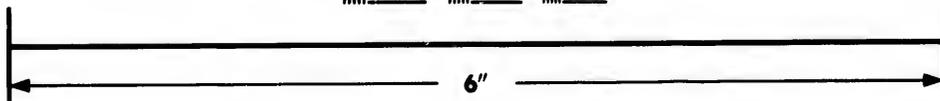
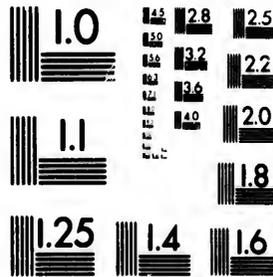


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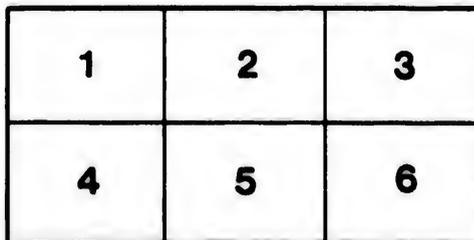
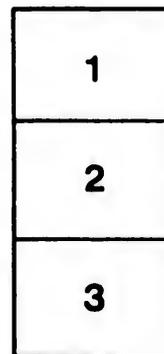
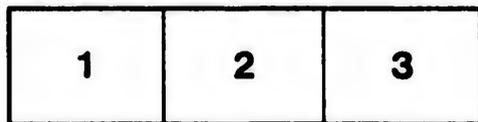
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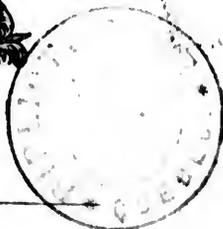
REPORT

ON

SEWERAGE FOR MONTREAL,

BY

CHARLES M. TATE, C. E.



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REPORT.

To the Chairman of the Road Committee.

SIR,

I beg to acknowledge the receipt of your communication of the 8th June last, conveying instructions from the Committee on Roads, of the Corporation of Montreal, to proceed to the examination and report upon a plan of drainage or sewerage for this City.

Accepting, as I do, the charge with which you have done me the honor to intrust me, I must beg to call the attention of your Committee to the following introductory remarks, preparatory to submitting for your approval a system of sewerage or drainage for the City of Montreal.

A subject of such vital importance to the welfare, not only of the present residents of this City, but of those who shall come after, requires to be considered with great care, and treated as a subject of such importance demands:—for it must be remembered that, as the City increases in prosperity from its commerce and manufactures, it also increases

in magnitude and population from the same cause, and what may be deemed with propriety ample sewerage accommodation for the wants of to day, may fall very far short of what the circumstances of to-morrow will require.

Using all diligence, then, to keep pace with the necessities of the times, and with a clear and comprehensive view for future requirements, no time must be lost in maturely considering and commencing such a system of sewerage as shall render the City of Montreal as famous for its cleanliness, as it will be for its commerce and importance throughout the whole of British North America.

Before proceeding to enter into any detail, or theorizing on this or that particular system, it will be well, for future guidance, to describe carefully in what a system of drainage or sewerage should consist, in order to produce the effect for which it was created.

In the first place, then, it must be extended, embracing as large a surface as possible, and conveying in the most direct and efficient manner the collection of surface water and street drainage to the natural drain of the Country, that is, in this instance, to the River St. Lawrence.

Secondly, the drains, sewers and culverts, which constitute it, must be permanent; constructed of the best material to be procured for such purposes, laid on good and sure foundations, and of such form and dimensions as will combine economy with perfect effect.

Thirdly, it must be accessible ; not liable to derangement from entraneous causes, and capable of discharging rapidly, the sudden accumulation of water during storms ; guarded as much as possible from the action of frost during winter, and capable of being cleansed by the introduction of fresh water for that purpose, during summer.

Fourthly, a good system of drainage requires, that all open drains be done away with, all stagnant pools dried up, and the surface of the ground, consisting of rotting and putrifying matter, be removed previous to the filling up of the same, to prevent the production of noxious gases and to cut off all future underground communication for water from the neighbourhood.

Such being a brief outline of the requirements of of a good system of drainage, (which may be not inaptly termed a machine for cleaning and keeping sweet a City,) perfectly under control at all times, by means of its cess-pools, gates and sluices, it will now be requisite to see how far this, or any system has been adopted here, and how so very desirable an object can be more perfectly attained by a one which may be commenced immediately, a portion of it so arranged as to meet existing wants, whilst its continuation may be left for future execution, without, at any rate, deteriorating the present drainage.

For many years, the natural drains in and about the City, were found to be sufficiently effective for the purpose of keeping the Streets dry and carrying

off the filth :—but as the City was extended, more accommodation became requisite, and the natural drains were changed into brick ones, without, however, materially altering either their levels or localities, hence some drains run in one direction, and others in a direction exactly opposite.

The period of the covering of the creek or natural drain, along Craig Street, should have been taken for arranging on a certain and permanent plan, all the drainage of the City. The time, however, for the temporary system of drainage for a City of such great importance, has long since passed its limits, and instead of allowing the chance existence of an open creek or *cours d'eau* to decide the direction of a drain, the experience of past years must aid in directing the manner in which such operations as the one now under consideration, are to be carried on.

With regard to the first requisition—It appears, that a large proportion of the City is without drains, or possesses only the open ones, which are most objectionable and offensive ; that these drains are neither direct nor efficient, as the state of the roads and streets abundantly prove.

With reference to the second, the small drains of twelve and nine inches diameter, are mechanically defective, as the material of which they are constructed does not admit of being worked to such dimensions, consequently, the drains are not tight, and the foul water from the houses leaks through and is absorbed by the earth, producing unwhole-

some effluvia, or rises to the surface and forms pools of impure matter. The sewers are not of such construction or strength as to enable them to retain their form or position, hence their frequent caving in, and the consequent stoppage of the drainage, with all the attendant inconveniences to the public and neighbourhood, from obstructed thoroughfares. Generally, wherever drains or sewers have been laid on made ground, or in the beds of old water courses, they have failed ; as often, when the ground has been favourable, faulty material (soft brick,) has caused the same result, which careless workmanship has not by any means aided to avert.

Thirdly, in many places it is difficult to find the locality of a drain, and in some there is no record by which to know that a drain exists at all. Winter and summer find the drains and sewers unprotected, nor are there any means of cleansing or repairing without great expense and inconvenience.

Fourthly, a very large portion of the ground is covered with decomposing vegetable and animal matter, which will, if covered up, as has hitherto been the case, be converted into a reservoir of gas equally obnoxious to health and the formation of solid ground.

Cess pools for preventing the introduction of solid or insoluble matter into the sewers, are wanted as well as gates for diverting or stopping the drainage, and sluices to admit water for keeping the drains clear.

The surface of the ground upon which the City of Montreal is built, offers facilities for the construction of three separate lines of main drains or sewers.—That is to say—the first and highest commences in St. Catherine Street, and runs in a N. Easterly direction to City Councillor Street, thence to Mayor Street, thence along Bleury to opposite Berthelet Street, when it takes a northerly direction about 300 feet. It proceeds hence to St. Constant Street, when it again changes its course easterly to midway between Amherst and Beaudry Streets, from whence it runs nearly at N. E. to the City Boundary.

This sewer will convey the water and drainage from Guy Street or the Priests' Farm, including the surface between Dorchester and Sherbrooke Streets, as far as the Union Avenue, and thence between Mignonne and Sherbrooke to St. Denis Street; from St. Denis Street it drains the swampy ground lying between Mignonne Street, Côte a Baron, and the New Barrack Ground, receiving the creek or *Cours d'eau*, which descends from the Côte along Beaudry Street, and passing to the N. W. of the Protestant Burying Ground, drains all that part of St. Mary's Ward, and follows the City Boundary to the Main Culvert.

The second, or what may be termed the main drain or sewer, commences at the City Boundary, or Canning Street, and there receives the *cours d'eau*, which crosses that Street to the N. W. of St. Bonaventure Street. This sewer drains the ground

or that part thereof which the St. Antoine drain, lying between Dorchester and St. Joseph Streets, does not take up, as far as Chaboillez Square, and thence until it enters Craig Street. At Haymarket Square, opposite Radegonde Street, it receives a connecting drain from Union Avenue, which passes down Beaver Hall Terrace, and the Griffintown sewer, which enters it opposite McGill Street; it then descends along Craig Street, to its mouth, below Gilbert's Slaughter House, outside of the City Boundary, receiving the drainage between Notre Dame and St. Mary Streets, and Dorchester Street, as well as the Papineau Road drain and the St. Catherine sewer.

The third line of drainage commences in St. Ann's Ward, near Cantin's Ship Yard, and runs along William to Gabriel Street, which it follows down to Queen Street, taking the drainage of the ground lying between St. Joseph Street and the undrained ground to the Canal, whence it turns either into William or Wellington Streets, and so along McGill Street, to Craig. From McGill Street it will continue down along Commissioners Street, to Barrack Street, where the Commissioners Street sewer debouches into the River, or to Lacroix Street, and thence to Craig Street by Tunnel.

The Commissioners Street sewer, takes in the drainage of that part of the City between Notre Dame Street and the River.

A subsidiary sewer is required along Dorchester Street, to take the drainage of the ground lying

between it and Mignonne Street, so as to leave the main sewer in Craig Street as free as possible.

In the section of the main sewer in Craig Street, furnished to me by Mr. McGill, the City Surveyor, every advantage has been taken of the limited fall between Radegonde St. and the River by the Jail, an additional advantage, however, can be obtained for the drainage, during the prevalence of high water particularly, by continuing the sewer to a point below the Slaughter House.

By means of sluices or gates at the corner of Union Avenue and St. Catherine Street, the direction of the first drainage can be diverted into Craig Street, in case of accident, or to meet the requirements of new work, so as to prevent the obstruction caused to the drainage in either of the above cases. In like manner, sluices placed in the sewer in Craig Street, will, for temporary purposes, divert the Radegonde and Bonaventure, as well as the Griffintown drainage, into Commissioner Street, whilst a sluice at St. Ann's Market will return the Griffintown drainage into its proper course to Craig Street. Other sluices or gates will be required for similar purposes elsewhere, in such places as may be pointed out hereafter.

The facility of changing the direction of the drainage, by these means, enables the sewers to be scoured from one extremity of the City to the other, with fair water from the tail race of the water works, and from other sources.

Existing drains will be introduced when desira-

ble and practicable into this system, and preparation will be made for the same in the work.

Flood or stop gates will be provided for the mouth of the Culvert, as well as for the sewer at Barrack Street, should it be found desirable to have a discharge at that point, above or below which, there will be no communication whatever with the River, and all existing openings will be shut up and closed, so as to prevent the possibility of water entering the drains, at least by those means:

All open drains of water will be taken up, and the courses diverted into the proposed sewers. No drainage or waste water will be allowed to enter the sewers, except in such manner or quantity, and at such times as may be decided upon by the person who has charge of the sewerage, to prevent accident from flooding the sewers when already full.

The contract to be founded on the following specification, embraces—the removal of the metal or paving with which the street or road is covered, to be relayed where required; the excavation for all drains, sewers, or cess-pools, where pointed out or laid down on the plan of the City which is appended hereto, or herein referred to, marked A and signed by the contracting parties; the providing of materials, tools, and labor of their respective kinds, as described more fully hereafter; and generally, the true and faithful execution of the works contracted for, according to the intent of the plan or specification. Under this heading, is comprised—the excavation for all drains, cess-

pools, temporary drains for carrying off or diverting existing drains or runs of water, during the progress of the works; the removal of all superfluous earth or material, not required for re-making the ground, and depositing the same in such places within the City limits, as may be pointed out by the officer or person in charge of the work. The re-making the ground; after the masons and bricklayers have completed their work, and leaving the road or street in all respects in a state of perfect and good repair. The providing and fixing all boarding, fences, and bars required in securing the public from accident; the forming good and sufficient bridging across the excavation to accommodate the traffic during the progress of the work, at the intersection of such streets or highways as may be directed. The providing, fixing, and maintaining all lanterns or lamps that may be required to indicate obstruction in the way as well as proper watchmen by night. The timber and shoring all places where the excavation is confined to narrow limits, that is, where, from the depth of cutting required, no slope can be given for the sides thereof. The pumping out or removing all accumulation of water in the cuts, and keeping the same free therefrom, until the masonry or brickwork is completed, with its filling in and backing.

Such timbering as may be deemed necessary by the Superintendent, to be retained for the security of the work, to be measured and paid for at the market price.

The stone for the masonry of the drains and sewers to be of the best Montreal Limestone, dressed to the natural bed, varying in thickness from 4 to 12 inches, and to have a bed of 9 inches from the face. The brick to be of the best hard, well-burnt brick, and where required, to be formed to mould, to suit the curve of the invert or crown of the work; to be in every respect equal to the samples exhibited at the office of the City Surveyor, or such other place as may be appointed. The mortar to consist of the best water, lime, clean sharp river sand, well mixed and compounded together in a pug mill, and made up under cover, in such proportions as the nature of the lime may require, according to the instructions of the Engineer. Water, lime, or cement, must be used in all cases where side-drains enter the main sewers, for a distance of three feet from the work on each side of the sewer, and in the side-drain so entering. All plank or flatted timber required for the foundations, is to be of good sound quality of Tamarac, Hemlock and Cedar, as described on the accompanying plans marked B and C.

The workmanship is to be of the best and most careful description. All the stone required to be dressed fair and true, to suit the particular portion of the work to which it is to be applied, whether for inverts, springing courses, crowns or curbs, and to be bedded fairly and truly in mortar, the joints in no case to exceed $\frac{1}{4}$ inch; no packing up with spawls. The ashler to be laid in headers and

stretchers, alternately, and the backing, or rubble work to make good bond therewith; the ashler work, to be carried on in regular courses, which must break joint well and truly with the other, in all cases the bond must be rendered fair. The curbs for receiving gradings or other iron work, cut to the dimensions shewn on the drawing, to be smooth boucharded,—the beds and joints of all ashler work, to be rough boucharded. The bricks to be well bedded in mortar with close joints, the end joints to be filled, good bond to be preserved throughout the work. No centreing will be allowed to be struck, until three days have elapsed from the time of turning and completing the arch, and each length of centreing to be of not less than 10 feet. Great care must be taken in rendering the bond good at the intersection or junction of other work or drains, and, also, where the increased dimensions of the sewers or culverts require them, as shewn on section and plan, for which proper templates, centres, and moulds must be provided. No bats or pieces are to be used in the brickwork. The whole surface joints of the invert and sides are to be carefully pointed with cement or water lime, as the work advances, and previous to the placing or fixing of the centreing for that portion. The foundations, where required, will be formed of Concrete, (varying in thickness according to the nature of the ground) which is to be composed of good clean gravel or broken stone, well mixed up with hot lime, in a proper trough; it is then to be

wheeled up on to a platform arranged for the purpose, and discharged from the barrow into the trench, and its upper surface formed to a mould prepared to correspond with the curve required to receive the brickwork or masonry. Where plank is used for the foundation, the sills must be laid longitudinally on each side, to come directly under the walls of the drain, and they must be bedded in the ground, which is to be punned and rammed down on each side, and the space between filled and rammed, so that the planks may bear solidly on the ground, as well as on the sills; every fourth plank is to be pinned with oak pins to the sill.

The backing of earth is to be put in with great care, and well rammed down, but in all cases proper walings and stretchers must be placed between the wall whilst this operation is in progress; the same care must be taken in filling in the earth above the crown of the drain and spandrils.

The contractors to provide and fix No. 5 Stones, not less than 8 inches in thickness, and 9 inches longer at each end, than the opening to each man-hole of main drains, to be placed 12 inches below the crown of the roadway. The brickwork of all shafts to be done in cement. The surface drains and gratings to be of similar dimensions to those adjoining the side-walk of the Revetment walls in Commissioners Street, and in such situations as represented in the general ground plan, or pointed out by the Superintendent.

The contractors to make good all damage or

defects, which may be occasioned either by carelessness or any other cause.

No materials of any kind, of an inferior quality, will be permitted to be used, or, remain on or near the works. The Superintendent of the works is to be at full liberty to order the discharge or to dismiss from the works any man or men, for incompetency, or misconduct, and the contractor is not to replace them without his approbation. It is also to be in the power of the Superintendent, to direct such alterations to be made during the progress of the work, as may be found expedient, which alterations, shall not in any case vitiate, or make void the contract, but shall be done by the contractor, according to the directions of the Superintendent, and the value of the same be ascertained by him whether in addition or deduction, and be added to, or deducted from the amount of contract as the case may be, and such amount of addition or deduction to be final.

The method of operation must be, as follows, and regularly carried out:— excavation, preparation of bottom or foundation, invert walls, filling in and ramming at back, centreing, turning crown, making road, and then striking the centres and stretchers. In many cases, the excavation must be carried far in advance of the other work, in other cases, it will not be requisite to have more than 100 feet of ground open at one time; by this arrangement great saving of time and labour will be effected and the work carried on more efficiently and with greater attention.

Payments will be made regularly every two weeks at the rate of per centum on the work done, the remaining per cent. to remain in the hands of the Corporation, as security for the full and satisfactory execution of the contract. The work is to be measured, and estimated according to the scale of prices for each description of work, by the Engineer or person in charge, and no payments will be made unless the warrant be certified by him.

I beg to submit to you the following estimate of the expense of constructing the main drain or culvert from Papineau Road to Canning Street, and from the same culvert at Hay-market Square to Seminary Street, in the St. Ann's Suburbs :—

From Papineau Road to St. Hubert Street,.....	£17,322	15	6
St. Charles Barromée Street,..	8837	13	0
St. Radegonde Street,.....	7228	1	3
Chaboillez Street,.....	2603	2	0
Canning Street,.....	1619	12	10
	<u>£37,611</u>	<u>4</u>	<u>7</u>
11 Manholes,.....	128	4	0
Sluice	250	0	0
	<u>£ 37,989</u>	<u>8</u>	<u>7</u>
<hr/>			
From Haymarket Square to Wellington Street....	£ 4248	9	1
Seminary Street,....	1982	7	0
10 Manholes,.....	101	4	0
2 Sluices	500	0	0
	<u>£ 6832</u>	<u>0</u>	<u>1</u>

Making a total of £44,821. 8s. 8d., which includes all the works necessary for excavations foundations, masonry and brick work, according to the plans and specifications now submitted, and in execution of the system explained already in my Report.

It will appear from the foregoing that the preliminary requirements, which I had the honor to submit to you, on the ninth of the present month, have been as strictly complied with as circumstances would allow, and that the system, now recommended, permits the commencement and execution of various parts of the work without delay, in furtherance of which, I beg to submit the accompanying rough plans, marked A. B. C., together with the specification; and I must here remark, that, in a matter of such moment as the sewerage of this City undoubtedly is, the strictest attention to the terms of the contract, according to the specification, must be insisted upon.

I have the honor to be,

Sir,

Your obedient servant,

CHARLES M. TATE.

C. E.

MONTREAL, July 28th, 1854.

