



# AGRICULTURAL ENGINEERING NEWS LETTER

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## The Outlet Problem in Farm Drainage

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Probably one of the greatest hindrances to full development of needed farm drainage is the lack of a suitable outlet for the system. Free outlets of tile mains on properly designed and effective drainage systems must, of necessity in most cases, be 5 feet or more below the surface of the land to be drained. Such mains, as a rule, discharge their water into natural streams or into artificial ditches provided for the purpose. For effective functioning of a tile drainage system, the open outlet channel must be deep enough to permit free flow of the flood water, which it carries, entirely below the mouth of the tile main which should not be even partially submerged because that will hinder the flow of the water therefrom. This means that the open channels must have a minimum depth of 7 to 8 feet below the general surface of the land. Relatively few natural creek channels are that deep, hence, whether the channel be a natural stream or an artificial ditch, considerable expensive construction or improvement work for several miles of channel is usually necessary to make it suitable as an ultimate outlet for tile drains.

As the often conflicting economic interests of many private individuals are usually involved in such a project which must be carried out, if at all, under definite process of law, interminable delays and unavoidable related expenses frequently run the total costs to the private land owner so high as to leave him unable, for a long period, to install his detailed farm drainage, without which the outlet channel becomes a distinct liability rather than an asset. In other words, it is not the outlet channel but the detailed drainage on the farm which is the dividend paying part of the drainage investment, essential as is the outlet channel to the practical value of the system.

For the average tile drainage system, therefore, ordinary highway ditches will not usually serve as gravity outlet channels as they are seldom over 3 feet deep below the general level of the adjoining land.

### PUMPING OUTLETS

The question then arises, are there no possible ways by which the operator of flat or nearly flat lands may overcome the handicaps just discussed and secure a suitable outlet for a tile drainage system? Until very recent years it has been gen-

erally maintained that there is not any such way within the range of safety or of reasonable cost. Some more recent experiences indicate that the degree of finality of this answer depends largely on what is the limit of reasonable cost in any given case. In our News Letter of September, 1936, it was pointed out that a single farmer lacking any form of purely gravity outlet for tile drainage may provide himself, at a cost ranging from \$600 to \$1200, according to the capacity required, with a pumping outlet which will usually pay for itself in from 1 to 3 years, at small maintenance cost and with a normal life of from 25 to 30 years. Such a pumping outlet enables collecting the drainage water in a concrete sump or cistern and, by means of an automatically controlled pump, and through a relatively small lift, raising the water from this sump and discharging it into a shallow existing surface stream or ditch where it can make its way gradually to the larger streams along with surface runoff.

The advantages of such an outlet are obvious when once given serious consideration. In the average case it is doubtful if the total cost of such an outlet is greater than that of a public outlet ditch. The private pumping outlet is under the sole control and care of its owner, whereas the public outlet ditch is a community responsibility, and past experience has shown that such a ditch seldom receives the care it should have after construction; hence its effectiveness often becomes early impaired. The maintenance cost of private pumping outlets, properly attended, is certainly no greater, through a term of years, than that of a properly maintained public ditch and, without doubt, in many instances it will be less.

To those, therefore, who have the problem of an effective drainage outlet to face, we recommend the earnest consideration, under qualified engineering counsel, of the pumping type of outlet.

### VERTICAL OUTLET DRAINS

Another type of outlet of almost negligible cost, that may sometimes be provided for relatively small drainage systems, is the vertical drain. It is, however, much of a lottery. Where a large bed or stratum of non-water-bearing sand or gravel or one which leads away to and eventually drains into some deeper stream gorge, is found within 12 to 15 feet of the ground surface a small well may be

bored with a post auger to tap this stratum and the hole curbed with drain tile or prevented from caving in by filling the hole with cobblestones. The tile curb capped with a beehive grate is, however, the more satisfactory. Whether the gravel stratum thus tapped is of sufficient capacity to serve as a drainage outlet can be determined only by trial, but the cost of such trial is almost negligible. One should, however, be warned against the use of regular wells, either old or new, leading into veins of underground water which are the actual or potential sources of domestic water supply, for it is obvious that such use is apt to result in contamination of the drinking water supply of entire communities. On this account such use of regular wells is forbidden by law in Minnesota.

### PROTECTION AND MAINTENANCE OF OUTLETS

A warning regarding protection and maintenance of outlets of tile drains of any type seems timely. Gravity outlets should always be screened against the entrance of birds and animals and should also be protected against crushing and undermining. Care should be taken that a drain outlet is kept clear and capable of functioning at all times. Such care is especially essential before winter closes in. Before freeze-up in the fall gravity outlets of tile drains should be inspected and all grass, leaves, brush, gravel, and other debris that causes any obstruction to free flow from the mouth of the drain should be cleared away. There are cases on record where such obstructions, allowed to remain at freeze-up, resulted in the destruction of the entire tile drainage system because the drains froze up full of water thus cracking every tile so that the entire drain finally fell in and had to be replaced at great expense.

In the case of pumping outlets provision should always be made for thorough drainage of the pumps themselves as cold weather comes on and, if there is any danger that the system may have to operate during the winter, means of warming the pump house and motor should be provided and automatic starting and stopping of the motor should not be wholly relied upon in freezing weather. The sumps of such outlet plants will, as a rule, be sufficiently deep so that the water from winter drainage will not be apt to freeze within the sump itself.