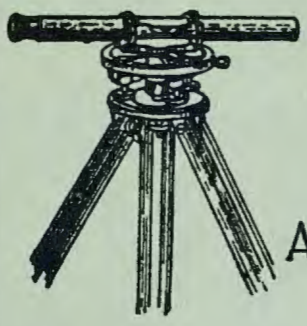

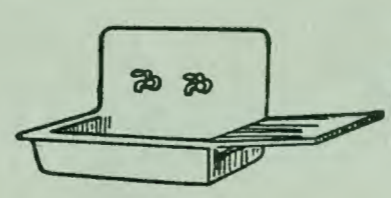

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Water Supplies for Irrigation in Minnesota

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SOURCES OF WATER SUPPLY

Practical sources of water for supplemental irrigation are streams, lakes, shallow wells, and deep wells.

Streams. Many irrigable tracts are located adjacent to dependable streams. The question will arise as to whether or not a given stream will be a reliable supply during the dry periods each summer when irrigation is most needed. For many years past the U. S. Geological Survey has, at intervals, obtained discharge data on most of the larger streams. From these records one may predict with reasonable certainty how often a river or stream may run dry.

Some of the larger streams have failed completely during the dry periods of several summers while others, much smaller, have never been recorded as dry. For example, one river in western Minnesota was found to have a flow of about 5 cubic feet per second in July, 1936, while the river into which it flows was, at the same time, completely dry several miles downstream. Small streams may often be dammed, at small cost, to impound a water supply.

Lakes. Numerous lakes throughout the state could be economically used as a water supply from which to irrigate suitable areas conveniently near to them. If the lift from a lake surface to the area to be watered is considerable, it is recommended that technical advice be sought before installing an irrigation system. Permission of the State Department of Conservation must be secured for use of water from streams and lakes for irrigation purposes.

Shallow Wells. Probably the most important and most common sources of water for supplemental irrigation in the state are shallow wells of some type. Shallow wells are found where the surface material is pervious or coarse textured, and the water table within 20 feet of the surface. The surface material may be glacial outwash, lake deposited sands and gravel, or alluvial materials.

Glacial Outwash. Satisfactory wells in the glacial outwash are found in practically every county in the state. An excellent example of a good shallow well supply in outwash sands is found northwest of Minneapolis near Brooklyn Center or Osseo, where many of the vegetables for the Minneapolis market are produced. In an area 5 to 10 miles square, there are at least 100 farmers each pumping an average of about 75 g.p.m. from these surface sands. The water comes from the higher lakes to the west which drain, through the subsurface of this area, eastward toward the Mississippi. In this area enough water to irrigate 10 or 15 acres of vegetables (about 75 g.p.m.) can usually be obtained from three 2½-inch sand points drive 20 to 30 feet deep. The depth of the static water table averages about 10 feet. Many other similar areas exist, scattered throughout the entire state near the larger river gorges.

Lake Deposited Sands. The areas in which a good water supply can be pumped from lake deposited sands are found principally in northwestern Minnesota in the area once occupied by glacial Lake Agassiz, which, in receding, formed many deposits of nearshore sands.

Alluvial Deposits. The coarse, alluvial deposits, as a source of surface well water, are found in many of the bottom lands of the larger streams. Often they are not valuable sources of water for irrigation, because the adjoining land is often overflowed and too low for use.

Excavated Pits. The excavation of a large pit into water-bearing sand and gravel has been tried in several places but has generally proven unsatisfactory, and the practice is not recommended.

GEOLOGIC INFLUENCES ON DEEP WELL SUPPLIES

The preceding discussion has considered only shallow well supplies. Considering deep wells, the state is naturally divided into three major geologic areas,

shown in the figure, each of which presents different water supply problems.

Area No. 1. The distinguishing characteristic of Area No. 1 is the presence of underlying beds of sandstone and other sedimentary rocks, important as a source of water for deep wells. These beds are usually covered by about 150 feet of glacial drift frequently yielding a water supply sufficient for irrigation. This area furnishes the most reliable deep well water supplies in the state.

Area No. 2. In general, Area No. 2 is covered with 150 to 200 feet of glacial drift, underlaid by a stratum of water-bearing sedimentary rock, known as Cretaceous, varying in thickness up to 500 feet. The source of water may be either the Cretaceous or veins of sand and gravel in the glacial drift. Between the Cretaceous and the lower lying crystalline rock is a layer of clay. Drilling should always be discontinued when this clay is reached because no more water will be obtained at greater depths. The northern part of this area was occupied by Lake Agassiz; hence, in this section there is a layer of lake deposited material over the drift.

Area No. 3. In Area No. 3 the glacial drift is directly underlaid by solid crystalline rock with no intervening sedimentary formations. The deep well supply in the western part of the area is similar to that in Area No. 2 except that the Cretaceous is absent. Hence, the glacial drift is the only source of water. The gray drift here does not yield so freely as the red drift in the east.

In the northeastern part of the area, there are a number of extensive outcrops of crystalline rock on which there is no drift cover. In these places there is no possibility of obtaining water from wells so that only surface supplies are available.

SUMMARY

A supplemental irrigation system large enough for 20 acres requires a constant yield of about 100 gallons per minute. However, requirements for different systems may vary from less than 10 to more than 1000 g.p.m. Therefore, it is essential that the water supply be investigated for each case to determine the most economical and dependable supply. The cost of pumping water greatly affects the economic feasibility of an irrigation project and is strongly influenced by the investment necessary to obtain water and by the height which it must be lifted. Supplies at the surface, or not more than 15 feet below it, are less expensive than those from deep wells.

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