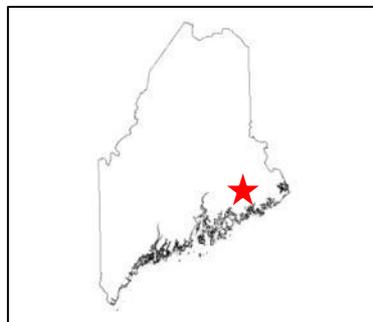


Geologic Site of the Month
June, 2001

Sand and Gravel Aquifer Maps - A Work in Progress



44° 39' 0.19" N, 67° 52' 6.88" W

Text by
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Introduction

The Maine Geological Survey's (MGS) sand and gravel aquifer maps have constantly improved over the years. Starting in 1978, MGS began publishing reconnaissance sand and gravel aquifer maps at a scale of 1:50,000. The base maps were a mix of 15-minute and 7.5-minute USGS topographic maps scaled to size. Geologic interpretation of the aquifers was based on the occurrence of sand and gravel units on reconnaissance surficial geologic maps. Data relating to ground water levels was sparse. Beginning in 1985, the significant aquifer map series started to replace the original sand and gravel aquifer maps. These maps were still at a scale of 1:50,000, but aquifer boundaries were more precisely located and additional subsurface information about the aquifers was portrayed. While these maps covered a large area, they lacked the detail needed by State, municipalities, water districts, and private consulting firms. In 1992, MGS began to publish significant aquifer maps at a detailed scale of 1:24,000, using the 7.5-minute USGS topographic map as a base. Added well data and seismic information increased the accuracy of aquifer boundary portrayal. Starting in 1998, the maps were generated in color which further improved readability by professionals and lay-people alike.



Map Revisions

Revision of the older 1:50,000 scale maps has been an ongoing process and involves compilation of all earlier collected data as well as newly acquired field and well inventory information (Figure 1). The map at left is from the reconnaissance sand and gravel aquifer map published in 1981 (scale 1:50,000). Light gray areas indicate yields of greater than 10 gpm. Dark gray indicates yields of over 50 gpm. The center map is the significant sand and gravel aquifer map published in 1988 (scale 1:50,000). Light gray areas indicate yields of greater than 10 gpm. The map at right is the significant sand and gravel aquifer map published in 2000 (scale 1:24,000). Yellow areas indicate yields of greater than 10 gpm. Red indicates yields of over 50 gpm. Note how the interpretation of high yield areas has changed over time.



Figure 1. Changing interpretations of sand and gravel aquifers for part of the Northeast Bluff quadrangle in eastern ME.

Map Revisions

The delineation of sand and gravel aquifers involves compiling all stratigraphic and water level data that can be gleaned from pit exposures, well, test boring and test pit logs, well yield, springs, stream and road cuts, bedrock outcrops and seismic refraction surveys. Locations are plotted on 7.5-minute topographic bases and digitized. Aquifers are identified based upon well yield or anticipated well yield of 10 gallons per minute or more. Also, a minimum saturated thickness of 10 feet is used in the identification process. All of this information is used in conjunction with surficial geologic and soils maps, aerial photographs, and topography to identify areas that should be classified as aquifers.

Despite our best efforts in the mapping of sand and gravel aquifers, areas where more data are collected sometimes result in the need to modify our maps. Between 1998 and 2000, Cherryfield Foods, Inc.(CFI), a blueberry grower and processor based in Cherryfield, Maine drilled over 100 wells and borings in search of ground water for use in irrigating their crop. This work initially involved the installation of 2.5-inch wells, preliminary pump testing, and where results were favorable, larger 8 to 24-inch wells were drilled and longer term pump testing was conducted.



Aquifer near Cherryfield Foods, Inc.

A site investigated by CFI in T24 MD BPP in Washington County revealed the need for further aquifer map revision. The sand and gravel aquifer map identified the area as underlain by aquifer capable of yields of greater than 10 gallons per minute (gpm) as well as greater than 50 gpm (Figure 2).

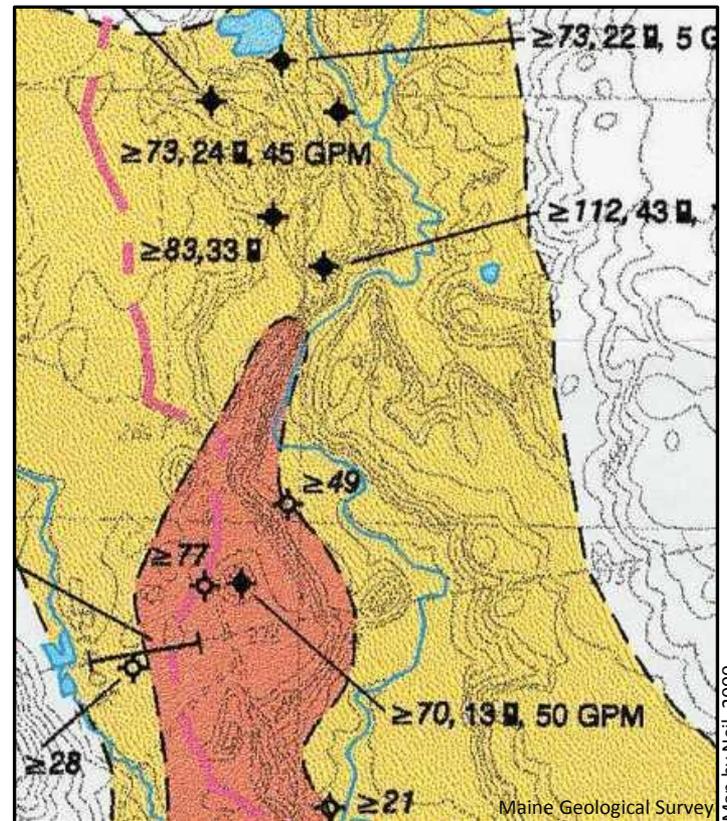


Figure 2. Current significant aquifer map of a portion of the Northeast Bluff 7.5-minute quadrangle.

Aquifer near Cherryfield Foods, Inc.

Wells were drilled at 12 locations, but at three of the locations, the wells were pulled because the material was considered overly fine-grained (Figure 3).

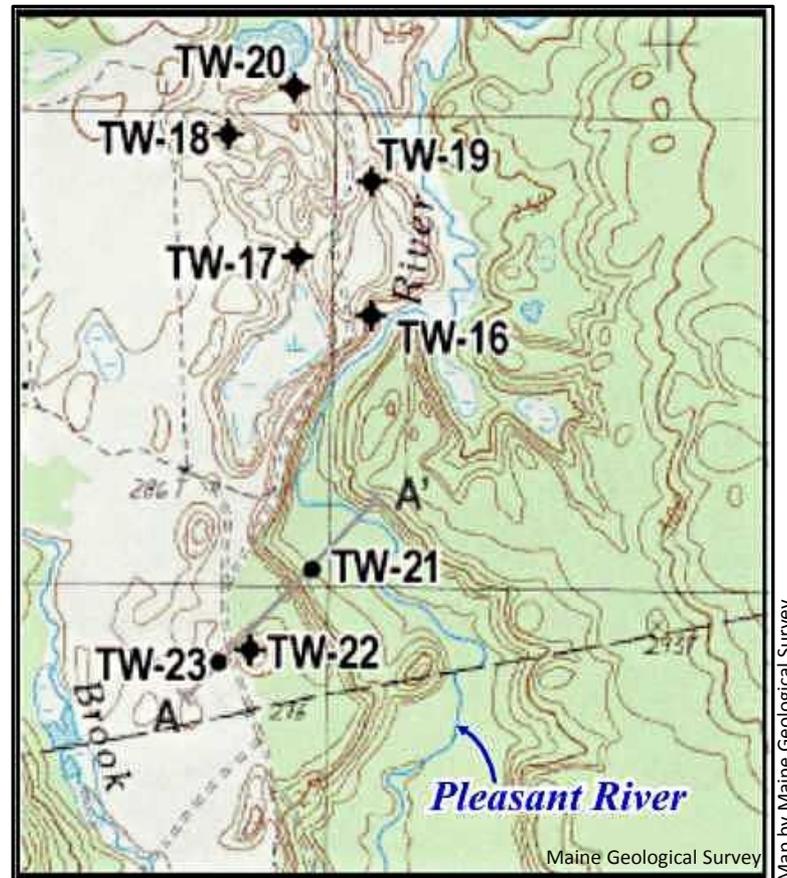


Figure 3. Area of Figure 2 showing location of CFI test wells and cross section shown in Figure 4.



Constructing a Cross-section

A schematic geologic cross-section, A-A' utilizing TW-23, TW-22 (adjacent to the 8-inch well), and TW-21 illustrates the vertical as well as horizontal extent of the aquifer (Figure 4). It is important to note here that the test drilling data used in this cross-section does not support the concept that the aquifer extends east to the Pleasant River nor does it appear that coarse-grained, water-saturated sand and gravel occurs a great distance to the west.

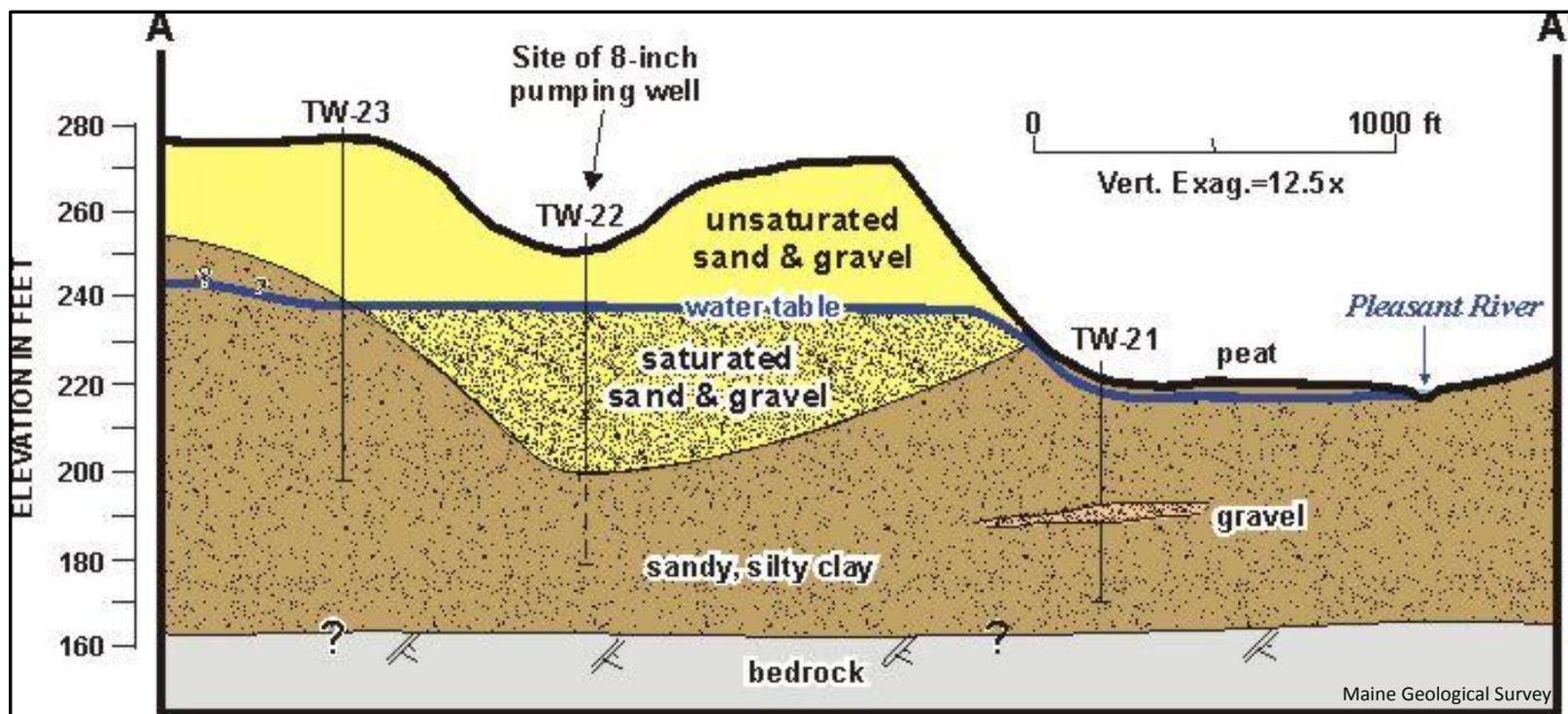


Figure 4. Schematic geologic cross section of traverse shown in Figure 3.



Test Pumping

In addition to the test drilling data, a three-day pumping test conducted on an 8-inch well appears to further support the presence of low permeability hydraulic boundaries or a limited aquifer. A semi-log plot of the time-drawdown data for the 8-inch pumping well and other nearby observation wells is shown in Figure 5.

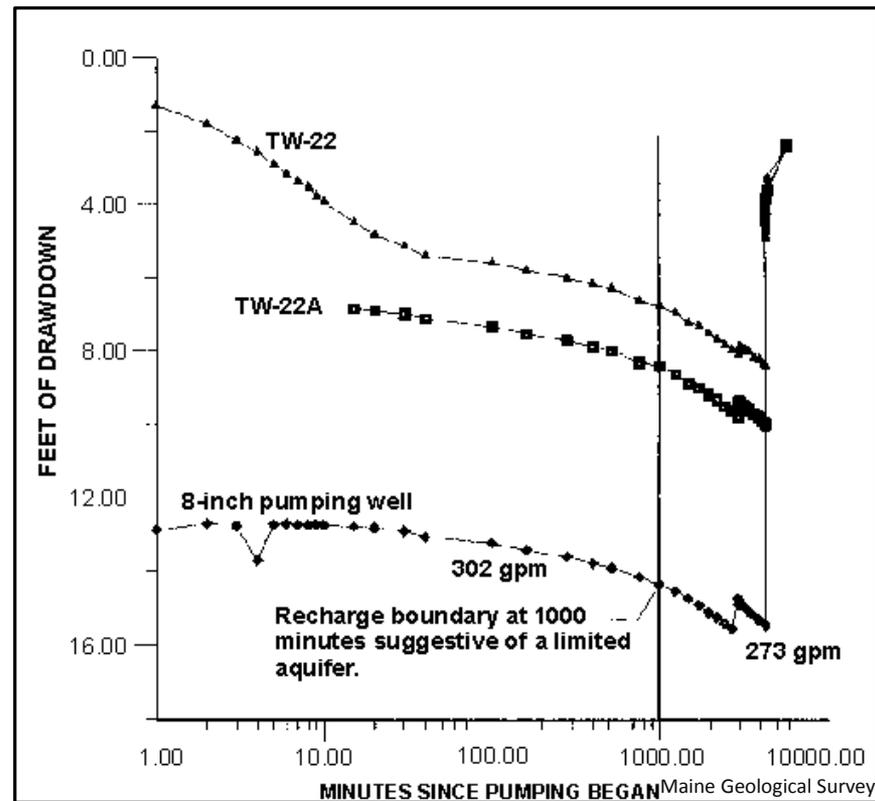


Figure modified from Cherryfield Foods, Inc., 2001

Figure 5. Semi-log plot of the time-drawdown data for the 8-inch pumping well and other nearby observation wells.



Test Pumping

The water level in the pumping well (pumping at 302 gpm) dropped about 12 feet quickly, and then began a slow decay that increased after about 1000 minutes of pumping. Drawdown in the adjacent observation wells was less, but showed a similar pattern. At 2950 minutes, the pumping rate was reduced to 273 gpm which resulted in a steady, logarithmic drawdown rate of 3.7 feet per log-cycle of time until pumping ceased at 4310 minutes. The three-day pump test indicates that the 8-inch well has a sustainable yield of about 273 gallons per minute. Also, for irrigation seasons spanning up to about 70 days, the well may be pumped at rates of 350 to 400 gpm.



Further Map Revisions

Based upon test drilling and well pump testing, it appears that the aquifer boundaries identified by the Maine Geological Survey at this site require modification. Figure 6 depicts a possible revision to the map. The Maine Geological Survey always welcomes new data whether the data supports our interpretations or not. The more information that we have, the more refined our maps become.

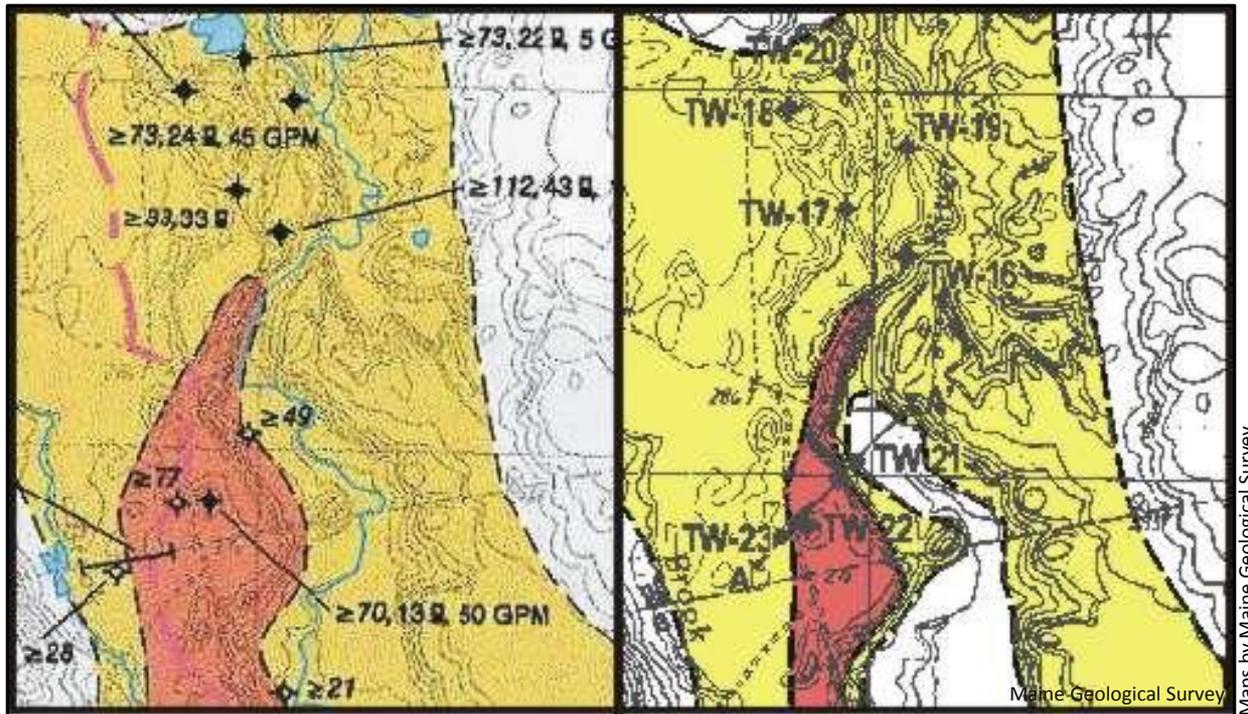


Figure 6. Map to right shows modified interpretation of aquifer boundaries based on new test drilling and well pump testing. Map at left shows previous boundaries. Note how the interpretation of the aquifer boundaries has changed.

For a historical perspective, refer back to Figure 1 to see previous interpretations of the aquifers.

References and Additional Information

Cherryfield Foods, Inc., 2001, Worcester lot 8-inch diameter test well and proposed 18-inch diameter irrigation well, hydrogeologic analysis: Cherryfield Foods, Inc., Cherryfield, Maine.

Neil, C. D., 2000, Significant sand and gravel aquifers of the Northeast Bluff quadrangle, Maine: Maine Geological Survey, Open-File Map 00-182.

We wish to acknowledge Dr. W. Bradford Caswell, Environmental Manager, Cherryfield Foods, Inc. for the use of their data which has greatly enhanced the State's knowledge of water resources and sand and gravel aquifers in Washington County.

