The outfall sewer from junction of the high-level and low-level sewers at No. 1 pumping station to the outfall works is laid along the centre of an embankment about 150 ft. wide, formed of dredgings and sleetch lifted from the harbor during the previous twenty years. There is a timber pond on each side. When the sewer was commenced this embankment was comparatively dry, and the trench stood without timbering; those in charge were charmed, and for a week or two boasted of how cheaply the work was being constructed. Alas for their hopes! A few wet days changed all this, and sheet piling had to be adopted and left in for the entire length of the work to keep the sewer in line. Notwithstanding this precaution the arch cracked from end to end, and had to be made good before the sewer could be used. Some portions of it have spread, and had to be replaced recently. A road 50 ft. wide is now made along the embankment, and forms the approach to the outfall works.

As a relief to the main outfall sewer, and to make it available in times of storm for the increased volume flowing from the high-level area by gravitation, it was arranged to lay a 4-ft. diameter pumping main direct from No. 1 pumping station to the outfall works, a distance of about 1,000 yds.

Before deciding on the use of steel pipes careful examination was made of similar pipes which had been in use for some time as a sludge main from the tanks to the jetty where the steamer is loaded, and also of some others carrying the main outfall sewer under a sea channel; these proved to be in such good condition that the city surveyor had no hesitation in adopting similar pipes for this main.

They are 4-ft. diameter welded-steel pipes, 3/8 in. thick, with spigot and faucet joints. The material is in accordance with the British Standard Specification, and has a tensile strength of not less than 24 tons nor more than 30 tons per square inch, with an elongation of not less than 22 per cent. on a test bar 6 in. long. The pipes were raised to a temperature of 300 deg. to 350 deg. Fahr., and then dipped in a bath of Dr. Angus Smith's bituminous compound kept at a temperature 300 deg. Fahr. during the operation, after which they were covered with a wrapping of asphalted jute. They were then weighed, and the weight painted in white lead on the inside of the socket. When laid, the joints were caulked with gasken and 2½ in. of lead wool.

One decided advantage in the use of these pipes is the smaller number of joints to be made in bad ground, and the reduction of the volume of underground water which can enter such a pipe.

The amount of subsoil water which finds its way into trunk sewers, notwithstanding all attempts to make them impervious, is very large. Careful investigation in Boston proved that in pipes from 8-in to 36-in. diameter at least 40,000 gallons per mile per day got into the sewer, and it is estimated that on the average of large trunk sewers, 75,000 gallons per mile per day had to be provided for. These figures have, I believe, been adopted in the reports of the New York Sewage Commission. In waterlogged ground the figures would doubtless be greater.

On the other side of the harbor the subsoil is of an entirely different nature; sand is found in the lower portions, and red clay a little higher up. In the sand the tide rises and falls, evidently following some of the old channels of prehistoric days.

Some years ago, when a 5-ft. diameter sewer was being laid in a street 60 ft. wide, the trench was close-sheeted, and every precaution taken, as the contractor thought, to exclude water; yet he found it almost impossible to keep the trench dry enough to get in the concrete foundation, and claimed 50s. a lineal yard for an extra 6-in depth of excavation and concrete. (He was allowed 9s.)

An examination of an old survey of 1791, which lately came into the author's possession, shows that the site was at that date under the sea, and from other sources it is now discovered that the site was reclaimed about 1833.

Extensions of this sewer several miles in length were made through good ground, but one branch (about 1 mile), along what at one time was the margin of the lough, was nearly all the way through running sand. The contractor, however, put on very powerful pumps, and was able to keep the water out of the trench a sufficient time to enable the lower part to be built. Cracks appeared in buildings about ½ mile from the site; fortunately for him, his pumping operations were not suspected.

A relief sewer parallel to the main one referred to is now being constructed about 300 yds nearer the sea; although the ground is not good much of it being infilling the difficulty of construction is much less than in the case of the original sewer.

LOST PRESSURE IN GASEOUS EXPLOSIONS.

The following item has been abstracted from a paper read before the British Association for the Advancement of Science by Professor W. M. Thornton, D.Sc.,D., Eng:

When the maximum pressure of an explosion is calculated from the heat of combustion of the elements of the gaseous mixture, values are obtained which are in all cases about twice those found by experiment. The mean of a large number of "efficiencies of explosion" for different combustible gases approaches one-half. To account for this, four chief suggestions have been made: (1) That there is dissociation of the products of combustion; (2) that the specific heats are much higher at explosion temperatures; (3) that the products are rapidly cooled by radiation to the walls of the vessel; (4) that the combustion is not complete at the time of reaching the maximum pressure. None of these is in itself sufficient to account for all the loss of pressure. The suggestion is now made that it may be caused by the forces of cohesion which come suddenly into play at the moment of formation of a molecule, check the translational energy to which alone pressure and temperature are due, and raise for the moment the rotational energy of the combining bodies. It is shown that the ratio of the translational energy of two colliding and cohering bodies before and after collision is one-half, and this ratio is to be expected for the whole mixture.

The suggestion receives support from the form of the curve connecting efficiency of explosion and changed percentage of gas in the mixture. This efficiency can be shown to have the form $\mu = 1 - BN$, where B is a constant and N is the number of combustible units in unit volume. A combustible unit is defined as that group of one molecule of combustible gas and of oxygen atoms just sufficient for its complete combustion. At the upper limit N is zero, and the efficiency curve is triangular on a base coinciding with the limits of inflammability. Its mean height is therefore one-half of the maximum, and this agrees very fairly well with the observed values given by Clerk in the case of coal gas.