ENGINEERING DEPARTMENT.

A. W. CAMPBELL,
O.L.S., C.E., M.C.S., C.E.

Sewage Disposal—Land Irregation.

The disposal of sewerage in land irrigation was referred to in the last number of THE MUNICIPAL WORLD. A recent issue of *Engineering News* contained an article descriptive of the Berlin (Germany) sewerage farm, by Allen Hazen. All of the sewage of Berlin is treated by applying it to the land, over 10,000 acres being under irrigation. The writer says :

"The sewage farm, which we visited on this bright autumn morning, was reached by carriage from the railway station of Neu Babelsburg, perhaps twenty miles southwest from the city. The land there is very slightly rolling and quite sandy, except along the streams where the meadows are perfectly flat and inclined to be swampy. A large part of the ground is naturally covered with an open growth of tall, straight trees, belonging to the pine family. The trees are so few and the foliage is so scanty that sunlight penetrates rather freely, and the ground is usually covered with a moderately good turf. Other areas are cultivated or used for pasture, but, as a rule, the soil is too poor to be profitably used in agriculture. The material of the soil itself, both in this and in other sewage farms, is remarkably uniform, and consists of a light brown sand.

Where the surface of the ground is covered with sod there is a little soil, but the soil layer is remarkably shallow and differs but little from the sand below it; so little, in fact, that it has been found unnecessary to keep it separate in grading, and cuts and fills are made without any regard to the material. This is, of course, possible on account of the remarkable uniformity of the material; under other conditions it would be impossible.

In preparing the ground for use in sewage irrigation, it is first cleared of the timber and stumps, where it has not already been cleared for other purposes, and is afterwards graded into level beds surrounded by low embankments, the beds being, as a rule, nearly square and less than an acre in area. Some of the beds are graded to slopes, but in this case the method of irrigation is entirely different.

After the grading is finished, the underdrains are laid. The drains are rather shallow and quite near together. The material in the ditches stands up perfectly, and by the use of special spades, having blades only four or five inches wide, men selected for their small size are able to dig a ditch not more than twelve inches wide at the top and eight inches wide at the bottom at a cost of less than one cent per lineal foot, the ditch being from four to six feet deep, according to circumstances. This is one of the lateral drains from two to three inches in diameter. The main or collecting drains, from four to six or seven inches in diameter, are usually laid somewhat deeper and the ditches are also wider, with a corresponding increase in cost. The lateral drains are not more than thirty feet apart, and are put down with grades as low as one in 250. The main drains of larger size have grades as low as one in 500. These main drains are continued until the quantity of effluent to be provided for exceeds the capacity of the largest ordinary agricultural tile, which are six or seven inches in diameter. These ditches are excavated in the sand with slopes of one to one and one-half, and the sides are prevented from sliding down by driving stakes at intervals on the sides, and between them is placed brush and other refuse obtained from the land cleared. Willows are also planted, and the bottom is supported by driving stakes, one-half to two inches in diameter, eight inches apart, back of which brush is placed. Poles are placed on the tops,and the two sides are held apart by frequent cross-pieces. These structures hold the bank from falling or washing for a few years, after which time they can be renewed, if necessary, but usually the willows and grass, whose development is aided by the sewage above and the effluent below, have obtained such a growth as to hold the banks without further care, beyond the occasional cleaning out of the channel at the bottom.

The distribution of the raw sewage is effected by a system of iron pipes, in which a sufficient pressure is maintained to allow sewage to be drawn freely from any of the outlets. To regulate the pressure in the pipe system, stand-pipes are placed on summits. This stand-pipe is provided with an over-flow which discharges into the beds in the immediate neighborhood, and thus prevents the pressure from exceeding a certain limit. It is desired, however, to use a pressure somewhat lower than this, and this is accomplished by placing a float in the stand-pipe which carries on a long rod a box sufficiently large to allow it to be seen for a long distance. This signal goes up and down with the pressure, and the gate-tenders for a long distance around can open or shut their gates accordingly, as the signal rises or falls.

The outlets from the iron pipes into the earth distributing channels are extremely simple. An ordinary gate allows the sewage to flow into a slight excavation in the ground, the sides of which are protected by rough wooden sticks, hardly two inches in diameter, backed by brush. The little sewage-distributing basin thus formed is divided by two partitions of similar construction to the outside walls, which compel the sewage to flow through it by a circuitous route before flowing into the earth carriers. Pieces of paper and other large suspended matters are deposited in these receivers, and are cleaned out from time to time and burned or otherwise disposed of. These receivers are extremely inexpensive, and there is nothing of a permanent nature about them except the iron pipe through which the sewage enters, but they seem to answer their purpose of removing the grosser matters of the sewage fairly well, although there is apt to be more odor from them than from any other part of the system. They are, however, regarded as desirable after many years' experience, and are always placed at outlets.

After leaving this slight receiving basin the sewage flows through a system of open carriers to the various beds. These carriers are made up by simply piling up the sand, perhaps throwing into them sod, if any is available. A little care is required to keep them in shape at first, but after they are once fairly brought into use a vigorous growth of grass appears over the surface and preserves them from further change of shape. The bottoms of these carriers are always somewhat higher than the surface of the beds to be irrigated from them, so that they can be completely drained when not in use. The flow of sewage in them and from them into the beds is controlled by wooden gates soaked in tar. These gates are reasonably tight, extremely inexpensive, and readily replaced when necessary.

An illustration accompanying the article shows a field under irrigation, from which a crop is being removed by a team of four oxen hitched up abreast. There are numerous villages on the sewage farms, surrounded by fields.

The cost of preparing land for irrigation is stated to be on an average about as follows :

	PER ACRE.
Grading and embankments	$ 39 00
Draining	39 00
Distribution system for raw sewage, including iron carriers and general expenses.....	48 00
Total expenses for preparing land for use.....	$126 00
Average cost of land to the city..	194 00
Total cost of land, ready for use..	$320 00

To the farmer and his family good roads are a vital concern of daily life and fortune, and happiness wait upon their coming.

About 100 miles of the Crow's Nest Pass road is already under contract, and track-laying began at Lethbridge on the 29th of July, and was commenced at McLeod, forty miles westward, early in August. The second fifty miles has been divided into sections of from five to ten miles long, and awarded to Messrs. McArthur, Buchanan, Strevel, Keith and Bowels, all of Winnipeg; McGillivery, of Vancouver, and Hugh Mann, of Rossland. It is more than probable that the first hundred miles will be completed before the end of the year and another section well under way.