

Surficial Geologic Map of the Middlesex Fells Reservation and Some Surrounding Parts of the Boston North and Lexington, MA 7.5-minute Quadrangles

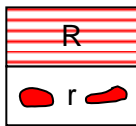
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Geology mapped and compiled in GIS format in 2005-2007 with continuing updates. The map area is contained in the 1956, 1971, and 2015 editions of the 7.5-minute Boston North, MA Quadrangle (1:24,000), 1985 Boston North, MA 7.5 x 15-minute Quadrangle (1:25,000 metric), and the 1909 Boston, MA 15-minute Quadrangle. The western edge of the map area includes a small portion of the 1956, 1971, and 2015 editions of the Lexington, MA 7.5-minute Quadrangle (1:24,000). The base map is a hill-shaded relief map based on 2015 MassGIS Lidar raster data with 1-meter resolution. The hillshade was produced with ESRI's Multi-Directional Hillshade Raster Function in ARCMAP 10.4 and then projected to 1983 NAD UTM zone 19T as the base map topography. Geologic map layers use UTM coordinates in zone 19T with either the 1927 or 1983 North American Datum. Transportation infrastructure adjacent to the Middlesex Fells is from the MassGIS MassDOT shape file with roads and rail lines (1983 NAD; last updated 2013). Trails and roads in the Middlesex Fells are from the MassGIS DCR Roads and Trails shape file (1983 NAD; last updated 2014). Water bodies and wetlands were traced as geologic units using the Lidar generated hill shaded base map as a guide and GPS coordinates collected in the field. In some places the map shows shoreline topography in areas mapped as open water because the Lidar data was obtained when reservoirs had very low levels. Mapping was done while water levels were higher.

DESCRIPTION OF MAP UNITS AND SYMBOLS

BEDROCK, WATER BODIES, AND ARTIFICIAL DEPOSITS



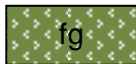
BEDROCK EXPOSURES - Ruled pattern (R) indicates areas where bedrock exposures are abundant or continuous, surficial cover is bedrock residuum or cover by till is consistently less than 6 ft (2m). Also included are areas where bedrock surfaces are interpreted to lie beneath artificial deposits and features. Small isolated areas of bedrock exposure in areas with thick surficial cover (r) are shown as solid red spots.



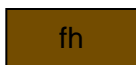
WATER BODIES – ponds, lakes and rivers outlined on base map.



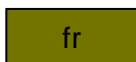
CONSTRUCTION FILL - Land concealed or formed as a result of construction of buildings.



GRADED AREAS - Land concealed or formed by grading of land surface for parks, parking lots, and other open areas along with construction of adjacent buildings.



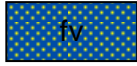
FILL FOR ROAD AND HIGHWAY CONSTRUCTION - Land concealed or formed as a result of road or highway construction.



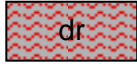
FILL FOR RAILROAD CONSTRUCTION - Land concealed or formed as a result of railroad or trolley line construction.



ARTIFICIAL FILL AND CONSTRUCTION FOR DAMS - Land concealed or formed as a result of construction of dams.

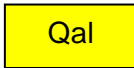


RESRVOIR FILL - Land concealed or formed as a result of filling of reservoirs. This occurs at the Fells Reservoir in the southwest Fells.



ROCK WASTE FROM QUARRIES, MINES, AND CONSTRUCTION - Thick deposits of bedrock spoils made of mostly angular pebbles to boulders.

POSTGLACIAL ALLUVIAL, PALUDAL, AND MASS MOVEMENT DEPOSITS



ALLUVIUM (HOLOCENE) - Sand, silt, and gravel with varying amounts of organic sediment in areas flooded in most years by modern streams. Generally, not greater than 5 ft (1.5 m) thick.



ALLUVIAL FAN DEPOSITS (HOLOCENE AND PLEISTOCENE) - Silt to boulders with varying amounts of organic sediment in alluvial fans derived from erosion of surficial deposits and bedrock. Up to 20 ft (6 m) thick.



SWAMP DEPOSITS (HOLOCENE AND PLEISTOCENE) - Muck, peat, and minor amounts of clay to sand. Generally less than 5 ft (1.5 m) thick but may be as much as 10 ft (3 m) beneath some large wetlands and ponds. Deposition may have been aided by prehistoric beaver dams and clear-cutting by humans.

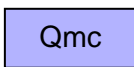


BOULDER COLLUVIUM (HOLOCENE AND PLEISTOCENE) - Bouldery deposits with a matrix of finer clastic and organic sediment derived from mass movement of glacial sediment with a secondary amount of bedrock derived debris. Up to 10 ft (3 m) thick.



BEDROCK COLLUVIUM (HOLOCENE AND PLEISTOCENE) - Angular to subangular pebbles to boulders with little or no matrix. Deposits are found at the base of steep bedrock slopes and derived from mass movement of bedrock. May be gently dipping or steep (talus). Up to 10 ft (3 m) thick.

GLACIAL DEPOSITS FROM THE LAST (LATE WISCONSINAN) GLACIATION



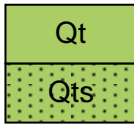
GLACIOMARINE FINE SAND, SILT, AND CLAY (“BOSTON BLUE CLAY”) – Mostly silt and clay beds of glaciomarine origin with varying composition. Unit may be cemented in places to form calcium carbonate concretions and may contain marine shells. No surface exposures are known but it commonly occurs in excavations and borings. This unit was excavated from pits in the lowland areas along the Mystic River and on the Tufts University campus (across the street from Cousens Gymnasium) until the 1940’s for the manufacturing of bricks and pottery. May be up to 100 ft (30 m) thick or more beneath sections of Boston Harbor.



GLACIOMARINE DELTAS AND NEARSHORE SAND AND GRAVEL DEPOSITS (UNDIVIDED) - Fine sand to cobbly pebble gravel. Deltaic topset, foreset, and bottomset beds deposited in glacial marine deltas and as nearshore sand and gravel deposits. Mostly small deltaic deposits at the mouths of small tributaries where outwash streams entered the ocean or where meltwater streams exited from beneath the receding glacier. Sand and gravel also occur along the margin of the bedrock upland where wave activity reworked glacial sediment. Up to 50 ft (15 m) and possibly thicker.

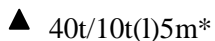


END MORaine DEPOSITS - Loose, stony to very bouldery diamicton and poorly sorted sand and gravel. Topographic expression and steepness of deposits may be accentuated by meltwater channels on their outer edges. Associated with ice front positions south of Spot Pond, along the south side of Ravine Road in Malden and Melrose and south of South Reservoir. Up to 50 ft (15 m) thick.



TILL AND SANDY TILL – Medium to dark gray, stony diamicton, dominantly till. Till matrix varies from sandy clayey silt derived from eroded preglacially weathered or micaceous rock formations to mostly sand (sandy till, Qts) derived from eroded coarse-grained igneous rocks and gneiss. In places the till is also composed of reworked preglacially weathered bedrock, especially gabbro. The drumlins in the southern part of the Boston North Quadrangle are composed of at least two till units, sometimes separated by sand and gravel and a weathered interval on the lower till, and were deposited during more than one glaciation (Newman and others, 1990). This stratigraphy has been recorded in borings in the drumlins and wave-cut bluffs along the sides of the drumlins in Boston Harbor. No attempt has been made here to map separate till units. Boulder accumulations at the till surface in some areas are due to erosion. Only mapped where thickness consistently exceeds 6 ft (2 m). At least 180 ft (55 m) thick where it occurs in drumlins in Chelsea and Revere.

MAP SYMBOLS



Exposure of natural surficial deposit with record of lithologies and thicknesses. Key to materials is given below.

Materials classification in natural and artificial exposures, and in well/boring records. Non-number symbols indicate lithologies in order of dominance and their special characteristics. Numbers indicate the maximum thickness of units in feet. Symbol groups separated by slashes indicate superposed units from top to bottom. Thin units or small exposures (less than 3 ft) shown without thicknesses. Observations are at exposure location symbol, in gravel pit, or at well/boring location.

- b - boulders
- c - cobbles
- p - pebbles
- s - sand
- m - silt and clay with fine sand
- o - peat or muck
- g - undifferentiated gravel
- r - rock (w) - preglacially weathered
- # - collapse structure created by deposition in contact with ice.
- * - sediment deformed by overriding ice.

- t - till or colluviated till
- Special till characteristics:
- (b) - bouldery
- (s) - sandy as a result of bedrock source
- (l) - composed of reworked clay and silt
- (g) - composed of reworked gravel and sand
- (o) - composed of preglacially weathered rock
- (x) - pre-Wisconsinan till



Locations where bedrock surface has interesting or unusual properties.



Position of photographic image of landscape or a view of the surrounding terrain.



Bedrock quarry or mine, only areas of large excavations outlined with dashed line. Letter abbreviations for deposits types: f - felsite, g - granite, G - gabbro, m - metasedimentary rock, d - dolerite.



Abandoned bedrock quarry, only areas of large excavations outlined with dashed line. Letter abbreviations for deposits types: f - felsite, g - granite, G - gabbro, m - metasedimentary rock, d - dolerite.



Gravel pit, only areas of large pits outlined with dashed line. Key to materials is given above.



Abandoned gravel pit, only areas of large pits outlined with dashed line. Key to materials is given above.
























Abandoned mine shaft on Silvermine Hill in the Middlesex Fells Reservation.



Exposure of preglacially weathered rock or saprolite (up to 10 m exposed). The only area of exposures is in the Medford Gabbro in the southern Fells.

Glacially transported boulders with a maximum dimension of 2 meters or more. Colors indicate rock types. Circle size indicates maximum boulder axis starting at 2 m with circles getting progressively larger for every 0.5-2 m up to 9 m.

	felsic (rhyolite to dacite) volcanic rock		2.0 m
	metabasalt as dark hornfels with vein structure		2.5 m
	dolerite and basalt dike rocks		3.0 m
	coarse-grained dark igneous rock (gabbrodiorite to gabbro)		3.5 m
	white to pink diorite, tonalite, granodiorite or granite with fine to medium grain size		4.0 m
	coarse-grained granodiorite to granite		4.5 m
	dark reddish-orange alkali granite and syenite		5.0 m
	metasedimentary rock (quartzite and argillite)		5.5 m
	high grade metamorphic rock with coarse mica (mostly gneiss)		6.0 m
	others not from Fells – coarse syenite porphyry (1)		7.0 m
			9.0 m



Meltwater spillway or nickpoint that served as a base level control for a glacial lake or glacial stream system. Map unit abbreviation may give unit formed by meltwater graded to spillway.



Abandoned glacial meltwater channel.



Crests of successive, closely-spaced till ridges in Sheepfold Park that are thought to be either annual moraines or subglacial till ridges. The spacing of the ridges suggests annual moraines but the ridges are subtle (not discernable in the field) and have only been seen on LiDAR imagery.



Ice flow direction inferred from striations, grooves, and rattails on bedrock. Observation at dot at center of arrow. Label indicates ice flow direction in degrees east or west of due south.



Drumlin or streamlined till surface. Long axis trend and inferred ice flow direction shown with line. (None occur in the Fells.)

CONVERSION TABLE

<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>
1	3.2808	9	29.527
2	6.5617	10	32.808
3	9.8425	20	65.616
4	13.123	30	98.424
5	16.404	40	131.23
6	19.685	50	164.04
7	22.965	100	328.08
8	26.246		

REFERENCES

Newman, W.A., Berg, R.C., Rosen, P.S., and Glass, H.D., 1990, Pleistocene stratigraphy of the Boston Harbor drumlins, Massachusetts: Quaternary Research, v. 34, p. 148-159.