

SURFICIAL GEOLOGIC MAPS DELINEATE AQUIFER DISTRIBUTION IN MAINE

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Figure 1: Location of Gray, Maine.

Problem:

A complex of sand and gravel deposits in the village of Gray, Maine (Figure 1), constitutes a major aquifer. The complex is composed of a series of glacial marine deltas, formed when the margin of the last great ice sheet was retreating. The land surface was depressed by the weight of the ice, and the sea flooding the area and was in contact with the ice front. At the ice margin, glacial meltwater charged with sand and gravel emanated from drainage tunnels into the sea, and provide the sediment to construct the ice-marginal deltas. After the ice sheet melted away, the land began to emerge from the sea. By the time the land was fully emerged, the deltas were recharged by precipitation, with fresh water replacing the saline ocean water in the interstitial voids of the sand and gravel deposit, thereby producing an excellent groundwater resource. Because sand and gravel deposits are used for many activities, careful delineation of the aquifer is a necessity to protecting the resource.

Geologic Map: A part of the surficial geologic map of Gray is shown in Figure 2 (Weddle, 1997). The map shows the distribution of materials of glacial origin that mantle the bedrock of the area. The village center of Gray is at the crossroads, left center of the map. Till (Pt) was deposited directly from the glacier as it melted and is an unsorted mix of cobbles, sand, silt and clay. The symbol Ptd indicates areas where this material is less than 10 feet thick. Marine mud (Pp) was deposited by the ocean when it was briefly higher over this area. Glacial marine deltas are shown by the unit abbreviations beginning with Pmd.

These are the primary sand and gravel deposits of the area. The units labeled Pmn are sand and gravel deposits that have been reworked by the ocean. The blue arrows indicate meltwater channels and the blue hachures represent successive positions of the ice margin as it retreated.

Using The Geologic Map: For the aquifer map in Figure 3 (Neil, 1999), boundaries are delineated based on the distribution of surficial units. For our purposes, an aquifer is a unit that can yield 10 gallons per minute or more of water to a well. The similarity of the boundaries of the glacial marine deltas and the mapped aquifers is readily observed on the two maps. The glacial marine deltas serve as the starting point for investigating aquifer distributions. Subsurface information in the form of test borings and geophysical seismic surveys provide information about depth to bedrock, depth to water table, and other characteristics of the deposit which further define the extent of the aquifer.

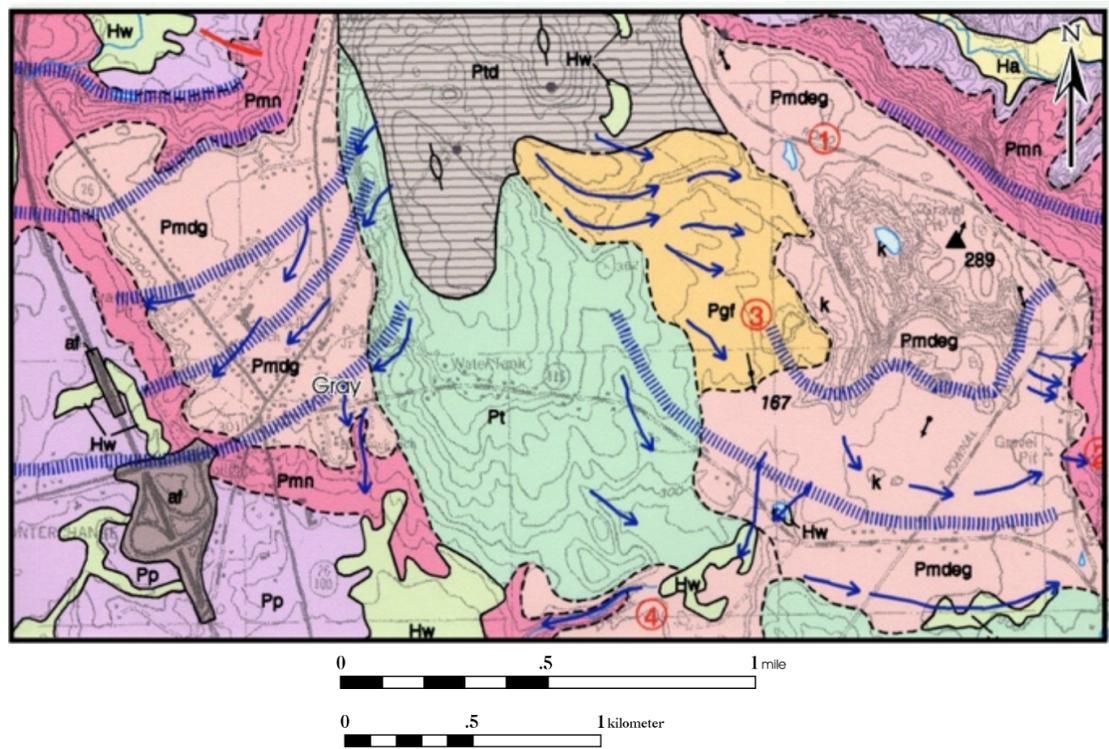


Figure 2. Portion of the Gray 7.5-minute surficial geologic map. Symbols beginning with Pmd - glacial marine deltas, Pt till, Pgf glacial outwash fan, Pmn marine nearshore deposit, Pp marine mud, Ptd thin drift, Hw wetland, af artificial fill.

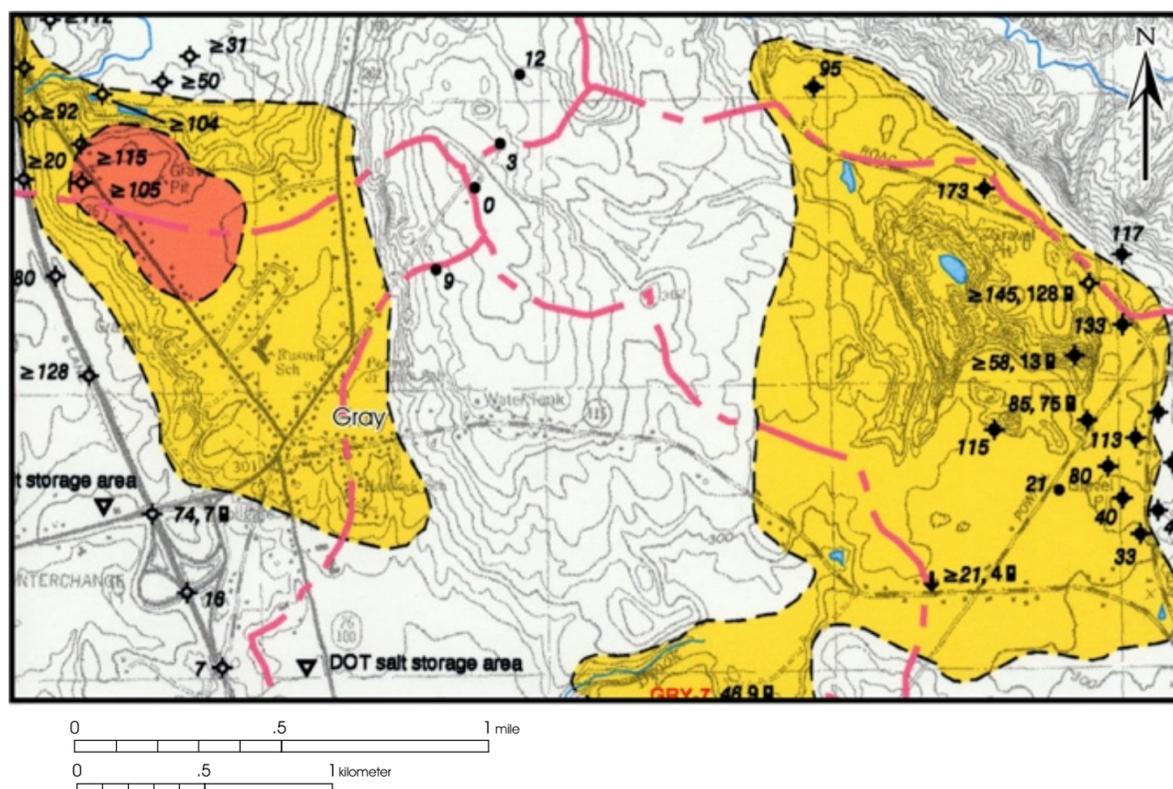


Figure 3. Sand and gravel aquifer map for the Gray quadrangle showing the same area as Figure 2. Yellow areas are aquifers which yield 10-50 gallons per minute; orange areas yield greater than 50 gallons per minute. Areas in white are surficial deposits with less favorable aquifer characteristics. Solid circles are drilled wells with depth to bedrock noted. Open circles are monitoring wells showing depth to bedrock and, where available, depth to water table.

Conclusion: The surficial geologic map forms the basis for delineating significant groundwater resources. Gray is typical of many Maine towns where the village center is located on the aquifer, with its industrial, municipal, and business functions. Several gravel extraction operations utilize the resource as well. The surficial geologic map and the derivative aquifer map can help town officials, planners, and interested citizens make informed decisions about land use in areas like this, where competing activities require best management practices to preserve the quality of the resource.

References:

- Niel, C.D., 1999, Significant sand and gravel aquifers, Gray quadrangle, Maine: Maine Geological Survey, Open-file No. 99-24, scale 1:24,000.
- Weddle, T.K., 1997, Surficial geology of the Gray 7.5-minute quadrangle, Maine: Maine Geological Survey, Open-file No. 97-58, scale 1:24,000, 10 page report.