POTENTIAL WELL YIELDS FROM THE UNCONSOLIDATED DEPOSITS

This map shows the potential range of yields from wells that tap the unconsolidated aquifers. Well yields depend on aquifer transmissivity, type of well, whether the aquifer is fully penetrated, and the degree of development. The potential well yields indicated at sand and gravel deposits are those to be expected from individual wells that are screened and developed. Potential well yields indicated at till, silt and clay, or thin sand and gravel deposits are those to be expected from dug wells. Yields do not represent sustained withdrawals from the deposit but reflect the transmissivity of the aquifer. Yields are estimates based mostly on geologic conditions, such as grain size and thickness of deposit, and on results of pumping tests and reported yields from drillers and well owners. The actual yield may differ from those indicated, but probably not significantly.

Geologic conditions may vary somewhat within each designated area; sediments in places that have several types of material are classified according to the dominant type. For example, fine-grained deposits are found within some areas shown to consist of sand and gravel.

WELLS

The choice of which type of well to use (fig. 1) depends on how much water is needed, whether the aquifer is surficial or buried, the degree of sorting and size of sediment (gravel or fine grain) that form the aquifer, the depth to the water table, and economic considerations. The variation in yield from four types of wells that tap sand and gravel deposits is shown in figure 2; the main characteristics of each type are described below.

Drilled Wells

Drilled wells in sand and gravel aquifers are of two types--open-end and screened. Open-end wells, in which only the end of the casing is exposed to admit water, are used for both domestic and farm supplies. Casings are typically 6 inches in diameter and have an intake area of 28 in^2. The disadvantages of open-end wells are that the aquifer must consist of coarse granular material (medium to coarse size sand, preferably gravel) to pump silt- or sand-free water, and that only moderate amounts of water (generally 5 to 30 gal/min) can be pumped.

Wells that are used for industrial or public water supplies have a screen 5 to 30 ft long. A screened well has a large area to admit water and thus produces more water than an open-end well. The size of intake slots in the screen is selected according to the grain-size distribution of the aquifer. Development of the well by pumping, surging, or backwashing removes the fine sediments from the vicinity of the screen and increases the efficiency of the intake. Screened wells are the most expensive type of well to install.

Driven Wells

These wells are constructed by driving a screened well point attached to 1.25- to 2.0-inch-diameter pipe to a depth below the water table. The well point can generally be driven 25 ft in sediments of sand to fine gravel, but friction reduces the potential driving depth in coarse gravel with clasts greater than 1 inch in diameter. Driven wells are the least expensive and easiest wells to construct.

A driven well, with its small diameter, presents a relatively small open area to admit water. A 3-ft well point 1.25 inches in diameter has an intake area of about 7 in^2, compared to an intake area of 28 in^2 for a 6-inch diameter open-end drilled well. This difference is reflected in the low yields of driven wells, as shown in figure 2.

Dug Wells

Dug wells are constructed either by hand or backhoe and are generally 24 to 48 inches in diameter and less than 25 ft deep. Water seeps into these wells from the bottom and sides, which are lined with stones or porous concrete tile. Dug wells are suitable where the aquifer is thin or contains a large percentage of fine sediments of low permeability. Dug wells are successful because they have a large area through which water can seep and a large storage capacity. For example, the sides of a 36-inch-diameter well extending 5 ft below the water table is in contact with 45.1 ft^2 of water-bearing material and stores 261 gal of water. Dug wells in well-sorted, coarse sand and gravel can yield from 100 to more than 1,000 gal/min of water (fig. 2).

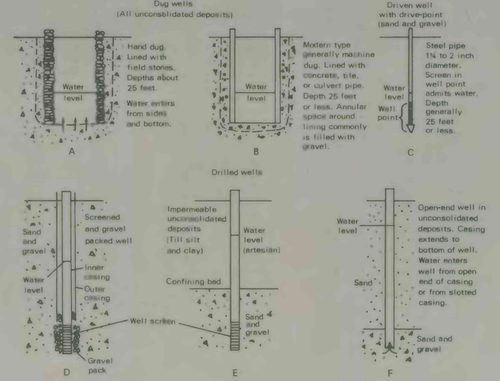

Figure 1.--Types of wells. (Modified from LaSala, 1968.)

REFERENCES CITED

Kantrowitz, I. H., 1970, Ground-water resources in the eastern Oswego River basin, New York: New York State Department of Environmental Conservation, Basin Planning Report ORB-2, 129 p.

LaSala, A. M., 1968, Ground-water resources of the Erie-Niagara basin, New York: State of New York Conservation Department Water Resources Commission, Basin Planning Report ENB-3, 113 p.

EXPLANATION

Well Yield and Description of Water-Bearing Unit

(Symbol in parentheses indicates type of well suitable for the geologic material described.[1])

- LESS THAN 1 TO 10 GALLONS PER MINUTE--Till or silt and clay. Yield is for a dug well. (Dug)
- 1 TO 100 GALLONS PER MINUTE--Sand or sand and gravel interbedded with silt, clay, or till. Thin saturated layers of moderately permeable material occurring at random. (Scr, Opn, Drn, Dug)
- 1 TO 50 GALLONS PER MINUTE--Sand under water-table conditions. (Scr, Drn, Dug)
- 10 TO 100 GALLONS PER MINUTE--Sand and gravel under water-table conditions but with thin saturated zone. May be necessary to drill into underlying bedrock to obtain adequate supply. Yield is for a dug well. (Dug)
- 1 TO 100 GALLONS PER MINUTE--Sand under confined conditions, overlain by very fine sand, silt and clay, or till. (Scr)
- 10 TO 250 GALLONS PER MINUTE--Sand and gravel of moderate transmissivity under water-table conditions. (Scr, Opn, Drn, Dug)
- 10 TO 250 GALLONS PER MINUTE--Sand and gravel of moderate transmissivity under confined conditions, overlain by very fine sand, silt and clay, or till. (Scr, Opn)
- GREATER THAN 250 GALLONS PER MINUTE--Coarse sand and gravel of high transmissivity, under water-table conditions. (Scr, Opn, Dug)
- GREATER THAN 250 GALLONS PER MINUTE--Coarse sand and gravel of high transmissivity under confined conditions, overlain by very fine sand, silt and clay, or till. (Scr, Opn)

BASIN BOUNDARY

[1] Scr = screened, Opn = open-end, Drn = driven, Dug = dug

Figure 2.--Well yields obtainable from four types of wells tapping unconsolidated deposits in eastern part of Lake Ontario basin. (Modified from Kantrowitz, 1970.)

Base from Army Map Service, Rochester, 1961 and Utica, 1960, 1:250,000 scale

GROUND-WATER AVAILABILITY IN THE EASTERN PART OF THE LAKE ONTARIO BASIN, NEW YORK

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