REPORT OF ALBERT F. NOYES, CITY ENGINEER AND EDWARD A. BUSS, C. E., ON PLAN FOR SURFACE DRAINAGE FOR THE CITY OF NEWTON, MASS, DEC. 12, 1892

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REPORT OF THE CITY ENGINEER

AND EDWARD A. BUSS, C. E.,

ON PLAN FOR

SURFACE DRAINAGE FOR THE CITY OF NEWTON.

OFFICE OF THE CITY ENGINEER,
WEST NEWTON, Dec. 12, 1892.

To His Honor the Mayor and the City Council of the City of Newton:

GENTLEMEN.—In accordance with order (No. 11680) of the City Council, under date of June 24, 1889; "that the City Engineer be requested to make additional surveys, and submit as soon as possible, detail sewer plans for surface and house drainage," this report with the plans and profiles accompanying it is herewith respectfully submitted. It is intended to cover in outline the various questions arising in connection with the surface drainage for the City of Newton.

Immediately upon the passage of the order, work was begun. Topographical maps of the city showing the elevation and change in level of most of the streets, streams, brooks, etc., were made, and a study of a system of sewerage and drainage was begun.

The execution of the large amount of extra work ordered by the City Council of the City Engineer's Department, demanded all of the office room, and the service of

such help as was available.

Finding I could obtain the services of Mr. Edward A. Buss, a Civil Engineer, now of Boston, but formerly associated with this office as assistant, I deemed the best interests of the City could be served by retaining his services to assist in making the plans and study of both of the questions to be considered.

As the study of the two questions progressed, it became evident that, that portion relating to surface drainage presented so many complex problems, their solution would take a longer time than was anticipated, and as it became necessary to submit the plans and report on the house drainage system at an early date, the study of this portion of the question was continued only so far as the two questions could be carried on to advantage together.

The report and plans for the house drainage system was submitted to the City Council Dec. 6, 1890. As soon as practicable after submitting said report, work on the plans for the surface drainage system was resumed, and the report which is now submitted is the result of the study as made by Mr. Edward A. Buss, in conjunction with the City Engineer, and is their joint report.

System of Drainage.

Before describing the system proposed, we take the liberty to refer to the report on house drainage, in referring to the methods of drainage usually adopted, which may be sub-divided, or classed as surface, house, and sub-drainage.

"SURFACE DRAINAGE should provide ample channels for taking the water which falls upon the surface of the ground, thereby preventing the flooding of land upon which dwellings have been built, and for draining lands which would otherwise be wet and unhealthy. It should also provide for taking the water by underground channels, from the streets at frequent intervals, thereby preventing the excessive washing

of the surface, and effecting a saving in the cost of their maintenance.

HOUSE DRAINAGE, or what is commonly spoken of as sewerage, should provide for taking all waste or drainage from the buildings and conveying it rapidly to some point of discharge, before putrification has taken place.

SUB-DRAINAGE should provide channels for conveying and lowering the ground water, thereby preventing the annoyance of wet basements, and by the presence of air in the soil, accomplishing its purification, and increasing the healthfulness of the dwelling-houses."

Former Systems.

The system of sewers in use until within a few years in most cities, was intended to cover the three questions which are being treated separately in Newton, and the consequence was, that a sewer must be placed deep enough to lower the ground water, made large enough to carry the storm flow without backing into the house connections, be of such form as should permit of ready inspection, and provide for a thorough cleansing during the periods of dry flow. The result of this attempt to accomplish three antagonistic results by means of one system of channels, was in too many cases a sewer that was too high, too small, and not self-cleansing.

House and Sub-drainage.

In many portions of the city the water is retained in the ground at so high a level as to make difficult, if not impossible, the construction of a water-tight system of sewers, (which for reasons explained in the report of the City Engineer to the City Council under date of Dec. 6, 1890, was necessary in the City of Newton), without first laying sub-drains at a lower level than the sewer, to carry off the ground water during construction, and by its infiltration in

the open joints of the pipe to permanently maintain the ground water at so low a level in the vicinity of the sewer as to prevent external water pressure.

By providing inlets in the sub-drain, and laying sub-drains to the basements of houses, where necessary, they can be made dry and healthy. The system of house and sub-drainage adopted, and which is being constructed, contemplates the laying of sewers to take the sewage or waste from houses only, and sub-drains laid at a lower level than the sewer to take the ground water, and removes two of the questions, leaving simply a question of providing water-ways of sufficient capacity to carry off all the rainfall necessary to avoid flooding the streets or private grounds.

Requirements.

It is no longer necessary to provide for carrying this quantity in the lower half of the drain, as there are no house connections entering it. It can be considered as a gravity main for conveying a certain amount of water which increases as each catch-basin or branch is passed, and the only limiting condition is that the water shall not overflow at the catch-basins or manholes, so that if necessary the drain may be run under a slight pressure, and thus avoid using large sizes when entering upon a section having a low grade.

It is no longer necessary to exercise the same care as formerly in selecting a suitable shape of channel for the dry weather flow, and in many portions of the system the flow through the drains will entirely cease as soon as the flow ceases in the gutters. In other cases there will still continue to be a flow of ground water, which has been collected by the underground drains and discharged into this main drain.

It is no longer necessary to provide a thoroughly water-tight drain along the whole length, as there is no objection to a reasonable amount of leakage into or out of the drain. The amount that is permissible varies with the location and

height of the drain relative to the adjoining property. Under the old system, the standard sewer was of brick or pipe, waterproofed in the most thorough manner to avoid the contamination of the soil by the sewerage which leaked out through the joints.

It is no longer necessary to provide so carefully for the self-cleansing of the drains, to prevent their becoming foul during periods of minimum flow, as the flow at that time is no longer objectionable.

New Problem.

On account of these reasons, there is a larger variety of the problems to be met and settled before reaching the design of greatest economy, although the expense of construction is reduced very decidedly below that which was needed under the old system. It is no longer simply a question of whether the city can afford to pay at the present time for a brick main drain of a certain diameter, but becomes one where, under varying circumstances, open channels, stone drains or brick drains may be employed. A few general rules indicate what will usually be the best construction on the question of economy and utility.

Saving to Land Owners.

In the construction of the main line through the valleys forming the thread of the different water sheds, it is desirable to provide for as low an elevation of the water surface as is practicable within reasonable cost, as the height of this maximum surface is the limit for the grade on each of the branch lines that enter it, and a little extra expenditure to procure one or two feet more in depth on the main line may result in a large reduction in the expenditure for the branches that enter from the side territory.

In order to accomplish this lowering of the water surface on the main line, it is necessary to resort to different methods

according to whether the drain is placed in the street or on private ground, and also according to whether the land damages by a taking would be excessive or reasonable.

There is quite a large portion of the city where the land in the vicinity of the main drain is now held at a very low figure, and is worth but little on account of being flowed during quite a portion of the year. This land cannot be made available for building without doing one of two things: either the channel of the brook must be lowered, or else the entire surface of the section must be raised so as to provide for cellars, etc., above the freshet level of the brook.

The usual custom in the past in the great majority of cases has been to grade up the lots in such a way as to raise them above the freshet line of the brook, and in too many cases economy has caused the building of houses at so low a level that the cellars are frequently flowed, or at least made damp by the rise in the drain or ditch. Economy to all concerned would call for the lowering of the brook, as a short consideration of the question will show.

If we assume a width of fifteen feet as necessary for the construction of the main drain through any valley, we have fifteen cubic feet of excavation required for each additional foot of depth. This would cost at a maximum figure of seventy cents a cubic yard in wet ground, or about thirty-nine cents per linear foot. If grading is substituted for the lowering of the channel, we will find that at twenty cents a cubic yard, this thirty-nine cents would only grade a section fifty feet wide, and as soon as the width of the valley increases beyond this amount, the difference in favor of the lowering of the channel becomes more marked.

There are many places in Newton where it would be necessary to grade up for a width of at least 500 feet, in order to bring the land high enough above the waterway to enable its use for building purposes, unless we resort to the other plan of deepening the channel; 500 feet in width would