Appendix 19
Nashua River Watershed
Assessment and Listing Decision Summary

Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle

CN: 505.1

November 2021

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2018/20 Cycle Impairment Changes

Waterbody	AU_ID	2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
Bare Hill Pond	MA81007	4a	4a	(Curly-leaf Pondweed*)		Added
Bare Hill Pond	MA81007	4a	4a	(Fanwort*)		Added
Bare Hill Pond	MA81007	4a	4a	(Water Chestnut*)		Added
Catacoonamug Brook	MA81-16	2	5	Dissolved Oxygen		Added
Catacoonamug Brook	MA81-16	2	5	Lack of a coldwater assemblage		Added
Catacoonamug Brook	MA81-16	2	5	Temperature		Added
Chaffin Pond	MA81017	4c	4c	(Fanwort*)		Added
Coachlace Pond	MA81019	3	4c	(Curly-leaf Pondweed*)		Added
Coachlace Pond	MA81019	3	4c	(Hydrilla*)		Added
Coachlace Pond	MA81019	3	4c	(Non-Native Aquatic Plants*)		Added
Crocker Pond	MA81025	3	4c	(Non-Native Aquatic Plants*)		Added
Dawson Pond	MA81028	4c	4c	(Fanwort*)		Added
Fall Brook	MA81-39	5	5	Temperature		Added
Fall Brook Reservoir	MA81038	3	5	Mercury in Fish Tissue		Added
Flannagan Pond	MA81044	4c	4c	(Curly-leaf Pondweed*)		Added
Flannagan Pond	MA81044	4c	4c	(Fanwort*)		Added
Gates Brook	MA81-24	5	5	Chloride		Added
Grove Pond	MA81053	5	5	(Curly-leaf Pondweed*)		Added
Grove Pond	MA81053	5	5	(Fanwort*)		Added
James Brook	MA81-20	5	5	Dissolved Oxygen		Added
Lake Shirley	MA81122	5	5	(Brittle Naiad, Najas Minor*)		Added
Lake Shirley	MA81122	5	5	(Fanwort*)		Added
Lake Whalom	MA81154	4c	4c	(Curly-leaf Pondweed*)		Added
Lancaster Millpond	MA81065	3	4c	(Non-Native Aquatic Plants*)		Added
Lower Crow Hill Pond	MA81026	3	4c	(Non-Native Aquatic Plants*)		Added
Malagasco Brook	MA81-29	5	5	Nutrient/Eutrophication Biological Indicators		Removed
Malden Brook	MA81-27	2	5	Temperature		Added
Maple Spring Pond	MA81077	3	4c	(Non-Native Aquatic Plants*)		Added
Mirror Lake	MA81085	5	5	(Curly-leaf Pondweed*)		Added
Monoosnuc Brook	MA81-13	5	5	(Non-Native Aquatic Plants*)		Added
Mulpus Brook	MA81-36	2	5	Temperature		Added
Mulpus Brook	MA81-37	5	5	Temperature		Added
Nashua River	MA81-05	5	5	(Water Chestnut*)		Added
Nashua River	MA81-06	5	5	(Curly-leaf Pondweed*)		Added
Nashua River	MA81-06	5	5	(Fanwort*)		Added
Nashua River	MA81-06	5	5	(Water Chestnut*)		Added
Nashua River	MA81-07	5	5	Phosphorus, Total		Removed
Nashua River	MA81-07	5	5	(Water Chestnut*)		Added

Waterbody	AU_ID	2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
Nashua River	MA81-08	2	4c	(Non-Native Aquatic Plants*)		Added
Nashua River	MA81-09	5	5	pH, Low		Added
Nashua River	MA81-09	5	5	Phosphorus, Total		Removed
Nissitissit River	MA81-21	5	5	Temperature		Added
North Nashua River	MA81-02	5	5	Fish Bioassessments		Added
North Nashua River	MA81-02	5	5	Lead		Added
Phillips Brook	MA81-12	2	5	Temperature		Added
Plow Shop Pond	MA81103	5	5	(Fanwort*)		Added
Quinapoxet River	MA81-32	4c	5	Temperature		Added
Robbins Pond	MA81111	4c	4c	(Curly-leaf Pondweed*)		Added
Robbins Pond	MA81111	4c	4c	(Non-Native Aquatic Plants*)		Removed
Sandy Pond	MA81117	3	4c	(Fanwort*)		Added
Sandy Pond	MA81117	3	4c	(Non-Native Aquatic Plants*)		Added
Scarletts Brook	MA81-25	3	5	Chloride		Added
Smith Brook	MA81-90	--	5	Temperature		Added
South Meadow Pond	MA81129	3	4c	(Curly-leaf Pondweed*)		Added
South Meadow Pond	MA81129	3	4c	(Hydrilla*)		Added
South Meadow Pond	MA81129	3	4c	(Non-Native Aquatic Plants*)		Added
South Meadow Pond	MA81165	3	4c	(Curly-leaf Pondweed*)		Added
South Meadow Pond	MA81165	3	4c	(Hydrilla*)		Added
South Meadow Pond	MA81165	3	4c	(Non-Native Aquatic Plants*)		Added
Spectacle Pond	MA81132	3	5	Dissolved Oxygen		Added
Still River	MA81-60	5	5	Dissolved Oxygen		Added
Stillwater River	MA81-31	5	5	Temperature		Added
The Quag	MA81170	3	4c	(Brittle Naiad, Najas Minor*)		Added
The Quag	MA81170	3	4c	(Non-Native Aquatic Plants*)		Added
Trout Brook	MA81-26	3	5	Temperature		Added
Unionville Pond	MA81143	4c	4c	(Non-Native Aquatic Plants*)		Added
Unnamed Tributary	MA81-49	3	5	Chloride		Added
Unnamed Tributary	MA81-54	3	5	Chloride		Added
Wachusett Lake	MA81146	3	5	Mercury in Fish Tissue		Added
Wachusett Reservoir	MA81147	4a	4a	(Brittle Naiad, Najas Minor*)		Added
Wachusett Reservoir	MA81147	4a	4a	(Fanwort*)		Added
Washacum Brook	MA81-47	3	5	Dissolved Oxygen		Added
Wekepeke Brook	MA81-72	5	5	Temperature		Added

Waterbody	AU_ID	2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
West Waushacum Pond	MA81153	3	4c	(Brittle Naiad, Najas Minor*)		Added
West Waushacum Pond	MA81153	3	4c	(Non-Native Aquatic Plants*)		Added
Whitman River	MA81-11	2	5	Lead		Added
Whitman River	MA81-11	2	5	(Non-Native Aquatic Plants*)		Added
Whitman River	MA81-11	2	5	Temperature		Added

Ashby Reservoir (MA81001)

Location:	Ashby.
AU Type:	FRESHWATER LAKE
AU Size:	36 ACRES
Classification/Qualifier:	B: ORW (impoundment on river designated ORW)

Fish, other Aquatic Life and Wildlife Use: Not Assessed (Alert)

Ashby Reservoir receives flow via Willard Brook (MA81-79) from Fitchburg Reservoir (MA81043), a surface water supply for the City of Fitchburg. Fitchburg Reservoir has two outlets: on the northeast, to Willard Brook; and on the south, to Falulah Brook. Fitchburg Reservoir is actively managed to release water, under routine conditions, through the gatehouse on the southern end of the reservoir into Falulah Brook to fill Lovell Reservoir. Although the spillway crest on the northern dam is lower than that on the southern dam, and flow would naturally be to Willard Brook, the normal pool height is usually at or below the northern spillway height, so flow over the northern spillway is typically associated with elevated pool level (precipitation events, snow melts, etc., i.e., high pool elevation conditions).

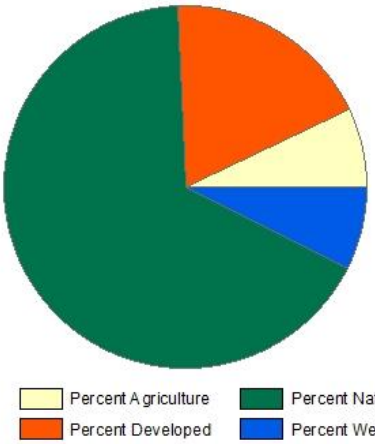
The Aquatic Life Use for Ashby Reservoir (MA81001) is Not Assessed due to the absence of recent data. This use is identified with an Alert status due to flow limitations under routine Fitchburg Reservoir operations (Fitchburg Reservoir partially discharges to Willard Brook, a tributary of Ashby Reservoir).

Asnebumskit Brook (MA81-56)

Location:	From outlet Eagle Lake, Holden to mouth at confluence with the Quinapoxet River, Holden.
AU Type:	RIVER
AU Size:	2.9 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Asnebumskit Brook - MA81-56

Watershed Area: 12.99 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	12.98	4.8	7.44	2.6
Agriculture	7.1%	3%	6.5%	1.8%
Developed	18.6%	27.2%	14.9%	20%
Natural	67%	61.4%	66.8%	64.7%
Wetland	7.4%	8.3%	11.8%	13.5%
Impervious Cover	6.4%			

Fish, other Aquatic Life and Wildlife Use: Not Supporting

A benthic survey was conducted in Asnebumskit Brook immediately upstream of Princeton St in Holden in August 2008 (Unique ID B0665). MassDEP biologists determined the RBPIII status was "slightly impaired" (62% comparable) when compared to the Nissitissit River reference (Unique ID: B0087). MassDFG conducted backpack electrofishing in Asnebumskit Brook downstream of Princeton St in July 2006 (Sample ID 1678). Two fluvial species, white sucker and brown trout (all adults of this cold water species) comprised 39% of the sample (n=23) and moderately tolerant macrohabitat generalists (mainly chain pickerel and pumpkinseed) comprised another 39% of the sample. MassDCR conducted water quality monitoring, also at this location (station M102), from 2008 to 2019. Discrete dissolved oxygen measurements from 2019 had a minimum of 6.09 mg/L (n=4) and pH measurements from 2019 ranged from 6.65-6.95 SU (n=4). Temperature was measured during the summer index period from 2008 to 2019 (n = 4-15/year) and the maximum reading was 24.9 °C (no violation of warm water criterion). Specific conductance readings (n = 14-51/year) were generally <825 µS/cm with one exception of 2,078 µS/cm (>994 µS/cm, the estimated chloride chronic criterion with a 10% margin to account for error in the model). Finally, DCR conducted very limited water quality monitoring near the mouth of the brook upstream of Mill St in Holden (station M101). Discrete temperature data collected from 2008 to 2010 had a maximum of 23.5 °C (n = 14-16/year) and specific conductance measurements from 2008 to 2010 (n = ~50/year) had a maximum of 284 µS/cm.

Although fish, benthic, and water quality data were indicative of good conditions, the Aquatic Life Use of Asnebumskit Brook (MA81-56) will remain assessed as Not Supporting due to the historic impairment “Ambient Bioassays – Chronic Aquatic Toxicity.”

Asnebumskit Pond (MA81002)

Location:	Paxton.
AU Type:	FRESHWATER LAKE
AU Size:	44 ACRES
Classification/Qualifier:	A: PWS, ORW (PWS and Tributary to PSW)

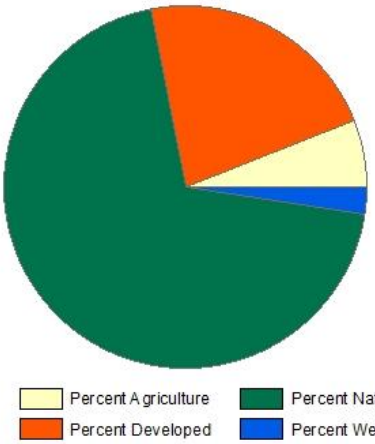
Fish, other Aquatic Life and Wildlife Use: Not Assessed
There are no available data to assess the Aquatic Life Use for Asnebumskit Pond. The Aquatic Life Use for Asnebumskit Pond (MA81002) is Not Assessed due to the lack of data.

Baker Brook (MA81-62)

Location:	Headwaters, confluence of Pearl Hill and Falulah brooks, Fitchburg to mouth at confluence with North Nashua River, Fitchburg.
AU Type:	RIVER
AU Size:	2.5 MILES
Classification/Qualifier:	B: CSO

Baker Brook - MA81-62

Watershed Area: 18.24 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	18.23	5.08	6.31	1.08
Agriculture	6%	5.7%	3.6%	2%
Developed	22%	51.6%	12.9%	37.4%
Natural	69.6%	40%	77.9%	52%
Wetland	2.4%	2.7%	5.6%	8.6%
Impervious Cover	9.6%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

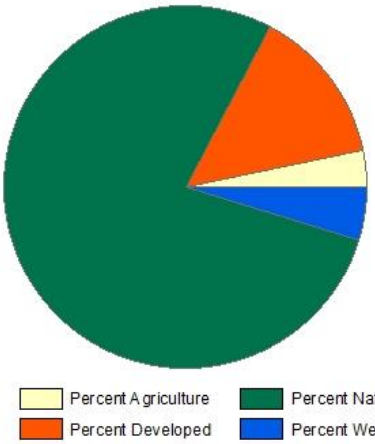
MassDFG biologists conducted backpack electrofishing at the downstream end of the AU, north of Falulah Road, Fitchburg (Sample ID 597) in June 2002. A total of 113 fish were collected, with 6 species represented. The sample was composed almost entirely of fluvial species (99%) including blacknose dace and longnose dace, and 36% were species considered to be moderately tolerant of pollution. It should be noted that MassDFG considers Baker Brook a CFR. However, given the absence of cold water species observed during the 2002 fish survey (and in a historical survey from 1974), the tributary is considered a warm water fishery. MassDEP staff collected 6 bacteria samples at the downstream end of the AU, at Crawford St, Fitchburg, during summer 2008 (W1836). There were no observations of dense or very dense filamentous algae during these site visits. Due to the age of the one fish sample collected in Baker Brook (MA81-62), there is Insufficient Information to assess the Aquatic Life Use.

Ball Brook (MA81-45)

Location:	Headwaters, north of Sterling Road, Holden to mouth at confluence with Stillwater River, Sterling.
AU Type:	RIVER
AU Size:	1.6 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Ball Brook - MA81-45

Watershed Area: 0.65 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.65	0.65	0.45	0.45
Agriculture	3.2%	3.2%	4.2%	4.2%
Developed	14.1%	14.1%	12.5%	12.5%
Natural	77.9%	77.9%	76.9%	76.9%
Wetland	4.8%	4.8%	6.4%	6.4%
Impervious Cover	5.1%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing in Ball Brook upstream of Rt 62 behind a tennis court in Sterling in July 2010 (Sample ID 3388). The sample (n=59) was comprised entirely of multiple age classes of Eastern brook trout, a sensitive cold water species. A short way downstream, MassDCR staff collected limited water quality data at Rt 140 in Sterling in 2008 (Station MD88). Temperature was measured 12 times during the summer index period with a maximum of 19.7 ˚C. Specific conductance was measured roughly weekly throughout the year and the maximum was relatively low at 105 µS/cm.

The Aquatic Life Use of Ball Brook (MA81-45) is assessed as Fully Supporting based primarily on the presence of a reproducing Eastern brook trout population; this species is indicative of excellent habitat and water quality.

Bare Hill Pond (MA81007)

Location:	Harvard.
AU Type:	FRESHWATER LAKE
AU Size:	310 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	(Curly-leaf Pondweed*)		Added
4a	4a	(Fanwort*)		Added
4a	4a	(Water Chestnut*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Two non-native aquatic macrophytes, variable milfoil (*Myriophyllum heterophyllum*) and water chestnut (*Trapa natans*), were identified during a 1998 synoptic survey of Bare Hill Pond performed by MassDEP biologists. The Town of Harvard commissioned a study of Bare Hill Pond and in October 2001, the town's consultant (ENSR) documented the presence of variable milfoil, as well as the non-natives, fanwort (*Cabomba caroliniana*) and curly-leaf pondweed (*Potamogeton crispus*). The presence of *Utricularia* spp. was also documented (this genus includes native and non-native species). The Town began a targeted approach to controlling nutrients and plants, winning three 319 Nonpoint Source Competitive Grants in fiscal years 2003 (Project ID 03-05/319), 2004 (Project ID 04-18/319), and 2008 (Project ID 08-04/319), to provide financial support for developing, installing and maintaining numerous BMPs.

The Aquatic Life Use for Bare Hill Pond (MA81007) is assessed as Not Supporting for Non-Native Aquatic Plants (due to the presence of variable milfoil / *Myriophyllum heterophyllum*, which does not have a species-specific code), as well as the specific non-natives, Water Chestnut (*Trapa natans*), Fanwort (*Cabomba caroliniana*), and Curly-leaf Pondweed (*Potamogeton crispus*).

Barrett Pond (MA81162)

Location:	Leominster.
AU Type:	FRESHWATER LAKE
AU Size:	7 ACRES
Classification/Qualifier:	B

Barrett Pond is also known as Barrett Park Pond and Colburns Reservoir.

Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Barrett Pond (MA81162) is Not Assessed due to the absence of available data.

Bartlett Pond (MA81009)

Location:	Leominster.
AU Type:	FRESHWATER LAKE
AU Size:	23 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

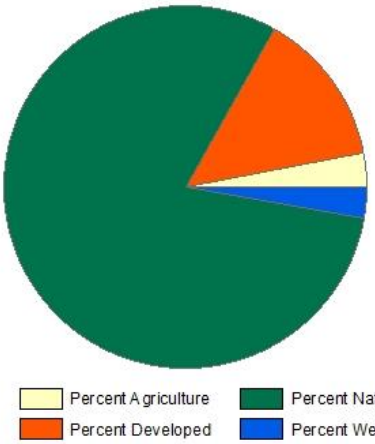
Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Bartlett Pond (MA81009) is Not Assessed due to the absence of recent data.

BAYBERRY HILL BROOK (MA81-68)

Location:	Headwaters, outlet small unnamed pond north of Bailey Road, Townsend to mouth at confluence with Squannacook River, Townsend.
AU Type:	RIVER
AU Size:	2.1 MILES
Classification/Qualifier:	B: ORW, CWF

BAYBERRY HILL BROOK - MA81-68

Watershed Area: 1.21 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.21	1.21	0.37	0.37
Agriculture	3%	3%	1.9%	1.9%
Developed	13.8%	13.8%	16.8%	16.8%
Natural	80.5%	80.5%	76.5%	76.5%
Wetland	2.7%	2.7%	4.8%	4.8%
Impervious Cover	4.4%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)

MassDFG biologists conducted backpack electrofishing in Bayberry Hill Brook, at two locations close to the downstream end of the AU in Townsend, in July 2003. Samples were collected upstream of Woodland Dr (Sample ID 845) and downstream of Woodland Dr (Sample ID 844). The upstream sample (n=11) consisted of multiple age classes of the intolerant cold water species, Eastern brook trout, with the exception of a single goldfish. The downstream sample contained only 1 Eastern brook trout. All the trout measured <140 mm. It should be noted that Bayberry Hill Brook is a designated cold water fishery. NRWA collected discrete dissolved oxygen data at the Woodland Dr crossing (Station BH0038). The data which met quality objectives were collected four times in 2019 between June and October. Two of the 4 measurements were below the 1-day minimum cold water criterion of 5.0 mg/L (minimum of 2.1 mg/L).

Given the age of the fish samples and limited water quality data available, there is Insufficient Information to assess the Aquatic Life Use for Bayberry Hill Brook (MA81-68). An Alert is being issued for low dissolved oxygen and a recommendation will be made for further fish/water quality monitoring.

Bixby Reservoir (MA81010)

Location:	Townsend.
AU Type:	FRESHWATER LAKE
AU Size:	21 ACRES
Classification/Qualifier:	B: ORW

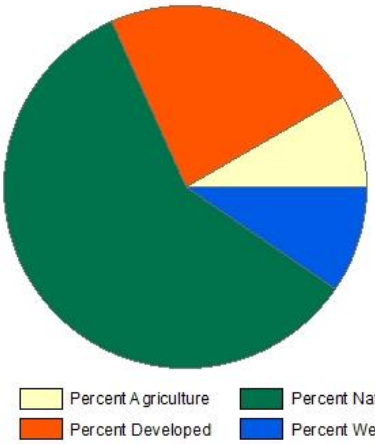
Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Bixby Reservoir (MA81010) is Not Assessed since no recent data are available.

BOWERS BROOK (MA81-73)

Location:	From outlet Bare Hill Pond, Harvard to mouth at inlet unnamed pond, Ayer.
AU Type:	RIVER
AU Size:	6.1 MILES
Classification/Qualifier:	B

BOWERS BROOK - MA81-73

Watershed Area: 11.65 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	11.64	5.93	2.39	1.05
Agriculture	8.3%	9%	5.8%	5.6%
Developed	23.4%	29.8%	13.5%	13.4%
Natural	58.8%	52.3%	54.3%	49.7%
Wetland	9.5%	9%	26.5%	31.4%
Impervious Cover	8.3%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

NRWA staff/volunteers collected discrete water quality data in Bowers Brook at the Bare Hill Pond Dam in Harvard (BR0895). The data which met quality objectives were collected from 2013-2015 (usually 6 times per year). Dissolved oxygen data were generally indicative of good conditions with 12 out of 15 measurements higher than the 1-day minimum warm water guideline of 4.0 mg/L (minimum 3.1 mg/L). However, 2 of the measurements occurred in 2014 (3.9 mg/L and 3.4 mg/L). DFG biologists conducted backpack electrofishing at 2 sites in Bowers Brook in Harvard in July 2006. Only 2 golden shiners were captured at the upstream location at Depot Rd (Sample ID 1907), while further downstream south of Rt 110 (Sample ID 1677) on that same day, 7 fish, including 5 fluvial specialist fallfish, were collected. While both sites were noted as being high gradient, the habitat along much of the Bowers Brook stream corridor is low gradient with surrounding wetland habitat. MassDEP staff conducted water quality (WQ) monitoring in the downstream 1/3 of the brook at Lancaster County Rd, Harvard (W1830) during summer 2008. The aquatic macrophyte *Potamogeton* sp. was noted (species confirmation is needed). Continuous loggers were set to record DO and temp. for three 2-day deployments in June, July and Aug. The minimum DO was 2.6 mg/L (all 3 minimums <4.0 mg/L), maximum saturation 77%, and maximum diel DO shift 2.3 mg/L. While the maximum temp. was slightly elevated at 30.7 °C, the maximum 24-hour rolling average was 27.4 °C and met the warm water guideline of 28.3 °C. The pH ranged from 6.2-6.5 SU (n=6), ammonia concentrations were low (≤0.04 mg/L, n=5), and the total phosphorus seasonal average was also low at 0.034 mg/L (maximum 0.054 mg/L, n=5). There were no observations of

excessive filamentous algae. Slightly further downstream, MassDEP staff conducted monitoring approx. 830 ft downstream of Lancaster County Rd, Harvard (MAP2-055) as part of the Probabilistic Wadeable Streams project (MAP2) during summer 2011. The benthic macroinvertebrate sample data from this project were not analyzed using an RBPIII approach, but will be compared to biocriteria thresholds currently under development and will be used as part of the Aquatic Life Use assessment in a future reporting cycle. DEP staff conducted backpack electrofishing in Aug 2011 as part of the MAP2 project (Sample ID 4583). The sample (n=146) was dominated by the fluvial species, fallfish (mainly) and white sucker. The WQ monitoring data collected in Bowers Brook at this location during summer 2011 (W2205) can be summarized as follows. The minimum DO measured by a deployed probe during three 4-day periods was 4.8 mg/L and the lowest 4DADMin was 5.3 mg/L, while the maximum diel DO shift was 1.5 mg/L and the maximum saturation was 79%. A thermistor was deployed for 108 days beginning on 12 May- the maximum 7DADM temp was 26.2 °C and the maximum daily average temp was 26.7 °C (no violations of warm water guidelines). The pH was good (6.3-6.9 SU, n=6). The total phosphorus seasonal average was low 0.027 mg/L (maximum 0.045 mg/L, n=5) and there were no observations of excessive filamentous algae. Ammonia concentrations were all low ($\leq$0.06 mg/L, n=5) and 2 clean metals samples did not exceed acute or chronic criteria. Clean metals sampling was also conducted near the mouth of the brook at Barnum Road in Ayer (W1842) in 2008 (n=3) and there were no exceedances.

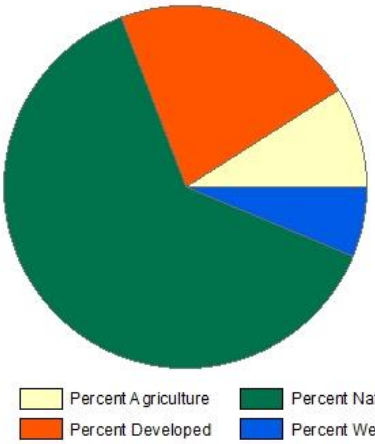
The Aquatic Life Use for Bowers Brook is assessed as Fully Supporting based primarily on the presence of fluvial specialist/dependent fish species and the generally good water quality conditions documented by MassDEP staff during the summers of 2008 and 2011. An Alert for low DO is being issued since two NRWA measurements downstream of the Bare Hill Pond Dam were <4.0 mg/L in 2014. Continuous measurements should be collected, and since this location is not very representative, an appropriate station should be chosen a little way downstream.

BUMBO BROOK (MA81-94)

Location:	Headwaters, perennial portion south of Streeter Road, Paxton to mouth at inlet of Pine Hill Reservoir, Paxton.
AU Type:	RIVER
AU Size:	1.5 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

BUMBO BROOK - MA81-94

Watershed Area: 0.78 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.77	0.77	0.45	0.45
Agriculture	9%	9%	5%	5%
Developed	21.8%	21.8%	14.8%	14.8%
Natural	63%	63%	69.8%	69.8%
Wetland	6.2%	6.2%	10.4%	10.4%
Impervious Cover	5%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

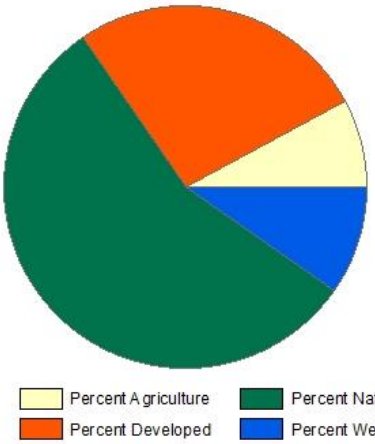
MassDFG biologists conducted backpack electrofishing downstream of the Streeter Road crossing of Bumbo Brook, Paxton on 7 July 2010 (Sample ID 3378). Twelve immature Eastern brook trout, a coldwater fluvial specialist species intolerant of pollution, were collected. Field notes indicated these were all wild trout. The Aquatic Life Use of Bumbo Brook (MA81-94), a CFR stream, is assessed as Fully Supporting based on the presence of a reproducing population of Eastern brook trout.

Catacoonamug Brook (MA81-16)

Location:	Outlet Lake Shirley, Lunenburg to mouth at confluence with Nashua River (backwater area), Shirley.
AU Type:	RIVER
AU Size:	2.7 MILES
Classification/Qualifier:	B

Catacoonamug Brook - MA81-16

Watershed Area: 20.08 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	20.08	7.62	4.25	1.6
Agriculture	7.8%	1.8%	5.6%	0.9%
Developed	26.7%	26.1%	22.8%	24.2%
Natural	55.8%	62.5%	52.1%	56.5%
Wetland	9.7%	9.6%	19.5%	18.4%
Impervious Cover	10.7%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	Dissolved Oxygen		Added
2	5	Lack of a coldwater assemblage		Added
2	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Catacoonamug Brook (MA81-16) will be assessed as a Tier 1 Existing Use Cold Water Fishery since several juvenile Eastern brook trout were collected by DFG biologists off Fredonian Park in Shirley in July 1987. Although no non-native aquatic macrophyte species were documented in this AU, several (*Cabomba caroliniana, Myriophyllum heterophyllum, M. spicatum* and *Najas minor*) are in Lake Shirley (just upstream). At the upstream end of this AU at Pond St in Shirley, MassDEP staff conducted benthic, fish, and water quality monitoring in 2011 as part of a probabilistic wadeable streams monitoring project (MAP2). The benthic macroinvertebrate data (B0708) were not analyzed using an RBPIII approach but will be compared to biocriteria thresholds which are currently under development. Therefore, these (benthic macroinvertebrate) data will not be used as part of the Aquatic Life Use assessment for this reporting cycle. MassDEP biologists also conducted backpack electrofishing in August 2011 (Sample ID 4582). The sample (n=33) did not contain any cold water species but was dominated

by the moderately tolerant fluvial specialist species, fallfish (and included single individuals from the fluvial species, common shiner and white sucker). The water quality monitoring data collected at this location during the summer of 2011 (W2186) can be summarized as follows: minimum DO measured by an unattended probe during three 4-day deploys was 6.2 mg/L and the maximum diel DO shift was 1.3 mg/L. A thermistor was deployed for 131 days starting May 12 with 109 exceedances of the cold water, 20.0 °C 7DADM chronic criterion (max 7DADM 28.1 °C) and the acute criterion was also exceeded (max daily average 26.8 °C). pH was good (7.0-7.4 SU, n=6). Ammonia concentrations were low (≤0.17 mg/L, n=5), as was the TP seasonal average of 0.035 mg/L (maximum 0.093mg/L, n=5). There were no exceedances of metals criteria from 3 clean metals samples either. Further downstream MassDEP biologists also conducted a benthic survey in the brook upstream of Main St, Shirley (B0663) in August 2008. The RBPIII analysis indicated the sample was "not impaired" (100% comparable) when compared to the Nissitissit River reference site (B0087). Water quality sampling was also conducted near this location by MassDEP staff during summer 2008 (W1812). Deployed probes measured DO/temp for 3-day periods in June, July, and August. The minimum DO was 5.6 mg/L, the lowest 3-day mean minimum was 5.7 mg/L (violating the cold water criterion), the maximum saturation was 95%, and the maximum diel DO shift was 1.7 mg/L. The maximum temp was 26.3 °C with a maximum 24-hour rolling average of 25.1 °C. pH ranged from 6.5-7.0 SU (n=6) and ammonia concentrations were low (≤0.13 mg/L), as was the TP seasonal average (0.018 mg/L, maximum 0.025 mg/L, n=5). There were no observations of excessive filamentous algae. NRWA staff/volunteers measured DO at three sites along this lower Catacoonamug Brook AU in Shirley as follows: near the Umbagog Building on Leominster Rd (CT0195), off Fredonian Park (CT0151) and at the Lovell St Bridge (CT0012). The minimum DO at CT0195 was 3.8 mg/L with three of 69 measurements <5.0 mg/L between 2008-2018, the minimum DO at CT0151 was 3.4 mg/L with only one of 12 measurements <5.0 mg/L in 2008 and 2017, and the minimum DO was 2.6 mg/L with three of 20 measurements <5.0 mg/L between 2017-2019.

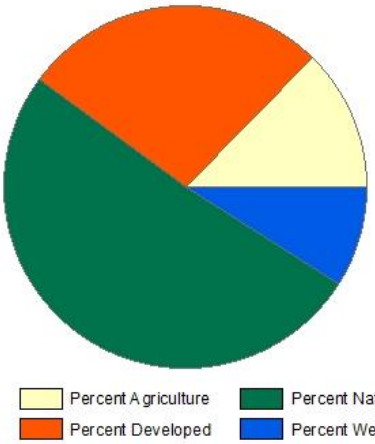
The Aquatic Life Use for this Catacoonamug Brook AU (MA81-16) is assessed as Not Supporting based on the lack of any cold-water fish species, elevated instream temperature, and the occasionally low DO in this Tier 1 Existing Use Cold Water Fishery. The other data were generally indicative of good conditions (good benthic community, absence of any indicators of nutrient enrichment, and no toxic criteria exceedances). The former Alert for dominance of macrohabitat generalist fish species in this AU (MA81-16) is being removed.

CATACOONAMUG BROOK (MA81-74)

Location:	Headwaters, northwest of Chestnut Street, Lunenberg to inlet Lake Shirley, Harvard.
AU Type:	RIVER
AU Size:	4.5 MILES
Classification/Qualifier:	B

CATACOONAMUG BROOK - MA81-74

Watershed Area: 8.56 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	8.56	7.87	1.84	1.68
Agriculture	12.6%	13.4%	9.2%	10%
Developed	27.4%	26.7%	20.6%	19.1%
Natural	51.1%	50.5%	49.3%	48.4%
Wetland	9%	9.4%	20.9%	22.4%
Impervious Cover	8.5%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)

Catacoonamug Brook (MA81-74) is identified as a CFR by DFG biologists. Notes were made by MassDEP staff indicating the presence of *Potamogeton* sp. in the brook at the Reservoir Rd crossing in Lunenburg (W1843) where bacteria samples were collected during the summer of 2008. During the 6 site visits, no observations of excessive filamentous algae were recorded. NRWA staff/volunteers measured DO in the brook at the Reservoir Road crossing once in August 2008 and once in June 2009. Both measurements were low (3.4 and 4.3 mg/L, respectively).

Too limited data are available to assess the Aquatic Life Use for this Catacoonamug Brook AU (MA81-74) so it is assessed as having Insufficient Information. An Alert is being identified for low DO, however, based on the two measurements reported by NRWA.

Chaffin Pond (MA81017)

Location:	Holden.
AU Type:	FRESHWATER LAKE
AU Size:	90 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4c	4c	(Fanwort*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

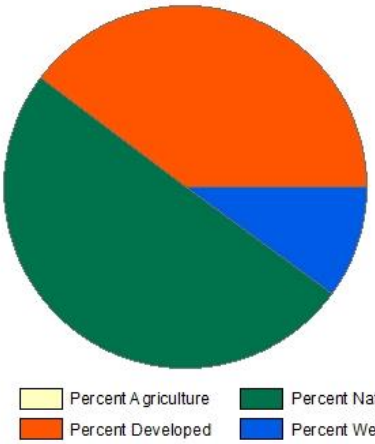
As was previously noted, MassDEP staff observed an infestation of the non-native aquatic macrophyte, fanwort (*Cabomba caroliniana*), during a 1998 synoptic survey of Chaffin Pond. DCR staff also reported the presence of variable milfoil (*Myriophyllum heterophyllum*) in the pond in 2015. The Aquatic Life Use of Chaffin Pond (MA81017) continues to be assessed as Not Supporting due to the presence of two non-native aquatic macrophytes. The species code Fanwort is being added for the *Cabomba caroliniana* infestation and the Non-Native Aquatic Plants impairment is being retained as an indicator of the recently confirmed variable milfoil (*Myriophyllum heterophyllum*) infestation.

Chaffins Brook (MA81-33)

Location:	Headwaters, perennial portion, south of Malden Street/west of Wachusett Street, Holden to mouth at inlet of Unionville Pond, Holden.
AU Type:	RIVER
AU Size:	0.9 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Chaffins Brook - MA81-33

Watershed Area: 5.92 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	5.92	5.12	3.42	3.01
Agriculture	0.8%	0.6%	1.1%	0.8%
Developed	39.4%	42.1%	34.5%	36.8%
Natural	49.9%	46.7%	51.1%	48.6%
Wetland	9.9%	10.6%	13.4%	13.8%
Impervious Cover	13.9%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDCR staff collected limited water quality data in Chaffins Brook upstream of Malden St in Holden (station M104) from 2008 to 2010. During the summer index period, discrete temperature maximums ranged from 23.0 to 24.1 ˚C (n = 15-16/year). During the same period, the maximum specific conductance reading was 380 µS/cm (n = 50/year). MassDFG staff conducted backpack electrofishing in the stream downstream of Malden St in June 2009 (Sample ID 3084). The small sample (n=11) was comprised of 73% fluvial specialist species including, in order of abundance, fallfish, blacknose dace, and 2 adult Eastern brook trout; the latter species is considered to be intolerant of pollution. The habitat comments indicated the water was flowing from a breached beaver dam at this location. Approximately 400 m downstream of Malden Street (off the end of Meadow Wood Drive, Holden), MassDEP biologists sampled the benthic macroinvertebrate community in August 2008 (station B0666). The RBPIII status was determined to be “not impaired/slightly impaired” (81% comparable) when compared to the Nissitissit River reference (Unique ID: B0087), with mostly optimal habitat conditions.

The Aquatic Life Use for Chaffins Brook (MA81-33) is assessed as Fully Supporting based primarily on benthic macroinvertebrate and fish bioassessments indicative of good conditions.

Coachlace Pond (MA81019)

Location:	Clinton.
AU Type:	FRESHWATER LAKE
AU Size:	31 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Curly-leaf Pondweed*)		Added
3	4c	(Hydrilla*)		Added
3	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

MassDCR staff reported in 2016 the presence of multiple non- native aquatic macrophytes- curly-leaf pondweed (*Potamogeton crispus*), hydrilla (*Hydrilla verticillata*), and variable milfoil (*Myriophyllum heterophyllum*)- in Coachlace Pond.

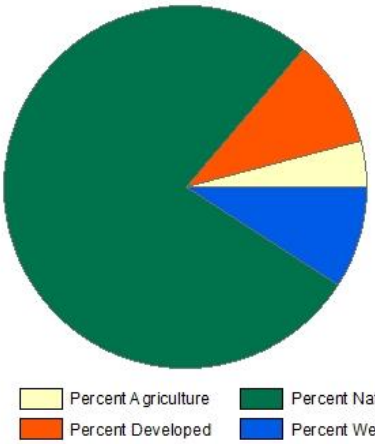
The Aquatic Life Use for Coachlace Pond (MA81019) is assessed as Not Supporting for Non-Native Aquatic Plants due to the presence of variable milfoil (*Myriophyllum heterophyllum*), for which no species-specific code is available, as well as for infestations of curly-leaf pondweed (*Potamogeton crispus*) and hydrilla (*Hydrilla verticillata*).

COBB BROOK (MA81-71)

Location:	Headwaters, outlet small unnamed pond west of Brooks Station Road, Princeton to mouth at confluence with South Wachusett Brook, Princeton.
AU Type:	RIVER
AU Size:	2.7 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

COBB BROOK - MA81-71

Watershed Area: 2.53 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.53	2.45	1.62	1.57
Agriculture	4%	4.2%	4.9%	5.1%
Developed	9.7%	9.9%	8.9%	9%
Natural	77.2%	76.7%	73%	72.6%
Wetland	9.1%	9.2%	13.1%	13.3%
Impervious Cover	3.1%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

Cobb Brook is considered a CFR stream by MassDFG. However, when DFG staff conducted electrofishing upstream of Bare Hill Rd in Princeton (Sample ID 1011) on 19 August 2004, no coldwater species were collected. The relatively large sample (n=217) was 85% fluvial specialist/dependent species (blacknose dace and white sucker). MassDEP conducted 6 bacteria surveys in Cobb Brook during summer 2008 and there were no observations of excessive filamentous algae.

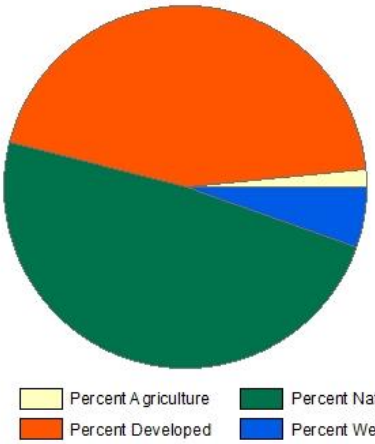
The Aquatic Life Use of Cobb Brook (MA81-71) is assessed as Fully Supporting based primarily on the strong representation of fluvial specialist and dependent species in the fish community. A water quality survey should be conducted along with an updated fish survey to provide a more complete sense of the condition of Cobb Brook.

COLD SPRING BROOK (MA81-82)

Location:	Headwaters, west of Old Mill Road (on the western side of railroad tracks), Harvard to mouth at confluence with Bowers Brook, Harvard.
AU Type:	RIVER
AU Size:	1.2 MILES
Classification/Qualifier:	B

COLD SPRING BROOK - MA81-82

Watershed Area: 1.91 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.91	1.91	0.16	0.16
Agriculture	1.6%	1.6%	2.9%	2.9%
Developed	44.4%	44.4%	4.9%	4.9%
Natural	48.6%	48.6%	67.9%	67.9%
Wetland	5.4%	5.4%	24.3%	24.3%
Impervious Cover	17.2%			

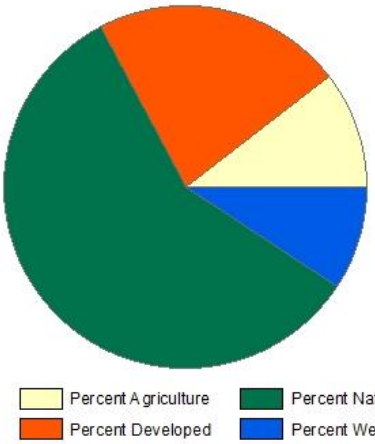
Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
Cold Spring Brook lies partly within the Fort Devens Superfund Site (operational as a base between 1917 and 1996), specifically near "Area of Concern 57," the site of a fuel oil spill(s) related to former use of the area for storage and maintenance of military vehicles. The Army conducted several surface soil excavation actions, and paved the site. In addition to the excavation, a drainage system was installed throughout the maintenance yards to collect stormwater from the new paved surface. A detention pond was constructed to store accumulated rainfall and minimize flow at the outfall to Cold Spring Brook during heavy storm events. In addition, an oil/water separator was installed as part of the storm drain system. No data for contaminants of concern are available that confirm or refute any impacts from the Fort Devens Superfund site on the surface waters of the brook at this time. MassDEP staff collected 3 clean metals samples in 2008 at two locations in the brook downstream of the Fort Devens Superfund Site: in the middle of the AU ~750 ft downstream of the railroad crossing south of Barnum Rd, Harvard (W2065) and at the downstream end of the AU East of Barnum Rd, ~550 ft upstream of the confluence with Bowers Brook (MA81-73), Harvard (W2064). There were no violations of the acute or chronic metals criteria. In addition, there were no observations of excessive filamentous algae during these surveys. There is Insufficient Information to assess the Aquatic Life Use of Cold Spring Brook (MA81-82). The Fort Devens Superfund Site (Area 57) is a concern but there are currently no surface water data available that confirm any impacts from that site on Cold Spring Brook. The use is identified with an Alert status due to possible impacts from the Fort Devens Superfund Site.

Connelly Brook (MA81-57)

Location:	Headwaters, southwest of Rowley Hill Road, Sterling to mouth at inlet The Quag, Sterling.
AU Type:	RIVER
AU Size:	2.9 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Connelly Brook - MA81-57

Watershed Area: 2.51 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.51	2.51	1.5	1.5
Agriculture	10.4%	10.4%	9.2%	9.2%
Developed	22.3%	22.3%	16%	16%
Natural	58.1%	58.1%	59.7%	59.7%
Wetland	9.2%	9.2%	15.1%	15.1%
Impervious Cover	11.3%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

MassDFG biologists attempted to sample the Connelly Brook fish population at Taft Rd in Sterling in July 2006 (Sample ID 1911). The "very high gradient" site was dry but this is likely due to natural conditions since the drainage area is very small upstream of this location (0.4 sq mi). DFG staff had more success at two other locations in Sterling, also sampled at the end of July 2006. Downstream of Old Princeton Rd (a high gradient site, ID 1910), 6 bluegills were captured- this is a tolerant macrohabitat generalist species. Moving downstream of a beaver impoundment at Jewett Rd (low gradient site, Sample ID 1935), moderately tolerant macrohabitat generalists (pumpkinseed, chain pickerel) comprised 48% of the sample (n=27). MassDCR conducted limited water quality monitoring at Jewett Rd (Station MD87) in 2008. Temperature was measured 12 times during the summer index period and the maximum was 22.1 ˚C. Specific conductance was measured roughly weekly throughout the year with a maximum of 503 µS/cm.

The Aquatic Life Use of Connelly Brook (MA81-57) is assessed as Fully Supporting based primarily on the presence of moderately tolerant fish species at the downstream, low gradient site. An Alert is being issued for the lack of diversity in the fish community and lack of fluvial species at the middle fish station (1910), however, this may be due to natural conditions, i.e. the small size of the sub-watershed and the downstream beaver dam limiting fish passage in the sub-watershed.

Coon Tree Pond (MA81168)

Location:	Pepperell.
AU Type:	FRESHWATER LAKE
AU Size:	29 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed

In July 1998, MassDEP staff conducted a synoptic survey of Coon Tree Pond- over 50% of the pond surface was covered with very dense aquatic plants.

The Aquatic Life Use for Coon Tree Pond (MA81168) is Not Assessed due to the absence of recent data. A recommendation will be made to conduct water quality monitoring and obtain data on indicators of enrichment.

Crocker Pond (MA81025)

Location:	Westminster.
AU Type:	FRESHWATER LAKE
AU Size:	101 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

In 2007, DCR staff in the Lakes and Ponds program reported the presence of the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*), in Crocker Pond.

The Aquatic Life Use for Crocker Pond (MA81025) is assessed as Not Supporting for Non-Native Aquatic Plants due to the presence of the non-native variable milfoil (*Myriophyllum heterophyllum*), for which no species-specific code is available.

Dawson Pond (MA81028)

Location:	Holden.
AU Type:	FRESHWATER LAKE
AU Size:	22 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4c	4c	(Fanwort*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

As previously noted, MassDEP staff conducted a synoptic survey of Dawson Pond on 18 August 1998. They noted the presence of the non-native aquatic macrophytes, *Cabomba caroliniana* (fanwort) and *Myriophyllum heterophyllum* (variable milfoil).

The Aquatic Life Use for Dawson Pond (MA81028) is assessed as Not Supporting based on the presence of the non-native aquatic macrophytes, *Cabomba caroliniana* (fanwort) and *Myriophyllum heterophyllum* (variable milfoil). The specific Fanwort impairment code is being applied, while Non-Native Aquatic Plants is being retained as an indicator of the variable milfoil infestation.

Eagle Lake (MA81034)

Location:	Holden.
AU Type:	FRESHWATER LAKE
AU Size:	56 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

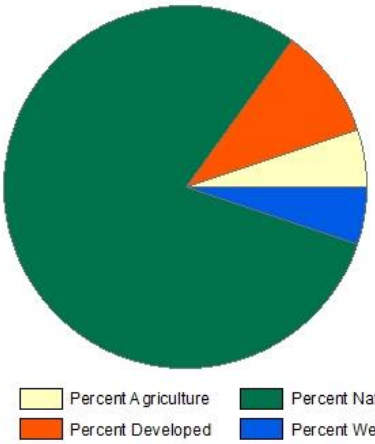
Fish, other Aquatic Life and Wildlife Use: Not Supporting
As was previously noted, MassDEP staff conducted a synoptic survey of Eagle Lake on 20 August 1998 and noted the presence of the non-native aquatic macrophyte, *Myriophyllum heterophyllum* (variable milfoil). The owners of the Eagle Lake dam are in the process of lowering the lake level by 4.5 feet to address dam deterioration issues. The Aquatic Life Use of Eagle Lake (MA81034) is assessed as Not Supporting based on the presence of the non-native aquatic macrophyte, *M. heterophyllum.* The Non-Native Aquatic Plants impairment is being retained.

East Wachusett Brook (MA81-30)

Location:	Headwaters northeast of Little Wachusett Mountain, Princeton to mouth at confluence with Stillwater River, Sterling.
AU Type:	RIVER
AU Size:	4.6 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

East Wachusett Brook - MA81-30

Watershed Area: 7.22 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	7.2	4.01	4.27	2.48
Agriculture	5.1%	4.8%	3.2%	2.3%
Developed	9.9%	11.5%	9.2%	10.7%
Natural	79.9%	77.2%	79.1%	76.8%
Wetland	5.1%	6.5%	8.4%	10.2%
Impervious Cover	4.1%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

MassDFG biologists conducted backpack electrofishing at 3 locations in East Wachusett Brook and MassDCR staff conducted water quality monitoring at 4 locations in the brook. At the upper end of the AU, north of Rt 31 in Princeton, fish site 1924 was surveyed in Aug 2006 and DCR site FPRN was sampled 2013-2019. The fish sample (n=53) contained 5 Eastern brook trout from multiple age classes. Fluvial species comprised 86% of the sample in total. Continuous temperature data were collected at this locale from 2017-2019. The maximum 7DADM was 19.24 ˚C and the maximum 24-hr rolling average was 19.7 ˚C. Discrete temperature data were similar. Nutrient grab samples were also collected, although most of these were collected during a storm event project. Nonetheless, the TP maximum seasonal average was 0.037 mg/L (the maximum concentration of 0.177 mg/L was measured during a storm event) and the maximum ammonia, 0.029 mg/L, did not violate screening criteria. The maximum specific conductance (SC) was 88 µS/cm (n = 4-47/yr). A short way downstream at the Rt 31 crossing, DCR staff collected limited WQ data in 2008 (Station MD91). The maximum temperature was 20.0 ˚C (n=15, summer index period) and the maximum SC was 900 µS/cm (n=44). Downstream at Houghton Rd, Princeton, DFG personnel collected a fish sample (#1923) in Aug 2006. The large sample (n=91) contained only fluvial species (mainly blacknose dace), but no cold water species at this high gradient site. Roughly mid-AU, at Bullard Rd just downstream of the outlet channel from Snow Pond Dam, DFG biologists collected another fish sample (#1929) and DCR staff conducted limited WQ monitoring (Station MD90). The fish sample (n=41; Aug 2006) at this high gradient location was comprised of 58% fluvial species (mainly white sucker), but again no

cold water species. The maximum temperature in 2008 was 22.0 ˚C (n=15 in the summer index period) with 2 measurements >20.0 ˚C and the maximum SC was 244 µS/cm (n=48/yr). Downstream of Rt 140 in Sterling (Station MD89, roughly 1400 ft upstream of the confluence with Stillwater River MA81-31), DCR staff conducted water quality monitoring from 2008-2019. The minimum DO concentration was 8.05 mg/L (n=4; 2019 only) and pH ranged from 7.28-7.63 SU (n=4; 2019 only). More than 10% of discrete temperature measurements exceeded 20.0 ˚C every year (2008-2019) and at least 1 measurement exceeded 22.0 ˚C in 6 of 12 years (maximum 24.3 ˚C). These warmer temperatures are likely a consequence of the natural flattening out of the topography in the downstream portion of the sub-basin. Specific conductance was measured roughly weekly from 2008-2013 and roughly biweekly in most later years with a maximum of 420 µS/cm.

The Aquatic Life Use of East Wachusett Brook (MA81-30) is assessed as Fully Supporting based primarily on the presence of a reproducing population of Eastern brook trout and continuous temperature data supportive of such a fishery in the upper reach of the AU, as well as a high proportion of fluvial species in all 3 fish samples. Warmer discrete temperature measurements in the downstream portion of the AU are of concern and an Alert is being issued. However, they are likely natural due to the flattening topography in this area.

East Waushacum Pond (MA81035)

Location:	Sterling.
AU Type:	FRESHWATER LAKE
AU Size:	181 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Fish, other Aquatic Life and Wildlife Use: Not Assessed

In the 2002 update to the Town of Sterling Open Space and Recreation Plan, it was noted that the East Waushacum Lake Associaticonducted a study which concluded that recurring algal blooms are affected by residential septic systems and potentially fertilizer use. However, this study was not submitted to MassDEP for review.

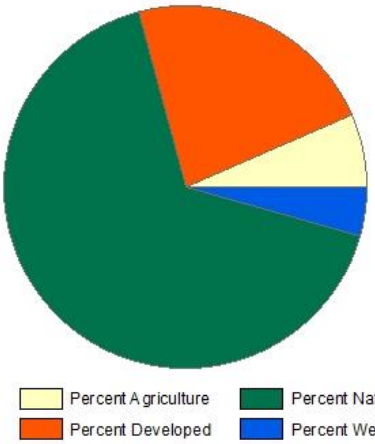
Without recent water quality data, the Aquatic Life Use for East Waushacum Pond (MA81035) is Not Assessed. A recommendation will be made to conduct a water quality survey.

Fall Brook (MA81-38)

Location:	From outlet Fall Brook Reservoir, Leominster to inlet Lake Samoset, Leominster (formerly part of 2008 segment: Fall Brook MA81-14).
AU Type:	RIVER
AU Size:	1.3 MILES
Classification/Qualifier:	B

Fall Brook - MA81-38

Watershed Area: 2.36 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.36	2.36	0.96	0.96
Agriculture	6.6%	6.6%	5%	5%
Developed	22.6%	22.6%	23.6%	23.6%
Natural	66.5%	66.5%	62.9%	62.9%
Wetland	4.3%	4.3%	8.5%	8.5%
Impervious Cover	5.9%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG staff sampled the Fall Brook fish population at 2 high

gradient locations on 11 Aug 2006. In an isolated pool downstream of the Pleasant and Wachusett St. intersection in Leominster (Sample ID 1683), there was 1 moderately tolerant macrohabitat generalist (a pumpkinseed) in the small sample (n=7). Given the isolated nature of the station, it is not considered representative of the rest of the AU. Just upstream of the inlet to Lake Samoset at Lakeview Drive (Sample ID 1931), 40% of the sample (n=20 in sample) was composed of the fluvial specialist species, blacknose dace, and 25% of the sample was the moderately tolerant macrohabitat generalist, largemouth bass. MassDEP conducted monthly bacteria monitoring from May-Sept 2008, during which there were no observations of excessive filamentous algae.

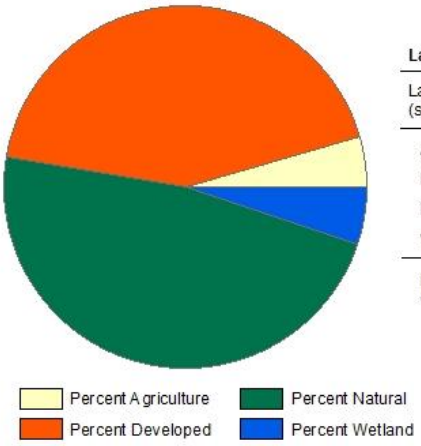
The Aquatic Life Use for the upstream Fall Brook AU (MA81-38) is assessed as Fully Supporting based primarily on the moderate abundance of a fluvial specialist species in the fish population sample collected near the inlet to Lake Samoset. Although DFG has identified this AU as a CFR, there is no evidence at this time that cold water fish are using this AU.

Fall Brook (MA81-39)

Location:	From outlet Lake Samoset, Leominster to mouth at confluence with the North Nashua River, Leominster (formerly part of 2008 segment: Fall Brook MA81-14).
AU Type:	RIVER
AU Size:	3 MILES
Classification/Qualifier:	B

Fall Brook - MA81-39

Watershed Area: 7.2 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	7.2	5.81	2.21	1.61
Agriculture	4.5%	4.5%	3.5%	3.9%
Developed	42.9%	49.9%	36.5%	43.5%
Natural	47.4%	40.5%	48.9%	40.9%
Wetland	5.2%	5.2%	11.2%	11.7%
Impervious Cover	17.7%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Fall Brook (MA81-39) is being assessed as a Tier 1 Cold Water Existing Use fishery because multiple age classes of Eastern brook trout and brown trout were present in a previously summarized sample (Sample ID 661) collected by MassDFG upstream of Route 12 in Leominster on 13 August 2002. MassDEP deployed a temperature logger in the vicinity of the fish sample for 70 days beginning on 20 June 2008 (Unique ID W1827). The Tier 1 CWF existing use chronic criterion (20.0 °C) was exceeded on 39 days but the maximum 24-hour rolling average temperature of 22.4 °C did not exceed the Tier 1 CWF existing use acute criterion (23.5 °C). Downstream, at Route 117 in Leominster (Unique ID W1826), MassDEP conducted 6 monthly bacteria monitoring surveys during summer 2008. During these surveys, there were no reports of excessive filamentous algae.

The Aquatic Life Use for Fall Brook (MA81-39) is assessed as Not Supporting because continuous temperature data exceeded the Tier 1 CWF existing use chronic criterion more than 11 times; in fact, there were 39 exceedances.

Fall Brook Reservoir (MA81038)

Location:	Leominster.
AU Type:	FRESHWATER LAKE
AU Size:	88 ACRES
Classification/Qualifier:	A: PWS, ORW

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	5	Mercury in Fish Tissue		Added

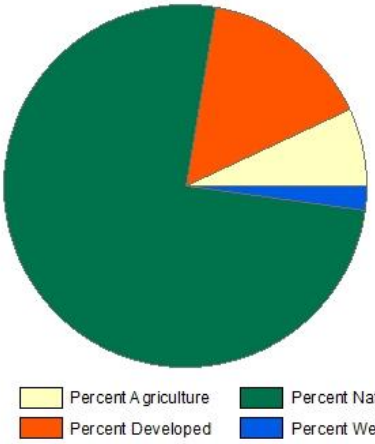
Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Fall Brook Reservoir (MA81038) is Not Assessed due to the absence of recent data.
Fish Consumption Use: Not Supporting
MassDEP biologists conducted fish toxics sampling at Fall Brook Reservoir in May 2017 as part of the probabilistic lake surveys (MAP2). Because of elevated mercury measured in fish filets, MassDPH issued the following fish consumption advisories: • *"Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body."* • *"The general public should limit consumption of all fish from this water body to two meals per month."* Since there is a site specific DPH advisory for elevated mercury in fish tissue, the Fish Consumption Use for Fall Brook Reservoir (MA81038) is assessed as Not Supporting. The likely source, although not confirmed, is atmospheric deposition. Data Source: (MassDPH 2019)

FALULAH BROOK (MA81-100)

Location:	From the outlet of Lovell Reservoir at Lovell Reservoir Dam (NATID#: MA00872), Fitchburg to mouth at confluence with Pearl Hill Brook, forming headwaters Baker Brook, Fitchburg (formerly part of 2016 segment: Falulah Brook MA81-63).
AU Type:	RIVER
AU Size:	4 MILES
Classification/Qualifier:	B

FALULAH BROOK - MA81-100

Watershed Area: 12.6 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	12.6	4.41	5.16	1.16
Agriculture	6.9%	8%	4%	1.8%
Developed	15.4%	34.4%	10.1%	29.4%
Natural	75.5%	56.3%	81.2%	64.4%
Wetland	2.2%	1.4%	4.8%	4.4%
Impervious Cover	6.5%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting
MassDFG biologists conducted backpack electrofishing in Falulah Brook (MA81-100) at 3 locations at the upstream end and 1 location in the downstream half of the AU, in Fitchburg. The 3 upstream samples were collected off Rindge Rd and downstream of the water tank (~ 1/3 mi north of Scott Rd, Sample ID 3396) in August 2010; above the power station on Rindge Rd (~ 0.1 mi north of Scott Rd, Sample ID 3397) in August 2010; and near Saima Park off the north side of Rindge Rd (Sample ID 601) in June 2002. Multiple age classes of the intolerant, cold water species, Eastern brook trout (EBT), were collected at all three stations (n = 17-34 EBT per station), and fluvial species dominated the samples. Given the presence of a reproducing brook trout population in Falulah Brook, this stream will be evaluated as a Tier 1 Existing Use Cold Water Fishery. MassDEP staff collected 6 bacteria samples in the middle of the AU, at Fisher Road, Fitchburg, during summer 2008 (W1837). There were no observations of excessive filamentous algae during these surveys. The fourth DFG electrofishing site, behind the Wallace Civic Center (Sample ID 606), was sampled in June 2002. Although no Eastern brook trout were captured, this was the largest (n=86) and most diverse sample (8 species), and was dominated by fluvial species, including several adult brown trout (an intolerant, cold water species).

Near the downstream end of the brook, NRWA collected discrete dissolved oxygen data at the Rt. 2A (Lunenburg Street) crossing in Fitchburg (Station BK0430). The data which met quality objectives were collected six times from May-October 2013 and were indicative of good conditions, with a minimum of 6.9 mg/L.

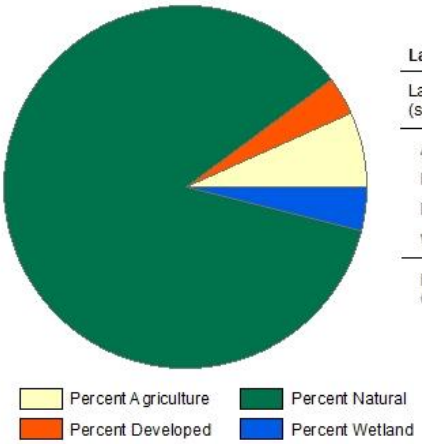
The Aquatic Life Use for Falulah Brook (MA81-100) is assessed as Fully Supporting based primarily on the presence of a reproducing wild population of Eastern brook trout (a species found in streams with excellent habitat and water quality), as well as limited water quality data indicative of good conditions for an Existing Use Cold Water Fishery.

FALULAH BROOK (MA81-99)

Location:	Headwaters near Ringe Road, Ashby to inlet Lovell Reservoir, Fitchburg (formerly part of 2016 segment: Falulah Brook MA81-63).
AU Type:	RIVER
AU Size:	2 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

FALULAH BROOK - MA81-99

Watershed Area: 4.13 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	4.12	3.7	2.16	2.03
Agriculture	6.6%	7.4%	4.9%	5.2%
Developed	3.4%	3.6%	2.6%	2.7%
Natural	86.1%	85%	85.9%	85.3%
Wetland	3.8%	4%	6.7%	6.8%
Impervious Cover	1.8%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing in Falulah Brook (MA81-99), a CFR stream, at three locations in Fitchburg within the downstream half of the AU in 2006 and 2010. Stations were located downstream of Ashby West Rd (Sample ID 3395, August 2010), adjacent to Rindge Rd (Sample ID 1548, July 2006), and along Rindge Rd, 0.6 miles west of Ashby West Rd (Sample ID 3394, August 2010). The samples ranged in size from 24 fish (2 species) at the upstream station to 132 fish (4 species) at the middle station. Multiple age classes of Eastern brook trout, a sensitive, cold water species, were captured at the middle (n=5) and downstream (n=2) stations. Additionally, the fluvial specialist, blacknose dace, dominated the samples at all three locations. The Aquatic Life Use for Falulah Brook (MA81-99) is assessed as Fully Supporting based on the presence of a reproducing wild population of Eastern brook trout, a species indicative of excellent habitat and water quality conditions.

Fitchburg Reservoir (MA81043)

Location:	Ashby.
AU Type:	FRESHWATER LAKE
AU Size:	150 ACRES
Classification/Qualifier:	A: PWS, ORW

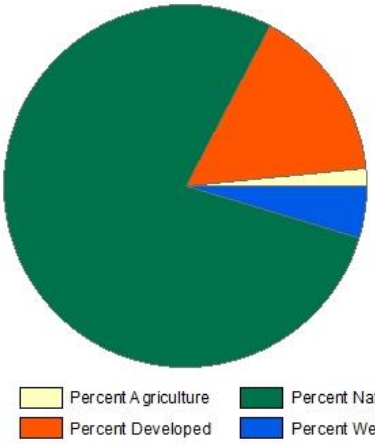
Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Fitchburg Reservoir (MA81043) is Not Assessed since no recent data are available.

Flag Brook (MA81-10)

Location:	Headwaters, outlet Crocker Pond, Westminster to mouth at inlet of impoundment (Wachusett Station Pond) of North Nashua River, Fitchburg (excluding approximately 0.7 miles through Sawmill Pond segment MA81118).
AU Type:	RIVER
AU Size:	2.2 MILES
Classification/Qualifier:	B

Flag Brook - MA81-10

Watershed Area: 12.8 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	12.77	5.89	4.84	1.39
Agriculture	1.6%	0.4%	1.5%	0.2%
Developed	15.7%	20.8%	16.5%	27.2%
Natural	78.1%	74.7%	73%	64.5%
Wetland	4.6%	4%	9%	8.2%
Impervious Cover	7.8%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

MassDEP conducted 6 bacteria surveys on lower Flag Brook from May to September, 2008. There were no observations of excessive filamentous algae during these site visits.

Due to the absence of recent substantial biological/water quality data, there is Insufficient Information to assess the Aquatic Life Use for Flag Brook (MA81-10).

Flannagan Pond (MA81044)

Location:	Ayer.
AU Type:	FRESHWATER LAKE
AU Size:	80 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4c	4c	(Curly-leaf Pondweed*)		Added
4c	4c	(Fanwort*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

As was previously reported, MassDEP staff conducted a synoptic survey of Flannagan Pond in July 1998 and observed multiple species of non-native aquatic macrophytes, including curly-leaf pondweed (*Potamogeton crispus*), fanwort (*Cabomba caroliniana*), and variable milfoil (*Myriophyllum heterophyllum*). Herbicide permit applications were filed with MassDEP in 2006, 2007, and 2011-2013 to treat the non-native aquatic macrophytes, variable milfoil (*Myriophyllum heterophyllum*) and fanwort (*Cabomba caroliniana*). Geosyntetc Consultants prepared a report for the Town of Ayer, describing the conditions of the lakes and ponds in the municipality. The consulting firm conducted an aquatic macrophyte survey of Flannagan Pond in September 2014 and documented 24 species, including 4 invasive species (1 of these was a wetland species). They noted that, "*Plant growth was most abundant in the eastern end of the pond, where white water lily dominated the surface canopy and eastern purple bladderwort was the dominant submerged species. The easternmost sampling station (station #1), near the inlet from Sandy Pond, was the only station where invasive fanwort was observed.*" They further noted, "*Although variable milfoil and fanwort were observed only in the eastern end of the pond during the 2014 survey, recurrence of these species is anticipated.*" The Aquatic Life Use of Flannagan Pond (MA81044) remains assessed as Not Supporting for Non-Native Aquatic Plants (due to the presence of the non-native variable milfoil / *Myriophyllum heterophyllum*, which does not have a species-specific code), and new species codes are being added for Fanwort (*Cabomba caroliniana*) and Curly-leaf Pondweed (*Potamogeton crispus*).

Fort Pond (MA81046)

Location:	Lancaster.
AU Type:	FRESHWATER LAKE
AU Size:	76 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Supporting

MassDEP staff conducted water quality monitoring at the deep hole of Fort Pond (Unique ID W0603) in 2005 as part of a Nutrient Criteria Study. A depth profile indicated that the lake was stratified, with a steep decline in temperature around 2.5-3.6 m in depth (maximum temperature was 26.5 °C at the surface). Dissolved oxygen dropped from 7.5 mg/L down to <0.2 mg/L at the bottom. DO dropped below 5.0 mg/L between 4.0-4.5 m in depth (equivalent to 13.1-14.8 ft). According to bathymetry data, the area of the lake at this depth encompasses roughly 5.7-7.3% of the area of the pond at the surface. The maximum DO saturation was 94% at the surface. pH in the pond ranged from 6.2-7.2 SU and the maximum specific conductance was 797 µs/cm at the greatest depth measurement. Total phosphorus was quite low at the surface, 0.006 mg/L, but elevated near the bottom (0.76 mg/L) where anoxic sediments can release total phosphorus. A depth integrated chlorophyll-*a* measurement over part of the depth (0-8.0 m) was low at 1.4 µg/L.

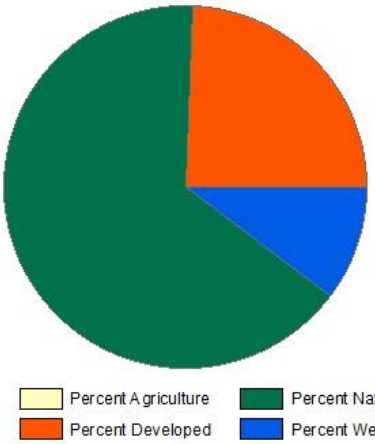
The Aquatic Life Use for Fort Pond (MA81046) remains assessed as Not Supporting for low dissolved oxygen due to the age of available dissolved oxygen data. Since the area at which DO dropped below 5.0 mg/L was <10% of the surface area of the pond, another water quality survey should be conducted to aid in a potential delisting. Other water quality data were generally indicative of good conditions.

French Brook (MA81-48)

Location:	Headwaters, west of Linden Street, Boylston to mouth at inlet Wachusett Reservoir (Andrews Harbor), Boylston.
AU Type:	RIVER
AU Size:	1.4 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

French Brook - MA81-48

Watershed Area: 2.01 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.01	2.01	1.28	1.28
Agriculture	0.9%	0.9%	1%	1%
Developed	24.1%	24.1%	19.4%	19.4%
Natural	64.8%	64.8%	64.1%	64.1%
Wetland	10.1%	10.1%	15.5%	15.5%
Impervious Cover	6.6%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

Backpack electrofishing was conducted by MassDFG biologists in French Brook at two locations. In the low gradient reach at the upstream end of the AU, at the Linden St crossing in Boylston, four species were collected on 28 July 2011 (Sample ID 3816). The fluvial specialist species, blacknose dace, comprised 30% of the sample (n=77 individuals). Further downstream in a high gradient reach at Cross St, Boylston sampling on 20 July 2006 (Sample ID 1676) resulted in the capture of 102 blacknose dace. MassDFG biologists attempted to sample a downstream location in 2006, but the brook was impounded by beavers so no sampling was conducted.MassDEP staff collected total phosphorus and ammonia grab samples in lower French Brook approximately 500 ft upstream of the Wachusett Reservoir inlet, west of Main St Circle, Boylston (W2066) on four surveys in 2008 (May-Aug). The TP seasonal average was 0.066 mg/L while the maximum was 0.11 mg/L. Although temperature and pH data were not collected at the station so site-dependent ammonia criteria could not be calculated, ammonia concentrations were relatively low with a maximum of 0.12 mg/L. There were no observations of excessive filamentous algae. MassDCR staff conducted water quality monitoring in the vicinity of the DEP station from 2008-2019 (Station MD01). Discharge ranged from no flow to 35.83 cfs, with low flow occurring during summer months and some of these instances occurred during periods of drought. The minimum dissolved oxygen measured in 2019 was 4.98 mg/L (n=6) and pH ranged from 6.86 to 7.45 SU (n=6). There were no violations of criteria for either parameter. Temperature was monitored continuously from 2017-2019. The maximum 7-DADM was 26.06 °C and the maximum 24-hour rolling average was 25.97 °C, neither of

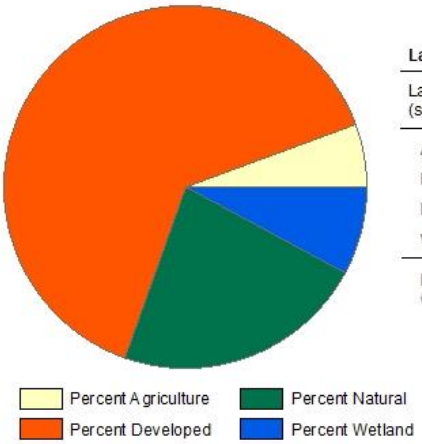
which exceeded acute or chronic criteria for warm water fisheries. Discrete temperature measurements (maximum of 27.2 °C) during the summers from 2008 to 2019 also did not exceed the WWF criterion. Total phosphorus was measured 3-7 times per year during the May-September summer season from 2008-2019. Seasonal averages ranged from 0.031-0.082 mg/L and were below 0.05 mg/L (the EPA Gold book recommended criterion for flowing waters entering a reservoir) in the last seven years of the sampling period. Ammonia was measured from 2008-2019 (n= 6-14 times per year) with a maximum reading of 0.25 mg/L that was below acute and chronic criteria (calculated using the station MD01 water temperature measurement from that date and the maximum pH measured by DCR in all the Wachusett Reservoir tributaries as a worst-case condition). The maximum chloride concentration from 2018 (n=14) and 2019 (n=8) was 163 mg/L. The maximum specific conductance reading (n=554) for 11 of the 12 years from 2008-2019 was 798 µS/cm. Only four measurements in 2016 exceeded 904 µs/cm (the criterion for evaluating chronic chloride toxicity using estimated data), ranging as high as 1,056 µS/cm. These exceedances occurred July through September during a period of drought.
The Aquatic Life Use for French Brook (MA81-48) is assessed as Fully Supporting based primarily on the strong representation of a fluvial specialist species in the fish population samples as well as generally good water quality conditions, particularly that documented in the extensive DCR data set (2008-2019). The prior alert for total phosphorus is being removed since seasonal averages were below 0.05 mg/L in the last seven years of DCR data.

Gates Brook (MA81-24)

Location:	Headwaters west of Prospect Street, West Boylston to mouth at inlet Wachusett Reservoir (Gates Cove), West Boylston.
AU Type:	RIVER
AU Size:	3.4 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Gates Brook - MA81-24

Watershed Area: 3.13 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	3.13	3.13	2.08	2.08
Agriculture	5.6%	5.6%	5.1%	5.1%
Developed	63.9%	63.9%	62.3%	62.3%
Natural	22.6%	22.6%	21.4%	21.4%
Wetland	7.9%	7.9%	11.2%	11.2%
Impervious Cover	17%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Chloride		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

Gates Brook has been extensively monitored by MassDFG (fish population 2007-09), MassDCR (water quality 2008-19), and MassDEP (benthic, fish, WQ in 2008). Of 6 DCR WQ stations, 4 were only sampled from 2008-2013 and are not discussed due to space constraints; data from all stations were similar. From upstream to downstream, stat. descriptions are as follows: in the middle of the AU, DCR MD73 (upstr. of Pierce St, W Boylston), DFG 3061, further downstr. of the Scarletts Brook confluence, DFG 3057, DFG 3058, DFG 2162, and clustered near the confluence with Gates Cove, DEP WQ stat. W1817 (~600 ft upstr. of Gates Cove, Wachusett Res, W Boylston), DEP benthic stat. B0662, DCR MD04, DFG 3059, DFG 2499, DFG 3060, DEP GB01. At DCR stat. MD73, limited DO (2019, min 8.22 mg/L, n=4) and pH data (2019, range 7.27-7.70 SU, n=4) were indicative of good conditions. In 5 of 12 years (summer index period June 1 – Sept 15, 2008-19), 2 temp. measurements (>10% of usually 15-16/year) were greater than 20.0 °C (max 21.5 °C). Although not statistically analyzed, there was an increasing trend in the percentage of specific conductance measurements (40-50/year, 2008-19) exceeding 994 µS/cm (the estimated chloride chronic criterion plus a 10% margin to account for error in the

model). From 2015-2019, more than 85% of samples each year exceeded 994 µS/cm (max 9,420 µS/cm). Of the 8 fish samples collected throughout Gates Brook, all were dominated by fluvial species, contained some combination of cold water species (Eastern brook trout, brown trout, inland salmon), and all but 2 contained multiple ages classes of Eastern brook trout. In the downstr. part of the brook, the RBPIII status of benthic sample B0662 was determined to be "not impaired" (86% comparable) when compared to the Nissitissit River reference (Unique ID: B0087). In the vicinity, DEP collected continuous temp. data and nutrient grab samples at W1817 during summer 2008. A thermistor was deployed for 82 days beginning on June 20. The max 7-DADM was 18.6 °C and the max 24-hour rolling average temp. was 19.9 °C (no violation of cold water fishery criteria). The seasonal average total phosphorus concentration was 0.022 mg/L (n=4; max 0.062 mg/L) and there were no violations of ammonia criteria (n=4). There were no observations of excessive filamentous algae. Also in this area, DCR collected WQ data from 2008-19 at station MD04. Limited DO and pH data were good and similar to MD73. Among discrete temp. measurements, the maximum was 20.0 °C (n= ~12 per summer index; 2008-19). Although the seasonal average of TP measurements (2008-19) ranged from 0.014-0.307 mg/L (n= 3-20 per season, max 0.018-2.13 mg/L), some of these measurements included stormwater samples and it should be noted that all of the individual measurements >0.05 mg/L, except one, corresponded with a stormwater sampling event. The absence of elevated concentrations in dry weather samples indicates that TP quickly flushed through the system. There were no violations among ammonia data (max 0.18 mg/L; n= 5-36/ year; 2008-19). Chloride samples were collected in 2018 (n=23) and 2019 (n=8) with concentrations exceeding 230 mg/L 70% and 88% of the time, respectively (avg/max 281/590 mg/L in 2018 and 269/312 mg/L in 2019). These data corroborated the SC data (max 4,121 µS/cm; >85% of samples >994 µS/cm from 2016-19), which were similar to DCR MD73 SC data.

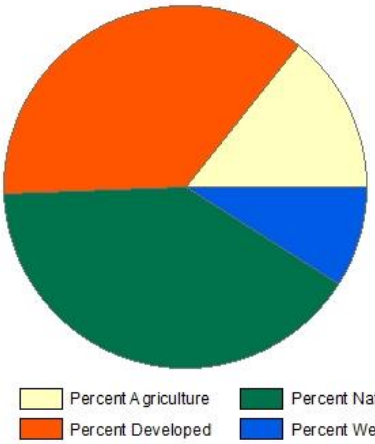
Although there is a reproducing population of Eastern brook trout in Gates Brook (MA81-24) and a benthic sample had an RBPIII status of not impaired, the Aquatic Life Use is assessed as Not Supporting for Chloride (chronic toxicity). The prior alert for total phosphorus is retained due to elevated concentrations in DCR stormwater samples. Although continuous temperature data from 2008 did not violate cold water fishery criteria, an Alert is being added since >10% of discrete measurements exceeded 20.0 °C in 5 of 12 years at DCR station MD73.

GOODRIDGE BROOK (MA81-66)

Location:	Headwaters, outlet impoundment at Old Ice Pond Dam (NATID: MA01560), Lancaster to mouth at confluence with Nashua River ("South Branch Nashua River"), Lancaster.
AU Type:	RIVER
AU Size:	1.8 MILES
Classification/Qualifier:	B: CWF

GOODRIDGE BROOK - MA81-66

Watershed Area: 2.84 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.84	2.84	0.79	0.79
Agriculture	14.3%	14.3%	8.4%	8.4%
Developed	36.3%	36.3%	24.6%	24.6%
Natural	40.5%	40.5%	44%	44%
Wetland	9%	9%	22.9%	22.9%
Impervious Cover	14.7%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

MassDFG biologists conducted backpack electrofishing in Goodridge Brook (MA81-66), a designated cold water fishery, at one location near St. John's cemetery, South Lancaster, in July 2002 (Sample ID 582). Multiple age classes of the intolerant cold water species, Eastern brook trout, were collected (178 individuals). Eastern brook trout are considered indicative of excellent habitat and water quality conditions. Another fluvial species, blacknose dace, comprised 28% of the large sample (n=250).

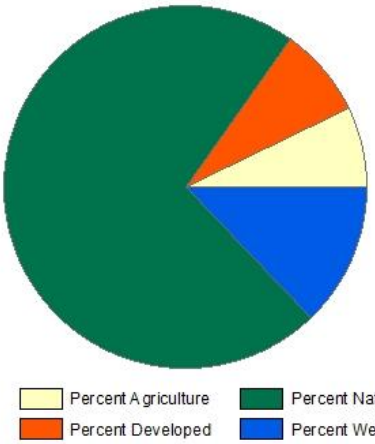
Due to the age of the one fish sample collected in Goodridge Brook (MA81-66), there is Insufficient Information to assess the Aquatic Life Use.

GOVERNOR BROOK (MA81-70)

Location:	Headwaters, east of Worcester Road (Route 31), and south of Flagg Hill, Princeton to mouth at confluence with Trout Brook, Holden.
AU Type:	RIVER
AU Size:	4.4 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

GOVERNOR BROOK - MA81-70

Watershed Area: 5.57 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	5.57	4.49	3.09	2.57
Agriculture	7.1%	7.2%	5.8%	5.5%
Developed	8%	5.8%	5.4%	4.3%
Natural	72.1%	72.6%	69%	68.7%
Wetland	12.7%	14.4%	19.8%	21.5%
Impervious Cover	2.5%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted electrofishing in a low gradient reach of Governor Brook at Coal Kiln Rd, Princeton on 30 June 2010. The small sample (Sample ID 3372; n=6 individuals) included an individual each of chain pickerel and pumpkinseed, both moderately tolerant macrohabitat generalists. Downstream at the Sterling Rd crossing in Holden (Unique ID W1839), MassDEP conducted six bacteria surveys from May-Sept 2008 during which there were no observations of excessive filamentous algae.

The Aquatic Life Use for Governor Brook (MA81-70) is assessed as Fully Supporting based primarily on the presence of two moderately tolerant fish species in a 2010 survey.

Grove Pond (MA81053)

Location:	Ayer.
AU Type:	FRESHWATER LAKE
AU Size:	68 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Curly-leaf Pondweed*)		Added
5	5	(Fanwort*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

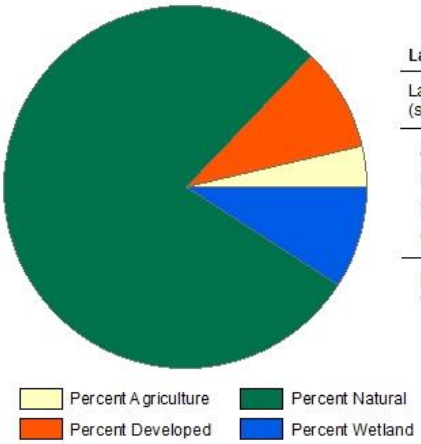
As was previously reported, MassDEP staff identified multiple non-native aquatic macrophytes- curly-leaf pondweed (*Potamogeton crispus*), fanwort (*Cabomba caroliniana*), and variable milfoil (*Myriophyllum heterophyllum*)- in Grove Pond during a July 1998 synoptic survey. A report was prepared for the Town of Ayer, describing the conditions of the lakes and ponds in the municipality. Geosyntec Consultants conducted an aquatic macrophyte survey of the pond in August 2014 and noted roughly the entire pond exhibited very dense growth of aquatic vegetation, particularly of submerged and floating-leaf types. They documented the presence of the non-native species, fanwort (*Cabomba caroliniana*), variable milfoil (*Myriophyllum heterophyllum*), and water chestnut (*Trapa natans*). The Aquatic Life Use of Grove Pond (MA81053) remains assessed as Not Supporting for Non-Native Aquatic Plants (due to the presence of (variable milfoil / *Myriophyllum heterophyllum*, for which no species-specific code is available) and the species codes for Curly-leaf Pondweed (*Potamogeton crispus*) and Fanwort (*Cabomba caroliniana*) are being added. Additionally, the historic impairment, Sediment Bioassay is being retained since no new benthic macroinvertebrate data are available to determine whether metals contamination in the sediments might have improved sufficiently to be reflected in an improved benthic community.

GULF BROOK (MA81-76)

Location:	Headwaters, outlet Heald Pond, Pepperell to the New Hampshire border, Pepperell approximately 0.2 miles upstream of mouth at confluence with Nissitissit River.
AU Type:	RIVER
AU Size:	2.6 MILES
Classification/Qualifier:	B: ORW, CWF

GULF BROOK - MA81-76

Watershed Area: 3.63 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	3.63	3.61	0.79	0.79
Agriculture	3.6%	3.6%	0.5%	0.5%
Developed	9.2%	9.3%	5.9%	5.9%
Natural	78.1%	78%	76.2%	76.2%
Wetland	9%	9.1%	17.3%	17.3%
Impervious Cover	3.7%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting
MassDFG biologists conducted backpack electrofishing at three locations in Pepperel in the downstream half of the Massachusetts portion of Gulf Brook, a designated cold water fishery. Upstream of Oak Hill St (just E. of Chestnut St, Sample ID 2170), the fish community was surveyed in September 2007, while downstream of Chestnut St (Oak Hill St, Sample ID 858), the fish community was surveyed in July 2003. Both of these samples contained over 100 individuals, of which >60% were multiple age classes of the intolerant cold water species, Eastern brook trout, (the fluvial specialist, blacknose dace, was also well represented in both samples). NRWA collected discrete water quality data at one station in Gulf Brook upstream of Chestnut Street, Pepperell (GB0312). The data which met quality objectives were collected between 2008 and 2018 (roughly 6 times per year). Dissolved oxygen data were indicative of good conditions with 66 of the 67 measurements greater than the 1-day minimum cold water criterion of 5.0 mg/L. Moving downstream, to the area upstream of Lawrence St (Sample ID 2169), a small fish sample (n=11) was collected by DFG staff in August 2007 that contained only macrohabitat generalists (3 species, 82% moderately tolerant). However, the sample reach was bordered by a beaver impoundment on one end and was located downstream of the confluence with Stewart Brook (the stream corridor of this tributary consists of coniferous wooded swamp) and a small wetland/pond area on Gulf Brook. The lack of cold water fish in this sample was likely due to these natural habitat limitations. MassDEP staff collected 6 bacteria samples at Lawrence Street, Pepperell during summer 2008 (Unique ID W1844). There were no observations of excessive filamentous algae during these surveys. The Aquatic Life Use for Gulf Brook (MA81-76) is assessed as Fully Supporting based primarily on the presence of a reproducing wild population of

Eastern brook trout, a species indicative of excellent habitat and water quality. Limited water quality data (dissolved oxygen only) were indicative of good conditions.

Haynes Reservoir (MA81055)

Location:	Leominster.
AU Type:	FRESHWATER LAKE
AU Size:	56 ACRES
Classification/Qualifier:	A: PWS, ORW (PWS and Tributary to PSW)

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

Haynes Reservoir (MA81055) is part of the public water supply for the City of Leominster. USEPA staff conducted a probabilistic lake survey in Haynes Reservoir on 19 July 2007 as part of the National Lakes Assessment. The benthic macroinvertebrate community was considered to be "Good," the highest condition assigned in this project (score of 57.2 fell above the 25th percentile least-disturbed threshold of 51.5 for the Eastern Highlands ecoregion reference sites). The Secchi disk depth indicated a clear water column, with visibility to the bottom (2.5 m). Water column profile data were indicative of good conditions (maximum temperature 25.28 ^{o}C; minimum DO 7.73 mg/L; pH range 6.14-6.28 SU; maximum specific conductance 34 µs/cm). One-time water chemistry data were indicative of low nutrient loadings (chlorophyll-a 2.088 µg/L; TP 0.005 mg/L).

The Aquatic Life Use of Haynes Reservoir is assessed as Fully Supporting based on the "good" benthic macroinvertebrate community and water quality data that were indicative of good conditions (good DO, temperature within criteria, low phosphorus and chlorophyll levels).

Heald Pond (MA81056)

Location:	Pepperell.
AU Type:	FRESHWATER LAKE
AU Size:	28 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Heald Pond (MA81056) is Not Assessed since no recent data are available.

Hickory Hills Lake (MA81031)

Location:	Lunenburg.
AU Type:	FRESHWATER LAKE
AU Size:	311 ACRES
Classification/Qualifier:	B

Also known as Dickinson Reservoir

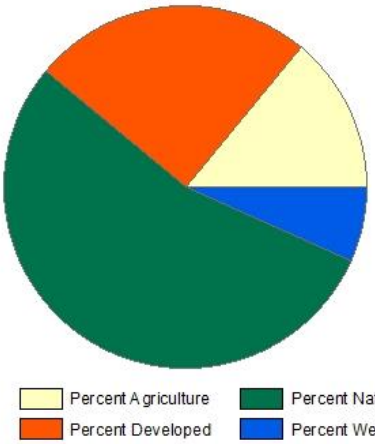
Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Hickory Hills Lake (MA81031) is Not Assessed due to the absence of recent data.

Houghton Brook (MA81-55)

Location:	Headwaters, south of Merrill Road, Sterling to mouth at confluence with Stillwater River, Sterling.
AU Type:	RIVER
AU Size:	1.5 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Houghton Brook - MA81-55

Watershed Area: 0.9 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.9	0.9	0.62	0.62
Agriculture	14%	14%	15.4%	15.4%
Developed	25%	25%	22.6%	22.6%
Natural	54.3%	54.3%	52.5%	52.5%
Wetland	6.7%	6.7%	9.5%	9.5%
Impervious Cover	7.3%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

MassDFG attempted to conduct fish surveys at the Merrill Rd and Rt 140 crossings of Houghton Brook in Sterling in August 2012 (Sample ID 4218). However, field notes indicated "No sample done. Upper stretch, Merrill Rd unsampleable. Rt 140, no water-swamp." This is likely a natural condition in this small watershed (0.9 sq mi), as 2012 was not a drought year and there are no groundwater withdrawals in the sub-basin. MassDCR staff did collect limited water quality data at the Rt 140 crossing in 2008 (Station MD92). The maximum temperature during the summer index period was 22.0 ˚C (n=15). Of 49 specific conductance measurements, most were <904 µS/cm (the estimated chloride chronic criterion) with two exceptions of 927 and 3053 µS/cm (this last occurred in January, likely after a winter storm event). Given the lack of biological data and limited water quality data, there is Insufficient Information to assess the Aquatic Life Use of Houghton Brook (MA81-55).

Hy-Crest Pond (MA81060)

Location:	Sterling.
AU Type:	FRESHWATER LAKE
AU Size:	104 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

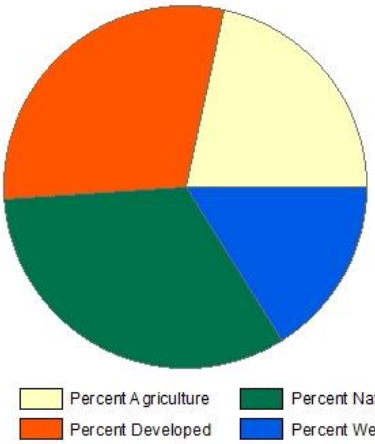
Fish, other Aquatic Life and Wildlife Use: Not Assessed (Alert)
There are no recent data available so the Aquatic Life Use for Hy-Crest Pond (MA81060) is Not Assessed. The use is identified with an Alert status due to the presence of an unidentified species of *Utricularia*, which may be the non-native aquatic macrophyte, *U. inflata.*

James Brook (MA81-20)

Location:	Headwaters, Groton to mouth at mouth at confluence with Nashua River, Ayer/Groton.
AU Type:	RIVER
AU Size:	3.9 MILES
Classification/Qualifier:	B

James Brook - MA81-20

Watershed Area: 4.38 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	4.38	4.35	1.03	1.03
Agriculture	21.6%	21.7%	10.7%	10.7%
Developed	29.5%	29.2%	19.8%	19.8%
Natural	32.8%	32.9%	27.4%	27.4%
Wetland	16.1%	16.1%	42.1%	42.1%
Impervious Cover	8.6%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Dissolved Oxygen		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

NRWA staff/volunteers collected discrete water quality data at four stations in James Brook, from upstream to downstream these stations were: Court St, Groton (JB0583, 2008-2011), Indian Hill Rd, Groton (JB0887, in 2019), Old Ayer Rd, Groton (JB0200, 2012-2016) and upstream of the Rt. 111 Bridge, Ayer (JB0121, 2010-2018). The data which met quality objectives were collected roughly 6 times per year. Dissolved oxygen data were sometimes indicative of poor conditions, especially in the upstream half of the brook, which runs through the center of Groton. Between a quarter and a half of the measurements for the most upstream three stations (JB0583, JB0887, JB0200) were below the 4.0 mg/L criterion in multiple years, most often in the warmest of the summer months, with minimums of 1.4, 1.9 and 2.4 mg/L, respectively. However, at the most downstream sample station (JB0121), where the most data were collected, only 5 of 53 measurements were less than 4.0 mg/l, with a minimum of 1.5 mg/L in October 2012.

MassDFG biologists conducted backpack electrofishing at two locations in the downstream half of the AU in Groton, in August 2006 and July 2012. The upstream station was located between the 3rd and 4th NRWA station,

upstream of Culvert Rd (Sample ID 1920) and the downstream fish station was located upstream of Rt 111/Groton School Rd (Sample ID 4016). The samples were small (9 individuals at the Culvert Rd station and 2 individuals at the Rt 111 station) but nearly all of the fish collected were intolerant or moderately tolerant macrohabitat generalists, considered indicative of good conditions for low gradient sites. The most abundant species were yellow perch, banded sunfish and chain pickerel.

MassDEP staff conducted water quality monitoring in the downstream portion of the brook at Rt. 111, Ayer (W1000) from May-Sept 2008 (in the vicinity of the downstream NRWA station and the downstream fish sample). A multiprobe was deployed to measure continuous dissolved oxygen and temperature for three 2-day periods in June, July and August, and data consistently met warm water guidelines. The minimum DO from all 3 deploys was 5.51 mg/L, with a maximum diel shift of 0.99 mg/L and a maximum saturation of 81%. The maximum temperature was 27.4 °C. Discrete probe and grab sample data (DO, temperature) were similar and pH data met criteria, ranging from 7.0-7.3 SU (n=6). The total phosphorus seasonal average was 0.027 mg/L with a maximum of 0.037 mg/L (n=5) and there were no observations of excessive filamentous algae. There were also no violations of the calculated criteria for ammonia-nitrogen (maximum 0.09 mg/L, n=5). The Town of Groton was awarded a 319 Nonpoint Source Pollution Competitive Grant in Fiscal Year 2007 (Project #07-09/319) to support their efforts to install BMPs and engage in outreach efforts in their Low Impact Development Zone overlaying the Station Avenue area of the town.

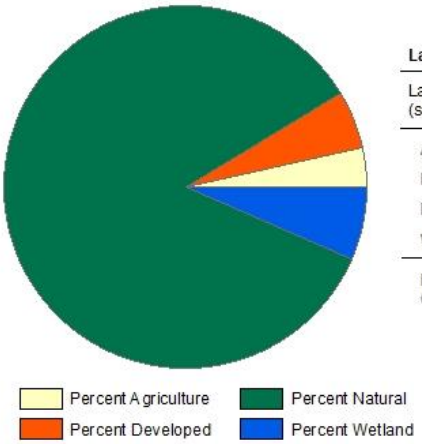
The Aquatic Life Use for James Brook (MA81-20) is assessed as Not Supporting, based on the low DO concentrations in the upstream section of the brook. The low DO concentrations are considered “not natural” due to the large percent coverage of “non-natural” land in the watershed, i.e. the combined agriculture and developed lands comprise 51.1% of the sub-watershed. The historical Alert for pH is being removed since recent pH data were indicative of good conditions.

Justice Brook (MA81-41)

Location:	Headwaters, outlet Stuart Pond, Sterling to mouth at confluence with Keyes Brook forming headwaters Stillwater River, Princeton/Sterling.
AU Type:	RIVER
AU Size:	1 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Justice Brook - MA81-41

Watershed Area: 5.11 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	5.11	4.56	2.61	2.4
Agriculture	3.5%	4%	1.7%	1.9%
Developed	5.1%	5.6%	4.2%	4.4%
Natural	84.8%	83.6%	84.1%	83.8%
Wetland	6.6%	6.8%	10%	10%
Impervious Cover	2.3%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing at two locations in Justice Brook. At the outlet of Stuart Pond (Sample ID 3074, south of Justice Hill cutoff, Sterling), the small sample (n=7) collected in June 2006 included white sucker, a fluvial dependent species, in moderate abundance (43%). Downstream of the Rt 140 crossing in Princeton/Sterling, close to the confluence of the stream with Keyes Brook (MA81-40), a sample collected in June 2009 (Sample ID 3075) contained all fluvial species (blacknose dace, white sucker, fallfish; total n=9). In the vicinity of this second fish site, MassDCR staff collected limited water quality data in 2008. Temperature measured during the summer index period (n=15) had a maximum of 22.0 ˚C. Specific conductance measurements taken roughly weekly throughout the year had a maximum of 70 µS/cm.

The Aquatic Life Use of Justice Brook (MA81-41) is assessed as Fully Supporting, based primarily on the presence of fluvial fish species in two samples.

Kendall Reservoir (MA81062)

Location:	Holden.
AU Type:	FRESHWATER LAKE
AU Size:	179 ACRES
Classification/Qualifier:	A: PWS, ORW (PWS and Tributary to PSW)

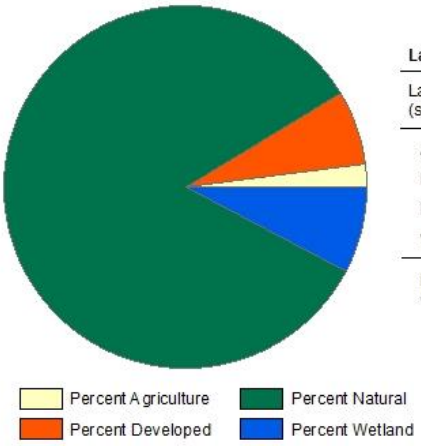
Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
MassDEP staff conducted a synoptic survey of Kendall Reservoir from August 18-20, 1998. The field sheet notes included the following: "Scattered dense beds of *Myriophyllum* sp. below the surface at the dam (north end)." The species identity needs to be confirmed when flowering heads are present. There is Insufficient Information to assess the Aquatic Life Use for Kendall Reservoir (MA81062). The use is identified with an Alert status due to the presence of an unidentified species of *Myriophyllum,* which could be a non-native species.

Keyes Brook (MA81-40)

Location:	Headwaters, outlet Paradise Pond, Princeton to mouth at confluence with Justice Brook forming headwaters Stillwater River, Princeton/Sterling.
AU Type:	RIVER
AU Size:	3.2 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Keyes Brook - MA81-40

Watershed Area: 5.11 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	5.11	3.76	2.84	2.3
Agriculture	2%	2.4%	2%	2.2%
Developed	6.7%	8%	8.3%	9.3%
Natural	83.6%	82.2%	77.2%	77.1%
Wetland	7.7%	7.4%	12.5%	11.3%
Impervious Cover	3.1%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing at a low gradient location in Keyes Brook downstream of the Paradise Pond outlet, near the 4WD trail east of Rt 31, Princeton in July 2006 (Sample ID 1675). Of 27 fish, all warmwater species (n=4), there was 1 chain pickerel and 1 pumpkinseed, which are both moderately tolerant habitat generalists. The majority of the fish in the sample were brown bullheads. MassDCR staff conducted limited water quality monitoring in 2008 at 3 locations (all in Princeton) downstream of the fish sample. These included the Hobbs Rd crossing (Station MD96), the unnamed pond outlet behind the Quik-Stop on Rt 140 (StationMD95), and the Gleason Rd crossing (Station MD94). Discrete temperature readings were measured on 15 occasions within the summer index period at each station and the overall maximum was 24.0 ^{o}C. Specific conductance was measured roughly weekly throughout the year at all 3 stations and the maximum reading was 103 µS/cm.

The Aquatic Life Use of Keyes Brook (MA81-40) is assessed as Fully Supporting due primarily to the presence of fish species that are moderately tolerant of pollution.

Lake Samoset (MA81116)

Location:	Leominster.
AU Type:	FRESHWATER LAKE
AU Size:	35 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Supporting

As was previously reported, MassDEP staff conducted a synoptic survey of Lake Samoset on 12 August 1998 when an infestation of the non-native aquatic macrophyte, *Myriophyllum heterophyllum* (variable milfoil), was documented.

The Aquatic Life Use for Lake Samoset (MA81116) continues to be assessed as Not Supporting due to an impairment for Non-Native Aquatic Plants (*Myriophyllum heterophyllum*, variable milfoil).

Lake Shirley (MA81122)

Location:	Lunenburg/Shirley.
AU Type:	FRESHWATER LAKE
AU Size:	360 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Brittle Naiad, Najas Minor*)		Added
5	5	(Fanwort*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to MADPH records, an advisory was issued for Lake Shirley on 22 August 2014 for a Harmful Algal Bloom; it was rescinded on October 16th of that year (duration of 56 days). As was previously noted, the non-native aquatic macrophyte, fanwort (*Cabomba caroliniana*), was identified in Lake Shirley during a 1998 synoptic survey performed by MassDEP staff. According to the DCR database of non-native species, the lake also has infestations of Eurasian water milfoil (*Myriophyllum spicatum*), brittle naiad (*Najas minor*), and variable milfoil (*Myriophyllum heterophyllum*). The Lake Shirley Improvement Corporation filed herbicide application permits with MassDEP to treat both non-native species of *Myriophyllum* annually from 2007-2016. The applications also listed *Najas*, but a specific species was not noted.

The Lake Shirley Improvement Corporation (LSIC) and the Town of Lunenburg have identified and invested in long-term solutions to address water quality issues in the lake, including the implementation of numerous BMPs. They won funding for such efforts through a MassDEP 319 Nonpoint Source Pollution Competitive Grant (awarded in Fiscal Year 2005 under project #05-10/319).

The Aquatic Life Use for Lake Shirley (MA81122) remains assessed as Not Supporting for "Non-Native Aquatic Plants" (due to the presence of variable milfoil / *Myriophyllum heterophyllum*, for which no species-specific code is available) and "Eurasian Water Milfoil, Myriophyllum spicatum." The new species codes for the prior impairments for "Fanwort" and "Brittle Naiad, Najas minor" are being added. Without new water quality data, the "Dissolved Oxygen" impairment is also being retained. Finally, a new impairment is being added for "Harmful Algal Blooms" due to the extended bloom in 2014.

Lake Wampanoag (MA81151)

Location:	Ashburnham/Gardner.
AU Type:	FRESHWATER LAKE
AU Size:	224 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Lake Wampanoag (MA81151) is Not Assessed since no recent data are available.

Lake Whalom (MA81154)

Location:	Lunenburg/Leominster.
AU Type:	FRESHWATER LAKE
AU Size:	97 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4c	4c	(Curly-leaf Pondweed*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

As previously noted, multiple non-native aquatic macrophytes- variable milfoil (*Myriophyllum heterophyllum*), Eurasian water milfoil (*Myriophyllum spicatum*), and curly-leaf pondweed (*Potamogeton crispus*)- were identified by MassDEP biologists during an August 1998 synoptic survey of Lake Whalom.

The Aquatic Life Use for Lake Whalom (MA81154) remains assessed as Not Supporting for Non-Native Aquatic Plants (variable milfoil, *Myriophyllum heterophyllum*- no species code is available), Eurasian water milfoil (*Myriophyllum spicatum*), and curly-leaf pondweed (*Potamogeton crispus*).

Lancaster Millpond (MA81065)

Location:	Clinton.
AU Type:	FRESHWATER LAKE
AU Size:	21 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

MassDCR staff observed an infestation of the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*), in Lancaster Millpond in 2016.

Additionally, MassDCR has noted the presence of Eurasian water milfoil *(Myriophyllum spicatum*), fanwort (*Cabomba caroliniana*), mudmat (*Glossostigma cleistanthum*), brittle naiad (*Najas minor*), and Asian waterwort (*Elatine ambigua*) immediately upstream in Wachusett Reservoir (MA81147).

In 2009, a $375,000 Renewable Energy Trust grant was awarded to the Massachusetts Water Resources Authority (MWRA) for the installation of a new turbine at the base of the Wachusett Reservoir Dam to generate hydropower. Formerly, power generated from 2 older turbines was released to an aqueduct to a downstream location on the Nashua River; the location of the new turbine will send water directly to Lancaster Milllpond, which the MWRA expected to improve river ecology.

The Aquatic Life Use for Lancaster Millpond (MA81065) is assessed as Not Supporting for Non-Native Aquatic Plants, based on the presence of the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*), for which no species-specific code is available. The use is also identified with an Alert status due to the presence of Eurasian water milfoil *(Myriophyllum spicatum*), fanwort (*Cabomba caroliniana*), mudmat (*Glossostigma cleistanthum*), brittle naiad (*Najas minor*), and Asian waterwort (*Elatine ambigua*) in the upstream Wachusett Reservoir (MA81147).

Lincoln Pond (MA81070)

Location:	Ashburnham.
AU Type:	FRESHWATER LAKE
AU Size:	31 ACRES
Classification/Qualifier:	B

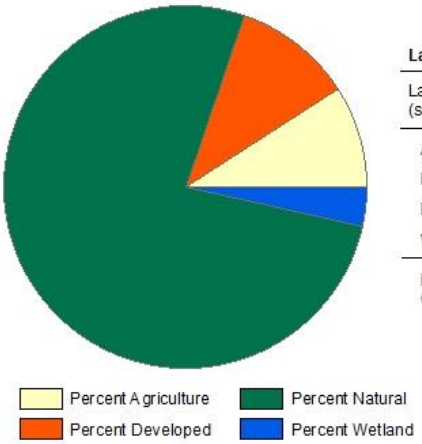
Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Lincoln Pond (MA81070) is Not Assessed due to the absence of recent data.

LOCKE BROOK (MA81-78)

Location:	From New Hampshire border, Ashby to mouth at confluence with Willard Brook, Townsend.
AU Type:	RIVER
AU Size:	4.4 MILES
Classification/Qualifier:	B: ORW

LOCKE BROOK - MA81-78

Watershed Area: 4.32 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.8	2.34	0.93	0.85
Agriculture	9%	8.8%	9.8%	10.8%
Developed	10.7%	11.3%	8.2%	8.9%
Natural	76.9%	76.8%	73.9%	73.7%
Wetland	3.5%	3.2%	8.1%	6.6%
Impervious Cover	3.5%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing in Locke Brook at 3 locations in Ashby in August 2013. Two locations in the upper half of the AU were sampled- upstream of Mason Rd (Sample ID 4803; n=191) and downstream of Locke Rd, (Sample ID 4802; n=313)- as well as one location in the lower half of the AU off of Davis Rd just west of the Townsend town line (Sample ID 4804; n=110). All three samples contained multiple age classes of the intolerant, cold water species, Eastern brook trout in abundance (n = 27-83/sample) and fluvial species as a whole dominated the samples (other common fluvial species were blacknose dace and white sucker). MassDEP staff collected 6 bacteria samples near the downstream end of the brook at West Meadow Rd in Townsend during summer 2008 (W1834). There were no observations of excessive filamentous algae during these surveys.

The Aquatic Life Use of Locke Brook (MA81-78) is assessed as Fully Supporting based primarily on the presence of a reproducing wild population of Eastern brook trout, a species indicative of excellent habitat and water quality.

Long Pond (MA81073)

Location:	Ayer/Groton.
AU Type:	FRESHWATER LAKE
AU Size:	46 ACRES
Classification/Qualifier:	B

Also known as Lower Long Pond

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
Geosyntec Consultants conducted an aquatic macrophyte survey of Long Pond in September 2014 and documented 28 species, all of which were native. There is Insufficient Information to assess the Aquatic Life Use for Long Lake (MA81073) due to the absence of recent water quality data collected under a QAPP.

Lovell Reservoir (MA81074)

Location:	Fitchburg.
AU Type:	FRESHWATER LAKE
AU Size:	35 ACRES
Classification/Qualifier:	A: PWS, ORW (PWS and Tributary to PSW)

Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Lovell Reservoir (MA81074) is Not Assessed since no recent data are available.

Lower Crow Hill Pond (MA81026)

Location:	Princeton/Westminster.
AU Type:	FRESHWATER LAKE
AU Size:	14 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

In 2007, DCR staff in the Lakes and Ponds program reported the presence of the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*), in Lower Crow Hill Pond.

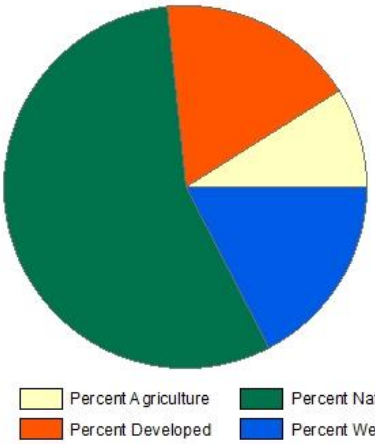
The Aquatic Life Use for Lower Crow Hill Pond (MA81026) is assessed as Not Supporting based on the presence of the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*); the generic impairment code, Non-Native Aquatic Plants is being applied.

Malagasco Brook (MA81-29)

Location:	Headwaters southwest of Apron Hill, Boylston through Pine Swamp to mouth at inlet Wachusett Reservoir (South Bay), Boylston.
AU Type:	RIVER
AU Size:	2.4 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Malagasco Brook - MA81-29

Watershed Area: 0.91 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.91	0.91	0.58	0.58
Agriculture	8.9%	8.9%	4.6%	4.6%
Developed	17.7%	17.7%	15.8%	15.8%
Natural	56%	56%	53.9%	53.9%
Wetland	17.4%	17.4%	25.7%	25.7%
Impervious Cover	9.7%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Nutrient/Eutrophication Biological Indicators		Removed

Fish, other Aquatic Life and Wildlife Use: Not Supporting

MassDEP biologists collected a benthic sample in Malagasco Brook approximately 100 m downstream of Rt 70 (Main St), Boylston in Aug 2008 (Unique ID B0664). The RBPIII status was determined to be "not impaired" (86% comparable) when compared to the Nissitissit River reference (Unique ID: B0087). A short way downstream, MassDFG biologists conducted backpack electrofishing in a low gradient reach at the West Temple St crossing in July 2010 (Sample ID 3385). The sample (n=36) was comprised of 72% fluvial specialist species, blacknose dace and tessellated darters. MassDEP and MassDCR staff also conducted water quality monitoring at this location. During summer 2008, DEP staff deployed multiprobes for three 3-day periods, which generated dissolved oxygen and temperature data indicative of good conditions. The minimum DO was 8.38 mg/L and there were no indications of enrichment (maximum DO diel shift 1.1 mg/L; maximum saturation 97%). The maximum temperature was 18.3 °C. Attended probe measurements and grab sample data (DO, temperature, pH, ammonia, total phosphorus) were indicative of good conditions and consistent with continuous data when

available. The pH ranged from 6.4 to 6.6 SU (n=6) and the total phosphorus seasonal average was 0.029 mg/L (maximum 0.06 mg/L; n=5). There were no observations of excessive filamentous algae. DCR collected water quality data from 2008 to 2019. DO (only for 2019) had a minimum of 7.9 mg/L (n=6) and pH data (only available for 2019) had a range of 7.17-7.73 SU (n=6). Temperature data were collected from 2008 to 2019 and had a maximum of 19.5 °C during the summer index period (usually n= 15-16 per year). With the exception of TP sampling conducted during wet weather conditions in 2014 (seasonal average 0.079 mg/L), TP seasonal averages were generally close to 0.05 mg/L (the EPA Gold Book recommendation for flowing waters entering a reservoir) or even less than that concentration, especially in the later years of the survey (maximum seasonal average of 0.054 mg/L, 2015-2019). The maximum ammonia concentration was relatively low (0.17 mg/L) and did not violate chronic or acute criteria when screened using the maximum temperature and pH values for the entire set of DCR data for the Wachusett Reservoir tributaries. Chloride data was collected in 2018 and 2019 and the maximum was 219 mg/L. Specific conductance data were collected over the entire time period (n=563) and the vast majority of data had a maximum of 875 µs/cm (less than the 904 µs/cm criterion for evaluating chronic chloride toxicity using estimated data) with one exception of 1,071 µs/cm.

The Aquatic Life Use of Malagasco Brook (MA81-29) will continue to be assessed as Not Supporting with the benthic macroinvertebrate impairment being carried forward until more recent data are collected that confirm the appropriateness of a delisting. It is noted however that the 2008 benthic macroinvertebrate sample was "not impaired" (86% comparable to reference), the fish sample was dominated by fluvial specialist species, and the water quality conditions (2008 to 2019) were generally indicative of good water conditions. The prior impairment for Nutrient/Eutrophication Biological Indicators is being removed (see Removal Comment for rationale).

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Nutrient/Eutrophication Biological Indicators	Applicable WQS attained; based on new data	Malagasco Brook was first listed as impaired for Nutrient/Eutrophication Biological Indicators (formerly Organic enrichment/Low DO) in 2002 based on information appearing in the 1998 Nashua River Basin Water Quality Assessment Report. A MassDCR (formerly MDC) report was cited, indicating that DCR staff had conducted a modified RBPIII analysis of a benthic macroinvertebrate sample collected near West Temple St, Boylston in 1996. The community was dominated by chironomids and was considered severely impaired. However, DCR noted "a large mulch pile near the headwaters has been removed and MDC [DCR] expects the condition of the macroinvertebrate community to improve." It appears that Organic enrichment/Low DO was added as an impairment due to the low scoring benthic sample. Subsequently, MassDEP biologists collected a benthic sample roughly 230 meters upstream (Unique ID B0664) in 2008. The RBPIII status was determined to be "Not Impaired" (86% comparable) when compared to the Nissitissit River reference (Unique ID: B0087) and the habitat score was considered "Comparable" to that of the reference. Although DEP biologists noted that the most prevalent family in the 2008 sample was still the Chironomidae, the specimens were dispersed among a large number of taxa, including

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
		some of low to moderate tolerance. Furthermore, the sample included individuals from Leuctra sp. and Nemouridae, sensitive stonefly taxa that are often associated with small, spring-fed brooks, and the sample contained the highest percentage of low tolerance individuals out of all the stations in the 2008 Nashua benthic survey. Finally, similar land use patterns in 2008 and 2019 satellite imagery were observed and therefore data collected within this timeframe are considered usable for water quality assessment, listing, and delisting decisions. Based on all this information, the Malagasco Brook impairment for Nutrient/Eutrophication Biological Indicators is being delisted since the benthic community has recovered from its impacted state in 1996.

Supporting Information for Delisted Impairments

Nutrient/Eutrophication Biological Indicators

Data Source: (Reardon 2014) MassDEP staff sampled the benthic macroinvertebrate community in Malagasco Brook approx 100 meters downstream of Route 70 (Main Street), Boylston (segment MA81-29) at station B0664 on 8/4/2008. The RBPIII status was determined to be "not impaired" (86% comparable) when compared to the Nissitissit River reference (Unique ID: B0087). This station had a habitat score of 169 considered to be "Comparable" when compared to the reference.

Table 4. Summary of RBP III analysis of macroinvertebrate communities sampled during the 2008 Nashua River Watershed survey. Shown are the calculated metric values, metric scores (in italics) based on comparability to the reference station (NT67-Nissitissit River). Refer to Table 1 for a listing and description of sampling stations.

SAMPLING STATION	NT67[1]		AST01		CAT01		CHF01		GAT25		MAG01		MON02		NM23B		NM30		NN09		NT61		QP00		WHR01	
STREAM	Nissitissit River		Asnebumskit Brook		Catacoon-amug Brook		Chaffins Brook		Gates Brook		Malagasco Brook		Monoosnuc Brook		Nashua River		Nashua River		North Nashua River		Sqaunna-cook River		Quinapoxet River		Whitman River	
HABITAT SCORE	178		138		138		176		145		169		114		159		177		153		172		173		172	
TAXA RICHNESS	27	*6*	21	*4*	28	*6*	27	*6*	32	*6*	29	*6*	18	*4*	21	*4*	25	*6*	21	*4*	26	*6*	39	*6*	31	*6*
BIOTIC INDEX	4.43	*6*	4.39	*6*	4.95	*6*	4.77	*6*	3.90	*6*	4.11	*6*	4.80	*6*	5.02	*6*	4.44	*6*	5.30	*4*	4.55	*6*	4.33	*6*	4.46	*6*
EPT INDEX	12	*6*	4	*0*	12	*6*	7	*0*	10	*4*	11	*6*	8	*0*	11	*6*	14	*6*	9	*2*	13	*6*	12	*6*	10	*4*
EPT/CHIRONOMIDAE	3.14	*6*	1.39	*2*	9.00	*6*	1.61	*4*	1.55	*4*	1.27	*2*	3.38	*6*	5.27	*6*	37.50	*6*	2.61	*6*	3.60	*6*	1.18	*2*	0.42	*0*
SCRAPER/FILTERER	0.18	*6*	0.05	*2*	0.31	*6*	0.13	*6*	2.29	*6*	0.16	*6*	0.07	*4*	0.33	*6*	0.32	*6*	0.01	*0*	0.63	*6*	0.48	*6*	0.55	*6*
REFERENCE AFFINITY	100%	*6*	68%	*6*	84%	*6*	80%	*6*	67%	*6*	55%	*4*	77%	*6*	66%	*6*	82%	*6*	83%	*6*	81%	*6*	73%	*6*	58%	*4*
% DOMINANT TAXON	11%	*6*	17%	*6*	14%	*6*	16%	*6*	27%	*4*	19%	*6*	25%	*4*	26%	*4*	15%	*6*	15%	*6*	18%	*6*	12%	*6*	27%	*4*
TOTAL METRIC SCORE	42		26		42		34		36		36		30		38		42		28		42		38		30	
HABITAT COMPARABILITY TO REFERENCE	Reference		Supporting		Supporting		Comparable		Supporting		Comparable		Partially Supporting		Comparable		Comparable		Supporting		Comparable		Comparable		Comparable	
BIOLOGICAL CONDITION -DEGREE IMPACTED	Reference Condition		Slightly impacted		Not impacted		Not impacted/ Slightly Impacted		Not impacted		Not impacted		Slightly impacted		Not impacted		Not impacted		Slightly impacted		Not impacted		Not impacted		Slightly impacted	

[1] Reference station

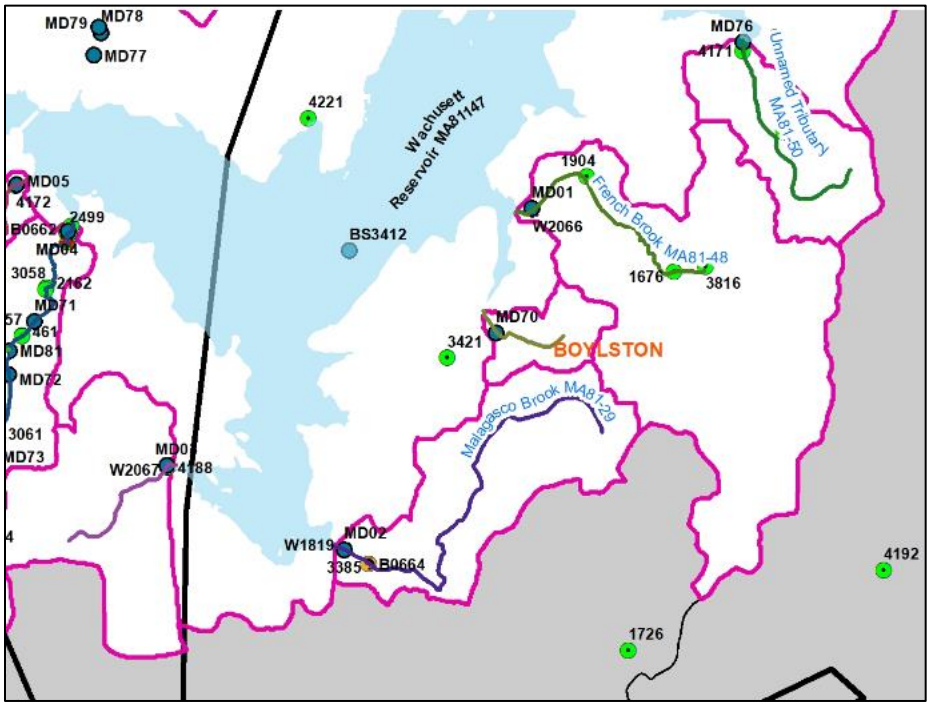
Screen capture from the Tech Memo for the 2008 Nashua benthic survey (Reardon 2014):

> Malagasco Brook, approximately 100 meters downstream of Route 70 (Main Street) in Boylston (Station MAG01), was considered "not impacted" when compared to the reference station. The benthic community in Malagasco Brook is very similar in terms of the taxa found to that in Gates Brook. The most prevalent family at the Malagasco Brook station was Chironomidae and this station scored poorly on the EPT/Chironomidae metric when compared to the reference station. The Malagasco Brook station has a very small watershed area (Appendix I, Table 2). Cold water temperatures were found during unattended probe deployments conducted by MassDEP in 2008 (MassDEP 2013). Similar to Gates Brook both *Leuctra* sp. and Nemouridae individuals were found. Approximately 38% of the individuals had a tolerance value ranging from 0–3, the highest percentage of all the sampling stations.

* *Leuctra* sp. and Nemouridae are taxa that are often associated with small, spring-fed brooks (Reardon 2014). Although there was a large number of chironomids in the sample, they were dispersed among a large number of taxa, including some of low to moderate tolerance (Reardon 2014).

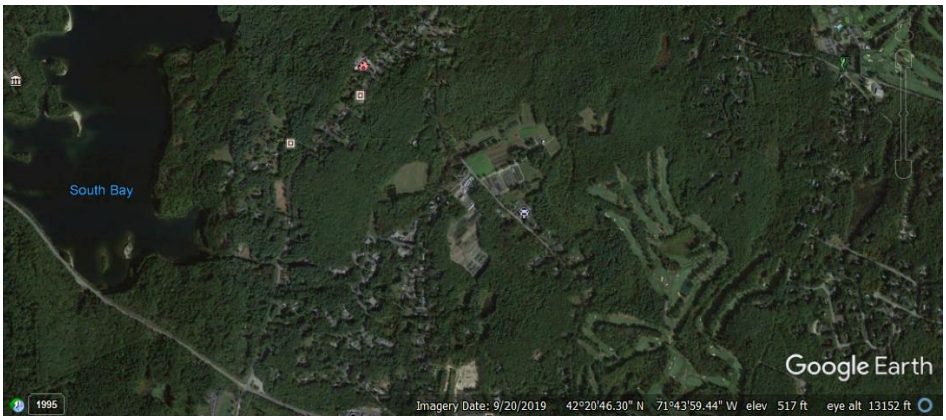
Similar land use patterns were observed in satellite imagery from 2008 and 2019. Therefore, data collected within this timeframe are considered usable for water quality assessment, listing, and delisting decisions.

Screen capture depicting Malagasco Brook sub-watershed delineation (MassDEP Undated 11):



2008 Satellite Imagery of the Malagasco Brook sub-watershed (Google Earth Pro Undated):

2019 Satellite Imagery of the Malagasco Brook sub-watershed (Google Earth Pro Undated):



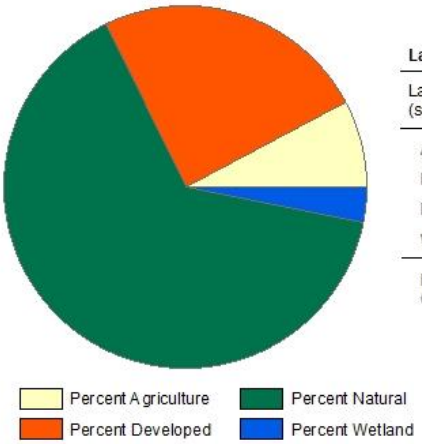
Based on all this information, the Malagasco Brook impairment for Nutrient/Eutrophication Biological Indicators is being delisted since the benthic community has recovered from its impacted state in 1996.

Malden Brook (MA81-27)

Location:	Headwaters northeast of Lee Street, West Boylston to mouth at inlet Wachusett Reservoir (Thomas Basin), West Boylston.
AU Type:	RIVER
AU Size:	1.9 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Malden Brook - MA81-27

Watershed Area: 1.29 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.29	1.29	0.64	0.64
Agriculture	7.7%	7.7%	4.4%	4.4%
Developed	24.4%	24.4%	19.9%	19.9%
Natural	64.7%	64.7%	69.7%	69.7%
Wetland	3.1%	3.1%	6%	6%
Impervious Cover	6.4%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Malden Brook (MA81-27) is considered a cold water fisheries resource by MassDFG. DFG biologists conducted backpack electrofishing in the upstream portion of the sub-watershed at Goodale St, West Boylston in July 2011 (Sample ID 3813). The sample (n=77) was comprised of 51% cold water species, slimy sculpin and Eastern brook trout, including 12 trout <140 mm. Near the mouth of the stream, MassDEP sampled the fish population upstream of Thomas St, West Boylston (Station MB01) in Aug 2008 and DFG sampled in the vicinity in July 2011 (Sample ID 3812). Although the DEP sample (n=74) did not include cold water species, the DFG sample (n=93) contained 22 Eastern brook trout from multiple age classes. Both samples were dominated by fluvial species, including white sucker and blacknose dace. Due to the presence of slimy sculpin and a reproducing population of Eastern brook trout in Malden Brook, it is being assessed as a Tier 1 Existing Use cold water fishery. MassDCR staff conducted water quality monitoring in Malden Brook upstream of Thomas St (station MD06) from 2008 to 2019. Dissolved oxygen data were measured on 6 occasions in 2019 and ranged from 7.83 to 9.19 mg/L. pH was also measured 6 times in 2019 and ranged from 7.12 to 7.40 SU. Continuous temperature data were

measured from 2017 to 2019. The 7-DADM was >20.0 °C 18 times during the 2018 summer index period but there were no exceedances in the other two years (maximum 7-DADM 20.33 °C). The maximum 24-hour rolling average temperature was 20.5 °C. Discrete temperature measurements (n = usually 15-16/year) were >20.0 °C in more than 10% of the measurements in 2010, 2014, and 2016. It should be noted that this region of the state was under a Drought Advisory during the later part of summer 2010 and the last half of 2016 when many of the elevated measurements occurred. Nutrient samples were also collected from 2008 to 2019. Seasonal average total phosphorus (May-September) concentrations ranged from 0.019-0.036 mg/L (maximum 0.024-0.063; n = 3-6/year). The maximum ammonia concentration from this period, 0.077 mg/L (n = 6-13/year) , did not exceed calculated chronic and acute criteria (derived using the maximum water temperature and pH found in the entire DCR dataset for Wachusett Reservoir tributaries as a worst-case). Of 21 chloride samples collected in 2018 into 2019, the maximum was 117 mg/L. Specific conductance measurements (n = usually 42-55/year; 2008-2019) were generally low (maximum of 480 µs/cm) with one exception, a measurement of 2,260 µs/cm in 2008. It should be noted there is an appearance of an increasing minimum SC over time, with SC <90 µs/cm in the first several years of the surveys and around 250 µs/cm in the last couple years. MassDEP collected continuous temperature data and nutrient grab samples also at the Thomas St crossing (Unique ID W1818) but only during summer 2008. A thermistor was deployed for 96 days beginning June 20. The 7-DADM exceeded 20.0 °C on 67 days (maximum 7-DADM 24.3 °C) and the maximum 24-hour rolling average was 22.5 °C (no exceedance of acute criteria). The seasonal average total phosphorus concentration was 0.024 mg/L (maximum 0.046 mg/L; n=4) and there were no observations of excessive filamentous algae. There were also no violations of ammonia criteria (maximum 0.06 mg/L; n=4).

Despite the presence of slimy sculpin and a reproducing population of Eastern brook trout in Malden Brook (MA81-27), as well as generally good water quality, the Aquatic Life Use is being assessed as Not Supporting for Temperature (violations of the chronic criterion for continuous temperature data in 2008 and 2018). The prior Alert status for elevated total phosphorus is being removed (seasonal averages ≤0.036 mg/L 2008-2019).

Maple Spring Pond (MA81077)

Location:	Holden.
AU Type:	FRESHWATER LAKE
AU Size:	38 ACRES
Classification/Qualifier:	A: PWS, ORW

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

MassDEP conducted a synoptic survey of Maple Spring Pond on 8/2/1998; they found patches of very dense emergent and floating-leaf vegetation along most of the perimeter of the pond, but this affected less than 25% of the entire surface area, and no non-native species were observed. Staff noted the presence of *Myriophyllum* sp., possibly a non-native aquatic macrophyte (*M. heterophyllum, M. spicatum*).

MassDCR staff reported the presence of the non-native aquatic macrophyte, *Myriophyllum heterophyllum,* in 2015.

The Aquatic Life Use for Maple Spring Pond (MA81077) is assessed as Not Supporting based on the presence of the non-native aquatic macrophyte, *Myriophyllum heterophyllum*.

Massapoag Pond (MA81080)

Location:	Lunenburg.
AU Type:	FRESHWATER LAKE
AU Size:	64 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Massapoag Pond (MA81080) is Not Assessed due to the absence of recent data.

Meetinghouse Pond (MA81083)

Location:	Westminster.
AU Type:	FRESHWATER LAKE
AU Size:	151 ACRES
Classification/Qualifier:	A: PWS, ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Meetinghouse Pond (MA81083) is Not Assessed due to the absence of recent data.

Mirror Lake (MA81084)

Location:	Fitchburg.
AU Type:	FRESHWATER LAKE
AU Size:	6 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Mirror Lake (MA81084) is Not Assessed due to the lack of available data.

Mirror Lake (MA81085)

Location:	Harvard.
AU Type:	FRESHWATER LAKE
AU Size:	28 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Curly-leaf Pondweed*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Water quality monitoring was conducted in Mirror Lake (MA81085) by MassDEP staff in August 2005 as part of a nutrient criteria study. During a depth profile, dissolved oxygen concentration/saturation, temperature, pH, and specific conductance were measured. Dissolved oxygen ranged from <0.2 mg/L at the bottom (14.8 m) to 13.8 mg/L around the metalimnion (5.1 m). DO dropped below 5.0 mg/L between 8.9 m and 10.8 m. Bathymetry data are not available, so the percentage of the lake experiencing depleted dissolved oxygen concentrations could not be calculated. DO saturation reached as high as 138% in the metalimnion. Temperature ranged from 26.1 °C at the surface down to 5.2 °C at the bottom. pH ranged from 6.9 to 8.0 SU and the maximum specific conductance was 228 µs/cm. The total phosphorus concentration was <0.005 mg/L at the surface and 0.18 mg/L near the bottom (TP may be released from sediments in anoxic conditions). A depth integrated chlorophyll-*a* sample of the upper 6.5 m of the lake had a concentration of <1 mg/m^3 (equivalent to µg/L). The non-native aquatic macrophyte, curly-leaf pondweed (*Potamogeton crispus*), was identified during this survey.

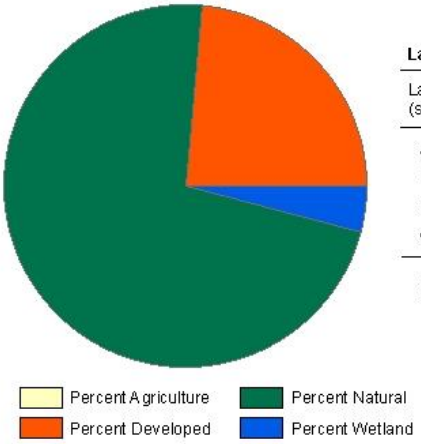
The Aquatic Life Use for Mirror Lake (MA81085) is assessed as Not Supporting, due to the presence of the non-native aquatic macrophyte, curly-leaf pondweed (*Potamogeton crispus*). Bathymetry data should be collected so that the extent of dissolved oxygen depletion in the lake can be calculated.

Monoosnoc Brook (MA81-13)

Location:	Headwaters, outlet Simonds Pond, Leominster to mouth at confluence with North Nashua River, Leominster (through former 2008 segments: Pierce Pond MA81101 and Rockwell Pond MA81112) (prior to 2002 this segment was only lower portion (1.5 miles) of brook).
AU Type:	RIVER
AU Size:	6.1 MILES
Classification/Qualifier:	B

Monoosnoc Brook - MA81-13

Watershed Area: 11.19 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	11.19	3.85	4.27	1.36
Agriculture	0.5%	0.4%	0.4%	0%
Developed	23.3%	48.3%	16.6%	37.3%
Natural	72.1%	49.1%	74.2%	58.4%
Wetland	4%	2.2%	8.7%	4.3%
Impervious Cover	11.4%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)
DFG biologists conducted backpack electrofishing in Monoosnoc Brook below the pump station, Leominster in a rocky, high gradient area (Sample ID 1913) in Aug 2006 but no fish were collected. Further downstream that same day near Route 2, Fitchburg (Sample ID 1684), 7 macrohabitat generalist species were collected with 70% sample moderately tolerant. NRWA staff/volunteers conducted sampling in upper half of the brook as follows: Inlet to Pierce Pond (MN0713) minimum DO in 2008 was 6.5 mg/L (n=6); West St & Fairfield (MN0630) minimum DO in 2017 6.53 mg/L (n=4), maximum temperature 22.5°C, maximum conductivity 182.3 µS/cm; and at Granite Street (MN0520) 2008 to 2017 minimum DO 3.28 mg/L but <5.0 mg/L only 3 times (2014, 2015) of 41 measurements, maximum temperature 24.7 °C (n=50), pH 5.86 to 6.72 SU (n=8 in 2010, 2011), maximum conductivity 236.7 µS/cm. No excessive filamentous algae noted by MassDEP staff at Granite Street (W1810) during summer 2008. Downstream part of brook. Minimum DO reported by NRWA behind Friendly's at 24

Monument Square (MN0419) 6.25 mg/L (n=18, 2008 – 2011) with pH 6.66 to 7.25 SU (n=8, 2010, 2011). MassDEP staff conducted benthic, fish, and water quality monitoring in the brook at Mechanic St, Leominster as part of a probabilistic wadeable streams monitoring project (MAP2) during summer 2011. Benthic sampling was included (B0703) but the data were not analyzed using an RBPIII approach. Rather, benthic data will be compared to biocriteria thresholds (currently under development) in a future reporting cycle. MassDEP biologists conducted backpack electrofishing here in August (Sample ID: 4581). Two tolerant fluvial specialist/dependent species were collected. Water quality data (W2180): minimum DO during three four-day probe deploys 7.4 mg/L, maximum saturation 100%, and maximum diel DO shift 1.0mg/L. Maximum temperature 27.5°C in thermistor deployment 12 May to 6 October. pH was good (7.3-7.5 SU, n=6), the total phosphorus seasonal average concentration was low (0.021 mg/L, maximum 0.04 mg/L) with three observations of dense/very dense filamentous algae. Ammonia concentrations were low ($\leq$0.08 mg/L). Except lead no exceedances of any other dissolved metal acute or chronic criteria during the three clean metal surveys. The chronic lead criteria were exceeded twice (2.51, 2.06 TUs). NRWA data collected further downstream at Whitney Carriage Parking Lot (MN0223) between 2008 and 2019: minimum DO 6.28 mg/L (n=63), maximum temperature 25.3 °C, pH range 6.79 to 7.57 SU (n=8, 2010, 2011), maximum conductivity 507 µS/cm. MassDEP biologists conducted benthic sampling in Monoosnoc Brook ~90 meters downstream of Whitney Street, Leominster (station B0667) in Aug 2008. The RBPIII analysis indicated the sample was “slightly impacted” (71% comparable) when compared to the Nissitissit River reference site (B0087). NRWA collected data upstream of Commercial Rd. Bridge (MN0009) 2008 to 2019: minimum DO 4.68 mg/L (only once below 5.78 mg/L, n=64), maximum temperature 23.3 °C (n=76), pH 6.57 - 6.91 SU (n=8), maximum conductivity 523 µS/cm. MassDEP staff identified the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*) in the brook in 2017 near Commercial Rd (W0994). This station had no excessive filamentous algae during 6 site visits in 2008. Efforts to reduce stormwater impacts also implemented at several locations (319 projects).

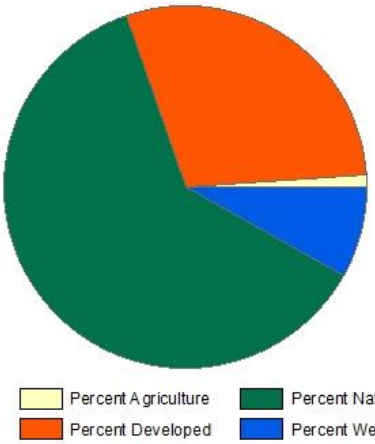
The Aquatic Life Use for Monoosnoc Brook (MA81-13) is assessed as Not Supporting for Non-Native Aquatic Plants based on the presence of the non-native variable milfoil (*M. heterophyllum*) in the brook (no species-specific code is available). An Alert for exceedances of the chronic lead criterion is being identified. Other data were indicative of generally good conditions.

MORSE BROOK (MA81-84)

Location:	Headwaters north of Patterson Road, Shirley to mouth at confluence with the Nashua River, Shirley.
AU Type:	RIVER
AU Size:	1.4 MILES
Classification/Qualifier:	B

MORSE BROOK - MA81-84

Watershed Area: 1.32 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.32	1.32	0.19	0.19
Agriculture	1.1%	1.1%	1.1%	1.1%
Developed	29.2%	29.2%	14.3%	14.3%
Natural	61.5%	61.5%	70%	70%
Wetland	8.2%	8.2%	14.6%	14.6%
Impervious Cover	10.4%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

Morse Brook is considered a CFR by MassDFG. MassDFG biologists conducted backpack electrofishing in two locations in the brook in Shirley in July 2012: Patterson Rd (~1/2 mi north of Ayer Rd) (Sample ID 4005) and 380 m upstream of Walker Rd, (Sample ID 4006). The intolerant, cold water species, Eastern brook trout, dominated the samples at both locations with multiple age classes present. One single fish of a different species was also observed at the downstream site (chain pickerel).

The Aquatic Life Use of Morse Brook (MA81-84) is assessed as Fully Supporting based on the presence of a reproducing wild population of Eastern brook trout, a species indicative of excellent habitat and water quality conditions.

Morse Reservoir (MA81086)

Location:	Leominster.
AU Type:	FRESHWATER LAKE
AU Size:	15 ACRES
Classification/Qualifier:	A: PWS, ORW (PWS and Tributary to PSW)

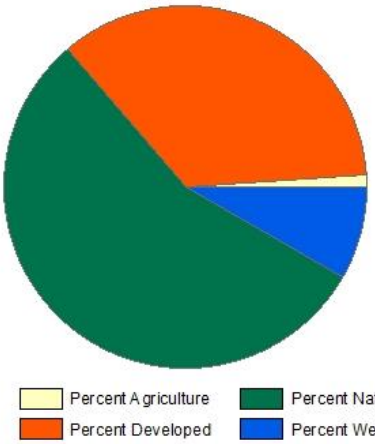
Fish, other Aquatic Life and Wildlife Use: Not Assessed
Morse Reservoir is part of the public water supply for the City of Leominster. The Aquatic Life Use for Morse Reservoir (MA81086) is Not Assessed due to the absence of recent data.

Muddy Brook (MA81-28)

Location:	Headwaters west of Shrewsbury Street, West Boylston to mouth at inlet Wachusett Reservoir (South Bay), West Boylston.
AU Type:	RIVER
AU Size:	0.8 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Muddy Brook - MA81-28

Watershed Area: 0.84 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.84	0.84	0.52	0.52
Agriculture	1.1%	1.1%	1.1%	1.1%
Developed	35.2%	35.2%	34.3%	34.3%
Natural	55.5%	55.5%	51.6%	51.6%
Wetland	8.3%	8.3%	13.1%	13.1%
Impervious Cover	9.4%			

Fish, other Aquatic Life and Wildlife Use: Not Supporting

MassDFG biologists conducted backpack electrofishing in Muddy Brook (MA81-28) upstream of Rt 140, West Boylston in August 2012 (Sample ID 4188). The sample (n=15 individuals) was comprised of 93% fluvial specialist/dependent species- blacknose dace, longnose dace, and common shiner. In the vicinity of the fish sample, MassDCR collected water quality data from 2008 to 2019. Dissolved oxygen (from 2019 only) had a minimum of 8.33 mg/L (n=6) and pH (also from 2019 only) ranged from 7.61-8.01 SU (n=6). Continuous temperature data were recorded from 2017 to 2019. The maximum 7-DADM was 22.49 °C and the maximum 24-hour rolling average was 21.57 °C. Discrete temperature data collected roughly monthly from 2008 to 2019 had a maximum of 21.2 °C; there were no violations of warm water guidelines for either the continuous or discrete temperature data. Seasonal averages for total phosphorus data (n=3-5 per year) collected over the same time period ranged from 0.014 to 0.030 mg/L, while the maximum ranged from 0.018-0.082 mg/L. The maximum ammonia concentration (n= 6-12 per year) was relatively low (0.18 mg/L) and did not violate chronic or acute criteria when screened using the maximum temperature and pH values found in the entire DCR dataset for the Wachusett Reservoir tributaries. Chloride data were measured only in 2018 and 2019 (n = 7 or 12 per year), exceeding 230 mg/L only once (max of 342 mg/L). Specific conductance was measured over the entire 2008-2019 time period (n= 21-60 per year), but only three measurements (maximum 2,774 µs/cm) exceeded 904 µs/cm, the chronic criterion for estimated chloride data. The maximum for the rest of the data was 578 µs/cm. MassDEP collected limited nutrient data in the same location during summer 2008 (Unique ID W2067). Total phosphorus data (n=4) had an average of 0.012 mg/L and a maximum of 0.015 mg/L. There were no violations of ammonia criteria (n=4) and also no observations of excessive filamentous algae. Although fish

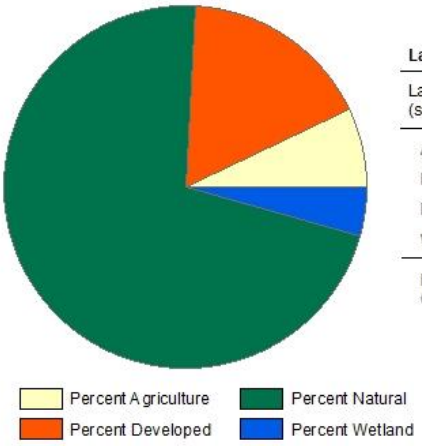
community and water quality data were generally indicative of good conditions, the Aquatic Life Use of Muddy Brook (MA81-28) is assessed as Not Supporting due to a prior impairment for Benthic Macroinvertebrates.

Mulpus Brook (MA81-36)

Location:	Headwaters, north of Howard Street, Lunenburg to the inlet of Hickory Hills Lake, Lunenburg (formerly part of 2008 segment: Mulpus Brook MA81-22).
AU Type:	RIVER
AU Size:	3.8 MILES
Classification/Qualifier:	B: CWF

Mulpus Brook - MA81-36

Watershed Area: 5.67 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	5.67	5.67	1.17	1.17
Agriculture	7%	7%	5.6%	5.6%
Developed	17.1%	17.1%	11.2%	11.2%
Natural	71.5%	71.5%	75.6%	75.6%
Wetland	4.3%	4.3%	7.5%	7.5%
Impervious Cover	5.5%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

Mulpus Brook is a designated Cold Water Fishery. MassDEP staff collected water quality data and nutrient grab samples in the middle of the AU at Holman St, Lunenburg (W1823) during summer 2008. A thermistor was deployed for 96 days beginning June 20. The maximum 7-DADM was 20.9 °C (with 20 exceedances of the Tier 1 cold water fishery chronic criterion, 20.0 °C) and the maximum 24-hour rolling average temperature was 20.7 °C. A multiprobe was deployed to measure continuous DO for three 3-day periods in June, July and August and the data were indicative of good conditions. The minimum DO concentration for the season was 7.59 mg/L, with a maximum diel shift of 1.57 mg/L and maximum saturation of 96.7% (no indication of enrichment). All discrete DO (n=6), temperature (n=8), and pH (n=6) data met their respective criteria. The total phosphorus seasonal average was 0.011 mg/L (maximum 0.016 mg/L; n=5) and there were no violations of calculated ammonia criteria (n=5). There were also no observations of excessive filamentous algae. NRWA collected discrete data at one station at the downstream end of Mulpus Brook, at the inlet to Hickory Hills Lake (MU2011). The data which met quality objectives were collected between 2011 and 2018 (5-6 times per year). Although most dissolved oxygen data were indicative of good conditions, there were 1-2 instances per year in 4 of 8 years when

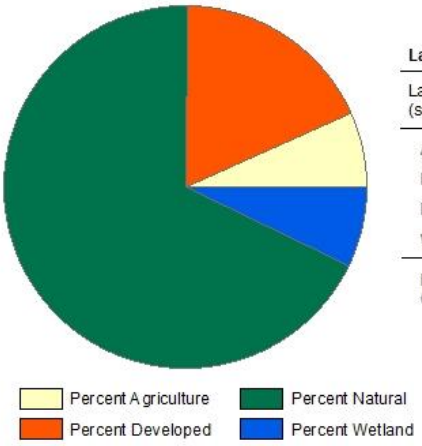
measurements fell below the 1-day minimum cold water criterion of 5.0 mg/L (minimum of 3.8 mg/L plus 1 additional measurement excluded that was taken under questionable QC conditions). Although most water quality data collected in Mulpus Brook (MA81-36) were indicative of good conditions, the Aquatic Life Use is assessed as Not Supporting for Temperature due to chronic violations of the Tier 1 Cold Water Fishery criterion. Elevated temperature is not considered natural since impervious cover in the sub-basin is >4%. The use is identified with an Alert status due to a few incidents of low DO in discrete data measured by NRWA at the inlet to Hickory Hills Lake. However, this may be due to natural causes since the topography is flatter in the downstream portion of the brook and a tributary with a wetland buffer (deep marsh and wooded swamp) joins the brook a short way upstream of the NRWA station. The historic Alert for a lack of cold-water fish species is being maintained since no recent fish survey data are available.

Mulpus Brook (MA81-37)

Location:	From outlet Hickory Hills Lake, Lunenburg to mouth at confluence with the Nashua River, Shirley (formerly part of 2008 segment: Mulpus Brook MA81-22).
AU Type:	RIVER
AU Size:	6.3 MILES
Classification/Qualifier:	B: CWF

Mulpus Brook - MA81-37

Watershed Area: 15.92 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	15.92	4.17	3.09	0.76
Agriculture	6.7%	3.9%	3.6%	2.6%
Developed	18.1%	17.5%	16.7%	16.2%
Natural	68%	68.6%	62.1%	50.3%
Wetland	7.2%	10%	17.6%	30.8%
Impervious Cover	6.1%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Mulpus Brook (MA81-37) is a designated Cold Water Fishery. NRWA collected discrete data close to the middle of the AU at the Brockelman Property, Lunenburg (MU0647) between 2008 and 2019, roughly 6 times per year. The data which met quality objectives are summarized as follows: dissolved oxygen data were often indicative of poor conditions at MU0647, with the minimum measurement falling below the 1-day minimum cold water criterion of 5.0 mg/L nearly every year (overall 14 of 79 measurements were <5.0 mg/L with a minimum of 2.8 mg/L in 2012). Note that per external data review by MassDEP staff, the individual measurements that were <5.0 mg/L in 2015, 2017 and 2018 (n=3) should be viewed with caution due to QA/QC issues with field duplicates/lab analysis. NRWA staff indicated that this sample location (MU0647) was actually in Perrins Pond (also known as Farm Pond and a run-of-river impoundment), an impounded section of Mulpus Brook with a partially breached dam kept intact by beavers. Therefore, these data are not considered representative of water quality conditions in Mulpus Brook. MassDEP staff deployed a thermistor to measure temperature in Mulpus

Brook a short way downstream at Rt. 225, Lunenburg (W1824) for 86 days beginning June 30, 2008. The maximum 7-DADM was 27.0 °C (70 exceedances of the Tier 1 Cold Water Fishery chronic criterion, 20.0 °C) and the maximum 24-hour rolling average temperature was 25.7 °C (violating the Tier 1 CWF acute criterion, 23.5 °C). NRWA collected discrete DO data 7 times in 2017, close to the downstream end of the AU at Hazen Rd off Rt 2A, Shirley (MU0101). All 7 DO measurements were indicative of good conditions for a CWF, i.e. all were >5.0 mg/L (minimum 5.4 mg/L). MassDEP staff conducted water quality monitoring from May-Sept 2008 at the downstream end of the AU at the trailer park road directly across from Kittredge Road, Shirley (W0998). A thermistor was deployed for 86 days beginning June 30. The maximum 7-DADM was 25.1 °C (70 exceedances of the Tier 1 CWF chronic criterion) and the maximum 24-hour rolling average temperature was 25.0 °C. The minimum DO measured during three 2-5 day probe deploys (June, August, September) was 7.27 mg/L, with a maximum diel shift of 0.62 mg/L and a maximum saturation of 96.9% (no indication of enrichment). Discrete DO and temperature data were similar to the continuous data and pH data met criteria (n=7). The total phosphorus seasonal average was 0.015 mg/L (maximum 0.022 mg/L; n=5) and there were no violations of ammonia criteria (n=5). There were also no observations of excessive filamentous algae.

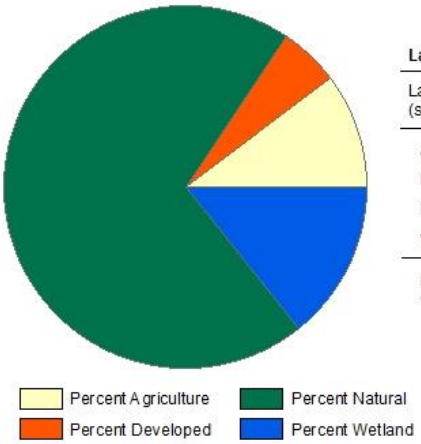
The Aquatic Life Use for Mulpus Brook (MA81-37) continues to be assessed as Not Supporting based on the lack of a cold water fish assemblage. A new impairment for Temperature is being added based on violations of the Tier 1 Cold Water Fishery chronic and acute criteria. These violations are considered to be unnatural as a result of impoundments on the brook.

MUSCHOPAUGE BROOK (MA81-69)

Location:	Headwaters, east of Glenwood Road, Rutland to mouth at inlet Quinapoxet Reservoir, Holden.
AU Type:	RIVER
AU Size:	3.5 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

MUSCHOPAUGE BROOK - MA81-69

Watershed Area: 4 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	4	3.66	2.71	2.55
Agriculture	10.2%	10.8%	6.6%	7%
Developed	5.4%	5.3%	4.5%	4.4%
Natural	70.1%	70.5%	69.8%	70.1%
Wetland	14.3%	13.4%	19.1%	18.5%
Impervious Cover	2.8%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG conducted backpack electrofishing in Muschopauge Brook, a CFR stream, North of the Wachusett St crossing (Sample ID 1925) and West of the Rt 68 crossing (Sample ID 1926) in Rutland on 27 July 2006. Multiple age classes of the intolerant cold water species, Eastern brook trout, were collected at the upstream station (26 of 158 individuals) and the rest of the sample was composed of fluvial species. The downstream sample was dominated by the fluvial specialist, blacknose dace (119 of 124 individuals) and also contained several moderately tolerant pumpkinseed. MassDEP conducted 6 bacteria surveys on Muschopauge Brook in the vicinity of the downstream fish station during summer 2008 (Unique ID W1840). There were no reports of excessive filamentous algae from these surveys.

The Aquatic Life Use for Muschopauge Brook (MA81-69) is assessed as Fully Supporting based primarily on the presence of a reproducing wild population of Eastern brook trout.

Muschopauge Pond (MA81089)

Location:	Rutland.
AU Type:	FRESHWATER LAKE
AU Size:	61 ACRES
Classification/Qualifier:	A: PWS, ORW (PWS and Tributary to PSW)

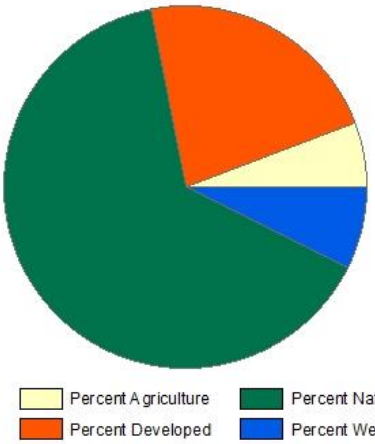
Fish, other Aquatic Life and Wildlife Use: Not Assessed
Muschopauge Pond is part of the public water supply for the Town of Rutland. The Aquatic Life Use of Muschopauge Pond (MA81089) is Not Assessed due to the absence of recent data.

Nashua River (MA81-05)

Location:	From confluence of North Nashua River, Lancaster to confluence of Squannacook River, Shirley/Groton/Ayer.
AU Type:	RIVER
AU Size:	14.2 MILES
Classification/Qualifier:	B: WWF

Nashua River - MA81-05

Watershed Area: 343.45 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	342.63	15.97	125.7	3.48
Agriculture	5.7%	3.5%	5.1%	1.5%
Developed	22.3%	34.7%	16.2%	25%
Natural	64.7%	53.1%	65.6%	53.8%
Wetland	7.3%	8.7%	13.1%	19.7%
Impervious Cover	8.8%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Water Chestnut*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)
The Midwest Biodiversity Institute conducted boat shocking ~¾ mi US of Rt 117 bridge in Aug 2009 (Sample ID 3294) in this Nashua River (MA81-05) AU. Fluvial specialists/dependents (white sucker, fallfish) were well represented (moderately tolerant and a few intolerant species present). NRWA data downstream of Rt 117 boat launch, Lancaster (NM5837): DO >5.0mg/L (~5 /year 2008-2018), max temp 24.5°C, pH 5.64 - 7.5SU (n=41, 2010-2016) with two <6.0SU. Further downstream NRWA DO at Still River Depot/Tank Rd footbridge, Harvard (NM6274), min DO 4.2mg/L but others >5.0mg/L (2015-2019). MassDEP staff sampling summer 2008 downstream of tank bridge (W0484) summarized as follows: min DO during three 2-day periods in June, July, Aug and one 5-day period in Sept was 4.41mg/L (5-day mean minimum 7.04mg/L in Sept), max diel DO shift 1.27mg/L, max sat 90.9%, max temp 25.5°C, pH 6.5-6.9SU (n=8), slightly elevated TP seasonal avg 0.11mg/L (n=5, max 0.23mg/L), but no observations of dense/very dense filamentous algae, low NH3-N (max 0.32 mg/L). The river flows through the former Fort Devens military base (federal Superfund site with pollutants associated with those activities). MassDEP site W0484 abuts Devens South Post; W2070 and W1001 abut

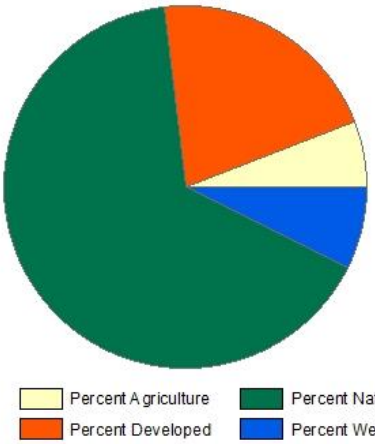
Devens North Post; and W0488 is just beyond Devens North Post downstream-most border. None of the river corridor is within or adjacent to a site with ongoing cleanup activities. The non-native aquatic macrophyte water chestnut (*Trapa natans*) infests the river near Rt.2. NRWA DO data at Hospital Rd, Devens (NM4426) 2015-2016 & 2018-2019 (~ 5 times/year) always ≥4.0 and >5.0mg/L most of the time. MassDEP sampling further downstream of Hospital Rd, Shirley/Harvard (within Ice House Dam impoundment, Ayer) (W2070) during a 5-day late Aug/early Sept multiprobe deploy in 2008: min DO 6.58mg/L, max diel DO shift 0.96mg/L, max sat 87%, max temp 20.3°C with no depletion at depth (min DO 6.6mg/L at 3.5m on 29 Aug). In the impoundment at Ayer Road/West Main St Shirley/Harvard (W1001), 2-day probe deployment (July 2008): the min DO was 4.9mg/L (mean daily min 5.26mg/L), max diel DO shift 1.83mg/L, max sat 88.3%, max temp 24.1^{o}C. The min DO at depth (3.7m) was 4.8mg/L on 16 July. NRWA DO data at Ice House dam (NM4201) between 2008-2016 (~ 6 times/year always ≥4.0 and >5.0mg/L the majority of time. MassDEP biologists conducted benthic sampling in the river ~200m downstream RR bridge crossing McPhearson Road, Ayer/Shirley (B0078) in August 2008. The RBPIII analysis was "not impaired" (90% comparable) when compared to Nissitissit River reference site (B0087). Between Mar 2008 - Dec 2018 survival of *C. dubia* exposed (48 hrs/~7days) to water collected upstream of Ayer WWTP (west of Macpherson Rd, Ayer) as ambient control in WET tests was ≥90% (n=53). No acute toxicity of effluent (LC_{50}s >100% effluent, n=57). Of 40 CNOEC results four (Sept 2012 & 2013, June & Sept 2018) were just below the 7.7% effluent limit. NRWA DO data at Filter Bed Rd, Ayer (NM4010) 2017 - 2019 (~5 times/year) always >5.0mg/L. MassDEP data at Rt 2A, Shirley/Ayer (W0488) from three 5-day probe deploys in Jun, Jul, Aug, 2008 can be summarized as follows: min DO 5.61mg/L, max diel DO shift 2.7mg/L, max sat 105%, max temp 25.7°C. Discrete pH 6.8 – 7.2SU (n=6), TP seasonal avg 0.068mg/L (n=5) with no observations of excessive filamentous algae, low NH3-N (max 0.17mg/L, n=5). *Potamogeton* was observed but species not confirmed. The Aquatic Life Use for this Nashua River AU (MA81-05) is assessed as Not Supporting. The total phosphorus, Sediment Bioassay, and Benthic macroinvertebrate bioassessments impairments are being carried forward and a non-native aquatic macrophyte Water Chestnut (*T. natans*) impairment is being added. An alert for episodic low pH in the upper reach (at NRWA station NM5837) is also being identified.

Nashua River (MA81-06)

Location:	From confluence of Squannacook River, Shirley/Groton/Ayer to Pepperell Dam (NATID: MA00373), Pepperell (through former 2008 segment: Pepperell Pond MA81167).
AU Type:	RIVER
AU Size:	9.1 MILES
Classification/Qualifier:	B: WWF

Nashua River - MA81-06

Watershed Area: 434.41 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	417.39	7.72	144.56	2.39
Agriculture	5.9%	11.8%	5.1%	8.7%
Developed	21%	16.1%	15.5%	9.1%
Natural	65.8%	61.3%	66.1%	62.9%
Wetland	7.3%	10.8%	13.3%	19.3%
Impervious Cover	8.1%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Curly-leaf Pondweed*)		Added
5	5	(Fanwort*)		Added
5	5	(Water Chestnut*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Groton School is permitted to discharge treated sanitary wastewater to this Nashua River AU (MA81-06). River water was collected (approx. 0.9 mi upstream/south of Rt 225, Groton) for use as a control in 15 WET tests (June 2008 to June 2018). Survival of *C. dubia* at ~48 hours was good at 95-100% of test organisms. In the summer 2008, MassDEP staff conducted water quality monitoring in the river at the Groton School boat house floating wharf, Groton (W0497). During multiprobe deployments (2 days in July, 5 days in August), min DO was 6.02 mg/L, max saturation 101%, max diel DO shift 2.11 mg/L, max temp. 24.0 °C. Discrete pH measurements were all 6.9 SU (n=3). The total phosphorus seasonal avg was 0.061 mg/L (n=2) with no observations of dense filamentous algae. Ammonia-N was also low (max 0.07 mg/L, n=2). In July 2004, DFG biologists conducted boat electrofishing ~1/3 mi south of Fitch's Bridge Rd, Groton (Sample 1039) and between Fitch's Bridge & Rt

119/111 (Sample 1040). Both samples were comprised of macrohabitat generalists mostly moderately tolerant of pollution. MassDEP staff WQ sampling at Rt 111/119 bridge, Groton/Pepperell (W0496) as part of the SMART monitoring program bi-monthly 2005 to 2013 (42 surveys, station NM27/INLTPEPPD) and more intensive sampling during summer 2008. Probe deploy data (four 2-5 day periods): min DO 5.48 mg/L, max saturation 95%, max diel DO shift 1.1 mg/L, max temp 23.9 °C. Attended probe and grab sample data: DO & temp similar, pH 6.6-7.8 SU (n=50), max specific conductance 435 µs/cm (n=50), max chloride 79 mg/L (n=45), max NH3-N 0.2 mg/L (n=44), TP seasonal averages ranged from 0.033-0.055 mg/L (overall max 0.074 mg/l in 2010) and there were 4 reports of dense/very dense filamentous algae but none after 2009. NRWA data upstream of Rt 119, (NM2928) 2008-2019 (~5 times/yr): DO >4.0 mg/L (1 exception 3.6 mg/L, July 2019) and >5.0 mg/L 74 of 77 measurements. Boat electrofishing was also conducted by DFG biologists in July 2004 at 3 sites in the Groton/Pepperell area: DS Rt 119 (Sample 1109), further DS Rt 111/119 crossing (Sample 1037), and "The Bay" W. of gravel pit, Groton (Sample 1038). The samples were dominated by macrohabitat generalists, of which a good percentage were moderately tolerant species. NRWA DO data 2008- 2011 (~5 times/yr) off the rail trail at Pepperell/Groton town line (NM2443B), always >4.0 mg/L and >5.0 mg/L 18 of 20 measurements. MassDEP deployed multiprobes 2 days in July and 5 days in Aug/Sept 2008 within the Pepperell Pond impoundment, ~180 yds upstream Main St, Pepperell (W0495). Min DO was 6.25 mg/L, max saturation was 119.5%, max diel DO shift was 2.79 mg/L, and max temp was 25.7 ^{o}C. Except for the single low DO at a depth of 4.7 m in July (<0.2 mg/L), the water column was well oxygenated (≥6.1 mg/L during both depth profiles (16 July and 29 Aug), and pH was good (6.6-7.0 SU, n=7). Nutrients data were not collected here. The non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*), was noted in the Pepperell Pond impoundment by MassDEP staff in 2017. Survival of *C. dubia* exposed (~48 hrs) to river water collected upstream of Main Street (Rt 113) and the Pepperell Paper Co. Dam was good (>95%, n=14 tests, June 2008 to Sept 2014, Pepperell WWTP (MA0100064) WET test control water). Long term trend analysis (1998-2013) of total phosphorus concentrations at 4 MassDEP sites indicated a statistically significant downward trend for both year-round data (p=9.98e-12) and seasonal (May-September) data (p=1.50e-08).

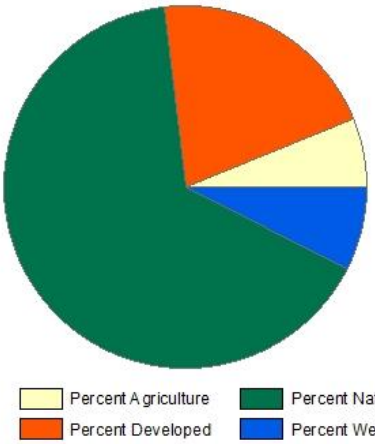
The Aquatic Life Use for this Nashua River AU (MA81-06) is assessed as Not Supporting. Former impairments (Benthic Macroinvertebrates, Nutrient/Eutrophication Biological Indicators, Non-Native Aquatic Plants) are carried forward (the latter for variable milfoil/*M. heterophyllum* observation in 2017). Species-specific codes (*T. natans*, *P. crispus*, *C. caroliniana*) are being added for prior impairments.

Nashua River (MA81-07)

Location:	From Pepperell Dam (NATID: MA00373), Pepperell to New Hampshire state line, Pepperell/Dunstable.
AU Type:	RIVER
AU Size:	3.7 MILES
Classification/Qualifier:	B: WWF

Nashua River - MA81-07

Watershed Area: 507.8 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	444.44	9.17	150.51	2.32
Agriculture	6.1%	11.6%	5.2%	12.8%
Developed	20.8%	24.9%	15.4%	15.6%
Natural	65.6%	54.8%	65.9%	56.1%
Wetland	7.5%	8.7%	13.5%	15.4%
Impervious Cover	8%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Phosphorus, Total		Removed
5	5	(Water Chestnut*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

NRWA staff/volunteers collected discrete water quality (WQ) data at one station at the upstream end of this Nashua River AU (MA81-07), upstream of the covered bridge at the Groton St crossing, Pepperell (NM2256). The data which met quality objectives were collected between 2008 and 2018 (excluding 2017 data which had QA/QC issues) roughly 6 times per year. Most dissolved oxygen data were >4.0 mg/L (the 1-day min criterion). However, the minimum was 3.0 mg/L (in 2016) and 1 other measurement in 2015 was also <4.0 mg/L.
As part of DEP's SMART program, discrete probe data and grab sample data (DO, temp., pH, total phosphorus, ammonia-N, chloride, specific conductivity) were collected bimonthly from 2005-2013 (~48 surveys) at ~1/2 mile downstream of the Groton St covered bridge, Pepperell (W0485/NM29A). All the data met criteria: DO (min 5.9 mg/L); temp. (max 26.0 ºC); pH ranged from 6.2-7.2 SU with just 1 value falling below the criterion (6.5 SU); ammonia-N (max 0.34 mg/L); chloride (max 80 mg/L); specific conductivity (max 378 µs/cm). The TP seasonal average ranged from 0.027 to 0.049 mg/L (max 0.057 mg/L; n= 2-3/season). There were 3

reports of dense/very dense filamentous algae but none after 2008. Staff also documented the presence of the non-native aquatic macrophyte, water chestnut (*Trapa natans*), as well as *Myriophyllum* sp. (possibly a non-native species) at this station.

Whole Effluent Toxicity testing was conducted between June 2008 and Sept 2018 on the effluent of the Pepperell WWTP, which discharges to the Nashua River downstream of the Reedy Meadow Brook confluence. There was no evidence of acute toxicity of effluent to *C. dubia*, as the LC_{50}s of 22 tests were >100% effluent and the Acute-NOECs were all 100% effluent. From 2015-2018, river water collected in this AU (~1,125 ft upstream of the outfall and ~125 ft upstream of the Reedy Meadow Brook confluence) was used as a control in 8 WET tests; survival of *C. dubia* after ~48 hours of exposure to ambient river water was good (95-100%).

MassDEP staff conducted WQ monitoring at Rt 111, Hollis, NH (W1806) from May-Sept, 2008. Although this station is located downstream of the MA81-07 AU (which ends at the state border), it was included to gain a picture of the entire AU. A multiprobe was deployed for four 2-5 day periods and most data met WWF guidelines (min DO 5.9 mg/L, max temp 25.6 °C). However, the July DO diel shift was 4.6 mg/L (next highest was 2.8 mg/L) and the DO saturation was 127%, both indicators of enrichment. Discrete DO and temp. data met WWF guidelines (n=8) and pH ranged from 6.6-7.1 SU (n=8). The TP seasonal average was 0.039 mg/L (max 0.051 mg/L, n=6) and there were no observations of dense filamentous algae. Ammonia-N was also low (max 0.07 mg/L, n=5). MassDEP biologists conducted a benthic survey of the Nashua River ~400 m downstream/north of W1806 (Station B0086) in Aug 2008. The RBPIII status was determined to be "not impaired" (100% comparable) when compared to the Nissitissit River reference (Unique ID: B0087). Long term trend analysis (1998-2013) of total phosphorus concentrations at 2 DEP stations in/downstream of the AU (W0485, W1806) showed a statistically significant downward trend (p = 9.96e-17) for year-round data, as well as for seasonal (May-September) data (p = 1.12e-09).

The Aquatic Life Use for the Nashua River (MA81-07) is assessed as Not Supporting, due to the presence of the non-native aquatic macrophyte, Water Chestnut (*Trapa natans*). The historical impairment for Benthic Macroinvertebrates will also remain at this time since data are not available from NM29, the location of the original data triggering the impairment. The impairment for total phosphorus is being removed since seasonal averages at 2 DEP sites were all <0.05 mg/L (see Removal Comment for rationale). The use is identified with an Alert status based on the presence of *Myriophyllum* sp. in this segment, possibly a non-native species (to be confirmed).

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Phosphorus, Total	Applicable WQS attained; original basis for listing was incorrect	This Nashua River AU (MA81-07) was initially impaired for "Nutrients" in 2002 (which was later converted to the "Phosphorus (Total)" code in 2010). The initial impairment was based on MassDEP data collected at W0485/NM29A (approx. ½ mile downstream/east from covered bridge at Groton St near abandoned railroad trestle supports, Pepperell) during a 1998 DEP survey. However, the impairment appears to have been an error, as the maximum total phosphorus concentration from that survey was 0.09 mg/L (n=6). Staff from the MassDEP WPP/SMART programs conducted monitoring at the same location between 2001 and 2003. Although the maximum total phosphorus concentration was 0.21 mg/L, it was measured in January (2002). The maximum concentration during the summer season (May-September), when total phosphorus is typically assessed

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
		per the MassDEP 2018 CALM guidance, was 0.098 mg/L. Seasonal averages for 2001-2003 ranged from 0.066-0.078 mg/L (n= 3-4 per season), well below the EPA Gold Book recommended concentration of 0.1 mg/L for flowing waters. Sampling at W0485/NM29A continued as part of the SMART program from 2005-2013 and total phosphorus seasonal averages ranged from 0.027-0.049 mg/L (n= 2-3 per season), with an overall summer maximum of 0.057 mg/L. In addition, long term trend analysis (1998-2013) of total phosphorus concentrations at two DEP stations (including W0485/NM29A as well as the W1806 station just downstream of the AU in Hollis, New Hampshire) showed a statistically significant downward trend (p = 9.96e-17) for year-round data, as well as for seasonal (May-September) data (p = 1.12e-09). Finally, similar land use patterns in 2011/2012 and 2019 satellite imagery are observed and therefore, data collected within this timeframe are considered usable for water quality assessment, listing, and delisting decisions. Based on all these data and information, "Phosphorus, Total" is being delisted as a cause of impairment for Nashua River MA81-07).

Supporting Information for Delisted Impairments

Phosphorus, Total

MassDEP WPP 2001-2003 total phosphorus data from W0485/NM29A (MassDEP Undated 11):

STATION	ALT_STATION_NAME	ACTIVITY_START_DATE	ANALYTE	RESULT	UNITS_CODE
W0485	NM29A	16-May-01	TP	0.079	mg/l
W0485	NM29A	11-Jul-01	TP	0.074	mg/l
W0485	NM29A	13-Sep-01	TP	0.082	mg/l
W0485	NM29A	08-May-02	TP	0.058	mg/l
W0485	NM29A	10-Jul-02	TP	0.084	mg/l
W0485	NM29A	11-Sep-02	TP	0.075	mg/l
W0485	NM29A	16-Jul-03	TP	0.056	mg/l
W0485	NM29A	07-May-03	TP	0.046	mg/l
W0485	NM29A	11-Jun-03	TP	0.064	mg/l
W0485	NM29A	13-Aug-03	TP	0.098	mg/l

* The discussion in the 2003 WQAR mentioned a maximum TP concentration of 0.21 mg/L from the 2001-2003 time frame. This concentration was measured in January (2002), not during the summer

season (May-Sept), which is typically used to assess total phosphorus. The next highest concentration was 0.1 mg/L (March 2002).

2005-2013 total phosphorus data from W0485/NM29A (copied from the Nutrients section below) (T. Beaudoin 2016a, T. Beaudoin 2016b, MassDEP Undated 3):

MassDEP conducted nutrient monitoring as part of the SMART program approximately ½ mile downstream from the Groton St covered bridge near abandoned railroad trestle supports, Pepperell (Station ID W0485/NM29A) from 1998-2013. Data were collected roughly bimonthly, and only summer seasonal total phosphorus data (May-Sept) from 2005-2013 are presented in the table below (n=23). The total phosphorus seasonal average ranged from 0.027-0.049 mg/L, well below the EPA recommended concentration for flowing waters (0.1 mg/L).

Total phosphorus measured on the Nashua River during the summer index period*, Site NM29A (W0485), from 2005-2013 (in mg/L)**

Year	Count	TP Average	TP Max
2005	2	0.049	0.051
2006	3	0.047	0.057
2007	2	0.047	0.051
2008	5	0.046	0.054
2009	2	0.044	0.051
2010	2	0.027	0.034
2011	2	0.038	0.042
2012	3	0.032	0.043
2013	2	0.036	0.050

***May1st-Sept 30th**

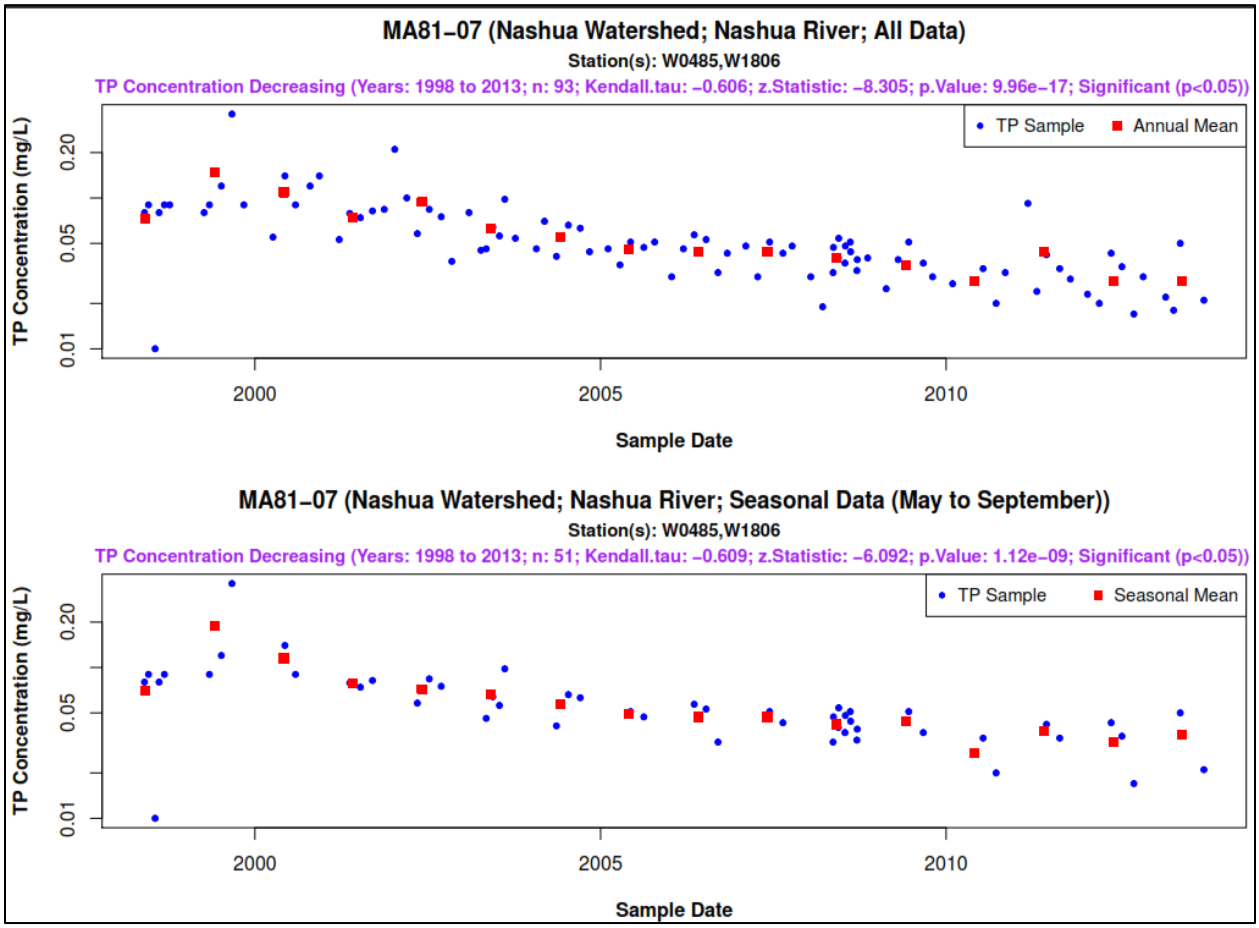
**** ~1/2 mile downstream/east from covered bridge at Groton Street near abandoned railroad trestle supports, Pepperell**

Data Sources: (MassDEP 2013b, MassDEP Undated 3) MassDEP staff conducted 6 nutrient surveys at Route 111, Hollis, NH (W1806) from May-Sept, 2008. This station is downstream of the MA81-07 AU but was included to gain a picture of the entire AU. The average total phosphorus was 0.039 mg/L while the maximum total phosphorus was 0.051 mg/L; both are well below the EPA recommended concentration for flowing waters (0.1 mg/L) There were no observations of dense or very dense filamentous algae.

Unique ID	Year	Field sheets	Filamentous Dense or Very Dense	TP Average (mg/L)	TP Max (mg/L)	pH Max (SU)	Max Daily DO Shift (mg/L)	Max Saturation (%)

W1806	2008	6	0	0.039	0.051	7.1	4.6	127

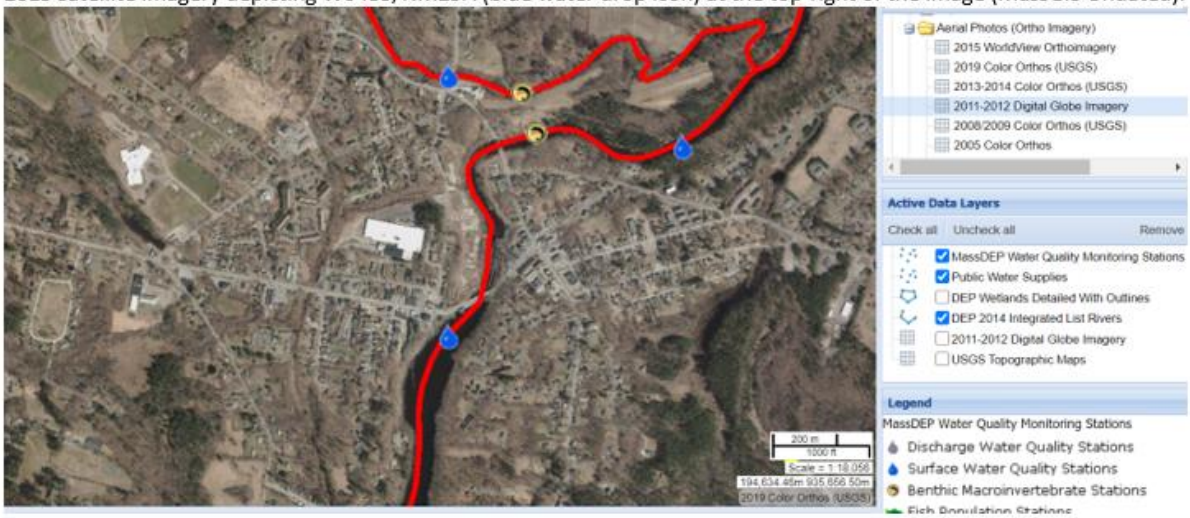
Long-term trend analysis of total phosphorus data from MassDEP stations (MassDEP Undated 4):



Similar land use patterns are observed in 2011/2012 and 2019 satellite imagery, therefore, data collected within this timeframe are considered usable for water quality assessment, listing, and delisting decisions.

2011/2012 satellite imagery depicting W0485/NM29A (blue water drop icon) at the top-right of the image (MassGIS Undated):

2019 satellite imagery depicting W0485/NM29A (blue water drop icon) at the top-right of the image (MassGIS Undated):

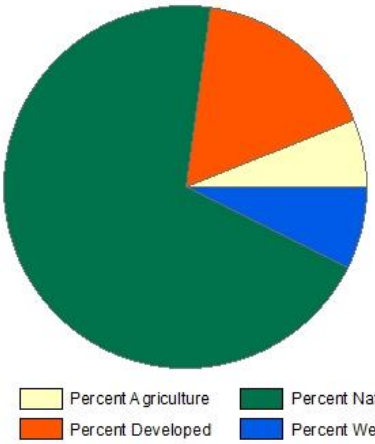


Nashua River (MA81-08)

Location:	("South Branch" Nashua River) Headwaters, outlet Lancaster Millpond, Clinton to Clinton WWTP discharge (NPDES: MA0100404), Clinton.
AU Type:	RIVER
AU Size:	2.8 MILES
Classification/Qualifier:	B: WWF

Nashua River - MA81-08

Watershed Area: 124.74 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	124.55	7.54	66.83	1.87
Agriculture	6%	12.5%	5.2%	10.5%
Developed	16.8%	29%	15.1%	28.5%
Natural	70%	53.8%	67.7%	49.5%
Wetland	7.2%	4.6%	12.1%	11.5%
Impervious Cover	5.7%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

The MWRA is authorized (under NPDES permit # MA0100404) to discharge sanitary wastewater from its Clinton Wastewater Treatment Plant to the Nashua River (at the upstream end of the next downstream AU MA81-09). Ambient water is collected in this AU (MA81-08) upstream of the discharge (east of High Street and approximately 50 to 100 feet upstream of the outfall, Clinton) for use as a diluent/control in Whole Effluent Toxicity tests utilizing *Ceriodaphnia dubia* organisms. From March 2007 to Dec 2018, survival of *C. dubia* in both acute & chronic tests was good (at least 80-100%) in 8 definitive acute tests, as well as the 48-hour point and the end of test point in 43 chronic tests. MassDEP staff conducted water quality monitoring at the downstream end of the AU, east of Rt 110 (upstream of the Clinton WWTP outfall), Clinton (W0482), from May-Sept 2008. A multiprobe was deployed to measure continuous temperature and DO for three 2-day periods in June, July & August and one 5-day period in September. The average of the daily maximum temperatures ranged from 14.6-24.0 °C and the maximum 24-hour rolling average was 22.8 °C, meeting WWF guidelines. Dissolved oxygen data were generally indicative of good conditions (most data were >6.1 mg/L) with the exception of the June 2-day deploy, when the minimum was 3.64 mg/L and the mean of the daily minimums was 3.73 mg/L. The maximum diel DO shift was 2.65 mg/L and the maximum saturation was 99.1% (no indication of enrichment). Discrete DO

and temperature data were similar to the continuous data and pH ranged from 6.4-6.6 SU (n=8). The total phosphorus seasonal average was 0.023 mg/L (n=5) with a maximum of 0.059 mg/L and there were observations of dense filamentous algae on 2 of the survey dates. Ammonia-N levels ranged from <0.02 to 0.48 mg/L (n=5), with no violations of calculated ammonia toxicity criteria. Also at this location, MassDEP staff noted an infestation of the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*), in June 2017.

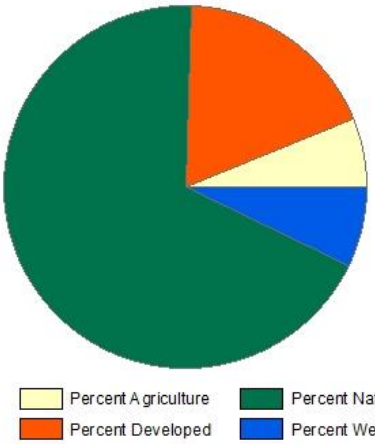
The Aquatic Life Use for this Nashua River AU (MA81-08) is assessed as Not Supporting for Non-Native Aquatic plants, due to the presence of the non-native, variable milfoil (*Myriophyllum heterophyllum*), for which no species-specific code is available. The use is identified with an Alert status based on the low dissolved oxygen concentrations observed at the downstream end of the AU in 2008.

Nashua River (MA81-09)

Location:	("South Branch" Nashua River) From Clinton WWTP discharge (NPDES: MA0100404), Clinton to confluence with North Nashua River, Lancaster.
AU Type:	RIVER
AU Size:	1.8 MILES
Classification/Qualifier:	B: WWF

Nashua River - MA81-09

Watershed Area: 131.06 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	130.88	9.08	68.24	2.28
Agriculture	6.1%	7.7%	5.2%	6.3%
Developed	18.4%	50.2%	15.4%	31.7%
Natural	68.3%	37.2%	67.3%	49.2%
Wetland	7.2%	4.8%	12.2%	12.9%
Impervious Cover	6.4%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	pH, Low		Added
5	5	Phosphorus, Total		Removed

Fish, other Aquatic Life and Wildlife Use: Not Supporting

This Nashua River AU (MA81-09) begins at the outfall for MWRA's Clinton WWTP. Between March 2007 and December 2018, 8 definitive acute and 47 chronic Whole Effluent Toxicity tests were conducted using *C. dubia* test organisms. The LC_{50}s of all the tests were >100% effluent. All definitive acute tests had ANOECs of 100% effluent. Of the 42 chronic tests with valid CNOEC data, 39 met the ≥62.5% effluent permit limit. The CNOECs of the 3 exceptions ranged from 12.5-25%. NRWA staff/volunteers collected discrete water quality data in the middle of the AU at Mill St, Lancaster (SN0169). The data which met quality objectives were collected between 2008 and 2018 (roughly 6 times per year). The majority of the data were indicative of good conditions: dissolved oxygen was ≥5.5 mg/L, the maximum temperature was 22.0 °C, and the maximum conductivity was 232 µs/cm. However, pH had a range of 4.07-7.8 SU (measured 2010-2016), failing to meet the 6.5 SU criteria- out of 29 measurements, there were 13 pH measurements <6.5 SU and 7 measurements were "severe" violations <6.0 SU. pH violations generally occurred once a year from 2010-2013, but then increased to 3-4 times per year (2014-2015) and occurred twice in 2016. MassDEP staff conducted water quality monitoring at the downstream end of the AU at Bolton Road (upstream of sporadic input on eastern shore just upstream of

road), Lancaster (W0483), during summer 2008. A multiprobe was deployed to measure continuous temperature and dissolved oxygen for four 5-day periods from June-September and the resulting data met WWF guidelines (minimum DO 4.77 mg/L, 5-day mean minimum DO ranged from 5.41-8.53 mg/L, maximum diel DO shift 2.13 mg/L, maximum saturation 99.9%, maximum temperature 25.7 °C). Discrete DO and temperature also met WWF guidelines, and pH ranged from 6.7-6.9 SU (n=8). Through DEP's Strategic Monitoring & Assessment for River basin Teams (SMART) program, discrete probe data and grab sample data (DO, temperature, pH, total phosphorus, ammonia, specific conductance) were collected bimonthly from 2005-2013 at the downstream end of the AU at Bolton Road (W0483) (2011-2013) and also immediately downstream at the "abandoned bridge" (Atherton Bridge), Lancaster (W0681) (2005-2010). Both these sampling locations were reported as SMART station "NS19" and are discussed as one site here. All the data met water quality criteria: DO minimum 5.6 mg/L (excluding one outlier measurement, noted to be suspect), DO saturation maximum 108%, temperature maximum 21.3 ^{o}C (n=24), specific conductance maximum 340 µs/cm (n=47), and pH ranged from 6.5-7.2 SU (n= ~55 each for DO, pH). There were no violations of the calculated site dependent acute and chronic criteria for ammonia (maximum 0.27 mg/L, n=48). The total phosphorus seasonal average ranged from 0.024 to 0.089 mg/L (maximum 0.140 mg/L, n= 2-3 in most years) and there were 4 reports of dense/very dense filamentous algae, but only in earlier years (2006-2008). Long term trend analysis (1998-2013) of total phosphorus concentrations at two DEP stations at the downstream end of the AU (W0483, W0681) showed a statistically significant downward trend (p = 6.71e-11) for year-round data, as well as for seasonal (May-September) data (p = 2.72e-07).
The Aquatic Life Use for this Nashua River AU (MA81-09) is assessed as Not Supporting due to incidents of low pH (as low as 4.07 SU) measured by NRWA staff/volunteers at the Mill St crossing in Lancaster. The impairment for total phosphorus is being removed since seasonal averages were below the EPA 0.1 mg/L criterion for flowing waters (see Removal Comment for rationale).

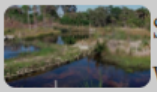
2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Phosphorus, Total	Applicable WQS attained; based on new data	This Nashua River AU (MA81-09) was initially impaired for "Nutrients" in 1996 (which was later converted to the "Phosphorus (Total)" code and in this cycle to "Phosphorus, Total") and then impaired again in 2002. The 2002 impairment was based on data collected at NS19/W4083/W0681 [Bolton Rd, Lancaster] during the 1998 MassDEP surveys in which instream samples were collected with total phosphorus concentrations ranging from 0.19-0.65 mg/L (n=6). It was also noted that EPA conducted a compliance sampling inspection at MWRA's Clinton WWTP (the facility's outfall marks the upstream boundary of this AU) in August 1998 and collected a sample of the facility's effluent with a total phosphorus concentration of 17.1 mg/L. In subsequent years, DEP staff collected water samples, as part of the SMART monitoring program, at the same Bolton Rd crossing (NS19) bimonthly from 2005 to 2013. Total phosphorus seasonal average concentrations ranged from 0.024-0.089 mg/L (n= 2-3 in most years), below EPA's recommended 0.1 mg/L criterion for flowing waters. In addition, long term trend analysis (1998-2013) of total phosphorus concentrations at two DEP stations at the downstream end of the AU (W0483 & W0681 which have both been called station NS19) showed a statistically significant downward trend (p = 6.71e-11) for year-round

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
		data, as well as for seasonal (May-September) data (p = 2.72e-07). It is likely that consistent upgrades at the MWRA Clinton WWTP (NPDES permit #MA0100404) over the years led to the improvement in water quality. Results of a pilot study were published in February 2012, in which disc filter technology was used to successfully reduce total phosphorus in the facility's effluent down to <0.1 mg/L TP "under all plant conditions." The Phosphorus Reduction Facility at the plant formally came online in 2017, shortly after the issuance of a new NPDES permit in December 2016 requiring that the facility discharge less than 0.15 mg/L of TP from April through October, and less than 1.0 mg/L between November and March. Finally, similar land use patterns in 2011/2012 and 2019 satellite imagery are observed and therefore, data collected within this timeframe are considered usable for water quality assessment, listing, and delisting decisions. Based on all these data and information, "Phosphorus, Total" is being delisted as a cause of impairment for Nashua River MA81-09.

Supporting Information for Delisted Impairments

Phosphorus, Total

MWRA's Clinton Wastewater Treatment Plant achieves phosphorus removal from treated effluent in a Phosphorus Reduction Facility that was completed in 2017 (MWRA 2020). A 2012 article in WaterWorld noted that a pilot study was successfully conducted at the facility that demonstrated the use of disc filter technology to meet the new permit limit (0.15 mg/L, April-October) in what was then the facility's draft Individual NPDES permit (WaterWorld 2012).



The Clinton WWTP pilot study

SALT LAKE CITY, UT, Feb. 28, 2012 -- A pilot study at the Clinton Wastewater Treatment Plant (WWTP) in Clinton, Mass., has successfully demonstrated the ability to treat effluent water to less than 0.1 mg/L of **total phosphorous** (TP).

discharged into the Nashua River. The Massachusetts Department of Environmental Protection has released a draft National Pollutant Discharge Elimination System permit stipulating phosphorus regulation changes to begin in 2014. The permit requires that the facility discharge less than 0.15 mg/L of TP from April through October, and less than 1.0 mg/L between November and March. To provide a safety margin and to improve environmental quality, Clinton set a treatment goal of <0.1 mg/L phosphorus year-round.

In the pilot study, **WesTech Engineering (Salt Lake City, UT)** successfully utilized the SuperDisc™ Disc Filter in multiple dosing rates of alum, ferric chloride, and various polymers to optimize filtrate quality and chemical dose. Results showed that with the addition of a polymer and ferric chloride, phosphorus levels were consistently below the goal of 0.1 mg/L TP under all plant conditions while operating with an efficiency between 95% and 97%.

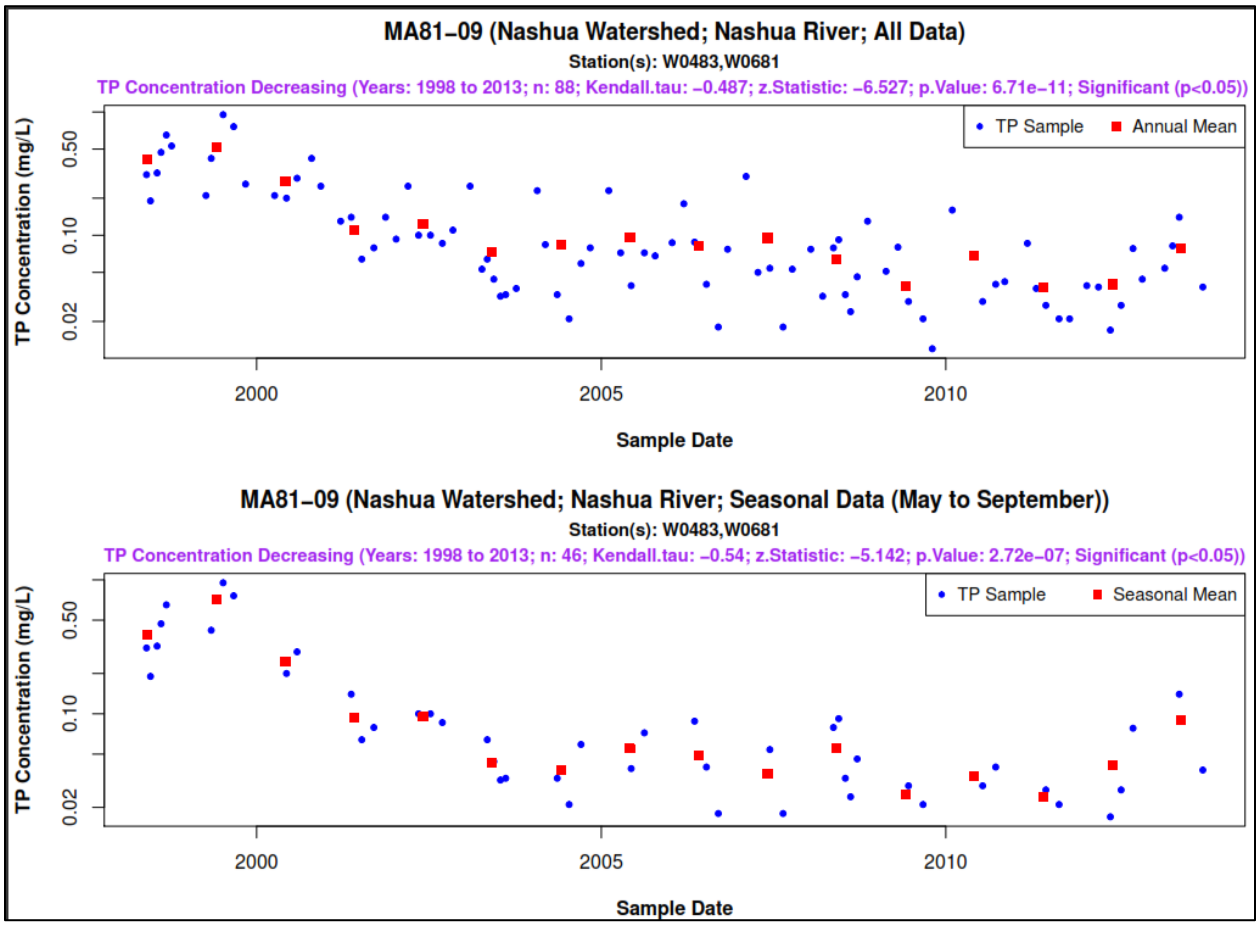
Data Sources: (T. Beaudoin 2016a, T. Beaudoin 2016b, MassDEP Undated 3) MassDEP staff measured total phosphorus in the Nashua River as part of the SMART program from 1998-2013. Station W0483 [at Bolton Road (upstream of sporadic input on eastern shore just upstream of road)] was sampled 2011-2013 but from 2005-2010, data were collected a little further downstream at station W0681 [at the “abandoned bridge" (Atherton Bridge)]. Both these sample locations were reported as SMART station “NS19” and since the data were indistinguishable, they are grouped and discussed as one site here. Data collected from 2005-2013 are presented in the table below. The Total Phosphorus seasonal average (May 1 – Sept 30) ranged from 0.024 to 0.089 mg/L, below the EPA recommended level of 0.1 mg/L for flowing waters.

Total phosphorus measured on the Nashua River during the summer index period*, Site NS19, from 2005-2013 (in mg/L)**

Year	Count	TP Average	TP Max
2005	2	0.056	0.072
2006	3	0.049	0.088
2007	2	0.036	0.054

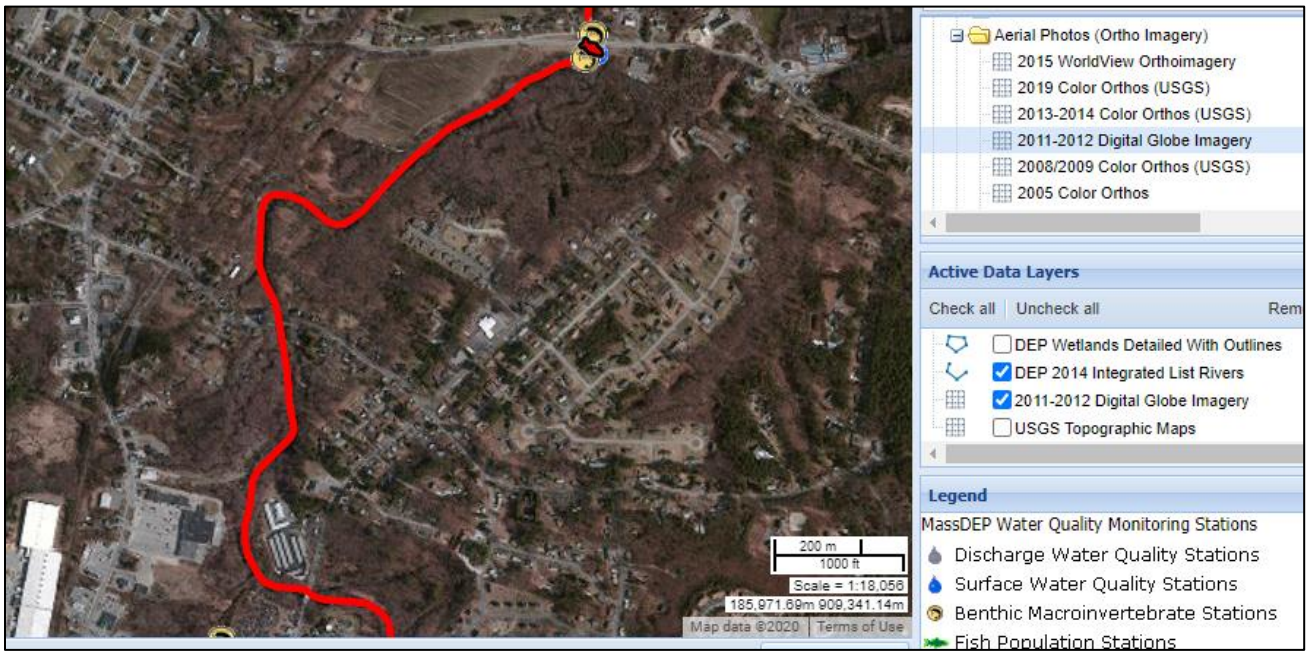
2008	5	0.055	0.092
2009	2	0.025	0.029
2010	2	0.035	0.040
2011	2	0.024	0.027
2012	3	0.041	0.078
2013	2	0.089	0.140
May1st-Sept 30th** * Unique ID's W0483 & W0681**			

Long-term trend analysis of total phosphorus data from MassDEP stations (MassDEP Undated 4):

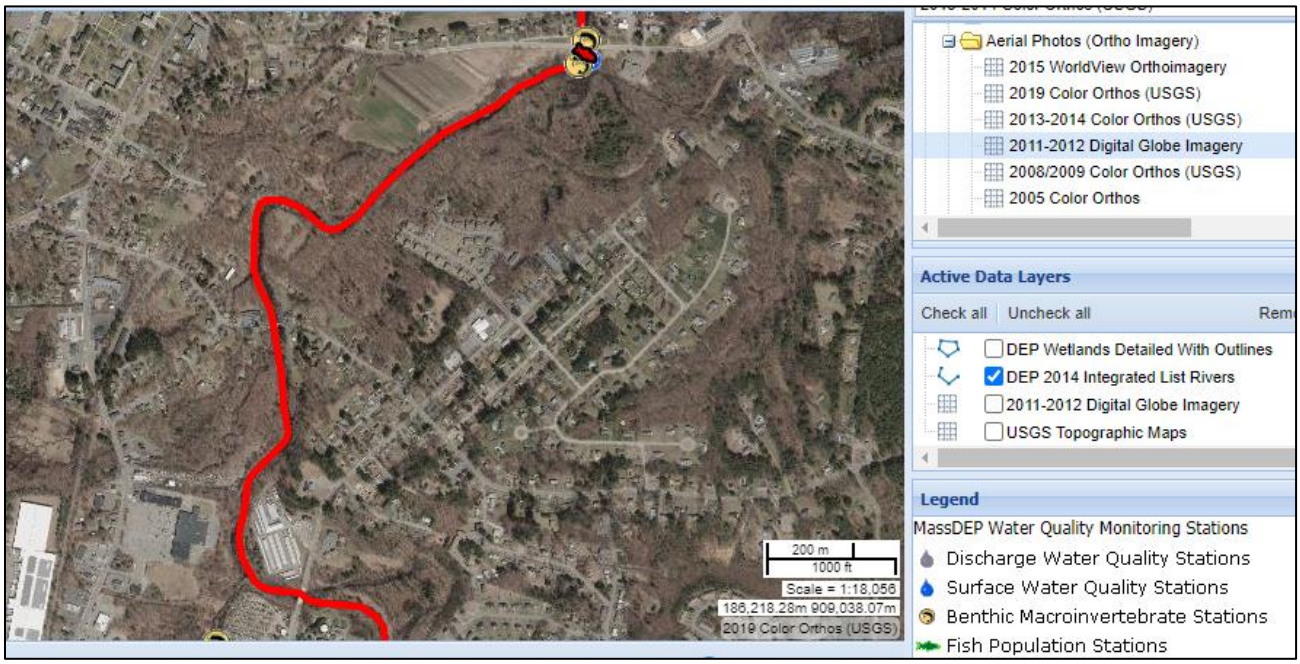


Similar land use patterns are observed in 2011/2012 and 2019 satellite imagery, therefore, data collected within this timeframe are considered usable for water quality assessment, listing, and delisting decisions.

2011/2012 satellite imagery depicting the NS19 station in the top center of the image (the river flows generally north at this location) (MassGIS Undated):



2019 satellite imagery depicting the NS19 station in the top center of the image (the river flows generally north at this location) (MassGIS Undated):

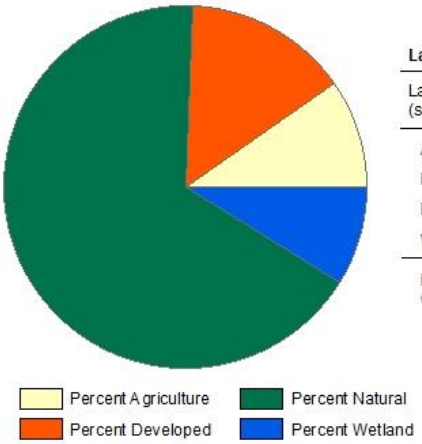


Nissitissit River (MA81-21)

Location:	New Hampshire state line, Pepperell to mouth at confluence with Nashua River, Pepperell.
AU Type:	RIVER
AU Size:	4.6 MILES
Classification/Qualifier:	B: ORW, CWF

Nissitissit River - MA81-21

Watershed Area: 60.73 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	14.43	6.86	3.22	1.93
Agriculture	9.6%	14.2%	9.6%	14%
Developed	14.8%	21.2%	9.7%	12.8%
Natural	66.8%	54.6%	63.7%	56.9%
Wetland	8.8%	10%	17%	16.2%
Impervious Cover	5.3%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

The Nissitissit River is a designated Cold Water Fishery. NRWA staff/volunteers collected discrete water quality data in the middle of the Nissitissit River AU at the Prescott St. bridge, Pepperell (NT0418) from 2008 to 2017. The dissolved oxygen data which met quality objectives (n = 5-7/year) were indicative of good conditions with a minimum concentration of 5.4 mg/L. MassDEP biologists sampled the benthic macroinvertebrate community of the Nissitissit River approximately 300 meters downstream/southeast of Prescott Street (Unique ID B0087) in August 2008. This location served as the reference station for the 2008 Nashua watershed benthic survey and the RBPIII status was determined to be “not impaired.” MassDEP staff collected water quality data and nutrient grab samples close to the downstream end of the Nissitissit River at Mill Street, Pepperell (W0486) during summer 2008. It should be noted that this sample location was just a short distance downstream of the Millie Turner Dam, which was ultimately removed in 2015. A thermistor was deployed for 86 days beginning 30 June 2008 to measure continuous temperature data. The maximum 7-DADM was 25.4 °C (with 67 exceedances of the Tier 1 cold water fishery chronic criterion) and the maximum 24-hour rolling average temperature was 25.4 °C (exceeding the Tier 1 cold water fishery acute criterion). A multiprobe was deployed for three 3-day periods (in June, July & August). The minimum dissolved oxygen concentration was good at 7.5 mg/L and there were no

indications of enrichment in the maximum DO diel shift of 0.8 mg/L and the 100% maximum saturation. Similar to the long term temperature data, the short-term data also violated both acute and chronic criteria (maximum 24-hour rolling average 24.1 °C, average daily maximum temperatures ranged from 21.4-24.5 °C). Discrete probe data were similar to continuous data (DO, temperature) and pH data did not violate criteria, ranging from 6.8-7.2 SU (n=6). The total phosphorus seasonal average concentration was 0.012 mg/L (maximum 0.013 mg/L, n=5) and there were no violations of ammonia-nitrogen criteria (maximum 0.03 mg/L, n=5). There was one observation of moderately dense filamentous algae in July 2008. NRWA staff/volunteers collected discrete water quality data just upstream from the mouth of the river, behind Lomar park, Pepperell (NT0082) from 2008 to 2019. The dissolved oxygen data which met quality objectives (n = 4-7/year) were generally indicative of good conditions with only one measurement below the 5.0 mg/L 1-day minimum cold water criterion (minimum 4.4 mg/L).

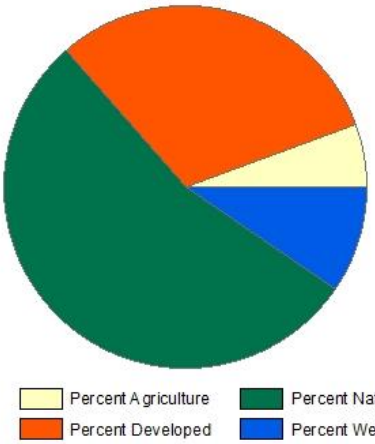
The Aquatic Life Use for the Nissitissit River (MA81-21) remains assessed as Not Supporting, based on the lack of a cold water assemblage in this designated cold water fishery. A new impairment is being added for elevated temperature due to the numerous violations of the cold water chronic criterion (and also the acute criterion) at Mill Street in Pepperell. These violations could not be attributed to natural conditions due to the proximity of the Millie Turner Dam to the Mill Street water quality station. However, since the dam was removed in 2015, the fish community should be resurveyed and new water quality data should be collected to determine if conditions have improved enough to warrant a delisting.

Nonacoicus Brook (MA81-17)

Location:	Outlet Plow Shop Pond, Ayer to mouth at confluence with Nashua River, Ayer/Shirley.
AU Type:	RIVER
AU Size:	1.4 MILES
Classification/Qualifier:	B

Nonacoicus Brook - MA81-17

Watershed Area: 18.71 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	18.7	9.46	3.56	1.7
Agriculture	5.6%	4.1%	4.1%	2.2%
Developed	30.8%	44.3%	24.3%	35.7%
Natural	54.1%	43.5%	49.1%	41.9%
Wetland	9.5%	8.1%	22.5%	20.2%
Impervious Cover	12.2%			

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

MassDFG biologists conducted backpack electrofishing close to the upstream end of the AU at Shirley St, Ayer in July 2012 (Sample ID 4004). The sample (n=29) included 5 of the fluvial specialist species, fallfish, as well as 38% intolerant/moderately intolerant macrohabitat generalists (yellow perch, swamp darter, and others). NRWA staff/volunteers collected discrete data at two stations in Ayer: at the upstream end of the AU at the Shirley St bridge (NB1947) and at the downstream end at the Bishop Rd bridge (NB0006). The data which met quality objectives were collected between 2009 and 2019 (roughly 6 times per year). Dissolved oxygen data were generally indicative of good conditions at both stations, with three exceptions (out of 48 measurements) falling below the 1-day minimum warmwater guideline of 4.0 mg/L once in 2018 at NB1947 (minimum 3.9 mg/L) and once each in 2011 and 2012 at NB0006 (minimum 2.9 mg/L). MassDEP staff conducted water quality monitoring from May to September 2008 at the downstream end of the AU (in the vicinity of the downstream NRWA station) just above the confluence with the Nashua River (W1813). A multiprobe was deployed to measure continuous DO and temperature during three 3-day periods in June, July & August. The minimum DO from all 3 deploys was 3.69 mg/L and the 3-day mean minimums ranged from 4.00-5.32 mg/L (violating WWF guidelines in August), with a maximum DO diel shift of 3.0 mg/L and a maximum saturation of 103%. The average daily maximum temperatures were >27.7 °C during both the June and July deploys (maximum 3-DADM of 28.8 °C) and the maximum 24-hour rolling average temperature was 25.8 °C. Discrete probe and grab sample data (DO, temperature, pH, total phosphorus, ammonia) were also collected. Temperature data were ≤25.6 °C (n=6), while pH ranged from 6.3-7.1 SU (n=6) and DO data were similar to the continuous multiprobe data with a minimum of 3.8 mg/L (n=6). The total phosphorus seasonal average was low at 0.032 mg/L (maximum 0.043 mg/L; n=5)

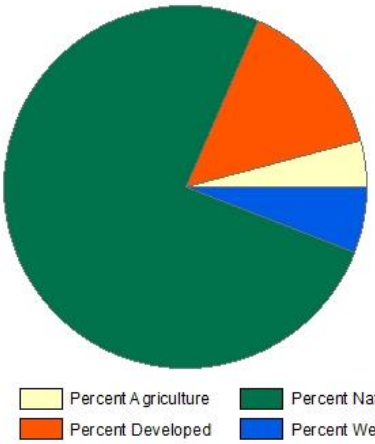
and there were no observations of excessive filamentous algae. There were also no violations of ammonia-nitrogen criteria (maximum 0.11 mg/L; n=5).
The Aquatic Life Use for Nonacoicus Brook (MA81-17) continues to be assessed as Not Supporting due to the historic impairment for low Dissolved Oxygen. An Alert is also being issued for elevated temperature and a long term temperature probe should be deployed near MassDEP station W1813.

North Nashua River (MA81-01)

Location:	Headwaters, outlet Snows Millpond, Fitchburg to Fitchburg Paper Company Dam #1 (NATID: MA00877), Fitchburg.
AU Type:	RIVER
AU Size:	1.7 MILES
Classification/Qualifier:	B: WWF, CSO

North Nashua River - MA81-01

Watershed Area: 58.81 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	58.2	13.91	16.47	4.06
Agriculture	4.1%	6%	3.5%	7.5%
Developed	14.3%	19.9%	14%	19.1%
Natural	75.7%	70.5%	71.5%	65.6%
Wetland	5.9%	3.6%	11%	7.8%
Impervious Cover	6.3%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

The City of Fitchburg was authorized to discharge treated effluent from the West Fitchburg Wastewater Treatment Facility (WFWWTF) close to the upstream end of the AU until December 2003, after which time all domestic wastewater flows were diverted to the East Fitchburg facility. Between 2003 and 2010 (when the WFWWTF was closed entirely) the flows at the WFWWTF were generated by three paper mills as well as occasional hauled wastewater, with an average monthly flow of approximately 2.85 MGD. Between Dec 2007 and Dec 2009, 9 valid WET tests were conducted on the WFWWTF effluent using *Ceriodaphnia dubia*. The LC50s were all >100% effluent. The CNOECs were 100% effluent with the exception of the Dec 2007 test (CNOEC = 81% effluent). Water from the North Nashua River was collected at Princeton Rd, Fitchburg for use as a diluent/control. Survival of *C. dubia* exposed (~7 days) to the river water was good, ranging from 90-100% of the test organisms (n=9).

MassDFG biologists conducted backpack electrofishing close to the upstream end of the AU, off Rt. 2A/31 at Waites Corner (below the dam, across from Ward St), Fitchburg (Sample ID 2387) in August 2007. DFG staff collected another sample just downstream of the Phillips Brook confluence (sample 6499, Mill No. 3 farm stand, West Fitchburg) in August 2017. The two fish samples, in combination, were 57% similar to the Target Fish Community model for the Nashua basin (target is 50% similarity). By far, the most common species in these samples was common shiner, followed distantly by blacknose dace, fallfish, and largemouth bass.

NRWA staff/volunteers collected discrete data at one station in the North Nashua River at Mill # 3, Fitchburg (NN3071). The data which met quality objectives were collected between 2010 and 2019 (roughly 6 times per year) and are as follows: dissolved oxygen data were generally indicative of good conditions, with occasional

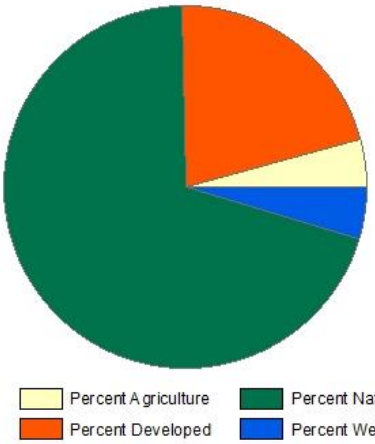
instances (3 of 65) when measurements were lower than the 1-day minimum warm water guideline of 4.0 mg/L (minimum 1.6 mg/L). The violations occurred in 2012, 2016 and 2019.
MassDEP staff conducted water quality monitoring nearby from May-Sept 2008 approximately 340 ft downstream of Depot Street, Fitchburg (W1780). Discrete probe and nutrient grab sample data were collected. DO, temperature and pH data all met warm water guidelines. The total phosphorus seasonal average was relatively low at 0.024 mg/L (n=5) with a maximum of 0.046 mg/L and there were no observations of excessive filamentous algae. Additionally, there were no exceedances among 11 ammonia samples. Six clean metals samples were also collected and there were no violations of acute or chronic criteria.
The Aquatic Life Use for the North Nashua River (MA81-01) is assessed as Fully Supporting, based primarily on the high similarity of two fish samples with the Nashua basin Target Fish Community model, as well as generally good water quality conditions and the good survival of *C. dubia* exposed to ambient river water. The use is identified with an Alert status due to the occasional incidence and extent of low DO noted at the downstream end of the AU by NRWA. A prior Alert for "low RBP III metrics" of a benthic macroinvertebrate sample (NN03, collected in 2003) is being removed since, under the 2018 CALM guidance, comparability of 60% with the reference sample (QP00) is considered supportive of the Aquatic Life Use.

North Nashua River (MA81-02)

Location:	From Fitchburg Paper Company Dam #1 (NATID: MA00877), Fitchburg to Fitchburg East WWTP outfall (NPDES: MA0100986), Leominster.
AU Type:	RIVER
AU Size:	6.9 MILES
Classification/Qualifier:	B: WWF, CSO

North Nashua River - MA81-02

Watershed Area: 86.57 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	85.95	5.99	24.82	1.27
Agriculture	4.2%	3%	3.3%	1.6%
Developed	21.1%	61.1%	16.3%	46.5%
Natural	70.1%	33.6%	71.5%	45.9%
Wetland	4.6%	2.3%	8.8%	6%
Impervious Cover	9.5%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Fish Bioassessments		Added
5	5	Lead		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

Near upstr. end of this N. Nashua River AU (MA81-02), MassDEP staff conducted monitoring during summer 2011 as part of MAP2 project downstr. of Mill Pond Dam #1, Fitchburg (MAP2-046). Benthic sampling (B0721) in Sept 2011 but not analyzed using an RBPIII approach. Data will be compared to biocriteria thresholds currently under development & used in the future. Barge electrofishing (Sample 4608) in Sept 2011- sample contained 4 fluvial species (n=38). Water quality (WQ) data (W2200): three 4-day probe deployments, min DO 7.9 mg/L, max saturation 104%, max diel DO shift 0.8 mg/L. Max temp. from thermistor deployed 12 May to 6 Oct was 33.7 °C, max 24-hour avg (28.5 °C) exceeded acute criterion (28.3 °C) & the 7DADM exceeded chronic criterion (27.7 °C) 5 times (max 7DADM 28.4 °C). pH ranged 7.2-7.4 SU (n=6). Total phosphorus (TP) seasonal avg was low (0.016 mg/L, n=5). Five notes of dense/very dense filamentous algae but no other indications of nutrient enrichment. Dissolved lead exceeded chronic criteria all 3 samples (TUs 1.42-2.15), copper exceeded chronic criterion once (1.01 TU). NRWA staff/volunteers conducted sampling at Kimball St, Fitchburg (NN2888) 2008-2017. Summary for data meeting quality objectives: all 65 DO measurements >4.0 mg/L (min 4.2 mg/L). Summer 2008, DEP staff sampled downstr. of Circle St, Fitchburg (W2068) 6 times. Discrete data: min DO 9.3

mg/L, max saturation 104%, max temp. 16.8 °C, pH 6.9-7.3 SU, ammonia (≤0.06 mg/L). Copper exceeded acute & chronic criteria once (1.23 and 1.63 TU, respectively, n=8). NRWA collected WQ data at Riverfront Park, Fitchburg (NN2657) 2008-2019. Data meeting quality objectives: min DO 3.1 mg/L (<4.0 mg/L 3 times, with 2 of these in 2019, excluded questionable 2015/2017 data, n=58). The N. Nashua River Restoration Project provided some instream habitat restoration (modification of a flood wall in Riverside Park); completed in 2010. DEP WQ site (W0840) at Airport Rd, Fitchburg & benthic site (B0076) ~150 m south of Airport/Falulah Rd sampled in 2008. WQ data (W0480): four 5-day probe deployments, min DO 5.85 mg/L, max saturation 101%, max diel DO shift 2.2 mg/L, max temp. 27.5 °C. pH 6.7-7.0 SU (n=14). TP seasonal avg (0.028 mg/L, n=5) & ammonia concentrations were low (≤0.19 mg/L, n=11); no excessive filamentous algae. Dissolved lead exceeded chronic criteria once (1.01 TU), no other toxicant exceedances (n=8). RBPIII analysis (B0076) at this location "slightly impaired" (67% comparable) when compared to the Nissitissit River reference site (B0087). DFG biologists conducted barge electrofishing in Aug 2007 off Crawford St, Fitchburg (Sample 2388). Sample contained 5 fluvial species (n=270). DEP WQ site upstr. of Hamilton St, Leominster (W2069), collected discrete data 6 times in summer 2008: min DO 9.1 mg/L, max saturation 100%, max temp. 16.5 °C, pH 6.6-6.7 SU, ammonia low (≤0.06 mg/L), no exceedances of any metals samples (n=8). Fish samples 6497 (upper AU), 6500 (behind Fitchburg East WWTF) & 2388 in combination were 36.5% similar to the Target Fish Community model for the Nashua (target is 50% similarity). From Dec 2007 to Mar 2019 survival of *C. dubia* exposed (~7 days) to river water collected upstr. of Fitchburg East WWTF discharge was good (≥78% except Dec 2015 test with survival 70%, n=44). Of 47 *P. promelas* tests (~7-day exposure), 39 tests had survival ranging from 75-100% but survival was <75% in 8 tests (17%), ranging from 23 to 70%, however, survival of *P. promelas* is noted to be improving.

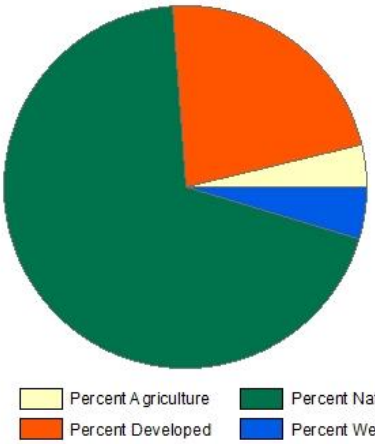
The Aquatic Life Use for this North Nashua River AU (MA81-02) is assessed as Not Supporting. Ambient Bioassays Chronic Aquatic Toxicity impairment and Benthic Macroinvertebrates bioassessments impairments are being carried forward, new impairments for Lead and Fish Bioassessments. New Alerts for temperature (W2200) and DO (NRWA NN2657) added although benthic and other water quality data were indicative of good conditions.

North Nashua River (MA81-03)

Location:	From Fitchburg East WWTP outfall (NPDES: MA0100986), Leominster to Leominster WWTP outfall (NPDES: MA0100617), Leominster.
AU Type:	RIVER
AU Size:	1.6 MILES
Classification/Qualifier:	B: WWF, CSO

North Nashua River - MA81-03

Watershed Area: 99.97 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	99.35	8.07	29.31	2.01
Agriculture	3.8%	2.1%	2.9%	0%
Developed	22.4%	60.4%	16.7%	43.9%
Natural	69.3%	34.6%	71.7%	52.3%
Wetland	4.5%	2.9%	8.8%	3.8%
Impervious Cover	10.3%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

The Fitchburg East WWTF is authorized to discharge treated effluent to the upstream end of this North Nashua River AU (MA81-03). Between Dec 2007 and Mar 2019, 44 Whole Effluent Toxicity tests were conducted on effluent using *C. dubia* and 47 tests were conducted using *P. promelas*. All tests had LC_{50}s meeting the permit limit (≥100%). However, chronic toxicity exceeded the permit limit (CNOEC ≥62% effluent) in 18% (7 tests) of valid *C. dubia* tests and 13% (6 tests) of valid *P. promelas* tests with CNOECs ranging from 6.25-50% effluent. NRWA staff/volunteers collected discrete data at 1 station at the upstream end of the AU, behind 120 Hamilton St, Leominster (NN1905). Of note, this sample location is just downstream of the Fitchburg East WWTF discharge. The data which met quality objectives were collected from 2008-2019 (roughly 6 times per yr). Dissolved oxygen measurements were less than the 4.0 mg/L criterion 6 times (n=78) with violations occurring twice in 2014 and 2016, and once in some other years (min 2.6 mg/L). MassDFG biologists conducted barge shocking near the middle of the AU in Leominster, east of the Searstown Mall, south of Rt. 2 in Aug 2007 (Sample ID 2967). In the vicinity, DFG staff collected a 2nd sample (Sample ID 6679) in Aug 2017. The 2 fish samples, in combination, were 50% similar to the Target Fish Community model for the Nashua basin (target is 50% similarity). The most common species in these samples was white sucker, followed by longnose dace, fallfish, and others. MassDEP staff conducted water quality monitoring nearby, ~600 ft downstream of Rt. 2 (W0993), during summer 2008. A multiprobe was deployed to measure continuous dissolved oxygen and temperature data during three 2-day periods in June, July & August, and one five-day period in September. The minimum DO from all 4 deploys was 5.87 mg/L, with a maximum diel shift of 1.49 mg/L and a maximum saturation of 98.7%. Temp. data consistently met WWF guidelines: the average daily maximum temp. ranged from 20.2-27.3 ^{o}C and the maximum daily average ranged from 19.6-24.7 °C. Discrete probe data (DO, temp.,

pH) all met criteria. The total phosphorus seasonal average concentration was quite elevated at 0.24 mg/L (maximum 0.6 mg/L, n=5), which exceeds the EPA "Gold Book" recommendation for rivers (0.1 mg/L). However, there were no observations of dense or very dense filamentous algae. Ammonia-N concentrations ranged from 0.04-1.7 mg/L, however, site-specific criteria could not be calculated due to a lack of pH and temperature data for the days in question. A short way downstream but still east of the Searstown Mall, DFG staff collected a fish sample (Sample ID 1954) in Sept 2003. The large sample (n=633) was dominated by the fluvial species, white sucker, blacknose dace, and longnose dace. These data were not included in the Target Fish Community analysis due to their age. The City of Leominster used water collected at the downstream end of this AU (~600 ft downstream of the Monoosnuc Brook confluence) in 32 controls for Whole Effluent Toxcity tests conducted between Mar 2008 and Dec 2018 on the effluent of the Leominster WPCF (which discharges to the upstream end of AU MA81-04). Survival of *Ceriodaphnia dubia* exposed (~7 days) to the river water was good, ranging from 90-100% of the test organisms.

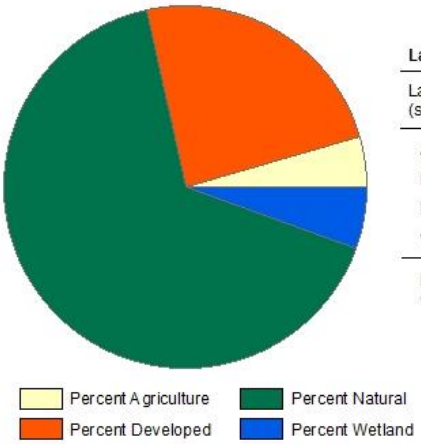
The Aquatic Life Use for the North Nashua River (MA81-03) is assessed as Fully Supporting, based primarily on the high similarity of two fish samples with the Nashua basin Target Fish Community model, as well as generally good water quality conditions and the good survival of *C. dubia* exposed to river water collected from the downstream end of the AU. An Alert status is noted for the use due to occasional chronic toxicity of Fitchburg East WWTF effluent to *C. dubia*, occasional incidences of low DO (NRWA NN1905 downstream of Fitchburg East WWTF), as well as occasional elevated ammonia and TP in 2008 (and prior for TP) at DEP station W0993.

North Nashua River (MA81-04)

Location:	From Leominster WWTP outfall (NPDES: MA0100617), Leominster to mouth at confluence with Nashua River ("South Branch" Nashua River), Lancaster.
AU Type:	RIVER
AU Size:	10.4 MILES
Classification/Qualifier:	B: WWF

North Nashua River - MA81-04

Watershed Area: 134.22 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	133.6	8.33	40.16	2.81
Agriculture	4.4%	10.7%	4%	14.9%
Developed	24%	17.8%	17.4%	10.9%
Natural	66.1%	60.7%	68.3%	57.7%
Wetland	5.4%	10.8%	10.3%	16.5%
Impervious Cover	10.7%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

This North Nashua River AU (MA81-04) begins at the Leominster WPCF outfall. The facility conducted 43 valid Whole Effluent Toxicity tests between Mar 2008 and Dec 2018- there was no sign of acute toxicity (LC_{50}>100% effluent, all tests) and all but one test met the CNOEC permit limit of ≥43.5% effluent.Mid-AU downstream of the I-190 crossing, Lancaster: DFG biologists conducted barge shocking in Aug 2007 (Sample 2966), while MassDEP staff and NRWA staff/volunteers collected water quality (WQ) data. DEP routine data were collected in summer 2008 and bimonthly from 2005-2013 as part of the DEP SMART monitoring program (W0481/NN12). A multiprobe was deployed for three 5-day periods in 2008 and data were indicative of good conditions for a WWF (min DO 4.8 mg/L, max DO diel shift 1.8 mg/L, max saturation 96%, max temp. 26.3 °C). Most discrete probe and grab sample data from the SMART program were also good (temp., DO, pH range 6.5-7.2 SU, max ammonia 1.5 mg/L, specific conductance max 587 µs/cm, max chloride 120 mg/L), however, total phosphorus seasonal averages (0.065-0.257 mg/L, n= 2-3/yr) were above the EPA recommendation of 0.1 mg/L in 7 of 9 years. There were some observations of dense/very dense filamentous algae, but these were less frequent in later years. NRWA discrete data (2008-2016) from this location (NN1194) which met quality objectives were also generally indicative of good conditions (min DO 4.9 mg/L, max temp. 24.1 °C, pH 5.88-7.56 SU with only 2 measurements <6.0 SU, n= 5-7/yr). Further downstream, DFG biologists conducted barge shocking near the Pellecchia Conservation Land canoe launch in Aug 2017 (Sample 6498) and a short way downstream off Ponakin Mill Rd and Schumacher Rd, Lancaster in Aug 2007 (Sample 2965). Staff from River Terrace Health Care (MA0025763) collected river water approx. 50 ft upstream of its outfall (NE of Schumacher and Ponakin Roads) for use as a diluent/control in *C. dubia* WET tests (n=12) conducted Oct 2008 to Sept 2019. Survival of *C. dubia*

exposed (~48 hours) to river water was good, ranging from 90-100% on all but one date. NRWA staff/volunteers collected discrete WQ data a short way downstream across from Langen Rd, Lancaster (NN0426) from 2008-2016. Data were generally good (min DO 5.67 mg/L, max temp. 23.5 °C, pH 5.91-7.53 SU with only 1 measurement <6.0 SU, n= 5-7/yr). DEP staff collected grab samples at the Rt 70 crossing, Lancaster during summer 2008 (W1781). Ammonia data did not violate criteria (max 1.2 mg/L, n=5). The TP seasonal average was elevated at 0.17 mg/L (max 0.3 mg/L, n=5) but there were no filamentous algae observations. Long term trend analysis (1998-2013) of TP concentrations at 3 DEP stations showed a statistically significant downward trend ($p = 1.21e-04$) for year-round data, but not for seasonal (May-Sept) data ($p = 0.270$). Near the downstream end of this AU, NRWA WQ data collected from 2008-2017 at the Main St railroad bridge, Lancaster (NN0049) were generally good (min DO 4.0 mg/L, temp. and pH similar to other 2 stations). A DFG fish sample was collected nearby in Aug 2017 (Sample 6501). The 4 fish samples, in combination, were 50% similar to the Target Fish Community model for the Nashua basin (target is 50% similarity). The most common species in these samples were white sucker and fallfish.

The Aquatic Life Use for this North Nashua River AU (MA81-04) is assessed as Fully Supporting based primarily on high similarity of 4 fish samples with the Target Fish Community model for the Nashua basin, as well as on WET testing data and water quality data that were generally indicative of good conditions. Elevated total phosphorus continues to be of concern, so the prior Alert will remain, as well as the prior Alert for low RBPIII metrics. An Alert will be added for occasional low pH (NRWA stations), as well as Nutrient/Eutrophication Biological Indicators, which will be added due to MassDEP SMART program observations of dense filamentous algae (DEP W0481/NN12).

Notown Reservoir (MA81092)

Location:	Leominster.
AU Type:	FRESHWATER LAKE
AU Size:	241 ACRES
Classification/Qualifier:	A: PWS, ORW (PWS and Tributary to PSW)

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No recent data are available so the Aquatic Life Use for Notown Reservoir (MA81092) is Not Assessed.

Paradise Pond (MA81097)

Location:	Princeton.
AU Type:	FRESHWATER LAKE
AU Size:	61 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Fish, other Aquatic Life and Wildlife Use: Not Supporting
As was previously reported, MassDCR Lakes and Ponds staff observed an infestation of the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*) in Paradise Pond in 2003, and more recently in 2007. The Aquatic Life Use for Paradise Pond (MA81097) remains assessed as Not Supporting for Non-Native Aquatic Plants based on the presence of the non-native variable milfoil (*Myriophyllum heterophyllum*).

Partridge Pond (MA81098)

Location:	Westminster.
AU Type:	FRESHWATER LAKE
AU Size:	25 ACRES
Classification/Qualifier:	B

Partridge Pond is also known as Ellis Pond.

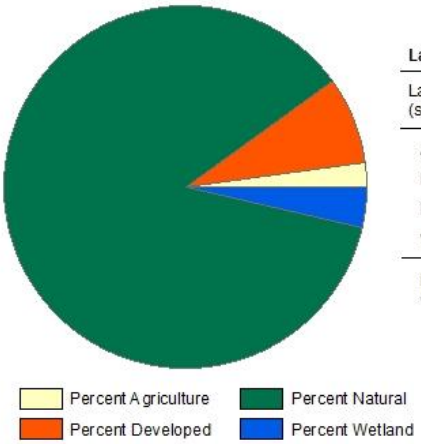
Fish, other Aquatic Life and Wildlife Use: Not Supporting
The Partridge Pond Association applied for herbicide application permits to treat the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*), in alternating years from 2006 through at least 2014. The Aquatic Life Use for Partridge Pond (MA81098) remains assessed as Not Supporting for Non-Native Aquatic Plants based on the presence of the non-native variable milfoil (*Myriophyllum heterophyllum*).

PEARL HILL BROOK (MA81-80)

Location:	Headwaters, outlet Wright Ponds, Ashby to mouth at confluence with Squannacook River, Townsend.
AU Type:	RIVER
AU Size:	6.7 MILES
Classification/Qualifier:	B: ORW

PEARL HILL BROOK - MA81-80

Watershed Area: 7.25 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	7.25	4.72	1.92	1.15
Agriculture	2.1%	1.6%	2.4%	2%
Developed	7.8%	7.8%	7.3%	7.3%
Natural	86.5%	87.7%	81%	83.2%
Wetland	3.6%	3%	9.3%	7.5%
Impervious Cover	3%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

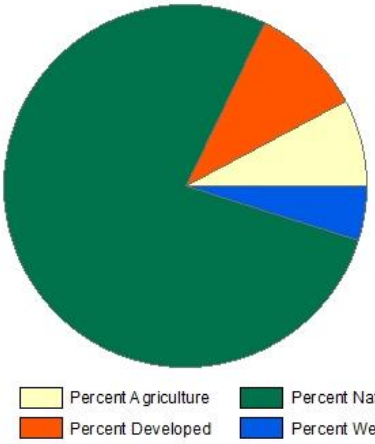
MassDFG biologists conducted backpack electrofishing at one location in the upstream half of Pearl Hill Brook in July 2006, ~100m upstream of Wares Road, Ashby (Sample ID 1551). The sample (n=16) was largely comprised of multiple age classes of Eastern brook trout, an intolerant, cold water species (11 out of 15 individuals were <140 mm). MassDFG staff also conducted electrofishing at two locations in the downstream half of the AU in Townsend in August 2013: downstream of Vinton Pond Rd (Sample ID 4793) and along New Fitchburg Rd approximately 0.15 mi north of Bayberry Hill Rd (Sample ID 4795). Both samples were small (n = 13 and 8, respectively) but contained fluvial species in at least moderate abundance (white suckers were collected at both sites). The Vinton Pond Rd sample also contained 1 adult Eastern brook trout and field notes indicated that a couple more escaped capture, although they were likely stocked individuals. The downstream sample contained 3 Eastern brook trout from multiple age classes. From May-Sept 2008, MassDEP staff conducted monthly bacteria monitoring at the downstream end of the AU, off the southern end of Pearl Brook Rd in Townsend (Unique ID W1835). Filamentous algal coverage was dense during one of these surveys. The Aquatic Life Use for Pearl Hill Brook (MA81-80) is assessed as Fully Supporting based primarily on the presence of a reproducing wild population of Eastern brook trout, a cold water species indicative of excellent habitat and water quality.

Phillips Brook (MA81-12)

Location:	Headwaters, outlet Winnekeag Lake, Ashburnham to Westminster Street (Route 2A/31), Fitchburg (segment includes McTaggarts Pond and unnamed tributary to North Nashua River) (qualifiers apply to 0.0 to 1.0 mile of river per 2007 SWQS, NOTE: CSO eliminated in 2006).
AU Type:	RIVER
AU Size:	8.4 MILES
Classification/Qualifier:	B: WWF, CSO (qualifiers apply to 0.0 to 1.0 mile of river per 2007 SWQS, NOTE: CSO eliminated in 2006)

Phillips Brook - MA81-12

Watershed Area: 15.82 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	15.75	5.85	4.76	2.13
Agriculture	7.7%	12.4%	8.5%	13%
Developed	10%	9.5%	12.1%	10.1%
Natural	77.4%	73.7%	70.9%	68.7%
Wetland	4.9%	4.4%	8.6%	8.3%
Impervious Cover	3.7%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Phillips Brook is being evaluated as a Tier 1 existing use cold water fishery (see the 2003 WQAR and the fish sample discussion below). NRWA collected discrete data at one station in Phillips Brook at Whitney Hill Rd (an old cart path/right-way connecting Willard Rd to the West with Rt 12 to the East, just across the street from Jewell Hill Rd) in Ashburnham (Station ID PB0840). The data which met quality objectives were collected roughly 6 times a year between May and October from 2011-2013. All dissolved oxygen data were indicative of good conditions for an existing use cold water fishery, with a minimum of 5.2 mg/L. MassDEP staff conducted water quality monitoring from May-Sept 2008 in the middle of the AU at the Rt. 12 stream crossing nearest to and north of the Fred Smith Road/Bean Porridge Hill Road intersection in Westminster (W1809). A thermistor was deployed for 96 days beginning June 20. The maximum 7-DADM was 23.2 °C (45 exceedances of the Tier 1 CWF

20.0 °C chronic criterion) and the maximum 24-hour rolling average temperature was 23.2 °C. Dissolved oxygen was measured during short-term probe deploys (2 days each) in June, July & August and the minimum concentration was 7.01 mg/L. The maximum DO diel shift was 1.3 mg/L and the maximum saturation was 96%, indicating that enrichment is not a problem in this stream. Discrete probe and grab sample data (DO, pH, total phosphorus, ammonia) did not violate criteria or were consistent with continuous data (temperature). Of note, the TP seasonal average was 0.015 mg/L (n=5), with a maximum of 0.025 mg/L and there were no observations of excessive filamentous algae. Further downstream, MassDFG biologists conducted backpack electrofishing along Rt 12 just south of McIntyre Rd, Fitchburg (Sample ID 3821) in Aug 2011. Multiple age classes of the intolerant cold water species, Eastern brook trout, were collected (4 of 45 individuals). Other fluvial species dominated the sample (96%), including blacknose dace, fallfish and white sucker. Near the mouth of the stream, DEP staff collected 6 bacteria samples roughly 1000 ft downstream of Westminster Hill Rd in Fitchburg during summer 2008 (W0991). There were no observations of excessive filamentous algae during these surveys. Although there is a reproducing population of Eastern brook trout in Phillips Brook (MA81-12) and water quality data were generally indicative of good conditions, the Aquatic Life Use is assessed as Not Supporting for Temperature (chronic violations of the Tier 1 Existing Use Cold Water Fishery criterion at DEP station W1809). The prior alerts for low fish sample size and low pH are being removed.

Pine Hill Reservoir (MA81102)

Location:	Paxton/Holden/Rutland.
AU Type:	FRESHWATER LAKE
AU Size:	336 ACRES
Classification/Qualifier:	A: PWS, ORW (PWS and Tributary to PSW)

Fish, other Aquatic Life and Wildlife Use: Not Assessed
Pine Hill Reservoir is part of the public water supply for the City of Worcester. The Aquatic Life Use for Pine Hill Reservoir (MA81102) is Not Assessed due to the absence of recent data.

Plow Shop Pond (MA81103)

Location:	Ayer.
AU Type:	FRESHWATER LAKE
AU Size:	29 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Fanwort*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

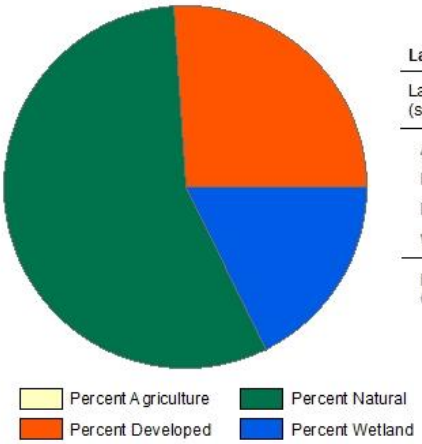
As previously noted, MassDEP staff conducted a synoptic survey of Plow Shop Pond in July 1998 when they identified an infestation of the non-native aquatic macrophyte, fanwort (*Cabomba caroliniana*). Plow Shop Pond is part of the Devens Superfund site, and pond sediments were found to have been contaminated with arsenic from groundwater seeping from the Shepley's Hill Landfill, as well as heavy metals from railroad activities. Remediation actions were conducted, including removal of contaminated sediments, and additional investigations determined that no further actions were needed to prevent risks to human health/welfare, or the environment. The Aquatic Life Use for Plow Shop Pond (MA81103) remains assessed as not supporting, based on the presence of the non-native aquatic macrophyte, fanwort (*C. caroliniana*), however, the Non-Native Aquatic Plants impairment code is being delisted and replaced with the specific Fanwort code. Other historic impairments that will remain include "Polycyclic Aromatic Hydrocarbons (PAHs) (Aquatic Ecosystems)" and "Sediment Bioassay."

PONAKIN BROOK (MA81-87)

Location:	Headwaters north of Shoefelt Road, Lancaster to mouth at confluence with the North Nashua River, Lancaster.
AU Type:	RIVER
AU Size:	1.9 MILES
Classification/Qualifier:	B

PONAKIN BROOK - MA81-87

Watershed Area: 1.74 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.74	1.74	0.43	0.43
Agriculture	0%	0%	0%	0%
Developed	26%	26%	20.6%	20.6%
Natural	56.3%	56.3%	41.3%	41.3%
Wetland	17.7%	17.7%	38.1%	38.1%
Impervious Cover	3.4%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

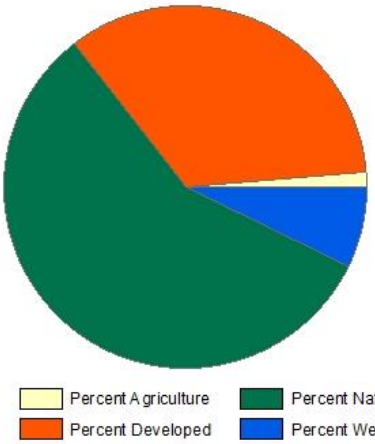
MassDFG biologists conducted backpack electrofishing at three locations in the upper half of Ponakin Brook, Lancaster (MA81-87) in August, 2007: north of Shoefelt Rd (Sample ID 2376); south of Shoefelt Rd, west of Shirley Rd (Sample ID 2168); and further south of Shoefelt Rd (Sample ID 2374). At the most upstream site, the entire sample consisted of the intolerant cold water species, Eastern brook trout (n=33), with all individuals measuring <140 mm. The sample from the middle site included 14% of the moderately tolerant macrohabitat generalist pumpkinseed and only 1 individual from a fluvial species (blacknose dace), however, it was dominated by the tolerant golden shiner (sample n=201). At the most downstream of the 3 sample sites, fluvial species dominated the sample (88%), including mainly blacknose dace and also 2 Eastern brook trout (1 = 140 mm). It should be noted that MassDFG considers Ponakin Brook a CFR and that all surveys were conducted in low gradient reaches. The Aquatic Life Use for Ponakin Brook (MA81-87) is assessed as Fully Supporting, given the presence of multiple age classes of Eastern brook trout, a species indicative of excellent habitat and water quality conditions.

Poor Farm Brook (MA81-52)

Location:	Headwaters, perennial portion, east of Salisbury Street, Holden to mouth at inlet Chaffin Pond, Holden.
AU Type:	RIVER
AU Size:	1.5 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Poor Farm Brook - MA81-52

Watershed Area: 1.19 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.18	1.18	0.64	0.64
Agriculture	1.4%	1.4%	2.1%	2.1%
Developed	34.1%	34.1%	27.5%	27.5%
Natural	57.3%	57.3%	58.2%	58.2%
Wetland	7.2%	7.2%	12.3%	12.3%
Impervious Cover	12.4%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG staff conducted backpack electrofishing at the upstream end of Poor Farm Brook downstream of Stanjoy Rd, Holden in August 2010 (Sample ID 3392). The entire collection consisted of the cold water fluvial specialist, Eastern brook trout, (n=22), with multiple age classes present. Staff noted poor capture efficiency due to stream conditions at the time. Due to the presence of a reproducing population of Eastern brook trout in Poor Farm Brook, it is being assessed as a Tier 1 Existing Use Cold Water Fishery. Near the downstream end of the AU, MassDCR staff collected limited water quality data from 2008 to 2010 at the Newell Rd crossing in Holden (station M106). The maximum water temperature was 20.0 ˚C (n = 15-16/year) and the maximum specific conductance was 192 µS/cm (n = ~50/year). The Aquatic Life Use for Poor Farm Brook (MA81-52) is assessed as Fully Supporting based primarily on the presence of multiple age classes of Eastern brook trout but also on good water quality data, though limited in scope.

Quinapoxet Reservoir (MA81108)

Location:	Holden/Princeton.
AU Type:	FRESHWATER LAKE
AU Size:	266 ACRES
Classification/Qualifier:	A: PWS, ORW (PWS and Tributary to PSW)

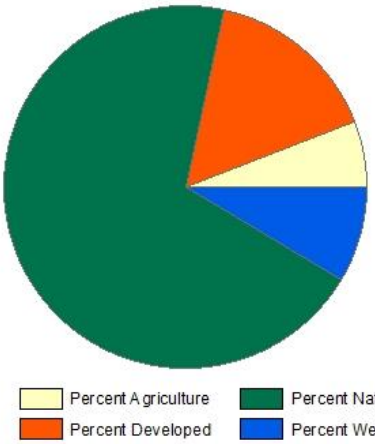
Fish, other Aquatic Life and Wildlife Use: Not Assessed (Alert)
Quinapoxet Reservoir is part of the public water supply for the City of Worcester. In 2015, MassDCR staff reported the presence of the non-native aquatic macrophyte, *Myriophyllum heterophyllum* (variable milfoil), in an upstream water body, Maple Spring Pond (MA81077). The Aquatic Life Use for Quinapoxet Reservoir (MA81108) is Not Assessed due to the absence of recent data. This use is identified with an Alert status due to the presence of the non-native aquatic macrophyte, *Myriophyllum heterophyllum* (variable milfoil), in an upstream water body, Maple Spring Pond (MA81077).

Quinapoxet River (MA81-32)

Location:	Headwaters, outlet Quinapoxet Reservoir, Holden to mouth at inlet Wachusett Reservoir (Thomas Basin), West Boylston.
AU Type:	RIVER
AU Size:	7.9 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Quinapoxet River - MA81-32

Watershed Area: 57.05 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	56.91	10.04	33.61	5.46
Agriculture	5.9%	4.1%	5.2%	4.5%
Developed	15.6%	17.6%	12.9%	14.6%
Natural	69.9%	70.9%	68.9%	67.8%
Wetland	8.6%	7.4%	13.1%	13.1%
Impervious Cover	5.4%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4c	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

Based on fisheries data from the 2003 WQAR, the Quinapoxet River is being assessed as an Existing Use Cold Water Fishery. MassDFG conducted a fish survey at the Mill St crossing in Holden in Jul 2006 (ID 2321); the diverse sample included cold water spp. 6 brown trout (2 wild), 1 rainbow trout, 1 Eastern brook trout (no YOY). In the vicinity, MassDCR collected limited WQ data in 2008 (Stat. M108): max temp of 20.0 ˚C (n=15 in summer index period), max specific conductance (SC) of 214 µS/cm (n=49). Downstream, MassDEP deployed a thermistor during summer 2008 at River St near Rt 31 in Holden (W1822, approx. mid-AU) beginning on June 20 and lasting 96 days over the index period. The 7DADM was >20.0 ˚C on 32 days (max 7DADM 21.1 ˚C), violating the chronic criterion, and the max 24-hr rolling average was 21.3 ˚C. DCR collected extensive WQ data (some stormflow and more baseflow data) from 2008-2019 upstr. of River St at Canada Mills in Holden (Stat. MD69). With the exception of temperature (>10% of measurements were >20.0 ˚C and the max temp. was >22.0 ˚C 1-5 times in most years; usually n = 15 each summer index period), WQ data were indicative of good conditions. Minimum DO was 7.17 mg/L (only 2019; n=6), pH range was 6.77-7.24 SU (only 2019; n=6), TP seasonal averages ranged from 0.016-0.035 mg/L (max 0.019-0.102 mg/L; n = 3-15/year), and ammonia max was 0.098 mg/L (n = 7-37/year). Chloride maximum from 2018-2019 was 91.9 mg/L (total n = 29) & SC data were generally

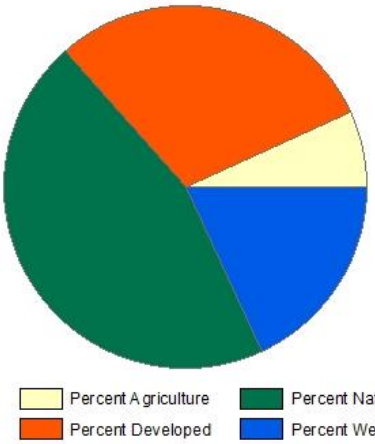
<600 µs/cm with 1 exception of 1228 µs/cm (n = 21-102/year). DEP sampled the benthic community approx. 175 m downstr./north of the crossing in Aug 2008 (ID B0083). The RBPIII status was determined to be "not impaired" (90% comparable) when compared to the Nissitissit River reference (Unique ID: B0087). A short way upstream of the Quinapoxet Dam at Oakdale Station (as of May 2020 in the preliminary permitting and design phase for removal with the goal of restoring 35 miles of cold water fish habitat), DEP biologists conducted backpack electrofishing in Aug 2008 north of River Rd approx. 2200 ft east of I-190 in West Boylston (ID 4486). The sample contained all fluvial species including 2 adult brown trout and 1 YOY landlocked salmon (both cold water species), but no Eastern brook trout. DEP staff also collected WQ data nearby during summer 2008 (W1821). Continuous DO and temp data were monitored during 3-day probe deploys in June, July and August. The lowest mean daily minimum DO concentration was 7.72 mg/L (meeting criteria), the max diel shift was <1.3 mg/L and the max saturation was 103% (not indicative of enriched conditions). The averages of the daily temp maximums were all >20.0 ˚C (max 24.1 ˚C), indicative of chronic temp violations but the maximum 24-hr rolling averages were <23.5 ˚C (max 22.2 ˚C, no acute violation). Discrete probe and grab sample data were all indicative of good conditions (DO, pH, ammonia, TP) or were consistent with continuous data (temp). Of note, the TP seasonal average was 0.019 mg/L (max 0.029 mg/L; n=5) and there were no observations of excessive filamentous algae. Immediately upstream of the dam, DCR staff collected limited water quality data from 2008-2011. More than 10% of temp data (n = 15-16/year) exceeded 20.0 ˚C from 2009-2011 and the maximum temp in those years was >22.0 ˚C (max 22.1-22.3 ˚C). SC data were generally <755 µS/cm with 1 exception of 2260 µS/cm (n = ~50/year). The Aquatic Life Use of the Quinapoxet River (MA81-32) is being assessed as Not Supporting due to a new impairment for Temperature (chronic and acute violations) as well as the previously noted Dewatering impairment. An Alert is added since multiple age classes of Eastern brook trout were not captured in two fish surveys from 2006 and 2008. An impairment decision is not being made at this time since neither location was in the vicinity of the one 2001 station with a large reproductive population of Eastern brook trout (ID 458).

REEDY MEADOW BROOK (MA81-64)

Location:	Headwaters, Reedy Meadow, Groton to mouth at confluence with Nashua River, Pepperell.
AU Type:	RIVER
AU Size:	2.3 MILES
Classification/Qualifier:	B: CWF

REEDY MEADOW BROOK - MA81-64

Watershed Area: 2.05 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.05	2.05	0.39	0.39
Agriculture	6.8%	6.8%	10.4%	10.4%
Developed	29.7%	29.7%	26.3%	26.3%
Natural	45.5%	45.5%	42.7%	42.7%
Wetland	18%	18%	20.6%	20.6%
Impervious Cover	8.1%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

MassDFG biologists conducted backpack electrofishing towards the upstream end of Reedy Meadow Brook (MA81-64), a designated cold water fishery, at Kirk Farm Road, Groton (Sample ID 856) in July 2003. The most abundant fish was the intolerant, cold water species, Eastern Brook Trout (n=39 of 56), all of which were <140 mm in size. The sample also contained 1 fallfish, a fluvial specialist, and 7 intolerant banded sunfish (a macrohabitat generalist). NRWA staff/volunteers collected discrete data in 2019 at one station close to the downstream end of the AU at Shawnee Rd in East Pepperell (RM0240). The data which met quality objectives can be summarized as follows: 4 of 5 dissolved oxygen measurements met the cold water criterion (>5.0 mg/L) with 1 exception (the minimum) of 3.25 mg/L.

Although the one fish sample collected in Reedy Meadow Brook was excellent, containing a large percentage of juvenile Eastern brook trout (this species is indicative of excellent habitat and water quality conditions), the age of the sample (from 2003) and limited amount of water quality data warrant that the Aquatic Life Use for Reedy Meadow Brook (MA81-64) be assessed as Insufficient Information. A recommendation will be made for more monitoring.

Robbins Pond (MA81111)

Location:	Harvard.
AU Type:	FRESHWATER LAKE
AU Size:	11 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4c	4c	(Curly-leaf Pondweed*)		Added
4c	4c	(Non-Native Aquatic Plants*)		Removed

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

As noted in the previous Water Quality Assessment Report, MassDEP staff performed a synoptic survey of Robbins Pond on 30 July 1998 and documented the presence of curly-leaf pondweed (*Potamogeton crispus*). They also noted *Myriophyllum* sp. and indicated that further confirmation would be required when flowering heads are present. This was not previously reported. The Aquatic Life Use for Robbins Pond (MA81111) remains assessed as Not Supporting due to the presence of the non-native aquatic macrophyte, curly-leaf pondweed (*Potamogeton crispus*). The Non-Native Aquatic Plants impairment code is being delisted and replaced with the specific Curly-leaf Pondweed code. The use is also being identified with an Alert status due to the presence of *Myriophyllum* sp. (members of this genus include native and non-native species).

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Non-Native Aquatic Plants	Clarification of listing cause	The generic Non-Native Aquatic Plants impairment code is being delisted and replaced with the specific Curly-leaf Pondweed code.

Supporting Information for Delisted Impairments

Non-Native Aquatic Plants

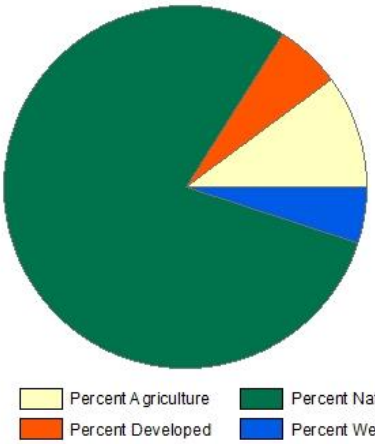
The non-native aquatic macrophyte, *Potamogeton crispus*, was identified during a 1998 synoptic survey of Robbins Pond. During that survey, there was also a sighting of *Myriophyllum* sp. (MassDEP 1998), but the species identity needs to be confirmed. The generic Non-Native Aquatic Plants impairment code is being delisted and replaced with the specific Curly-leaf Pondweed code.

Rocky Brook (MA81-42)

Location:	Headwaters, outlet Hy-Crest Pond, Sterling to mouth at confluence with Stillwater River, Sterling.
AU Type:	RIVER
AU Size:	3 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Rocky Brook - MA81-42

Watershed Area: 2.38 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.38	2.33	1.14	1.14
Agriculture	10.1%	10.2%	9.4%	9.4%
Developed	5.9%	6%	4.2%	4.2%
Natural	79%	78.8%	78.3%	78.3%
Wetland	5%	5%	8%	8%
Impervious Cover	2.2%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing in Rocky Brook downstream of the Beaman Rd crossing in Sterling (Sample ID 1680) in July 2006. The sample (n=41) was comprised of 80% wild Eastern brook trout (a sensitive, cold water species), including 23 from early age classes (≤140 mm). In the vicinity, MassDCR staff conducted limited water quality monitoring in 2008 (Station MD97). The maximum of 15 temperature measurements taken during the summer index period was 19.4 ˚C, meeting Existing Use Cold Water Fishery criteria. Specific conductance was measured roughly weekly throughout the year and the maximum was relatively low at 144 µS/cm.

Based primarily on the presence of a reproducing Eastern brook trout population, the Aquatic Life Use of Rocky Brook (MA81-42) is assessed as Fully Supporting. Eastern brook trout are indicative of excellent habitat and water quality.

Round Meadow Pond (MA81114)

Location:	Westminster.
AU Type:	FRESHWATER LAKE
AU Size:	54 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
During a 1998 synoptic survey of Round Meadow Pond conducted by MassDEP biologists, the presence of *Myriophyllum* sp. was noted. The species identity needs to be confirmed. Since no recent data are available, there is Insufficient Information to assess the Aquatic Life Use for Round Meadow Pond (MA81114). This use is identified with an Alert status due to the presence of an unidentified species of *Myriophyllum* (both native and non-native species are present in Massachusetts).

Sandy Pond (MA81117)

Location:	Ayer.
AU Type:	FRESHWATER LAKE
AU Size:	69 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Fanwort*)		Added
3	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Geosyntec Consultants conducted an aquatic macrophyte survey of Sandy Pond in September 2014 and noted that most of the plant growth in the pond was sparse, with very dense growth only seen in 2 coves, where they noted the presence of the non-natives, variable milfoil (*Myriophyllum heterophyllum*) and fanwort (*Cabomba caroliniana*). Herbicide permit applications were filed with MassDEP in 2006, 2007, and 2011 to treat the non-native aquatic macrophytes, variable milfoil (*Myriophyllum heterophyllum*) and fanwort (*Cabomba caroliniana*), as well as some nuisance native species. The Aquatic Life Use for Sandy Pond (MA81117) is assessed as Not Supporting for Non-Native Aquatic Plants (due to the presence of the non-native variable milfoil / *Myriophyllum heterophyllum*, which does not have a species-specific code) and Fanwort (*Cabomba caroliniana*).

Sawmill Pond (MA81118)

Location:	Fitchburg/Westminster.
AU Type:	FRESHWATER LAKE
AU Size:	65 ACRES
Classification/Qualifier:	B

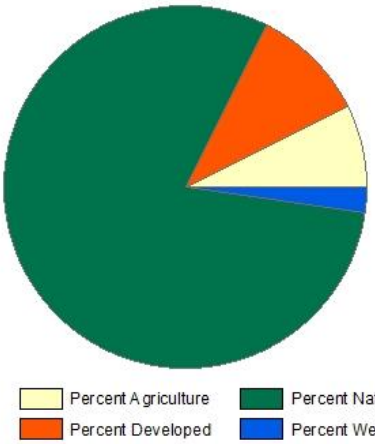
Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)
As was previously noted, the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*), was identified in Sawmill Pond during a 1998 synoptic survey conducted by MassDEP biologists. Field sheet notes from this survey indicated that there was very dense plant coverage (including the non-rooted species, *Lemna* sp. and *Wolffia* sp.) of the entire pond surface and a 2019 satellite image indicates that dense plant growth is ongoing. The Aquatic Life Use for Sawmill Pond (MA81118) remains assessed as Not Supporting for Non-Native Aquatic plants due to the infestation by the non-native variable milfoil (*Myriophyllum heterophyllum*). An Alert status is being added for Nutrient/ Eutrophication Biological Indicators since the presence of non-rooted macrophyte species (*Lemna* sp. and *Wolffia* sp.) can be an indicator of enriched conditions.

Scanlon Brook (MA81-44)

Location:	Headwaters, west of Birch Drive, Sterling to mouth at confluence with Stillwater River, Sterling.
AU Type:	RIVER
AU Size:	1.5 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Scanlon Brook - MA81-44

Watershed Area: 1.05 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.05	1.05	0.47	0.47
Agriculture	7.3%	7.3%	11.7%	11.7%
Developed	10.3%	10.3%	4.8%	4.8%
Natural	80.2%	80.2%	78.9%	78.9%
Wetland	2.2%	2.2%	4.6%	4.6%
Impervious Cover	3.9%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

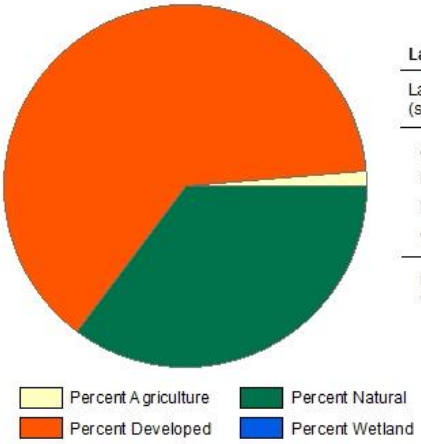
MassDFG biologists conducted backpack electrofishing in Scanlon Brook upstream (Sample ID 2637) and downstream (Sample ID 2636) of Crowley Rd, Sterling in the downstream portion of the AU in August 2008. The upstream sample was comprised exclusively of multiple age classes of Eastern brook trout (n=9), a sensitive, cold water species. The downstream sample was much larger (8 species, 199 individuals), containing mainly fluvial species, including four Eastern brook trout <140 mm. Due to the presence of multiple age classes of Eastern brook trout, Scanlon Brook is being assessed as an Existing Use Cold Water Fishery. In the vicinity of the upstream fish sample, MassDCR staff conducted limited water quality monitoring from 2008 to 2011 (Station MD98). Temperature was measured 10 or 15 times each summer index period. While most measurements were <20.0 ˚C (the cold water fishery criterion), 2 of 10 measurements (20%) in 2010 were >20.0 ˚C with a maximum of 22.2 ˚C. Specific conductance was measured roughly weekly and the maximum was relatively low at 156 µS/cm. The Aquatic Life Use of Scanlon Brook (MA81-44) is assessed as Fully Supporting based primarily on the presence of a reproducing Eastern brook trout population; this species is indicative of excellent habitat and water quality. An Alert is being issued for potential chronic and acute temperature violations of Existing Use Cold Water Fishery criteria which should be confirmed with continuous data.

Scarletts Brook (MA81-25)

Location:	Headwaters west of West Boylston Street (Route 12), West Boylston to mouth at confluence with Gates Brook, West Boylston (stream entirely intermittent; per SARIS and the 1983 Worcester North USGS topographic quadrangle).
AU Type:	RIVER
AU Size:	0.5 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Scarletts Brook - MA81-25

Watershed Area: 0.37 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.37	0.37	0.24	0.24
Agriculture	1.3%	1.3%	1.2%	1.2%
Developed	63%	63%	65.2%	65.2%
Natural	34.9%	34.9%	32.3%	32.3%
Wetland	0.9%	0.9%	1.3%	1.3%
Impervious Cover	19.4%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	5	Chloride		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Scarletts Brook (MA81-25) is an intermittent stream and tributary of Gates Brook (MA81-24). Roughly the first third of Scarletts Brook flows through the Wachusett Country Club (golf course), then a forested area. The final third of the stream is culverted and underground, covered by impervious surfaces nearly to its confluence with Gates Brook. When DFG biologists attempted to sample the fish population at the Rt 12 crossing in West Boylston in August 2012, they reported that there was no flow. However, this is considered a natural condition due to the intermittent nature of the stream. MassDCR conducted water quality monitoring at two stations in West Boylston: at the Rt 12 crossing upstream of the Walmart (MD82) only in 2008 and behind the Walmart above the confluence with Gates Brook (MD81) from 2008 to 2019. Dissolved oxygen and pH data were only available for 2019. The minimum DO at MD81 was 7.88 mg/L (n=4) and the pH ranged from 7.35-7.66 SU (n=4). The maximum temperature from the 2008 summer index period at MD82 was 17.8 °C (n=13) and the maximum

temperature from all 12 survey years for MD81 was 22.1 °C (n=165). The maximum specific conductance at MD82 was 309 µS/cm (n=47). Specific conductance was measured usually 50 times per year (2008-2019) at MD81 (total = 520). Although most data were less than 994 µs/cm (the estimated chloride chronic criterion with a 10% margin to account for error in the model), there were 1 to 6 instances of elevated SC per year in most years from 2011 following. There were two instances of consecutive measurements >994 µs/cm (3 measurements in 2017 and 2 measurements in 2019). There were also two instances of acute exceedances greater than 3,512 µs/cm (the estimated chloride acute criterion with a 10% margin to account for error in the model)- 3,561 µs/cm in 2014 and 3,702 µs/cm in 2017- these measurements were spaced slightly less than 3 years apart.

The Aquatic Life Use of Scarletts Brook (MA81-25) is assessed as Not Supporting for Chloride due to estimated measurements indicating acute and chronic violations (consecutive measurements above the chronic criterion).

Scott Reservoir (MA81119)

Location:	Fitchburg.
AU Type:	FRESHWATER LAKE
AU Size:	33 ACRES
Classification/Qualifier:	A: PWS, ORW

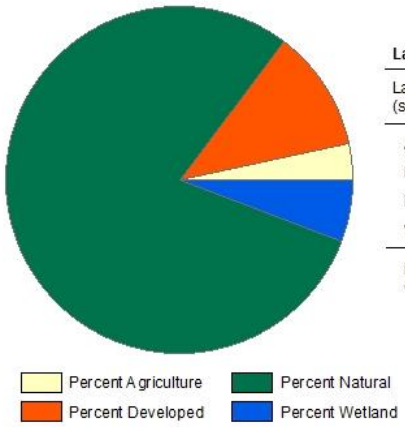
Fish, other Aquatic Life and Wildlife Use: Not Assessed
Scott Reservoir is part of the public water supply for the City of Fitchburg. The Aquatic Life Use for Scott Reservoir (MA81119) is not assessed due to the absence of recent data.

SMITH BROOK (MA81-90)

Location:	Headwaters, outlet Meetinghouse Pond, Westminster to mouth at inlet Wyman Pond, Westminster.
AU Type:	RIVER
AU Size:	1.6 MILES
Classification/Qualifier:	A: PWS, ORW

SMITH BROOK - MA81-90

Watershed Area: 2.27 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.23	2.23	1.31	1.31
Agriculture	3.3%	3.3%	1.9%	1.9%
Developed	11.4%	11.4%	9.7%	9.7%
Natural	79.5%	79.5%	79.4%	79.4%
Wetland	5.8%	5.8%	9%	9%
Impervious Cover	4.7%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

Smith Brook is identified as a CFR by DFG biologists. MassDEP staff conducted water quality monitoring in Smith Brook ~575 ft downstream from West Princeton Rd, Westminster (W2216) during the summer of 2011 (the station was initially part of the MAP2 Wadeable Streams Project but was dropped after the June survey because of resource limitations). The minimum DO for the four-day multiprobe deployment in June was 4.7 mg/L with a mean daily minimum of 5.7 mg/L and a maximum diel DO shift of 1.8 mg/L. The maximum saturation was 67%. The maximum temperature recorded by the long-term thermistor deployed between 12 May and 6 October was 26.9 °C. The 7DADM exceeded 20.0 °C 19 times (maximum 7DADM 24.3°C) and the maximum 24-hour average was 23.5 °C. Two discrete pH measurements were low (5.4 SU) and very low concentrations of total phosphorus, ammonia-nitrogen, and chloride were measured ($\leq$0.005 mg/L, <0.02 mg/L, and $\leq$69 mg/L, respectively). Further downstream MassDFG biologists conducted backpack electrofishing in Smith Brook upstream of Andrea Ln, Westminster in July 2012. The sample was comprised entirely of multiple age classes of Eastern brook trout (n=27). Notes indicated the water was cloudy with stagnant pools. 2012 was not considered a drought year. Given the presence of a reproducing brook trout population the brook is assessed as an Existing Use Tier 1 Cold Water Fishery. The Aquatic Life Use for Smith Brook (MA81-90) is assessed as Not Supporting because of elevated temperatures in this Existing Use Tier 1 Cold Water. An Alert is being identified for low dissolved oxygen, low pH, and low flows. The other data collected were indicative of good conditions (presence of multiple age classes of Eastern brook trout, no evidence of any nutrient enrichment problems).

Snows Millpond (MA81127)

Location:	Fitchburg/Westminster.
AU Type:	FRESHWATER LAKE
AU Size:	38 ACRES
Classification/Qualifier:	B

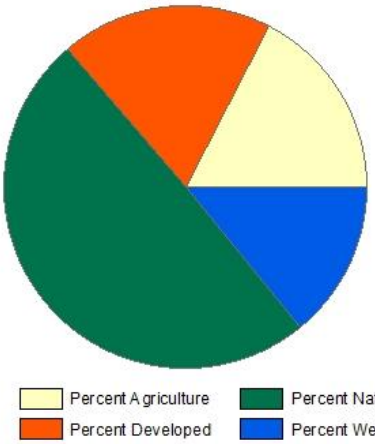
Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
MassDEP biologists conducted a synoptic survey of Snows Millpond in August 1998 and noted the presence of *Myriophyllum* sp. The species identity should be confirmed when flowering heads are present, as this genus contains both native and non-native species in Massachusetts. There is Insufficient Information to assess the Aquatic Life Use for Snows Millpond (MA81127) since no recent data are available. This use is identified with an Alert status due to the presence of an unidentified species of *Myriophyllum*; there are both native and non-native members of this genus present in Massachusetts.

SOUTH MEADOW BROOK (MA81-67)

Location:	Headwaters, outlet Fitch Pond, Sterling to mouth at inlet South Meadow Pond, Clinton.
AU Type:	RIVER
AU Size:	1.8 MILES
Classification/Qualifier:	B: CWF

SOUTH MEADOW BROOK - MA81-67

Watershed Area: 2.28 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.28	2.28	0.75	0.75
Agriculture	17.4%	17.4%	11.8%	11.8%
Developed	18.9%	18.9%	16.2%	16.2%
Natural	49.7%	49.7%	45.5%	45.5%
Wetland	14%	14%	26.5%	26.5%
Impervious Cover	5.3%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing in South Meadow Brook (MA81-67), a designated cold water fishery, at one location behind the Clinton Dump in Sterling, in July 2002 (Sample ID 668). Multiple age classes of the intolerant cold water species, Eastern brook trout, were collected (56 of 58 individuals), the majority (54 individuals) measuring <140 mm.

Due to the age of the one fish sample collected in South Meadow Brook (MA81-67), there is Insufficient Information to assess the Aquatic Life Use.

South Meadow Pond (MA81129)

Location:	[East Basin] Clinton.
AU Type:	FRESHWATER LAKE
AU Size:	37 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Curly-leaf Pondweed*)		Added
3	4c	(Hydrilla*)		Added
3	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

MassDCR staff reported in 2016 the presence of multiple non-native aquatic macrophytes- curly-leaf pondweed (*Potamogeton crispus*), hydrilla (*Hydrilla verticillata*), and variable milfoil (*Myriophyllum heterophyllum*)- in the East Basin of South Meadow Pond (MA81129). The Aquatic Life Use for South Meadow Pond (MA81129) is assessed as Not Supporting for Non-Native Aquatic Plants due to the presence of variable milfoil (*Myriophyllum heterophyllum*), for which no species-specific code is available, as well as for infestations of curly-leaf pondweed (*Potamogeton crispus*) and hydrilla (*Hydrilla verticillata*).

South Meadow Pond (MA81165)

Location:	[West Basin] Clinton/Lancaster.
AU Type:	FRESHWATER LAKE
AU Size:	34 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Curly-leaf Pondweed*)		Added
3	4c	(Hydrilla*)		Added
3	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

MassDCR staff reported in 2016 the presence of multiple non-native aquatic macrophytes- curly-leaf pondweed (*Potamogeton crispus*), hydrilla (*Hydrilla verticillata*), and variable milfoil (*Myriophyllum heterophyllum*)- in the West Basin of South Meadow Pond (MA81165). The Aquatic Life Use for South Meadow Pond (MA81165) is assessed as Not Supporting for Non-Native Aquatic Plants due to the presence of variable milfoil (*Myriophyllum heterophyllum*), for which no species-specific code is available, as well as for infestations of curly-leaf pondweed (*Potamogeton crispus*) and hydrilla (*Hydrilla verticillata*).

Spectacle Pond (MA81132)

Location:	Lancaster.
AU Type:	FRESHWATER LAKE
AU Size:	61 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	5	Dissolved Oxygen		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

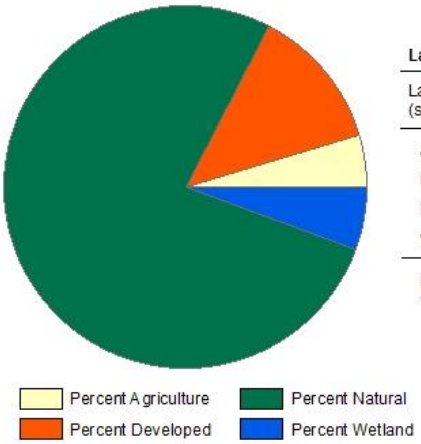
MassDEP staff sampled the Spectacle Pond deep hole (Unique ID W1299) on 3 August 2005 as part of the Nutrient Criteria project. The maximum depth was 15.9 m; Secchi depth was 5.5 m. Chlorophyll-*a* measured in a depth integrated sample over a portion of the pond depth (0-6.5 m) was 2.0 mg/m^3 (equivalent to µg/L), well below the recommended threshold (16 µg/L). In situ data indicated the water column was stratified with the temperature dropping sharply between 5.1-6.9 m (maximum temperature was 27.3 °C). DO dropped below 5.0 mg/L between 10.1 to 12.0 m (equivalent to 33.1-39.4 ft). According to bathymetry data, the area at this depth roughly encompasses >15% of the area at the surface of the pond. DO saturation exceeded 125% between 5.1-6.9 m (142%), an indicator of enriched conditions. pH ranged from 6.0 to 9.0 SU; elevated pH can also be an indicator of enriched conditions. Total phosphorus measured near the surface was below the method detection limit (<0.005 mg/L) but was higher near the bottom (0.10 mg/L), where anoxic conditions can lead to release of phosphorus from the sediments. The Aquatic Life Use for Spectacle Pond (MA81132) is assessed as Not Supporting for Dissolved Oxygen since the area where DO fell below 5.0 mg/L encompassed >10% of the area at the surface of the pond. The use is identified with an Alert status due to elevated pH and DO supersaturation, indicators of enrichment. The water quality survey should be repeated with a chlorophyll-*a* depth integrated sample collected over a larger depth range.

Squannacook River (MA81-18)

Location:	Headwaters, confluence Mason and Willard brooks, Townsend to Hollingsworth and Vose Dam (NATID: MA00443), Groton/Shirley (through former 2008 segment: Harbor Pond MA81054).
AU Type:	RIVER
AU Size:	12.6 MILES
Classification/Qualifier:	B: ORW, CWF

Squannacook River - MA81-18

Watershed Area: 68.33 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	52.13	7.45	13.49	1.81
Agriculture	4.6%	1.8%	3.7%	0.4%
Developed	12.7%	14.3%	10.5%	8.8%
Natural	77.1%	77.3%	74.2%	76.5%
Wetland	5.6%	6.6%	11.6%	14.2%
Impervious Cover	4.6%			

Fish, other Aquatic Life and Wildlife Use: Not Supporting

The Squannacook River is a designated cold water fishery with historical presence of immature Eastern Brook Trout. NRWA collected discrete data at 4 stations in the upper 2/3 of the AU in Townsend: Mason Rd downstr. of dam on river right (SQ2400; 2008-17); downstr. of Bayberry Hill Brook confluence (SQ1840; 2008); off of Elm Circle, W. side of Rte. 13 (SQ1788; 2009-19); downstr. from Shepards Auto Body (SQ1329; 2009-19). Usable data were collected approx. 6 times per year. DO data (n=214) were generally indicative of good conditions (>5.0 mg/L, the cold water 1-day minimum criterion) with only 3 exceptions (minimum 4.1 mg/L). pH was only measured once in 2011 at 7.4 SU at SQ2400. MassDEP staff collected water quality and nutrient grab samples at Turnpike Rd (W1283) near SQ1788 during summer 2008. A thermistor was deployed for 96 days beginning June 20, documenting chronic cold water violations (max 7DADM 22.2 °C with 36 measurements >20.0 °C) and a max 24-hour rolling avg of 22.4 °C. A multiprobe measured good DO during three 3-day periods (minimum DO 6.8 mg/L, max diel shift 0.9 mg/L, max saturation 97%). Discrete DO & temp data were similar to the continuous data & pH ranged from 6.2-6.4 (n=6). The total phosphorus seasonal avg was 0.038 mg/L (n=5; max 0.1 mg/L) with no observations of excessive filamentous algae.

An “outside party” sampled the fish community using a seine net at Old Meetinghouse Rd, Townsend (Sample ID 2822) in July 2008. The sample (n=17) was dominated by the fluvial specialist, fallfish, and did not contain cold water species, but it was not a total pickup.

MassDEP staff also collected water quality samples close to the downstream end of the AU, W. of Townsend Rd (across from Candice Lane), Groton (W0487) during summer 2008. A thermistor was deployed for 86 days beginning June 30, documenting chronic cold water violations (max 7DADM 24.1 °C with 52 measurements >20.0 °C) and a max 24-hour rolling avg of 24.2 °C (an acute violation). A multiprobe measured generally good DO during three 5-day periods (min DO 5.59 mg/L, max diel shift 1.26 mg/L, max saturation 92.9%). However, the 5-day mean min DO violated the cold water criterion in July (5.77 mg/L). Through the DEP SMART program, discrete probe data & grab samples (DO, temp., pH, total phosphorus, ammonia, chloride) were collected 5-6 times per year from 2005-2013 (the following summary includes routine discrete data from 2008). DO did not violate cold water criteria (min 5.4 mg/L) but temp exceeded criteria occasionally (max of 25.2 ^{o}C). Half of the pH measurements every year were between 6.0-6.5 SU (minor exceedances). The TP seasonal avg ranged from 0.014-0.040 mg/L (max concentration 0.086 mg/L in July 2006) and there were no observations of excessive filamentous algae. Ammonia (max 0.07 mg/L) and chloride concentrations (max 53 mg/L) were relatively low. Long term trend analysis (1998-2014) of total phosphorus concentrations at five DEP stations in this AU showed a statistically significant downward trend (p = 1.06e-07) for year-round data, as well as for seasonal (May-September) data (p = 6.32e-06).

Hollingsworth and Vose Co. is authorized to discharge treated stormwater, laboratory process water and paper production process water to the Squannacook River at the upstream end of the next downstream AU (MA81-19). River water was collected at the screen intake upstream of the Hollingsworth and Vose Dam, southwest of the Kemp Street and Townsend Road intersection, Groton for use as a diluent/control in whole effluent toxicity tests conducted utilizing *Ceriodaphnia dubia* organisms in 4 tests per year from Dec 2007 to Dec 2018. Survival of *C. dubia* in both acute and chronic tests was good (80-100%; n=45 tests).

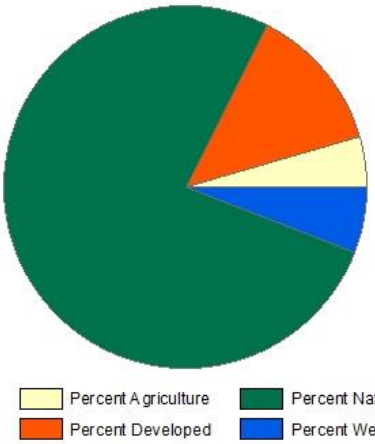
The Aquatic Life Use for the Squannacook River (MA81-18) continues to be assessed as Not Supporting, with historical impairments remaining (lack of a cold water assemblage, low pH, acute and chronic Temperature violations).

Squannacook River (MA81-19)

Location:	Hollingsworth and Vose Dam (NATID: MA00443), Groton/Shirley to mouth at confluence with Nashua River, Shirley/Groton/Ayer.
AU Type:	RIVER
AU Size:	3.7 MILES
Classification/Qualifier:	B: WWF

Squannacook River - MA81-19

Watershed Area: 71.07 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	54.87	3.57	13.97	0.74
Agriculture	4.5%	3.1%	3.6%	0.7%
Developed	13%	17.6%	10.6%	12.6%
Natural	76.6%	69%	73.9%	69.7%
Wetland	5.9%	10.3%	11.9%	16.9%
Impervious Cover	4.7%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

The Hollingsworth & Vose Co. is authorized to discharge treated stormwater, laboratory process water & paper production process water to the Squannacook River, at the upstream end of this AU. Between December 2007 and December 2018, 45 valid whole effluent toxicity tests were conducted on the Hollingsworth and Vose Co. effluent using *C. dubia* test organisms. The LC_{50}s were all >100% effluent. Of the 38 tests with valid CNOEC data, the CNOECs ranged from 75-100% effluent, meeting the permit limit (≥60% effluent). NRWA collected discrete data at one station in the Squannacook River, downstream of the Rt 225 bridge, Groton/Ayer. The data which met quality objectives were collected between 2008 and 2017. All data were indicative of good conditions. Dissolved oxygen was measured roughly 6 times per year from 2008-2017 and was nearly always ≥4.0 mg/L (the minimum DO of 3.2 mg/L was the lone exception, measured in October 2015). pH was only measured once in 2010 but was indicative of good conditions at 7.1 SU. MassDEP sampled the benthic macroinvertebrate community ~200 meters downstream/south of Rt 225, Shirley/Groton (Station B0079) in August 2008. The RBPIII status was determined to be "not impaired" (100% comparable) when compared to the Nissitissit River reference (Unique ID: B0087). MassDEP also conducted bacteria monitoring on 6 occasions approx. 1 mile downstream of Rt 225 (and the Squannacook River Dam), off the Shirley Rod & Gun Club private road, Shirley in 2008. There were no observations of excessive filamentous algae during these site visits.

The Aquatic Life Use for the lower Squannacook River (MA81-19) is assessed as Fully Supporting, based primarily on the benthic data collected in 2008 and the good survival of test organisms exposed to the Hollingsworth &

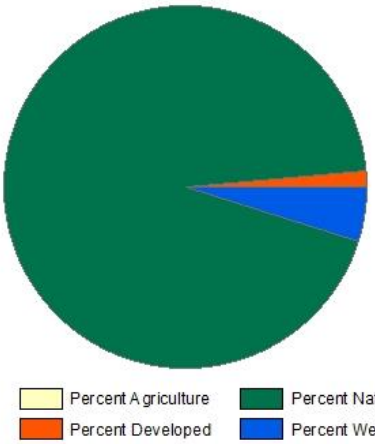
Vose effluent. Limited water quality data (mainly DO) were also indicative of good conditions. The prior Alert for low pH is being maintained until such time as more data can be collected indicating otherwise. The prior Alert for dominance of the fish community by macrohabitat generalists is being removed since the dominance of these species in itself is not considered a negative indicator for low gradient, warm water reaches under the 2018 CALM, as long as some of the species are classified as intolerant or moderately tolerant of pollution.

STEAM MILL BROOK (MA81-96)

Location:	Headwaters east of Laurel Lane, Princeton to mouth at confluence with Bartlett Pond Brook, Sterling.
AU Type:	RIVER
AU Size:	1.9 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

STEAM MILL BROOK - MA81-96

Watershed Area: 1.76 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.76	1.76	0.87	0.87
Agriculture	0.3%	0.3%	0%	0%
Developed	1.5%	1.5%	1.3%	1.3%
Natural	93.4%	93.4%	89.8%	89.8%
Wetland	4.8%	4.8%	8.9%	8.9%
Impervious Cover	1.5%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

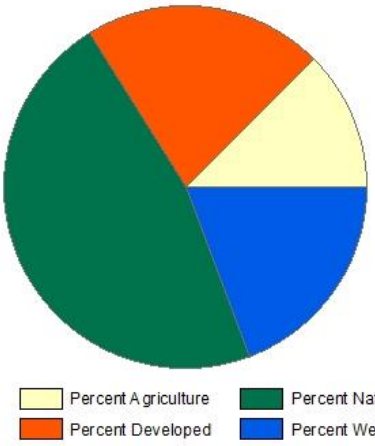
MassDFG biologists conducted backpack electrofishing at two locations in Steam Mill Brook in July 2006. Upstream of the intersection of the Wolf Pack Rd and Hell's Highway unpaved roads in Leominster State Forest, Princeton (Sample ID 1927), five Eastern brook trout, all <140 mm, were captured. Eastern brook trout are a sensitive, cold water species. A small way downstream, south of the Center Rd crossing in Princeton (Sample ID 1903), 24 Eastern brook trout from multiple age classes were collected. In June 2009, MassDFG staff attempted to sample (Sample ID 3111) the fish community at Lucas Rd, just upstream of Stuart Pond (MA81137). However, they were deterred by "multiple staged beaver dams" which made the water too deep. The Aquatic Life Use of Steam Mill Brook (MA81-96) is assessed as Fully Supporting based on the presence of a reproducing population of Eastern brook trout, a species indicative of excellent habitat and water quality conditions.

Still River (MA81-15)

Location:	From Route 117, Bolton to mouth at confluence with Nashua River, Harvard/Lancaster (prior to 2010 this segment included portion upstream of Route 117).
AU Type:	RIVER
AU Size:	2.7 MILES
Classification/Qualifier:	B

Still River - MA81-15

Watershed Area: 4.04 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	4.04	3.94	1.52	1.52
Agriculture	12.5%	12.6%	11%	11%
Developed	21.4%	21.9%	12.2%	12.2%
Natural	46.9%	45.8%	39%	39%
Wetland	19.2%	19.7%	37.8%	37.8%
Impervious Cover	8.4%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

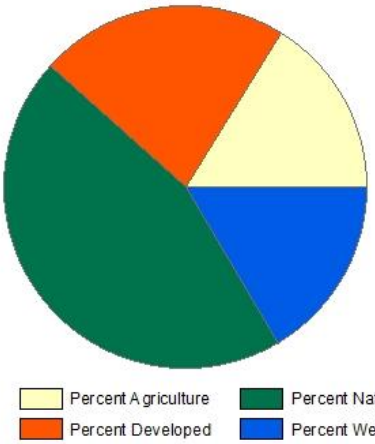
MassDEP staff collected 6 bacteria samples in the middle of the Still River MA81-15 AU, west off Rt. 110 at the footbridge at the Bolton Flats Wildlife Management Area entrance (southwest of Autumn Lane), Bolton during summer 2008 (W1811). There was 1 recorded observation of moderate filamentous algae, but none were dense or very dense during these surveys. There was also a report of the presence of *Potamogeton sp*. during the 2008 surveys, but the species identity needs to be confirmed since this genus contains both native and non-native species of aquatic macrophytes. There is Insufficient Information available to assess the Aquatic Life Use for the Still River (MA81-15).

Still River (MA81-60)

Location:	Headwaters, Lancaster to Route 117, Bolton (formerly part of 2008 segment: Still River MA81-15).
AU Type:	RIVER
AU Size:	0.6 MILES
Classification/Qualifier:	B: CWF

Still River - MA81-60

Watershed Area: 2.34 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.34	2.34	0.86	0.86
Agriculture	16.1%	16.1%	11.5%	11.5%
Developed	22.3%	22.3%	13.7%	13.7%
Natural	45.1%	45.1%	36.7%	36.7%
Wetland	16.4%	16.4%	38%	38%
Impervious Cover	9.8%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Dissolved Oxygen		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

MassDEP staff collected water quality data and nutrient grab samples at the downstream end of the Still River MA81-60 AU at Route 117, Bolton (W0995) during summer 2008. A multiprobe was deployed to measure continuous dissolved oxygen for two 3-day periods in June and August. The minimum DO from the two deploys was 0.2 mg/L, and the 3-day mean minimums were both also 0.2 mg/L (violating the cold water criterion of 6.0 mg/L), with a maximum diel DO shift of 4.75 mg/L & a maximum saturation of 54.5%. A thermistor was deployed for 86 days beginning June 30. The maximum 7-DADM was 20.8 °C (with 9 exceedances of the cold water chronic criterion) and the maximum 24-hour rolling average temperature was 21.3 °C (meeting the Tier 1 cold water acute criterion). Discrete temperature data all met the cold water criterion (n=6) and all discrete DO data failed the criterion (<5.0 mg/L), ranging from 0.5-4.6 mg/L (n=4). Discrete pH data ranged from 6.3-6.5 SU (n=4). The total phosphorus seasonal average was 0.081 mg/L (maximum 0.13 mg/L; n=5). There were no observations of excessive filamentous algae. Ammonia-N concentrations ranged from 0.02 to 0.13 mg/L and none violated the calculated acute and chronic criteria. There was a report of the presence of *Potamogeton sp.* during one of the 2008 MassDEP surveys of the river at water quality station W0995, but the species identity needs to be confirmed since this genus contains both native and non-native species of aquatic macrophytes.

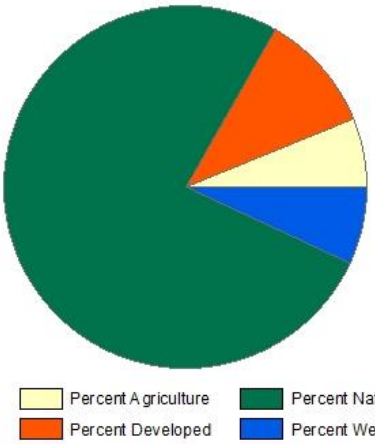
The Aquatic Life Use for the Still River (MA81-60) is assessed as Not Supporting for low Dissolved Oxygen, since undue human influences could not be ruled out at this time (impervious cover comprises 9.8% of the sub-basin and natural/wetland land uses combine to encompass 61.5% of the sub-basin, failing to meet the criteria of a natural condition). However, it is likely that low DO, in fact, is a natural condition given the low gradient wetland character of the stream buffer and likely groundwater seep influence, so additional sampling is recommended. An Alert status is being issued due to multiple instances of the 7-DADM temperature exceeding 20.0 °C in a single season.

Stillwater River (MA81-31)

Location:	Headwaters, confluence of Justice and Keyes brooks, Princeton/Sterling to mouth at inlet of Wachusett Reservoir (Stillwater Basin), Sterling.
AU Type:	RIVER
AU Size:	6.7 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Stillwater River - MA81-31

Watershed Area: 29.42 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	29.4	7.12	16.51	4.41
Agriculture	6.1%	11.2%	5.2%	11.5%
Developed	10.6%	18.8%	10%	16.5%
Natural	76.4%	61.1%	73.9%	59.3%
Wetland	6.9%	8.9%	10.9%	12.8%
Impervious Cover	3.9%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

From 2006 through 2013, MassDFG biologists conducted 28 backpack electrofishing surveys along the entire length of the Stillwater River and MassDEP staff conducted 1 survey in 2008. Samples were usually collected in similar locations in 2006, 2007, 2008, 2010 (some locations), 2012 (some locations), and 2013. Sample IDs and locations from upstream to downstream are as follows: Across from N. Oakdale Cutoff, Princeton/Sterling (Samples 1804, 2164, 2498, 4679); Approx. 600 feet downstream of N. Oakdale Cutoff, Princeton/Sterling (Sample 4138); Rt 140 crossing, Princeton/Sterling (Samples 1803, 2163, 2497, 4139, 4678); Crowley Rd, Sterling (1800, 2097, DEP SWR01, 2500, 3233, 4137, 4677); Muddy Pond Rd (bridge) / Dana Hill Rd, Sterling (1801, 2098, 2501, 3232, 4136, 4676); Off of DCR access road, downstream of Muddy Pond Rd, Sterling (4135); Off Dee Rd, approx. 1/4–1/3 mile south of Muddy Pond Rd, Sterling (1802, 2099, 2502, 3231, 4675). Every sample contained at least 1 cold water species. Although there was evidence of a reproducing population of Eastern brook trout (EBT) at some stations (particularly the Muddy Pond Rd station where they were collected in multiple years), immature EBT were generally not abundant. Other cold water species collected include landlocked salmon, and

brown and rainbow trout. Landlocked salmon (generally all <200 mm) was often the most abundant species in the samples. Given the presence of a reproducing EBT population, Stillwater River will be assessed as an Existing Use Cold Water Fishery. MassDCR staff conducted limited water quality (WQ) monitoring in 2008 roughly mid-AU at the Rt 62 crossing in Sterling (Station MD99). The maximum temp. during the summer index period (n=15) was 23.1 ˚C and 5 measurements were >20.0 ˚C (cold water criterion). The maximum specific conductance (SC) measurement was 465 µS/cm (n=49 all year). MassDEP staff conducted a WQ survey during summer 2008 at the Muddy Pond Rd crossing in the downstream portion of the river (Unique ID W1820). A thermistor was deployed for 96 days beginning on June 20. The maximum 7DADM was 23.9 ˚C and the Tier 1 cold water fishery chronic criterion was exceeded on 54 days. The maximum 24-hour rolling average temp. was 23.4 ˚C. Nutrient grab samples for ammonia and total phosphorus were indicative of good conditions, with a TP seasonal average of 0.023 mg/L (maximum 0.05 mg/L; n=4) and no observations of excessive filamentous algae. MassDCR collected extensive WQ data downstream of the Muddy Pond Rd crossing (Station MD07) from 2008-2019. Dissolved oxygen data (2019 only; n=6) had a minimum of 6.4 mg/L and pH data (also 2019 only; n=6) ranged from 6.5-7.49 SU. Temp. measurements exceeded 20.0 ˚C 2-7 times every year (2008-2019; n = 6-31/summer index period) but were greater than 22.0 ˚C in only 3 years (maximum 23.0 ˚C). Nutrient grab samples were collected during baseline conditions, but some samples were also collected to characterize storm events. However, the TP seasonal averages were still generally <0.05 mg/L, ranging from 0.016-0.054 mg/L with only 1 elevated seasonal average (n = 4-16/season). Ammonia concentrations (maximum 0.112 mg/L; n = 8-37/year) did not violate calculated screening criteria. From 2018 through August 2019, the maximum chloride concentration was relatively low at 65 mg/L (total n=43). SC was measured roughly weekly in most years (2008-2019) with a maximum of 404 µS/cm.

Although cold water species and fluvial species in general dominated the fish community in the Stillwater River (MA81-31), the Aquatic Life Use is assessed as Not Supporting for Temperature (due to chronic violations noted in continuous data as well as extensive discrete data). The low number of immature Eastern brook trout in numerous fish samples is of concern and an Alert is being issued. The prior alert for high temperature is being removed but the prior alert for low pH will be retained until more data can be collected.

Streeter Pond (MA81136)

Location:	Paxton/Holden.
AU Type:	FRESHWATER LAKE
AU Size:	18 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
MassDEP staff conducted a synoptic survey of Streeter Pond on 18 August 1998. The entire surface area was covered with dense/very dense native aquatic macrophytes, however, floating non-rooted macrophytes like *Wolffia* or *Lemna* were not observed (overabundance of these would indicate a problem with anthropogenic sources of enrichment). Staff scientists noted that, in the absence of development (and the associated anthropogenic sources of nutrients), Streeter Pond may be a natural successional pond. There is insufficient information to assess the Aquatic Life Use of Streeter Pond (MA81136). An updated macrophyte survey should be conducted and water quality and biological data should be collected in order fully assess this AU.

Stuart Pond (MA81137)

Location:	Sterling.
AU Type:	FRESHWATER LAKE
AU Size:	42 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Fish, other Aquatic Life and Wildlife Use: Not Supporting
As was previously reported, MassDEP staff conducted a synoptic survey of Stuart Pond in 1998 and noted the presence of the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*). They also noted that the entire pond surface exhibited very dense coverage of aquatic plants. The Aquatic Life Use for Stuart Pond (MA81137) remains assessed as Not Supporting for Non-Native Aquatic Plants based on the presence of variable milfoil (*M. heterophyllum*).

Stump Pond (MA81171)

Location:	Holden.
AU Type:	FRESHWATER LAKE
AU Size:	27 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

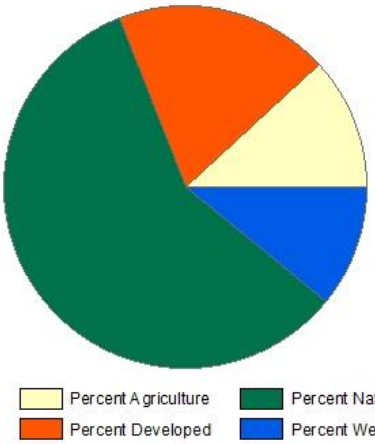
Fish, other Aquatic Life and Wildlife Use: Not Supporting
As was previously noted, MassDEP staff conducted a synoptic survey of Stump Pond on 20 August 1998 in which they noted that the entire surface was covered with very dense aquatic vegetation, including the non-native aquatic macrophyte, *Myriophyllum heterophyllum* (variable milfoil). Stump Pond is hydrologically connected to Eagle Lake, and ongoing efforts to reduce the water level in Eagle Lake by 4.5 feet are reportedly going to reduce the water level in Stump Pond as well. The Aquatic Life Use of Stump Pond (MA81171) is assessed as Not Supporting based on the presence of the non-native aquatic macrophyte, *M. heterophyllum* (variable milfoil). Therefore, the prior impairment for Non-Native Aquatic Plants is retained.

Sucker Brook (MA81-23)

Location:	Headwaters outlet Coon Tree Pond, Pepperell to mouth at confluence with Nissitissit River, Pepperell.
AU Type:	RIVER
AU Size:	4 MILES
Classification/Qualifier:	B: ORW

Sucker Brook - MA81-23

Watershed Area: 3.58 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	3.58	3.51	0.91	0.88
Agriculture	11.8%	12%	11.4%	11.8%
Developed	19.1%	19.1%	10.3%	10.5%
Natural	58.3%	57.9%	55.4%	54.1%
Wetland	10.8%	11%	22.9%	23.6%
Impervious Cover	6.9%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

NRWA staff/volunteers collected discrete water quality data in Sucker Brook, at approximately the mid-point of the MA81-23 AU, downstream of the Sartelle St crossing in Pepperell (SB0295) from 2008-2018. The data which met quality objectives were collected 4-7 times per year. Dissolved oxygen data generally met the cold water criterion of 5.0 mg/L, with only 1 exception of 3.4 mg/L. MassDFG biologists conducted backpack electrofishing in the reach downstream of Sartelle St in Aug 2007 (Sample ID 2172). Of 150 fish collected, 55 were Eastern brook trout from multiple age classes (this is an intolerant, cold water species). Most of the rest of the sample was comprised of the fluvial species, white sucker and blacknose dace. Given the presence of a reproducing brook trout population, Sucker Brook will be assessed as a Tier 1 Existing Use Cold Water Fishery. Near the downstream end of the brook, MassDEP staff collected water quality data at Brookline St in Pepperell (W1816) and NRWA staff/volunteers collected water quality data downstream of Brookline St (SB0025). During summer 2008, MassDEP staff deployed probes (at W1816) to measure continuous dissolved oxygen and temperature data over two 3-day periods and one 5-day period. The minimum DO was good at 5.7 mg/L, while the maximum DO diel shift (1.3 mg/L) and maximum saturation (89%) gave no indication of enrichment. However, 2 of 3 mean daily maximum temperatures exceeded the 20.0 °C cold water criterion (maximum 3-DADM 25.1 °C) and the maximum 24-hr average was 22.0 °C (no acute exceedance). Discrete probe data (DO, temperature, pH) were similar to continuous data or did not violate criteria in the case of pH (n=7). The total phosphorus seasonal average was low at 0.027 mg/L (maximum 0.037 mg/L; n=5) and there were no violations of ammonia criteria

(maximum 0.06 mg/L; n=5) or observations of excessive filamentous algae. The NRWA DO data from this area (SB0025) were collected 4-7 times per year from 2008-2019. Although most measurements were >5.0 mg/L, there were 2 violations in 2 of the years and a handful of single exceedances in other years (minimum 3.1 mg/L). MassDFG biologists conducted backpack electrofishing at 2 nearby locations (2171, 2971) downstream of Brookline St on the same date in Sept 2007. The large samples (n= 183 and 334, respectively) did not contain cold water species but were dominated by fluvial species, mainly the moderately tolerant fallfish and also included several intolerant species (creek chubsucker, banded sunfish). Much of the Sucker Brook corridor flows through wetlands and there is a large shrub swamp area upstream of these fish sample locations, likely contributing to the absence of cold water species in this area.

The Aquatic Life Use for Sucker Brook (MA81-23) is assessed as Fully Supporting based on the presence of a reproducing wild population of Eastern brook trout (a species indicative of excellent habitat and water quality conditions) and generally good water quality. The occasional incidences of low dissolved oxygen observed at Brookline Street by NRWA are likely due to the upstream wetland habitat. The use is identified with an Alert status due to the elevated temperature (exceeding the chronic criterion) in June and August at Brookline Street. A recommendation will be made for more monitoring in this downstream reach.

The Quag (MA81170)

Location:	Sterling.
AU Type:	FRESHWATER LAKE
AU Size:	32 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Brittle Naiad, Najas Minor*)		Added
3	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

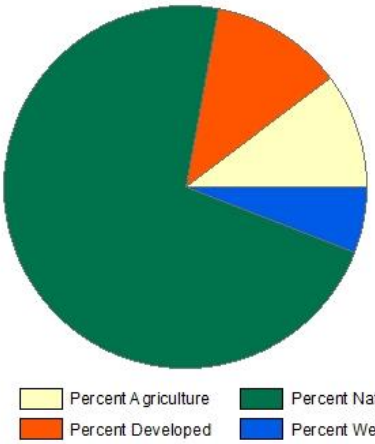
MassDCR staff first reported the presence of two non-native aquatic macrophytes, variable milfoil (*Myriophyllum heterophyllum*) and brittle naiad (*Najas minor*), in The Quag in 2010 and 2015, respectively. The Aquatic Life Use for The Quag (MA81170) is assessed as Not Supporting based on the presence of multiple non-native aquatic macrophyte species. The specific code "Brittle Naiad, Najas Minor" is being applied, as well as the generic code, "Non-Native Aquatic Plants," in lieu of a species code for variable milfoil (*Myriophyllum heterophyllum*).

TRAPFALL BROOK (MA81-77)

Location:	Headwaters, north of Jones Hill Road, Ashby to mouth at confluence with Willard Brook, Ashby.
AU Type:	RIVER
AU Size:	5.5 MILES
Classification/Qualifier:	B: ORW

TRAPFALL BROOK - MA81-77

Watershed Area: 5.87 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	5.7	4.42	1.67	1.34
Agriculture	10.2%	10.5%	4.3%	4.7%
Developed	11.8%	13.9%	8.7%	10.1%
Natural	72.1%	69.4%	75.3%	73%
Wetland	5.8%	6.2%	11.8%	12.3%
Impervious Cover	4.1%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

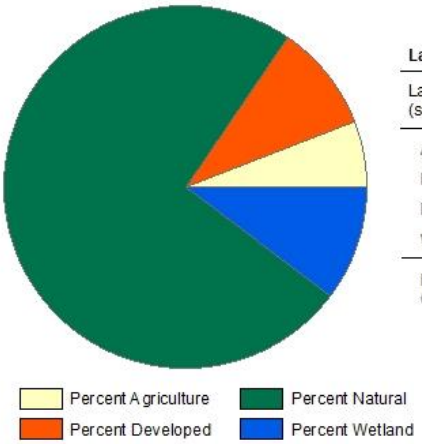
MassDFG biologists conducted backpack electrofishing in Trapfall Brook in Ashby at one location in the middle of the AU in July 2006, ~100 m downstream from New Ipswich Rd (Sample ID 1549) and at a second location in the downstream half of the AU in August 2000, 50 ft. above and below the Greenville Rd bridge (Sample ID 137). Fluvial species dominated both samples (including white sucker and blacknose dace), and multiple age classes of the intolerant, cold water species, Eastern brook trout, were collected in the Greenville Rd sample (20 of 95 individuals). Given the presence of a reproducing brook trout population in Trapfall Brook, this stream will be evaluated as a Tier 1 Existing Use Cold Water Fishery. Near the downstream end of the brook, MassDEP staff collected 6 bacteria samples at Turnpike Rd, Ashby during summer 2008 (W1833). There were no observations of excessive filamentous algae during these surveys. NRWA staff/volunteers collected discrete data at the downstream end of the AU at Trap Falls (upstream of Rt.119) in Ashby (Station ID TF0033) in 2018. The dissolved oxygen data which met quality objectives were collected from May to October (n=5) and were indicative of good conditions for an existing use cold water fishery, with a minimum of 7.4 mg/L. Given the age of fish samples, there is Insufficient Information to assess the Aquatic Life Use for Trapfall Brook (MA81-77).

Trout Brook (MA81-26)

Location:	Headwaters, outlet Cournoyer Pond, Holden to mouth at confluence with Quinepoxet River, Holden.
AU Type:	RIVER
AU Size:	1.9 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Trout Brook - MA81-26

Watershed Area: 8.49 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	8.49	4.95	4.62	2.68
Agriculture	5.8%	7.3%	4.8%	6.6%
Developed	9.7%	7.6%	7.1%	5.6%
Natural	74.2%	74.2%	71.5%	70.5%
Wetland	10.3%	10.9%	16.6%	17.3%
Impervious Cover	2.8%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Backpack electrofishing was conducted in Trout Brook near Manning Street in Holden in July 2006 (Sample IDs 2003 and 1679) by DFG biologists and again in August 2011 by MassDEP biologists (Sample ID 4584). All samples were dominated by fluvial species and included multiple age classes of Eastern brook trout (or 1 juvenile brook trout in the case of sample 2003). Given the presence of a reproducing brook trout population in Trout Brook, the brook will be evaluated as an Existing Use Tier 1 Cold Water Fishery. MassDEP staff sampled Trout Brook as part of a Reference Site Network monitoring project (RSN) beginning in the summer of 2011. Benthic sampling was also conducted at this location (B0743) but those data were not evaluated using an RBPIII analysis and will be compared to biocriteria thresholds which are currently under development. These data will be used in a future IR reporting cycle. As part of the RSN project, MassDEP staff deployed a long-term thermistor in the brook (W2226/TR01) on 13 June, 2011 and retrieved it on 18 October. The maximum 24-hour average temperature exceeded the acute criterion of 23.5 °C at 23.8°C and the 7DADM exceeded 20.0 °C 55 times (maximum 23.0 °C). The total phosphorus seasonal average concentration was 0.069 mg/L (n=3), less than

EPA's 0.1 mg/L criterion for flowing waters. The three ammonia-nitrogen and chloride concentrations were very low (<0.02 mg/L and maximum 16 mg/L, respectively). There were no observations of any filamentous algae present either. MassDCR staff also conducted water quality monitoring in Trout Brook downstream of Manning St, Holden (M110) between 2008-2019. The minimum DO in early/mid- afternoon (not pre-dawn worst case) was 8.08 mg/L and pH ranged from 6.46 to 6.96 SU (n=6 each, 2019 only). The maximum discrete temperature measurement taken during the summer (June to mid-September, 2008-2019) was 23.0 °C (n=127) and 21% of measurements exceeded 20.0 °C. In 2018 and 2019 thermistors were deployed. The maximum 24-hour average temperatures exceeded the acute criterion of 23.5 °C (23.51 °C in 2018 and 23.57 °C in 2019) and the 7DADM exceeded 20.0 °C both years as well (51 times in 2018 with a maximum of 23.72 °C and 39 times in 2019 with a maximum of 23.27 °C). The total phosphorus seasonal average concentrations ranged from 0.042 to 0.069 mg/L (n=5 samples most years 2015 to 2019). Ammonia-nitrogen (maximum 0.036 mg/L, n=54, 2015 to 2019) and chloride concentrations (maximum 42.5 mg/L, n=19, 2018-2019) were both very low, and the maximum specific conductance was 835 µS/cm (n=406, 2008-2019).

The Aquatic Life Use for Trout Brook is assessed as Not Supporting based on temperatures that exceeded both acute and chronic criteria for an Existing Use Tier 1 Cold Water Fishery. All other data were indicative of good conditions.

Unionville Pond (MA81143)

Location:	Holden.
AU Type:	FRESHWATER LAKE
AU Size:	19 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4c	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

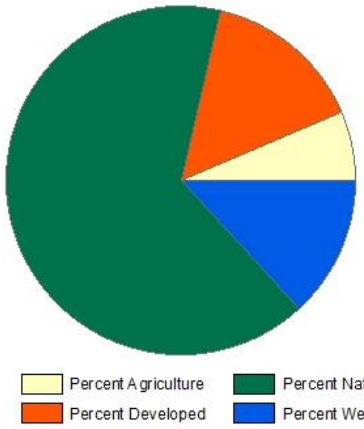
As noted previously, the non-native aquatic macrophyte, Eurasian water milfoil (*Myriophyllum spicatum*), was identified during an August 1998 synoptic survey of Unionville Pond conducted by MassDEP biologists. DCR staff subsequently reported an infestation of the non-native variable milfoil (*Myriophyllum heterophyllum*) in 2010 and 2015. The Aquatic Life Use for Unionville Pond (MA81143) is identified as Not Supporting based on the presence of the non-native aquatic macrophytes, Eurasian water milfoil (*Myriophyllum spicatum*) and variable milfoil (*M. heterophyllum*). The generic impairment code Non-Native Aquatic Plants is being added as an indicator of the latter species.

UNKETY BROOK (MA81-81)

Location:	Headwaters, east of Chicopee Row, Groton to mouth at confluence with Nashua River, Dunstable.
AU Type:	RIVER
AU Size:	6.7 MILES
Classification/Qualifier:	B

UNKETY BROOK - MA81-81

Watershed Area: 6.92 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	6.88	3.53	1.56	0.78
Agriculture	6.4%	6.8%	3%	5.2%
Developed	15%	17.8%	10.8%	9.7%
Natural	65.5%	61.4%	59.5%	52.5%
Wetland	13.1%	14%	26.7%	32.6%
Impervious Cover	3.9%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)

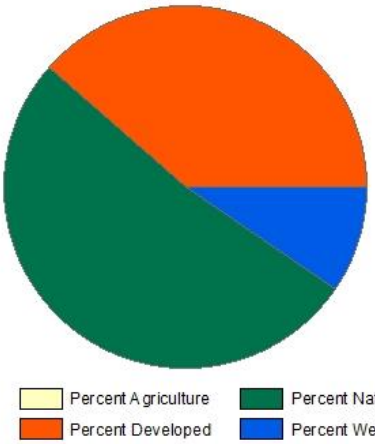
MassDFG biologists conducted backpack electrofishing at two locations near the upstream end of Unkety Brook in Groton in July 2003. The large samples were collected in low gradient locations downstream of Chicopee Rd (Sample ID 853) and at Raddin Rd (Sample ID 855). The Chicopee Rd sample (n=172) had the largest percentage (45%) of pumpkinseed, a moderately tolerant macrohabitat generalist species, and also included 23% of the fluvial specialist, blacknose dace, as well as 19% intolerant macrohabitat generalist species (banded sunfish and swamp darter). There were no cold water species in the sample. The Raddin Rd sample (n=78) contained 28% pumpkinseed and 23% intolerant species- banded sunfish, Creek chubsucker, and 1 adult of the cold water species, Eastern brook trout (DFG staff noted that it should be assumed wild since there is no stocking of brook trout in Unkety Brook). Of note, DFG staff indicated that four samples collected from 1974-1989 in the middle of the Unkety Brook AU, very roughly 1.5 miles (or more) downstream of Raddin Rd each contained multiple age classes of Eastern brook trout, ranging from 7-103 individuals. MassDEP staff collected 6 bacteria samples at the downstream end of the AU, at River Street, Dunstable, during summer 2008 (W1829). There was a single observation of dense filamentous algae in the July site visit. NRWA staff/volunteers collected discrete data also at River Street (Station ID UK0675). The data which met quality objectives were collected 5 times in 2018 between May and October. Two of 5 dissolved oxygen measurements (1 each in August and September) were below the 5.0 mg/L cold water criterion (minimum 3.4 mg/L), however, DO may be affected by the wetlands buffer (deep marsh, shallow meadow marsh or fen, etc.) surrounding most of the brook. There is currently Insufficient Information to assess the Aquatic Life Use for Unkety Brook (MA81-81), as available fish data are dated and although only 1 Eastern brook trout was collected in 2003, these sampling locations were upstream from locations where trout were historically abundant. The use is identified with an Alert status due to the lack of a cold water assemblage, as well as low DO (based on two NRWA measurements <5.0 mg/L at the River St, Dunstable location). A recommendation will be made for additional fish and water quality monitoring.

Unnamed Tributary (MA81-35)

Location:	Unnamed tributary to Quinepoxet River locally considered "Lower Chaffin Brook", headwaters outlet Unionville Pond, Holden to mouth at confluence with Quinepoxet River, Holden.
AU Type:	RIVER
AU Size:	0.5 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Unnamed Tributary - MA81-35

Watershed Area: 7.08 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	7.07	5.4	4.08	3.13
Agriculture	0.7%	0.7%	1%	0.9%
Developed	38.3%	43.6%	32.1%	36.2%
Natural	51.6%	45.2%	53.9%	48.9%
Wetland	9.4%	10.5%	13.1%	14%
Impervious Cover	13%			

Fish, other Aquatic Life and Wildlife Use: Not Supporting

MassDCR staff collected limited water quality data from Unnamed Tributary MA81-35 upstream of Wachusett St at the Unionville Pond outlet in Holden (station M103) from 2008 to 2010. The maximum discrete temperature measurement during the summer index period was 27.5 ˚C (n = 15-16/year). The maximum specific conductance reading over the same period (n = ~50/year) was 296 µS/cm with one outlier of 929 µS/cm which exceeded 904 µs/cm (the criterion for evaluating chronic chloride toxicity using estimated data).

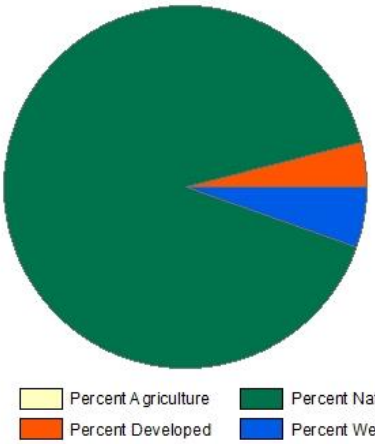
The Aquatic Life Use for Unnamed Tributary MA81-35 is assessed as Not Supporting based on historic impairments, Benthic Macroinvertebrates and Dissolved Oxygen. Recent data with which to reevaluate these impairments were not available.

Unnamed Tributary (MA81-46)

Location:	Unnamed tributary to Rocky Brook, headwaters south of Upper North Row Road, Sterling to mouth at the confluence with Rocky Brook, Sterling.
AU Type:	RIVER
AU Size:	0.7 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Unnamed tributary - MA81-46

Watershed Area: 0.28 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.28	0.28	0.17	0.17
Agriculture	0%	0%	0%	0%
Developed	4%	4%	4.1%	4.1%
Natural	90.6%	90.6%	87.8%	87.8%
Wetland	5.4%	5.4%	8%	8%
Impervious Cover	1.6%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDCR staff conducted water quality monitoring in Unnamed Tributary MA81-46 upstream of Rowley Hill Rd in Sterling (Station MD13) from 2008 to 2011. Temperature was measured 8-15 times during each of the summer index periods with a maximum of 20.2 ˚C. Nutrients data were measured from 2008 through 2010. Total phosphorus seasonal averages ranged from 0.009-0.027 mg/L (maximums 0.011-0.042 mg/L; n = 2-4/year) and there were no violations of calculated ammonia criteria when those data (n = 5-6/year) were screened using the maximum water temperature and the maximum pH found in the entire DCR dataset for Wachusett Reservoir and its tributaries (as a worst-case). Specific conductance was measured roughly weekly from 2008 to 2011 with most data less than 325 µS/cm and a maximum of 598 µS/cm.

Based on DCR water quality data, the Aquatic Life Use of Unnamed Tributary MA81-46 is assessed as Fully Supporting.

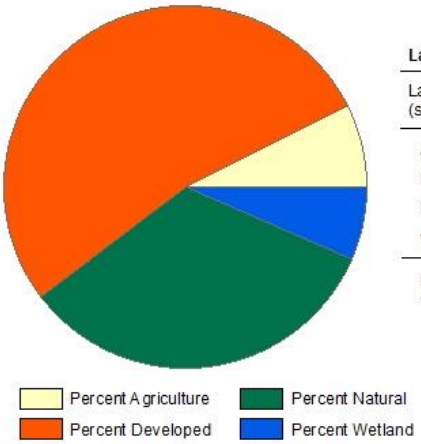
Unnamed Tributary (MA81-49)

Location:	Unnamed tributary to Wachusett Reservoir, headwaters, outlet Carrolls Pond, West Boylston to mouth at inlet Wachusett Reservoir, West Boylston.
AU Type:	RIVER
AU Size:	0.8 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Aka West Boylston Brook

Unnamed tributary - MA81-49

Watershed Area: 0.38 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.38	0.38	0.26	0.26
Agriculture	7.4%	7.4%	9.3%	9.3%
Developed	53%	53%	41.5%	41.5%
Natural	33.2%	33.2%	39.6%	39.6%
Wetland	6.5%	6.5%	9.6%	9.6%
Impervious Cover	14.4%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	5	Chloride		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Unnamed Tributary MA81-49 is considered a cold water fisheries resource by MassDFG. DFG biologists conducted fish population monitoring in the stream at the DCR access road to Wachusett Reservoir off Rt 140/12 in West Boylston in June 2012 (Sample ID 4172). The small sample (n=6) was composed entirely of fluvial specialist species, including multiple age classes of the cold water species, brown trout (n=3), indicating that the stream should be assessed as an existing use Tier 2 cold water fishery. MassDCR staff conducted water quality monitoring in the tributary (referred to by DCR as West Boylston Brook) upstream of the access road inside Gate 25, West Boylston (Station MD05) from 2008 to 2019. Dissolved oxygen was measured on 6 surveys in 2019 and ranged from 7.73 to 9.44 mg/L. However, data were not from the pre-dawn time period (therefore not worst-case conditions). pH was also measured 6 times in 2019 and ranged from 6.69 to 7.23 SU. Continuous temperature data were measured from 2017 to 2019. The maximum 7-DADA was 19.50 °C and the maximum 24-hour rolling average was 20.50 °C. Discrete temperature measurements were collected from 2008

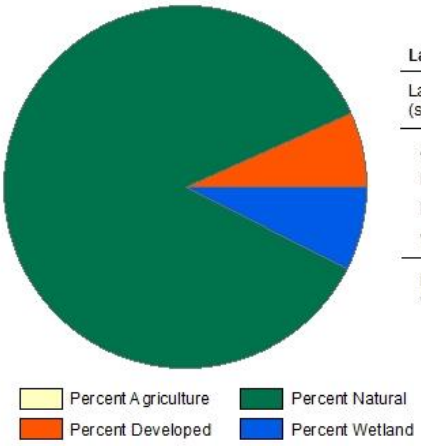
to 2019 roughly 15-16 times per year and the maximum recorded temperature was 18.9 °C. There were no exceedances of the Tier 2 cold water fishery criteria among either the continuous or discrete data. Nutrient samples were also collected from 2008 to 2019. Seasonal averages of total phosphorus (May-September) data ranged from 0.015-0.058 mg/L (just once in 2008 exceeding the recommended EPA Gold book criterion of 0.05 mg/L for flowing waters entering a reservoir), while the maximum ranged from 0.017-0.106 mg/L (n = 3-5/year). The maximum ammonia concentration from this period, 0.34 mg/L (n = 6-12/year) , did not exceed calculated chronic and acute criteria (derived using the water temperature from the date of the sample and the maximum pH found in the entire DCR dataset for Wachusett Reservoir tributaries as a worst-case). Of 19 chloride samples collected roughly monthly from 2018 into 2019, 12 exceeded the chronic chloride toxicity criterion (230 mg/L) and 1 sample exceeded the acute toxicity criterion (860 mg/L), with exceedances ranging from 243-1,930 mg/L. These data corroborated the specific conductance data. Although not statistically analyzed, there was an increasing trend in the percentage of specific conductance measurements (usually 40-60/year, 2008-2019) exceeding 994 µS/cm (the estimated chloride chronic criterion plus a 10% margin to account for error in the model). From 2015-2019, 52-86% of samples each year exceeded 994 µS/cm (maximum 14,167 µS/cm). Although Unnamed Tributary MA81-49 contains a reproducing population of brown trout and water quality data were generally indicative of good conditions, the Aquatic Life Use for this stream is assessed as Not Supporting for Chloride (chronic toxicity). The previously identified Alert status for elevated total phosphorus is being removed since all seasonal averages after 2008 were less than 0.05 mg/L.

Unnamed Tributary (MA81-50)

Location:	Unnamed tributary to Wachusett Reservoir, headwaters, east of Linden Street, Boylston to mouth at inlet Wachusett Reservoir (Hastings Cove), Boylston.
AU Type:	RIVER
AU Size:	1.3 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Unnamed tributary - MA81-50

Watershed Area: 0.55 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.55	0.55	0.28	0.28
Agriculture	0%	0%	0%	0%
Developed	6.7%	6.7%	6.3%	6.3%
Natural	85.9%	85.9%	80.3%	80.3%
Wetland	7.4%	7.4%	13.4%	13.4%
Impervious Cover	3.1%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

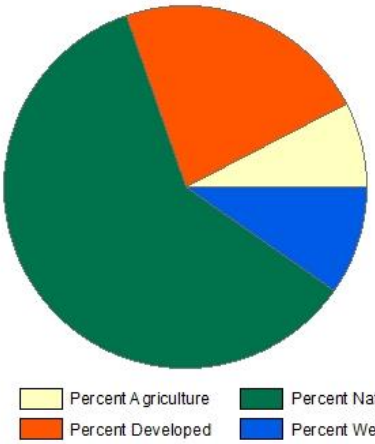
MassDFG biologists sampled the fish population near the mouth of an Unnamed Tributary (MA81-50) to the southeastern section of Wachusett Reservoir on 21 June 2012 (Sample ID 4171, upstream and downstream of the Rt 70 crossing, Boylston). All 20 fish collected were blacknose dace, a fluvial specialist considered tolerant of pollution. Staff noted that the stream was armored and channelized and all fish were collected upstream of the channelized section. An attempt was made to sample mid-way up the AU (at Linden St), but there was little to no flow, and the habitat was described as a grassy swamp meadow. MassDCR staff collected water quality data from the tributary in the vicinity of fish sample 4171 (Station MD76, above mouth of Hastings Cove off Rt. 70, Boylston). Among 88 discrete temperature readings measured within the summer index periods from 2008-2013, the maximum temperature was 21.7 ^{o}C. Roughly 4 dozen specific conductance measurements were taken each year over the same period and the maximum SC was 625 µs/cm with 1 exception. The Aquatic Life Use for Unnamed Tributary (MA81-50) is assessed as Fully Supporting primarily since the fish sample included a fluvial specialist species. However, the use is identified with an Alert status due to the lack of diversity in the sample and the domination of the fish community (100%) by a pollution-tolerant species.

Unnamed Tributary (MA81-51)

Location:	Unnamed tributary to Quinapoxet River, headwaters, south of Malden Street, Holden to mouth at confluence with the Quinapoxet River, Holden.
AU Type:	RIVER
AU Size:	1.5 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Unnamed tributary - MA81-51

Watershed Area: 1.31 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.31	1.31	0.81	0.81
Agriculture	7.6%	7.6%	9.9%	9.9%
Developed	22.8%	22.8%	20.1%	20.1%
Natural	60.1%	60.1%	55.2%	55.2%
Wetland	9.6%	9.6%	14.7%	14.7%
Impervious Cover	4.9%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting
MassDFG biologists conducted backpack electrofishing in Unnamed Tributary MA81-51 downstream of Malden St, Holden in August 2008 (Sample ID 2640). The sample (n=25) was comprised exclusively of multiple age classes of the intolerant, cold water species, Eastern brook trout, including 24 fish ≤140 mm. Downstream of Harris St (in Holden), DFG staff collected a sample in the same month (Sample ID 2639) in which 40 of 55 individuals were Eastern brook trout, again mostly juveniles. That year, MassDCR staff conducted limited water quality monitoring at the Harris St crossing (station M109). Of 15 temperature measurements from the summer index period, all but one were less than 20.0 °C (the Tier 1 Existing Use Cold Water Fishery criterion) and the maximum was 21.0 °C. Specific conductance readings were recorded roughly weekly with a maximum of 635 µS/cm. Just upstream of the confluence with the Quinapoxet River (MA81-32), MassDFG staff collected a final fish population sample in August 2008 (Sample ID 2638). Of 53 individuals, 31 were Eastern brook trout, all <140 mm. The Aquatic Life Use of Unnamed Tributary MA81-51 is assessed as Fully Supporting based primarily on the presence of a reproducing Eastern brook trout population, an indicator of excellent habitat and water quality.

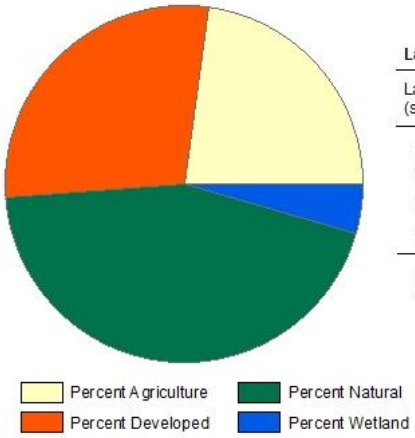
Unnamed Tributary (MA81-54)

Location:	Unnamed tributary to Wachusett Reservoir, headwaters, west of Route 140, West Boylston to mouth at inlet Wachusett Reservoir (Stillwater Basin), West Boylston.
AU Type:	RIVER
AU Size:	0.8 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Also known as Oakdale Brook

Unnamed tributary - MA81-54

Watershed Area: 0.43 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.43	0.43	0.29	0.29
Agriculture	22.8%	22.8%	21.2%	21.2%
Developed	28.3%	28.3%	25.1%	25.1%
Natural	44.4%	44.4%	47%	47%
Wetland	4.5%	4.5%	6.7%	6.7%
Impervious Cover	15.9%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	5	Chloride		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

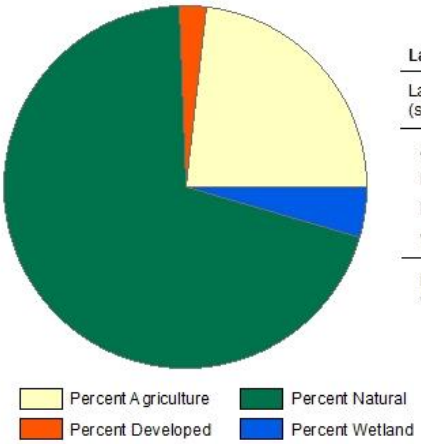
MassDCR staff conducted water quality monitoring downstream of the Waushacum St crossing (east of Rt 140) of Unnamed Tributary MA81-54 (referred to by DCR as Oakdale Brook, Station MD80) in West Boylston from 2008 to 2019. Discrete dissolved oxygen data were measured in 2019 and had a minimum of 8.93 mg/L (n=4) while pH data from that year ranged from 7.15-7.29 SU (n=4). Temperature was measured during the summer index period from 2008 to 2019 (n = 4-16/year) with a maximum of 17.2 ˚C. Specific conductance was measured (n = 14-51/year) from 2008 through August 2019. In the last four survey years, 44-80% of specific conductance measurements exceeded 994 µs/cm (the estimated chloride chronic criterion plus a 10% margin to account for error in the model), with a data set maximum of 2,589 µs/cm occurring in 2012. The Aquatic Life Use of Unnamed Tributary MA81-54 is assessed as Not Supporting for Chloride due to chronic violations of estimated chloride data.

Unnamed Tributary (MA81-58)

Location:	Unnamed tributary to Quinapoxet Reservoir, headwaters, west of Route 68, Rutland to mouth at confluence with unnamed tributary to the Quinapoxet Reservoir (east of Bryant Road), Holden.
AU Type:	RIVER
AU Size:	1.3 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Unnamed tributary - MA81-58

Watershed Area: 0.66 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.66	0.66	0.5	0.5
Agriculture	23.1%	23.1%	16.2%	16.2%
Developed	2.4%	2.4%	2%	2%
Natural	70%	70%	76%	76%
Wetland	4.4%	4.4%	5.8%	5.8%
Impervious Cover	2.1%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting
MassDCR conducted water quality monitoring in Unnamed Tributary MA81-58 upstream of Rt 68 in Rutland from 2008 to 2019 (station MD12). Discrete dissolved oxygen data were measured in 2019 and had a minimum of 6.29 mg/L (n=7) while pH data from that year ranged from 6.64-7.96 SU (n=7). Temperature data were measured during the summer index periods from 2008 to 2019 (usually n = 7-15/year) and the maximum was 20.7 °C. The total phosphorus seasonal averages for 2008 to 2010 ranged from 0.033-0.046 mg/L, while the maximums ranged from 0.043-0.078 mg/L (n = 3-4/year). The maximum ammonia reading for that period of time was 0.36 mg/L (n = 5-6/year) and when screened using the maximum water temperature for station MD12 in 2009 and the maximum pH found in the entire DCR data set for the Wachusett Reservoir tributaries, there were no violations of the calculated worst-case criteria. Specific conductance readings were recorded 15-55 times per year from 2008 to 2019 and the maximum measurement was 358 µS/cm. MassDFG biologists attempted to sample the fish population of the unnamed tributary in the vicinity of the water quality station in July 2012 (Sample ID 4214) but noted that the stream was dried up. However, there are no known groundwater withdrawals in this small catchment area (0.19 mi^2 upstream of this location) and 2012 was not a drought year. Based on the extensive DCR water quality data set, the Aquatic Life Use of Unnamed Tributary MA81-58 is assessed as Fully Supporting. The prior Alert status for elevated total phosphorus is being removed (2008-2010 seasonal averages 0.033-0.046 mg/L). Although the stream was dry during a 2012 DFG site visit, this is likely due to natural causes.

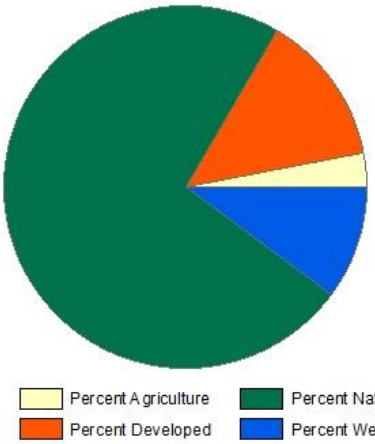
Unnamed Tributary (MA81-59)

Location:	Unnamed tributary to Quinapoxet River, headwaters, southwest of Hog Hill, Sterling to mouth at confluence with the Quinapoxet River, West Boylston.
AU Type:	RIVER
AU Size:	1.6 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Aka Hog Hill Brook

Unnamed tributary - MA81-59

Watershed Area: 1.03 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.03	1.03	0.57	0.57
Agriculture	3%	3%	3.6%	3.6%
Developed	13.5%	13.5%	13.5%	13.5%
Natural	73.4%	73.4%	65.3%	65.3%
Wetland	10.1%	10.1%	17.7%	17.7%
Impervious Cover	4.5%			

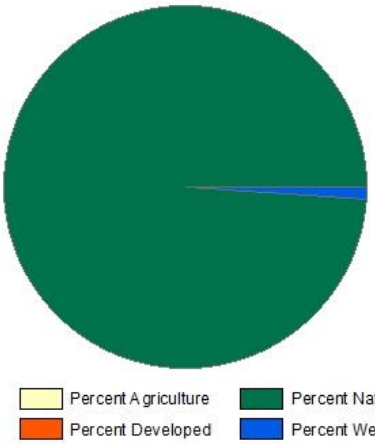
Fish, other Aquatic Life and Wildlife Use: Fully Supporting
MassDFG biologists conducted backpack electrofishing (or attempted sampling) at four locations (all in West Boylston) in Unnamed Tributary MA81-59, a tributary of the Quinapoxet River (MA81-32), on 17 July 2009. Upstream of Legg Rd and I-190 no fish were caught but frogs and crayfish were noted (Sample ID 3096). Upstream of Laurel St (Sample ID 3070), 4 of 33 individuals captured were adult Eastern brook trout, an intolerant cold water species; the other two species (blacknose and longnose dace) were also fluvial specialists. In the vicinity of this location, MassDCR staff collected limited water quality monitoring the prior year (2008) at station M107. Of 12 discrete temperature readings measured within the summer index period, the maximum was 21.0 °C and only this one measurement was >20 °C (the cold water criterion). Specific conductance was measured roughly weekly (n=48) with most measurements ≤563 µS/cm and only two measurements >904 µs/cm, the estimated chloride chronic criterion (maximum of 1,538 µS/cm). Moving downstream to the area around the Mass Central Rail Trail crossing, MassDFG conducted fish surveys upstream (Sample ID 3071) and downstream (Sample ID 3072) of the crossing. Both samples included multiple age classes of Eastern brook trout as well as other fluvial species and the downstream sample was more species rich (5 species), likely an indicator of its proximity to the confluence with the Quinapoxet River. The Aquatic Life Use for Unnamed Tributary MA81-59 is assessed as Fully Supporting based primarily on the presence of a reproducing population of Eastern brook trout as well as limited water quality data.

Unnamed Tributary (MA81-83)

Location:	Unnamed tributary to Pearl Hill Brook, headwaters north of Sauna Row Road, Townsend to mouth at confluence with Pearl Hill Brook, Townsend.
AU Type:	RIVER
AU Size:	0.8 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA81-83

Watershed Area: 0.61 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.61	0.61	0.09	0.09
Agriculture	0%	0%	0%	0%
Developed	0.6%	0.6%	0%	0%
Natural	98.4%	98.4%	96.8%	96.8%
Wetland	1%	1%	3.2%	3.2%
Impervious Cover	0.6%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing in an Unnamed Tributary (MA81-83) of Pearl Hill Brook (MA81-80) off New Fitchburg Rd, Townsend just upstream of the confluence in August 2013 (Sample ID 4794). The entire sample consisted of multiple age classes of the intolerant, cold water species, Eastern brook trout. Although 47 fish were captured, DFG staff noted that the battery on the electrofisher died and they "missed a lot of EBTs in snags & under banks."

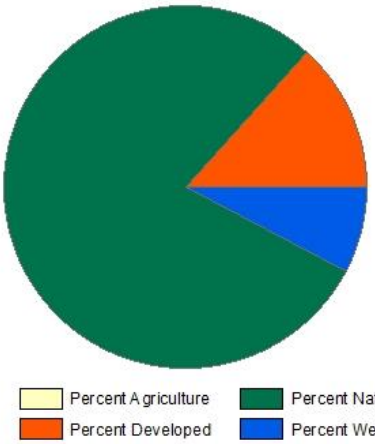
The Aquatic Life Use for Unnamed Tributary MA81-83, a CFR stream, is assessed as Fully Supporting, based on the presence of a reproducing wild population of Eastern brook trout, a species indicative of excellent habitat and water quality.

Unnamed Tributary (MA81-85)

Location:	Unnamed tributary to unnamed tributary to Slate Rock Pond, headwaters north of State Road, Lancaster to mouth at confluence with unnamed tributary west of Old Shirley Road, Lancaster.
AU Type:	RIVER
AU Size:	1.3 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA81-85

Watershed Area: 0.63 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.63	0.63	0.22	0.22
Agriculture	0.7%	0.7%	0%	0%
Developed	13.3%	13.3%	3%	3%
Natural	78.4%	78.4%	80.7%	80.7%
Wetland	7.6%	7.6%	16.3%	16.3%
Impervious Cover	6.5%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

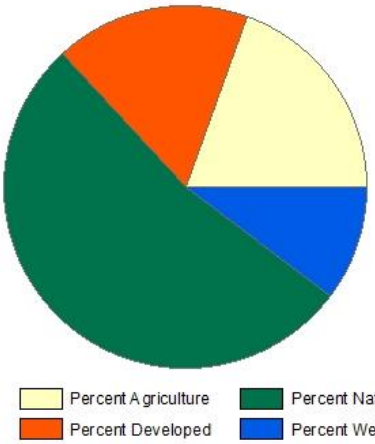
MassDFG biologists conducted backpack electrofishing in a CFR stream, an Unnamed Tributary (MA81-85) to Slate Rock Pond, downstream/south of Rt 2 (just east of Shirley Rd Exit on Rt 2), Lancaster, in August 2007 (Sample ID 2378). The entire sample (n=75) consisted of multiple age classes of the intolerant cold water species, Eastern brook trout. The Aquatic Life Use for Unnamed Tributary (MA81-85) is assessed as Fully Supporting, based on the presence of a reproducing wild population of Eastern brook trout, a species indicative of excellent habitat and water quality conditions.

Unnamed Tributary (MA81-86)

Location:	Headwaters outlet small unnamed pond northeast of Main Street, Bolton to mouth at confluence with Still River, Lancaster.
AU Type:	RIVER
AU Size:	2.6 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA81-86

Watershed Area: 1.74 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.73	1.73	0.6	0.6
Agriculture	19.5%	19.5%	13.2%	13.2%
Developed	17.3%	17.3%	12.8%	12.8%
Natural	53%	53%	49.3%	49.3%
Wetland	10.2%	10.2%	24.7%	24.7%
Impervious Cover	7.9%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing in an Unnamed Tributary (MA81-86), which is locally considered part of the Still River. Sampling occurred in the middle of the AU downstream of Forbush Mill Rd, 1/3 mile west of Main St, Bolton in August 2012 (Sample ID 4194). Most of the sample (n=86) consisted of multiple age classes of Eastern brook trout (n=83 individuals), an intolerant, cold water species.

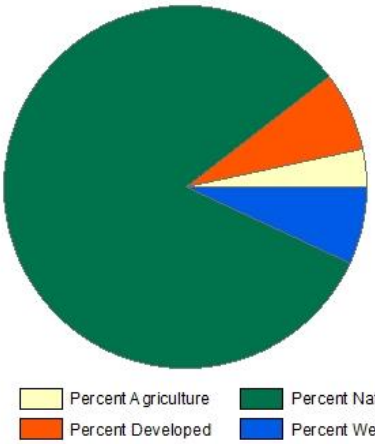
The Aquatic Life Use for Unnamed Tributary (MA81-86) is assessed as Fully Supporting, based on the presence of a reproducing wild population of Eastern brook trout, a species indicative of excellent habitat and water quality conditions.

Unnamed Tributary (MA81-88)

Location:	Unnamed tributary to Lynde Basins, headwaters outlet Fitch Basin to mouth at inlet Lynde Basins, Sterling.
AU Type:	RIVER
AU Size:	0.4 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA81-88

Watershed Area: 0.52 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.52	0.52	0.23	0.23
Agriculture	3.4%	3.4%	0.7%	0.7%
Developed	7%	7%	3.2%	3.2%
Natural	82.7%	82.7%	89.2%	89.2%
Wetland	6.9%	6.9%	6.9%	6.9%
Impervious Cover	1.6%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG conducted electrofishing in an Unnamed Tributary (MA81-88) to Upper Lynde Basin Reservoir (not an AU) downstream of Heywood Rd, Sterling on 21 Aug 2013 (Sample ID 4962). The small sample (n=5) was comprised entirely of multiple age classes of Eastern brook trout, a cold water fluvial specialist species considered to be intolerant of pollution. In Dec 2019, the Town of Clinton received $176,250 from a grant program developed to assist Massachusetts communities in addressing deteriorating dams and coastal infrastructure. Clinton will utilize the funds to design and permit the removal of 3 dams, including the Upper Lynde, the Lower Lynde and the Fitch Basin Dams.

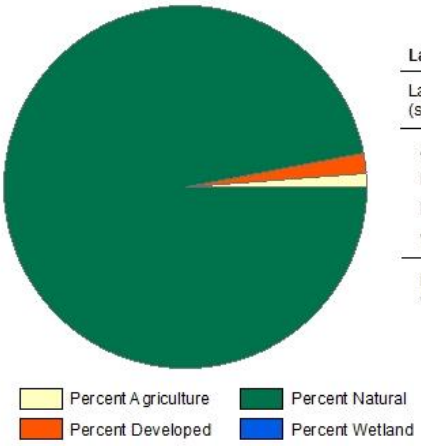
The Aquatic Life Use for Unnamed Tributary (MA81-88) is assessed as Fully Supporting based on the presence of a reproducing population of Eastern brook trout, a species indicative of excellent habitat and water quality conditions.

Unnamed Tributary (MA81-89)

Location:	Unnamed tributary to Lovell Reservoir, headwaters, perennial portion south of Billings Road, Fitchburg to mouth at inlet Lovell Reservoir (a Falulah Brook impoundment), Fitchburg.
AU Type:	RIVER
AU Size:	0.7 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Unnamed Tributary - MA81-89

Watershed Area: 0.66 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.66	0.66	0.39	0.39
Agriculture	1.2%	1.2%	1.8%	1.8%
Developed	1.7%	1.7%	2.7%	2.7%
Natural	96.3%	96.3%	94.2%	94.2%
Wetland	0.8%	0.8%	1.3%	1.3%
Impervious Cover	1.3%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG conducted backpack electrofishing in an Unnamed Tributary (MA81-89) to Lovell Reservoir (MA81074) at the downstream end of the AU, upstream of Rindge Rd, Fitchburg in August 2010 (Sample ID 3393). The entire sample (n=23) consisted of multiple age classes of Eastern brook trout (all lengths were less than 140 mm). Eastern brook trout are intolerant, cold water fluvial specialists.

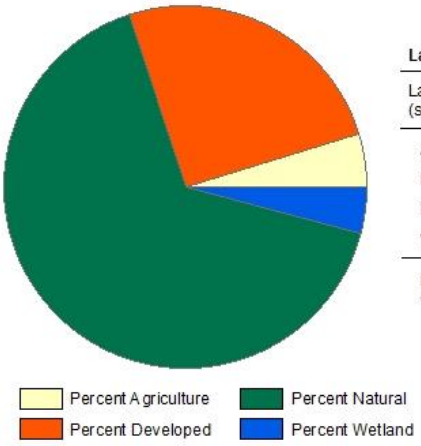
The Aquatic Life Use for Unnamed Tributary (MA81-89) is assessed as Fully Supporting based on the presence of a reproducing wild population of Eastern brook trout, a species indicative of excellent habitat and water quality.

Unnamed Tributary (MA81-91)

Location:	Unnamed tributary to Whitman River, headwaters south of Batherick Road, Westminster to mouth at confluence with Whitman River, Westminster.
AU Type:	RIVER
AU Size:	0.8 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA81-91

Watershed Area: 0.24 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.24	0.24	0.09	0.09
Agriculture	4.7%	4.7%	3.5%	3.5%
Developed	25.3%	25.3%	16.7%	16.7%
Natural	65.9%	65.9%	74.5%	74.5%
Wetland	4.1%	4.1%	5.3%	5.3%
Impervious Cover	8.9%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing in an Unnamed Tributary (MA81-91) to the Whitman River (MA81-11) at two locations close to the downstream end of the AU in Westminster. In June 2012 and July 2010, sampling was conducted upstream of the Depot Rd crossing, (Sample ID 4169) and downstream of the railroad crossing north of Bathrick Rd (Sample ID 3379, more accurately described as roughly 100 ft upstream of the confluence with the Whitman River MA81-11), respectively. Both samples (n=39 & n=14) consisted entirely of multiple age classes of Eastern brook trout, of which the majority were less than or equal to 140 mm. Eastern brook trout are intolerant cold water fluvial specialists.

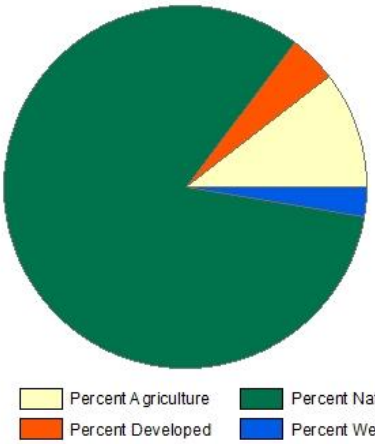
The Aquatic Life Use for Unnamed Tributary (MA81-91) is assessed as Fully Supporting based on the presence of a reproducing wild population of Eastern brook trout, a species indicative of excellent habitat and water quality conditions.

Unnamed Tributary (MA81-92)

Location:	Unnamed tributary to Whitman River, headwaters west of railroad tracks downstream from Crocker Pond, Westminster to mouth at confluence with Whitman River, Westminster.
AU Type:	RIVER
AU Size:	0.2 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA81-92

Watershed Area: 0.24 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.24	0.24	0.03	0.03
Agriculture	10.5%	10.5%	0%	0%
Developed	4.2%	4.2%	3.1%	3.1%
Natural	82.7%	82.7%	96.9%	96.9%
Wetland	2.6%	2.6%	0%	0%
Impervious Cover	1.6%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing in an Unnamed Tributary (MA81-92) to the Whitman River (MA81-11) at two locations in the middle and downstream end of the AU in Westminster. In June 2012 and July 2010, sampling was conducted west of the railroad crossing upstream to the Depot Rd culvert (Sample ID 4170) and downstream of the railroad crossing (Sample ID 3380), respectively. Both samples consisted entirely of multiple age classes of Eastern brook trout, an intolerant cold water species. Staff attempted to sample on both sides of the railroad crossing between the other two locations, in 2009, but at this earlier time the stream was flooded due to beaver activity.

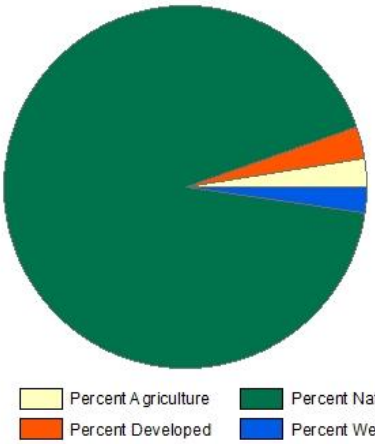
The Aquatic Life Use for Unnamed Tributary MA81-92 is assessed as Fully Supporting based on the presence of a reproducing wild population of Eastern brook trout, a species indicative of excellent habitat and water quality conditions.

Unnamed Tributary (MA81-93)

Location:	Unnamed tributary to Eagle Lake, headwaters outlet Kendall Reservoir, Holden to mouth at inlet Eagle Lake, Holden.
AU Type:	RIVER
AU Size:	0.3 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Unnamed Tributary - MA81-93

Watershed Area: 1.89 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.89	1.89	0.93	0.93
Agriculture	2.6%	2.6%	3.6%	3.6%
Developed	2.8%	2.8%	2.7%	2.7%
Natural	92.4%	92.4%	89.5%	89.5%
Wetland	2.3%	2.3%	4.2%	4.2%
Impervious Cover	1.7%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG staff conducted backpack electrofishing in this unnamed tributary (MA81-93) at the Kendall Road crossing, Holden (Sample 3814) on 27 July 2011. The sample was dominated by the intolerant cold water species, Eastern brook trout (66% of 82 fish in the sample). Field sheet notes indicated that these were wild specimens constituting five age classes.

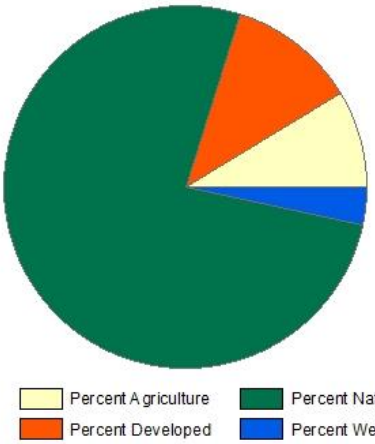
The Aquatic Life Use of this unnamed tributary (MA81-93) is assessed as Fully Supporting based on the presence of a reproducing population of Eastern brook trout.

Unnamed Tributary (MA81-95)

Location:	Unnamed tributary to Pine Hill Reservoir, headwaters east of Maple Avenue (Route 56), Rutland to mouth at confluence with Pine Hill Reservoir, Rutland.
AU Type:	RIVER
AU Size:	0.8 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Unnamed Tributary - MA81-95

Watershed Area: 0.21 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.21	0.21	0.13	0.13
Agriculture	8.6%	8.6%	4.8%	4.8%
Developed	11.6%	11.6%	9.9%	9.9%
Natural	76.5%	76.5%	80%	80%
Wetland	3.3%	3.3%	5.2%	5.2%
Impervious Cover	5%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG staff sampled the fish population of Unnamed Tributary MA81-95, a CFR stream, at Emerald Rd in Rutland just upstream of Pine Hill Reservoir on 10 August 2011. The entire sample consisted of immature Eastern brook trout (n=10), a cold water fluvial specialist species intolerant of pollution. Field notes indicated that these were all wild trout with 3-4 age classes present.

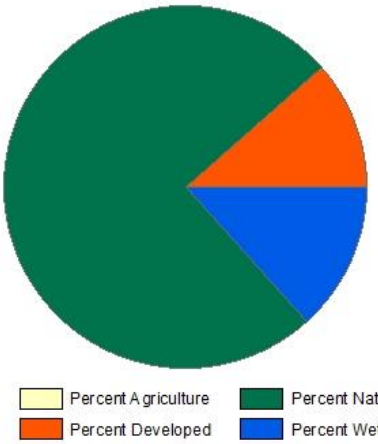
The Aquatic Life Use for Unnamed Tributary (MA81-95) is assessed as Fully Supporting based on the presence of a reproducing Eastern brook trout population.

Unnamed Tributary (MA81-97)

Location:	Unnamed tributary to Phillips Brook, headwaters east of Cowees Hill, Westminster to mouth at confluence with Phillips Brook, Westminster.
AU Type:	RIVER
AU Size:	1.6 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA81-97

Watershed Area: 0.81 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.81	0.81	0.2	0.2
Agriculture	0.9%	0.9%	0%	0%
Developed	11.4%	11.4%	4.5%	4.5%
Natural	74.6%	74.6%	59.4%	59.4%
Wetland	13.1%	13.1%	36.1%	36.1%
Impervious Cover	2.6%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDEP staff conducted benthic, fish, and water quality monitoring as part of a probabilistic wadeable streams monitoring project (MAP2) in this Unnamed Tributary AU (MA81-97) at Potato Hill Rd, Westminster (Station MAP22-067) during the summer of 2011. While benthic macroinvertebrate sampling was included as part of this project (B0729) the data were not analyzed using an RBPIII approach. Rather, the benthic data will be compared to biocriteria thresholds which are currently under development so these (benthic macroinvertebrate) data will be used as part of the Aquatic Life Use assessment in a future reporting cycle. MassDEP biologists also conducted backpack electrofishing in August 2011 (Sample ID: 4578). Fluvial specialists/dependents and species moderately tolerant of pollution (blacknose dace, pumpkinseed, common shiner and others) dominated the large sample (n=165), but no cold water species were collected (DFG biologists indicate this is a CFR stream). It is noted, however, that a large wetland likely resulting from beaver activity has formed upstream of the sampling area and the land use in this small watershed (drainage area 0.81mi^2) is 87.7% natural so it passes the natural condition evaluation. The water quality monitoring data collected during the summer of 2011 (Unique ID W2209) can be summarized as follows: The minimum DO measured by an unattended probe during the three four-day deploys was 7.7 mg/L, maximum saturation was 99%, and the maximum diel DO shift was 0.8 mg/L. The maximum 7DADM temperature was 26.7 °C during the thermistor deployment from 12 May to 6 October 2011 and the maximum 24-hour average was 26.8 °C. pH ranged from 6.2-6.8 SU (n=6). The total phosphorus seasonal average concentration was low at 0.039 mg/L (maximum 0.071 mg/L) and there were no observations of dense/very dense filamentous algae. Ammonia-nitrogen concentrations were also very low ($\leq$0.03 mg/L). The Aquatic Life Use for this Unnamed Tributary AU (MA81-97) is assessed as Fully Supporting based on the fish community sample (comprised almost exclusively of

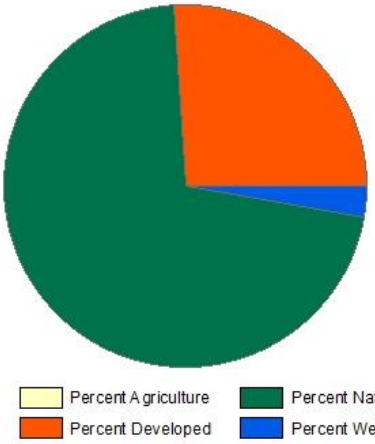
fluvial specialists/dependents and species moderately tolerant of pollution) and good water quality conditions documented at the Potato Hill Rd crossing in Westminster. Although this stream is identified as a CFR and no cold-water fish species were collected, nor were temperatures indicative of cold water habitat, these conditions are considered natural (presence of beaver activity upstream, natural land use ~87.7% in this small watershed), so no alert is being identified.

Unnamed Tributary (MA81-98)

Location:	Unnamed tributary to the North Nashua River, headwaters east of Westminster Hill Road, Fitchburg to mouth at confluence with the North Nashua River, Fitchburg (approximately 900 feet culverted between Overland and Westminster streets).
AU Type:	RIVER
AU Size:	0.9 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA81-98

Watershed Area: 0.63 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.63	0.63	0.1	0.1
Agriculture	0%	0%	0%	0%
Developed	26%	26%	35.3%	35.3%
Natural	71.3%	71.3%	60.3%	60.3%
Wetland	2.7%	2.7%	4.4%	4.4%
Impervious Cover	16%			

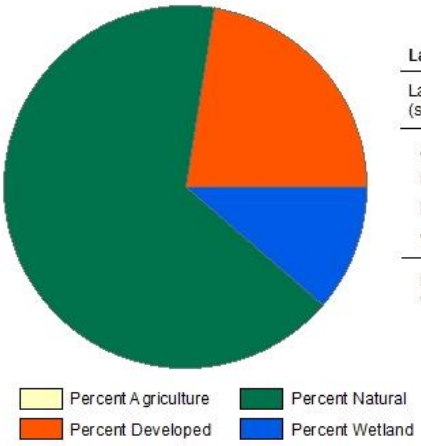
Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Unnamed Tributary (MA81-98) is not assessed due to the absence of data.

Unnamed Tributary (Boylston Brook) (MA81-34)

Location:	Unnamed tributary locally known as "Boylston Brook." Headwaters north of French Drive, Boylston to mouth at confluence with Potash Brook, Boylston.
AU Type:	RIVER
	0.5 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Unnamed Tributary (Boylston Brook) - MA81-34

Watershed Area: 0.21 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.21	0.21	0.16	0.16
Agriculture	0%	0%	0%	0%
Developed	22.4%	22.4%	15%	15%
Natural	66.3%	66.3%	70.2%	70.2%
Wetland	11.3%	11.3%	14.8%	14.8%
Impervious Cover	8.4%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDCR collected discrete water quality measurements on Unnamed Tributary MA81-34 (locally known as Boylston Brook) downstream of Route 70, Boylston from 2008-2019 (Station MD70). Discrete temperature readings measured within the summer index periods had a maximum temperature of 23.3 ^{o}C (n=111). Among the vast majority of the 436 specific conductance readings, the maximum measurement was 854 µS/cm but there were 8 measurements that were ≥904 µs/cm (the criterion for evaluating chronic chloride toxicity using estimated data), with a maximum of 1,290 µS/cm. Discrete pH measurements in 2019 ranged from 7.1-7.19 SU and the minimum dissolved oxygen concentration in 2019 was 6.71 mg/L (n=3 each parameter).

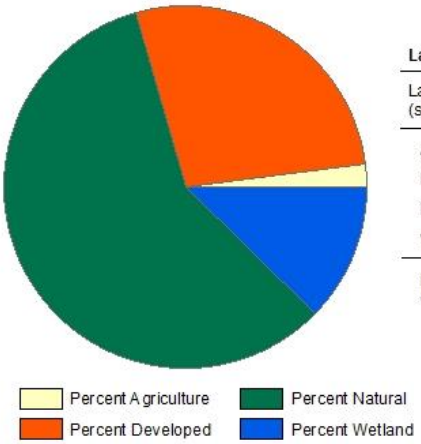
The Aquatic Life Use for the Unnamed Tributary (MA81-34), locally known as Boylston Brook, is assessed as Fully Supporting based on generally excellent water quality data meeting the criteria for a warm water fishery.

Unnamed Tributary (Burnt Mill Pond Brook) (MA81-65)

Location:	Unnamed tributary to Snows Millpond locally known as "Burnt Mill Pond Brook", headwaters outlet Round Meadow Pond, Westminster to mouth at inlet Snows Millpond, Fitchburg/Westminster.
AU Type:	RIVER
AU Size:	2 MILES
Classification/Qualifier:	B: CWF

Unnamed Tributary (Burnt Mill Pond Brook) - MA81-65

Watershed Area: 5.77 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	5.75	3.53	1.34	1.04
Agriculture	2%	3%	0.2%	0.3%
Developed	27.3%	32.3%	23.1%	26.2%
Natural	58.3%	57.9%	55.7%	60.3%
Wetland	12.3%	6.8%	21%	13.2%
Impervious Cover	11.5%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting
MassDFG conducted backpack electrofishing in Unnamed Tributary MA81-65 (locally known as Burnt Mill Pond Brook), a designated cold water fishery, at two locations around the middle of the AU in Westminster, in August 2009- near Rt 2A at the powerline crossing (Sample ID 3053) and upstream from the Depot Rd crossing along Rt 2A (Sample ID 3054). Two wild adult Eastern brook trout, an intolerant cold water species, were captured at the upstream station and multiple age classes were collected at the downstream site. Other fluvial species (longnose and blacknose dace, white sucker) were well represented in both samples. The Aquatic Life Use for Unnamed Tributary MA81-65 (Burnt Mill Pond Brook) is assessed as Fully Supporting based on the presence of a reproducing wild population of Eastern brook trout.

Upper Crow Hill Pond (MA81169)

Location:	Westminster.
AU Type:	FRESHWATER LAKE
AU Size:	5 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed (Alert)

MassDEP biologists conducted a synoptic survey of Upper Crow Hill Pond in August 1998. They noted the presence of the macrophyte, *Myriophyllum* sp., with species confirmation required when flowering heads are present. Subsequently, in 2007, DCR staff in the Lakes and Ponds program reported the presence of the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*), in Lower Crow Hill Pond MA81026 (which is immediately upstream of Upper Crow Hill Pond MA81169).

No recent data are available so the Aquatic Life Use for Upper Crow Hill Pond (MA81169) is Not Assessed. The use is identified with an Alert status based on the unconfirmed presence of *Myriophyllum heterophyllum* in Upper Crow Hill Pond, and the documented presence of the non-native aquatic macrophyte, *M. heterophyllum*, in Lower Crow Hill Pond (MA81026), immediately upstream.

Vinton Pond (MA81145)

Location:	Townsend.
AU Type:	FRESHWATER LAKE
AU Size:	16 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Vinton Pond (MA81145) is Not Assessed since no recent data are available.

Wachusett Lake (MA81146)

Location:	Westminster/Princeton.
AU Type:	FRESHWATER LAKE
AU Size:	129 ACRES
Classification/Qualifier:	A: PWS, ORW

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	5	Mercury in Fish Tissue		Added

Fish, other Aquatic Life and Wildlife Use: Not Assessed

Wachusett Mountain Associates was awarded a 319 Nonpoint Source Pollution Competitive Grant (awarded in Fiscal Year 2002 under project #02-11/319) to reduce total suspended solids from the Wachusett Mountain Ski Area (parking lots and access road) that were impacting Wachusett Lake. The project funds were used to install a series of BMPs to control and treat stormwater flow, including a diversion manhole with an underground infiltration galley that includes an isolation row, a sediment/grit separator, a sediment forebay, and a deep sump catch basin. Post-construction monitoring indicated that there was "a marked decrease in the occurrence of elevated turbidity levels following storm events." The project was completed as of June 2007.

The Aquatic Life Use for Wachusett Lake (MA81146) is Not Assessed due to the absence of recent water quality/biological data.

Fish Consumption Use: Not Supporting

MassDEP biologists conducted fish toxics sampling at Wachusett Lake in July 2017 as part of the probabilistic lake surveys (MAP2). Because of elevated mercury measured in largemouth bass filets, MassDPH issued the following fish consumption advisories:

- *"Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any of the affected fish species (largemouth bass) from this water body."*
- *"The general public should limit consumption of affected fish species (largemouth bass) to two meals per month."*

Since there is a site specific DPH advisory for elevated mercury in fish tissue, the Fish Consumption Use for Wachusett Lake (MA81146) is assessed as Not Supporting. The likely source, although not confirmed, is atmospheric deposition. Data Source: (MassDPH 2019)

Wachusett Reservoir (MA81147)

Location:	Boylston/West Boylston/Clinton/Sterling.
AU Type:	FRESHWATER LAKE
AU Size:	3962 ACRES
Classification/Qualifier:	A: PWS, ORW

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	(Brittle Naiad, Najas Minor*)		Added
4a	4a	(Fanwort*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

DCR and DEP staff have been reporting infestations of multiple non-native aquatic macrophytes- variable milfoil (*Myriophyllum heterophyllum*), Eurasian water milfoil *(Myriophyllum spicatum),* and fanwort (*Cabomba caroliniana*)- in Wachusett Reservoir as far back as 1996. Between 2010 and 2015, DCR staff identified new non-native species in the reservoir, including mudmat (*Glossostigma cleistanthum*), brittle naiad (*Najas minor*), and Asian waterwort (*Elatine ambigua*). From 2008 to 2018, DCR staff collected water quality profile data 1-4 times per year at three locations in the Thomas Basin (TB3427), South Basin (BS3412), and North Basin (BN3417) of Wachusett Reservoir, with 6-10 years of data collected, depending on the station and analyte. Chlorophyll *a* data were generally less than 8 µg/L at all three stations with a few exceptions at the North Basin station (maximum 15.96 µg/L). Dissolved oxygen data were generally >5.0 mg/L among 61 profiles at the 3 locations, with a few exceptions at greater depths in two South Basin profiles (minimum 4.55 mg/L). The maximum DO saturation was 117.7% among all profiles. The maximum temperature was 27.0 °C and the maximum specific conductance was 224 µS/cm among all profiles. Over the same time period, DCR staff also collected quarterly grab samples (n=390) at the 3 stations that were analyzed for ammonia-nitrogen and total phosphorus. Although pH data were not available with which to calculate a site-dependent criterion for ammonia, the maximum ammonia concentration of 0.0375 mg/L is relatively low. Total phosphorus concentrations were generally less than 0.025 mg/L except for two measurements from Sept. 2011 (maximum 0.029 mg/L).

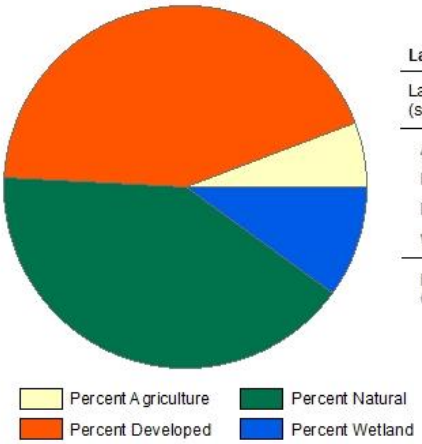
The Aquatic Life Use for Wachusett Reservoir (MA81147) is assessed as Not Supporting due to the presence of multiple non-native aquatic macrophyte species, including variable milfoil (*Myriophyllum heterophyllum*), Eurasian water milfoil *(Myriophyllum spicatum*), and fanwort (*Cabomba caroliniana*), and new for this reporting cycle, mudmat (*Glossostigma cleistanthum*), brittle naiad (*Najas minor*), and Asian waterwort (*Elatine ambigua*). For those species where a specific impairment code was not available, the generic Non-Native Aquatic Plants was applied. Water quality data collected by DCR staff from 2008 to 2018 were generally indicative of excellent conditions.

Warren Tannery Brook (MA81-53)

Location:	Headwaters, perennial portion, north of Route 122A, Holden to mouth at confluence with Asnebumskit Brook, Holden.
AU Type:	RIVER
AU Size:	1.4 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Warren Tannery Brook - MA81-53

Watershed Area: 1.35 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.35	1.35	0.65	0.65
Agriculture	5.7%	5.7%	3.3%	3.3%
Developed	43.5%	43.5%	34.8%	34.8%
Natural	40.9%	40.9%	42.7%	42.7%
Wetland	9.9%	9.9%	19.3%	19.3%
Impervious Cover	16.1%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

MassDFG biologists conducted backpack electrofishing in Warren Tannery Brook at two locations in Holden in June 2009. Downstream of the Quinapoxet St crossing (Sample ID 3087), 30 of 31 individuals captured were multiple age classes of the insensitive cold water species, Eastern brook trout, and 27 of these were ≤140 mm. MassDCR staff collected limited water quality data the prior year (2008) in the vicinity (station M111). Of 15 temperature measurements from the summer index period, all but one were less than 20.0 °C (the Tier 1 Existing Use Cold Water Fishery criterion) and the maximum was 21.0 °C. Specific conductance readings were recorded roughly weekly with a maximum of 492 µS/cm. The second DFG fish sample was collected just upstream of the confluence with Asnebumskit Brook (MA81-56), west of Heather Circle (Sample ID 3086). Of 63 individuals captured, all were from fluvial species and 48 were Eastern brook trout from multiple age classes (41 ≤140 mm).

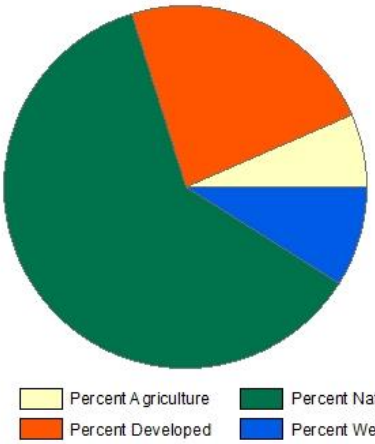
The Aquatic Life Use of Warren Tannery Brook (MA81-53) is assessed as Fully Supporting based primarily on the presence of a reproducing Eastern brook trout population, an indicator of excellent habitat and water quality.

Washacum Brook (MA81-47)

Location:	Headwaters, outlet West Waushacum Pond, Sterling to mouth at inlet Wachusett Reservoir (Stillwater Basin), West Boylston.
AU Type:	RIVER
AU Size:	1.8 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Waushacum Brook - MA81-47

Watershed Area: 7.61 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	7.61	6.59	4.21	3.64
Agriculture	6.5%	5.2%	6.1%	5.5%
Developed	23.3%	24.4%	19.6%	20.7%
Natural	61.4%	61.1%	59.2%	57.9%
Wetland	8.9%	9.4%	15.1%	15.9%
Impervious Cover	8.4%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	5	Dissolved Oxygen		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

MassDCR staff collected limited water quality data in Washacum Brook in Sterling at the West Waushacum Pond outlet (Station MD85) in 2008. The maximum temperature measured during the summer index period (n=15) was 25.7˚C and the maximum specific conductance measured throughout the year (n=49) was 481 µS/cm. In the middle of the AU, upstream of Fairbanks St (Sterling), MassDFG biologists conducted backpack electrofishing in August 2008 (Sample ID 2642) which resulted in the collection of only two yellow bullheads, a warm water species tolerant of pollution. DCR staff also conducted limited water quality sampling near this site (Station MD84) in 2008. The maximum temperature during the summer index period (n=15) was 24.1 ˚C while the annual maximum specific conductance was 410 µS/cm (n=49). In the lower portion of the brook, downstream of Prescott St (West Boylston), DFG biologists conducted a 2nd backpack electrofishing survey in August 2008 (Sample ID 2641). The sample (n=8) contained 4 species, including 2 fallfish, a moderately tolerant fluvial specialist species. DCR staff also conducted much more extensive water quality monitoring in the brook (2008-2019) and discharge measurements (2012-2019) downstream of Prescott St (Station MD83). Discharge ranged from 0-129.5 cfs over the 8 years of record. Dissolved oxygen concentrations in 2019 were low (range 2.92-4.78 mg/L) with four of the six measurements <4.0 mg/L, although it is noted the area upstream of this station is

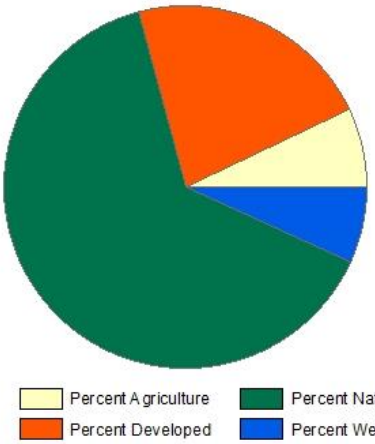
wetland. Continuous temperature data collected from 2017-2019 met warm water guidance (maximum 7DADM 26.96 ˚C; maximum 24-hour rolling average 26.45 ˚C). Discrete temperature measurements were also recorded usually 15-16 times per year from 2008-2019 with a maximum of 30.6 ˚C only once >28.3 ˚C (the warm water criterion). pH (2019 only) ranged from 6.48-7.35 SU (n=6). Total phosphorus and ammonia grab samples were collected from 2012-2019 during baseline conditions and for some storm events in 2013 and 2014. Seasonal average total phosphorus concentrations (all data) were low (range 0.020-0.036 mg/L, n=4-13/year) while maximums ranged from 0.023-0.180 mg/L with only 1 measurement, taken during a storm event, >0.05 mg/L. There were no exceedances of calculated acute or chronic ammonia criteria, as the maximum ammonia concentration of 0.12 mg/L was screened using the maximum water temperature and pH in the entire DCR dataset for Wachusett Reservoir tributaries (to capture the worst-case condition). The maximum chloride concentration (grab samples collected from 2018 through August 2019, n=23) was low (121 mg/L). The maximum specific conductance, measured roughly weekly in most years from 2008-2019, was 567 µS/cm.
The Aquatic Life Use for Washacum Brook (MA81-47) is assessed as Not Supporting based primarily on the low DO conditions documented in 2019 at the DCR Prescott St station (MD83), although wetland influence likely contributes to these conditions. While one fish sample contained two fluvial specialists, few fish were collected at either site sampled, which may also be indicative of flow related habitat constraints (this AU begins at the outlet of the dammed West Waushacum Pond MA81153). Whether or not flow related habitat constraints impact the fish community is unknown, but this is being identified with an Alert. An Alert is also being issued for low flow / habitat constraints. All other data were indicative of good conditions.

WEKEPEKE BROOK (MA81-72)

Location:	Headwaters, outlet Heywood Reservoir, Sterling to mouth at confluence with North Nashua River, Lancaster (through former 2014 segments: Bartlett Pond MA81008 and Unnamed Tributary MA81-61).
AU Type:	RIVER
AU Size:	5.8 MILES
Classification/Qualifier:	B

WEKEPEKE BROOK - MA81-72

Watershed Area: 9.84 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	9.84	5.33	3.52	1.75
Agriculture	7.1%	6.1%	5.9%	3.7%
Developed	22%	26.8%	16.7%	18.4%
Natural	64.2%	58.4%	64.6%	59.4%
Wetland	6.7%	8.7%	12.7%	18.5%
Impervious Cover	9.6%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

DFG biologists identify Wekepeke Brook as a CFR. Between August 2006 and August 2013 MassDFG biologists conducted backpack electrofishing at eight sites along the entire length of Wekepeke Brook. Fluvial specialist and dependent species comprised >50% of all samples and multiple age classes of Eastern brook trout were found at five of the sites so this AU will be evaluated as an Existing Use Tier 1 Cold Water Fishery. MassDEP staff conducted benthic, fish, and water quality monitoring as part of a probabilistic wadeable streams monitoring project (MAP2) in Wekepeke Brook ~160 ft upstream of I-190, Lancaster (MAP2-071) during the summer of 2011. While benthic macroinvertebrate sampling was included as part of this project (B0732) the data were not analyzed using an RBPIII approach. Rather, the benthic data will be compared to biocriteria thresholds which are currently under development so these (benthic macroinvertebrate) data will be used as part of the Aquatic Life Use assessment for a future reporting cycle. MassDEP biologists conducted backpack electrofishing in this reach of the brook in August 2011 (Sample ID: 4586). The sample was dominated by fluvial species and included multiple age classes of Eastern brook trout and brown trout. The water quality monitoring data collected in Wekepeke Brook at this location during the summer of 2011 (W2212) can be summarized as follows:

continuous DO data were measured during three 4-day probe deploys with a minimum concentration of 7.9 mg/L, a maximum saturation of 98%, and a maximum diel DO shift of 0.7 mg/L. The maximum temperature was 25.8 °C during the thermistor deployment from 17 June to 11 October 2011. The maximum 7DADM (23.5°C) exceeded the chronic criterion of 20.0 °C 68 times while the maximum 24-hour average (24.0 °C) also exceeded the acute criterion of 23.5 °C. Discrete pH measurements were good (7.1 to 7.3 SU, n=6). The total phosphorus seasonal average concentration was low 0.034 mg/L (maximum 0.046 mg/L, n=5) and there was one observation of dense/very dense filamentous algae. Ammonia-nitrogen concentrations were also low ($\leq$0.04 mg/L, n=5). In June 2014, the Town of Lancaster removed the Bartlett Pond Dam and completed site improvements to the surrounding Robert Frommer Conservation Area. NRWA staff and/or volunteers conducted water quality sampling in the brook downstream of Rt 117, Lancaster (WE0034) between 2008 and 2019 (roughly 5 times per year). Dissolved oxygen was less than 5.0 mg/L 3 out of 61 measurements (once each in 2010, 2011 and 2017). The maximum temperature was 22.0 °C (n=60) with a few exceedances prior to the dam removal (once in 2008, twice in 2010 and once in 2013). pH ranged from 6.17-7.52 SU and the maximum conductivity was 606 µs/cm.

The Aquatic Life Use for Wekepeke Brook is assessed as Not Supporting based on the elevated temperatures that exceeded both acute and chronic Tier 1 Existing Use Cold Water temperature criteria, documented during the summer of 2011. All other data were indicative of good water quality conditions including the presence of multiple age classes of Eastern brook trout, the lack of any evidence of nutrient enriched conditions, and habitat restoration efforts (Bartlett Pond dam removal in June 2014).

West Waushacum Pond (MA81153)

Location:	Sterling.
AU Type:	FRESHWATER LAKE
AU Size:	111 ACRES
Classification/Qualifier:	A: PWS, ORW (Tributary)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Brittle Naiad, Najas Minor*)		Added
3	4c	(Non-Native Aquatic Plants*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

DCR staff confirmed the presence of the non-native aquatic macrophytes, *Myriophyllum heterophyllum* (variable milfoil) and *Najas minor* (known as brittle or European naiad), in West Waushacum Pond in 2015.

The Aquatic Life Use for West Waushacum Pond (MA81153) is assessed as Not Supporting, based on the presence of the non-native aquatic species, *Myriophyllum heterophyllum* (Non-Native Aquatic Plants) and *Najas minor* (Brittle Naiad, Najas Minor).

White Pond (MA81155)

Location:	Lancaster/Leominster.
AU Type:	FRESHWATER LAKE
AU Size:	47 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

As was previously reported, the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*), was identified by MassDEP staff during a July 1998 synoptic survey of White Pond. There is also a report of curly-leaf pondweed (*Potamogeton crispus*) in the MassDEP Freshwater Aquatic Invasive Species database, but the presence of this species should be confirmed.

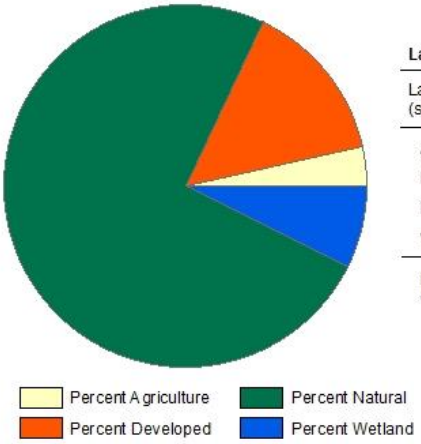
The Aquatic Life Use for White Pond (MA81155) remains assessed as Not Supporting for Non-Native Aquatic Plants due to the presence of variable milfoil (*Myriophyllum heterophyllum*); the generic code is used since no species-specific code is available. The use is identified with an Alert status due to the potential presence of curly-leaf pondweed (*Potamogeton crispus*) which needs to be confirmed.

Whitman River (MA81-11)

Location:	Headwaters, outlet Lake Wampanoag, Ashburnham to mouth at inlet Snows Millpond, Fitchburg/Westminster (excluding the approximately 1.2 miles through Whitmanville Reservoir segment MA81109 and the approximately 0.8 miles through Crocker Pond segment MA81025).
AU Type:	RIVER
AU Size:	6.3 MILES
Classification/Qualifier:	B

Whitman River - MA81-11

Watershed Area: 28.16 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	27.65	9.18	6.42	2.41
Agriculture	3.5%	3.3%	1.5%	1.4%
Developed	14.4%	22.2%	11.6%	17.9%
Natural	74.7%	69.9%	72.4%	71.8%
Wetland	7.3%	4.6%	14.5%	8.9%
Impervious Cover	6%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	Lead		Added
2	5	(Non-Native Aquatic Plants*)		Added
2	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Backpack electrofishing was conducted by DFG biologists in the Whitman River downstr. of Whitmanville Reservoir along S. Ashburnham Rd ~0.2 mi N. of Oakmont Ave, Westminster in Jul 2007 (SampleID 2381). The sample (n=17) was 41% fluvial species (fallfish, white sucker). MassDEP biologists conducted benthic sampling ~70 m upstr. of Whitmanville Road, Westminster (B0668) in Aug 2008. The RBPIII status was “slightly impaired” (71% comparable) when compared to the Nissitissit River reference site (B0087). MassDEP staff conducted water quality monitoring as part of a probabilistic wadeable streams monitoring project (MAP2) during summer 2011 ~50 ft upstr. of Whitmanville Rd, Westminster (MAP2-035). Benthic macroinvertebrates were sampled here (Unique ID B0716) but these data will be compared to biocriteria thresholds (currently under development) in a future reporting cycle. MassDEP biologists conducted backpack electrofishing in this reach of the river (SampleID 4614) in Aug 2011 which resulted in the capture of 9 species. The sample (n=113) was majority fluvial

species (63%), including fallfish, white sucker, and others. Water quality (WQ) data summary for this location (W2194): (three 4-day probe deploys) minimum DO 7.3 mg/L, maximum saturation 96%, maximum diel DO shift 0.9 mg/L. Maximum 7DADM temp. 25.2 °C (92 cold water exceedances during thermistor deployment 12 May - 6 Oct) and maximum 24-hr average 25.5 °C; both acute and chronic Tier 1 cold water violations. pH 6.6-6.7 SU (n=6) and total phosphorus seasonal average 0.021 mg/L with no observations of excessive filamentous algae. Ammonia concentrations low (≤0.03 mg/L, n=5), no violations acute metals criteria (3 clean metal surveys) but chronic criteria were exceeded for copper twice (both 1.2 TUs) and lead all 3 samples (3.1, 1.87, 3.14 TUs). WQ data summary from summer 2008 (W1808, Whitmanville Rd): during three 2-day probe deployments (Jun, Jul, Aug), minimum DO 6.9 mg/L, maximum saturation 95%, maximum diel DO shift 0.8 mg/L, and highest average of the daily maximum temp 26.6 °C (maximum 24-hr rolling average 24.6 °C). pH 6.4-6.6 SU (n=6) and TP seasonal average low (0.021 mg/L, maximum 0.032 mg/L) with no observations of excessive filamentous algae. Ammonia concentrations low (≤ 0.04 mg/L; n=5). DFG biologists conducted backpack electrofishing at 4 sites downstream of Crocker Pond in Jul 2010 and except for the most upstream site (SampleID 3384), multiple age classes of Eastern brook trout were collected (Sample IDs 3383, 3382, and 3381); this stream will be assessed as a Tier 1 Existing Use Cold Water Fishery. All 4 sites were dominated by fluvial species. MassDEP staff conducted sampling ~200 ft downstr. of Rt 2A, Westminster (MAP2-030) in summer 2011. Benthic data (B0712) will be used in a future reporting cycle. Barge electrofishing (SampleID 4580) yielded 3 fluvial species (no Eastern brook trout, beaver activity noted). The non-native aquatic macrophyte, *M. heterophyllum*, was present. Data summary (W2190): (three 4-day probe deploys) minimum DO 6.5 mg/L, maximum saturation 99%, maximum diel DO shift 1.4 mg/L. Maximum 7DADM temp 26.7 °C (111 cold water exceedances during thermistor deployment 12 May - 6 Oct) and maximum 24-hr average 26.0 °C; both acute and chronic Tier 1 cold water violations. pH ranged 6.4-6.7 SU (n=6). TP seasonal average low (0.014 mg/L) with one observation dense/very dense filamentous algae. Ammonia concentrations low (≤0.03 mg/L, n=5), no violations acute metals criteria (3 clean metal surveys) but 1 lead exceedance of chronic criterion (1.82 TU) in July.

The Aquatic Life Use for the Whitman River (MA81-11) is assessed as Not Supporting for Non-Native Aquatic Plants (due to presence of *M. heterophyllum*; no species-specific code available), elevated Temperature above Tier 1 cold water criteria, and Lead chronic criteria exceedances. New Alert for copper chronic exceedances. All other data indicative of good conditions.

Whitmanville Reservoir (MA81109)

Location:	Westminster/Ashburnham.
AU Type:	FRESHWATER LAKE
AU Size:	107 ACRES
Classification/Qualifier:	B

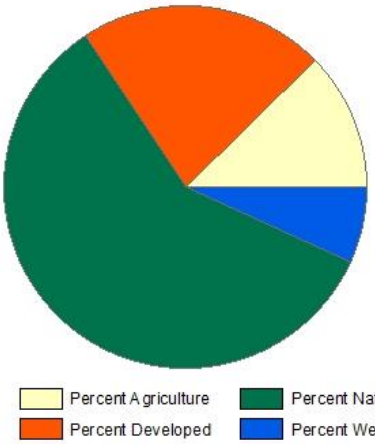
Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Whitmanville Reservoir (MA81109) is Not Assessed due to the absence of recent data.

Wilder Brook (MA81-43)

Location:	Headwaters west of Osgood Road, Sterling to mouth at confluence with Stillwater River, Sterling.
AU Type:	RIVER
AU Size:	2.3 MILES
Classification/Qualifier:	A: PWS, ORW (Tributary)

Wilder Brook - MA81-43

Watershed Area: 1.19 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.19	1.19	0.75	0.75
Agriculture	12.3%	12.3%	8.4%	8.4%
Developed	22%	22%	18.3%	18.3%
Natural	58.9%	58.9%	63.1%	63.1%
Wetland	6.8%	6.8%	10.1%	10.1%
Impervious Cover	5.8%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)

MassDFG biologists briefly attempted to conduct backpack electrofishing in Wilder Brook near the Beaman Rd crossing in Sterling in July 2006 (Sample ID 1909). Field sheet comments read "sampled short distance, no fish." MassDCR staff conducted limited water quality monitoring further downstream at the Wilder Rd crossing (Station M100) in 2008. Only two temperature measurements were recorded during the summer index period with a maximum of 14.0 ˚C. Specific conductance was measured 30 times throughout the year and the maximum was relatively low at 193 µS/cm.

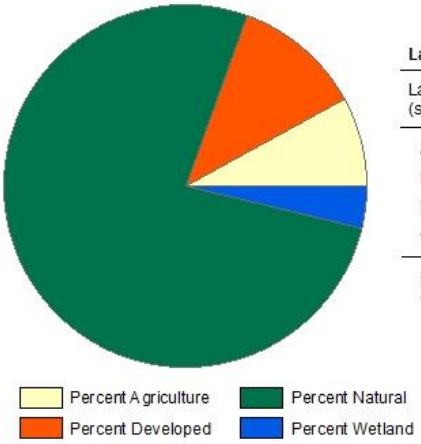
Given limited data on biological integrity and water quality in Wilder Brook (MA81-43), there is Insufficient Information to assess its Aquatic Life Use. There are no dams on Wilder Brook and although the sub-watershed is relatively small (1.2 sq mi), the lack of fish in the 2006 sample is concerning, so an Alert is being issued.

WILLARD BROOK (MA81-79)

Location:	Headwaters, outlet Fitchburg Reservoir, Ashby to mouth at confluence with Mason Brook forming headwaters Squannacook River, Townsend (excluding the approximate 0.3 mile through Ashby Reservoir, segment MA81001).
AU Type:	RIVER
AU Size:	6.2 MILES
Classification/Qualifier:	B: ORW

WILLARD BROOK - MA81-79

Watershed Area: 17.18 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	15.47	7.16	5.08	2.29
Agriculture	7.9%	7.1%	5.8%	6.8%
Developed	11.5%	12.9%	9.6%	9.6%
Natural	76.8%	76.6%	77.7%	77.1%
Wetland	3.8%	3.5%	7%	6.6%
Impervious Cover	4.2%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)

Willard Brook is a CFR stream that begins at the outlet of Fitchburg Reservoir (MA81043), a surface water supply for the City of Fitchburg. Fitchburg Reservoir has two outlets: on the northeast, to Willard Brook; and on the south, to Falulah Brook (MA81-99). Fitchburg Reservoir is actively managed to release water, under routine conditions, through the gatehouse on the southern end of the reservoir into Falulah Brook to fill Lovell Reservoir. Although the spillway crest on the northern dam is lower than that on the southern dam, and flow would naturally be to Willard Brook, the normal pool height is usually at or below the northern spillway height, so flow over the northern spillway is typically associated only with elevated pool level (precipitation events, snow melts, etc., i.e., high pool elevation conditions). MassDFG biologists conducted backpack electrofishing at 2 locations in the upper half of the AU (in Ashby) in July 2006: upstream of Richardson Rd (between Fitchburg Res. and Ashby Res., Sample ID 1546) and adjacent to Valley Rd (downstream of Ashby reservoir; Sample ID 1547). At the most upstream location (between the 2 reservoirs) only 1 white sucker was captured- staff noted that the brook was very shallow and looked like it might dry up during the summer months. This is likely influenced by operations at the Fitchburg Reservoir, as noted above. The Valley Rd sample (n=128) was dominated by fluvial species (blacknose dace, fallfish) but did not contain any cold water species. Near the downstream end of the brook, DFG staff conducted backpack electrofishing from a dirt road off West Meadow Rd in Townsend (Sample ID 136) in Aug 2000. The same two fluvial species were again most numerous in the sample (total n=76) but multiple age classes of the intolerant cold water species, Eastern brook trout (3

individuals) and brown trout (3 individuals) were also collected. Given the presence of reproducing brook trout, Willard Brook is considered a Tier 1 Existing Use Cold Water Fishery. MassDEP staff conducted water quality monitoring at West Meadow Road, Townsend (Site W1832) during summer 2008. A multiprobe was deployed to measure continuous temperature and DO data for two 46-hour periods (in June & August) and one 5-day period (in September). The minimum DO from all 3 deploys was 7.33 mg/L, with a maximum diel shift of 0.99 mg/L and maximum saturation of 99.6% (no indication of enrichment). Although the maximum temps for the Aug and Sept deploys were <20.0 °C, 51 of 94 half-hour measurements in the June deploy were >22.0 °C (maximum 25.0 °C). The maximum 24-hour rolling average temp was 22.7 °C (not an acute exceedance). Discrete probe data for DO and pH did not violate criteria, but 3 of 7 temp measurements were >20.0 °C and 2 of these were >22.0 °C (maximum 23.1 ^{o}C). The total phosphorus seasonal average was 0.01 mg/L (n=5; maximum 0.014 mg/L) and there were no violations of ammonia criteria (n=5). There were no observations of excessive filamentous algae. Although DFG identifies Willard Brook as a CFR stream, the historic information that supported this decision was limited, with the exception of several cold water fish captured near the mouth of this 6.2 mile-long AU. Currently, there is Insufficient Information to assess the Aquatic Life Use for Willard Brook (MA81-79). However, this use is being identified with an Alert status due to 1) the lack of a cold water fish assemblage in the upstream portion of the brook, 2) instances of low flow in the upstream portion of the brook likely due to flow release practices at Fitchburg Reservoir, and 3) elevated temperature documented in a 46-hr probe deploy (exceeding existing use cold water criteria) at the downstream station (West Meadow Rd, Townsend). Recommendations will be made for further monitoring.

Winnekeag Lake (MA81157)

Location:	Ashburnham.
AU Type:	FRESHWATER LAKE
AU Size:	113 ACRES
Classification/Qualifier:	B

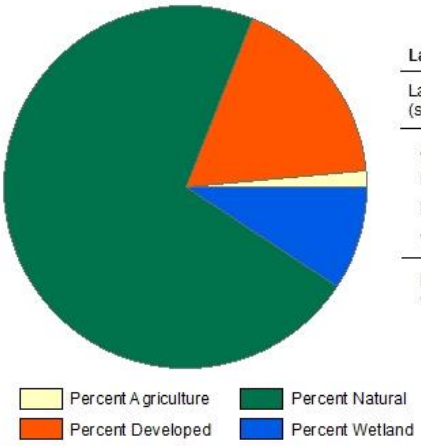
Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Winnekeag Lake (MA81157) is Not Assessed since no recent data are available.

WITCH BROOK (MA81-75)

Location:	Headwaters, outlet small unnamed pond west of Pierce Road, Townsend to mouth at confluence with Squannacook River (backwater area), Townsend.
AU Type:	RIVER
AU Size:	2.5 MILES
Classification/Qualifier:	B: ORW

WITCH BROOK - MA81-75

Watershed Area: 3.74 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	3.74	3.74	0.72	0.72
Agriculture	1.5%	1.5%	0.6%	0.6%
Developed	17.4%	17.4%	12%	12%
Natural	71.8%	71.8%	72.2%	72.2%
Wetland	9.3%	9.3%	15.2%	15.2%
Impervious Cover	5.6%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

MassDFG staff collected 6 bacteria samples in the downstream half of Witch Brook at the Warren Rd crossing, Townsend during summer 2008 (Unique ID W1845). There were no observations of excessive filamentous algae during these surveys. MassDFG biologists conducted backpack electrofishing downstream of Warren Road, Townsend (Sample ID 847), in July 2003. The sample (n=11) was dominated by macrohabitat generalists (91%), including two intolerant swamp darters and six moderately tolerant chain pickerel. Staff identified this reach as low gradient. Due to the age of the one fish sample collected in Witch Brook (MA81-75), there is Insufficient Information to assess the Aquatic Life Use.

Wright Pond (MA81159)

Location:	**[West Basin] Ashby.**
AU Type:	**FRESHWATER LAKE**
AU Size:	**21 ACRES**
Classification/Qualifier:	**B: ORW**

Aka Fitchburg Rod and Gun Club Pond, Upper Wrights Pond

Fish, other Aquatic Life and Wildlife Use: Not Assessed
The Aquatic Life Use for Wright Pond (MA81159) is Not Assessed due to the absence of recent data.

Wyman Pond (MA81161)

Location:	Westminster.
AU Type:	FRESHWATER LAKE
AU Size:	198 ACRES
Classification/Qualifier:	A: PWS, ORW

Wyman Pond is also known as Smith Reservoir.

Fish, other Aquatic Life and Wildlife Use: Not Supporting
As noted previously, the non-native aquatic macrophyte, variable milfoil (*Myriophyllum heterophyllum*), was identified in Wyman Pond during a 1998 synoptic survey conducted by MassDEP biologists. The Aquatic Life Use for Wyman Pond (MA81161) remains assessed as Not Supporting for Non-Native Aquatic Plants based on the presence of the non-native, variable milfoil (*Myriophyllum heterophyllum*).

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