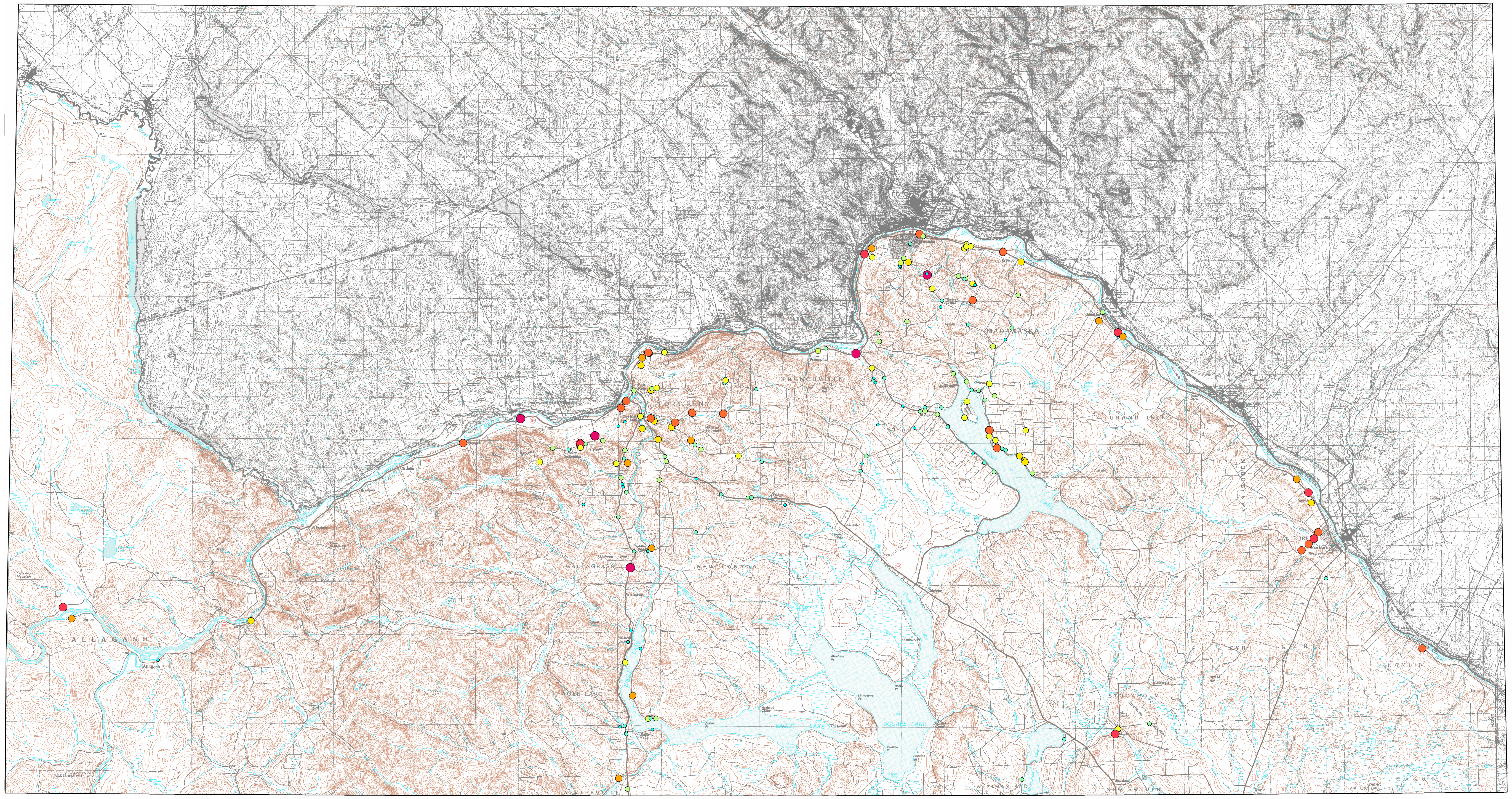
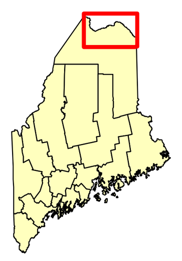
# Overburden Thickness




## Quadrangle location



N

1:150:000

0 1.5 3 6 9 12 15 18 Kilometers

0 1 2 4 6 8 10 Miles

Topographic base from U.S. Geological Survey Madawaska, Allagash, and Van Buren, Maine 1:100,000-scale topographic maps. Contour interval 10 meters. National geodetic vertical datum of 1929. Elevations shown to the nearest meter.

## Explanation

Overburden thickness in feet

- 0-5 feet
- 5-10 feet
- 10-15 feet
- 15-20 feet
- 20-25 feet
- 25-30 feet
- 30-40 feet
- 40-50 feet
- 50-75 feet
- 75-100 feet
- 100-200 feet
- >200 feet

The bedrock that forms the foundation of Maine and New England comes from the same variety of sources active in the world today, including volcanoes (lava and ash), intrusion of molten rock (granite and gabbro), and weathering and erosion of landforms (sandstone and mudstone). Regardless of their various origins, however, these bedrock formations have very similar ground-water-bearing characteristics because of metamorphism and crustal deformation that has left them first brittle and now highly fractured. Metamorphism, caused by high heat and pressure associated with deep burial in the crust, changed the texture and mineralogy of the original formations giving us today the hard schists and gneisses that are seen nearly everywhere in Maine and New England except where there are granitic rocks.

Like the numerous granites and gabbros that cooled slowly from intrusions of molten rock several miles beneath the ancient crust, the metamorphic rocks are water bearing only where they are fractured. This is quite in contrast to bedrock formations in other parts of the country, for example along the Atlantic coast south of New York City. Sandstone formations in this region are unmetamorphosed and therefore retain their original high potential for ground-water storage and transport in the open spaces and channels among the sand grains.

Characterization of Maine's bedrock ground-water resource is complicated by the nature of ground water flow through crystalline bedrock. This flow is controlled by the distribution and characteristics of brittle fractures in the bedrock. These brittle fracture systems cannot be mapped easily, and estimating their hydraulic properties is also difficult.

The Maine Geological Survey's bedrock ground water resources program collects, analyzes, and publishes information on bedrock wells drilled by commercial well drillers. The data is portrayed on a series of maps showing well yield, depth, and thickness of overburden. The information presented on these maps provides a first step towards evaluating and understanding Maine's bedrock ground water resources and may be used by agencies involved in ground-water protection and ground-water remediation, development permit review, and planning.

### Other Maps in the Bedrock Ground-Water Resources Series

In addition to the overburden thickness shown on this map, related maps showing well yield and well depth are also available. The ***well yield*** map shows bedrock well yields in gallons per minute (gpm). Bedrock wells in Maine most often yield relatively small quantities of water. Clusters of wells with yields of 10 gpm or more ***may*** define zones favorable for bedrock ground-water exploration. Other factors such as cost and borehole storage may determine the final acceptable yield for a well. Also, at the scale of these maps the brittle fractures that are the primary control on well yield may be smaller than the well symbol. For this reason, we have not attempted to outline zones of high yield wells, and want to emphasize that the yield data presented on the map should be used cautiously when evaluating potential well yields in an area.

The ***well depth*** map shows the completed depth of a well as reported by the well driller. For most domestic wells, it is the depth to which the driller goes in order to obtain the desired yield and/or provide adequate storage in the well for peak demand at the available yield. Total depth includes the thickness of overburden penetrated. Plotting the total depth of many water wells in an area shows the typical depth at which sufficient water usually can be obtained. The information may be helpful in assessing the general range of well depth necessary in a given region. It is also suggestive of geologic controls, both bedrock and surficial, that, if understood, can help in the selection of the most favorable well sites in the crystalline bedrock.

### Other Sources of Information


Tolman, S. S., 2010, Bedrock well yields in the Madawaska 30x60 minute quadrangle and portions of the Allagash and Van Buren 30x60 minute quadrangles: Maine Geological Survey, Open-File Map 10-60.

Tolman, S. S., 2010, Bedrock well depths in the Madawaska 30x60 minute quadrangle and portions of the Allagash and Van Buren 30x60 minute quadrangles: Maine Geological Survey, Open-File Map 10-58.

Caswell, W. B., 1987, Ground water handbook for the State of Maine (second edition): Maine Geological Survey, Bulletin 39, 135 p.


Significant aquifer maps (1:24,000) portray water-bearing sand and gravel aquifers and information about water wells.

Surficial geology maps (1:24,000) show the distribution of sediment types.

Surficial materials maps (1:24,000) provide information about overburden thickness and sediment type.

### Methods for locating wells on these maps

Wells shown on these maps were located in one of three ways: (a) matching the well ownership and well location information provided by the well drillers with property tax records in local town offices, transferring the well location from the tax map to a 1:24,000 U.S. Geological Survey quadrangle map, and digitizing the well location, (b) using valid E911 street addresses and plotting the well at the E911 address location, or (c) when a GPS location is provided by the driller, plotting the well at the GPS location. For wells located using the E911 address, the well is plotted on the road centerline. A comparison of well locations obtained by the first two methods above with GPS locations yielded a median error of 59 meters for the plotted well location (which is typically smaller than the map symbol), and less than 5-percent of the plotted locations were more than 500 meters from the GPS location.

The following towns and townships have not completed their E911 addressing. Wells that could be located using the E911 address have not been plotted for these towns and townships:

T15 R5 WELS
T15 R9 WELS
T16 R6 WELS
T16 R8 WELS

## Madawaska 30x60-minute Quadrangle

and portions of the Allagash and Van Buren 30x60 minute quadrangles


compiled by
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Open-File No. 10-59
2010



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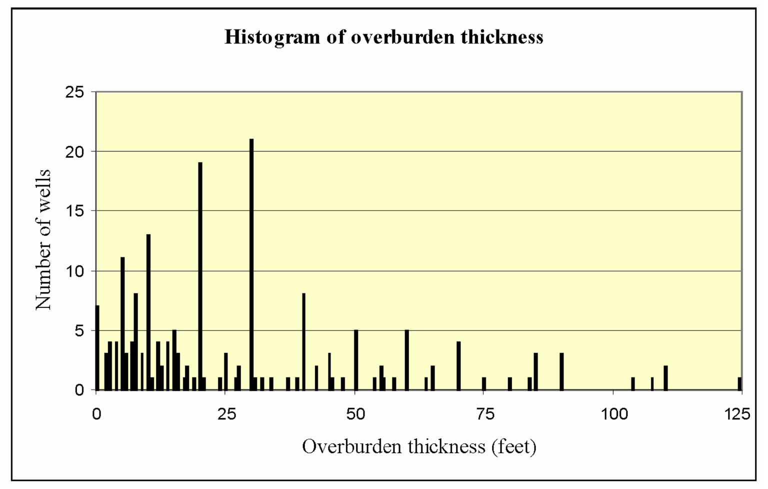
### OVERBURDEN THICKNESS

Overburden thickness is used by the driller to determine the length of casing needed to seal a well from direct infiltration of shallow ground water. Loose soil deposits (overburden) are a source of water not only for dug wells or well points, but also for bedrock wells. Permeable soil cover permits a greater rate of infiltration of precipitation and transmits this water downward to the bedrock. When a well in the bedrock is pumped, ground water from the overlying saturated overburden moves downward into the bedrock in response to the pumping and maintains the yield of the well. Thick, coarse-grained deposits are the most favorable for providing recharge to the bedrock ground water system.

Overburden thickness and type are related to ground water contamination as well as to yields. Because most purification processes take place in the unsaturated zone above a water table and in the loose sediment overlying the bedrock, overburden thickness is indicative of the susceptibility of local bedrock ground water system to pollution from surface sources of contamination. Bedrock overlain by thin, coarse-grained deposits is most susceptible to contamination.

A total of 187 wells are shown on the map at left. At the map scale of 1:150,000, wells in the more densely populated areas may plot at the same location. The median depth to bedrock for the wells shown is 20 feet. Half of the wells shown on the map have a depth to bedrock greater than the median and half have a depth to bedrock less than the median. The minimum reported depth to bedrock is 0 feet. The maximum reported depth to bedrock is 125 feet. The graph shown below is a histogram of depth to bedrock for wells shown on the map. This distribution of depths is characteristic of a highly skewed data set; there are many more wells with low and intermediate depths to bedrock (less than 25 feet) than wells with depth to bedrock greater than 25 feet.




### ANATOMY OF A DRILLED BEDROCK WELL

Using a drill rig, well drillers begin by drilling a hole about 9 inches in diameter through the overburden sediment overlying bedrock. When bedrock is encountered, drilling continues until intact bedrock is reached, generally between 10 and 20 feet. Steel casing is then installed in this hole and sealed to the bedrock. This casing seals the well from potential contaminants from surface infiltration. Drilling continues through the bottom of the casing until water-bearing fractures are encountered. Ground water fills the well to a level based on local geologic conditions. A submersible pump is then lowered into the well to bring water to the surface. The well casing protrudes out of the ground surface and is covered with a sanitary cap to prevent contamination. The water in the well above the pump is in storage and is available to be pumped out when needed. A bedrock well with low yield can still provide enough water for household use if the well boring itself holds enough water in storage to meet periods of peak demand.