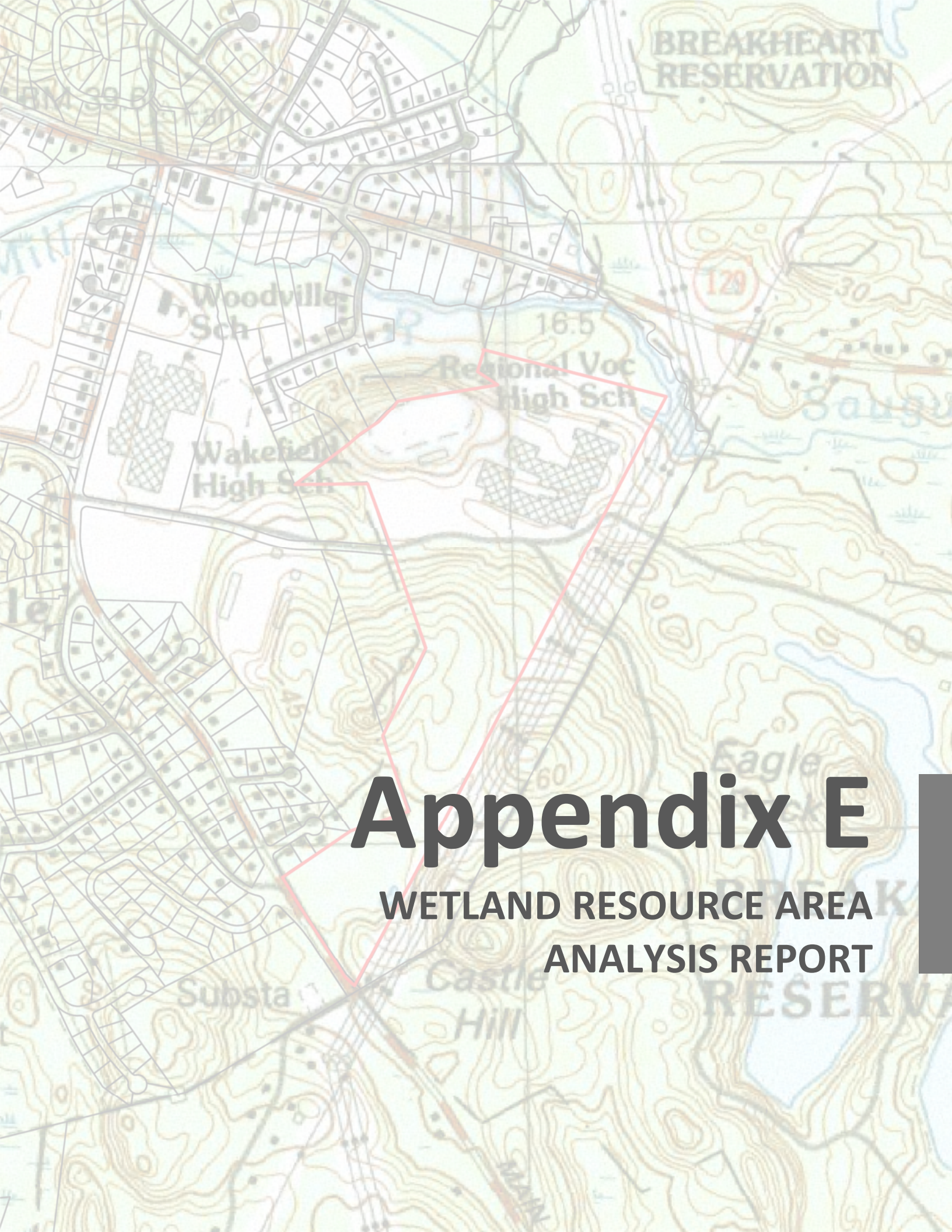




Appendix E

**WETLAND RESOURCE AREA
ANALYSIS REPORT**

April 3, 2020

Email (dseguin@nitscheng.com)

Mr. Denis Seguin, PLS
Nitsch Engineering
2 Center Plaza, Suite 430
Boston, MA 02108

**Re: Wetland Resource Area Analysis Report
Northeast Metro Technical High School
100 Hemlock Road
Parcel ID: 40A-000-0RS
Wakefield, Massachusetts**

[LEC File #: NEI20-009.04]

Dear Mr. Seguin:

Pursuant to your request, LEC Environmental Consultants, Inc., (LEC) conducted a site evaluation and Wetland Resource Area boundary determination at the Northeast Metro Technical School located at 100 Hemlock Road (Parcel ID: 40A-000-0RS) in Wakefield, Massachusetts. Our site evaluation was conducted in accordance with the *Massachusetts Wetlands Protection Act* (Act, M.G.L. c. 131, s. 40), its implementing Regulations (Act Regulations, 310 CMR 10.00); and the criteria provided in *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* (March 1995) and *Field Indicators for Identifying Hydric Soils in New England* (Version 4, May 2018, the *Field Indicators Guide*). The Town of Wakefield does not administer a Wetland Protection Bylaw. The following report provides a general site description, wetland delineation methodology, and a description of the Wetland Resource Areas and potential regulatory implications.

General Site Description

The 60± acre site is located south of Water Street (Route 129), southeast of Wiley Street, east of the Wakefield Memorial High School and Woodville School, east and north of Farm Street, and west of the Wakefield/Saugus municipal boundary, within the eastern portion of Wakefield, Massachusetts (Attachments, Figure 1). Residential development associated with Wiley Street, Water Street, and Farm Street is located northwest, northeast, west, and southwest of the site. The Commonwealth of Massachusetts' Breakheart Reservation, including undeveloped forested and scrub-shrub uplands and wetlands, is located directly north and east of the site. Located off site within the Reservation, the Saugus River occurs to the north and the New England Power Company right-of-way parallels the property boundary to the east of the site.

LEC Environmental Consultants, Inc.

www.lecenvironmental.com

12 Resnik Road
Suite 1
Plymouth, MA 02360
508-746-9491
508-746-9492 (Fax)

PLYMOUTH, MA

380 Lowell Street
Suite 101
Wakefield, MA 01880
781-245-2500
781-245-6677 (Fax)

WAKEFIELD, MA

100 Grove Street
Suite 302
Worcester, MA 01605
508-753-3077
508-753-3177 (Fax)

WORCESTER, MA

P. O. Box 590
Rindge, NH 03461
603-899-6726
603-899-6726 (Fax)

RINDGE, NH

The Northeast Metro Technical School and associated site amenities are located within the northern portion of the site, while open space areas are generally located within the southern portion of the site. Paved parking areas surround the school building, while athletic fields including a football field/track, tennis/basketball courts, softball/baseball fields, and a practice field, are located north and west of the school building. Access to the site is provided via Hemlock Road, which extends easterly from Farm Street to the paved parking areas of the School. Parking for and pedestrian access to the Reservation is provided on school property. Undeveloped lands containing forested uplands and wetlands are located within the western corner and the southern portion of the site. A series of dirt foot paths occur within the forested southern portion of the site and connect to the Breakheart Reservation trail system.

Topography within the developed portions of the site is generally flat. Topography descends steeply along a fill slope from the developed portion of the site to the west. Topography within the southern, undeveloped portion of the site is rolling, with topography generally descending northerly toward Hemlock Road and southerly into low-lying forested wetlands. Rocky outcrops occur throughout the forested uplands (see Photo 1.).



Photo 1. Representative photo of a rocky outcrop within the forested upland.

Vegetation within the forested upland portions of the site include a canopy dominated by eastern white pine (*Pinus strobus*) and northern red oak (*Quercus rubra*), with white oak (*Quercus alba*), black cherry (*Prunus serotina*), red maple (*Acer rubrum*), hickory (*Carya* sp.), and yellow birch (*Betula alleghaniensis*). The understory contains saplings from the canopy, witch hazel (*Hamamelis virginiana*), sapling sassafras (*Sassafras albidum*), entanglements of oriental bittersweet (*Celastrus orbiculatus*), and individuals of spicebush (*Lindera benzoin*). The ground cover includes

lowbush blueberry (*Vaccinium angustifolium*), huckleberry (*Gaylussacia* sp.), bracken fern (*Pteridium aquilinum*), cinnamon fern (*Osmunda cinnamomea*), wintergreen (*Gaultheria procumbens*), sheep laurel (*Kalmia latifolia*), and partridge berry (*Mitchella repens*).

According to the Natural Resource Conservation Service (NRCS) Soil Survey (Web Soil Survey and Middlesex County, Massachusetts, Version 19, September 12, 2019), the developed portions of the site include predominantly Urban Land soil and Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky. The forested upland portions of the site contain predominantly Rock outcrop-Hollis complex, 3 to 35 percent slopes. The forested wetland portions of the site contain predominantly Swansea muck, 0 to 1 percent slopes; Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony; and Freetown muck, 0

to 1 percent slopes, ponded. Forested wetlands also occur within low-lying areas and depressions containing Rock outcrop-Hollis complex, 3 to 35 percent slopes; Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes; and Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes.

NRCS describes Urban Land soils as areas where 85 percent of the land surface is covered by structures or impervious surfaces. Charlton-Urban land-Hollis complex, rocky soils are described as nearly level to rolling complex consisting of very deep, well drained Charlton soils; areas of Urban land, and shallow, somewhat excessively drained Hollis soils on uplands. Rock outcrop-Hollis complex soils are described as rolling to steep, shallow, somewhat excessively drained Hollis soils and exposed bedrock. Swansea muck soils are described as very deep, nearly level, very poorly drained soils in depressions or in low, level areas. Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony soils are described as very deep, gently sloping, poorly drained soils in upland depressions and drainageways. Freetown muck soils are described as very deep, nearly level, very poorly drained organic soil in depressions and along streams and rivers. Charlton-Hollis-Rock outcrop complex soil is described as gently sloping very deep and shallow soils on uplands where the relief is affected by the underlying bedrock. Hollis-Rock outcrop-Charlton soils are described as areas of exposed bedrock and moderately steep, shallow and very deep soils on hills and ridges where the relief is highly affected by the underlying bedrock.

Utilizing a hand-held, Dutch-style auger, LEC inspected soils conditions within the forested upland and generally observed an 8-inch thick, loamy sand topsoil (A horizon) with a soil matrix color of 10YR 2/2, underlain by a 5-inch thick, loamy sand subsurface horizon (AB horizon) with a soil matrix color of 10YR 3/3. The subsurface horizon is underlain by a 7-inch thick, loamy sand subsoil (B_w horizon) with a soil matrix color of 2.5Y 4/3 up to a depth of 20 inches. No redoximorphic features were observed within the soil profile. LEC also inspected soil conditions within the forested upland along the BVW boundary and observed a 6-inch thick loamy sand topsoil (A horizon) with a soil matrix color of 10YR 2/2. The topsoil is underlain by a 7-inch thick sandy subsoil (B_w horizon) with a soil matrix color of 10YR 3/4. The subsoil is underlain by a historically buried, mucky loamy sand topsoil (A_b horizon) with a soil matrix color of 10YR 2/1. No redoximorphic features were observed within the soil profile. These soil profiles are not considered hydric in accordance with the *Field Indicators Guide*.

Natural Heritage and Endangered Species Program (NHESP) Designation

According to the 14th Edition (effective August 1, 2017) of the Natural Heritage Endangered Species Program (NHESP) *Massachusetts Natural Heritage Atlas* and the MassGIS data layer, the site is not located within *Estimated Habitat of Rare Wildlife* or *Priority Habitat of Rare Species*. While there are no mapped certified vernal pools (CVPs) or potential vernal pools (PVPs) on the site, an offsite CVP abuts the eastern property boundary, southeast from the School building within wetland Series-6; and 200± feet east from the southeast corner of the site.

Floodplain Designation

According to the June 4, 2010 *Federal Emergency Management Agency Flood Insurance Rate Map* for Middlesex County, Massachusetts (Map Number: 25017C0431E), the site is located within Zone X

[unshaded]: *Areas determined to be outside the 0.2% annual chance floodplain* (Attachment, Figure 3). As a result, no portion of the site is located within the 100-year floodplain.

Wetland Boundary Determination

On March 18 and 23, 2020, LEC conducted a site evaluation to identify and characterize existing protectable Wetland Resource Areas located within or immediately adjacent to the site, and to delineate the outermost resource area boundaries. The extent of Wetland Resource Areas was determined through observations of existing plant communities, hydrologic indicators, and bankfull indicators in accordance with the *Act* and the *Act Regulations*.

Based on our observations, LEC determined that the Wetland Resource Areas associated with the site include Bordering Vegetated Wetland (BVW), Isolated Vegetated Wetland (IVW), Bank associated with an Intermittent Stream, and Riverfront Area associated with the Saugus River. The 100-foot Buffer Zone extends from BVW and Bank boundaries, while the 200-foot Riverfront Area extends from the off-site Saugus River Bank-MAHW boundary. LEC demarcated the BVW/IVW boundaries with sequentially-numbered, blaze orange surveyor's tape with the words "LEC Resource Area" printed in black. LEC flagging stations 1-1 through 1-43, 3-1 through 3-12, 6-1 through 6-8, 7-1 through 7-6, 8-1 through 8-29, 9-1 through 9-20, and 10-1 through 10-4 demarcate the BVW boundaries. LEC flagging stations 2-1 through 2-9, 3A-1 through 3A-6, 4-1 through 4-6, and 5-1 through 5-8 demarcate the IVW boundary.

LEC demarcated the Bank to intermittent stream boundary with sequentially-numbered, blaze blue surveyor's tape. Flagging stations B1 through B11 demarcate the Bank to intermittent stream.

The Bank-MAHW line to the Saugus River occurs off-site along the northern property boundary and within an emergent marsh. At the time of LEC's evaluation, safe access through the marsh to establish the Bank-MAHW line to the Saugus River was not possible. Therefore, the MAHW line will be approximated by Nitsch Engineering based on orthoimagery.

Bordering and Isolated Vegetated Wetlands

Bordering Vegetated Wetlands (BVW)

According to the *Act Regulations* [310 CMR 10.55(2)] Bordering Vegetated Wetlands are defined as: *freshwater wetlands which border on creeks, rivers, streams, ponds, and lakes...Bordering Vegetated Wetlands are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants...The boundary of Bordering Vegetated Wetlands is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist.*

Six (6) BVWs associated with intermittent streams, and one (1) BVW associated with the Saugus River are associated with the site. Wetland Series-1, Series-3, and Series-9 are characterized as forested, red maple swamps, and occur within the southern portion of the site (Series-1 and Series-3) and within the northern portion of the site (Series-9). The eastern boundary of Series-1 (see Photo 2.) generally occurs at the bottom of a rock fill slope. Surface water within Series-1 flows northwesterly into an intermittent stream which discharges off site into a culvert. During periods of high flow, surface water within Series-3 (See Photo 3.) overflows southerly into a manmade channel (intermittent stream) that dissipates further downhill. The Series-9 wetland receives roadway drainage from an upgradient culvert, which flows northwesterly into the forested wetland/intermittent stream located at the toe-of-rock fill slope to the western baseball field. The stream turns westerly and continues offsite.



Photo 2. View of forested Series-1 BVW



Photo 3. Northerly view of Series-3 BVW

Vegetation within the forested wetlands include a canopy dominated by red maple (*Acer rubrum*), with yellow birch (*Betula alleghaniensis*), ash (*Fraxinus* sp.), American elm (*Ulmus Americana*), gray birch (*Betula populifolia*), and eastern white pine (*Pinus strobus*). The understory includes saplings from the canopy, spicebush (*Lindera benzoin*), highbush blueberry (*Vaccinium corymbosum*), sweet pepperbush (*Clethra alnifolia*), winterberry holly (*Ilex verticillata*), northern arrowwood (*Viburnum dentatum*), speckled alder (*Alnus rugosa*), and glossy buckthorn (*Frangula alnus*). The ground cover includes cinnamon fern (*Osmunda cinnamomea*), skunk cabbage (*Symplocarpus foetidus*), sphagnum moss (*Sphagnum* sp.), and seedlings from the canopy.

The remaining BVWs (Series-6, Series-7, Series-8, and Series-10) are characterized as scrub-shrub wetlands. Series-6 and Series-7 occur along the eastern site boundary and are associated with an intermittent stream which originates offsite to the east, flows westerly through Series-6 and into an underground culvert, before daylighting through a culvert to the north and flowing easterly through Series-7 (see Photo 4.). Series-8 is associated with the Saugus River. Immediately adjacent to the site, the Series-8 BVW is characterized as a forested and a scrub-shrub wetland (see Photo 5.). It occurs within the northeast corner of the site and continues offsite along the northern site boundary and to the east within Breakheart Reservation. It generally occurs along the toe-of-rock fill slope to the developed

portion of the site. Series-10 occurs along the east-central property boundary and is associated with an offsite intermittent stream located within the New England Power Company right-of-way to the east.



Photo 4. Easterly view of Series-7 scrub-shrub BVW and Intermittent Stream.



Photo 5. Easterly view of Series-8 scrub-shrub

Vegetation within the scrub-shrub wetlands includes a sapling/shrub layer of sapling red maple, sapling willow (*Salix* sp.), highbush blueberry, glossy buckthorn, speckled alder, sweet pepperbush, elderberry (*Sambucus nigra*), dogwood (*Cornus* sp.), northern arrowwood, winterberry holly, and maleberry (*Lyonia ligustrina*). The ground cover includes sensitive fern (*Onoclea sensibilis*), sheep laurel (*Kalmia latifolia*), wintergreen, and skunk cabbage. Vegetation within the forested portion of Series-8 is similar to the forested BVWs described above.

LEC inspected soil conditions within the BVWs using a hand-held Dutch-style soil auger and observed a 20-inch thick mucky, loamy sand topsoil (A horizon) with a soil matrix color of 10YR 2/1 and redoximorphic concentrations with a color of 5YR 3/4 starting at 8 inches. This soil profile meets the Dark Surface (S7.) indicator for a hydric soil according to the *Field Indicators Guide*. At times, LEC also observed a 12-inch thick, loamy sand topsoil (A horizon) with a soil matrix color of 10YR 3/1. The topsoil is underlain by an 8-inch thick, loamy sand subsoil (B horizon) with a soil matrix color of 7.5YR 2.5/1. This soil profile also meets the Dark Surface (S7.) indicator for a hydric soil according to the *Field Indicators Guide*.

Isolated Vegetated Wetlands

Four (4) IVWs are located within depressions along the eastern property boundary within the southern portion of the site.

Wetland Series-2 is characterized as a wet meadow and occurs along a shallow, concave area at the intersection of two (2) foot paths located along the southeastern site boundary (see Photo 6.). Vegetation within the wet meadow includes a sparse sapling layer of red maple and a few entanglements of oriental bittersweet along the perimeter. The ground cover includes sedge (*Carex* sp), rushes (*Juncus* sp), and sphagnum moss.

Series-5 is a scrub-shrub IVW located at the bottom of a depression at the edge of the New England Power Company right-of-way along the eastern site boundary (see Photo 7.). At the time of LEC's evaluation, the IVW contained roughly 8 to 12 inches of standing water. Vegetation within Series-5 includes a sapling/shrub layer around its perimeter consisting of sapling red maple, highbush blueberry, and sweet pepperbush. The IVW is not vegetated in its center where standing water occurs.



Photo 6. Southerly view of Series-2 wet meadow IVW.



Photo 7. Easterly view of Series-5 scrub-shrub IVW.

Series-3A and Series-4 are forested IVWs also located at the bottom of depressions. Vegetation within the forested IVWs is similar to the composition of the forested BVWs described above.

LEC inspected soil conditions within the BVWs using a hand-held Dutch-style soil auger and observed an 8-inch thick, loamy sand topsoil (A horizon) with a soil matrix color of 10YR 2/1, underlain by a depleted, loamy sand subsoil (B_g horizon) with soil matrix color of 10YR 4/2 and redoximorphic concentrations with a color of 7.5YR 4/4. This soil profile meets the Depleted Below Dark Surface (A11.) indicator for a hydric soil according to the *Field Indicators Guide*.

Bank to Intermittent Stream Status

According to *Act Regulations* [310 CMR 10.54(2)] Bank is defined as *the portion of the land surface which normally abuts and confines a water body. It occurs between a water body and a vegetated bordering wetland and adjacent flood plain, or, in the absence of these, it occurs between a water body and an upland... The upper boundary of a Bank is the first observable break in the slope or the mean annual flood level, whichever is lower. The lower boundary of a Bank is the mean annual low flow level.*

Intermittent streams occur within and/or downgradient to each BVW (Series-1, Series-3, Series-6, Series-7, Series-9, and Series-10). The stream channels vary in width (ranging from 2 to 8 feet wide) with Bank heights ranging from 6 to 12-inch tall. The streams bottoms are cobble lined (Series-9) or contain mucky, leaf-littered substrate (Series-1, Series-3, Series-6, Series-7, Series 10), and the Banks are comprised of a mucky/rocky substrate vegetated with forbs, shrubs, saplings, and trees.

Intermittent Stream Status

According to the *Act Regulations* [310 CMR 10.58 (2)(a)(1)] a. a river or stream shown as perennial on the current United States Geological Survey (USGS) or more recent map provided by the Department is perennial. b. A river or stream shown as intermittent or not shown on the current USGS map or more recent map provided by the Department, that has a watershed size greater than or equal to one square mile, is perennial. c. a stream shown as intermittent or not shown on the current USGS map or more recent map provided by the Department, that has a watershed size less than one square mile, is intermittent unless: i. The stream has a watershed size of at least $\frac{1}{2}$ (0.50) square mile and has a predicted flow rate greater than or equal to 0.01 cubic feet per second at the 99% flow duration using the USGS Stream Stats method. The issuing authority shall find such streams to be perennial;



Photo 8. Westerly view of Intermittent Stream in Series-6 BVW.

LEC utilized the USGS water resources web application, StreamStats, to calculate the contributing watershed area and 99% flow duration for the stream associated with the Series-6 and Series-7 BVWs. This stream is tributary to the Saugus River (see Photo 8.). Based on the attached StreamStats Statistics Report, the contributing watershed area of 0.36 square miles is less than the minimum 0.50 square mile threshold required for a perennial stream determination. Therefore, the Intermittent Stream Status is confirmed.

Bank-Mean Annual High Water

According to the *Act Regulations*, Mean Annual High Water (MAHW) is defined as *the line that is apparent from visible markings or changes in the character of soils or vegetation due to the prolonged presence of water and that distinguishes between predominantly aquatic and predominantly terrestrial land. Field indicators of bankfull conditions shall be used to determine the mean annual high-water line. Bankfull field indicators include but are not limited to: changes in slope, changes in vegetation, stain lines, top of pointbars, changes in bank materials, or bank undercuts...* [the *Act Regulations*, 310 CMR 10.58(2)(a)(2)].

The Saugus River is located off site and meanders easterly along the northern property boundary within a flooded scrub-shrub wetland. As noted above, the Saugus River was inaccessible so the Bank-MAHW Line will be estimated by Nitsch Engineering based on orthoimagery.



Riverfront Area

Riverfront Area is defined in the *Act Regulations*, 310 CMR 10.58 2(a), as *the area of land between a river's mean annual high-water line and a parallel line measured horizontally 200 feet away*.

Riverfront Area extends 200 feet horizontally from the approximate Bank-MAHW line of the Saugus River and primarily includes the adjacent BVW and forested uplands located within the northeast corner of the site.

Summary

LEC conducted a site evaluation and wetland delineation on March 18, and 23, 2020 to determine the extent of Wetland Resource Areas subject to jurisdiction under the *Act* and the *Act Regulations*. Based on our site evaluation and review of pertinent maps, LEC determined that the on-site Wetland Resource Areas include BVW, IVW, Bank to Intermittent Stream, their associated 100-foot Buffer Zones and Riverfront Area. Any work proposed within these resource areas and/or their corresponding Buffer Zone will require compliance with performance standards enumerated in the *Act Regulations* and filing for the appropriate permits with the Town of Wakefield Conservation Commission and/or the Massachusetts Department of Environmental Protection, and may require additional wetlands permitting depending on the extent and scope of work.

Thank you for the opportunity to provide these services. Should you have any questions or require additional information, do not hesitate to contact me in our Worcester office at 508-753-3077 or at akendall@lecenvironmental.com.

Sincerely,

LEC Environmental Consultants, Inc.

Andrea Kendall
Senior Environmental Scientist

Julia Hooageboom
Wetland Specialist

alk: projects\20-009 NEI WRAA

Attachments

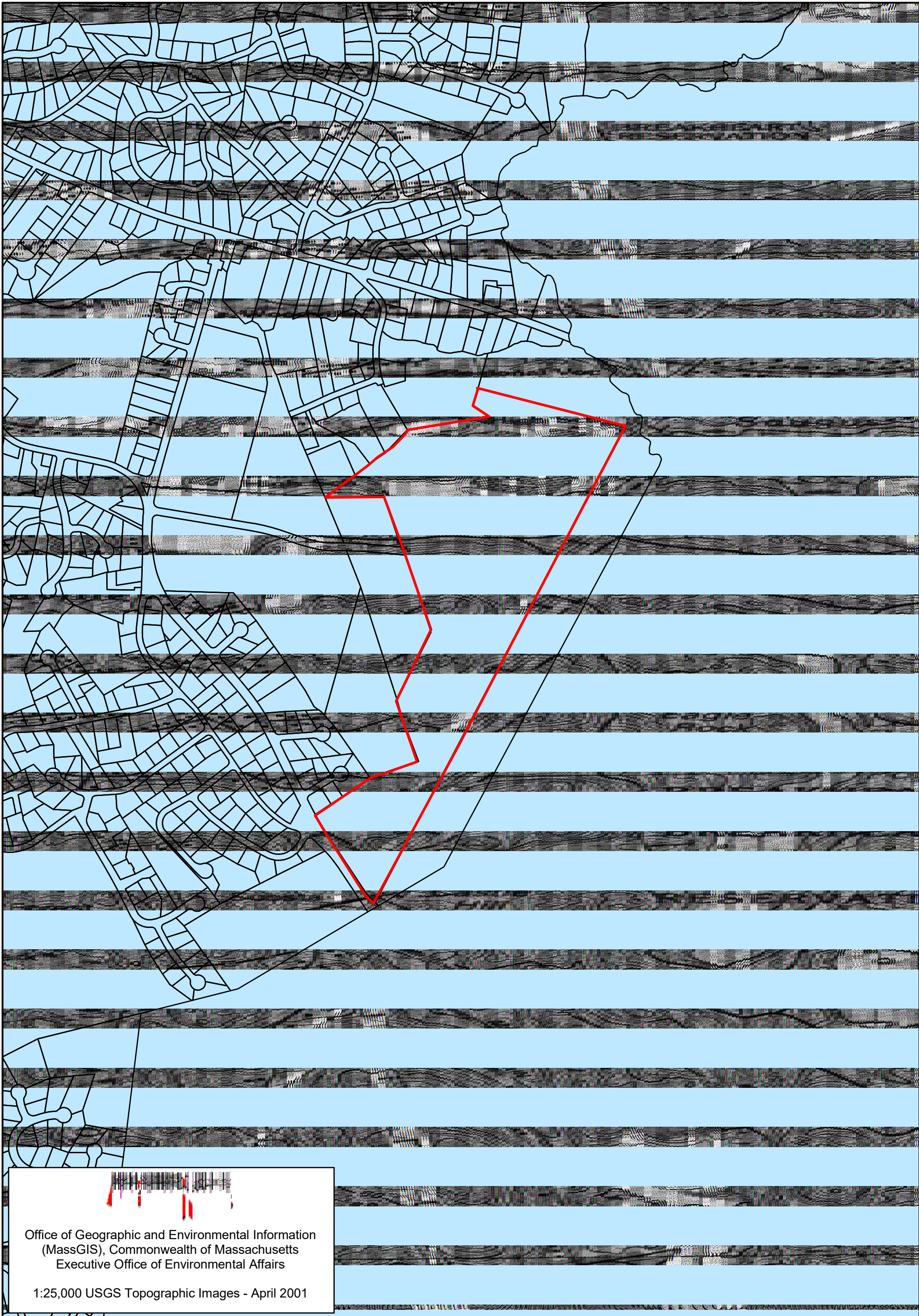
Figure 1. USGS Topographic Map

Figure 2. USGS Color Ortho Imagery with NHESP Estimated & Priority Habitats

Figure 3. FEMA Flood Insurance Rate Map

MassDEP BVW Delineation Field Data Forms

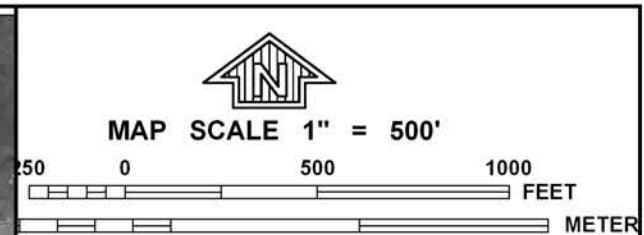
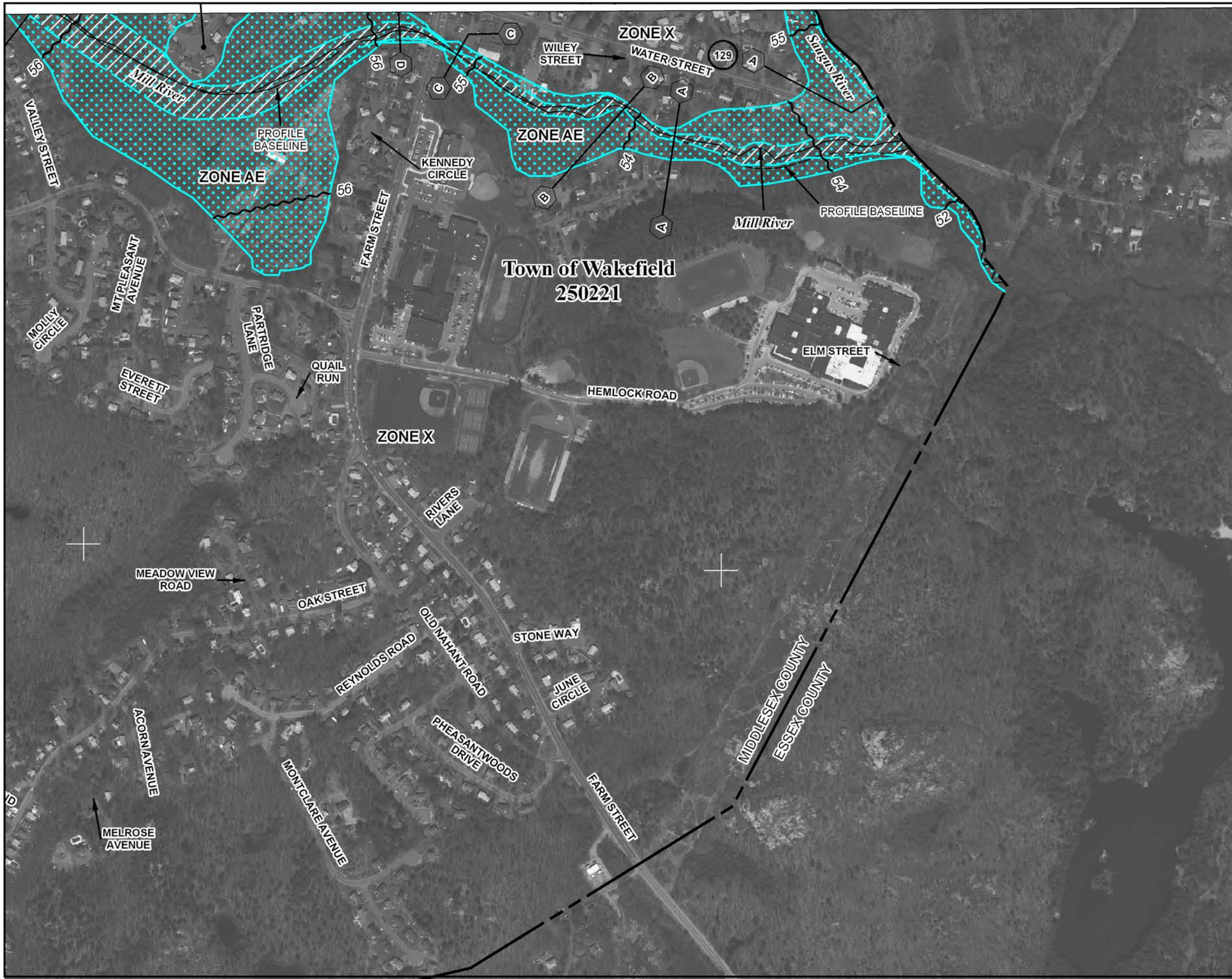
USGS Stream Stats Report



Office of Geographic and Environmental Information
(MassGIS), Commonwealth of Massachusetts
Executive Office of Environmental Affairs

1:25,000 USGS Topographic Images - April 2001





NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0431E

FIRM

FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY,
MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 431 OF 656
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MELROSE, CITY OF	250206	0431	E
WAKEFIELD, TOWN OF	250221	0431	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER
25017C0431E

EFFECTIVE DATE
JUNE 4, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

LEGEND



SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.



FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.



ZONE X

OTHER FLOOD AREAS

Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.



ZONE X

OTHER AREAS

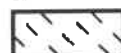
Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D

Areas in which flood hazards are undetermined, but possible.



COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS



OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.



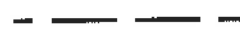
1% annual chance floodplain boundary



0.2% annual chance floodplain boundary



Floodway boundary



Zone D boundary



CBRS and OPA boundary



Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.



Base Flood Elevation line and value; elevation in feet*

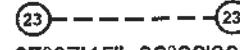
(EL 987)

Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988



Cross section line



Transect line

87°07'45", 32°22'30"

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

2476000mN

1000-meter Universal Transverse Mercator grid values, zone 19

600000 FT

5000-foot grid values: Massachusetts State Plane coordinate system, Mainland zone (FIPSZONE 2001), Lambert Conformal Conic projection

DX5510 x

Bench mark (see explanation in Notes to Users section of this FIRM panel)

● M1.5

River Mile

MAP REPOSITORY

Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

June 4, 2010

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: _____ Prepared by: LEC Environmental Consultants, Inc
Julia Hooeboom, Wetland Specialist

Project location: 100 Hemlock Road, Wakefield, MA
 LEC File #: NEI\20-009.04 DEP File #: _____

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☒ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: 1 (Upland)		Transect Number: 1 (WF 9-1 & 9-2)	Date of Delineation: March 23, 2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (Midpoints used)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category* Dominant plants in Bold
Ground cover				
Cinnamon fern (<i>Osmunda cinnamomea</i>)	10.5%	100%	Yes	FACW*
Shrub				
Sapling ash (<i>Fraxinus</i> sp.)	10.5%	39%	Yes	FAC* (presumed)
Sapling hickory (<i>Carya</i> sp.)	3.0%	11%	No	FAC* (presumed)
Sapling yellow birch (<i>Betula alleghaniensis</i>)	3.0%	11%	No	FAC*
Spice bush (<i>Lindera benzoin</i>)	10.5%	39%	Yes	FACW*
Sapling (Absent)				
Canopy				
Yellow birch (<i>Betula alleghaniensis</i>)	20.5%	27%	Yes	FAC*
Hickory (<i>Carya</i> sp.)	3.0%	4%	No	FAC* (presumed)
American elm (<i>Ulmus Americana</i>)	10.5%	15%	No	FACW*
Northern red oak (<i>Quercus rubra</i>)	20.5%	27%	Yes	FACU
White oak (<i>Quercus alba</i>)	20.5%	27%	Yes	FACU

* Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:

Number of dominant wetland indicator plants: 4

Number of dominant non-wetland indicator plants: 2

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? ☒ yes ☐ no
title/date: NRCS Web Soil Survey and Middlesex County,
Massachusetts Version 19, September 12, 2019
map number: N/A
soil type mapped: Hollis-Rock outcrop-Charlton complex, 15 to 25
percent slopes
hydric soil inclusions: None

Are field observations consistent with soil survey? yes ☐ no ☒
Remarks: Field observations are more coarse than what is described in the
soil survey.

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A	0-6"	10YR 2/2 loamy sand	
B	6-13"	10YR 3/4 sand	
A _b	13- 20"	10YR 2/1 mucky loamy sand	

Remarks: Buried A horizon due to sand deposits by drainage outfall. No
redoximorphic features observed.

3. Other:

Conclusion: Is soil hydric? yes ☐ no ☒

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated: _____
- ☐ Depth to free water in observation hole: _____
- ☐ Depth to soil saturation in observation hole: _____
- ☐ Water marks: _____
- ☐ Drift lines: _____
- ☐ Sediment Deposits: _____
- ☐ Drainage patterns in BVW: _____
- ☐ Oxidized rhizospheres: _____
- ☐ Water-stained leaves: _____
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):

- ☐ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	X	_____
Wetland hydrology present:		
Hydric soil present	_____	X
Other indicators of hydrology present	_____	X
Sample location is in a BVW	_____	X

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: _____ Prepared by: LEC Environmental Consultants, Inc
Julia Hooeboom, Wetland Specialist

Project location: 100 Hemlock Road, Wakefield, MA
 LEC File #: NEI\20-009.04 DEP File #: _____

Check all that apply:

- ☐ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ☒ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ☐ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: 2 (Wetland)		Transect Number: 1 (WF 9-1 & 9-2)	Date of Delineation: March 23, 2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (Midpoints used)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category* Dominant plants in Bold
Ground cover				
Skunk cabbage (<i>Symplocarpus foetidus</i>)	3.0%	100%	Yes	OBL*
Shrub				
Sapling ash (<i>Fraxinus</i> sp.)	10.5%	34%	Yes	FAC* (presumed)
Sapling red maple (<i>Acer rubrum</i>)	20.5%	66%	Yes	FAC*
Sapling (Absent)				
Woody Vine				
Oriental bittersweet (<i>Celastrus orbiculatus</i>)	10.5%	100%	Yes	UPL
Canopy				
Red maple (<i>Acer rubrum</i>)	20.5%	66%	Yes	FAC*
Yellow birch (<i>Betula alleghaniensis</i>)	10.5%	34%	Yes	FAC*

* Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:

Number of dominant wetland indicator plants: 5

Number of dominant non-wetland indicator plants: 1

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? yes no
title/date: NRCS Web Soil Survey and Middlesex County,
Massachusetts Version 19, September 12, 2019
map number: N/A
soil type mapped: Hollis-Rock outcrop-Charlton complex, 15 to 25
percent slopes
hydric soil inclusions: None

Are field observations consistent with soil survey? yes no
Remarks: Field observations are more coarse than what is described in the
soil survey for both Charlton and Hollis soils.

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
A	0-20"	10YR 2/1 mucky loamy sand	5YR 3/4 @ 8"

Remarks: Meets the Dark Surface (S7.) indicator for a hydric soil according to
Field Indicators for Identifying Hydric Soils in New England (Version 4, May
2018).

3. Other:

Conclusion: Is soil hydric? yes no

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated: _____
- ☐ Depth to free water in observation hole: _____
- ☒ Depth to soil saturation in observation hole: Soil saturated to surface
- ☐ Water marks: _____
- ☐ Drift lines: _____
- ☐ Sediment Deposits: _____
- ☐ Drainage patterns in BVW: _____
- ☐ Oxidized rhizospheres: _____
- ☐ Water-stained leaves: _____
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):

- ☐ Other: _____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	X	
Wetland hydrology present:		
Hydric soil present	X	
Other indicators of hydrology present	X	
Sample location is in a BVW	X	

Submit this form with the Request for Determination of Applicability or Notice of Intent.

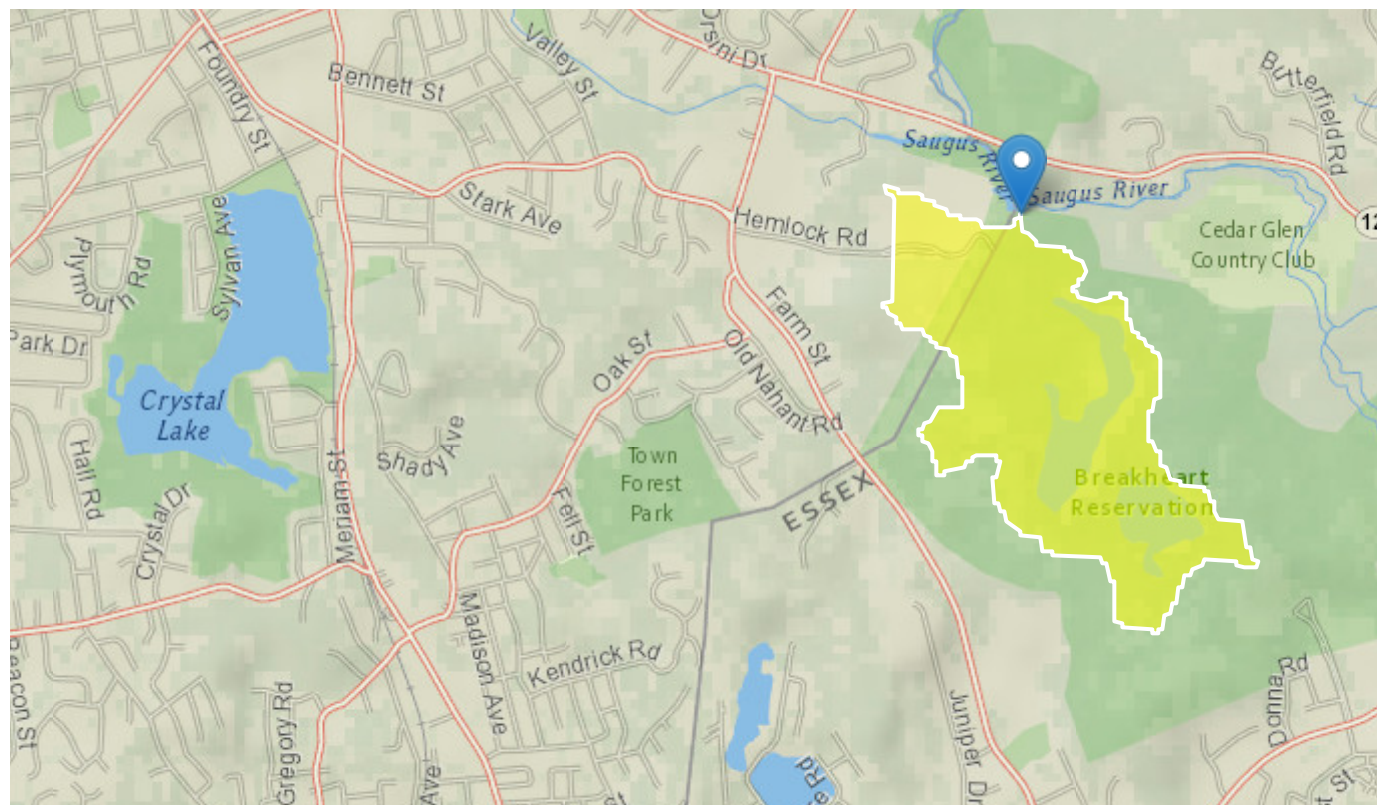
StreamStats Report- 100 Hemlock Road, Wakefield, MA

Region ID: MA

Workspace ID: MA20200331204806499000

Clicked Point (Latitude, Longitude): 42.49566, -71.03997

Time: 2020-03-31 16:48:24 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.36	square miles
DRFTPERSTR	Area of stratified drift per unit of stream length	-100000	square mile per mile
MAREGION	Region of Massachusetts 0 for Eastern 1 for Western	0	dimensionless
BSLDEM250	Mean basin slope computed from 1:250K DEM	4.899	percent

Flow-Duration Statistics Parameters[Statewide Low Flow WRIR00 4135]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.36	square miles	1.61	149
DRFTPERSTR	Stratified Drift per Stream Length	-100000	square mile per mile	0	1.29
MAREGION	Massachusetts Region	0	dimensionless	0	1
BSLDEM250	Mean Basin Slope from 250K DEM	4.899	percent	0.32	24.6

Flow-Duration Statistics Flow Report[Statewide Low Flow WRIR00 4135]

Statistic	Value	Unit
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Flow-Duration Statistics Citations

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Application Version: 4.3.11