TOWN OF PETERBOROUGH

PROVINCE OF ONTARIO

REPORT

ON PROPOSED

SYSTEM OF SEWERAGE

BY

ALAN MACDOUGALL

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TORONTO

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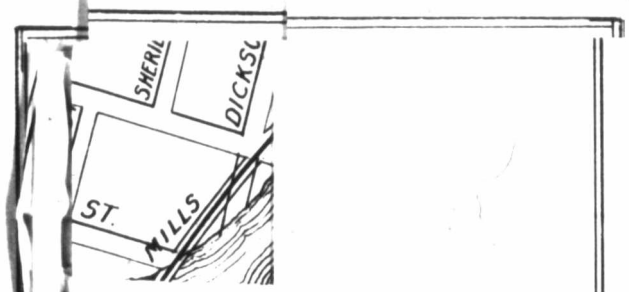

SHERIL
DICKSU
ST.
MILLS

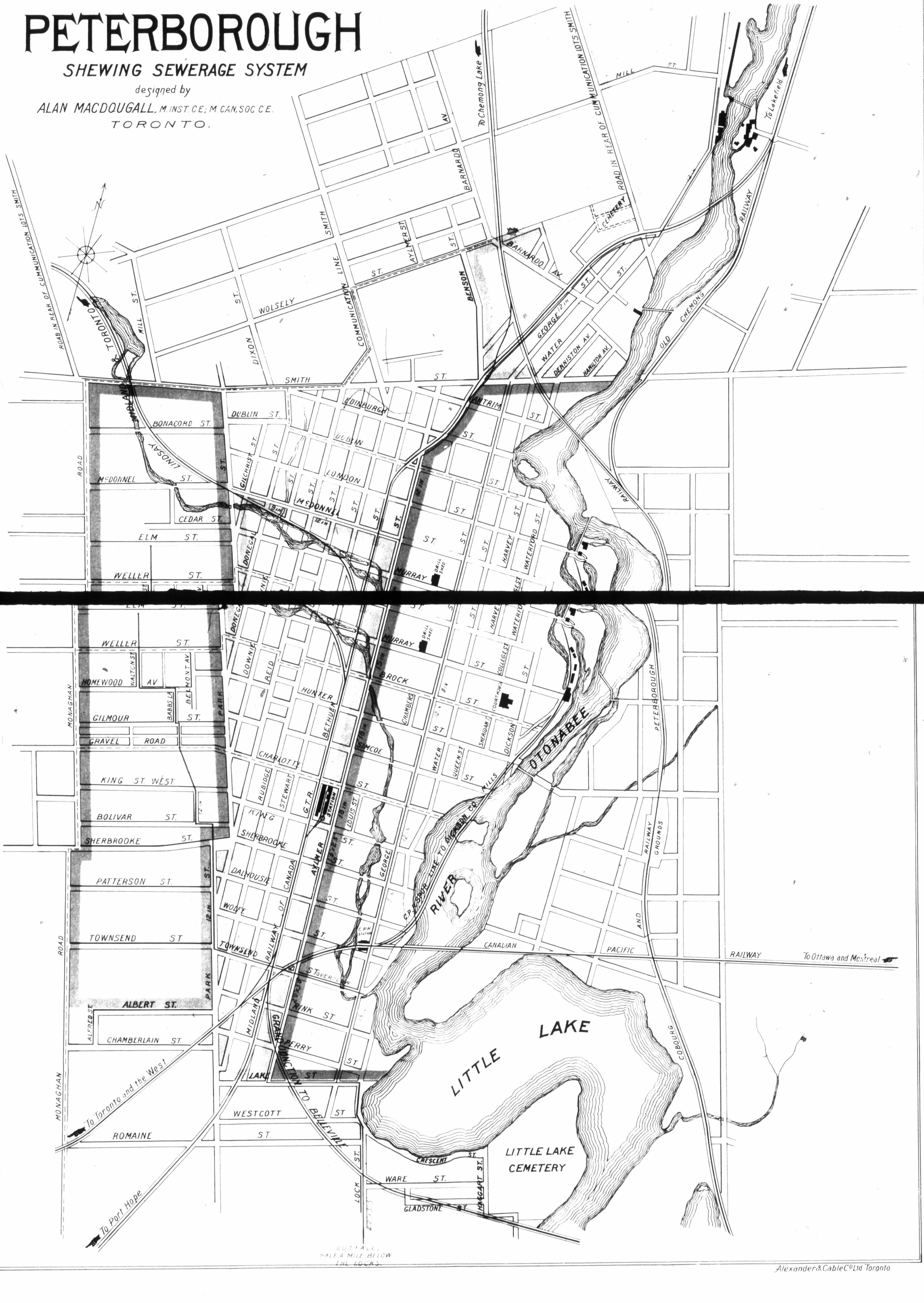
MAP OF THE TOWN OF

PETERBOROUGH

SHEWING SEWERAGE SYSTEM

designed by

ALAN MACDOUGALL, M. INST. C.E.; M. CAN. SOC. C.E.
TORONTO.



Alexander & Cable Co Ltd Toronto.

To the Worshipful

THE MAYOR AND COUNCIL

OF THE

TOWN OF PETERBOROUGH.

Gentlemen,—I have the honor to report on a System of Sewerage for the town of Peterborough.

I have visited the town on several occasions, and have made myself well acquainted with the locality, and have also had several interviews with the members of the Special Committee on Sewerage and your City Engineer, who has at all times readily and cheerfully given me all the information I required, and from whom I received the plan with the levels marked thereon, on which I have based my system.

SURFACE, OR STREET DRAINAGE.

It is not intended to consider any scheme for the disposal of the surface water which may accumulate during rain storms, as your town is so favorably situated for disposing of it; the gradual fall from north to south gives good grades for the streets, and the frequent intersections of these by the mill stream or creek afford ready means of carrying off storm water. To this must be added the porous nature of the subsoil which forms an absorbing and filtering medium. So far as I am able to learn, much inconvenience or damage has not been caused by street floodings, except perhaps on Water and George streets; this water can readily be cut off at Brock street, and drained into the mill stream or the river at a moderate cost.

THE SYSTEM RECOMMENDED.

You are all familiar with the several methods adopted in constructing sewerage systems, it is not necessary to enter into any consideration of them. The system I have adopted is what is called in this country the separate system, based on the "Suggestions for Sewerage" by Sir Robert Rawlinson, C.B., late Chief Engineer to the Local Government Board in England, when the Public Health Act was passed in 1875. This system provides for the introduction

of roof and cellar water into the sewers as well as the household wastes which constitutes the "sewage" proper. The system has been introduced with success into many English and Colonial towns, and numerous examples of it can be found in the United States.

The actual quantity of sewage from any given area is comparatively small, the capacity of the smallest sized sewer which experience dictates, is greatly in excess of the volume of sewage ordinarily flowing into it, the introduction of a moderate amount of rain fall does not call for increased size, consequently no increased cost is caused by introducing roof water. In the main sewers which act as interceptors and trunk lines, the volume is increased when cellar and roof water is introduced with the sewage; the increase in size of the sewer will depend on the area drained and the possibilities of obtaining discharge points for the roof water. The more frequently roof water can be discharged at an overflow the more nearly will this system, generally known as the Rawlinson System, approach to the system known in America as the Waring system, called after Colonel George E. Waring, Jr, who introduced it. When the Waring system is introduced, it is customary to use a special drain to carry off the cellar water, this drain is either connected to the sewer at given intervals, or provided with a separate outfall. The "sewage" comes from the house to the sewer by one "connection" as it is technically called, and the cellar water is connected to its special drain by its own "connection." The householder thereby has two connections and two sets of drains, one for sewage, the other for ground water. Under the Rawlinson System one drain does for both, no increased size of sewer is required, nor is any increased outlay incurred, except in the intercepting sewers, which may have to convey an extra quantity of water till an overflow discharge is reached. To put it to a practical proof in the case of your town, the only sewer which is increased in size to accommodate rain water is the Aylmer street sewer, between Hunter and Townsend streets. The chief difference arises between King and Townsend, where a material increase is made for roof water. A comparison of cost of this portion of the sewer, against the smaller pipe sewer, with a special drain for cellar water, and a second house connection for cellar water, leaves the balance in favor of the system adopted.

FLUSHING APPLIANCES.

An important necessity of the small sewer system is the flushing appliance; the sewage of itself will not keep the sewer clean for a considerable distance from its upper end; to help it to do so, self acting or automatic flush tanks are used which discharge a given quantity of water, usually 150 gallons, at regular intervals of time. A sufficient

flow is thus established to make the sewer self-cleansing. The introduction of rain water acts in a similar manner and with even better results, as the flushing effect is more wide-spread, causing the sewers to get a better flush than can be obtained by artificial means. The rain water also helps materially in flushing the higher or "dead" ends of sewers when flush tanks are not in use.

SYSTEM DESIGNED TO BE CONSTRUCTED IN SECTIONS AND ECONOMICALLY.

In the scheme for the sewerage of your town now presented to you, care has been taken to design it so that from time to time any portion can be constructed, and joined on to the main sewer, thereby ensuring an efficient outfall, and preserving the benefits derived from working to an already carefully thought out and elaborated general design.

The problem of economical construction has been kept in view throughout.

SUBDIVISION OF TOWN INTO DRAINAGE AREAS.

The general arrangement of the design is to divide the city into drainage districts, intercepting each by a special intercepting sewer, which will connect with the main on Aylmer street.

The first district lies to the north of Smith street and east of the railway; the most favorable location for the intercepting sewer will be along the east fence of the Railway from the crossing on River street to Dublin street.

The second lies to the west of Aylmer as far as Park street, and embraces the area north of McDonnell street, on which the intercepting sewer will be built.

The third lies to the east of Aylmer and south of Smith, this is perhaps the most important as it contains the present business part of the town. There are two sewers in this area, Water street joins George street at King street and then George street falls into the main outfall at Lake street, near the corner of Lock street.

The fourth lies to the west of Aylmer and includes from Smith to Lake street, as far west as Park street. Each street parallel to Aylmer has its own sewer, discharging directly into the Townsend street intercepting sewer

The fifth embraces the district between Park street and Monaghan Road, as far south as the Edison Co's. Works and will also be collected on Townsend street. The southern portions will be

drained into Lake street, and as much as can be reached by it, into the Lock street sewer.

There is a small district at Sheridan Terrace, lying to the south of the Court House which cannot be connected to the general system, The population is very limited, and owing to the configuration of the land, cannot increase much beyond the present number; this must be temporarily drained into the river. The amount of pollution will be so small it cannot be classed as a nuisance.

As the manufacturing interests of the town increase along the river bank, it is certain that pollution of the river will take place and necessitate the construction of a sewer along the bank to which the above area can be connected. This sewer will be connected to the George street sewer, and discharged at the foot of Lock street. Allowance has been made for this in the sizes of the George street and Lock street outfall sewer.

OVERFLOW SEWERS FOR RAIN WATER.

Provision has been made to dispose of the roof water on George and Water streets at Sherbrook street, and a special overflow sewer will be built on Townsend street to carry off all the rain water coming from the north, and the extra water likely to be conveyed by the 16 inch pipe called for under the Edison Company's agreement with the Town.

From Townsend street southwards, the outfall sewer will carry very little roof water, so that the discharge can be estimated as pure sewage.

POPULATION ALLOWED FOR.

The population to be provided for has been estimated at over 30,000, of whom the greater part 20,000, have been located between Smith street on the north, Lake street on the south, Park street on the west, and the river on the east. In the business parts over 100 persons have been taken to the acre; the average over the whole area is 60 to the acre. The balance of the population is spread over the area embraced within the present town limits. The sewage is calculated on a basis of 75 gallons per head per diem, and roof water at the rate of 0.50 cubic feet per second per acre of roof area, which is a fair allowance for summer storms. The roof surface has been estimated at 30 per cent of the area in the most densely populated district, with increased allowance in the business streets, and 10 per cent. for the remaining portion.

DESCRIPTION AND SIZE OF SEWERS.

The sewers on all side streets will be 9 inches in diameter the smallest size it has been found prudent by experience to make them.

The Aylmer street sewer, which is the trunk sewer, will be 12 inches in diameter at the north end, increasing to 18 inches at Hunter street.

At King street it will increase to an oval or egg shape 1 ft. 6 in. by 2 ft. 3 ins., till it reaches Townsend, where it will discharge its cellar and roof water, and then continue on a grade at 1 in 900, of oval form 2 ft. 0 ins. by 3 ft. 0 ins.

The intercepting sewer on Townsend street will be oval 2 ft. 0 ins. by 3 ft. 0 ins, a tumbling bay will be constructed at the intersection with Aylmer street of sufficient size to discharge only the sewage into Aylmer street, the rest of the water being discharged into the mill stream or creek at its crossing of Townsend. The ordinary flow at the Edison works will be limited to the capacity of a 9 inch pipe, running full, laid on a grade of 1 in 300, all above that quantity is treated as storm water, and will be discharged by the Townsend street overflow.

The main outfall sewer commences at Townsend street on Aylmer which it follows to Lake street; at the intersection of George street, it will receive the sewage only, of that district and then follow down Lock street to the river where the discharge will be pure sewage. It will be oval in shape, 2 ft. 2 ins. by 3 ft. 3 ins. I have carefully kept in view the question of pollution to the river and the possibility arising at some date of purification being required. When occasion arises to consider this, the sewage only, practically unmixed with rain water will have to be treated.

GRADES AND DISCHARGE OF SEWAGE.

The grades are all favorable to the rapid discharge of water; sewage should be discharged into the river within 2 hours of entering the sewers.

It must be borne in mind that these sewers will not be self-flushing until the quantity flowing through them can give a velocity of about 2½ feet per second, or 150 feet in the minute and even then it will be necessary to flush the higher ends of every street, as there will be frequent dry periods when the sewage alone will be insufficient to keep them clean. Water for flushing purposes can be obtained from the creek and Water Works Co'y. quite readily.

TEMPORARY PUMPING AT THE OUTFALL.

A difficulty will be encountered after these works are constructed at the outfall. In every year, for a period of 21 to 28 days during the months April to June, the river below the Locks rises from 7 to 8 feet the cause of which is well known to all the inhabitants.

This rise of water will close or "lock" the outfall sewer and render it necessary to pump the sewage during that period. This will require the construction of a penstock near the river and the erection of a small pumping plant, which could be worked by a windmill, or by a small engine temporarily employed, until the volume of sewage has reached such proportions as to necessitate larger pumping plant being introduced.

RIVER POLLUTION.

The question of pollution of the river need hardly be considered; an estimated population of 30,000 using 75 gallons per head per diem, is equal to a discharge of 1,560 gallons per minute. The discharge of the river at its lowest summer level has been ascertained by your Engineer Mr. Belcher, to be 45,000 cubic feet or 281,250 gallons per minute, or 180 times greater than the sewage received. This will be enormously increased as the river rises and its volume is increased. There are no towns or villages on the river below Peterborough, which can be affected by the discharge of the towns sewage into the river. There is a rapid flowing river having a large discharge, which will rapidly dilute the sewage, and afford it ready means for self purification by oxidation. There is a long stretch of river (over 20 miles) before the lake is reached, it can safely be affirmed that until the population reaches 30,000, no harm can be done to the river by the sewage. The discharge of the present population, if the whole town were connected to the system, would cause so slight a pollution to the water of the river it could not be called creating a nuisance.

FILTRATION OF SEWAGE.

Should it ever be required to consider some means of purification, your town is most fortunately situated for purification by filtration. Immediately to the south of the town there is a large tract of beautiful level gravelly land on which sewage can be easily purified by broad irrigation, and downward filtration. I know of no town in the Province which is so fortunately situated in this respect as Peterborough.

RIGHT OF WAY OR EASEMENT.

It may be well to mention that the best route for the intercepting sewer of the northern portion of the town, is to follow the fence of the railway from the crossing at River street to the crossing on Aylmer. This will place the greater part of the sewer on private lands, over which a right of way, or easement, will have to be acquired, which ought not to be a costly matter. It is very important that the easement be acquired before the construction of the sewer is commenced.

BETHUNE STREET SEWER.

The presence of the railway tracks on Bethune street will cause some trouble when house connections have to be made. Your attention is directed to this, as possibly it may be necessary to lay a sewer on each side of the railway.

I believe this street can be accommodated by sewers laid at the backs of the lots, in the manner to be described.

SEWERS IN REAR OF LOTS.

I desire now to bring under your notice a very important subject, to which I have given a great deal of thought and attention in connection with sewerage works. It is a general practice, to lay all sewers in the centre of the street and connect house drains to them ; this leads to the almost universal practice of carrying the house drain (or drains) under the house.

The practice has hitherto been to make these drains of glazed earthenware pipe, and it has been found very difficult to make perfectly air-tight joints in them ; as sanitary science has advanced the use of glazed pipe has been abandoned, and heavy cast-iron pipe introduced, and it is now the general custom to use this material inside the walls of all dwellings.

Plumbing by-laws, everywhere in use, call for a trap to be placed on the house connection between the sewer and the house, with a fresh air inlet placed upon it, a further regulation demanding that the soil pipe be carried up above the roof of the building. One result of this is the appearance of rows of unsightly iron pipes in front of all buildings, from which a certain quantity of foul air from the house drain is emitted. It is not possible to determine how far this air may be the cause of zymotic disease. Another result of having the sewer in the centre of the street is the constant destruction of the street

surface and interruption to traffic caused by forming house connections. In the plans and "suggestions" of Sir Robert Rawlinson made in his report to the British Government he obviates this trouble by placing sewers at the backs of the houses, and connecting them at one point, so that each block has only one or perhaps two street connections. I am quite familiar with this arrangement in my native city Edinburgh, Scotland, where it is extensively used, and I have used my best endeavors to introduce it into my practice during the past four years. I have recommended it at Calgary and Brandon in the Northwest, and St. John's, Newfoundland.

A little consideration will readily impress on one's mind the advantages of this plan, a few of which may be noted. The drains being outside the house, there can be no danger from defective joints and poisoning by sewer air; the drain can be put in better and more cheaply if outside, as glazed pipe can be employed instead of costly iron; the drains will be at the back of the house, and will afford better opportunities for overhead ventilation; there will not be the constant interruptions to the street and destruction of the street surface. This method can be easily adopted where there are lanes in the rear of each block: it may be urged that in the case of Peterborough this will not be practicable as there are no lanes.

This objection can hardly be accepted as insurmountable as a city ordinance can be passed or the proper legal power easily acquired to enter upon private lands for the purpose of laying sewers and connecting house drains thereto. In the city of Washington this question is being dealt with, and powers sought to "condemn" land for this purpose. The introduction of this system will be of such great advantage especially in George street, that I have prepared a special small plan showing how one or two blocks can be treated, which I recommend to the most favorable consideration of your worshipful council. It will also have a practical effect on the pocket of the ratepayer, who can have short connections at the rear of his property at a moderate cost, instead of long expensive iron drains under his house, and corporation charges for connections to the sewers in the streets; and he will also benefit by not being called upon to pay yearly taxes for the repairs to street surfaces which will be caused by the constant addition of house connections to the sewer in the street.

MANHOLES.

The sewers will be laid in right lines from manhole to manhole, for the purpose of inspection, junctions of one sewer with another will be made within the manhole according to the Rawlinson principle; detailed drawings are furnished shewing these junctions.

TUMBLING BAYS.

Several of the sewers will join the intercepting and outfall sewers at higher levels than the invert; this is all set forth on the general drawings, and special drawings are submitted for such cases in which it has been considered necessary.

LAMP HOLES.

In some of the streets in the northern portion where the grades are unusually steep, the sewer has been stepped, to break the rush of the water. At these points lamp holes may be used in place of manholes, though I give my preference to the latter.

FLUSH TANKS.

There are several makers of flushing tanks who have put on the market useful mechanical devices for this purpose. It is not necessary to name any special maker. Your Engineer is fully informed on these points.

HOUSE CONNECTIONS.

It is of the greatest importance that the house drain should leave the house immediately, the *desideratum* is to have the soil pipe in one straight vertical line, and carry it out at the foot beyond the house wall. This leaves no drain under the cellar floor or unexcavated portions of the house, to emit deadly gases into the house and steadily poison the inmates. I wish to urge on your attention the great importance and value to health of this arrangement. A small sketch is given shewing the arrangement I adopt.

CELLAR DRAINAGE.

The drainage of cellars by means of open jointed tile pipes laid under the floor, commonly called "weeping tiles," requires the most careful arrangement possible. They should on no account be connected to the house drain direct; to connect them to a trap and then to the house drain is one of the commonest and most fatal errors in house drainage, the trap is never attended to, it runs dry, and a direct communication with the foul air of the soil pipe is established. It is always desirable to lay the "weeping drain" along the outer side of the house wall, where it can work quite as effectively as on the inside; by so doing, if at any time sewer air should enter the drain, it is kept on the outside of the house.

The most approved method and the safest, is to connect these drains to the rain water pipe system, on the house side of the trap, which must be placed between the rain water leaders and the house drain or sewer. The arrangement will be easily understood by referring to the sketch showing house drainage.

ESTIMATE.

An estimate of cost is submitted in which the several drainage areas are treated separately. I have made it out in a minutely detailed form, unnecessarily so, perhaps, for a report of this nature; by the figures now presented to you, the residents of each street can know what the cost of the sewer on their street will be.

The estimate provides for the following lengths of sewers, complete with manholes, flush tanks, etc.

TO WIT.

4,400	lineal feet	brick sewer 2 ft. 2 ins. by 3 ft. 3 ins.
2,200	"	" 2 ft. 0 in. by 3 ft. 0 ins.
1,770	"	" 1 ft. 6 in. by 2 ft. 3 ins.
1,440	"	18 inch pipe sewer.
4,000	"	15 " "
11,500	"	12 " "
84,990	"	9 " "
1,650	"	2 ft. and 3 ft. brick sewer, roof water overflow on Townsend street.
360	"	15 inch pipe, roof water overflow on George street at King street.

The total amount of the estimate is $167,000

All of which is respectfully submitted.

I have the honor to be, gentlemen,

Your obedient servant,

ALAN MACDOUGALL,

M. Can. Soc. C.E. M. Inst. C.E.

TORONTO, *February 15, 1892.*

TOWN OF PETERBOROUGH.

Detailed estimate of cost of proposed System of Sewerage.

THE OUTFALL SEWER.

Brick Sewer, 2 ft. 2 in. by 3 ft. 3 in. lineal ft	4,400	$4 50	$19,800 00	
Manholes, number	15	60 00	900 00	
Penstock and Manhole	1	250 00	250 00	
Steel Pipe, 33 in. diameter laid to river			600 00	
				$21,550 00

AYLMER STREET TRUNK SEWER.

Brick Sewer, 2 ft. 0 in. by 3 ft. 0 in. lineal ft	2,200	$3 50	$7,700 00	
Brick Sewer, 1 ft. 6 in. by 2 ft. 3 in. lineal ft	1,770	3 00	5,310 00	
Sewer, 18 in. pipe, lineal ft	1,400	1 40	1,960 00	
" 15 " "	1,330	1 25	1,662 50	
" 12 " "	900	1 00	900 00	
Manholes, number	30	60 00	1,800 00	
				$19,332 50

NORTHERN INTERCEPTING SEWER.

Pump house to Aylmer at Dublin, 12 in. pipe, lineal ft	4,900	$1 00	$4,900 00	
Extra deep, lineal ft	1,000	1 60	1,600 00	
Manholes and flush tank, number	16	60 00	960 00	
" extra deep, "	4	80 00	320 00	
				$7,780 00

MCDONNELL STREET INTERCEPTING SEWER.

9 in. pipe, lineal ft	770	$0 60	$462 00	
12 " "	1,430	1 00	1,430 00	
Manholes, number	8	60 00	480 00	
				$2,372 00

TOWNSEND STREET INTERCEPTING SEWER.

Brick Sewer, 2 ft. 0 in. by 3 ft. 0 in. lineal ft	1,650	$3 50	$5,775 00	
Manholes	4	70 00	280 00	
Tumbling bay	1	150 00	150 00	
				$6,205 00
Carried forward				$57,239 50

Brought forward				$57,239 50

INTERCEPTING SEWER, AREA BETWEEN PARK AND MONOGHAN.

Nine inch pipe, lineal ft	2,550	$0 70	$1,785 00	
Twelve " "	1,770	1 00	1,770 00	
Manholes, number	14	50 00	700 00	
Flush tanks	1	130 00	130 00	
				$4,385 00

GEORGE.

9 in. pipe, lineal ft	3,550	$0 70	$2,485 00	
12 " "	1,400	1 00	1,400 00	
15 " "	2,860	1 25	3,575 00	
Manholes, number	20	50 00	1,000 00	
Flush tank	1	130 00	130 00	
Roof water overflow, 15 in. pipe, lineal ft	360	1 25	450 00	
				$9,040 00

WATER.

9 in. pipe, lineal ft.	4,500	$0 70	$3,150 00	
Side streets, 9 in. pipe, lineal ft	4,000	0 60	2,400 00	
Manholes, Water Street, 12 ; side streets, 15 ; number	27	50 00	1,350 00	
Flush tanks, Water Street, 1 ; side streets, 6 ; number	7	130 00	910 00	
				$7,810 00

BETHUNE.

North of McDonnell.

9 in. pipe, lineal ft	1,800	$0 70	$1,260 00	
Manholes and lampholes, number.	7	50 00	350 00	
Flush tank, number	1	130 00	130 00	
				$1,740 00

South of McDonnell.

9 in. pipe, lineal ft	3,630	$0 70	$2,541 00	
Manholes, number	9	50 00	450 00	
Flush tank	1	130 00	130 00	
				$3,121 00

STEWART.

North of McDonnell.

9 in. lineal ft	1,750	$0 70	$1,225 00	
Manholes and lampholes, number.	8	50 00	400 00	
Flush tank	1	130 00	130 00	
				$1,755 00
Carried forward				$85,090 50

Brought forward				$85,090 50
South of McDonnell.				
9 in. lineal ft.	4,060	$0 70	$2,842 00	
Manholes, number	8	50 00	400 00	
Flush tank	1	130 00	130 00	
				$3,372 00
RUBIDGE.				
North of McDonnell.				
9 in., lineal ft.	1,750	$0 70	$1,225 00	
Manholes and lampholes, number.	8	50 00	400 00	
Flush tank	1	130 00	130 00	
				$1,755 00
South of McDonnell.				
9 in., lineal ft	3,630	$0 70	$2,541 00	
Manholes	7	50 00	350 00	
Flush tank	1	130 00	130 00	
				$3,021 00
REID.				
North of McDonnell.				
9 in., lineal ft	1,550	$0 70	1,085 00	
Manholes and lampholes, number.	6	50 00	300 00	
Flush tank	1	130 00	130 00	
				$1,515 00
South of McDonnell.				
9 in., lineal ft.	2,900	$0 70	$2,030 00	
Manholes	10	50 00	500 00	
Flush tank	1	130 00	130 00	
				$2,660 00
DOWNIE.				
North of McDonnell.				
9 in., lineal ft.	1,500	$0 70	$1,050 00	
Manholes, number	4	50 00	200 00	
Flush tank, "	1	130 00	130 00	
				$1,380 00
South of McDonnell.				
9 in., lineal ft.	1,900	$0 70	$1,330 00	
Manholes, number	7	50 00	350 00	
Flush tank, "	1	130 00	130 00	
				$1,810 00
Carried forward				$100,603 50

Brought forward				$100,603 50
DONEGAL.				
North of McDonnell.				
9 in., lineal ft.....	1,400	$0 70	$980 00	
Manholes, number.....	3	50 00	150 00	
Flush tank, "	1	130 00	130 00	
				$1,260 00
South of McDonnell.				
9 in. lineal ft.....	1,050	$0 70	$735 00	
Manholes.....	3	50 00	150 00	
Flush tank.....	1	1 30	130 00	
				$1,015 00
GILCHRIST.				
North of McDonnell.				
9 in., lineal ft.....	850	$0 70	$595 00	
Manholes, number.....	2	50 00	100 00	
Flush tank, "	1	130 00	130 00	
				$825 00
PARK.				
North of McDonnell.				
9 in., lineal ft.....	1,150	$0 70	$805 00	
Manholes, number.....	5	50 00	250 00	
Flush tank, "	1	130 00	130 00	
				$1,185 00
South of McDonnell.				
9 in., lineal ft.....	3,500	$0 70	$2,450. 00	
12 in., "	1,050	1 00	1,050 00	
15 in., "	252	1 25	315 00	
Manholes, number.....	14	50 00	700 00	
Flush tank, "	1	130 00	130 00	
				$4,645 00
Cross streets lying between George and Aylmer, extending from Dublin to Dalhousie.				
9 in. pipe, lineal ft.....	8,800	$0 70	$6,160 00	
Manholes, number	22	50 00	1,100 00	
				$7,260 00
Carried forward.....				$116,793 50

Brought forward				$116,793 50
Cross streets lying between Park and Monaghan, extending from Elm Street to Edison Works.				
9 in. pipe, lineal ft.....	16,800	$0 70	$11,760 00	
Manholes, number.....	50	50 00	2,500 00	
Flush tanks, "	16	130 00	2,080 00	
				$16,340 00
The rest of the town south of Townsend Street.				
9 in. pipe, lineal ft.....	10,200	$0 70	$7,140 00	
Manholes, number.....	32	50 00	1,600 00	
Flush tanks "	10	130 00	1,300 00	
				$10,040 00
RIVER ROAD (Water St. north of Smith).				
9 in. pipe, lineal ft.....	2,400	$0 70	$1,680 00	
Manholes, number.....	6	50 00	300 00	
Flush tanks "	2	130 00	260 00	
				$2,240 00
GEORGE (North of Smith).				
9 in. pipe, lineal ft.....	2,200	$0 70	$1,540 00	
Manholes, number.....	5	50 00	250 00	
Flush tanks "	2	130 00	260 00	
				$2,050 00
SHERIDAN AVE., DICKSON, QUEEN, BROCK, HUNTER, SIMCOE.				
9 in. pipe, lineal ft.....	3,000	$0 70	$2,100 00	
Manholes, number.....	4	50 00	200 00	
Flush tanks "	4	130 00	520 00	
				$2,820 00
MURRAY ST. INTERCEPTING SEWER.				
9 in. pipe, lineal ft.....	1,100	$0 70	$770 00	
9 in. pipe, lineal ft.....	1,000	1 00	1,000 00	
				$1,770 00
				$152,053 50
Engineering and inspection.....				$7,602 50
				$159,656 00
Contingencies.....				$7,344 00
Total amount of estimate.....				$167,000 00

ALAN MACDOUGALL,

M. Can. Soc. C.E. M. Inst., C.E.

TORONTO, *February 15, 1892.*