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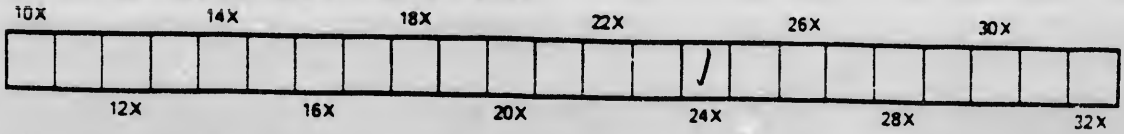

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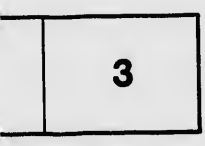

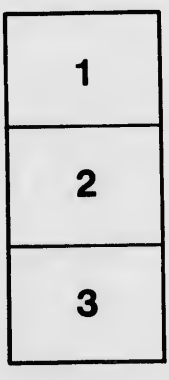

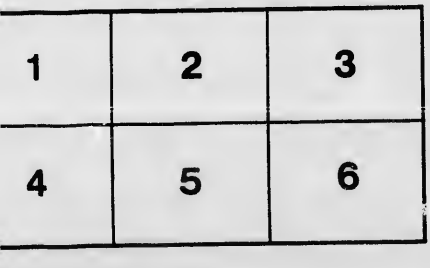

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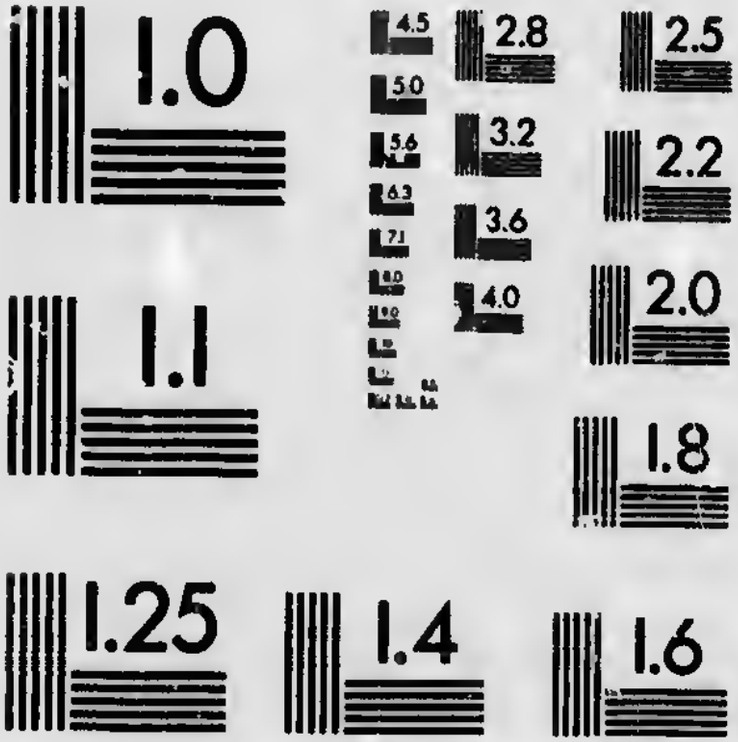

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13

REPORTS

—ON THE—

SANITARY CONDITION

—OF THE—

CITY OF WINNIPEG

MANITOBA,

WITH REFERENCE TO WATER SUPPLY, SEWERS, SEWER VENTILATION, SEWER GAS AND SANITARY CONDITION OF BUILDINGS, MORTUARY STATISTICS, ETC.

MADE IN ACCORDANCE WITH INSTRUCTIONS FROM THE MARKET, LICENSE AND HEALTH COMMITTEE OF THE CITY COUNCIL

—BY—

H. N. RUTTAN, CITY ENGINEER.

PRINTED BY ORDER OF THE CITY COUNCIL.

WINNIPEG:
THE STOVEL CO., PRINTERS.
1893.

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189

OFFICE OF THE CITY ENGINEER,

WINNIPEG, MAN. 9th Nov., 1893.

His Worship the Mayor and Council of Winnipeg :—

GENTLEMEN—

Having been instructed to do so by the Market License and Health Committee, I beg to submit the following Report upon the present condition of the water supply and sewers of the city.

WATER SUPPLY.

The present sources of supply are the Assiniboine River and the Public Wells.

The river has a drainage area of about 58,000 square miles.

The lowest recorded flow is 600 cube feet per second, the present flow is probably 1000 cube feet per second.

The quantity required to furnish a first-class fire service and all domestic requirements would be, at time of greatest draught, about (7) seven cube feet per second. The present draught is probably between 1 and 1½ cube feet per second.

The water at this time of year and during the winter months will be, as regards its purity, at its best.

The following analysis is by Dr. T. M. Drown, of the Mass. Test of Technology—Oct. 1892.

Appearance—Distinct clayey.
Sediment—Earthly and woody.
Color—·08.
Odor—Cold, faintly vegetable.
" Hot—Distinctly vegetable and woody.

Parts per 100,000—

Residue on evaporation	58·60
Loss of ignation	9·90
Fixed	48·70
Albuminoid Ammonia	·0206
Free Ammonia	none
Oxygen consumed	·4675
Chlorine	2.45
Hardness	40
Metallic iron	.12

The Mass. State Board of Health has made a very full examination of streams with a view to determine the amount of sewerage contamination caused by population on watersheds. From my report of 26th Sept., 1892:

"As .01 per 100,000 of chlorine above the normal is "merely an indication of slight contamination, and as the "population on the watershed of the Assiniboine does not "exceed one-twentieth of the minimum above given by the "State Board of Health, it may be stated with certainty "that the Assiniboine supply is not contaminated by "sewage."

The most objectionable feature of the Assiniboine water is the large quantity of clay which it carries in suspension in the spring.

In comparing the Assiniboine with the artesian well waters, the latter is better in every respect but that of hardness.

Either water may be much improved by a suitable softening and filtering process.

Before artesian wells can be considered as a source of supply, it will be necessary to determine by pumping tests the quantity of water which can be obtained. Upon its being determined beyond doubt that sufficient water can be obtained from wells, I think wells should be adopted; in the meantime the Assiniboine is the only available source of supply.

In my report of Sept., 1892, I say:

"Both the Assiniboine River and artesian wells should "be looked upon as temporary sources of supply. The "filtering and softening processes are cumbersome, and, "for large quantities of water, expensive. If the City of "Winnipeg grows, as it gives promise of doing, in the "future, it will no doubt be able to afford to bring water "from the Winnipeg River, about 65 miles distant, where "the supply is unlimited and the quality of the water the "best that can be obtained."

More full information on this subject will be found in my report of 26th Sept., 1892, referred to above.

A large number of the citizens use the water from the public wells, of which there are 47 in use. These wells are constructed of 4 and 5 inch wrought iron casing, with screw joints. The casing is driven into the water-bearing gravel or to the rock.

The quality of the water is that of the artesian wells' supply referred to above and in report of 1892. In its normal condition its chief objection is its excessive hardness.

It is quite possible that in the course of time, by destruction of the casing or soakage from surface water down the outside of it, the well water may be contaminated.

The only way to insure a healthy supply would be by periodical analysis of the water, and the immediate closing of any well showing contamination.

A table of the analysis of several waters is attached, so that comparisons may be made.

THE SEWER SYSTEM—VENTILATION AND FLUSHING.

The sewer system of the city consists at present of about 35 miles of brick and pipe sewers.

With the exception of a few miles laid previous to 1882, the sewers are designed and built in accordance with the best modern practice.

Though there are now several outlets into the rivers, the system is so constructed that an intercepting sewer may at any time be built to deliver all the sewage into the Red River north of the City leaving the present outlets to act as storm water overflows only.

The sewers are constructed on what is known as the combined system—that is, they carry off the street drainage as well as the house sewerage.

The sewers are ventilated through manholes into the open air, generally in the centre of the street.

These manholes are very often objectionable, particularly on some of the large brick sewers, which have very little sewage running through them in dry weather. This is unavoidable in the present stage of development of the City; as house connections are made and large quantities of water taken into the sewer they will gradually improve.

The system of ventilation by manholes is the best known at the present day.

The following remarks are from Baldwin Lathams' Sanitary Engineering :

"The objections raised against the use of simple open-"ings into the sewers, that deleterious gases escape from "them, and are left to take their own course comparative-"ly uncontrolled. In combating this objection it should "be borne in mind that gases escaping in the centres of "roads become considerably diluted before they can arrive "at the footpath or houses. The amount of dilution sup-"posing the gas to be uniformly distributed through the "atmosphere, would be proportional to the cube of the dis-"tance from the point of discharge, and dilution means in "this matter something more than the dilution of effect. "These open ventilating shafts act at certain periods both "as upcast and downcast shaft, and the fact should not be "lost sight of that they can be made as efficient when "viewed in the light of ventilating shafts as the lofty "shafts, which have been referred to, and at considerably "less expense. The efficiency of a shaft is proportionate "to the square root of its height, consequently, short shafts "of larger area may be made quite as effective as smaller "shafts of greater altitude.

"* * * * * Moreover less pressure will "be exercised throughout a system of sewerage where ven-"tilation takes place through low instead of high shafts.

"One of the most important things to be considered in "connection with the ventilation of sewers is the disposal "of the sewer gas in an innoxious manner. It should be

"observed in reference to this matter that the mere evi-
"dence of smell or its absence is no indication or otherwise
"of danger.

"Smelling gases may be harmless, while those matters
"which are most pernicious are usually devoid of odor.

"It has already been pointed out that the great safe
"guard against the evil effect of sewer gas is dilution, only
"allow the gas to combine with sufficient pure air and it is
"harmless even if carrying the germs of disease. Evidence
"on this point is very conclusively shown by refer-
"ence to our fever hospitals, which in bygone days
"when overcrowded and ill-ventilated, the death rate
"among patients and attendants was awful to contemplate,
"but since these institutions have been provided with per-
"fect ventilation, disease seldom spreads, in fact, if an at-
"tendant contracts disease it is looked upon as sure evi-
"dence that the ventilation is defective, or in other words
"that the dilution of the fever poison is insufficient.

Dr. John S. Billings, U. S. A., speaking of sewer gases, says:

"These gases and odors do not produce specific diseases,
"but when they are distinctly present in a house, the in-
"mates are liable to be affected with various forms of dis-
"turbed digestion, loss of appetite, slight headache, and a
"depressed state of vitality. * * * * Upon the whole,
"the dangers from gases only in connection with house
"drainage are small, and comparatively easy to avoid, the
"main thing for this purpose being a complete and constant
"ventilation of the pipes.

"In part the dangers are due to extremely minute par-
"ticles of living matter, most, if not all of which, are veg-
"etable organisms known as bacteria. There are many
"different kinds of bacteria, and they have very different
"properties and powers, but those which concern us in this
"connection are those which grow and multiply in decom-
"posing organic matters, and especially in excreta. Al-
"most without exception these bacteria belong to species
"which are found in the air of streets, in all intestinal dis-
"charges, and in all putrifying matters; they are not only
"harmless, under all ordinary circumstances, but are high-
"ly useful in decomposing dead organic matter into simple

"compounds available for the nutrition of plants. They "are found in countless numbers in the slimy pulpy layer "of decomposing matter lining the interior of soil pipes, "which matter they are constantly decomposing into gases "and soluble products readily washed away. They are "also present in large quantities in sewage as it flows in "the sewers.

"There are a few forms of bacteria which we have good "reason to believe are the causes of certain diseases called "specific. Each of these specific diseases has a definite "course, and is due to the entrance into the body of par- "ticles of living matter derived, directly or indirectly, from "the body of a person affected with the same disease.

"We now know the particular kinds of bacteria which "cause several of these diseases, and can identify them "with considerable certainty. Those of most interest in "connection with house drainage, are those which are sup- "posed to cause suppuration, septicœmia, perperal fever, "erysipelas, intestinal irritation and diarrhœa, typhoid "fever, and sore throat and diptheria.

"These diseases are less frequent and less fatal in the "sewered than in the unsewered cities, and in the central "sewered portion of a city than in the unsewered suburbs. "Systematic house-to-house inspections in cities have shown "that over one-half of the houses have more or less defec- "tive and foul fixtures, and leaky soil pipe joints, so that "if specific germs are often present there should be much "more sickness than there is. As a matter of fact there is "no evidence that scarlet fever, measels, small pox or "whooping cough has ever been transmitted by sewer air.

"There is no reason to think that in a few and excep- "tional cases, diptheria and typhoid have been caused by "inhaling sewer or soil pipe air, but the danger of incur- "ring these diseases in this way is small as compared with "the other and usual sources of origin, although it is pro- "bable that the ordinary non-specific sore throats which "sewer air tends to produce, form a specially favourable "site for the development of the specific microbe of diptheria "and that in this way foul air is a predisposing cause of "this disease. Schools are much more dangerous than "sewers as regards the propagation of diptheria. * * *

"It will be seen, therefore, that while attempts to scare "people by depicting the horrors of sewer gas, etc., in or- "der to prevent the construction of sewers, to promote the "sale of certain fixtures, or to improve the house inspection "business, are not justifiable, it is certainly true that, upon "ordinary insurance principles, it is wise to prevent as far "as possible, the entrance of sewer and soil pipe air into "houses, offices and public buildings, and that a munici- "pality is justified in taking measures to secure such pre- "vention for those who are too ignorant, too indifferent or "too helpless to do it for themselves."

The above extracts are from an article by Dr. Billings, in the Popular Science Monthly, republished in the Engineering Record, on "House drainage from various points of view."

The following is from the "Engineering Record," of 5th March, 1892 :

"For the last four or five years the popular literature "on the subject of sewer gas has been moderate in quan- "tity and tolerably sensible as to quality ; and it is only "occasionally that some ingenious inventor has announced "his discovery of the terrible evils connected with it, and "of some new method of ventilation or disinfection which "is to do away with a large part of the sufferings of muni- "cipal residents. * * * It is not true that the un- "healthiness of cities is due mainly or to any appreciable "extent to sewer air, even a poor system of sewers lowers "the death rate, and in a well constructive system of "sewers the danger to health and life produced by travers- "ing them and inhaling the air which they contain, is so "small as to be entirely inappreciable.

"If it were asserted that the chief cause of unhealthi- "ness in cities is the public schools it would be as near the "truth as to say it is sewer gas. * * * * *

"The writers of the article above referred to assert, "with regard to their scheme for purifying the air from "sewer gas by means of wind currents, that if successful "the health of towns would be greatly improved, and dip- "theria, typhoid fever, and other kindred diseases would "almost disappear, and the London fogs would cease to be "deadly.

"On the contrary we are of the opinion that it would "have no appreciable effect on the mortality from diptheria "or typhoid, nor upon the effect of the London fog, and "that all such statements as the above quoted is simply "'darkening of council by-words without knowledge.'"

The following question and answers in reference to typhoid fever from the same authority will be of interest :

"One of my children is seriously ill with typhoid fever. "Is there not some simple way by which I can ascertain if "there is any dangerous gas in the house from defective "plumbing? Water-closets, etc., empty into a cesspool; "no sewer.

"As he is not alone in his affliction, especially in towns "relying upon cesspools for disposal of filth, we would "state that typhoid fever is caused by a very small rod-"shaped vegetable organism known as a bacillus, which "can grow and multiply either in the human body or out-"side of it when supplied with nutritient material, moisture "and suitable temperature.

"In every case of typhoid fever this organism has found "its way into the intestinal canal usually with articles of "food or drink. In rare cases it may be conveyed by the "air, but even then the danger is not so much from its "inhalation into the lungs as from its falling upon particles "of food or into fluid such as water or milk which are "swallowed. * * * *

"This organism is not generated or produced by de-"posits of filth any more than an oak tree or a cabbage is. "Every case of typhoid fever is due to a bacillus coming "directly or indirectly from some previous case of typhoid "fever, and the importance of collections of excreta, such "as collect in cesspools, in relation to typhoid fever is, first, "that *they are especially liable to receive the bacillus, and* "*second, that they are especially favorable for preserving it* "*alive and favoring its growth and multiplication.*

"Bearing these points in mind, and that they are not "mere speculations or theories, but facts which have been "established by repeated experiments and observations,

"the answer to the question of our correspondent is ob-
"vious.

"The presence of the typhoid fever bacillus in the air
"of the house could only be detected by what is called the
"culture method, requiring special apparatus and a skilled
"observer. There is no simple test for the presence of
"dangerous gas as distinguished from other gases given off
"from a cesspool, but it is not difficult to determine whether
"air from a cesspool is passing into the house through im-
"proper plumbing, since this can be effected by pouring
"two or three ounces of oil of peppermint into the soil pipe
"from the opening above the roof, with the usual precau-
"tions in the use of this test. The smell will soon pervade
"the house if the plumbing is defective."

I have selected the above extracts from authorities who are everywhere recognized. Volumes might be filled with extracts from scientific investigators confirming these opinions.

With reference to flushing, wherever connection can be obtained with the City waterworks, flush tanks are constructed at the end of all branches, and the sewers are, in dry weather, flushed daily. On the sewers where flowing wells can be obtained, several of the branches are connected with wells and automatic flush tanks, and are flushed several times daily. All other sewers are flushed systematically by the use of water-cart and dams in the sewers. As far as I have been able to obtain information, we spend more money per mile and our flushing is better than that of any other city using the combined system of sewerage.

The sewerage system can be improved in the following ways:—

First, by increasing the number of house connections.

Second, by extending the waterworks so that flush tanks can be used on all branches. This would save a large expenditure in labor and be more effective than the system now in use where there are no waterworks.

A study of the vital statistics will show that with the construction of sewers the general death rate has decreased. Old residents will remember that before any sewers were constructed the city suffered every fall from almost an epidemic of Red River (typhoid) fever.

I have heard of at least two towns in Manitoba (unsewered) where from 25 to 40 per cent. of the population are said to have suffered from typhoid fever this fall.

It has been determined in many places, by observations and experiments, that the ground water is a most frequent cause of spreading diseases. In former reports I have pointed out how filth and disease germs had been, and no doubt they still are, carried for long distances by surface water flowing through strata of sand on top of the impervious clays which underlie this district, and that any cellar without water-tight walls and floor is almost sure to be contaminated. The sewers do good work intercepting and carrying off the ground water, but I have no doubt that many places still exist where there is direct communication between cess pits and cellars by means of water-bearing strata of sand.

Probably one of the most prolific sources of disease is an unclean dairy. All dairies should be subject to strict inspection, and furnished with periodical certificates of health, the names of those who have received such certificates should be published.

With reference to the prevention of the spread of disease, all sanitarians agree that a rational system of isolation and disinfection is the only remedy. This is acted upon in the case of small-pox, and until it is enforced in cases of other contagious diseases the community will be liable to serious out-breaks. In order to see the force of this it is only necessary to imagine what the effect would have been if the cases of small-pox which were brought into the city last spring, had been allowed to distribute themselves throughout the city, and the authorities had confined themselves to fruitless discussion of matters which had no direct bearing upon the case.

The great difficulty in the way of isolation is the popular objection to official control and what it carries with it, viz.: The removal of a patient to a hospital, the quarantine and disinfection of the house where the case originated.

Those who have experienced the benefit of trained hospital nursing will always be glad to take advantage of it again, and if private wards with lodging for the mother or one of the friends of the patient were provided, the chief

objection to isolation would be overcome. It would be a simple, and not very expensive, matter to construct wards in connection with the General hospital, where everything necessary for the comfort of children and their attendants would be provided, and parents would feel that in sending a child there they were doing the best, not only for the patient but for those who remained at home.

Your obedient servant,

H. N. RUTTAN,
City Engineer.

His Worship the Mayor and the Council of Winnipeg:

GENTLEMEN,—In continuation of my report of the 9th inst., on sewers, I beg to enclose a short memorandum in reference to the design of the sewerage system, and the means employed to flush it. I would suggest for the consideration of the Council the advisability of publishing the reports in pamphlet form, together with abstracts of the Plumbing By-law and a few general directions as to keeping houses in a sanitary condition.

Your obedient servant,

H. N. RUTTAN,
City Engineer.

THE SYSTEM.

Prior to 1882, the wooden sewer in Main street and a few pipe sewers in the more thickly built-up portion of the city had been built. The Main Street sewer having been built in 1876 and the others added as they were required, till 1882, when it became evident that the growth of the city was going to be so rapid that it was necessary to adopt some comprehensive system and place the sewer construction on a business-like and permanent basis.

Mr. Chesborough, city engineer, afterwards consulting engineer of Chicago, was brought here for the purpose of reporting on the best means of sewering the city. He reported in favor of a combined system, the principal feature of which was a trunk-sewer discharge into the Red river below Point Douglas avenue, and located on Main and Princess street and Portage avenue. This trunk sewer was to be supplied with sub-mains and branches in the ordinary way.

The cost of the trunk sewer, which was estimated at some $500,000, was considered too great for the means of the city at that time, and it would have absorbed practically, the whole of the appropriation available for sewer construction.

In order to meet the demands of the city for sewerage and still keep within the city's means, it was finally decided to modify Mr. Chesborough's plans by transferring the location of the trunk sewer to Assiniboine and Main streets, not building it in the meantime, and to provide in its stead storm-water outfalls from the sub-mains, which could be used as main sewers till the city was in a position to continue the trunk sewer, which may now be called an intercepting sewer, from Assiniboine street, along Main street, to the proposed outlet in the northern portion of the city.

The essential difference between Mr. Chesborough's first plan and the one finally adopted, was that Mr. Chesborough's trunk sewer had to be of sufficient capacity to take practically all storm water to its outlet. While in the system adopted the trunk sewer will only require to be large enough to take the dry-weather flow, leaving the storm flow to be carried into the river by the various storm outlets.

The trunk sewer, under the present plan, will require to be only about one-sixth the capacity at its outlet of that first proposed, thus effecting a very large saving in its cost.

It is difficult to say to whom the finally adopted plan of the system is due. The ground work of the present system is undoubtedly Mr. Chesborough's, The modifications were probably worked out in conjunction with him. All the present outlets have been provided with discharge

pipes under low-water level, and running some distance out into the river, so that all sewage is discharged into the river below low water line. The old outlets being used only for storm water.

The sewerage system is well designed and comprehensive, capable of indefinite extension without the necessity of alterations of any of the portions built except these mentioned above.

Every sewer that is now constructed, no matter what its location, is a portion of the permanent system, and designed and built for the work it will have to do as such.

The system upon which the sewers are built is one of the best known and most generally used the world over. While, before any system had been adopted or before the present one had been so much extended, much was to have been said in favor of separate systems, for disposal of street water and house sewage, it is now believed that the system adopted was upon the whole the best.

FLUSHING AND CLEANING.

In addition to the remarks on flushing in my last report, I find from the report of the City Engineer of Toronto, which I have just received, that last year the expenditure in 75 miles of sewer in flushing and cleaning (the 75 miles being those sewers only which were cleaned and flushed) was $4,117, or $54.90 per mile.

In Winnipeg, for the last fiscal year, in about 28 miles of sewers the cost of cleaning and flushing was $2,725, or $97.32 per mile. The number of automatic flush tanks in use in Toronto was 31, and in Winnipeg 65, connected with the waterworks or wells, and 25 filled by hose or tanks. In addition to the water from the Waterworks Co., we have five flush tanks connected with flowing wells at the heads of branches on Nena Street, which supply for flushing purposes, on these sewers abut 30 millions of gallons per annum, which is not included in the above statement of expenditure. Where neither waterworks nor flowing wells are available, the sewers are flushed by making a reservoir of a manhole by putting a stopper in the sewer and filling the sewer above the stopper with water by means of hose or water-carts. When a sufficient quantity of water has been

collected, the stopper is pulled out, and the sewer flushed. This is an expensive means of flushing, and is only resorted to where connections with waterworks cannot be obtained.

For the benefit of those who are not familiar with the sewer plans, it may be explained that each main outlet at the river drains its own district. The main sewer and branches may be compared to a tree, the main being the trunk, the branches becoming smaller as they approach the limit of the drainage area. It is at the extreme end of these branches, which are 12 inch pipes, that the flush tanks are located. When, therefore, the flush tanks are started, the branches, sub-mains and mains are in turn flushed.

Except on rare occasions, when clay is washed into the sewers, or when bones, bottles, dish-cloths, etc., find their way into drains, there is no such thing as accumulation ot solid matter in the sewers. The light sediment from ordinary sewage is readily stirred up and flushed into the river.

Many of our large sewers have grades of 1 in 1,000 to 1,500. This is very flat, and until the sewer runs, say quarter full, sediment lies on the botom and is stranded on the sides, until flushed out.

At present the sewers have only about quarter the number of house connections which they should have. When fully connected, it is certain that the annoyance from smelling manholes will be very much reduced, if not quite done away with.

The only way to make the sewers absolutely non-odorous would be to deodorize and disinfect the sewage before placing it in the sewer, a proceeding which, at present, is not anywhere attempted.

PLUMBING BY-LAW.

Extracts from By-law 467, a By-law of the City of Winnipeg to make provisions to secure the sanitary condition of buildings:

1. The house connection with the public sewer having first been laid in accordance with the By-law regulating the same, the connection between soil pipe and house connection shall be made outside the walls of the house. At the foot of the soil pipe, and inside the wall of the house, shall be placed the house trap. An inlet pipe for the admission of fresh air shall be connected with the soil pipe on the inside of the house trap. All soil pipes within the walls of any building shall be of iron or brass, and shall be continued at least three feet above any opening in the roof, and three feet above any opening into an adjoining building when such building is within ten feet of any such pipe, and left open so that the whole of the inside drainage may be thoroughly and constantly ventilated. Approved tile pipe may be used under ground when outside of house.

2. All drains and plumbing fixtures of every house or other buildings shall be provided with sufficient traps and vents to prevent gas from the sewer drain or waste pipes from escaping into any apartment, and each such fixture shall have its own trap with sufficient vent. No fixture shall drain through more than one trap (main trap excepted), the vent to be not less than one size smaller than trap and no vent of less than one and one-quarter inches in diameter. No trap vent pipe shall be less than three inches in diameter where it passes through the roof. Approved automatic vents may be substituted when necessary or advisable on special permit of City Engineer.

3. Each house or building must have its own separate soil pipe and drain, and such soil pipe or drain shall be so placed as to be always readily inspected without destruction to walls, and the plumber shall be responsible for the proper connection of his work with the system of drainage, which connection shall be made by a cast-iron bend and three feet of pipe extending horizontally from the vertical

soil pipe, and no two or more houses or buildings shall have drain in common until each separate drain shall have passed outside the walls of the house or building which it serves. All drains must be properly connected with the private drain, and not covered until inspected. In no case shall the drains between the walls of the house and the street line be laid until the private drain from the street line to the public sewer has first been laid and completed.

4. Vertified, salt-glazed, earthenware drain pipes shall be equal in quality to those used for the private drain connections; they shall be laid and jointed with Portland cement, or otherwise as shall be specified from time to time by the City Engineer for the private drain connection contract. The pipe used for surface or weeping-drains must be laid round the outside of the house walls where practicable, and trapped to connect with rain-water leader. They shall have a trap placed on them which shall be easily accessible for flushing. All earthenware drains laid on newly-made ground, or on very wet soil, to be laid on a prepared foundation of plank or concrete.

5. After the passing of this By-law no pan closets shall be fitted up or used in any building, and no closet or other convenience which allows the escape into the house of air or gas which has been confined to any part of it, or from the drain or soil pipe, or which allows the accumulation of filth in or about it, shall be fitted up or used.

6. All work contemplated in this By-law shall be done in a workmanlike manner, and shall be subject to the inspection, supervision and approval of the City Engineer, or any Inspector, appointed by the Council of the city of Winnipeg for that purpose, and all faulty or defective work which may at any time be discovered, shall be made satisfactory to the said City Engineer or Inspector, as the case may be, and when found satisfactory the certificate shall issue to the plumbers at the expiration of the twenty days from date of inspection, unless in the meantime such work shall have become faulty or defective.

7. No arrangements shall be made for supplying water closets except by self-closing cocks; and no arrangements shall be made for cleaning water closets or privy vaults by waste pipes from wash basins or sinks, or by any other means of evasion; but they shall be fitted up with the fixtures and appurtenances belonging to them respectively.

8. The City Engineer and any Inspector appointed for that purpose shall have the right, at proper hours of the day, and upon reasonable notice given and request made upon the owner, to enter upon and have free access to all parts of any building in the city of Winnipeg in which plumbing has been done under the provisions of this By-law.

A large number of the houses in the City, where plumbing was done before the adoption of plumbing regulations and inspection, are fitted with inferior and dangerous plumbing. If householders will compare the condition of their plumbing with the requirement of the By-Law, defects may be readily detected.

The plumbing in every house should be inspected by an expert at least once a year. Even plumbing put in with the greatest care is liable to be injured and made unsafe by settlement in the house walls and other causes which may disturb the pipes and open the joints.

CELLARS AND BASEMENTS.

The soil of Winnipeg consists of alternate layers of impervious clay and porous quick sand clay. In some portions of the City the porous strata conduct water from cess pits, closets, etc., for long distances. Cellars excavated in the porous strata are certain to be contaminated unless provided with water tight and germ proof walls and floors.

The conducting capacity of the porous strata is proved by the fact that excavations for water pipes, sewers, etc.,

on the street at considerable distances from cess-pools often fill with water so foul that it is with difficulty that the men work in the trenches.

No cellar that is unprovided with masonry or concrete walls and floors which are water and germ proof should be considered to be in a sanitary condition.

Ordinary masonry and concrete is neither damp proof nor germ proof.

DAMP AND GERM PROOF CELLAR FLOORS AND WALLS.

The cellar floor after having been properly underdrained should be covered with three inches of hydraulic cement concrete. When the concrete has set it should be covered with boiled coal tar and a layer of heavy tar paper, on top of the paper should be laid a finishing course of concrete at least two inches in thickness.

The cellar walls should be carefully painted on the outside with two heavy coats of boiled tar, and through the walls connecting with the damp proof course in cellar floor should be built a damp proof course of Asphalt or tar felt. The foundations should be properly underdrained as it is almost impossible to keep water out of cellar if it stands outside the wall above the level of the cellar floor. Danger from improperly constructed cellars may be minimised by thorough ventilation, but no cellar can be relied upon that is not constructed in accordance with the above description.

The outbreak of diseases occur at the time of year when the houses are first closed and the fires started for the winter. In all cases it will be found advantageous to start the fires say a week or ten days earlier than is necessary, and to keep windows and doors open sufficiently to thoroughly ventilate and dry out the cellar before it becomes necessary to close the windows and doors for the winter.

Basements in Winnipeg are, as a rule, made too deep, and consequently are difficult to light and ventilate. The cellar floor of residence should in no case be more than four feet below the surface of the ground outside.

MORTUARY STATISTICS.

Year.	Number of Deaths.	Population.	Rate per 1000.	Number Sewer Connections
1884.....	469	16,694	28	240
1885.....	310	19,574	16	282
1886.....	400	19,525	21	298
1887.....	522	21,257	24	348
1888.....	524	22,098	23	398
1889.....	385	21,328	19	470
1890.....	295	23,000	13	553
1891.....	265	24,068	11	639
1892.....	...	29,189	..	857
1893.....	...	32,119	..	1067

The deaths from 1884 to 1891 are taken from the Dominion Government returns supplied by Dr. Neilson.

The population is from the census taken annually by the assessors.

The returns for 1892-3 are not yet available, but will be published later.

Upon the whole, the results show a uniform reduction from 28 per 1000 in 1884, to 11 per 1000 in 1891, a result which is highly satisfactory.

There is no doubt the present rate can be further reduced by strict enforcement of sanitary regulations.

GENERAL REMARKS.

Cheap or half way measures are generally not effective and through failure tend to discredit all sanitary regulations. If the following precautions are attended to, the death rate from preventable diseases will largely decrease.

1. Have cellars made as far as possible water proof and germ proof.

2. Have all plumbing done under plumbing by-law and inspected annually.

3. Use no milk that comes from an unclean or unhealthy dairy.

4. If a case of infectious disease ~~leaks~~ breaks out at once isolate the patient.

5. If a number of pupils of any school have, at the same time, an infectious disease, close the school for the incubation period of the disease, thoroughly disinfect it, and readmit only pupils with clean bills of health.

EXAMPLES OF INSANITARY HOUSES AND DEFECTIVE PLUMBING FROM THE SEWER INSPECTOR'S REPORTS OF 1893.

1. "I have examined the cellars and closets at———— "and find in the cellar a drain which from what I could "see is badly constructed. There is a rainwater cistern "which has no overflow, and when full runs over the top. "* * * I found in the back kitchen a sink and pump. "The water from the sink is carried to a pit closet at the "back door, and emptied there. A more disgraceful piece "of work could hardly be imagined, A new floor of con- "crete cement should be laid in the cellar and the base- "ment built of stone to prevent the earth from caving in."

2. "There is nothing but wet clay all over, water from "outside soaks in under the footings of the walls and all "this causes a damp foul air to rise and circulate to all parts "of the house. I also find that an old drain which was "formerly used for the closets, sink, etc. has never been "removed, but remains as it always was, to act as a weep- "ing drain, and whatever sewer gas may generate in this "drain will rise to this point and escape through any defect "there may be in the pipes (of the old drain) and then pass "into the house and be drawn in by the furnace in the cel- "lar. The plumbing I find is very defective."

The above are examples of a number of reports which have been made on houses where illness has occurred and there can be no doubt that they point directly to the sources of disease.

INDEX.