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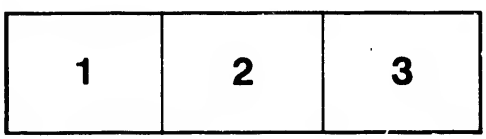

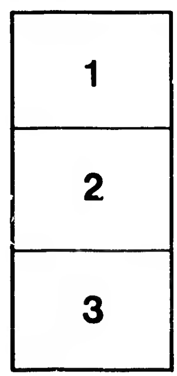

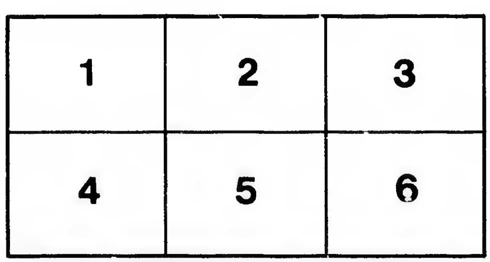

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DESCRIPTIVE STATEMENT

OF THE

GREAT WATER HIGHWAYS

OF THE

DOMINION OF CANADA.

HYDROLOGY OF THE BASIN OF THE GULF AND RIVER ST. LAWRENCE,

BY THE LATE T. E. BLACKWELL, Esq., C.E.

WITH APPENDICES RELATING TO THE

COMMERCE AND NAVIGATION OF CANADA,

WM. J. PATTERSON,

Secretary of the Montreal Board of Trade, and of the Corn Exchange Association; also of the Dominion Board of Trade.

MONTREAL:
PUBLISHED BY DAWSON BROTHERS;
AND SOLD ALSO BY F. E. GRAFTON, AND DRYSDALE & CO

1874

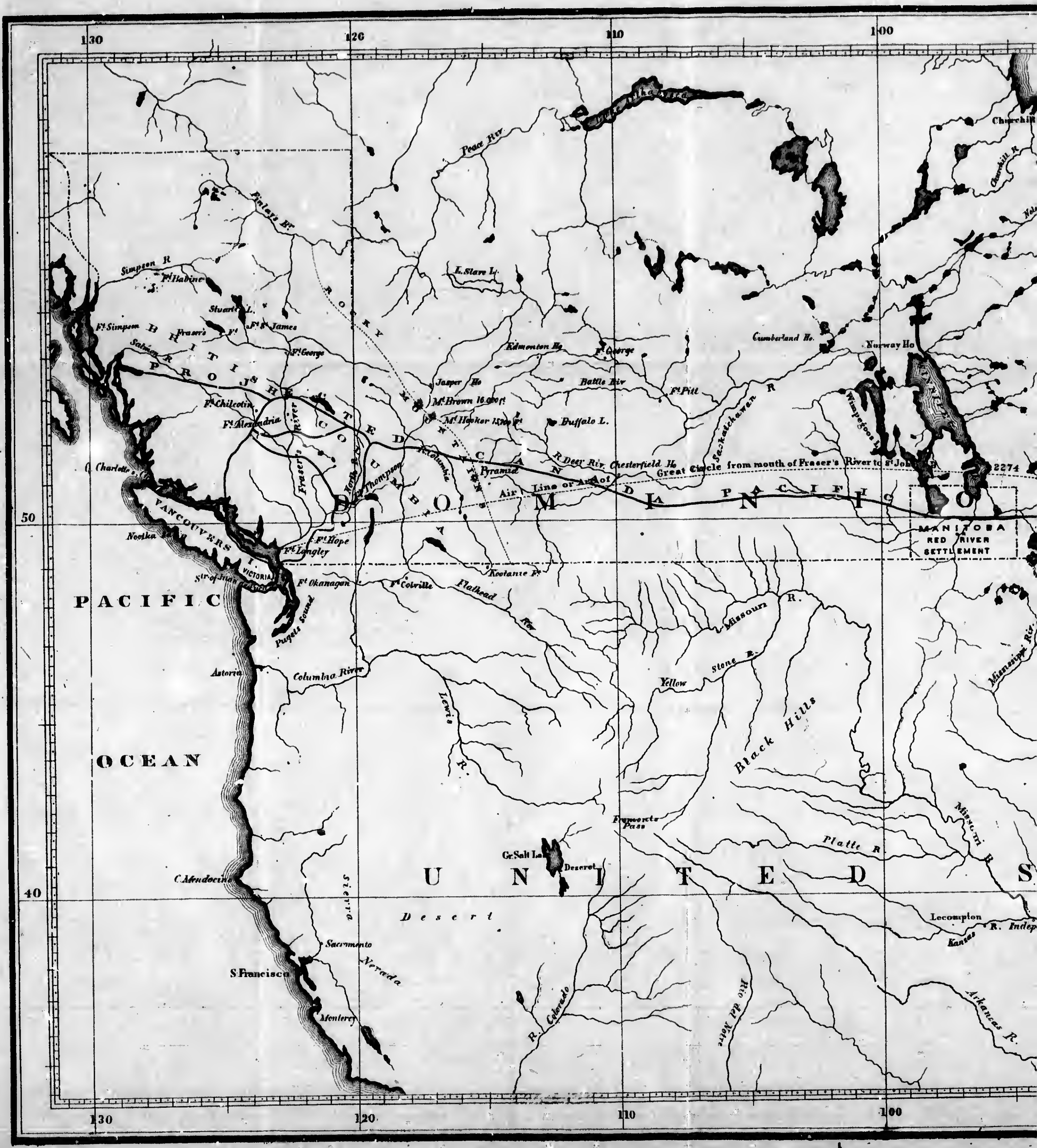
ERRATA.

The paragraph about FREIGHTS on page 69, in the Appendix, would be more clearly stated as follows:—

"THE GENERAL RATE OF FREIGHT, during the season of 1874, on wheat from Kingston to Montreal is 4 cents per bushel. A fair average *through* rate from Chicago to Kingston, for the same season, would be 7½ cents American currency,—although that is an exceptionally low one. The upward *through* freight from Montreal to Chicago by propellers, consists of Pig Iron and Salt at $2.50 per long ton; with general merchandise at $3.00 to $4.00 per long ton.

The paragraph on page 69, of the Appendix, relating to ELEVATING CAPACITY, &c., should read as follows:—

"THE ELEVATING CAPACITY connected with warehousing facilities in Montreal comprises 11 elevators, capable of transferring 3,000 bushels of grain per hour,—while the Storage capacity equals 2,000,000 bushels. In addition, the Montreal Elevating Company have 9 floating harbor elevators, each capable of handling about 4,000 bushels per hour, or an aggregate of 36,000 bushels. The Storage capacity for Flour equals 200,000 *barrels.*



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Ft St James
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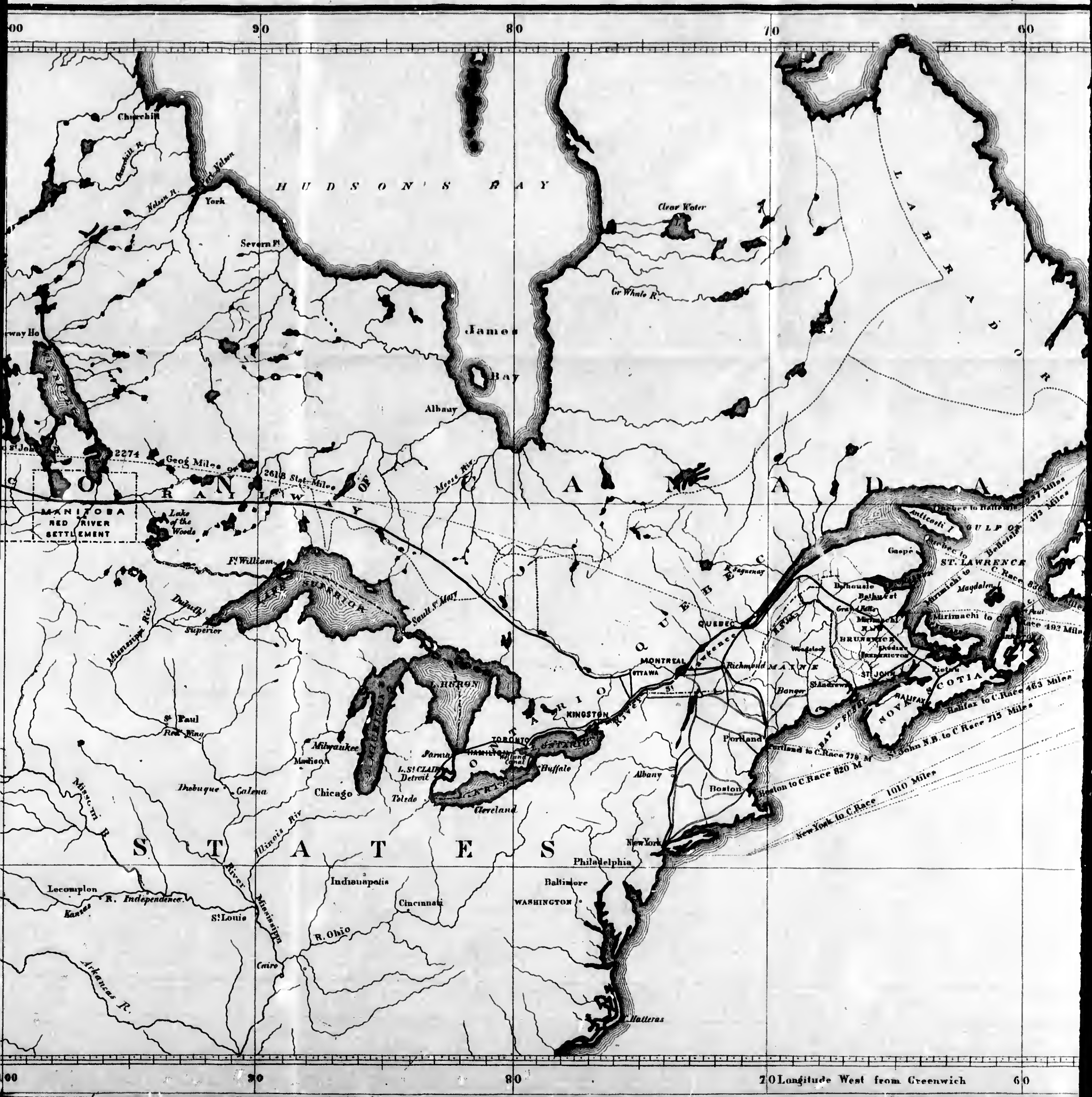

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Scilly
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PARIS
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Nantes
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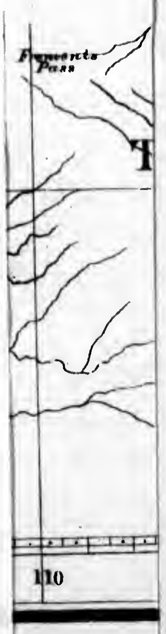

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INTRODUCTION.

ST. LAWRENCE ROUTE FROM THE WESTERN STATES TO THE OCEAN.

If a thread be stretched upon a Globe, from any point in the British Channel to Toledo, on Lake Erie, and arranged so as to be upon the shortest line, it will be found that the St. Lawrence does not deviate at any point more than 30 miles, *connecting, in the shortest possible distance, with the most capacious, speedy and economical mode of communication, the greatest food-consuming country in Europe, with the greatest food-producing country in America,—inhabited by the parent and offspring of the most favored race of men.*

The coast of British America is more than 1000 miles nearer to Britain than New York,—because every degree of longitude contains a less number of miles as we approach the poles.

The comparative distances shew that Lake Erie is 548 miles nearer Liverpool, with a lockage of 158 feet less than by the Hudson; the cost, charges, and time occupied, prove that the voyage may be performed at a saving of 10 cents per bushel of wheat and in 9 to 17 days less time by the St. Lawrence than by New York. *

The ocean freights between the Ports of Quebec or Montreal, and New York to Liverpool, from 1846 to 1854, are said to have been very largely in favor of New York. It is alleged that this striking difference is to be attributed to the closing of the St. Lawrence during the winter season, and the high price of insurance arising from the hazard thus increased.

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* A writer in the London (Eng.) *Morning Chronicle*, February, 1858, said:—The distance from Quebec to Liverpool is 475 miles less than from New York to Liverpool. Kingston, at the foot of Lake Ontario, is 125 miles nearer Liverpool than New York. From Hamilton, at the head of Lake Ontario, is the same distance as from New York to Glasgow. From Lakes Ontario, Erie, and the southern point of Huron, is nearly a straight line to the ports of Great Britain, through the Straits of Belle Isle.—W. J. P.

In the above statement there appears to be a double mistake :—(1.) The average date of first arrivals at Quebec is, say, 1st May—and their departure may be prolonged to the 1st December. The average opening of the Erie Canal, at Buffalo, is about the 25th April (10 or 12 days before a boat could reach Albany), and the close is about the 5th December. In point of time, then, the duration of navigation is equalized by both routes by water. (2.) By a comparative statement of actual losses on the coast of the United States and in the St. Lawrence, is shown a far greater number on the former. An extensive ship-owning house, who are their own insurers, only lost *two* out of 406 vessels employed in the Quebec trade during 11 years.

The chief cause of the difference is, however, that steamers and sailing vessels to New York now carry the greater part of the emigration and freight to that port; this cause will, it is hoped, soon be removed, by the employment of a larger number of screw steamers in the St. Lawrence trade, which will consequently tend to bring a more extensive emigration and freight by that route, which must be found to be the *shortest*, *the cheapest*, *and the safest*, between the West and Europe. A supply of large first-class propellors can at any time be found for the inland traffic above Quebec.

The great and leading object, to secure the carrying trade between the West and Europe, is *cheap ocean-freights*, every other advantage being in favor of the St. Lawrence route.

I am indebted to a friend for the foregoing statement,—(written about twenty years ago,)—by the late John Bruce, Esq., at one time Comptroller of H. M. Customs at Quebec, and subsequently Secretary of the Board of Trade of that city. Mr. Bruce's paragraphs are given without emendation,—rather as a text, than a dissertation; and they are made, not inappropriately it is believed, to introduce a more elaborate, but still exceedingly popular account of the Great Water Highways of the Dominion.

Anything like a general idea of the route of the River St. Lawrence, ought to embrace a description of the natural features of the vast area of arable, mineral, and timber-lands, to which it stands in the relation of an highway. Such a description, involving great labor and expense, was prepared by the late T. E. Blackwell, Esq., C.E., and some time Managing Director of the Grand Trunk Railway of Canada, in a paper read before a meeting of the American Philosophical Society, at Philadelphia, in March, 1866, and subsequently published in the transactions of that Society.

The opinion having been expressed, that it was a pity Mr. Blackwell's interesting treatise should remain in the archives of a Society in the United States, unknown to the general public in Canada, I have risked an humble attempt to give it greater publicity. But for the additional pecuniary outlay that would have been incurred, I would gladly have arranged for the republication of the entire document,—with all the accompanying illustrations.

The present publication, therefore, consists: (1.) of Mr. Blackwell's very popular and instructive treatise, slightly abridged,—its unity remaining unbroken, a few changes rendered necessary by lapse of time being given within brackets [ ]; and (2.) of a series of Appendices, elucidating many of the points referred to by him,—the whole forming a comprehensive, and, it is hoped, an interesting descriptive statement of commercial progress in the Great St. Lawrence Valley.

The various statements in the Appendix may not coincide exactly with all the conclusions arrived at by Mr. Bruce; nevertheless, his general accuracy is quite remarkable, when it is recollected that he could not have had at hand such variety and details of information as are now accessible.

It may be remarked, that, while a good deal of the information in the Appendices, has been specially prepared for this work, a portion of the matter has been reproduced from some of the earlier numbers of the Annual Reports compiled by me, and published at the instance of the Montreal Board of Trade, and Corn Exchange Association,—some information being also taken from the Report of the Canal Commission, 1871. The attention of the reader is requested to statements contained in Appendices No. V. and VI., on pp. 57–69,—relating to the Flour and Grain Trade of Canada, since 1793,—also respecting the Grain Trade of this City from 1845,—with comparative rates of freight, &c., &c. The movement of vegetable food from West to East, by rail and water, through the State of

New York, during a series of years, is also presented in tabular form. An important letter from Hon. John Young, Chairman of the Montreal Board of Harbour Commissioners, is printed in Appendix No. VII.,—see p. 70.

The accompanying skeleton map is merely intended to show comparative distances by various ocean routes. An examination of the exceedingly useful map of Canada, prepared by T. C. Keefer, Esq., C.E., for the Paris Exhibition of 1855, (with subsequent additions,) — will show that the shortest line that may be drawn from New Orleans to Glasgow touches the Province of Quebec, passing through Miramichi in New Brunswick. A straight line from San Francisco to Cape Canso in Nova Scotia, passes through Sault St. Marie and (north of Montreal) through the city of Quebec. The shortest route from St. Louis to Liverpool would pass far to the north of this city; and it would, therefore, appear that all that part of North America west of St. Louis, will find the shortest, and otherwise most available route for exporting to, or importing from Europe, to be that which is afforded by the River St. Lawrence.

It would have been easy to expand this pamphlet by adding statements regarding the British American route to Japan and China, when the Canadian trans-continental railway is built. The locations of a few cities are given in the Map,—Montreal being more particularly referred to, on account of its intermediary position between ocean and inland navigation. But the main object of the present publication is to supply for easy reference, in a convenient and concise form, information principally in the interest of European, and especially of British merchants, that they may be able to appreciate more fully that the River St. Lawrence is the most available highway for their commercial intercourse with the interior of North America.

WM. J. PATTERSON.

MONTREAL, 30*th November*, 1874.

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HYDROLOGY OF THE BASIN OF THE GULF AND RIVER ST. LAWRENCE.

APPENDICES.

HYDROLOGY OF THE BASIN

OF THE

RIVER SAINT LAWRENCE.

TOPOGRAPHY.

THE hydrographical basin of the St. Lawrence is divisible by geographical lines and geographical features into six basins. *The first* embraces the Gulf and the lower river as high as Three Rivers, and includes the tidal estuary of the Saguenay as high as Chicoutimi, seventy miles above its mouth.

The second is the basin of the St. Lawrence proper, embracing the river between Three Rivers and the Thousand Islands, a distance of two hundred miles; together with the Ottawa River, between Montreal and the Lac des Chats, a distance of one hundred and twenty miles; the St. Maurice, from its mouth to the entrance of the mountains, thirty miles; and on the other, or southern side, the valley of the Chaudiere, and the St. Francis, the plain of the Richelieu, and the valley of Lake Champlain and Lake George. From the head of Lake George to the mouth of the Richelieu, is one hundred and ninety miles.

The third basin embraces Lake Ontario, with its southern tributary, the Genesee River, descending from the table-lands of Pennsylvania, through Western New York, and its northern tributary, the Trent and Otonabee, meandering through a labyrinth of lakes which dot the uneven table-land between the shore and the foot of the Northern mountains; the principal, taken in a west-east order, being Scugog, Balsam, Camerons, Sturgeon, Pigeon, Buckhorn, Mud, Salmon, Trout, Rice, Stoney, White, Belmont, and Marmora Lakes.

The fourth basin is that of three upper great lakes, embracing Lakes Erie and St. Clair, Lake Huron and its Georgian Bay, with Lakes Simcoe, Nepessing, and Tamagamingue, Lake Michigan and its Green Bay, together with a narrow fringe of short affluents, draining small areas in Northwestern Ohio, Northern Indiana, and Eastern Wisconsin, as well as the two principal peninsulas of Michigan and Upper Canada.

The fifth is the basin of Lake Superior, separated from the other great lakes by the Sault Ste. Marie, and fed by the smaller lakes and rivers from the unexplored lands beyond.

The sixth is the great general basin of the North; a country of unknown extent, studded with lakes, and traversed by the mighty branches of the Ottawa, by the St. Maurice, and by the rivers flowing from all sides into the Lake St. John, and Saguenay. *

The first, or tidal basin, of the Gulf and Lower St. Lawrence, is in fact a prolongation of the basin of the St. Lawrence proper, eastward, beyond Three Rivers, and differs from it no otherwise than in being tidal, and therefore, also, of greater breadth. As it is of no particular interest in the discussion of the hydrography of the flowing waters of Canada, and as its limits are also prolongations of the limiting mountain ranges of the basin of the St. Lawrence River proper, no further notice of it seems necessary, than to mention that the influence of the tide is felt upon the surface of Lake St. Peter, a broad expanse of the river, beyond the stated head of tide at Three Rivers. The St. Maurice River enters the St. Lawrence not far below this lake, its embouchure being nearly on the boundary between the two first basins. This point is ninety miles above Quebec, where the lower river, as it is called, commences. The Saguenay comes into it one hundred and ten miles below Quebec; and one hundred and twenty miles still further down, at Point des Monts, the estuary, widening suddenly on the north, may be considered as merging in the Gulf, but the south shore moves forward in an unbroken curve for one hundred and thirty miles more to Cape Gaspé. The whole length of the tidal basin may be therefore called four hundred and fifty miles. The basin of the St. Lawrence proper is limited, both on the northwest and on the southeast, by mountain ranges. That on the north is called the range of the Laurentide Mountains. That on the south is called by various local names, but may be termed the range of the Green Mountains. The Laurentide Mountains begin in Labrador, at the Straits of Belleisle, and run on in a southwest direction parallel in several instances, spreading out southwards so as to form bold bluffs and mountains close to the water's edge, as at Cape Tourment, which is sixteen hundred feet high; they range at an average distance back from the Gulf and river from twelve to fifty miles; across the Saguenay and behind Quebec, across the St. Maurice and behind Montreal, up the Ottawa to the Lac des Chats, a distance of at least seven hundred miles. They form the northern background to all the pictures of the river scenery. They are composed of the oldest rocks known to geological science, and spread themselves at an average elevation of about two thousand feet above the sea, back from the front line just described, over a table land of forests and lakes, far towards the waters flowing into Hudson's Bay; westward, beyond Lakes Huron and Superior; and southward, across the

* **For details of Gulf and Inland Navigation, see App. No. I.**

Ottawa to the foot of Lake Ontario, and across the St. Lawrence at its outlet from the lake, into Northern New York, filling up the country west of Lake Champlain with mountains, some of which exceed five thousand feet in height above the sea. The western or head line limit of the St. Lawrence River basin is at the foot of the Laurentian rocks, from Lac des Chats on the Ottawa, to the Thousand Islands on the St. Lawrence. Its northern border is formed by the Laurentide Mountains north of the Ottawa, and its southern by the Laurentian Adirondack Mountains of New York, along the Canada Boundary Line. The triangular space between the Ottawa and the St. Lawrence, with its apex at Montreal, is a great plain of almost horizontal lower Silurian rocks, covered with variable depths of post-tertiary clays, showing themselves in remarkable terraces around the border lines, at an average elevation of two hundred feet above the plain. Five or six masses of trap form as many isolated mountains, from six hundred to twelve hundred feet high, standing upon the plain like stranded ships upon a beach. One of these is the mountain of Mont Royale. Around these island-mountains the terraces of post-tertiary clay are visible. The plain, however, is not confined to the triangular space between the two great rivers; it spreads on eastward, past the Richelieu and Lake Champlain, to the foot of the Green Mountains, next to be described, and so along the range past the Yamaska and St. Francis, in a long and narrow belt, even to Quebec. The whole area of this plain thus described contains about eighteen hundred square miles, the most of which is fertile arable land, well watered and level, through the midst of which flow the two great rivers named.

The only important adjunct of the basin of the St. Lawrence proper is to be found in the extension of this lower Silurian plain southward up the Vermont, or eastern shore of Lake Champlain, the western or New York shore of which rises at once into the Adirondack heights. Starting from the head of Lake Champlain, a narrow winding gorge between high mountains of Laurentian rocks terminates in Lake George (so famous among tourists), the upper end of which is separated only by seven miles from one of the principal head rivers of the Hudson, the difference of elevation, however, in favor of Schroen River being at least five hundred feet.

We must now describe the eastern portion of the southern barrier of the St. Lawrence basin. It has no connection whatever with the western portion already described. Lake Champlain, with its side plain of lower Silurian rocks, opening up a great highway between Canada and the Atlantic States, isolates the Adirondack Mountains on its western shore from the Green Mountain range, from which its eastern affluents descend. Unlike the Laurentide Mountains on the north, the southern limit of the basin is a corrugated plateau or chain of parallel ridges of quartzite, slate, and limestone rocks, of lower Silurian age, about fifteen hundred feet high, upon the top of which rise to a still loftier elevation the Schick-Shock, and other isolated groups of synclinal lower Silurian mountains, probably connected geologically with the Katahdin Mountains of Maine, and the

White Mountains of New Hampshire. Commencing at Cape Gaspé, this barrier ranges along the southern shore of the Gulf and Estuary, in a graceful curve, three hundred miles, to the neighborhood of Quebec, where it leaves the river, by slowly diminishing the radius of its curve, towards the south. Crossing the Chaudiere and St. Francis, the waters of which drain back valleys, it skirts the great plain, and enters the State of Vermont, which it traverses under the name of the Green Mountains, three thousand feet high. It is continued as the Berkshire Hills in Western Massachusetts, and as the Taconic Hills in Eastern New York; crosses the Hudson as the Highlands of West Point, and the Delaware as the Durham, or Easton Hills. Lost for a few miles between the Schuylkill and the Susquehanna at Harrisburg, it re-emerges from beneath the New Red plain as the chain of the South Mountains of Southern Pennsylvania. In Maryland, it crosses the Potomac at Harper's Ferry, to form the Blue Ridge of Virginia, and the Smoky Mountains which divide Tennessee from North Carolina; where the Black Mountain group, a little east of the line, attains elevations ranging between six and seven thousand feet above the sea. Traversing Georgia, the chain sinks beneath the Cretaceous plain of Middle Alabama, and is seen no more, after having a geographical range of not less than sixteen hundred miles.

The geological cause for the shape and position of the estuary and lower river of the St. Lawrence must not be overlooked. It is to be found in the presence of a remarkable fault or fissure in the crust of the earth, running close along the southern shore from Gaspé to Quebec, thence through the middle of the plain up the east shore of Lake Champlain, and down the Hudson River into New Jersey. All the rock formations on the northern and western side of this fault, both in Canada and in New York, are thrown down to a depth varying from five to ten thousand feet. The top of the lower Silurian system in the west wall of the fault, is brought down to a level with the bottom of the same system in the east wall. In these soft Hudson River slates, as they are called, have therefore been excavated, all along on the west side of the fault, the estuary of the St. Lawrence, the Lakes St. Peter and Champlain, and the Hudson River valley; for the same agency brings abruptly to an end in the Catskill Mountain, three thousand feet high, on the west bank of the Hudson River, the Alleghany Mountain system coming up from the southwest through Middle and Northern Pennsylvania.

Passing now to a description of the basin of Lake Ontario, its limits are of quite another order. Its eastern end abuts against the Laurentian rocks of the Adirondack Mountains of New York, and its outlet is over the low and narrow barrier of the same forming the Thousand Islands. The lake itself is excavated out of the soft lower Silurian rocks described. The northern limit of the basin is an east and west line, about fifty miles back from the northern shore; the western continuation of the Laurentide Mountains in their course from the Thousand Islands to the foot of Lake Simcoe. Its southern limit is made by three remarkable escarpments, ranging in parallel east and west lines from the

Hudson River to Lake Erie, caused by the broad outspread and almost imperceptible southern dip of the whole Palæozoic system, from the Potsdam sandstone at the bottom of the Silurian, to the coal beds at the bottom of the Carboniferous rocks. This dip being towards the south, and away from the great lakes, the basset edges of the formations necessarily front the north, and form a series of steps or terraces facing the north, while down the southern slope of these strata flow all northern subsidiaries of the Delaware, Susquehanna, and Ohio Rivers, almost from the margins of the lakes themselves.

The lowest escarpment is that of the Niagara or Middle Silurian Formation, which commences at a slight elevation between Albany and Utica, along the south side of the Mohawk Valley, and crosses the Niagara River at Lewiston. Back of this runs the escarpment of the Helderberg or Lower Devonian limestones, forming high hills south of the Mohawk, but dying away as it approaches Lake Erie. Still further south, and at a still higher elevation runs the high escarpment of the upper Devonian sandstone, from the base of Catskill Mountain, on the Hudson, to Lake Erie, along the southern shore of which it ranges away beyond Cleveland into South-western Ohio. On the summit of this uppermost platform, and at an elevation of fifteen hundred feet above the sea, and one thousand feet above Lake Erie, lie outspread the broad, flat shallow basins of the bituminous coal field of Pennsylvania and Ohio, constituting the great Appalachian coal basin. From the northern part of this coal field the Genesee River cuts down through all the escarpments into Lake Ontario.

Across the soft Lower Devonian terrace between the middle and upper escarpments, lie in parallel north and south, cut valleys, the deep and narrow lakes Canandaigua, Cayuga, Seneca, Crooked Lake, Auburn, and Skaneateles, all of them, with Lake Oneida at the foot of the lowest escarpment, drained by the Oswego River into Lake Ontario. But the principal drainage of Southern New York, even from the edge of the Niagara escarpment, is the other way southward, through the upper escarpment, and by deep gorges in the Alleghany Mountains of Pennsylvania, by the Susquehanna River and Chesapeake Bay, into the Atlantic. In Western New York, the same set of the waters away from Lake Erie carries the drainage into the Alleghany, the Beaver, and other affluents of the Ohio, the head waters of which, therefore, overlook Lake Erie, a thousand feet, from a distance of scarce a dozen miles. There is one spot in Potter County, Pennsylvania, where the same cloud will shed its waters by the Genesee into the Gulf of St. Lawrence, by the Susquehanna into the Cheapeake Bay, and by the Alleghany into the Gulf of Mexico. Following the lowest or middle Silurian escarpment across the Niagara River, we see it become the constant limit of the basin of Lake Ontario.

At Lewiston Heights it is three hundred and sixty feet above the lake. Rising slowly as it enters Upper Canada, it sweeps close around the head of the lake, runs northward, and then northwest along the southwest shore of Georgian Bay, and projects into Lake Huron at Cape Hurd; casting off southwestward all the way of the waters of the peninsula into Lakes Erie, St. Clair, and Huron, and forming a well-defined barrier for a separate water-basin between three hundred and four hundred feet above that of Lake Ontario. On the top or back of the escarpment, south of Georgian Bay, are piled upper Silurian strata to an elevation fifteen hundred feet above the sea, in what are called the Blue Mountains. By the run of the escarpment, Georgian Bay would seem to be excluded from the region of the upper lakes, and to belong properly to the area of Lake Ontario. It and Lake Simcoe, in fact, lie in an excavation of the same lower Silurian rocks with the Gulf of St. Lawrence, Lake Champlain, and Lake Ontario, and in the prolongation of the belt of small lakes to the north of Lake Ontario. A water communication by these larger lakes and the streams which connect them, has been, in fact, accomplished by means of a system of canals, which has replaced the old portages or carrying places where no navigable water passages existed. Yet in spite of this geological and commercial connection, Georgian Bay is an arm of Lake Huron, and at a level above Lake Ontario of three hundred and forty four feet, while Lake Simcoe, which communicates with it, lies one hundred and thirty-three feet higher. The explanation of this anomaly is to be found in the rise of the surface of the lower Silurian rocks in that direction, the whole broad outcrop being covered over with a sloping plain of northern drift, among the hillocks and ridges of which lie the smaller lakes, and a barrier of which effectually cuts off all hydrographic connection between Lake Ontario and Georgian Bay. Excavated, as has been said, in the same soft rocks of the lower Silurian system, in which Lake Champlain and the Gulf of St. Lawrence have been excavated, Lake Ontario would form part of the same water-basin with them, were it not for the intervention of the Laurentian rock barrier at the Thousand Islands. There was a time, no one doubts, and that in recent geological days (when this part of the continent was submerged from three hundred to four hundred feet beneath the present ocean level), that two broad estuary connections were established between it and the ocean; the one round the Adirondack Mountains to the north, over the plain of Montreal, the other to the south, through the valley of the Mohawk. At that time, of course, Northern New York was one island, and Vermont and Western Massachusetts was another; while the north shore of the Gulf of St. Lawrence extended up along the foot of the Laurentide Mountains to the Lac des Chats.

The basin of the Devonian lakes, as they are called, is now to be described. The Niagara barrier seems to end at Cape Hurd, the north of Georgian Bay, but is, in fact, continued as the Manitoulin Islands around the head of Lake Huron, and the foot of Lake Michigan, through the Straits of Mackinaw, and forms those two remarkable promontory peninsulas which almost isolate Green Bay from Lake Michigan, in the same way as the escarpment isolates the Georgian Bay from Lake Huron. Geologically considered, Green Bay is yet another of the lower Silurian lakes; while hydrographically, it is but an arm of Lake Michigan. The Niagara barrier, much attenuated, and therefore low, continues south-ward to the head of Lake Michigan, obliging the waters of Wisconsin to feed Green Bay before they can enter Lake Michigan.

Curving round the head of Lake Michigan, the Niagara rocks sweep east-ward in a narrow belt to the head of Lake Erie, thus closing a hydrographic, as well as a geological circle, around the great peninsula of Michigan, with its isolated coal basin in its centre. In troughs hollowed out of the concentric belt of soft Devonian shales, just inside this circle of Niagara rocks, lie Lakes Michigan and Huron; and in a third trough excavated from the same shales, thrown eastward by the great Detroit and Cincinnati anticlinal, lies Lake Erie, also. This anticlinal is a swell of the earth's crust, separating the Appalachian coal area of Eastern Kentucky and Tennessee from the coal area of Western Kentucky and Illinois, and casting off the rock-dips gently east and west from its broad back. Commencing in Tennessee, it crosses the Ohio in the region of Cincinnati, and the head of Lake Erie into Upper Canada. But for this anti-clinal Lake Erie would have had no existence; and the other two lakes must then have emptied their waters by way of Georgian Bay into Lake Ontario.

The escarpment, limiting Lake Erie on the south, has already been described, and the disposition of the head waters of the Ohio to form along its summit and flow south. In like manner, but in a more remarkable degree, the belt of Niagara rocks, circling around the head of Lake Michigan, cuts off the drainage into it. The head waters of the Illinois, a tributary of the Missis-sippi, and of the Wabash, a tributary of the Ohio, start close to its margin on their long career to the Gulf of Mexico. In fact, there is a marsh but five miles back of Chicago, only seventeen feet above the level of the lake, and in wet seasons its waters flow partly into the lake and partly down the Illinois. Only at the head of Lake Erie can drainage be said to enter, in any abundance, the Canadian Basin. Here the Miami brings in the waters of a belt of Lower Devonian country of no great size, lying along the anticlinal in Northern Indiana.

The basin of Lake Superior lies apart from the other great lakes, at the extreme north-west limits of the formations which have been described. Its immense area, and profound trough, nearly eight hundred feet deep, excite new interest by their surroundings. Hollowed out in part from the lowest Silurian rocks, it is the highest of the lakes. Its mineral resources, copper and iron, belong to still older formations, which surround it on all sides except the south. Laurentian and Huronian mountains support a back country of forests and lakes of great extent, which pour their waters into all its shores, and offer commerce with the unknown regions of the interior of the continent; in fact, the western end of the great northern basin drained by the Ottawa, St. Maurice, and Sague-nay.

All that can be said of this northern basin is, that it is a wilderness of small lakes, the areas of which, if summed together, would make a water surface nearly, if not quite, as extensive as lake Ontario, and of rivers rivalling in magnitude the largest affluents of the St. Lawrence.

The Ottawa, by which the waters of this region find their way out of the Laurentian mountains, at the Lac des Chats, upon the plain of Montreal, is so copious of flood, that it colors with its brown waters the north side of the current of the St. Lawrence River as far down as Lake St. Peter; just as the turbid waters of the Missouri color the west side of the Mississippi far below St. Louis. Large as the St. Maurice River is, it is not larger than the Gatineau, one of the northern branches of the Ottawa. The Saguenay is but a tidal estuary arm of the Gulf of St. Lawrence, the outlet of Lake St. John; but into this also flows from all sides the drainage of another section of the same area. Reviewing, then, the narrow southern and western border, and feeble tributaries of the chain of great lakes, and the small rain areas of the peninsulas of Michigan and Upper Canada inclosed between them; and on the other hand, the great outspread of the northern basin, its many large rivers and standing lakes, it may be justly said that the basin of the St. Lawrence is the basin of Canada; that it belongs almost wholly to the North, and finds its grandest hydrographic traits of character in a country almost unexplored. Its whole area Sir William Logan has stated at five hundred and thirty thousand square miles, more than eight-tenths of which he says belongs to Canada, and the residue to the United States. Its chief peculiarity lies in the reservoirs of water, great and small, scattered over almost its entire surface, protecting its rivers from those disastrous floods which desolate the river banks of other regions of the world, especially the neighboring valleys of the Western States. So effectual is this protection, that the total variation of the level of the St. Lawrence River, due to excessive rains or melting snows, and exclusive of the local influence of the ice-gorges at its narrows, does not exceed three to four feet; whereas the Ohio River at Cincinnati has been known to rise sixty feet in as many hours.

Having described the leading features of the topography of the basin, and shown how this must depend so largely upon the geological features of the whole district, it is further to be remarked that sheets of water, besides the larger lakes, the names of which have frequently occurred in this description, are very numerous, and that they are found extending over a vast area of country principally on the north side of the longitudinal axis of the basin.

It may be said that all the largest of these lakes are hollowed out in the old Laurentian formation, and in its bands of limestone; and, as has been mentioned, similar depressions occur in the azoic rock of the Adirondack country. The smaller lakes occur, also, to a very large extent, in drift on both sides of the axis of the valley; and of these we may mention the series lying upon the course of the Otonabee and the Trent, on the north side of Lake Ontario. But the most extensive development of these small surfaces of water occurs in that flat region of country forming the great southern peninsula of Michigan, which is generally described as covered with a great thickness of drift.

In the course of the Michigan survey, the topographers have already laid down on the maps fourteen hundred and twenty-five lakes, occupying areas of from one thousand to three thousand five hundred acres, which would be in the proportion of one acre of water to thirty-nine acres of land.

We cannot properly pass from this subject without referring to Lake St. Clair, which is only a shallow depression in the drift. It consists of an expansion of the straits leading down from Lake Huron to Erie, and may be assumed as twenty-one miles in length, by eighteen and a half in width. Its depth is only twenty feet, and Lake Erie, which does not exceed eighty-four feet, is the recipient of the alluvial deposits of the rivers which flow into it. The inlet to Lake St. Clair is an interesting delta, and islands of alluvium are constantly forming, which tend to choke up its numerous channels. Although the average depth of Lake St. Clair is about twenty feet, the navigation through it has to pass a channel which is naturally about ten feet.

A moderate gale of wind soon raises a sea in this shallow lake, causes the whole to become turbid, and tends thus to distribute the detrital matter, and to convey it through the Detroit straits into Lake Erie, where similar accumulations, on a larger scale, occur. The depth of Erie over its upper end scarcely averages eighty feet, its deepest part being near the east end, where it begins to narrow towards the outlet, in the direction of Niagara. Here, too, an ordinary storm raises a very heavy and somewhat dangerous sea, and soon disturbs the bottom, and favors the distribution of natural deposits which settle in calmer weather in the *upper* portion of this shallow basin.

Reflecting upon the relative levels of these upper lakes, and the peculiar character of the water-shed which limits the basin on the west side of Lake Michigan, it appears that if the barrier now regulating the discharge through the Niagara River were lifted to the extent of about thirty feet, the whole of the great lakes would be converted into one vast sea, on a uniform level, which, while placing under water from eight to nine thousand square miles in Western Canada and Michigan, and the other borders of the lakes, would determine the direction of the outlet of this great basin towards the Mississippi, and place the present dividing ridge from seven to eight feet below the surface of this expanded sheet of water.

RIVER ST. LAWRENCE. *

The whole of the River St. Lawrence, from its entrance at Pointe des Monts to Montreal, has been elaborately surveyed by Admiral Bayfield; and the charts and sailing directions which are published by the Admiralty are so extensive and so well known, that it is deemed wholly unnecessary to make any statements with respect to the navigation of the tidal part of the river.

The tides at Quebec range, upon the gauge which is there fixed, from eighteen feet at spring tides to thirteen feet at neaps. Unusually high spring

* See App. No. I. for a number of interesting particulars relative to opening and closing of navigation, &c., at Quebec and Montreal.

tides, accompanied with gales of wind from the northeast, occasionally give from two to two-and-a-half feet more at high water, and a smaller range towards low water, but the mean for all practical purposes may be taken at seventeen feet. At neaps the tides range about eleven and a half feet, the low-water level both at spring and neaps, rarely varying more than eighteen inches. Spring tides are felt up the river as far as the entrance into Lake St. Peter, which for all hydrographical purposes may be described as the head of tidal navigation. From this point onwards the river has for some years past been the object of constant superintendence; and works of considerable magnitude have been carried out for improving this navigation, together with that of the river up to Montreal.

The depth of water existing on the Flats of St. Peter in 1845, is reported by the authorities as only capable of passing vessels drawing not more than eleven feet at low stages of the river, and other impediments existed in the river above. But under the direction of the Harbor Commissioners of Montreal, a general deepening of the whole of the fairway of the navigation, wherever necessary, is being carried out. The works consist of a channel dredged out of the clay and mud bottom of Lake St. Peter, three hundred feet wide, and is intended to afford a depth of water, when completed, of twenty-one [24] feet at low water.

[Lake St. Peter is 21 miles long. The improvement of its navigation was first suggested about the year 1836,—the work on the "straight channel" being commenced in 1844, but abandoned in 1847, after an expenditure of $300,000. Operations were begun on the natural channel on 12th June, 1857, and continued, with some interruptions, until now that the dredged channel is 11½ miles long, 300 feet wide, and 9 feet deep, at an expense of $1,250,000,—admitting of the large steamships of the mail line coming up to the wharves at Montreal. The quantity of silt taken up and deposited on the flats at more than a mile from the dredged channel, was about 4,500,000 cubic yards. A further deepening has been determined upon, so as to give a depth of 22 feet (and ultimately 25 feet or more) at low water, to admit of the largest steamships coming up to the wharves without lighterage.]

From this point to Montreal the general course of the river is direct, although the fairway of the channel is somewhat tortuous, and there are many islands of alluvium which divert the direction of the fairway, but all the courses are duly marked and lighted, and no difficulty is felt in clearing vessels through the improved channel between Montreal and Quebec.* The slope on the surface of the river from the head of Lake St. Peter to the foot of St. Mary's current (a small rapid at the lower end of the harbor of Montreal), is about two and three-quarter inches per mile, and the average velocity is one and a quarter miles per hour in the fairway channel. The rapid last mentioned is formed in a contracted part of the river between St. Helen's Island and the north shore, which

* See App. No. III. for statements of disasters and wrecks on Lake and River navigation.

is here about two thousand feet across. The current through the rapid in ordinary stages of the water, is about four and three-quarter miles per hour, but occasionally reaches from five to five and a quarter miles per hour.

[The harbor of Montreal has wharf accommodation for a large and increasing trade,—the *ocean* vessels visiting the port in 1873 representing 413,478 tons, and the river and inland craft 933,462 tons. This accommodation has been obtained by building wharves of crib-work out into the stream of the River St. Lawrence, and by dredging out a suitable depth for vessels to lie alongside. The existing wharfage measures 17,140 lineal feet, or say 3¼ miles. There are 4,450 feet of wharf room in 10 feet depth of water; 11,690 feet in 20 feet; and 1000 feet in 24 feet; there being 3,700 feet more under contract in 24 feet, and 1,800 feet in 10 feet of water,—with contemplated additions of 11,700 feet, which will make a total lineal extent of 6½ miles of wharf-room. The increased capacity of ships coming up to Montreal is indicated by the following memoranda from the Harbor Master's Register,—showing the draught of water of vessels clearing at the Custom House during the past six seasons :—

	18 ft and over.	19 ft and over.	20 ft and over.	21 ft and over.	22 ft and over.	Total drawing 18 ft to 23 ft.
No of vessels in 1869..........	41	26	38	14	6	125
" " " 1870..........	68	48	17	5	none.	138
" " " 1871..........	97	47	18	7	2	171
" " " 1872..........	95	63	21	4	2	185
" " " 1873..........	86	52	30	17	7	192
" " " 1874..........	73	39	29	18	12	171

In the season of 1873, four vessels cleared from Montreal drawing 23 feet; in 1874, one vessel cleared drawing 23 feet, another 23½ feet, but the returns were not complete at time of going to press.] *

This harbor was, until the construction of the canals, the head of navigation for sea-going craft; and until the commencement of the canal system, the real difficulties of the navigation of the river began at this point.

It was a great thing to witness a river, rarely less than two miles in width, gradually extending to twenty miles, flowing for five hundred miles of its course with great regularity for eight months in the year, and affording accommodations for square-rigged ships of six hundred tons, which then reached Montreal; it was another thing to attempt the movement of freight from this point upwards. The work up the Valley for the first ten miles above Montreal, was performed either by the Portage Road, so called, or by dragging up by the sides of the rapid current, with long teams of oxen or horses, sometimes in, sometimes out, of the water; and such portages as these occurred at nine distinct points between

*** See a very important Letter from Hon. John Young, Chairman Board of Harbour Commissioners, in Appendix No. VII.**

Montreal and Kingston, and similar portages were also necessary on the Ottawa.

The work was chiefly done by canoes or large bateaux, which rarely exceeded twenty-five tons burthen; and it may readily be understood how the freights and charges, for the movement of goods and passengers, acted as a most formidable barrier to progress in the settlement of the country; and as movements over the deep alluvial soil of the valley, in a state of nature, could only be undertaken either in the driest season of the year, or in sleighs over the snow, it is not surprising that forty [fifty] years ago, the settlements of Canada consisted only of a few villages and farms fringing the most favorable sites on the banks of the river and Lake Ontario. Still more difficult of access was the country, and more sparse the population of those then remote regions on the border of the upper lakes.

The Niagara Portage was, however, established early in the present century, and assumed a great importance up to the time of the completion of the Welland Canal. While up the Ottawa, the country at the beginning of the present century, on both sides of the river, could have advanced but little in material prosperity and settlement since the time when the Jesuits narrated (in their most interesting letters written one hundred and fifty years before), their occasional visits to these regions.

There are, however, two periods which we must now mark, as the first great steps towards the real progress of the country; and one of these which has only fulfilled in American waters what has been the result in all others, is that of the commencement of steam navigation; the other is the establishment of the canal system.

It is an agreeable fact to state that on the River St. Lawrence, and on Lake Champlain, almost the first successful attempt was made to employ steam for the propulsion of vessels; and the following narrative, drawn up by a local committee, will be read with some interest by engineers:—*

"In 1807, Fulton first launched his first steamer on the Hudson. In 1809, his example was followed on Lake Champlain and the St. Lawrence.

"The first movement towards the steam navigation of the St. Lawrence was

* The following facts in the history of steam navigation, may be noted here:—

In the year 1831, the steamer "Royal William," built at Quebec by a ship-builder named Black,—(it has been stated that Mr. J. S. Campbell was the builder,)—was finished on 15th July, and registered 363 tons at the Custom-house in that City, on 22nd August. This ship was owned by Messrs Finlay, Walker, and Leaycroft, Trustees for the Quebec and Halifax Steam Navigation Company. The "Royal William" appears to have plied between Quebec and Halifax until 1833; and in that year she made the first trip across the Atlantic that had been accomplished entirely by steam propulsion. She was cleared at the Custom-house in Quebec, on 3rd August, 1833,—McDougall master;—sailed from that port for London, on Monday morning, 5th August, at 5 o'clock, and (having called at Pictou, N.S.) made the passage in 25 days.—W. J. P.

made by the late Hon. John Molson, in conjunction with David Bruce, a ship-builder, and John Jackson, an engineer.

"The vessel built by them was the 'Accommodation;' she was but a small boat, seventy-two feet in length, with sixteen feet beam, propelled by an engine constructed by Mr. Jackson, of not much exceeding six horse power.

"It required no ordinary courage and enterprise on the part of these pioneers, to undertake the difficult task which they thus essayed. But all the difficulties encountered were successfully overcome, and on All Saint's Eve, 1809, the steamer started on her first voyage to Quebec. As she passed after nightfall some of the settlements, going without sails against an easterly wind, the sparks flying out in a continuous stream from her funnels, as has been the case elsewhere, the consternation of the inhabitants residing along the banks of the river, at the unwonted sight, must have been very great; and we can easily suppose that it might well be taken for some phantom ship, or other fearful apparition. It was held dangerous to continue their progress through the night, and three days were consumed in the downward trip of one hundred and eighty miles to, and four days in the upward one from, Quebec. Therefore it was, that those who had to reach Quebec either by the tedious land route or the more uncertain transport of sailing craft upon the river, hailed the prospect of this more swift and certain steam navigation with satisfaction. The experiment proved a failure. The engine was, of course, too weak, and of imperfect construction.

"Yet notwithstanding the lack of immediate success, and the money lost by the first attempt, Mr. Molson did not abandon the enterprise. His practical mind saw, even in that failure, the certainty of a final success, which he lived to realize. He went to England, and there contracted with the firm of Bolton & Watt, for the engine of a larger boat, some of the castings and rougher parts of which were made in Lower Canada. The London engine builders could build the engine, but they knew nothing of the appliances by which it was adapted to navigation: these required to be furnished here.

"In 1811, the new vessel, the 'Swiftsure,' was launched and at work, and in 1812, did 'the state some service' in the transport of troops and stores during the unhappy interruption of our relations with the United States. This boat had nearly five times the power of the 'Accommodation.' Her length was one hundred and twenty feet, her beam twenty-four feet, the engine was rated at twenty-eight horse power, and she was fitted up and equipped in all respects in a superior manner.

"The 'Malsham' was the next boat placed on the line, still superior to the 'Swiftsure;' and after her the 'Lady Sherbrooke,' vessels at that time of very considerable tonnage and power.

"At this period the river was not lighted and buoyed as at present: it was, therefore, thought unsafe to run after dark. The pilots, too, were less experienced than at present: it was, therefore, usual to anchor at night. Frequent and expensive delays were also caused by strong southerly winds in getting up the current St. Mary, more especially when the boats were heavily loaded, as they generally were at that time. Oxen and horses were sometimes employed to tow the vessels up this very powerful current.

"In a few years later than the period referred to, we find the St. Lawrence Steamboat Company, and their competitors (afterwards their coadjutors) the Montreal Towboat Company, running their boats during the night with perfect safety, and ascending the current in any state of the wind, triumphing over all the former difficulties of the navigation.

"To the late founder of the St. Lawrence Company, the Hon. John Molson, the celebrity of being the first to establish steam traffic on our noble river must be accorded,—a traffic which, by the enterprise of Upper Canada and that of our neighbors in the adjoining States, is now made to enter from Superior City, on Lake Superior, and Chicago, on Lake Michigan, to the ocean,—aye, and across the ocean, also.

"To the late Robert Hamilton, Esq., Upper Canada is indebted for the first steamer on Lake Ontario, the engine of whose boat was constructed from the model of the 'Malsham's' engine.

"In contrast with the dimensions, power, and speed, of the little 'Accommodation,' we subjoin those of the 'John Munn,' the largest steamer now (1856) plying between this city and Quebec:

Length,..	312	feet.
Breadth of beam,..	29	"
Cylinder,..	72	inches.
Stroke,..	11	feet.

"She made the downward trip easily enough in ten hours, and the upward in from eleven to twelve hours."

In 1819, * the canal system was begun in the construction of the Lachine Canal, and following this, other works of the same nature, for the improvement of the Ottawa and the St. Lawrence, which will hereafter be described.

From Montreal up the natural course of the river, there is a series of rapids which give a high velocity to the water, in some cases not less than eighteen miles per hour, which give rise to a rapid turbulent stream, over a rocky bottom of an uncertain depth; alternated with lakes or wider stretches of the river, which have reduced the velocity to a minimum of half a mile per hour, in the centre of Lakes St. Louis and St. Francis.

ST. CLAIR FLATS.

Among the works undertaken on the line of inland navigation, is the deepening of the St. Clair Flats, forming the delta at the head of the shallow lake elsewhere described. Up to the year 1856, great inconvenience was felt at this point, particularly at low stages of the western waters, where there was barely six feet of water in some places; and to escape the shoals and shifting sands (which in rough weather were even dangerous), it was the common practice to lighten, at a considerable cost, a part of the cargoes of the ordinary lake schooners.

The attention of the United States and Canadian legislatures was at length successfully drawn to the subject, and appropriation was made accordingly, to effect the clearing up, and buoying and lighting of a channel; and since that time, viz., from and including the year 1857, to the end of 1858, the total quantity of dredging done was one hundred and fifty thousand seven hundred and sixty cubic yards, and the channel at the upper end was made two hundred feet wide, the average width being two hundred and seventy-five feet wide.

The channel is now [1865] excavated to insure a minimum depth of twelve

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* See App. No. II.

feet throughout; and in the middle of the channel, for a width of two hundred and thirty feet, the depth is thirteen feet.*

There are three main channels or passes through the delta, known as the North, Middle and South Passes,—the latter being the one selected for the operations described, and forming the boundary line between Canada and the United States.

ICE.

The phenomena attending the formation of the ice, and its removal, which form the natural limits to all the economical operations of the people living within the district, deserve especial consideration. During the long winters, in the earlier periods of the history of the country, the people were driven to their homes, without much occupation beyond what was essential to the support of existence. It was a period of four months, with a mean temperature of twelve degrees below the freezing point,—but with extreme fluctuations, of deep snows,—and during which, if they could not obey the same instincts which led most of the animals of this vast region to migrate, they would follow that of others which were fitted for hibernation. It is this curtailment, perhaps of a third part of the year, which has encouraged—if it has not developed—that remarkable activity and change in habits (rapid as the changes of the temperature itself), observable in every person and in every operation, upon the opening of navigation.

Travelling through the Northern country, and the *transportation of goods*, during the open seasons, since the discovery of Canada, were chiefly carried on through the lakes, rivers, and streams, in bateaux, or canoes hollowed out of pine logs,—or in the still more fragile craft, birch-bark canoes,—which were hauled out at rapids and falls, and carried around by the Portage roads to the navigable water above or below, as the case varied.

These brought into action a peculiar class of hardy French-Canadians, with Indians and half-breeds, all known as "voyageurs," and it is not to be wondered at that the opening of the long-frozen waters is hailed with pleasure, as the commencement of a new existence, in the interior of the country.

The temperature of the lakes and rivers, and of the soil, has been referred to; and the study of a sufficient number of observations would probably enable us to define the general laws of cooling: but all the leading phenomena connected with the advent of winter, and with the well-established but slight moderation, known as the "January thaw," the mode and time of breaking up of the ice, have naturally been long and patiently watched and noted; and as the variations of temperature and their effects on the streams and rivers are again and again repeated, with much general regularity, there is little room for error in taking only a few years' observations for the establishment of the leading general characteristics of a given locality; and the uniformity of recur-

* See depth of water in inland harbors, in App. No. I.

rence in the phenomena under consideration is one of the most striking features of the natural history of the country.

The average number of days of closed navigation is:*

At Quebec,	
At Montreal,	145
Of the St. Lawrence Canals,	135
Of the Ottawa,	
Of the Lake at Kingston,	90
Of Lake Erie, at Buffalo,	130
Of the New York Canals,	134
Of the Welland Canal,	116
Of the Detroit River,	117
Of the Sault Ste. Marie Canal,	156
Of the Illinois and Michigan Canal,	118

The few frosts which occasionally occur early in October, and effect that remarkable change in the color of vegetation so often dwelt on by those who have resided in, or visited, during the "fall," the northeastern portion of the continent, are generally followed by unsettled weather, with occasional heavy rains, and a temperature corresponding to the mean of the year. This is succeeded, early in November, by a slight flurry of snow, and then by a warm and genial season, with an increased degree of moisture in the air, and a peculiar haze, much resembling our season of early October in the southern counties of England, and is called, in the transatlantic country, the "Indian Summer." This charming period is suddenly terminated by cold, clear weather, and by about the 25th of November the still waters become frozen on the surface. Generally by the 5th of the following month, there is a fall of more or less snow, which, while covering with a protective mantle, and retarding the cooling of the earth, aids the formation of the "ground ice," or "anchor ice," in the streams.

The author, having attentively watched the formation of this description of ice, recognizes it as the precise repetition of the same phenomenon in the Thames and Kennet, of England.

The results of his observations in England, on the rivers named, have been supported by similar observations in American rivers, and serve to show that the primitive crystals of ice formed first in contact with the cold air, at the surface of the streams, or derived from snow falling thereon, are carried down, by counter-currents and eddies, below the surface, where they become fastened to the best conducting media. Occasionally portions of the agglutinated mass are broken off by the force of the current, or by other causes,—among which may be, and probably is, the change in the atmospheric pressure, and in the temperature of the stream, and consequent change in specific gravity, which would induce the rising of the mass to the surface; and in the large American rivers this soon takes effect, and the whole becomes frozen into a solid mass of field or surface

* See opening and closing of navigation at the ports of Quebec and Montreal, also in the Canals, in Appendix Nos. I. and II.

ice. Much of the ice, however, is for the time held to the bottom, by contact with stones or a rocky bed, and is then known as anchor-ice. Much travels, rolling slowly along on the bed, loaded with gravel or sand, which increasing the specific gravity of the mass, prevents its rising to the surface.

Soon the small bays and indentations of the banks fill up, and shallows become more effectual barriers to the stream, producing comparatively still waters, which, under the influence of the *all-pervading* cold, with the increased falls of snow, augment the thickness and strength of the floating masses. Then begins an actual blockade, causing an increase in the height of the river, which relieves, for the moment, some of the ice and the pent up water, which flows towards the next retarding point.

In the large rivers this is particularly interesting, and some of its features are really imposing. At Montreal, for instance, the movements are possessed of a certain degree of grandeur. Here the current, before described, flowing between the northwest bank and St. Helen's Island, although the narrowest channel, soon becomes the master current; for that which flows through the wider and shallow space, on the south side of the Island, although really in the most direct course to the lower reaches of the river, soon becomes almost blocked up. The great discharge of the field-ice, broken up first in the Rapids of Lachine, is, to a partial extent, reset into floes in the Bay of Laprairie, above the Victoria Bridge, and approaches the St. Mary's current in such masses and quantity as soon to fill up the reaches below, which, by this time, are more or less blocked up by the accumulation of the solid field ice, which commences in Lake St. Peter, and extends for many miles upwards through the low islands and over the shallow rivers between Sorel and Berthier. The next blockade below the city forms at Boucherville, where local circumstances favor its collection. The subsequent filling up of the whole surface of the river, for about seven miles of its course, is rarely the work of three days.

Now the most interesting feature begins to show itself. The ice continues to come down in undiminished quantity and mass, and gradually reduces the channel of St. Mary's Rapid, which results in a rising of the surface to obtain the required discharge through the diminished cross section. Often temporary relief is obtained. The water falls suddenly, and rises again, for like reasons, until at length an uniform "regime" is established. During these sudden rises and falls, the ice coming down with the velocity due to the river, pushes or shoves and packs,—rising up and piling itself in mounds on the banks; covering the wharves—already submerged—to the extent of from two to twelve feet; mounts, generally, a retaining wall twenty feet above the ordinary level of the river, occasionally packing and piling upon it, and obstructing the wide front street, with a mound rising in some instances to the eaves of the warehouses, from twenty-five to thirty-five feet high.

In other places, as on the low islands in the river, and in shoals in that part of it opposite the city, the accumulation goes on, while the projecting up-stream side of St. Helen's Island receives its share.

Doubtless the discharge of the river is, to some extent, reduced in quantity through the freezing up of streams whose volume is not regulated by lakes on their respective water-courses; and the discharge of the large lakes is also greatly reduced by the obstruction caused by the barrier of ice across their mouths; and where, as the head cannot rise in the like proportion (*i. e.* to a degree sufficient to compensate for the reduction of the hydraulic mean depth of the river at its outlet), the mean velocity and discharge must decrease. Such effect, at least, is perceived at the lower parts of the river, where, in general, from six to ten days elapse after the final taking, and all shoving has ceased. The whole surface then falls, except in those parts where the ice has grounded; for although the ice is, over a good part of the area under consideration, estimated at from ten to twelve feet thick, some portions may be deeper, and actually resting firmly on the bed of the river. There successively appear indications of shoal water: and we may recognize in some of the large mounds on the surface, when it has fallen to its final "regime" of minimum level (which is attained generally in ten days after the final taking), the shoals and dangers of the navigation,—a sort of parallel repetition and model of the surface of the bottom.

The circumstances which have been here related occur again at most of the Rapids; and there are interesting illustrations every year at Lachine,—on no occasion or place more so than the remarkable shove which took place last December [1865 ?], four miles above Montreal, also at Cornwall, and in other Rapids up stream. Similar effects take place on the river in the Richelieu Rapids, below Lake St. Peter, which generally rises far above its usual level, and causes considerable inundation in the district above this part of the river, and on both sides of it.

But perhaps the most striking feature of the season is its breaking up, which is generally attended with the same features on even a more extended scale, the average period of this being about the 10th of April; and at Montreal it has been accompanied by many curious effects, of jamming and shoving, and what is more important, by certain occasionally attendant floods, so as to render it a matter of surprise, in spite of repeated warnings, and with a past history of the river, which nature has painted in such distinct and marked lines as cannot be misinterpreted,—that the subject of a remedy has not long since met with more becoming attention from the authorities of the city, especially in the interest of a portion of it extending towards Lachine swamp, which bears marks of its ancient office, as an important channel of the river.

The breaking up is always accompanied by the shoving, and generally with more or less packing. In these movements are tested the value of the cribwork elsewhere described. The wharves being kept low, they are comparatively clear of the moving mass of ice; and if sufficiently loaded with stone, and left with smooth surfaces, no considerable injury results. Instances of the removal of large masses of cribwork, although known, are rare; and where they have occured, the fact has generally arisen from want of attention to their loading or their undue height, or to injudicious position or direction of their sides.

The tidal portion of the river occasionally "takes" at the Richelieu Rapids; and in about four years out of five it takes for a few days, at least, and sometimes even for the whole time, in the narrow gorge of the river, opposite Cap Rouge, from six to eight miles above Quebec.

At Quebec the much wished for "taking," and the formation of a "pont" so called, is less frequent; and it seems that one year in four is about the frequency of occasions. When the ice bridge or "pont" exists, the surface is generally frozen for a considerable distance to the head of, and sometimes down both channels of the river at the sides of, the Island of Orleans, from one to six miles.

The navigation at and below Quebec soon generally becomes obstructed through the large accumulation of drift-ice in the tideway, which fills up most rapidly, and sometimes to the extent even of almost the whole surface of the river, for eighty miles down its course, before the end of January.

The manner of its accumulation is chiefly to be observed in the bays and indentations, where accumulations go on increasing until an occasionally higher tide than usual floats large fields of ice into the stream; this, of course, generally drags along the shore of the river, or becomes attached to older drift-ice, or to stones and rocks, which it grinds and rubs to a smooth, rounded, *moutonnée* surface, recognizable on all rocks subjected to glacial action, and a "bordage" accumulates, having a width and thickness chiefly affected and modified in form by winds and tides.

WINTER AND LUMBERING.

The progress of civilization and of trade in Canada, has developed occupations for the farmers in winter, who avail themselves of the frozen rivers and lakes to move heavy loads of produce which could not be carried over the unmetalled roads of this vast district of soft surface clay and marl, and, therefore, winter is now looked for with almost as much interest as the harvest.

The lumbering operations of Canada are almost all performed in the depth of winter, and while there is a great depth of snow, the trees generally being felled when there is from two to three feet of snow in the woods. These are then hewed down to suitable sizes, and hauled out by horses, on the snow or across the ice to the frozen streams, upon which they are moved forward, first singly, then in drams,—a number of which go to form a raft,—and in this state, at the opening of navigation, they travel for many hundreds of miles, down rivers, across lakes, and overcoming rapids by means of slides or shoots, having a slight depth of water to facilitate their movement.

METEOROLOGY.

With respect to the temperature of the waters of the valley of the St. Lawrence, the writer is not aware of any other continued observations than those which have been made in the River St. Lawrence at Montreal.

The following is the result of one year's observations on the mean temperature of the water, and the mean temperature of the air, taken at two stations at 9 A. M., noon, and 3 and 6 P. M., for the year 1861, near to the City.* These results show that the mean temperature of the year was 45.03°; that the mean of the air during November, December, January, February and March, 151 days, was 24.20°; that the maximum was 47.50°, and the range 76°; and that the number of days at and below zero was 16; at and below 32°, 113; and at and below 24.20°, the mean, 75. That in the next period,—April, May and October,—92 days, the mean was 49.23°; the maximum, 73.50°; the minimum, 21.50°; the range being 52°; and at and below 32°, there were 8 days; at and below 49.23°, 58 days; at and above 60°, 19 days; at and above 70°, 3 days.

Of the remaining 122 days, namely, June, July, August and September, the mean was 67.91°; the maximum, 91°; the minimum 45.50°; the range, 45.50°. That at and below 50°, there were 4 days; above 67.91°, 86 days; at and above 80°, 14 days; at and above 90°, 3 days. The total number of days in the year below 32°, was 121; the extreme range of the year, between 9 in the morning and 6 in the evening, was 119.5°; in any 24 hours in the summer, was on July 10th and 11th 20.50°; and in winter, January 10th and 11th, 38°. The mean temperature of the water, during the year, was 45.80°; the mean of the month of August was 69°, and of January, 30.50°. And the records show that the temperature of the water for four months, namely, January, February, March, and December, were, respectively, 30.50°, 30.55°, 31.20°, and 31.90°. The extreme range of the temperature of the water was 46°,—its maximum temperature was 75°, on the 5th of August, and the minimum 29°, on the 8th of February, on which day the minimum atmospheric temperature was also observed.

The mean temperature of the soil has been observed, for a considerable period, at Burlington in Vermont; and also at Dr. Smallwood's Observatory, at Isle Jesus, near Montreal; and the mean temperature, at four feet beneath the surface, is stated to be 44.70°. The majority of deep springs which have been observed by the author give a temperature of 44°.

With respect to the penetration of the frost into the ground, much depends upon the nature of the soil, and character of the vegetation, or the depth of

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* The observations were made, and elaborate statements prepared by Mr. Thomas D. King of Montreal,—tables of the daily observations being printed along with Mr. Blackwell's treatise. The table containing summary of means, &c., for the year will be found in App. No. IV.—W. J. P.

snow which covers the surface of the earth. But as a general rule, for the guidance of engineers in the country, it is stated that no water-pipes are safe at a less depth than four feet; and at this depth there were many indications of frost during the existing winter, in the trenches prepared for gas and water-pipes, in the city of Montreal.

FLOODS.

Attention has been drawn to the remarkable absence of floods in the River St. Lawrence. Although those in the Ottawa are felt, yet they rarely exceed seven feet in the greatest instance, the whole basin forming an exception to the general rule of all North American rivers. In fact, taking the St. Lawrence River proper, from Lake Ontario downwards, it is most remarkable that, except under the influence of the packing of the ice (the effects of which are elsewhere explained), the floods in the river, due to freshets, are scarcely perceptible; the extreme fluctuation which generally takes place in the months of April and May being about two feet two inches above the normal level. This is, of course, due to the compensating effect of the great lakes, the area of the rivers themselves, and the uncounted lakes and swamps scattered over the whole of the basin on the slope of the northern side of the drainage area. And it is not a little remarkable that these lakes appear to be most numerous in the Laurentian system. The same feature is observable in the Adirondack region, which is also full of streams and lakes, many of which are found at seventeen hundred to eighteen hundred feet above tidewater at the head of the Moose River, and the Black River, naturally draining into Lake Ontario, at Sackett's Harbor, and lying closely contiguous to the head waters of the Scroen and Mohawk, flowing to the Hudson, and those of the Raquette, which drains into the St. Lawrence, at Cornwall.

If we examine the basin of the Ohio (the southern neighbor of the St. Lawrence), draining the northeast portion of the Mississippi basin, and having its source from five hundred to one thousand feet above the level of Lakes Ontario and Erie, the dividing ridge not averaging thirty miles away from the shore of both of them, and having an area of about two hundred thousand square miles, one is struck with the remarkable contrast in its discharge. The river flows for its entire length (about nine hundred miles), in its low state with a gentle current, unintercepted by rapids, except at the Falls of Ohio, near Louisville, where there is a sudden fall of twenty-six feet in three miles; and it is during the summer season a scanty, shallow stream, a succession of long pools and ripples, with a current alternately sluggish and rapid, with bars in the upper part of it consisting of gravel, and in the lower part of shifting sand.

The rain fall of the Ohio Valley may, perhaps, slightly exceed that over the average of the St. Lawrence Valley, as far as we have the means of calculating (the average fall over its area being, perhaps, fifteen per cent. more than that of the St. Lawrence basin); yet the range between extreme low and extreme high water is about forty-five feet throughout the river. At Wheeling, Virginia, eight hundred and ninety miles above its junction with the Mississippi, it is forty-five feet; at Louisville, forty-two feet on the Falls, and sixty-four feet below them; at Evansville, forty feet; at Paducah, fifty-one feet; and at its confluence with the great Mississippi, fifty-one feet. The usual range does not exceed twenty-five feet. The usual rise in the Ohio takes place in February, and occasionally as late as March. This arises from the melting of the snows, and generally amounting to twenty-five feet; the river remains high for about six weeks. Another rise takes place in May, or June, due to the summer rains, lasting from three to four weeks at Cairo, and from one to two at Louisville. In October the lowest stage is obtained, when it is navigable chiefly for boats of eighteen inches draught; but in November, the river generally begins to rise, and continues to do so until the banks are full. These floods are due to the autumn rains, which are sometimes continued as late as the end of December.

FLUCTUATIONS OF LEVEL IN THE ELEVATION OF THE SURFACES IN THE GREAT LAKES.

It cannot be surprising that suppositions have been entertained as to the existence of tides upon these large masses of water; and we find in the "Relations des Jésuites," recorded in the very interesting correspondence sent to France, between 1660 and 1680, frequent references to the subject. Later than that the subject was noticed by Dr. Weld, in his travels in Canada, from 1790 to 1795, who stated that it was believed by many that the waters of Lake Ontario were influenced by a tide ebbing and flowing frequently in the course of twenty-four hours; and he instances the fact of its rising and falling fourteen inches every four hours in the Bay of Quinte. Other writers, as well as observers, have altogether denied the latter statement, and have attributed the remarkable fluctuations which occasionally occur on Lake Ontario, and on Lake Huron to other causes; and have not hesitated to ascribe them to partial and local changes in atmospheric pressure.

But it was impossible to dispute the fact of great fluctuations existing over a long period, the range of rise and fall in which has occupied several years to complete.

The fluctuation, as may be supposed, is a matter of extreme importance to the various interests which have sprung up on the borders of the lakes, and the great rivers connecting them, but to none more than to the canal interests, as in the case of the Erie Canal, at Black Rock, the supply to which canal is derived through its uppermost reach, direct from Lake Erie, and in which the extreme fluctuations that occurred, as recently as in 1853, caused very considerable anxiety to the managers of that canal; and the relief from which was only to be found in the deepening of the whole of the canal for about twenty-two miles, the greater part of it through a limestone cutting.

As to the causes of this class of fluctuations, a great variety of suggestions have been thrown out, and, as it appears to the writer, some degree of unnecessary difficulty suggested, as to the explanation of the causes, which we should probably find little difficulty in explaining, and even of predicting the fluctuations, if suitable arrangements existed for obtaining data by a sufficiently extended series of observations upon the quantity, the rate, and the time of the fall of rain and snow, and of all the other meteorological phenomena which affect the conversion of the snow into vapor or water. It would be necessary to record the prevalence, direction, and continuance of the winds, which are observed to produce the most extraordinary effect on the surface of these lakes. And, lastly, should be observed the manner and the form of the taking of the ice at the outlets of these great lakes.

This latter feature appears to have been almost entirely overlooked in the suggestions which have been made to account for the increase or decrease of level in the lakes. But it will at once be apparent that the existence of a broad belt of ice over the whole surface of a rapid river, running at the rate of from three to four miles an hour, must have a great effect in regulating the discharge of that river, and so far modifying its surface. For instance, as at Fort Gratiot, at the foot of Lake Huron, where the river is about nine hundred feet wide, and usually runs at the rate of about three and a half miles per hour (the depth being about forty-five feet), through about half a mile of its course. The river, also, for several miles below, has about double the width mentioned, and is from twenty-five to thirty-five feet deep, with a fall of about six inches per mile, producing a surface velocity of 1.45 miles per hour. The flatter surface last mentioned is generally covered with ice throughout the winter, but the rapid at the lake outlet is rarely covered more than once in five years. And under these circumstances, it will be observed that the hydraulic mean depth will be reduced from forty to forty-five per cent., by addition of the coating of irregular masses of ice forming the surface, which thus adds to the wetted perimeter, our divisor in hydraulic calculations.

The same facts have been observed to take place at the discharge of Lake Erie, near Buffalo, which is described by Major Lachlan, in the Canadian Journal, of 1854, at the breaking up of the ice of that year, as having had the effect of reducing, for forty hours, the discharge of the Niagara River, so as (according to other testimony), to have reduced the apparent discharge of the cataract by at least one-half, and on which occasion operations were carried on by the mill-owners, on the American side of the river, far out into the stream. The writer also observed, in September, 1857, a rise of two feet nine inches, in the level of the water at the Ferry wharf, below the Falls, which took place in the course of one night. This result was not due to rain, nor to any other circumstance, but the continuance, for about twelve hours, of a heavy gale from the southwest, which had the effect of raising the head, and thus increasing the discharge through the rapids at Buffalo, so as to require the additional head of two feet nine inches, in the reach of the river, immediately below the Falls, to enable that deep section of the river between the Falls and the Suspension Bridge, to carry off the increased volume.

The writer by no means desires to imply that all these fluctuations in levels are to be explained by the effects of the accumulation of ice, or by its entire absence; as it is obvious that these only form one of the many circumstances which regulate the very interesting phenomena to which reference has been made.

It will be observed from the facts above stated, that notwithstanding the extensive area of these great lakes, which act in general as compensatory reservoirs, in equalizing the discharge to an almost uniform quantity; yet there are times, as before explained, when an excessive discharge, as well as the reverse action, will introduce abnormal conditions which would have to be eliminated in any calculations of actual quantity; and it may be stated, as an interesting fact bearing on this subject, that the rise of water, to the extent of one foot, on Lake Huron, for about twenty hours, in the summer of 1858, appears to have affected the discharge of the whole of the River St. Clair, the Detroit River, and the intermediate Lake St. Clair, throughout its length, the increase twenty miles down having been about seven inches, and at Detroit two and three-quarter inches: the central surface velocity at the point first mentioned being increased from three and a quarter to six and a half miles per hour.

Up to the present time [1865] there have, unfortunately, been very few opportunities of obtaining these observations by any special scientific or professional investigation.

THE OTTAWA.

The Ottawa is a magnificent river, having three points of confluence with the St. Lawrence; one passing by Vaudreuil, entering at the foot of the Cascade Rapids, another by St. Anne's, at the upper part of Lake St. Louis, about twenty-four miles above Montreal, and the third opposite Varennes, thirty miles below that city. The northern stream (which flows to the north, and thus insulates the district of Montreal), bifurcates near the village of St. Eustache, and further insulates the district of Laval, known by the name of Isle Jesus. The two reuniting once more close to the lower confluence with the St. Lawrence, both branches of the river pour down their brown, peaty-colored waters and stain the north-west side of the St. Lawrence nearly into Lake St. Peter, the blending there being favored by the various currents induced by the low alluvial islands occupying the river, which is about six miles wide (between Sorel and Berthier).

From St. Anne's, passing up the Ottawa, we pursue an almost westerly course to Ottawa, one hundred and ten miles above Montreal, where the Fall known as the "Chaudiere," interrupts the navigation: the Fall itself, with six miles of rapid water above it, having a total descent of sixty-seven feet.

In that part of the river now described, the Ottawa receives many very important affluents from the northern side, draining the front and the vast plateau in rear of the Laurentian Hills. The chief of these are the "Du Lievre," and the "Gatineau;" the latter joining close to the town of Ottawa, and having its sources as far north as the forty-eighth parallel, its head waters lying closely contiguous to the head waters of the St. Maurice and the Saguenay. A very limited extent of settlement has been carried out in this direction, and the region is comparatively unexplored and unknown,—still less surveyed; although those who have crossed it in various directions report it as being filled with uncounted lakes, which regulate the annual supply to the rivers of the whole of this vast region.

The affluents on the south side are the Petite Nation, and the Rideau Rivers, the head waters of the former draining back into the country, within nine miles of the main stream of the St. Lawrence, at Prescott, where its head water is forty-nine feet above it, and about ninety feet above its confluence with the Ottawa. The line of the main channel of this small stream extends its tortuous course through deep alluvial soil, for upwards of a hundred miles, passing through and producing swamps which have the same effect, to a certain extent, as the lakes on the northern side. The Rideau River has proportionately a very large drainage area, filled with lakes and streams flowing chiefly from, and determined in outline by the outcrop of the Laurentian formation, which has been described as sweeping down from the Chats Falls to the Thousand Isles, near Kingston.

Above Ottawa there is rapid water extending for upwards of six miles, and from this point the stream, although less direct, passes on in the direction of the northwest, over and through a wilder country of the Laurentian Hills, with heavy forests of pine and other timber extending down to its very margin. The irregular and tortuous channel, swelling occasionally into deep, wide lakes, terminates immediately above Allumette Island; and from this point the river, taking a slight bend once more in a west-northwest direction, pursues its course through a series of long reaches, separated from one another by short, abrupt falls or rapids, with a tolerably uniform width and depth, as far as the affluence of the Mattawan; then turning to a direction almost northward, it is described as terminating in a series of lakes, the largest of which, in the direct course of the river, is "Temiscaming," "Tamagaminque," and "Grand Lake," the one lying [illegible] distance to the west, and the other about as far to the east of Temiscaming, pouring their waters into it by the "Montreal" and "Moose" Rivers respectively, and the drainage occupying the whole district lying as far north as the forty-ninth parallel, and generally separated from the drainage into the river below Ottawa by the meridian of seventy-six and a half degrees. The affluents upon both sides of the river, for the portion west of Ottawa, are much more numerous, and are all very much smaller than the streams previously mentioned. On the north side they consist of the "Colonge," uniting close to Portage du Fort, the "Du Moine," the "Bear," and the "Kippeway." On the south side, the chief of these streams are the Mississippi, the Madawaska, the Bonne Chere, the Petawawee, and the Mattawan. These drain a vast extent of Laurentian formation, covered for the most part with heavy pine timber, the district of the chief lumbering operations in Canada at the present moment. The country is very much broken, and the bottoms of its valleys and creeks are occupied by numerous streamlets and lakes lying at elevations extending up to fourteen hundred feet above tidewater; at which elevations may be found the sources of the streams last mentioned, draining into the Ottawa, and the head waters of the Maganatawan, flowing into Lake Huron.

One tributary, on the right bank of the river, unites with the main Ottawa, at Mattawan, the point of northern divergence just mentioned; and it is important as being the favorite route of the early voyageurs in their journeys to Lake Huron and Lake Superior. Starting from the Hudson's Bay Post, at its confluence with the river, the Mattawan is traceable in a course generally westerly, through five or six small lakes, terminating in Trout Lake, which is the head of the drainage in this direction, and about six hundred and fifty-nine feet above the sea.

Among the various schemes which have been proposed for the improvement of the navigation between the upper lakes and the Atlantic, that of Mr. Shanly, which is gaining (and perhaps deservedly) the most favor, is one which proposed, after improving the River Ottawa, up to the mouth of the Mattawan, to follow the line of this tributary up to its head water in the Trout Lake. From this point it is proposed to lock down into Lake Nipissing, which is only about twenty-three feet below it, through the valley of the "Vase." Lake Nipissing, which receives the drainage of the "Sturgeon," the "Namanitigong," and other rivers, with that of numerous lakes, at their several head waters, communicates with the Georgian Bay, through French River, the length of the river being about sixty miles, and the descent, effected in a series of weir-like falls, sixty-four feet.

The entire distance from the Georgian Bay to Montreal, by the route which has now been described (and which, of course, includes improvements of the river to overcome the falls at Ottawa, the Chats, and other points of interruption, as well as the reconstruction of the small canal near Carillon and Grenville), being four hundred and thirty miles,—the lockage upwards from Lake Huron to the summit would be eighty-seven feet, and the fall downwards would be six hundred and nineteen feet, to the harbor of Montreal.

And having now generally referred to this enormous river, a full description of which might have occupied a far more extensive space,—and having mentioned the proposal to improve the water communication, by a more direct route, between the upper lakes and the Atlantic, it is only proper to draw attention to another project, with the same object in view. This consists of a canal commencing at the level of Lake Huron, near Nottawassauga Bay, passing through part of the Valley of the Muskoka and of the Severn, which constitute the drainage of Lake Simcoe, into Georgian Bay. It is proposed to make Lake Simcoe, which is one hundred and thirty feet above Georgian Bay, the summit level; and cutting through the dividing ridge, to a depth of two hundred feet, lock down its southern slope, four hundred and seventy feet, into Lake Ontario, near Toronto. With regard to both of these plans, however, little has been done beyond preliminary surveys.

Taking Chicago and Montreal as common points, and comparing both with the Welland Canal, the following would be the position of affairs:

	DISTANCES FROM CHICAGO.				LOCKAGE.		
	Miles. Lake.	Miles. River.	Miles. Canal.	Miles. Total.	Up.	Down.	Total.
No. 1. Welland Canal, Lake, and River,	1,145	132	71	1,348		535	535
" 2. Toronto and Georgian Bay, . .	775	155	120	1,050	130	675	805
" 3. French River and Ottawa, . .	575	347	58	980	87 ?	619 ?	706

From which figures it appears that in point of distance, No. 3, namely, by the Ottawa, holds a very wide advantage over both the rival routes, and is also superior, in point of lockage, to the Georgian Bay route.

CANALS OF CANADA.*

The system of canals which were exclusively undertaken, or are controlled, by the Provincial Government of Canada, consists of a series of works for overcoming the Rapids, on the line of the main discharge of the waters of the upper lakes through the St. Lawrence Valley; secondly, in improvements of the same nature applied to the Ottawa River; thirdly, in a connection effected by a cross canal between the Ottawa River and the city of that name, with the River St. Lawrence, at Kingston, which is at the outlet of Lake Ontario; fourthly, of improvements on the Chambly, or Richelieu River, which is the outlet of Lake Champlain. There is, also, a series of minor improvements in the form of locks, or very short canals, in the district occupied by the line of lakes extending almost parallel with the north shore of Lake Ontario, from Lake Scugog by way of Peterboro' and the Trent River, to Trenton, at which place the Trent discharges into the lake.

The first of these great improvements was commenced about the year 1819, by a private company, which undertook the construction and completion of the Lachine Canal, which proposed to overcome the Rapids from Lake St. Louis down to Montreal, the total length of fall being four thousand three hundred and seventy-five feet. This canal commenced in the St. Lawrence River, at a place called Windmill Point, and near the upper end of the present harbor at Montreal. One

* See App. No. II.

of the original locks still remains at this point,* and the dimensions are one hundred and twenty-six feet by twenty-four. The line proceeds across a marsh for about four miles, and eventually passes into more solid ground, and terminates in a rock of the Trenton group at Lake St. Louis. The number of locks originally was *nine.*

Following this great improvement, which at once overcame the most considerable difficulties in the inland navigation, some improvements were commenced on the River Ottawa, consisting first, of the St. Ann's lock and dam, to overcome the Rapids of St. Anne, at the entrance of the Ottawa River, about twenty-four miles west of Montreal.

The length of the entire work is about half a mile, and the fall, which is on the average about three and a half feet, is overcome by one lock one hundred and ninety feet long and forty-four feet wide. At Carillon there is a small lockage, consisting of two combined locks rising twenty-three feet to pass over a small summit (the cost to cut through which was considered too expensive), and one single descending lock 12.93 feet; so that the actual fall surmounted at this point is only about ten feet. The length of the canal is about $2\frac{1}{10}$ miles. The Chute à Blondeau is the next canal, and closely contiguous to the former one; its length being about one-sixth of a mile, overcome by one lock surmounting a lift of three feet ten inches. The Grenville Canal, still further up stream, is a canal having the same object, five and three-quarter miles in length, having six locks, overcoming a lift of forty-six feet; the total lift for the three canals being 72.88 feet ascending, descending 12.93 feet, or 59.95 feet.

All locks upon the system last mentioned have a depth of five feet upon the sills, are one hundred feet long, nineteen feet wide, and were constructed before the year 1833.

The Rideau Canal, of which there is a very full description given in an elaborate paper by Lieutenant Frome, late of the Royal Engineers, in the R. E. papers, is a work of considerable importance, and was constructed at a very large cost by the British Government. It was commenced about the year 1826, and completed about 1831. Its supply of water is from the Rideau Lake, from which lake the river flows in a general northeasterly and southwesterly direction. The length of the canal is about eighty-four and a quarter miles. Its cross section is forty-eight feet wide at the top, twenty-eight feet at the bottom, with five feet' depth of water. There are thirty-three locks, one hundred and thirty-four feet long, thirty-three feet wide, and the depth on the sills is five feet. The greatest lift is fourteen feet six inches. With regard to the construction of the canal, it was carried on under the direction of Colonel By, whose name first characterized

* When Mr. Blackwell wrote, the lock referred to existed;—it is now (Nov., 1874,) being enlarged, and will be converted into an additional outlet to connect the canal with the harbour.—W. J. P.

the locality of the city [Ottawa] which has been chosen as the future seat of government in Canada."

The Welland Canal intersects the barrier which separates, and maintains the difference of level between Lake Erie and Lake Ontario, the natural discharge of the former being by Niagara River and Cataract.

The work consists of a reach of canal extending from Lake Erie to the head of a series of lockages overcoming a lift of three hundred and thirty-one feet, which are grouped rather closely together on the rapid descent through the villages of Thorold, St. Catharine's, and Port Dalhousie. The entire length of the canal is twenty-eight miles, in addition to which there is a feeder of twenty-one miles in length, derived from the Grand River, which is dammed up to the extent of seven feet, for the purpose of affording a steady supply of water, as well as of avoiding an expensive difficulty in construction by extending the depth of the excavation, which has been a constant source of trouble; but it was, perhaps, the more desirable, in consequence of the extreme fluctuations which take place in the level of Lake Erie. The chief work upon this canal is the Summit Level Cutting, cut through the Niagara limestone, which has caused very considerable difficulty by slips and slides. The locks, twenty-four in number, are one hundred and fifty feet long, twenty-six feet six inches wide, and vary from fourteen feet to nine feet lift. The capabilities of the canal admit of vessels one hundred and forty-two feet long, twenty-six feet beam, and ten feet draught. There is also a work connected with this, called the Welland Feeder, extending to Dunville, and the Broad Creek Branch, connecting the last-named feeder with Port Maitland. The Welland Feeder has the same width at top and bottom as the main canal, viz., seventy-one feet at top and thirty-five feet at bottom, and has eight feet depth; while the Broad Creek Branch has ten feet depth, and in width is eighty-five and forty-five feet respectively at top and bottom. The locks are built of stone, and the whole work, which is under the able control and management of the Hon. H. H. Killaly, Commissioner of Public Works, has received every attention and appliance for facilitating and economizing the transit of the very heavy traffic, of which it is the medium.

The *Lachine Canal*, as before described, was started in the year 1819,* upon the limited width mentioned; but in the year 1833, after the fullest attention given to the subject by the Provincial Government, a new system was begun, which proposed to construct works up the line of the St. Lawrence, capable of passing large steamers, suited to the navigation of the upper lakes. And the important works which followed, including the re-construction of the Lachine Canal, are quite worthy of the age, in an engineering point of view.

The Lachine Canal has been widened and deepened, to one hundred and twenty feet width at top, eighty feet at bottom, and ten feet in depth. The

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* See App. No. II

terminal points and the length (which is eight and a half miles) are the same. The locks, which are four in number, are forty-two feet three inches wide at the lower level, and forty-five feet across at the top-water surface. The maximum lift is thirteen feet, the minimum eight and three-quarters feet. Vessels of one hundred and eighty-five feet length, forty-four feet beam, and nine feet draught, are the limits of capacity.

The navigation from the head of the Lachine Canal upwards passes through Lake St. Louis, and crosses over to the south-east side near the upper end of the lake, to enter the Beauharnois Canal, which is the next work. It connects Lake St. Francis with that of St. Louis, at the foot of the Cascade Rapid, and this canal avoids also the Cedars and Coteau Rapids. The length of the canal is eleven and three-quarters miles. Its width at top-water is the same as that of Lachine. The locks are nine in number, two hundred feet long, forty-five feet broad at top-water, forty-three and a half feet at the lower water surface. The greatest lift is eleven feet, the least eight feet, and the same class of vessels navigate it as pass the Lachine Canal; it is the only canal which takes the south side of the river,—the mean distance from the American frontier is twenty-five miles.

Passing up stream through Lake St. Francis, we arrive, at a distance of sixty-three miles from Montreal, at the foot of the Cornwall Canal, which is eleven and a half miles long, and surmounts the Long Sault Rapid, which has a total fall of forty-eight feet. The width of the canal is one hundred and fifty feet at top, and one hundred feet at bottom, with a depth of ten feet. It is principally formed by reclaiming out of the space originally occupied by the river and its bank, sufficient space for the formation of the cross section described.

It may be as well to remark that the centre of the river from this point onwards, is the dividing line between Canada and the United States, the line of forty-five degrees north latitude striking the River St. Lawrence at St. Regis, a short distance below the lower end of this canal. And it is interesting to observe the small width of the river near this point, and that the narrowest width between United States territory and the Canadian shore is about six hundred feet, measured between the northwestern side of Croiles Island and the canal bank. The locks on this canal are two hundred feet long, fifty-five feet on the top of the walls, and fifty-three and a half feet at the lower level.

The Williamsburg Canal, consisting of four short canals, the last of these so-called St. Lawrence Canals, commences at eighty-nine and a half miles above Montreal, and was constructed to avoid the Farren's Point, Rapid Plat, Point Iroqouis, and Galops Rapids, which have a total fall of twenty-nine and a half feet. With the construction of these canals was completed, in 1847, the last link of this great inland system. Their aggregate length is nine and three quarters miles; their cross section is ninety feet top, fifty feet bottom, and ten feet deep. There are six locks two hundred feet long, forty-five feet wide at top—forty-three and a half feet at low water. The lift of these locks is eleven and a half feet maximum, three and a half feet minimum.

All these St. Lawrence Canals admit of vessels having an extreme length of one hundred and eighty-five feet, forty-four feet beam, and nine feet draft; but the Cornwall Canal would admit of the passage of vessels with fifty-three feet beam.

The traffic on this part of the river consists of through passenger traffic, which usually assumes some importance about the first week of July, and continues until about the middle of September. The vessels engaged in this traffic are lake-going steamers, which run in connection, more or less, with some of the railways on both sides of the lake, and either in close connection, or in violent competition, with the railways for the through traffic in passengers, which it may be here stated, in the course of the summer can be barely remunerative to either system of transit. The steamers have, usually, side wheels; are very lightly built, having a draft not exceeding six feet; and they perform the distance from Toronto to Kingston, about one hundred and seventy miles (usually by night), in fourteen hours; and from Kingston to Montreal, shooting all the Rapids, in about thirteen hours, the distance being one hundred and seventy-five miles.

This route, which is a highly popular one in the country, and taken by all the strangers who visit, is very attractive through a certain degree of hazard and interest which is attached to the "shooting of the Rapids."

It need scarcely be added that the boats return to the point from whence they came, by the canals, upper river, and lake, and that they depend for their subsistence chiefly upon the western bound freight in merchandise from Montreal, the chief city of commerce in Canada. The most extensive and important business is carried on by screw propellers, as well as by lake and river schooners, scows and barges. Towing is performed by steamers.

The water communication between Montreal and the State of New York is carried on by rather an indirect line of navigation, * down the River St. Lawrence to the embouchure of the Richelieu, forty-five miles below Montreal, and about one hundred and thirty-five miles above Quebec. At Sorel, the direction of the route is a little to the west of south. The river has an average rate of about a mile and a half per hour, and in low stages of the river it occasionally runs at a rate of four miles an hour in certain localities; besides which, at St. Ours, there is a decided rapid, having a fall of five feet, where a lock and dam have been introduced, the dimensions of which admit of vessels one hundred and eighty-five feet long, and forty four feet wide, with a draft of seven feet, and at Chambly another rapid exists, amounting to a seventy-four foot fall, extending through eleven and a half miles of the river. This rapid is overcome by a canal and nine locks, the dimensions of the canal being sixty feet top-water, thirty-six feet at

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* See App. No. II.

bottom, and eight feet depth; and the locks are one hundred and twenty feet long, twenty-four feet wide at top, and twenty-two and a half feet at low water, and will admit of vessels one hundred and ten feet long, twenty-two feet wide, and seven feet draft. The navigation, which extends up to Lake Champlain, which is reached at about eighty miles from Sorel, meets with no further obstacle, and is continued free through Lake Champlain to the New York Champlain Canal, at Whitehall, where it has only to overcome a height of fifty-five feet before commencing to fall to the tidewater of the Hudson at Troy.

IMPROVEMENTS TO THE NAVIGATION OF THE INLAND WATERS OF THE NEWCASTLE DISTRICT.

Above the town of Peterboro, the Otonabee, for some miles, maintains the character of a fine river, nearly two hundred feet wide, discharging a large supply of water at all seasons, and affording admirable sites for factories requiring large power. The river there spreads out into a number of lakes, which are the recipients of several considerable streams: some of these navigable, and some, it is stated, capable of being made so at a very small cost. The connection with this district is of considerable importance, on account of the large quantity of timber abounding in that section, and the valuable nature of the country for agricultural purposes. Some improvements have been commenced, but no very extensive or permanent works executed. Improvements in the Scugog River have been carried on, and a dredging engine employed for the deepening of shoal places. The value of the several reaches of continuous water communication may be considered as created by these limited works, and daily become more manifest. They extend through a distance not less than one hundred and thirty miles; and when the various improvements proposed have been carried out, a great benefit will be extended to a large district of country.

Among the collateral advantages which have been afforded by the construction of the various canals in Canada, is that afforded by their water power, by means of which the Provincial Government has been enabled to offer encouragement to manufactures on canal banks; and arrangements were made, in the first instance, for a considerable supply of water for manufacturing purposes, which, in several instances, has been carried to a very great and injurious limit: as, for instance, on the Lachine Canal, the velocity in which has become a serious inconvenience to the traffic; so much so, that a large expenditure has been rendered necessary during the present winter, for the enlargement of the cross section through the rock cutting already mentioned near Lachine.

APPENDICES.

APPENDIX No. 1.

CANADIAN NAVIGATION.

This line of ocean and inland navigation extends from the Straits of Belle-Isle, Gulf of St. Lawrence, to Fond du Lac, at the head of Lake Superior, a distance of 2384 Statute miles. The distances on the several sections, comprising the Gulf and River St. Lawrence, as well as the greater and lesser lakes, with intersecting and connecting canals, are shown in the following table :—

	Intermediate distances in Statute miles.	Total distances from Belle-Isle.
From the Straits of Belle-Isle to the head of tide-water (Three Rivers)	900	——
From the head of tide-water (Three Rivers) to Lachine Canal......	86	986
The Lachine Canal..	$8\frac{1}{2}$	$994\frac{1}{2}$
From Lachine Canal to Beauharnois Canal, (Lake St. Louis).......	$15\frac{1}{4}$	$1009\frac{3}{4}$
The Beauharnois Canal..	$11\frac{1}{4}$	1021
From the Beauharnois Canal to the Cornwall Canal, (Lake St. Francis)	$32\frac{3}{4}$	$1053\frac{3}{4}$
The Cornwall Canal..	$11\frac{1}{2}$	$1065\frac{1}{4}$
From the Cornwall Canal to Farran's Point Canal..................	5	$1070\frac{1}{4}$
The Farran's Point Canal.....................................	$\frac{3}{4}$	1071
From Farran's Point Canal to Rapide Plat Canal...................	$10\frac{1}{2}$	$1081\frac{1}{2}$
The Rapide Plat Canal.......................................	4	$1085\frac{1}{2}$
From the Rapide Plat Canal to the Iroquois and Galops Canal.....	$4\frac{1}{2}$	1090
The Iroquois and Galops Canal................................	$7\frac{5}{8}$	$1097\frac{5}{8}$
From the Iroquois and Galops Canal, to Prescott.................	$7\frac{3}{8}$	1105
From Prescott to Kingston....................................	59	1164
From Kingston to the Welland Canal...........................	170	1334
The Welland Canal...	27	1361
From the Welland Canal to Sault Ste. Marie Canal, (passing through Lake Erie, the Detroit River, Lake St. Clair, the St. Clair River, and Lake Huron)..	625	1986
The Sault Ste. Marie Canal....................................	1	1987
From Sault Ste. Marie Canal to Fond du Lac, head of Lake Superior	397	2384

Note.—It may be noted, that in the foregoing tabular statement, the Lakes mentioned in the navigation between Lachine and Cornwall, are merely expansions of the St. Lawrence river proper. Further, the Sault Ste. Marie Canal, uniting Lakes Huron and Superior, is an American work, being constructed on the United States side of the St. Mary's river.

DEPTH OF WATER IN THE HARBOURS ON THE INLAND LAKES.

Furnished to the Canal Commission by the Collectors of Customs at the several Ports;—the information in the column headed "capability," having been added by the Secretary, S. Keefer, Esq , C. E.

Harbours of Ontario.	Highest.	Lowest.	Ordinary.	Capability.	Authority and Remarks.
Kingston	18·00	12·00	12·00	14·00	William B. Simpson and Harbour Master.
Cobourg	11·00	9·00	10·00	12·00	George Perry.
Port Hope	18·00	11·00	12·00	14·00	M. Whitehead and Harbour Master.
Newcastle	9·00	7·50	8·00	14·00	F. Farncomb; sandy bottom, no rock.
Darlington	14·00	9·00	12·00	14·00	A. Dixon; Company intends to dredge it out.
Whitby	10·50	8·00	9·00	12·00	W. Warren; Company intend dredging to 12 ft.
Toronto—Main Western Entrance	15·44	12·60	13·00	14·00	James E. Smith and Harbour Master.
" Eastern Entrance	10·00				The Eastern Channel uncertain; should be closed.
Oakville	10·50	7·50	9·00	11·00	R. H. Chisholm.
Hamilton—B. B. Canal	17·00	15·00	14·00	14·09	W. H. Kittson.
Dalhousie	16·00	10·50	13·00		Official Report, P.W., 1867. Depth on sill of Lock.
Niagara	22·00	20·00	20·00	20·00	J. W. Taylor and Captain Milloy.
Oswego	23·00	18·00			C. C. P. Clarke and Lieut. D. B. Green, U.S.N.
Port Colborne	18·75	10·00	13·00	14·00	S. D. Woodruff, Supt. W.C., and Official Returns. Lock Sill.
Port Maitland	16·25	9·00	11·00	14·00	Do do do Lock Sill.
Port Burwell	12·00	9·00	9·00	12·00	E. A. Dunham; Harbour not formed; variable depth.
Port Stanley	13.00	11·00	12·00	14·00	W Hemphill and Harbour Master.
Port Dover	10.00	8·00	9·00	10·00	T. B. Barrett.
Buffalo	22.00	8·00	14·00	14·00	W. Daniels.
Erie	14·00	12·75	14·00	14·00	R. F. Gaggin and Captain.
Sandusky	13·00	10·00	13·00		John Young.
Toledo	11·50	8·00	10·50		H. Osborn, Dy. Col.
Detroit	21·00	18·00	18·00	18·00	Major C. B. Comstock, Engineer, U S A.
St. Clair Flats, Channel	14½	13·00	14·00	14·09	John Brown, Contractor, Thorold, and C. B. Comstock, Major Eng., U.S.A.

DEPTH OF WATER IN THE HARBOURS ON THE INLAND LAKES.

St. Clair Flats, Channel	14½	[illegible]			Comstock, Major Eng., U.S.A.

DEPTH OF WATER IN THE HARBOURS ON THE INLAND LAKES.

Furnished to the Canal Commission by the Collectors of Customs at the several Ports;—the information in the column headed "attainable," having been added by the Secretary, S. Keefer, Esq., C. E.

Harbours of Huron and Michigan.	Highest.	Lowest.	Ordinary.	Attainable.	Authority and Remarks.
Goderich	12·00	11·00	11·00		D. Doty.
Southampton	10·50	9·00	10·00		Alex. Sinclair (Reeve), for Mr. Keith.
Grand Haven	22·00	17·00	19·00	19·00	J. A. Stephenson, Deputy Collector.
Chicago	16·00	13·50	14·00	14·00	J. E. McLean, and J. W. Steele, Harbour Master.
Milwaukee	15·00	13·50	14·00	14·00	S. T. Hooker.
Green Bay	13·00	11·00	11·00	13·00	T. P. Dousman; improvements aim at 13 feet.
River St. Marie					
Lake George, St. Mary's River	14·00	14·00	14·00	14·00	Capt. Fraser, H.M. Gunb't *Prince Alfred*, Am.Chan.
Sault St. Marie Canal, American side	12·50	12·00	12·00	14·00	To be deepened to 14 feet; P. W. Report, 1867.
Lake Superior					
Fort William (Thunder Bay, L.S.)					
Duluth (Fond du Lac, L.S.)					

INLAND NAVIGATION—FROM CHICAGO TO ATLANTIC PORTS.

ROUTES.	Lockage.	No. of Locks.	Miles Canal.	Miles River.	Miles Lake.	Total Distance
1st. Chicago to Montreal by the Welland and St. Lawrence Canals	553	54	71	185	1005	1261
2nd. Chicago to Montreal by the proposed Ottawa Canal	710	69	29	402	560	991
3rd. Chicago to New York by Buffalo and Erie Canal	655	72	352	202	865	1419
4th. Chicago to New York *via* Welland Canal and Oswego	955	94	224	196	983	1403
5th. Chicago to New York *via* St. Lawrence and proposed Caughnawaga Canals	717	72	158	363	1116	1637
6th. Chicago to New York *via* proposed Ottawa and Caughnawaga Canals	872	87	125	572	671	1368
7th. Duluth to Montreal *via* Welland and St. Lawrence Canals	572	56	72	230	1095	1406
8th. Duluth to Montreal *via* proposed Ottawa Canal	729	71	30	456	610	1096
9th. Duluth to New York by St. Lawrence and proposed Caughnawaga Canals	736	74	159	417	1206	1782
10th. Duluth to New York *via* proposed Ottawa and Caughnawaga Canals	891	89	126	626	721	1473

STATEMENT showing the opening and closing of navigation at the Port of Quebec in each year from 1860 to 1874 inclusive :—

Year.	Arrivals from Montreal—Steamer.	Arrivals from Sea.	Sailed for Sea.	Time of Ocean Navigation.
1860	April 26	April 28	November 26	6 Months 29 Days.
1861	" 26	" 22	" 26	7 " 5 "
1862	" 30	" 16	" 29	7 " 0 "
1863	May 3	May 4	" 27	6 " 25 "
1864	April 21	April 27	" 30	7 " 4 "
1865	" 21	" 29	" 28	7 " 0 "
1866	" 26	" 28	December 1	7 " 4 "
1867	May 3	" 17	November 29	7 " 13 "
1868	April 28	" 23	" 28	7 " 6 "
1869	" 30	" 27	" 27	7 " 1 "
1870	" 25	" 16	December 2	7 " 17 "
1871	" 18	" 22	November 27	7 " 9 "
1872	May 3	" 30	" 26	6 " 27 "
1873	" 2	" 28	" 23	6 " 24 "
1874	" 10	" 28		

STATEMENT showing the opening and closing of navigation at the Port of Montreal in each year from 1861 to 1874 inclusive :—

Year.	Opening of Navigation.	Close of Navigation.	First Vessel from Sea.	Last Vessel for Sea.	Length of Season.
1861	April 24	December 22	April 27	December 4	[illegible] Months 29 Days.
1862	" 25	" 7	" 28	November 27	7 " 15 "
1863	" 25	" 12	May 6	" 26	7 " 18 "
1864	" 13	" 11	April 28	December 7	7 " 29 "
1865	" 10	" 16	May 3	November 24	8 " 7 "
1866	" 19	" 15	" 1	" 23	7 " 27 "
1867	" 22	" 6	" 4	" 29	7 " 15 "
1868	" 17	" 9	" 4	" 27	7 " 23 "
1869	" 25	" 6	April 30	" 24	7 " 12 "
1870	" 18	" 18	" 22	" 27	8 " 1 "
1871	" 8	" 1	" 22	" 29	7 " 24 "
1872	May 1	" 8	May 5	" 28	7 " 8 "
1873	April 25	November 26	" 4	" 21	7 " 1 "
1874	" 25		" 11		

FIRST ARRIVALS FROM SEA.

The following is a list of the first arrivals from sea, at the Ports of Quebec and Montreal from the year 1831 to 1874:—

QUEBEC.		MONTREAL.	
1831—Brig Nemesis	April 16	1831—	....
....		1832—......Cherub	May 12
....		1833—......Richard Watson	April 27
....		1834—......Robertson	May 10
....		1835—......Robertson	May 13
....		1836—......Canada	May 15
....		1837—......Great Britain	May 4
....		1838—......Great Britain	May 9
....		1839—......Arabian	May 10
....		1840—......Great Britain	April 30
....		1841—......Great Britain	May 5
....		1842—......Caledonia	May 9
....		1843—......Great Britain	May 7
....		1844—......Great Britain	May 5
....		1845—......Great Britain	May 4
1846—Ship Albion,	April 24	1846—Ship Albion	April 27
1847—Ship St. Andrew	May 8	1847—Ship St. Lawrence	May 14
1848—Ship Caledonian	May 1	1848—Ship Caledonia	May 3
1849—Ship Albion	April 28	1849—Ship Albion	May 4
1850—Ship Montreal	April 17	1850—Ship Great Britain	April 28
1851—Ship Toronto	April 20	1851—Ship Toronto	April 28
1852—Ship Toronto, and Ship Albion	April 15	1852—Ship Shandon	May 2
1853—Ship Shandon	April 24	1853—Ship Shandon	April 28
1854—Ship Glencairn	May 10	1854—Ship America	May 20
1855—Ship Ottawa	May 6	1855—Ship Ottawa	May 9
1856—Ship Queen of the Lakes	April 28	1856—Ship Queen of the Lakes	April 30
1857—Ship City of Toronto	April 20	1857—Ship Montreal	May 1
1858—Ship Shandon	April 28	1858—Ship Toronto	April 30
1859—Bark Emigrant	April 29	1859—Steamship United Kingdom	May 3
1860—Steamship United Kingdom	April 28	1860—Steamship United Kingdom	April 30
1861—Ship Shandon	April 22	1861—Steamship Jura	April 27
1862—Ship Shandon	April 22	1862—Ship Shandon	April 28
1863—Ship City of Quebec	May 3	1863—Ship City of Quebec	May 6
1864—Ship Shandon	April 26	1864—Ship Ard illan	April 28
1865—Ship Shandon	April 29	1865—S.S. Peruvian, and Ship Shandon	May 3
1866—Ship Shandon	April 28	1866—Ship Gleniffer	May 1
1867—Ship Gleniffer	April 24	1867—S.S. Moravian, and Ship Gleniffer	May 4
1868—Ship Gleniffer	May 2	1868—S.S. Hibernian	May 2
1869—Ship Gleniffer	April 24	1869—S.S. Nestorian	April 4
1870—Bark Melpomene	April 15	1870—Ship Abeona	April 30
1871—Ship Lake Superior	April 29	1871—Ship Lake Superior	April 22
1872—Steamship Scandinavian	April 20	1872—Steamship Scandinavian	May 5
1873—Steamship Peruvian	April 26	1873—Steamship Prussian	May 4
1874—Steamship Sarmatian	April 28	1874—Steamship Quebec	May 11

SEA-GOING TONNAGE AT MONTREAL.

The following tabular statement shows the number and tonnage of sea-going vessels at the Port of Montreal, during each of the seasons specified :—

Classes.	1864.		1865.		1866.		1867.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
Steamers	51	59,071	63	78,015	70	75,474	106	87,199
Ships	47	35,462	33	26,086	51	42,169	55	47,463
Barques	90	40,000	56	24,789	119	54,397	81	39,883
Brigs	21	5,036	13	3,139	27	6,415	18	3,757
Brigantines	38	5,849	35	4,943	69	9,981	64	9,273
Schooners	131	16,183	158	15,971	180	17,339	140	11,478
Total	378	161,901	358	152,943	516	205,775	464	199,053

Classes.	1868.		1869.		1870.		1871.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
Steamers	105	101,566	117	117,965	144	133,912	142	146,927
Ships	41	36,693	66	64,484	78	73,175	99	92,502
Barques	75	31,871	103	45,710	157	75,797	170	82,363
Brigs	21	4,875	18	4,735	16	4,183	26	6,539
Brigantines	49	7,807	49	9,243	62	10,351	47	7,839
Schooners	187	15,947	204	17,726	223	19,428	180	15,551
Total	478	198,759	557	259,863	680	316,846	664	351,721

Classes.	1872.		1873.		1874.*			
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.		
Steamers	215	217,713	242	245,237	247			
Ships	67	62,775	72	65,823	46			
Barques	182	87,199	164	75,594	163			
Brigs	20	5,221	18	4,660	14			
Brigantines	68	11,504	59	8,581	59			
Schooners	175	14,388	147	12,583	155			
Total	727	398,800	702	412.478	684	399,647		

* From opening of navigation to 1st November.

ATLANTIC WINTER PORTS OF THE DOMINION.

During the Winter season, Canada's Winter Port has been at Portland, Maine, *via* Grand Trunk Railway—that being the terminus for the Mail Steamers; shipments of Produce have also been made in winter *via* Boston, and sometimes (though but seldom) *via* New York City. When the Intercolonial Railroad is completed, Montreal will have direct railway connection with St. John, N.B., and Halifax, N.S.,—as indicated in the map. Connection with St. John will be nearer, when the River du Loup and Fredericton Railway is completed.

APPENDIX No. II.

THE CANAL SYSTEM OF CANADA.

The Lachine Canal.—The first work on the main line of the St. Lawrence navigation, is the Lachine Canal, which, beginning at the city of Montreal, extends westward a distance of 8½ miles to Lachine, thus overcoming the natural obstacle in the rapids on the river between the latter village and the former city. The construction of this work was suggested, and at times earnestly urged even before the passage of the Constitutional Act of 1791. But it was not until 1815 that any practical measures were adopted, when, its necessity becoming apparent from a military point of view, the Legislative sanction for an appropriation of £25,000 was obtained; but peace immediately ensuing, the work was not begun. In 1819 a Joint Stock Company became incorporated, with a capital of $600,000,—the Act of 1815 being repealed; but this scheme also came to naught, their charter being annulled in 1821 by the passage of a Bill authorizing the Government to construct the canal as a government work, commissioners being appointed to manage the project, while actual operations were commenced in July of that year. Upon condition that all military stores should have free access to the canal, the sum of $50,000 was contributed by the British Government towards the performance of the work, while the Province paid the remaining expenditure, the whole cost to the end of 1826 being $438,404.15. In 1825 the canal was opened to the passage of vessels; its dimensions were: 28 feet wide at bottom, 48 feet at water-surface, with a depth of 4½ feet, while the locks were seven in number, and strongly built of stone, being 100 by 20 feet each. But with the extension of trade, especially from the western province, this canal became inadequate to the requirements. With the proposal to unite the provinces of Upper and Lower Canada, arose the question of canal improvement, the exigencies of the increasingly important Lake Trade being considered, when it was det[illegible] retain the old location of the canal, and enlarge it to the dimensions it posses[illegible]resent time, viz: locks 200 by 45 feet, with 9 feet of water on the sills, and a wid[illegible] at bottom, and 120 feet at water-li[illegible]. In accordance with a decision arri[illegible]14, the two locks nearest Montreal (Nos. 1 and 2) were deepened to 16 feet on the s[illegible] 1848, [illegible] admitting large sea-going vessels into the basin of the canal; but it was not until [illegible] spring of 1862, that the entire canal was excavated to its full width. The report of [illegible] Public Works Department gives the whole cost of the work, up to July [illegible], at $2,587,532.85.

The Beauharnois Canal.—Previous to the construction of this canal, the obstacles which it was designed to overcome, viz: the "Cascades," "Cedar," and "Coteau" Rapids were surmounted by four short canals, giving facilities to craft of light draught [illegible] between Lakes St. Louis and St. Francis. Although the subject of improving th[illegible] navigation was frequently agitated, and reports presented to the Legislature at different times, yet no decisive action beyond recommendations was taken until the summer of 1842, when contracts for construction were commenced. This work was built upon the South Shore of the St. Lawrence, although the North Shore route was then and is even now contended for. The dimensions of this canal are similar to those of the Lachine. The total cost to July 1867, was $1,611,424 11.

The Cornwall Canal.—This work was the first in the series of St. Lawrence Canals constructed on the present scale, its dimensions serving as the standard for the others. The rapids of the "Long Sault" were the obstacles to be surmounted. Although the improvement of the navigation below Prescott was a matter of Governmental consideration, as early as 1817-18, yet it was not until 1832 that an appropriation of over a quarter of a million dollars was made by the Legislature of Upper Canada. Meanwhile surveys were made and dimensions determined, so that the first sod was not cut until 1834; then came the rebellion and financial depression to hinder progress, thus deferring the formal opening of the Canal, until the summer of 1843. The dimensions, both of the locks and the water-course, are larger than any other of the Canadian Canals.

The Williamsburg Canals.—Under this name are included the series known as the "Farrans Point," "Rapide Plat," and "Galops" Canals. The first two were completed about 1847. The last mentioned was originally three short canals, but in 1856 joined into one, under the designation of the Galops Canal. Their dimensions are uniform, as will be seen by the table annexed.

The Welland Canal.—The next Canal going westward is the Welland, at the head of Lake Ontario, which connects the latter with Lake Erie, by carrying navigation around the Niagara Falls. This work was, from its inception, attended with difficulties. The first practical measure was undertaken in 1821, when a commission to consider the subject of inland navigation, was appointed by the Parliament of Upper Canada, its report being received two years later in favor of constructing the Welland Canal. As a result, incorporation was obtained by a private company in 1824. The various trials, and disappointments, need not be detailed. Work was prosecuted with private capital, supplemented at different times by Governmental aid. By 1833, the Canal occupied almost the same site as the present one, and was practically completed, although the locks were of small dimensions, and built of wood. But after the union of the two provinces, and in 1839, Parliament authorized Government to purchase all the private stock, thus to make the work public property; but it was not until 1841 that the Board of Works assumed sole control. Henceforward systematic improvement was prosecuted, the wooden locks being replaced by stone works, while locks and water course were both enlarged to the present dimensions given in the appended table.

Sault Ste. Marie Canal.—The Canadian system of Canals connecting the western Lakes with the River St. Lawrence terminates with the Welland; but Dominion craft have access to Lake Superior through an American canal at Sault St. Marie. It is a mile and one-seventeenth long, and capable of passing vessels of 2000 tons burthen.

Another classification may be made for the Ottawa and Rideau route, between Montreal, Ottawa and Kingston. After the Lachine Canal, the first in the series is the

St. Anne Lock, built to overcome the rapids of the same name at the Junction of the Ottawa with the St. Lawrence. It has been completed since 1843.

The Carillon, the *Chute a Blondeau* and the *Grenville Canals* form a chain commencing 27 miles above St. Anne, surmounting rapids and using navigable stretches of water for 13 miles, after which there is a clear course to Ottawa City.

The Rideau Canal.—Like the three preceding canals, this work was constructed by the Imperial Government as a military necessity, and was completed in the year 1832. It extends from Ottawa to Kingston, making the Rideau and Cataraqui navigation available for craft of a certain depth of water, the distance being 126½ miles.

The dimensions of this set of canals are given in the tabular statement annexed.

The Richelieu Canals form a third series in the general canal system. Entering the Richelieu river from the St. Lawrence at a point 46 miles below Montreal, and ascending towards Lake Champlain, the obstructions to navigation are overcome by the St. Ours lock, and farther on, the Chambly Canal, extending from the basin of same name to St. Johns, a distance of twelve miles. These two are called the "Richelieu" Canals,—after which navigation is free from difficulties to the head of Lake Champlain, where the Americans have the Whitehall canal, through which access is obtained to the Hudson river. Particulars respecting these works are given in the general table.

DIMENSIONS OF CANALS.

The following table affords a concise view of the details of the various canals of the Dominion :—

Dimensions of Canals.	Lachine Canal.	Beauharnois Canal.	Cornwall Canal.	Williamsburg Canals.			Welland Canal.	Sault Ste. Marie Canal. (American.)
				Farrans' Point.	Rapide Plat.	Iroquois and Galops.		
Total rise of Lockage.......	44¾ ft.	82½ ft.	48 ft.	4 ft.	11½ ft.	15¾ ft.	330 ft.	—
Length of Canal......... ..	8½ m.	11¼ m.	11 m.	¾ m.	4 m.	7⅝ m.	27 m.	1 m.
Number of Locks..........	5	9	7	1	2	3	27	—
Length of "	200 ft.	200 ft.	200 ft.	200 ft.	200 ft.	200 ft.	{ 2=200 ft. 24=150 " 1=230 "	—
Width of "	45 "	45 "	55 "	45 "	45 "	45 "	{ 3= 45 " 24=26½ "	—
Depth of water on Sills...	{ 2=16 ft. 3= 9 " }	9 "	9 "	9 "	9 "	9 "	10½ "	—
Breadth of Canal at bottom.	80 "	80 "	100 "	50 "	50 "	50 "	——	—
" " water surface	120 "	120 "	150 "	90 "	90 "	90 "	——	—

Dimensions of Canals.	Ste. Anne Lock.	Carillon Canal.	Chûte à Blondeau	Grenville Canal.	Rideau Canal.	Richelieu Canals.	
						St. Ours Lock.	Chambly Canal.
Total rise of Lockage	3 ft.	{ 21¾ ft. up 13 ft. do'n	3¾ ft.	45¾ ft.	{ 282¼ ft. up 164 ft do'n	5 ft.	74 ft.
Length of Canal	⅛ m.	2⅛ m.	⅛ m.	5¾ m.	126¼ m.	⅛ m.	12 m.
Number of Locks.........	1	3	1	7	47	1	9
Length of "	190 ft.	{ 1 =128 ft 2 =126½ "	130 5-6 ft.	106 5-6 @ 130⅔ ft.	134 ft.	200 ft.	118@122 ft
Width of "	54 "	{ 2 =32½ " 1 =32¾ "	{ 32 5-6 ft. upper 36¼ ft. lower.	19 @ 32⅓ ft	33 "	45 "	23 @ 23¼ "
Depth of water on Sills ...	6@7 "	6½ "	6 ft.	6½ ft.	4½ @ 5 ft.	7 "	7 ft.
Breadth of Canal at bottom	—	30 "	30 "	20 @ 30 "	54 @ 60 "	—	36 "
" " watersurface	—	50 "	30 "	25 @ 30 "	80 "	—	60 "

STATEMENT SHEWING THE DATE OF THE OPENING AND CLOSING OF NAVIGATION ON THE CANALS, FROM 1850 TO 1874, INCLUSIVE.

Year.	Lachine Canal.			Beauharnois Canal.			Cornwall Canal.			Farran's Point Canal.			Rapide Plat Canal.			The Galops Canal.			Welland Canal.		
	Opened.	Closed.	No. of days open.	Opened.	Closed.	No. of days open.	Opened.	Closed.	No. of days open.	Opened.	Closed.	No. of days open.	Opened.	Closed.	No. of days open.	Opened.	Closed.	No. of days open.	Opened.	Closed.	No. of days open.
1850...	April 22	Dec. 7	230	April 26	Dec. 4	223	April 20	Dec. 7	232	April 27	Dec. 10	228	April 27	Dec. 10	228	April 27	Dec. 10	228	April 1	Dec. 12	255
1851...	April 22	Dec. 10	233	April 25	Nov. 25	215	April 25	Dec. 12	232	April 25	Nov. 25	215	April 25	Nov. 25	215	April 25	Nov. 25	215	M'rch 25	Dec. 12	261
1852...	Map 7	Dec. 16	224	May 2	Dec. 13	226	May 1	Dec. 16	230	April 13	Nov. 24	226	April 13	Nov. 24	226	April 13	Nov. 24	226	April 13	Dec. 14	245
1853...	May 20	Dec. 2	197	April 29	Nov. 24	209	April 29	Dec. 14	230	May 1	Dec. 1	215	May 1	Dec. 1	215	May 1	Dec. 1	215	April 1	Dec. 17	261
1854...	May 13	Dec. 2	204	May 1	Dec. 2	216	April 30	Dec. 10	225	May 3	Dec. 8	220	May 3	Dec. 8	220	May 3	Dec. 8	220	April 3	Dec. 4	246
1855...	May 1	Nov. 28	212	May 1	Nov. 28	212	April 30	Dec. 18	233	April 20	Dec. 15	230	April 20	Dec. 15	230	April 20	Dec. 15	230	April 16	Dec. 1[illegible]	241
1856..	May 1	Dec. 3	217	May 1	Dec. 1	215	April 28	Dec. 6	223	April 28	Dec. 6	223	April 28	Dec. 6	223	April 28	Dec. 6	223	April 26	Dec. 13	232
1857...	May 4	Nov. 27	208	May 2	Nov. 26	209	May 1	Dec. 12	226	May 1	Dec. 12	226	May 1	Dec. 12	226	May 1	Dec. 12	226	May 1	Dec. 15	229
1858...	April 25	Dec. 1	221	April 26	Nov. 26	215	April 26	Dec. 7	226	April 25	Dec. 11	231	April 25	Dec. 11	231	April 25	Dec. 11	231	April 7	Dec. 7	245
1859...	April 21	Nov. 30	224	April 19	Nov. 29	225	April 26	Dec. 7	232	April 30	Dec. 5	220	April 30	Dec. 5	220	April 30	Dec. 5	220	April 1	Dec. 8	252
1860...	April 20	Dec. 5	230	April 19	Dec. 3	229	April 21	Dec. 10	234	April 21	Dec. 10	234	April 21	Dec. 10	234	April 21	Dec. 10	234	April 1	Dec. 6	250
1861...	April 24	Dec. 4	225	April 24	Dec. 3	224	April 24	Dec. 12	233	April 24	Dec. 10	231	April 24	Dec. 10	231	April 24	Dec. 10	231	April 8	Dec. 12	249
1862...	May 4	Dec. 6	216	April 30	Nov. 30	215	May 1	Dec. 12	226	April 29	Nov. 30	216	April 29	Nov. 30	216	April 29	Nov. 30	216	April 15	Dec. 15	244
1863...	May 4	Dec. 10	220	May 2	Dec. 4	217	May 4	Dec. 12	222	May 1	Dec. 7	221	May 1	Dec. 7	221	May 1	Dec. 7	221	April 13	Dec. 13	244
1864...	April 25	Dec. 10	229	April 24	Dec. 3	224	April 27	Dec. 10	227	April 26	Dec. 10	229	April 26	Dec. 10	229	April 26	Dec. 10	229	April 14	Dec. 11	242
1865...	May 1	Dec. 12	226	April 25	Dec. 7	227	April 26	Dec. 13	231	April 29	Dec. 13	229	April 29	Dec. 13	229	April 29	Dec. 13	229	April 17	Dec. 15	242
1866...	May 2	Dec. 13	226	April 30	Dec. 8	223	April 30	Dec. 13	227	May 1	Dec. 11	225	May 1	Dec. 11	225	May 1	Dec. 11	225	April 17	Dec. 11	238
1867...	May 1	Dec. 2	216	April 29	Dec. 2	218	May 1	Dec. 1	215	May 1	Dec. 6	220	April 30	Dec. 6	221	April 30	Dec. 6	221	April 23	Dec. 7	229
1868...	April 27	Dec. 5	223	April 27	Dec. 2	220	April 27	Dec. 8	226	April 26	Dec. 5	224	April 26	Dec. 5	224	April 26	Dec. 5	224	April 15	Dec. 9	239
1869...	May 3	Dec. 7	218	May 3	Nov. 30	211	May 3	Dec. 7	218	May 1	Dec. 3	216	May 1	Dec. 3	216	May 1	Dec. 3	216	April 21	Dec. 10	233
1870...	April 29	Dec. 16	225	April 28	Dec. 5	221	April 28	Dec. 8	224	April 23	Dec. 10	231	April 23	Dec. 10	231	April 23	Dec. 10	231	April 20	Dec. 16	240
1871...	April 24	Dec. 6	226	April 19	Dec. 2	227	April 20	Dec. 8	232	April 21	Dec. 6	229	April 21	Dec. 6	229	April 21	Dec. 6	229	April 6	Dec. 9	247
1872...	May 1	Dec. 4	218	May 1	Dec. 2	216	May 2	Dec. 8	221	May 1	Dec. 7	221	May 1	Dec. 7	221	May 1	Dec. 7	221	April 22	Dec. 10	233
1873...	May 5	Nov. 29	209	May 1	Nov. 24	208	May 1			May 1			May 1			May 1			April 21		
1874...	April 29			May 3																	

PROPOSED CANAL IMPROVEMENTS.

The rapidly increasing trade of the country, and the lack of adequate transportation facilities, led the Dominion Government to appoint a commission in 1870, whose duty it was to inquire into and report upon the canal system of Canada in its then present form, and to suggest further improvements. After considerable investigation, the first point arrived at was, that the development of the St. Lawrence navigation, had, doubtless, to a large extent, been retarded by the lack of an uniform system in its canals. They then set forth recommendations of systematic improvement. As the western traffic through the St. Lawrence canals is mainly regulated by the capacity of the Welland Canal, the enlargement of the latter was deemed of primary importance. The uniform size of lock recommended, and decided upon by Government, for the Sault Ste. Marie, Welland, and St. Lawrence Canals was: 270 feet length of chamber, 45 feet width, and 12 feet of clear draught over the mitre sills. As regards the Welland, the contracts were given out during the present year, and the mode of enlargement on the scale adopted for it is progressing.

The enlarging of the St. Lawrence Canals throughout has not yet been commenced, although tenders are advertised for on that portion between this city and Lachine; but the construction of another set of locks, at the Montreal entrance of the Lachine Canal,—the same to have 17 feet of water on the mitre sills, forming a second line of connection between the harbor and the upper basin, was begun during the past summer months.

The improvement of canal navigation from Ottawa City to Lachine, and the enlargement of the Chambly Canal, on the scale of 200 feet length of lock, 45 feet width, and a general draught of 9 feet over the mitre sills, was recommended.

It may be noted that the main features of every existing or proposed canal route, came under the notice of the Commissioners, and were either commented upon simply, or placed in the form of recommendations, according as their importance seemed to demand.

The construction of the proposed Bay Verte Canal, to connect the waters of the Gulf of St. Lawrence, at Bay Verte, with those of the Bay of Fundy, at Cumberland Basin, by cutting across the Isthmus of Chignecto which unites Nova Scotia to New Brunswick, was recommended. Various surveys have been made, and the line of construction has been determined on by government,—the dimensions to be those as recommended, viz: 270 feet length of lock, 40 feet in width, and having 15 feet draught of water on the mitre sills. Advertisements have been inserted in the public press, calling for tenders for the work.

APPENDIX No. III.

MARINE DISASTERS ON INLAND WATERS.

Accurate records of casualties and losses, of recent occurrence, are not easily obtainable, although an effort has been made to procure later details than are given in the annexed tabular statements,—the one on page 54 being that appended to Mr. Blackwell's treatise. Such information is important, as influencing the rates of Marine Insurance,—though its import is more evident in connection with Gulf and river navigation. But these figures are of comparatively little service, without a record of the tonnage engaged in the trades,—both inland and ocean,—out of which the disasters have arisen.

The table immediately following is a comparative statement of the accidents and wrecks, which happened on the great lakes to both American and Canadian craft, during the seasons specified. But many of the instances recorded are mere mishaps, perhaps only affecting the cargo, rather than the vessel, yet still placed under the head of "disasters." The *second* table following, however, gives the actual wrecks (total loss) in 1867 compared with 1873—the figures for intermediate years not being found accessible :—

	1867	1872	1873
January	2	3	12
February	2	7	2
March	7	10	7
April	34	39	50
May	125	77	115
June	63	46	97
July	58	46	134
August	83	63	114
September	153	197	235
October	110	84	291
November	286	179	211
December	40	8	48
	963	759	1316

The tonnage lost may be thus classified :—

VESSELS.	1867.		1873.		
	Number.	Tonnage.	Number.	Tonnage.	Value.
Steamers	3	450	2	551	$ 48,000
Propellors	6	3,143	14	8,513	469,000
Tugs	6	565	5	273	32,000
Barques	9	4,121	2	696	30,000
Brigs	2	624	—	—	—
Schooners	52	11,196	36	6,276	209,800
Barges	1	462	7	3,240	67,000
Scows	7	509	4	365	10,900
Total	86	21,070	67	19,914	$866,700

STATEMENT of the Number and Tonnage of Wrecks and Casualties that have happened to Inland Vessels on the lakes and Inland Waters of the Dominion during each of the Calendar years following :—

DESCRIPTION OF VESSELS.	1870.		1871.		1872.		1873.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Steamers	5	1,574	8	1,311	12	4,983	9	3,046
Propellors	7	2,644	5	971	7	1,568	1	....
Tugs	3	302	..	....	2	60	1	5
Barques	3	350	..	....	5	1,147	3	726
Barquantines	5	1,998	1	444	..	....	..	....
Brigs	1	600	..	....	..	....	..	....
Brigantines	..	....	6	2,247	1	366	..	....
Schooners	73	9,461	42	6,718	36	6,271	11	1,394
Barges	6	....	1	50	6	1,115	4	299
Totals	103	16,929	63	11,741	69	15,510	29	5,469

STATEMENT of the extent of Wrecks and Casualties, with the Months in which they occurred on the Lakes and Inland Waters of the Dominion,—during the Calendar years 1870–1873, inclusive :—

MONTHS.	1870.		1871.		1872.		1873.	
	No.	Damage.	No.	Damage.	No.	Damage.	No.	Damage.
		$		$		$		$
January	..	....	..	....	..	....	..	....
February	..	....	1	16,500	..	....	..	....
March	..	....	..	....	..	....	1	7,000
April	2	1,600	..	....	1	100	2	4,300
May	3	19,000	3	....	11	22,582	2	32,000
June	4	3,100	4	20,000	4	77,440	3	2,000
July	3	33,500	2	450	2	50,000	2	1,000
August	6	3,600	1	....	6	11,400	5	25,650
September	5	4,300	6	12,600	16	86,183	2	....
October	52	161,8[illegible]0	14	37,745	8	68,393	6	35,500
November	17	53,661	11	53,800	18	67,166	3	50,000
December	1	900	3	32,000	1	30,000	1	....
Totals	93	$281,561	45	$173,095	67	$413,264	27	$157,450

AGGREGATE OF LOSSES AND DISASTERS ON THE LAKES AND ST. LAWRENCE,

In Steamers and Sailing Vessels, including Loss and Damage of Cargo, for the years 1848 to 1855, both inclusive (being 8 years).

Manner of Loss.	Steamers.		Propellers.		Barques.		Brigs.		Schooners.		Scows.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Wrecked and Sunk	25	$914,500	19	$903,000	15	$231,500	31	$345,600	182	$1,100,226	7	$12,600
Stranded	52	305,150	35	98,050	14	18,200	82	118,500	377	515,370	11	6,850
Fire	19	492,600	8	222,800					10	47,300		
Damaged	108	385,500	92	361,150	35	87,900	160	222,375	444	644,334	29	15,975
Jettison	4	39,500	19	83,500	3	9,000	9	28,500	46	80,280	2	600
Collision	67	286,000	54	747,440	9	65,700	43	152,950	102	270,300	2	2,300
Sunk and Raised			1	100,000								
Derrick		20,000										
Flood										25,000		
	275	$2,443,250	228	$2,515,940	76	$412,300	325	$867,925	1161	$2,682,810	51	$38,325

Total Steam disasters, No. 503, Value. $4,959,190 — Total Sailing vessel disasters, . . . No. 1,613, Value. $4,001,360

For the years 1856 to 1861, both inclusive (being 6 years).

Manner of Loss.	Steamers.		Propellers.		Barques.		Brigs.		Schooners.		Scows.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Wrecked and Sunk	27	$362,650	30	$972,760	15	$154,650	22	$145,850	179	$1,392,048	54	$193,650
Stranded	39	118,455	83	317,770	39	215,343	76	211,050	503	1,336,644	47	48,023
Fire	17	435,000	24	370,600			1	450	4	9,550	1	1,200
Damaged	97	175,675	151	165,740	79	98,830	75	50,485	551	409,419	33	18,000
Jettison	5	16,300	13	67,755	3	5,764	8	17,000	68	72,584	4	360
Collision	41	149,210	58	174,325	29	21,085	37	83,950	235	459,546	12	8,462
	226	$1,257,290	359	$2,068,950	165	$495,672	219	$508,785	1540	$3,679,791	151	$269,695

Total Steam disasters, No. 585, Value. $3,326,240 — Total Sailing vessel disasters, . . . No. 2075, Value. $4,953,943.

The two preceding statements on page 53 are compiled from information, published in the Annual Reports of the Department of Marine and Fisheries, during the years specified. But as these returns do not show all the wrecks, or loss of life, or property, the figures require to be taken with the reservation : that they are correct in so far as information has been received. For example the first table cannot be considered altogether accurate, inasmuch as the tonnage of the vessel meeting with a mishap is in numerous instances omitted from the Departmental Report. In like manner, the money-value of damage received, as noted in the second table, is frequently left blank in the Report ; while there are further cases where the month in which a casualty has happened does not appear. Notwithstanding these discrepancies, however, the information is compiled from the official source mentioned, as being probably nearer the mark than any other statements would be. The proportion of total wrecks is comparatively small, if the aggregate of the casualties be the point from which to draw conclusions. But it must be remembered that a large number of the so-called disasters appearing in these tables, are often merely partial damage to the hull or the cargo, or perhaps to both.

A comparison of the money-value of *total* losses (vessel and cargo) during the years 1872 and 1873, according to the Departmental figures, shows the following :—

	1872.	1873.
Propellors	2	..
Steamers	4	4
Schooners	9	3
Tugs	..	1
Barges	4	1
Value	$332,793	$133,000

APPENDIX No. IV.

METEOROLOGICAL SUMMARIES.

The Mean Monthly Temperatures at Hamilton and Toronto, Ont., Montreal and Quebec, Q., for the year 1855, were as follows :—

MONTHS.	HAMILTON, Ont. (Lat. 43° 16′) Head of Lake Ontario.	TORONTO, Ont. (Lat. 43° 39′) 341 feet above the Sea.	MONTREAL, Que. (Lat. 45° 32′).	QUEBEC, Que. (Lat. 46° 49′).
January	29.37	29.95	17.88	16.70
February	19.14	15.41	11.23	10.55
March	32.11	28.46	24.08	21.06
April	45.48	42.43	40.15	34.14
May	56.95	53.07	56.85	49.03
June	62.63	59.93	62.39	58.34
July	71.65	67.95	72.73	68.86
August	68.08	64.06	64.94	61.54
September	64.02	59.49	58.55	55.16
October	47.89	45.39	46.35	45.43
November	41.08	38.58	31.58	28.75
December	29.21	26.99	20.84	18.09
Annual Mean	10 y'rs, 48.73	16 y'rs, 44.27	3 y'rs, 42.24	1855, 38.09
Min. 1855	—20.00	—25.00	—33.09	—29.05
Max. 1855	96.00	92.08	97.00	90.00

ANALYSIS OF OBSERVATIONS ON TEMPERATURE AT MONTREAL.

The annexed Statement affords an Analysis of observations made at Montreal during the year 1861, the same being summarized from statements of extensive and detailed observations, all of which accompanied Mr. Blackwell's treatise :—

1861.	Monthly Mean of Water at Noon.	Monthly Mean Temperature of Air.				Monthly Mean of Air.
		9 A. M.	Noon.	3 P. M.	6 P. M.	
January	30.50°	10·0°	13·5°	15·2°	13.7°	12.90°
February	30·55	17·0	22·1	23·0	22·5	21.20
March	31·20	21·0	25·8	28·2	26·3	25.40
April	33·80	37·0	42·5	43·9	44.0	41·70
May	48·80	50·6	56·4	59·1	57.5	55·90
June	61·60	63·0	69·4	72·0	70.6	68·77
July	66·60	66·5	70·7	73.0	72·1	70·50
August	69·00	66·1	72·1	72.6	71·2	70·90
September	61·10	57·2	62.3	64·1	60·0	61·48
October	48·00	47·5	51·0	52·2	50.1	50.10
November	36·60	34·4	37·1	38·2	36.6	36.60
December	31·90	22·1	25·8	26·2	24.9	24.95
		9 A. M.	Noon.	3 P. M.	6 P. M.	
Means,	45·80°	40·96°	45·72°	47·30°	45·80°	45·03°

Mean Temperatures between 9 a.m. and 6 p.m.

		Number of days	
Mean of Air, Nov., Dec,, Jan., Feb., March (151 days)	24·2°	At and below zero	16
Maximum	+47·5	" " 32°	113
Minimum	—28·5	" " 24·2°	75
Range	76°		
April, May, October (92 days)	49·23°	At and below 32°	8
Maximum	73·5	" " above 49·23°	58
Minimum	21·5	" " " 60°	19
Range	52°	" " " 70°	3
June, July, Aug., Sept. (122 days)	67·91°	At and below 50°	4
Maximum	91	" " above 67·91°	86
Minimum	45·5	" " " 80°	14
Range	45·5°	" " " 90°	3

Total number of days in the year below 32°......121.

Extreme Range of the year between 9 a.m and 6 p.m	119·5°
" " in any 24 hours, Summer, July 10 and 11	20·5
" " " " " Winter, January 10 and 11	38·0

Extreme Range of Temperature of Water, 46°.
Maximum Temperature, 75°. Minimum Temperature, 29°.
Total number of days at and below 32°, 120.

APPENDIX No. V.

STATEMENTS RELATING TO THE CANADIAN GRAIN TRADE.

*The Trade at Port of Quebec from the year 1793 to 1869.**

YEARS.	No. of Vessels Clear'd.	Total Tonnage Cleared.	FLOUR. brls.	WHEAT Bushels.	PEAS Bushels.	BARLEY Bushels.	OATS Bushels.
1793	....	....	10,916	487,096	198	....	3,803
1794	....	....	13,787	414,552	915	....	1,418
1795	....	....	17,967	394,752	3,508	....	1,411
1796	....	....	4,352	3,168	298	....	....
1797	....	....	13,932	31,424	1,349	....	1,862
1798	....	....	9,530	91,708	3,568	7	3,393
1799	....	....	14,475	128,872	545	79	595
1800	64	14,293	20,271	217,128	3,512	1,555	6,896
1801	89	18,142	38,146	472,472	7,215	4,211	6,266
1802	101	21,264	28,301	1,010,032	466	6,283	2,372
1803	95	20,399	14,432	367,568	1,766	506	1,825
1804	85	16,797	14,319	201,544	315	4,785	3,726
1805	69	15,076	18,590	22,016	4,571	7,774	6,270
1806	79	19,041	10,997	96,912	6,810	5,803	3,417
1807	239	42,293	20,442	201,544	7,899	5,636	2,961
1808	334	70,275	42,462	186,704	58,227	6,743	3,336
1809	434	87,825	20,726	198,216	66,872	3,913	9,425
1810	661	143,893	12,519	170,904	20,821	18	1,082
1811	532	116,687	19,340	856	4,936	....	1,270
1812	399	86,436	37,652	263,176	24,622	....	1,372
1813	193	46,514	517	....	3,390	....	....
1814	181	38,605	1,217	....	....	....	648
1815	194	37,382	1,920	....	217	....	....
1816	288	61,211	1,137	....	187	....	766
1817	334	76,559	38,047	145,664	6,329	....	19,688
1818	409	94,675	30,543	401,792	54,601	14,587	7,561
1819	650	155,842	12.086	37,896	11,947	2,348	1,352
1820	596	149,661	45,369	319,048	3,467	768	4,625
1821	436	102,898	22,635	318,480	3,372	777	4,971
1822	641	149,353	47,674	147,288	3,469	767	6,363
1823	609	138,219	46,538	4,710	2,732	42	37,849
1824	680	159,662	41,901	5,396	4,974	....	3,968
1825	883	227,707	40,167	718,016	16,976	1,660	11,100
1826	801	198,848	33,666	228,635	26,082	2,590	3,907
1827	678	162,096	54,004	391,420	31,830	4,193	19,385
1828	763	191,199	35,760	120,112	21,056	835	20,017
1829	922	240,399	25,689	40,462	12,971	....	....
1830	900	226,518	71,749	590,101	17,193	3,345	31,915
1831	1,045	266,899	81,062	1,329,269	7,130	2,520	35,246
1832	1,053	281,598	51,058	657,240	346	82	70
1833	969	247,933	59,561	106,301	1,748	....	6,185
1834	1,123	298,672	60,122	166,771	3,439	985	1,637
1835	1,144	315,974	69.399	2,122	1,426	950	2,732
1836	1,227	352,575	83,921	1,958	1,740	1,290	8,405
1837	1,050	322,877	29,383	50	1,165	....	1,124
1838	1,059	340,935	44,346	....	1,283	....	1,468

* The particulars in this table, from the year 1823 to 1873 inclusive, were most obligingly furnished by J. W. Dunscomb, Esq., Collector of Customs at Quebec.

The Trade at Port of Quebec from the year 1793 *to* 1869.—Continued.

YEARS.	No. of Vessels Clear'd.	Total Tonnage Cleared.	FLOUR brls.	WHEAT Bushels.	PEAS Bushels.	BARLEY Bushels.	OATS Bushels.
1839	1,116	370,051	26,626	150	1,305	120	310
1840	1,314	449,085	202,773	[illegible],910	35,076	70	369
1841	1,263	438,849	174,53[illegible]	159,429	75,054	48	620
1842	878	298,674	112,293	57,140	40,359	18	100
1843	1,249	450,412	139,416	54,513	27,869	859	...
1844	1,239	453,896	190,677	26,964	46,631	8,291	4,071
1845	1,499	584,540	214,725	68,544	55,166	46	24,671
1846	1,467	572,373	313,004	28,041	59,890	4,427	11,091
1847	1,215	489,817	371,111	66,034	29.491	55	19,651
1848	1,194	457,430	244,146	65,568	41,667	40	6,162
1849	1,243	481,227	143,781	17,704	4,770	1,197	28,129
1850*	1,275	494,021	151,094	512	6.543	3,470	11,541
1851	1,394	586,033	145,268	25,510	12,184	1,051	5,827
1852	1,270	533,913	82,111	2,223	23,819	54	1,663
1853	1,406	599,567	129,266	103,535	8,970	185	2,009
1854	1,558	693,588	65,284	19,930	3,035	105	500
1855	877	408,994	28,269	74,113	2,180	760	4,659
1856	1,083	510,855	83,931	187.193	27,731	....	5,924
1857	1,355	644.262	35,505	232,200	3,753	3,818	....
1858	1,058	518 600	54,007	95,979	11,437	....	4.014
1859	1,051	539,135	34,262	29,204	31,667	1,015	18,781
1860	1,491	685 576	4[illegible],148	29,204	15,899	1,015	35,281
1861	1,534	767,142	55.963	19,332	3,917	124	5.561
1862	1,319	619,106	62,955	97,956	3,482	68	2.972
1863	1,785	861,208	74,008	115,319	8,321	[illegible]	916
1864	1,561	777,575	28,727	13.475	5,104	....	5,146
1865	1,517	902,554	55,408	21,670	3,449	150	5.078
1866	1,410	727,793	47,902	92	11,289	14,870	80,489
1867	1,252	637,410	18,311	[illegible]33	59,172	12	23,793
1868	1,038	754,600	7,018	....	5,466	3,052	22,597
1869	993	662,995	17,968	205,832	8,622	4,512	1,500
1870	1,007	726.360	11,519	227,520	8,520	4,112	300
1871	899	698,987	7,374	511,772	23,336	....	10
1872	1,030	808,542	6,777	446,612	24.870	18	....
1873	875	683,928	14,359	502,055	4,126	....	117

During the first forty years specified in these tables of Flour and Grain, shipped from the Port of Quebec, the Richelieu Valley was the chief Wheat-growing region of Canada; the principal flouring mills being in that city and neighborhood. While the large quantities exported, (*very* large for those early times,) lead naturally to the belief that there must have been a much larger yield, to admit of so great a surplus for shipment,—the present condition of that Valley and of the Province of Quebec in general shows that, as in the United States, the progress of Wheat culture is westward. The conjecture that any considerable quantities of Baltic and Black Sea Wheat were, in the years referred

* Foreign vessels were first permitted, in 1850, to proceed under license to Montreal for the purpose of loading,—returning to Quebec for a sea-clearance. Many of the foreign vessels, therefore, which are noted as clearing at Quebec in 1850 and following years, were actually loaded at Montreal.

† On and after 1st July, 1867, Flour and Grain shipped to ports in Nova Scotia and New Brunswick from ports in Ontario and Quebec, were not recorded at Custom-houses as exports, and are, therefore, not included in the above table.

to, shipped to Canada, and re exported to Great Britain, thus evading a certain amount of duty, is not verified by any record to which the writer has had access. But a gleam of light is thrown upon the question,—Where did all the Grain, referred to in the table as shipped fifty or sixty years ago, come from ?—by the following paragraph taken from a valuable contribution by T. C. Keefer, Esq., C. E., to a volume on Canada, published several year ago, entitled "Eighty Years Progress" :—

"During the first quarter of the present century,—before the State of New York had availed herself of that remarkable pass through the Alleghany range, which is afforded by the Hudson River, and had tapped Lakes Champlain, Ontario and Erie by means of her grand canals,—exports from Northern Vermont and New York via Lake Champlain (or Corlaer's Lake, as the Dutch had named it,) as well as from those tributaries of the St. Lawrence which take their rise in the 'Empire State,' sought an outlet at Quebec and Montreal. Previous to the year 1822, American lumber, grain, &c., were admitted into Canada duty free, and exported with all the privileges afforded to Canadian products, to the British West India colonies. While New York was pressing forward her canals (commenced in 1817 and completed in 1824,) the Imperial authorities, in 1822, prepared the way for the complete diversion of American exports from the St. Lawrence to those canals, by imposing a duty upon such exports to Canada. Sir J. B. Robinson, in 1822, as the agent of Upper Canada in London, very properly suggested that the propriety, or otherwise, of such a duty might safely be left to the Canadians; but the defence to the measure was that, as Canadian products were admitted into the British West India colonies free of duty, while American were taxed, the free admission of the latter into Canada would be a discrimination in favor of British bottoms, via the St. Lawrence, against American bottoms, via the Mississippi, of which the Americans would complain as an evasion of the relaxation professed to be made in the navigation laws for the benefit of a reciprocal commerce." This blunder was, however, acknowledged, in 1831, by the re-admission of American exports, as before, free of duty."

An interesting article published in the Oswego *Advertiser and Times*, entitled "Sketches of the Commercial History of Oswego," by H. C. Stillman, Esq., Secretary of the Board of Trade of that city, contains the following statement corroborative of Mr. Keefer's remarks :—

"For many years prior to the construction of the Welland and Oswego Canals, the products of Western New York, including wheat found their market chiefly at Montreal and Quebec—from the Oswego, Genesse and Niagara Rivers principally, in vessels to Kingston, Prescott or Ogdensburg, then re-shipped on board Durham boats, French batteaux and rafts. The navigation of the Mohawk had been improved, so that goods taken on board of Durham boats at Schenectady, by way of Wood Creek and Oneida Lake, reached Oswego Falls. Here was a portage, and the goods re-shipped on boats of a smaller size, were conveyed to Oswego. Property destined for the west was shipped to Lewiston in vessels, taken to Schlosser in wagons, thence in boats to Black Rock, there shipped on board vessels and towed by oxen into Lake Erie. The rival route was from Albany to Buffalo in wagons."

The differential regulation in favor of the importation of Canadian Wheat and Wheat Flour into the United Kingdom was not established prior to 1815; it was in that year provided that Foreign Wheat could not be imported free of duty until the price of British Wheat reached 82s. 6d. per quarter, nor Colonial Wheat until the price of British Wheat reached 69s. 1⅓ per quarter. From about the year 1828 to 1842, a sliding-scale of duties prevailed. The rates upon Foreign Wheat varied from 1s. to 20s. 5d. per quarter, as the price of British Wheat ranged from 73s. to 66s. per quarter; and an additional shilling per quarter was charged for every further fall in price of one shilling or fractional part thereof. The rates of duty upon Colonial Wheat were 5s. per quarter, when the average of British Wheat was under 67 s.,—and 6d. per quarter when the price was at or above 67s.

In 1843, the duty upon Canadian Wheat was reduced to 1s. per quarter, at which it remained until the free admission of "Corn" in 1869. Foreign Wheat was also subject to the same rate of duty (1s. per quarter) between the years 1849 and 1869.

TABLE SHOWING THE QUANTITIES OF FLOUR AND GRAIN RECEIVED AT, AND SHIPPED FROM, MONTREAL DURING A PERIOD OF TWENTY-NINE YEARS.

YEARS.	FLOUR. Receipts.	FLOUR. Shipments.	WHEAT. Receipts.	WHEAT. Shipments.	CORN. Receipts.	CORN. Shipments.	PEAS. Receipts.	PEAS. Shipments.	BARLEY. Receipts.	BARLEY. Shipments.	OATS. Receipts.	OATS. Shipments.
	Barrels.	Barrels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
1845......	494,295	......	344,890	......	......	......	29,028	......	1,055	......	7,367	......
1846......	582,922	202,821	439,177	376,852	......	......	1,350	94,360	489	......	......	30,992
1847......	627,137	271,559	540,957	560,858	......	......	50,184	86,069	10,213	24,120	15,505	155,074
1848......	546,292	154,908	482,645	130,187	44,150	......	59,035	64,678	7,291	200	12,001	......
1849......	485,961	535,593	357,960	481,768	50,514	......	48,637	6,985	2,911	357	18,243	12,001
1850......	483,603	182,988	345,272	71,359	51,965	5,719	21,256	98,066	512	350	3,677	1,661
1851......	510,738	255,546	443,477	129,114	96,930	26,912	22,770	59,921	2,372	......	29,189	......
1852......	565,938	215,524	724,956	307,656	92,199	300	63,592	98,514	4,239	734	21,873	7,494
1853......	595,698	244,400	906,989	485,669	83,421	......	75,654	175,847	7,415	37,770	38,894	......
1854......	484,684	97,724	531,785	122,636	651,149	146,748	10,098	67,264	21,457	......	11,197	......
1855......	433,611	53,383	634,317	45,707	622,208	28,629	33,956	105,215	17,938	1,799	49,728	9,366
1856......	589,767	196,771	1,340,705	774,167	437,154	158,234	52,932	218,116	24,194	2,075	43,063	8,643
1857......	573,445	239,301	1,667,724	859,912	330,084	28,631	16,773	186,142	19,410	4	15,007	120
1858......	669,064	197,742	1,774,464	669,241	105,087	14,967	177,908	423,018	23,881	300	113,566	32,160
1859......	575,810	105,973	635,424	58,065	71,430	3,015	113,186	344,189	27,925	29,068	63,093	12,600
1860......	577,196	277,567	2,622,602	1,645,269	138,214	24,387	776,129	1,298,845	27,483	252	37,637	206,732
1861......	1,095,339	605,942	7,738,084	5,584,727	1,565,477	1,477,114	1,409,879	1,529,136	132,749	Incom-	122,399	1,040,085
1862......	1,174,602	597,477	8,534,172	6,500,796	2,661,261	1,774,546	534,679	711,192	236,930	plete	106,792	979,639
1863......	1,193,286	616,021	5,509,143	3,741,146	862,534	638,281	669,265	745,414	307,461	709,239	403,972	3,086,835
1864......	858,795	858,071	4,194,217	2,406,531	158,564	21,974	357,207	499,629	371,055	854,770	232,616	3,437,810
1865......	782,216	637,001	2,648,674	787,938	934,421	734,849	436,751	681,910	317,688	1,010,392	163,694	3,251,566
1866......	704,376	575,198	773,208	83,278	2,117,208	1,870,223	1,036,315	1,141,733	336,951	427,322	2,122,305	3,383,536
1867......	738,518	569,021	2,939,295	1,576,528	891,605	681,708	1,302,306	1,761,960	413,320	901,037	309,268	1,425,950
1868......	790,311	683,612	2,426,869	1,081,958	1,086,152	782,497	520,395	663,545	267,416	451,366	215,075	903,024
1869......	975,295	966,667	7,462,033	5,595,332	141,982	108,018	559,984	576,984	66,238	163,372	84,086	330,738
1870......	1,061,273	975,513	6,508,315	5,973,048	83,656	6,043	892,969	1,747,723	40,465	250,609	172,449	635,830
1871......	951,760	908,841	8,224,805	7,680,834	3,171,757	2,870,998	292,308	796,143	83,259	57,601	122,946	86,818
1872......	921,973	832,931	4,665,314	3,818,450	7,656,440	7,546,390	652,649	1,175,026	129,064	118,496	211,684	436,446
1873......	1,130,666	863,569	9,788,730	8,225,649	3,544,514	3,520,918	455,799	917,761	194,872	153,362	163,069	331,439

RECEIPTS OF WHEAT-FLOUR AT MONTREAL *VIA* GRAND TRUNK RAILWAY, AND *VIA* LACHINE CANAL, EACH MONTH FOR TEN YEARS, 1863 TO 1873 INCLUSIVE.

Year	RECEIVED.	JANUARY.	FEBRUARY.	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUGUST.	SEPTEMB'R	OCTOBER.	NOVEMBER	DECEMBER
	Via	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
1863	G. T. Railway....	32,191	29,156	34,453	27,923	86,924	41,[illegible]07	18,043	29,525	10,332	37,771	37,525	49,647
	Lachine Canal...	....	....	....	....	224,433	168,186	67,352	67,619	36,870	76,681	78,656	15,385
1864	G. T. Railway...	25,259	40,018	55,833	23,199	40,593	22,094	9,271	24,966	12,520	52,872	40,741	25,762
	Lachine Canal...	....	....	....	....	115,564	97,227	39,147	64,885	38,772	59,566	41,039	12,668
1865	G. T. Railway....	20,960	21,151	44,594	37,104	29,353	26,617	18,040	10,655	13,656	24,706	41,923	40,406
	Lachine Canal...	....	....	....	....	88,753	67,964	65,901	51,883	26,303	54,100	72,803	13,633
1866	G. T. Railway....	20,114	19,804	12,408	36,236	51,157	18,598	24,233	13,723	11,726	52,619	38,249	49,712
	Lachine Canal...	....	....	....	....	77,710	40,970	42,795	34,431	23,864	80,340	73,169	8,849
1867	G. T. Railway....	28,394	38,886	31,528	40,120	23,568	26,505	26,359	17,961	14,688	46,241	44,789	39,192
	Lachine Canal...	....	....	....	....	56,073	25,518	37,003	42,181	28,829	67,787	52,329	3,216
1868	G. T. Railway....	27,691	22,778	21,937	63,554	33,952	29,849	38,145	21,049	34,472	37,424	65,776	55,341
	Lachine Canal...	....	....	....	700	70,688	30,697	27,603	18,816	51,041	66,084	65,777	7,688
1869	G. T. Railway....	36,134	29,024	27,392	27,100	41,923	52,930	57,821	43,230	43,232	49,440	57,696	81,402
	Lachine Canal...	....	....	....	....	68,794	59,497	56,198	44,119	53,479	76,882	71,046	6,790
1870	G. T Railway....	22,366	28,100	24,828	38,667	49,867	54,326	48,578	62,497	24,022	34,392	48,778	38,555
	Lachine Canal...	....	....	....	....	99,102	68,284	59,095	77,129	59,061	92,267	94,335	9,815
1871	G. T. Railway....	20,863	27,949	28,534	45,598	60,444	37,942	36,096	40,604	56,234	72,186	92,151	39,100
	Lachine Canal...	....	....	....	....	109,541	58,272	40,298	39,060	36,449	43,464	61,086	5,842
1872	G. T. Railway....	48,489	30,500	20,200	25,500	91,290	58,875	51,367	31,641	28,515	98,113	68,401	48,345
	Lachine Canal...	....	....	....	....	67,946	41,545	30,870	25,755	30,159	62,932	50,561	4,881
1873	G. T. Railway....	26,298	40,730	48,900	52,405	112,700	59,116	40,254	51,827	42,126	53,761	67,050	66,109
	Lachine Canal...	....	....	....	....	70,967	60,174	47,939	47,803	59,536	108,976	66,425	7,548

RECEIPTS OF WHEAT AT MONTREAL *VIA* GRAND TRUNK RAILWAY, AND *VIA* LACHINE CANAL, EACH MONTH FOR TEN YEARS, 1863 TO 1873 INCLUSIVE.

Year	RECEIVED.	JANUARY.	FEBRUARY	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUGUST.	SEPTEMB'R	OCTOBER.	NOVEMBER	DECEMBER
	Via.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1863	G. T. Railway....	30,422	66,880	27,004	1,700	21,360	32,923	30,615	20,308	21,800	98,938	62,193	58,599
	Lachine Canal...	....	....	....	....	1,210,470	1,252,308	634,501	810,096	190,077	414,783	439,627	18,237
1864	G. T. Railway....	30,800	22,311	39,752	4,900	26,601	32,375	20,152	24,130	16,850	89,808	47,650	35,700
	Lachine Canal...	....	....	....	....	491,105	1,021,663	670,893	937,820	413,296	155,919	58,943	....
1865	G. T. Railway....	46,315	16,400	32,860	36,950	20,107	8,050	9,420	21,700	32,200	50,900	107,644	64,483
	Lachine Canal...	....	....	....	....	277,250	523,939	461,339	248,285	79,852	210,563	354,011	46,406
1866	G. T. Railway....	25,600	25,200	3,850	9,450	18,550	16,950	21,750	17,900	14,150	88,870	52,540	85,240
	Lachine Canal...	....	....	....	....	7[illegible],998	92,338	56,582	81,058	14,491	132,761	98,643	18,576
1867	G. T. Railway....	22,470	20,408	25,200	21,894	51,250	21,700	29,400	12,960	5,950	94,100	44,300	40,750
	Lachine Canal...	....	....	....	....	67,512	86,100	65,029	140,270	409,401	1,015,128	608,474	49,359
1868	G. T. Railway....	9,450	2,809	3,898	11,705	39,200	44,450	26,590	29,209	52,985	56,700	67,960	28,000
	Lachine Canal...	....	....	....	....	144,774	333,014	143,260	73,073	315,356	458,821	389,690	195,925
1869	G. T. Railway....	11,200	10,500	12,930	4,049	42,100	98,567	29,353	29,433	25,900	36,084	44,744	54,246
	Lachine Canal...	....	....	....	....	403,870	1,376,485	642,706	821,488	1,411,292	1,230,375	961,044	89,980
1870	G. T. Railway....	9,450	7,700	2,800	33,250	74,250	64,050	28,204	6,590	350	2,100	350	....
	Lachine Canal...	....	....	....	....	1,057,060	1,050,526	625,829	1,295,574	557,546	665,426	1,001,655	5,794
1871	G. T. Railway....	....	2,100	350	1,750	700	20,650	17,910	31,596	150,250	257,375	208,810	30,349
	Lachine Canal...	....	....	....	....	1,559,937	1,054,412	409,180	1,015,016	1,146,001	1,204,747	1,113,660	....
1872	G. T. Railway....	27,300	21,525	7,000	3,530	15,650	32,225	63,014	2,894	56,976	238,050	46,900	13,700
	Lachine Canal...	....	....	....	....	312,848	229,089	410,817	282,372	784,657	1,413,435	703,332	....
1873	G. T. Railway....	19,950	44,480	42,400	9,800	73,800	145,800	59,110	59,850	71,120	147,750	41,800	45,460
	Lachine Canal...	....	....	....	....	812,879	1,420,659	1,194,119	829,484	1,721,606	2,167,877	773,577	107,114

SHIPMENTS OF WHEAT FROM MONTREAL TO GREAT BRITAIN, EACH MONTH DURING THE LAST EIGHT YEARS, 1866 TO 1873 INCLUSIVE.

YEARS.	JANUARY.	FEBRUARY	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUGUST.	SEPTEMB'R	OCTOBER.	NOVEMBER	DECEMBER
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1866	....	 8	....	....	....	2,895	....	605	....	....	163	13,000
1867	....		....	....	50	6,382	....	20,989	156,936	650,924	611,356	12,985
1868	....	6,631	....	....	65,109	212,503	138,773	596	104,906	239,076	259,624	17,126
1869	29,030	....	....	....	199,244	940,381	811,119	449,124	1,128,226	953,968	976,235	8,782
1870	16,809	25,100	36,779	....	531,770	767,505	909,422	1,154,226	384,554	454,010	1,204,472	38,088
1871	34,397	41,348	1,947	30,144	1,114,278	915,145	682,035	1,032,587	877,427	1,274,573	1,361,362	126,632
1872	42,958	68,744	18,925	1,600	80,800	256,514	379,469	196,579	520,282	852,293	999,109	70,875
1873	5,791	7,432	4,407	....	514,649	1,100,185	1,264,336	1,032,414	1,392,093	1,863,167	821,819	12,344

SHIPMENTS OF CORN FROM MONTREAL TO GREAT BRITAIN, FACH MONTH DURING THE LAST EIGHT YEARS, 1866 TO 1873 INCLUSIVE.

YEARS.	JANUARY.	FEBRUARY	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUGUST.	SEPTEMB'R	OCTOBER.	NOVEMBER	DECEMBER
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1866	....	....	....	....	54,433	174,517	379,596	387,204	275,821	354,775	197,280	7,423
1867	....	....	....	....	53,104	141,605	278,117	132,163	37,434	15	1,100	....
1868	....	....	....	....	89,515	205,328	136,829	169,410	86,201	25,378	17,761	....
1869	....	....	....	....	28,188	23,036	21,971	....	....	5,104	....	....
1870	....	....	....	....	308	....	....	....	....	....	....	....
1871	....	....	....	6,033	297,821	414,250	257,639	492,971	409,176	376,085	545,399	....
1872	....	....	....	....	616,493	1,459,679	1,644,179	1,236,215	1,083,697	817,836	587,407	57,378
1873	24,809	....	....	....	361,220	391,864	672,456	869,647	743,841	337,016	76,445	....

No Maize to Great Britain in 1864.

APPENDIX No. VI.

MOVEMENT OF BREADSTUFFS FROM WEST TO EAST.

As affording a comprehensive view of the major part of the carrying trade in Breadstuffs from the interior to the sea-board, the two following tables will be found valuable. In the first is shown the aggregate freight earnings on the merchandise transported for a series of eighteen years—over the New York Central, and Erie Railroads, together with the freight and tolls passing through the New York Canals, while the average rate of freight per ton per mile is also given in each instance; the second table gives for a like period, and for the same routes, the quantities in tons of Vegetable Food, and of Wheat and Flour, together with the aggregates by these rail and water lines.

YEARS.	N. Y. Central Railroad.		Erie Railway.		New York Canals.	
	Amount of Freight earned.	Average rate per ton per mile.	Amount of Freight earned.	Average rate per ton per mile.	Amount of Freight and Tolls.	Average rate per ton per mile.
1856	$ 4,328,041	2.97 cents.	$ 4,545,782	2.48 cents.	$ 6,573,225	1.11 cents.
1857	4,559,276	3.13 "	4,097,610	2.45 "	3,876,000	7.99 mills.
1858	3,700,270	2.59 "	3,843,310	3.32 "	4,502,437	7.97 "
1859	3,337,148	2.13 "	3,195,869	2.17 "	3,665,806	6.72 "
1860	4,095,934	2.06 "	3,884,343	1.84 "	8,049,450	9.94 "
1861	4,644,449	1.96 "	4,351,464	1.73 "	9,369,378	1.08 cents.
1862	6,607,331	2.22 "	6,642,915	1.89 "	10,780,431	9.59 mills.
1863	7,498,509	2.40 "	8,432,234	2.09 "	9,065,005	8.76 "
1864	8,542,370	2.75 "	9,355,087	2.31 "	10,039,609	1.15 cents.
1865	8,776,028	3.31 "	10,726,264	2.76 "	8,605,961	1.10 "
1866	9,671,920	2.92 "	11,611,023	2.45 "	10,160,051	1.00 "
1867	9,151,750	2.53 "	11,204,689	2.04 "	8,663,119	0.90 "
1868	9,491,427	2.59 "	11,425,739	1.92 "	9,012,659	0.88 "
1869	10,457,582	2.20 "	13,046,804	1.60 "	8,492,131	0.92 "
1870	14,327,418	1.86 "	12,328,027	1.37 "	7,552,988	0.83 "
1871	14,647,580	1.65 "	13,232,235	1.47 "	10,779,887	1.02 "
1872	16,259,647	1.69 "	14,509,745	1.52 "	10,648,711	1.02 "
1873	19,616,018	1.57 "	15,015,808	1.45 "	9,267,503	0.88 "

YEARS.	New York Central Railroad.		Erie Railway.		New York Canals.		Aggregates by Railways and Canals.	
	Tons of Vegetable Food.	Aggregate Tonnage.	Tons of Vegetable Food.	Aggregate Tonnage.	Tons of Wheat and Flour.	Aggregate Tonnage.	Tons of Food.	Grand Aggregate of Tonnage.
1856	283,027	776,112	148,943	933,221	474,385	4,116,082	906,355	5,825,415
1857	275,941	838,791	120,617	978,066	263,141	3,344,061	659,699	5,160,918
1858	301,507	765,407	154,534	816,965	454,831	3,655,192	910,872	5,237,564
1859	249,751	834,319	112,727	869,072	250,872	3,781,684	613,350	5,485,075
1860	343,872	1,028,183	197,233	1,139,554	710,138	4,650,214	1,251,243	6,817,951
1861	441,562	1,167,302	243,959	1,253,419	1,054,295	4,507,635	1,739,816	6,928,356
1862	469,885	1,387,433	261,824	1,632,955	1,177,299	5,598,785	1,909,008	8,619,173
1863	405,380	1,449,604	228,632	1,815,096	846,446	5,557,692	1,480,458	8,822,392
1864	461,511	1,557,148	215,986	2,170,798	606,891	4,852,941	1,284,388	8,580,887
1865	349,103	1,275,299	212,677	2,234,350	420,343	4,729,654	982,423	8,239,303
1866	453,663	1,602,197	397,963	3,242,792	289,166	5,775,220	1,140,792	10,620,209
1867	495,194	1,667,926	277,432	3,484,546	332,589	5,688,325	1,165,215	10,840,797
1868	568,680	1,846,599	302,451	3,908,243	390,852	6,442,225	1,261,983	12,197,067
1869	764,831	2,281,885	322,978	4,312,209	636,670	5,859,080	1,724,479	12,453,174
1870	1,297,481	4,122,000	468,976	4,852,505	575,684	6,173,769	2,342,141	15,148,274
1871	1,459,919	4,532,056	745,676	4,844,208	678,450	6,467,888	2,884,039	15,844,152
1872	1,158,894	4,393,965	711,720	5,564,274	356,917	6,673,370	2,227,531	16,631,609
1873	1,452,962	5,522,724	584,030	6,312,702	682,827	6,364,782	2,719,819	18,200,208

QUANTITIES OF FLOUR, MEAL AND GRAIN PASSING INTO CANADA AT PORT COLBORNE BY WELLAND CANAL,

Showing also the Proportions from and to Ports in Canada and the United States.

	FLOUR.	CORN MEAL.	WHEAT.	INDIAN CORN	BARLEY.	OATS AND OTHER GRAIN.
1872.	BARRELS.	BARRELS.	BUSHELS.	BUSHELS.	BUSHELS.	BUSHELS.
Total passing inwards..........	244,242	....	9,598,347	8,655,148	358,806	671,969
From Canadian to Canadian Ports..........	43·58 ₩ ct.	₩ ct.	9·56 ₩ ct.	0·82 ₩ ct.	6.40 ₩ ct.	22·25 ₩ ct.
From Canadian to U. States Ports..........	.....	....	0·48 "	0·29 "	15·53 "	1·57 "
From U. States to U. States Ports..........	53·97 "	....	52·59 "	48·89 "	78·07 "	75·10 "
From U. States to Canadian Ports..........	2·45 "	....	37·37 "	50·00 "	......	1·08 "
1870.						
Total passing inwards..........	223,794	1,312	12,720,256	2,238,123	312,824	788,185
From Canadian to Canadian Ports..........	3·95 "	77·67 "	5·86 "	0·17 "	0·40 "	14·49 "
From Canadian to U. States Ports..........	.....	....	0·42 "	......	9·90 "	1·98 "
From U. States to U. States Ports..........	82·92 "	22·33 "	53.51 "	92·83 "	89·70 "	81·98 "
From U. States to Canadian Ports..........	13·13 "	....	40·21 "	7·00 "	......	1·55 "
1869.						
Total passing inwards..........	267,400	338	13,605,129	3,215,685	9,446	343,822
From Canadian to Canadian Ports..........	1·20 "	....	4·79 "	......	all	55·51 "
From Canadian to U. States Ports..........	......	....	0·33 "	......	......	3·47 "
From U. States to U. States Ports..........	94·27 "	0·51 "	55·86 "	93·27 "	......	38·76 "
From U. States to Canadian Ports..........	4·53 "	99·49 "	40·02 "	6·73 "	......	2·26 "
1868.						
Total passing inwards..........	289,526	71.54	8,914,710	5,460,488	53,788	1,329,360
From Canadian to Canadian Ports..........	0·24 "	21·30 "	3·20 "	......	2·26 "	16·44 "
From Canadian to U. States Ports..........	......	....	1·10 "	......	26·39 "	14·07 "
From U. States to U. States Ports..........	91·16 "	0·25 "	74·67 "	72·75 "	71·35 "	61·06 "
From U. States to Canadian Ports..........	8·60 "	78.45 "	21·03 "	27·25 "	......	8·43 "
1867.						
Total passing inwards..........	237,687	2,683	7,239,773	5,510,699	113,224	562,274
From Canadian to Canadian Ports..........	0·55 "	....	3·47 "	......	......	.....
From Canadian to U. States Ports..........	......	....	1·91 "	......	1·60 "	......
From U. States to U. States Ports..........	92·92 "	63·13 "	67·95 "	80·98 "	98·40 "	.....
From U. States to Canadian Ports..........	6·53 "	36·87 "	28·67 "	19·02 "	......	......
1866.						
Total passing inwards..........	150,079	1,345	5,756,579	5,147,852	40,934	583,565
From Canadian to Canadian Ports..........	1·14 "	....	3·41 "	0·32 "	......	......
From Canadian to U. States Ports..........	......	....	1·92 "	......	21·57 "	......
From U. States to U. States Ports..........	95·51 "	52·63 "	84·57 "	65·75 "	78·43 "	......
From U. States to Canadian Ports..........	3·35 "	47·37 "	10·10 "	33·93 "	......	......

MOVEMENT OF FLOUR AND GRAIN FROM THE LAKE REGIONS OVER LAKE ONTARIO.

Movement in 1873.

Receipts at	Flour.	Grain.	Total in bu.
Oswego	....	8,547,720	8,547,720
Charlotte	35	79,465	79,640
Cape Vincent	....	314,227	314,227
Ogdensburg	116,593	3,111,781	3,694,746
Montreal	1,130,641	14,159,816	19,813,036
Total	1,247,272	26,213,009	32,449,360

Movement in 1872.

Receipts at	Flour.	Grain.	Total in bu.
Oswego	110	9,224,429	9,224,979
Charlotte	32	192,596	192,756
Cape Vincent	....	437,373	437,373
Ogdensburg	137,859	3,786,689	4,475,984
Montreal	921,963	12,937,663	17,547,503
Total	1,059,969	26,578,750	31,878,595

Movement in 1871.

Receipts at	Flour.	Grain.	Total in bu.
Oswego	1,552	14,209,214	14,216,974
Charlotte	12	85,834	85,894
Cape Vincent	....	538,692	538,692
Ogdensburg	199,605	3,954,234	4,952,259
Montreal	941,633	11,457,314	16,165,479
Total	1,142,802	30,245,288	35,659,298

Movement in 1870.

Receipts at	Flour.	Grain.	Total in bu.
Oswego	5,752	12,250,286	12,279,046
Charlotte	32	111,169	111,329
Cape Vincent	....	455,756	455,756
Ogdensburg	216,502	2,566,502	4,649,502
Montreal	1,031,021	7,469,813	12,624,918
Total	1,253,307	23,853,526	30,120,551

Movement in 1869.

Receipts at	Flour.	Grain.	Total in bu.
Oswego	3,522	13,378,972	13,396,582
Charlotte	320	81,799	83,449
Cape Vincent	194	207,476	208,446
Ogdensburg	247,895	2,884,701	4,124,176
Montreal	984,192	8,118,827	13,039,787
Total	1,236,133	24,671,775	30,852,440

Movement in 1859.

Receipts at	Flour.	Grain.	Total in bu.
Oswego	64,941	7,022,145	7,346,850
Charlotte	1,764	425,711	434,531
Cape Vincent	9,390	503,369	550,319
Ogdensburg	294,659	1,132,231	2,605,076
Montreal	597,573	915,782	3,903,697
Total	968,247	9,999,238	14,840,473

The percentage each port received is shown in the following table:—

	1873.	1872.	1871.	1870.	1869.	1859.
Oswego	26.34	28.83	39.64	40.77	43.44	49.60
Charlotte	.24	.60	.29	.37	.27	2.92
Cape Vincent	.97	1.35	1.49	1.51	.67	3.70
Ogdensburg	11.39	14.00	13.89	15.48	13.06	17.55
Montreal	61.06	55.22	44.69	41.92	42.26	26.23

Annual Receipts of Western (U.S.) Wheat and Corn at Kingston, from 1850 *to* 1873.

YEARS.	WHEAT. Bushels.	CORN. Bushels.	YEARS.	WHEAT. Bushels.	CORN. Bushels.
1850	145,472	......	1862	5,079,417	1,913,010
1851	148,364	31,622	1863	3,135,055	653,855
1852	28,936	109,906	1864	1,813,152	121,978
1853	......	117,537	1865	1,686,718	640,041
1854	33,301	253,912	1866	274,252	1,442,912
1855	372,258	472,924	1867	2,064,509	700,692
1856	651,882	679,905	1868	1,461,272	999,515
1827	1,443,919	380,844	1869	5,092,571	171,220
1858	1,228,468	169,781	1870	4,839,591	165,283
1859	347,376	90,688	1871	5,546,193	2,766,449
1860	1,184,062	218,929	1872	2,754,148	6,300,959
1861	2,850,677	1,013,554	1873	5,561,446	2,580,877

SUMMARY OF COMPARATIVE GRAIN FREIGHTS.

The following table affords a concise statement of comparative average rates of freight for Grain per bushel from Chicago to New York city and to Montreal,—there being also comparative averages via Buffalo and Oswego. The averages from Chicago to Montreal largely favor the St. Lawrence route,—the saving of time in transport being also a very valuable item :—

CHICAGO TO NEW YORK, Via BUFFALO.					CHICAGO TO NEW YORK Via OSWEGO.			CHICAGO TO MONTREAL, BY SCHOONER TO KINGSTON.	
YEARS.	No. of days in Canal.	Highest rate Chicago to Buffalo.	Highest rate Buffalo to New York.	Average rate of Freight.	Highest rate Chicago to Oswego.	Highest rate Oswego to New York.	Average rate of Freight.	Through rates.	
1861	8½	26 c.	30 c.	27¼ c.	30½c.	22 c.	27 c.	....	Rates by Propellors are variable, according to the state of trade,—sometimes higher than by schooner to Kingston, and sometimes lower.—On the overage there is probably no difference.
1862	8½	17 c.	24½c.	26½ c.	22¼c.	18 c.	26¼ c.	26 c.	
1863	9	12½c.	25 c.	23 c.	17 c.	18 c.	22¾ c.	16 c.	
1864	10	18 c.	22 c.	28¼ c.	24 c.	18 c.	28½ c.	18½ c.	
1865	10	19 c.	26 c.	26¾ c.	27 c.	18 c.	27¼ c.	18½ c.	
1866	10	23 c.	23 c.	30½ c.	30 c.	20 c.	31¼ c.	18½ c.	
1867	10	15 c.	25 c.	22½ c.	18½c.	17 c.	22½ c.	17½ c.	
1868	10	13½c.	24 c.	23 c.	16 c.	17 c.	23 c.	17½ c.	
1869	10	12 c.	25 c.	23 c.	16½c.	20 c.	23¼ c.	16 c.	
1870	10	10 c.	16 c.	17 c.	15 c.	12 c.	18½ c.	16 c.	
1871	11	18 c.	17 c.	20¼ c.	20 c.	14 c.	21¼ c.	14½ c.	
1872	11	18 c.	17 c.	24¼ c.	20 c.	14 c.	23¼ c.	21½ c.	
1873	11	13 c.	13 c.	19 c.	20 c.	9 c.	22 c.	18½ c.	

All the rates noted in this table are in U. S. currency.

NOTES ON GRAIN TRANSFER.

Facilities for Handling Grain at Kingston are afforded by five floating elevators, capable of transferring 250,000 bushels per day of twelve working hours. The barge capacity for transporting the same to Montreal is as follows:

Montreal Transportation Company........................	550,000 bushels
St. Lawrence and Chicago Forwarding Company............	420,000 "
Messrs. Holcomb & Stewart..............................	200,000 "
" Millar & Jones.......................................	200,000 "

Thus in one trip downwards by the barges of these lines, about a million and-a-half bushels can be moved; and if it be calculated that on an average each boat could make thirteen trips during the navigable season, there is shown a capacity for transporting over 18 millions of bushels. Of course, this barge capacity is only supplemental to the sailing craft from Chicago to Kingston. But there are fully 30 steam propellors regularly making *through* trips from the first named port to Montreal, which have an aggregate grain carrying capacity of 5 millions of bushels,—while there are other transient craft in the trade,—altogether showing facilities for transporting an aggregate of probably 25 millions of bushels.

The General Rate of Freight, during the season of 1874, on wheat from Kingston to Montreal is 4 cents per bushel. A fair average *through* rate from Chicago to Kingston would be 7½ cents American currency. The upward *through* freight to Chicago by propellors consists of Pig Iron and Salt at $2.50 per long ton; with general merchandise at $3.00 to $4.00 per long ton.

The Average Time, during season 1874, occupied by schooners in coming from Chicago to Kingston is 13 days; average time of transfer and delay at the latter port 1 day; and the time of barges from Kingston to Montreal is 3½ days, making in all 17½ days from Chicago to the head of Ocean navigation at Montreal by schooners and barges. Propellors usually perform the trip in 9 to 10 days.

The Elevating Capacity connected with warehousing facilities in Montreal comprises 11 elevators, capable of transferring 3,000 bushels of grain per hour. In addition, the Montreal Elevating Company have 9 floating harbor elevators, each capable of handling about 4,000 bushels per hour, or an aggregate of 36,000 bushels. The storage capacity for flour equals 200,000 bushels.

ROUTES FROM THE INTERIOR TO LIVERPOOL.

A table is given on page 43, showing distances from the head of Lakes Superior and Michigan, to Montreal and New York respectively, by existing routes. The following figures indicate further comparative distances:—

Chicago to Liverpool, *via* Welland Canal and Montreal..................	4088 miles
Chicago to Liverpool, *via* Erie Canal and New York.....................	4480 "
Difference in favor of St. Lawrence Route...............................	392 "

APPENDIX No. VII.

DEEPENING OF SHIP CHANNEL, AND HARBOUR IMPROVEMENTS.

WM. J. PATTERSON, ESQ., MONTREAL, *2nd Nov.* 1874.
Secretary Board of Trade.

SIR,

In your note of the 28th ult., you ask me to give you a brief statement of the present capacity of the channel for navigation between Montreal and Quebec, and the accommodation which now exists for ships coming to our Harbour;—as well as the intended improvements, in both the Channel and the Harbour, which the Commissioners are about to undertake.

In doing this, it may be well to observe first, that previous to 1850, no successful improvement of the channel between Quebec and Montreal had been made, and the size of the ship trading to Montreal was limited to a draft of 11 feet at low water;—that being the depth of water through Lake St. Peter, for a distance of 12 miles. Lighterage of cargo at the season of lowest water was so expensive, that few vessels were employed in the trade of over 350 tons burthen. The necessity of deepening a channel from Montreal to Quebec, through Lake St. Peter, and other shallow parts of the river early engaged the attention of the merchants of Montreal, say from 1838 to 1843, when the Government of Canada, unsuccessfully, made an attempt to do so. But it was not until 1850, when a plan of operation was commenced, which in 1853 resulted in a ship being taken through from Montreal to Quebec drawing 16 feet of water, where before there was only 11 feet. The channel was further deepened to 18 feet in 1859; and in November 1865, the present channel of 20 feet at low water, and 300 feet wide at bottom in the narrowest place, was completed, and tested by a vessel loaded down to 20 feet, passing through when there was 11 feet in the old channel.

The result of this is, that steamers of 3500 tons and over, for most of the season, come to Montreal without breaking bulk; but when the water falls to the lowest point, or 11 feet in the flats of Lake St. Peter, giving 20 feet in the channel, large steamers have to lighten to come to, or go from Montreal, with full cargoes, and sometimes it is found unprofitable for the largest steamers, say of 3900 tons, to come up at all.

The effect on the cost of outward freight, by the deepening of the channel to 20 feet, and employing the large ship, has been to reduce freight 33⅓ per cent. compared with the rates current, previous to the improvement of the channel. As a large vessel therefore can carry cheaper than a small one, it is highly important, not only for the trade of Montreal, but of Canada, that the channel should be so deepened and the Harbour so improved by facilities therein, for loading and discharging, that ships and steamers from sea of the very largest size, should at all times, and at the lowest depth of water, be able to come from and go to sea without breaking bulk. The Harbour Commissioners believe that the cost of freight will thus be diminished, and as a consequence that the value of what is exported will be increased to the producer, and imports cheapened to the consumer.

The Commissioners have therefore resolved to deepen the channel from 20 to 25 feet at lowest water. There was some doubt as to whether this depth could be obtained, as it was known that rock existed in the channel at "Cap Charles," and "Cap à la Roche," where the tide rises from four to six feet. From an examination, however, which has lately been made by engineers, there is no longer any doubt that at these places (50 miles above Quebec) a 25 foot channel at low tide can be secured, while there is no difficulty in getting the same depth, through Lake St. Peter, and other parts of the river. A new channel, parallel with that now in use at Lavaltrie, a distance of seven miles, has been suggested, on the south side of the river, opposite Contrecœur, which is very wide and deep, and which will require so little dredging that it is estimated a saving of $350,000 will thus be made by this change.

A Dredge and a stone lifter have been working at Cap Charles, since the opening of navigation, and next spring the Commissioners will be prepared and ready to begin their great work of the 25 feet channel, with 7 powerful Dredges, 7 Steamers or Tenders to same, 5 Spoon Dredges, 1 Stone Lifter, and 36 Scows, which when fully manned, will give employment to over four hundred men, and the consumption of coal for the season is estimated at 15,000 tons. It is proposed to carry a cut throughout, first of 2½ feet, thus securing a channel of 22½ feet—and, when this is done, to go through with another cut of 2½ feet, making the 25 feet. It is supposed that all this will be accomplished during five years.

The next important consideration is, that simultaneously with the improvement of the Channel to 25 feet, the Harbour must also be improved to correspond. At present there are no berths for steamers or ships in the harbour drawing over 20 feet, and only a few berths of that depth. The depth of water in the channel opposite the City is only 20 feet, and the question comes up: where can ships and steamers drawing 25 feet find berth room in the Harbour?

The present wharves built and under contract in all parts of the harbour, have a frontage of 22,640 feet, affording accommodation for vessels from 10 to 20 feet at low water. The Commissioners are now engaged in dredging out the river in rear of the factories on Mill street. This cannót be completed in less than five seasons, and will give a further accommodation of 4,300 feet, with 25 feet depth.

Opposite the city is an extensive Shoal, which engineers have advised should be wharved, and outside of the shoal, a new channel 25 feet deep can easily be dredged. In Hochelaga Bay there is ample water, but that point is very distant from the centre of business and the mouth of the Canal.

Then there is the scheme of Docks recommended by Messrs. T. C. Keefer, Chas. Legge, Kirkwood, Childe, and McAlpine, below the Victoria Bridge and abutting thereon, extending down to Wind-Mill Point, covering a space of 120 acres, the property of the Commissioners, and now useless. This space can be filled with water to the depth of 26 feet, above the level of the water in the harbour, from the St. Lawrence between Lachine and the Harbour. Messrs. McAlpine, Kirkwood and Childes, declare that from the water power which can thus be created in this Dock for Mills, Elevators, and Manufactories of all kinds, a revenue will be obtained which will more than three times pay the cost of its construction, while Dry Docks for building purposes can also be secured.

The subject is extremely important, and doubtless will force itself on public attention; but looking at the future requirements of the trade of the St. Lawrence, from and to the West, there can be little doubt, that its probable magnitude, will fully warrant the largest expenditure.

From what I have stated, it will be seen that there are ample means for harbour enlargement. If a comprehensive view is taken of our position at the foot of Canal Navigation, and at the head of Ocean Navigation, there should be no doubt as to the wisdom of urging forward to completion the river and harbour improvements referred to; for by creating every possible facility, cheapening charges to the utmost, and lessening the time of inland and ocean ships in the harbour, all interests of the country will be promoted.

I am, Sir, Your very respectfully,

JOHN YOUNG, Chairman Harbour Commissioners.