

FUTURE NEED FOR TILE DRAINAGE IN ONTARIO*

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Land drainage has played a large part in the history and development of Ontario. People have been aware, in a general way, of the importance and the large cost of this water management practice but it is generally not appreciated how much drainage work remains to be done in the future to maintain land in full agricultural production.

The purpose of the study reported here was to make an estimate of: (1) the area of land that has been tile underdrained in the past; (2) the area of land that could profitably make use of tile underdrains, and (3) the general geographical areas where this work will probably be carried out in the future.

This information will be valuable in planning the extent and best location for research and extension activities, as well as land-use, rural zoning and conservation planning.

DRAIN TILE PRODUCTION

Manufacturers of drain tile are required by law to report their annual production and sales to the Dominion

Bureau of Statistics. These accumulated statistics are published by the Dominion Bureau of Statistics (2) and by the Ontario Department of Mines (5). Annual drain tile production data are available for Ontario from 1891 to date. A summary of these statistics is shown by Irwin (3).

The Agricultural Engineering Extension Service of the Ontario Department of Agriculture makes an annual survey (4) of drain tile manufacturers and obtains an estimate of total annual production, anticipated price for the year, and an estimate of the total annual production which was sold for agricultural use. A Report (1) of the Central Mortgage and Housing Corporation gives the number of housing and building starts each year. The total number of drain tile used for this purpose can be estimated by assuming an appropriate number of footing tile that would be used for each house, apartment, duplex and commercial building. From statistics presented in this same report an estimate may also be made of the number of drain tile used for septic tank fields. The above applications constitute the major non-

agricultural use for drain tile in Ontario.

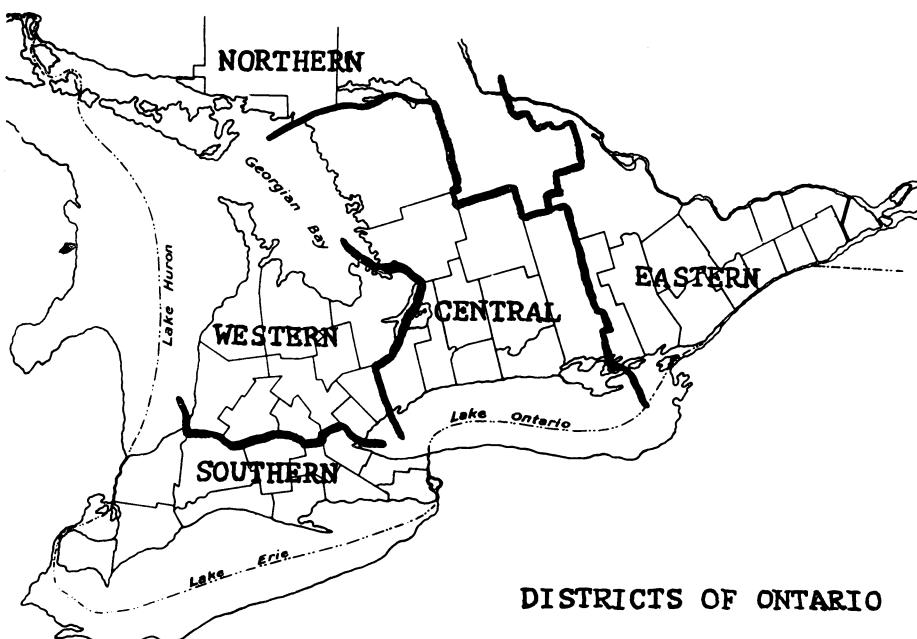
The drain tile manufacturers reported (4) that 54 million feet of all sizes of drain tile were manufactured in 1961, a typical year. The manufacturers also estimated that approximately 40 million feet, or 75 per cent, was sold for agricultural use of which 21 million feet or 40 per cent of the total production was financed under the Tile Drainage Act. This is about 50 per cent of the drain tile sold for agricultural use.

In the 40-year period 1921 to 1960 inclusive there were manufactured in Ontario for agricultural use about 600 million feet of drain tile of which 325 million feet were produced since 1948.

DRAIN TILE USE

Records of the Drainage Division, Ontario Agricultural College for 1906 to 1919 show that 18,609 miles of drain was designed for 153,531 acres and for 3,206 jobs. This is an average of 640 feet per acre, 48 acres per job and 30,600 feet per job. These figures are probably much higher than the average for the province since professional assistance tended to design the more difficult and more intensive systems. The figures for 1929 are 325 feet per acre, 26 acres per job and 8,400 feet per job. These are probably more representative values and agree more closely with other records based on an analysis of Tile Drainage Act returns which show 91.8 million feet designed for 306,000 acres or about 300 feet per acre. Calculations in this paper are based on the assumption of a long term average drain tile use of 350 feet per acre.

The Tile Drainage Act (7) makes provision for assistance to farmers, by means of a low interest loan, with the underdrainage of their farms. Townships which have made this legislation available to their residents are required to report each year full cost details of each loan to the Minister of Agriculture. These statistics are available from 1878 and contain accurate details of



DISTRIBUTION OF TOTAL LAND AREA BY DRAINAGE NEED AND CROP ADAPTABILITY ('000 acres)

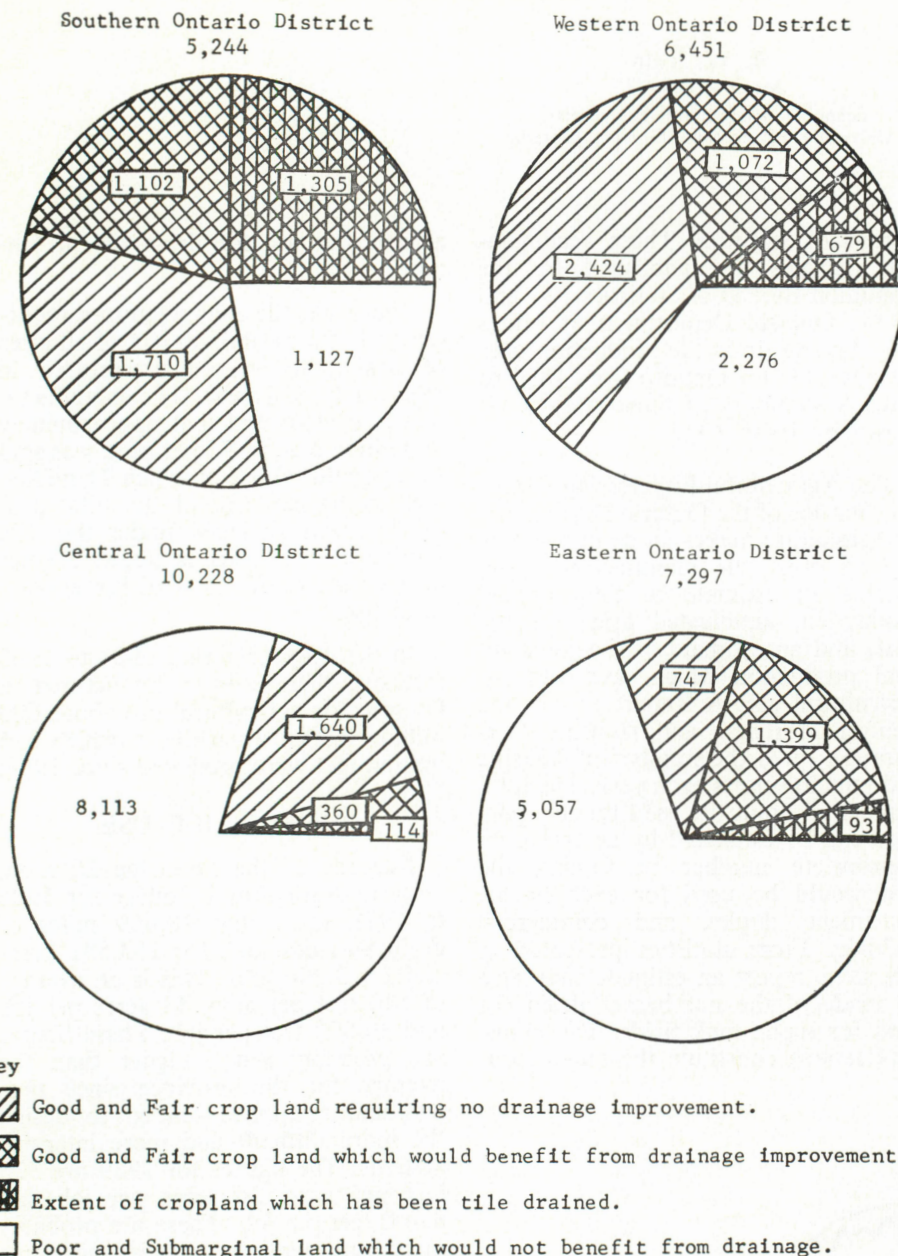


Figure 1

the installation cost and the average length of drain tile installed on each farm.

Irwin (3) reported that the total amount of the loans made under the Tile Drainage Act from 1878 to 1948 was \$5,267,044.96. Since then an additional \$8,436,000.00 has been loaned. An analysis of the Tile Drainage Act returns for the year 1961 showed that about 900 individual loans were made. The average length of drain tile installed per loan was 20,000 feet. The total length of drain tile installed under the *Tile Drainage Act* in 1961

was, therefore, 18 million feet, which is in reasonable agreement with the estimate made above by the drain tile manufacturers. This amount of drain tile at 350 feet per acre would drain about 51,000 acres.

Similarly, it would appear that the 1961 production of 40 million feet of drain tile for agricultural use would drain about 115,000 acres of land and for the period 1921 to 1960 the land tile drained would be 1.7 million acres.

It has been current practice to depreciate a tile drainage system over a 40-year period. The actual life of a

tile drainage system will depend upon the maintenance it receives, the soil in which it is placed, and the cultural practices followed by the farmer.

Since the life of a tile drainage system is often less than 40 years and since some land has been retiled at closer spacings it is most probable that the amount of land that is effectively tile-drained in Ontario at this time is 1.25 million acres. The current rate at which land is being tile-drained is 115,000 acres per year.

SOIL DRAINAGE

The effectiveness of tile underdrainage is dependent upon the provision of adequate outlets and a good surface drainage system. Soil may be inadequately drained because of poor surface drainage, seepage, high water-table, or slow movement of water through a fine-textured soil.

Many imperfect and poorly-drained soil series, may, through tile drainage be brought into a high state of production. In some locations these same soil series do not warrant the added cost of artificial drainage. In these cases all that is required is to use crops which are adapted to wet conditions. Other soil series are either too difficult to drain or no special advantage is gained in doing so.

The soils of Ontario have been surveyed by the Ontario Soil Survey (6) and a map and report which indicate the extent and distribution of the various soils has been published for most counties. The soils have been grouped into six Land-Use Capability Classes based on their productivity, workability and conservability in relation to the production of general farm crops. The most important factors which affect the ability of a soil to produce are drainage, fertility and climate. To produce good crops it is usually necessary to improve the drainage of many soils by the use of tile drains. The soils are then more productive. The ratings used are for the natural drainage of soils and are based on the production of oats and alfalfa. These crops were chosen because they respond to drainage improvement, are the least affected by climate, and are generally grown throughout the Province. The best measure for a crop adaptability rating is average yield of each crop.

The Ontario Soil Survey (6) in their mapping program also records the natural internal soil drainage in three

general classifications of good, imperfect and poor drainage. The installation of tile drains in an imperfect or poorly drained soil usually improves the crop adaptability rating for that soil. Generally the increase is a single rating class although certain fair and poor soils, when drained, may attain a good rating. Poor soils frequently will not be rated higher when tile drained. Tile drains are generally not installed economically in soils with a rating lower than fair.

Figure 1 shows the relative distribution of the total land area by crop adaptability and drainage rating in each geographical district. These charts show that there are 6,124,050 acres of soil with a drainage hazard which would probably be improved with the installation of tile drains. This value is for the total land area and gives no indication of the proportion that is cleared land under production although it is probable that the majority of the soils with the highest rating capability are now under production.

FARMER'S OPINION

The Dominion Bureau of Statistics, in co-operation with the Statistics Branch of the Ontario Department of Agriculture, provided space for answering four questions relating to farm drainage in their schedule for the 1960, 1961, and 1963 Annual June Survey of Crops, Livestock and Poultry. The questions were designed to determine the area which, in the farmer's opinion, would be benefited by tile drainage and to estimate how much work had been done. Additional information regarding the availability of outlet ditches and the type of land was also solicited in these surveys. The surveys are difficult to correlate because the questions asked differed each year. This became necessary to clarify problems that appeared in each survey.

The 1960 survey, based on a sample of 5,904 returns of which 65 per cent answered the drainage question, forecast there were still 3.6 million acres of cleared land in Ontario which would

be improved by tile drainage. About 11 per cent of this land did not have a satisfactory outlet. The concept of rolling land is not the same across the Province and the estimate of 41 per cent rolling land requiring drainage may range from hills to gentle undulating.

In 1961, which was a Census year, there were more returns in the survey, although fewer persons answered the drainage question. The questions were more specific than the 1960 survey. An analysis of the replies showed that there were 3 million acres of cleared land in Ontario which would be improved by tile drainage. About 8 per cent of the land did not have a suitable outlet.

In 1963 special mechanical equipment made it feasible to enlarge the sampled population. There were 42,000 returns of which 27,434 answered the drainage question. Based on this intensive sampling of farmer's opinion it appears that there are 6 million acres of farm land which require tile drainage including land already improved by tile drains. About 14 per cent of the land did not have an outlet.

The survey also shows that there are 2.2 million acres or 37 per cent of land already tile drained so there are 3.8 million acres of additional land which would be improved by tile drainage. About one million acres does not have a satisfactory outlet.

About 88 per cent of the land requiring tile drainage is in the Southern and Western Ontario Districts. About 40 per cent of this is now tile drained. These statistics in the survey are influenced by the Farmer's consciousness regarding drainage need and since experience is relative, two different farmers may not draw similar conclusions about the same farm.

SUMMARY

There is no single source in Ontario where detailed information regarding the extent of past, current or future drainage work is available. This paper

has used the most accurate information available from many sources to make such an estimate.

In the agricultural area of Ontario excluding those of Northern Ontario and the District of Nipissing, there are 6 million acres of land which would be improved by the installation of tile drains. About 14 per cent of the land does not have a satisfactory drainage outlet.

Based on tile production figures it was estimated that 1.25 million acres are now tile drained. In the farmer's opinion this value should be 2.2 million acres.

It is also estimated that there remains about 4 million acres of cleared land to be tile-drained when economic conditions permit. The present rate of installing tile drains is believed to be about 115,000 acres per year.

The greatest activity in land drainage has been in the Southern and Western districts of Ontario and this will continue. About 35-40 per cent of the land has been tile drained but over half of the land which would benefit from drainage in Ontario is still in this area.

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