adopted by Mr. Garfield, the engineer of the scheme, is as follows: The sludge, on its arrival at the receiving-tanks, is lifted to the boiling-up vats by means of compressed air. here it is heated by live steam, and passed into three steel vessels placed underneath, and from which it is forced by compressed air to the sludge-filter presses. Each press contains forty-seven chambers, 3 ft. square. The object of heating the sludge is to facilitate the filter pressing, and to render liquid the grease contained in the sludge. The grease and water coming away from the filter-presses are separated in tanks, from which the water is pumped back again into the sewage, and the grease into the purification-vats.

From these vats the grease is run into barrels, pumped into tank-wagons on the adjoining railroad, or discharged into the storage-vats, whichever may be necessary. It has been found that the 100 filter presses now in operation produce from 12 to 15 tons of grease per twenty-four hours, which is valued at from 8l. to 10l. per ton, and the resulting cake is more valuable than that usually produced, consequent upon the fact that it contains no lime and only 28 to 30 per cent. of moisture. It is sold at the price of 3s. per ton at the works, where it is loaded direct from the filter-presses into the railway-wagons below.

Two main sewers eventually will convey the sewage of Bradford to Esholt. The larger sewer will be 10 ft. in diameter with a gradient of 1 in 2,000, and be capable of discharging 180 million gallons of sewage daily. This sewer will be in tunnel for 4,807 yards, and the work is about to be commenced. The smaller sewer has been completed, the contractors being Messrs. H. Arnold and Sons, of Doncaster. This sewer intercepts the sewage of Eccleshill and Idle, and conveys it to the works by gravitation, the cross-section being egg-shaped in form, 3 ft. 6 in. by 2 ft. 4 in., 1 mile in length (one-third of which is in tunnel) with a gradient of 1 in 630, and capable of discharging 12 million gallons of sewage. Into this sewer will be pumped the low-lying area of Greengates, where a pumping station with two 6-in. centrifugal pumps of the "Stereophagus" type is now being erected. These pumps will be electrically driven and automatically controlled, and have been designed to pass unscreened sewage. They are capable of raising 2,000,000 gallons of sewage and trade effluent through a 12-in. rising main to a height of 100 ft. daily. Tanks have been provided at the works to treat temporarily the sewage of these districts and of the district of Yeadon by chemical precipitation, the effluent being finally purified by land filtration.

The engineer of the scheme is Mr. Joseph Garfield, Assoc.M.Inst.C.E. For the 10-ft. diameter sewer and Aire Valley Crossing the engineers are Messrs. James Watson, M.Inst.C.E., and Joseph Garfield, Assoc.M.Inst.C.E., acting jointly; whilst the resident engineer is Mr. Howard Wontner-Smith, Assoc.M.Inst.C.E.

TRAIL LOCATION AND CONSTRUCTION.

In a paper published in the Forest Club Annual of the University of Nebraska, Mr. Ernest Wohlenberg gives an interesting discussion on trail location and construction. He states that the first and most important consideration in trail construction is always the location, and grade is the determining factor in location. Where it is steep, switchbacks should be resorted to. The methods used in location are: (1) Compass and Abney hand level (accurate); (2) hand level only (fairly accurate), and (3) ocular levelling (inaccurate).

A route should first be reconnoitered and definitely decided upon before it is staked out. The main points can be sketched in on a map by means of a compass and hand level. On short distances the hand level will be sufficient. Laying out by eye is a poor method and inaccurate at its best. The route should be staked every 50 to 100 ft. and blazed, but as a usual thing routes are laid out by blazing only. The blazes should be made close together along the trail so that there will never be any trouble in following them. Location should always be from the top of a hill to the bottom, otherwise the maximum grade is apt to be exceeded, because in locating from the bottom there is danger of making the grade steeper than necessary. Location work can be done with a crew of three men and costs from $2 to $10 per mile.

There are several choices for trail routes: (1), Valley or canon; (2), ridge route; (3), trails crossing mountains, and (4), foothill. The use of one of the first two routes depends somewhat on the nature of the country. Where the canons are extremely steep, narrow, and full of boxes or interrupted by cliffs, the ridges and sidehills can be followed without much trouble. For the latter, the south sidehills should be used, because they are passable three weeks earlier in spring and later in autumn than north hillsides. Where the country has been worn down the valleys have a gentle grade and are fairly wide, so that they make good trail routes. Routes crossing the mountains are usually expensive and contain steep grades. Foothill routes are undesirable because there is so much winding in and out of the heads of canons, to keep an even grade, that the trail becomes extremely long.

Factors which influence the building and cost of trails are: (1), Grade; (2), width of the cleared space and the tread; (3), nature of soil; (4), cost of labor; (5), distance for packing supplies; (6), distance men have to walk to the work; (7), cost of supplies; (8), supervision. Grade is the determining factor.

The cleared space varies from 6 to 14 ft., and the tread from 1 to 4. ft. Ordinarily a tread of 18 in. is wide enough, for a horse will almost invariably travel on the lower side of a trail and always in the same place; if the trail is wider, the inside will fill up with sliding material and the extra cost in excavation will be thrown away. On turns, trails are widened and on switchbacks the width is doubled. The trail bed should be flat. Excavation should be made into the bank instead of building up the outer side of the trail, because on steep slopes earth thrown out of the trail makes a poor footing. The supervision of the crew is a most important factor, for if the work is not arranged as it should be, the trail will be expensive under the most favorable conditions.

The size of the crews varies from 2 to 15 men. In crews of 8 to 15 men it is necessary to have a cook, a packer, and a foreman. The brushing out can be done by 2 to 4 men, while 5 to 8 can do the grading. Small crews vary from 2 to 5 men.

On side-hill locations where water will run down a trail, it is always best to put in water bars; that is, small ditches 2 to 4 in. deep, running diagonally across the trail and banked on the lower side with earth or a small log sunk a few inches in the ground. These will turn the water and prevent any great amount of washing, which might ruin a trail. The number of water bars will vary with the grade of the trail and the degree of slope of the side hill. It is much cheaper to put them in when building the trail than afterward. Under ordinary conditions they can be located from 150 to 225 ft. apart. In building a trail, the country should first be reconnoitered and the route fully decided upon. It should then be located by stakes or blazes, and cleared and brushed, after which it will be graded and the tread formed to the specified width.