Comprehensive Planning Resource Packages

March 2022

Geological information from the Maine Geological Survey

Lowell

Significant sand and gravel aquifer maps:

Foster, Lauren E. (Compiler), Smith, Troy T. (Compiler), and Locke, Daniel B. (Mapper), 2015, Significant sand and gravel aquifers in the Lincoln West quadrangle, Maine: Maine Geological Survey, Open-File Map 15-23, map, scale 1:24,000.

Maine Geological Survey, ----, The Lincoln East 7.5-minute quadrangle has been mapped for significant aquifers, but no significant aquifers were identified: --.

Foster, Lauren E. (Compiler), Smith, Troy T. (Compiler), and Baker, Edward B. (Mapper), 2001, Significant sand and gravel aquifers in the Passadumkeag quadrangle, Maine: Maine Geological Survey, Open-File Map 01-200, map, scale 1:24,000.

Neil, Craig D. (Compiler), and Locke, Daniel B. (Mapper), 1998, Significant sand and gravel aquifers in the Burlington quadrangle, Maine: Maine Geological Survey, Open-File Map 98-61, map, scale 1:24,000.

Surficial geology maps:

Lowell, Thomas V., 1980, Reconnaissance surficial geology of the Lincoln [15-minute] quadrangle, Maine: Maine Geological Survey, Open-File Map 80-12, map, scale 1:62,500.

Holland, William R., 1981, Reconnaissance surficial geology of the Winn [15-minute] quadrangle, Maine: Maine Geological Survey, Open-File Map 81-28, map, scale 1:62,500.

Borns, Harold W., Jr., 1981, Reconnaissance surficial geology of the Passadumkeag [15-minute] quadrangle, Maine: Maine Geological Survey, Open-File Map 81-4, map, scale 1:62,500.

Holland, William R., 1981, Reconnaissance surficial geology of the Saponac [15-minute] quadrangle, Maine: Maine Geological Survey, Open-File Map 81-26, map, scale 1:62,500.

Coastal geology maps:

Additional Coastal Geology Information Resources

Highest Astronomical Tide Line

1. Map viewer and data download
   https://www.maine.gov/dacf/mgs/hazards/highest_tide_line/index.shtml

Sea Level Rise

1. Scientific assessment of sea level rise and storm surge in Maine: Dickson, S.M., Slovinsky, P.A., and Kelley, J.T., 2020, Sea Level Rise and Storm Surge, *in*: Arnold, S., et. al., *Scientific Assessment of Climate Change and Its Effects in Maine*, Maine Science and Technology Subcommittee, Maine Climate Council, September 23, 2020, PDF or flipbook.
2. Sea Level Rise Ticker https://www.maine.gov/dacf/mgs/hazards/slr_ticker/index.html
3. Sea Level Rise Dashboard https://mgs-collect.site/slr_ticker/slr_dashboard.html
4. Sea level and storm surge map viewer and data download
   https://www.maine.gov/dacf/mgs/hazards/slr_ss/index.shtml

Coastal Sand Dune Geology

1. Description and uses https://www.maine.gov/dacf/mgs/pubs/mapuse/series/descrip-dunes.htm
2. Maps and data download https://www.maine.gov/dacf/mgs/pubs/online/dunes/dunes.htm

Beach Shoreline Change

1. Map viewer and data download
   https://www.maine.gov/dacf/mgs/hazards/beach_mapping/index.shtml

Coastal Structure and Dune Crest Overtopping

1. Map viewer and data download
   https://www.maine.gov/dacf/mgs/hazards/csdciop/index.shtml

Coastal Bluff Maps

1. Description and data download
   https://www.maine.gov/dacf/mgs/pubs/mapuse/series/descrip-bluff.htm

Coastal Landslide Hazard Maps

1. Description and data download
   https://www.maine.gov/dacf/mgs/pubs/mapuse/series/descrip-slide.htm

Maine Flood Resilience Checklist

1. Overview https://www.maine.gov/dacf/mgs/hazards/coastal/MaineFloodResilienceChecklistOverview.pdf
2. Checklist document: Sherwin, Abbie, 2017, Maine Flood Resilience Checklist; A self-assessment tool for Maine's coastal communities to evaluate vulnerability to flood hazards and increase resilience: Maine Geological Survey, Open-File Report 17-15, report 44 p. *Maine Geological Survey Publications*. 521. http://digitalmaine.com/mgs_publications/521

Maine Floodplain Mapping Program

1. Home page and link to FEMA https://www.maine.gov/dacf/flood/mapping.shtml
2. Map viewer https://maine.maps.arcgis.com/apps/webappviewer/index.html?id=3c09351397764bd2aa9ba385d2e9efe7

Hurricane Inundation

1. SLOSH map viewer and data download https://www.maine.gov/dacf/mgs/hazards/slosh/index.shtml

Coastal Hazards to Property

1. Homeowner's guide https://www.maine.gov/dacf/mgs/hazards/chg/index.html

Tsunami Hazards

1. Gulf of Maine https://www.maine.gov/dacf/mgs/hazards/tsunamis/index.shtml

Potential Tidal Marsh Migration

1. Map viewer and data download https://www.maine.gov/dacf/mnap/assistance/marsh_migration.htm

Living Shorelines along Coastal Bluffs

1. Demonstration projects https://www.maine.gov/dacf/mgs/explore/marine/living-shorelines/

Decision support tool and map viewer for Casco Bay (more areas coming)
https://www.maine.gov/dacf/mgs/hazards/living_shoreline/index.shtml

Landslide susceptibility:

General ground water information:

Caswell, W. Bradford, 1987, Ground water handbook for the State of Maine: Maine Geological Survey, Bulletin 39, 2nd edition, 135 p., 78 figs., 5 tables. *Maine Geological Survey Publications*. 180. http://digitalmaine.com/mgs_publications/180 .

Potential zones of high ground water transmissivity (bedrock):

Water well data base:

https://www.maine.gov/dacf/mgs/pubs/digital/well.htm

Sand and gravel aquifer map information

From the map explanation:

WHAT IS AN AQUIFER?

Ground water, as the name implies, is water found below the land surface in the pore spaces between sand grains and in fractures in the bedrock (see diagrams below). An *aquifer* is a water-bearing geologic formation capable of yielding a usable amount of ground water to a well. In Maine there are two types of aquifers; loose soil materials (such as sand, gravel, and other sediments) and fractured bedrock. A sand and gravel deposit is considered a *significant aquifer* when a well in that deposit is capable of being continuously pumped at a rate of 10 gallons per minute (gpm) or more. To sustain a yield of 10 gpm or more, a deposit must be permeable enough for water to flow readily into the well as it is pumped (see section on *porosity* and *permeability* below), and there must be a sufficient depth of water in the well so that it will not be pumped dry.

The diagram below shows a schematic cross section of a sand and gravel aquifer in Maine. The symbols above the diagram correspond to the well symbols shown on the map at left. Information typically shown for these wells includes type of well, depth to bedrock, depth to water, and well yield. The blue line in the diagram is the *water table*. The area below the water table is called the *saturated zone*, where all pore spaces between the sediment particles are filled with water. In order to yield water, a well must extend below the water table into the saturated zone. Notice that the water table corresponds to the water level in most wells and in the stream.

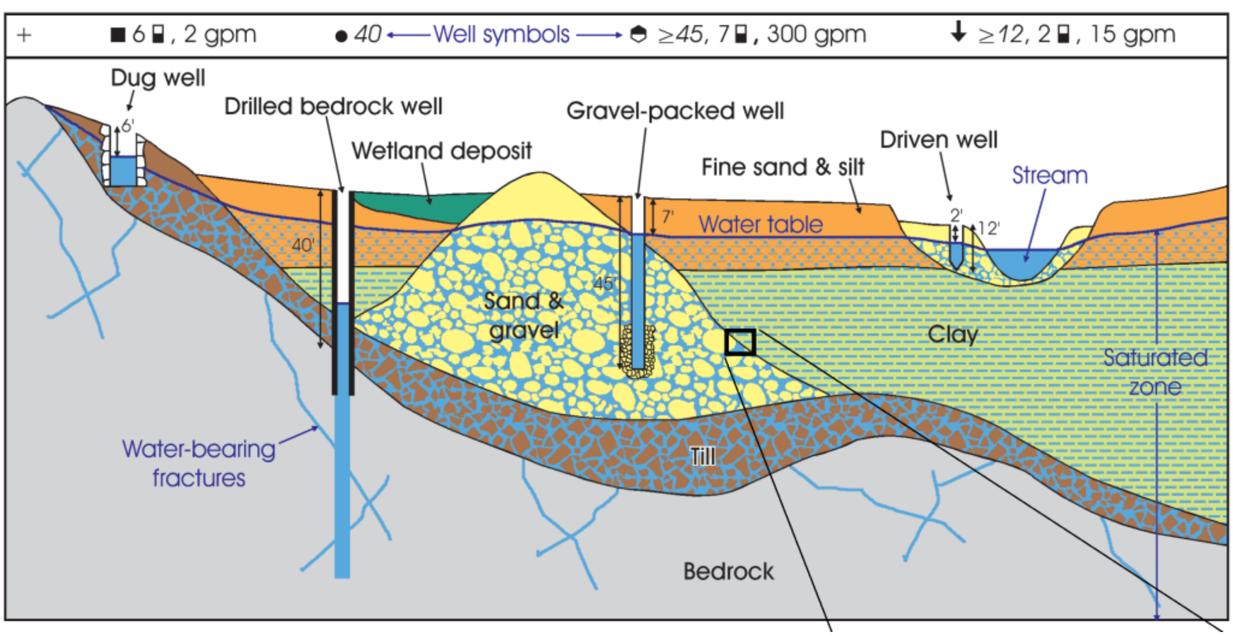
Several types of wells, common in Maine, are shown in the diagram. A *dug well* is a large diameter hole excavated by hand or backhoe. The hole is kept from caving in by installing a lining that may be stone, tile, or cement blocks. The hole must be deep enough to extend below the water table. The shallow dug well in the diagram has a yield of 2 gpm. Although the yield is often low, dug wells generally supply enough ground water for a household because of the large amount of water stored in the well.

A *gravel-packed* well is usually installed into coarse-grained sediment and is drilled with a much larger diameter than the final casing and screen diameter. To increase the yield and pumping efficiency of the well, the space around the well screen is filled with selected gravel that increases the permeability in the immediate vicinity of the well. The gravel-packed well in the diagram has a high yield of 300 gpm. Such high-yielding gravel-packed wells are commonly drilled for municipal or industrial water systems.

A *driven well* or *well point* can be installed into sand and gravel where the water table is within about 20 feet of the ground surface. A 2 to 3 inch diameter pipe, equipped with a well screen at its lower end, is driven into the deposit until the screen is below the water table. This pipe acts as a casing, and water is pumped directly from the aquifer. The driven well in the diagram has a significant yield of 15 gpm. Although the yield is relatively high, driven wells generally only supply a single household because very little water is stored in the well casing.

Wells of any type constructed in the other sediments shown in the diagram (clay or fine sand and silt) would yield some water, but yields would be lower than for wells in coarse-grained sand and gravel deposits.

Another type of well common in Maine is the *drilled bedrock well*. This well is drilled into the underlying rock with steel casing to isolate the well from potential surface-water contamination. In this type of well, water is found when the well hole intersects water-bearing fractures in the bedrock. Notice how the water level in this well is not the same level as the water table. The well casing isolates the bedrock well from the overlying sediments. The water level is controlled by water pressure in the fractures in the bedrock and is not related to the water table in the overlying materials.



Coastal bluff map information

What is a coastal bluff?

On this map, a bluff is defined as a steep shoreline slope formed in sediment (loose material such as clay, sand, and gravel) that has three feet or more of vertical elevation just above the high tide line. Cliffs or slopes in bedrock (ledge) surfaces are not bluffs and are not subject to significant erosion in a century or more. Beaches and dunes do not form bluffs, except along the seaward dune edge as a result of erosion. The map sidebar (pdf) contains additional information describing coastal bluffs.

Coastal Bluffs Maps

Coastal Bluffs Maps show the shoreline type and relative stability of bluffs along the Maine coast. The slope, shape, and amount of vegetation covering a coastal bluff and the adjacent shoreline are directly related to the susceptibility of the bluff face to ongoing erosion. For more information, read the map explanation (pdf) or link to our tips for reading coastal bluffs maps.

Uses of coastal bluff information

These maps can help identify shorelines with increased risk of coastal erosion. Bluff erosion can result in a landward shift of the top edge of the bluff. This shoreline change is a natural process that, by itself, is not a coastal hazard. Only when erosion threatens something of value, such as a building near the bluff edge, does bluff retreat become a hazard. Understanding local erosion rates can help determine the severity, and perhaps longevity, of coastal development along a bluff edge.

Additional information on coastal bluff maps:
http://www.maine.gov/dacf/mgs/pubs/mapuse/series/descrip-bluff.htm

Coastal landslide hazard map information

What are coastal landslide hazards?

Sea level is gradually rising along the coast of Maine. This rise in the ocean allows waves to erode beaches and flats at the base of coastal bluffs. Over time, erosion removes material from the base of a coastal bluff and steepens the face of the bluff. Sediments at the base of the bluff stabilize it, and when they are removed, the bluff is no longer in equilibrium. Only the strength of the material within the bluff holds the bluff in place. Continued erosion or lubrication of the bluff materials by ground water may overcome this internal resistance, particularly in clay bluffs, and result in a landslide. The map sidebar (pdf) contains additional information describing coastal landslide hazards.

Coastal Landslide Hazards Maps

Coastal Landslide Hazards Maps show locations of known landslides and areas of potential landslide hazard on bluffs along the Maine coast. The explanation describes factors influencing landslide risk. For more information, read the map explanation (pdf) or link to our tips for reading landslide hazard maps.

Uses of coastal landslide hazard information

This map provides an introduction to understanding landslide risk and guidance on what steps to take if the risk of a landslide is a concern in a particular coastal area. Landslides can occur in high coastal bluffs composed of muddy sediment. This landslide hazards map describes the internal stability of sediment bluffs.

Additional information on coastal hazards:
http://www.maine.gov/dacf/mgs/explore/marine/facts/coastal-hazard.htm

Surficial geology information

Surficial deposits are the unconsolidated earth materials that overlie bedrock. They cover a large percentage of the State and include sediments deposited by wind, water, and glacial ice. Glacial deposits are by far the most abundant surficial materials in Maine.

Consideration of surficial materials is important for land-use planning. The properties of these materials affect their values as aquifers, landfill or sewage disposal sites, construction sites, and sources of gravel and other resources.

> Glacial sand and gravel deposits: These coarse-grained deposits are often good groundwater aquifers; sources of gravel aggregate
>
> Glacial marine mud and lake deposits: these fine-grained deposits are poorly drained and are the material in which most landslides occur in Maine.

Further information can be found in Bulletin 44: Surficial geology handbook for southern Maine.

Landslide susceptibility maps

Maine Geological Survey

Landslide Sites and Areas of Landslide Susceptibility Maps

Read the map sidebar (pdf).
Read the map explanation (pdf).
List of **ONLINE** landslide susceptibility maps

What are areas of landslide susceptibility?

Landslides are a common geologic hazard in Maine. Although they usually occur on a small scale and cause minimal damage, recent increased damage from landslide activity in the state has raised awareness of this hazard and has demonstrated the need to examine the landslide threat on a regional basis. Areas susceptible to future landslides are mapped based on geologic and terrain-related risk factors. The primary geologic factor influencing landslide susceptibility is sediment grain size. Geologic mapping shows that a majority of earth movements occur in fine-grained sediments such as clay, silt, and mud, which are prone to move by slumping, sliding, or creep when saturated with water. The most important terrain-related risk factor influencing slope stability is the steepness of the slope. Additional terrain-related risk factors that increase landslide susceptibility include slope aspect, slope curvature, and local relief.

Landslide Sites and Areas of Landslide Susceptibility Maps

Landslide Susceptibility Maps show locations and types of known landslides and areas susceptible to future landslide activity in southern Maine. The map explanation (pdf) and map sidebar (pdf) contain additional information describing geologic and terrain-related factors influencing landslide risk.

Uses of landslide susceptibility information

This map can be used to identify areas with historical landslide activity and to identify areas that are susceptible to future landslide activity. In these areas, additional steps should be undertaken before construction or other development is started that could be at risk due to a future landslide.

Find additional information at: http://www.maine.gov/dacf/mgs/pubs/mapuse/series/descrip-slide-suscep.htm

All maps, reports, and digital data are available from the Maine Geological Survey http://www.maine.gov/dacf/mgs/

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