged to working expenses, and as no locomotives were taken out of service the stock has been increased by that number.

The rolling stock of the Eastern Extension, Oxford and New Glasgow, and Cape Breton Railways—26 locomotives, 1,013 cars, 4 snow ploughs and 4 flangers—was

added to that of the Intercolonial Railway, making the total number of locomotives 206, of cars 6,876, of snow ploughs 56, and of flangers 23.

Eight passenger train cars, 399 freight cars and 7 snow ploughs were purchased or rebuilt to replace those taken out of service as unfit for use.

The water service was efficiently maintained and improved, ten new tanks of 50,000 gallons capacity each having been erected.

STORES.

The value of stores purchased was	$1,526,820	86
The value of stores used was	1,454,206	08
The value of old material sold was	78,582	39
The value of stores on hand at the end of the year was :—		
Ordinary stores, including fuel	$ 517,501	14
Iron and steel rails and fastenings	309,651	22
Old material for sale	106,283	84
	$ 933,436	20

GENERAL.

The winter of 1890-91 was not a severe one, and the trains were seldom delayed by snow.

On the 18th December, 1890, the first serious accident which has happened on this railway occurred at St. Joseph, near Lévis, in the Province of Quebec. The express train bound from Halifax to Montreal was derailed at that place, and, sad to relate, five passengers were killed and a considerable number hurt more or less seriously.

There were no fires in any of the cars, the whole train being, as is usual with the Intercolonial, heated by steam from the locomotives, so that although the cars were overturned and some of them very much broken they did not catch fire.

I have the honour to be, Sir,

Your obedient servant,

D. POTTINGER,

Chief Superintendent.

COLLINGWOOD SCHREIBER, Esq.,
Chief Engineer and General Manager
Government Railways, Ottawa.

No. 1.—INTERCOLONIAL RAILWAY.

DR. CAPITAL ACCOUNT, Year ending 30th June, 1891. CR.

1890.		$ cts.	$ cts.	1890.		$ cts.
June 30...	To Cost of road and equipment		46,908,233 81	June 30...	By Dominion of Canada	46,908,233 81
1891.						
June 30...	Increased accommodation, Moncton	10,608 73				
	do St. John	4,355 17				
	St. Charles Branch	12,033 49				
	Indiantown do	402 63				
	Dartmouth do	413 94				
	Construction	531 94				
	Rolling stock	50,083 44				
	Y at Truro	1,500 00				
			79,929 34	1891. June 30...	By Dominion of Canada	79,929 34
			46,988,163 15			46,988,163 15

MONCTON, N.B., 30th June, 1891.

THOMAS WILLIAMS,
Chief Accountant and Treasurer.

No. 2.—INTERCOLONIAL RAILWAY.

DR. REVENUE ACCOUNT, Year ending 30th June, 1891. CR.

Previous Year.	Expenditure.	Year ending 30th June, 1891.	Previous Year.	Earnings	Year ending 30th June, 1891.
$ cts.		$ cts.	$ cts.		$ cts.
1,144,372 74	Locomotive power, Abstract No. 1.	1,281,800 32	854,794 31	Passenger traffic..	962,316 88
768,757 96	Car expenses, Abstract No. 2....	808,212 35	1,926,927 14	Freight do ..	1,854,629 88
	Maintenance of way and works,		146,359 47	Mails and sundries	160,448 62
998,613 16	Abstract No. 3	955,293 68			
370,202 98	Station expenses, Abstract No. 4.	396,320 22	2,928,080 92		2,977,395 38
164,995 27	General charges do No. 5.	197,006 56	553,392 05	Balance.....	684,946 56
3,446,942 11		3,638,633 13			
34,530 86	Car mileage.....	23,708 81			
3,481,472 97		3,662,341 94	3,481,472 97		3,662,341 94

THOMAS WILLIAMS,
Chief Accountant and Treasurer.

MONCTON, N.B., 30th June, 1891.

No. 3.—INTERCOLONIAL RAILWAY.

LOCOMOTIVE POWER—(Abstract No. 1.)

Previous Year.		Year ending 30 June, 1891.
$ cts.		$ cts.
10,776 29	Mechanical Superintendent's salary, clerks, office and travelling expenses..	11,851 10
244,717 34	Wages, drivers, firemen and cleaners.....	274,281 45
496,378 15	Fuel.....	555,848 04
52,506 58	Oil, tallow, waste and small stores.....	52,172 11
262,317 95	Repairs to engines, tenders and engine tools.....	304,550 77
40,952 32	Water, including pump and tank repairs.....	51,496 55
36,724 11	Miscellaneous	31,600 30
1,144,372 74		1,281,800 32

THOMAS WILLIAMS,
Chief Accountant and Treasurer.

MONCTON, N.B., 30th June, 1891.

No. 4.—INTERCOLONIAL RAILWAY.

CAR EXPENSES—(Abstract No. 2).

Previous Year.		Year ending 30th June, 1891.
$ cts.		$ cts.
94,347 36	Repairs to passenger cars	102,388 24
25,842 43	do postal, express and baggage cars	24,627 52
259,324 15	do freight cars and vans	283,029 80
7,163 87	do snow ploughs and flangers	21,181 51
252,602 61	Wages of conductors, train baggagemasters and brakesmen	259,940 94
28,481 87	Oil and waste for packing	27,101 53
78,165 24	Small stores and fuel	64,975 67
22,830 43	Miscellaneous	24,967 14
768,757 96		808,212 35

THOMAS WILLIAMS,

MONCTON, N.B., 30th June, 1891. *Chief Accountant and Treasurer.*

No. 5.—INTERCOLONIAL RAILWAY.

MAINTENANCE OF WAY AND WORKS—(Abstract No. 3).

Previous Year.		Year ending 30th June, 1891.
$ cts.		$ cts.
7,157 72	Chief and Assistant Engineers, salaries, clerks, office and travelling expenses.	7,864 26
340,790 89	Wages in repairing roadway, fences and semaphores, including new sidings laid in	396,937 65
250,089 17	Rails and fastenings, including new sidings laid in	181,364 70
53,517 50	Ties	45,975 39
171,761 95	Timber, lumber, &c., for repairs to bridges, cattle-guards, sheds, fences, &c	159,894 31
10,612 69	Repairs to wharves	5,345 04
99,613 51	Repairs to buildings and platforms	68,755 29
13,232 23	Repairs to tools	13,020 80
50,513 23	Clearing ice and snow	74,055 07
1,324 27	Miscellaneous	2,081 17
998,613 16		955,293 68

THOMAS WILLIAMS,

MONCTON, N.B., 30th June, 1891. *Chief Accountant and Treasurer.*

No. 6.—INTERCOLONIAL RAILWAY.

STATION EXPENSES—(Abstract No. 4).

Previous Year.	——	Year ending 30th June, 1891.
$ cts.		$ cts.
	Salaries and wages of Station Masters, Agents, Clerks, Telegraph Operators, Station Baggage Masters, Yard Masters, Switchmen, Watchmen and	
284,702 61	Labourers	297,226 60
85,500 37	Fuel, oil, light, stationery, tickets and other incidental expenses	99,093 62
370,202 98		396,320 22

THOMAS WILLIAMS,
Chief Accountant and Treasurer.

MONCTON, N.B., 30th June, 1891.

No. 7.—INTERCOLONIAL RAILWAY.

GENERAL CHARGES—(Abstract No. 5).

Previous Year.	——	Year ending 30th June, 1891.
$ cts.		$ cts.
	Chief Superintendent, District Superintendents, Train Despatchers, General Freight Agent, General Passenger Agent, Clerks, office and travelling	
66,074 96	expenses	73,338 73
	Accounting Department—Salaries of the Chief Accountant and Treasurer,	
23,443 42	Traffic Auditor, Paymaster, Cashier, Clerks, office and travelling expenses	25,248 67
5,318 69	Damages to men, animals and goods	16,964 06
11,884 81	Ferry service	26,674 42
1,284 17	Telegraph expenses (not including pay to operators)	1,298 51
42,677 56	Miscellaneous—Printing, advertising, &c.	38,901 19
14,311 66	Agency expenses	14,580 98
164,995 27		197,006 56

THOMAS WILLIAMS,
Chief Accountant and Treasurer.

MONCTON, N.B., 30th June, 1891.

No. 8.—INTERCOLONIAL RAILWAY.

DR. GENERAL STORES ACCOUNT, Year ending 30th June, 1891. CR.

1890.		$ cts.	$ cts.	1891.		$ cts.	$ cts.
June 30...	To Balance		707,042 05	June 30...	By Issues during year	1,454,206 08	
1891.					Sales of material, fuel, &c., to other railways, &c	54,521 68	
June 30...	Purchases during year	1,511,837 98			Sales of old material	78,582 39	
	Charges from other Departments	210,643 30					1,587,310 15
	Labour	63,743 62			Balance—		
	Staff pay-rolls	12,496 52			Ordinary stores, including fuel	517,501 14	
			1,798,721 42		Iron and steel rails and fastenings	294,668 34	
					Old material for sale	106,283 84	
							918,453 32
			2,505,763 47				2,505,763 47

MONCTON, N.B., 30th June, 1891.

THOMAS WILLIAMS,
Chief Accountant and Treasurer.

No. 9.—INTERCOLONIAL RAILWAY.

General Balance, Year ending 30th June, 1891.

Dr.

		$ cts.
Cash		10,446 09
General Stores—		
Ordinary stores, fuel	$517,501 14	
Iron and steel rail fastenings	294,668 34	
Old material for sale	106,283 84	
		918,453 32
Stations		46,108 71
Rents		2,864 77
Departmental Accounts—		
Marine	$ 24 86	
Post Office	5,130 01	
Militia	2,031 76	
Agriculture	5,917 09	
		13,103 72
Canadian Pacific Railway rolling stock		22,159 71
Quebec Central Railway		2,523 36
Northern and Western Railway—Traffic	$ 8,016 59	
do do General	248 63	
		8,265 22
Windsor and Annapolis—Traffic	$ 2,526 31	
do General	618 17	
		3,144 48
Oxford and New Glasgow Railway		5,709 94
Allan Steamship Line		1,892 13
Kent Northern Railway		8 52
Temiscouata Railway		161 99
Canadian Pacific Railway—General		7,479 99
Buctouche and Moncton Railway		356 73
Joggins Railway		620 49
Caraquet Railway		314 09
Central Railway of New Brunswick		28 14
Cape Breton Railway		10,351 68
Baie Chaleurs Railway		108 98
Prince Edward Island Steam Navigation Co		1 82
Tobique Valley Railway		19,750 24
Elgin, Peticodiac and Havelock Railway		12 72
Dominion Express Co		214 70
Albert Southern Railway		3,752 90
New Brunswick Railway		3,319 69
Salisbury and Harvey Railway		151 75
South Eastern Railway		12 50
Nova Scotia Central Railway		10 56
Prince Edward Island Railway		3 80

Cr.

		$ cts.
Dominion of Canada		1,151,279 48
Suspense		2,731 51
Grand Trunk Railway—Traffic	$ 14,021 29	
do General	646 46	
		14,667 75
New Brunswick Railway		0 04
Canadian Pacific Railway—Traffic		9,526 11
Unclaimed freight		232 89

Maine Central Railway		19 30
Chignecto Marine Railway		245 09
New York and New England Railway		9 89
Great Eastern Fast Freight Line		0 91
Pullman Palace Car Co		381 70
Chatham Railway		12 80
Acadia Coal Co		1,887 63
Intercolonial Coal Co		888 63
Cumberland Railway and Coal Co		40 13
Canadian Locomotive and Engine Co		719 12
Union Pearing Co		928 18
Halifax Cotton Co.—Siding		7,507 14
Poulson Iron Works		273 25
Black Diamond Coal Co		8 36
Londonderry Iron Co		8 48
I. C. Ry. Relief and Insurance Association		65 92
Town of Dartmouth		20,000 00
Western Union Telegraph Co		634 99
St. John Street Railway		20 00
Nova Scotia Steel and Forge Co		267 62
Ontario Car and Foundry Co		1,276 00
Steamer "Admiral"		6,670 58
Montreal Car Wheel Co		1,919 50
Halifax Rolling Mills		13 50
Great Northwestern Telegraph Co.		1 02
New Glasgow Iron and Coal Co		977 04
Remittances destroyed		788 81
Nauwigewauk Station		3 00
Glengarry Station		5 00
Schooner "Mary Jane"		71 30
Bloomfield Station		25 21
Coal Branch Station		65 84
Welford Station		55 00
Ste. Luce Station		80 00
St. Arsène Station		6 11
Western Counties Railway—General	$15,893 35	
do do Traffic	1,657 42	
		17,550 77
Spring Hill and Parrsboro' Railway		3,161 99
Halifax and Cape Breton Railway		1,546 82
Elgin Branch Railway		726 10
Cold Brook Rolling Mills		1,967 41
Bic Station		22 00
Individual accounts		26,252 90
Total		1,178,437 78

Total 1,178,437 78

E. O. E.

THOMAS WILLIAMS,
Chief Accountant and Treasurer.

MONCTON, N.B., 30th June, 1891.

No. 10.—INTERCOLONIAL RAILWAY.

COMPARATIVE STATEMENT of Averages, Year ending 30th June, 1891.

	1891.	1890.
Mileage of railway	1,094	894
Engine mileage	6,080,791	5,895,369
Train do	5,027,791	4,929,770
Car do	56,492,801	58,966,695
Receipts per engine mile.....Cents.	48·96	49·67
do mile of railway.....Dollars.	2,721·57	3,275·25
Percentage of passenger earnings to gross earnings	32·32	29·19
do freight do do	62·29	65·81
do other do do	5·39	5·00
Expenses per engine mile—		
Drivers, firemen and cleaners' wages.....Cents.	4·51	4·15
Fuel	9·14	8·42
Oil, tallow, waste and small stores	·86	·89
Repairs to engines	5·01	4·45
Water and tank repairs	·84	·70
Miscellaneous	52	·62
Total	20·88	19·23
Mechanical Superintendent's salary, office and travelling expenses	·20	·18
Total	21·08	19·41
Locomotive power per engine mile	21·08	19·41
Car expenses do	13·29	13·04
Maintenance of way and works do	15·71	16·94
Station expenses do	6·52	6·28
General charges do	3·24	2·80
	59·84	58·47
Car mileage	·39	·58
Total per engine mile	60·23	59·05
Locomotive power per train mile	25·49	23·21
Car expenses do	16·08	15·59
Maintenance of way and works do	19·00	20·26
Station expenses do	7·88	7·51
General charges do	3·92	3·35
	72·37	69·92
Car mileage	·47	·70
Total per train mile	72·84	70·62
Working expenses per mile of railway.....Dollars.	3,347·66	3,894·26

THOMAS WILLIAMS,
Chief Accountant and Treasurer.

MONCTON, N.B., 30th June, 1891.

INTERCOLONIAL RAILWAY,
CHIEF ENGINEER'S OFFICE,
MONCTON, N.B., 1st October, 1891.

SIR,—I have the honour to submit my report of the Engineering Department for the year ending 30th June, 1891.

TRACK.

The mileage of the main line and branches maintained under my charge has been increased from 894 to 1,048 miles by the addition of 67 miles completed between Oxford Junction and Brown's Point, and that portion of the line extending from New Glasgow to Mulgrave and reported on separately last year under the head of the Eastern Extension.

A branch of 5 miles has also been completed between Pugwash Junction and Pugwash.

During 1890, 16½ miles of steel rails, weighing 56 lbs. to the yard, were replaced with rails weighing 67 lbs. to the yard.

TIES.

During the year 215,086 ordinary ties and 68 sets of switch ties were renewed.

BALLASTING.

About 174,400 cubic yards of ballast were used during the year throughout the whole line. The expenditure for the service was $55,310.46.

SEMAPHORE SIGNALS.

Thirteen new semaphore signals were put up during the year, and a large number were overhauled and put in good repair.

SIDINGS.

During the year 10,529 feet additional siding accommodation has been provided to meet the increased traffic developed throughout the line.

FENCING.

One hundred and two miles of new barbed wire and woven wire fencing were erected during the year and a large quantity overhauled and repaired. The expenditure for fencing during the past year amounted to $50,236.65.

SNOW SHEDS AND SNOW FENCES.

One thousand four hundred and forty lineal feet of snow shedding was built on Northern Division No. 3, and a large quantity overhauled and repaired on this division and other parts of the line ; 84,249 feet of snow fencing was renewed, and a large quantity overhauled and repaired.

WHARVES AND TRESTLES.

At the Deep Water Terminus, Halifax, 120 feet of the old hemlock trestle approaching the coal shed was renewed.

The south side of the Deep Water Terminus wharf was planked, and many of the caps renewed.

At Truro the coal shed trestle was renewed.

Necessary repairs were made to Maitland siding wharf.

At Moir's Mills necessary repairs were made to the trestle.

At Mulgrave the west side of the wharf, which was damaged by fire at the time of burning of the SS. "Norwegian," was repaired, and a large portion of the planking of the wharf renewed

At Antigonish the coal trestle received temporary repairs.

At Pictou Landing some stringers were put in new west wharf, also a few fender piles.

Some slight repairs were also made to covering of wharf.

The corner of the old wharf damaged by SS. "Stanley" was repaired, and the wing of old shed was taken down and the lumber used for snow fencing.

At Dorchester a new top was put on the old wharf 200 by 72 feet, and the cribwork repaired.

At St. John the top of ballast wharf was raised and levelled.

At Dalhousie a number of the mooring posts were renewed. The top of wharf was also overhauled and thoroughly repaired.

At Rivière du Loup and St. Charles necessary repairs were made to the coal trestles and sheds. Necessary repairs were made to the wharves at Lévis and Pointe Lévis.

BUILDINGS AND PLATFORMS.

At North Street Station a room 12 by 6 feet was made for the Post Office Department in which to store the mails. The exterior and interior of station building was painted.

A new approach 230 feet long by 26 feet wide, was built to accommodate teams at the freight shed at the Deep Water Terminus.

At Richmond a coal shed 60 feet long by 16 feet wide, with 12 feet posts, was erected for the use of the Canadian Pacific Railway.

The roof of cattle shed received a coat of paint.

At Princes Lodge the platform was renewed.

At Bedford the roof of freight shed and one side of station roof was re-covered with metallic shingles. Necessary repairs were also made to the Intercolonial Railway dwelling at this station.

At Windsor Junction the roof of freight shed was re-shingled with metallic shingles.

At Dunn's Crossing, two miles south of Shubenacadie, a new milk platform was erected.

At Stewiacke a new platform 200 feet long was provided.

At Alton a new tool house was erected for the section foreman.

At Brookfield a new loading platform 200 feet long was erected.

At Truro necessary repairs were made to the station and freight house. The exterior and interior of the station building was painted. Repairs were made to the walls of engine house where damaged by a locomotive, also to the pit timbers and floor.

At Johnson's a new chimney was built.

At Valley a new loading platform 60 feet long was erected.

At Riversdale the dwelling for agent was clapboarded, the roof re-covered with metallic shingles, and repairs made to chimneys of station. The building was also painted.

At Lansdowne the roof of station was recovered with metallic shingles.

At Glengarry the station was painted.

At New Glasgow a part of the north corner of the station was taken down and rebuilt, and the doors of station and freight shed repaired. The passenger platform, 160 feet long by 10 feet wide, was renewed. The baggage room received a coat of paint.

At Pictou Landing new end sills were put under station, and building overhauled, repaired and painted. The old station platform was removed, the ground levelled off, and covered with cinders.

At Pirate Harbour the engine shed and coal shed were overhauled, repaired and painted with two coats of fire-proof paint.

At Harbour au Bouche necessary repairs were made to the station, and a loading platform, 64 feet long and 9 feet wide, erected for loading and unloading freight at the siding.

At Tracadie one side of the roof of station was renewed with metallic shingles, and painted. A well and pump were also provided at this station.

At Afton the walls of the station were re-shingled.

At Bayfield Road a new hardwood floor was laid in the agent's office.

At Heatherton the east end of station was clapboarded and other necessary repairs made, and the station painted.

At Pomquet a well was dug and a pump provided for the use of the station agent.

At South River the east end of station was clapboarded and station painted. A well was provided for the use of the station.

At Antigonish a new baggage room, 15 by 20 feet, was erected, and the room formerly used for baggage in station has been converted into a ladies' waiting room. The windows in roof were overhauled and repaired. The dwelling apartments of station were also overhauled and repaired inside, and painted; other necessary repairs were made to buildings. The freight shed also received repairs. A good water supply for the stations and trains, and for protection for the buildings, etc., was provided at this place by an agreement with the town authorities.

At Murphy's Crossing, 2 miles west of Antigonish, a new platform, 100 feet long and 10 feet wide, was erected.

At James River the west end of station was clapboarded and other necessary repairs made, and the station painted.

At Marshy Hope the roof of station was covered with metallic shingles and painted.

At Avondale the station was overhauled and repaired and the platform extended 64 feet.

At Merigonish the roof of the station was covered with metallic shingles and painted.

At Stellarton the roof of engine shed was repaired, and the general waiting room, ladies' waiting room and stationmaster's office painted.

At Westville the interior of station received a coat of paint and the ceilings were whitewashed. The baggage room was also painted and the platform repaired.

At Sylvester necessary repairs were made to the platform.

At Loch Broom the outside of station was painted.

At Brown's Point a platform 200 feet long was erected.

At Pictou the exterior and interior of station was painted and the ceilings whitewashed. Necessary repairs were made to the doors of engine shed.

At River John repairs were made to the platform.

At Ross' Road siding a new flag-station was erected and the cattle-guards repaired.

At Pugwash Junction a roof was put on the temporary tank house.

At Pugwash Station a new roof was put on the baggage room, to replace the one destroyed by a heavy storm.

At Oxford Junction a door was made in the coal shed, and the floor overhauled and put in good repair.

At Belmont a new floor was put in the kitchen and the roof covered with metallic shingles.

At Westchester a new loading platform 65 feet long was built.

At East Mines a new kitchen was erected for the accommodation of the agent.

At Londonderry an addition was made to the freight house to meet the increased traffic.

At Springhill Junction the floor of coal-delivery shed was raised and necessary repairs made to the tank house. The baggage room, waiting rooms and office were painted.

At Athol necessary repairs were made to the roof of station buildings.

At Maccan the waiting room received a coat of paint.

At Amherst a new hardwood floor was put in freight office, and other necessary repairs made. The exterior and interior of station building was painted.

At Aulac the roof of station was re-covered with metallic shingles and painted, a new loading platform, 104 by 24 feet was erected, and the station platform rebuilt.

At Rockland the station building was raised and necessary repairs made to foundation.

At Painsec the station building received a coat of paint.

The platforms at the following stations were overhauled and repaired:—DeBert, Belmont, Londonderry, Wentworth, Greenville, Thompson, River Philip, Salt Springs, Spring Hill, Nappan, Amherst, Rockland, College Bridge, Memramcook and Painsec.

At Moncton an addition was made to the freight shed of 130 feet, to meet the increased traffic, at a cost of $1,745. Some alterations were made in the basement vaults of general offices.

At Penobsquis the roofs of station and freight house were re-covered with metallic shingles, and a new platform was erected. The station house roof was painted.

At Sussex the roof of freight shed was covered with metallic shingles and painted.

At Apohaqui the freight shed roof was re-covered with metallic shingles.

At Norton a new floor was laid in the waiting room, and a new top put on the loading platform. The roof of freight shed was painted.

At Bloomfield the station and office were sheathed, and a new platform erected. The interior of office was painted.

At Hampton the station building and freight shed was painted.

At Nauwigewauk two new sills were placed under the station and a new floor put in office. A new loading platform (of crib wharfing), 94 feet long, was also erected.

At Quispamsis the station and office were sheathed, and the woodwork of interior painted.

At Rothsay the station and office were sheathed and an addition of 100 feet made to the platform. The stationmaster's office and waiting room received a coat of paint.

At Riverside the station building was raised, and necessary repairs made.

At St. John necessary repairs were made to the roofs of train shed, freight sheds and tin shop. Ten ash-pits were rebuilt in the round house and the floor repaired. The floors in the New Brunswick freight shed were raised and levelled, also necessary repairs were made to the floors of train shed and coal sheds. A new platform was put up for the exhibition building, and a watercloset placed in the freight shed.

At Berry's Mills a new cattle pen was erected, and the roof of section foreman's house re-shingled.

At Birch Ridge siding a new flag station and platform were erected, to replace those destroyed by fire.

At Harcourt the roof of freight shed was re-covered with metallic shingles, and painted. A new coal shed and cattle pen were also erected at this place.

At Trent Junction a temporary platform was erected, to replace the one destroyed by fire.

At Rogersville the roof of tank house was re-shingled.

At Barnaby River the roof of tank house was re-shingled.

At Acadieville a new loading platform was built.

At Newcastle twenty-five squares of metallic shingles were put on the roof of station building. Necessary repairs were made to the floors and pits of round house, and ten new smokestacks were put on this building. A buffer was put on the coal shed, and a new chimney provided for the blacksmith's shop.

All station and other platforms between Moncton and Newcastle received repairs where necessary.

At Beaver Brook necessary repairs were made to the station.

At Bartibogue two new doors were provided and other needed repairs made.

At Red Pine a new door was put in station building, and roof and sides of building repaired where necessary. The station platform was also repaired.

At Gloucester Junction some slight repairs were made to the gutters of windows on roof of station building.

At Bathurst a new floor was laid in the station and the doors of baggage room repaired.

The freight house platform was repaired and the tank house painted. Water was put into the station agent's dwelling apartments.

At Petit Roche necessary repairs were made to the station and storm windows provided. The freight house platform was repaired.

At Belledune storm windows were provided for the station, the platform repaired and the tank house painted.

At Jacquet River repairs were made to the roof and doors of station building and freight house, and the coal shed and tank house painted. The platform was extended 150 feet.

At New Mills the floor and doors of freight house were repaired and necessary repairs made to the platform.

At Charlo necessary repairs were made to the station building and the tank house painted.

At Eel River the station agent's office and waiting room were sheathed.

At Dalhousie Junction the tank house was painted.

At Dalhousie the roof of engine house was repaired.

A passenger platform, 50 feet long and 10 feet wide, was erected at Green Point, and another one of similar dimensions was put up at Hodgins' Siding.

At Campbellton an addition was made to the ice-house, and the old part repaired. A new baggage room, station coal shed and iron store were provided; new floors were also laid down in the dwelling apartments of stationmaster.

The roof of station building was re-covered with metallic shingles.

Necessary repairs were made to the station building, carpenter's shop and coal shed; a new hoisting winch was put in coal shed. Repairs were also made to the ladies' watercloset.

At Metapedia some changes were made in the interior arrangements of the office, and the wood was painted; a new hardwood floor was also put down. The freight house platform was rebuilt.

At Causapscal a new foundation of cedar was put under the station, and new windows put in section foreman's house.

At Amqui the freight shed was repaired. The interior of station, roof of freight shed and watercloset were painted.

At Sayabec the round house received necessary repairs.

At Little Métis new hardwood floors were laid in the stationmaster's office and waiting room, and repairs made to baggage room.

At St. Octave a kitchen was built, and new hardwood floors laid in agent's office and waiting room. Necessary repairs were also made to the freight shed. The interior of station building, coal shed and roof of freight shed were painted.

At St. Flavie the roof of station was painted.

At Rimouski a new cattle-guard was put in.

At St. Simon a new platform was erected.

At Bic the roof of station was painted.

At Trois Pistoles the interior and exterior of station building was painted. The roof of restaurant also received a coat of paint.

At St. Eloi the roof of station building was painted.

At Isle Verte the roof of station was re-covered with metallic shingles and painted. A new platform was provided.

At St. Arsene a new station platform was built.

At Cacouna a new station platform was erected.

At Rivière du Loup a new pit was put in the round house and necessary repairs made to the floor of machine shop. A part of the old coal shed was taken down and repairs made to the remaining portion of shed. The station building, baggage and reading rooms, and house occupied by mechanical foreman, were painted.

At St. Paschal and Ste. Anne the roof of freight sheds were re-covered with metallic shingles and painted.

At L'Islet necessary repairs were made to the station platform.

At Cap St. Ignace the freight shed and waiting room of station were painted.

At St. Thomas and St. Charles the waiting rooms were painted.

At Chaudière new floors were laid in the station building and the roof re-covered with metallic shingles. Repairs were also made to the tank building. The station agent's dwelling and baggage room were painted. The old engine house at this station was repaired and used as a covering for the track scale.

At Lévis new doors were provided for the freight shed and a new loading platform erected. The baggage room was repaired where damaged by fire, and painted; new floors were put in the kitchen and pantry of the the resturant and the coal shed received a coat of paint. The pontoon was also caulked and painted.

At Quebec a new baggage shed was erected and the waiting room painted.

Bridge and Culverts.

At Water street, Halifax, the flooring of the overhead bridge was renewed with 6-inch timbers.

At Richmond a hemlock sewer, 160 feet long, was renewed with cedar.

Near Wellington a new culvert, 56 feet long, of 18-inch terra cotta pipes, with end walls of masonry, was put in to drain a field filled by the obstruction of the original passage through large rocks in the bottom of the embankment.

At Elmsdale the culvert in the yard was extended about 16 feet, to provide for an extension of the siding which was made at this place.

At Milford a pair of wooden stringers were taken out and replaced with a pair of rail girders. A standard top was put in the new girders.

An old 2 by 6 box culvert, broken down at that place, was renewed.

At Rawdon River the girders of the bridge were lifted up and new stone bridge seats provided, which was done to obviate necessity of renewing the longitundial stringers. A cedar box culvert was put in to drain a pond that had accumulated on the north side of the embankment near Rawdon River.

East of West River the wooden stringers of two 15-feet beam culverts were replaced with iron rail girders, fitted with standard tops and guard-rails.

At Mulgrave Road the wooden structure carrying the track over that road was replaced with a pair of iron girders.

At South River a pair of wooden stringers, 17 feet long, were replaced with iron rail trusses.

A number of the trestle bents of the pile trestle bridge near Pomquet were badly damaged by ice last winter, and it was necessary to renew them.

At Marsby Hope a 24-feet wooden trestle was renewed.

The stone abutments of Sutherland's River bridge were overhauled and repaired. One of the abutments of this bridge was considerably damaged by a heavy storm in December last; a portion of the abutment was taken down and rebuilt on a new foundation.

Necessary repairs were made to the trestle bridge at Loch Broom and Broom's Point, which were considerably disturbed by a severe storm in December last.

Ten open culverts between Truro and Painsec were provided with standard floors and iron guard-rails.

The masonry culverts at Westchester and Brown's Brook were renewed, the stone used originally having fallen to pieces.

A gang of masons were engaged three months on the division between Truro and Painsec, overhauling, pointing and repairing the masonry of culverts and bridge.

A cedar box drain 220 feet long was put in to drain the track scale at Chaudière curve, and one 400 feet long was put in at the west end of Chaudière yard to drain the sidings on the south side of the yard.

A cedar box drain 300 feet long was put in at Lévis yard.

The following bridges were painted in whole or in part as shown:—

Government steel bridge, St. Joseph	Ties only.	North River bridge	Ties only.
St. Joseph steel bridge do do		Petitcodiac River bridge	Iron and wood.
Isle Verte bridge do		Salmon do	Ties only.
Small bridge near Isle Verte	Iron and ties.	Passekeag bridge	do
Trois Pistoles bridge	Iron only.	Gallagher's do	do
Small bridge near Trois Pistoles	Iron and ties.	Secord's do	do

Grand Bic bridge	Iron and ties.	Stanley street bridge, St. John (overhead)	One coat.
Bic bridge	do	Wall St. bridge, St. John (overhead).	do
Small bridge near Bic	do	Dorchester street bridge, St. John (overhead)	do
Rimouski bridge	Ties only.	Sackville street bridge	Iron and ties.
St. Pierre River bridge	Iron and wood.	Overhead bridge at Lawrence	One coat.
Mill Stream	do	River Philip bridge	Iron and ties.
New iron work of Restigouche bridge	One coat.	Greenville do	do
do Miramichi bridges.	do	Folly River do	Iron only.
Overhead bridge, Derby Junction	do	Ingonish do	do
1st crossing Barnaby River	Iron and wood.	Stewart's do	do
2nd do do	Ties only.	12 spans rail girders between Truro and Enfield	do
3rd do do	do	Canal bridge	do
Kouchiboguacis River bridge	do	Rawdon River bridge	do
North Branch, Coal Branch bridge	do	Beaver bridge	Iron and ties.
South do do	do	Dartmouth Road bridge	do
Richibucto River bridge	do	East River bridge	do
Buctouche do	do		
North Branch Cocaigne bridge	do		
South do do	do		

The roof trusses and other iron work of the following buildings were scraped and painted :—

Hadlow engine house.
St. Flavie do
Newcastle do
Truro engine house.
St. John train shed.

Additional lateral bracings were put on the following bridges :—

Causapscal bridge	3 spans 100 feet.	North River bridge, Truro	2 spans 100 feet.
Red Pine do	3 do 40 do	Salmon do do	3 do 100 do

The following bridges were thoroughly overhauled and all loose rivets replaced :—

Causapscal bridge	3 spans 100 feet.	North River bridge, Truro	2 spans 100 feet.
Gilmour's Brook bridge	1 do 60 do	Salmon do do	3 do 100 do
Gordon's do	1 do 40 do	Rawdon do	3 do 26 do
Red Pine bridge	3 do 40 do	Riversdale bridge	3 do 40 do
Sackville do	3 do 160 do		

The following deck bridges were raised 18 inches and placed on new stone bridge seats. This was done to avoid using longitudinal timbers on the decks.

These same bridges were provided with standard floors of Georgia pine and iron guard-rails :—

Trois Pistoles bridge	5 span.	100 feet.	Tête-à-Gauche bridge	5 span.	100 feet.
Grand Bic do	1 do	80 do	Little River do	1 do	60 do
North Branch Charlo bridge	2 do	50 do	Bartibogue River bridge	1 do	80 do
South do do	2 do	50 do	2nd crossing Barnaby River bridge	1 do	80 do
New Mills bridge	2 do	80 do	3rd crossing Barnaby River bridge	1 do	80 do
Benjamin River bridge	3 do	50 do	Kouchibouguacis River bridge	1 do	80 do
Elm Tree bridge	1 do	80 do	Richibucto do do	3 do	50 do
Nigadoo do	1 do	80 do	North River bridge	1 do	50 do
Mill Stream (Beresford) bridge	1 do	80 do			
Grant's Brook bridge	1 do	80 do			

The following bridges were provided with new standard floor of Georgia pine and iron guard-rails :—

St. Pierre River bridge	1 span.	85 feet.	Sproul's Brook bridge	1 span.	30 feet.
Otter Brook do	1 do	24 do	Jones Meadow Brook bridge	1 do	17 do
Gilmour's do	1 do	60 do	Memramcook River do	1 do	60 do
Morton's Millrace bridge	1 do	30 do	Rail girders near Calhoun's	2 do	12 do
Jacquet River bridge	3 do	100 do	Skurg's Culvert	1 do	13 do
Red Pine do	3 do	40 do	Keillar's do	1 do	12 do
1st crossing Barnaby River bridge	1 do	100 do	Rail girders on Dorchester grade	2 do	15 do
Buctouche River bridge	1 do	30 do	Nappan bridge	1 do	100 do
North Cocaigne do	1 do	24 do	Greenville do	1 do	60 do
South do do	1 do	24 do	Mud Creek do	1 do	50 do
Peticodiac River do	2 do	86 do	Bible Hill do	1 do	23 do
Holmes' Brook do	1 do	15 do	Rail girders (Johnston's)	2 do	21 do
Hayward's Brook do	1 do	30 do	do near Elmsdale	2 do	18 do
Stone's do do	1 do	15 do	Rawdon River	3 do	26 do
Secord do do	1 do	17 do	Pomquet Howe truss bridge		
Salmon River (near Sussex) bridge	2 do	86 do	Black River bridge		
Penobsquis River bridge	1 do	14 do	Dewar's bridge		

The old wooden Howe truss bridge at Rivière du Loup (3 spans of 100 feet each) was replaced with a new lattice street bridge of 3 spans of the same length, at a cost of $23,900.

The steel trusses were 13 feet shallower than the old wooden trusses, and this extra height was made up by carrying the piers and abutments up with concrete, which to date has proved very satisfactory.

An old overhead wooden trestle bridge at Durlotte's Crossing, near Jacquet River, was replaced with an iron span and stone abutments at a cost of $1,400.

Throughout the line 15 spans of wood, varying in length from 10 to 20 feet, were replaced with old rail girders provided with standard top.

3 by 5 angle iron was provided for the guard-rails on the Miramichi and Restigouche bridges. Chock blocks were also put in between the ties throughout the length of these bridges.

With a very few exceptions, all open culverts and bridges are now covered with ties placed 4 inches apart, with chocks the full depth of the tie placed between them, securely spiked to the side of the tie, and iron guard-rails laid throughout, and for some distance beyond the ends of each bridge or culvert.

One of the piers of Mill Creek bridge, near Campbellton, was repaired by casing it with concrete.

A gang of masons was engaged on each division overhauling, painting and repairing bridges and culverts where necessary.

Contracts were let for the following steel girders which were necessary to strengthen and replace a number of bridges between Rivière du Loup and Hadlow, which are considered too light for the traffic carried over them :—

12 pairs 44 feet steel plate girders.
2 do 54 do do
8 do 64 do do
102 rolled beams.

A new plate girder was put in at St. Romuald, near Etchemin, to strengthen a light pair of girders of 24 feet, at that place.

Necessary repairs were made to the iron bridge at St. Joseph, damaged by the derailment of passenger train at that place on the 18th of December last.

The Howe truss spans of Barney's River and Murphy's, near Antigonish, were renewed with steel girders of 60 and 70 feet spans respectively.

General.

The masonry foundation of the track scale at Chaudière was taken down and rebuilt.

About 200 pairs of old spruce and hemlock cattle guards have been replaced with the standard cedar guard now used throughout the line.

A number of pairs of iron surface guards have been given a trial at a number of places throughout the line. They have not proved satisfactory, as they have failed to keep the cattle off the line.

A wooden turntable, 27 feet long, was put in at St. Thomas, to be used for turning snow ploughs in winter. The bulk of the snow on the Rivière du Loup division falls west of St. Thomas, and by having a turntable at this point the extra run between St. Thomas and Rivière du Loup is avoided.

The Semaphore signals, switch, stands, ladders and sign-board crossings were thoroughly overhauled and painted where necessary.

A new dredging plant has been obtained, and used in cleaning and deepening the docks at Halifax, Pictou Landing and St. John. The plant consists of a 15-ton steam crane, a Wild's patent grab bucket, 2 scows for carrying the steam crane and 4 dump scows for the dredged material. This work was continued steadily throughout the working season at a large expense. The steam crane above referred to was one of two imported some three years ago for handling the heavy freight at the Deep Water

Terminus, Halifax. One has been found sufficient to meet the requirements of the business.

I have the honour to be, Sir,

Your obedient servant,

P. S. ARCHIBALD,

Chief Engineer.

D. POTTINGER, Esq.,
Chief Superintendent Intercolonial Railway,
Moncton, N.B.

INTERCOLONIAL RAILWAY OF CANADA,
OFFICE OF THE MECHANICAL SUPERINTENDENT,
MONCTON, N.B., 30th October, 1891.

SIR,—I beg to submit for your information the following statements of the operations of the Mechanical Department for the year ending 30th June, 1891.

A.—Statement showing the number of locomotives and various classes of cars.

B.—Statement showing the locomotives and car mileages, and the average number of passenger and freight cars hauled per mile run by engines.

C.—Abstract of locomotive returns.

D.—Statement of the cost of locomotive power for each month during the year.

E.—General statement of the expenses of the Mechanical Department.

Previously to this year the accounts of the Oxford and New Glasgow and Eastern Extension were kept separately, and the rolling stock did not appear in the annual statement.

On 1st July, 1890, the following engines and cars were transferred to this railway, viz:—Eighteen locomotives, 7 first-class cars, 13 second-class cars, 4 postal cars, 6 baggage cars, 175 box cars, 11 cattle cars, 220 platform cars, 150 hopper cars, 8 vans, 2 snow ploughs, and 2 flangers.

In November last the railway commenced to operate the Cape Breton Railway, and 8 locomotives, 5 first-class cars, 6 second-class cars, 3 postal cars, 3 baggage cars, 100 box cars, 20 cattle cars, 176 platform cars, 4 vans, 2 snow ploughs and 2 flangers were transferred to the Intercolonial Railway.

Four new locomotives were purchased and charged to revenue.

Two new boilers, 7 new cabs, 10 new cylinders, 20 new smoke-box extensions, 169 driving tyres, 2 new tenders complete, 6 new tender frames and 2 new tender trucks were supplied.

New driving wheels were put under 6 engines, changing them from 61 inches to 69 inches diameter, to make them suitable for passenger service.

Three new parlour cars were purchased at cost of capital.

Five first-class, 2 postal and smoking, 1 baggage and express, 62 box, 11 cattle, 157 platform, and 10 20-ton coal cars were rebuilt.

One hundred and fifty-nine old gondolas were replaced by 139 20-ton flat cars, and 50 6-ton hoppers.

Three ordinary and 4 wing snow ploughs were also rebuilt; 4 wing and 1 common snow plough received heavy repair, almost amounting to rebuilding; 2 parlour, 13 sleeping, 43 first-class, 15 postal, 24 baggage cars and 37 vans received heavy repairs and were thoroughly renovated.

Thirty-seven freight cars were strengthened so as to enable them to carry loads of 34,000 pounds, instead of 24,000 thousand pounds.

Two hundred and eleven freight cars had very heavy repair, and upwards of 6,000 cars passed through the shops, receiving more or less heavy repair.

Steam-heating devices were supplied to 6 sleeping, 5 parlour, 14 first, 21 second, 8 postal and 9 baggage cars.

Electric light was applied to 1 car.

There are now 165 cars steam-heated, and 82 lighted by electricity.

Up to end of this year steam-heating appliances had been applied to 52 engines.

WATER SERVICE.

Trestle under tank at Halifax repaired. Moncton reservoir cleaned and 763 feet of cast iron pipe laid, and new water crane put up.

Newcastle—New trestle under tank.

Jacquet River—New trestle and reservoir cleaned out.

Causapscal—Three hundred and fifty feet of 3½-in. galvanized iron pipe laid.

St. Luce—The tank at this station having become useless, a tank was taken from Bathurst and erected in its place.

Metapedia—Old tank taken from St. Fabien and erected here.

St. Valier—Put up temporary tank and erected house over it, using a steam pump, the old tank and pump having become useless.

Pictou Landing—Water supply here was thoroughly repaired.

Indiantown Branch—Hoops reset.

The following tanks have been painted during the year:—Stellarton, Thomson, Bayfield Road, Pictou, Antigonish, Piedmont and Indiantown.

Ten new tanks spoken of in last report have been completed.

I have the honour to be Sir,

Your obedient servant,

H. A. WHITNEY,

Mechanical Superintendent.

D. POTTINGER, Esq.,
Chief Superintendent.

A.—INTERCOLONIAL RAILWAY.

STATEMENT showing the number of Locomotives and the various classes of Cars on the 1st July, 1890, and on the 30th June, 1891.

	Locomotives.	THE VARIOUS CLASSES OF CARS.																				
		First Class Sleepers.	Second Class Sleepers.	Parlor.	First Class Passenger.	Second Class Passenger.	Postal and Smoking.	Baggage and Express.	Box.	Cattle.	Platform, 10, 15 and 20 tons.	Hoppers, 5 and 6 tons.	Gondolas, 20 tons.	Coal Cars, 20 tons.	Vans.	Total.	Snow Plough.	Wing Plough.	Flangers.	Steam Plough.	Total.
On hand, 1st July, 1890, serviceable	176	15	6	2	73	76	17	27	1,793	62	1,574	695	672	701	85	5,798	40	10	17	2	69
do do condemned	....	....	....	....	2	....	....	3	3	10	14	....	....	....	....	32	....	....	....	....	....
Total	176	15	6	2	75	76	17	30	1,796	72	1,588	695	672	701	85	5,830	40	10	17	2	69
Received from Oxford and New Glasgow Railway	9	....	....	....	1	8	3	4	150	6	150	....	....	100	8	430	2	....	2	....	4
do Eastern Extension Railway	9	....	....	....	6	5	1	2	25	5	70	150	....	....	2	266	....	....	....	....	....
do Cape Breton Railway	8	....	....	....	5	6	3	3	100	20	176	....	....	....	4	317	2	....	2	....	4
Purchased and charged to Capital	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....
do do Revenue	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Changed from Gondolas to 20-ton Platform cars	....	....	....	....	....	....	....	....	....	....	139	....	*139	....	....	....	....	....	....	....	....
do do Hoppers	....	....	....	....	....	....	....	....	....	....	....	50	†20	....	....	....	....	....	....	....	....
Total	206	15	6	5	87	95	24	39	2,071	103	2,123	895	513	801	99	6,876	44	10	21	2	77
Condemned 1st July, 1890	....	....	....	....	2	....	....	3	3	10	14	....	....	....	....	32	....	....	....	....	....
do during the year	....	....	1	....	6	....	2	1	63	8	157	5	159	17	2	421	4	4	1	....	....
Total condemned	....	....	1	....	8	....	2	4	66	18	171	5	159	17	2	453	4	4	1	....	....
Rebuilt	....	....	....	....	5	....	2	1	62	11	157	....	*159	10	....	407	3	4	....	....	....
To be built	....	....	1	....	3	....	....	3	4	7	14	5	....	7	2	46	1	....	1	....	....

* Replaced by 139 platform. † Replaced by 50 hoppers.

MONCTON, N.B., 30th June, 1891.

J. SUTTON,
Mechanical Accountant.

B.—INTERCOLONIAL RAILWAY.

STATEMENT of Locomotive and Car Mileage for the Year ending 30th June, 1891.

Months.	Locomotive Mileage.		Car Mileage.						
	Passenger.	Freight.	Passenger.	Express, Postal and Baggage.	Freight.	Total.	Snow Plough Mileage.	Average Passenger	Average Freight.
1890—July	132,033	227,816	542,845	271,626	3,038,420	3,852,891	.....	6·16	13·33
August	128,292	223,994	535,962	259,537	3,035,419	3,830,918	.....	6·19	13·99
September	115,075	294,403	516,865	248,925	3,864,103	4,629,943	.....	6·62	13·12
October	113,026	344,036	485,672	252,694	4,882,114	5,320,480	.....	6·52	13·31
November	97,502	352,357	424,611	226,633	4,870,498	5,523,742	1,753	6·69	13·82
December	94,036	373,784	422,426	212,035	4,519,085	5,155,546	16,222	6·76	12·09
1891—January	95,077	377,991	407,849	194,966	4,430,333	5,033,145	21,369	6·33	11·72
February	89,560	320,266	369,506	169,142	3,739,426	4,278,074	27,343	6·02	11·05
March	98,856	326,705	428,293	183,193	4,070,988	4,682,474	9,247	6·18	12·46
April	97,441	334,872	438,988	193,383	4,464,381	5,096,752	1,480	6·49	13·33
May	93,084	309,118	405,232	191,903	4,023,797	4,620,932	1,300	6·41	13·01
June	107,489	280,978	445,826	213,258	3,808,817	4,467,901	502	6·12	13·58
Total	1,261,471	3,766,320	5,428,075	2,617,295	48,447,431	56,492,801	79,216	6·38	12·86

MONCTON, N.B., 30th June, 1891.

J. SUTTON,
Mechanical Accountant.

C.—INTERCOLONIAL RAILWAY.

ABSTRACT of Locomotive Returns for the Year ending 30th June, 1891.

Months.	Hours in Steam.	Locomotive Mileage.	Consumption.				Average Consumption per 100 Miles.				
			Tons of Coal.	Pints of Oil.	Pints of Valve Oil and Pounds Tallow.	Pounds Waste.	Miles Run to hour in Steam.	Pounds Coal.	Pints Oil.	Valve Oil and Pounds Tallow.	Pounds Waste.
1890—July	39,892	443,002	11,908	22,910	23,961	11,314	11·11	6,021	5·17	5·41	2·55
August	38,046	427,395	11,758	21,276	23,383	10,563	11·23	6,162	4·97	5·47	2·47
September	44,603	488,208	14,950	24,648	26,587	12,055	10·95	6,861	5·05	5·44	2·46
October	50,792	544,257	17,791	25,341	26,539	12,966	10·71	7,322	4·65	4·88	2·38
November	50,624	534,489	18,812	24,519	24,921	11,244	10·55	7,913	4·58	4·66	2·10
December	59,322	575,498	21,735	30,795	29,010	12,977	9·70	8,506	5·35	5·04	2·25
1891—January	60,773	585,982	21,505	35,341	29,949	12,763	9·64	8,221	6·03	5·11	2·17
February	52,951	505,683	18,664	32,636	28,587	12,516	9·55	8,267	6·45	5·65	2·48
March	50,591	517,429	18,456	32,383	26,650	13,381	10·23	7,989	6·25	5·15	2·58
April	48,096	514,476	17,063	29,803	24,921	13,734	10·69	7,429	5·79	4·84	2 67
May	44,594	481,111	14,650	29,252	25,892	12,869	10·79	6,821	6·07	5·38	2·67
June	42,526	463,261	13,760	29,025	26,710	12,165	10·89	6,650	6·26	5·77	2·62
Total	582,810	6,080,791	201,122	337,929	317,110	148,547	10·43	7,408	5·55	5·21	2·44

MONCTON, N.B., 30th June, 1891.

J. SUTTON,
Mechanical Accountant.

D.—INTERCOLONIAL RAILWAY.

STATEMENT of the cost of Locomotive Power for each month, from 1st July, 1890, to 30th June, 1891.

Months.	Miles run by Engines.	Mechanical Supt.'s Salary and Office Expenses.	Enginemen's Wages.	Fuel.	Oil, Tallow and Water.	Repairs to Engines, Tenders and Tools.	Water.	Engine houses and Turntables.	Total.	Average per 100 miles.							
										Mechanical Supt., &c.	Wages.	Fuel.	Oil, Tallow and Waste.	Repairs.	Water.	Eng.-houses & Turntab.	Total.
		$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.								
1890—July..	443,002	1,167 38	20,660 57	33,435 65	4,557 87	29,055 55	4,436 12	2,582 50	95,895 94	17	4·66	7·54	1·02	6·56	1·00	59	21·64
Aug..	427,395	897 45	20,535 29	34,217 35	4,060 44	28,288 40	1,915 11	2,584 59	92,498 63	21	4·80	8·01	·95	6·62	·45	60	21·64
Sept..	488,208	880 22	20,283 56	41,305 71	4,271 69	31,995 01	6,655 48	3,077 36	108,449 03	18	4·15	8·46	·87	6·55	1·36	64	22·21
Oct..	544,257	978 50	22,969 65	49,402 11	4,386 68	26,534 78	6,698 24	2,388 56	113,358 52	18	4·22	9·07	·81	4·87	1·24	43	20·82
Nov..	534,489	935 69	23,017 85	51,261 37	4,013 41	22,585 22	6,651 03	2,201 95	110,666 52	17	4·30	9·59	·75	4·23	1·25	41	20·70
Dec..	575,498	911 27	24,308 09	59,815 33	5,004 15	21,918 46	5,603 84	3,435 54	120,996 68	16	4·22	10·39	·87	3·81	·98	59	21·02
1891—Jan..	585,982	921 30	24,392 55	58,548 85	4,900 11	34,622 76	4,253 30	3,208 24	130,847 11	16	4·16	9·99	·84	5·91	·73	54	22·33
Feb..	505,683	1,205 97	23,471 95	52,035 04	4,894 90	22,468 73	4,258 33	3,503 32	111,838 24	24	6·64	10·29	·97	4·44	·84	69	22·11
Mar..	517,429	1,059 45	25,607 49	51,951 36	4,958 83	28,391 78	2,636 60	2,013 46	116,618 97	21	4·95	10·04	·95	5·48	·51	39	22·53
April.	514,476	921 12	24,699 15	47,871 45	4,476 65	28,966 72	2,227 27	2,824 10	111,986 46	17	4·80	9·31	·87	5·63	·43	55	21·76
May..	481,111	922 99	22,297 60	39,727 02	4,413 27	23,814 28	2,977 78	1,713 51	96,496 45	19	4·76	8·26	·92	4·95	·62	35	20·05
June..	463,261	1,049 76	21,407 70	36,276 80	2,234 11	5,909 08	3,203 45	2,066 87	72,147 77	23	4·62	7·83	·48	1·28	·69	44	15·57
Total....	6,080,791	11,851 10	274,281 45	555,848 04	52,172 11	304,550 77	51,496 55	31,600 30	1,281,800 32	19	4·52	9·12	·86	5·01	·85	52	21·07

J. SUTTON,
Mechanical Accountant.

MONCTON, N.B., 30th June, 1891.

E.—INTERCOLONIAL RAILWAY.

GENERAL STATEMENT of the Expenses of the Mechanical Department, for the Year ending 30th June, 1891.

The miles run by trains		5,027,791
do	engines	6,080,791
do	cars	56,492,801
do	snow ploughs	79,216
		$ cts.
The cost of locomotive power		1,281,800 32
The cost of car repairs:		
Repairs to passenger cars		102,388 24
do	postal, express and baggage cars	24,627 52
do	freight cars and vans	283,029 80
Oil and waste for packing		21,181 51
Miscellaneous		27,101 53
	Total cost of car expenses	458,328 60
The cost of locomotive power per 100 miles run by trains		25 49
do do do	engines	21 08
do do do	cars	2 27
The cost of repairs to cars and ploughs per 100 miles run by trains		9 12
do do	engines	7 54
do do	cars	0 81
The cost of oil and waste for packing per 100 miles run by trains		0 54
do do do	engines	0 44
do do do	cars and ploughs	0 05
The cost of repairs to cars per 100 mile run by them:		
do	passenger, per 100 mile run by them	1 89
do	express and baggage, per 100 mile run by them	0 94
do	freight cars and vans do	0 58
do	ploughs and flangers do	26 74

J. SUTTON,
Mechanical Accountant.

MONCTON, N.B., 30th June, 1891.

INTERCOLONIAL

RETURN of Accidents and Casualties which have occurred in Canada on the

Date.	Time of Day.	No. of Trains.	Description of Train.	Name of Conductor.	Name of Driver.	No. of Engine.
1890.						
July 1..	7.35	2	Express	A. Rainnie	J. Stewart	108
do 2..	21.10	Special..	Freight	James Card	Geo. Speer	34
do 4..	15.00	19	Express	Geo. C. Dividson	J. McEachern	26
do 5..	20.00	Special..	Freight	C. H. Bass	Jno. Stewart	182
do 6..	9.45		Light engine		Ben. Cooke	135
do 10..	17.45	Special..	Working	E. Bowser	R. H. Coggin	186
do 11..	9.20		Shunting	J. Keys	W. Appleton	36
do 15..	23 10	Special..	Freight	J. McIntosh	D. Duncan	123
do 23..		16	do	J. Craigie	J. J. Ferguson	16
do 25..						
do 26..	21 55	26	Express	W. Gunn	John Ross	57
Aug. 1..	13.40	45	do	Louis Couture	D. Jolivet	45
do 1..	15.30		Shunting		J. Coté	18
do 6..	24.50	34	Express	A. Olive	J. Morton	148
do 8..		33	do	G. Walker	— Cameron	161
do 11..	10.00	Special..	Working	E. Bowser	E. Kean	179
do 12..	13.00	do ..	Freight	John McDonald	J. H. Campbell	167
do 16..	22.15	do ..	Passenger	C. H. Bass	C. Langley	92
do 23..	23.45	9	Express	D. McQuarry	G. A. Kentley	152
do 24..	2.07	16	Freight	J. Craigie	R. Wilson	8
do 27..	2.10		Shunting		M. O'Brien	99
Sept. 8..	20.30	Special..	Freight	N. Merrill	Jno. Gratten	39
do 10..	15.12	do ..	Working	E. Bowser	W. G. Bell	40
do 13..	11.30		Shunting		J. Phinney	87
do 13..	16.40	8	Express	J. Sproul	F. Whitney	65
do 14..	18.50	Special..	Working	T. McDermott	J. McGuiggan	182
do 19..	3.45	do ..	Freight	J. B. Pollock	R. Wilson	136
do 20..	11.50		Shunting	W. Bovard	F. H. Moore	186
do 27..	14.45	Special..	Working	J. Paradis	L. Boulet	3
do 29..	14.25	26	Express	J. Millican	R. Carr	69
Oct. 1..	9.15	50	Freight	E. Camire	O. Brock	21
do 3..	7.50	Special..	do	J. Carroll	Jas. Cooke	155
do 4..	16.10	do ..	do	A. G. Grant	J. H. Campbell	167
do 4..	10.30		Shunting		J. Coté	18
do 13..	15.30		do		do	18
do 18..	15 25	Special..	Freight	J. G. McNaughton	J. W. Welling	119
do 22..						
do 24..	12.30	70	Freight	G. A. Chesley	S. Watson	49

RAILWAY.

Line of the Intercolonial Railway during the Year ended 30th June, 1891.

Place of Accident.	Name of Person Injured.	Whether Passenger or Employé.	Particulars of Accident.	Extent of Injury.	Verdict of Coroner's Jury.
Torryburn	Thos. Fleming	Passenger	Jumped off train while in motion.	Foot injured	
Beaver Brook	Geo. Speer	Employé	Gauge glass broke	Hand scalded	
Near Mulgrave	John Walsh	Passenger	Fell from train while in motion.	Slightly injured.	
Calhouns	John McLeod	Employé	Struck on head by stone thrown at train.	do	
Truro yard	Arthur Purdy	do	Fell from tender of engine	Nose injured	
East Jacquet River	Félix Legouff	do	Jumped from train while in motion.	Slightly injured.	
Richmond	Albert Stone	Neither.	Fell while getting on cars in motion.	Arm broken	
West River	J. McIntosh	Employé	While coupling	Slightly injured.	
Sackville	J. Craigie	do	Slipped when getting on van.	Rib broken	
Beaver Brook	M. Power	do	While assisting to work hand car.	Fingers bruised	
Stewiacke	Thos. McGrath	Passenger	Jumped off train while in motion.	Foot crushed	
East of H. Simon	—— Basse (boy).	Neither.	do do	Fatal	Accidental.
Moncton	E. Harvey	Employé	While coupling	Finger crushed	
New Mills	F. Dixon	do	Slipped and fell when getting on train.	Knee injured	
West of Metapedia.	John Dell	Passenger	Fell off train while in motion.	Seriously injured	
Jacquet River	F. Arseneau	Employé	While unloading timber	Considerably injured.	
New Glasgow	Duncan Cameron	Neither.	Struck by engine crossing track with team.	Slightly injured.	
DeBert bridge	A. Price	Employé	While signalling driver his hand struck end of bridge.	Considerably injured.	
Folleigh	Geo. Riley	do	While coaling engine	Hand injured	
West of Maccan.	W. Colpelts	do	Fell off cars and was run over.	Fatal	Accidental.
Moncton	S. Tuttlle	do	While coupling	Fingers crushed.	
Weldford	S. Townsend	do	While oiling engine	Finger crushed.	
Jacquet River	Alex. Major	do	While unloading rails	Thumb crushed.	
Truro	C. Caudle	do	While coupling	Slightly injured.	
St. John	Victoria Hoon	C.P.R. passenger.	Got on wrong train and jumped off while train in motion.	Considerably injured.	
East of Rogersville.	Pacific Arseneau	Neither.	Walking on track was struck.	Head injured	
Richmond	John Brown	Employé	Fell off top of car	Slightly injured.	
Newcastle	W. Bovard	do	While coupling	Finger crushed	
St. Arsène	H. Bastille	do	Fell off train while in motion.	Leg broken	
Cold Brook	—— Buckout	Passenger	Jumped off train while in motion.	Head and leg injured.	
West of St. Francis.	Louis Buteau	Neither.	Lying on track was struck by engine.	Fatal	Accidental.
Sackville	O. Scott	Employé	While coupling	Finger crushed	
East of New Glasgow.	Chas. M. Hill	Neither.	Attempting to jump on train in motion.	Fatal	Accidental.
Moncton	E. White	Employé	While coupling	Finger crushed	
do	D. McWilliams	do	do	do	
Hampton	Robt. Cleveland.	do	While cleaning ash pan	Finger injured	
Berry's Mills	C. B. Keith	do	Struck by semaphore lever	Arm injured	
Pollet River	J. R. Raymond	Passenger	Slipped when stepping on train.	Side injured	

INTERCOLONIAL

RETURN of Accidents and Casualties which have occurred in Canada

Date.	Time of Day.	No. of Train.	Description of Train.	Name of Conductor.	Name of Driver.	No. of Engine.
1890.						
Oct. 25..	18.45	Special..	Working	J. L. Hebert	L. Tardiff	83
do 30..	15.45		Shunting		E. Tobin	93
do 30..	23.45	Special..	Freight	L. N. Latarte	E. Parsons	134
do 31..	23.10		Shunting		F. Welling.	190
do 31..	16.40	Special..	Freight	W. McClafferty	E. Kennedy	9
Nov. 3..	8.00	do ..	Ballast	J. H. Richardson	H. Trites	112
do 6..	14.00	36	Freight	P. E. Heine	O. McGinity.	39
do 12..						
do 14..	14.00	Special..	Working	E. Bowser	W. Keith	29
do 19..	12.40	38	Freight	E. L. Watts	J. Williamson	144
do 20..	17.40	81	do	C. Upham	Jno. Ross	57
do 21..	10.30	16	do	J. J. Daley	Geo. Feetham	107
do 27..	16.30					
do 28..	19.15	Special..	Freight	W. Papineau	W. E. Turner	132
do 28..	2.40	do ..	do	C. Ayer	W. C. Hunter	60
do 29..	14.00		Shunting		H. Como	191
Dec. 2..	10.00		do		R. James	100
do 5..	5.30	3	Freight	W. J. Campbell	G. C. Palmer	51
do 13..	22.00	Special..	do	J. B. Pollock	W. Appleton	126
do 17..	14.00	do ..	do	Thos. Guinan	J. W. Nairn	197
do 18..	8.20	41	do	A. Bergin	J. Deveraux	139
do 18..	11.50	33	Express	Geo. Walker	J. Murphy.	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11 50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151

RAILWAY.

on the Line of the Intercolonial Railway, &c.—*Continued.*

Place of Accident.	Name of Person Injured.	Whether Passenger or Employé.	Particulars of Accident.	Extent of Injury.	Verdict of Coroner's Jury.
Sacre Cœur	Geo. Costin	Employé	While coupling	Finger crushed.	
Richmond	D. McTiernan	Employé	While coupling	Hand crushed.	
Chaudière	Z. Filteau	do	do	do	
Moncton	J. P. Laughy	do	do	do	
Oxford Junction	J. Weathersbee	do	do	do	
Meadowville	A. B. Almon	do	Slipped when getting off engine.	Shoulder injured	
West of Canaan	F. Dupuis	do off duty.	While asleep on track was struck.	Fatal	Accidental.
Campbellton	P. Trainer	Employé	Fell between coal shed and engine.	Considerably injured.	
East of Charlo	H. Melanson	do	While loading rails	Hand injured	
Gloucester Jctn	John Thompson.	do	While coupling	Hand slightly injured.	
Rockingham	A. Smith	Passenger	Jumped off train while in motion.	Considerably injured.	
Oakfield	E. W. Lutes	Employé	While coupling	Finger cut off	
Truro	Chas. McKean	Passenger	Died on station platform from natural causes.		Heart disease.
East of St. Luce	Thos. Gosselin	Employé	While applying brake fell from car.	Fatal	Accidental.
Moncton	Martin Haley	do	While coupling	Finger crushed.	
St. John	A. Tuttle	do	do	do	
do	J. Maher	do	do snow plough	Ankle injured.	
Point du Chêne	N. Stableford	do	do	Finger injured.	
Stewiacke	A. Chisholm	do	do	Shoulder injured	
Truro	Wm. Hamilton	do	do	Hand crushed.	
Assametquaghan	P. Fraser	do	While unloading freight.	Hand injured.	
St. Joseph	Max. Drespool	Passenger	Train ran off track.	Fatal	
do	A. Dessaint	do	do	do	
do	J. P. Blais	do	do	do	
do	F. X. Leclerc	do	do	do	
do	Frs. Gauvin	do	do	do	
do	Mrs. Beauchemin	do	do	Fatally injured.	
do	M. LeBel	do	do	do	
do	Jeremie Beaulieu	Employé	do	do	
do	Albert Coffin	Passenger	do	Leg fractured.	
do	Mrs. Coffin	do	do	Collar bone fractured.	
do	Willie Coffin	do	do	Wrist fractured.	
do	Ernest Coffin	do	do	Shoulder and ear injured.	
do	Geo. Walker	Employé	do	Slightly injured.	
do	T. Dubé	Passenger	do	Nose and arm fractured.	
do	Mrs. G. Gagnon	do	do	Ribs fractured.	
do	J. P. Lavoie	Employé	do	Head and wrist injured.	
do	F. Marceau	Passenger	do	Head, face and chest injured.	
do	Eug. Arseneault	do	do	Head and chest injured.	
do	Mrs. Frs. Côté	do	do	Seriously injured	
do	S. Dionne	do	do	do	
do	Mrs. Cayouette	do	do	Collar and breast bone fractured.	
do	Abel Migneault	do	do	Arm fractured.	
do	Widow A. Godin	do	do	Considerably bruised.	
do	Thos. Wilson	do	do	Head and arm injured.	

INTERCOLONIAL

RETURN of Accidents and Casualties which have occurred in Canada

Date.	Time of Day.	No. of Train.	Description of Train.	Name of Conductor.	Name of Driver.	No. of Engine.
1890.						
Dec. 18..	11.50	33	Express	George Walker	J. Murphy	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11 50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 18..	11.50	33	do	do	do	151
do 19..	11 30	Special..	Freight	J. W. Johnston	R. Wilson	9
do 19..	8.20	34	Express	A. McLellan	M. Bellevance	37
do 19..	11.00	....	Shunting	....	P. Forgarty	188
do 22..	14.00	....	do	....	M. Lobin	98
do 29..	23.00	Special..	Freight	J. B. Pollock	R. Kennedy	63
do 29..	10.37	42	do	F. Bouchard	L. Lardiff	83
1891.						
Jan. 2..	11.22	17	do	C, J. Rhodes	H. Smith	137
do 5..	10.00	....	....	....	....	....
do 6..	3.30	Special..	Freight	L. N. Lebart	George Lamothe	109
do 8..	8·40	do	do	Geo. Couchy	J. Cloutier	109
do 9..	9·45	73	do	Jas. McDonald	John Ferguson	45
do 10..	1.30	....	Shunting	....	Charles McHugh	18
do 13.	11.00	Special..	Freight	D. Haines	D. Cool	200
do 14..	.....	....	....	....	....	....
do 17..	20.10	46	Freight	R. M. Orchard	A. J. Sharp	201
do 18..	14.05	Special.	Plough train	J. Hamilton	J. G. Scott	187

RAILWAY.

on the Line of the Intercolonial Railway, &c.—*Continued.*

Place of Accident.	Name of Person Injured.	Whether Passenger or Employé.	Particulars of Accident.	Extent of Injury.	Verdict of Coroner's Jury.
St. Joseph	Rev. M. Garveau	Passenger	Train ran off track.	Forehead bruised	
do	Alfred Dobson	do	do	Leg fractured	
do	H. Gagnon	do	do	do and head cut.	
do	T. Fuller	do	do	Hand and head injured.	
do	Mrs. Fuller	do	do	Nervous shock	
do	Miss McGarry	do	do	do	
do	E. S. Farrel	do	do	Slightly injured.	
do	O. Brochu	do	do	do	
do	M. Plante	do	do	do	
do	A. Gagne	do	do	do	
do	Paul Côté	do	do	do	
do	Pierre Dube	do	do	Side injured	
do	Mr. Bolduc	do	do	Head injured	
do	P. Bouchard	do	do	Leg slightly injured.	
do	Rev. M. Lessard	do	do	Head injured	
do	Sim. Godbout	do	do	do	
do	Alphonse Côté	do	do	Slightly injured.	
do	Rev. Jos. Lavoie	do	do	do	
do	— Michand	Newsboy	do	do	
do	Dr. Tanguay	Passenger	do	do	
do	Dr. Morrisett	do	do	do	
do	Thos. Pelletier	do	do	do	
do	Mrs. Hayden & 5 children.	do	do	All slightly injured.	
do	Miss Pope	do	do	Slightly injured.	
do	Mrs. Dubois	do	do	do	
do	James Wilson	do	do	do	
do	J. Robitaille	do	do	do	
do	E. Robitaille	do	do	do	
do	Miss Caron	do	do	do	
do	A. Granville	do	do	do	
Stellarton	G. A. Campbell	Employé	While loading freight	Finger injured	
Jacquet River	Thos. Brown	do	Slipped and fell when getting on train.	Slightly injured.	
Moncton	Chas. Ayles	do	While coupling	Hand slightly injured.	
Richmond	F. Hinch	do	Fell off car	Seriously injured	
Lily Lake	H. Baker	do	While coupling	Hand crushed	
St. Fabien	A. Beaulieu	do	do	Finger crushed	
Halifax	J. Cooper	do	Fell off cars and was run over.	Fatal	Accidental.
Moncton	J. W. Clarke	do	Fell off coal trestle	Seriously injured	
St. Valiet	D. Vachon	do	While coupling	Slightly injured.	
St. Pierre	— Deschamps	do	Fell off engine.	Seriously injured	
Wallace	Wm. Yeomans	do	While coupling	Finger crushed.	
Moncton	Chas. Green	do	While shunting	Finger bruised	
West of Bathurst	D. Cool	do	Tire of driving wheel broke	Slightly injured.	
East of St. Fabien.	Unknown	Neither	Found dead on track		Found dead with wounds. Supposed to have been struck by I. C.R. train.
Sayabec	N. Beaulieu	Employé	Struck with semaphore lever.	Face injured	
West of Dalhousie.	— Miller	Neither	Struck by plough while crossing track with team.	Fatal	Accidental.

INTERCOLONIAL

RETURN of Accidents and Casualties which have occurred in Canada

Date.	Time of Day.	No. of Train.	Description of Train.	Name of Conductor.	Name of Driver.	No. of Engine.
1891.						
Jan. 18..	16.30	Special..	Freight	A. Bégin	J. Belleau	28
do 23..	7 20	do ..	Snowplough train..	Jas. Card.	T. M. Rippey	203
do 23..	9.00	do ..	do	F. Morency	Alex. Doig F. Cloutier	194 111
do 24..	12.30	do ..	Freight	F. Dixon	James Howie W. G. Bell	182 39
do 24..	14.40	do ..	do	J. Thompson	James Cook	205
do 25..	10.00	do ..	do	Geo. McElhenny	Peter Fraser	114
do 27	13.25	do ..	do	H. Y. Archibald	L. Starratt	171
do 29..	22.00	do ..	do	G. Soucey	E. Ouellette	129
Feb. 4..	18.50	38	do	E. Watts	D. McQuarry	112
do 4..	14.00	.....	Shunting		J. W. Boyd	95
do 5..	8.00	Special.	Freight	J. McDonald	J. Sproule	173
do 9..	9.30	3	do	W. J. Campbell	G. C. Palmer	51
do 10..	6.10	Special.	do	A. C. McLean	T. W. Hennessy	5
do 12..	5.05	34	Express	T. Corbett	B. Lutes	147
do 13..	15.00	.....	.....	.....	.....	.....
do 20..	.....	75	Freight	M. Cummings	J. Stratton	25
do 21..	22.00	.....	Shunting.	.....	M. O'Brien	99
do 22..	12.30	Special.	Snowplough train.	Jas. McIntosh	H. Stewart	30
do 23..	24.25	.....	Shunting	.....	M. O'Brien	99
do 25..	8.40	.....	do	.....	T. O'Brien	87
do 25..	8.00	59	Freight	E. S. Vye	F. H. Moore	70
Mar. 1..	13.15	33	Express	M. Letarte	Jos. Collet	76
do 5..	24.00	.....	Shunting	.....	J. Weldon	18
do 7	20.15	40	Freight	H. Barreau	J. Howie F. Setchell	192 40
do 12..	15.00	37	do	E. Watts	J. Williamson	186
do 13..	5.10	Special.	do	J. B. Crockett	S. Wilson	122
do 13..	24.00	do ..	do	C. H. Bass	B. C. Gesner	200
do 16..	20.30	do ..	do	D. Hains	J. Deboo	6
do 20..	7.30	do ..	do	A. T. Moreau.	Geo. Topping	165
do 23..	13.45	do ..	do	C. A. Atkinson	L. Bradshaw	179
do 24..	19.20	12	do	A. W. Melick	S. Watson	60
do 28..	13.00	Special.	do	D. McIntosh	A. Sproul	113
April 2..	19.00	do ..	do	W. Bovard	W. Smallwood	182
do 2..	21.00	do ..	do	F. Robbins	W. C. Hunter	144
do 9..	11.00	.....	Shunting	.....	T. W. Rioux	14

RAILWAY.

on the line of the Intercolonial Railway, &c.—*Concluded.*

Place of Accident.	Name of Person Injured.	Whether Passenger or Employé.	Particulars of Accident.	Extent of Injury.	Verdict of Coroner's Jury.
St. Charles snow shed.	D. Samson....	Neither...	While walking on track was struck by train.	Seriously injured	
	A. Turgeon...	do ...	do do ...	do ..	
West of Dalhousie Junct'n	Geo. Thompson.	Employé ...	While walking on track was struck by snow-plough.	Ankle broken...	
St. Charles	F. Morency. ..	do	While looking out of car door, head was struck by part of a scaffold.	Seriously injured	
Petit Rock.. ...	W. G. Bell.	do ...	Fell off engine and was run over.	Fatal	Accidental.
Lakeville Siding.	John Thompson.	do ...	While uncoupling slipped and fell.	Foot crushed....	
Atkinson do .	Geo. McElhenny	do ...	Fell off car.	Seriously injured	
Thomson.....	D. Goodwin	do ...	While coupling	Finger crushed..	
Hadlow	A. Laverdière ..	do ...	While coupling got caught between engine and snowplough.	Slightly injured.	
Bathurst	G. Fryers.....	do ...	While fireman was breaking coal in tender, struck his foot with pick.	do ..	
Truro	J. L. Barahill...	do ...	While coupling... ...	Fingers crushed.	
West of Stellarton.	D. Cowan	do ...	Fell off car while in motion	Seriously injured	
Petitcodiac.....	A. Atkinson...	do ...	While coupling..... ..	Fingers crushed.	
Oxford Junc..	— Crowell.....	do .	Collided with a train at	Both slightly in-	
	T. W. Hennessy	do .	station.	jured.	
East of Petit Rock.	B. Lutes.....	do ..	Snow broke cab window..	Face injured ...	
Halifax.....	John Mitchell ..	do ...	While oiling machinery of elevator was caught in cogwheel.	Fatal	Accidental.
Barnaby River..	M. Haley.....	do ...	Slipped while getting off car.	Ankle sprained .	
Moncton	F. Storey.....	do ...	While shunting.	Leg broken.....	
East of Folleigh Lake.	H. Stewart	do ...	Side rod of engine broke..	Slightly injured.	
Moncton	J. A. McManus.	do ...	While coupling	Fingers bruised..	
Halifax	J. A. Puskie....	Neither.....	While walking on track was struck by a car.	Shoulder slightly injured.	
Indiantown	T. Anderson....	Employé ...	While shunting.....	Shoulder injured	
St. Joseph	Pierre Stophile..	Neither.....	Struck by engine while walking on track.	Fatal	Accidental.
Moncton	R. Bowers.....	Employé ...	While coupling.... ...	Fingers crushed.	
East of Campbellton.	M. Callahan....	Neither...	Struck by a train while walking on track.	Fatal	Accidental.
Gloucester Junc.	J. Thompson ...	Employé ...	While loading freight....	Ankle sprained..	
Penobsquis.....	C. Lutes.....	do ...	Fell while shunting	Face bruised....	
Spring Hill Junc	M. Connolly....	do ...	While coupling pin flew out.	Nose broken...	
Newcastle	J. T. Poirier....	do ...	While coupling	Hand crushed...	
Lévis..... ...	Geo. Torque. ..	do ...	do	Hand do ...	
Mortimore	E. Amos.....	do ...	do	Fingers do ...	
Nemwigewaux..	John Mullen ...	Neither.....	Struck by train while walking on track.	Slightly injured.	
Oxford Junction	F. Muirhead....	Employé ...	Slipped when getting off car.	Ankle sprained..	
Newcastle . ..	D. Armstrong...	do ...	Fell while shunting.....	Back injured....	
Rogersville	G. Anderson ..	do ...	While coupling	Hand do	
Ste. Flavie.....	J. B. Thibault..	do ...	While uncoupling foot caught in frog.	Slightly injured.	

INTERCOLONIAL

RETURN of Accidents and Casualties which have occurred in Canada

Date.	Time of Day.	No. of Train.	Description of Train.	Name of Conductor.	Name of Driver.	No. of Engine.
1891.						
April 10..	9.15	34	Express	J. Berry	J. McNairn	197
do 17..	10.37	18	Freight	J. N. Miller	D. Duncan	135
do 17..	11.55	18	do	do	do	135
do 21..	15.00	.....	Shunting		H. Como	190
do 23..	19.30	33	Express	Geo. McCully	J. McNairn	197
do 25..	9.10	Special..	Freight	W. W. Irving	A. Wood	183
do 27..	10.45	.....	Shunting		J. Cole	18
May 1..	8 20	Special..	Freight	Geo. Sears	J. Gilfillan	90
do 7..	19.00	do ..	do	E. Bowser	J. McCracken	34
do 8..	16.25	1	Express	A. Rainnie	T. W. Prince	163
do 11..	12.10	30	do	J. McFadgen	Jos. H. Moore	74
do 11..	23.00	70	Freight	Jas. Daley	J. Brownell	41
do 11..	7.00	.....	Shunting	W. McPherson	A. McDonald	71
do 14..	16.50	Special..	Freight	Geo. Sears	F. Welling	206
do 16..	11.15	73	do	Jas. McDonald	J. Ferguson	54
do 18..	13.30	.....	Light engine Calg'y Ry. & C. Co.		R. Richmond	4
do 25..	.....	Special..	Freight	W. McClafferty	T. W. Hennessy	198
do 25..	5.30	5	do	J. Hughes	J. Gratten	90
do 29..	9.55	55	do	W. J. Dickson	J. Wall	8
June 2..	14.00	Special..	Ballast train	H. McDormand	L. Harratt	113
do 2..	1.25	39	Freight	W. Crockett	J. Stratton	192
do 18..	8.45	.....	Shunting	D. McTiernan	T. O'Brien	189
do 19..	19.45	.....	Freight	W. W. Irving	W. C. Hunter	81
do 23..	10.15	do ..	Ballast train	J. L. Chisholm	R. Kennedy	116
do 29..	17.00	do ..	Freight	Thos. Guinan	J. McDonald	196
do 30..	15.15	60	do	E. S. Vye	F. H. Moore	70

RAILWAY.

on the line of the Intercolonial Railway, &c.—*Continued.*

Place of Accident.	Name of Person Injured.	Whether Passenger or Employé.	Particulars of Accident.	Extent of Injury.	Verdict of Coroner's Jury.
Oxford Junction	J. R. McKean	Employé	Shot at by a passenger	Slightly wounded	
Truro	A. Peters	Passenger	Jumped off train while in motion.	Leg broken	
W. of Stewiacke	J. L. Jinks	Neither	While walking on track was struck by engine.	Severely injured.	
St. John	H. McDade	Employé	While coupling	Slightly do	
Moncton	A. Johnston (boy).	Neither	Attempted to jump on train in motion.	Fatally injured.	
New Castle	F. Raymond	Employé	While coupling	Finger crushed	
Moncton	J. A. White	do	While shunting	Foot injured	
Sussex	R. Bower	do	While applying brake	do	
Weldford	W H. Morton	do	When stepping off train	Sprained ankle	
East of Sussex	Robt. Saunders	Passenger	Fell off train while in motion.	Head and face cut.	
Point du Chêne wharf.	M. Clear	Neither	Struck by steps of car while working near track.	Slightly injured.	
Brookville	D. Trenholm	Employé	While releasing air-brake.	Foot severely injured.	
Pictou	M. Daley	do	While shunting fell off car	Back injured	
Maccan	N. Stableford	do	Fell off engine in motion.	Head cut	
Oxford	W. McDonald	do	Wind caused car door to shut violently.	Fingers bruised	
Spring Hill Junction.	D. McKenzie	do	While walking on track was struck by engine.	Foot injured	
West of Oxford Juncton.	Frank Jones	Neither	do train	Foot crushed	
East of Rothesay	John Philips	do	Found dead on track; had been struck by a train.		
Barney's River	— McLeod (boy).	do	Attempted to make a coupling.	Fingers crushed.	
Ballast Pit, Scotsburn.	C. McKenzie	Employé	While coupling	do	
Chatham Junction.	A. McEachern	do	Fell while loading cattle	Ankle sprained	
Halifax	E. McGrath	do	Was caught between cars when attempting to cross track.	Fatal	Accidental.
Rogersville	N. Morton	do	While coupling	Fingers crushed.	
Thompson	J. Singer	do	Fell between cars while in motion.	Fatal	
East of Glengarry.	Jas. McDonald	do	Hand car was struck by a train.	Slightly injured.	
East of Derby Junction.	A. Morrison	Passenger	Fell from train while in motion.	Seriously injured	

EASTERN EXTENSION RAILWAY.

OFFICE OF THE CHIEF SUPERINTENDENT,
MONCTON, N.B., 13th November, 1891.

SIR,—I have the honour to submit the following report with reference to the Eastern Extension Railway, for the fiscal year which ended the 30th June, 1891.

On the 1st of July, 1890, the accounts for the maintenance and operation of this railway, which had heretofore been kept separate, were, by your orders, merged in the similar accounts of the Intercolonial Railway.

I enclose a statement of the capital account.

The total cost of road and equipment on the 30th June, 1890, was	$1,318,731 49
There was added during the year for increased accommodation at Mulgrave	3,255 40
Making a total cost on the 30th June, 1891	$1,321,986 89

The expenditure was for filling in a vacant space to make more yard room, and providing additional accommodation for passenger and freight business.

I have the honour to be, Sir,
Your obedient servant,
D. POTTINGER,
Chief Superintendent.

COLLINGWOOD SCHREIBER, Esq.,
Chief Engineer and General Manager Government Railways,
Ottawa.

No. 1.—EASTERN EXTENSION RAILWAY.

DR. CAPITAL ACCOUNT, Year ending 30th June, 1891. CR.

1890.		$ cts.	1890.		$ cts.
June 30.	To cost of road and equipment	1,318,731 49	June 30.	By Dominion of Canada	1,318,731 49
1891.			1891.		
June 30.	Increase at Mulgrave	3,255 40	June 30.	do do	3,255 40
		1,321,986 89			1,321,986 89

THOMAS WILLIAMS,
Chief Accountant and Treasurer.

MONCTON, N.B., 30th June, 1891.

WINDSOR BRANCH RAILWAY,

OFFICE OF THE CHIEF SUPERINTENDENT,
MONCTON, N.B., 13th November, 1891.

SIR,—I have the honour to submit the following statements showing the results of the working of the Windsor Branch Railway, for the year which ended the 30th June, 1891.

No. 1. Revenue Account.
2. Maintenance of way and works.

3. General balance.
4. Statement of earnings.

I also send you the report of the Chief Engineer on the condition of the permanent way and works.

This line, 32 miles in length, was operated during the year by the Windsor and Annapolis Railway Company on the same terms as last year, the company being allowed to retain two-thirds of the gross earnings, the balance, one-third, being paid over to the Government, the latter maintaining the line.

There was an increase in the earnings accruing to the Government, when compared with last year, as follows :—

In 1890-91	$30,235 13
1889-90	30,162 46
	$ 72 67

The expenses of maintenance were more than last year, as follows :—

In 1890-91	$28,931 71
1889-90	18,982 82
	$ 9,948 89

This increase of expenditure was caused by the making of the improvements hereafter mentioned.

The earnings and expenses compare as follows :—

Earnings	$30,235 13
Expenses	28,931 71
	$ 1,303 42

The necessary repairs and renewals were made, including the laying of 4 miles of new steel rails. A wooden trestle bridge over Jordan River, requiring renewal, was replaced by a new steel bridge of 7 spans.

The water supply at Newport was also improved at an expense of $3,200.

The permanent way and works are in good order.

I have the honour to be, Sir,

Your obedient servant,

D. POTTINGER,

Chief Superintendent.

COLLINGWOOD SCHREIBER, Esq.,
Chief Engineer and General Manager Government Railways,
Ottawa.

INTERCOLONIAL RAILWAY,
CHIEF ENGINEER'S OFFICE,
MONCTON, N.B., 7th November, 1891.

SIR,—I have the honour to submit the following report for the maintenance of the Windsor Branch for the year ending 30th June, 1891 :

TRACK.

The mileage remains the same as last year. Four miles of new steel rails have been laid in place of badly-worn iron rails, removed from the track.

TIES.

During the year 12,950 ordinary ties and 4 sets of switch ties have been removed.

SIDINGS.

A new siding was put in near the Three-mile Plains, for the accommodation of a large saw mill recently erected at that plate by Mr. Gould Northrup.

The old T rails in the siding at Mount Uniacke and 3 sidings in Windsor yard have been replaced with a better quality of rails recently taken up from the main line.

FENCING.

During the year 2,308 rods of barbed and woven wire fencing have been erected.

BUILDINGS AND PLATFORMS.

The platform at Beaver Bank station was renewed. Extensive repairs were made to the platforms at Windsor Junction and Newport.

Very considerable repairs were made to the station house and freight shed at Windsor.

A new tool house was erected at Mount Uniacke.

BRIDGES.

The old wooden trestle bridge at Jordon River was replaced with 7 spans of steel plate girders with a floor of Georgia pine ties chocked, and an iron guard-rail, extending across and 20 feet beyond either end of bridge.

The balance of the ties on the Big Bog bridge were renewed and iron guard-rails put on, and the ties chocked and painted.

The approaches on either end of the high bridge at St. Croix were widened and the guard-rail extended to more efficiently protect the bridge.

Three spans of rail girders, one of 12 feet, one of 13 feet and one of 14 feet, were put in place of wooden stringers on beam culverts between Newport and Ellershouse.

The floor of Sackville bridge was painted.

Two steel girders were put in, one east and the other west of Ellershouse. These were necessary, on account of the stoppage of the old stone drains originally put in at the foot of the embankments.

WATER SUPPLIES.

A gravitation water supply was provided at Newport, at a cost of about $3,200, the old supply having entirely failed.

I have the honour to be, Sir,

Your obedient servant,

P. S. ARCHIBALD,

Chief Engineer.

D. POTTINGER, Esq.,
Chief Superintendent Intercolonial Ry.,
Moncton, N.B.

No. 1.—WINDSOR BRANCH RAILWAY.

DR. REVENUE ACCOUNT, Year ending 30th June, 1891. CR.

Previous Year.	Expenditure.	Year ending 30th June, 1891.	Previous Year.	Receipts and Earnings.	Amount, Year ending 30th June, 1891.
$ cts.		$ cts.	$ cts.		$ cts.
18,982 82	Maintenance of way and works, Abstract No. 1.....	28,931 71	10,369 12	Passenger traffic.....	10,746 38
			18,641 50	Freight traffic.....	18,336 91
			1,151 84	Mails.....	1,151 84
11,179 64	Balance.....	1,303 42			
30,162 46		30,235 13	30,162 46		30,235 13

Certified correct,

T. WILLIAMS,
Chief Acct. and Treas., I. C. R.

MONCTON, N.B., 30th June, 1891.

R. B. BOGGS,
Acct., W. B. Ry.

No. 2.—WINDSOR BRANCH RAILWAY.

MAINTENANCE of Way and Works.

Previous Year.	Particulars.	Amount.
$ cts.		$ cts.
10,567 94	Repairs to track	12,642 04
106 51	Cr.—Rails and fastenings	4,052 02
2,750 50	Ties	3,529 30
2 70	Switch locks	12 60
1,191 55	Bridges	5,422 36
4 05	Signals	3 00
673 94	Culverts and cattle guards	467 49
963 14	Wharf at Windsor	
213 29	Buildings and platforms	463 09
1 40	Hand cars and trollies	27 45
195 77	Tools and repairs	173 31
113 35	Snow ploughs and flangers	134 95
1,237 45	Fencing	850 59
1,114 82	Accountant's office and expenses	1,104 72
59 43	Miscellaneous	48 79
18,982 82		28,931 71

Certified correct,
T. WILLIAMS,
Chief Acct. and Treas., I.C.R.
MONCTON, N.B., 30th June, 1891.

R. B. BOGGS,
Acct., W. B. Ry.

No. 3.—WINDSOR BRANCH RAILWAY.

DR. GENERAL BALANCE. CR.

1891.		$ cts.	1891.		$ cts.
June 30.	Windsor and Annapolis Railway	2,745 25	June 30.	Intercolonial Railway....	.....
	Old material account..... ..	8,000 00		Dominion account..	10,745 25
		10,745 25			10,745 25

R. B. BOGGS,
Acct., W. B. Ry.

Certified correct,
T. WILLIAMS,
Chief Acct. and Treasurer, I. C. R.
MONCTON, N.B., 30th June, 1891.

No. 4.—WINDSOR BRANCH RAILWAY.

MONTHLY STATEMENT of Receipts—One-third Earnings.

Month.	Passengers.	Freight.	Mails.	Totals.
	$ cts.	$ cts.	$ cts.	$ cts.
1890—July	1,086 38	113 06	1,361 14	2,560 58
August.....	1,454 86	80 76	1,282 14	2,817 76
September.....	1,362 45	96 90	2,142 91	3,602 26
October..	891 60	96 91	2,257 77	3,246 28
November.....	761 04	96 91	1,838 22	2,696 17
December....	832 15	96 90	1,477 15	2,406 20
1891—January.....	624 48	94 46	1,616 19	2,335 13
February..	490 57	94 45	1,318 64	1,903 66
March	689 45	94 45	1,438 30	2,222 20
April	713 15	95 68	1,297 90	2,106 73
May	785 89	95 68	1,179 24	2,060 81
June.....	1,054 36	95 68	1,127 31	2,277 35
	10,746 38	1,151 84	18,336 91	30,235 15

R. B. BOGGS,
Acct., W. B. Ry.

Certified correct,
T. WILLIAMS,
Chief Acct. and Treasurer, I. C. R.
MONCTON, N.B., 30th June, 1891.

PRINCE EDWARD ISLAND RAILWAY.

SUPERINTENDENT'S OFFICE,
CHARLOTTETOWN, P.E.I., 16th September, 1891.

SIR,—I have the honour to submit the following report on the working of the Prince Edward Island Railway, for the fiscal year ended 30th June, 1891.

I enclose the following statements prepared by the Accountant and Auditor :—

No. 1. Capital account.
2. Revenue account.
3. Locomotive power. (Abstract No. 1.)
4. Car expenses. (do 2.)
5. Maintenance of ways and works. (do 3.)
6. Station expenses. (do 4.)
7. General charges. (do 5.)
8. Statement of general stores account.
9. General balance.
10. Comparative statement of averages.

CAPITAL ACCOUNT.

The total expenditure on capital account to 30th June, 1890, was	$3,741,780 89
No additions being made during the year, the total expenditure to 30th June, 1891, was the same as the previous year	$3,741,780 89

REVENUE ACCOUNT.

The gross earnings for the year amounted to	$174,258 05
Previous year	160,971 78
Increase	$ 13,286 27

The earnings per mile of railway compare with the previous year, as follows :—

1889-90	$766 53
1890-91	829 90
An increase per mile of	$ 63 37

The length of the road operated in each year was the same, namely, 221 miles.

STATEMENT.

	Passengers Carried.	Earnings.
1889–90	138,099	$69,399 72
1890–91	145,508	72,292 23
Increase	7,409	$ 2,892 51
	Tons of freight carried.	**Earnings,**
1889–90	51,604	$73,663 06
1890–91	59,511	81,660 82
Increase	7,907	$ 7,997 76
Mails and sundries, 1889–90		$17,909 00
do 1890–91		20,305 00
Increase		$ 2,396 00

	Earnings.
The engine mileage compared with last year was :—	
1889–90	315,943
1890–91	335,202
Increase	19,259
The train mileage as compared with last year was :—	
1889–90	252,573
1890–91	272,475
Increase	1,902
The car mileage as compared with last year was :—	
1889–90	1,316,355
1890–91	1,420,428
Increase	104,073

Expenditure.

The working expenses as compared with last year were as follows :—

Renewals.

	Ordinary.	Rolling Stock, Rails and Fastenings.	Total.
1889–90	$248,270 55	$ 18,215 30	$266,485 85
1890–91	257,039 13	950 95	257,990 08
Increase	$ 8,768 58	$17,264 35	$ 8,495 77

Included in the above ordinary expenditure are the following amounts for new works :—

Iron bridge at Milton	$1,712 31
do Moore's	3,308 86
New abutments at Pig Brook bridge	3,098 64
Deviation of track at Moore's bridge	2,680 78
Extension of Summerside wharf	1,285 95
Total new works	$12,086 54

Track.

The mileage remains the same as last year, 125 miles laid with iron rails, and 85 miles laid with steel rails. Total, 210 miles.

The track at Moore's bridge was deviated from the original line for the length of one-half mile.

Sidings.

A siding 164 feet long was moved from near Conway and placed at Lynch Road.
The siding at Bedford was extended 250 feet and made a through siding.
A spur siding 341 feet long was put in at the Charlottetown Driving Park.
The siding at Morell was extended 150 feet.

Sleepers.

During the year 84,587 sleepers were put in track ; 13 sets of switch sleepers and 20 head blocks with switch frames were renewed.

BALLASTING.

During the year 7,088 cubic yards of ballast were distributed.

BRIDGES, CULVERTS, &C.

The embankments at Morell, Marie, Midgell bridges, and St. Peter's breastwork received extensive repairs, about 2,400 cubic yards rip-rap being used. This work was necessitated to repair the heavy damage done by the unprecedently heavy storms which occurred on the 1st December last.

Milton bridge was renewed with a 20-foot iron rail girder and stone abutments.

A new top was put on Emerald bridge.

A new top was put on Mill River bridge.

Stone abutments were built at Pig Brook bridge. The embankments at each end of this bridge were raised 2 feet, in order to give the necessary headway for the public highway underneath.

A new bent was placed under the bridge on the Alberton wharf track.

The west end of St. Peter's bridge was repaired and other necessary work done.

Marie bridge received 1 truss brace. The stringers and 50 sleepers were renewed.

Morell bridge received 12 new floor beams.

Naufrage bridge received 38 truss braces, 2 strutt plates, 1 wall plate and 80 sleepers.

McEwan's bridge, lot 40, received new wall plates and a new top.

Mount Stewart bridge had 7 truss braces renewed and other necessary repairs done.

All wooden bridges received the necessary repairs.

Pierce's culvert, near Royalty Junction, was rebuilt with two 12-inch iron pipes of a total length of 120 feet. This culvert was carried away by a freshet.

Four timber culverts were rebuilt, and 6 culverts had stringers and sleepers renewed.

Two 12-inch iron pipe culverts were put in, one 36 feet and the other 24 feet long.

Arch culverts between Harmony and Souris were pointed with cement.

Fifteen cattle guards were rebuilt, and 5 received new stringers and sleepers.

The clay pipe culvert ½ mile east of Summerside was rebuilt.

BUILDINGS, PLATFORMS, &C.

At Colville siding the platform was renewed.

At Richmond siding a new shed was erected and the platform renewed.

At McNeill's Mill siding, between Ellerslie and Conway, a new shed and platform were erected.

Bradalbane and Emerald stations were painted.

Nine of the flag stations between Charlottetown and Summerside were also painted.

At Alberton the office and waiting room were repaired and painted, and the roof of the baggage room was renewed.

At Tignish the roof of the freight house was re-shingled and the roof of the engine house was partly re-shingled. The roof of the baggage room was renewed.

At Charlottetown the sills on the north side of the station building were renewed and the platform was rebuilt. The roof of the train shed was re-shingled. Repairs were made to the carpenter shop, iron house, machine shop and coal shed. The foundation of the freight house was rebuilt and the flooring was renewed. The foundation of the coal shed was repaired.

At Royalty Junction the platform was rebuilt.

At Scotchfort the station and platform were rebuilt.

The station at Mount Stewart was repaired and painted.

At Marie and Midgell the stations were repaired and painted, and the platforms were rebuilt.

At Souris the roofs of the engine house and freight shed were partly re-shingled.

At Georgetown new floors were laid in the office, waiting room, baggage room. The platform was rebuilt and the freight house was re-shingled.

At St. Peter's the coal shed was repaired and the roof was re-shingled.

At Summerside the coal shed received extensive repairs, and new cedar sills were put under the freight house.

WHARVES.

At Summerside extensive repairs were made to the wharf, it having been considerably damaged last fall by two severe storms with very high tides. The outer end of the wharf was made 14 feet wider for a distance of 300 feet. This was necessary in order to accommodate the new steamer "Northumberland," now plying between Summerside and Point du Chêne.

At Souris the plank covering of the wharf was repaired, and 150 tons of stone were put in wharf.

The wharf at Georgetown received 50 fenders, 36 chocks and 140 tons of stone ballast.

At Charlottetown the breastwork east of the station received extensive repairs. On the east side new timbers 460 feet long and 14 inches high have been put down. Twelve cars of brush and 190 tons of stone were used.

The breastwork at St. Peters received extensive repairs, having been badly damaged last fall by a very severe storm.

FENCING.

Eighteen miles of woven wire fence, 8½ miles of barb wire, and 3,316 feet of wire and picket fence were erected to replace the old fence burnt and worn out.

One thousand two hundred feet of the Cape Traverse Branch fence was rebuilt.

Four thousand seven hundred and forty feet of snow fence was rebuilt and 825 feet was erected.

STORES.

The purchase of stores during the year amounted to $114,549.86.

The value of stores on hand to 30th June, 1891, was:—

General stores	$84,279 05
Coal	902 74
New steel rails and fastenings	32,672 80
Old iron rails and fastenings	16,320 82
Old material serviceable	7,932 00
	$142,107 41

These stores have for the most part been purchased by tender and contracts, which follows out the practice of previous years.

I enclose a return of accidents and casualties which have occurred on the railway during the year.

I am pleased to say that the road-bed, buildings and rolling stock are in good condition.

I have the honour to be, Sir,

Your obedient servant,

J. UNSWORTH,

Superintendent and Mechanical Superintendent.

COLLINGWOOD SCHREIBER, Esq.,
Chief Engineer and General Manager Government Railways,
Ottawa.

No. 1.—PRINCE EDWARD ISLAND RAILWAY.

DR. CAPITAL ACCOUNT. CR.

1890.		$ cts.	1890.		$ cts.
June 30..	To Cost of Road and Equipment to date.....	3,741,780 89	June 30..	By Dominion of Canada..	3,741,780 89
			1891.		
			June 30..	do do ...	... .
		3,741,780 89			3,741,780 89

W. T. HUGGAN,
Accountant and Auditor

CHARLOTTETOWN, P.E.I., 30th June, 1891.

No. 2.—PRINCE EDWARD ISLAND RAILWAY.

REVENUE ACCOUNT for Year ended 30th June, 1891.

Previous Year.	Expenditure.	Year ended 30th June, 1891.	Previous Year.	Receipts.	Year ended 30th June, 1891.
$ cts.		$ cts.	$ cts.		$ cts.
60,907 99	Locomotive power, per Abstract No. 1.	64,158 96	69,399 72	Passenger traffic.....	72,292 23
			73,663 06	Freight traffic	81,660 82
38,026 89	Car expenses, per Abstract No. 2.	37,696 58	17,909 00	Mails and sundries.....	20,305 00
126,919 05	Maintenance of way and works, per Abstract No. 3.	115,195 66	160,971 78	Total receipts.....	174,258 00
			105,514 07	Balance	83,732 03
28,717 52	Station expenses, per Abstract No. 4.	29,551 09			
11,914 40	General charges, per Abstract No. 5.....	11,387 79			
266,485 85	...Totals.....	257,990 08	266,485 85	. .Totals.....	257,990 08

W. T. HUGGAN,
Accountant and Auditor.

CHARLOTTETOWN, P.E.I., 30th June, 1891.

No. 3.—PRINCE EDWARD ISLAND RAILWAY.

LOCOMOTIVE POWER—(Abstract No 1)

Previous Year.	Details.	Year ended 30th June, 1891.
$ cts.		$ cts.
1,380 00	Mechanical Superintendent's salary, clerks, office and travelling expenses	1,412 16
16,419 37	Wages of drivers, firemen and cleaners	17,481 16
14,213 69	Fuel	14,905 62
2,042 36	Oil, tallow, waste and small stores	2,599 97
23,861 53	Repairs to engines, tenders and engine tools	24,524 71
897 72	Water, including pump and tank repairs	1,139 06
2,093 32	Miscellaneous	2,096 28
60,907 99	Totals	64,158 96

W. T. HUGGAN,
Accountant and Auditor.

CHARLOTTETOWN, P.E.I., 30th June, 1891.

No. 4.—PRINCE EDWARD ISLAND RAILWAY.

CAR EXPENSES—(Abstract No. 2).

Previous Year.	Details.	Year ended 30th June, 1891.
$ cts.		$ cts.
10,481 02	Repairs to passenger cars	10,648 03
1,457 97	do postal and baggage cars	1,546 58
7,789 59	do freight cars and vans	5,302 64
13,654 79	Wages of conductors, train baggagemasters and brakesmen	15,470 95
633 80	Oil and waste for packing	535 03
2,633 05	Small stores and fuel	3,270 96
1,376 67	Miscellaneous	922 39
38,026 89	Totals	37,696 58

W. T. HUGGAN,
Accountant and Auditor.

CHARLOTTETOWN, P.E.I., 30th June, 1891.

No. 5.—PRINCE EDWARD ISLAND RAILWAY.

MAINTENANCE of Way and Works—(Abstract No. 3).

Previous Year.	Details.	Year ended 30th June, 1891.
$ cts.		$ cts.
669 96	Engineer's salary, clerks, office and travelling expenses	419 21
49,215 18	Wages in repairing roadway, fences and semaphores	48,543 46
17,109 48	Rails, chairs and spikes	3,497 12
25,168 94	Ties	25,445 10
17,933 97	Timber and lumber for repairs to bridges, cattle-guards, fences, &c.	13,984 56
5,476 47	Repairs to wharves	3,146 41
7,784 54	do buildings and platforms	7,562 83
2,499 71	do snow ploughs, flangers and tools	2,894 10
1,060 80	Clearing ice and snow	9,702 87
126,919 05	Totals	115,195 66

W. T. HUGGAN,
Accountant and Auditor.

CHARLOTTETOWN, P.E.I., 30th June, 1891.

No. 6. PRINCE EDWARD ISLAND RAILWAY.

STATION EXPENSES—(Abstract No. 4).

Previous Year.	Details.	Year ended 30th June, 1891.
$ cts.		$ cts.
20,255 44	Salaries and wages of station masters, agents, clerks, telegraph operators, station baggage men, yardmasters, switchmen, watchmen and labourers	21,073 19
8,462 08	Fuel, oil, light, stationery, tickets and other incidental expenses	8,477 90
.....	Miscellaneous	.....
28,717 52	Totals	29,551 09

W. T. HUGGAN,
Accountant and Auditor.

CHARLOTTETOWN, P.E.I., 30th June, 1891.

No. 7.—PRINCE EDWARD ISLAND RAILWAY.

GENERAL CHARGES—(Abstract No. 5).

Previous Year.	Details.	Year ended 30th June, 1891.
4,425 88	Superintendent's and train despatcher's salaries, clerks, office and travelling expenses	4,308 49
5,298 44	Accountant and auditor's, paymaster's and cashier's salaries, clerks, office and travelling expenses	5,269 99
660 42	Advertising	849 85
318 38	Damages to men, animals and goods	84 46
461 52	Telegraph expenses (not including pay to operators)	375 47
749 76	Miscellaneous	499 53
11,914 40	Totals	11,387 79

W. T. HUGGAN,
Accountant and Auditor.

CHARLOTTETOWN, P.E.I., 30th June, 1891.

No. 8.—PRINCE EDWARD ISLAND RAILWAY.

STATEMENT of General Stores Account, Year ended 30th June, 1891.

1890.	Dr.	$ cts.	$ cts.
June 30.	To Balance brought forward		103,078 65
1891.			
June 30.	To Purchase during the year, including rails	114,549 86	
	Charges from other Departments	14,978 39	
	Pay-rolls	2,583 60	
			132,111 85
			235,190 50
	Cr.		
1891. June 30.	By Issues during the year		93,083 09
	Balance — Ordinary stores $84,279 05; Fuel 902 74; Rails and fastenings on hand 48,993 62; Old material, serviceable 7,932 00		142,107 41

W. T. HUGGAN,
Accountant and Auditor.

CHARLOTTETOWN, P.E.I., 30th June, 1891.

No. 9.—PRINCE EDWARD ISLAND RAILWAY.

Dr.	General Balance.		Cr.
	$ cts.		$ cts.
General stores	142,107 41	Dominion account	145,580 54
Cash	6,100 91	Accident insurance	4,919 89
Stations	1,288 96		
Militia Department	70 49		
Anglo-American Telegraph Co	46 43		
Judge Weatherbee	30 00		
Sidney Gray	25 00		
Railway Extension, Charlottetown	812 83		
Local Govt. P. E. Island	18 40		
Total	150,500 43	Total	150,500 43

W. T. HUGGAN,
Accountant and Auditor.

Charlottetown, P.E.I., 30th June, 1891.

No. 10.—PRINCE EDWARD ISLAND RAILWAY.

COMPARATIVE STATEMENT of Averages for Year ended 30th June, 1891.

Details.	1891.	1890.
Mileage of railway open	210	210
Engine mileage	335,202	315,943
Train do	272,475	252,573
Car do	1,420,425	1,316,355
Receipts per engine mile.....Cents.	51·99	50·94
do mile of railway.....Dollars.	829·80	766·53
Percentage of passenger earnings to gross receipts	41·49	43·11
do freight do do	46·86	45·76
do other do do	11·65	11·13
Expenses per engine mile—		
Drivers, firemen and cleaners' wages	5·21	5·20
Fuel	4·45	4·50
Oil, tallow, waste, and small stores	0·78	0·65
Repairs to engines	7·32	7·55
Water and tank repairs	0·34	0·28
Miscellaneous	0·62	0·66
	18·72	18·84
Mechanical Superintendent's salary, office and travelling expenses	0·42	0·44
Total.....Cents.	19·14	19·28
Locomotive power per engine mile	19·14	19·28
Car expenses do	11·25	12·04
Maintenance of way and works do	34·37	40·17
Station expenses do	8·81	9·09
General charges	3·40	3·77
Total per engine mile.....Cents.	76·97	84·35
Locomotive power per train mile	23·55	24.11
Car expenses do	13·83	15·06
Maintenance of way and works do	42·28	15·25
Station expenses do	10·84	11·37
General charges do	4·18	4·72
Total per train mile.....Cents.	94·68	105·51
Working expenses per mile of railway.....Dollars.	1,228·52	1,268·98

W. T. HUGGAN,
Accountant and Auditor.

CHARLOTTETOWN, P.E.I., 30th June, 1891.

PRINCE EDWARD ISLAND RAILWAY.

RETURN of Accidents and Casualties which have occurred on the Prince Edward Island Railway, during the Year ending 30th June, 1891.

Date.	Time of Day or Night.	No. of Train.	Description of Train.	Name of Conductor.	Name of Driver.	No. of Engine.	Place of Accident.	Name of Persons Injured.	Whether Passenger or Employé.	Particulars of Accident.	Extent of Injury.	Verdict of Corner's Jury.
1890.												
Sept. 10.	11·30 a.m.	..	Working..	G. Tanton....	R. Dongan....	16	Mount Stewart..	A. D. McDonald	Employé ..	Fell between engine and cars, while attempting to get on the train.	Leg fractured.	
do 19.	7·00 a.m.	..	Working..	do . .	do	16	....	W. Cary..	Employé ..	While coupling cars.....	Finger crushed	
Dec. 27.	5·55 a.m.	2	Accommodation.	J. Thomson...	H. Craswell ..	5	Tignish.....	A. McLeod.....	Employé ..	While coupling cars.. . .	Arm crushed..	
1891.												
Mar. 8.	8·10 a.m.	1	Accommodation.	do ...	do ..	16	Colville.....	F. Praught.....	Employé ..	While coupling cars.....	Thigh injured.	

MECHANICAL SUPERINTENDENT'S OFFICE,
CHARLOTTETOWN, P.E.I., 26th August, 1891.

SIR,—I beg to submit for your information the following statements, showing the operations of the Mechanical Department of this railway for the fiscal year ending 30th June, 1891.

A.—Monthly statement of the cost of locomotive power.

B.—Statement of the performance and consumption of locomotives.

C.—Monthly statement of car mileage.

D.—Statement showing the number of locomotives, cars, snow ploughs and flangers.

E.—Comparative statement of the expenses of the Mechanical Department for the years 1889-90 and 1890-91.

During the year four 10-ton platform cars have been rebuilt, at a cost of $950.95, which has been included in the cost of freight cars.

By reference to statement "D" it will be seen that the stock of locomotives, cars, snow ploughs and flangers provided on capital account consists of:—

21 locomotives.
17 first-class passenger cars.
15 second-class passenger cars.
175 box cars.
125 platform cars.
3 postal and smoking cars.
3 conductors' vans.
1 pay car.
8 snow ploughs.
7 flangers.

I am pleased to be able to report that the efficiency of the rolling stock has been well maintained during the year, and is in good condition.

I have the honour to be, Sir,

Your obedient servant,

J. UNSWORTH,

Superintendent and Mechanical Superintendent.

COLLINGWOOD SCHREIBER, Esq.,
Chief Engineer and General Manager Government Railways,
Ottawa.

PRINCE EDWARD

MECHANICAL

A.—STATEMENT of the Cost of Locomotive

Months.	Miles run by Engines, Less Ballasting.	Cost of				
		Enginemen's Wages.	Fuel.	Oil, Tallow, Waste, &c.	Repairs.	Water, including Tank and Pump Repairs.
		$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
1890—July	34,150	1,551 85	1,184 52	194 97	1,832 33	205 90
August	30,729	1,488 14	1,101 04	207 95	2,362 61	289 14
September	30,436	1,521 00	1,201 54	222 29	1,600 28	42 25
October	31,498	1,519 84	1,199 42	209 84	1,832 98	105 80
November	31,099	1,461 23	1,424 27	233 00	2,096 82	59 47
December	31,569	1,716 49	1,696 60	276 59	2,866 59	114 23
1891—January	22,492	1,348 91	1,021 90	186 10	2,433 81	29 00
February	23,439	1,523 98	1,419 70	232 53	2,344 02	30 49
March	25,218	1,513 87	1,279 40	215 09	2,091 44	180 69
April	21,506	1,181 94	1,016 57	160 17	1,816 32	23 22
May	23,585	1,264 16	1,114 10	176 78	1,307 58	13 48
June	29,478	1,389 75	1,246 56	221 66	1,939 93	45 39
Totals	335,202	17,481 16	14,905 62	2,599 97	24,524 71	1,139 06

ISLAND RAILWAY.

DEPARTMENT.

Power, for the Year ended 30th June, 1891.

		Average per Mile Run.						
Miscellaneous, including Expenses of Office and Engine House.	Total.	Engine-men.	Fuel.	Oil, Tallow, &c.	Repairs.	Water.	Miscel-laneous.	Total.
$ cts.	$ cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
227 67	5,197 24	4·54	3·47	0·57	5·36	0·60	0·67	15·21
221 40	5,733 28	4·84	3·58	0·88	7·69	0·94	0·72	18·65
427 41	5,014 77	4·99	3·95	0·73	5·26	0·14	1·40	16·47
279 47	5,147 35	4·83	3·80	0·66	5·82	0·34	0·89	16·34
321 84	5,596 63	4·70	4·58	0·75	6·74	0·19	1·03	17·99
356 14	7,026 64	5·43	5·37	0·88	9·08	0·36	1·13	22·25
343 51	5,363 23	5·99	4·54	0·83	10·82	0·13	1·53	23·84
305 86	5,856 58	6·50	6·06	0·99	10·00	0·13	1·30	24·98
274 07	5,554 56	6·00	5·07	0·85	8·29	0·72	1·09	22 02
307 49	4,505 71	5·49	4·73	0·74	8·45	0·11	1·43	20·95
225 82	4,101 92	5·36	4·75	0·74	5·54	0·05	0·95	17·39
217 76	5,061 05	4·72	4·23	0·75	6·58	0·15	0·73	17·16
3,508 44	64,158 96	5·22	4·44	0·78	7·32	0·34	1·04	19·14

PRINCE EDWARD

MECHANICAL

B.—STATEMENT of the Performance and Consumption

Months.	Hours in Steam.	Train Mileage.				Miles run by Engines.			
		Passenger.	Freight and Mixed.	Ballasting.	Piloting.	With Train.	Light.	Shunting.	Total.
1890—July	4,132	14,146	14,395	789	76	29,406		5,633	35,039
August	4,049	11,757	13,720	3,329		28,806	78	5,409	34,293
September	4,275	11,262	13,799	6,059	49	31,169	88	5,733	36,990
October	4,230	11,887	14,269	3,190		29,346	10	5,821	35,177
November	3,896	10,168	15,238	525		25,931	167	5,601	31,699
December	4,295	7,653	17,562	1,458	448	27,121	211	5,961	33,293
1891—January	3,329	2,414	13,744	82	1,338	17,578	80	4,916	22,572
February	4,145	2,972	12,724		3,200	18,896	73	4,470	23,439
March	3,944	2,794	15,621	36	1,698	20,149	20	5,085	25,254
April	3,240	2,064	14,485	533		17,082	48	4,969	22,099
May	3,571	4,556	14,056	1,825		20,437	60	5,096	25,593
June	3,698	10,588	13,792	1,802		26,182	222	5,091	31,495
Totals	46,804	92,261	173,405	19,628	6,809	292,103	1,057	63,785	356,945

ISLAND RAILWAY.

DEPARTMENT.

of Locomotives, for the Year ended 30th June, 1891.

Total Mileage.		* Average of Cars per Mile run with Train.	Average Mileage.		Consumption.				Consumption per 100 Miles run by Engines.			
Cars.	Snow Ploughs.		Miles to one hour in Steam.	Of Cars to one of Engine.	Bushels of Coal	Pints of Oil.	Pounds of Tallow.	Pounds of Waste.	Bushels of Coal	Pints of Oil.	Pounds of Tallow.	Pounds of Waste.
154,081	.....	5·25	8·48	4·39	13,850	1,495	527	654	39·55	4·26	1·50	1·86
159,785	.....	5·54	8·47	4·66	14,218	1,538	486	732	41·46	4·48	1·41	2·13
176,437	.....	5·67	8·65	4·77	16,017	1,896	608	738	43·39	5·12	1·64	1·99
154,025	.....	5·25	8·31	4·37	15,763	1,776	598	726	44·81	5·04	1·70	2·06
146,681	.....	5·65	8·14	4·62	16,202	1,867	457	635	51·11	5·89	1.44	2·00
125,394	4,875	4·70	7·75	3·76	17,372	2,335	317	723	52·18	7·01	0·95	2.17
81,384	6,581	5·01	6·78	3·60	11,850	1,898	2	446	52·49	8·40	0·01	1·97
63,966	10,324	4·07	5·65	2·73	14,248	2,284	57	481	60·78	9·74	0·24	2·05
100,859	4,418	5·46	6·40	3·99	13,383	2,216	56	461	52·99	8·77	0·22	1·82
103,168	928	6·04	6·82	4·67	8,985	1,519	189	425	40·65	6·87	0·85	1·92
134,483	.....	6·58	7·16	5·25	12,125	1,779	247	514	47·76	6·95	0·96	2·60
134,813	.....	5·11	8·51	4·28	12,614	1,967	376	602	40·05	6·24	1·19	1·91
1,535,076	27,126	5·38	7·62	4·30	166,627	22,570	3,920	7,137	46·68	6·32	1·09	1·99

* Deduct piloting in making these averages.

J. UNSWORTH,
Superintendent and Mechanical Superintendent.

PRINCE EDWARD ISLAND RAILWAY.

MECHANICAL DEPARTMENT.

C.—MONTHLY STATEMENT of Car Mileage for Year ended 30th June, 1891.

Months.	First-Class.	Second-Class and Baggage.	Postal and Smoking.	Box and Stock.	Platform.	Total.
1890—July	38,012	27,307	22,076	48,026	18,660	154,081
August	27,113	24,698	22,272	47,634	38,068	159,785
September	28,444	25,998	24,651	43,304	54,040	176,437
October	29,366	29,395	23,796	47,309	24,159	154,025
November	23,617	18,693	24,176	62,522	17,673	146,681
December	25,166	17,430	23,813	46,042	12,943	125,394
1891—January	16,064	14,105	12,680	27,508	11,027	81,384
February	13,929	10,733	12,431	16,713	10,160	63,966
March	17,402	14,829	15,237	29,396	23,995	100,859
April	15,927	16,332	11,652	43,405	15,852	103,168
May	19,375	16,049	18,902	54,959	25,198	134,483
June	24,779	20,672	21,123	41,743	26,496	134,813
Totals	279,194	236,241	232,809	508,561	278,271	1,535,076
LESS—Ballasting			16,846	3,806	93,996	114,648
Balance	279,194	236,241	215,963	504,755	184,275	1,420,428

J. UNSWORTH,
Superintendent and Mechanical Superintendent.

PRINCE EDWARD ISLAND RAILWAY.

MECHANICAL DEPARTMENT.

D.—STATEMENT showing the Number of Locomotives and the various classes of Cars and Snow Ploughs on hand 30th June, 1891.

Particulars.	Locomotives.	Classification of Cars.								Snow Ploughs.	Flangers.	Total.
		1st Class.	2nd Class and Baggage.	Postal and Smoking.	Box and Stock.	Platform.	Vans.	Pay Car.	Total			
On hand 30th June, 1890, serviceable	21	17	15	3	175	122	3	1	336	8	7	15
do do condemned	....	....	....	..	....	3	....	..	3	....	....	....
Total stock, 30th June, 1890	21	17	15	3	175	125	3	1	339	8	7	15
Condemned on hand 1st July, 1890	....	....	....	....	....	3	....	..	3	....	....	....
do during the year	....	....	....	..	....	2	....	....	2	....	....	....
	....	....	....	....	....	5	....	....	5	....	....	....
LESS—Rebuilt	....	....	....	....	....	4	....	....	4	....	....	....
	....	....	....	....	....	1	..	....	1	....	....	....
ADD—Serviceable and repairing	21	17	15	3	175	124	3	1	338	8	7	15
Total on record 30th June, 1891	21	17	15	3	175	125	3	1	339	8	7	15

J. UNSWORTH,
Superintendent and Mechanical Superintendent.

J—7

PRINCE EDWARD ISLAND RAILWAY.

MECHANICAL DEPARTMENT.

E.—COMPARATIVE STATEMENT of the Expenses of the Mechanical Department for the Year ended the 30th June, 1891.

	1891.	1890.
The miles run by trains were	272,475	252,573
do engines were	335,202	315,943
do cars were	1,420,428	1,316,355
do snow ploughs were	27,126	13,212
	$ cts.	$ cts.
The cost of locomotive power was	64,158 96	60,907 99
do repairs to cars	17,497 25	19,728 58
do labour, oil, and waste for packing	535 03	633 80
do repairs to passenger cars was	10,648 03	10,481 02
do do postal and smoking cars was	1,546 58	1,457 97
do do freight cars and vans was	5,302 64	7,789 59
The cost of locomotive power per 100 miles run by trains was	23 54	24 11
do do do engines was	19 14	19 28
do do do cars was	4 51	4 62
The cost of repairs to cars per 100 miles run by trains was	6 42	7 81
do do do engines was	5 22	6 24
do do do cars was	1 23	1 49
The cost of labour, oil and waste, for packing, per 100 miles run by trains was	0 19	0 25
do do do do engines was	0 15	0 19
do do do do cars was	0 03	0 04
Repairs to passenger cars per 100 miles run by trains were	3 90	4 15
do postal and smoking cars were	0 56	0 57
do freight cars and vans were	1 94	3 08

J. UNSWORTH,
Superintendent and Mechanical Superintendent.

APPENDIX No. 5.

DEPARTMENT OF RAILWAYS AND CANALS, MONTREAL DIVISION,
SUPERINTENDING ENGINEER'S OFFICE,
MONTREAL, 30th November, 1891.

SIR,—As requested by your letter No. 86215, dated 29th September last, I have the honour to submit my report on the various works under my charge, for the fiscal year 1890-91 ended 30th June last. The works are:

1st. The Lachine and Beauharnois canals on the St. Lawrence route.

2nd. The St. Ours and Chambly canals on the Richelieu and Lake Champlain route.

3rd. The Ste Anne, Carillon and Grenville and Culbute canals on the Ottawa river.

These canals have be maintained in an efficient state, without accident or interruption to traffic.

Statements are annual, showing the amounts collected for fines damages, &c., together with the monthly returns of the highest and lowest water registered on the lower and upper entrances of each canal and on each of the mitre sills of St. Ours lock.

LACHINE CANAL.

The canal was closed by ice on the 29th of November, 1890, and re-opened on the 28th of April, 1891.

No accident occurred, and navigation was efficiently maintained during the whole season, the water having been kept at a good height in all the levels, both for navigation and manufacturing purposes.

The work done on this canal during last fiscal year is classified under two heads viz. :—Repairs and Income.

REPAIRS.

The water was drawn off on the night of the 11th April last and let in again on the night of the 27th of the same month, the canal being open to traffic on the following day.

While the water was out of the canal all the works under water were overhauled and repaired.

During the early part of the fiscal year the canal management underwent a change by the sudden death of the superintendent, the late Michael Conway, which took place on the 15th of October, the vacancy being filled by the appointment of Mr. Edward Kennedy.

Subjoined is given a synopsis of the works of repairs executed by the latter during the balance of the year.

It was noticed during the latter portion of February that the stone masonry pier supporting the stationary bridge above St. Gabriel lock was canting over, and, with the enormous traffic going over it, was exposed to fall down at any moment.

The bridge was therefore raised during April, the pier taken down and rebuilt on an enlarged scale.

Necessary pointing and grouting were done to the masonry walls in and around lock No. 2, at the raceway above St. Gabriel lock, and rest piers of the Lachine swing bridge. Some of the stones at the latter point which were broken and displaced were renewed and re-set.

All the mechanical structures, such as lock, weir gates and bridges, underwent considerable repairs.

The stationary bridges at St. Gabriel lock, as well as the bridge over the raceway, which forms part of the traffic way, were repaired, and re-planked and the planking and sheeting torn away by the force of the water at the Cote St. Paul weir were also renewed.

A new lower mitre sill was made and placed at lock No. 4, and the superstructure in the piers above and below said lock renewed.

The towpaths on each side of the canal, which measures 14 miles in length, were kept in good order.

The 9,000 feet of planked footpaths in connection with Government property in the city of Montreal has not only been well maintained, but also kept free from snow and ice during the winter months.

The canal roads, at the basins between St. Gabriel lock and the lower canal entrance, including Mill street, have been kept in good condition, and several portions macadamized.

Five stone piers in the waste weir at Lachine, which had been considerably damaged by the action of ice and water, were partially rebuilt while the water was out of the canal in April.

The renewal of the planking of bridges, wharves and flour sheds was attended to where required, and the waling or fender timbers at the bridges and locks renewed.

The snubbing posts along the line of canal, on the towpaths, were repaired and twenty new ones set.

The upper gates of old lock No. 2 were taken out and replaced by new ones, and the upper gates of new lock No. 3 readjusted.

The accumulation of silt, sand, dirt and gravel in the bottoms of locks Nos. 1 and 2 were removed by means of the diver and a dredge.

The river St. Pierre, which passes through the Lachine swamp lands, as well as the new cut (3 miles in length) and all the off-take drains in connection with the canal, were thoroughly cleaned and kept in good order.

The piers and booms at Lachine, and on the canal proper, received the necessary repairs.

Repairs were also made, when needed, to the weir and head gates of the mills and factories.

New platforms and bars have been placed on the upper north gate of new lock No. 3, and 12 chain hole covers made and placed at locks Nos. 1 and 4.

The timbers in the superstructure of the pier at Côte St. Paul bridge, on the north side, were renewed, and bridge No. 1 raised and the pivot readjusted, and three stationary bridges at Cote St. Paul were painted.

A portion of the dry rubble wall on the north side of the canal, between the guard-lock and the Canadian Pacific Railway swing bridge, which had tumbled down, was rebuilt.

The electric plant for lighting the canal, between the lower entrance and St. Gabriel lock, has been maintained in good order and has given full satisfaction.

Income.

The canal telephone line, which was operated by the Bell Telephone Company under lease, has been rebuilt with metallic circuit, the instruments put in order and the line complete transferred to the Department at a cost of $1,600.

This private line is working well, and is of great advantage in connection with the efficient management of the canal. At night, however, some difficulty is experienced, caused by the electric wires being strung on the same posts, and in order to obviate this trouble it will be necessary to put in a separate line of posts for the electric wires between locks Nos. 2 and 3.

On her return from St. Ours lock, where she had been stationed during the winter for the purpose of furnishing motive power to the machinery and pumps installed for unwatering the lock, dredge No. 2 was set to work in the Lachine canal, removing projecting points and deepening the canal bottom between locks Nos. 2 and 3, at the entrance of the Wellington basin.

This work was completed at the end of the fiscal year, when the dredging fleet was sent to Lake St. Louis to make test pits in connection with the proposed improvement of the lake channel.

BEAUHARNOIS CANAL.

This canal was closed on the 30th of November, 1890, and reopened to navigation on the 24th of April, 1891.

There was no accident, and navigation has therefore been efficiently maintained during the whole season.

During the latter part of April the water was taken out of the canal and repairs made to the slope walls and under structures where required.

The work done during the lapsed fiscal year is described under two headings, viz. :— Repairs and Income.

Repairs.

Two and a-half pairs of lock gates were built during the winter, one pair being placed at each of the lower sills of locks Nos. 6 and 10 and one gate at lock No. 9.

The lower gates of locks Nos. 8, 11 and 12 were raised and readjusted, and the upper gates of locks Nos. 9 and 14 received sundry repairs.

Seven chain rollers were placed at locks Nos. 6, 7, 9 and 14, and chains for opening gates were renewed at locks Nos. 7 and 8.

The valve of gates at locks Nos. 7, 8 and 11 were also renewed, and the working gear of all the gates overhauled and repaired where required.

Five new fender posts were erected at each of locks Nos. 6, 8, 9, 10 and 13, and repairs made to other posts at locks Nos. 7 and 9. Sixty new mooring posts were set and repairs made to others where required.

A new swing bridge has been built and placed at lock No. 7, and the planking of the bridges at locks Nos. 12 and 14 renewed.

The swing bridges at locks Nos. 8, 9, 10, 11, 12 and 13 were raised, adjusted and painted, and the bridges of the waste weirs at locks Nos. 9 and 10 rebuilt.

The farm bridges were repaired where required, and maintained in good order.

Twelve new oak anchor timbers for gates were made and placed at locks Nos. 6, 9 and 10.

A new frame dwelling house, 24 x 24 ft., well finished, painted outside and inside, was built for one of the lockmen of lock No. 13. Two extension kitchens were also built, one for the lockmaster at Valleyfield and the other for one of the lockmen's houses at the lower entrance.

All the other Government buildings on this canal, as well as the fences, were kept in good repairs.

The Hungry Bay dyke and the dams underwent considerable repairs, and the canal banks on both sides of the canal have been maintained in good order.

The sides or slopes were repaired, and the canal towpath between locks Nos. 7 and 10 has been partly macadamized and covered with a layer of good gravel.

The culvert wells, discharges, drains and side ditches were cleaned during the summer, and in the spring cleared of snow and ice.

The weeds were mowed as usual on both sides of the canal.

One hundred and fifty feet in length of the north wall of the waste weir at lock No. 11, which was in a dilapidated condition, were taken down and rebuilt

The canal private telephone line has been kept in order.

Income.

A sum of $1,000 having been voted towards utilizing on the canal part of Edison electric plant, formerly used on the Lachine canal, and now replaced by the Arc system, a suitable building was erected and annexed to the canal workshops. A line of posts was also erected on a length of over one mile on the north side, between the lower

entrance and lock No. 5, and at the beginning of July, 1891, the five lower locks, the workshops and the superintendent's office were lit by electricity.

This system of lighting has, so far, proved very efficient, and met with universal praise from navigators and public.

From July, 1890, to the 15th November of same year, steam dredge No. 2, with steam derrick and scows, were employed at deepening the upper extremity of the canal entrance at Valleyfield, making a channel in the bay, so as to give better access to the mills, factories and Government wharves at the lower dam. The material excavated was utilized to widen portions of the canal bank on the north side. Some dredging was also done above the St. Timothy bridge, where most needed, for facilitating the passage of vessels.

On the 15th November the dredge fleet, with the exception of the steam derrick, which wintered on the Beauharnois canal, proceeded to St. Ours, where her services were utilized in connection with the work of reconstruction and overhauling of the lock foundations.

A sum of $2,000 having been voted towards the improvement of that branch of the river known as the lost channel, and which is used as a tail-race for the mills and factories at Valleyfield, work for that amount was done during the month of July.

A large quantity of boulders was removed on the whole length between the lower dam and the site of the Canada Atlantic railway bridge, or on a distance of about ¾ of a mile. Some points were also widened and deepened. This work has proved very beneficial to the lessees of hydraulic lots, but in order to remove all cause of complaints in future it is estimated that fully $8,000 will have to be spent to complete the work.

CHAMBLY CANAL.

The canal was closed on the 24th November, 1890, and re-opened to navigation on the 4th May last.

No accident occurred, and navigation was efficiently maintained during the whole season.

Considerable works were executed during the fiscal year, and are described under the following two heads, viz:—Ordinary Repairs and Improvements chargeable to Income.

Repairs.

One scow 60 x 18, was built for hauling stone required for the works.

The planking of the long pier at the lower entrance and of the wharves above lock No. 7 on the west side was partly renewed.

Two sets of stop logs were made, one for lock No. 2 and the other for bridge No. 1, each set comprising eight sticks of pine timber measuring 24 x 35 in length, respectively.

Three thousand five hundred feet of wooden railing or garde-corps, were replaced by ⅜ in. steel wire cable, with metallic caps on head of each post, with swivels, at different points to tighten the cable when required. Besides 1,500 feet of the old garde-corps were repaired.

One pair of new lower gates were built and placed at lock No. 2, and the lower sill of said lock repaired.

The lower gates of lock No. 4 were taken out and replaced by spare gates built in 1889, and sundry repairs made to the upper gates.

Three guard piers, one above lock No. 2 and two below locks Nos. 3 and 4, were rebuilt, and three improved frame sluices placed in the walls of locks Nos. 2, 7 and 8.

Five new improved moveable derricks with 45 feet booms, three triangle gins, one crane on wheels, were built at the shops, besides five watch-houses for the locks, fifty wheel-barrows, thirty-six ladders, two hand trucks and sixty cedar life buoys, which were distributed at the different locks, bridges and wharves, &c.

Fifty mud boxes for the dredge scows were repaired, and forty-five new mooring posts set on the canal bank.

All the canal ditches, drains and discharges were thoroughly cleaned, the fences kept in good order and the weeds mowed on both sides of the canal.

The slope walls were repaired and the canal bottom cleaned while the water was out during the month of April.

The workshops, comprising the valuable plant installed for their economical working, have been maintained in good order during the year.

The masonry in lock walls and bridge piers has been pointed with Portland cement, and all the Government buildings repaired and painted.

Some alterations were made to the moveable bridge built for the winter crossing at the ferry site at Ile Ste. Thérèse by replacing the steel cables supporting the bridge with 1¼-inch iron bars with swivel attachments to give more rigidity to the bridge.

Since the last four years considerable works of improvement have been made to this canal, such as deepening, raising and strengthening of banks, reconstruction of locks, wharves and weirs.

There remains, however, to perform a very important work, which imposes itself, namely, the construction of a heavy rubble wall, facing on the whole length of the canal slope on the west side, between bridge No. 3, and the guard lock at St. John's, or a distance of eight miles.

The slope in this reach on the public road side is very high, almost perpendicular, and keeps continually sliding in the canal. So far we have been able to cope with these land slides with the dredge stationed in the canal, but once the dredge is away it would be necessary to empty the canal to remove these obstructions, should they occur again; therefore, it is the intention to provide for this urgent work in the next Estimates.

The private telephone line has proved very efficient, and repairs were made when required by canal employés.

All that portion of the upper canal entrance comprised between the Central Vermont railway bridge and the guard lock is now lit with five arc lights, furnished by the St. Johns Electric Light Company, at a cost of $250 per season, and is a decided improvement as compared with the twenty-one coal oil lamps formerly used to light the harbour of St. Johns and the lock.

Improvements Chargeable to Income.

The work done on this canal during the lapsed fiscal year is subdivided as follows:—

Dredging.

Steam dredge No. 1 was employed during part of the season in deepening the harbour of St. Johns on a distance of 500 x 88 feet

Considerable dredging was also done in the canal proper between Locks No. 1, and 3 the material excavated being utilized in the raising canal banks on the towpath side and filling behind the walls built on the west side to protect the road embankment.

Rebuilding Walls, Locks No. 7 and 8.

The east chamber wall of lock No. 8, commencing at the upper hollow quoin of lock No. 9, and comprising the recess, abutment, chamber, as well as the recess, abutment and part of the east chamber of lock No. 7, were taken down and rebuilt, the portion under water being built with pine timber, and the portion above water with cemented stones, which could be saved from the old walls.

Protection Wall at St. Thérèse Mill.

From St. Thérèse mill to Fryer's by-wash the canal embankment on the east side follows the shore line of the Richelieu river, on a distance of 3,000 feet. This embankment has originally been built for a length of 2,100 feet on a slight slope, but on the remaining 900 feet the bank was resting against a perpendicular wall. The height of the bank facing the canal is 9 feet, whereas in the rear on the river side the height averages 16 feet, the canal bottom being therefore 7 feet higher than the river.

The river, which passes at the foot of the embankment in the rear, is very rapid at this particular point, and had undermined the protection wall to such an extent that, with the enormous pressure of the canal water against it, a serious break was appre-

hended, and in fact 40 feet of this embankment gave way previous to opening of navigation.

Steps were immediately taken to rebuild that portion of the bank, but while doing so it was ascertained that in order to ensure the permanency of repairs to the embankment at that particular point it was imperative to rebuild the protection wall on the length of 900 feet referred to.

This work was done by building a heavy rubble wall in rear of the embankment, 900 feet in length, 10 feet wide at bottom, with a slope giving 6 feet in width at top.

This work was done in the space of a month, and this part of the canal which was considered the most dangerous is to-day perfectly safe and secure.

Dry Rubble Wall, Ile St. Thérèse and Langelier's Bridge.

The towpath at Ile St. Thérèse, of blue clay formation and not protected by a stone facing, was exposed to be destroyed by the water of that portion of the canal known as "Petit Lac." A dry rubble stone wall was therefore built on the face of the bank for a distance of 11,800 feet and the towpath macadamized.

The inside slope wall on the east side, between St. Luc road and Langelier's mill was also rebuilt on a distance of 3,500 feet, the whole being covered by dredged material, rolled, and a layer of gravel laid over it.

Bridge Seats Nos. 1, 3, 4 and 5.

The bridge seats of swing bridges Nos. 1, 3 and 5 were rebuilt in cement masonry, and the guide piers on each side thoroughly repaired.

The abutment of bridge No. 4 was taken down and rebuilt with square timber.

Electric Light.

The magnificent water power created at the new by-wash, 400 feet above lock No. 2, has been utilized for the proposed lighting with electricity of the Chambly canal, and with a view to provide motive power to the canal work shops. One of the three sluices in the by-wash, 3 x 4 ft., has been set apart for supplying water to the turbine wheel, placed 325 ft. below, on the river shore, through an iron pipe 40 inches in diameter.

A two stories 31 x 26 ft. electric station was built below the fall, on solid cemented stone foundations, the lower story to receive the dynamos and station apparatus, and the upper reserved as a dwelling for the electrician.

A 30 inch turbine of the capacity of 100 horse power was placed at the end of the feeder pipe, said pipe being protected against the action of the water coming through the other two sluices by a 2 in. plank partition, 300 feet in length by 5 feet in height.

The necessary shafting has been placed in position, and everything is now in readiness at the station to receive the dynamos, once a selection is made amongst the tenders forwarded to the Department on the 14th of November, 1890.

In addition to the above work, seventy-five cedar posts were erected on the east side from the station to the foot of the canal, and 16,000 feet of copper wire strung over them for the incandescent lighting of the workshops.

This line of post is prepared for the reception of the necessary wire required for the arc lighting of that portion of the canal between lock No. 2 and the extremity of the long pier in the Chambly basin, and which comprises eight locks, four swing bridges, four weirs, three extensive wharves and five basins.

ST. OURS LOCK.

The lock was closed on the 28th November, 1890, and reopened to navigation on the 8th May, 1891.

There was no accident, and therefore no detention to the trade.

The works done at this lock during the fiscal year are sub-divided under two heads, viz. :—Repairs and Income.

REPAIRS.

The canal or lock embankments on each side of the lock were raised, macadamized and covered with gravel.

The lock gates were raised, adjusted and some sundry repairs made to the mechanical structures. Some planking at the bottom of the lock was renewed by means of the diver, and the lower sill cleaned.

Stone was placed on the abutments of the dam, and the bank below on the west side to prevent land slides.

Repairs were made to the piers above and below the lock, the ice cut away around them and at the gates, and the gates themselves loaded down, at the beginning of the winter, to prevent their being lifted by high water in the spring. Ladders and mooring posts were made and set at the piers; the booms were removed in the fall, placed in winter quarters and replaced in position at the opening of navigation in May.

The superintendent's dwelling, outbuildings and lockmen's shanty and fences received the usual repairs.

The Government ground on the island, which had been damaged by the works at the dam and the high waters, had been filled in and repaired.

The scows were hauled out, and caulked and repaired, and a crane derrick installed on one of them.

INCOME.

At the close of navigation work was resumed towards overhauling and repairing the bottom of the lock.

This work was carried on under the immediate supervision of Mr. L. G. Papineau, C. E.

This work, which was commenced in December, 1888, and carried on during the winter months, was successfully completed on the 7th of May last.

During the winter of 1888–89, owing to the insufficiency of the plant at our disposal, nothing of importance was done in the way of repairs, beyond building the necessary cofferdams, unwatering the lock and ascertaining the extent and nature of damages.

At the close of navigation in November, 1890, work was resumed, the cofferdams were rebuilt, and on the 21st of December of same year the lock was nearly unwatered when a leak occurred under the north-west pier, filling the lock, submerging the pumps and suspending the work.

The leak having been stopped, the lock was again unwatered; but on the 15th of February, 1890, another leak occurred near the same place, again flooding the works.

No sooner was this new breach repaired than heavy rains occurred and the river rose above the lower cofferdam, and remained at that height until the end of March.

These two accidents and the unusual height of the Richelieu had by this time made it impossible to do any work of repairs, but at the close of navigation in November, 1890, the works were again resumed, and, as above stated, carried to successful completion on the 7th of May last.

When the lock was unwatered it was ascertained that the bottom was in a bad condition, specially at the mitre sills.

Under the flooring, above and below, large excavations were found, some of which, measuring 9 feet in depth and connecting with each other beneath the sills and under the wall on the west side. The centre portion of the lock was, however, in a fair condition, notwithstanding the fact that the site of the lock is permeated by natural springs.

The whole masonry was in a good state of preservation, specially below low water level, owing, no doubt, to the fact that it was originally built on piles.

The repairs consisted mainly in renewing the mitre sills, in filling with concrete the excavations under the walls above and below the mitre sills, and renewing the flooring at the upper and lower ends of the chamber.

This lock, which so badly needed repairs, is now almost as good as when newly built.

SURVEYS.

The work done under the lapsed year under this head has been mostly confined to preliminary surveys in connection with a proposed system of drainage along the northern boundary of the Lachine canal, and the proposed improvement of the channel of Lake St. Louis.

The work done under the above head is briefly summarized as follows :—

Lachine Canal Drainage.

The general plans for the proposed system of drainage along the northern boundary of the Lachine canal were made during the fiscal year 1890-91, but all the plans of details and specifications of the work to be done were made during the present year.

Tenders for building this proposed drain were called for on the 12th of February, 1891, and the contract awarded to Messrs. Heney and Borthwick, at the close of the fiscal year.

LAKE ST. LOUIS.

The hydrographic survey of this lake, in view of a deep-water channel, was commenced on the 11th of September, 1890, and continued until the 1st of December following.

During this period the north shore of the lake was surveyed on a distance of about three miles ; and soundings on lines laid parallel, at a distance of 200 feet from one to another, were taken from the north shore of the lake to the south side of the present channel on a distance of two miles.

A considerable loss of time has occurred during the season owing to the stormy and rainy state of the weather.

During the winter months a preliminary plan of the above survey was made and, as the bottom of the lake proved to be very irregular, it was found advisable to take more soundings before making a final plan of this portion of the lake, and the work was left over until the following year.

REPAIRS TO VESSELS.

Dredge No. 1 and scows.

Some parts of the hull of the dredge were renewed and strengthened and the deck replanked.

The machinery and dredge fittings have been carefully overhauled. Sundry repairs were made to the six scows, floating derrick and two lodging scows. These vessels were besides well caulked and painted.

Dredge No. 2, steam derrick and scows.

The hulls of the steam dredge and derrick were caulked and painted. The derrick's swinging table and frame supporting it were strengthened by means of oak posts and knees.

The machinery and fittings of both vessels were thoroughly overhauled and everything on board put in readiness to resume operations in the spring. The four dredge scows were repaired, caulked and painted.

STE. ANNE'S LOCK.

Navigation closed here on the 25th November, 1890, and reopened on the 25th April, 1891. No interruption to the traffic occurred during the season.

The lock walls and gates, the mechanical structures, range lights, towpath, fences and bridges were kept in a good state of repair, and the working of the canal was very satisfactory all through.

INCOME.

A sum of $20,000 having been voted towards the strengthening of the old Grand Trunk pier at St. Anne's, the contract for doing the work was awarded to Messrs. Broder & McNaughton, and signed by these gentlemen on the 26th of August, 1890.

Work was commenced in the latter part of October, 1890, but the difficulties experienced in doing the rock excavation contemplated along the old pier soon brought the works to a close.

The old cribwork was found to be in such a dilapidated condition that no blasting could be done near it without it being entirely destroyed, and operations had to be suspended in consequence on the 27th November, after six foundation cribs had been sunk in position at the upper end.

The contractors resumed work in the first week of June, 1891, it having been decided in the meantime to fasten the foundation cribs to the river bottom with rock bolts, instead of levelling the bed of rock to receive them as originally intended.

The seats of the cribs had, however, to be cleared of all loose material, and this proved to be a difficult matter, as the old pier kept emptying out from the bottom almost as fast as the divers could remove the stone. To overcome this difficulty, a large portion of the old work had to be demolished and replaced by new cribwork.

At the end of June several cribs had been built and the bottom of the river prepared for them, but the water being still too high, none of them were put in place till the beginning of July.

Such good progress has been made since that the works will be brought to completion in a few days.

CARILLON CANAL.

This canal was closed on the 29th November, 1890, and re-opened 23rd April, 1891.

The repairs to the works here were as follows:—

The mooring pier at the lower end and the guide pier at the upper end entrance were re-floored.

The fences, bridges, towpath and range lights were kept in good repair and the canal prism cleaned.

The watch-houses at locks Nos. 1 and 2 were repaired, and had their roofs shingled; 460 feet of boom were repaired, strengthened and planked over.

GRENVILLE CANAL.

The closing and reopening of navigation here occurred on the same dates as on the Carillon canal.

The canal prism was carefully cleaned and the banks strengthened at a couple of weak points, and rip-rapped.

The towpath was widened for some 300 feet in length between locks Nos. 6 and 7.

Lock No. 5.

The gates were raised by means of plates put in the heel post sockets, to ensure easier working, and the top bars of gates renewed.

Lock No. 6.

The gates were repaired and painted and two new towpath bridges built.

Lock No. 7.

The top bars of gates were renewed, the gates painted, and two new valves put in.

Navigation was maintained without interruption on both the Carillon and Grenville canals during the whole season.

CULBUTE LOCKS.

The repairs done to these works during the year consisted in the re-setting of the gates in position and some planking on top of the lock walls, together with some slight work done on the dam at the head.

The traffic on this section of the Ottawa river, is insignificant, and seems to be constantly decreasing.

I have the honour to be, Sir,
Your obedient servant,
E. H. PARENT,
Superintending Engineer.

T. TRUDEAU, Esq.,
Acting Secretary, Railways and Canals.
Ottawa.

LACHINE CANAL.

STATEMENT showing the depth of the River Water on the Mitre Sills of Lock No. 1 at Lower Entrance and Lock No. 5 at Upper Entrance during the Fiscal Year ending 30th June, 1891. (From Lockmaster's Returns).

Months.	Lock No. 1, Lower Sill.				Lock No. 5, Upper Sill.			
	Highest.		Lowest.		Highest.		Lowest.	
1890.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
July	23	3	19	5	13	11	12	6
August	19	6	18	6	12	6	11	8
September	20	2	18	2	12	5	11	0
October	18	4	17	8	11	6	11	0
November	18	10	17	6	11	11	11	1
December	33	3	17	5	12	11	10	6
1891.								
January	30	5	27	1	12	9	10	5
February	29	2	25	9	12	5	10	3
March	31	8	27	9	13	6	11	1
April	33	10	24	2	15	3	12	9
May	24	3	21	0	15	2	13	2
June	21	0	18	7	13	0	11	5

Beauharnois Canal.

Statement showing the depth of the River Water on the Mitre Sills of Lock No. 6 at Lower Entrance and Lock No. 14 at Upper Entrance, during the Fiscal Year ending 30th June, 1891. (From Lockmaster's Returns).

Months.	Lock No. 6, Lower Sill.				Lock No. 14, Upper Sill.			
	Highest.		Lowest.		Highest.		Lowest.	
1890.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
July	13	8	11	11	13	6	13	0
August	12	0	11	4	13	1	12	5
September	11	6	11	0	13	0	12	3
October	11	3	10	8	12	10	12	0
November	10	8	10	2	12	10	12	3
December	15	10	10	4	13	2	12	3
1891.								
January	18	0	15	0	13	0	12	2
February	18	8	15	3	12	9	12	1
March	16	10	14	1	13	5	12	3
April	14	10	13	0	13	7	13	0
May	14	9	12	8	13	9	12	8
June	12	7	11	1	12	8	12	3

Chambly Canal.

Statement showing the depth of the River Water on the Mitre Sills of Lock No. 9 at Lower Entrance and Lock No. 1 at Upper Entrance, during the Fiscal Year ending 30th June, 1891. (From Lockmaster's Returns).

Months.	Lock No. 9, Lower Sill.				Lock No. 1, Upper Sill.			
	Highest.		Lowest.		Highest.		Lowest.	
1890.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
July	13	5	10	6	11	4	8	5
August	11	1	9	2	9	5	7	8
September	15	4	11	0	9	9	8	11
October	12	1	11	0	10	4	8	11
November	14	5	11	6	10	4	9	2
December	16	5	11	10	9	11	8	0
1891.								
January	16	6	14	6	9	3	8	9
February	17	4	15	10	10	8	9	3
March	21	10	17	5	11	5	10	5
April	19	7	17	3	12	3	11	1
May	17	5	13	6	11	11	10	0
June	13	4	10	7	10	2	8	6

St. Ours Lock.

Statement showing the depth of the River Water on the Mitre Sills of St. Our's Lock during the Fiscal Year ending 30th June, 1891. (From Superintendent's Return).

Months.	Lock No. 1, Lower Sill.				Lock No. 1, Upper Sill.			
	Highest.		Lowest.		Highest.		Lowest.	
1890.	ft.	in.	ft.	in.	ft.	in.	ft.	in
July	13	7½	9	10	11	2	9	3
August	11	0	9	0	9	8	8	5
September	12	11	9	4	12	6	9	6
October	10	4	9	0	10	2	9	6
November	11	0	9	4	11	2	9	11
December	13	0	10	3½	10	4	8	5
1891.								
January	14	2	11	2½	10	2	8	7½
February	17	1	12	8	13	10	9	0
March	22	2	16	3	17	9	12	2
April	21	11	17	4	17	8	13	11
May	17	2	13	1	13	11	11	1½
June	12	10	9	11	11	5	9	3

Lachine Canal.

Statement of Fines and Damages collected during the Fiscal Year ending 30th June, 1891.

Date.	Name of Vessels.	Name of Owner.	Fines.	Damages.	Totals.
1890-91.			$ cts.	$ cts.	$ cts.
July 18..	Barge "Fame"	F. Laplante, jun	20 00		20 00
Aug. 11..	Steamer "Eveline"	H. Dobell & Co	10 00		10 00
do 26..	do "Cholmley"	Carbray & Routh	10 00	200 00	210 00
		Totals	40 00	200 00	240 00

JOHN O'NEILL,
Collector.

Canal Office,
Montreal, 1st July, 1891.

LACHINE CANAL.

STATEMENT of the Fines and Damages collected during the Fiscal Year ending 30th June, 1891.

Date.	Name of Vessels.	Name of Owner.	Fines.	Damages.	Totals.
1890.			$ cts.	$ cts.	$ cts.
Aug. 15...	Steamer "Ariel".	Jas. Cowley..	4 00	.....	4 00

J. B. DESCHAMPS,
Pro Collector.

CANAL OFFICE,
MONTREAL, 1st July, 1891.

BEAUHARNOIS CANAL.

STATEMENT of Damages collected during the Fiscal Year ending 30th June, 1891.

Date.	Names of Vessels.	Names of Owners.	Fines.	Damages.	Totals.
1890.			$ cts.	$ cts.	$ cts.
Nov. 1....	Barge "Jennie"...	Montreal Transportation Co...	20 00	... .	20 00
1891.					
June 2....	Dredge "St. Joseph".....	Messrs. Connolly.....	.....	5 00	5 00
do 9....	Barge "Jennie"	Montreal Transportation Co...	.....	60 00	60 00
do 9....	do "Acadia"..... ...	do do ...	.. ..	20 00	20 00
		Totals.....	20 00	85 00	105 00

D. DANIS,
Collector.

CANAL OFFICE,
VALLEYFIELD, Nov., 1891.

CHAMBLY CANAL.

STATEMENT of Fines and Damages collected during the Fiscal Year ending 30th June, 1891.

Date.	Names of Vessels.	Names of Owners.	Fines.	Damages.	Totals.
1890.			$ cts.	$ cts.	$ cts.
Aug. 21...	Barge "W. Henry".	Captain Arpin	.....	2 00	2 00
do 21.	do "St. Jean Baptiste"..	do M. Lavallée.....	....	2 00	2 00
		Totals		4 00	4 00

D. S. MARTEL,
Collector

CANAL OFFICE,
CHAMBLY BASIN, Nov., 1891.

ST. OURS LOCK.

STATEMENT of Fines and Damages collected during the Fiscal Year ending 30th June, 1891.

Date.	Names of Vessels.	Names of Owners.	Fines.	Damages.	Totals.
			$ cts.	$ cts.	$ cts.
1890-91...	Str. "James".....	Capt. Gedeon Lebrun.....	2 00	.....	2 00
	Scow St. Joseph	do E. Lussier	.....	75	75
		Totals.....	2 00	75	2 75

PHILIPPE MATHIEU,
Collector.

CANAL OFFICE,
ST. OURS, Sept., 1891.

LACHINE CANAL.

STATEMENT of Amounts collected for Wood Dues and Winterage of Vessels, during the Fiscal Year ending 30th June, 1891.

Date.	Items.	Amounts.
		$ cts.
1890-91...	Wood dues..	124 70
	Winterage.....	589 97
	Total	714 67

JOHN O'NEILL,
Collector.

CANAL OFFICE,
MONTREAL, July, 1891.

LACHINE CANAL.

STATEMENT of Wharfage, Basin and Bank Dues collected during the Fiscal Year ending 30th June, 1891.

Date.	Items.	Amounts.
		$ cts.
1890-91...	Wharfage dues	21 36
	Basin dues.....	1,576 83
	Bank dues.....	12 00
	Total...	1,610 19

J. B. DESCHAMPS,
Per Collector,

CANAL OFFICE,
LACHINE, July, 1891.

APPENDIX No. 6.

ST. LAWRENCE DISTRICT.

SUPERINTENDING ENGINEER'S OFFICE,
CORNWALL, 31st December, 1891.

SIR,—As requested in your letter No. 86214, I beg to submit the annual report on the present condition of the canals in the district under my charge, including also the works of construction and surveys in connection with their enlargement.

This district comprises the "Cornwall canal," the Farran's Point, Rapide Plat and Galops canals, styled the "Williamsburg Canals," and the "Murray Canal," and extends from the province line, Lake St. Francis, to Presqu'Isle harbour on Lake Ontario, including the navigable intermediate reaches.

CORNWALL CANAL.

(Opened for traffic, 1843.)

MAINTENANCE.

The canal was closed for the season of 1890 on the 4th of December.

The water was drawn off for purposes of construction and repairs on the 23rd of March last, and re-opened for traffic on the 4th May following, and again closed for the season of 1891 on the 5th of December.

Navigation was maintained in a fairly satisfactory manner, in view of the extensive works of the contractors for the enlargement, which were vigorously prosecuted throughout the canal during the entire season of navigation. These operations, together with the partial discontinuance of the use of horses in towing, and the abnormally low stage of the water in the St. Lawrence, which prevailed during the past year, must necessarily have entailed some trifling inconvenience and delay to the business of the forwarders and vessel owners.

Mr. D. A. McDonell, the ex-superintendent, continues to assist Mr. Superintendent Ross in the discharge of his duties during the season of navigation, and whilst the contractors' works are in progress.

Owing to the low water, the supply for manufacturing purposes was seriously affected and reduced, and during the latter part of the season of navigation almost wholly stopped, and resort had to steam power, with which the principal mills are supplied.

The attention of the Department is is called to the necessity which exists for providing the levels between locks Nos. 18 and 19 and Nos. 19 and 20 with waste-weirs discharging into the river, with a view to acquire a more perfect control of the intermediate levels.

A telephone service from the head to the foot of the canal, connecting all the locks, bridges, &c., with the superintendent's office, is urgently required, not only for the future working of the canal but also for present use during the enlargement.

The winter of 1890-91 was occupied by the superintendent and his staff at the Government workshops in repairing and renewing the spare lock gates and other mechanical appliances and plant, and generally in preparing for the customary annual repairs.

During the time the canal remained unwatered the old locks, weirs and other structures, as also the embankments or towpaths, were overhauled and temporarily repaired.

A guard or glance pier was also constructed in front of the weir at lock No. 19 in connection with the enlargement. This has had the desired effect of extinguishing the eddy and cross-current which previously existed, and which caused frequent accidents to vessels approaching the lock.

The accidents which occurred during the past season and which necessitated the lowering of either of the levels in the canal were as follows :—

1st. May 7.—To repair a serious leak in towpath at the Mille Roches bridge. Water out for 9 hours. No delay to navigation.

2nd. June 11.—To repair the lower gates of lock No. 20 damaged by steamer "Corinthian." Traffic suspended 17 hours.

3rd. August 25.—To examine and repair land slide, and serious subsidence in the embankment 1,200 feet west of lock No. 18. Water out about 5 hours. No stoppage of traffic.

4th. September 12.—To repair a second land slide in the embankment 800 feet west of lock No. 18. Navigation not interfered with.

5th. October 28.—To form earthen dome at head of lock No. 18, the stop-log dam having collapsed. Seven hours. No delay to navigation.

6th. November 4.—To recover the body of lock labourer Robinson, drowned at head of old lock No. 17 whilst on night duty. No delay to navigation.

One pair of gates, adapted to the raised level of the Cornwall reach, was placed at head of old lock No. 17 ; and the lower gates of lock No. 20, damaged by steamer "Corinthian," replaced by spare ones in good condition.

The gates of locks Nos. 15, 16 and 17 of the old lower entrance were temporarily repaired in the early part of last season, in order to render it available in the event of accident to the new entrance.

An appropriation of $2,000 was subsequently (at the last session of Parliament) granted, sufficient to thoroughly repair the lower gates of the three locks above mentioned, which amount it is proposed to expend during the ensuing season.

A further appropriation of $500 was also made for repairs and fencing, &c., at the residence of collector of tolls, Cornwall, which sum will be expended during the present fiscal year.

The addition of a storehouse for iron and tools has been made to the canal workshops, and the carpenter's shop newly shingled.

Also, the lockmaster's house, at lock No. 18, has been temporarily repaired, and small wooden kitchens built at lock labourer's houses at the lower entrance.

A new lighthouse has been erected on the pier-head at the upper entrance by the Department of Marine and Fisheries.

The superstructure of this pier, as well as that on the north or landward side of canal,is in a ruinous condition, and should be temporarily repaired, pending the completion of the contemplated works of enlargment at this point.

The highest water recorded at the guard lock (No. 21) during the year 1891 was 12 feet on the mitre still, and the lowest 7 feet 8 inches.

The highest water at lock No. 15 was 30 feet 2 inches (the effects of the usual "ice-jam") and the lowest 8 feet 10 inches.

The amount of damages assessed on 11th June as against the Richelieu and Ontario Steamboat Company on account of the "Corinthian" running into lock No. 20, the lower gates being closed and lock in use, was $498.50. An account for this sum was duly rendered by the collector to the company, but it has not yet been paid.

No fines were imposed ; nor any dues collected for wood or winterage during the past year.

Thomas Robinson, one of the lock labourers at lock No. 17, and a contributor to the superannuation fund, was accidentally drowned on the night of the 4th of November whilst on duty. J. Durocher, a deck hand employed on one of the contractor's tugs, was seriously hurt by the premature closing of the Cornwall swing bridge, and has preferred a claim on the Government for compensation therefor.

The entrance locks of both the old and new canals were dismantled and otherwise prepared for the winter on the 7th December, and the Gate lifter and other scows laid up in Cornwall basin.

By the completion of Wood's Creek culvert the annual flooding occasioned by back water from the river has been entirely prevented.

Urgent representations have been made at frequent intervals by the authorities of the town of Cornwall relative to the alleged liability of the Department to reconstruct the Government sewer on Water street, originally built in 1835 in connection with the canal, and of adapting it to the present requirements of the drainage system now in progress; also of adopting measures to relieve the culvert or drain to the river under the canal of some portions of the sewage which is now discharged into it. This matter is now under consideration, and a plan and estimate will be prepared.

CORNWALL CANAL ENLARGEMENT.

CONSTRUCTION.

This canal has a total lockage of 48 feet, and overcomes the rapids of the Longue Sault. It extends westwards from the town of Cornwall to the village of Dickinson's Landing, a distance of about 11½ miles.

It is located on the north side of the St. Lawrence, on ground sloping rapidly towards the river, and at a considerable elevation (generally about 30 feet) above it.

By closely following the margin of the river high embankments became necessary, which, when imperfectly constructed (as has been found to have been the case) have under certain conditions been subjected to frequent land slides, accompanied by subsidence, entailing, as in 1888, very serious consequences.

The work of enlargement now under contract consists in the deepening of the old channel, and in constructing new and enlarged locks abreast of those now in use.

No change in the existing sinuous alignment is contemplated or provided for in the contract, and attention is therefore directed to the fact that the class of vessels for which the enlarged canal is designed will have great difficulty in navigating it, and that on certain curves, particularly those west of Moulinette, it will be practically impossible for vessels of full canal size to pass each other when under headway.

The enlargement was first begun in 1876 on section No. 1, at the lower entrance, and with the exception of some work on old lock No. 17 and the head-race to the mills, &c., was completed in 1882.

Work was subsequently—1884—resumed on section No. 10 at the upper entrance, the contract for which was awarded to Messrs. Jocks & Delorimier in April, 1884, which is still in progress.

In 1888 the remainder of the work required to complete the enlargement was placed under contract, consisting of sections Nos. 2, 3 and 4 (including the completion of section No. 1), which was awarded to Messrs. Wm. Davis & Sons, of Ottawa, and of sections Nos. 5, 6, 7 and 8, awarded to the Gilbert Blasting and Dredging Company, of Montreal, the whole to be finished in 1891.

NOTE.—Section No. 8 adjoins No. 10.

Sections Nos. 2, 3 and 4, Wm. Davis & Sons, contractors. Contracts entered into 5th November, 1888, to be completed 5th April, 1891.

In order to facilitate the contractor's operations, towing by horses on these sections was prohibited by Order in Council 20th August, 1890.

The canal was unwatered on the 23rd March, 1891, and so continued untill the 4th of May, to enable the contractors to prosecute their contemplated summer's work to better advantage. Work was therefore commenced immediately (23rd March) and vigorously pushed until the 9th December, when all work stopped, with the exception of that of providing and delivering materials.

The stone delivered in 1891 was procured from the Cornwall and Mille Roches quarries, and also from the local quarry at lock No. 20, Maple Grove.

As a result of the season's operations, the abutments for the Cornwall swing bridge and also for the road bridge over the raceway to the mills, have been completed, and the culverts at Wood's Creek, and also at Robertson's Creek, have both been finished and brought into use.

The masonry of locks 18, 19 and 20, including the extension walls, paving, &c., in connection therewith, together with the greater part of the extension walls of the north abutment of the swing bridge, have been completed.

And the masonry of the glance pier, extending east from lock No. 18, was commenced in April last, and will be continued when the canal is unwatered in the spring, as will also the extension walls of the south abutment of the swing bridge, for both of which structures the stone has been provided and delivered.

Work on a heavy retaining wall to support and strengthen the high embankment above lock No. 20 was commenced last September and continued until the end of the season.

Both approaches to lock No. 18 have been dredged and the new towpath formed. The western approach to lock No. 19 has been excavated chiefly by manual labour, and the new embankment in the river below the lock is nearing completion.

The high embankment forming the towpath west of lock No. 18, whereat slides and subsidence have been so frequent, has been strengthened by the formation of a continuous stone toe, composed of a line of detached wedge-shaped cribs, which, with the intermediate spaces, are filled with stone to the level of ordinary water. Upon this base an embankment has been commenced, which is proposed to be 20 feet in height and to terminate in a broad level berne abutting against the river slope of the existing bank, and to be hereafter weighted and protected by a rip-rap wall. This work was begun shortly after the last slide of the 25th of August, and continued until stopped by frost.

It is proposed, in the case of all high embankments, to support and strengthen the base by a heavy berne bank as described above; also to lighten the upper portion by reducing the top width of the towpath to 15 feet. And, further, to prohibit its use west of lock No. 18 as a public road.

The rip-rap wall at the commencement of section No. 2 in continuation of that on section No. 1 has been begun.

A large amount of "dredgings" has been deposited on the low point opposite the Cornwall swing bridge, the surface of which it is intended to reduce to a uniform level, to protect the bridge, and to form a site for the bridge-keeper's house.

A temporary road to the steamboat wharf was maintained during the progress of this work, for the convenience of the public using it.

The whole of the "dredgings" on sections Nos. 2, 3 and 4, with the exception of the spoil at Robertson's culvert, has thus far been utilized in the work for forming banks, &c.

The dredging has been carried on chiefly on sections Nos. 2 and 3. That required on section No. 4, above lock No. 20, will not be begun until after the retaining wall and berne bank in rear of it is completed,

A glance pier of cribwork has been built in front of the old weir at lock No. 19, which has had the effect of preventing further accidents to vessels using the lock.

Additional land has been acquired on both sides of the canal between lock No. 18 and the Government workshops; also at Robertson's culvert, where the prism of canal over the old tunnel has been widened.

The whole of the land on the south side of the Canal from the lower entrance to the west end of section No. 4, is now owned by the Government, and the necessity for crossing the canal or of using the towpath as a public road is therefore removed.

Sections 5, 6, 7 and 8.

The Gilbert Blasting and Dredging Company, contractors. Contracts entered into 2nd November, 1888, to be completed 20th of April, 1891,

From the 23rd of March to the 4th May, the period during which the canal remained unwatered, the south abutments and retaining walls of the swing bridges at Mille Roches and Moulinette were built to the normal level of the water in the long reach.

At Mille Roches bridge a serious leak was discovered in rear of the structure, three days after the opening of the canal, necessitating the formation of an earthen bank in front of it, in order that navigation should not be interrupted,

This bank it is proposed to remove, and to thoroughly overhaul and replace the defective masonry and puddle wall in rear.

The dredging on section No. 5 was continued throughout the season, and the material deposited in spoil, with a view to its subsequent use in forming a berne bank in rear of the retaining wall to strengthen the embankment west of lock No. 20.

On sections Nos. 6 and 7 but little dredging was done after the month of July, and the formation of the stone toe to embankment was also discontinued, for the reason that all work on these sections would be more or less affected in the event of the adoption of the proposed Sheik's Island Channel; therefore, pending a decision on this question, which is now under consideration by the Department, the dredges were removed to section No. 8, where they recommenced work, which was continued without further interruption until the close of the season.

The dredgings on sections Nos. 6 and 7 were deposited on the outer slope of the embankment, where a stone toe had been formed, whilst those on section No. 8 were either spoiled on the flat opposite the head of Sheik's Island or dumped in the river near Wagner and Grassy Islands, above the upper entrance to the canal.

A large quantity of stone for protection to banks has been provided and delivered on the work, and the timber and stone required to complete the bridges has also been delivered.

Section No. 10.

Jocks, DeLorimier & Broder, contractors. Contract with Jocks & DeLorimier entered into 7th April, 1884, to be completed 1st June, 1886.

The new guard lock was completed in all respects at the end of the season of 1890, but has not yet been brought into use.

The coping of this lock is considered too low for the high water stages of the river, and provision should therefore be made for raising it at least 18 inches.

The supply weir, which was begun in September last, is now in a half finished state, and the weir pit has therefore been flooded to protect the masonry.

All materials (including machinery for valves, &c.) have been provided and delivered at the work, and the structure will probably be completed early next season.

An extra bay, containing three valves, has been added to the breast wall, and the area of the floor below the breast wall has been enlarged to protect the foundations of the works from wash from the valves.

The excavation in prism of canal is nearly completed, except at the upper entrance, and is in the vicinity of the supply weir and the old guard lock No. 21.

The dredged material of last season was conveyed in dump scows to the dumping ground at Wagner's Island. The entire completion of the contract, which includes the removal of the old guard lock, may possibly be accomplished by the end of June, 1893.

Attention is here directed to the necessity of improving the Upper Entrance to the Cornwall Canal to meet the requirements of the class of vessels for which the enlargement is designed.

WILLIAMSBURG CANALS.

MAINTENANCE.

The several divisions of these canals, viz; Farran's Point, Rapide Plat, and the Point Iroquois, Junction and Galops, now known as the "Galops Canal," were closed for navigation on the 4th of December, 1890, and again opened for the passage of vessels on the 21st of April, 1891.

The present superintendent (Dr. Hickey) was appointed to the position 11th May, 1891, in succession to Mr. J. D. Reid, Acting Superintendent, resigned.

The buoy service between Prescott and Dickinson's Landing (Cornwall canal) was completed in time for the opening of navigation, and 25 new buoys were substituted in place of those found to be unfit for use.

No casualties of any moment occurred during the past season to vessels using the canals, other than occasional grounding, owing to overloading beyond the depth warranted by the water on the mitre sills, and the navigation was fairly well maintained notwithstanding the adverse circumstances attending an unusually low stage of the river, combined with—in the case of the Rapide Plat and Galops canals—the prosecution of the works of enlargement in the narrow channels.

The usual repairs were made to the various structures and the gates, bridges, banks, booms and entrance piers. Other important repairs will be referred to further on.

During the last session of Parliament an appropriation of $12,000 was made to provide three pairs of spare gates for the old locks, and a further appropriation of $700 towards the reconstruction of the mooring pier at Pier island. Of this amount, $449.97 has been expended on that work, and it is proposed to complete it, and also to build the spare gates during the next season.

On the night of the 26th of Janurary last an attempt to form an ice-bridge was made by parties on Croil's Island, U.S., by cutting loose the ice in a bay below Farran's Point eddy and swinging it by the force of the current across the channel to the Canadian shore. Information of these proceedings was sent to the mill owners at Morrisburg on the following day, and immediate steps were taken by them to break it up, thereby preventing a repetition of the disastrous ice jam of February, 1887, by which the water in the river was backed up stream to the rapid of Rapide Plat, above Morrisburg.

Only one fine has been imposed, viz; that of $5 on barge "Beaufort," by Mr. J. D. Reid, late acting superintendent, for injury to upper gates when entering lock No. 24 without snubbing.

The lock labourer's house at lock No. 22, Farran's Point, is not considered habittable, nor, owing to its insecure foundation, worth repairing. It is therefore proposed to allow the two lock labourers a sum sufficient to cover the cost of house rent in the vicinity of the lock, pending the completion of the proposed enlargement.

For the better supervision of the Farran's Point canal, it is recommended that it should be attached to the Cornwall canal for purposes of maintenance, as being in the same County and more easily reached from the headquarters of the superintendent of the latter work.

The chain vessel "Iroquois," which since the completion of the Galops Rapid channel had been moored opposite the starch factory below lock No. 26, was (as a matter of precaution against fire) removed last summer to her present berth in the canal below Frazer's Point.

A proposition has been made by the authorities of the village of Iroquois binding themselves and their successors to maintain the bridge on King street, crossing the Government drain, on condition that the Government assumes the maintenance of that over the flume or headrace to the mills. This favourable offer of a settlement of a vexed question should be accepted.

In addition to ordinary repairs during the season of 1891, the following necessary work and renewals have been accomplished, viz. :—

Farran's Point.

(Opened for traffic, 1847.)

The ice-breaker at head of canal was largely renewed and a foot bridge built across the flume at head of lock for the convenience of boatmen. All worn sheaves in chain wells were replaced, and a new "buffer post" affixed to the north wall of lock.

The new pier, rebuilt in 1889, was planked in part, and the masonry of the south-west wing partly rebuilt.

Rapide Plat.

(Opened for traffic, 1847.)

New valves were put in one gate of lower recess of lock No. 23, and new sheaves in the chain wells.

The four old gates, formerly sunk in Heegles Bay, were removed to the bay below the lower entrance.

In the new lock, No. 24, one of the gates, which had been damaged by a barge, was repaired, and a combined watch-house and store-house built.

Point Iroquois.

(Opened for traffic, 1847.)

The lower gates of lock No. 25 were replaced by a spare pair in good order, having been rebuilt in 1890. A foot bridge on the upper gates was also constructed for the convenience of residents on the south side of the canal, and the old sheaves in the chain wells renewed, and also the timber work of the weir at head of flume.

The masonry of the south-west wing above water was rebuilt.

The new wharf at the foot of the lock was finished for a distance of 380 feet east, and filled with stone, and for half its width blinded with gravel.

A fence or railing from the head of the swing bridge for a considerable distance west along the river wall has been constructed to prevent accidents to the owners of vehicles residing on the point.

The bridge was thoroughly overhauled and its approaches renewed.

The old wharf was repaired and planked, and the booms and fenders in the channel through the rock cut, repaired and strengthened.

The "Junction."

(Opened for traffic, 1856.)

The towing-path embankment, which connects the Point Iroquois and Galops Canals was badly constructed originally, and therefore requires to be constantly watched. During the past year several leaks started, but were discovered and remedied before anything serious occurred.

A waste weir is required on this long level, and its construction should at once be provided for.

Galops.

(Opened for Traffic, 1846.)

At lock No. 26, Cardinal, about 250 feet of the south pier below the lock has been renewed.

The lower gates were taken out last season and repaired, as well as their unsound condition would admit; they are, however, intended to be replaced by others which are now being overhauled.

The swing bridge and approach crossing the head-race have been thoroughly repaired, and the foot bridge on the upper gates enlarged, as at lock No. 25. Old sheaves and chains for operating the gates, where worn, have been replaced by others.

A blacksmith's shop has been built on the Repair service ground, where the buoy boat and scows are at present laid up, and piers to support roadway have been sunk and ballasted ready for planking.

At lock No. 27 (the guard lock) new valves were placed in upper gates, and the foot bridges, &c., renewed.

The north pier at foot of lock was partly rebuilt, and a new "buffer post" placed on the upper recess. Part of the superstructure of south pier with ice-breaker on the pier head at upper entrance was renewed, and a quantity of sunken timber and boulders removed by divers from the channel near the lock.

These canals were closed for navigation on the 12th December, 1891.

WILLIAMSBURG CANALS ENLARGEMENT.

CONSTRUCTION.

FARRAN'S POINT.

This canal has a total lockage of 3½ feet, and is nearly ¾ of a mile in length. It surmounts a short rapid, and is located on the north bank of the river St. Lawrence, about 5 miles west of the head of the Cornwall canal and 11¼ miles east of the village of Morrisburg. There are no works under the head of construction to report.

A location survey for the enlargement of this canal was commenced in December, 1890, and continued until the breaking up of the ice in the spring, and was subsequently completed.

This work included a general survey and examination of the channel leading from the proposed new upper entrance above Empey's Point (Point Avoyon), following the north shore westwards through the passage between Little Cat Island and the village of Aultsville, on the mainland, and from the present lower entrance the survey was extended to Baker's Point below the Big Eddy, connecting with the deep straight channel leading to the Cornwall canal.

Plans have been prepared showing the proposed manner of enlarging and extending the entrances to this canal.

RAPIDE PLAT.

This canal has a total lockage of 11½ feet, and overcomes the "Rapide Plat" rapids; it extends west about 3¾ miles, following the north bank of the river St. Lawrence to "Flagg's Bay," 4 miles east of the village of Iroquois.

The only noteworthy change from original construction is in an increase of 4 inches in the depth of water on the sill of the lock No. 24, due to the extension of the pier-head up stream.

Sections Nos. 1 and 3.

Messrs. Poupore & O'Brien, contractors. Both contracts entered into 26th January, 1891

Section No. 1 to be completed 1st April, 1894, and section No. 3 to be completed 20th April, 1893.

Section No. 1.

The work of enlargement on these sections consists in the deepening and widening of the existing channel, and in the construction of a new and larger lock alongside of the old lock No. 23.

No improvement in alignment is provided for in the contract, and it is therefore considered proper to direct attention to the fact, that, the class of vessels for which the enlargement is designed will have great difficulty in rounding the existing sharp curves on the Williamsburg Canals generally,

Work was begun in March last and continued until the end of the season. About 1,400 lineal feet of protection crib-work for the new bank above the lock has been completed, also some derrick cribs to be used in connection with the spoil ground in the bay below lower entrance

On section No. 3 the steam shovel commenced to work in July last and continued until November, the material excavated being spoiled in Flagg's Bay.

The new road on the north side of the canal has been graded and the macadamizing commenced.

Dredging in prism of canal has also been commenced and the "dredgings" scowed to a bay on the American side of the channel and dumped.

Materials for crib-work and cofferdams have been delivered, and quarries opened on Wolfe and Howe islands and also near Belleville.

Section No. 2.

The Weddell Dredging Company, contractors. Contract entered into 12th January, 1891, to be completed 20th April, 1893.

The work under contract consists in deepening and widening the present channel.

Work was commenced in February last by delivering materials for derrick cribs, &c., and in May the dredging in prism was commenced at Stata's Bay and continued to the close of the season, during the latter part of which two dredges were engaged.

The material dredged was used in enlarging the bank on the river slope, and in forming a "Service" ground in Stata's Bay for general canal repairs, &c.

Derrick cribs have been built in Stata's Bay, and a small quantity of "talus" formed.

Satisfactory progress in excavation has been made on the section.

Section No. 4.

William Broder, Contractor. Contract entered into 2nd April, 1884, to be completed 1st June, 1886.

This work, which is now completed and in use, embraced the construction of a new and enlarged guard lock, and the deepening and widening of the upper entrance.

The work was actually completed in 1888.

The shoal formed by the contractor improperly dumping in the river above the pier-head has been removed.

The final estimate is now being prepared and is stated to be well advanced.

POINT IROQUOIS.

This canal was originally 3 miles in length, with a total lockage of 5½ feet, at the lock No. 25, and extended west to Presqu'Isle, overcoming several stretches of swift water.

A change of some note since the original construction of the canal occurred in 1858, when the lower mitre sill of lock No. 25 was lowered 3 feet 2 inches; and the depth of water on the upper mitre sill (and therefore in the canal) was also increased after the connection was made (in 1856) between this canal and the Galops.

There are no works of construction to report.

JUNCTION.

The "Junction" commences at Presqu'Isle and extends west to lock No. 26, at the village of Cardinal, connecting the Point Iroquois and the Galops canals, by means of an embankment 2½ miles in length which was completed in 1856.

The fall in the river between the above mentioned canals is 1 foot 7½ inches.

There are no works here under the head of construction on which to report.

GALOPS.

This, the original Galops canal, had a total lockage of 6⅔ feet and extended from the village of Cardinal 2½ miles west to the head of the Galops rapid, which it was designed to overcome.

Its upper entrance is about 7 miles east of the town of Prescott by the North Channel.

The only noteworthy change in this canal since its original construction is in the increased depth of water (11½ inches) on the upper mitre sill of lock No. 27, caused by the extension to the pier-head a considerable distance up stream.

Section at Upper Entrance.

Messrs. Murray & Cleveland, Contractors. Contract entered into 14th November, 1888, to be completed 15th June, 1891.

The works of enlargement now in progress were commenced in April, 1889, and embace a lift-lock, guard-lock and supply weir, also the deepening and widening of the upper entrance.

As a result of last season's operations the guard-lock has been completed.

The foundation of the lift-lock has also been completed and fully loaded, by laying a course of masonry "backing" throughout. Satisfactory progress has been made in drilling and blasting and in excavating the rock in entrance channel, as also with the earth excavation in enlarging the prism.

All dredgings have been taken in dump scows to the dumping ground near Pier Island.

The coffer dams enclosing the area occupied by the new locks have proved to be perfectly staunch and watertight, and, as the springs are not numerous, pumping has been reduced to a minimum.

A large quantity of stone has been delivered on the section and provided in both the Belleville and the Galops quarries; and a strong force of stonecutters is now employed at Belleville on the face stone for the lift-lock.

With a view to guard against accident to the upper gates of the lift-lock, attention is directed to the necessisy for providing guard gates above the upper recess, or, as an alternative, reverting to the old plan of constructing a "breast" wall between the chamber and upper recess.

Also, as in the case of the new guard lock No. 21, Cornwall canal, and for the same reason, it may be necessary to raise the coping of both guard and lift-locks on this work.

The contractors have made very satisfactory progress during the past season.

Arrangements are being made to commence at an early date the necessary surveys in connection with the enlargement of the remaining portion of the "Galops" and also the "Junction" and "Point Iroquois" divisions, which are collectively known as the "Galops canal."

A survey will also be made to establish the exact line for a practicable channel between the Upper Entrance of the Galops canal and of the New Channel through the Galops Rapid, into the deep water in the Prescott reach.

Galops Rapid Improvement.

E. E. Gilbert & Sons, contractors. Contract entered into 5th August, 1879, to be completed 1st June, 1881.

This work, which was completed in November, 1888, consisted in the formation, by sub-marine excavation, of a straight channel about 3,300 feet in length and 200 feet in width through the rapid, and adapting it to a 14 feet navigation.

This, as stated by the late Chief Engineer in his report for 1889, "has been com-"pleted. It is now 200 feet in width, straight, and from 16½ to 17 feet in depth; but "pilots, as usual, prefer putting up with all the disadvantages of the old, crooked, "shallow line, rather than use a new one, with which they are unfamiliar. It is no "uncommon occurrence for even this important and useful class of men to be a little "prejndiced in favour of the route they have been accustomed to follow. It is, how-"ever, quite likely that the new line will, ere long, be found the most advantageous; "at all events, this is certain to be the case when a larger, deeper-laden class of vessels "are brought into use."

In the early part of last season doubts were expressed by some as to the accuracy of the above report, and tentative measures were adopted to test the matter by attaching poles representing the specified draft to a steam tug specially adapted for the purpose, and repeatedly running her both up and down the channel—with this result, that during the "medium stage" of the water in the river (11 feet on mitre sill of lock No. 27) the least depth discovered was on Island Shoal (16 feet) on what appeared to be some loose masses of rock, which it is barely possible (as asserted by the contractor) had been swept into the channel by the action of the ice since its completion in 1888.

These tests, which although proving conclusively that the channel was sufficiently deep and practicable for vessels of 14 feet draft at all stages of the river, were nevertheless not considered to have supplied the necessary information to enable the exact levels and dimensions of these sub-marine cuttings to be accurately ascertained. It was there-

fore determined to make a thorough survey of the bed of the river in its present state, including the new channel and its approaches, and the banks on either side.

This work was accordingly begun last September, and a steam tug, the "Gilbert," specially adapted for working in the rapids, was engaged, and fitted, at considerable expense, with the most perfect mechanical appliances which could be devised for obtaining depths correctly in the strong current.

The surveying and levelling operations were continued until the close of the season and completed so far as affects the New Channel, and from the information obtained a careful estimate of the quantities of work done has been computed and communicated to the Department.

And as a further and most satisfactory result of the levelling operations, the fact was clearly established that the *grade line* representing the bottom of the channel as decided upon at the inception of the work, and which the contractors adhered to throughout its progress, *has proved to be that which is best adapted to all variations in the depth of water in the rapid.*

The first propeller to run the New Channel was the steam barge "Niagara," Captain Morgan, on the 25th September, 1891, and was followed by the propeller "Ocean" on the 19th October, both of which vessels continued to use the channel until the close of navigation.

The original scheme for improving the channel through the rapid contemplated a dam across the "Gut."

This idea was, however, postponed, for the reason that it was deemed advisable to first ascertain the effect produced by the cutting of the new channel. Ample time (three years) for observation and consideration of the question has elapsed since its completion in 1888, and it is now submitted that the construction of the dam is necessary to the completion of this important work, as it would undoubtedly have the effect of correcting if not of wholly doing away with the existing cross currents, which it is considered now constitute the only element of danger in navigating this rapid.

It is recommended that the channel, which is now marked by ranges only, should be properly buoyed.

Further, it is considered an important matter to endeavour to ascertain whether the shallow portions of the new channel are occasioned by rock *in situ*, or by loose material swept in from the banks, and lodged in the irregularties of the bottom. This question can only be settled satisfactorily by sending a dredge to make an actual test, doubtless an expensive method, but in my opinion fully warranted by the circumstances of the case.

MURRAY CANAL.

MAINTENANCE.

The canal which was closed for traffic on the 27th of November for the season of 1890, was again opened for the passage of vessels on the 16th of April, 1891, and closed for the season on the 15th of December, 1891.

Navigation was maintained in a satisfactory manner throughout the past season notwithstanding the low stage of water in Lake Ontario.

No casualties occurred to cause any delay to vessels whilst passing through the canal, but in approaching the entrances, owing to some of the buoys which define the channel having been misplaced, or having drifted out of position, vessels occasionally grounded on obstructions which were known to exist outside the dredged channel.

The duty of placing the buoys from the entrance of Presqu'Isle harbour to Indian Island is performed by contract under the direction of the Department of Marine and Fisheries. This, it is suggested, might properly devolve upon the *officer in charge* of the Canal, who would be responsible for placing and maintaining them in position during the season of navigation.

The temporary lights placed on the entrance piers have answered a useful purpose, but are not considered sufficiently powerful. It is therefore suggested that suitable range lights should be provided, and that those now in use be utilized at the railway bridge.

The bridges are in good working order, but their superstructure requires painting, and the masonry of the piers and abutments to be pointed,

The turn-table of the railway bridge will require to be thoroughly overhauled before the opening of navigation, and arrangements with that object in view have been made with the Trenton Bridge Works.

All the bridges, entrance piers, banks, &c., have received the ordinary repairs usually provided for, and have been kept in good condition during the past season.

The banks where ever repaired have been sown with grass seed.

A Collector's office has also been built in a convenient situation, between Trenton and the railway bridges.

And in this connection it should be stated that a wharf is very much wanted at this point for the convenience of vessels stopping to pay tolls.

A scow is being built on the work for the repairing staff.

In addition to ordinary repairs, advantage was taken of the low water to overhaul and restore a considerable length of the stone protection to banks which, from having been commenced and built when the water of the lake was at a higher stage, had become undermined.

No fines have been imposed since the opening of the canal for traffic.

CONSTRUCTION.

This canal is situated about 75 miles west of Kingston, and is simply a straight channel, without locks, cut through the Isthmus of Murray to connect the waters of the Bay of Quinte with Presqu'Isle harbour on Lake Ontario.

Contractors, J. D. Silcox & Company. Contract entered into 24th August, 1882, to be completed 1st July, 1885.

The work was not however completed until August, 1890, although, by arrangement with the contractor, the public were occasionally permitted to use it during the latter part of 1889.

The final estimate is being prepared and is nearly completed.

The necessity having arisen for completing the facing or protection to the banks with stone, a contract was entered into with Mr. J. D. Silcox, contractor, 28th May, 1890, to be completed 10th December, 1890.

This work was finished last season, and the final estimate has been prepared.

SURVEYS ST. LAWRENCE CANALS.

The survey for the enlargement of the Farran's Point canal was completed last summer and the plan prepared. An estimate of cost will be made and submitted at an early date.

A very elaborate survey has been made of Sheik's Island and the North Channel, and all necessary information obtained relating to the question of the proposed Dams. This survey was subsequently extended to the upper entrance of the Cornwall canal, and thence westward along the river to Archibald's Point, connecting with the surveys of the Hooples Creek and Sand Bridge route.

The plans of this survey are being prepared.

The survey of the Galops rapid and River in the vicinity, including also a re-survey of the New Channel, was commenced in September last and continued until November, when, owing to the prevailing low stage of the river, 9 ft. on the mitre sill of Dock No. 27, work was suspended for the season.

The re-survey of the new channel was, however, completed and the information obtained communicated to the Department.

The abnormally low stage of the water in the St. Lawrence and lakes has caused much loss and inconvenience to the forwarding trade, and vessel owners, and others; and for the reason that many persons are under the impression that this state of the

water is unprecedented, I have appended a statement, compiled from official returns, showing the *highest* and *lowest water* in each year on all canals in the St. Lawrence District.

I have the honour to be, Sir,

Your obedient servant,

TOM S. RUBIGE,

Superintending. Engineer.

T. TRUDEAU, Esq.,
Acting Secretary Dept. Railways and Canals,
Ottawa.

STATEMENT of the Highest and Lowest Water on the Canals in the St. Lawrence District—1890.

MONTH.	CORNWALL CANAL.								WILLIAMSBURG CANAL.																		LAKE ONTARIO.			
	Lock No. 15.				Lock No. 21.				Lock No. 22.				Lock No. 23.				Lock No. 24.				Lock No. 25.				Lock No. 27.				Murray Canal.			
	Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.	
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
January...	27	3	10	6	11	5	9	0	10	10	7	11	10	9	8	9	10	4	7	6	12	4	11	4	11	6	9	0	13	11	13	2
February..	28	9	18	4	10	11	9	11	10	10	8	7	10	10	9	6	10	3	9	0	13	3	11	3	10	6	9	0	14	3	13	5
March. ...	19	9	11	4	11	1	10	3	10	10	9	0	10	6	9	9	10	9	9	9	13	1	11	0	10	9	10	0	14	8	14	0
April	11	10½	11	1½	12	3	10	10	11	6	9	6	10	9	10	0	10	9	9	10	13	10	12	0	11	6	10	2	14	8	14	3½
May.	12	2½	11	3	11	10	10	9	11	8	10	0	11	3	10	0	12	2	10	0	14	6	13	0	12	0	10	6	15	3½	14	7½
June.....	12	3½	11	0	12	2	11	4	11	6	10	10	11	9	11	0	12	3	11	0	14	9	13	6	12	0	11	0	15	7	15	2
July.....	12	0½	11	7½	12	0	11	6	11	6	10	11	11	9	11	0	12	3	10	11	15	0	14	0	12	2	11	1	15	7	15	0½
August. ...	11	8	11	2	11	9	10	11	11	3	10	0	10	10	10	0	10	11	10	2	14	1	13	0	11	2	10	0	15	0	14	3
September.	11	9	11	0	11	1	10	7	10	5	9	0	10	10	9	9	10	9	9	9	13	11	12	9	11	6	10	2	14	7	14	4
October....	11	0½	10	8	11	0	10	2	10	6	9	4	10	3	9	0	10	3	9	0	13	5	11	10	11	4	9	9	14	5½	13	11
November..	11	10½	10	8½	11	0	10	2	10	2	9	2	10	0	9	5	10	9	9	6	13	4	12	2	10	4	9	9	14	1	13	10
December..	18	6	10	8	10	11	9	0	9	10	8	4	10	4	8	9	10	5	8	4	13	5	11	0	10	6	9	4	14	0	13	5

STATEMENT of the Highest and Lowest Water on the Canals in the St. Lawrence District—1891.

MONTHS.	CORNWALL CANAL.								WILLIAMSBURG CANAL.																LAKE ONTARIO.			
	Lock No. 15.				Lock No. 21.				Lock No. 22.				Lock No. 23.				Lock No. 24.				Lock No. 25.				Lock No. 27.				Murray Canal.			
	Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.	
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
January...	27	2	18	6	11	0	9	6	10	6	8	4	10	0	9	2	1	8	81	0	12	0	11	2	9	8	8	10	13	9	13	3½
February.	22	10	20	4	10	9	9	0	10	0	8	4	10	0	8	4	9	9	8	0	12	6	10	10	10	4	8	1	13	11½	13	4
March.....	30	2	13	4	11	1	7	11	10	11	8	10	10	6	9	6	10	9	8	9	13	2	11	0	10	11	9	0	14	9	13	10
April.....	12	10	11	8	12	0	10	11	10	11	10	3	11	3	10	4	11	6	10	0	13	9	10	3	11	2	10	9	14	11	14	6
May.....	11	10	11	4	11	11	10	0	10	11	9	9	11	1	10	0	12	0	10	0	13	11	13	0	12	0	10	6	14	9	14	7½
June ...	11	5	11	1	11	0	10	3	10	5	9	10	10	3	9	6	10	6	9	7	13	3	12	4	10	7	10	0	14	5½	14	1½
July.....	11	2	10	7½	11	0	10	3	10	6	9	10	10	4	9	6	10	7	9	2	13	3	12	3	11	0	10	0	14	2	13	8½
August...	10	8½	10	5	10	7	9	6	9	11	9	0	9	8	8	9	9	9	8	8	12	8	11	4	10	6	9	7	13	9	13	4
September.	10	6½	9	9	10	1	9	5	9	5	8	8	9	0	8	3	9	3	8	0	12	0	10	5	10	2	9	0	13	4	12	9
October....	10	0½	9	3½	9	7	8	7	8	11	8	0	8	6	7	4	8	6	7	4	11	6	7	10	9	4	8	2	12	10½	11	11½
November..	9	8	8	9½	10	5	8	2	9	9	7	6	9	6	7	0	10	0	6	9	13	0	9	1	10	9	8	0	13	0	11	5½
December..	9	8	8	10	10	9	8	3	9	0	7	5	8	5	5	10	8	10	5	8	11	6	7	6	9	6	7	6	13	1	11	4½

[1891]

STATEMENT of the Highest and Lowest Water on the Canals in

YEAR.	CORNWALL CANAL.											
	Lock No. 15.				Lock No. 21.				Lock No. 22.			
	Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.	
	M'th.	Ft. in.	M'th.	Ft. in.	M'th.	Ft. in.	M'th.	Ft. in.	M'th.	Ft. in.	M'th.	Ft. in.
1849	Nov	10 1	Oct	9 1	June	10 7	Oct	8 6	June	10 11	Sept	8 3
1850	May	11 2	Nov	9 4	May	10 10	Nov	8 0	do	10 0	Nov	7 6
1851	July	11 0	do	9 10	June	11 0	do	9 1	July	10 6	do	8 0
1852	June	12 2	do	10 5	July	12 0	Oct	9 5	June	12 6	Oct	9 6
1853	do	12 10	do	10 10	May	12 2	Nov	10 1	do	12 3	Nov	9 10
1854	May	12 0	do	10 1	June	11 5	do	9 3	do	11 0	do	8 6
1855	Oct	12 0	May	10 2	Aug	11 0	May	9 2	Aug	11 3	do	9 3
1856	May	11 4	Nov	9 2	June	11 10	Nov	9 1	May	10 9	do	8 3
1857	July	11 11	Oct	9 8	July	11 10	Oct	9 4	June	11 3	do	9 6
1858	Aug	13 3	do	10 3½	Aug	12 8	do	11 0	do	12 0	do	9 3
1859	July	12 4	Nov	10 3	June	12 9	Nov	10 3	May	11 6	do	8 6
1860	do	11 6	do	10 5	Nov	12 10	do	8 11	Nov	11 9	Oct	8 3
1861	do	12 10	Sept	11 3½	May	12 7	Oct	11 2	May	11 3	May	9 0
1862	May	12 10	Nov	10 4	do	12 11	Nov	10 2	do	11 9	Oct	8 0
1863	do	12 0	do	10 5	June	12 2	do	10 1	June	10 3	May	8 6
1864	do	11 10	do	10 8	do	12 1	do	10 1	do	10 6	Oct	8 9
1865	do	11 9	Oct	9 9	do	11 10	do	9 1	do	10 9	Nov	8 6
1866	June	11 3	May	10 4	July	11 7	Sept	9 5	do	10 0	do	8 6
1867	do	12 7	Nov	9 7	June	12 5	Nov	9 4	do	10 6	do	8 0
1868	do	10 11	Oct	9 7	do	10 8	do	8 10	do	9 9	do	8 3
1869	do	11 9	Nov	10 7	July	11 8	do	9 9	July	9 9	do	8 6
1870	do	12 8	do	10 3	May	12 9	do	10 4	May	11 6	do	8 9
1871	do	11 4	Oct	9 0	do	11 4	do	8 4	do	9 9	do	8 0
1872	July	10 0	Nov	8 8	July	9 10	Oct	8 3	June	9 0	May	7 6
1873	May	11 4	Oct	9 9	June	11 2	do	8 7	May	11 3	Nov	7 6
1874	do	11 9	Nov	9 6½	May	12 0	Nov	9 4	...	...	Oct	8 9
1875	do	10 8	do	9 4	June	10 4	do	8 5	June	9 3	do	7 6
1876	do	12 2½	do	10 6½	July	12 6	do	10 2	July	12 6	do	8 6
1877	do	11 0	Oct	9 2	May	11 0	Oct	8 8	do	10 0	do	7 10
1878	do	11 2	Nov	10 4	do	11 2	Nov	9 11	Sept	10 3	do	8 6
1879	do	11 3½	do	9 3	do	11 10	do	8 7	June	10 0	do	8 0
1880	June	10 10	Oct	9 4½	Nov	11 8	Oct	8 9	Nov	11 0	Oct	8 3
1881	May	11 1	Nov	9 1	June	10 6	Nov	8 7	July	9 6	Nov	7 6
1882	June	11 7	do	9 7	do	11 7	do	9 3	do	11 3	do	8 5
1883	July	11 10½	do	10 4	Aug	12 1	May	9 4	June	10 11	Oct	8 6
1884	May	12 0	do	10 1	May	12 3	Nov	9 8	May	11 6	Nov	9 0
1885	Aug	11 0	do	10 8	June	11 9	do	10 0	July	10 11	Oct	9 5
1886	May	12 3	do	10 2	do	12 11	do	9 2	May	11 10	Nov	8 6
1887	do	12 2	do	9 10	do	12 0	do	9 3	do	11 6	do	8 6
1888	do	10 9	do	9 6	July	10 6	do	8 4	July	9 10	do	7 8
1889	June	11 1½	do	9 4	May	11 4	do	8 2	do	10 8	do	7 6
1890	do	12 3½	Oct	10 8	June	12 2	do	10 2	May	11 8	do	9 2
1891	May	11 10	Nov	8 9½	May	11 11	do	8 2	do	10 11	do	7 6

the St. Lawrence District, May to November in each year.

WILLIAMSBURG CANALS.

Lock No. 23.				Lock No. 24.				Lock No. 25.				Lock No. 27.			
Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.	
M'th.	Ft. in.	M'th.	Ft.in	M'th.	Ft. in.	M'th.	Ft.in	M'th.	Ft. in.	M'th.	Ft.in	M'th.	Ft. in.	M'th.	Ft.in
June..	11 3	Nov.	8 5												
Aug..	10 6	May..	8 6												
May..	11 0	Nov..	7 9												
Nov..	12 9	May..	9 6									June..	11 11	Nov..	10 0
July..	12 10	Oct..	10 6									July..	12 11	do ..	10 3
May..	13 3	do ..	9 3					May..	16 6	Nov..	11 9	May..	13 0	do ..	9 9
Nov..	13 0	Nov..	9 0	Sept..	11 8	Oct..	8 10	Nov.	15 6	Oct..	10 11	Aug..	11 9	Oct..	9 5
June..	12 9	do ..	10 3	May..	13 6	Nov..	10 0	May..	16 8	Nov.	12 6	May..	13 0	Nov..	10 4
May..	13 4	do ..	9 3	do .	13 0	do ..	8 10	do ..	16 10	do ..	11 6	do ..	13 0	do ..	9 7
June..	12 0	do ..	9 3	do ..	12 8	do ..	8 0	June..	15 2	do ..	11 3	June..	12 9	do ..	9 6
do ..	12 0	do ..	9 6	June..	12 6	do ..	9 0	do ..	15 2	Oct..	11 8	do ..	12 3	Oct..	9 4
May..	11 6	do ..	8 0	do ..	12 0	do ..	8 3	do ..	14 11	do ..	9 9	do ..	11 10	do ..	8 9
do ..	10 9	do ..	8 9	July..	11 0	do ..	8 9	July..	13 7	May..	11 1	Sept..	11 3	May..	9 6
June..	12 10	do ..	8 6	do ..	12 6	do ..	8 6	do ..	15 8	Nov..	11 0	June..	12 6	Nov..	9 0
May..	10 0	do ..	7 6	do ..	10 2	do ..	7 3	June..	13 0	do ..	9 1	do ..	10 9	do .	8 6
July..	11 6	do ..	9 3	do ..	11 9	do ..	9 6	Aug..	14 5	do ..	11 8	July.	11 4	do ..	10 0
May..	12 9	do ..	8 9	May..	13 0	do ..	8 6	May..	16 2	do ..	11 2	May..	13 0	do ..	10 0
do ..	11 0	do .	6 9	Oct..	12 0	do ..	7 6	do ..	13 9	do ..	9 3	Oct..	11 6	do ..	8 4
July..	8 10	Oct..	7 0	July..	9 0	do ..	7 2	July..	11 3	Oct..	9 3	Aug..	9 10	Oct..	8 0
June..	10 6	Nov..	7 11	June..	11 0	do ..	8 0	June..	13 7	Nov..	10 4	May..	11 3	do ..	8 8
do ..	10 11	do ..	7 9	do ..	11 6	do ..	7 4	July..	14 2	do ..	10 6	June..	11 9	Nov..	9 0
May..	10 0	do ..	6 0	do ..	9 9	do ..	6 3	June..	12 2	do ..	8 4	do ..	10 1	do ..	8 2
July..	12 6	do ..	9 3	May..	12 9	do ..	9 3	July..	15 8	do ..	11 11	July..	12 8	do ..	9 4
June..	10 5	Oct..	7 2	June..	11 10	do ..	7 6	June..	13 0	Oct..	9 3	Aug.	10 9	Oct..	8 3
do ..	11 6	Nov..	9 0	Sept..	12 0	do ..	8 9	Sept..	14 6	Nov..	11 9	May..	11 10	Nov..	9 0
May..	10 4	do ..	7 6	do ..	10 9	do ..	7 0	July..	13 8	do ..	9 6	Aug.	10 8	Oct..	8 4
do ..	10 3	Oct..	7 9	Nov..	11 0	do ..	8 0	Nov..	14 3	Oct..	9 10	Nov..	11 6	do ..	8 7
June..	9 9	Nov..	7 0	July..	9 9	do ..	7 0	Aug..	12 6	Nov..	9 2	July..	10 4	Nov .	8 0
do ..	11 3	do .	7 11	June..	11 3	do ..	8 0	June.	14 2	do ..	10 10	June..	11 7	do ..	9 2
Sept..	11 10	May..	8 4	July..	11 9	May..	8 3	July..	14 8	May..	11 0	May..	12 0	May..	9 4
May..	12 9	Nov..	8 5	May..	12 6	Nov..	8 9	May..	15 10	Nov..	11 4	do ..	12 8	Nov..	9 9
June..	11 2	do ..	9 0	June..	12 0	do ..	9 0	June..	14 10	July..	10 3	June..	11 9	Oct..	9 10
May..	12 3	do ..	9 0	May..	12 2	do ..	8 9	May..	15 3	Nov..	11 3	May..	12 8	Nov..	9 7
June..	11 8	do ..	8 4	do ..	11 9	do ..	8 3	June..	14 9	do ..	8 4	do ..	12 2	do ..	9 0
July..	9 11	do .	6 9	do ..	10 6	do .	7 6	do ..	12 6	do ..	9 0	July.	11 1	do ..	8 0
May..	10 9	do ..	6 4	do ..	11 3	do ..	6 0	do ..	13 7	do ..	9 0	May..	11 6	do ..	7 1
June..	11 9	Oct..	9 0	June..	12 3	Oct..	9 0	July..	15 0	Oct..	11 10	July..	12 2	do ..	9 9
May..	11 1	Nov.	7 0	May..	12 0	Nov..	6 9	May..	13 11	do ..	7 10	May..	12 0	do ..	8 0

STATEMENT of the the Highest and Lowest Water taken at Presqu'Isle Harbour, Lake Ontario, 1854 to 1881, and on the Murray Canal from 1881 to 1891.

MONTHS.	LAKE ONTARIO. Murray Canal. Highest.			Lowest.			
	Months.	Ft.	In.	Months.	Ft.	In.	
1854	June	15	6½	December	13	0	Level reduced to Murray Canal standard.
1855	August	14	11½	April	12	7	
1856	June	15	2½	December	12	10½	
1857	July	16	1½	January	12	7½	
1858	do	16	2	November	13	11½	
1859	May	16	1	do	13	6½	
1860	July	14	6½	do	13	5	
1861	June	15	9	January	13	3	
1862	May	16	1½	December	13	2	
1863	do	15	4½	do	13	2	
1864	June	15	5½	February	12	10	
1865	May	15	0	December	12	6	
1866	June	14	2	February	11	11	
1867	do	15	8	December	12	1	
1868	July	13	11	February	11	6	
1869	do	14	9½	do	12	4	
1870	May	16	5	December	13	6	
1871	do	14	8	do	11	11½	
1872	June	12	9½	March	11	1½	
1873	May	14	5	January	11	3	
1874	June	14	11	December	12	1	
1875	do	13	6	February	11	3	
1876	July	15	11	January	12	4	
1877	April	14	0½	November	12	4½	
1878	December	14	7	January	12	5	
1879	January	14	4	October	11	11½	
1880	June	14	1	December	11	11	
1881	July	13	9	do	11	11	Murray Canal.
1882	June	14	11½	January	12	3	
1883	July	15	6	do	12	4	
1884	May	15	10	November	13	3	
1885	August	15	4	March	12	10	
1886	May	16	4	November	13	8½	
1887	do	15	9	December	12	9	
1888	June	13	11½	do	12	6	
1889	July	14	4	November	12	5	
1890	June	15	7	January	13	2	
1891	April	14	11	December	11	4½	

APPENDIX No. 7.

WELLAND CANAL.

ST. CATHARINES, 14th December, 1891.

SIR,—I have the honour to submit the following report upon the Welland canal and its branches, for the fiscal year ending 30th June, 1891.

At Port Dalhousie the deepening of the entrance to the harbour, under Messrs. MacDonald Aylmer's contract, was proceeded with, and has since been completed.

Under that contract the channel between the entrance piers has been dredged to a depth of 2½ feet below the mitre sill of the new lock, and outside the piers for a mean width of 250 feet the entrance has been dredged to a depth of 4½ feet below the mitre sill just mentioned.

The renewal of the superstructure of the east pier was not commenced, in consequence of the late date when the appropriation became available.

From Port Dalhousie to the guard-lock above Thorold the repairs, though of a minor character, have been extensive.

The canal having been unwatered in the early spring, the lock bottoms were cleaned out, and the obstructions removed from the reaches where found; gates, valve and operating machinery received a thorough overhauling, and repairs and renewals were made where necessary.

Below many of the weirs extensive repairs with large stones were necessary, to protect the aprons.

These repairs, repeated to a greater or less extent at each of the twenty-five locks and weirs, involved a large expenditure for labour and materials.

On the summit level between the guard lock and Port Colborne the renewals of the bridge fenders were proceeded with at Marlatt's bridge, at Allanburgh and at the Quaker bridge, and at Port Robinson the swing bridge crossing the lock to Chippewa river was rebuilt.

The sodding of the deep cut slopes, under Messrs. Johnson & Lawson's contract, was also proceeded with and has since been completed.

At Port Colborne the lock gates, which were becoming unsound, were renewed, rebuilt above the water line, and replaced.

On the old canal a new swing bridge was constructed at lock No. 1, also at lock Nos. 5, and seven of the lock gates which were decayed above the water line were rebuilt and put in place again.

On the feeder division the Junction Dunnville and Port Maitland locks were cleaned out, and such minor repairs as were necessary attended to.

The Forks Road, Stromness, and Port Maitland bridges were overhauled and put in good order, and the bridge over the guard-lock at Dunnville was rebuilt.

At the Dunnville dam the flood gates and weirs were put it proper working order, repairs to banks were made where required, ditches opened, and the drainage generally attended to.

Two detentions to traffic, worthy of notice, occurred during the year.

On 1st September, 1890, the steam barge "T. D. Stunson" upward bound, ran into the head gates of lock No. 18, resulting in their being carried away, as were also the two foot gates.

A mistaken signal was the cause, and navigation was interrupted for forty-six hours.

Again, on 18th September, 1890, the head gates of lock No. 18 were again carried away by the steam barge "Samoa," upward bound, in consequence of the slack of the lines not being taken in as the lock filled with water, when, the vessel surging ahead, parted the lines with the result above mentioned, causing an interruption of traffic for sixteen hours. In both cases the renewal and repairs were effected with commendable rapidity.

During the past year the water, though generally lower than in the previous year, was never less than 14 feet upon the mitre sill of the new lock (No. 1) at Port Dalhousie.

On the mitre sill of the new lock (No. 27) at Port Colborne there were two occasions when the water fell below 14 feet, but only to the extent of 2 inches.

Since the close of the fiscal year the low water which has been noticeable throughout the lakes and rivers, has been felt at Port Colborne to the extent of there being two days in September, sixteen days in October, and twenty-one days in November when there was less than 14 feet of water upon the mitre sill, the deficiency ranging from 14 to 13 feet 4 inches, and on one occasion of short duration the water fell to 12 feet 10 inches upon the mitre sill.

These periods of low water were often of short duration, and a delay of an hour or so frequently enabled vessels to pass.

With an elevator at Port Colborne, and another at Port Dalhousie, and rapid transit between them, the detentions need not however have been as great as they were, and it is questionable whether the time lost and money spent in tug-hire in endeavouring to force a passage through the lock might not have been more profitably invested in lightering at the elevator. Indeed the necessity for preserving the mitre sills will make it desirable to pay more attention to this matter next season than it has hitherto received.

The design of the Welland canal was for 14 feet of water upon the mitre sills, subject at the entrance locks to occasional variations, as in the past season.

The impression appears to have gone abroad among vessel men that the 14 feet spoken of referred to the draught of vessels, not to the depth of water upon the sills, and for some years past the endeavour to pass vessels of deeper draught than the canal was designed for has added greatly to the cost of maintenance of the Canal, as well as to the expense of those navigating it.

With the elevator facilities at each end of the canal this need not be so.

With reference to the low water, it may be said that while the clearing up of the country has undoubtedly a steadily—diminishing effect upon the water supply and maintenance of streams, it is believed that the present season of low water is traceable to natural and direct causes, such as a year of unusual drought, and strong westerly gales, which have forced the water out of the lakes unduly.

This opinion is strengthened by the fact that in the years 1850, 1865 and 1872 the yearly mean low water of Lake Erie was practically the same or a trifle lower than the mean low water of the current year, with intervening periods of higher water.

The canal was closed 5th December, 1890, and was opened for navigation 20th April, 1891.

Attached will be found a statement of fines, damages and rents collected during the year; also a statement of the monthly highest and lowest water on the mitre sills of lock No. 1 and lock No. 27 at Port Dalhousie and Port Colborne, respectively, during the past fiscal year.

I have the honour to be, Sir,

Your obedient servant,

W. G. THOMPSON,

M. Inst. C. E.

T. TRUDEAU, Esq.,
Acting Secretary Railways and Canals,
Ottawa.

STATEMENT showing the Highest and Lowest Water on the Mitre Sill of New Lock No. 27, at Port Colborne, Welland Canal, for the Fiscal Year ending 30th June, 1891.

Months.	Upper Sill.				Months.	Upper Sill.			
	Highest.		Lowest.			Highest.		Lowest.	
1890.	ft.	in.	ft.	in.	1891.	ft.	in.	ft.	in.
July	16	9	15	7	January	15	11	14	1
August	16	5	15	3	February	15	9	13	11
September	16	1	14	6	March	17	0	14	0
October	16	2	14	7	April	15	6	14	10
November	16	2	14	7	May	15	7	14	0
December	16	4	13	10	June	15	3	14	5

"C."

STATEMENT showing the Highest and Lowest Water on the Lower Mitre Sill of New Lock No. 1, at Port Dalhousie, Welland Canal, for the Fiscal Year ending 30th June, 1891.

Months.	Lower Sill.				Months.	Lower Sill.			
	Highest.		Lowest.			Highest.		Lowest.	
1899.	ft.	in.	ft.	in.	1891.	ft.	in.	ft.	in.
July	18	3	17	7	January	16	11	15	11
August	17	8	17	0	February	16	7	15	9
September	17	10	16	9	March	17	3	16	3
October	16	10	16	4	April	17	5	17	1
November	16	8	16	3	May	17	5	17	1
December	16	7	16	0	June	17	2	16	5

"A."

STATEMENT of Fines and Damages collected from Vessels and Steamers, and Rents from occupants of Government Lockhouses; also, for use of Government Plant, during the Fiscal Year ending 30th June, 1891.

Date.	Name of Vessel or Steamer.	Fines.	Damages.	Rent Government House.	Use of Government Plant.	Totals.
1890.		$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
August 1..	"D. C. Whitney".....	.....	100 00			
do 7..	Steam barge "Marshall"...	.....	75 00			
October 4..	do "Tecumseh"..	.....	41 65			
1891.						
June 15..	"C. W. Whitman".....	.....	75 00			
do 30..	Steamer "Samoa".....	.....	840 73			
				.....	.....	1,132 38
	Tug "Jas. Norris"... ...	5 00				
	do "Jas. Webster".....	5 00				
	do "G. R. Boyle".....	5 00				
			.....	.....	.....	15 00
	Canal Lock-house.					
	"Jno. Ryckman".....	.....	.....	15 00		
	"H. Donald".....	.....	.....	6 00		
	"J. Cockle".....	.....	.....	9 00		
	"L. Burtch".....	.....	.....	8 00		
	"P. Phœlan".....	.....	.....	6 00		
					.....	44 00
	Lease of Government Plant.					
	McDonald and Aylmer.. ..	.....	.....	.....	10 00	10 00
						*1,201 38

*Amount in hand of H. H. Collier, Collector of Canal Tolls, &c., St. Catharines Port.

APPENDIX No. 8.

RIDEAU CANAL OFFICE,
OTTAWA, 30th October, 1891.

SIR,—I have the honour to submit the annual report of the works under my charge for the fiscal year ending 30th June, 1891.

Navigation closed at Ottawa, 29th November, and at Kingston Mills 26th November, 1890. Opened at Ottawa 28th April, and at Kingston Mills 1st May, 1891.

On both the ascending and descending reaches from the summit level (Little Rideau Lake) the water was maintained to give the full depth required on the locks throughout the season of navigation. No interruption to navigation occurred. The principal repairs executed at the stations were as follows :—

Kingston Mills.

One pair of lock gates renewed; repairs to lockmaster's house and extension to lock labourers'.

Brewer's Lower Mills.

Upper lock gates removed and 50 yards of gravel placed on dam and around the lock walls.

Brewer's Upper Mills.

Timber delivered for one pair of lock gates and general repairs to station.

Brass' Point.

Repairs to bridge and approaches.

Jones' Falls.

Lower lock gates renewed; lower lock cleaned out by diver; revetment cribwork on side of road to lockmaster's house; one pair of sluice frames.

Davis' Lock.

Lockmaster's kitchen clapboarded and general repairs to station.

Chaffey's Lock.

Repairs to masonry; two new swing beams, and two new water boards.

Newboro'.

New storehouse and repairs to station.

Narrows.

Rebuilt wing-wall of lock; repairs to upper lock gates; bottom of lock cleaned by diver; addition built to lockmaster's house and repairs to block house.

Poonamalie.

General repairs to station.

Smith's Falls.

One pair of lock gates renewed; two new sluice frames, and general repairs to station.

Old Slys.

Two new sluice frames; chain blocks and other small repairs.

Edmund's Rapids.

One pair of swing beams.

Maitland's Rapids.

Repairs to back dam; swing bridge painted.

Merrickville.

Upper basin wall taken down and rebuilt; culvert put in for unwatering the same; one pair of sluice frames and two new swing beams.

Clowe's Quarry.

One pair of lock gates renewed, and repairs to lockmaster's kitchen.

Nicholson's.

Small repairs to station, and timber delivered for removing swing bridge.

Long Island.

Two pairs of lock gates renewed; pier at head of the lock rebuilt, and eight new chain blocks.

Black Rapids.

Top of long dam repaired; flash boards put on; lockmaster's house raised and new roof put on, and other repairs to station.

Hogsback.

Two new additional foot boards; eight new chain blocks; rebuilt pier west side of bulkhead and repaired breach of dam, caused by the water in spring.

Hartwell's.

New bridge built over the waste weir; lockmaster's house re-shingled; store and lock labourers' house painted.

Little's Bridge.

New addition to bridgetender's house.

Stewarton Bridge.

Bridgetender's house built.

Ottawa.

One pair of lock gates renewed; nine new ladders built for different stations; two new sluice frames, and two swing beams; repairs to masonry of locks; replanking portions of the wharf round basin. The east side of the basin was deepened by contract to the same depth as the rock cut was made the winter before, an improvement much appreciated by the forwarders.

The deepening of the west side it is proposed to do this coming winter.

A survey of the drowned lands between Birmingham's Point and Kingston Mills was made during the fall and the winter, after the ice had taken, with the object of ascertaining what acreage of these lands could be reclaimed, by lowering the sill of the upper lock at Kingston Mills and building a new lock at Birmingham's.

The result of the survey, together with plan, was reported to the Department 21st September, 1891.

Perth Branch

No repairs of any consequence will be required. The dredge "Rideau" was engaged during the season deepening and cutting channels through points of low land, shortening the route very considerably.

This spring the dredge was fitted with improved steam hoisting apparatus for raising and lowering the spuds; strengthening hog-rods were also put in, with other necessary repairs. She was removed down to below Long Island locks at the end of June, to straighten the channel at the "Picketts."

The extension upwards from the basin was let in January, 1891, and will be completed during the year.

Two lines of freight steamers have been placed on the route, one from Montreal and the other from Kingston. They are well supported by the merchants of Perth and the surrounding townships.

I have the honour to be, Sir,

Your obedient servant,

FRED. A. WISE,

Superintendent.

T. TRUDEAU, Esq.,
Chief Engineer of Canals.

APPENDIX No. 9.

TRENT VALLEY CANAL,

SUPERINTENDING ENGINEER'S OFFICE,
PETERBOROUGH, 31st October, 1891.

SIR,—I have the honour to submit the annual report on the works under my charge for the fiscal year ending 30th June, 1891.

Navigation closed 24th November, and opened again on 20th April. There was a good depth of water on all the stretches during the season—there being from 5 to 6 feet on the sills. There would be little difficulty in holding 7 feet on the sills and comparatively little damage would be caused.

The effect caused by the lumbermen—having cut all their timber—abandoning their limits in the northern counties is beginning to be greatly felt. This spring the freshet was very high—higher than it has been on some stretches for twenty years—owing, in a great measure, to the scores of dams on these abandoned limits of the lumbermen not having been closed, as formerly. The whole body of water was thus allowed to come down at once, not only causing damage to property, but the loss of this water during the dry season is severely felt.

I would suggest that in future some supervision be had over these dams, so that a more even flow may be maintained throughout the season.

The number of lockages was 2,616. The number of lockages does not fairly represent the traffic on these waters, as there are a number of daily passenger routes which do not pass through any lock and therefore are not recorded. The fleet of boats on these waters keeps increasing every year. Last year two large side-wheelers were built and put on the stretch between Lakefield and Balsm Lake, besides a number of small pleasure steamers.

There are now twenty-three steamers on the stretch between Lakefield and Balsm Lake and six between Peterboro' and Heeley's Falls.

The want of a small dredge is greatly felt on account of the deposits of sawdust and shallow places.

The following work was done along the route :—

Fenelon Falls.

A breach was made by ice in the side dam leading from the main dam. This was repaired, as it allowed the water to fall below the normal level.

Scugog River.

There was an appropriation for removing boulders and widening the river, but this work was proceeded with by the Ontario Government, who are evidently anxious to assume control of this river.

Bobcaygeon.

A workshop was built at the dry dock for the convenience of those using the dock.

Buckhorn.

A large quantity of gravel was washed down from the canal into the lock chamber. This was removed.

Burleigh.

The dams here were thoroughly gravelled. It was found that a much greater quantity was required to make a thorough job than was at first thought necessary. The dams are now tight, and there has been no trouble since in keeping the water at its normal height. The apron of one of the sluices was taken out by sawlogs. This was repaired.

Young's Point.

A boat slide for the passage of small boats over the dam was constructed at a small expenditure. This has been greatly appreciated by the owners of small boats who are continually passing up and down.

Lakefield.

A top was built on one of the old piers at the Narrows, so as to form an ice-break. Provision was also made for the placing of a light on it.

Peterboro'.

A landing pier was built at the south end of the town, extending from the north side of Wolf street to the Canadian Pacific Railway track. The want of sufficient landing space has long been felt. The landing pier was placed in its present position at the solicitation of the street and bridge committee of the town. The ice did considerable damage to the sluice piers, which were repaired.

Hastings.

When the old wooden swing bridge was removed it was found that a considerable portion of the pivot pier had to be rebuilt in order to get a good foundation to set the new iron swing bridge on. A new iron swing bridge made at the Central Bridge Works, Peterboro', replaced the old wooden structure and has given every satisfaction.

The navigation channel between Lakefield and Bobcaygeon was cleaned out and buoyed.

I have the honour to be, Sir,

Your obedient servant,

RICHARD B. ROGERS,

Superintending Engineer.

T. TRUDEAU, Esq.,
Acting Secretary Railways and Canals,
Ottawa.

APPENDIX No. 10.

SAULT STE. MARIE CANAL.

OTTAWA, 5th December, 1891.

SIR,—I have the honour to report upon the progress made in the construction of the Sault Ste. Marie canal during the fiscal year ending 30th June, 1891.

It may be well to repeat briefly what has been said in former reports, namely, that the total length of the canal and approaches may be taken as 3½ miles, which is divided into three sections, the first of which, 5,300 feet in length, extends from the navigable channel of the St. Mary's river below the rapids to the foot of St. Mary's island, at which point the second section, 3,500 feet in length, commences, and extends to the head of the island, where the third section commences, and extends 9,300 feet up the river through shoals, until the navigable channel above the rapids is again reached.

Section No. 1.

This section is under contract to Messrs. Hugh Ryan & Co., and embraces the excavation of a channel 250 feet in width to a depth of 18½ feet below the lowest recorded water surface at the foot of the rapids; also the construction of entrance piers and a beacon.

At the end of the fiscal year the excavation was about half done, and the sinking of cribs for the north landing pier was well under way.

The quantities of the different items of work returned to 30th June, 1891, are as follows:—

Excavation dredging and deepening channel, cubic yards		80,901
Timber in sides and ends of cribs, lineal feet		1,100
Timber for ties, bottoms, &c.	do	1,145
Binding pieces	do	72
Blocks under heads of ties, No		40
Wrought iron in bolts, lbs		485
Stone filling in cribs, cubic yards		40

The operations of dredging and crib-building have been continued with fair progress up to 21st November, at which date work on the section was practically closed for the season.

Section No. 2.

This section, also under contract to Messrs. Hugh Ryan & Co., embraces the excavation for the lock pit and prism of the canal, the masonry for the lock, also for a guard-gate above the lock, and the construction of side walls and puddle trenches, &c., &c.

The contract provides for the prism of the canal being 145 feet in width, at a depth of 18 feet below the lowest recorded water surface above the rapids.

The dimensions of the lock chamber were originally intended to be 600 feet in length between the hollow quoins, 85 feet mean width, with entrances 60 feet wide, and a depth of 16¼ feet of water upon the mitre sills at the lowest recorded water surface at the foot of the rapids.—the upper gates to mitre above a breast wall, and the lock to be filled and emptied by means of culverts below the lock floor.

In consequence, however, of representations made by interested parties, certain changes sanctioned by Parliament at its last session have been made in the lock dimensions, with a view to providing for the passage of deeper draft vessels than originally

intended, the main feature of the change being the lowering of the mitre sills to a depth of 19 feet below the lowest recorded water surface at the foot of the rapids, the lift of the lock being 18 feet.

This increased depth will enable vessels to pass through the Canadian lock, when completed, with as great a draught of water as the lock now being built on the United States side of the river provides for.

The above alterations have made it necessary to increase the time for executing the work, and an extension to 10th May, 1893, has therefore been granted.

At the close of the fiscal year about a third of the excavation for the prism of the canal had been removed, and a commencement made in the excavation required for the lock enlargement.

The quantities of the different items of work returned up to 30th June, 1891, are as follows:—

Chopping, clearing and grubbing, acres	30
Earth excavation in side trenches, cubic yds	2,507
Rock do do do	74
Earth excavation in prism of canal do	46,315
Rock do do do	53,178
Earth excavation in lock pit do	38,494
Rock do do do	81,051
Rough stone for lock delivered at Sault Ste. Marie, cub. yds	1,072
do do do do	2,688

Since the close of the fiscal year a strong force has been employed chiefly, in the lock pit enlargement and in preparing stone for the lock, the quantity of dressed stone delivered for that structure being 4,553 cubic yards, and the quantity of rough stone returned for the same work being 6,586 cubic yards.

Section No. 3.

This section, under contract to Messrs. Allan & Fleming, embraces the excavation for the upper entrance to the canal to a width of 250 feet and a depth of 18 feet below the lowest recorded water service above the rapids, the construction of a beacon in 28 feet of water and the construction of entrance piers.

At the end of the fiscal year about three-fourths of the dredging was done, and the beacon was practically completed, the quantities returned to 30th June being as follows:—

Excavation dredging and deepening channel, cubic yds	194,814
Rock elm in sides of beacon, cubic feet	6,392
Cross ties, lineal feet	10,760
Blocks under heads of ties, No	402
Pine plank in binders, lineal feet	560
Stone filling, cubic yds	2,018
Sheeting, 5 inches thick, M. ft. B. M	16,000
Top covering pine plank do	5,700
Wrought iron in bolts, lbs	9,400
Wrought iron in straps, lbs	5,500
Pressed spike lbs	700

Since the end of the fiscal year the dredging has been continued with one dredge, and seventeen cribs of the north and south landing piers have been put together, sunk and filled with stone.

I have the honour to be, Sir,

Your obedient servant,

W. G. THOMPSON,

M. Inst. C.E.

APPENDIX No. 11.

ST. PETER'S CANAL.

ST. PETER'S, 28th October, 1891.

SIR,—I have the honour to submit the following with reference to the St. Peter's Canal.

In June last, owing to the dangerous condition of the retaining wall from decay, a small force of men was employed, removing part of the weight, which was pressing against it, thereby relieving the front retaining wall as well (which it partly rests on), which also showed signs of giving way.

On the 4th of July I was informed that the Department, acting on my recommendation, had decided to slope the ground from the towpath level, instead of renewing the back retaining wall, and I was directed to proceed with the work at once, which I did, employing an average daily force of six foremen, one hundred and fifty men, fifty horses and three mechanics. The material (principally hard clay) is removed from the top with horses and carts, and from the bottom with dump carts running on light steel rails. The work, when completed, will have the advantage of being of a permanent character, besides enabling some necessary alterations and repairs to the front wall to be executed much more readily and economically than they could be with the retaining wall resting on it, as now.

Temporary repairs were made to the wooden frame and turntable on the swing bridge over the canal, and at the close of navigation it is proposed to thoroughly overhaul this bridge, and put it in good working order. The lock gates are all working more or less stiff, owing partly to the unevenness of the tracks they run on, and partly from the pulleys being rusted and corroded; but these matters will form the subject of a report later on.

A wharf, 247 feet long, 20 feet wide on top and 28½ feet high, with a depth of 18½ feet of water at low tide, is being constructed at the southern entrance to the canal by Mr. Archibald McKinnon, contractor, who is pushing the work vigorously, and should the weather prove favourable he confidently expects to have it finished within the specified time. This wharf, when completed, will be a decided convenience to vessels calling at this port.

The other repairs, such as replacing hanging fenders, repairing and painting buildings, grading road, &c., will be carried on as speedily as circumstances will admit of.

Navigation through the canal closed on the 24th of December of last year and opened on the 22nd of April of this.

I have the honour to be, Sir,

Your obedient servant,

WM. McCARTHY,

Resident Engineer.

T. TRUDEAU, Esq.,
Acting Secretary Railways and Canals,
Ottawa.

APPENDIX No. 12.

ST. LAWRENCE NAVIGATION—TABLE OF DISTANCES—A.

FROM STRAITS OF BELLE ISLE TO PORT ARTHUR, AT HEAD OF LAKE SUPERIOR, BY WATER.

From.	To	Sections of Navigation.	Statute Miles. Intermediate	Statute Miles. Total to Straits of Belle Isle.
Straits of Belle Isle	Cape Whittle	Gulf of St. Lawrence	240	240
Cape Whittle	West Point, Anticosti	do	201	441
West Point, Anticosti	Father Point	River St. Lawrence	202	643
Father Point	Rimouski	do	6	649
Rimouski	Bic	do	12	661
Bic	Isle Verte	do	39	700
Isle Verte (opp. Saguenay)	Quebec	do	126	826
Quebec	Three Rivers	do to Tide-water	74	900
Three Rivers	Montreal	do	86	986
Montreal	Lachine	Lachine Canal	8½	994½
Lachine	Beauharnois	Lake St. Louis	15½	1,009¾
Beauharnois	Ste. Cécile	Beauharnois Canal	11¼	1,021
Ste. Cécile	Cornwall	Lake St. Louis	32¾	1,053¾
Cornwall	Dickinson's Landing	Cornwall Canal	11½	1,065¼
Dickinson's Landing	Farran's Point	River St. Lawrence	5	1,070¼
Farran's Point	Upper end of Croyle's Island	Farran's Point	¾	1,071
Upper end Croyle's Island	Williamsburg or Morrisburg	River St. Lawrence	10½	1,081½
Williamsburg	Rapide Plat	Rapide Plat Canal	4	1,085½
Rapide Plat	Point Iroquois Village	River St. Lawrence	4½	1,090
Point Iroquois Village	Upper end Presqu'Isle	Point Iroquois Canal	3	1,093
Presqu'Isle	Point Cardinal, Edwardsburg	Junction Canal	2⅝	1,095⅝
Point Cardinal	Head of Galops Rapids	Galops Canal	2	1,097⅝
Galops Rapids	Prescott	River St. Lawrence	7⅜	1,105
Prescott	Kingston	do	59	1,164
Kingston	Port Dalhousie	Lake Ontario	170	1,334
Port Dalhousie	Port Colborne	Welland Canal	26¾	1,360¾
Port Colborne	Amherstburg	Lake Erie	232	1,592¾
Amherstburg	Windsor	River Detroit	18	1,610¾
Windsor	Foot of St. Mary's Island	Lake St. Clair	25	1,635¾
Foot of St. Mary's Island	Sarnia	River St. Clair	33	1,668¾
Sarnia	Foot of St. Joseph's Island	Lake Huron	270	1,938¾
Foot of St. Joseph's Island	Foot of Sault Ste. Marie	River St. Mary	47	1,985¾
Sault Ste. Marie	Head of Sault Ste. Marie	Sault Ste. Marie Canal	1	1,986¾
Head of Sault Ste. Marie	Pointe aux Pins	River St. Mary	7	1,993¾
Pointe aux Pins	Port Arthur	Lake Superior	266	2,259¾
Port Arthur to Lake Shebandowan			45	
Lake Shebandowan to North-West Angle			312	
North-West Angle to Winnipeg			95	
Pointe aux Pins to Duluth			390	

Of the 2,259¾ miles from the Straits of Belle Isle to the head of Lake Superior, 71 miles are artificial navigation, and 2,188¾ open navigation.

Straits of Belle Isle to Liverpool, 1,942 geographical or 2,234 statute miles.

The total fall from Lake Superior to Tide-water is about 600 feet.

The steamboat voyage from Collingwood to Port Arthur is 532 miles.

APPENDIX No. 13.

TABLE of distances of Stations between the Cities of Ottawa and Kingston.

No. of Stations.	Name of Station.	Distances from Ottawa.	Locks.		Dams.			Length of Artificial Canal at each Station in miles.
			No.	Lift at Low Water.	No.	Length.	Height.	
		Miles.		Rise. Ft. in.		Feet.	Feet.	
1	Ottawa	0	8	82 0	3	230 1,320 1,616	13 33 14	4·00
2	Hartwell's	4¼	2	22 0	...	100	28	
3	Hogsback	5½	2	13 6	1	320	60	
4	Black Rapids	9½	1	10 0	1	300	12	0·13
5	Long Island	14¾	3	27 0	3	850	68	0·13
6	Burritt's	40¾	1	10 6	1	240	14	1·50
7	Nicholson	43¾	2	15 2	1	500	9	0·50
8	Clowes	44½	1	10 0	1	481	16	0·05
9	Merrickville	46¾	3	25 0	1	150	6	0·33
10	Maitland	55	1	4 9	1	270	8	0·13
11	Edmunds	59½	1	10 10	1	343	8	0·06
12	Old Slys	60½	2	15 6	1	250	20	0·25
13	Smith's Falls	61½	4	33 9	2	600	24	0·13
14	First Rapids or Poonamaie	64	1	7 9	1	260	5	1·25
15	Narrows	83¼	1	4 0	1	600	9	0·06
	Total rise at low water		....	292 3				
				Fall.				
16	Isthmus	87½	1	4 0	....	.....	.....	1·25
17	Chaffey's	92	1	12 6	....	.....	.....	0·13
18	Davis	94½	1	9 9	1	300	15	0·06
19	Jones' Falls	97¾	4	60 0	1	300	60	0·25
20	Brewer's Upper Mills	108¼	2	19 0	1	200	20	1·75
21	do Lower Mills	110	1	14 2	1	200	12	4·25
22	Kingston Mills	120¼	4	46 8	1	6,042	14	0·25
23	Kingston	126¼	....	.....	....	.....	.....	.....
	Total fall at low water	.....	....	165 4	.....	.....	.....	.....
	Total	.....	47	.....	24	15,472	.....	16 46

APPENDIX No. 14.

TABLE showing the dates of the closing of the Canals in the Autumn of 1890 and of the opening in the Spring of 1891.

Canals.	Closing.	Opening.
Lachine Canal	29th November, 1890	28th April, 1891
Beauharnois Canal	30th do 1890	24th do 1891
Cornwall Canal	4th December, 1890	5th Dec., 1891
St. Anne's Lock and Dam	25th November, 1890	25th do 1891
Carillon Canal	29th do 1890	23rd do 1891
Grenville Canal	29th do 1890	23rd do 1891
Culbute Lock and Dam		
Chute à Blondeau		
Rideau—Kingston Mills	26th November, 1890	1st May, 1891
Rideau—Ottawa	29th do 1890	29th April, 1891
St. Ours Lock	28th do 1890	8th May, 1891
Chambly Canal	24th do 1890	4th do 1891
Williamsburg Canal	4th December, 1890	21st April, 1891
Welland Canal—		
New Canall	5th December, 1890	20th April, 1891
Old Canal		
Erie Canal (New York)	30th November, 1890	5th May, 1891
St. Peter's Canal (Cape Breton)	24th December, 1890	22nd April, 1891
Trent Canal Works	24th November, 1890	28th do 1891
Murray Canal	27th do 1890	16th do 1891

APPENDIX No. 15.

STATEMENT of Contracts entered into during the Fiscal Year ended 30th June, 1891.

1. SUBSIDIZED RAILWAYS.

No. of Contracts.	Name of Contract.	Date of Signature.	General Description.
10426	St. Catharines and Niagara Central Railway Co. ...	1st Aug., 1890..	From St. Catharines 20 miles towards Hamilton.
10480	Columbia and Kootenay Railway and Navigation Co....	8th Oct., 1890...	From outlet of Lake Kootenay to junction of rivers Columbia and Kootenay, &c.
10275	Irondale, Bancroft & Ottawa Railway Co.....	14th May, 1890..	From Victoria branch, Midland division of Grand Trunk Railway near Kinmount, township Snowdon, to Bancroft.
10487	Stewiacke Valley and Lansdown Ry. Co. (Limited)....	30th Aug., 1890..	From I.C.R. through Stewiacke Valley towards Lansdowne.
10488	do do	30th do ..	From Brookfield to Newport, on Windsor Branch, I.C.R.
10500	Quebec and Lake St. John Railway Co.....	2nd Dec., 1890..	From Lorette, *via* Charlesbourg to Quebec, and bridges
10501	Great Northern Railway Co..	8th Oct., 1890...	do St. Andrews to Lachute (supersedes No. 9928).
10624	Central Railway Co.....	1st Dec., 1890 ..	do Grand Lake to Norton Station, I.C.R.
10638	Drummond County Ry. Co..	2nd Feb., 1891...	do Drummondville to Ste. Rosalie.
10650	Great Eastern Railway Co...	Not signed.....	do St. Gregoire eastwards towards Chaudière Junction Station, I.C.R.
10680	Waterloo Junction Ry. Co...	17th Feb., 1891..	From Waterloo to Elmira.
10739	St. Lawrence and Adirondack Railway Co.	29th April, 1891.	do Valleyfield to Huntingdon.
10768	Quebec Central Railway Co..	Not signed.....	do Tring to Lake Megantic.
10769	Great Eastern Railway Co...	20th June, 1891..	Bridges over Nicolet and St. Francis rivers.
O.C.	North-Western Coal & Navigation Co.	25th June, 1890..	From Lethbridge to Crow's Nest Pass (subsidy in land).
10743	St. Catharines and Niagara Central Railway Co.	16th April, 1891.	Masonry to replace wooden structures.

2. CAPE BRETON RAILWAY.

10598	McDonald & Moffatt.....	20th Oct., 1890..	Coal shed at Point Tupper.
10626	do	1st Oct., 1890....	Crib wharfage at Shunacadie.
10724	McDonald, Moffatt, Treen & Co.....	10th April, 1891.	Coal shed at Sydney and sheds, &c., along line.

3. OXFORD AND NEW GLASGOW RAILWAY.

10503	D. P. Kent.	10th Aug., 1889.	Boring and lining wells.
10547	Western Union Telegraph Co.	12th Jan., 1891..	Extend No. 9810 to P. & N. G. Ry. and Pugwash branch.
10597	Jas. Brown..	31st Oct., 1890...	Freight house at River John.

ST. PETER'S CANAL.

10734	A. McKinnon	27th June, 1890.	Wharf at south entrance.

APPENDIX No. 15.—Statement of Contracts entered into during the Fiscal Year ended 30th June, 1891—*Continued*.

4. PRINCE EDWARD ISLAND RAILWAY.

No. of Contracts.	Name of Contract.	Date of Signature.	General Description.
10628	Barrow Hematite Steel Co., Limited	—Nov, 1890	Steel rails and fish plates.
10656	Patent Bolt and Nut Co., Limited	29th Nov., 1890	Iron bolts and nuts.
10651	P. N. Pate	3rd Dec., 1890	Hemlock timber and spruce scantling.
10652	P. Whalen	20th do	Fence posts.
10653	R. Ellis, jun	3rd do	do
10654	J. T. Windsor	20th do	Sleepers.
10655	J. R. Larkins	20th do	Switch sleepers and hemlock timber.
10700	Barrow Hematite Steel Co., Limited	12th Feb., 1891	Steel rails.
10763	Acadia Coal Co	2nd May, 1891	Coal for engines.

5. INTERCOLONIAL RAILWAY.

10513	Barrow Hematite Steel Co., Limited	29th Aug., 1890	Steel rails for Windsor branch.
10515	A. J. Grant & Co	1st do	Passenger coach oil.
10516	J. D. Shatford	24th July, 1890	Spindle oil.
10517	Imperial Oil Co	24th do	Petroleum and oil.
10518	A. Holden & Co	24th do	Cylinder oil.
10519	J. R. Hutchins	24th do	Engine oil.
10520	Maritime Oil Refining Co	24th do	Passenger coach oil.
10539	Acadia Coal Co., Limited	16th June, 1890	Coal.
10542	J. F. Teed	11th Sept., 1890	Baggage room and coal shed at Campbellton.
10543	D. McDonald	15th do	Overhead bridge north of Rogersville station.
10544	W. H. Law	18th Aug., 1890	Floor beams for girder deck bridges and steel plate girder bridge.
10546	Canadian Pacific Ry. Co	1st July, 1890	Traffic between St. John and Halifax.
10627	Chas. Cammell & Co., Ltd	29th Oct., 1890	Steel rails.
10699	Barrow Hematite Steel Co., Limited	2nd Feb., 1891	do
10701	do do	23rd do	do
10725	W. E. Logan	23rd do	Farm crossing gates.
10726	J. Harris & Co	6th Dec., 1890	6 Russell snow ploughs (superseded by three contracts, Nos. 10984, 10985 and 10986).
10730	Estate J. Crossen	15th Nov., 1880	3 parlor cars.
10941	W. H. Law	1st June, 1891	Bridges on Missequash and Sutherland's rivers.
10942	Cumberland Ry. and Coal Co.	26th do	Supply coal.
10784	Soley Station Indicator Co	5th do	Fix up passenger cars with their indicators.
10943	Intercolonial Coal Mining Co.	26th do	Supply coal.
10944	International Coal Co	26th do	do
10945	J. P. Burchell	26th do	do
10946	Acadia Coal Co., Limited	26th do	do
10947	Canada Coal Co	26th do	do

6. LACHINE CANAL.

10939	Heney & Borthwick	25th July, 1891	Improve drainage system along canal, &c.

7. RIDEAU CANAL.

10636	John O'Leary	12th Dec., 1890	Clean out basin at Ottawa.
10674	John O'Toole	26th Jan., 1881	Complete extension of Tay canal.
10715	Canadian Bridge and Iron Co.	23rd March, 1891	Iron swing bridge over Tay canal at Perth.

APPENDIX No. 15.—Statement of Contracts entered into during the Fiscal Year ended 30th June, 1891—*Concluded.*

8. SAULT STE. MARIE CANAL.

No. of Contracts.	Name of Contract.	Date of Signature.	General Description.
10790	Hugh Ryan & Co.	19th June, 1891.	Changes in lift-lock.
10791	J. Ryan & M. J. Haney	13th do	Power of attorney to Hugh Ryan to sign any document for Hugh Ryan & Co.

9. TRENT VALLEY CANAL.

10278	Chas. Wynn	8th April, 1890.	Reference of claims to J. Page.

10. WELLAND CANAL.

Letter 123501	Grand Trunk Railway Co.	5th March, 1890.	Acct. $157.70 for repairs to drawbridges crossed by new Welland canal at two places on Welland Railway. They were built and are to be maintained by Government.
Letter 133599	do do	12th March, 1981	Acct. $99.50 for removing track in 1890 on swing bridge at Hoover's Pond, and between St. Catharines and Port Dalhousie.

11. WILLIAMSBURG CANALS.

Con.			
10660	Weddell Dredging Co.	12th Jan., 1891.	Enlarge Sec. 2, Rapide Plat Division, &c.
10664	Poupore, Fraser & O'Brien	26th do	do 1 do do
10666	do do	26th do	do 3 do do

GENERAL STATEMENT.

APPENDIX

GENERAL STATE

1st. Water Power and other Public Property, leased by the Department

Date of Signature.	Term of Lease.	Lessees.	Property Leased.	Area of Property Leased.
			Lachine Canal.	
Sept. 1, '90	Pleasure of the Government.	City of Montreal. ..	Lay 2 pipes under canal at Montmorency street, Montreal.	....
March 30, '90	do ..	do	Has laid a supply pipe for hydrants south of canal to Mill street, Montreal.	....
Oct. 23, '90	do ..	Dominion Lime Co. (Limited).	Pt. lot 323, St. Ann's Ward, Montreal, at Wellington Basin.	.....
April 3, '91	do ..	Canada Meat Packing Co.	4" pipe from Basin No. 2, Montreal N. of canal to their factory, Wellington St.	....
June 17, '91	do ..	Benj. Ethier	Lot at Ste. Cunégonde, Montreal, N.W. of canal.	1,950 feet. ...
			Intercolonial Railway.	
Oct. 8, '90	Pleasure of the Government.	Chignecto Marine Transport Ry. Co.	Lay tracks across Ry. at Fort Lawrence.	.....
June 5, '91	do ..	Soley Station Indicator Co.	Fit up passenger cars with Co.'s indicator.	... .
			Annapolis and Digby Railway.	
April 27, '91	Pleasure of the Government.	O'Neil & Campbell..	Hire of 1 engine and 15 platform cars....	....
May 4, '91	do ..	do ..	Hire of 6 platform cars.....	.....
			Rideau Canal.	
March 31, '91	Pleasure of the Government.	Wm. Miller.....	Pt. sub-lot 5 of lot 35, con. B, Nepean...	2 acres.....
Not signed 1891	10 years	Clark Hamilton.....	Pt. lot 38, in 4th con. Kingston.....	7 acres.....
Letters 82331 Sept., 1890	Pleasure of the Governmtnt.	J. McNicol.....	May drain water only from his house on Bank St. road, above swing bridges.	....
April 21, '91	do ..	W. D. Morris.....	Pt. of Reserve on lot K, con. C, Nepean.	1·20 acres.....
June 22, '91	do ..	J. & T. Ballantyne..	do do F, do	2 roods, 19 per.
Sept. 18, '91	do ..	Estate T. McKay...	do do K, do	.....
			Welland Canal.	
Dec. 18, '90	Pleasure of the Government.	Grand Trunk Ry. Co.	Lay pipe on lot S. ½ 21, 5th con., Humberstone.	69′ x 5′... .....
March 28, '91	do ..	L. McGlashan	Lots 20, 21, 22 and pt. 12, George street, Petersburg.	130′ 8″ x 314′...
Not signed..	do ..	St. Catharines & Niagara Central Ry. Co	Lot 15, tp. Thorold, above Lock 24.....	8·63 acres.....
			Trent Valley Canal.	
Not signed..	Pleasure of the Government.	Midland Railway of Canada.	Wharf lot east of Lake Katchawanooka, Lakefield.	594 feet. ... .

No. 16.

MENT SHOWING

of Railways and Canals, during the Fiscal Year ended 30th June, 1891.

For what Purpose used.	Amount of Water Power Leased.	Date from which Lease is reckoned.	Annual Rental.	Terms of Payment.			Remarks.
				Amount of each instalment	When due each year.	When first instalment was due.	
			$ cts.	$ cts.			
Watering, &c...	.....	July 1, '90	1 00	1 00	July 1.. .	July 1, '90	In advance.
Fire protection..	24" tapering to 12" pipe.	. .. .	Free.....	....	.....	.....	Verbally [permitted.
Lime shed	....	Oct. 1, '90	100 00	100 00	Oct. 1	Oct. 1, '90	In advance.
Meat packing factory.	4" pipe....	Sept. 1, '89	40 00	40 00	Sept. 1....	On delivery of lease.	do
Storage of wood and coal.	....	May 1, '91	40 00	40 00	May 1....	do ..	
....	.....	Oct. 8, '90	1 00	1 00	Oct. 8	Oct. 8, '90	In advance.
.....	.....	July 1, '91	..... .	....	.....	. .....	
....	.....	....	Engine $10 per day, each car 50 c. per day.	....	.....	.....	For tracklaying, &c.
. .. .	.....	....	Each 50c. per day.	.....	.....	....	do
....	.....	Jan. 1, '90	2 00	2 00	Jan. 1....	On delivery of lease.	In advance—Supersedes lease No. 4549.
Grist and flour mill.	All surplus water, from pond only.	July 1, '90	105 00	52 50	Jan. 1, July 1.	July 1, '90	In advance.
Drainage.....	....	.....	Free..	....	.....	... .	
Ornamental grounds.	....	Aug. 1, '90	2 00	2 00	Aug. 1....	On delivery of lease.	Supersedes lease No. 5688.
Barrel stave factory.	....	Jan. 1, '91	20 00	20 00	Jan. 1....	do ..	
Ornamental grounds.	.....	Sept. 1, '91	1 00	1 00	Sept. 1 ...	do ..	
Water for engines not over 500 gals. per day.	5" pipes ..	Dec. 1, '90	1 00	1 00	Dec. 1....	On delivery of lease.	
Plated goods factory.	.....	March 1, '91	24 00	24 00	March 1..	do ..	
.. ..	....	May 1, '91	200 00	200 00	May 1....	do ..	
.. ..	.... ..	July 1, '90	1 00	1 00	July 1....	On delivery of lease.	

12ND. PROPERTY Purchased, or Damaged, by the Department of Railways and Canals, during the Fiscal Year ended 30th June, 1891.

Date of Signature.	Who sold to Her Majesty.	Property Purchased, &c.			Area of Land.	Amount Paid.	Remarks.
		Lot.	District, Parish or Township.	County.			
			Annapolis and Digby Railway.		Acres.	$ cts.	
Aug. 29, 1890.	I. J. Whitman	120*a*	Clements	Annapolis	5,000 ft.		
Dec. 4, 1889.	E. A. Ambrose *et al.*	26*a*, 26*b*, 26*c*	Deep Brook	do	3·40	1,400 00	
Feb. 14, 1891.	W. Pinkney	68*a*, 68*b*	Clements	do	3·82	301 00	
Oct. 23, 1890.	W. Starrett	156*a*, 156*b*	do (Upper)	do	0·07	8 40	
April —, 1890.	J. Sandford	154*a*, 154*b*	do	do	0·04	5 40	
do 4, 1890.	I. Purdy	153*a*, 153*b*	do (Upper)	do	0·04	6 00	
Dec. 13, 1889.	C. M. Card	28	Bear River	do	0·11	650 00	
do 31, 1889.	C. Jones	42	Clements	do	0·33	200 00	
Jan. 2, 1889.	G. H. Carey	37	Clementsport	do	1·03	80 00	
do 7, 1889.	I. Jones	33	do	do	0·79	100 00	
Dec. 11, 1889.	T. Tracey	38	do	do	1·20	90 00	
do 10, 1889.	J. Rawding	36	do	do	0·43	225 00	
Jan. 2, 1890.	E. C. Berry and E. Rawding	35	do	do	0·72	75 00	
Dec. 24, 1889.	S. A. Roop and W. A. Gilliatt	44	do	do	1·13	600 00	
do 4, 1889.	D. Pinkney	31	Clements	do	4·14	306 00	
Jan. 25, 1890.	E. J. and M. Adams	29	do (West)	do	2·23	100 00	
Dec. 3, 1889.	W. Pinkney	32	do (do)	do	1·60	75 00	
Jan. 21, 1890.	J. Lowe	Lot.	Clementsport	do	0·70	20 00	Between river and lot 39.
June 14, 1890.	J. Robinson	166*a*	Annapolis	do	0·10	12 00	
do 30, 1890.	T. Cain	155*a*, 155*b*	do	do	0·25	35 00	
July 3, 1890.	C. E. Taylor	30	Clements	do	0·02	45 00	
April 30, 1890.	R. W. Potter	118*a*	do (Upper)	do	½	10 00	
June 28, 1890.	S. Bowlby	152*a*, 152*b*	do (do)	do	0·09	10 80	
do 25, 1890.	J. Lacey	165*a*, 165*b*, 167*a*	Annapolis	do	1·38	107 10	
July 8, 1890.	N. Woodbury & F. J. Balcom	158*a*, 158*b*	Upper Clements	do	0·24½	30 00	
do 10, 1890.	S. F. Whitman	151*b*	do	do	0·04	5 00	
March 10, 1890.	W. H. Long	32	Clementsport	do	0·13	20 00	
May 9, 1890.	C. Pinkney	27	Bear River	do	0·01	20 00	
July 18, 1890.	J. E. Harris	150*b*, 150*c*	Upper Clements	do	0·12	14 40	
June 28, 1890.	H. P. Hardwick	157*a*, 157*b*	do	do	0·28	33 60	
Dec. 26, 1890.	C. McLaughlin, *et ux*	43	Clementsport	do	0·56	100 00	
March 18, 1891.	J. S. Rice	169*a*	Annapolis	do	0·04	4 80	
Jan. 3, 1891.	Heirs of G. Ryerson	139*a*, 139*b*, 141*a* 141*b*	Upper Clements	do	0·40	45 40	
March 11, 1891.	P. Hicks and C. Purdy	151*a*	Clementsport	do	0·04	4 80	
Feb. 16, 1891.	E. R. Pinkney	67*a*, 67*b*	Clements	do	3·18	394 00	

April	30, 1890	J. Horsfall	140*a*, 140*b*	do (Upper)	do	0·41	41 00	
July	29, 1890	N. and J. H. Merritt	147*a*, 147*b*	Clementsport	do	0·09	10 80	
Aug.	4, 1890	D. Harris, *et al*	148*a*, 148*b*	Upper Clements	do	0·02	2 40	
June	29, 1890	Trustees Methodist Church	41	Clementsport	do	0·02	30 00	
July	3, 1890	J. M. Owen	170*a*	Annapolis	do	0·05	3 60	
April	1, 1890	A. Fullerton	152½*a*, 152½*b*	do	do	0·09	10 80	
Dec.	9, 1890	W. A. McLeod	171*a*, 171*b*	do	do	0·10	14 00	
Aug.	15, 1890	Potter Bros	143*a*, 143*b*	Upper Clements	do	0·25	25 00	
Nov.	2, 1890	J. Burrill	45	Clementsport	do	0·85	275 00	
Dec.	6, 1890	W. Dargie	172*a*, 172*b*	Annapolis	do	0·30	36 00	
June	30, 1890	M. W. O'Dell, *et al*	149*a*, 149*b*	Upper Clements	do	0·04	120 00	
May	15, 1890	W. H. Ray	150*a*, 150*b*	Clementsport	do	0·13	120 00	Should be $5.16.
Oct.	23, 1890	E. Robinson	142*a*, 142*b*	Upper Clements	do	0·09	10 00	
Aug.	11, 1891	Executors of W. S. Gilpin	1 & 2	Township of Digby	Digby	0·52	700 00	
				Beauharnois Cannl.—Fences and Ditches, Bridges, &c., Maintenance.				
April	16, 1891	Toussaint Dàoust	355	Parish of St. Clement de Beau'nois	Beauharnois		21 87	Fences and ditches.
do	16, 1891	F. Dàoust	356	do do	do		20 00	do
do	16, 1891	E. Groulx	364	do do	do		22 25	do
do	16, 1891	O. Trudel	366	do do	do		11 13	do
do	21, 1891	J. Ellis	370, 371	do do	do		81 58	do
do	16, 1891	L. Godin	374	do do	do		44 50	do
do	16, 1891	P. Cartier	379	do do	do		6 67	do
do	26, 1891	J. B. and J. Groulx	378	do do	do		21 87	do
do	16, 1891	J. Smith	Pt 379	do do	do		4 44	do
do	16, 1891	W. St. Michel	Pt 379	do do	do		6 67	do
do	16, 1891	J. Lebœuf	Pt 379	do do	do		4 44	do
do	16, 1891	A. Montpetit	Pt 379	do do	do		4 44	do
do	24, 1891	C. Pregent	Pt 379	do do	do		7 55	do
June	16, 1891	S. Lalonde, *es quel*	395	do do	do		13 33	do
April	17, 1891	P. Laberge	384	do do	do		21 87	do
do	18, 1891	Wldow A. Boyer	385	do do	do		43 75	do
Dec.	10, 1890	M. Lebœuf	391	do do	do		138 54	Fences, ditches, bridges, &c.
do	10, 1890	do	388	do do	do		43 75	Fences and ditches.
do	10, 1890	do	389	do do	do		58 33	do
May	7, 1891	F. Pilon	394	St. Timothée (Parish)	do		72 91	do
do	7, 1891	A. Bessette	2 & 6	do	do		72 91	do
Dec.	11, 1890	J. Payment	7	do	do		43 75	do
do	16, 1890	B. Payment	8	do	do		43 75	do
Jan.	4, 1891	F. Pilon	9	do	do		43 75	do
Dec.	10, 1890	A. Daoust	10	do	do		43 75	do
do	10, 1890	A. Daoust, père	13	do	do		43 75	do
do	10, 1890	N. Papineau	14	do	do		43 75	do
do	10, 1890	do	17	do	do		43 75	do
do	10, 1890	P. Théoret	18	do	do		43 75	do
do	20, 1890	A. Miron, père	19	do	do		43 75	do

Date of Signature.	Who sold to Her Majesty.	Property Purchased, or Damaged.			Area of Land.	Amount Paid.	Remarks.
		Lot.	Parish, or Township, or District.	County.			
			Beauharnois Canal.—Fences and Ditches, Bridges, &c., Maintenance—Continued.				
March 30, 1891	A. Mercier	25	Parish of St. Timothée	Beauharnois		29 17	Fences and ditches.
do 30, 1891	do	26, 28	do	do		58 33	do
Dec. 10, 1890	P. Theoret	24	do	do		43 75	do
April 14, 1891	N. Papineau	24	do	do		58 33	do
Dec. 20, 1890	A. Miron, père	33	do	do		43 75	do
do 15, 1890	A. Meloche	37	do	do		29 17	do
do 12, 1890	J. Meloche	40	do	do		29 17	do
do 12, 1890	do	41	do	do		29 17	do
do 12, 1890	do	44	do	do		43 75	do
do 11, 1890	J. Julien, fils adoptif d'Ambroise	45	do	do		43 75	do
do 10, 1890	A. Julien, fils de Frs.	48	do	do		43 75	do
do 12, 1890	A. Belair	49	do	do		43 75	do
do 10, 1890	N. Mathieu	54	do	do		43 75	do
do 10, 1890	do	55	do	do		43 75	do
May 9, 1891	Fust. Langevin	58	do	do		12 50	Discharge.
Dec. 10, 1890	E. Bergevin, fils	58	do	do		29 17	Fences and ditches.
Jan. 22, 1891	E. Dagneault	68	do	do		87 50	do
do 22, 1891	do	69	do	do		29 18	do
Dec. 11, 1890	F. Boyer	101	do	do		43 75	do
do 15, 1890	Fabrique St. Timothée	116	do	do		43 75	do
do 12, 1890	A. Chauret	½ N.E. 120	do	do		29 17	do
do 27, 1890	A. Bergevin	½ S.W. 120	do	do		14 58	do
do 11, 1890	N. Papineau	126	do	do		43 75	do
do 10, 1890	L. Lebœuf	Pt 144	do	do		14 58	do
do 10, 1890	D. Bougie	145	do	do		29 17	do
do 10, 1890	D. Durocher	146	do	do		43 75	do
March 10, 1891	F. Lebœuf, fils de Basile	149	do	do		43 75	Fences, ditches, bridges and discharges.
Dec. 22, 1890	Alf. Leduc, fils de Louis	153	do	do		87 50	Fences and ditches.
do 15, 1890	Ant. Leduc, fils de Louis	156	do	do		87 50	do
do 11, 1890	Nap. Leduc, fils de Louis	157	do	do		87 50	do
do 10, 1890	Mrs. M. C. Depocas	160	do	do		43 75	do
Jan. 3, 1891	Z. Dubois, ès qual	161	do	do		43 75	do

do	17, 1891..	A. Bergevin *et al*	164	do	do		58 33	Fences, ditches, bridges and discharges.
do	17, 1891..	A. & E. & L. Bergevin	167	do	do		189 59	Fences and ditches.
do	10, 1891..	J. Leger	169	do	do		43 75	do
do	10, 1891..	do	172	do	do		43 75	do
Dec.	12, 1890..	G. & F. Faubert	173	do	do		43 75	do
do	16, 1890..	G. Mahaire	176	do	do		43 75	do
do	10, 1890..	F. Poirier	177	do	do		87 50	do
do	18, 1890..	J. Sauvé	105	Parish of Ste. Cecile	do		72 92	do
do	18, 1890..	do	180	Parish of St. Timothée	do		43 75	do
do	18, 1880..	F. Poirier	181	do	do		87 50	do
do	10, 1890..	do	186	do	do		43 75	do
April	28, 1891..	J. Sauvé	189	do	do		29 17	do
Dec.	9, 1890..	E. Lefebvre	190	do	do		14 58	do
do	9, 1890..	do	102	Parish of Ste. Cecile	do		14 58	do
do	12, 1890..	T. Daoust	109	do	do		43 75	do
do	12, 1890..	do	110	do	do		43 75	do
April	26, 1891	T. Lebœuf	Pt 113	do	do		3 33	do
do	26, 1891..	A. Lebœuf	Pt 113	do	do		36 67	do
Aug.	3, 1891..	Widow J. Meloche	⅓ 358 & 356	Parish of St. Clement	do		14 58	do
July	11, 1891..	E. Dagneault	68, 69	Parish of St. Timothée	do		75 00	Bridges and discharges.
do	6, 1891..	J. Julien, fils de Louis	34	do	do		43 75	Fences and ditches.
do	5, 1891..	J. Sauvé & T. Daoust	206	Parish of Ste. Cecile	do		43 75	do
do	5, 1891..	J. Sauvé	185	Parish of St. Timothée	do		43 75	do
do	1, 1891..	L. Bergevin	167	do	do		210 00	Bridge and discharge.
June	30, 1891..	T. Brossoit & T. Daoust	357	Parish of St. Clement	do		9 27	Fences and ditches.
do	30, 1891..	C. H. Prégent, fils	362	do	do		35 00	Bridge and discharge.
do	27, 1891..	N. Mathieu	54, 55	Parish of St. Timothée	do		115 00	do
				Cornwall Canal.				
Dec.	26, 1890..	P. N. Tait	W. ½ 26	1st Con. Cornwall	Stormont	0.05	250 00	
do	20, 1890..	D. Tait	E. ½ 28 and W. ½ 27.	do do	do	0.61	1,500 00	
			W. ½ 31	do do	do	0.24	1,600 00	
Mar.	27, 1891..	S. H. Barnhardt	12	do do	do	5.94	850 00	Damages.
May	8, 1891..	Executors of Wm. Mattice	12	do do	do	7.71	1,850 00	
do	28, 1891..	Estate Hon. J. S. McDonald	E. ½ 32	do do	do	1.35	450 00	
June	25, 1891..	J. N. Dixon						
				Cape Breton Railway.				
Nov.	24, 1890..	N. McNeil	166*a*	Jamesville	Victoria	0.30		Conveyed back to him by Her Majesty.
Jan.	7, 1891..	do	166*a*	do	do			Release for damages to Her Majesty.
do	27, 1890..	A. McNeil	177, 181	Grand Narrows	do	9.21 2.26	725 41	
Feb.	3, 1890..	J. McNeil *et al*	180	do	do	6.53	300 00	Discharge.
Oct.	23, 1890..	Rev. H. McLeod	260	Town of Sydney	Cape Breton	0.57	663 00	do

Date of Signature.	Who Sold to Her Majesty.	Property Purchased or Damaged.			Area of Land.	Amount Paid.	Remarks.
		Lots.	Township or District.	County.			
			Cape Breton Railway—Continued.		Acres.	$ cts.	
Sept. 21, 1890.	P. D. Lewis *et al*	239	Town of Sydney	Cape Breton	0.25	180 40	Discharge.
Jan. 29, 1891.	H. F. McDougall *et al*	1	Grand Narrows	do	6.20	2,628 91	do
July 17, 1891.	do	21 & 34	Christmas Island	do	1.53 1.70	382 43	do do
Aug. 13, 1890.	J. G. Bourinot		Sydney	do	0.25	1 00	
Mar. 18, 1891.	R. Nicholson		Long Island	do	1.44	75 00	
June 23, 1891.	H. McNeil	127*a*	Boisdale	do	1.84	200 00	
do 23, 1891.	A. McNeil	127*a*	do	do	5.17	480 00	
do 9, 1891.	J. McArthur	139	do	do	2.56	75 00	
Sept. 5, 1891.	C. G. Swann	near 29	Town of North Sydney	do	0.39	1 00	
do 9, 1891.	W. Cunard	29	do do	do	0.58	1 00	
do 30, 1891.	J. McArthur	139	Boisdale	do	2.56	153 40	
Mar. 30, 1889.	W. England	4	Georges River	do	0.62	10 00	North Sydney extension.
do 2, 1889.	W. Almon	7	do	do	0.11	20 00	do do
do 2, 1889.	J. Almon	8	do	do	0.71	20 00	do do
Feb. 21, 1889.	A. Watson	15	do	do	2.47	200 00	do do
Mar. 18, 1889.	J. Almon	17	do	do	0.66	100 00	do do
Feb. 21, 1889.	J. Moore, sen	21	do	do	1.03	100 00	do do
Oct. 22, 1887.	Sydney Town Council	Resolution to	furnish free right of way from	Freshwater Creek	to Barrack	Point, in Town of Sydney.	
Not settled yet.	Town Council of N. Sydney	do	do do do	Johnston's lot to	Irving's wharf.		
			Carillon Dam—(Damages.)				
Nov. 11, 1890.	T. Ranger	cad. 398	Block C, 1st r. Chatham	Argenteuil		30 00	
Jan. 9, 1891.	D. Filion *et al*	N. W. pt. 6	1st Con. Hawkesbury	Prescott	2.00	20 00	
do 19, 1891.	J. Clairmont *et al*	N. E. pt. 6	do do	do	2.00	60 00	
			Intercolonial Railway.				
Jan. 19, 1891.	Sir John A. Macdonald		Declaration of ownership of ship "Mayflower"				
do 19, 1891.	do to E. A. Bent.		Bill of sale of ship "Mayflower"			2,000 00	
June 30, 1890.	W. B. Hamilton		Land for Dartmouth Branch		ac. 0.24	3,119 20	

April	23, 1891..	W. R. Boisvert.....	Cad. lot 393	St. Laurent Ward, Levis..	Levis.	31 ft. front	800 00	Pt. of Chapman property
July	27, 1891..	R. McLearn	.....	Land at Mount Uniacke	Hants, N.S.....	10,700 ft.	Exchanged	Crown grant to him.
do	27, 1891..	do	.....	do do	do	10,700 ft.	do	He transfers to Crown.
April	15, 1878..	W. Hazen *et al* and Madras School Trustees	.....	Land at St. John, N. B., along Bond street.	.. ..	5.40 acres	32,500 00	
				Ottawa River—Damages by Dams at Rocher Fendu and Grand Calumet Falls—(Culbute Works.)				
Oct.	2, 1890..	Mrs. P. Brousseau *et al*.. .	21	1st r. Grand Calumet	....	... .	60 00	Damages.
May	8, 1890..	J. Hanratty.	23	do do	.....	.....	50 00	do
do	14, 1890..	E. Davis..... ...	14	do Mansfield	... ...	... ...	300 00	do
Sept.	22, 1890..	J. Somerville *et al*...	N. E. ½ 19	do Litchfield	. . ..	.....	82 00	do
Oct.	7, 1890..	G. Cahill.....	5	5th r. Grand Calumet	....	.....	195 00	do
May	17, 1890..	H. Laporte	G. H.	South r. do	.....	.....	30 00	do
Nov.	27, 1890..	Corporation Fort Coulonge.		Roads in village of Fort Coulonge	....	....	1,000 00	do
do	27, 1890..	do Mansfield.....	....	do Tp. of Mansfield... ...	....	....	1,500 00	do
do	26, 1890..	do Grand Calumet	....	do do Grand Calumet .	. . ..	.....	5,750 00	do
Jan.	20, 1891..	A. Lamarche *et al*.....	18	do do Westmeath	....	....	130 00	do
Dec.	20, 1890..	J. Dufoult, jun	7	2nd r. Grand Calumet	....	.....	85 00	do
do	20, 1890 .	do	9	do do	....	... .	10 00	do
Jan.	17, 1891..	D. Frost...	N. ½ 1	R. B. Mansfield	.. ..	....	275 00	do
May	18, 1891..	J. U. Laporte.....	4	South r. Grand Calumet	....	.. ..	42 00	do
Dec.	20, 1890..	A. Leblanc.....	3	do do	.....	.....	100 00	do
Aug.	14, 1890..	J. Rivet	8, 9, 10, 12	North R. do	.....	.....	200 00	do
Jan.	2, 1891 .	W. G. LeRoy.....	7	N. of Front st., village of Bryson.	... ..		250 00	do
Aug.	10, 1891..	Mrs. D. Moorhead *et al*. .	8	1st r. Litchfield....	.. ..		425 00	do
June	19, 1891..	J. Proudfoot *et al*...	1	R. A, Mansfield	....		100 00	do
				Lachine Canal.				
May	8, 1891..	Corporation Town of Lachine.....	....	Bond to pay all costs of expropriation of cad. lots 933, 932, 930, St. Anges de Lachine	....	.....	....	For covered drain.
June	—, 1891..	do do	....	Resolution to *maintain* covered drain	....	....	.....	
				Oxford and New Glasgow Ry.				
Sept	29, 1890..	Montreal and European Short Line Railway Co..	.. ..	Right of way and all lands, moneys, &c.	Cumberland and Colchester.....	. .....	103,140 72	
Nov.	13, 1890..	D. McLeod.	92, 98	....	Pictou.....	6·66....	200 00	
Dec.	13, 1890..	A. McDonald....	95, 95½	....	do	2·85....	28 50	
do	13, 1890 .	L. & E. Hayward.....	94	....	do	1·47....	34 96	
Sept.	20, 1890..	A. W. Campbell	106	....	do	2·88....	25 39	

Date of Signature.	Who sold to Her Majesty.	Property Purchased, &c. — Lot.	District, Parish or Township.	County.	Area of Land.	Amount Paid.	Remarks.
			Oxford and New Glasgow Railway —Continued.		Acres.	$ cts.	
Jan. 10, 1891	P. F. McConnell	107		Pictou	0·51	5 51	
July 5, 1890	C. H. Munro	123, 123½		do	3·00	45 00	
Dec. 8, 1890	W. Elliott	74		do	1·92	7 68	
Nov. 22, 1890	J. & D. Sutherland	55		do	1·25	66 00	
Oct. 6, 1890	Alliance Society	93		do	2·93	31 84	
Nov. 14, 1890	W. O'Grady	134		do	2·24	49 28	Logan Tannery siding.
do 14, 1890	do	134*a*		do	0·53	25 00	
Sept. 9, 1890	J. Johnston	10	West Tatamagouche	Colchester		30 00	
May 23, 1891	J. H. Brown	152	Pictou	Pictou	8·66	562 90	
do 29, 1891	W. Brown	152	do	do	8·66	1 00	His interest.
June 4, 1891	J. O'Grady	133½	West River Road	do	0·48	21 60	Logan Tannery siding.
March 18, 1891	Jane Rae (Guardian)	86, 86½	Back Meadows	do	6·77	146 23	
Feb. 26, 1889	D. Campbell	96*a*	Meadowville	do			Use of borrow pit.
do 26, 1889	D. Clark	83*a*	do	do		5 00	
July 22, 1888	N. Bigney	51½	River John	do		16 80	do
do 18, 1890	G. McIntosh *et al*	91*e*	Dewar's River	Cumberland	0·17	2 00	
do 18, 1890	J. A. Robertson	89*a*	Wallace	do	0.37	10 00	
June 16, 1891	C. J. Scott	73½	Wallace Bridge	do	0·32	2 00	
July 15, 1890	F. & G. Battye	70, 70*a*, 70½	Wallace	do	9·60 1·27 0·86	1,500 00	
Sept. 9, 1890	A. Wilson	48, 49	Doherty Creek	do	4·47 5·86	115 38	
June 2, 1890	R. S. Morse	41*a*, 41*b*	Conn's Mills	do	1·22 0·86	16 00	
July 17, 1890	W. Crawford	39*a*	Hartford	do	0·80	8 00	
March 10, 1890	W. H. Macdonald	38, 38*a*, 38*b*	Conn's Mills	do	5·13 2·26	15 00	
Aug. 12, 1890	A. N. & R. B. Fillmore	35*a*	do	do	0·2	1 00	
July 17, 1890	J. W. Mattinson	28*a*, 28*b*	do	do	1·74	25 00	
June 28, 1890	J. D. Embree	20½	Oxford	do	0·56	8 00	
Dec. 5, 1890	J. J. Tucker *et al*	11*a*, 11*b*	Pugwash	do	3·75	375 00	
Aug. 24, 1891	J. D. Henderson	69		do	4·50	65 25	This supersedes deed of 12th Sept., 1888.
do 24, 1891	J. W. Henderson *et al*	68, 69*a*	Wallace	do	9·17 0·65	52 25	This supersedes deed of 14th Nov., 1888.

Rideau Canal Damages (Releases).

April	18, 1891	G. Patterson	E½ 37, W½ 38	6th con. Kingston	Frontenac		100 00	
do	25, 1891	T. Donoghue	1	3rd con. Pittsburg	do		67 00	
May	2, 1890	T. Connell	W½ 3	do	do		30 00	
April	30, 1891	A. Martin	1	do	do		140 00	
May	2, 1891	E. & W. Milton	4	do	do		130 00	
do	14, 1891	D. McBride	E pt. 3	do	do		40 00	
do	12, 1891	J. Darragh	E½ 2	do	do		100 00	
do	16, 1891	J. Scott	S & W½ 33	do	do		75 00	
do	16, 1891	M. Fowler	S½ W½ 37	6th con. Kingston	do		60 00	
June	26, 1891	L. J. Joyce *et al*	W½ 18	6th con. Pittsburg	do		100 00	
May	13, 1891	J. R. Birmingham *et al*	15	do	do		370 00	
June	26, 1891	E. W. Hodgson	6	6th con. Storrington	do		190 00	
April	13, 1891	Dept. of Interior to Dept. of Railways and Canals	Sub-lots 51, 52 of lot 22	Gore of Gloucester	Carleton			For stone quarry for canal

Canadian Pacific Railway.

Nov.	4, 1890	J. B. McKillop	S E ¼ sec. 5	Tp. 3, r. 3 E	Pembina Branch		8 00	
July	15, 1889	Beatty & Mackenzie	SW ¼ 30 & N ½ N W ¼ 19	8, r. 4 E	do	6·00		Torrens certificate.
Feb.	18, 1888	J. F. Ruttan	N E ¼ 36	7, r. 3 E	do	4·00	40 00	
Sept.	30, 1890	A. S. Irving	S ½ S W ¼ 31	8, r. 3 E	do	2·00	10 00	
Jan.	8, 1891	Manitoba and North-West Land Co. (Limited)	2, 3	Block 5, Town of Emerson	do	0·10		
			7, 8, 9, 10	do 17, do	do	0·19		
			1, 2	do 18, do	do	0·10	21 90	
			2, 3	do 40, do	do	0·05		
			5	do 40, do	do	0·025		
Feb.	17, 1891	P. A. Mittlebury	1, 2	do 18, do	do		1 00	Quit claim.
			7, 8, 9, 10, 2, 3, 5	do 17, do	do			
				do 40, do	do			
do	28, 1891	V. Nadeau	S½ S½ N W¼ 7	Tp. 6, r. 4 E	do	1·00	5 00	
April	18, 1891	A. J. Helliwell	SW ¼ & S½ N W ¼ 38	5, r. 4 E	do	6·00	30 30	
Jan.	22, 1891	H. J. Dexter (*re* Ruttan)	NE ¼ 36	7, r. 3 E	do	4·00	1 00	
March	7, 1887	T. Clarke	32	Ste. Agathe	do	3·56	103 40	
Aug.	17, 1891	G. Durnerin	N E ¼ 1 & S ½ S E ¼ 12	Tp. 5, r. 3 E	do	12·77		Torrens certificate.

Canadian Pacific Railway (Pembina Branch) Con.

Aug.	27, 1890	L. N. B. Wyse	N.E. ¼ and N. ½ S.E. ¼ 13, Tp. 8, R. 3 E.			6·00	30 00	
July	4, 1891	E. P. Simcox	N.W. ¼ 33, Tp. 2, R. 3 E				38 20	
Feb.	19, 1891	N. G. Ritchot	N.W. ¼ and N. ½ S.W. ¼ 18, Tp. 8, R. 4 E			6·60	30 00	
July	15, 1891	Bertrand & Holiday	Lot 220, St. Andrews, outer 2 miles N. extension			0·76	7 60	
do	3, 1891	N. Matheson	Lot 204 do do				7 50	
do	20, 1891	T. Truthwaith	Lot 176 do do			0·76	7 50	
Oct.	7, 1891	W. F. Alloway	Lot 95, St. Clement do			0·76	7 60	

Date of Signature.	Who sold to Her Majesty.	PROPERTY PURCHASED, &c. — Lot, Township, &c.	County.	Area of Land.	Amount Paid.	Remarks.
		(Stonewall Branch.)		Acres.	$ cts.	
March 26, 1891..	Estate W. Inkster.....	Lot 3, Kildonan....	.....	.....	82 06	Receipt-Judgment of Exchequer Court.
		(East of Selkirk.)				
Aug. 15, 1890..	J. Clare	S.E. ¼ sec. 25, Tp. 12, R. 8 E.....	.....	6·36	.....	Torrens certificate.
Feb. 3, 1891..	W. Park.....	N.E. ¼ sec. 26, Tp. 12, R. 8 E.....	.....	6·38	.....	do
March 5, 1891..	M. McKay.....	N. ½ S.E. ¼ sec. 31, Tp. 12, R. 8 E.....	.....	6·33	.....	do
Feb. 26, 1891..	J. Ross.....	N.W. ¼ and N. ½ S.W. ¼ 31, Tp. 12, R. 8 E....	.....	6·33	.....	do
May 27, 1891..	D. McArthur	S.E. ¼ and S. ½ N.E. ¼ 14, Tp. 12, R. 2 E.... ..	.....	.....	101 38	Heath and Elford.
June 17, 1891..	G. F. Carruthers & D. McArthur	Lot 4, Kildonan.....	.....	.....	83 57	
do 17, 1891..	H. W. Kennedy.	S.E. ¼ 21, Tp. 13, R. 2 E	.....	0·21	2 02	
		Trent Valley Railway—(Damages.)				
Sept. 20, 1890..	G. Galorie.....	Lot 1, in 16th Con., Harvey	Peterboro'	.....	100 00	Damages.
Oct. 6, 1890..	T. Crowley.....	E. ½ 19, in 11th Con., Emily	Victoria	.....	30 00	do Buckhorn.
do 13, 1890..	Ann O'Donoghue.....	Lot 23, in 11th Con. do	do	.....	66 00	do do
do 10, 1890..	E. J. Murray	Lots 5 and 6, in 11th Con., Ennismore.....	Peterboro'	.....	50 00	do do
do 11, 1890..	Luke Maloney	Lot 19, in 10th Con., Emily.....	Victoria	.....	100 00	do do
Nov. 20, 1890..	Trustees of H.J.B. Williams	Lot 32, in 15th Con., Smith	Peterboro'	.....	100 00	do Otonobee river.
May 23, 1890..	C. Armstrong.	Lot 14, Tupperville village, in 8th Con., Sydney.	Hastings	1·75	1 00	Deed of sale.
Jan. 16, 1891	J. N. Telford	Lots 8 and 7, in 3rd Con., Ennismore..	Peterboro'	.....	75 00	Damages—Buckhorn.
do 20, 1891..	A. Holmes.....	Burleigh Island (or 15) Smith	do	.....	200 00	do Burleigh.
do 21, 1891..	R. Perdue	S. ½ 21, in 12th Con., Emily	Victoria	.....	60 00	do Buckhorn.
do 27, 1891..	J. Shllivan.....	N. ½ 21, in 12th Con. do	do	.....	120 00	do do
do 30, 1891..	M. Devine	S. ½ 21, in 13th Con. do	do	.....	30 00	do do
do 31, 1891..	J. Owens	Lot 3, in 10th Con., Ennismore.	Peterboro'	.....	10 00	do do
Feb. 13, 1891..	J. Sullivan	Lot 3, in 9th Con. do	do	.....	70 00	do do
do 16, 1891..	J. Meehan...	Lot 22, in 13th Con., Emily.....	Victoria	.....	120 00	do do
do 6, 1891..	P. Gillece.	Lots 22, 23, in 14th Con., Emily.....	do	.....	110 00	do do
do 23, 1891..	T. G. Grieve	Lot 23, in 5th Con.; 21, 22, in 6th Con., Douro .	Peterboro' .. .	.....	700 00	do Lakefield.
do 4, 1891..	M. & C. Crough.	Lot 13, in 5th Con., Ennismore.	do	.....	130 00	do Buckhorn.

Feb.	12, 1891	H. Gillece	E. ½ 1, in 10th Con., Verulam	Victoria		55 00	do	do
March	28, 1891	T. Murphy	Lot 15, in 6th Con., Ennismore	Peterboro'		20 00	do	do
April	10, 1891	P. McAuliffe	E. ½ and S.W. ¼ 20, in 9th Con., Emily	Victoria		25 00	do	do
June	24, 1891	W. H. Cluxton	Lot 6 and 5, in 18th Con., Harvey	Peterboro'		300 00	do	do
Aug.	6, 1891	E. A. McCracken	W. ½ 29 and 31, in 4th Con., Dummer		5·00	100 00	do	Young Pt. Dam
do	17, 1891	E. A. & R. C. Strickland	E. ½ 2, 5th Con., South Burleigh	Peterboro'		50 00	do	do

Williamsburgh Canals (Rapid Plat Canal).

Nov.	22, 1890	R. J. Nash	Removal of shops			200 00	Damages.	
Jan.	27, 1891	Trustees Methodist Cemet'y	Lot 35, in 1st Con., Williamsburgh		0·66	340 00		
do	27, 1891	M. Van Allan	E. ¼ 1, in 1st Con., Matilda		0·35	532 50		
do	27, 1891	G. M. Merkley	Lot 35, in 1st Con., Williamsburgh		0·13	100 00		
do	26, 1891	J. Carter	Lots 37, 38 & A, in 1st Con. W'msburgh & Matilda		1·03 0·47 0·08	470 00		
do	27, 1891	O. Casselman	Lot 34, in 1st Con., Williamsburgh		1·03	397 00		
do	27, 1891	Est. J. N. Rose, Executors	Lot 36, in 1st Con. do		0·243 0·129	100 00		
do	27, 1891	J. C. Robertson	E. ½ 35, in 1st Con. do		0·66	350 00		
do	27, 1891	John Doran	W. ½ 1, 2 E. ½ 3, in 1st Con., Matilda		2·12	3,500 00		
do	27, 1891	Executors estate Jas. Doran	W. ½ 3 & E. ¼ 4, in 1st Con. do		1·45	2,850 00		
do	27, 1891	Trustees Presbyt'n Cemet'ry	Lot 36, 1st Con., Williamsburgh		0·33	500 00		
do	27, 1891	H. S. Dawson *et al*	E. ¾ 1, in 1st Con., Matilda		0·84	4,500 00		
do	27, 1891	T. Moorhouse	E. ½ of W. ½ and W. ½ of E. ½ 5, Matilda		0·175	72 50		
Aug.	21, 1891	M. E. Anderson *et vir.*	W. ½ 35, 1st Con., Williamsburgh		0·23	108 00		

Welland Canal.

Nov.	4, 1890	W. Mellanby	26	W. of West St., Port Colborne village	Welland		50 00	Damages.
Aug.	10, 1891	F. J. Hardison	C D	E. of East St., Port Colborne village	do	0·46	255 00	do
March	2, 1891	H. W. Herrick	16	4th c. Wainfleet	do	0·12	500 00	do
May	12, 1891	H. A. Rose *et al*	27; H A R	5th c. Crowland, in town of Welland	do	0·51 0·09	1,000 00	Deeded.
do	18, 1891	T. F. Brown *et al*	27	5th c. Crowland	do	0·26	1 00	do
do	30, 1891	J. Saunders *et al*	5, 6, 7, 8	E. Hill St. and 2 W. Carl St., Port Robinson, or 213 Thorold Tp.	do		150 00	Damages by removal of bridge.
Aug.	12, 1890	P. Gibbons	27; J	1st c. Humberstone; E. of East St., Port Colborne	do		300 00	Damage by enlargement.
Sept.	30, 1890	Executors Wm. Gibson	N. ½ 2; W. ½ 4, W. ½ 5	Jones tract, N. Cayuga	Haldimand		25 00	Dunnville dam (damages)
April	6, 1891	S. Meyer *et al*	W. ½ 7	4th c. S. Cayuga	Monck		125 00	do do
May	18, 1891	Adm. of D. Auger's estate	pt. 7	2nd c. N. Dover Road, Tp. Dunn	do		67 00	do do
March	1, 1889	A. Boyle	C	N. of Main St., Dunnville	do		50 00	do do
June	27, 1891	W. Edie	8, 9	4th c. S. Cayuga	do		550 00	do do

3rd. AGREEMENTS respecting Subsidies in Aid of Construction of

Date of Signature.	Name of Railway Company.	Lines of Railway to be Constructed.	Acts of Canada granting Subsidy.	Amount of Subsidy.	
				Per Mile.	Not more in all than
1890.				$	$
May 14..	Irondale, Bancroft & Ottawa Ry. Co.	From Victoria Branch, Midland Div. Grand Trunk Ry., near Kinmount Tp., Snowdon, to Bancroft.	52 V. c. 3	3,200	145,000
Dec. 1..	Central Ry. Co.....	From Grand Lake to Norton Station, I. C. R.....	52 V. c. 3 53 V. c. 2	.....	128,000 14,400
1891.					
Feb. 2..	Drummond County Ry. Co.	From Drummondville to Ste. Rosalie.	53 V. c. 2	.....	76,800
Not signed	Great Eastern Ry. Co	From St. Gregoire eastwards towards Chaudière Junction Station, I.C.R.	52 V. c. 3	.....	64,000
1891.					
Feb. 17..	Waterloo Junction Ry. Co.	From Waterloo to Elmira.....	53 V. c. 2	.....	35,200
April 29..	St. Lawrence & Adirondack Ry. Co..	From Valleyfield to Huntingdon.....		.....	57,600
Not signed	Quebec Central Ry. Co.	From Tring to Lake Megantic.....	.....	$21,191 54 per yr. for 20 years.	288,000
1891.					
June 20..	Great Eastern Ry. Co.	Bridges near Nicolet and St. Francis Rivers.	.....	15 p. ct. on value of structure.	37,500
1890.					
June 25..	North Western Coal & Navig. Co.	From Lethbridge to Crow's Nest Pass	53 V. c. 4	3,840 acres per mile.	.....

OTTAWA, 30th Oct., 1891.

Railways, entered into during the fiscal year ended 30th June, 1891.

No. of Miles Subsidized.	Maximum Grade, Feet per Mile.	Radius of Curvature, not less than	Width of Clearing each side.	Width of Cuttings.	Embankments.	Steel Rails, lbs. per lineal yard.	When to be Completed.	Remarks.
No.	Feet.	Fect.	Ft.	Feet.	Ft.	Lbs.		
50	60	1,000	50	15	20	56	May 1, 1892..	
44½	74	955	....	....	.....	52	Dec. 1, 1891..	Trestle bridges.
24	53	2,865	...	.....	....	56	Dec. 31, 1891..	
20	33	....	....	.....	....	.....	....	
10¼	53	1.146	33	.....	....	.....	Nov. 1, 1891..	
18	.....	1,910*	50	.....	..	.....	July 1, 1893..	*Except in town of Valleyfield 1,273, 1,146, 818 ft. radius curves.
58	60	1,042	..	....	....	.....	July 1, 1893..	
.....	.....	....	....	.....	.....	.....	July 1, 1892.. / July 1, 1894..	
100	Subject to approval of Min. of Railways as to grade, gauge, mileage, location.						Aug. 1, 1892.. / Dec. 1, 1894..	50 miles from Lethbridge. / Balance.

H. A FISSIAULT.

APPENDIX No. 17.

Alphabetical List of Railways Subsidized by the Parliament of Canada.

Authority for Grant. A D	Designation of Act.	Company or Work Subsidized.	Details of Grant. Rate per Mile. Money, Land or Rails.	Estimated Number of Miles.	If per Mile. Total for the whole work not to exceed—	If for a term of Years. Amount and duration of Instalments.	Total of Grant to each Company. No. of Miles Subsidized.	Money.	Land.
			$		$ cts.			$ cts.	Acres.
1889	52 Vic., c. 4.	Alberta Railway and Coal Co., Lethbridge to International Boundary.	6,400 acres	50			50		320,000
1890	53 Vic., c. 3.								
1887	50-51 Vic., c. 23	Alberta and Athabaska Ry. Co., Bow River, on C.P.R., between Calgary and Crowfoot, to point near Town Plot of Edmonton. (*See* North-Western Railway Co. of Canada)	6,400 acres	300			300		1,920,000
1886	49 Vic., c. 10	Albert Ry. Co., Salisbury to Hopewell	Loan		15,000 loan.			15,000 00	
1888	51 Vic., c. 3.		Iron rails.	776 tons.	14,665 45			14,665 45	
1884	47 Vic., c. 8.	Albert Southern Ry. Co., Hopewell to Alma.	3,200	16	51,200 00		16	51,200 00	
1889	52 Vic., c. 3.								
1889	52 Vic., c. 3.	Amherstburg, Lake Shore and Blenheim Ry. Co.	3,200	20	64,000 00		20	64,000 00	
1884	47 Vic., c. 8.	Baie des Chaleurs Ry. Co. — Metapediac towards Paspebiac		70	300,000 00				
1883	46 Vic., c. 25.	Baie des Chaleurs Ry. Co. — From 20 miles end to Paspebiac			320,000 00				
1886	49 Vic., c. 17.	Acts of Amendment. Subsidy voted for the first section of 20 miles transferred to the second 20 miles, and that for the 70th to the 100th to the subsidy for the 40th to the 70th mile.					70	620,000 00	
1889	52 Vic., c. 3.								
1887	50-51 Vic., c. 24.	Beauharnois Junction Ry. Co., St. Martin's towards Anicet	3,200	30	96,000 00		30	96,000 00	
1885	48-49 Vic., c. 59.	Belleville and North Hastings Ry. Co., Madoc to Eldorado	1,500	7	10,500 00		7	22,400 00	
1886	49 Vic., c. 10.		1,700		11,900 00				
1890	53 Vic., c. 2.	Belleville and Lake Nipissing, Belleville to Tweed and Bridgewater.	3,200	30	96,000 00		30	96,000 00	
1890	53 Vic., c. 4.	Brandon and South-Western Ry. Co., from point in Township 1, Range 23 or 24, west of 1st Principal Meridian, to Deloraine	6,400	17					108,800 00
1887	50-51 Vic., c. 24.	Brantford, Waterloo and Lake Erie Ry. Co., Brantford to Hagarsville or Waterford, or some intermediate point on Canada Southern Railway	3,200	18	57,600 00		18	57,600 00	

1885 48-49 Vic., c. 59..	Brockville, Westport and Sault Ste. Marie Ry. Co.	Brockville to Westport.....	3,200	40	60	128,000 00	.....	60	192,000 00	.....
1891 54-55 Vic., c. 8..		Point near Newboro' towards								
1890 53 Vic., c. 2.....		Palmer Rapids.	3,200	20		64,000 00				
1886 49 Vic., c. 10....	Buctouche and Moncton Ry. Co.....	Moncton to Buctouche.....	3,200	30	32	96,000 00	.....	32	102,400 00	.....
1887 50-51 Vic., c. 24..		From W. end of section subsidized to Moncton.....	3,200	2		6,400 00				
1890 53 Vic., c. 4 and c. 5	Calgary and Edmonton Ry. Co., from Calgary to a point at or near Edmonton, and from Calgary to International Boundary.....		6,400 ac.	190 / 150		.....	.....	.....	.....	2,176,000
1885 48-49 Vic., c. 59.	Canada Atlantic Railway	Valleyfield to west of Johnson's and Johnson's to Lacolle....	1,600			96,000 00				
		Terminus, Ottawa, to Chaudière Falls.	3,200							
1886 49 Vic., c. 10....		Clarke's Island to Valleyfield.. Lacolle to International Boundary.	3,200	53		38,400 00	.....	53	314,400 00	.....
1887 50-51 Vic., c. 24.		For a bridge over the St. Lawrence, at Coteau Landing, on line of Canada Atlantic Ry..	15% on cost			180,000 00				
1874 37 Vic., c. 14....	Canada Central Ry., Pembroke to Callender..		12,000	120		1,440,000 00	.....	120	1,525,250 00	.....
1883 46 Vic., c. 2.....	do to recoup Town of Pembroke.....		.....	.....		35,250 00	.....			
1881 44 Vic., c. 1.....	Canadian Pacific Ry. Co., Callender to Port Arthur, and Selkirk to Kamloops.....		.....	.....		.....	.....	2,005	25,000,000 00	25,000,000
1890 53 Vic., c. 4.....	Canadian Pacific Ry. Co.	From Glenboro' westerly to a proposed branchrunning from Brandon south-westerly. ..	6,400 acres	60		384,000 acres	.....	.....	.....	384,000
		From Brandon south-westerly to near Tp. 3, Range 27, west of 1st Principal Meridian, and thence westerly	6,400 acres	100		640,000 acres	.....	.....	.....	640,000
1891 54-55 Vic., c. 10.		Branch from western end of 100 miles, to a point at or near La Roche Percée, Tp. 1, Rge. 6, west of 2nd Meridian....	6,400 acres	60		384,000 acres	.....	.....	.....	384,000
		From Brandon branch to Deloraine	6,400 acres	25		160,000 acres	.....	.....	.....	160,000
1884 47 Vic., c. 8.....	For extension of C.P.R..	St. Martin's Junction to Quebec	6,000	160		960,000 00	.....	160	1,500,000 00	.....
1885 48-49 Vic., c. 58..		do do (additional)	.....			340,000 00				
1884 47 Vic., c. 8. ...		Connecting Jacques Cartier Union Junc. with North Shore	.....	.....		200,000 00				
1886 49 Vic., c. 10....	Cap Rouge and St. Lawrence Ry. Co., Lorette to Quebec..		3,200	12		38,400 00	.....	12	38,400 00	.....
1883 46 Vic., c. 25....	Caraquet Railway Co..	Bathurst to Caraquet.....	3,200	36	67	115,200 00	.....	67	224,000 00	.....
1884 47 Vic., c. 8. ...		Caraquet to Shippegan Harbour	3,200	24		76,800 00				
1887 50-51 Vic., c. 24..		Lower Caraquet to Shippegan...	.....	7		32,000 00				
1889 52 Vic., c. 3. ...	Central Ry. Co. N.B.	Head of Grand Lake to Intercolonial Railway, Sussex, N.B...	3,200	40	44½	128,000 00	.....	44·50	142,400 00	.....
1890 53 Vic., c. 2.. .		In extension	3,200	4½		14,400 00				
1888 51 Vic., c. 3. ..		Iron rails.....	4,052 tons.	.....		83,612 54	.....	rails.	83,612 54	.....
1888 51 Vic., c. 3.....	Chatham Branch Ry., iron rails.....		958 tons.	.....		24,439 84	.....	rails.	24,439 84	.....

Alphabetical List of Railways Subsidized by the Parliament of Canada—*Continued.*

Authority for Grant.		Company or Work Subsidized.	Details of Grant.				Total of Grant to each Company.		
A D	Designation of Act.		Rate per Mile. Money, Land or Rails.	Estimated Number of Miles.	If per Mile. Total for the whole work not to exceed—	If for a term of years. Amount and duration of Instalments.	No. of Miles Subsidized	Money.	Land.
			$		$ cts.			$ cts.	Acres.
1882 1886	45 Vic., c. 55.... 49 Vic., c. 18....	Chignecto Marine Transport Ry. Co., Ship Railway—Gulf of St. Lawrence to Bay of Fundy.....	.....	16·85	.....	½ yearly instalments of $85,301 for 20 years	.....	.....	.....
1890	53 Vic., c. 2.	Cobourg, Northumberland and Pacific Ry. Co., Cobourg to Ontario and Quebec Ry.....	3,200	30	96,000 00	.....	30	96,000 00	.....
1887 1889	50-51 Vic., c. 24.. 52 Vic., c. 3. ...	Cornwallis Valley Ry. Co.. Kentville to Kingsport	3,200	13	41,600 00	.....	14	44,800 00	.....
		From end of subsidized line to Kingsport.....	3,200	1	3,200 00				
1890	53 Vic., c. 2..	Columbia and Kootenay Ry. Co., Kootenay Lake to near junction of Kootenay and Columbia Rivers	3,200	35	112,000 00	.....	35	112,000 00	.....
1887	50-51 Vic., c. 24...	Cumberland Ry. and Coal Co., near Spring Hill to near Oxford Village..	3,200	14	44,800 00	.....	14	44,800 00	.....
1887	50-51 Vic., c. 24...	Dominion Lime Co., from point on Quebec Central Ry. to Dudswell Lime Co.'s quarries	3,200	7	22,400 00	.....	7	22,400 00	.....
1887 1889 1890	50-51 Vic., c. 24.. 52 Vic., c. 3..... 53 Vic., c. 2.....	Drummond County Ry Co. Drum'ondville towards Nicolet	3,200	30	96,000 00	.....	58·50	187,200 00	.....
		From end of subsi. line to Ball's Wharf, St. Lawrence River..	3,200	4½	14,400 00				
		Drummondville to Ste. Rosalie	3,200	24	76,800 00				
1883 1888	46 Vic., c. 25.... 51 Vic., c. 3....	Elgin, Petitcodiac and Havelock Ry. Co... Petitcodiac to Havelock Corner..	3,200	12	38,400 00	.....	12	38,400 00	.....
		Iron rails	2,201 tons.	.....	44,252 82	.....	.....	44,252 82	.....
1884 1890	47 Vic., c. 8..... 53 Vic., c. 2.....	Erie and Huron Ry. Co. Wallaceburg to Sarnia.....	3,200	30	96,000 00	.....	52	166,400 00	.....
		Petrolia *vid* Oil Springs to Dresden	3,200	22	70,400 00				
1884	47 Vic., c. 6.....	Esquimalt and Nanaimo Ry. Co., Esquimalt to Nanaimo, Vancouver's Island.....	.....	71	.....	.....	71	750,000 00	1,900,000
1890	53 Vic., c. 2.	For a line, Fredericton *vid* Oromocto and Gagetown to New Brunswick Railway	3,200	30	96,000 00	.....	30	96,000 00	.....
1887 1889	50-51 Vic., c. 26.. 52 Vic., c. 3....	Fredericton and St. Mary's Bridge Co., for a bridge over the St. John River at Fredericton.....	.....	.....	300,000 00	Loan of 80 p. c. on cost repayable in 15 yrs.	bridge.	300,000 loan	.....
			.....	.....	30,000 00			30,000 00	.....

[1891]

1889	52 Vic., c. 3.	Grand Trunk, Georgian Bay and Lake Erie Ry. Co., from Tara or point between Tara and Hepworth to the Town of Owen Sound	3,200	15	48,000 00		15	48,000 00	
1886	49 Vic., c. 10	Great Eastern Ry. Co. — Yamaska to River St. Francis	3,200	10	32,000 00				
1887	50-51 Vic., c. 24	Great Eastern Ry. Co. — St. Francis to St. Grégoire	3,200	30 60	96,000 00				
1891	54-55 Vic., c. 8.	Great Eastern Ry. Co. — St. Grégoire towards Chaudière Junction, I.C.R.	3,200	20	64,000 00		60	229,500 00	
1889	52 Vic., c. 3.	Great Eastern Ry. Co. — To bridge Nicolet and St. Francis Rivers			37,500 00	15 p. c. on cost.			
1890	53 Vic., c. 2.								
1884	47 Vic., c. 8.	Great Northern Ry. Co. — St. Jérôme to New Glasgow	3,200	10	32,000 00				
1886	49 Vic., c. 10.	Great Northern Ry. Co. — New Glasgow or St. Lin to Montcalm	3,200	18	57,600 00				
1891	54-55 Vic., c. 8.	Great Northern Ry. Co. — St. Andrew's to Lachute	3,200	7 50	22,400 00		50	160,000 00	
1886	49 Vic., c. 10.	Great Northern Ry. Co. — At or near Montcalm to C.P.R., between Joliette and St. Félix de Valois	3,200	15	45,000 00				
1889	52 Vic., c. 3.								
1890	53 Vic., c. 2.								
1886	49 Vic., c. 11	Great North-West Central Ry. Co., Brandon to Battleford	6,400 acres	450			450		2,880,000
1887	50-51 Vic., c. 24	Guelph Junction Ry. Co., from Campbellville, on C.P.R., to Guelph	3,200	16	51,200 00		16	51,200 00	
1888	51 Vic., c. 3.	Halifax Cotton Co., ironrails	233 tons.		4,335 00			4,335 00	
1887	50-51 Vic., c. 24	Harvey Branch Ry. Co., from southern terminus of Albert Railway to Harvey Bank	3,200	3	9,600 00		3	9,600 00	
1886	49 Vic., c. 10	Hereford Railway Co. — Hereford to International Ry.	3,200	34	108,000 00		49	156,800 00	
1889	52 Vic., c. 3.	Hereford Railway Co. — Cookshire to Quebec Central Railway at Dudswell	3,200	15	48,000 00				
1883	46 Vic., c. 25	International Railway Co., Sherbrooke to International Boundary	3,200	49	156,800 00		49	156,800 00	
1890	53 Vic., c. 2.								
1885	48-49 Vic., c. 58	International Railway Co. (Atlantic and North-Western) Montreal to Harbours of St. Andrews, St. John and Halifax, in three Sections			$250,000 per an. for 20 yrs. apportioned as under—				
		Sec. 1. St. Lawrence to Lennoxville		108	To Section 1, $ 71,100				
		2. Moose River to Mattawamkeag		144	do 2, 115,500				
		3. Harvey to near Salisbury		115	do 3, 63,400				
1890	53 Vic., c. 2.	Inverness and Richmond Railway Co., Port Hawkesbury to Broad Cove	1,000	50	50,000 00		50	50,000 00	
1884	47 Vic., c. 8.	Irondale, Bancroft and Ottawa Railway Co., Victoria Branch of Midland Railway to Bancroft	3,200	50	160,000 00		50	160,000 00	
1889	52 Vic., c. 3.								
1886	49 Vic., c. 10.	Joggins Railway Co. — McCann Station to Joggins	3,200	12	38,400 00				
1887	50-51 Vic., c. 24.	Joggins Railway Co. — From south end to the wharves	3,200	1¼ 18¼					
1889	52 Vic., c. 3.	Joggins Railway Co. — From some point on Joggins Railway to Young's Mills	3,200	5	4,000 00		18·25	58,400 00	
					16,000 00				
1888	51 Vic., c. 3.	Kent Northern Railway of New Brunswick, iron rails	2,549 tons.		58,334 27			58,334 27	
1884	47 Vic., c. 8.	Kingston and Pembroke Ry. Co., Mississippi to Renfrew	3,200	15	48,000 00		15	48,000 00	
1890	53 Vic., c. 2.	Kingston, Smith's Falls and Ottawa Ry. Co. — Kingston towards Smith's Falls	3,200	20	64,000 00				
1891	54-55 Vic., c. 8.	Kingston, Smith's Falls and Ottawa Ry. Co. — End of 20 miles subsidized to Smith's Falls	3,200	36 56	115,200 00		56	179,200 00	
1886	49 Vic., c. 10.	L'Assomption Railway Co., L'Assomption to L'Epiphanie	3,200	3½	11,200 00		3·50	11,200 00	
1890	53 Vic., c. 2.	For a line, Lachine Bank on G.T.Ry. to Rivière des Prairies	3,200	15	48,000 00		15	48,000 00	
1887	50-51 Vic., c. 24.	Lake Erie, Essex and Detroit River Ry. Co — Walkerville to Cedar Creek St'n		27 77	118,400 00		77	278,400 00	
1890	53 Vic., c. 2.	Lake Erie, Essex and Detroit River Ry. Co — As fixed by Order in Council	3,200	50	160,000 00				

Authority for Grant.		Company or Work Subsidized.	Details of Grant.				Total of Grant to each Company.		
A D	Designation of Act.		Rate per Mile. Money, Land or Rails.	Estimated Number of Miles.	If per Mile. Total for the whole work not to exceed—	If for a term of years. Amount and duration of Instalments.	No. of Miles Subsidized	Money.	Land.
			$		$ cts.			$ cts.	Acres.
1887	50-51 Vic., c. 24.	Lake Temiscamingue Colonization Railway Co. — Long Sault to Lake Temiscamingue (amended)	3,200	6	19,200 00				
		To overcome rapids of the Ottawa River at La Micharge, La Cave, Les Erables and La Montagne, and for construction of wharves and landings at such rapids		2	12,400 00		53·50	177,800 00	
1887	50-51 Vic., c. 24.	Long Sault to Lake Kippewa	3,200	10½	33,600 00				
1889	52 Vic., c. 3.	Mattawa to Long Sault or Long Sault towards Mattawa	3,200	15	48,000 00				
1890	52 Vic., c. 2.	From end of 15 miles subsidized to Long Sault	3,200	20	64,000 00				
1889	52 Vic., c. 4.	Lake Manitoba Railway and Canal Co. — From Portage la Prairie to southern boundary of Lake Manitoba	6,400 acres	17			142		902,000
1890	52 Vic., c. 4.	From Portage la Prairie to Lake Winnipegoosis, at or near Meadow Portage	6,400 do	125					
1890	53 Vic., c. 4.	Lac Seul Railway Co., from point at or near Shelley St'n, C.P.R., to a point at or near White Mud Lake, Winnipeg River	6,400 do	18			18		115,200
1885	48-49 Vic., c. 59.	Leamington and St. Clair Ry. Co. — Comber to Lake Erie	3,200	14	44,800 00		16	51,200 00	
1887	50-51 Vic., c. 24	From N. end of sec. subsi. to Comber	3,200	2	6,400 00				
1890	53 Vic., c. 2.	Lindsay, Bobcaygeon and Pontypool Railway Co., Bobcaygeon to Midland Railway	3,200	16	51,200 00		16	51,200 00	
1885	48-49 Vic., c. 60.	Manitoba and North Western Ry. Co. — Portage la Prairie to 20 miles from Prince Albert	6,400 acres	430	456		456		2,918,400
1886	49 Vic., c. 11.	Branch from Todburn to Shellmouth	6,400 do	26					

1885	48-49 Vic., c. 60.	Manitoba South-Western Railway Co., Winnipeg to White Water Lake		6,400	do	150	960,000						
1891	54-55 Vic., c. 10.	do	Extension	6,400	do	62	396,500 00			218½			1,396,800
1890	53 Vic., c. 4.	Manitoba South-Eastern Railway Co., Winnipeg to a point on west side of the Lake of the Woods.	Branch, Carman to Barnsley	6,400	do	64	40,000 00						
1890	53 Vic., c. 2.	Manitoulin and North Shore Railway Co., Little Current to Algoma Branch of C. P. R.		6,400	do	110				110			794,000
1888	51 Vic., c. 3.	Massawippi Junction Railway Co.	From point on Atlantic and North-Western Railway near Magog, to Ayer's Flat St'n. on the Massawippi Railway	3,200		30	96,000 00			30	96,000 00		
1889	52 Vic., c. 3.		Ayer's Flat to Coaticook	3,200		25	32,000 00			25	80,000 00		
1889	52 Vic., c. 3.	Maskinongé and Nipissing Railway Co.	From near Maskinongé or Louiseville towards Parish of St. Michel des Saints, P. Q.	3,200		15	48,000 00			30	96,000 00		
1890	53 Vic., c. 2.		Extension	3,200		15	48,000 00						
1887	50-51 Vic., c. 23.	Medicine Hat Railway and Coal Co., Medicine Hat to Coal Fields		6,400	acres	8				8			
1885	48-49 Vic., c. 59.	Montreal and Sorel Railway Co.	St. Lambert to Sorel	1,000		45	72,000 00			45	112,000 00		51,200
1890	53 Vic., c. 2.		To complete line				40,000 00						
1885	48-49 Vic., c. 59.	Montreal and Champlain Junction Railway Co.	Brousseau to Dundee	500		60	30,000 00			63	103,000 00		
1887	50-51 Vic., c. 24.		Salmon River at Fort Covington to Massena Springs			63	64,000 00						
1888	51 Vic., c. 3.	Montreal and Western Railway Co., St. Jérôme towards Le Désert	From end of subsidized line	3,200		3	9,600 00						
1890	53 Vic., c. 2.												
1886	49 Vic., c. 10.	Montreal and Lake Maskinongé Railway Co.	St. Félix to Lake Maskinongé	5,161		70	361,270 00			70	361,270 00		
1890	53 Vic., c. 2.		For extension	3,200		10	32,000 00			13·50	42,200 00		
1887	50-51 Vic., c. 24.	Montreal and Ottawa Railway Co.	Vaudreuil to Hawkesbury	3,200		30	96,000 00			60	192,000 00		
1890	53 Vic., c. 2.		From end subsi. towards Ottawa	3,200		30	96,000 00						
1891	54-55 Vic., c. 8.												
1883	46 Vic., c. 25.	Napanee, Tamworth and Quebec Railway Co.	Napanee to Tamworth	3,200		28	89,600 00			60	204,400 00		
1886	49 Vic., c. 10.		Tamworth to Tweed			18	70,000 00						
1887	50-51 Vic., c. 24.		From north end of section subsidized to Tweed	3,200		4	12,800 00						
1889	52 Vic., c. 3.		Yarker to Harrowsmith and Harrowsmith to W. Sydenham	3,200		3	32,000 00						
1885	48-49 Vic., c. 59.	New Brunswick and Prince Edward Ry. Co., Sackville to Cape Tormentine				7							
1884	47 Vic., c. 8.			3,200		37	118,400 00			37	118,400 00		
1885	48-49 Vic., c. 59.	Northern and Western Railway Co.	Fredericton to Miramichi River	3,200		40	128,000 00						
			End of line previously subsidized to Boiestown										
1886	49 Vic., c. 10.		Additional between Fredericton and Indiantown and extension to deep water at Chatham	3,200		6	19,200 00						
1885	48-49 Vic., c. 59.		Indiantown to Junction with Northern and Western Ry. at or near Boiestown	3,200		10	32,000 00			100	320,000 00		
				3,200		44	140,800 00						

[1891]

Alphabetical List of Railways Subsidized by the Parliament of Canada—*Continued.*

Authority for Grant.		Company or Work Subsidized.	Details of Grant.				Total of Grant to each Company.		
A.D.	Designation of Act.		Rate per Mile, Money, Land or Rails.	Estimated Number of Miles.	If per Mile. Total for the whole work not to exceed—	If for a term of years. Amount and duration of Instalments.	No. of Miles Subsidized	Money.	Land.
			$		$ cts.			$ cts.	Acres.
1882	45 Vic., c. 14.	Northern and Pacific Junction Railway Co. (Gravenhurst to Callander	6,000	110	660,000 00		110	1,320,000 00	
1883	46 Vic., c. 25.	Northern and Pacific Junction Railway Co. (Additional	6,000	110	660,000 00		110	1,320,000 00	
1889	52 Vic., c. 3.	Northern and Pacific Junction Railway Co.					110	1,320,000 00	
1890	53 Vic., c. 2.	Northern and Pacific Junction Railway Co.					110	1,320,000 00	
1889	52 Vic., c. 4.	North-Western Railway Co. of Canada, from Calgary to near Edmonton, and Calgary to Lethbridge	10,000 ac.	330			330		3,300,000
1885	48-49 Vic., c. 60.	North-Western Coal and Navigation Co. Medicine Hat to Belly River	3,800 do	109½			209½		1,091,100
1887	50-51 Vic., c. 23.	North-Western Coal and Navigation Co. Additional do do	40 do	109½			209½		1,091,100
1889	52 Vic., c. 4.	North-Western Coal and Navigation Co. do do	2,600 do	109½			209½		1,091,100
1890	53 Vic., c. 4.	North-Western Coal and Navigation Co. Lethbridge to Crow's Nest Pass	3,840 do	100			209½		1,091,100
1887	50-51 Vic., c. 24.	Nova Scotia Central Railway Co. Lunenburg to a point in district of New Germany, and branch to Bridgewater Railway Wharf	3,200	34	108,800 00		80	256,000 00	
1888	51 Vic., c. 3.	Nova Scotia Central Railway Co. Lunenburg to a point in district of New Germany, and branch to Bridgewater Railway Wharf	3,200	46	147,200 00		80	256,000 00	
1889	52 Vic., c. 3.	Ontario and Pacific Railway Co., Cornwall to Ottawa	3,200	53	172,400 00		53	172,400 00	
1890	53 Vic., c. 2.	Orford Mountain Ry. Company, Eastman and Kingsbury	3,200	31	99,200 00		31	99,200 00	
1887	50-51 Vic., c. 24.	Oshawa Railway and Navigation Co., Port Oshawa towards Raglan	3,200	7	22,400 00		7	22,400 00	
1891	54-55 Vic., c. 8.	Oshawa Railway and Navigation Co., Port Oshawa towards Raglan					7	22,400 00	
1885	48-49 Vic., c. 59.	Ottawa and Gatineau Valley Railway Co., Hull Station towards Le Désert		62	320,000 00		62	320,000 00	
1889	52 Vic., c. 3.	Ottawa and Gatineau Valley Railway Co., Hull Station towards Le Désert		62	320,000 00		62	320,000 00	
1888	51 Vic., c. 3.	Ottawa and Parry Sound Ry. Co. from a point on C.P.R. to Eganville	3,200	22	70,400 00		52	166,400 00	
1890	53 Vic., c. 2.	Ottawa and Parry Sound Ry. Co. Eganville to Barry's Bay	3,200	30	96,000 00		52	166,400 00	
1890	53 Vic., c. 2.	For a line, Ottawa to Morrisburgh	3,200	52	166,400 00		52	166,400 00	
1889	52 Vic., c. 3.	Parry Sound Colonization Railway Co., Parry Sound to Sundridge	3,200	40	128,000 00		40	128,000 00	
1884	47 Vic., c. 8.	Pontiac Pacific Junc. Ry. Co. Hull to Pembroke	3,200	82	272,000 00		92·50	337,100 00	
1888	51 Vic., c. 3.	Pontiac Pacific Junc. Ry. Co. From 3 miles E. of Pembroke to Pembroke	3,200	3	9,600 00				
1890	53 Vic., c. 2.	Pontiac Pacific Junc. Ry. Co. Hull to Aylmer	3,200	7½	24,000 00				
		Pontiac Pacific Junc. Ry. Co. Bridging Ottawa at Culbute, &c.		92·50	31,500 00				

1889	52 Vic. c. 3.....	Pontiac and Renfrew Railway Co., opposite Braeside or Bristol to Pontiac Pacific Junction Railway, near Quion River.....	3,200		6	19,200 00	.....	6	19,200 00	.....	
1888	51 Vic., c. 3. ..	Port Arthur, Duluth and Western Ry. Co.	Port Arthur to Gun Flint Lake...	3,200	84⅔	893/4	271,200 00	.....	89·75	287,200 00	.....
1890	53 Vic., c. 2.....		Branch to Kabeka Falls.....	.....	5		16,000 00	.....	.....	.....	.....
1884	47 Vic., c. 8.....	Provincial Government	of Quebec, Montreal to Quebec...	6,000	159	279	954,000 00	.....	279	2,394,000 00	.....
		do	do do Ottawa...	12,000	120		1,444,000 00				
1885	48-49 Vic., c. 60.	Qu'Appelle, Long Lake and Saskatchewan Ry. & Steamboat Co.	Regina to Long Lake.....	6,400 acres	23⅓	348¼	.....	.....	348·33	.....	2,229,333
1887	50-51 Vic., c. 23.		Long Laketon, near Elbow N. Saskatchewan, with branches to Prince Albert and Battleford	6,400 do	325						
1884	47 Vic., c. 8.....	Quebec Central Ry. Co	Beauce Junction to International Boundary (amended).....	3,200		15	60,342 00	.....	105	348,342 00	.....
1888	51 Vic., c. 3....		St. Francis Station to near Moose River on Atlantic and North-Western.....	.....		90	288,000 00	$21,191.54 per annum for 20 years, or guarantee of a like sum as interest on bonds of Co., representing a grant in cash of $288,000.....			.....
1890	53 Vic., c. 2. ...										
1882	45 Vic., c. 14....	Quebec and Lake St. John Ry. Co.	St. Raymond to Lake St. John...	3,200	120	248	384,000 00	.....	248	1,003,495 00	.....
1883	46 Vic., c. 25 ...		(additional)	3,200	25		80,000 00				
1885	48-49 Vic., c. 59.		Junction on North Shore Railway to St. Raymond.....	3,200	32		96,000 00				
1886	49 Vic., c. 10....		50 miles north of St. Raymond to Lake St. John (additional).....	.....	(95)		186,295 00				
1887	50-51 Vic., c. 25.		Quebec to Lake St. John—being portion uncovered by previous subsidies (additional).....	3,200	9		28,800 00				
1888	51 Vic., c. 3.....		St. John towards Chicoutimi.....	3,200	30		96,000 00				
1889	52 Vic., c. 3.....		From end of section subsidized from St. John towards Chicoutimi.....	3,200	20		64,000 00				
1890	53 Vic., c. 2....		For St. Charles Bridge and from Lorette to Charlesbourg...	3,200	12		30,000 00 38,400 00				
1891	54-55 Vic., c. 8.										
1889	52 Vic., c. 3.	Quebec, Montmorency and Charlevoix Railway Co., East bank of St. Charles River to or near Cape Tourmente		3,200		30	96,000 00	....	30	96,000 00	.....
1889	52 Vic., c. 3....	For a line, Cape Tourmente towards Murray Bay.....		3,200		20	64,000 00	.....	20	64,000 00	.....
1891	54-55 Vic., c. 9....	Red Deer Valley and Coal Co., from Town of Calgary, to point on Township 29, Range 23, west 4th Meridian..		6,400 acres		55	.....	....	55	....	352,000
1890	53 Vic., c. 3.... ..	For a line, Shelburne and Liverpool towards Annapolis...		3,200		75	240,000 00	....	75	240,000 00	....
1889	52 Vic., c. 3.....	Shuswap and Okanagan Railway Co., from Sicamous to a point on Lake Okanagan.....		3,200		51	163,200 00	.....	51	163,200 00	....
1887	50-51 Vic., c. 24...	South Norfolk Railway Co., Port Rowan to Simcoe.....		3,200		17	54,400 00	.....	17	54,400 00	.....
1889	52 Vic., c. 3. ...	South Ontario Pacific Railway Co., Woodstock to Hamilton		3,200		49	158,400 00	....	49	158,400 00	....
1891	54-55 Vic., c. 8..										
1887	50-51 Vic., c. 24.	St. Catharines and Niagara Central Ry. Co...	St. Catharines to Bridge over Niagara River.....	3,200	12	46	38,400 00	.....	·46	147,200 00	....
1889	52 Vic., c. 3.....		End at St. Catharines towards Hamilton	3,200	20		64,000 00				
1890	53 Vic., c. 2....		End of 20 miles to Hamilton..	3,200	14		44,800 00				
1889	52 Vic., c. 3.....	For a line, St. Césaire to St. Paul d'Abbotsford.....		3,200		5	16,000 00	.....	5	16,000 00	....

AUTHORITY FOR GRANT.		COMPANY OR WORK SUBSIDIZED.	DETAILS OF GRANT.				TOTAL OF GRANT TO EACH COMPANY.		
A.D.	Designation of Act.		Rate per Mile. Money, Land or Rails.	Estimated Number of Miles	If per Mile. Total for the whole work not to exceed—	If for a term of years. Amount and duration of Instalments.	No. of Miles Subsidized	Money.	Land.
			$		$ cts.			$ cts.	Acres.
1889	52 Vic., c. 3.	St. Clair Frontier Tunnel Co., for a tunnel under St. Clair River at or near Sarnia		2¼	375,000 00		Tunnel, 2¼	375,000 00	
1887	50-51 Vic., c. 24.	St. Lawrence and Lower Laurentian and Saguenay Ry. Co., Grand Piles to Junction with Lake St. John Ry.		40	217,600 00		40	217,600 00	
1891	54-55 Vic., c. 8.								
1890	53 Vic., c. 2.	St. Lawrence and Adirondack Railway Co., Valleyfield to Huntingdon	3,200	18	57,600 00		18	57,600 00	
1884	47 Vic., c. 8.	St. Louis, Richibucto and Buctouche Railway Co., Richibucto to St. Louis	3,200	7	22,400 00		7	22,400 00	
1883	46 Vic., c. 26.	St. John Bridge and Railway Extension Co., to build bridge and connections				$500,000 loan			
1890	53 Vic., c. 2.	For a line, Fredericton to the Village of Prince William	3,200	22	70,400 00		22	70,400 00	
1890	53 Vic., c. 2.	St. John Valley and Rivière du Loup Railway Co., Village of Prince William towards Town of Woodstock	3,200	22	70,400 00		22	70,400 00	
1890	53 Vic., c. 2.	St. Stephen and Milltown Railway Co., St. Stephen to Milltown	3,200	3½	11,200 00		3·50	11,200 00	
1888	51 Vic., c. 3.	Steel Co. of Canada, N.S., iron rails	597 tons.		11,964 66			11,964 66	
1890	53 Vic., c. 2.	For a line, from a point on Intercolonial Railway through Stewiacke Valley towards Iron Mines, &c.	3,200	25	80,000 00		25	80,000 00	
1890	53 Vic., c. 2.	For a line, Summerside to Richmond Bay, P.E.I.	3,200	3	9,600 00		3	9,600 00	
1882	45 Vic., c. 14.	Témiscouata Ry. Co. — Rivière du Loup to Edmundston	$3,200 for 75 ms. $3,800 for 75 ms. $6,000 for 8 ms.	83	240,000 00 258,000 00		119	649,200 00	
1885	48-49 Vic., c. 58.								
1888	51 Vic., c. 3.	Branch from Edmundston towards St. Francis River		20	100,000 00				
1890	53 Vic., c. 2.	In extension of 20 miles subsidized	3,200	16	51,200 00				
1889	52 Vic., c. 3.	Thousand Islands Ry. Co. — Gananoque to Gananoque Junc., G.T.R. Gananoque Junc., G.T.R., to connect with Brockville, Westport and Sault Ste. Marie Railway	3,200	4 13	54,400 00		17	54,400 00	

[1891]

1890	53 Vic., c. 2	Tobique Valley / Perth Centre towards Plaister Rock			14	89,600 00		25	124,800 00		
1891	54-55 Vic., c. 8	Ry. Co. / In extension of 14 miles			11	35,200 00					
1886	49 Vic., c. 10	Toronto, Grey and Bruce Ry. Co., Glenannan to Wingham	3,200		5	16,000 00		5	16,000 00		
1889	52 Vic., c. 3	For a line, Truro to Newport	3,200		49	156,800 00		49	156,800 00		
1890	53 Vic., c. 2	Waterloo Junction Railway, Waterloo to Elmira	3,200		11	35,200 00		11	35,200 00		
1887	50-51 Vic., c. 25	Western Counties Railway, Digby to Annapolis			20			20	500,000 00		
1889	52 Vic., c. 8	For a line, Woodstock *vid* London to Chatham, Ont. (*See* Ontario and Pacific)									
1890	53 Vic., c. 2	And West Ontario Pacific Railway	3,200		80	256,000 00		80	256,000 00		
1884	47 Vic., c. 25	Winnipeg and Hudson Bay Railway Co., Winnipeg to Hudson Bay	6,400 acres in Man. 12,800 ac. in N.W.T.		No distance named						
1886	49 Vic., c. 11	Wood Mountain and Qu'Appelle Railway Co., from Wood Mountain *vid* Qu'Appelle and Fort Qu'Appelle to the Manitoba and North-Western Railway	6,400 acres		240			240			1,536,000
1890	53 Vic., c. 2	Woodstock and Centreville Railway Co., end of 20 miles subsidized to International Boundary	3,200		6	19,200 00					
		Vaudreuil and Prescott Railway Co. (*See* Montreal and Ottawa Railway Co.)									

GRANTS under Subsidy Acts—

Year.	Act.	Company or Work Subsidized.
1886..	49 Vic., c. 10.....	Albert Southern Ry. Co., Salisbury to Hopewell.....
1884..	47 Vic., c. 8.....	For a railway, Annapolis to Digby.....
1883..	49 Vic., c. 25.....	Baie des Chaleurs Ry. Co., towards Paspebiac.....
1887..	50 51 Vic., c. 24...	Beauharnois Junction Ry. Co.....
1887..	50-51 Vic., c. 24...	Belleville and North Hastings.....
1887..	50-51 Vic., c. 24...	Brantford, Waterloo and Lake Erie.....
1889..	52 Vic., c. 3.....	Brockville, Westport, &c., Railway.....
1887..	50-51 Vic., c. 24...	Buctouche and Moncton.....
1886..	49 Vic., c. 10.....	Caraquet Ry. Co., for 10 miles, Lower Caraquet to Shippegan.....
1887..	50-51 Vic., c. 24...	Canada Atlantic.....
1887..	50-51 Vic., c. 24...	Carillon and Grenville.....
1887..	50-51 Vic., c. 24...	Cumberland Ry. and Coal Co.....
1886..	49 Vic., c. 10.....	Cap Rouge and St. Lawrence, Lorette to Quebec.....
1884..	47 Vic., c. 8.....	Central Ry. Co., of N.B., Grand Lake to I.C.R.....
1885..	48-49 Vic., c. 49...	Central Ontario Ry. Co., Coe Hill to Bancroft.....
1887..	50-51 Vic., c. 24...	Dominion Lime Co.....
1884..	47 Vic., c. 8.....	For a branch of the I. C. Ry., Derby to Indian Town.....
1886..	49 Vic., c. 10.....	Fredericton and St. John Valley Ry — Fredericton to Village of Prince William.....
1887..	50-51 Vic., c. 24...	Fredericton and St. John Valley Ry — Prince William to Woodstock.....
1886..	49 Vic., c. 10.....	Gananoque, Perth and James' Bay Ry. Co.....
1883..	46 Vic., c. 25.....	Gatineau Valley Ry. Co. — For first 50 mile section from Hull station.....
1884..	47 Vic., c. 8.....	Gatineau Valley Ry. Co. — From Kazabazua to Le Désert.....
1885..	48-49 Vic., c. 59...	Gatineau Valley Ry. Co. — Hull to Le Désert.....
1883..	46 Vic., c. 25.....	Great American and European Short Line Ry. Co., for 80 miles from Canso or Louisburg or Sydney.....
1887..	50-51 Vic., c. 24...	Guelph Junction Ry.....
1884..	47 Vic., c. 8.....	For a railway — From Grand Piles to Lake Edward.....
1885..	48-49 Vic., c. 59...	For a railway — From Grand Piles to Lake Edward.....
1887..	50-51 Vic., c. 24...	Jacques Cartier Union Railway—To complete line.....
1886..	49 Vic., c. 10.....	For a railway, Ingersol *vid* London to Chatham.....
1889..	52 Vic., c. 3.....	Kingston and Smith's Falls and Ottawa Railway.....
1890..	53 Vic., c. 2.....	Kingston and Smith's Falls and Ottawa Railway.....
1887..	50-51 Vic., c. 24...	Harvey Branch.....
1887..	50-51 Vic., c. 24...	Hereford Ry.....
1884..	47 Vic., c. 8.....	Irondale, Bancroft and Ottawa Ry., Victoria Branch Midland Ry. to Bancroft.
1886..	49 Vic., c. 10.....	Lake Erie, Essex and Detroit Riv. Ry. Co., for 37 miles, Windsor to Leamington
1885..	48-49 Vic., c. 59...	Lake Temiscamingue Ry. Co. — For 8 miles of railway from Long Sault to foot of Lake Temiscamingue.
1886..	49 Vic., c. 19.....	Lake Temiscamingue Ry. Co. — For wharves and landing stages.....
1887..	50-51 Vic., c. 24...	Massawippi Ry. Co., for 10 miles of their railway, Magog to Ayer's Flat.....
1887..	50-51 Vic., c. 24...	Minudie Branch Ry.....
1887..	50-51 Vic., c. 24...	Mount Forest and Walkerton.....
1888..	47 Vic., c 8.....	Line, Montreal to St. John and Halifax.....
1883..	46 Vic., c. 25,.....	Montreal and Western.. — For first 50-mile section out of St. Jérome, P.Q.....
1884..	47 Vic., c. 8.....	Montreal and Western.. — From end of line subsidized towards Le Désert.....
1886..	49 Vic., c. 10.....	Montreal and Western.. — From end of line subsidized towards Le Désert.....

Cancelled, Amended or Lapsed.

Amount.		Authority for Change, and Particulars.
$		
31,771	Lapsed.....	Re-voted—52 Vic., c. 3.
64,000	do	
244,500	do	Re-voted—52 Vic., c. 3.
37,100	do	Unearned by 1st August, 1891.
512	do	do do
4,790	do	do do
64,000	....	Re-voted by 54-55 Vic., c. 8.
35,380	Lapsed.....	Unearned by 1st August, 1891.
32,000	Cancelled ..	By 50-51 Vic., c. 24, 1887.—$32,000 was voted for 7 miles, in place of 10 miles, and in lieu of grant made under 49 Vic., c. 10, to same work
32,044	Lapsed.....	Unearned by 1st August, 1891.
38,400	do	do do
4,950	do . ..	do do
38,400	do	Re-voted—52 Vic., c. 3.
128,000	do	Re-voted—52 Vic., c. 3.
64,000	do	
7,040	do	Unearned by 1st August, 1891.
140,000	do	Constructed by Government.
70,400	Cancelled...	By 53 Vic., c. 2.
70,400	do ..	By 53 Vic., c. 2.
54,400	Lapsed. ...	
160,000	Cancelled.	By 48-49 Vic., c. 59, 1885.—The sum of $320,000 was granted for 62 miles from Hull towards Le Désert, in lieu of the subsidies granted by 46 Vic., c. 25, and 47 Vic., c. 8.
16,000	do ..	
320,000	Lapsed...	Re-voted—52 Vic., c. 3.
....	Amended...	By 47 Vic., c. 8, sec. 2.—The words "To the Great American and Short Line Railway" were struck out; the word "the" substituted for "their," and words and figures "for 80 miles of" omitted. See also—Oxford to Louisburg or Sydney, below.
5,250	Lapsed.....	Unearned by 1st August, 1891.
217,600	Cancelled...	By 48-49 Vic., c. 59, 1885.—The same amount of subsidy, $217,600, for a specified distance of 50 miles in lieu of that granted by 47 Vic., c. 8 for an unnamed distance.
217,600	do ..	By 50-51 Vic., c. 24, 1887.—Subsidy of $217,600 was granted to the St. Lawrence, Lower Laurentian and Saguenay Ry. Co., in lieu of subsidy granted by 48-49 Vic., c. 59.
20,000	Lapsed. ...	
256,000	Cancelled...	By 53 Vic., c. 2.—Same amount granted for a line from Woodstock *vid* London to Chatham.
179,200	do ..	And re-voted by 54-55 Vic., c. 8.
4,046.43	Lapsed.....	Unearned by 1st August, 1891.
1,600	do	do do
145,000	do	Re-voted—52 Vic., c. 3.
118,400	Cancelled...	By 50-51 Vic., c. 24, 1887.—$118,400 was voted for 27 miles in place of 37 miles, and in lieu of grant made under 49 Vic., c. 10.
6,400	do ..	By 50-51 Vic., c. 24, 1887.—The grant of $25,600 for 8 miles of railway, at $3,200 per mile, was altered to $19,200 for 6 miles, and a further sum of $12,400 was granted (in lieu of the $6,400 deducted from the $25,600, and in lieu of the $6,000 granted by 49 Vic., c. 10) to complete the three short sections of railway, about 2 miles in length, required to overcome the four rapids, known as La Mi-charge, La Cave, Les Erables and La Montagne, and for the construction of wharves and landing stages thereon.
6,000	do ..	
32,000	do ..	51 Vic., c. 3, grants subsidy of $32,000 for the work, distance unnamed, in lieu of $32,000 for 10 miles, under 50-51 Vic., c. 24.
17,600	Lapsed.....	Unearned by 1st August, 1891.
76,800	do	do do
....	Amended...	By 48-49 Vic., c. 55.
160,000	Cancelled.	By 40 Vic., c. 10, 1886.—A subsidy of $361,270 was granted for 70 miles of their railway, in lieu of the subsidies granted under 46 Vic., c. 25, and 47 Vic., c. 8.
160,000	do ..	
361,270	do ..	By 53 Vic., c. 2.—Subsidy of $361,270 was granted for 70 miles of their railway, to be paid by instalment as certain specified sections are completed.

GRANTS under Subsidy Acts—Cancelled,

Year.	Act.	Company or Work Subsidized.
1886..	49 Vic., c. 10.....	Montreal and Maskinongé Railway .....
1884..	47 Vic., c. 8.....	Napanee, Tamworth and Quebec Ry. Co. .... For a line of railway from Tamworth towards Bogart or Bridgewater.
1885..	48-49 Vic., c. 59.	For 16 miles of railway from Tamworth towards Bogart or Bridgewater.
1886..	49 Vic., c. 10.....	For a railway from Newcastle to opposite Chatham.....
1889..	48-49 Vic., c. 59...	New Brunswick and Prince Edward .....
1882..	45 Vic., c. 14.....	Northern Pacific Junction Ry., Gravenhurst to Callender .....
1883..	46 Vic., c. 25.....	
1883..	46 Vic., c. 25.....	Northern and Western Railway Co., I.C.R., near Miramichi to Morans (32 miles), near Demphy Village .....
1885..	48-49 Vic., c. 59...	Northern and Western .....
1884..	47 Vic., c. 8.....	Ontario Pacific Ry., Cornwall to Perth. .....
1887..	50-51 Vic., c. 22..	
1885..	48-49 Vic., c. 59...	Ottawa, Waddington and New York Ry. Co., Ottawa to Waddington.....
1882..	45 Vic., c. 14.....	Oxford and New Glasgow.....
1883..	46 Vic., c. 25 ...	Oxford, Sydney and Louisburg .....
1884..	47 Vic., c. 8.....	
1886..	49 Vic., c. 14.....	For a railway, Oxford to Louisburg or Sydney, and amendments on becoming a Government work.
1886..	49 Vic., c. 10.....	Parry Sound Colonization Ry., Parry Sound to Sandridge .....
1886..	49 Vic., c. 10.....	For a railway from point on C.P.R. to Eganville.....
1884..	47 Vic., c. 8.....	Quebec Central Ry. Co.. Beauce Junction to International Boundary... .....
1888..	51 Vic., c. 3.....	Beauce Junction to International Boundary.....
1887..	50-51 Vic., c. 94...	Richmond Hill Junction. .....
1887..	50-51 Vic., c. 24...	Saguenay and Lake St. John Ry. Co., for 30 miles, Lake St. John towards Chicoutimi, or Chicoutimi towards Lake St. John .....
1886..	49 Vic., c. 10.....	Stewiacke Valley Ry. Co., from point on I.C.R. through Stewiacke Valley, &c.
1884..	47 Vic., c. 8.....	For a railway, St. Andrew's to Lachute. .....
1886..	49 Vic., c. 10.....	For a railway, St. Andrew's to Lachute.....
1886..	49 Vic., c. 10.....	For a railway, St. Eustache to St. Placide.....
1887..	50-51 Vic., c. 24...	Temiscouata Ry. Co., for 30 miles, Edmundston towards St. Francis River.....
1885..	48-49 Vic., c. 59.	Thunder Bay Colonization Ry. Co., Murillo to Crooked Lake.....
1886..	49 Vic., c. 10.....	
1886..	49 Vic., c. 10.....	Toronto, Grey and Bruce.....
1886..	49 Vic., c. 10.....	For a railway for 28 miles, Perth Centre to near Plaister Rock.....
1887..	50-51 Vic., c. 24...	Tobique Valley Railway do do .....
1886..	49 Vic., c. 10.....	For a railway, Truro to Newport.....
1887..	50-51 Vic., c. 24...	Woodstock and Centreville Ry.....

DEPARTMENT OF RAILWAYS AND CANALS,
1st October, 1891.

Amended or Lapsed—*Concluded.*

Amount.		Authority for Change, and Particulars.
$		
920	Unearned ..	And lapsed.
70,400	Cancelled..	By 48-49 Vic., c. 59.
70,000	do ..	By 49 Vic., c. 10.—A subsidy of $70,400 was granted for 18 miles, in lieu of 16 miles, and in lieu of the subsidy granted under 48-49 Vic., c. 59.
19,200	Lapsed.....	
4,960	do	Unearned by 1st August, 1891.
35,600	do	$35,000 re-voted by 52 Vic., c. 3, and $600 re-voted by 53 Vic., c. 2.
192,400	Cancelled...	By 47 Vic., c. 8.—A subsidy of $128,000 was granted for a line from Fredericton to Miramichi, in lieu of subsidy under 46 Vic., c. 25.
8,000	Lapsed....	Unearned by 1st August, 1891.
362,400	do	
19,200		
166,400	do	
224,000	do . . .	Work undertaken by Government and cost provided by special vote of Parliament.
256,000		
$30,000 p. ann. for 15 years, with lease or transfer of Eastern Extension from New Glasgow to Canso, and $170,000 per an. for 15 yrs.		
128,000	do . . .	Re-voted—52 Vic., c. 3.
70,400	Cancelled..	By 51 Vic., c. 3.—A subsidy of $70,400 was granted to Ottawa and Parry Sound Ry. Co., for 22 miles of their road, in lieu of subsidy under 49 Vic., c. 10.
150,858	do ..	By 51 Vic., c. 3.—The grant of $211,200, under 47 Vic., c. 8, was reduced to $60,342 for 15 miles, and in lieu of the unexpended balance of $150,858, a new grant of $288,000 was authorized to complete the line to the Atlantic and N.W. Ry., near Moose River, a distance of 90 miles. Total subsidy to the company is $60,342 + $288,000 = $348,342.
288,000	do ..	By 53 Vic., c. 2.
16,000	Lapsed....	Unearned by 1st August, 1891.
96,000	Cancelled by transfer.	51 Vic., c. 3.—Transferred the subsidy to the Quebec and Lake St. John Ry. Co.
80,000	Cancelled...	By 53 Vic. c. 2.
22,400	do ..	49 Vic., c. 10.
22,400	do ..	Re-voted—52 Vic., c. 3.
57,600	Lapsed. ...	
96,000	Cancelled...	By 51 Vic., c. 3.—A subsidy of $100,000 was granted for 20 miles of the same road, in lieu of the subsidy of $96,000 for 30 miles granted under 50-51 Vic., c. 24.
179,200	do ..	By 51 Vic., c. 3.—A subsidy of $271,200 was granted to the Port Arthur, Duluth and Western Ry. Co., for 84½ miles of railway from Port Arthur to Gun Flint Lake, in lieu of the subsidies granted under 48-49 Vic., c. 59, and 49 Vic., c. 10.
92,000		
1,344	Lapsed.....	Unearned by 1st August, 1891.
89,600	Cancelled.	By 50-51 Vic., c. 24, a subsidy of $89,600 was granted to the Tobique Valley Ry. Co. for 14 miles of the road, in lieu of 28 miles, and in lieu of the subsidy granted under 49 Vic., c. 10 and 50-51 Vic., c. 24, again cancelled by 54-55 Vic., c. 8.
89,600	do ..	
156,800	Lapsed. ...	Re-voted—52 Vic., c. 3.
64,000	do	Unearned by 1st August, 1891.

APPENDIX No. 18.

LIST OF RAILWAY SUBSIDIES GRANTED BY PARLIAMENT.

NOTE.—The marginal number opposite each subsidy has reference to the alphabetical list in the Minister's report showing the action taken in cases where a contract for work has been made with any company.

By the Acts of Parliament below specified, authority has been placed in the hands of the Governor in Council to grant, upon certain conditions, aid towards the construction of various lines of railway throughout the Dominion, as follows, namely:—

By the Act 45 Vic., cap. 14 (1882.) *(Assented to 17th May, 1882):—*

1. For a railway from Gravenhurst to Callander, both in the Province of Ontario, a subsidy not exceeding $6,000 per mile, nor exceeding in the whole $660,000

2. For a railway from St. Raymond to Lake St. John, both in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 384,000

3. For a railway from a point on the Intercolonial Railway at Rivière du Loup or Rivière Ouelle, in the Province of Quebec, or between them, to Edmundston, in the Province of New Brunswick, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 240,000

4. For a railway from Oxford to New Glasgow, both in the Province of Nova Scotia, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 224,000

The said subsidies to be granted to such companies as shall be approved by the Governor in Council as having established, to his satisfaction, their ability to complete the said railways respectively, within a reasonable time, to be fixed by Order in Council, and according to descriptions and specifications to be approved by the Governor in Council on the report of the Minister of Railways and Canals, and specified in an agreement to be made by the company with the Government, and which the Government is empowered to make, and to be payable out of the Consolidated Revenue Fund of Canada, by instalments on the completion of each ten miles of railway, proportionate to the value of the portion so completed in comparison with the whole work undertaken, such proportion to be established by the report of the said Minister; provided always, that the granting of such bonuses or subsidies shall be subject to such conditions for securing such running powers or traffic arrangements and other rights as will afford all reasonable facilities and equal mileage rates to all railways connecting therewith, as the Governor in Council may determine.

By the special Act 45 Vic., cap. 55 (1882.) *(Assented to 17th May, 1882):—*

5. A subsidy authorized in favour of "The Chignecto Marine Transport Railway Company," provided that they construct and thereafter maintain and operate a ship railway, to be approved by the Government, across the Isthmus of Chignecto, from the Gulf of St. Lawrence to the Bay of Fundy, per year, for twenty-five years $150,000

By the Act 46 Vic., cap. 25 (1883.) *(Assented to 25th May, 1883):—*

6. To the Baie des Chaleurs Railway Company, for 100 miles of their railway, from Metapediac, on the Intercolonial Railway, to Paspebiac, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole $320,000

7. To the Caraquet Railway Company, for 36 miles of their railway from a point near Bathurst to Caraquet, in the Province of New Brunswick, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole $115,200

8. To the Gatineau Valley Railway Company, for the first 50-mile section of their railway, from Hull station, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole .. 160,000

9. To the Great American and European Short Line Railway Company, for 80 miles of their railway from Canso to Louisburg or Sydney in the Province of Nova Scotia, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 256,000

10. To the International Railway Company, for 49 miles of their railway from Sherbrooke, in the Province of Quebec, to the International boundary line, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 156,800

11. To the Northern and Western Railway Company, for 32 miles of their railway, from the Intercolonial Railway, near the Miramichi, to Moran's, near Demphy village, in the Province of New Brunswick, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 102,400

12 To the Montreal and Western Railway Company, for the first 50-mile section of their railway, out of St. Jérôme, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 160,000

13. To the Napanee, Tamworth and Quebec Railway Company, for 28 miles of their railway from Napanee to Tamworth, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 89,600

14. To the Quebec and Lake St. John Railway Company, for 25 miles of their railway, from St. Raymond to Lake St. John, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 80,000

In addition to the subsidy granted by the Act forty-fifth Victoria, chapter fourteen.

15. For a railway from the Intercolonial Railway at Petitcodiac to Havelock Corner, in the Province of New Brunswick, 12 miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 38,400

16. For a railway from Gravenhurst to Callander, 110 miles, a subsidy not exceeding $6,000 per mile, nor exceeding in the whole 660,000

In addition to the subsidy granted by the Act forty-fifth Victoria, chapter fourteen.

"The nine subsidies first mentioned to be granted to the companies hereinbefore named respectively; and the two subsidies last mentioned to be granted to such companies as shall be approved by the Governor in Council as having established to his satisfaction their ability to complete the said railways, respectively; and all the eleven lines above mentioned, and also the lines of railway in respect of which it is provided by the Act of forty-fifth Victoria, chapter fourteen, that subsidies may be granted, shall be commenced within two years from the first day of July next, and completed within a reasonable time, not to exceed four years from and after the passing of this Act, to be fixed by Order in Council, and according to descriptions and specifications to be approved by the Governor in Council, on the report of the Minister of Railways and Canals, and specified in an agreement to be made by each company with the Government, and which the Government is empowered to make; and all the said subsidies authorized by this Act, respectively, to be paid out of the Consolidated Revenue Fund of Canada by instalements, on the completion of each section of not less than ten miles of railway, proportionate to the

value of the portion so completed in comparison with the whole work undertaken, to be established by the report of the said Minister: Provided always, that the granting of such subsidies shall be subject to such conditions for securing such running powers or traffic arrangements and other rights as will afford all reasonable facilities and equal mileage rates to all railways connecting with those so subsidized as the Governor in Council may determine."

By the special Act 46 Vic., cap. 26 (1883.) *(Assented to 25th May, 1883)*:—

17. An advance authorized in favour of the "St. John Bridge and Railway Extension Company," to enable them to build a railway bridge across the River St. John, N.B., with railway connection with the Intercolonial, such advance to be secured by a mortgage on their entire property, not to exceed 80 per cent of the expenditure on the work, nor a total sum of..... $ 500,000

By the Act 47 Vic., cap. 8 (1884.) *(Assented to 19th April, 1884)*:—

18. To the Government of the Province of Quebec, in consideration of their having constructed the railway from Quebec to Ottawa, forming a connecting line between the Atlantic and Pacific coasts *vid* the Intercolonial and Canadian Pacific Railways, and being as such a work of national and not merely provincial utility, a subsidy not exceeding $6,000 per mile for the portion between Quebec and Montreal, 159 miles, nor exceeding in the whole..... 954,000

19. And for the portion between Montreal and Ottawa, 120 miles, $12,000 per mile, nor exceeding in the whole..... 1,440,000

20. For the construction of a line of railway connecting Montreal with the harbours of St. John and Halifax by the shortest and best practicable route, after the report of competent engineers, a subsidy not exceeding $170,000 per annum, for fifteen years, or a guarantee of a like sum for a like period as interest on bonds of the company undertaking the work.

21. For the construction of a line of railway from Oxford station, on the Intercolonial Railway, to Sydney or Louisburg, a subsidy not exceeding $30,000 per annum for fifteen years, or a guarantee of a like sum for a like period as interest on the bonds of the company undertaking the work, in addition to the subsidies previously granted, and also a lease or transfer to such company of the Eastern Extension Railway, from New Glasgow to Canso, with its present equipment.

22. To the Quebec Central Railway Company, for a line of railway from Beauce Junction to the International boundary line, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 211,200

23. For the extension of the Canadian Pacific Railway, from its terminus at St. Martin's Junction, near Montreal, or some other point on the Canadian Pacific Railway, to the harbour of Quebec, in such manner as may be approved by the Governor in Council, a subsidy not exceeding $6,000 per mile, nor exceeding in the whole..... 960,000

24. To the Irondale, Bancroft and Ottawa Railway Company, for a line of railway from the Victoria branch of the Midland Railway to the village of Bancroft, in the Township of Dungannon, County of Hastings, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 160,000

25. To the Pontiac Pacific Junction Railway, for a line of railway from Hull or Aylmer to Pembroke, provided the Ottawa River is crossed at some point not east of Lapasse, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 272,000

26. To the Gatineau Railway Company, for a line of railway from Kazubazua to Le Désert, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole $160,000

27. To the Napanee, Tamworth and Quebec Railway Company, for a line of railway from Tamworth to Bogart and Bridgewater, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 70,400

28. To the Montreal and Western Railway Company, for a line of railway from the end of the line subsidized in the now last Session of Parliament, towards Le Désert, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 160,000

29. To the Northern and Western Railway Company, for a line of railway from Fredericton to the Miramichi River, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole (instead of the subsidy proposed in 1883) 128,000

30. To the Erie and Huron Railway Company, for a line of railway from Wallaceburg to Sarnia, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 96,000

31. To the Ontario and Pacific Railway Company, for a line of railway from Cornwall to Perth, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 262,400

32. To the Kingston and Pembroke Railway Company, for a line of railway from Mississippi to Renfrew, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 48,000

33. To the Great Northern Railway Company, for that portion of their railway between St. Jérôme and New Glasgow, in the County of Terrebonne, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 32,000

34. For a line of railway and bridge between the Jacques Cartier Union Railway Junction with the Canadian Pacific Railway and St. Martin's Junction, connecting the Jacques Cartier Union Railway with the North Shore Railway proper, a subsidy not exceeding in the whole.. 200,000

35. For a line of railway from Richibutoo to St. Louis, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 22,400

36. For a line of railway from Hopewell to Alma, in the Province of New Brunswick, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 51,200

37. For a line of railway from St. Andrews to Lachute, in the County of Argenteuil, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 22,400

38. For a line of railway from the Grand Piles, on the River St. Maurice, to Lake Edward, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 217,600

39. For a line of railway from Annapolis to Digby, in the Province of Nova Scotia, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 64,000

40. For a line of the Central Railway, from the head of Grand Lake to the Intercolonial Railway, between Sussex and St. John, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 128,000

41. To the Caraquet Railway Company, for the extension of their line of railway from Caraquet to Shippegan Harbour, in the Province of New Brunswick, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 76,800

42. For a branch of the Intercolonial Railway, from Metapediac eastward towards Paspebiac, twenty miles, in the Province of Quebec, a sum not exceeding in the whole 300,000

43. For a branch of the Intercolonial Railway, from Derby Station to Indiantown, fourteen miles, a sum not exceeding in the whole 140,000

"The subsidies hereinbefore mentioned as to be granted to companies named for that purpose shall be granted to such companies, respectively; the other subsidies shall be granted to such companies as shall be approved by the Governor in Council as having established, to his satisfaction, their ability to construct and complete the said railways, respectively. All the lines for the construction of which subsidies are granted shall be commenced within two years from the first day of July next and completed within a reasonable time, not to exceed four years, to be fixed by Order in Council, except the line mentioned in the fourth section of this Act,* which shall be commenced within one year, and shall also be constructed according to descriptions and specifications and upon conditions to be approved by the Governor in Council, on the report of the Minister of Railways and Canals, and specified in an agreement to be made in each case by the company with the Government, and which the Government is hereby empowered to make; the location also of every such line of railway shall be subject to the approval of the Governor in Council; and all the said subsidies, respectively, shall be payable out of the Consolidated Revenue Fund of Canada, by instalments on the completion of each section of the railway of not less than ten miles, proportionate to the value of the portion so completed in comparison with that of the whole work undertaken, to be established by the report of the said Minister. The subsidies to the Province of Quebec shall be capitalized, and the interest shall be payable at such time and in such manner as the Government of Canada shall agree upon with the Government of the said province. The two subsidies last mentioned in the list are for works to be constructed by the Government of Canada.

"Provided always, that the granting of such subsidies to the companies mentioned, respectively, shall be subject to such conditions for securing such running powers or traffic arrangements and other rights as will afford all reasonable facillties and equal mileage rates to all railways connecting with those so subsidized, as the Governor in Council may determine."

By the special Act 47 Vic., cap. 6 (1884). (*Assented to 19th April*, 1884):—

44. Relating to an agreement with the Province of British Columbia, authority was given, *inter alia*, for the grant of a subsidy to "the Esquimalt and Nanaimo Railway Company" in aid of the construction of a line of railway and telegraph between the points named; such subsidy to be in lands *en bloc* on Vancouver Island, the boundaries being fixed by the Act, and in money $750,000

By the Act 48-49 Vic., cap. 59 (1885). (*Assented to 20th July*, 1885):—

45. To the Ottawa, Waddington and New York Railway and Bridge Company, for a line of railway from Ottawa to Waddington, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 166,400

46. To the New Brunswick and Prince Edward Island Railway Company, for a line of railway from Sackville to the Straits of Northumberland, at or near Cape Tormentine, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 118,400

47. To the Montreal and Sorel Railway Company, for a line of railway from St. Lambert to Sorel, a subsidy not exceeding $1,600 per mile, nor exceeding in the whole 72,000

48. To the Brockville, Westport and Sault Ste. Marie Railway Company, for a line of railway from Brockville to Westport, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole $128,000

49. To the Quebec and Lake St. John Railway Company, for a line of railway from its junction on the North Shore Railway to St. Raymond, upon condition of the company extending their road to a point 50 miles north of St. Raymond, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 96,000

* The extension of the Canadian Pacific Railway from its terminus at St. Martin's Junction, or some other point on the said railway, to the harbour at Quebec.

50. To the Northern and Western Railway Company, for a line of railway from the northern end of the 40 miles subsidized between Fredericton and the Miramichi River by 47 Victoria, chapter 8, to Boiestown, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole $19,200

51. To the Montreal and Champlain Junction Railway Company, for a line of railway from Brosseau's to Dundee, a subsidy no exceeding $500 per mile, nor exceeding in the whole 30,000

52. To the Thunder Bay Colonization Railway Company, for a line of railway from the Murillo station of the Canadian Pacific Railway to the east end of Whitefish Lake, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 92,000

53. To the Central Ontario Railway Company, for a line of railway from Coe Hill or Rathburn, to Bancroft, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 64,000

54. To the Belleville and North Hastings Railway Company, for a line of railway from the village of Madoc to the junction with the Central Ontario Railway at Edorado, a subsidy not exceeding $1,500 per mile, nor exceeding in the whole 10,500

55. For a line of railway from Long Sault to the foot of Lake Temiscamingue, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 25,600

56. For a line of railway from a point on the Canada Southern Railway near Comber, to Lake Erie, at or near the village of Leamington, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole .. 44,800

57. To the Napanee, Tamworth and Quebec Railway Company, for a line of railway from Tamworth towards Bogart and Bridgewater, 16 miles, in lieu of the subsidy granted by 47 Vic., chapter 8, a subsidy of ... 70,000

58. To the Gatineau Railway Company, for a line of railway from Hull station towards Le Désert, a distance of 62 miles, in lieu of the subsidies granted by 46 Vic., chap. 25, and 47 Vic., chap. 8, a subsidy of 320,000

59. For a line of railway from the Grand Piles, on the River St. Maurice, to its junction with Lake St. John Railway, a distance of about 50 miles, in lieu of the subsidy granted by 47 Victoria, chapter 8, for a line of railway from the Grand Piles, on the River St. Maurice, to Lake Edward, a subsidy of 217,600

60. To the Canada Atlantic Railway Company, for a line of railway from Valleyfield to a point one and a-half miles west of Johnston's, a subsidy not exceeding $1,600 per mile, and from one and a-half miles west of Johnston's to Lacolle; also from the present terminus at Ottawa, to the Chaudière Falls, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 96,000

61. For a line of railway from Indiantown *vid* the Miramichi Valley, to its junction with the Northern and Western Railway at or near Boiestown, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 140,800

"The subsidies hereinbefore mentioned as to be granted to companies named for tthat purpose shall be granted to such companies, respectively; the other subsidies shall be granted to such companies as shall be approved by the Governor in Council as having established to his satisfaction their ability to construct and complete the said railways, respectively. All the lines for the construction of which subsidies are granted shall be commenced within two years from the first day of August next, and completed within a reasonable time, not to exceed four years, to be fixed by Order in Council; and shall also be constructed according to descriptions specifications and upon conditions to be approved by the Governor in Council, on the report of the Minister of Railways and

Canals, and specified in an agreement to be made in each case by the company with the Government, and which the Government is hereby empowered to make; the location, also, of every such line of railway shall be subject to the approval of the Governor in Council; and all the said subsidies, respectively, shall be payable out of the Consolidated Revenue Fund of Canada, by instalments, on the completion of each section of the railway of not less than ten miles, proportionate to the value of the portion so completed in comparison with that of the whole work undertaken, to be established by the report of the said Minister.

"Provided always, that the granting of such subsidies to the companies mentioned, respectively, shall be subject to such conditions for securing such running powers or traffiic arrangments and other rights as will afford all reasonable facilities and equal mileage rates to all railways connected with those so subsidized, as the Governor in Council may determine."

By the Act 48-49 Vic., cap. 58 (1885). (*Assented to 20th July*, 1885):—

62. "For a railway from a point on the Intercolonial Railway at Rivière du Loup or Rivière Ouelle, in the Province of Quebec, to Edmundston, in the Province of New Brunswick, a subsidy not exceeding two thousand eight hundred dollars per mile for seventy-five miles, and six thousand dollars per mile for eight miles, nor exceeding in the whole two hundred and fifty-eight thousand dollars; the said subsidy to be in addition to the subsidy authorized to be granted in aid of the construction of the said railway by the Act forty-fifth Victoria, chapter fourteen, and constituting, with the subsidy so authorized, a subsidy not exceeding in the whole four hundred and ninety-eight thousand dollars, and to be granted for the said railway upon the terms and conditions specified in the said Act, and payable out of the Consolidated Revenue Fund of Canada; and for the purpose of incorporating the persons undertaking the construction of the said railway and those who shall be associated with them in the undertaking, the Governor may grant to them, under such corporate name as he shall deem expedient, a charter conferring upon them the franchises, privileges and powers requisite for the said purposes, which shall be similar to such of the franchises, privileges and powers granted to railway companies during the present Session as the Governor shall deem most useful or appropriate the said undertaking; and such charter being published in the *Canada Gazette*, with any Order or Orders in Council relating to it, shall have force and effect as if it were an Act of the Parliament of Canada."

63. "For a line of railway from the south bank of the St. Lawrence river, opposite or near Montreal, to the harbours of St. Andrews, St. John and Halifax, *viâ* Sherbrooke, Moosehead Lake, Mattawamkeag, Harvey, Fredericton and Salisbury, a subsidy not exceeding eighty thousand dollars per annum for twenty years, forming in the whole, together with the subsidy authorized by the Act forty-seventh Victoria, chapter eight, for a line of railway connecting Montreal with the said harbours of St. John and Halifax by the shortest and best practicable route, which the line above described is found to be, a subsidy not exceeding two hundred and fifty thousand dollars per annum, the whole of which shall be paid in aid of the construction of such a line of railway for a period of twenty years, or a guarantee bond of a like sum for a like period as interest on the bonds of the company undertaking the work; the said subsidy to be so granted upon the terms and conditions of and payable out of the Consolidated Revenue Fund in the manner specified in the said last mentioned Act in respect of the subsidy thereby authorized in aid of the said line of railway."

64. "The Governor in Council may grant a further subsidy as an aid towards procuring free access as hereinafter described for the trains and traffic of the Canadian Pacific Railway Company from St. Martin's Junction, near Montreal, or from some other point on their railway to be selected by the said company, to the harbour of Quebec, in such a manner as shall be approved by the Governor in Council, that is to say: an additional subsidy not exceeding three hundred and forty thousand dollars, constituting, together with the subsidy authorized by the said last mentioned Act to aid in procuring the extension of the Canadian Pacific Railway to Quebec, and the subsidy also thereby authorized to aid in constructing a line connecting the Canadian Pacific Railway at the Jacques Cartier Union Junction with the North Shore Railway proper (which subsidies shall be applicable to the said first mentioned purpose) a sum not exceeding in the whole the sum of one million five hundred thousand dollars, payable out of the Consolidated Revenue Fund of Canada."

The said Act further provided as follows in relation to this matter:—

"If it should be expedient so to do in order to facilitate such access, the Governor in Council may acquire the North Shore Railway, and may apply the said sum of one million five hundred thousand dollars, or any part thereof, in aid of such acquisition; and upon such acquisition may transfer and convey or lease the said railway to the Canadian Pacific Railway Company, subject to such obligation as the Government shall have assumed in acquiring it."

By the Act 49 Vic., cap. 10 (1886). (*Assented to 2nd June*, 1886):—

65. For a railway from a point at or near Moncton, to Buctouche, in the Province of New Brunswick, thirty miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole ..... $ 96,000

66. For a railway from Ingersoll *vid* London to Chatham, in the Province of Ontario, eighty miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 256,000

67. To the Northern and Western Railway Company for ten miles of their railway, intervening between the termini of the portions of their railway for which subsidies are already granted, the one from Fredericton and the other from Indiantown, and an extension of two miles down to deep water at Chatham, in the Province of New Brunswick, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 32,000

68. To the Caraquet Railway Company, for ten miles of their railway from the end of the present subsidized portion at Lower Caraquet to Shippegan, in the Province of New Brunswick, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 32,000

69. To the Lake Erie, Essex and Detroit River Railway Company, for thirty-seven miles of their railway, from Windsor to Leamington, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 118,400

70. To the Thunder Bay Colonization Railway Company, for fifty-six miles of their railway, from the end of the present subsidized section to a point near Crooked Lake, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 179,200

71. To the Parry Sound Colonization Railway Company, for forty miles of their railway, from the village of Parry Sound to the village of Sandridge, on the line of the Northern Pacific Junction Railway, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 128,000

72. For a railway from a point at or near New Glasgow or St. Lin, to or near to Montcalm, in the Province of Quebec, eighteen miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 57,600

73. For a railway from Hereford to the International Railway, in the township of Eaton, in the Province of Quebec, thirty-four miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... $108,800

74. For a railway from St. Félix to Lake Maskinongé, Parish of St. Gabriel, in the Province of Quebec, ten miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 32,000

75. For a railway from Glenannan to Wingham, in the Province of Ontario, five miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 16,000

76. For a railway from a point at or near the McCann Station, on the Intercolonial Railway, to the Joggins, on Cumberland Basin, in the Province of Nova Scotia, twelve miles, a subsidy not exceeding $2,200 per mile, nor exceeding in the whole..... 38,400

77. For a railway from L'Assomption to L'Epiphanie, in the Province of Quebec, three miles and a-half, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 11,200

78. To the Montreal and Western Railway Company, for seventy miles of their railway from St. Jérôme, north-westerly towards Désert, in the Province of Quebec, a subsidy of $5,161 per mile, in lieu of the subsidies granted by 46 Victoria, chapter 25, and 47 Victoria, chapter 8, not exceeding in the whole..... 361,270

79. For a railway from St. Andrews to the Canadian Pacific Railway at or at any point east of the Town of Lachute, in the County of Argenteuil, in the Province of Quebec, seven miles, in lieu of the subsidy granted by 47 Victoria, chapter 8, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 22,400

80. To the Canada Atlantic Railway Company, for twelve miles of their railway from Clark's Island to Valleyfield, and from Lacolle, in the Province of Quebec, to the International boundary, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 38,400

81. For a railway from Truro to Newport, in the Province of Nova Scotia, forty-nine miles, a subsidy not exceeding $2,200 per mile, nor exceeding in the whole..... 156,800

82. To the Quebec and Lake St. John Railway Company, for ninety-five miles of their railway, from a point fifty miles north of St. Raymond to Lake St. John, in the Province of Quebec, a subsidy not exceeding $1,961 per mile, nor exceeding in the whole (in addition to the subsidy granted by 45 Victoria, chapter 14, and 46 Victoria, chapter 25, of $3,200 per mile..... 186,295

83. To the Cap Rouge and St. Lawrence Railway Company, for twelve miles of their railway from Lorette *viâ* Cap Rouge to Quebec in the Province of Quebec, a subsidy not exceeding $3,200 per mile nor exceeding in the whole..... 38,400

84. For the construction of wharves and landing stages on the line of the railway from Long Sault to the foot of Lake Temiscamingue, a subsidy of..... 6,000

85. To the Gananoque, Perth and James' Bay Railway Company, seventeen miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 54,400

86. For a railway from St. Eustache to St. Placide, County of Two Mountain, eighteen miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 57,600

87. For a railway from a point on the Intercolonial Railway through the Stewiacke Valley, on the line which will afford facilities of communication with the Iron Mines, Spring Side, Upper Stewiake, and Musquodoboit settlements, twenty-five miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 80,000

88. For a railway from Yamaska to the River St. Francis, in the Province of Quebec, ten miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole $32,000

89. For a railway from Perth Centre station, on the New Brunswick Railway, to a point near Plaister Rock Island, in the Province of New Brunswick, twenty-eight miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 89,600

90. For a railway from Fredericton to the village of Prince William, in the Province of New Brunswick, twenty-two miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 70,400

91. For a railway from a point on the Intercolonial Railway near Newcastle or *viâ* Douglastown to a point on the River Miramichi, opposite the Town of Chatham, in the Province of New Brunswick, six miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole .. 19,200

92. For a railway from a point on the Canadian Pacific Railway to Eganville, in the Province of Ontario, twenty-two miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 70,400

93. To the Belleville and North Hastings Railway Company, for seven miles of their railway, from the village of Madoc to the junction with the Central Ontario Railway at Eldorado, in the Province of Ontario, a subsidy (in addition to the subsidy of $1,500 per mile granted by 48-49 Victoria, chapter 59), not exceeding $1,700 per mile, nor exceeding in the whole 11,900

94. To the Napanee, Tamworth and Quebec Railway Company, for eighteen miles of their railway from Tamworth to Tweed, in lieu of the subsidy granted by 48-49 Victoria, chapter 59, a subsidy of 70,000

95. To the Albert Railway Company, for their railway from Salisbury to Hopewell, in the Province of New Brunswick, which is a feeder to the Intercolonial Railway, in the form of a loan, repayable at such time and secured in such manner as the Governor in Council determines, a subsidy of 15,000

"The subsidies hereinbefore mentioned as to be granted to the companies named for that purpose shall be granted to such companies, respectively; the other subsidies shall be granted to such companies as shall be approved by the Governor in Council as having established to his satisfaction their ability to construct and complete the said railways respectively. All the lines for the construction of which subsidies are granted shall be commenced within two years from the first day of August next, and completed within a reasonable time, not to exceed four years, to be fixed by Order in Council, and shall be so constructed according to descriptions and specifications and upon conditions to be approved by the Governor in Council, on the report of the Minister of Railways and Canals, and specified in the agreement to be made in each case by the company with the Government, and which the Government is hereby empowered to make; the location, also, of every such line of railway shall be subject to the approval of the Governor in Council, and all the said subsidies, respectively, shall be payable out of the Consolidated Revenue Fund of Canada, by instalments on the completion of each section of the railway of not less than ten miles, proportionate to the value of the portion so completed in comparison with that of the whole work undertaken, to be established by the report of the said Minister: Provided always, that the granting of such subsidies to the companies mentioned, respectively, shall be subject to such conditions for securing such running powers or traffic arrangements, and other rights, as will afford all reasonable facilities and equal mileage rates to all railways connecting with those so subsidized, as the Governor in Council may determine."

By Section 2 of this Act authority was given for the grant of a charter by the Governor in Council for the purpose of constructing a railway from Long Sault to the foot of Lake Temiscamingue.

By the Act 50-51 Vic., cap. 24 (1887.) *(Assented to 23rd June, 1887)* :—

96. To the St. Catharines and Niagara Railway Company, for twelve miles of their railway from the City of St. Catharines to the bridge over the Niagara River, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole ..... $ 38,400

97. To the Vaudreuil and Prescott Railway Company, for thirty miles of their railway from Vaudreuil towards Hawkesbury, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 96,000

98. To the Richmond Hill Junction Railway Company, for five miles of their railway from Richmond Hill junction, on the Northern Railway of Canada, to Richmond Hill village, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 16,000

99. To the Drummond County Railway Company, for thirty miles of their railway from Drummondville towards Nicolet, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 96,000

100. To the Joggins Railway Company, for one and a quarter miles of their railway extending from the southern end of the portion subsidized by the Act forty-ninth Victoria, chapter ten, to the wharves, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 4,000

101. To the Moncton and Buctouche Railway Company, for two miles of their railway from the west end of the portion subsidized by the Act forty-ninth Victoria, chapter ten, to Moncton, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 6,400

102. To the Beauharnois Junction Railway Company, for thirty miles of their railway from St. Martin's towards St. Anicet, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 96,000

103. To the Harvey Branch Railway Company, for three miles of their railway from the southern terminus of the Albert Railway to Harvey Bank, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 9,600

104. To the Brantford, Waterloo and Lake Erie Railway Company, for eighteen miles of their railway from the town of Brantford to the Village of Hagarsville or the village of Waterford, or some intermediate point on the Canada Southern Railway, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 57,600

105. To the Guelph Junction Railway Company, for sixteen miles of their railway from its junction with the Canadian Pacific Railway to the Town of Guelph, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 51,200

106. To the Massawippi Railway Company, for ten miles of their railway from a point on the Atlantic and North Western Railway, near the village of Magog, to Ayer's Flat station, on the Massawippi Valley Railway, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 32,000

107. To the Napanee, Tamworth and Quebec Railway Company, for four miles of their railway from the north end of the section subsidized by the Act passed in the session held in the forty-eighth and forty-ninth years of Her Majesty's reign, chapter fifty-nine, to Tweed, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole... 12,800

108. To the Dominion Lime Company, for seven miles of their railway from a point on the Quebec Central Railway, in the township of Dudswell, to the Dudswell Lime Company's quarries, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 22,400

109. To the South Norfolk Railway Company, for seventeen miles of their railway from Port Rowan to the town of Simcoe, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 54,400

110. To the Jacques Cartier Union Railway Company, extending and completing their railway, a subsidy of $20,000

111. For a line of railway from Mount Forest to Walkerton, twenty-four miles in length, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 76,800

112. To the Oshawa Railway and Navigation Company, for seven miles of their railway from Port Oshawa towards Rglan, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 22,400

113. To the Saguenay and Lake St. John Railway Company, for thirty miles of their railway from Lake St. John, towards Chicoutimi, or from Chicoutimi towards Lake St. John, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 96,000

114. To the Great Eastern Railway Company, for thirty miles of their railway from the River St. Francis to the Arthabaska Railway, at St. Grégoire station, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 96,000

115. To the Ontario and Pacific Railway Company, for six miles of their railway from the northern end of the portion subsidized by the Act forty-seventh Victoria, chapter eight, to the town of Perth, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 19,200

116. To the Caraquet Railway Company, for seven miles of their railway from Lower Caraquet to Shippegan, in lieu of the subsidy granted by the Act forty-ninth Victoria, chapter ten, a subsidy not exceeding in the whole 32,000

117. To the St. Lawrence and Lower Laurentian and Saguenay Railway Company, for the section of this railway from Grand Piles, on the St. Maurice River, to its junction with the Quebec and Lake St. John Railway, in lieu of the subsidy granted by the Act passed in the session held in the forty-eighth and forty-ninth years of Her Majesty's reign, chapter fifty-nine, for a line of railway from Grand Piles, on the St. Maurice River, to its junction with the Lake St. John Railway, a distance of about fifty miles, a subsidy of 217,600

118. To the St. John Valley and River du Loup Railway Company, for twenty-two miles of their railway from the village of Prince William towards the town of Woodstock, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 70,400

119. To the Lake Temiscamingue Railway Company, for four short sections of railway, in all about two miles in length, to overcome the rapids of the Ottawa River, known as "La Mi-Charge," "La Cave," "Les Erables," and "La Montagne," and for the construction of wharves and landing stages at these rapids, to connect the Canadian Pacific Railway at Mattawa with Lake Temiscamingue by steamboats, railways and other works (in lieu of a portion two miles in length, out of the eight miles of railway subsidized by the Act passed in the session held in the forty-eighth and forty-ninth years of Her Majesty's reign, chapter fifty-nine, under which about six miles of railway have already been built from the foot of Long Sault proper to the foot of Lake Temiscamingue, and in lieu also of the subsidy granted by the Act forty-ninth Victoria, chapter ten), a subsidy of... 12,400

120. To the Carillon and Grenville Railway Company, for twelve miles of their railway from St. Eustache to Sault-au-Récollet, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 38,400

121. To the Minudie Branch Railway Company, for five and a-half miles of their railway from its junction with the Joggins Railway, near the River Hébert railway bridge, to the village of Minudie, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 17,600

122. To the Lake Témiscamingue Colonization and Railway Company, for ten and a-half miles of their railway from the Long Sault to Lake Kippewa, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole $33,600

123. To the Leamington and St. Clair Railway Company, for two miles of their railway from the north end of the section subsidized by the Act passed in the session held in the forty-eighth and forty-ninth years of Her Majesty's reign, chapter fifty-nine, to the village of Comber, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole: . 6,400

124. To the Cumberland Railway and Coal Company, for fourteen miles of their railway from a point on the Spring Hill and Parrsboro' Railway, near Spring Hill, to a point on the railway between Oxford and New Glasgow, near Oxford village, a subsidy nor exceeding $3,200 per mile, nor exceeding in the whole 44,800

125. To the Montreal and Champlain Junction Railway Company, a subsidy of 64,000

126. To the Quebec and Lake St. John Railway Company, for nine miles of their railway, the distance which the previous subsidies granted are short of covering from the City of Quebec to Lake St. John, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 28,800

127. To the Temiscouata Railway Company, for thirty miles of a branch of their railway from Edmundston towards the St. Francis River, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 96,000

128. To the Cornwallis Valley Railway Company, for thirteen miles of their railway from Kentville to Kingsport, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 41,600

129. To the Nova Scotia Central Railway Company, for thirty-four miles of their railway, a subsidy not exceeding $3,200 per mile, not exceeding in the whole 108,800

130. To the Tobique Valley Railway Company, for fourteen miles of their railway from Perth Centre station towards Plaister Rock Island, in lieu of the subsidy granted by the Act forty-ninth Victoria, chapter ten, for a railway from Perth Centre station, on the New Brunswick Railway, to a point near Plaister Rock Island, a subsidy of 89,600

131. For a railway from Woodstock towards Centreville, twenty miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 64,000

132. For a railway bridge over the St. Lawrence River, at Coteau Landing, on the line of the Canada Atlantic Railway, a subsidy of fifteen per cent on the value of the structure, not to exceed 180,000

133. To the Lake Erie, Essex and Detroit River Railway Company, for twenty-seven miles of their railway, in lieu of the subsidy granted by the Act forty-ninth Victoria, chapter ten, a subsidy not exceeding 118,400

"For the purpose of granting corporate powers to persons or companies undertaking the construction of railways or parts of railways, mentioned in the next preceding section, for the construction of which no corporate powers exist at the time of the passing of this Act, the Governor in Council may grant to them, under such corporate name as he shall deem expedient, a charter conferring upon them the franchises, privileges and powers requisite for the said purposes, as the Governor in Council shall deem most useful or appropriate to the said undertaking; and such charter being published in the *Canada Gazette*, with any Order or Orders in Council relating to it, shall have force and effect as if it were an Act of the Parliament of Canada.

"The subsidies hereinbefore mentioned as to be granted to companies named for that purpose shall be granted to such companies respectively; the other subsidies, including subsidies granted for railways over a line extending beyond a point to which any company hereinbefore mentioned by name is authorized to construct their railway, shall

be granted to such companies as shall be approved by the Governor in Council as having established to his satisfaction their ability to construct and complete the said railways respectively; all the lines for the construction of which subsidies are granted shall be commenced within two years from the first day of August next, and completed within a reasonable time, not to exceed four years, to be fixed by Order in Council; and shall also be constructed according to descriptions and specifications and upon conditions to be approved by the Governor in Council, on the report of the Minister of Railways and Canals, and specified in an agreement to be made in each case by the company with the Government, and which the Governmant is hereby empowered to make; the location, also, of every such line of railway shall be subject to the approval of the Governor in Council; and all the said subsidies respectively shall be payable out of the Consolidated Revenue Fund of Canada, by instalments, on the completion of each section of the railway of not less than ten miles, proportionate to the value of the portion so completed in comparison with that of the whole work undertaken, to be established by the report of the said Minister, or upon completion of the work subsidized, except as regards the subsidy for the bridge over the St. Lawrence River, upon which shall be paid fifteen per cent of the value of work done on monthly progress estimates, certified by the Chief Engineer, and upon the approval of the Minister of Railways and Canals.

The granting of such subsidies to the companies mentioned, respectively, shall be subject to such conditions for securing such running powers or traffic arrangements and other rights as will afford all reasonable facilities and equal mileage rates to all railways connecting with those so subsidized, as the Governor in Council determines.

Notwithstanning anything contained in the Act forty-fifth Victoria, chapter fourteen, or in the Act forty-sixth Victoria, chapter twenty-five, the balances of the sums granted for a railway from St. Raymond to Lake St. John and to the Quebec and Lake St. John Railway Company by the said Acts respectively, which have not yet been paid by the Government, may be paid at any time within one year from the passing of this Act, subject to the conditions in the said Act contained.

By the Act 51 Vic., cap. 3 (1888). (*Assented to 22nd May*, 1888) :—

134. To the Ottawa and Parry Sound Railway Company, for 22 miles of their railway from a point on the Canadian Pacific Railway to Eganville, in lieu of the subsidy granted by 49 Victoria, chapter 10, for a railway from a point on the Canadian Pacific Railway to Eganville, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... $70,400 00

135. To the Nova Scotia Central Railway Company, for 46 miles of their railway, in the Province of Nova Scotia, a subsidy not exceeding 3,200 per mile, nor exceeding in the whole..... 147,200 00

136. To the Montreal and Champlain Junction Railway Company, for 3 miles of their railway from the end of the present subsidized section, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 9,600 00

137. To the Massawippi Junction Railway Company, for their railway from a point on the Atlantic and North-West Railway, near the village of Magog, to Ayer's Flat station, on the Massawippi Valley Railway, in lieu of the subsidy granted by 50-51 Victoria, chapter 24, a subsidy of..... 32,000 00

138. To the Pontiac Pacific Junction Railway Company, for bridging the several channels of the Ottawa River at Culbute and west thereof, a subsidy of $31,500, to be paid out monthly as the work progresses, upon the certificate of the Chief Engineer of Government Railways, in the proportion which the value of the work executed bears to the value of the whole work undertaken, and for three miles of their railway extending from a point three miles east of Pembroke to Pembroke, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding

in the whole $9,600, provided that the entire work subsidized upon this railway shall be completed within four years from the passing of this Act, the subsidy granted by this Act not to exceed in the whole $41,100 00

139. To the Port Arthur, Duluth and Western Railway Company, for 84¾ miles of their railway from Port Arthur towards Gun Flint Lake, in lieu of the subsidies granted by 48-49 Victoria, chapter 59, and 49 Victoria, chapter 10, for the construction of a railway from Murillo Station to Crooked Lake, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 271,200 00

140. To the Quebec and Lake St. John Railway Company, for 30 miles of their railway from Lake St. John towards Chicoutimi, or from Chicoutimi towards Lake St. John, being a transfer made at the request of the Saguenay and Lake St. John Railway Company of the subsidy granted to them by 50-51 Victoria, chapter 24, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 96,000 00

141. To the Temiscouata Railway Company, for 20 miles of their branch railway from Edmundston towards the St. Francis River, in the Province of Quebec, in lieu of the subsidy granted by 50–51 Victoria, chapter 24, a subsidy of 100,000 00

142. To the Quebec Central Railway Company, for the construction and completion of a line of railway from Saint Francis Station to a point on the Atlantic and North-West Railway near Moose River, 90 miles, in lieu of the balance of the subsidy, unearned, granted by 47 Victoria, chapter 8, a subsidy not exceeding $21,191.54 per annum for twenty years, or a guarantee of a like sum for a like period as interest on the bonds of the company, such annual subsidy for twenty years representing a grant in cash of 288,000 00

143. To the Central Railway Company of New Brunswick, a grant as subsidy (the road to be first laid with new steel rails weighing not less than 56 pounds per lineal yard, and after an Order in Council has been passed authorizing their transfer to the company) of 4,052 tons of used iron rails and fastenings loaned to the St. Martin's and Upham Railway Company, now forming part of the Central Railway, which rails and fastenings stand in the Public Accounts as an asset of 83,612 54

144. To the Elgin, Petitcodiac and Havelock Railway Company of New Brunswick, a grant as subsidy (the road to be first laid with new steel rails weighing not less than 56 pounds per lineal yard, and after an Order in Council has been passed authorizing their transfer to the company) of 2,201 tons of used iron rails and fastenings loaned to the Elgin Branch Railway, now forming part of the Elgin, Peticodiac and Havelock Railway, which rails and fastenings stand in the Public Accounts as an asset for 44,252 82

145. To the Kent Northern Railway Company of New Brunswick, a grant as subsidy (the road to be first laid with new steel rails weighing not less than 56 pounds per lineal yard, and after an Order in Council has been passed authorizing their transfer to the company) of 2,549 tons of used iron rails and fastenings loaned to the company, which rails and fastenings stand in the Public Accounts as an asset for 58,334 27

146. To the Halifax Cotton Company of Nova Scotia, a grant as subsidy (the road to be first laid with new steel rails weighing not less than 56 pounds per lineal yard, and after an Order in Council

has been passed authorizing their transfer to the company) of 233 tons of used iron rails and fastenings loaned to the company, which rails and fastenings stand in the Public Accounts as an asset for..... $4,335 00

147. To the Steel Company of Canada, in Nova Scotia, a grant as subsidy (the road to be first laid with new steel rails weighing not less than 56 pounds per lineal yard, and after an Order in Council has been passed authorizing their transfer to the company) of 597 tons of used iron rails and fastenings loaned to the company, which rails and fastenings stand in the Public Accounts as an asset for..... 11,964 66

148. To the Albert Railway Company of New Brunswick, a grant as subsidy (the section of road to be first laid with new steel rails weighing not less than 56 pounds per lineal yard, and after an Order in Council has been passed authorizing their transfer to the Company) of 726 tons of used iron rails and fastenings loaned to the company, which rails and fastenings stand in the Public Accounts as an asset for..... 14,665 45

149. To the Chatham Branch Railway of New Brunswick, a grant as subsidy (the road to be first laid with new steel rails weighing not less than 56 pounds per lineal yard, and after an Order in Council has been passed authorizing their transfer to the company) of 958 tons of used iron rails and fastenings loaned to the company, which rails and fastenings stand in the Public Accounts as an asset for..... 24,439 84

All the lines, for the construction of which subsidies are granted, shall be commenced within two years from the first day of August next, and completed within a reasonable time, not to exceed four years, to be fixed by Order in Council, and shall also be constructed according to descriptions and specifications, and upon conditions to be approved by the Governor in Council, on the report of the Minister of Railways and Canals, and specified in an agreement to be made in each case by the company with the Government, and which the Government is hereby empowered to make; the location also of every such line of railway shall be subject to the approval of the Governor in Council; and also the said subsidies respectively, payable in cash, shall be payable out of the Consolidated Revenue Fund of Canada by instalments, on the completion to the satisfaction of the Minister of Railways and Canals of each section of the railway of not less than 10 miles, proportionate to the value of the portion so completed in comparison with that of the whole work undertaken, to be established by the report of the said Minister, or upon completion of the work subsidized.

By the Act 52 Vic., cap. 3 (1889). (*Assented to 2nd May*, 1889):—

150. To the Ontario and Pacific Railway Company, for a line of railway from Cornwall to Ottawa, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 172,400 00

151. To the Ottawa and Gatineau Railway Company, for a line of railway from Hull station towards Le Désert, a distance of 62 miles, a subsidy not exceeding in the whole..... 320,000 00

152. To the Cap Rouge and St. Lawrence Railway Company, for twelve miles of their railway, from Lorette *vid* Cap Rouge to Quebec, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 38,400 00

153. To the Parry Sound Colonization Railway Company, for forty miles of their railway, from the village of Parry Sound to the village of Sundridge, or some other point on the line of the Northern and Pacific Junction Railway, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 128,000 00

154. For a railway from St. Andrew's to the Canadian Pacific Railway, at or at any point east of the town of Lachute, in the County of Argenteuil, in the Province of Quebec, seven miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... $22,400 00

155. For a railway from Truro, or a point between Truro and Stewiacke, to Newport or to Windsor, in the Province of Nova Scotia, forty-nine miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 156,800 00

156. For a line of the Central Railway from the head of Grand Lake to the Intercolonial Railway, in the Province of New Brunswick, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 128,000 00

157. To the Albert Southern Railway Company, the balance remaining unpaid of the subsidy granted by the Act 47th Victoria, chapter 8, not exceeding in the whole..... 31,771 43

158. To the Baie des Chaleurs Railway Company, the balance remaining unpaid of the subsidy mentioned in the Act 49th Victoria, chapter 17, not exceeding in the whole..... 244,500 00

159. To the Irondale, Bancroft and Ottawa Railway Company, for a line of railway from the Victoria Branch of the Midland Railway to the village of Bancroft, in the County of Hastings, the balance remaining unpaid of the subsidy granted by the Act 47th Victoria, chapter 8, not exceeding in the whole..... 145,000 00

160. To the Northern and Pacific Junction Railway Company, for a railway from Gravenhurst to Callander, the balance remaining unpaid of the subsidies granted by the Acts 45th Victoria, chapter 14, and 46th Victoria, chapter 25, not exceeding in the whole..... 35,000 00

161. For a railway from some point on the Joggins Railway, near the Hébert River, to Young's Mills, in the Province of Nova Scotia, a distance of five miles, a subsidy not exceeding $3,200 per mile, and not exceeding in the whole..... 16,000 00

162. To the St. Clair Frontier Tunnel Company, for the construction of a tunnel under the St. Clair River, from a point at or near Sarnia, to a point at or near Port Huron, a subsidy not exceeding the whole..... 375,000 00

163. To the Pontiac and Renfrew Railway Company, for six miles of their railway from the north bank of the Ottawa River, opposite Braeside, or from Bristol Iron Mines, to the Pontiac Pacific Junction Railway, near the Quion River, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, and not exceeding in the whole..... 19,200 00

164. To the Quebec, Montmorency and Charlevoix Railway Company, for thirty miles of their railway, from the east bank of the St. Charles River, to or near to Cap Tourmente, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, and not exceeding in the whole..... 96,000 00

165. To the Fredericton and St. Mary's Bridge Company, for a bridge over the St. John River, at Fredericton, in the Province of New Brunswick, a subsidy not exceeding in the whole..... 30,000 00

166. To the Napanee, Tamworth and Quebec Railway Company, for seven miles of their railway, from a point at or near Yarker to a point at or near Harrowsmith, and to a company for three miles of railway from a point at or near Harrowsmith to a point at or near Sydenham, a subsidy not exceeding $3,200 per mile, and not exceeding in the whole..... 32,000 00

167. For a railway from a point near Sicamous, on the Canadian Pacific Railway, to a point on Lake Okanagan for fifty-one miles of such railway, a subsidy not exceeding $3,200 per mile, and not exceeding in the whole $163,200 00

168. To the Cornwallis Valley Railway Company, for one mile of their railway, from the end of the line subsidized by the Act 50–51 Victoria, chapter 24, to Kingsport. in the Province of Nova Scotia, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 3,200 00

169. To the Lake Témiscamingue Colonization and Railway Company, for fifteen miles of their railway, from Mattawa station on the Canadian Pacific Railway, towards the Long Sault, or from the Long Sault towards the said Mattawa station, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 48,000 00

170. To the Maskinongé and Nipissing Railway Company, for fifteen miles of their railway, from a point on the Canadian Pacific Railway at or near Maskinongé or Louiseville, towards the Parish of St. Michel des Saints, on the River Mattawin, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 48,000 00

171. To the Kingston, Smith's Falls and Ottawa Railway Company, for twenty miles of their railway, from the city of Kingston towards Smith's Falls, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 64,000 00

172. To the South Ontario Pacific Railway Company, for forty-nine and one-half miles of their railway, from Woodstock to Hamilton, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 158,400 00

173. For a railway from St. Césaire to St. Paul d'Abbotsford, in the Province of Quebec, five miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 16,000 00

174. To the Great Eastern Railway Company, for twenty miles of their railway, from the east end of the line subsidized by the Act 50–51 Victoria, chapter 24, at St. Grégoire, towards the Chaudière Junction station on the Intercolonial Railway, in the Province of Quebec, a subsidy not exceeding $3,200 per annum, nor exceeding in the whole 64,000 00

175. To the Drummond County Railway Company for four and one-half miles of their railway, from the end of the line subsidized by the Act 50–51 Victoria. chapter 24, to Ball's Wharf, on the St. Lawrence River, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 14,400 00

176. To the St. Catharines and Niagara Central Railway Company, for twenty miles of their railway, from the end of the line subsidized by the Act 50–51 Victoria, chapter 24, at St. Catharines, towards the city of Hamilton, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 64,000 00

177. To the Quebec and Lake St. John Railway Company, for twenty miles of their railway, from the end of the section of thirty miles from Lake St. John towards Chicoutimi, subsidized by the Act 51 Victoria, chapter 3, towards Chicoutimi, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 64,000 00

178. To the Grand Trunk, Georgian Bay and Lake Erie Railway Company, for fifteen miles of their railway, from the village of Tara or some point between Tara and Hepworth, to the Town of Owen Sound, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... $48,000 00

179. To the Hereford Railway Company, for fifteen miles of their railway, from Cookshire to a junction with the Quebec Central Railway at Dudswell, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 48,000 00

180. To the Massawippi Junction Railway Company, for fifteen miles of their railway, from Ayer's Flat to Coaticook, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 48,000 00

181. To the Brockville, Westport and Sault St. Marie Railway Company, for twenty miles of their railway, from a point at or near Newboro', towards Palmer's Rapids, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 64,000 00

182. To the Thousand Islands Railway Company, for four miles of their railway, from a point near the St. Lawrence River, in Gananoque village, to Gananoque Junction of the Grand Trunk Railway, and for thirteen miles of their railway, from Gananoque Junction of the Grand Trunk Railway to a junction with the Brockville, Westport and Sault Ste. Marie Railway, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 54,400 00

183. For a railway from Cape Tourmente towards Murray Bay, twenty miles, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 64,000 00

184. To the Amherstburg, Lake Shore and Blenheim Railway Company, for twenty miles of their railway, in the Province of Ontario, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 64,000 00

So much of the subsidy of three thousand two hundred dollars per mile, which under the provisions of the Act forty-ninth Victoria, chapter seventeen, and of this Act, may be paid to the Baie des Chaleurs Railway Company in respect of the thirty miles of their railway, from the seventieth to the hundredth mile, eastward from Metapediac, shall be applicable to the section of the said railway, comprised between the fortieth and the seventieth mile thereof, eastward from Metapediac, instead of to the said first mentioned section of thirty miles, making six thousand four hundred dollars per mile applicable to the secondly mentioned section of thirty miles; but the foregoing provision shall be subject to the condition that the said company undertake to complete the thirty miles of their railway from the seventieth to the hundredth mile eastward from Metapediac within a reasonable time, not to exceed four years, to be fixed by Order in Council, and without any further subsidy from the Government of Canada, and that they deposit with the Minister of Railways and Canals, as security to the Crown that they will well and truly carry out their undertaking, their bonds to the amount of two hundred thousand dollars.

The subsidies hereinbefore mentioned as to be granted to companies named for that purpose, shall be granted to such companies respectively; all the lines for the construction of which subsidies are granted, unless they are already commenced, shall be commenced within two years from the first day of August next, and completed within a reasonable time, not to exceed four years, to be fixed by Order in Council, and shall also be constructed according to descriptions and specifications and upon conditions to be approved by the Governor in Council, on the report of the Minister of Railways and Canals, and specified in an agreement to be made in each case by the company with the

Government, and which the Government is hereby empowered to make; the location, also, of every such line of railway shall be subject to the approval of the Governor in Council; and all the said subsidies, respectively, shall be payable out of the Consolidated Revenue Fund of Canada, by instalments, on the completion of each section of the railway of not less than ten miles, proportionate to the value of the portion so completed in comparison with that of the whole work undertaken, to be established by the report of the said Minister, or upon the completion of the work subsidized, except as respects the tunnel under the St. Clair River, in which case there shall be paid fifteen per cent of the value of work done on monthly progress estimates, certified by the Chief Engineer, and upon the approval of the Minister of Railways and Canals.

The granting of such subsidies, respectively, shall be subject to such conditions for securing such running powers or traffic arrangements and other rights, as will afford all reasonable facilities and equal mileage rates to all railways connecting with those so subsidized, as the Governor in Council determines.

And for the removal of doubts it is hereby declared and enacted that the provision in the Act passed in the fifty-first year of Her Majesty's reign, and chaptered three, relating to the Pontiac Pacific Junction Railway Company, extended and extends the several subsidies in aid of the said company for four years from the passing of the said Act, that is to say, from the twenty-second day of May, one thousand eight hundred and eighty-eight.

By the Special Act, 52 Vic., cap. 5, 1889. *Assented to 2nd May,* 1889):—

185. "In order to enable the Qu'Appelle, Long Lake and Saskatchewan Railroad and Steamboat Company to complete their railway from Regina to some point on the South Saskatchewan River at or near Saskatoon, and thence northward to Prince Albert, the Governor in Council may enter into a contract with such company for the transport of men, supplies, materials and mails, for twenty years, and may pay for such services during the said term, eighty thousand dollars per annum in manner following, that is to say:—the sum of fifty thousand dollars to be paid annually on the construction of the railway to a point at or near Saskatoon, such payment to be computed from the date of the completion of the railway to such point; and the remaining thirty thousand dollars annually on the extension of the railway to Prince Albert, such payment to be computed from the date of such last mentioned completion: Provided that if the second portion of the said railway is not built and operated to Prince Albert within two years after the completion of the railway to the South Saskatchewan as aforesaid, the payment of fifty thousand dollars shall cease until the whole railway is finished to Prince Albert."

By the Act 53 Vic., cap. 2 (1890). (*Assented to 16th May,* 1890):—

186. To the Montreal and Ottawa Railway Company, for 30 miles of their railway, from the western end of the 30 miles subsidized by the Act 50-51 Victoria, chapter 24, towards Ottawa, a subsidy not exceeding $3,200 per mile, and not exceeding in the whole. $96,000

187. To the Waterloo Junction Railway Company, for 11 miles of their railway, from Waterloo to Elmira, a subsidy not exceeding $3,200 per mile, and not exceeding in the whole..... 35,200

188. To the Northern and Pacific Junction Railway Company, for a railway from Gravenhurst to Callendar, the balance remaining unpaid of the subsidies granted by the Acts 45 Victoria, chapter 14, and 46 Victoria, chapter 25, not exceeding in the whole.... 600

189. For a railway from Woodstock *vid* London to Chatham, in the Province of Ontario, 80 miles, in lieu of the subsidy granted by the Act 49 Victoria, chapter 10, for a railway from Ingersoll

viâ London to Chatham, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	$256,000
190. To the St. Catharines and Niagara Railway Company, for 14 miles of their railway, from the end of the 20 miles subsidized by the Act 52 Victoria, chapter 3, to Hamilton, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	44,800
191. To a railway from Ottawa to Morrisburg, 52 miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	166,400
192. To the Erie and Huron Railway Company, for 22 miles of their railway from Petrolea *viâ* Oil Springs to Dresden, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	70,400
193. To the Brockville, Westport and Sault Ste. Marie Railway Company, for a railway from Brockville to Westport, the balance remaining unpaid of the subsidy granted by the Act 48-49 Victoria, chapter 59, not exceeding in the whole	83,000
194. To the Manitoulin and North Shore Railway Company, for 30 miles of their railway from Little Current to the Algoma Branch of the Canadian Pacific Railway, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	96,000
195. To the Port Arthur, Duluth and Western Railway Company, for 5 miles of their railway, being a branch from the main line of railway to the Kakabeka Falls, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	16,000
196. To the Lake Erie and Detroit River Railway Company, for 50 miles of their railway, on a line to be fixed by the Governor in Council, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	160,000
197. To the Lindsay, Bobcaygeon and Pontypool Railway Company, for 16 miles of their railway, from Bobcaygeon to the Midland Railway, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	51,200
198. To the Kingston, Smith's Falls and Ottawa Railway Company, for 36 miles of their railway, from the north-east end of the 20 miles subsidized by the Act 52 Victoria, chapter 3, to Smith's Falls, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	115,200
199. To the Ottawa and Parry Sound Railway Company, for 30 miles of their railway, from Eganville to Barry's Bay, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	96,000
200. To the Belleville and Lake Nippissing Railway Company, for 30 miles of their railway, from Belleville to Tweed and thence to Bridgewater, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	96,000
201. To the Cobourg, Northumberland and Pacific Railway Company, for 30 miles of their railway, from Cobourg to the Ontario and Quebec Railway, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	96,000
202. To the St. Stephen and Milltown Railway Company, for 3½ miles of their railway, from the town of St. Stephen to the town of Milltown, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	11,200
203. To the Woodstock and Centreville Railway Company, for 6 miles of their railway, from the western end of the 20 miles subsidized by the Act 50-51 Vic., chap. 24, to the International boundary between the Province of New Brunswick and the State of Maine, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole	19,200

204. For a railway from a point at or near Fredericton, *vid* Oromocto and Gagetown, to a point on the New Brunswick Railway west of Westfield station, for 30 miles thereof, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole $96,000

205. To the Central Railway Company of New Brunswick, for 4½ miles of their railway, the distance which the previous subsidy granted is short of covering, from the head of Grand Lake to the Intercolonial Railway, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 14,400

206. To the Montreal and Western Railway Company, for 70 miles of their railway, from St. Jérôme, north-westerly towards Désert, in the Province of Quebec, in lieu of the subsidy granted by the Act 49 Vic., chap. 10, a subsidy not exceeding $5,161 per mile, nor exceeding in the whole 361,270

Provided, that the subsidy hereby granted to the Montreal and Western Railway Company may be paid by instalments on the completion of each section of the railway as follows, that is to say:—

SECTIONS.	Approximate length in miles.
St. Jérôme to Shawbridge	8
Shawbridge to St. Sauveur	4
St. Sauveur to Ste. Adèle	6
Ste. Adèle to Lac à la Fourche	6
Lac à la Fourche to Ste. Agathe	6½
Ste. Agathe to St. Faustin	14
St. Faustin to St. Jovite	7½
St. Jovite to Summit Lake	8
Summit Fakotola Chute aux Iroquois	7
La Chute aux Iroquois towards Désert	3

Such instalments to be proportionate to the value of the portion so completed in comparison with that of the whole work undertaken, to be established as aforesaid.

207. For 75 miles of the railway from Shelburne, in the County of Shelburne, and from Liverpool, in the County of Queen's, towards Annapolis, in the Province of Nova Scotia, to be so contracted for as to secure the construction to both Shelburne and Liverpool, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole ..... $ 240,000

208. To the Inverness and Richmond Railway Company for 50 miles of their railway from Port Hawkesbury to Broadcove, a subsidy not exceeding $1,000 per mile, nor exceeding in the whole..... 50,000

209. To the International Railway Company, for a railway from Sherbrooke to the International boundary, the balance remaining unpaid of the subsidy granted by the Act 46 Vic., ch. 25, not exceeding in the whole 3,840

210. For completing the Montreal and Sorel Railway from St. Lambert to Sorel 40,000

211. To the Pontiac Pacific Junction Railway Company, for 7½ miles of their railway, from Hull to Aylmer, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 24,000

212. To the Montreal and Lake Maskinongé Railway Company, for 3¼ miles of their railway, the distance which the subsidy granted by the Act 49 Vic., ch. 10, is short of covering from St. Félix to Lake Maskinongé, in the Parish of St. Gabriel, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 10,200

213. To the Great Eastern Railway Company, for a bridge over the Nicolet River, and also a bridge on the St. Francis River, a

subsidy of 15 per cent. on the value of the structures, not to exceed..... $37,500

214. To the Drummond County Railway Company, for 24 miles of their railway, from Drummondville to Ste. Rosalie, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 76,800

215. To the Great Northern Railway Company, for 15 miles of their railway, from, at or near Montcalm to the Canadian Pacific Railway, between Joliette and St. Félix de Valois, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 48,000

216. To the Lake Temiscamingue Colonization Railway Company, for 20 miles of their railway, from the northern end of the 15 miles subsidized by the Act 52 Victoria, chapter 3, to the Long Sault, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 64,000

217. To the Maskinongé and Nipissing Railway Company, for 15 miles of their railway, from the northern end of the 15 miles subsidized by the Act 52 Victoria, chapter 3, towards the parish of St. Michel des Saints, on the River Mattawa, in the Province of Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 48,000

218. To the St. Lawrence and Adirondack Railway Company, for 18 miles of their railway, from Valleyfield to Huntingdon, on the Montreal and Champlain Junction Railway, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 57,600

219. To the Quebec Central Railway Company, for 90 miles of their railway, from St. Francis Station, on the Quebec Central Railway, to a point on the Atlantic and North-Western Railway, near Moose River, or from a point on the Quebec Central Railway between the Chaudiere River and Tring Station, to a point on the International Railway at or near Lake Megantic, in lieu of the subsidy granted by the Act 51 Victoria, chapter 3, a subsidy not exceeding $21,191.54 per annum for twenty years, or a guarantee of a like sum for a like period, as interest on the bonds of the company, such annual subsidy for twenty years representing a grant in cash of..... 288,000

220. To the Quebec and Lake St. John Railway Company, for a railway bridge over the St. Charles River, to give access to the city of Quebec, a subsidy not to exceed in the whole $30,000; also for 12 miles of their railway from Lorette *via* Charlesbourg to Quebec, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole $38,400..... 68,400

221. For a railway from Summerside to Richmond Bay, in the Province of Prince Edward Island, 3 miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 9,600

222. To the Columbia and Kootenay Railway Company, for 35 miles of their railway, from the outlet of Kootenay Lake to a point on the Columbia River as near as practicable to the junction of the Kootenay and Columbia Rivers, a subsidy not exceeding $3,200 per mile, nor to exceed in the whole..... 112,000

223. For a railway from a point on the Intercolonial Railway through the Stewiacke Valley on a line which will afford facilities of communication with the Iron Mines, Springside, Upper Stewiacke and Mosquedoboit settlements, 25 miles, in lieu of the subsidy granted by the Act 49 Victoria, chapter 10, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 80,000

224. For a railway from Fredericton to the Village of Prince William, in the Province of New Brunswick, 22 miles, in lieu of the subsidy granted by the Act 49 Victoria, chapter 10, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... $70,400

225. To the St. John Valley and Rivière du Loup Railway Company, for 22 miles of their railway from the village of Prince William towards the town of Woodstock, in lieu of the subsidy granted by the Act 50–51 Victoria, chapter 24, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 70,400

226. To the Temiscouata Railway Company, for 16 miles of their railway, from the west end of the 20 miles of their branch railway from Edmundston, subsidized by the Act 51 Victoria, chapter 3, towards the St. Francis River, a subsidy not exceeding $3,200 per mile, not exceeding in the whole..... 51,200

227. For a railway from the north end of the 14 miles for which a subsidy was granted by the Act 50 and 51 Victoria, chapter 24, to the Tobique Valley Railway Company, from Perth Centre towards Plaister Rock Island, 11 miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 35,200

228. To the Orford Mountain Railway Company, for 31 miles of their railway, between Eastman and Kingsbury, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 99,200

229. For a railway from Lachine Bank, on a line of the Grand Trunk Railway, to a point at or near Rivière des Prairies, a distance of 15 miles, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 48,000

The subsidies hereinbefore mentioned as to be granted to companies named for that purpose, shall be granted to such companies respectively ; the other subsidies, including subsidies granted for railways over a line extending beyond a point to which any company hereinbefore mentioned by name is authorized to construct its railway, shall be granted to such companies as shall be approved by the Governor in Council as having established to his satisfaction their ability to construct and complete the said railways respectively. All the lines for the construction of which subsidies are granted shall be commenced within two years from the first day of July next, and completed within a reasonable time, not to exceed four years, to be fixed by Order in Council,—except the Erie and Huron Railway, which shall be completed within two years from the first day of July next. And they shall also be constructed according to descriptions and specifications, and upon conditions to be approved by the Governor in Council, on the report of the Minister of Railways and Canals, and specifying an agreement to be made in each case by the company with the Government,, and which the Government is hereby empowered to make. The location, also, of every such line of railway shall be subject to the approval of the Governor in Council. And all the said subsidies respectively shall be payable out of the Consolidated Revenue Fund of Canada, by instalments, on the completion of each section of the railway of not less than ten miles, proportionate to the value of the portion so completed in comparison with that of the whole work undertaken, to be established by the report of the said Minister, or upon the completion of the work subsidized,—except as regards the Erie and Huron Railway Company, upon which payment shall be made only upon the completion of the work,—except, also, as regards the subsidies to the Inverness and Richmond Railway, which shall be paid on the completion of each ten-mile section, in accordance, as nearly as practicable, with the agreement between the company and the municipality of Inverness, and with section four of the Act of the Legislature of Nova Scotia, 1890, intituled: "An act to enable the County of Inverness to borrow money,"—except, also, as regards the subsidies to the Great Eastern Railway Company for bridges over the Nicolet and St. Francis Rivers, and to the Quebec and Lake St. John Railway for the bridge over the St. Charles River, upon which shall be paid fifteen per

cent. of the value of work done, on monthly progress estimates certified by the Chief Engineer, and upon the approval of the Minister of Railways and Canals,—and except also the subsidy grantd to the Quebec Central Railway Company, the first annual payment upon which shall be made at the end of twelve months from the date of the Chief Engineer's certificate of the completion of the work, and each subsequent payment at the end of each twelve months thereafter, for the term of twenty years.

The granting of such subsidies to the companies mentioned, respectively, shall be subject to such conditions for securing running powers or traffic arrangements or other rights as will aford all reasonable facilities and equal mileage rates to all railways connecting with those subsidized, as the Governor in Council determines."

By the special act 53 Vic., ch. 5 (1890.) *(Assented to 16th May, 1890.)*

230. In order to enable the Calgary and Edmonton Railway Company to construct so much of their railway as reaches from a point on the line of the Canadian Pacific Railway Company within the town of Calgary to a point on the North Saskatchewan River near Edmonton, the Governor in Council may enter into a contract with such Company for the transport of men, supplies, materials and mails for twenty years, and may pay for such services during the said term, eighty thousand dollars per annum, in manner following, that is to say: the sum of eighty thousand dollars to be paid annually on the construction of the railway from Calgary to a point on the North Saskatchewan River near Edmonton,—such payment to be computed from the date of the completion of the railway between such points: Provided that the Governor General in Council may order such sums to be paid in semi-annual instalments, and may permit the Company to assign the same by way of security for any bonds or securities which may be issued by the Company in respect of the Company's undertaking.

By 54-55 Victoria ch. 8 (1891). (*Assented to* 30 *Sept*, 1891):—

231. To the Great Northern Railway Company, for a railway from a point at or near New Glasgow or St. Lin to or near to Montcalm, in the Province of Quebec, eighteen miles, the balance remaining unpaid of the subsidy, not exceeding $3,200 per mile, granted by the Act forty-ninth Victoria, chapter ten, not exceeding in the whole $28,100 00

232. To the Quebec and Lake St. John Railway Company, for the railway bridge over the St. Charles River to give access to the City of Quebec, the difference between the amount already paid to the company and the sum of $30,000 mentioned as not to be exceeded by the Act fifty-third Victoria, chapter two, a subsidy not exceeding 5,250 00

233. To the Oshawa Railway Company, for seven miles of their railway from Port Oshawa towards Raglan in lieu of the subsidy for a like amount granted by the Act passed in the Session held in the fiftieth and fifty-first years of Her Majesty's reign, chapter twenty-four, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole 22,400 00

234. To the St. Lawrence, Lower Laurentian and Saguenay Railway Company, for the section of their railway from Grand Piles, on the St. Maurice River to its Junction with the Quebec and Lake St. John Railway, the balance remaining unpaid of the subsidy granted by the Act passed in the session held in the fiftieth and fifty-first years of Her Majesty's reign, chapter twenty-four, not exceeding in the whole 92,784 00

235. To the Great Eastern Railway Company, for thirty miles of their railway, from the River St. Francis to the Arthabaska Railway, at St. Grégoire station, the balance remaining unpaid of the subsidy, not exceeding $3,200 per mile, granted by the Act passed in the session held in the fiftieth and fifty-first years of Her Majesty's reign, chapter twenty-four, not exceeding in the whole 79,700 00

236. To the South Ontario Pacific Railway Company, for forty-nine and one-half miles of their railway from Woodstock to Hamilton, in the Province of Ontario, in lieu of the subsidy for a like amount granted by the Act fifty-second Victoria, chapter three, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole. $158,400 00

237. To the Montreal and Ottawa Railway Company (formerly the Vaudreuil and Prescott Railway Company), for thirty miles of their railway, from Vaudreuil towards Hawkesbury, the balance remaining unpaid of the subsidy granted by the Act passed in the session held in the fiftieth and fifty-first years of Her Majesty's reign, chapter twenty-four, not exceeding in the whole. 46,040 00

238. To the Tobique Valley Railway Company, for fourteen miles, from Perth Centre station towards Plaister Rock Island, in lieu of the subsidy for a like amount granted by the Act passed in the session held in the fiftieth and fifty-first years of Her Majesty's reign, chapter twenty-four, a subsidy not exceeding $6,400 per mile, nor exceeding in the whole..... 89,600 00

239. To the Kingston, Smith's Falls and Ottawa Railway Company, for fifty-six miles of their railway, from the City of Kingston to Smith's Falls, in lieu of the subsidies, not to exeeed $179,200, granted by the Acts fifty-second Victoria, chapter three, and fifty-third Victoria, chapter two, a subsidy not exceeding $12,534 per annum, to be paid in semi-annual instalments of $6,267 each, for twenty years, which represents a grant in cash of 179,200.00

Provided, that upon the completion of twenty-eight miles of the said railway a semi-annual subsidy may be paid proportionate to the value of the portion so completed in comparison with that of the whole fifty-six miles; Provided also, that the Company may deposit with the Minister of Finance and Receiver General a sum not exceeding $1,170,000, in consideration whereof there shall be paid to the Company, for twenty years, a semi-annual annuity calculated on a basis of three and one-half per cent on the amount so deposited; Provided further, that the Governor in Council may permit the Company to assign the said subsidy and annuity to trustees by way of security for any bonds or securities which may be issued by the company in respect of their undertaking.

240. To the Brockville, Westport and Sault Ste. Marie Railway Company, for twenty miles of their railway, from a point at or near Newboro' towards Palmer's Rapids, in the Province of Ontario, in lieu of a subsidy for a like amount granted by the Act fifty-second Victoria, chapter three, a subsidy not exceeding $3,200 per mile, nor exceeding in the whole..... 64,000.00

Provided that the subsidy hereby granted to the Brockville, Westport and Sault Ste. Marie Railway Company may be paid by instalments, on the completion of each section of the railway as follows, that is to say:—

Sections.	Length in miles.
From at or near Newboro' to Westport.....	4
From Westport towards Palmer's Rapids.....	16

2. The subsidies hereinbefore mentioned as to be granted to companies named for that purpose shall be granted to such companies respectively; all the lines for the construction of which subsidies are granted, unless they are already commenced, shall be commenced within two years from the first day of August next, and completed within a reasonable time, not to exceed four years, to be fixed by Order in Council; and shall also be constructed according to descriptions and specifications and upon conditions to be approved by the Governor in Council, on the report of the Minister of Railways and Canals, and specified in an agreement to be made in each case by the Company with the Government, and which the Government, is hereby empowered to make; the location, also, of every such line of railway, shall be subject to the approval of the Governor in Council; and all the said subsidies respectively shall be payable out of the

Consolidated Revenue Fund of Canada, by instalments, on the completion of each section of the railway of not less than ten miles, proportionate to the value of the portion so completed in comparison with that of the whole work undertaken, to be established by the report of the said Minister, or upon the completion of the work subsidized,—except as to the subsidy granted to the Kingston, Smith's Falls and Ottawa Railway Company, the first semi-annual payment upon which shall be made at the end of six months from the date of the Chief Engineer's certificate of the completion of twenty-eight miles of the railway, and each subsequent payment at the end of each six months thereafter, for the term of twenty years,—except also as to the Quebec and Lake St. John Railway Company, the subsidy to which shall be paid upon the completion of the work—except also as to the Brockville, Westport and Sault Ste. Marie Railway Company, the subsidy to which shall be paid as follows: on the completion of that portion of the said road from, at or near Newboro' to Westport, a distance of four miles, the sum of twelve thousand eight hundred dollars, and on the completion of the remaining sixteen miles from Westport towards Palmer's Rapids, the sum of fifty-one thousand two hundred dollars.

2. Within one month after the commencement of each Session of Parliament, whilst any of the said moneys are being paid out, there shall be laid before Parliament a statement showing all payments of such moneys during the then next preceding year, the names of the respective persons to whom such payments have been made, and the amounts paid them respectively, together with the engineer's report upon which payments have been recommended, and copies of all contracts between the Government and the company under which the said subsidies are authorized to be paid.

3. The granting of such subsidies respectively shall be subject to such conditions for securing such running power or traffic arrangements and other rights as will afford all reasonable facilities and equal mileage rates to all railways connecting with those so subsized, as the Governor in Council determines.

LAND SUBSIDIES.

By 47 Vic., cap. 25, clause 7 (1884). (*Assented to 19th April*, 1884):—

1. "The Governor in Council is hereby authorized, in aid of the construction of a railway from some point on the Canadian Pacific Railway to Hudson's Bay, to make a free grant of not more than six thousand four hundred acres for each mile of railway within Manitoba, and not more than twelve thousand eight hundred acres for each mile in the North-West Territories."

By 48-49 Vic., cap. 60 (1885). (*Assented to 20th July*, 1885):—

2. To the North-Western Coal and Navigation Company (Limited), Dominion lands to an extent not exceeding three thousand eight hundred acres for each mile of the company's railway, from Medicine Hat to the coal banks on the Belly River, about one hundred and ten miles.

3. To the Manitoba and South-Western Colonization Railway Company, Dominion lands to an extent not exceeding six thousand four hundred acres for each mile of the company's railway, from its commencement at Winnipeg to its terminus at Whitewater Lake, about one hundred and fifty miles.

4. To the Manitoba and North-Western Railway Company, Dominion lands to the extent of six thousand four hundred acres for each mile of the company's railway, for the whole distance from Portage la Prairie to the crossing of the South Branch of the River Saskatchewan, twenty miles from Prince Albert, about four hundred and thirty miles.

5. To the Qu'Appelle, Long Lake and Saskatchewan Railroad and Steamboat Company, Dominion lands to an extent not exceeding six thousand four hundred acres for each mile of the company's railway, from its commencement near Regina to the navigable waters of Long Lake.

"The said grants, and each of them, may be so made in aid of the construction of the said railways respectively, in the proportion and upon the conditions fixed by the Orders in Council made in respect thereof,—each of the said enterprises being respectively subject to any modification thereof which may hereafter be made by the Governor in Council; and except as to such conditions, the said grants shall be free grants, subject only to the payment by the grantees respectively of the cost of survey of the lands and incidental expenses, at the rate of ten cents per acre in cash on the issue of the patents therefor."

By 49 Vic., cap. 11 (1886). (*Assented to 2nd June*, 1886):—

6. To the Manitoba and North-Western Railway Company, Dominion lands to the extent of six thousand four hundred acres per mile for each mile of the company's branch railway running from a point on the main line of that railway, at or near Todburn, in a north-westerly direction through the County of Russell to the Assiniboine River, near the Town of Shellmouth, about twenty-six miles.

7. To the North-West Central Railway Company, or to such other company as may undertake the construction of the railway or a railway from a point on the Manitoba and North-Western Railway *vid* Rapid City, westward, Dominion lands to the extent of six thousand four hundred acres for each mile of the company's railway, for the whole distance from Brandon station, on the Canadian Pacific Railway, or from such point on the Manitoba and North-Western Railway as aforesaid, to Battleford, in the Provisional District of Saskatchewan, about four hundred and fifty miles.

8. To the Wood Mountain and Qu'Appelle Railway Company, Dominion lands to the extent of six thousand four hundred acres for each mile of the company's railway for the whole distance commencing at a point in township number four, in range number thirty, west of the Second Meridian, in the Dominion lands system of survey, passing through the town of Fort Qu'Appelle, to join the Manitoba and North-Western Railway at a point to be fixed for that purpose by the Governor in Council, about two hundred and forty miles.

The said grants, and each of them, may be so made in aid of the construction of the said railways respectively, in the proportions and upon the conditions fixed by the Orders in Council made in respect thereof,—each of the said enterprises being respectively subject to any modification thereof which may hereafter be made by the Governor in Council; and, except as to such conditions, the said grants shall be free grants, subject only to the payment by the grantees respectively of the cost of survey of the lands and incidental expenses at the rate of ten cents per acre in cash on the issue of the patents therefor.

By section 4 of this Act authority was given for the incorporation by the Governor in Council of a company to construct the line from Brandon, or other point indicated, to Battleford, subsidized by this Act.

By 50-51 Vic., cap. 22 (1887)

9. The subsidy to the North-Western Coal and Navigation Company, granted by 49 Vic., ch. 60, was increased from 3,800 acres per mile to 3,840 acres per mile.

By 50-51 Vic., cap. 23 (1887). (*Assented to 23rd June*, 1887);—

10. To the Alberta and Athabaska Railway Company, Dominion lands to an extent not exceeding six thousand four hundred acres for each mile of the company's railway from some point on the Bow River or Canadian Pacific Railway, at or between Calgary and Crowfoot Creek, to a point near the town plot of Edmonton, about three hundred miles.

11. To the Qu'Appelle, Long Lake and Saskatchewan Railway and Steamboat Company, Dominion lands to an extent not exceeding six thousand four hundred acres for each mile of the company's railway, from a point near the northern terminus of the completed portion of that railway, at or near Long Laketon, on the navigable waters of Long Lake, to a point at or near where the fifty-

second parallel of latitude crosses the South Saskatchewan River, thence to a point at or near the elbow of the North Saskatchewan River, with branches to Prince Albert and Battleford, about three hundred and twenty-five miles.

12. To the Medicine Hat Railway and Coal Company Dominion lands, to an extent not exceeding six thousand four hundred acres for each mile of the company's railway, from a point at or near Medicine Hat, on the line of the Canadian Pacific Railway, to the coal field in or near townships twelve and thirteen, range six, west of the fourth principal meridian, a distance of about eight miles, to be selected out of such lands as are at the disposal of the Government in the proximity of the line of the company's railway.

"The said grants, and each of them, may be so made in aid of the construction of the said railways respectively, in the proportions and upon the conditions fixed by the Orders in Council made in respect thereof,—each of the said enterprises being respectively subject to any modification thereof which may hereafter be made by the Governor in Council; and, except as to such conditions, the said grants shall be free grants, subject only to the payment by the grantees respectively of the cost of survey of the lands and incidental expenses at the rate of ten cents per acre in cash on the issue of the patents therefor."

By 52 Vic., cap. 4 (1889). (*Assented to 2nd May*, 1889):—

13. To the North-Western Coal and Navigation Company (Limited), in addition to the grant provided for by section one of the Act passed in the session held in the forty-eight and forty-ninth years of Her Majesty's reign and chaptered sixty, Dominion lands to an extent not exceeding two thousand six hundred acres for each mile of the company's railway from Dunmore station, on the Canadian Pacific Railway, to Lethbridge, on the Belly River, the present terminus of the said railway, a distance of one hundred and nine and one-half miles,—such additional grant to be made only on condition that the gauge of the said railway be made standard width; and also to the said North-Western Coal and Navigation Company (Limited), Dominion lands to an extent not exceeding six thousand four hundred acres for each mile of the company's railway from Lethbridge to the International boundary, a distance of about fifty miles.

14. To the Red Deer Valley Railway and Coal Company, Dominion lands to an extent not exceeding six thousand four hundred acres for each mile of the company's railway from Cheadle Station, on the Canadian Pacific Railway, to its terminus at a point in or near township twenty-nine, range twenty-three, west of the fourth meridian, a distance of about fifty-five miles.

15. To the North-Western Railway Company of Canada, Dominion lands to an extent not exceeding ten thousand acres for each mile of the company's railway from Calgary, on the Canadian Pacific Railway, northerly to a point on the North Saskatchewan River, at or near Edmonton, a distance of about two hundred and ten miles; and also to the said North-Western Railway Company of Canada, Dominion lands to an extent not exceeding ten thousand acres for each mile of the company's railway from Calgary southerly to Lethbridge, a distance of about one hundred and twenty miles.

16. To the Lake Manitoba Railway and Canal Company, Dominion lands to an extent not exceeding six thousand acres for each mile of the company's railway from Portage la Prairie to the southern boundary of Lake Manitoba, a distance of about seventeen miles.

The said grants, and each of them, may be so made in aid of the construction of the said railways respectively, in the proportions and upon the conditions fixed by the Orders in Council made in respect thereof, and except as to such conditions, the said grants shall be free grants, subject only to the payment by the grantees respectively of the cost of survey of the lands and incidental expenses, at the rate of ten cents per acre in cash on the issue of the patents therefor.

The Governor in Council may make the grant of land provided for by section three of the Act forty-ninth Victoria, chapter eleven, being for the line of the Wood Mountain

and Qu'Appelle Railway, of about two hundred and forty miles in length, applicable to the line of railway of the said company, as authorized by the Act respecting the Wood Mountain and Qu'Appelle Railway Company, passed during the present session of Parliament, upon the like terms and subject to the like conditions as those upon which the grant hereinbefore mentioned was authorized to be made to the said company by the Act in this section first cited,"

By the Act 53 Vic., cap. 4 (1890). (*Assented to 16th May*, 1890):—

17. To the Canadian Pacific Railway Company, Dominion lands to an extent not exceeding six thousand four hundred acres per mile for a branch line to be constructed from Glenboro' westerly a distance of about sixty miles, to a point on the proposed branch of the said Company running from Brandon south-westerly;

18. To the Canadian Pacific Railway Company, Dominion lands to an extent not exceeding six thousand four hundred acres per mile for a branch line of railway from a point at or near Brandon, on the main line of the Canadian Pacific Railway, south-westerly to or near township three, range twenty-seven, west of the First Principal Meridian, and thence westerly, a total distance of one hundred miles; and also a similar grant, at the same rate per mile, for the said company's proposed branch from a point on the line just described at or near Township three, Range twenty-seven, west of the First Principal Meridian, easterly to Deloraine, a distance of about twenty-five miles, making the total length of railway to which this grant is applicable one hundred and twenty-five miles.

19. To the Brandon and South-Western Railway Company, Dominion lands to an extent not less than six thousand four hundred acres per mile for the line of railway from a point in township one, in either Range twenty-three or twenty-four west of the First Principal Meridian, to Deloraine, a distance of about seventeen miles.

20. To the Lac Seul Railway Company, Dominion lands to an extent not exceeding six thousand four hundred acres per mile for a line of railway from a point at or near Shelly Station, on the main line of the Canadian Pacific Railway, to a point at or near White Mud Lake, on the Winnipeg River, a distance of about eighteen miles.

21. To the Calgary and Edmonton Railway Company, Dominion lands to an extent not exceeding six thousand four hundred acres for each mile of the company's railway from Calgary to a point at or near Edmonton, on the North Saskatchewan River, a distance of about one hundred and ninety miles; and also a grant of six thousand four hundred acres for each mile of the company's railway from Calgary to a point on the International boundary between Canada and the United States, a distance of about one hundred and fifty miles.

22. To the North-Western Coal and Navigat on Company, (Limited,) Dominion lands to an extent not exceeding three thousand eight hundred and forty acres for each mile of the company's railway from Lethbridge to the Crow's Nest Pass, a distance of about one hundred miles.

23. To the Lake Manitoba Railway and Canal Company, Dominion lands to an extent not exceeding six thousand four hundred acres per mile, for a line of railway from Portage la Prairie to Lake Winnipegosis, at or near Meadow Portage, a distance of about one hundred and twenty-five miles.

24. To the Manitoba and South-Eastern Railway Company, Dominion lands to an extent not exceeding six thousand four hundred acres per mile, for a line of railway from Winnipeg southerly or south-easterly to a point on the west side of the Lake of the Woods, a distance of about one hundred and ten miles.

The said grants and each of them may be made in aid of the construction of the said railways respectively, in the proportion and upon the conditions fixed by the Orders in Council made in respect thereof, and, except as to such conditions, the said grants shall be free grants, subject only to the payment by the grantees respec-

tively of the cost of survey of the lands and incidental expenses at the rate of ten cents per acre in cash on the issue of the patents therefor.

The lands by this Act authorized to be granted to the Canadian Pacific Railway Company shall be taken and held, and may be disposed of, free and clear of any incumbrance on the lands or property of the said company created before the passing of this Act.

By the special Act 53 Vic., cap. 3 (1890). *Assented to 26th March*, 1890):

25. The Act 52 Vic., ch. 4 authorizing, in error, the grant of land to the North Western Coal and Navigation Company, for 50 miles from Lethbridge to the International boundary, was amended—the said grant being made to the Alberta Railway and Coal Company.

By 54-55 Vic., cap. 9 (1891). (*Assented to 18th Sept.*, 1891):

26. In lieu of the subsidy in land authorized by the Act fifty-second Victoria, chapter four, to be granted to the Red Deer Valley Railway and Coal Company, and subject to the conditions in the said Act mentioned, the Governor in Council may grant Dominion lands to the said Company to an extent not exceeding six thousand four hundred acres for each mile of the said Company's railway, from the town of Calgary, in the District of Alberta, in the North-West Territories, to a point in or near Township twenty-nine, Range twenty-three, west of the Fourth Meridian, a distance of about fifty-five miles.

By 54-55 Vic., cap. 10 (1891). (*Assented to 30th Sept.*, 1891):

27. To the Manitoba South-Western Colonization Railway Company, in addition to the subsidy for one hundred and fifty miles of railway authorized by the Act passed in the session held in the forty-eighth and forty-ninth years of Her Majesty's reign, chapter sixty, Dominion lands to the extent of six thousand four hundred acres per mile for the balance of the two hundred and twelve miles of railway which have been constructed and are in operation, that is to say, for a distance of sixty-two miles.

28. Also, to the Manitoba South-Western Colonization Railway Company, Dominion lands to the extent of six thousand four hundred acres for each mile of the Company's branch line of railway from Carmen to Barnsley, a distance of about six and one-quarter miles.

29. To the Canadian Pacific Railway Company, in addition to the subsidy authorized by the Act fifty-third Victoria, chapter four, for the Company's branch line running in a south-westerly and westerly direction from a point at or near Brandon for a distance of one hundred miles, Dominion lands to the extent of six thousand four hundred acres for each mile of the extension westward of the said branch line, from the western limit of the said one hundred miles to a point at or near La Roche Percée, situated in Township one, Range six, west of the Second Meridian, a distance of about sixty miles.

30. The said grants and each of them shall be made in aid of the construction of the said railways respectively, in the proportion and upon the conditions fixed by the Orders in Council made in respect thereof, and, except as to such conditions, the said grants shall be free grants, subject only to the payment by the grantees respectively of the cost of survey of the lands and incidental expenses at the rate of ten cents per acre in cash, on the issue of the patents therefor.

APPENDIX No. 20.

DEPARTMENT OF RAILWAYS AND CANALS.

CANALS REVENUE BRANCH.

OTTAWA, 6th October, 1891.

To the Secretary Department of Railways and Canals.

SIR,—I have the honour to submit herewith the statements of canal revenues collected, and summary of traffic moved for the several canals, during the fiscal year ended 30th June, 1891.

The following summary of revenues accrued shows a decrease of $3,755, after deducting the refunds made under various Orders in Council modifying the tariff:—

—	1889-90.	1890-91.	Increase.	Decrease.
	$	$	p. c.	p. c.
Canal tolls, &c	371,626	345,143	.....	4·43
Hydraulic rents	38,168	37,995	.....	0·45
Minor public works	50	41	.....	18·00
Total	409,844	383,139	.....	6·5
LESS—Refunds	48,391	25,511		
Net revenue	361,453	357,628		

The following is a comparative statement of the revenues accrued on the following divisions of the canals for the years 1890 and 1891, showing the increases or decreases as compared with the previous year:—

Canals.	1889-90.	1890-91.	Increase.	Decrease.
	$	$	p. c.	p. c.
Welland	220,160	188,586	.....	14·34
St. Lawrence	70,604	79,924	13·2	
Chambly	17,703	20,187	14·03	
Ottawa	53,094	47,149	.....	11·19
Rideau	6,782	6,153	.....	9·29
St. Peter's	2,453	1,707	.....	30·41
Trent Valley	238	731	23·49	
Murray	592	711	198·74	
Total	371,626	345,148		
LESS—Refunds	48,138	25,511		
	323,488	319,637		

The following statement will exhibit the increases and decreases upon the Welland Canal, and the classes of articles upon which they arose :—

—	1889-90.	1890-91.	Increase.	Decrease.
	$	$	p. c.	p. c.
Vessels..	19,295	15,907	.....	17·56
Passengers	207	354	71·01	
Produce of the forest	29,698	20,157	.....	32·12
do animals	331	176	.....	46·82
do agriculture	109,970	94,330	.....	14·22
Manufactures and merchandise	56,291	56,407		
Total tolls	215,792	187,331		
Fines and damages	4,367	1,255		
Total	220,159	188,586		
Less—Refunds	47,251	24,914		
Net revenue	172,888	163,672		

The decrease in the amount of tolls refunded as shown above is due to the fact that no refunds of tolls on grain were made during the months of May and June, in consequence of an Order in Council of 18th May, 1891, authorizing such refunds to be made at the close of navigation and not during the season, as heretofore.

The total quantity of freight transported on the several divisions of the canals, and classified as under, is as follows :—

Canals.	Farm Stock.	Forest Produce of Wood.	Manufactures.	Merchandise.	Agricultural Products.	Total Tons.
	Tons.	Tons.	Tons.	Tons.	Tons.	
Welland	54	138,205	23,104	317,044	481,095	959,502
St. Lawrence	1,107	126,128	67,280	348,696	286,093	829,304
Chambly	234	98,868	3,218	118,830	3,914	225,064
Ottawa	1,167	622,329	844	11,483	5,155	640,978
Rideau	38	74,530	2,336	20,728	3,055	100,687
St. Peter's	.....	2,619	.....	19,232	7,668	29,519
Murray	25	4,124	1,659	4,205	3,572	13,585
Trent Valley	.....	23,038	20	582	35	23,675

It will be seen by the following figures that the largest quantity of freight passed through the Welland Canal since 1867 was during the fiscal year of 1874, when the quantity was 1,540,081 tons.

The smallest quantity passed through in any one year was 1882, when the quantity decreased to 644,727 tons; in 1890 the quantity increased to 1,104,553 tons, and decreased in 1891 to 959,502 tons.

The largest tonnage passed through the Welland Canal, between United States ports, for the same period, was during the fiscal year 1871, the quantity being 747,756 tons; the quantity, however, decreased to 191,817 tons in 1882, but has since gradually increased to 563,856 tons in 1891.

The following statement shows the total quantity of freight passed through the Welland Canal, and the quantity passed through the canal between United States ports, during the fiscal years ended 30th June, 1867 to 1891, inclusive :—

Years.	Total.	From United States Ports to United States Ports.
	Tons.	Tons.
1867	933,260	458,386
1868	1,161,821	641,711
1869	1,231,903	688,700
1870	1,311,956	747,756
1871	1,478,122	772,567
1872	1,319,996	638,039
1873	1,391,692	634,913
1874	1,540,081	703,185
1875	1,142,853	595,217
1876	1,121,802	524,197
1877	1,126,429	482,878
1878	1,091,898	448,413
1879	918,924	361,304
1880	896,122	248,944
1881	798,809	196,285
1882	644,727	191,817
1883	861,634	337,619
1884	965,890	417,972
1885	839,521	416,825
1886	934,862	443,961
1887	838,587	387,109
1888	827,300	387,555
1889	938,254	464,415
1890	1,104,553	550,844
1891	959,502	563,856

The statements of the quantity of grain transhipped at Ports Colborne and Kingston, and comparative statements of the movement of traffic on the different routes competing for the carrying trade from the west to the sea-board, will be given in the supplementary report for the season of navigation.

I have the honour to be, Sir,

Your obedient servant,

B. H. TEAKLES,

Chief Clerk, Canals Revenue.