MASSACHUSETTS watershed·based plans

WATERSHED-BASED PLAN

Upper Manhan River (MA34-11)

(HUC-12 watershed 010802010608)

September 2024

Prepared By:

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Prepared For:

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

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Contents

Executive Summary

Introduction: The purpose of a Massachusetts Watershed-Based Plan (WBP) is to organize information about Massachusetts' watersheds and present the information in a format that will enhance the development and implementation of projects that will restore water quality and beneficial uses in the Commonwealth. The Massachusetts WBP follows the United States Environmental Protection Agency's (USEPA's) recommended format for "nine-element" watershed plans. This WBP was developed by Geosyntec Consultants, Inc. (Geosyntec) under the direction of the Massachusetts Association of Conservation Districts (MACD) with funding, input, and collaboration from the Massachusetts Department of Environmental Protection (MassDEP).

This WBP focuses on the Upper Manhan River watershed located within the towns of Southampton, Westfield, Montgomery, Westhampton, Huntington, and Easthampton (12-digit hydrologic unit code [HUC-12] watershed 010802010608). The total area of the Upper Manhan River watershed is approximately 23,249 acres (36.3 square miles). The Upper Manhan River watershed has also been designated as a National Water Quality Initiative (NWQI) watershed[1]. This WBP is focused on the area downstream of the Tighe Carmody Reservoir (MA34089), which serves as the public drinking water supply for the City of Holyoke, Massachusetts. Major streams in the watershed include Manhan River (MA34-11), Moose Brook (MA34-17), Tripple Brook (MA34-16), Sacket Brook (MA34-45), Brickyard Brook (MA34-13), Red Brook (MA34-92), and Potash Brook (MA34-12). The discharge point of the watershed is at the location just upstream of where the North Branch Manhan River enters the Manhan River.

Impairments and Pollution Sources: Manhan River (MA34-11) is a category 5 water body on the 2022 Massachusetts Integrated List of Waters (303(d) list) due to *Escherichia coli* (*E. coli*) from unknown sources and Water Chestnut from accidental or non-accidental introduction of non-native organisms. Data available from 2008 indicated elevated levels of *E. coli* [above the Massachusetts Water Quality Standards] and elevated levels of Total Phosphorus (TP) [above the USEPA Gold Book Standard] at two locations in the watershed. Data available from 2016 and 2022 also indicated elevated levels of *E. coli* at various locations in the watershed. A study conducted by the Pioneer Valley Planning Commission (PVPC) identified agricultural runoff as potential pollution sources to Moose Brook, Potash Brook, and Manhan River in the Whittemore Conservation Area. MS4 discharges and beaver activity have also been identified as additional pollution sources in the Upper Manhan River watershed.

Goals, Management Measures, and Funding: The long-term goal of this WBP is to reduce *E. coli* and Total Phosphorus (TP) loading to the Upper Manhan River watershed, eventually leading to delisting of the Manhan River from the 303(d) list. It is expected that these pollutant load reductions will result in improvements to other water quality parameters throughout the watershed as well.

It is expected that these goals will be accomplished primarily through installation of structural and non-structural best management practices (BMPs) to capture runoff and reduce *E. coli* loading as well as implementation of watershed education and outreach to achieve additional pollutant load reductions. MACD was a recipient of Clean Water Act (CWA) Section 319 funding in Fiscal Year 2022 for its Agricultural Nonpoint Source Regional Coordinators for Franklin, Hampshire, Hampden Counties program. Under this project, MACD is supporting the Massachusetts Nonpoint Source Program through regional agricultural coordinators.

[1] https://www.nrcs.usda.gov/programs-initiatives/national-water-quality-initiative

The coordinators focus their efforts to restore impaired waters and protect unimpaired/high quality and threatened waters within Western Massachusetts watersheds including the Upper Manhan River watershed.

It is expected that future funding for management measures will be obtained from a variety of sources including CWA Section 319 Grant Funding, Massachusetts Environmental Trust (MET) grants, Massachusetts Department of Agricultural Resources (MDAR) [such as the Climate Smart Agricultural Program (CSAP) and the Agricultural Produce Safety Improvement Program (APSIP)], Town capital funds, volunteer efforts, and United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) programs including the Environmental Quality Incentives Program (EQIP) and the Agricultural Management Assistance (AMA) program.

Public Education and Outreach: Goals of public education and outreach are to provide information about farm conservation plans and agricultural BMPs and their anticipated benefit to farm operations as well as water quality benefits; provide information to farmers on funding resources for BMP implementation; provide information to all residents within the watershed to promote watershed stewardship; provide information to all residents in the watershed about proposed stormwater improvements and their anticipated water quality benefits; and to meet Massachusetts Small MS4 Permit Requirements.

Two stakeholder meetings were held on November 3, 2023, and March 21, 2024, which included core stakeholders in the Upper Manhan River watershed. The purpose of these meetings was to introduce stakeholders to one another and gain consensus on elements of this WBP.

Implementation Schedule and Evaluation Criteria: The implementation schedule includes milestones for monitoring, farmer outreach for implementation of structural and non-structural BMPs, public education and outreach, and plan updates.

As part of the NWQI program, MassDEP started monitoring the Upper Manhan River watershed in 2024, which includes sampling at key locations along the Upper Manhan River and tributaries for at least the next four years. This will help achieve a better understanding of water quality trends in the Upper Manhan River including determining sources of pollution, evaluating the effectiveness of implemented BMPs, and tracking compliance with the water quality goals identified in this WBP.

This WBP is meant to be a living document, re-evaluated at least once every three years and adjusted as needed based on ongoing efforts (e.g., based on monitoring results, funding, etc.). It is recommended that a working group of watershed stakeholders be established to meet at least biannually to implement and update this WBP, and track progress. A stakeholder should also be designated for maintaining this plan and coordinating periodic plan evaluations and updates.

Introduction

What is a Watershed-Based Plan?

Purpose & Need

The purpose of a Massachusetts Watershed-Based Plan (WBP) is to organize information about Massachusetts' watersheds and present the information in a format that will enhance the development and implementation of projects that will restore water quality and beneficial uses in the Commonwealth. The Massachusetts WBP follows the United States Environmental Protection Agency's (USEPA's) recommended format for "nine-element" watershed plans, as described below.

All states are required to develop WBPs, but not all states have taken the same approach. Most states develop WBPs only for selected watersheds. Massachusetts Department of Environmental Protection's (MassDEP's) approach has been to develop a tool to support statewide development of WBPs, so **that good projects in all areas of the state may be eligible for federal watershed implementation grant funds** under Section 319 of the Clean Water Act.

USEPA guidelines promote the use of Section 319 funding for developing and implementing WBPs. WBPs are required for all projects implemented with Section 319 funds, and are recommended for all watershed projects, whether they are designed to protect unimpaired waters, restore impaired waters, or both.

Watershed-Based Plan Outline

This WBP for the Upper Manhan River watershed includes nine elements (a through i) in accordance with USEPA Guidelines:

a) An **identification of the causes and sources** or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this WBP (and to achieve any other watershed goals identified in the WBP), as discussed in item (b) immediately below.

b) An **estimate of the load reductions** expected for the management measures described under paragraph (c) below (recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time).

c) A **description of the nonpoint source management measures** needed to achieve the load reductions estimated under paragraph (b) above (as well as to achieve other watershed goals identified in this WBP), and an identification (using a map or a description) of the critical areas in which those measures will be needed to implement this plan.

d) An **estimate of the amounts of technical and financial assistance needed**, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan. As sources of funding, States should consider the use of their Section 319 programs, State Revolving Funds, United States Department of Agriculture's (USDA's) Environmental Quality Incentives Program (EQIP) and Conservation Reserve Program, and other relevant Federal, State, local and private funds that may be available to assist in implementing this plan.

e) An **information/education component** that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.

f) A **schedule for implementing the nonpoint source management measures** identified in this plan that is reasonably expeditious.

g) A description of **interim, measurable milestones** for determining whether nonpoint source management measures or other control actions are being implemented.

h) A set of **criteria to determine if loading reductions are being achieved** over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether this WBP needs to be revised or, if a nonpoint source total maximum daily load (TMDL) has been established, whether the TMDL needs to be revised.

i) A **monitoring component** to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) immediately above.

Project Partners and Stakeholder Input

This WBP was developed by Geosyntec under the direction of the Massachusetts Association of Conservation Districts (MACD) with funding, input, and collaboration from MassDEP, with funding from the Section 319 program. MACD was a recipient of Section 319 funding in Fiscal Year 2022 for its Agricultural Nonpoint Source Regional Coordinators for Franklin, Hampshire, Hampden Counties program. Under this program, MACD is supporting the Massachusetts Nonpoint Source Program through regional agricultural coordinators. The coordinators focus their efforts to restore impaired waters and protect unimpaired/high quality and threatened waters within Western Massachusetts watersheds including the Upper Manhan watershed.

The following are core Upper Manhan WBP stakeholders:

- Michael Leff – MACD
- Judith Rondeau – MassDEP
- Meghan Selby – MassDEP
- Malcolm Harper – MassDEP
- Therese Beaudoin – MassDEP
- Padmini Das – MassDEP
- Catherine Magee – USDA Natural Resources Conservation Service (NRCS)
- Sylvia Muniz-Gaya – USDA NRCS
- Mark Defley – USDA NRCS
- Michelle Cozine – USDA NRCS
- Tom Andrew – Holyoke Water Works
- Edwin Mator – Holyoke Water Works
- Gerrit Stover – Pascommuck Conservation Trust
- Dianne McLane – Pascommuck Conservation Trust
- Randall Kemp – Southampton Highway Department and Southampton Agricultural Commission
- Ryan O'Donnell – Connecticut River Conservancy (CRC)
- Bridget Likely – Kestrel Land Trust
- Patty Gambarini – Pioneer Valley Planning Commission (PVPC)
- Cassie Tragert – City of Easthampton Conservation Commission

- Matthew Karas—Hampden Hampshire Conservation District (HHCD)

This WBP was developed as part of an iterative process as outlined below:

- The Geosyntec project team first collected and reviewed existing data from MACD and other available sources.
- Subsequently, two stakeholder meetings were held on November 3rd, 2023, and March 21st, 2024, to solicit additional input and gain consensus on elements included in the plan (identifying problem areas, BMP projects, water quality goals, public outreach activities, etc.). The meeting minutes from the stakeholder conference calls are included in **Appendix A**.
    - A National Water Quality Initiative (NWQI) watershed assessment for the Upper Manhan watershed is also being developed. The November stakeholder meeting focused on the NWQI, while the March meeting addressed both the NWQI and the WBP. Meeting minutes from both meetings are included in **Appendix A**.
- Next, a WBP was drafted and reviewed by MACD.
- The WBP was updated and finalized based on MACD input and submitted to MassDEP for review.

This WBP is meant to be a living document. It should be reevaluated at least once every three years and adjusted as needed based on ongoing efforts (e.g., based on monitoring results, 319 funding). It is strongly recommended that a working group including the stakeholders listed above and possibly additional stakeholders be established to meet at least biannually to implement and update this WBP, and track progress.

Data Sources

This WBP was developed using the framework and data sources provided by MassDEP's WBP Tool and supplemented by information provided in the Section 319 grant application for "Agricultural Nonpoint Source Regional Coordinators for Franklin, Hampshire, Hampden Counties" (MACD, 2021). Additional data sources were reviewed and are included in subsequent sections of this WBP.

Element A: Identify Causes of Impairment & Pollution Sources

Element A: Identify the causes and sources or groups of similar sources that need to be controlled to achieve the necessary pollutant load reductions estimated in the watershed based plan (WBP).

General Watershed Information

This WBP focuses on the Upper Manhan River watershed located within the towns of Southampton, Westfield, Montgomery, Westhampton, Huntington, and Easthampton (12-digit hydrologic unit code [HUC-12] watershed 010802010608). The watershed is located within Hampshire County, except for the portion located in Westfield and Montgomery, which is in Hampden County. The Upper Manhan River watershed is within the larger 8-digit hydrologic unit code (HUC-8) 01080201 (Middle Connecticut) drainage area.

The discharge point of the Upper Manhan watershed is the location where the North Branch Manhan River enters the Manhan River on the border of Easthampton and Southampton. The Manhan River continues from this point for approximately four miles through the City of Easthampton before discharging into "The Oxbow" and then into the Connecticut River.

The headwaters of the Manhan River begins near the boundary between the towns of Huntington and Westhampton and flows southeast to the White Reservoir and onto the Tighe Carmody Reservoir.

The White Reservoir is owned by Holyoke Water Works and was reportedly drained more than 35 years ago; it only holds water when there is heavy rain and debris clogs drainage infrastructure (Masslive 2008). The 2020 Municipal Vulnerability Preparedness Program for the Town of Southampton recommended conducting a dam assessment and dam removal feasibility study for the White Reservoir dam (Fuss & O'Neill 2021).

The Tighe Carmody Reservoir is located within Southampton, is owned and operated by the Holyoke Water Works, and supplies the drinking water to the City of Holyoke, Massachusetts. The Reservoir has an impound capacity of 4.825 billion gallons and a safe yield of 13.0 million gallons of water per day. The Tighe-Carmody Reservoir dam is an earthen embankment type structure, with a structural height of 130 feet and an approximate length of 2,200 feet. The dam is classified by the Massachusetts Department of Conservation and Recreation (DCR) as a large size structure and a High (Class I) hazard dam (HWW 2024).

In the Fall of 2022, the Manhan River Restoration project was completed, which involved removal of the Lyman Pond Dam, located on the Manhan River mainstem in Southampton close to where the river intersects with Route 10. The dam removal helped to restore connectivity to approximately 27 miles of river habitat upstream (including the Manhan River mainstem and tributaries). Much of the watershed upstream of the former dam has been designated Core Habitat or Critical Natural Landscape by the Natural Heritage and Endangered Species Program (MassDER 2023).

The main tributaries to the Manhan River impaired segment (MA34-11, downstream of the Tighe Carmody Reservoir) are Red Brook, Sacket Brook, Brickyard Brook, Moose Brook, Potash Brook, and Tripple Brook.

Areas of the watershed in Southampton, Easthampton, and Westfield include municipal separate storm sewer system (MS4). The Town of Southampton, the City of Easthampton, and the City of Westfield are therefore both permitted under the 2016 Massachusetts Small MS4 General Permit[2]. **Appendix B** includes the MS4 area within Southampton, Westfield, and Easthampton.

Table A-1 presents the general watershed information for the Upper Manhan watershed and **Figure A-1** includes a map of the watershed boundary.

Table A-1: Upper Manhan River General Watershed Information

Waterbody Name (Assessment Unit ID):	Manhan River (MA34-11) Tighe Carmody Reservoir (MA34089) White Reservoir Moose Brook (MA34-17) Tripple Brook (MA34-16) Sacket Brook (MA34-45) Brickyard Brook (MA34-13) Red Brook (MA34-92) Potash Brook (MA34-12)
Major Basin:	Connecticut
Watershed Area:	23,249 acres (36.3 square miles)

[2] https://www.epa.gov/npdes-permits/massachusetts-small-ms4-general-permit

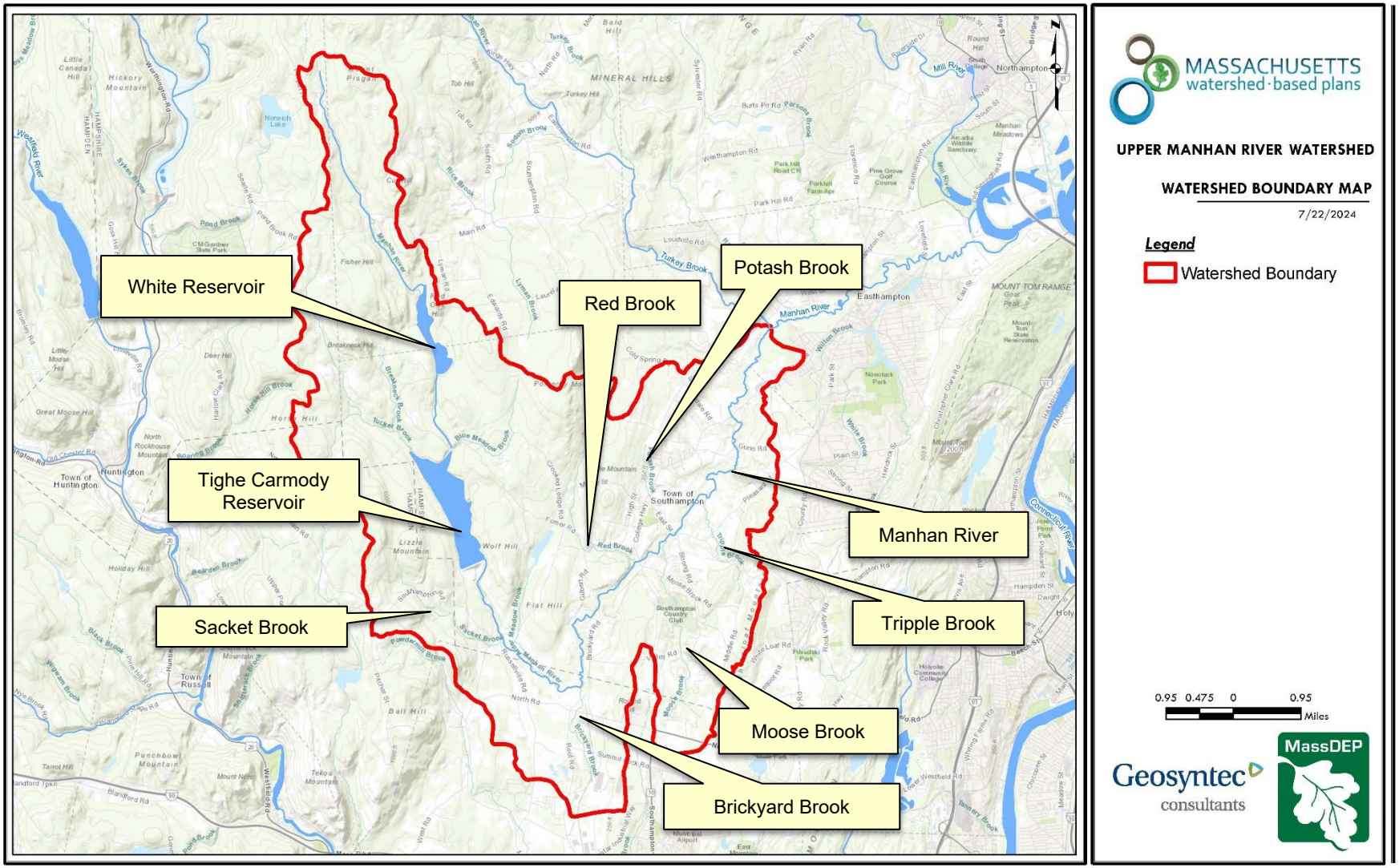


Figure A-1: Upper Manhan River Watershed Boundary Map
(MassGIS, 2007; MassGIS, 1999; MassGIS, 2001; USGS, 2016)
Ctrl + Click on the map to view a full-sized image in your web browser.

MassDEP Water Quality Assessment Report and TMDL Review

The section below summarizes the findings of the available Water Quality Assessment Reports and/or TMDLs that relate to water quality and water quality impairments.

The following water quality assessment report is available:

- Connecticut River Watershed 2003 Water Quality Assessment Report (MassDEP, 2008)

The Upper Manhan watershed does not have a TMDL[3]. Select excerpts from the water quality assessment report relating to the water quality in the Upper Manhan watershed are included in **Appendix C** (note: relevant information is included directly from this document for informational purposes and has not been modified).

Water Quality 303 (d) List Impairments

Impairment categories from the MassDEP 2022 Massachusetts Integrated List of Waters (303(d) List) (MassDEP, 2023a) are listed in **Table A-2**. Known water quality impairments, as documented in the 2022 303(d) List are illustrated in **Figure A-2** and listed in **Table A-3**, which indicates that the Manhan River (MA34-11) is identified as a category 5 waterbody due to Escherichia coli (*E. coli*) and Water Chestnut (*Trapa natans*). The source of the *E. coli* impairment is listed as unknown, and the source of the Water Chestnut impairment is listed as accidental or intentional introduction of non-native organisms. The Manhan River segment (MA34-11), with these listed impairments, extends from the outlet of Tighe Carmody Reservoir to the confluence at the Connecticut River. The portion of the Manhan River segment (MA34-11) from the outlet of Tighe Carmody Reservoir to the confluence with the North Branch Manhan River is within the Upper Manhan River watershed.

Table A-2: 2022 Massachusetts Integrated List of Waters Categories

Integrated List Category	Description
1	Unimpaired and not threatened for all designated uses.
2	Unimpaired for some uses and not assessed for others.
3	Insufficient information to make assessments for any uses.
4	Impaired or threatened for one or more uses, but not requiring calculation of a Total Maximum Daily Load (TMDL), including: 4a: TMDL is completed 4b: Impairment controlled by alternative pollution control requirements 4c: Impairment not caused by a pollutant - TMDL not required
5	Impaired or threatened for one or more uses and requiring preparation of a TMDL.

[3] The Upper Manhan River is part of the Connecticut River watershed; the Connecticut River flows into the Long Island Sound. The Long Island Sound has a TMDL: "A Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound".

Additionally, the "DRAFT Massachusetts Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies" (MassDEP, 2024a) includes segments within the Upper Manhan River watershed. This WBP should be updated with information from this TMDL after the TMDL is finalized.

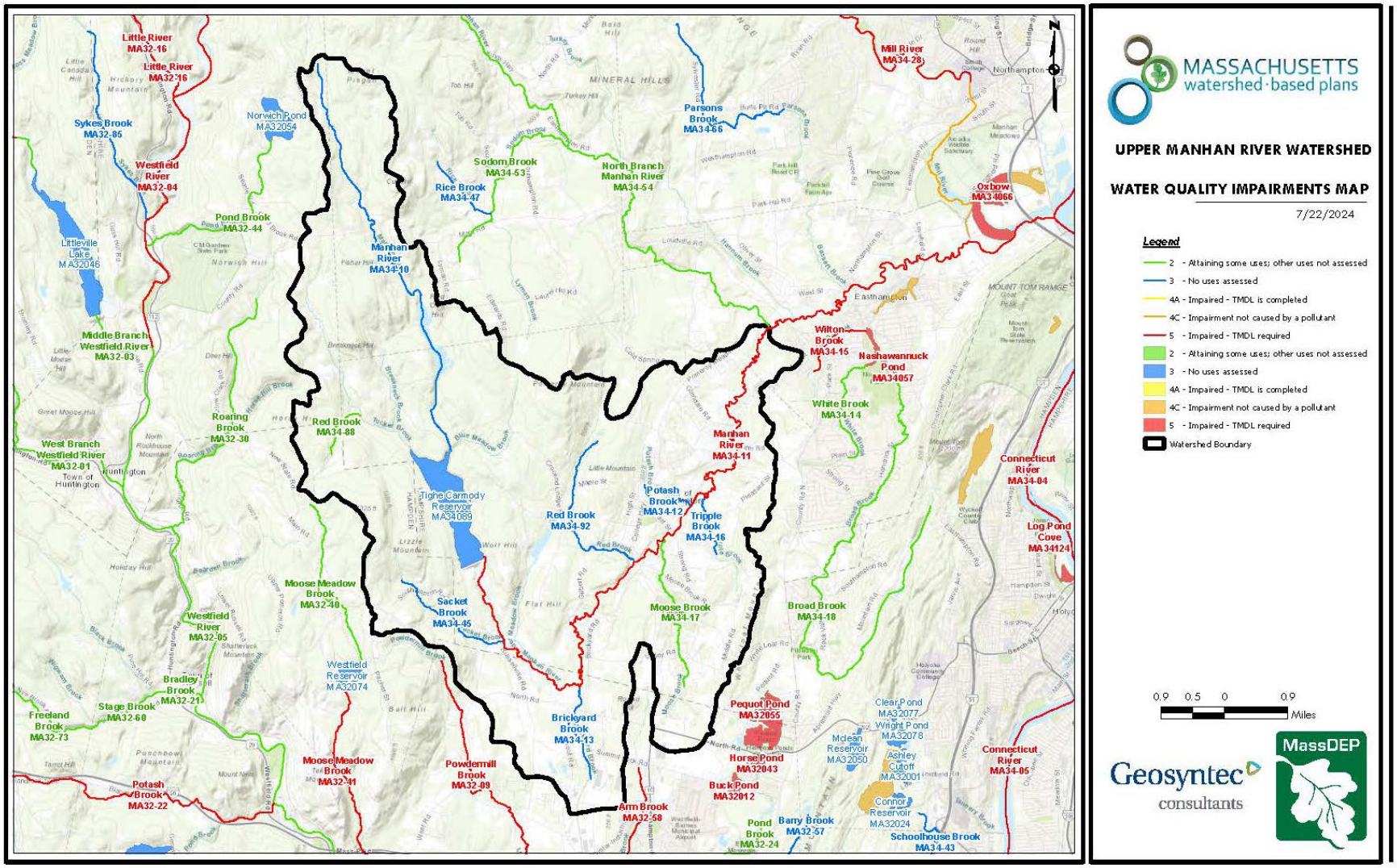


Figure A-2: Upper Manhan River Watershed Water Quality Impairments Map
(MassGIS, 2022a; MassGIS, 2022b; ESRI et al., 2023)

Table A-3: Water Quality Impairments (MassDEP, 2023a)

Assessment Unit ID	Waterbody	Integrated List Category	Designated Use	Impairment Cause	Suspected Impairment Source
MA34-11	Manhan River	5	Primary Contact Recreation	Escherichia Coli (*E. coli*)	Source Unknown
			Fish, other Aquatic Life and Wildlife	Water Chestnut	Introduction of Non-Native Organisms (Accidental or Non-Accidental)

November 3rd, 2023, and March 21st, 2024, Stakeholder Meeting Pollutant Sources Identification

The main potential pollution sources in the Upper Manhan River watershed that were discussed during the two stakeholder meetings included:

- Runoff from agricultural properties (particularly cattle pastures in the Moose Brook and the Potash Brook subwatersheds)
- Beaver activity
- MS4 discharges

Water Quality Data

MassDEP Water Quality Monitoring Program Data

Historical and current Technical Memoranda (TM) produced by the MassDEP Watershed Planning (WPP) Program are organized by major watersheds in Massachusetts. Most of these TMs present the water chemistry and biological sampling results of WPP monitoring surveys. Many of these TMs have helped inform Clean Water Act 305(b) assessment and 303(d) listing decisions (MassDEP 2023b).

MassDEP WPP Water quality monitoring data for *E. coli* and TP was available for two locations within the impaired segment of the Manhan River (MA34-11) within the Upper Manhan River watershed for the year 2008 (MassDEP 2023b). Data was also available from 2014 for one location approximately 2.2 miles upstream of the Tighe Carmody Reservoir.

The *E. coli* data is presented in Table A-4. The 2008 data for the two locations downstream of the Tighe Carmody Reservoir showed exceedances of the Massachusetts Surface Water Quality Standards (MSWQS) (MassDEP, 2021) for *E. coli*, which states that E. coli concentrations shall not exceed 126 colony-forming units per 100 milliliters (CFU/100mL), calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and no more than 10 percent of all such samples shall exceed 410 CFU/100 mL (a statistical threshold value). The *E. coli* data for the location upstream of the reservoir (from 2014) did not show any exceedances of the MSWQS.

Table A-4: MassDEP Water Quality Monitoring Program *E. coli* Data for Upper Manhan Watershed (MassDEP, 2023b)

Unique ID	Sampling Location	Date	*E. coli* (CFU/100 mL or MPN/100 mL)	90-Day Geometric Mean (CFU/100 mL or MPN/100 mL)	Geometric Mean Criterion Exceeded? (126 CFU/100 mL)	STV Criterion Exceeded? (410 CFU/100 mL)	Meets SWQS/Water Quality Goal?
W1787	Moose Brook at Moose Brook Road, Southampton	5/6/2008	12	12	No	No	Yes
		6/3/2008	12	12	No	No	Yes
		7/1/2008	30	16	No	No	Yes
		7/29/2008	20	17	No	No	Yes
		9/3/2008	50	31	No	No	Yes
		9/9/2008	4000	105	No	Yes	**No**
W1793	Manhan River at Gunn Road, Southampton	5/6/2008	24	24	No	No	Yes
		6/3/2008	32	28	No	No	Yes
		7/1/2008	20	25	No	No	Yes
		7/29/2008	130	38	No	No	Yes
		9/3/2008	50	51	No	No	Yes
		9/9/2008	1200	112	No	Yes	**No**
W2460	Tucker Brook, east of Sampson Road, Huntington (approximately 2.2 miles from the mouth at the inlet of Tighe Carmody Reservoir, Southampton)	5/15/2014	--	0	No	No	Yes
		6/11/2014	83	83	No	No	Yes
		7/15/2014	38	56	No	No	Yes
		8/7/2014	6	27	No	No	Yes
		9/3/2014	28	27	No	No	Yes

Sources: MassDEP, 2023b
"MPN/100 mL" = most probable number per 100 milliliters
"CFU/100 mL"= colony forming units per 100 milliliters
"STV" = statistical threshold value
"SWQS" = Massachusetts Surface Water Quality Standards (MassDEP 2021)
Samples taken samples taken in 2008 were reported in CFU/100 mL and those taken in 2014 were reported in MPN/100 mL

MassDEP WPP Water quality monitoring TP data was available for the same locations and dates as the *E. coli* data. The TP data is presented in **Table A-5** and indicated TP concentrations above the TP USEPA "Gold Book" (USEPA, 1986) standard of 50 micrograms per liter (µg/L) for rivers/streams in September 2008 at the two locations located downstream of the Tighe Carmody Reservoir. The 2014 data for the location upstream of the Tighe Carmody Reservoir did not have any exceedances of the TP standard.

Table A-5: MassDEP Water Quality Monitoring Program TP Data for Upper Manhan Watershed (MassDEP, 2023b)

Unique ID	Sampling Location	Date	*Total Phosphorous* (µg/)
W1787	Moose Brook at Moose Brook Road, Southampton	5/6/2008	16
		6/3/2008	22
		7/1/2008	24
		7/29/2008	30
		9/9/2008	**330**
W1793	Manhan River at Gun Road, Southampton	5/6/2008	14
		6/3/2008	21
		7/1/2008	23
		7/29/2008	33
		9/9/2008	**70**
W2460	Tucker Brook, east of Sampson Road, Huntington (approximately 2.2 miles from the mouth at the inlet of Tighe Carmody Reservoir, Southampton)	5/15/2014	--
		6/11/2014	24
		7/15/2014	32
		8/7/2014	14
		9/3/2014	20

Sources: MassDEP, 2023
"µg/L" = micrograms per Liter

MassDEP WPP Water quality monitoring temperature data was available for four locations downstream of the Tighe Carmody Reservoir and three locations upstream of the reservoir. Four of the locations also included DO data. These data are presented in **Table A-6** and do not indicate any exceedances of the MSWQS for DO and temperature (see water quality goals section below for the standards).

Table A-6: MassDEP Water Quality Monitoring Program Temperature and Dissolved Oxygen Data for Upper Manhan Watershed (MassDEP, 2023)

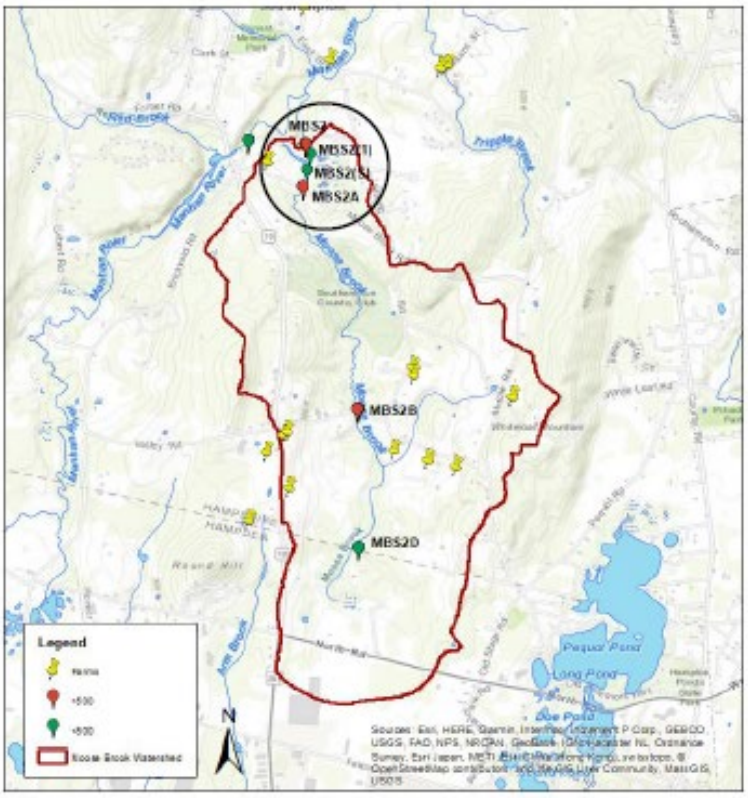
Unique ID	Sampling Location	Date	Temperature (Degrees Celsius)	Dissolved Oxygen (mg/L)
W1793	[Gunn Road, Southampton]	5/6/2008	13.2	10.4
		6/3/2008	18.2	9.5
		7/1/2008	20.8	9.1
		7/29/2008	22.8	7.9
		9/9/2008	18.2	8.2
W1787	[Moose Brook Road, Southampton]	5/6/2008	13.1	10.7
		6/3/2008	14.9	9.6
		7/1/2008	16.2	9.8
		7/29/2008	17.8	8.6
		9/9/2008	15.9	8.6
W2860	[off Riverdale Road, approximately 500 feet downstream from Gunn Road, Southampton]	10/23/2018	8.5	11.0
		12/4/2018	4.9	12.3
		2/6/2019	2.7	13.1
		4/4/2019	5.2	12.0
		6/5/2019	16.7	10.0
W2879	[Former Road, Southampton]	6/25/2019	19.3	--
		7/31/2019	21.7	--
		8/27/2019	^^	--
W2460	[east of Sampson Road, Huntington approximately 2.2 miles from the mouth at the inlet of Tighe Carmody Reservoir, Southampton]	8/7/2014	17.5	8.4
		9/3/2014	19.5	8.1
		9/30/2014	##	9.0
W2875	[west of Rhodes Road, approximately 475 feet upstream of Route 66 (Main Road), Westhampton]	6/25/2019	15.9	--
		7/31/2019	20.2	--
		8/27/2019	14.0	--
		9/25/2019	13.3	--
W2876	[approximately 850 feet upstream/north from Former Road crossing nearest Tighe Carmody Reservoir, Southampton]	6/25/2019	17.4	--
		7/31/2019	20.7	--
		8/27/2019	14.1	--
		9/25/2019	13.4	--

Pioneer Valley Planning Commission Bacterial Source Tracking

PVPC and its partners conducted *E. coli* water quality sampling during the Summer of 2016 in the Manhan River watershed as part of its bacterial source tracking project (PVPC 2018). Fifteen monitoring locations were selected, and of these, five of the locations were within the Upper Manhan River watershed. The most upstream sampling location was located slightly upstream of the confluence of Moose Brook with the Manhan River. The locations were selected based on mapping, site reconnaissance, and conversations with municipal officials and watershed stakeholders. Grab samples were collected during three dry and three wet weather events between July 12—September 20, 2016. Bacterial source tracking was conducted in June of 2017 based on the results of the monitoring that was conducted in 2016. Areas in the Upper Manhan River watershed that were identified for source tracking including Moose Brook and the Manhan mainstem at the Whittemore Conservation Area. Potash Brook sampling from 2016 also had consistent elevated levels of *E. coli* and the sources were determined to likely be from the cattle pasture located along Potash Brook and possibly beaver activity. See **Figure A-3**, **Figure A-4**, and **Figure A-5** for the locations and results of Moose Brook, Potash Brook, and Manhan River in the Whittemore Conservation Area.

Prior to PVPC's Manhan River bacterial source tracking project in 2018, there was not a clear understanding about the individual factors contributing to the *E. coli* impairment in the Manhan River. MassDEP's 2003 water quality assessment report (see **Appendix C**) noted that sources of potential contamination in the Manhan River were unknown and recommended further examination upstream (MassDEP 2003). Since MassDEP's 2003 study, many of the illicit discharges within the City of Easthampton that were found, which may have been potential sources for *E. coli* contamination, were resolved. Prior to the 2018 PVPC project, potential sources in the Upper Manhan River watershed had not been investigated as potential sources of *E. coli* contamination (PVPC 2018). The results of PVPC's bacterial source tracking project indicated that downstream water quality conditions in Easthampton have improved, while inputs from the Upper Manhan River watershed (particularly agricultural (livestock) land uses in Southampton) are potentially significant sources of *E. coli* contamination in the Manhan River (PVPC 2018).

2017 Moose Brook Source Tracking



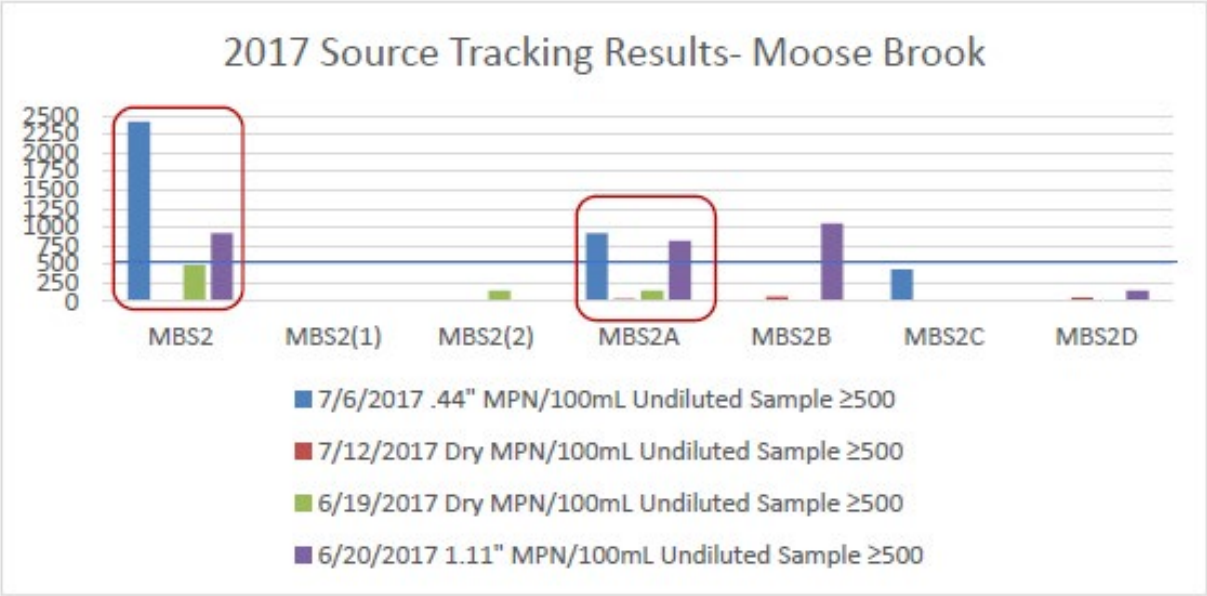


Figure A-3: Bacterial Source Tracking Results for Moose Brook (PVPC, 2018)

2017 Source Tracking – Potash Brook

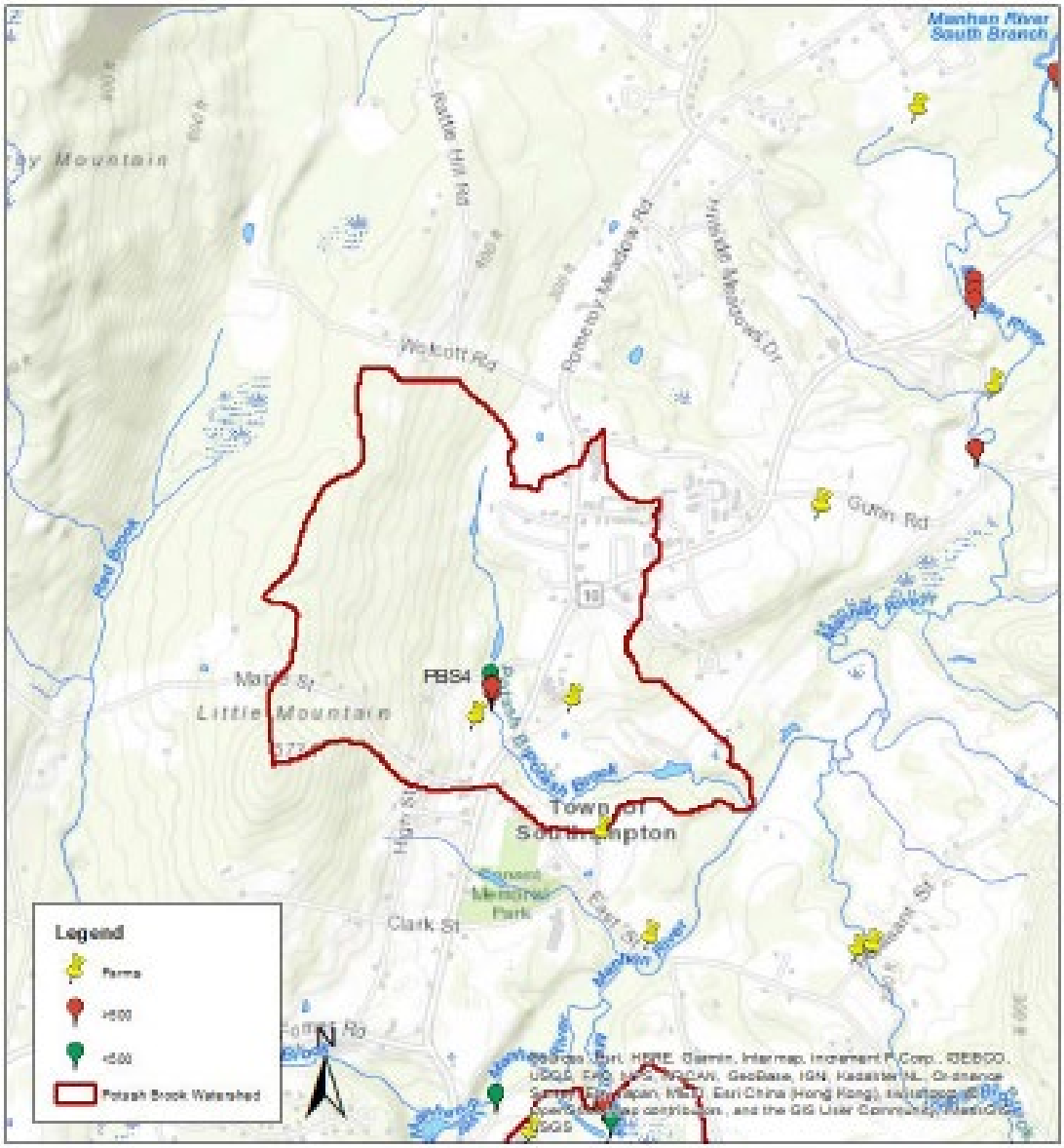
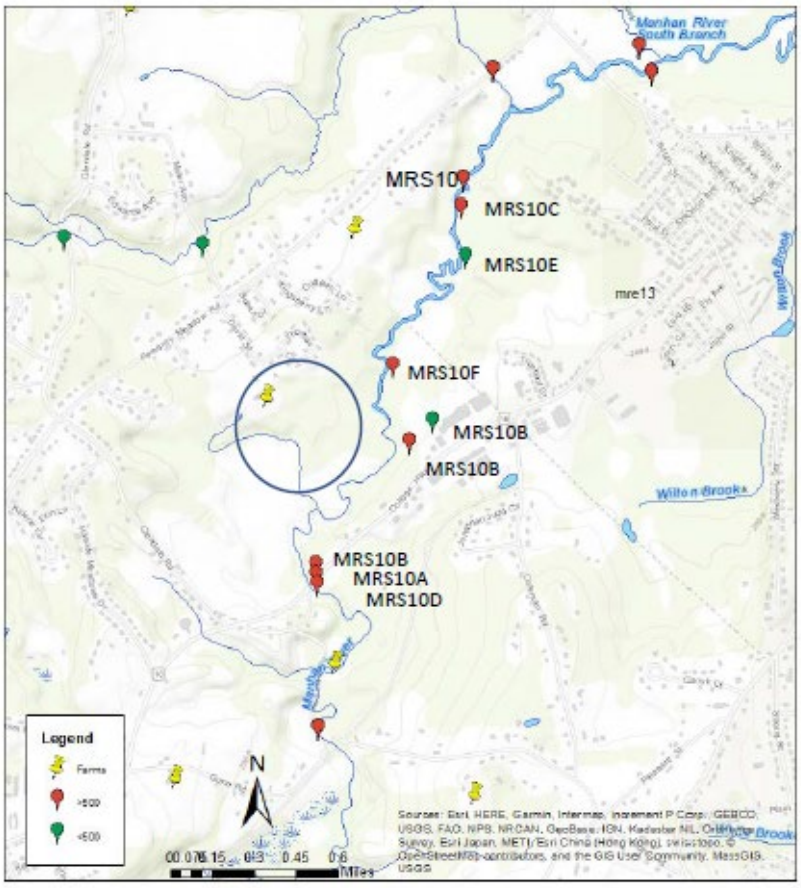


Figure A-4: Bacterial Source Tracking Results for Potash Brook (PVPC, 2018)

2017 Source Tracking - Whittemore Conservation Area



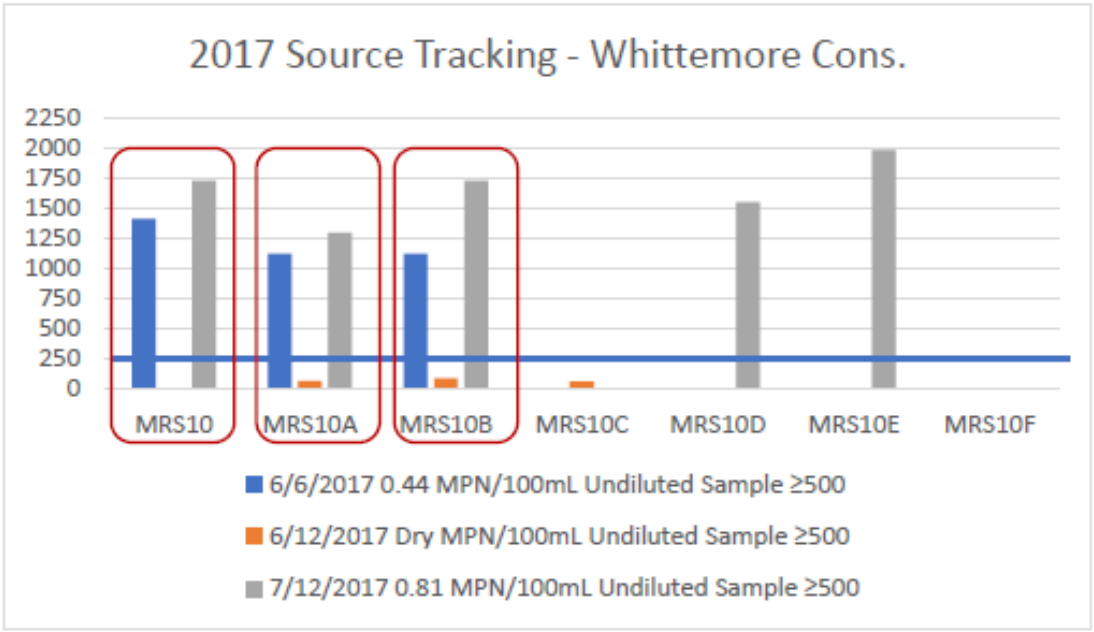


Figure A-5: Bacterial Source Tracking Results for Whittemore Conservation Area (PVPC, 2018)

Town of Southampton Outfall Monitoring Data

To address requirements of the 2016 Massachusetts Small MS4 General Permit, Southampton conducted dry weather flow outfall screening and sampling in 2020 and wet weather flow outfall screening and sampling in 2022.

Of the dry weather flow sampling that was conducted (on 4/23/2020) four of the outfalls were located within the Upper Manhan River watershed. These locations (5_OF, 6_OF, 7_OF, and 8_OF) are identified on **Figure A-6**. No location sampled during the dry weather outfall screening and sampling field effort met EPA's criteria for a likely sewer input and no *E. coli* was detected (Tighe and Bond, 2020).

Of the wet weather flow outfall screening that was conducted (on 9/13/2022) three of the outfalls were located within the Upper Manhan River watershed. These locations (5_OF, 6_OF, and 7_OF) are identified on **Figure A-6**. All three locations had elevated levels of *E. coli* above the MSWQS, which states that *E. coli* concentrations shall not exceed 126 colony-forming units per 100 milliliters (CFU/100mL), calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and no more than 10 percent of all such samples shall exceed 410 CFU/100 mL (a statistical threshold value) (Tighe and Bond, 2022a; MassDEP, 2021).

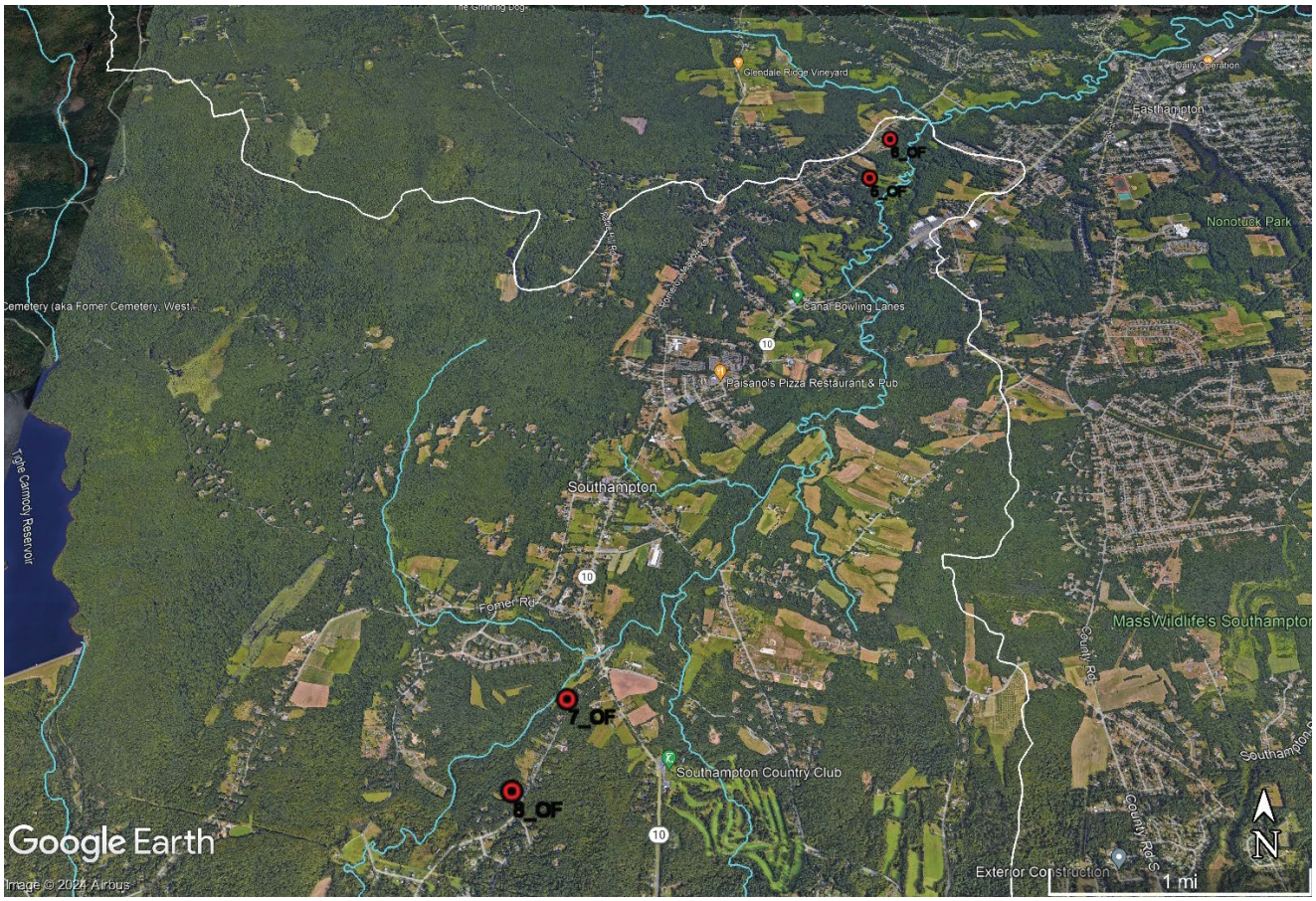


Figure A-6: Southampton Outfall Monitoring Locations 5_OF, 6_OF, 7_OF, and 8_OF

Water Quality Goals

Based on the impairments and water quality data identified above, the long-term water quality goal in the Upper Manhan watershed is to reduce bacterial and TP loading, so the watershed meets its designated uses for fish, other aquatic life, and wildlife; and primary contact recreation. Based on stakeholder input, a water quality goal is also included for temperature and dissolved oxygen (DO). The water quality goals are focused on the impaired segment of the Manhan River (MA34-11) and its tributaries within the Upper Manhan River watershed[4].

As noted above, the Upper Manhan watershed does not have a TMDL, but it is within the Connecticut River watershed, which flows into the Long Island Sound. The Long Island Sound has a TMDL: "A Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound", which has a target to attain a 58.5 percent reduction in nitrogen discharges to Long Island Sound from Connecticut and New York and a 10 percent reduction target for discharges to the Connecticut River from Massachusetts (NYSDEC, 2000). It is expected that progress made toward achieving the water quality goals will also result in reductions in nitrogen discharges to the Connecticut River stemming from the Upper Manhan watershed.

The water quality goals for *E. coli*, temperature, and DO are based on the MSWQS (MassDEP, 2021), which prescribe the minimum water quality criteria required to sustain a waterbody's designated uses. **Table A-6** includes the Massachusetts surface water classifications by assessment unit within the Upper Manhan watershed. All the assessment units in the watershed downstream of the Tighe-Carmody Reservoir are designated as Class 'B' waterbodies. Class B is assigned to waters designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth, and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06 (of the MSWQS), they shall be suitable as a source of public water supply with appropriate treatment ("Treated Water Supply"). Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value (MassDEP, 2021).

Moose Brook (MA34-17), Tripple Brook (MA34-16), and Sacket Brook (MA34-45) are also identified as Cold Water Fisheries, which indicates "waters in which the mean of the maximum daily temperature over a seven day period generally does not exceed 68°F (20°C) and, when other ecological factors are favorable (such as habitat), are capable of supporting a year-round population of cold water stenothermal aquatic life such as trout (Salmonidae)" (MassDEP, 2021).

[4] The water quality goals do not apply to the Tighe Carmody Reservoir and tributaries, which serves as the public water supply for Holyoke, Massachusetts.

Table A-6: Surface Water Quality Classification by Assessment Unit

Assessment Unit ID	Waterbody	Class	Qualifier
MA34-11	Manhan River	B	
MA34-13	Brickyard Brook	B	
MA34-92	Red Brook	B	
MA34-17	Moose Brook	B	Cold Water Fishery
MA34-12	Potash Brook	B	
MA34-16	Tripple Brook	B	Cold Water Fishery
MA34-45	Sacket Brook	B	Cold Water Fishery
MA34089	Tighe Carmody Reservoir	A	Public Water Supply, Outstanding Resource Water

The water quality goal for TP is based on target concentrations established in the Quality Criteria for Water (EPA, 1986) (also known as the "Gold Book"). The Gold Book states that TP should not exceed 50 µg/L in any stream at the point where it enters any lake or reservoir, nor should TP exceed 25 µg/L within a lake or reservoir. For the purposes of developing WBPs, MassDEP has adopted 50 µg/L as the TP target for all streams (that do not have a TP TMDL) at their downstream discharge point, regardless of which type of water body the stream discharges to.

Refer to **Table A-7** for a list of water quality goals for TP, bacteria, temperature, DO, and TN. Element C of this WBP includes proposed management measures to address these water quality goals.

Table A-7: Water Quality Goals for the Upper Manhan (MA34-11) and its tributaries

Pollutant	Waterbody Name (Assessment Unit ID)	Goal	Source
Total Phosphorus (TP)	Manhan River (MA34-11) and its tributaries	TP should not exceed 50 µg/L	Quality Criteria for Water (USEPA, 1986)
Bacteria (*E. coli*)	Manhan River (MA34-11) and its tributaries	**Class B Standards** • E. coli concentrations shall not exceed 126 CFU/100mL, calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and • no more than 10 percent of all such samples shall exceed 410 CFU/100 mL (a statistical threshold value).	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2021)
Temperature	Moose Brook (MA34-17) Sacket Brook (MA34-45) Tripple Brook (MA34-16)	• Temperature shall not exceed 68 degrees Fahrenheit (20 degrees Celsius) based on the mean of the daily maximum temperature over a seven-day period, unless naturally occurring. • Where a reproducing cold water aquatic community exists at a naturally occurring higher temperature, the temperature necessary to protect the community shall not be exceeded and the natural daily and seasonal temperature fluctuations necessary to protect the community shall be maintained.	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2021)
	Manhan River (MA34-11) Brickyard Brook (MA34-13) Red Brook (MA34-92) Potash Brook (MA34-12)	• Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained. There shall be no changes from natural background conditions that would impair any use assigned to this Class, including those conditions necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms.	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2021)
Dissolved Oxygen (DO)	Moose Brook (MA34-17) Sacket Brook (MA34-45) Tripple Brook (MA34-16)	• DO shall not be less than 6.0 mg/L. • Where natural background conditions are lower, DO shall not be less than natural background conditions.	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2021)
	Manhan River (MA34-11) Brickyard Brook (MA34-13) Red Brook (MA34-92) Potash Brook (MA34-12)	• Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2021)
Total Nitrogen (TN)	All Assessment Units within the watershed	• 10% reduction in TN	A TMDL Analysis to Achieve Water Quality Standards for DO Long Island Sound (NYSDEC, 2000)

"E. coli" = Escherichia coli; "CFU/100 mL"= colony forming units per 100 milliliters; "µg/L" = micrograms per Liter; "mg/L" = milligrams per Liter

Land Use and Impervious Cover Information

Land use information and impervious cover is presented by the below tables and figures. Land use source data is from 2005 and was obtained from MassGIS (2009b).

Watershed Land Uses

Table A-8 and **Figure A-5** present the land uses in the Upper Manhan River watershed. Land use in the Upper Manhan River watershed is mostly forested (approximately 79 percent); approximately 10 percent of the watershed is agricultural; and approximately 7 percent of the watershed is low density residential. The remaining approximately 5 percent of the watershed consists of water, open land, commercial, highway industrial, or medium-high density residential land use.

Table A-8: Subwatershed Land Uses

Land Use	Area (acres)	% of Watershed
Forest	18,276	78.6
Agriculture	2,237	9.6
Low Density Residential	1,532	6.6
Water	453	1.9
Open Land	350	1.5
Commercial	129	0.6
Highway	98	0.4
Industrial	65	0.3
Medium Density Residential	57	0.2
High Density Residential	52	0.2

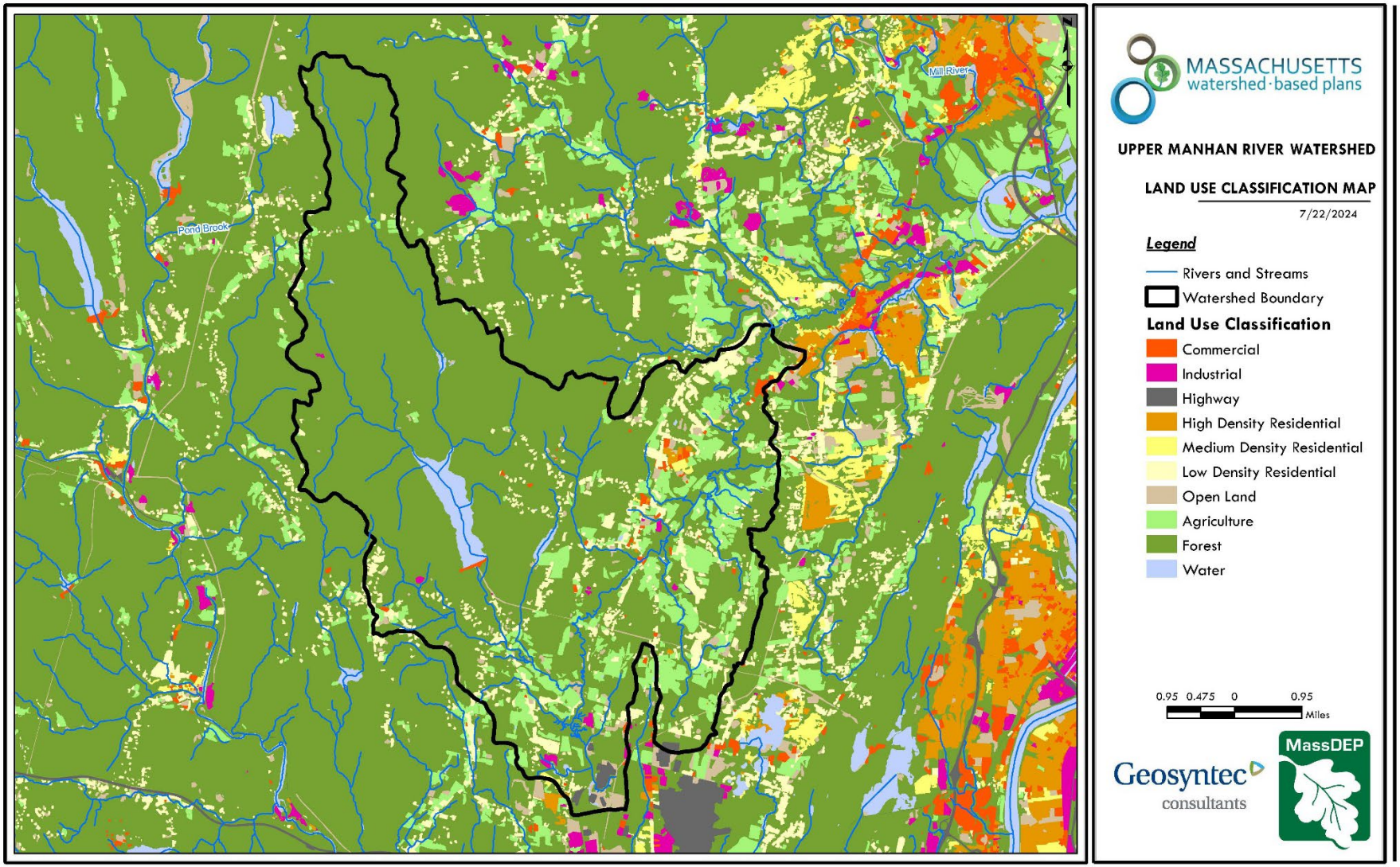


Figure A-5: Upper Manhan River Watershed Land Use Map
(MassGIS, 2007; MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Watershed Impervious Cover

There is a strong link between impervious land cover and stream water quality. Impervious cover includes land surfaces that prevent the infiltration of water into the ground, such as paved roads and parking lots, roofs, basketball courts, etc. Impervious area in the Upper Manhan River watershed mainly consists of roadways, industrial areas along Brickyard Brook in Westfield, and in the commercial area along Route 10 in the downstream portion of the watershed. **Figure A-6** is an impervious cover map for the Upper Manhan River watershed.

Impervious areas that are directly connected (DCIA) to receiving waters (via storm sewers, gutters, or other impervious drainage pathways) produce higher runoff volumes and transport stormwater pollutants with greater efficiency than disconnected impervious cover areas which are surrounded by vegetated, pervious land. Runoff volumes from disconnected impervious cover areas are reduced as stormwater infiltrates when it flows across adjacent pervious surfaces.

An estimate of DCIA for the watershed was calculated based on the Sutherland equations. USEPA provides guidance (USEPA, 2010) on the use of the Sutherland equations to predict relative levels of connection and disconnection based on the type of stormwater infrastructure within the total impervious area (TIA) of a watershed. The estimated TIA and DCIA for the Upper Manhan River watershed is 3.6 percent and 2.6 percent, respectively.

The relationship between TIA and water quality can generally be categorized as listed by **Table A-9** (Schueler et al. 2009). The TIA value for the watershed range is 3.6 percent; therefore, the river and surrounding tributaries would be expected to have high quality. However, Upper Manhan River watershed additionally has a high percentage of agricultural land use, which is likely an additional major source of water quality stress.

Table A-9: Relationship between Total Impervious Area (TIA) and water quality (Schueler et al. 2009)

% Watershed Impervious Cover	Stream Water Quality
0% to 10%	Typically high quality, and typified by stable channels, excellent habitat structure, good to excellent water quality, and diverse communities of both fish and aquatic insects.
11% to 25%	These streams show clear signs of degradation. Elevated storm flows begin to alter stream geometry, with evident erosion and channel widening. Streams banks become unstable, and physical stream habitat is degraded. Stream water quality shifts into the fair/good category during both storms and dry weather periods. Stream biodiversity declines to fair levels, with most sensitive fish and aquatic insects disappearing from the stream.
26% to 60%	These streams typically no longer support a diverse stream community. The stream channel becomes highly unstable, and many stream reaches experience severe widening, downcutting, and streambank erosion. Pool and riffle structure needed to sustain fish is diminished or eliminated and the substrate can no longer provide habitat for aquatic insects, or spawning areas for fish. Biological quality is typically poor, dominated by pollution tolerant insects and fish. Water quality is consistently rated as fair to poor, and water recreation is often no longer possible due to the presence of high bacteria levels.
>60%	These streams are typical of “urban drainage”, with most ecological functions greatly impaired or absent, and the stream channel primarily functioning as a conveyance for stormwater flows.

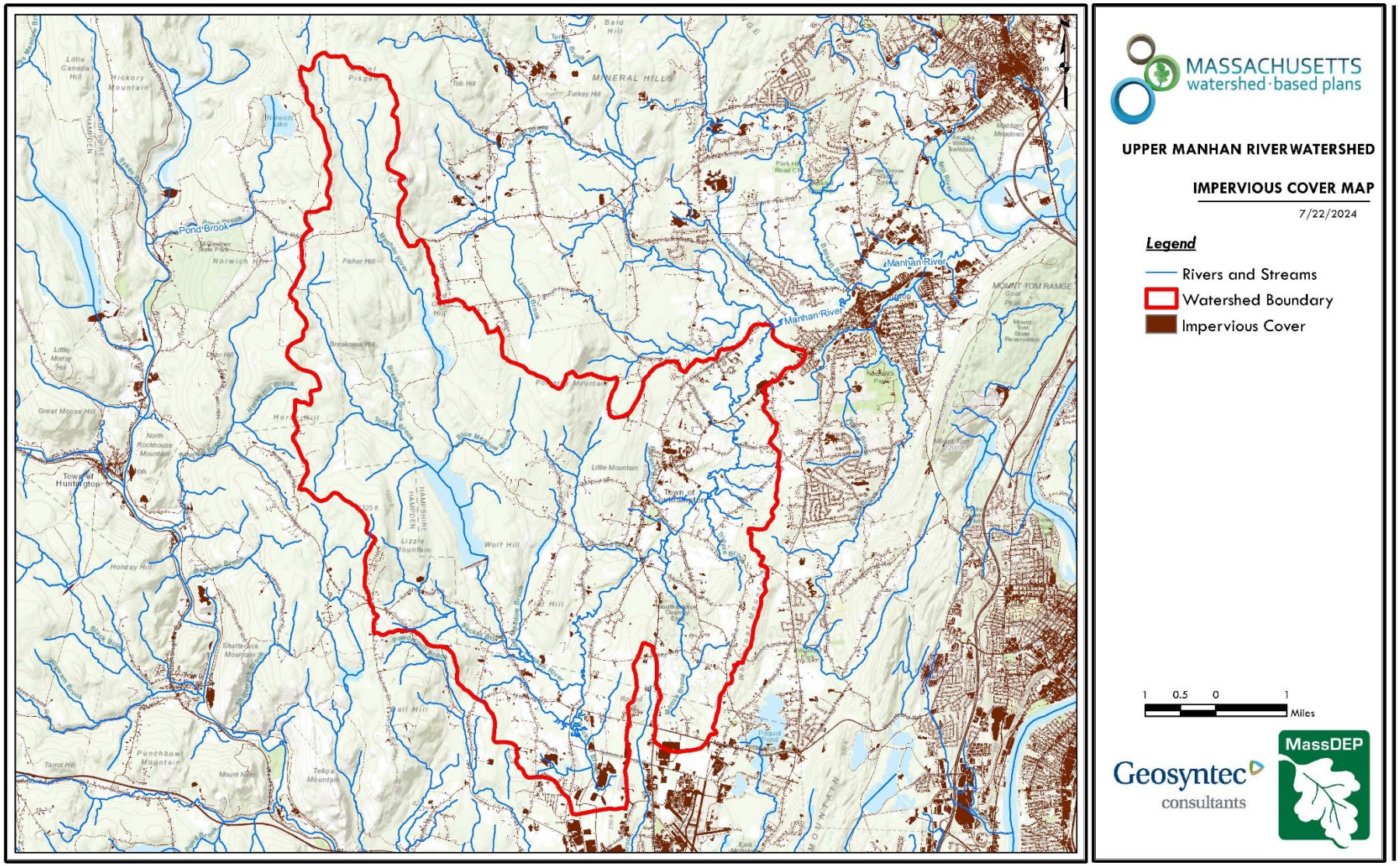


Figure A-6: Upper Manhan River Watershed Impervious Surface Map

(MassGIS, 2007; MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Pollutant Loading

Geographic Information Systems (GIS) was used for the pollutant loading analysis. The land use data (MassGIS, 2009b) was intersected with impervious cover data (MassGIS, 2009a) and United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soils data (USDA NRCS and MassGIS, 2012) to create a combined land use/land cover grid. The grid was used to sum the total area of each unique land use/land cover type.

The amount of DCIA was estimated using the Sutherland equations as described above and any reduction in impervious area due to disconnection (i.e., the area difference between TIA and DCIA) was assigned to the pervious D soil category for that land use to simulate that some infiltration will likely occur after runoff from disconnected impervious surfaces passes over pervious surfaces.

Pollutant loading for key nonpoint source pollutants in the watershed was estimated by multiplying each land use/cover type area by its pollutant load export rate (PLER) as follows:

$$L_n = A_n * P_n$$

Where L_n = Loading of land use/cover type n (pound per year (lb/yr)); A_n = area of land use/cover type n (acres); P_n = pollutant load export rate of land use/cover type n (pound per acre per year (lb/acre/yr))

The PLERs are an estimate of the annual total pollutant load exported via stormwater from a given unit area of a particular land cover type. The PLER values for TN and TP were obtained from USEPA (USEPA, 2020; UNHSC, 2018, Tetra Tech, 2015) (see values provided in **Appendix D**).

Table A-10 presents the estimated land-use based TP, TN, and TSS within the Upper Manhan River watershed. The largest contributor of the land use-based TP, TN, and TSS load originates from areas designated as forest. TP, TN, and TSS generated from forested areas is generally a result of natural processes such as decomposition of leaf litter and other organic material; the forested portions of the watershed therefore are unlikely to provide opportunities for nutrient load reductions through best management practices. Agricultural areas are the second largest contributors of land-use based TP, TN, and TSS in the watershed. Agricultural areas provide excellent opportunities for nutrient load reductions through agricultural BMPs as described in **Element C**.

Table A-10: Estimated Pollutant Loading in the Upper Manhan River Watershed for Key Nonpoint Source Pollutants

Land Use Type	Pollutant Loading[1]					
	Total Phosphorus (TP)		Total Nitrogen (TN)		Total Suspended Solids (TSS)	
	(lb/yr)	Percent of Total Load	(lb/yr)	Percent of Total Load	(tons/yr)	Percent of Total Load
Agriculture	1,100	25%	6,619	25%	76.8	10%
Commercial	121	3%	1,051	4%	13.2	2%
Forest	2,359	54%	11,631	44%	524.8	70%
High Density Residential	51	1%	326	1%	5.0	1%
Highway	90	2%	723	3%	47.1	6%
Industrial	77	2%	664	3%	8.3	1%
Low Density Residential	387	9%	3,884	15%	52.8	7%
Medium Density Residential	20	0%	168	1%	2.4	0%
Open Land	123	3%	1,089	4%	22.3	3%
TOTAL	4,329	100%	26,154	100%	752.6	100%

[1]These estimates do not consider loads from point sources or septic systems.

"lb/yr" = pounds per year

It is important to note pollutant loads presented in **Table A-10** do not consider loads from point sources or septic systems. Septic system sources should be separately evaluated to determine whether septic system upgrades or sanitary sewer system conversion would cost-effectively reduce bacteria and nutrient sources in the watershed.

Element B: Determine Pollutant Load Reductions Needed to Achieve Water Quality Goals

Element B of your WBP should:

Determine the pollutant load reductions needed to achieve the water quality goals established in Element A. The water quality goals should incorporate Total Maximum Daily Load (TMDL) goals, when applicable. For impaired water bodies, a TMDL establishes pollutant loading limits as needed to attain water quality standards.

Estimated Pollutant Loads

Estimated land use-based pollutant loads for TP (4,329 lb/yr), TN (26,154 lb/yr), and TSS (752.6 tons/yr) were previously presented in **Table A-10** of this WBP. *E. coli* land use-based loading has not been estimated for this WBP, as there are not yet established PLERs available for *E. coli*: this may be updated in future revisions to this WBP.

Water Quality Goals and Required Load Reduction

There are many methodologies that can be used to set pollutant load reduction goals for a WBP. Goals can be based on water quality criteria, surface water standards, existing monitoring data, existing TMDL criteria, or other data. As discussed in Element A, water quality goals for this WBP are focused on reducing *E. coli* and TP loading to the Upper Manhan River watershed.

While *E. coli* loads are not estimated, *E. coli* reductions may be determined by comparing monitored water quality concentrations to the goals for *E. coli* presented in Element A and **Table B-1**.

The TN load reduction goal is based on the 10 percent reduction goal for Massachusetts in the Long Island Sound TMDL (NYSDEC, 2000).

The method used[5] for calculating a TP loading goal produces loading value that is greater than the estimated TP load of 4,329 lb/yr. Given the iterative and adaptive nature of this WBP, the monitoring portion of this WBP (**Element I**) recommends that monitoring be performed to better understand the existing TP loading to the Upper Manhan River, which may help establish a specific TP related water quality loading goal with the next update of

[5] According to the EPA Gold Book, TP should not exceed 50 ug/L in any stream at the point where it enters any lake or reservoir. The water quality loading goal was estimated by multiplying this target maximum TP concentration (50 ug/L) by the estimated annual watershed discharge for the Deerfield River Mainstem – North River to Mouth watershed. To estimate the annual watershed discharge, the mean flow was used, which was estimated based on United States Geological Survey (USGS) "Runoff Depth" estimates for Massachusetts (Cohen and Randall, 1998). Cohen and Randall (1998) provide statewide estimates of annual Precipitation (P), Evapotranspiration (ET), and Runoff (R) depths for the northeastern U.S. According to their method, Runoff Depth (R) is defined as all water reaching a discharge point (including surface and groundwater), and is calculated by: P - ET = R. A mean Runoff Depth R was determined for the watershed by calculating the average value of R within the watershed boundary.

the WBP (expected in 2027). In the interim, a 10 percent reduction in the estimated watershed loading to 3,896 lb/yr is proposed to improve the water quality within the Upper Manhan River watershed.

The water quality goals, and corresponding required loading reductions are included in **Table B-1**. The proposed projects described in this WBP are expected to reduce *E. coli*, TP, and TN loads to the Upper Manhan River watershed; however, additional load reductions may be required to meet the water quality goals.

The following adaptive sequence is recommended to sequentially track and meet these load reduction goals:

1. Continue the baseline water quality monitoring program in accordance with **Element I**. Results from the monitoring program should advise if **Element C** management measures have been effective at addressing listed water quality impairments or water quality goals for other indicator parameters established by **Table A-9** of this WBP. Results can further be used to periodically inform or adjust load reduction goals presented in **Table B-1**.
2. Based on monitoring data, establish additional long-term reduction goal(s), if needed, to lead to delisting of the Manhan River (MA34-11) from the 303(d) list over the next 15 years.

Table B-1: Pollutant Load Reductions Needed for Upper Manhan River Watershed

Pollutant	Existing Estimated Total Load	Water Quality Goal	Required Load Reduction
Total Phosphorus (TP)	4,329 lb/yr	3,896 lb/yr	433 lb/yr
Bacteria (*E. coli*)	*MSWQS for bacteria are concentration standards (CFU/100 mL), which are difficult to predict based on estimated annual loading.*	• E. coli concentrations shall not exceed 126 colony-forming units per 100 milliliters (CFU/100mL), calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and • no more than 10 percent of all such samples shall exceed 410 CFU/100 mL (a statistical threshold value).	N/A Concentration-based
Total Nitrogen	26,154 lb/yr	23,539 lb/yr	2,615 lb/yr

"E. coli" = Escherichia coli
"CFU/100 mL" = colony forming units per 100 milliliters
"lb/yr" = pounds per year
"MSWQS" = Massachusetts Surface Water Quality Standards
"N/A" = Not applicable

Element C: Describe management measures that will be implemented to achieve water quality goals

Element C: A description of the nonpoint source management measures needed to achieve the pollutant load reductions presented in Element B, and a description of the critical areas where those measures will be needed to implement this plan.

Management measures, also referred to as stormwater best management practices (BMPs) manage stormwater runoff by reducing peak runoff rates, managing runoff volume, and improving water quality by reducing nutrients and pollutants. There are two main types of BMPs: structural BMPs that are engineered systems such as (but not limited to) rain gardens, water quality swales, and subsurface infiltration units; and non-structural BMPs that are practices such as street sweeping and catch basin cleaning which indirectly reduce the pollutant load to waterbodies.

Ongoing and Future Management Measures

Agricultural Nonpoint Source Regional Coordinators for Franklin, Hampshire, Hampden Counties

MACD was awarded Fiscal Year 2022 Section 319 grant funding for its "Agricultural Nonpoint Source Regional Coordinators for Franklin, Hampshire, Hampden Counties". The MACD agricultural regional coordinators worked with the Hampden Hampshire Conservation District (HHCD), the Franklin Conservation District (FCD), the Franklin Regional Council of Governments (FRCOG), and the PVPC to develop a database of prioritized watersheds. In addition to waterbody impairment, the group used desktop and dashboard surveys as well as informal interviews to assess the level of agricultural activity in the watersheds. The database of watersheds created from this effort will provide guidance for future efforts focused on agricultural areas in addition to identifying at least three watersheds to advance to watershed-based planning; the Upper Manhan River watershed was one of the selected prioritized watersheds for WBP development (MACD, 2021).

MACD's general strategy is to conduct outreach and education to farmers; support the development of conservation plans outlining BMPs to reduce pollutant runoff; assist landowners in obtaining access to technical and financial resources to implement the BMPs; and ensure farmers follow operation and maintenance practices recommended by MACD and/or NRCS. MACD has applied for additional grant funding to continue this work into the future. Numerous farms in the Upper Manhan River watershed have been identified for outreach and possible implementation of agricultural BMPs.

Appendix E includes a list of agricultural BMPs, with estimated TN pollutant load reduction numbers, that are included in MACD conceptual projects for agricultural properties in the Upper Manhan River watershed. The estimated pollutant load reduction (TP, TN and/or *E. coli*) that may be achieved from implementing BMPs is site-specific, can be fine-tuned once BMPs are closer to completion, and may be updated in future iterations of this WBP.

A list of typical agricultural BMPs is also included below.

1. **Livestock Exclusion:** This practice involves the fencing of an area not intended for grazing to exclude livestock from accessing that area. Livestock exclusion may improve water quality by preventing livestock from being in the water, preventing access to steep or highly erodible banks, and by preventing animal waste deposition in surface waters. This practice prevents compaction of the soil by livestock and prevents losses of vegetation and undergrowth. This may maintain or increase evapotranspiration. Increased soil permeability may reduce erosion and decrease the transport of sediment and other pollutants to surface waters. By protecting existing vegetation, this practice also promotes shading along streams and may reduce surface water temperature.

2. **Riparian Buffers:** A riparian buffer is the area of trees, shrubs and grasses adjacent to a river that can intercept pollutants from both surface and shallow groundwater before reaching a river or stream. This practice involves the protection, maintenance, and restoration of riparian forest areas. The ability of a riparian buffer to remove pollutants is dependent on the width of the buffer, the type of vegetation, the manner in which runoff traverses the vegetated areas, the slope and the soil composition within the riparian area. Riparian buffers also provide habitat for wildlife and enhance fish habitat by reducing water temperature.

3. **Alternative Livestock Water Supply:** An alternate livestock drinking water supply located away from surface waters can reduce stream bank erosion, prevent the deposition of animal waste within water bodies, protect riparian vegetation, and provide a dependable, clean source of water for livestock. In some locations, artificial shade may also be constructed to encourage use of upland sites for shading and loafing. Alternative livestock water can be provided through the following practices:

    - Pond: A water impoundment made by constructing a dam or an embankment or by excavation of a pit or dugout.
    - Trough or Tank: By the installation of troughs or tanks, livestock may be better distributed over the pasture, grazing can be better controlled, and surface runoff reduced, thus reducing erosion.
    - Well: A drinking water supply well can be constructed or improved to provide water for livestock.
    - Spring Development: This practice includes improving springs and seeps by excavating, cleaning, capping, or providing collection and storage facilities. Temporary erosion and sedimentation may occur from any disturbed areas during and immediately following any related construction activities.
    - Pipeline/Pump System: A gravity pipeline or pump system can be developed in combination with the practices described above to increase to distance between a water source (e.g., well, spring) and targeted water supply areas within the pasture.

4. **Rotational Grazing Systems and Improved Pasture Management:** Rotational grazing systems and improved pasture management are recommended in conjunction with livestock exclusion and alternative livestock water supply projects. Grazing systems and improved pasture management allow farmers to better use grazing land and includes:

    - managing livestock rotation to maintain minimum grazing height recommendations and sufficient rest periods for plant recovery;
    - locating feeding and watering facilities away from sensitive areas (see alternative livestock water supply above);

- designating a sacrifice lot/paddock (that does not drain directly into ponds, creeks, etc.) to locate livestock during the rainy season or when pastures are not growing actively to prevent overgrazing and trampling[6];
- using compost-bedded pack barns (large, open resting area, under covered housing, usually bedded with sawdust or dry, fine wood shavings and manure composted into place and mechanically stirred on a regular basis) for dairy cows; and
- chain harrowing pastures (at least twice a year) to break up manure piles and uniformly spread manure, after livestock are removed.

5. **Afforestation of Hay and Pastureland:** Using a small portion of hay and pastureland for tree planting. This converts pasture that is not well suited for grazing due to slope and other characteristics, optimizes the use of suitable pastureland in the watershed, and prevents runoff and soil loss from marginal pastures.

6. **Cropland Management Practices:** Cropland management practices include, among others, continuous no till, cover crops, and fertilizer management.

    - Continuous no till is used to encourage procedures to convert fields under some degree of tillage to a system of minimal soil disturbance that will maintain a minimum a 60% rain drop intercepting residue cover.
    - Cover crops keep cover on fields during times of year when they would otherwise be left barren in order to minimize runoff and erosion from the soil surface and also decrease leaching of nitrogen through the soil.
    - Farmers can implement fertilizer management practices to help maintain high yields and save money on fertilizers while reducing nonpoint source pollution. A Crop Nutrient Management Plan[7]; is a tool that farmers can use to achieve these goals.

MACD references guidance from USDA when planning and implementing BMPs with farm owners. The Massachusetts "Field Office Technical Guide" provides detailed information on agricultural BMPs that may be implemented at farms in the watershed[8]. **Appendix F** also includes a list, provided by FRCOG, of potential agricultural BMPs that may be implemented in the watershed.

National Water Quality Initiative (NWQI)

The Upper Manhan River watershed was designated as a National Water Quality Initiative (NWQI) watershed in Fiscal Year 2023. The NWQI is a partnership among USDA NRCS, MassDEP and the USEPA to identify and address impaired waterbodies through voluntary conservation. As part of the program, NRCS will provide targeted funding for financial and technical assistance for implementation of conservation systems within the watershed. Conservation systems include practices that promote soil health, reduce erosion and lessen nutrient runoff, such as filter strips, cover crops, reduced tillage and manure management (see also examples above under the

[6] See here for more information and recommended footing materials recommended for sacrifice areas: https://ag.umass.edu/sites/ag.umass.edu/files/fact-sheets/pdf/horse_footing_materials_15_05.pdf

[7] See here for ten key components to include in a crop nutrient management plan: megamanual.geosyntec.com/npsmanual/cropnutrient.aspx

[8] The Massachusetts "Field Office Technical Guide" can be accessed at: https://efotg.sc.egov.usda.gov/#/state/MA/documents/section=4&folder=-3 ; the list of BMPs, as well as detailed information on each, is found under "Section 4 - Practice Standards and Supporting Documents" > "Conservation Practice Standards & Support Documents".

Agricultural Nonpoint Source Regional Coordinators for Franklin, Hampshire, Hampden Counties program). The goal is to implement practices that not only benefit natural resources but also enhance agricultural productivity and profitability by improving soil health and optimizing the use of agricultural inputs.

The NWQI includes two phases:

- Readiness Phase: Prior to receiving targeted technical and financial assistance, the Readiness Phase provides funding for watersheds to develop a watershed assessment, expand on-farm planning and outreach, and increase support for local staff.
- Implementation Phase: In the Implementation Phase, NRCS provides technical and financial assistance for producers to implement conservation practices that address resource concerns identified in the watershed assessment, developed in the Readiness Phase.

Upper Manhan River Watershed is currently in the NWQI Readiness Phase. MassDEP and other partners will also contribute additional resources for watershed planning, implementation and outreach. For example, MassDEP is leading the monitoring effort under this program (see **Element HI**), and MACD is currently leading the NWQI watershed assessment[9].

Pioneer Valley Planning Commission Bacterial Source Tracking

Agricultural BMP concepts were created under the PVPC bacterial source tracking study, which addressed locations within the Moose Brook and Potash Brook subwatersheds as well as along the Manhan River in the Whittemore Conservation Area (PVPC, 2018). These concepts are included in **Appendix G**. No pollutant load reduction estimates were provided with the concepts. It is recommended that these concepts be evaluated and prioritized based on estimated pollutant load reductions and other criteria (see section below on "identification of priority locations for structural BMPs").

Nitrogen and Phosphorous Source Identification Report, Town of Southampton

This document was one among 20 Nutrient Source Identification Reports prepared by the Neponset River Watershed Association (NepRWA) and the PVPC. These reports are meant to provide MS4 permitted municipalities with documents they can finalize and submit to USEPA as part of their Year 4 reporting requirements. This work was made possible through a grant from the MassDEP Municipal Assistance Program (PVPC, 2021). PVPC developed a screening process approach to identify public properties that might be most appropriate for green infrastructure stormwater retrofit locations. PVPC mapped, evaluated, and prioritized all parcels within the MS4 regulated area of Southampton for Nitrogen and Phosphorus loading. Shape files were developed in ArcMap for Desktop and displayed in the on-line viewer. The following parcel (which is within the Upper Manhan River watershed) was identified as a high-priority parcel to be considered for control of Nitrogen and Phosphorus loading: 180 Brickyard Road (Parcel ID F_319214_2902056). The following parcels (within the Upper Manhan River watershed) were identified as high-priority parcels to be considered for control of Nitrogen loading: Moose Brook Road (F_325357_2904585), Clark Street (F_323423_2909575), 8 Fomer Road (F_321941_2907931), and 178 College Highway (F_323851_2913043) (PVPC, 2021).

[9] More information about the NWQI program can be found here: https://www.nrcs.usda.gov/programs-initiatives/national-water-quality-initiative

Southampton BMP Evaluation

To address requirements of the 2016 Massachusetts Small MS4 General Permit, Southampton hired Tighe and Bond to prepare five BMP concepts within the MS4 area; four of these are also located within the Upper Manhan River watershed (Tighe and Bond, 2022b). The locations include:

- Transfer Station on Moose Brook Road (Parcel number 35_48)
- Gilbert and 180 Brickyard Road (Parcel number 34-179)
- Whittemore Conservation Area, Meadow Lane (Parcel number 8_36)
- Conant Memorial Park, Clark Street (Parcel number 23_78)

The concepts are included in **Appendix H**. No pollutant load reduction estimates were provided with the concepts. It is recommended that these concepts be evaluated and prioritized based on estimated pollutant load reductions and other criteria (see section below on "identification of priority locations for structural BMPs").

Identification of Priority Locations for Structural BMPs

Implementing agricultural BMPs, along with incorporating structural BMPs (e.g., low impact development practices) on new and existing development, and investigation and remediation of potential other sources such as failing septic systems will be necessary to achieve a measurable and sustainable improvement in water quality in the Upper Manhan River watershed.

The following general sequence is recommended to identify and implement future structural BMPs[10]. Examples of structural BMPs include (but not limited to):

- bioretention areas and rain gardens,
- deep sump catch basins,
- dry wells,
- constructed stormwater wetlands (e.g., gravel wetland),
- porous pavement,
- sand filters,
- vegetated filter strips,
- wet ponds,
- infiltration basins and trenches,
- oil/grit separators, and water quality swales.

Note this approach applies largely to non-agricultural BMPs that might be implemented by other watershed stakeholders, as MACD's work focuses on building relationships with the agricultural community to guide agricultural BMP implementation.

1. **Identify Potential Implementation Locations:** Perform a desktop analysis using aerial imagery and GIS data to develop a preliminary list of potentially feasible implementation locations based on land use; soil type

[10] For detailed information on BMP selection, siting and sizing, refer to the following document: https://prj.geosyntec.com/prjMADEPWBP_Files/Files/BMP%20Selection,%20siting%20and%20sizing%20Guidance_FINAL.pdf.
An additional reference for developing BMP concepts in unpaved road areas/eroded streambanks is "Massachusetts Unpaved Roads BMP Manual" (Berkshire Regional Planning Commission, 2001): https://megamanual.geosyntec.com/npsmanual/Unpaved%20Road.pdf

(i.e., hydrologic soil groups A and B); available public open space (e.g., lawn area in front of a police station); potential redevelopment sites where additional public-private partnerships may be leveraged; and other factors such as proximity to receiving waters, known problem areas, or publicly owned right of ways or easements. See BMP Hotspot Map analysis below, which helps identify potential implementation locations.

2. **Visit Potential Implementation Locations:** Perform field reconnaissance, preferably during a period of active runoff-producing rainfall, to evaluate potential implementation locations, gauge feasibility, and identify potential BMP ideas. During field reconnaissance, assess identified locations for space constraints, potential accessibility issues, presence of mature vegetation that may cause conflicts (e.g., roots), potential utility conflicts, site-specific drainage patterns, and other factors that may cause issues during design, construction, or long-term maintenance.

3. **Develop BMP Concepts:** Once potential BMP locations are conceptualized, use the Element C BMP-selector tool on the WBP tool to help develop concepts. Concepts can vary widely. One method is to develop 1-page fact sheets for each concept that includes a site description, including definition of the problem, a description of the proposed BMPs, annotated site photographs with conceptual BMP design details, and a discussion of potential conflicts such as property ownership, O&M requirements, and permitting constraints. The fact sheet can also include information obtained from the BMP-selector tool including cost estimates, load reduction estimates, and sizing information (i.e., BMP footprint, drainage area, etc.).

4. **Rank BMP Concepts:** Once BMP concepts are developed, perform a priority ranking based on site-specific factors to identify the implementation order. Ranking can include many factors including cost, expected pollutant load reductions, implementation complexity, potential outreach opportunities and visibility to public, accessibility, expected operation and maintenance effort, and others. Prioritized BMP concepts should focus on reducing *E. coli* and TP loading to the Upper Manhan River as summarized by **Element B.**

BMP Hotspot Map

The following GIS-based analysis[11] was performed within the watershed to identify high priority parcels for BMP (also referred to as management measure) implementation:

- Each parcel within the watershed was evaluated based on ten different criteria accounting for the parcel ownership, social value, and implementation feasibility (See **Table C-1** for more detail below);
- Each criterion was then given a score from 0 to 5 to represent the priority for BMP implementation based on a metric corresponding to the criterion (e.g., a score of 0 would represent lowest priority for BMP implementation whereas a score of 5 would represent highest priority for BMP implementation);
- A multiplier was also assigned to each criterion, which reflected the weighted importance of the criterion (e.g., a criterion with a multiplier of 3 had greater weight on the overall prioritization of the parcel than a criterion with a multiplier of 1); and
- The weighted scores for all the criteria were then summed for each parcel to calculate a total BMP priority score.

Table C-2 presents the criteria, indicator type, metrics, scores, and multipliers that were used for this analysis. Parcels with total scores above 60 are recommended for further investigation for BMP implementation suitability. **Figure C-3** presents the resulting BMP Hotspot Map for the Upper Manhan River watershed.

[11] GIS data used for the BMP Hotspot Map analysis included: MassGIS (2015a); MassGIS (2015b); MassGIS (2017a); MassGIS (2017b); MassGIS (2020); MA Department of Revenue Division of Local Services (2016); MassGIS (2005); ArcGIS (2020); MassGIS (2009b); MassGIS (2012); and ArcGIS (2020b).

This analysis solely evaluated individual parcels for BMP implementation suitability and likelihood for the measures to perform effectively within the parcel's features. This analysis does not quantify the pollutant loading to these parcels from the parcel's upstream catchment. When further evaluating a parcel's BMP implementation suitability and cost-effectiveness of BMP implementation, the existing pollutant loading from the parcel's upstream catchment and potential pollutant load reduction from BMP implementation should be evaluated.

Table C-2: Matrix for BMP Hotspot Map GIS-based Analysis

Criteria	Indicator Type	METRICS																										Multiplier	Maximum Potential Score
		Yes or No?		Hydrologic Soil Group				Land Use Type								Water Table Depth				Parcel Area			Parcel Average Slope						
		Yes	No	A or A/D	B or B/D	C or C/D	D	Low and Medium Density Residential	High Density Residential	Commercial	Industrial	Highway	Agriculture	Forest	Open Land	Water	101-200 cm	62-100 cm	31-61 cm	0-30 cm	Greater than 2 acres	Between 1-2 acres	Less than 1 acre	Less than 2%	Between 2% and 15%	Greater than 15%	Less than 50%	Between 51% and 100%		
Is the parcel a school, fire station, police station, town hall or library?	Ownership	5	0																									2	10
Is the parcel's use code in the 900 series (i.e., public property or university)?	Ownership	5	0																									2	10
Is parcel fully or partially in an Environmental Justice Area?	Social	5	0																									2	10
Most favorable Hydrologic Soil Group within Parcel	Implementation Feasibility			5	3	0	0																					2	10
Most favorable Land Use in Parcel	Implementation Feasibility							1	2	4	2	4	5	1	4	X[1]												3	15
Most favorable Water Table Depth (deepest in Parcel)	Implementation Feasibility																5	4	3	0								2	10
Parcel Area	Implementation Feasibility																				5	4	1					3	15
Parcel Average Slope	Implementation Feasibility																							3	5	1		1	5
Percent Impervious Area in Parcel	Implementation Feasibility																										5	2.5	1	5
Within 100 ft buffer of receiving water (stream or lake/pond)?	Implementation Feasibility	5	2																									2	10

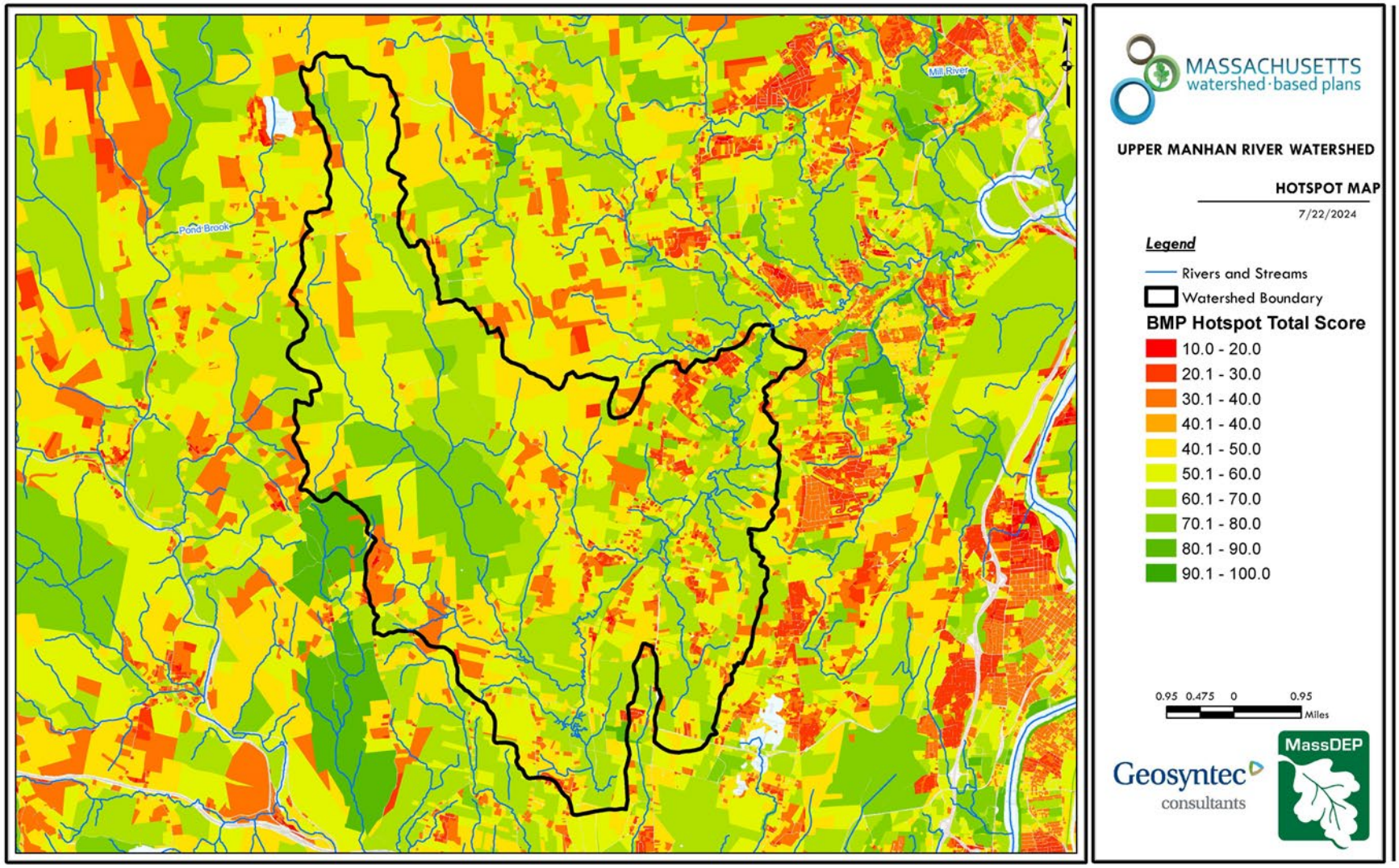


Figure C-3: Upper Manhan River Watershed BMP Hotspot Map (MassGIS (2015a), MassGIS (2015b), MassGIS (2017a), MassGIS (2017b), MassGIS (2020), MA Department of Revenue Division of Local Services (2016), MassGIS (2005), ArcGIS (2020), MassGIS (2009a), MassGIS (2012), ArcGIS (2020b))

Additional Non-structural BMPs

It is recommended, if it has not already been done, that nonstructural BMPs that the Town of Southampton and the Cities of Westfield and Easthampton currently implement, including street sweeping and catch basin cleaning, be evaluated and potentially optimized for removal of TP and *E. coli*. First, it is recommended that potential pollutant load removals from ongoing activities be calculated in accordance with **Elements H and I** of this document. Next, it is recommended that ongoing activities be evaluated to see if potential improvements can be implemented to achieve higher pollutant load reductions, such as increased frequency or improved technology. Other nonstructural BMPs that are recommended to be implemented include (but not limited to):

- septic system maintenance,
- pet waste management,
- municipal sewer system inspection and maintenance,
- land use regulation revision (e.g., construction erosion and sediment control requirements),
- protection and conservation of open space, riparian buffers, wetlands and stream corridors,
- impervious cover reduction,
- Impervious cover disconnection (e.g., disconnecting roof downspouts from impervious areas),
- Municipal adoption of
- adoption of good housekeeping practices (e.g., yard waste management, leaf litter disposal, fertilizer application best practices), and
- public education and outreach (see Element E).

WBP Implementation

As stated in the introduction, this WBP is meant to be a living document. It should be reevaluated at least once every three years and adjusted as needed based on ongoing efforts (e.g., based on monitoring results, 319 funding, etc.). It is strongly recommended that a working group including additional stakeholders be established to meet at least biannually to implement and update this WBP, and track progress, and that someone is designated to lead the implementation of this plan.

Element D: Identify Technical and Financial Assistance Needed to Implement Plan

Element D: Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.

Current Management Measures

The funding needed to implement ongoing and future management measures detailed in **Element C** is presented in **Table D-1**.

Table D-1: Summary of Ongoing and Planned BMPs Costs

Project	Estimated Cost (Engineering, Permitting, and Construction)	Funding Source(s)
Transfer Station, Moose Brook Road	To be determined	To be determined
Gilber and 180 Brickyard Road	To be determined	To be determined
Whittemore Conservation Area	To be determined	To be determined
Conant Memorial Park	$98,000 (Tighe and Bond, 2022b)	To be determined

Additional Future Management Measures

Agricultural BMPs

As noted in Element C, MACD will be performing outreach to farms in the watershed for potential implementation of agricultural BMPs and the Upper Manhan has been designated as an NWQI watershed. The estimated costs of BMP implementation through these projects are currently unknown but can be updated in future iterations of this WBP.

Identification of Additional Management Measures

Funding for future BMP installations to further reduce loads within the watershed may be provided by a variety of sources including Section 319 funding, Climate Smart Agricultural Program (CSAP), Massachusetts Environmental Trust (MET) grants, the Agricultural Produce Safety Improvement Program (APSIP), Town and City capital funds, volunteer efforts, and NRCS grants including the Environmental Quality Incentives Program (EQIP) and the Agricultural Management Assistance (AMA) program. MACD has previously been successful with and will continue to pursue securing grant funding through various sources. Guidance is available to provide additional information on potential funding sources for nonpoint source pollution reduction efforts[12].

[12] Guidance on funding sources to address nonpoint source pollution: http://prj.geosyntec.com/prjMADEPWBP_Files/Guide/Element%20D%20-%20Funds%20and%20Resources%20Guide.pdf

Element E: Public Information and Education

Element E: Information and Education (I/E) component of the watershed plan used to:

1. Enhance public understanding of the project; and
2. Encourage early and continued public participation in selecting, designing, and implementing the NPS management measures that will be implemented.

Public information and education a topic discussed during the stakeholder meetings on November 3, 2023 and March 21, 2024 (**Appendix A**). A component of the MACD Agricultural Nonpoint Source Regional Coordinators Program involves outreach to farmers. Farmer outreach through this program includes building relationships with farm owners through phone calls, farm visits, direct mailings, workshops, farm tours, newsletter/newspaper articles, and social media. Public Outreach and Education was also conducted as part of the PVPC bacterial source tracking project (see **Appendix G**).

Additional components of the watershed public information and education program are described below. Additional outreach efforts will be determined when future management measures and activities are planned for implementation in the watershed. This section of the WBP will be updated when the plan is reevaluated in 2027 in accordance with elements F&G of this document.

Step 1: Goals and Objectives

The goals and objectives for the watershed information and education program.

1. Provide information and incentives to farmers on funding resources for BMP implementation.
2. Provide information about farm conservation plans and agricultural BMPs and their anticipated water quality benefits.
3. Provide information to promote watershed stewardship.
4. Provide information to all residents in the watershed about proposed stormwater improvements and their anticipated water quality benefits.
5. Meet Massachusetts Small MS4 Permit Requirements

Step 2: Target Audience

Target audiences that need to be reached to meet the goals and objectives identified above.

1. Farmers in the watershed
2. Watershed organizations and other user groups.
3. Businesses, schools, and local government within the watershed.
4. Developers (construction) within the watershed.
5. Industrial facilities within the watershed.

6. All watershed residents.

Step 3: Outreach Products and Distribution

The outreach product(s) and distribution form(s) that will be used for each.

1. MACD representatives will conduct one-on-one meetings with farmers and support the development of farm conservation plans.
2. MACD will conduct outreach and education activities, including farm tours highlighting agricultural BMPs.
3. CRC provides information about the Connecticut River watershed including the Manhan River watershed on its websites (https://www.ctriver.org/) and host events such as the annual source to sea cleanup (https://www.ctriver.org/source-to-sea-cleanup) .
4. Informational signs will be developed and posted at implemented BMP locations.
5. The Stormwater Management Programs (SWMP) for the Town of Southampton and the City of Westfield, include additional outreach efforts being conducted within the two municipalities (Town of Southampton, 2023; City of Westfield, 2023).
   Details can be found on the Town of Southampton and City of Westfield, websites (https://www.townofsouthampton.org/government/administration/highway; https://www.cityofwestfield.org/233/Stormwater)

Step 4: Evaluate Information/Education Program

Information and education efforts and how they will be evaluated.

1. Track the number of farm tours and the attendance at each.
2. Track the number of farmers participating in outreach and education efforts, conservation plans, and implementation of BMPs.
3. Track the number of materials and information, such as fact sheets and emails, and the size of the lists receiving these materials.

Resources for Additional Outreach Products

The EPA's "Nonpoint Source Outreach Toolbox" (www.epa.gov/nps/toolbox) provides information, tools, and more than 700 outreach materials that can be used or adapted to develop an outreach campaign. The toolbox focuses on six nonpoint source pollution categories:

- stormwater
- household hazardous waste
- septic systems
- lawn care
- pet care
- automotive care

Outreach products in the Toolbox include print ads, public service announcements, and a variety of materials for billboards, signage, kiosks, posters, brochures, fact sheets, and giveaways that help to raise awareness and promote non-polluting behaviors. Permission-to-use information is included for outreach products, which makes

it easy to tailor them to local priorities. Evaluations of several outreach campaigns also offer real-world examples of what works best in terms of messages, communication styles, and formats. Other helpful resources include:

- MassDEP's Clean Water Toolkit (https://megamanual.geosyntec.com/npsmanual/default.aspx)
- USEPA's Soak Up the Rain materials (https://www.epa.gov/soakuptherain)
- USEPA's Green Infrastructure Collaborative (https://www.epa.gov/green-infrastructure/green-infrastructure-federal-collaborative#Green%20Infrastructure%20Collaborative%20Resources)

Elements F & G: Implementation Schedule and Measurable Milestones

Element F: Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.

Element G: A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.

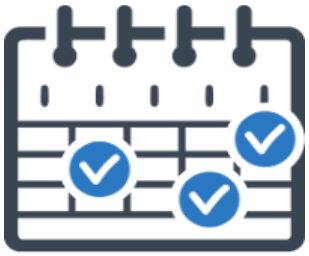


Table FG-1 provides a preliminary schedule for implementation of recommendations provided by this WBP. It is expected that the WBP will be re-evaluated and updated in 2027, or as needed, based on ongoing monitoring results and other ongoing efforts. New projects will be identified through future data analysis and stakeholder engagement and will be included in updates to the implementation schedule.

Table FG-1: Implementation Schedule and Interim Measurable Milestones[13]

Category	Measurable Milestones	Year(s)
Agricultural Nonpoint Source Regional Coordinators	Conduct outreach to build relationships and scope potential implementation sites for agricultural BMPs.	2021—2024
	Support the development of conservation plans outlining BMPs to reduce pollutant and nutrient runoff. Implement agricultural BMPs at farms in the watershed (contingent on available funding)	2025--2028
Agricultural BMPs	Implement agricultural BMPs under the NWQI Implementation Phase	2025—2028
Nonstructural BMPs	Document potential pollutant removals from nonstructural BMPs (i.e., street sweeping, catch basin cleaning). The methodology is included in the 2016 Massachusetts Small MS4 Permit and in Elements H&I of this WBP.	Annually
	Evaluate ongoing nonstructural BMPs and determine if modifications can be made to optimize pollutant removals (e.g., increase frequency).	Annually
	Routinely implement optimized nonstructural BMPs.	Annually
Structural BMPs	Identify locations, develop and rank structural BMP concepts	To be determined
Public Education and Outreach	Conduct outreach and education activities including farm tours highlighting agricultural BMPs.	2021—2027
	River cleanup events including CRC source to sea cleanup	Annually
Monitoring	MassDEP perform water quality sampling at key locations along the Upper Manhan River and tributaries in the Upper Manhan River watershed per Element H&I	2024—2028
Adaptive Management and Plan Updates	Establish a working group that includes stakeholders and other interested parties to implement recommendations and track progress. Meet at least twice per year.	2024
	Reevaluate WBP at least once every three years and adjust, as needed, based on ongoing efforts (e.g., based on monitoring results, 319 funding, etc.). – Next update, August 2027	2027
	Use monitoring results to reevaluate BMP effectiveness at reducing *E. coli* and TP and/or other indicator parameters in the Upper Manhan River watershed and establish additional long-term reduction goal(s), if needed.	**2034**
	Delist the Manhan River from the 303(d) list.	**2039**

[13] Note that goals and milestones of this WBP are intended to be adaptable and flexible. Stakeholders will perform tasks contingent on available resources and funding.

Elements H & I: Progress Evaluation Criteria and Monitoring

Element H: A set of criteria used to determine (1) if loading reductions are being achieved over time and (2) if progress is being made toward attaining water quality goals. Element H asks "**how will you know if you are making progress towards water quality goals?**" The criteria established to track progress can be direct measurements (e.g., E. coli bacteria concentrations) or indirect indicators of load reduction (e.g., number of beach closings related to bacteria).

Element I: A monitoring component to evaluate the effectiveness of implementation efforts over time, as measured against the Element H criteria. Element I asks "**how, when, and where will you conduct monitoring?**"

The water quality goals are presented in **Element A** of this WBP, and the TP loading reduction goal is presented in Element B of this WBP. Element C of this plan describes management measures that will be implemented to help achieve this targeted load reduction. The evaluation criteria and monitoring program described below will be used to establish a baseline and measure the effectiveness of the proposed management measures (described in Element C) in improving the water quality of the Upper Manhan River and in making progress toward achieving the water quality goals.

Direct Measurements

Upper Manhan NWQI Baseline Monitoring Program

MassDEP collaborates with the EPA and USDA to conduct annual monitoring in support of the National Water Quality Initiative (NWQI) program. As described in **Element C**, the Upper Manhan River watershed was designated as an NWQI watershed in Fiscal Year 2023, and a comprehensive monitoring program began in May of 2024. Beginning in 2024, MassDEP will be conducting biweekly monitoring of *E. coli*, TN, TP, DO, and temperature at four key sites on the Manhan River and four sites on tributaries to the Manhan River from May—October. The monitoring program will run for at least four years. The monitoring locations are shown in **Figure HI-1** (MassDEP, 2024b).

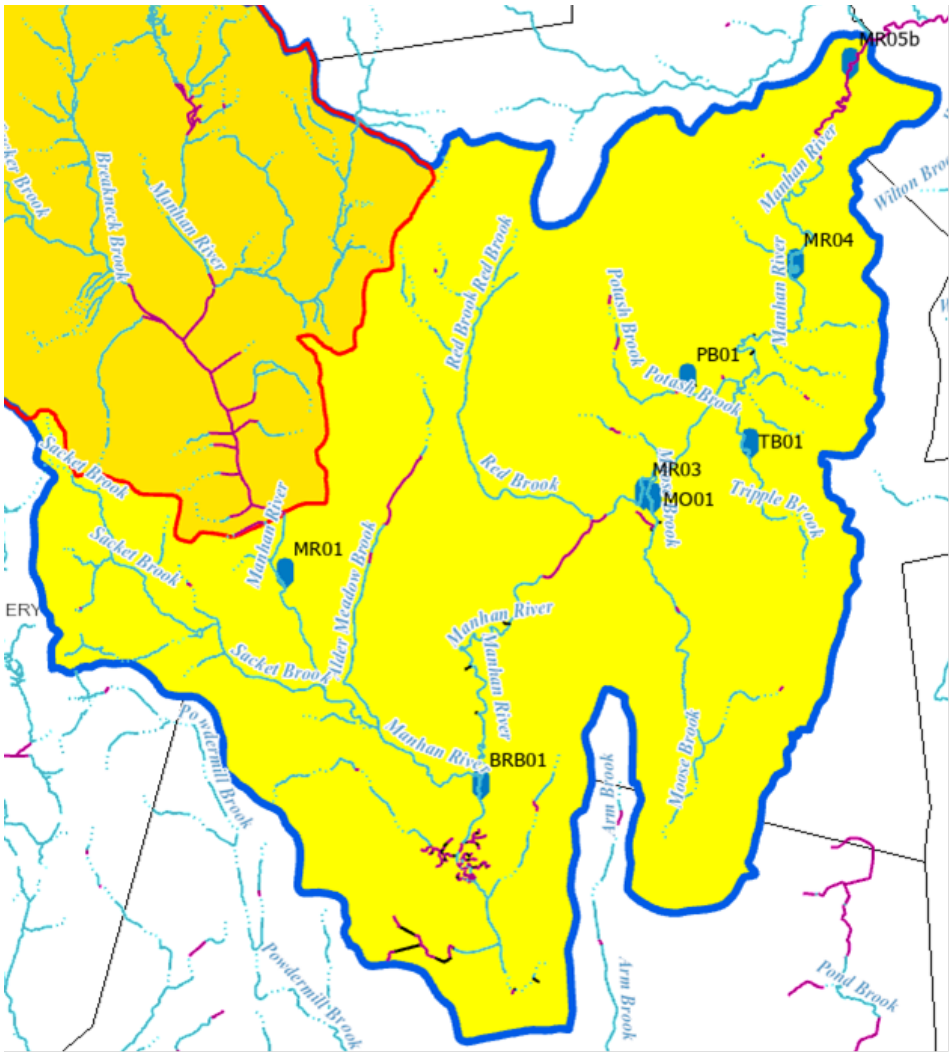


Figure HI-1: MassDEP/EPA/USDA NWQI Monitoring Locations in the Upper Manhan River Watershed 2024—2028 (MassDEP, 2024b)

Indirect Indicators of Load Reduction

Non-Structural BMPs

Potential load reductions from non-structural BMPs (i.e., street sweeping and catch basin cleaning) can be estimated from indirect indicators, such as the number of miles swept, or the number of catch basins cleaned. Appendix F of the 2016 Massachusetts Small MS4 General Permit (USEPA, 2020) provides specific guidance for calculating TP removal from these practices. As indicated in **Element C**, it is recommended (if not already completed) that potential TP removal from these ongoing actives be estimated. Next, it is recommended that ongoing activities be evaluated to see if potential improvements can be implemented to achieve higher pollutant load reductions such as increased frequency or improved technology.

Project-Specific Indicators

Number of BMPs Installed and Pollutant Reduction Estimates:

Anticipated pollutant load reductions from future BMPs should be estimated and tracked as BMPs are installed; this information should be included in future iterations of this WBP.

Adaptive Management

It is recommended that a working group be established that includes stakeholders and other interested parties (starting with the list of stakeholders identified in the introduction section of this WBP) to implement recommendations and track progress and meet at least twice per year. It is also recommended that a stakeholder be identified that will lead implementation and updates to this WBP.

As discussed by **Element B**, the Upper Manhan NWQI baseline monitoring program will be used to evaluate and establish a long-term (i.e., 15-year) *E. coli* and TP load reduction goal (or other parameter(s) depending on results). Long-term goals will be re-evaluated at least **once every three years** and adaptively adjusted based on additional monitoring results and other indirect indicators. If monitoring results and indirect indicators do not show improvement to the *E. coli* and TP concentrations and other indicators measured within the watershed, the management measures and loading reduction analysis (Elements A through D) will be revisited and modified accordingly.

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Appendices

Appendix A – Stakeholder Meeting Minutes

Meeting Minutes

Project Name:	Upper Manhan River NWQI Watershed Assessment Plan and Upper Manhan River WBP		
Location:	Upper Manhan River Watershed (Southampton, Westhampton, Westfield, Huntington, Montgomery, Easthampton), Massachusetts		
Meeting Date, #:	March 21, 2024	Meeting Time:	10:00 – 11:30 PM
Prepared By:	Bella D'Ascoli	Meeting Location:	Teams videoconference per Geosyntec invitation
Distribution:	All listed below		

Attendees:

Name	Organization	Contact Information
Bella D'Ascoli	Geosyntec Consultants, Inc	idascoli@geosyntec.com
Julia Keay	Geosyntec Consultants, Inc	jkeay@geosyntec.com
Meghan Selby	Massachusetts Department of Environmental Protection (MassDEP)	Meghan.Selby@mass.gov
Mark Defley	United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)	Mark.defley@usda.gov
Randall Kemp	Southampton Highway Department	highwaydept@townofsouthampton.org
Judith Rondeau	MassDEP	Judith.Rondeau@mass.gov
Gerrit Stover	Pascommuck Conservation Trust	gerrit@crocker.com
Cassie Tragert	City of Easthampton, Conservation Agent	Ctragert@easthamptonma.gov
Therese Beaudoin	MassDEP	Therese.beaudoin@mass.gov
Michelle Cozine	NRCS	Michelle.cozine@usda.gov
Padmini Das	MassDEP	Padmini.das@mass.gov

Minutes to be considered final unless comments are received within five (5) business days.

Agenda

- Greeting/introduction to NWQI
- Brief introductions from all participants
- Introduction to NWQI and WBP
- Watershed overview/Update on NWQI Plan and WBP
- Discussion (suggested topics)
  - Issues/concerns in the watershed related to water quality
  - Water quality goals and objectives
  - Monitoring information/metrics to track progress
  - Completed, ongoing, and future efforts
  - Outreach to landowners/NRCS programs
  - Recommendations for field investigation efforts
  - Schedule

Greeting/Introduction to NWQI

Julia Keay. Good morning, thanks for joining. This is the second stakeholder meeting for the Upper Manhan River watershed. The first call was focused on the National Water Quality Initiative (NWQI) Watershed Assessment Plan. We are also working on a watershed-based plan (WBP) for the watershed. This meeting is regarding both the NWQI and the WBP.

Brief introductions from all participants

Julia Keay: I work for Geosyntec Consultants, We are working with MACD (Massachusetts Association of Conservation Districts) on this project (NWQI) as well as the WBP. I am project manager and I am a Water Resources Engineer. Michael from MACD had a last-minute conflict and is unable to attend today.

Bella D'Ascoli: With Geosyntec, Staff Environmental Engineer helping with the WBP and NWQI.

Gerrit Stover: With the Pascommuck Conservation Trust in the Lower Manhan River. Just keeping an eye on what is happening upstream and hope to be inspired to build on whatever the outcome of this is in terms of landowner education and practices.

Randall Kemp: Town of Southampton Highway Dept. My connection to Manhan is that a lot of the headwaters are in Southampton as well as tributaries travel through, and it is important for our drinking water supply.

Therese Beaudoin: MassDEP, overseeing MassDEP part of NWQI monitoring. The program has been monitoring in Nashua for the last 4 years, and this year we are switching to the Manhan. We are starting baseline water quality monitoring this May through October and subsequent years.

Judy Rondeau: MassDEP, NPS outreach coordinator and grant coordinator for the agricultural regional coordinator grant that MACD is currently undertaking.

Meghan Selby: MassDEP, coordinator for the 604b management and planning grant program and help coordinate watershed-based-plan program with Judy.

Michelle Cozine: State biologist with NRCS. I was the conservation planner in the Hampshire County and Hampden County for 8 years. I was also involved in the big dam removal project in Southampton. I am familiar with a lot of our farms and western Massachusetts in general.

Padmini Das: Section Chief in MassDEP NPS management section in Watershed Planning Program. Our section manages 604b and 319 grants.

Mark Defley: NRCS acting for Catherine Magee State conservationist. Connection will be that I will go see it from the Amherst office. My background includes watershed planning in Gulf states and Pacific Islands.

Cassie Tragert: Conservation Agent for City of Easthampton. My connection to the Manhan is that I help projects remain in compliance with the Wetlands Protection Act and the Upper Manhan River feeds into Easthampton.

Julia Keay: I also forgot to mention I live in Easthampton in the Manhan River watershed, just downstream of Upper Manhan watershed.

Introduction to NWQI and WBP
Watershed overview/Update on NWQI Plan and WBP

Julia Keay. This is a brief overview of the watershed-based plan and the NWQI. The NWQI is a partnership between NRCS and other federal, state and local partners focused on improving water quality and targeted agricultural watersheds.
And the idea is to have a partnership-based initiative to pull public and private resources to improve the water quality as well as strengthening agricultural productivity. It focuses on smaller watersheds that can deliver the greatest benefits for local, regional and national water quality. The Upper Manhan is an NWQI watershed. Once the watershed selected, there are two phases: the readiness phase and the implementation phase. The readiness phase is developing this watershed assessment and to expand on farm planning and outreach and increasing support for local staff.

I also wanted to go over the reason why we're also doing the watershed-based plan for the Upper Manhan. MACD, has a 319 grant project where Western Massachusetts agricultural nonpoint source program regional coordinators are working with farmers to develop conservation plans and implementing BMP's to help enhance farm operations and protect water quality. The goal of the NWQI is very similar, so they're focusing their efforts to restore impaired waters in Western Massachusetts, including the Connecticut River watershed. One of the watersheds within the Connecticut River that they're focusing on is this Upper

Manhan River watershed. Part of the 319 program is that in order to receive the implementation funding, you need to have a watershed-based plan which has to include EPA's required 9 elements.

Shared figure comparing WBP to NWQI Assessment Plan. The figure indicates a lot of overlap between the two but a few notable differences. There's a lot of overlap, and then there's some elements in the watershed based plan that are a little more involved like cost, schedule and monitoring. A lot of the same information that we're going to include in the NWQI we will also be including in the watershed-based plan.

Presented slide on Watershed Overview in Meeting Presentation) to give the overview of the Upper Manhan, It's about a 36 square mile watershed. It has two listed impairments and I'll show some figures after so we can see exactly where we're talking about, but the listed impairments are *E. coli* and water chestnut and the sources that are listed are unknown and introduction of nonnative organisms. There is a pretty high percentage of agriculture in the watershed. We have currently these targets that we're going to include in the NWQI and also the watershed-based plan: bacteria, temperature (from the last meeting as a recommendation to include), and dissolved oxygen. Those will all be based on the Massachusetts Surface Water Quality Standards. We will also include a phosphorus (TP) goal, which is based on an EPA reference for target concentration. We'll also indicate that because the watershed is in the Long Island Sound watershed, there is a total maximum daily load (TMDL) for the Long Island Sound watershed overall, which has an overall 58.5% in a nitrogen reduction target, and we'll mention that we're in the Long Island Sound watershed and that's a large basin wide goal.

Discussion

Julia Keay: Shared 5 figures depicting the extents of the Upper Manhan River watershed including the watershed base map with sub watersheds broken out with major tributaries, wetlands, major land resources areas, ecoregions, and water quality monitoring locations within the watershed. The watershed discharge point is where the North branch Manhan River enters the Manhan River on the border of Southampton and Easthampton. The Tighe Carmody reservoir, is the water supply for the city of Holyoke. For the purposes of the plan, we are mainly focused on the area downstream of Tighe Carmody. The red line on the watershed base map is the impaired section of the Upper Manhan River. The different colors on the water quality monitoring locations map represent different studies. The red ones represent the Southampton outfall monitoring that's been conducted. We also included the Pioneer Valley Planning Commission study that was conducted for bacterial source tracking, and the MassDEP monitoring stations. We can add the future locations planned by MassDEP on this figure as well.

Therese Beaudoin: We have seven in the study area, which is from Tighe Carmody to the North branch. I can send you a spreadsheet of the future locations.

Julia Keay: Are those locations set?

Therese Beaudoin: Yes we are finished and going to send to EPA. They're based on existing data as well as the percent agricultural land use in individual tributary watersheds. So there's four stations on the main stem from right below Tighe Carmody to right before the North branch at the Whittemore Conservation Area. There is one at Gunn Road, one at the Brickyard Road Extension, one on Potash Brook/Brickyard Brook, and one on Tripple Brook. Tripple Brook has the highest amount of agricultural use of the sub watersheds. The problem is that there's no access to the bottom of the brook, so we can't actually capture what gets into the Manhan, but the easiest public access is roughly in the mid reach at Pleasant St. The day that they we were there, all of the waters were raging, but Tripple brook only had one to two inches of water in it, which led us to believe that it probably goes dry even on a non-drought year. We ended up having to drop that one for the baseline study.

Julia Keay: Were you also planning to do one on Moose Brook?

Therese Beaudoin: Yes, we're doing Moose Brook at the Brickyard Road Extension.

Julia Keay: I think in the Pioneer Valley study there was high *E.coli* as well as phosphorous in that location.

Therese Beaudoin confirms.

Gerrit Stover: This is going to be kind of a question in my mind through the whole process. I understand the agricultural land use focus of the funding and the projects, so maybe it's a question about what could be added to deal with downstream portions.

What other programs are out there that might help with monitoring impacts downstream? Are urban and suburban land uses adding from the end point of your current testing?

Therese Beaudoin: I can address that to some extent. The reason the study area is here is because downstream of roughly where the North branch comes in, is in MS4 and we're expecting that nonpoint sources from there are being addressed by Easthampton's MS4 permit.

Gerrit Stover: I'm not trying to derail or steer things away from that focus. Maybe it's a standing question for Easthampton and particularly for the Connecticut River. Additionally, what are the avenues for expanding or supplementing what these studies are going to do and actions are going to do to make sure that will improve what's going into the Connecticut ultimately.

Julia Keay: Are you interested in conducting more monitoring downstream in Easthampton downstream of this watershed? Is that what you're saying and what programs are available for that kind of thing?

Gerrit Stover: Yeah, just looking at Nashawannuck pond and the siltation over the last 20 years. There's clearly a lot happening, and with new climate regimes, those impacts are not declining.

Julia Keay: Well, two things that come to mind and I think Judy could talk about this, but there's currently an RFP out for the 319 grant as well as the 604B. Judy, did you want to comment on that?

Judy Rondeau: I wasn't going to talk so much about the grants, but I just kind of wanted to clarify. The focus for the NWQI report is really on agricultural sources. The watershed-based plan should be looking at any pollutant source in the watershed, so the plan can try to identify some of those more urban sources in the Easthampton area. Easthampton is an MS4 town, so there should be at least some data collected by the town that will have a pollutant loads related to their stormwater outfalls. That can certainly be included in the plan and used to try to identify pollutant loading hotspots--what neighborhood seemed to be contributing higher loads of pollutants through the storm water system. If there are any organizations that are doing water quality monitoring in the area or would like to start doing water quality monitoring in the area, there are several funding sources that could support that.

Meghan Selby: Yeah, I was just going to highlight the programs that we offer. Like Julia said, there's two RFP's out right now, so we cannot talk about projects specifically if you're going to apply this round. But we do fund water quality monitoring through the 604b planning grant. If you were interested in seeing what types of projects we fund and things like that, take a look at our website, there's a lot of information on there about past projects and the RFP is available on our website as well.
And that details eligible projects and all sorts of good stuff that you might be interested in as well.

Judy Rondeau: And I could add to that that we do have in the watershed planning program a small water quality monitoring grant as well. I believe that's already gone out for this this coming year, but interested organizations could apply later this year, when it comes out, I think it'll come up probably in late summer, early fall.

Julia Keay: I can send you the two grant programs just so you can see the information.

Gerrit Stover: Great. This is obviously a learning process for land conservation folks.

Padmini Das: I think the question is really good, and I just want to add that there is another grant, the MS4 stormwater grant program. This covers anything that is related to the NPDES (National Pollutant Discharge Elimination System) (MS4) permit, 319 is the other side of it. It is non-point source, so anything that is required by the permit cannot be covered by 319, but it can be covered by the MS4 stormwater grant. So if something is eligible under that, you can think of the next year funding in the next cycle.

Judy Rondeau: That grant will also be released in the fall.

Julia Keay: And the current 319 and 604b grants are due sometime in May.

Padmini Das: Yeah it is May 8th for 604b and May 22nd for 319.

Julia Keay: Any other comments on that? Ok so Therese I'll have this figure updated with that information. I did have one thought, you probably can't change the locations at this point, but I think you had one location that was up at the outlet of Tighe Carmody. I was just thinking because I think they the Holyoke Water Works, they already do monitoring as part of since they're the water supply and they do it. I was just thinking, would it make sense to move that location downstream before Brickyard Brook comes in? I know there's some farms along there.

Therese Beaudoin: It's possible; we could add a station. We need the station near Tighe Carmody because it will provide background of what's coming out of the upper watershed.

Julia Keay: Ok that makes sense.

Therese Beaudoin: Yeah, I don't think it's too late to add a station. The PVPC did a great job when they used the 604b money back in 2017. I think they had some valuable notes like on Potash Brook. They came across a place where some people had just purchased a farm and unknowingly were stashing their horse manure right next to the brook. The Pioneer Valley folks use that as an opportunity to instruct them on what that was actually doing to the brook and when they were sampling in Moose Brook, a similar situation, they found a farm with cows and the cows were fenced in with the stream. They were literally walking right through the stream. They did some great outreach while they were out there.

Julia Keay: Yes it was a really helpful study.

Therese Beaudoin: Yes we used their data and their observations when we selected the stations for this project.

Julia Keay: Yeah, I think that will be really good. We were aiming to have this NWQI assessment done this March but we have a little bit longer now due to an extension. We'll try to have it wrapped up by the summer. I think when we get the results from your initial monitoring, we could add that in possibly in the Fall if that works.

Therese Beaudoin: I'll inquire as to the data availability. The data for *E. coli* we will be analyzing in house and those should be available sooner than the samples that are going to analytical lab.

Julia Keay: We have some additional figures here. Shared Upper Manhan Soils and Impervious Cover Map depicting soil types and ground cover in the watershed. You can see up in the upstream area, there's a lot of these soils which have low infiltration rate and then most of the impervious (shown in red) is concentrated downstream as well as in the Westfield portion. There's a lot of soils which filter better, but not very well for infiltrating. These Class A would be good if you were to implement any type of infiltration BMPs. This will be used more for modeling by sub watershed. And we'll be considering the soil types, the land use, and impervious when we do that. Shared the Upper Manhan Watershed Land Use Map showing land use within the watershed based on residential, agricultural, water, and additional uses. It is fairly busy, but you can see a lot of forests and the upstream yellow light yellow is a pasture area.

Mark Defley: A question on the impervious cover map. I'm assuming that your analysis includes the transportation network and the impervious network and it's just that the two skinny to show up on a map to scale, right?

Julia Keay: Yes the roads are included. 202 is a bigger road so you can see it better but a lot of the roads are smaller. The biggest road is route 10, which goes through Southampton.

Gerrit Stover: What is the grey on the map?

Julia Keay: That is unavailable soils data. In those cases, we would just assume hydrologic soil group D for conservative modeling. Then this figure is showing the environmental justice areas. And you can see it's the only environmental justice area, and this watershed is in this portion, which is in Westfield. Is there anything that we haven't discussed regarding issues or concerns in the watershed? As Judy mentioned is doesn't just have to be agricultural related.

Randall Kemp: I just have a quick question on sampling locations. The town now owns the rail corridor that is semi parallel to Route 10 and so if there were any sampling locations that crossed the rail corridor, they might be a hike to get to. But we technically have access if you want it.

Therese Beaudoin: Our Potash Brook station does access your right of way along that rail line to get to Potash Brook from I think it's East Street or East Road.

Julia Keay: Ok awesome are there still plans to do a bike trail on that?

Randall Kemp: Yes, they are current under development I think the timeline is 2027. It would basically go from Coleman Road where the current bike trail terminates to the ice cream shop right before the rail trail crosses Route 10.

Julia Keay: Did anyone have any comments on the water quality goals?

Gerrit Stover: Julia can you remind me of the particular aspects of water quality that are listed that you're looking at?

Julia Keay: We have a goal for *E. coli*. We also included phosphorous as that's something you can quantitatively monitor, because there's also the issue with the invasive plants. Elevated phosphorus could be an indicator of invasive plants. Temperature was brought up last meeting because a lot of the tributaries are considered cold water fisheries, so the temperature would be important and then dissolved oxygen as well.

Gerrit Stover: Global thing I am curious about is fish population, invertebrates, and drinking water are the end users for whom we are improving water quality?

Julia Keay: Yes all of the above. Your question is who is this for?

Gerritt Stover: Yes, always interesting to watch technical sides and the complexities you deal with for funding criteria and project parameters. As a member of general public, my question is always what is the end result and objectives. And this is great because you are going out to farmers and working with them to help them be better for the environment.

Julia Keay: I think it is a marathon not a sprint. But you have to start somewhere. Having goals is a thing you can quantify. To work towards something.

Therese Beaudoin: All of the waters in the Manhan are classified as Class A or Class B. Class A is for public water supply. Class B is for wildlife habitat, emergency back-up water supply, swimming and boating. The goal is for water quality to meet those goals and be suitable to wildlife.

Julia Keay: Any other questions on the goals? I think we went over all the monitoring information. I guess another thing that is important to include are any planned projects for stormwater BMPs, that are planned or in concept level, that could be included in the watershed-based plan.

Randall Kemp: For the East street bridge replacement, some of the stormwater that previously directly discharged into the Manhan now goes through a water quality unit and grassy swale for some sort of treatment. The second one is at Conant Park, which is between East Street, Route 10 and Clark Street; we're going to be doing a BMP demonstration project. And so that will also discharge into the Manhan very close to the same location. It is just a grassy swale infiltration. It's in the design phase now.

Julia Keay: Are you able to share drawings for that; we could include it as an attachment to the plan?

Randall Kemp: Yes possibly? I'll get you what I have and whether it's appropriate for the location is debatable.

Julia Keay: Ok great we can at least mention it, so it is in there. Anything else? So, for outreach to landowners and NRCS programs, that's kind of going to be like the next step here. Does NRCS folks on the call have any thoughts or recommendations on that process?

Michelle Cozine: I do not, I think it all sounds great.

Julia Keay: Ok and in the NWQI we include that in the future the main source of grant funding that could be applied for is EQIP?

Michelle Cozine: Yes. Are you asking for other programs for the outreach?

Julia Keay: Yes, what are your recommendations for programs that farmers could get funding from to implement projects; on our last call, it sounded like EQIP (Environmental Quality Incentives Program) was the best funding source?

Michelle Cozine: EQIP is the best funding source to address resource concerns but we do have a CSP (Conservation Stewardship Program) which is a program for producers that are within the watershed that have already applied for EQIP in the past and could maybe just have a step up in management.

Julia Keay: And for field investigation, we've done some of that just going around to where we know there are some hotspots and we're going to fine tune that to do a little more field investigation. This would be going out, taking photos, and we also plan to identify about 15 hotspot locations to implement some kind of BMP or conservation practice. Are there any recommendations?

Gerrit Stover: Randall mentioning town projects makes me wonder again about with watershed-based plan having a wider focus of towns not just in terms of the audience, but also the activities that you're addressing in terms of best management practices. Does outreach go only to farmers? Does it also deal with other large landowners? With the municipalities, the information about best management practice is going to be available to broadcast a bit more widely than just agricultural audience, but to other people as well.

Julia Keay: Yeah, part of the watershed-based plan is a public outreach and education element. We will definitely want to include plans for that and what's being done so far; is there any public education and outreach currently happening in terms of nonpoint source pollution that anyone wanted to bring up?

Randall Kemp: We perform some as an MS4 requirement. A lot of work with PVPC in the Connecticut River Stormwater coalition as well as I put out a lot of public service messages on our town Facebook page. In addition, we have a yearly public meeting with the select board to go over our MS4 activities.

Julia Keay: I think we talked about that at last meeting too. We will definitely include information from that. I know the Pascommuck Conservation Trust does a lot of outreach and it's more downstream of this watershed but it is important and we could possibly include some of that.

Gerrit Stover: We definitely would be happy to disseminate materials and act as a communication conduit.

Mark Defley: On the topic of best management practices, or what we call conservation practices for nonagricultural land uses. Our agency's responsibility to implement the Farm bill is so overwhelming that the vast majority of people in our agency never deal with anyone but producers. However, in a partnership setting where we have multiple nonagricultural land uses throughout the planning area, many people are not aware that more than half of NRCS conservation practices or best management practices were developed for multiple nonagricultural land uses. It's just that we as an agency don't use them in nonagricultural settings. So many of our planners, and even perhaps some of our technical service providers, are not familiar, that they are available for use, and were developed for use including on nonagricultural land uses. So that's it's very hidden on our web page. But I can do a sidebar with anyone who wants to know how to find the land uses that are applicable for any given conservation practice on our national web page.

Julia Keay: You're saying on the website there's conservation practices specifically not geared towards agricultural use or are like residential?

Mark Defley: No, all of our practices are geared towards different agricultural land uses, but more than half of our practices, for instance, are available for use and were developed for use on developed land. So they could be employed on developed land. Those are the national practice standards and are meant more for information purposes. When it gets down to actual planning and implementation and a local setting, we urge you to go to the State Field Office technical guide for any state specific differences there might be in those planning standards. But the document to look for in our national website is called the conservation planning physical effects document (CPPE). Each conservation practice has its own web page with linked documents, and one of the linked documents is the CPPE. That document, as I said, very well hidden in the upper right-hand corner of that PDF document. It has the land uses that that particular practice was prepared for and can be used on if you follow

our standards. I can sidebar with anyone or feel free to contact me and I can walk you through that at some point or if you want. (https://www.nrcs.usda.gov/sites/default/files/2022-09/Riparian_Forest_Buffer_391_CPPE.pdf)

Mark Defley (via chat): This is the main link to all national NRCS conservation practice standards. On that page, once you click a practice standard link on the list, on most practice standard pages there's another link for the practice CPPE (conservation practice physical effects) document https://www.nrcs.usda.gov/resources/guides-and-instructions/conservation-practice-standards.

Judy Rondeau: I just want to reiterate a couple other points that Julia made regarding outreach in the watershed-based plan. It should not only identify outreach that has been conducted or is currently being conducted, but it should also identify future outreach that could be conducted that targets pollutant sources that are identified during the development of the watershed-based plan, evaluation or assessment. If any of you are aware of particular pollutant sources in your communities that should be addressed and that outreach could be beneficial for you know it could be something like "Don't mow your lawn and dump the grass in the stream behind your house" or "pick up after your dog". Whatever the pollutant source is, let Julia know and she can include that in the plan as future targeted outreach.

Julia Keay: Anything else anyone wants to bring up?

Cassie Tragert: I just wanted to mention that Easthampton is an MS4 community and you were interested potentially in that data related to that. If you want to email me separately, I can connect you. It seems mostly that either the water department would have that information or the city engineer has been kind of pioneering or managing that status. He's on vacation for this week, but I believe he is back next week, so if you want to connect offline, we can try to get you that information.

Julia Keay: Ok awesome thank you.

Therese Beaudoin: I just want to clarify that the work that we're doing is what we consider to be baseline monitoring. We don't know if our federal partners are out working with the agricultural operators in the area yet. we're assuming no and that the monitoring that we're going to be doing is going to be before any BMP work is done in the watershed. In it, we are going to be sampling. At this point, we anticipate probably about four years and keeping with what we've done in other NWQI watersheds, the focus is on *E coli* as that's what it is impaired for during the bathing beach season (roughly May to October). And as we mentioned earlier, it'll also be for nutrients. Nutrients can be associated with runoff from various types of land uses, including agricultural. The focus of the program will be on nutrients and *E coli* and we'll also deploy a logger that will measure temperature and dissolved oxygen (DO) for about four months.

Julia Keay: Ok, great. That goes pretty nicely with the goals that we've included, which are for all those parameters. But were you saying that the monitoring program will be four years and then the idea is that implementation won't occur until after that four year period?

Therese Beaudoin: No. The premise is that the federal partners want to be able to work with the agricultural operators and be able to tell them that they are not coordinating with enforcement agencies like the EPA or DEP. So we don't know when they're going out or if any of the agricultural operators are doing anything. At this point, we haven't heard anything about any ongoing effort. We are going under the assumption that no BMP's have been started other than whatever outreach has already been conducted. For example, by PVPC and by the town of Southampton and the city of Easthampton, et cetera. We at some point will assume we'll be contacted and requested for us to go out and conduct post BMP sampling because the goal is to show that the water quality has improved as a result of all the efforts people have put in. But right now the next four years, we're under the assumption that those efforts have not yet really begun.

Julia Keay: Ok thank you that makes a lot of sense. But it is nice to know the parameters that you're sampling for.

Therese Beaudoin: Yea it'll be great to have the long-term temperature and DO too. This way you can see if there are big oxygen sags at any time or overnight.

Gerrit Stover: I have one last question and wanted to say thank you for putting up with my ignorance. Isn't turbidity important for a lot of aquatic species, and it is that something that gets tested for? But I'm just thinking, having just been walking in a lot of our conservation areas and watch the huge piles of sand from the December rainstorm, just curious about that.

Julia Keay: Therese do you want to respond to that?

Therese Beaudoin: Turbidity is a good measurement and we will have monthly turbidity measurements because we have that deployed logger that measures temperature and oxygen; we go out monthly and take in situ measurements that are just reflecting exactly what's going on at the moment that we are there. We don't have a long-term turbidity probe. We'll have a few measurements, whether that's representative of what's going on over time or not, we will not have enough measurements to qualify that. However, it is enough for us to check whether our temperature in our loggers are working well and turbidity is if you have the right equipment. It's not an expensive analysis. A lot of the monitoring groups in Massachusetts have a turbidity meter and do measure that; it's kind of a low hanging fruit type of analysis.

Judy Rondeau: You said that we'll be deploying a logger to measure temperature and DO for about four months. What is that time period?

Therese Beaudoin: We be deploying those in June and picking them up either the end of September or the very beginning of October.

Gerrit Stover: Just so you know that the Pomeroy Meadow Conservation area on the Easthampton side. We have a trail that goes right down to the river and it's just upstream of the North Branch confluence.

Therese Beaudoin: Yeah, we did investigate that. I followed the trails that are on the trail map. The only problem with that is that it's about a mile up and back from the vehicle, which is not a problem physically, but it's a time sink in terms of getting our samples back within the holding time for the *E coli*. So I was looking for something shorter. If there's a trail that's not on the map, that would be really helpful to have that.

Gerrit Stover: No.

Therese Beaudoin: It's ok. Yeah, I looked online and I thought I saw something pretty close, but it might include some bush whacking. So we wouldn't undertake something like that without permission.

Randall Kemp: Just one more thing. If you need to get to any sampling locations in Southampton, give me a call. I might have some resources. I was on the Conservation Commission for eight years before I worked for the town.

Therese Beaudoin: Maybe you could make a good access to the River of through Whittemore, so that we don't have to wade through briars. That would be really appreciated.

Randall Kemp: That one's a little tough, but if it's somewhere you need to get, I have access to weed wackers and such.

Therese Beaudoin: You have no idea how happy that would make us. We went down the to do recon and our clothes got all cut up trying to wade through. We found the place where PVPC went thanks to Patty. But whatever trail they had been using, there is overgrown by briars now, so anywhere there are no briars to get to the edge of the river would be really appreciated.

Randall Kemp (via chat): Dan Murphy - Easthampton Town Engineer is the one I see on CT River Stormwater Coalition meetings so he would have MS4 info. but it should be posted on City website as well as it is another condition of MS4 permit.

Julia Keay. Ok awesome this has been a very helpful meeting and feel free to reach out to Bella and I if there's any questions on either plans or if there's any information you wanted to send over that you want us to include and we'll be in touch soon! Thank you all for contributing to this meeting!

Contact: Julia Keay, JKeay@geosyntec.com
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Meeting Minutes

Project Name:	Upper Manhan River NWQI Watershed Assessment Plan		
Location:	Upper Manhan River Watershed (Southampton, Westhampton, Westfield, Huntington, Montgomery, Easthampton)		
Meeting Date, #:	November 3, 2023	Meeting Time:	10:00 – 11:30 PM
Prepared By:	Bella D'Ascoli	Meeting Location:	Teams videoconference per Geosyntec invitation
Distribution:	All listed below		

Attendees:

Name	Organization	Contact Information
Bella D'Ascoli	Geosyntec Consultants, Inc	idascoli@Geosyntec.com
Julia Keay	Geosyntec Consultants, Inc	JKeay@Geosyntec.com
Michael Leff	Massachusetts Association of Conservation Districts (MACD)	mleffmacd@gmail.com
Meghan Selby	Massachusetts Department of Environmental Protection (MassDEP)	Meghan.Selby@mass.gov
Bridget Likely	Kestrel Land Trust	bridget@kestreltrust.org
Malcolm Harper	MassDEP	malcolm.harper@mass.gov
Catherine Magee	United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)	catherine.magee@usda.gov
Sylvia Muniz Gaya	USDA NRCS	sylvia.munizgaya@usda.gov
Randall Kemp	Southampton Highway Department	highwaydept@townofsouthampton.org
Judith Rondeau	MassDEP	Judith.Rondeau@mass.gov
Ryan O'Donnell	Connecticut River Conservancy	rodonnell@ctriver.org
Tom McAndrew	Holyoke Water Works	contid@holyoke.org
Gerrit Stover	Pascommuck Conservation Trust	gerrit@crocker.com
Patty Gambarini	Pioneer Valley Planning Commission (PVPC)	Pgambarini@pvpc.org
Zoe Fox	New England Consulting Services	zoe@neconsultingservices.com
Dianne McLane	Pascommuck Conservation Trust	dtmclane@charter.net
Edwin Matos	Holyoke Water Works	contid@holyoke.org

Minutes to be considered final unless comments are received within five (5) business days.

Agenda

- Greeting/introduction to NWQI
- Brief introductions from all participants
- Watershed overview
- Discussion
  - Issues/concerns in the watershed related to water quality
  - Water quality goals and objectives
  - Monitoring information/metrics to track progress
  - Completed, ongoing, and future efforts
  - Outreach to landowners/NRCS programs
  - Recommendations for field investigation efforts
  - Plan for second stakeholder meeting

Greeting/Introduction to NWQI

Julia Keay. Good afternoon, thanks for joining. This is the first stakeholder meeting for the Manhan River NWQI Watershed Assessment Plan. The purpose of this meeting is to get stakeholders together and to get your input and information for the plan. The purpose is to get input from all of you and hoping to get as much information from all of the stakeholders. Towards the end we will plan on having a second stakeholder meeting and get additional stakeholders' information to include in the process moving forward.

Michael Leff. Director of MACD. This particular meeting stems from NWQI actions proposed to develop a watershed assessment plan for the Upper Manhan River watershed. The plan will support the National Water Quality Initiative and the actions proposed to be undertaken will enable both agencies (NRCS and MACD) and many partners to more effectively meet their collective obligations for water resources. MACD is involved in various types of related work for MassDEP which are a couple of 319 projects (Non-point source pollution control) with two currently active projects and one being the entire Connecticut River watershed with an agricultural focus (Agricultural Regional Coordinator project). Zoe Fox is leading that project as the Agricultural Regional Coordinator. NWQI is similar to WBPs (Watershed Based Plans) which is similar to our work with MassDEP. Our task number 1 on the Manhan River NWQI is to identify primary subcontractor to work on project technical aspects. We have identified and selected Geosyntec. We work with Geosyntec on some of the other WBPs so they are the natural leads on this. At any point if there are other entities that we should loop in, that would be very helpful to know.

Julia Keay: To add to that the NWQI has two phases, so the Upper Manhan has been selected as a targeted NWQI watershed, and we're currently in this readiness phase, which is prior to receiving targeted technical and financial assistance. This readiness phase provides funding for watersheds to develop watershed assessments, expand on farm-planning and outreach, and increase support for local staff. But we also are not just putting our blinders on for agricultural sources. We also would like to understand any additional problems or issues in the watershed and capture that in the plan as well. Now we can go through and give introductions. I can start, we are working with MACD to implement this NWQI plan. I am Julia Keay, the project manager and I do have a strong connection with the watershed in that I live in Easthampton. I'm not in the watershed, but I'm very close to the outlet point of the Upper Manhan. So yes, I'm excited to do this work for that reason as well.

Brief introductions from all participants

Zoe Fox: I work for New England Consulting Services and as Michael said, I'm acting as the agricultural regional coordinator in Western Mass, so I work with farmers who identify best management practices and help access the NRCS funding and other sources of funding as part of both 319 projects. We'll also be looking at the Manhan for a watershed-based plan and I'm excited to learn more about it.

Bridget Likely: I am a conservation manager at Kestrel Land Trust and we're working on several land protection projects in both Easthampton and Southampton, which are related to the Manhan River.

Bella D'Ascoli: I'm Julia's coworker at Geosyntec and I am excited to work on this project with you all. I don't have a ton of connection to the watershed, but I live in Boston, so I have a lot of connections to Massachusetts in general, and I'm excited to work on the project.

Catherine Magee: I am the state resource conservationist for NRCS, so I am managing the agreement from our side of things.

Dianne McLane: I am President of the Pascommuck Conservation Trust and as you know, we're very interested, incredibly interested in the Manhan. A lot of our properties abut the Manhan and we just acquired a property that is located on both sides of the Manhan. So, we're happy to be part of this. Thanks.

Julia Keay: Is that property in Southampton?

Dianne McLane: No in Easthampton. But on the line of Southampton.

Sylvia Muniz-Gaya: (from chat): Good morning everyone, unfortunately my computer microphone is not working this morning. I'm Sylvia M. Muniz-Gaya, and I work for the MA Natural Resources Conservation Service (NRCS), and the District Conservationist covering the Western MA Counties- Franklin, Hampden/Hampshire and Berkshire.

Tom McAndrew (from chat): Good Morning. My name is Tom McAndrew also from Holyoke Water Works. Mic not working at this time.

Edwin Matos: We work for Holyoke Water Works. We own a lot of surrounding protected wetlands in the area. And we are just trying to get some more information on how we are going to be affected by any of these projects.

Meghan Selby: I work for MassDEP in the watershed planning program in the nonpoint source management section and I coordinate the 604B Water Quality Management planning grant.

Randall Kemp: Randall Kemp - Highway Superintendent, Transfer Station Manager & Parks Commissioner for Town of Southampton. I also administer our MS4 program. The Manhan snakes through approximately 14 miles of Southampton including one former and one current reservoir for the City of Holyoke. In addition to the Manhan there are a dozen or so tributaries of the Manhan and many involve road crossings.

Patty Gambarini: I work for the Pioneer Valley Planning Commission. And we did that 2016 study that was funded by the 604B program.

Judith Rondeau: I am with MassDEP in the nonpoint source management program with Meghan and Malcolm. I am the nonpoint source outreach coordinator and I also am managing the agricultural regional coordinator grant that Michael mentioned earlier.

Gerritt Stover: Works for the Pascommuck Conservation Trust and the Pascommuck owns about 3 miles of riverbank on the other downstream portion, so clearly what happens in the upper part of the watershed is really important to us. And we've also worked on protecting farmland along the Manhan and some watershed land in Southampton as well. It's interesting that the focus is on farmland uses, which is clearly important for that upper section of the watershed. We're dealing with development on the tributaries and on the main stem and we are, especially with today's climate, concerned about the aggravated impacts of erosion and the like. Plus, I am really happy about some of the fisheries habitat improvements, the dam removal and things like that that are great news. Thanks.

Ryan O'Donnell: I'm the water quality program manager at the Connecticut River Conservancy, and we have an e. coli monitoring program in Massachusetts and soon to be nitrogen monitoring program. We don't currently monitor the Upper Manhan, but we do monitor the lower Manhan in a couple spots.

Malcolm Harper: I work for the MassDEP and I coordinate the section 319 nonpoint source grant program. I don't live near the Manhan, but I am one town away in Northampton, so I'm quite familiar with the Manhan and some of its challenges. I would love to see a successful 319 grant proposal to deal with some of the pollutants, the targeted pollutants in the Manhan. Thank you.

Watershed Overview

Julia Keay. This is a brief overview of the watershed. The area of watershed is 36 square miles and it is a Category 5 on the Massachusetts integrated list. Impairments include E.coli and water chestnut. About 8% is agriculture, open land and recreation is 29%, tax exempt relatively high but I think mostly due to the reservoir being designated as tax exempt. Long term quantitative water quality targets for bacteria and phosphorous based on MA Surface water quality standards and EPA target concentrations. May add additional goals/targets based on review and stakeholder input.

Julia Keay. (Showed reference map with main tributaries to the Manhan River.) I also have a Google Earth delineation to share in order to look at specific locations later on in the meeting. (Also showed land use map with land use classifications and impervious cover map.) The impervious cover is concentrated at the downstream end of the watershed. We have the MassDEP monitoring locations on the figures and have that data; we are interested in any additional monitoring data (MassDEP data is

from 2008). Now we can move on to discussion, Start with any issues or concerns that we should be aware of related to water quality.

Discussion

Dianne McLane: Wondering if you would be able to share slides?

Julia Keay: Yes after the meeting.

Dianne McLane: Yes, thank you.

Julia Keay: (Has Google Earth open with two points Randall mentioned flooding.) It is helpful to pin areas of concern when we're putting additional figures together.

Patty Gambarini: Julia I have a question. Did you see the 2016 data that came out of the 604 B analysis set my agency did?

Julia Keay: Yes we have that and haven't reviewed in detail and will be helpful.

Patty Gambarini: Good because that shows a lot on Moose Brook and Potash Brook and impact there.

Julia Keay: Yes it did indicate that agriculture was a big source.

Patty Gambarini: Yes that's correct.

Julia Keay: And the recommendation was public outreach which is good because that's what we are doing.

Randall Kemp (in chat) Mic still not functioning. You already mentioned agriculture - there are two farms of which I am aware that pasture cattle adjacent to Moose Brook and Manhan. ...and Patty just said very similar to what I was typing.

Julia Keay: Yes farms are identified in that plan Patty?

Patty Gambarini: Yes I cannot see chat easily.

Michael Leff: (Re-reads Randall's chat.)

Patty Gambarini: From our study there was evidence of cows in streams.

Julia Keay: Has anything been done since to reach out to those farmers?

Patty Gambarini: Not that I know of.

Julia Keay: Ok good to know. I was curious of additional water quality monitoring in the watershed.

Ryan O'Donnell: There was a temperature study where CRC helped with some volunteers for that.

Julia Keay: Ok.

Patty Gambarini: I wonder if there was any analysis done on the dam removal that might be helpful.

Julia Keay: Good point, does anyone have info on dam removal?

Patty Gambarini: I think the Division of Ecological Restoration was involved, so there might be a good starting place.

Randall Kemp: Only other monitoring would be the MS4 outfall screening which I provided.

Julia Keay: Randall do you recall if they are all in the watershed? Some may be outside, as a figure we will include locations.

Randall Kemp via chat: I would have to check.

Julia Keay: Ok we can check too.

Michael Leff: Back to future stakeholders on the point about Division of Ecological Restoration. Carrie Banks would be who I'd be most familiar with if that's still within her realm. She's based out of the Westfield office last I heard.

Julia Keay: Question for NRCS, one of the things we are supposed to include in plan are the NRCS programs that may be available for implementation. Is this something we could talk about on the call or follow up?

Michael Leff: Sylvia or Catherine.

Catherine Magee: Asks Julia to repeat question.

Julia Keay: Repeats question.

Catherine Magee: EQIP, CSP. Mainly EQIP with more funding under NWQI. Suggests we can ask for more specific amount of funding per year from the national office under the NWQI to implement a plan. Once the plan is completed then we can go back and ask our National Office to implement the plan and then we ask for a specific amount of funding per year. Usually, it's wrapped up in August when they ask us how much we need per year to implement the plan. So, it can be adjusted each year but it's going to be primarily under EQIP.

Michael Leff: Explains what EQIP stands for (Environmental Quality Incentive Program).

Julia Keay: Awesome thanks. Asks if any questions of quantitative targets. Any qualitative goals or objectives included?

Patty Gambarini: I think the temperature data could be helpful to see if it meets cold water standards.

Gerritt Stover: Can you briefly describe what are you trying to promote regarding qualitative goals? Habitat? Drinking water?

Julia Keay: Generally related to water quality in watershed. Trying to get thoughts from stakeholders as to what you would want as a goal.

Gerritt Stover: It's actually the other end I'm curious. You currently have two criteria aquatic invasives and e coli, but up on land, terrestrial invasives have much greater impact. Not sure what falls within guidelines. I'd be concerned about habitat impacts and recreational user impacts.

Michael Leff: We are casting a wide net and very broadly looking at request for proposal information gathering stage. We want to find goals that support healthy watersheds and diverse land use communities, protect communities and people through rehabilitated watershed structures, enhance and improve water quality and water quantity and provide habitat for diverse and important fish and wildlife species. So, in this information gathering stage, if you've got something in mind might as well put it out there.

Julia Keay: Yeah I think temperature study is a good point. I do want to look at additional temperature data in more detail.

Dianne McLane: seconds temperature study is important.

Michael Leff: If we are not acknowledging you, you can also use the raise hand feature at the top of Teams.

Patty Gambarini: Since we are talking in grand way, I remember from 2016 that beaver activity might be having an impact, Belchertown was working with consultant to look at beaver activity and resilience to larger intensity storms and where is it threatening. So that might be one thing to look at.

Julia Keay: Ok good

Gerrit Stover (in chat): Additional outreach candidates: You might want to contact Friends of Conte who just hosted Connecticut River Watershed Partnership meeting. Many reps from National Fish & Wildlife Service (esp. fisheries-related), recreational users, etc. Mass Audubon ecologists, too.

Julia Keay: Gerrit, you mentioned terrestrial invasives?

Gerritt Stover: At least in Easthampton there are Japanese knotweed (Randall seconds in chat). Incredibly difficult to control, division of ecological restoration opened up stretch of riverbank and deal with fresh areas of mud that are good habitat for invasives.

Michael Leff and **Julia Keay**: agree good point and ongoing maintenance.

Randall Kemp (in chat): Black swallow wart as well (terrestrial invasive)

Julia Keay: Another component of this effort is field investigation; we will visit some of the locations that are mentioned. If anyone wanted to meet for that feel free to email me. The other thing we would be interested in if there is any completed, ongoing or future efforts.

Julia Keay. Does anyone know of any stormwater management projects and treatment projects planned or recently done?

Randall Kemp (in chat): Bridge replacement on East Street

Michael Leff: Asks about measures more in depth.

Randall Kemp (in chat): storm capture, grassy swale, check dams.

Julia Keay: As part of MS4 compliance, there should be additional information in SWMP? Randall confirms.

Julia Keay: Asks about anything else in this watershed regarding studies or information we should be aware of.

Judith Rondeau: It will come after the development of this plan but it is very likely that we are moving NWQI monitoring to the Manhan next year and we may be able to use this info about where we do monitoring.

Julia Keay; Asks about NWQI funding?

Judith Rondeau: Yes so, we have a number of designated waterbodies, partner with NRCS and EPA and do monitoring for a watershed.

Julia Keay: That's exciting, should we include that as a part of this plan?

Judith Rondeau: Let me confirm but it looks like that's the direction.

Julia Keay: Ok, yes any recommendations for monitoring would be helpful?

Judith Rondeau: Yes.

Gerritt Stover (in chat): Mentions worth asking UMass and other colleges to search out related research projects.

Julia Keay: That's a good suggestion Gerritt. I do have a good contact at UMass, so maybe I'll add him as part of the next stakeholder invite. Masoud, I don't know if anyone knows him, but I feel like he's done a lot of agricultural related projects. I think I did ask him and he hasn't really done anything in this watershed, but he might be a good resource for recommendations for farmer outreach etc.

Malcolm Harper (in chat): Masoud Hashemi (UMass) would be a great resource if available.

Patty Gambarini; Based on our study what stopped us from moving forward is that farmer outreach is so important and I want to shine a light on Zoe's work. You know we don't have that expertise in my agency to approach farmers. But you know, a couple of the things that were recommended, as you know, livestock exclusions from Potash and Moose brook and nutrient BMP's as being critical. So, to the extent that you can sort of carry that forward, I think that would be helpful. And so, you might be covering some of that in the watershed-based plan that you're thinking about already.

Julia Keay: Yes definitely.

Randall Kemp: mentions he is on Southampton Agricultural Commission.

Julia Keay: OK, great, because I actually did email them as part of this invite, but it bounced back the email that's on their website wasn't working. I guess if for the next stakeholder call, I was just wondering if we should try to invite farmers as part of that, or if what people's thoughts were on just outreach, if maybe that's not the best way to reach farmers just because I know they're busy during the day generally so might not be a convenient time.

Judith Rondeau: I think that if you get one farmer on board then use them as ambassador to other farmers. Maybe Randall has insights?

Gerritt Stover: You need to make it clear that it's not a punitive action that's coming down the Pike and that it's a start of a conversation with farmers that can help them improve their operations. And that if there is assistance that's available to them financially and in terms of management practices that that you make it clear that that's the next part of this, that you're going to be helping them and not hindering them.

Julia Keay: Agrees.

Randall Kemp (in chat): Agrees about forwarding to agricultural commission and to include farmers that are interested.

Michael Leff: Asks Catherine to speak about financial assistance available.

Catherine Magee: So right now, like anyone in any part of Massachusetts can apply to any of our programs where at the beginning of our fiscal year and we have about double the budget that we normally have due to the IRA funding, which is like climate funding from National office. So, we have plenty of money and we could do any work with farmers or stream work or anything right now, after this project is over with the plan, then we can apply for specific funding for this project. But before that, there's plenty of money if you find farmers that are interested, we can work with them. So just tell them to contact our offices. And Sylvia, who is on the call too. She's the district conservationist for this area, so she can assign them a planner, and we can get them assistance right now before this plan is completed.

Michael Leff: Zoe might be able to speak about farmer outreach?

Zoe Fox: Yeah I'm excited for this portion, it's not a mandate and that's the way to go about it. I have not done outreach yet but it is planned for winter and that is going to include encouraging them to apply to NRCS programs.

Malcolm Harper: There is funding from 604b and 319 grant programs from MassDEP. But there is a precedent for getting funding for farmers who wish to remain anonymous. For the BMP's, they're installing, which is sort of interesting, but we pulled that off with the assistance of MACD and we could conceivably easily do that in the future. That's a long conversation for some other time, but there is funding available from the 319 program in particular for implementation work. And currently we expect that it would require a match, but Padmini Das who runs our nonpoint source program has been working very hard to reduce

that match and we might have some very exciting news regarding the reduction of match in the near future, but I can't really comment on that any further.

Catherine Magee: Can match be federal?

Malcolm Harper: It's EPA funding, so we cannot use any federal funding as match. But if there was an expensive project or the funding worked out that NRCS money and MassDEP money could be used together, the federal money from the NRCS could not be used as match. But we can work together, as in one project if that helps that particular farmer or farmers. We have no problem with that at all.

Michael Leff: Portion may be funded directly by farmer can be used as match.

Malcolm Harper: Generally, they have the equipment and the expertise, so they can use that time and the value of the equipment usage and the value of materials you might have on hand this match. Although we really anticipate there were being serious change in the match requirements in a positive way, so maybe they'll be less concern going forward. But, assuming nothing changes, absolutely farmers can apply their time and their equipment and the like toward match.

Michael Leff: This will all be known when the next RFP is released December 1st?

Malcolm Harper: Yes in December and the pre RFR will be in the next few weeks. Announce how to deal with match and greater priority to EJ communities, so there will be a few changes in the next 319 RFR.

Julia Keay: Zoe wondering when you start outreach, so we can coordinate and know where you are reaching out?

Zoe Fox: Yes I can and will be taking notes and reaching out to folks on this call separately.

Julia Keay; A big benefit of this call is people can connect offline. Just wanted to mention schedule on this. We are hoping to have a draft plan by March. Try to schedule stakeholder call in the next two months or so and do some field investigation. If there is anything not mentioned after this call feel free to email me and Michael. Anything you can provide will be helpful. For second call everyone is welcome to attend and we are opening up to recommendations as well. I also wanted to clarify that Emma is no longer involved with Geosyntec and Bella will be taking her role on this project. Is there anything else?

Michael Leff: No, I do not have anything else and give opportunity for everyone to provide input and chime in.

Julia Keay: Question for Holyoke Water Works. Is there monitoring that happens as part of the reservoir operations?

Edwin Matos: Yes we monitor for invasive species and pollutants in the Manhan area. On our end we would be interested in the area we regularly don't monitor.

Julia Keay: Any feeder brooks?

Edwin Matos: Correct, unregulated contaminants we monitor for and EPA guidelines, water chestnut and beavers.

Julia Keay: Do you monitor outlet discharge or reservoir?

Edwin Matos: Not sure of yearly monitoring, but we can figure that out and go from there.

Julia Keay: Is that confidential?

Edwin Matos: Most information is made public yearly.

Julia Keay: Can we find that on the website?

Edwin Matos: Most likely but website may not be up to date, but any correspondence can go to Matthew Smith in case the website doesn't reflect it.

Julia Keay: Can we reach out if we have any questions on that?

Edwin Matos: Oh yeah.

Michael Leff: Looking at participation, I think we have pretty much had everyone speak up at one time or another.

Julia Keay: I am excited about the participation and this is just the beginning and good to get everyone together. Feel free to reach out to us. Hopefully this plan can be used in the future for other grant funding opportunities. Anything else?

Michael Leff: Really appreciate everyone's participation and have a lot of good follow up and we will stay in touch.

Julia Keay. Thank you all for contributing to this meeting!

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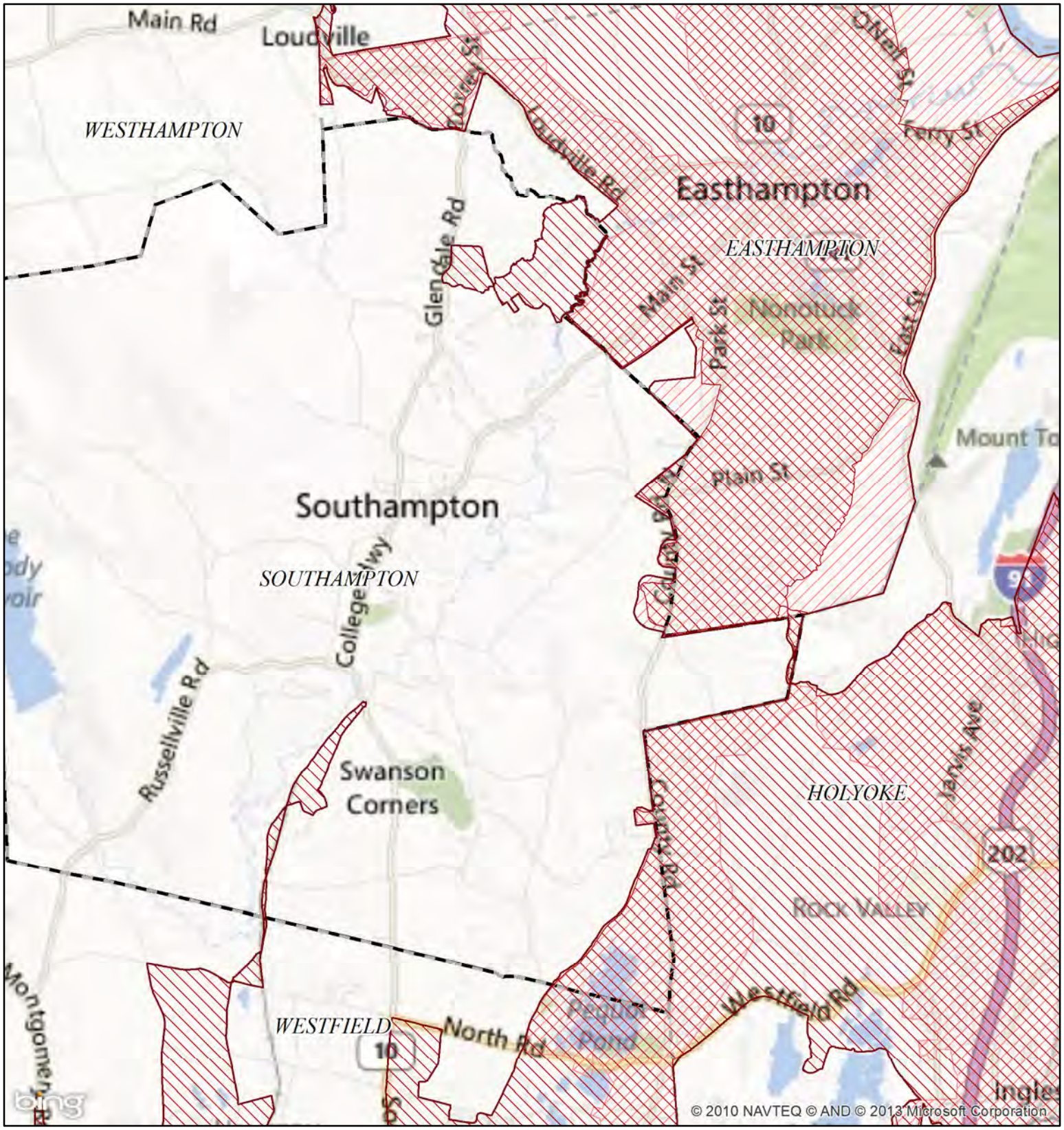
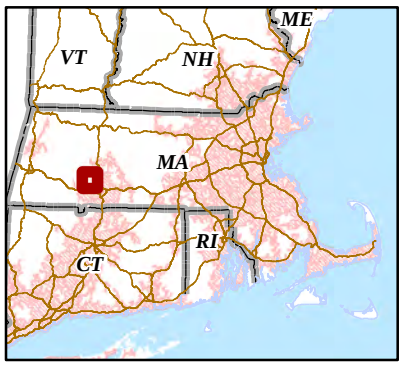
Michael Leff, mleffmacd@gmail.com

Appendix B – MS4 Map (USEPA 2020)





NPDES Phase II Stormwater Program
Automatically Designated MS4 Areas
Southampton MA

Regulated Area:

UA Based on 2000 Census | UA Based on 2010 Census

0 1 2 3 4 Kilometers

0 1 2 3 Miles

Town Population:	5834
Regulated Population:	1107

(Populations estimated from 2010 Census)

EPA

Urbanized Areas, Town Boundaries:
US Census (2000, 2010)
Base map © 2013 Microsoft Corporation
and its data suppliers

US EPA Region 1 GIS Center Map #8824, 8/9/2013

Appendix C – Select excerpts from the Connecticut River Watershed 2003 Water Quality Assessment Report (MassDEP, 2008) relating to the water quality in the Upper Manhan watershed (note: relevant information is included directly from these documents for informational purposes and has not been modified).

Connecticut River Watershed 2003 Water Quality Assessment Report (MA34-17 - Moose Brook)
AQUATIC LIFE Biology MA DFG collected fish community data at Moose Brook upstream from the Moose Brook Road crossing (Site 744) in Southampton in 2002 (Richards 2006). The sample was comprised solely of pollution intolerant fluvial specialist species. A total of 92 fish were collected at this station, including: 55 slimy sculpin, 26 brown trout (multiple age classes) and 16 brook trout (multiple age classes). Moose Brook is assessed as support for the Aquatic Life Use based on the fish community data. **Report Recommendations:** Conduct water quality monitoring to evaluate designated uses.

Connecticut River Watershed 2003 Water Quality Assessment Report (MA34-11 - Manhan River)
AQUATIC LIFE Habitat Currently, the Manhan Dam on the Manhan River in Easthampton blocks the upstream migration of anadromous fish. A project is underway to construct a fish ladder at the Manhan dam to enable anadromous fish to access spawning and nursery habitat upstream from the dam (USACOE 2007). Biology MA DFG collected fish community data at two sites on the Manhan River in Southampton in 2002 (Richards 2006). Site 784 was located upstream from Russelville/Manhan Roads, and Site 785 was located downstream from the Tripple Brook confluence. The fish community at Site 784 was dominated by fluvial specialist/dependant species that are tolerant or moderately tolerant to pollution. Twelve species were collected, including: 141 blacknose dace, 131 common shiner, 62 white sucker, 9 creek chub, 8 bluegill, 7 slimy sculpin, 6 brown trout (multiple age classes), 4 smallmouth bass, 3 golden shiner, 2 longnose dace, 1 fallfish, and 1 tessellated darter. The fish community at Site 785 was also dominated by fluvial specialist/dependant species that are tolerant or moderately tolerant to pollution. Eleven species were collected, including: 118 fallfish, 110 blacknose dace, 54 white sucker, 21 tessellated darter, 14 sea lamprey, 7 common shiner, 3 brook trout, 2 brown trout, 1 bluegill, 1 creek chub, and 1 redfin pickerel. Chemistry - water DWM conducted water quality sampling at two stations on this segment of the Manhan River between April and October 2003. Station 11A was located at Loudville Road in Easthampton, while Station 11C was located at Fort Hill Road in Easthampton (Appendix B and E). Water quality measurements at both stations generally met standards. Total phosphorus levels were slightly elevated at both stations, with a range of 0.018 to 0.061 mg/L observed at Station 11A and a range of 0.027 to 0.099 mg/L observed at 11C. This segment of the Manhan River is assessed as support for the Aquatic Life Use based on the fish community and water quality data. Total phosphorus levels at the downstream station are high enough to be of concern, resulting in Alert Status for this use.

PRIMARY AND SECONDARY CONTACT RECREATION AND AESTHETICS USES
DWM collected E. coli samples at stations 11A and 11C on this segment of the Manhan River between April and November 2003 (Appendix B). The geometric mean of the samples collected at Station 11A was 99 cfu/100ml. The geometric mean of the samples collected at Station 11C was 157 cfu/100ml.

Baystate Environmental Consultants, Inc., in an "Assessment of Stormwater Management Systems" report for the City of Easthampton, identified two stormwater outfalls close to the Manhan River (in between the two DWM water quality stations) in Easthampton that were considered priority level one due to the presence of detergents and the presence of elevated levels of ammonia or nitrite-nitrogen. Additional follow up was recommended for the priority level one outfalls (Baystate 2004).

DWM personnel made field observations at Station 11A and 11C during surveys conducted between April and October 2003. Station 11A was free from odors and scum during all visits, though trash was noted to be present on two surveys. The water clarity was recorded as highly turbid on one occasion (MassDEP 2003). Station 11C was free from odors during all visits, though trash was noted to be present on one survey and white foam was noted during another survey. Water clarity was reported as appearing highly turbid on two occasions, otherwise it was generally reported as clear (MassDEP 2003).

The upper 13.0 miles of this segment (upstream from Station 11A at Loudville Road in Easthampton) support the Primary Contact Recreational Use. However, the Primary Contact Recreational Use is assessed as impaired for the lower 6.2 miles (downstream from Station 11A) because of elevated E. coli bacteria counts. The Secondary Contact Recreation and Aesthetics uses are assessed as support based upon bacteria counts that are acceptable for secondary contact and the lack of objectionable conditions.

Report Recommendations:
According to the permit issued in September 2007, the City of Easthampton will be required to conduct whole effluent toxicity tests on their secondary Outfall #002 to the Manhan River. Review these tests results when they are available.

Bacteria monitoring should be conducted to assess the Primary and Secondary Contact Recreation uses in the upper and lower sections of this segment. Bacteria monitoring in the lower section could show reduced bacteria counts since the Easthampton Water Department's NPDES permit was reissued in 2007. Additionally, evaluate whether the presence of stormwater outfalls noted by Baystate within this segment may be candidates for monitoring by the bacteria source tracking team.

Connecticut River Watershed 2003 Water Quality Assessment Report (MA34-16 - Tripple Brook)

Biology
MA DFG collected fish community data at Tripple Brook upstream from East Street (Site 810) in Southampton in 2002 (Richards 2006). The sample was dominated by brook trout, a pollution intolerant fluvial specialist species. A total of 74 fish were collected at this station, including: 43 brook trout (multiple age classes) and 31 blacknose dace. Although this station is located in the headwaters of Tripple Brook, just upstream from the upper end of this 1.0 mile segment, the fish community was determined to be representative of the cold water conditions within this segment.

Tripple Brook is assessed as support for the Aquatic Life Use based on the fish community data.

Report Recommendations:
Conduct water quality monitoring to evaluate designated uses.

Connecticut River Watershed 2003 Water Quality Assessment Report (MA34-12 - Potash Brook)
No recent data are available for Potash Brook; thus, all uses are not assessed. **Report Recommendations:** Conduct water quality monitoring to evaluate designated uses.

Connecticut River Watershed 2003 Water Quality Assessment Report (MA34-13 - Brickyard Brook)
No recent data are available for the Brickyard Brook; thus, all uses are not assessed. **Report Recommendations:** Conduct water quality monitoring to evaluate designated uses.

Appendix D – Pollutant Load Export Rates (PLERs)

Land Use & Cover[1]	PLERs (lb/acre/year)		
	(TP)	(TSS)	(TN)
AGRICULTURE, HSG A	0.45	7.14	2.59
AGRICULTURE, HSG B	0.45	29.4	2.59
AGRICULTURE, HSG C	0.45	59.8	2.59
AGRICULTURE, HSG D	0.45	91.0	2.59
AGRICULTURE, IMPERVIOUS	1.52	650	11.3
COMMERCIAL, HSG A	0.03	7.14	0.27
COMMERCIAL, HSG B	0.12	29.4	1.16
COMMERCIAL, HSG C	0.21	59.8	2.41
COMMERCIAL, HSG D	0.37	91.0	3.66
COMMERCIAL, IMPERVIOUS	1.78	377	15.1
FOREST, HSG A	0.12	7.14	0.54
FOREST, HSG B	0.12	29.4	0.54
FOREST, HSG C	0.12	59.8	0.54
FOREST, HSG D	0.12	91.0	0.54
FOREST, HSG IMPERVIOUS	1.52	650	11.3
HIGH DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.27
HIGH DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.16
HIGH DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.41
HIGH DENSITY RESIDENTIAL, HSG D	0.37	91.0	3.66
HIGH DENSITY RESIDENTIAL, IMPERVIOUS	2.32	439	14.1
HIGHWAY, HSG A	0.03	7.14	0.27
HIGHWAY, HSG B	0.12	29.4	1.16
HIGHWAY, HSG C	0.21	59.8	2.41
HIGHWAY, HSG D	0.37	91.0	3.66
HIGHWAY, IMPERVIOUS	1.34	1,480	10.2
INDUSTRIAL, HSG A	0.03	7.14	0.27
INDUSTRIAL, HSG B	0.12	29.4	1.16
INDUSTRIAL, HSG C	0.21	59.8	2.41

Land Use & Cover[1]	PLERs (lb/acre/year)		
	(TP)	(TSS)	(TN)
INDUSTRIAL, HSG D	0.37	91.0	3.66
INDUSTRIAL, IMPERVIOUS	1.78	377	15.1
LOW DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.27
LOW DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.16
LOW DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.41
LOW DENSITY RESIDENTIAL, HSG D	0.37	91.0	3.66
LOW DENSITY RESIDENTIAL, IMPERVIOUS	1.52	439	14.1
MEDIUM DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.27
MEDIUM DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.16
MEDIUM DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.41
MEDIUM DENSITY RESIDENTIAL, HSG D	0.37	91.0	3.66
MEDIUM DENSITY RESIDENTIAL, IMPERVIOUS	1.96	439	14.1
OPEN LAND, HSG A	0.12	7.14	0.27
OPEN LAND, HSG B	0.12	29.4	1.16
OPEN LAND, HSG C	0.12	59.8	2.41
OPEN LAND, HSG D	0.12	91.0	3.66
OPEN LAND, IMPERVIOUS	1.52	650	11.3

[1]HSG = Hydrologic Soil Group

Appendix E – Summary of Agricultural BMPs included in Conceptual Projects and associated Planning-level Nitrogen Load Reductions in the Upper Manhan River Watershed

Upper Manhan Conceptual Projects and Potential Nitrogen Load Reductions

- **Waste Storage Facility (313)**
  - Definition - A waste storage impoundment made by constructing a pond (embankment and/or excavated pit or dugout), or by fabricating a structure.
  - Purpose - To temporarily store wastes such as manure, wastewater, and contaminated runoff as a storage function component of an agricultural waste management system.

    - The estimated nitrogen load reduction of a waste storage facility for a herd of 40 cows is approximately 9,900 lbs/year.

- **Roofs and Covers (367)**
  - Definition - A rigid, semi-rigid, or flexible manufactured membrane, composite material, or roof structure placed over a waste management facility.
  - To provide a roof or cover for:
    - water quality improvement
    - diversion of clean water from animal management areas (i.e. barnyard, feedlot or exercise area), waste storage facilities, waste treatment facilities, or agrichemical handling facilities.
    - capture of biogas for energy production
    - reducing net effect of greenhouse gas emissions
    - air quality improvement and odor reduction

    - Typically paired with a roof runoff structures in conjunction with a waste storage facility or heavy use area.
    - When paired with Heavy Use Area Protection and functioning as a "bedded pack" system, the estimated nitrogen load reduction for a herd of 20 beef cattle is approximately 2,700 lbs/year.

- **Filter Strip (393)**
  - Definition - A strip or area of herbaceous vegetation that removes contaminants from overland flow.
  - Purpose - Reduce suspended solids and associated contaminants in runoff, reduce dissolved contaminant loadings in runoff, reduce suspended solids and associated contaminants in irrigation tailwater.

    - Typically paired with fencing, waste stage facilities, heavy use areas, and other field-based practices with pollutant load reductions.

- **Roof Runoff Structure (558)**
  - Definition - Structures that collect, control, and transport precipitation from roofs.
  - Purpose - To improve water quality, reduce soil erosion, increase infiltration, protect structures, and/or increase water quantity.

    - Typically paired with a roof/cover in conjunction with a waste storage facility or heavy use area.
    - The estimated nitrogen load reduction of this practice for a herd of 20 cattle is 1,080 lbs/year.

- **Heavy Use Area Protection (561) & Underground Outlet (620)**
  - **Heavy Use Area Protection**
    - Definition - The stabilization of areas frequently and intensively used by people, animals or vehicles by establishing vegetative cover, by surfacing with suitable materials, and/or by installing needed structures.
    - Purpose -
      - Reduce soil erosion
      - Improve water quantity and quality
      - Improve air quality
      - Improve aesthetics
      - Improve livestock health
  - **Underground Outlet**
    - Definition - A conduit or system of conduits installed beneath the surface of the ground to convey surface water to a suitable outlet.
    - Purpose - To carry water to a suitable outlet from terraces, water and sediment control basins, diversions, waterways, surface drains or other similar practices without causing damage by erosion or flooding.

      - These two practices may be paired with a waste storage facility, sediment basin, roof runoff structure, and/or a roof/cover.
      - The estimated nitrogen load reduction of these practices for a herd of 20 beef cattle is approximately 1,840 lbs/year.

- **Nutrient Management (590)**
  - Definition – Manage rate, source, placement, and timing of plant nutrients and soil amendments while reducing environmental impacts.
  - Purpose – This practice is used to accomplish one or more of the following purposes:
    - Improve plant health and productivity
    - Reduce excess nutrients in surface and ground water
    - Reduce emissions of objectionable odors
    - Reduce emissions of particulate matter (PM) and PM precursors
    - Reduce emissions of greenhouse gases (GHG)
    - Reduce emissions of ozone precursors
    - Reduce the risk of potential pathogens from manure, biosolids, or compost application from reaching surface and ground water
    - Improve or maintain soil organic matter

      - Nutrient Management plans are developed according to the amount of cropland and animal manure associated with a farm. These plans can help determine which practices at which amounts could be implemented to ensure proper manure storage and application of nutrients to farmland.

- **Water and Sediment Control Basin (638)**
  - Definition - An earth embankment or a combination ridge and channel constructed across the slope of minor watercourses to form a sediment trap and water detention basin with a stable outlet.
  - Purpose -
    - Reduce watercourse and gully erosion
    - Trap sediment
    - Reduce and manage onsite and downstream runoff

      - This practice may be paired with waste storage facilities, heavy use areas, roofs/covers, roof runoff structures, and underground outlets to manage water flow and treatment.
      - The estimated nitrogen load reduction of this practice for a dairy farm with 40 cows is approximately 3,960 lbs/year.

*Nitrogen reduction estimates are variable based on animal numbers, location, and final design of the practice.

Appendix F – List of Potential Agricultural BMPs with USDA NRCS Code (Provided to Geosyntec by Franklin Regional Council of Governments [FRCOG]).

The Massachusetts "Field Office Technical Guide" can be accessed at: https://efotg.sc.egov.usda.gov/#/state/MA/documents/section=4&folder=-3 .Detailed information on each BMP can be found under "Section 4 - Practice Standards and Supporting Documents" > "Conservation Practice Standards & Support Documents"

207-Site Assessment and Soil Testing for Contaminants Activity	656-Constructed Wetland
216-Soil Health Testing	309-Agrichemical Handling Facility
217-Soil and Source Testing for Nutrient Management	311-Alley Cropping
309-Agrichemical Handling Facility	314-Brush Management
311-Alley Cropping	315-Herbaceous Weed Control
313-Waste Storage Facility	338-Prescribed Burning
316-Animal Mortality Facility	350-Sediment Basin
317-Composting Facility	351-Water Well Decommissioning
327-Conservation Cover	356-Dike
328-Conservation Crop Rotation	362-Diversion
329-Residue and Tillage Management, No Till/Strip Till/Direct Seed	367-Roofs and Covers
330-Contour Farming	378-Pond
332-Contour Buffer Strips	380-Windbreak/Shelterbelt Establishment
340-Cover Crop	381-Silvopasture Establishment
342-Critical Area Planting	382-Fence
345-Residue and Tillage Management, Reduced Till	402-Dam
355-Water Well Testing	422-Hedgerow Planting
360-Waste Facility Closure	430-Irrigation Pipeline
366-Anaerobic Digester	441-Irrigation System, Micro irrigation
386-Field Boarder	442-Sprinkler System
390-Riparian Herbaceous Cover	443-Irrigation System, Surface & Subsurface
391-Riparian Forest Buffer	462-Preision Land Forming
393-Filter Strip	464-Irrigation Land Leveling
395-Stream Habitat Improvement and Management	468-Lined Waterway or Outlet
410-Grade Stabilization Structure	484-Mulching
412-Grassed Waterway	511-Forage Harvest Management
436-Irrigation Reservoir	512-Forage and Biomass Planting
449-Irrigation Water Management	516-Livestock Pipeline
472-Access Control	558-Roof Runoff Structure
528-Prescribed Grazing	560-Access Road
561-Heavy Use Area Protection	574-Spring Development
575-Trails and Walkways	578-Stream Crossing
580-Streambank and Shoreline Protection	582-Open Channel
590-Nutrient Management	585-Stripcropping
600-Terrace	587-Structure for Water Control
601-Vegetative Barrier	595-Integrated Pest Management
612-Tree/Shrub Establishment	603-Herbaceous Wind Barriers
629-Waste Treatment	607-Surface Drain, Field Ditch
634-Waste Transfer	608-Surface Drain, Main or Lateral
635-Vegetative Treatment Area	614-Watering Facility
638-Water and Sediment Control Basin	620-Underground Outlet
632-Solid/Liquid Waste Separation Facility	650-Windbreak/Shelterbelt Renovation
642-Water Well	657-Wetland Restoration
643-Restoration and Management of Declining Habitats	658-Wetland Creation
644-Wetland Wildlife Habitat Mangement	659-Wetland Enhancement

Appendix G – Agricultural BMP Concepts from Bacterial Source Tracking Study (PVPC, 2018)

Focus Areas Defined Through Source Tracking

Source tracking in wet weather was found to vary significantly in terms of results, likely based on the amount of precipitation and time since a storm passed. The contours of the river itself as well as the presence of wildlife (beavers mainly) can also likely influence outcomes, all to say that it was difficult to definitively identify clear locations of non-point source contamination. This was particularly the case at Fort Hill Road and Whittemore Conservation Area, which after one storm event had "undulating" results that increased and decreased at various points within the approximate length of one mile.

The focus areas for this study revolve around agriculture uses due to presence of equine and livestock in or near waterways during sampling. Resource evaluations were done of these sites using various methods, depending on ability to contact landowners and time constraints. They include:

<u>Whittemore Conservation Area</u>

A mixed equine/livestock operation was identified as a potential source of contamination. Social media suggests that they also have heifers and various small livestock in addition to horses. Aerial photos combined with social media posts suggest that the farm could benefit from a grazing and nutrient management plan.

The landowners were contacted via phone call and social media (Facebook Messenger) to talk about the project. They did not respond. Further outreach is suggested. They would be excellent candidates for conservation programs.

<u>Moose Brook</u>

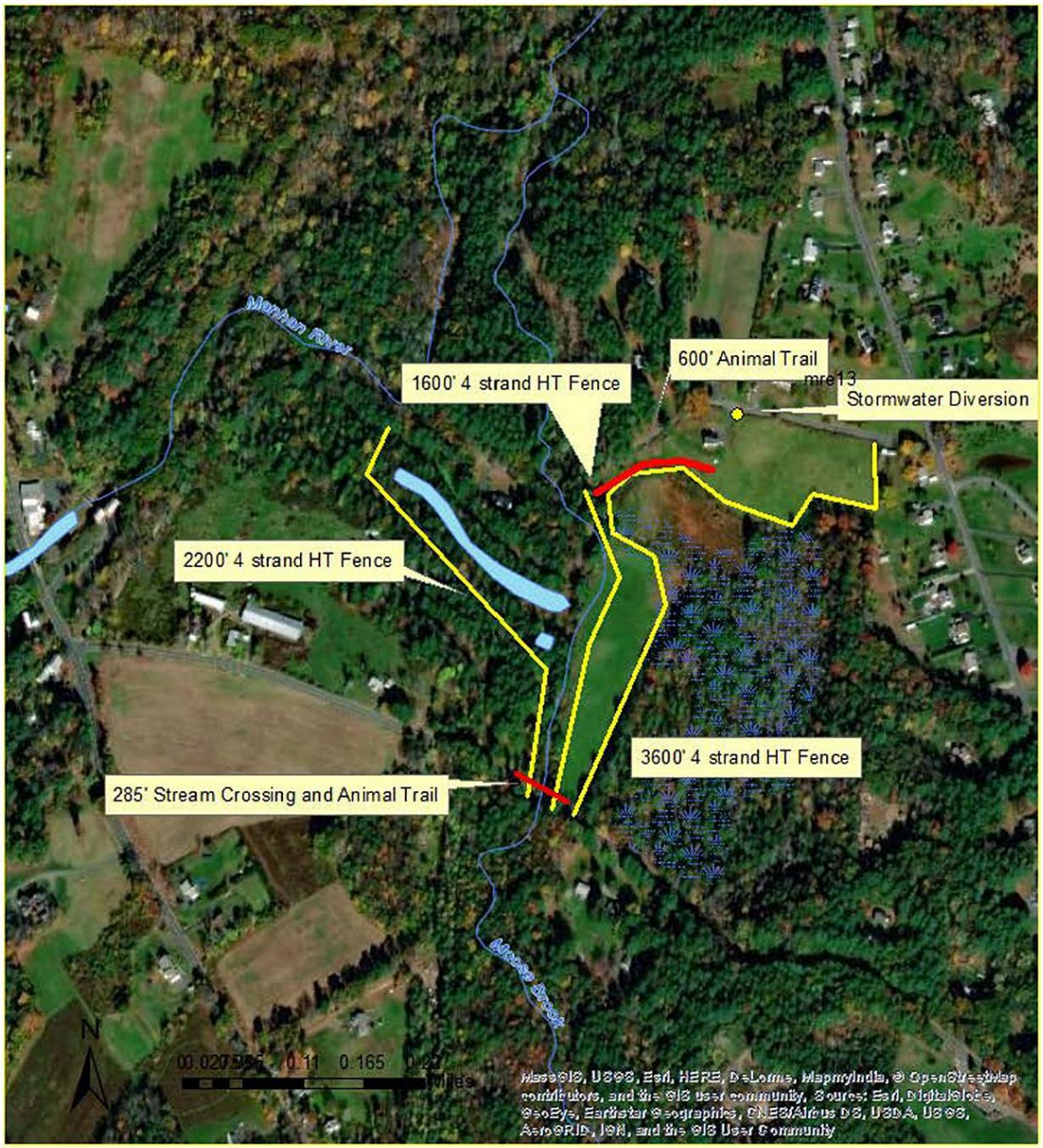
A mixed livestock operation (beef, goat, and chicken) was identified as the most likely source. A family living on Brickyard Extension Road (local name of road) owns part of the land on Brickyard Extension Road and also manage land owned by the Goral family on Moose Brook Road. Land where animals are managed is continuous. Traditionally, the farm was managed as a dairy operation, but ceased operations in the 1980's. There is infrastructure to manage cattle in a confinement system on the Goral property.

Pastures are swamp, brush and rough pasture, with cattle having free unfettered access to resource areas, including a swamp, ponds, and Moose Brook.

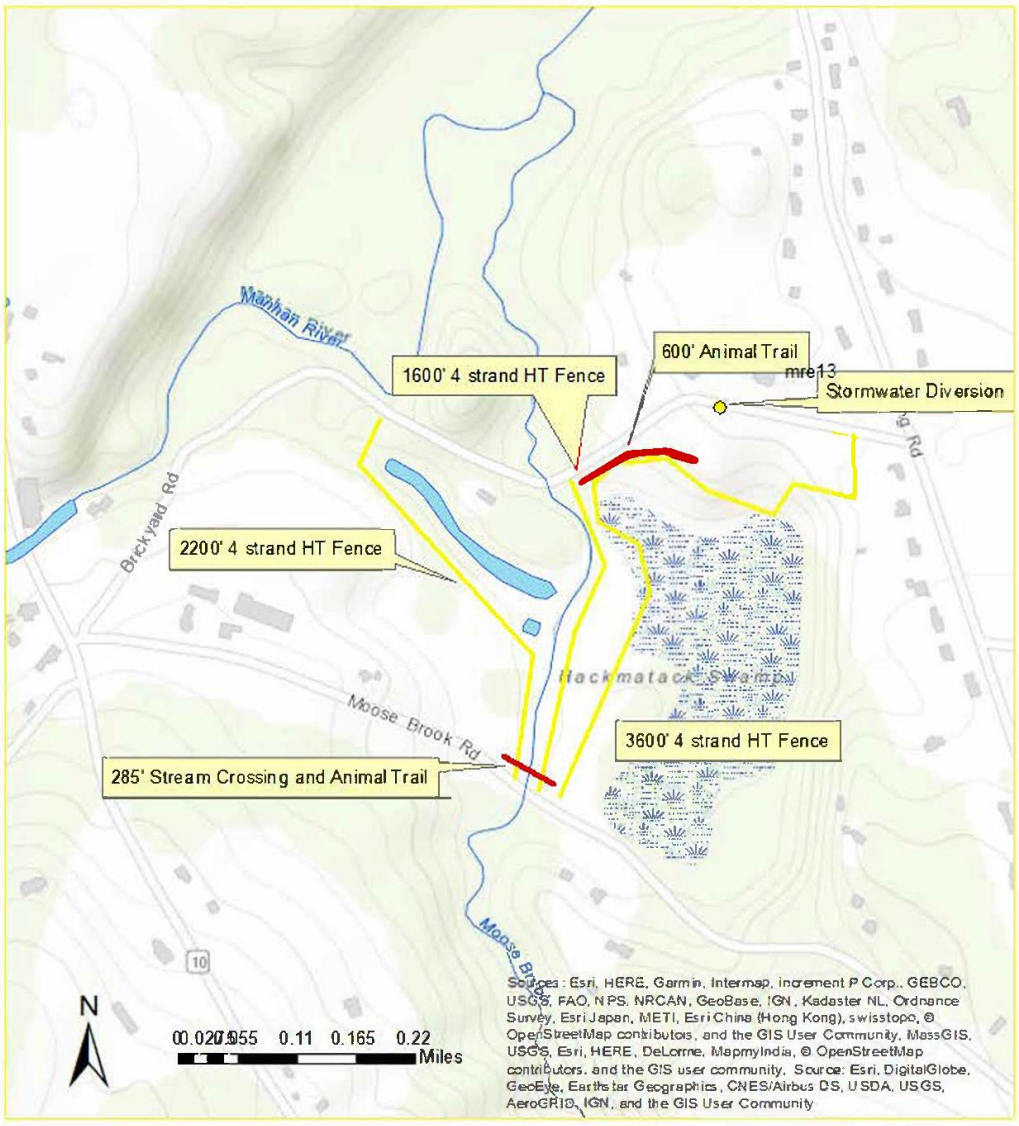
The conservation commission has also expressed concern about an old storm drain that crosses Brickyard Extension Road between their house and their new goat barn. This causes significant stormwater issues compounded by filling in with bedding and manure from their goat and chicken operation. Other issues include interest in draining portions of a swamp and a bridge that was attempted to help young stock navigate the swamp between two pastures.

Due to significant resource concerns, it is suggested that this farm have a conservation plan done by Rita Thibodeau at NRCS (see Appendix C) to address resource concerns that the Conservation Commission has.

Moose Brook Watershed
Livestock Exclusion System



Moose Brook Watershed
Livestock Exclusion System



Potash Brook

Regular water sampling in 2016 identified a pasture on Potash Brook as a source of E.Coli into Potash Brook. Cattle and their manure were observed in the stream during sampling. Further conversations with the landowner has identified management changes that have taken place since testing was done in 2016. This includes destocking in 2017 and introduction of a smaller number of cattle during grazing season, rather than year-round.

Destocking and reducing the amount of time that cattle spend in pastures with direct access to streams has been shown to reduce E.Coli levels in streams. Table below gives a rough estimate of fecal coliform level changes based on management changes since 2016 testing.

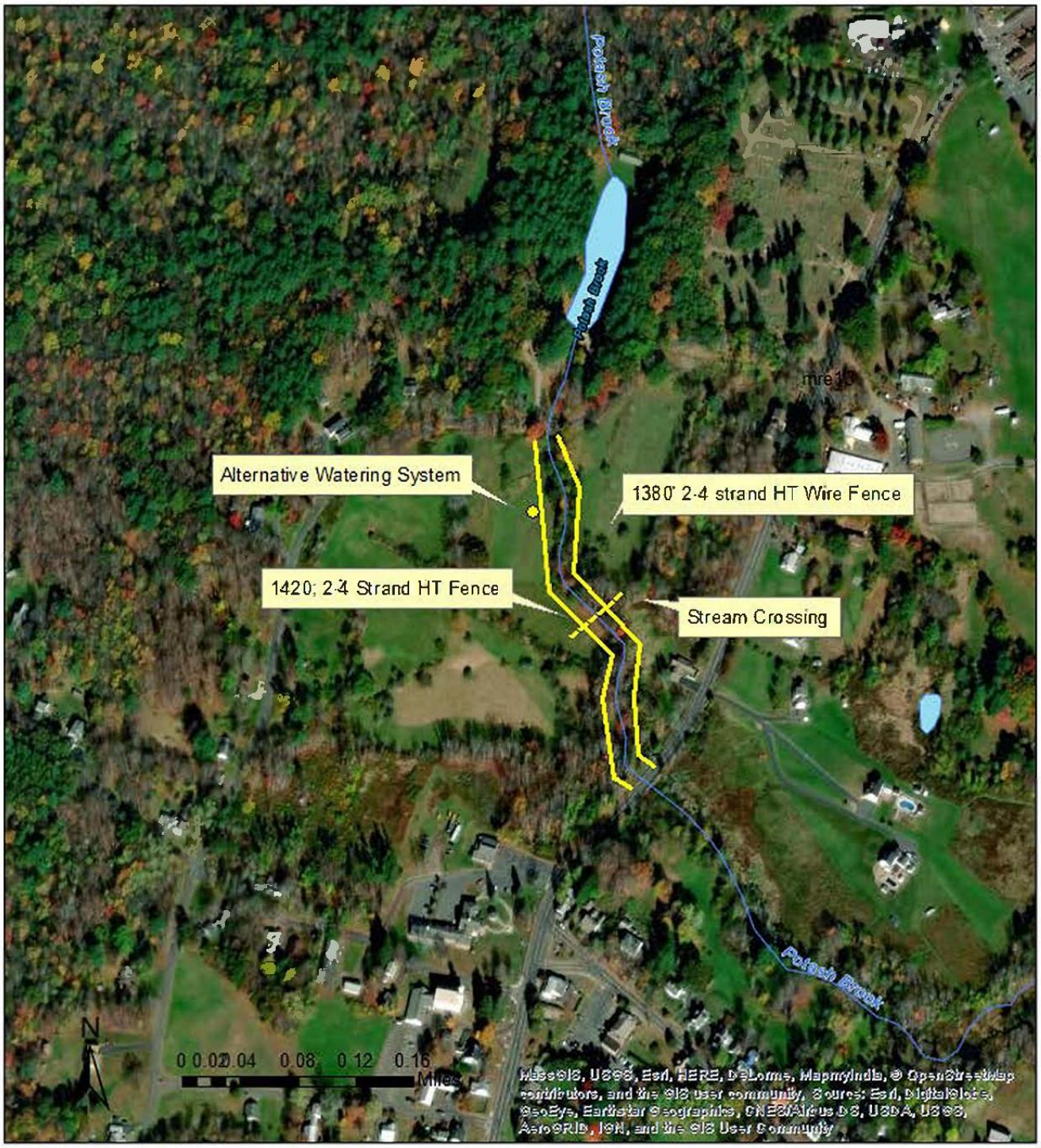
Total livestock exclusion of cattle from Potash Brook could further reduce levels 51-100% depending on buffer width and combination of Best Management Practices installed.

Table : Common Fecal Coliform Concentration from Grazed Pastures

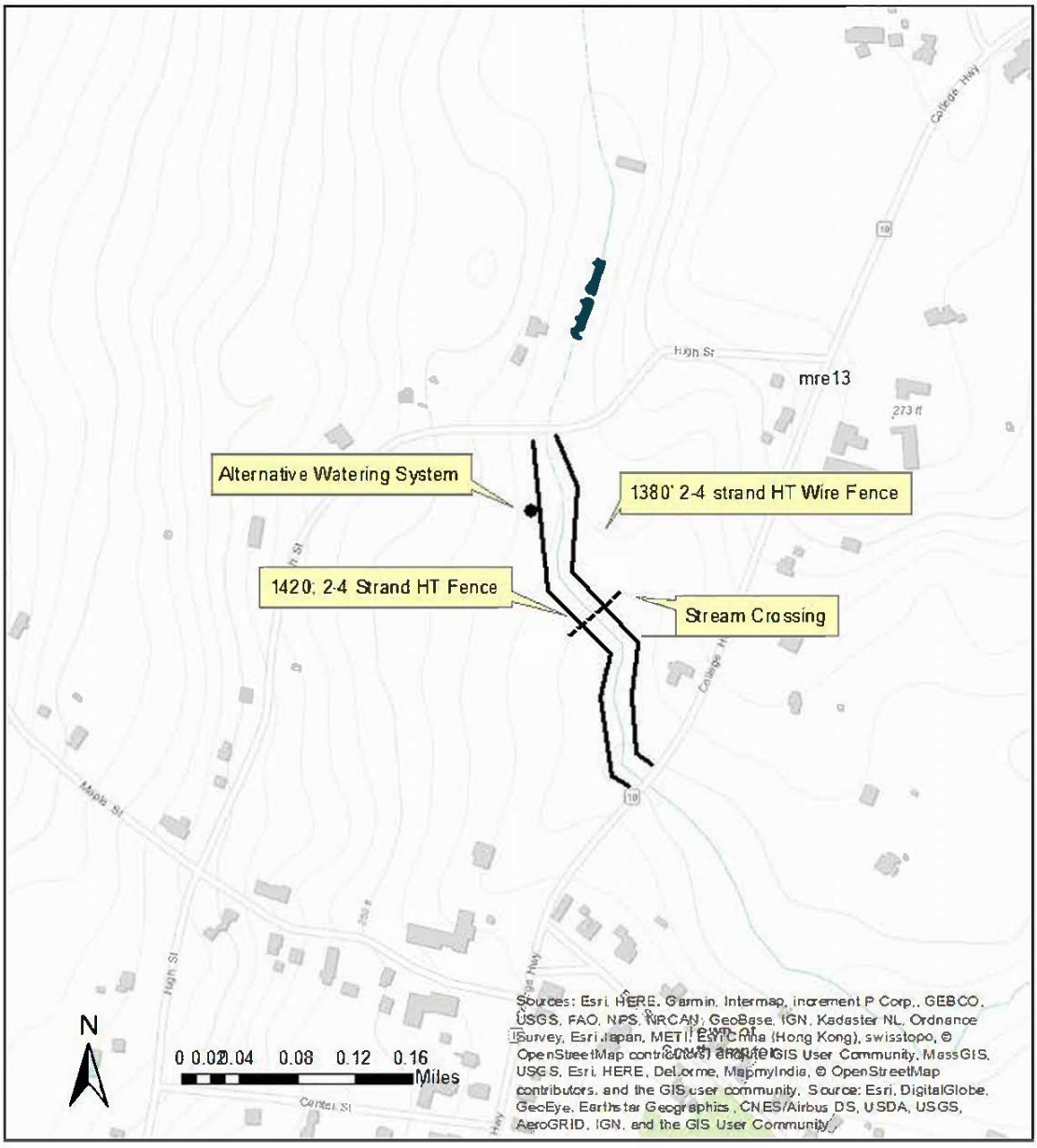
Year	Management	Fecal Coliform Concentration (col/gal)
2016	Pastures under Continual Grazing Year Round	1.894 x 10^6
2017	Pastures Grazed for Two Months (September/October)	3.409 x 10^5
2018	Pastures Grazed for Half of the Year	3.295 x 10^5

Outreach with the landowner suggests that she is not willing to install a livestock exclusion system because she is not interested in seeing the fence from her house. We did explain that participation in the implementation of BMP's on her property were completely voluntary, that management decisions that she did make did help, and that due to the time constraints and the goals of the project at that time, further water testing was not going to happen in 2018. She and the owner of the cattle feel that further water testing needs to be done and that it is beavers and a housing development above her pasture, not cattle in the stream, that is causing the E.Coli.

Potash Brook Watershed
Livestock Exclusion



Potash Brook Watershed
Livestock Exclusion



Potash Brook/Manhan River

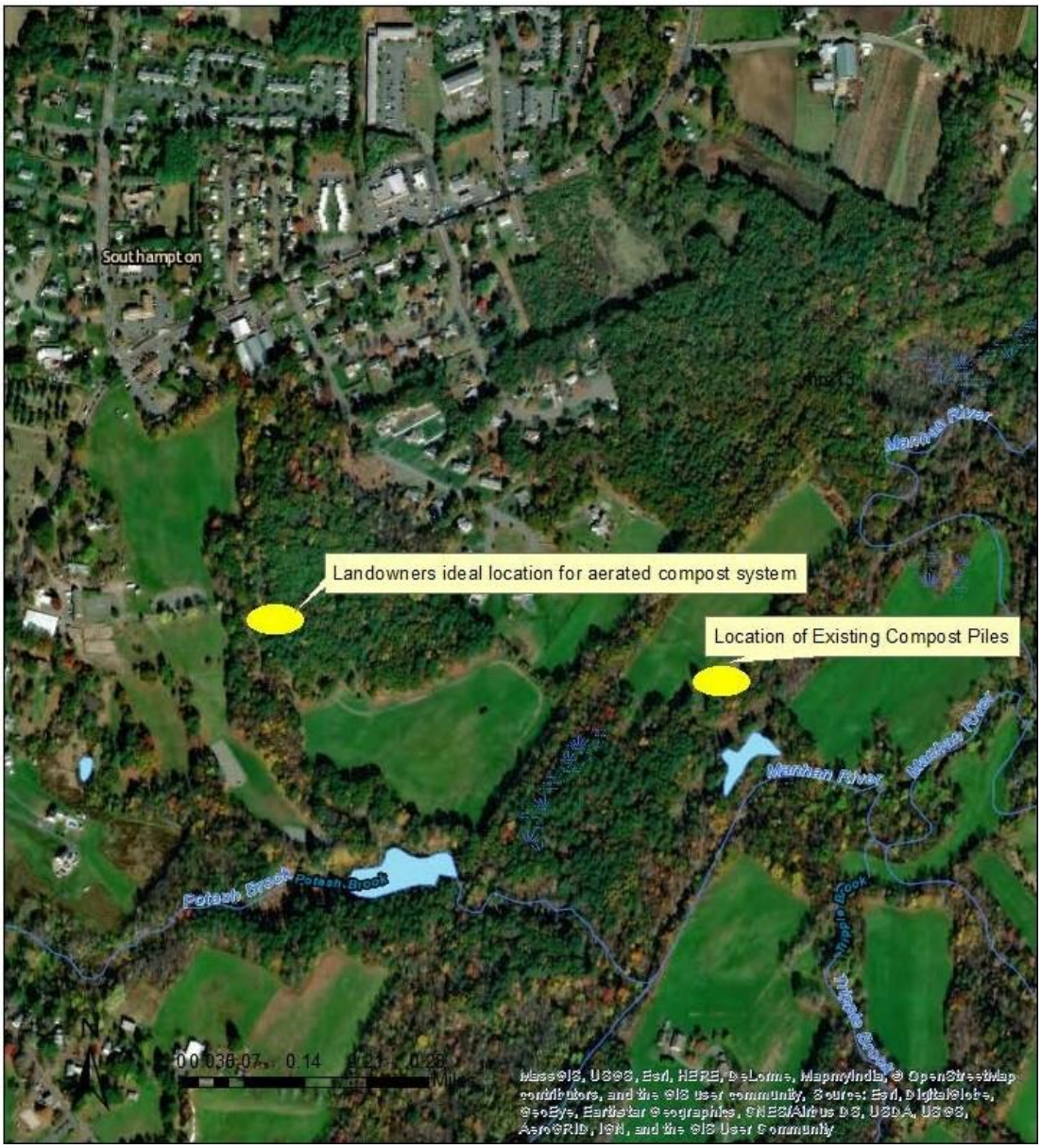
During outreach, Grindstone Farm was identified as a potential location that could benefit from a conservation plan. The farm was traditionally a horse boarding and training facility. The current owners are interested in expanding into beef and/or dairy cattle and are actively bringing land back into production. They also identified septic systems from houses upstream from Lost Pond as potential impacts into the Potash Brook and are willing to work with agencies to further water quality testing on Potash Brook on their property.

They also expressed concern about their compost pile and would like to move it closer to the farm headquarters and away from the edge of the Manhan River. This farm has APR restrictions on parts of their land. They are aware of the process to inform MDAR of changes that they plan to make on APR land. They also plan to work with MACD/NRCS or other conservation planners to implement the composting system on their farm. They will also benefit from a nutrient management plan.

Grindstone Mountain Farm

Potash Brook Watershed

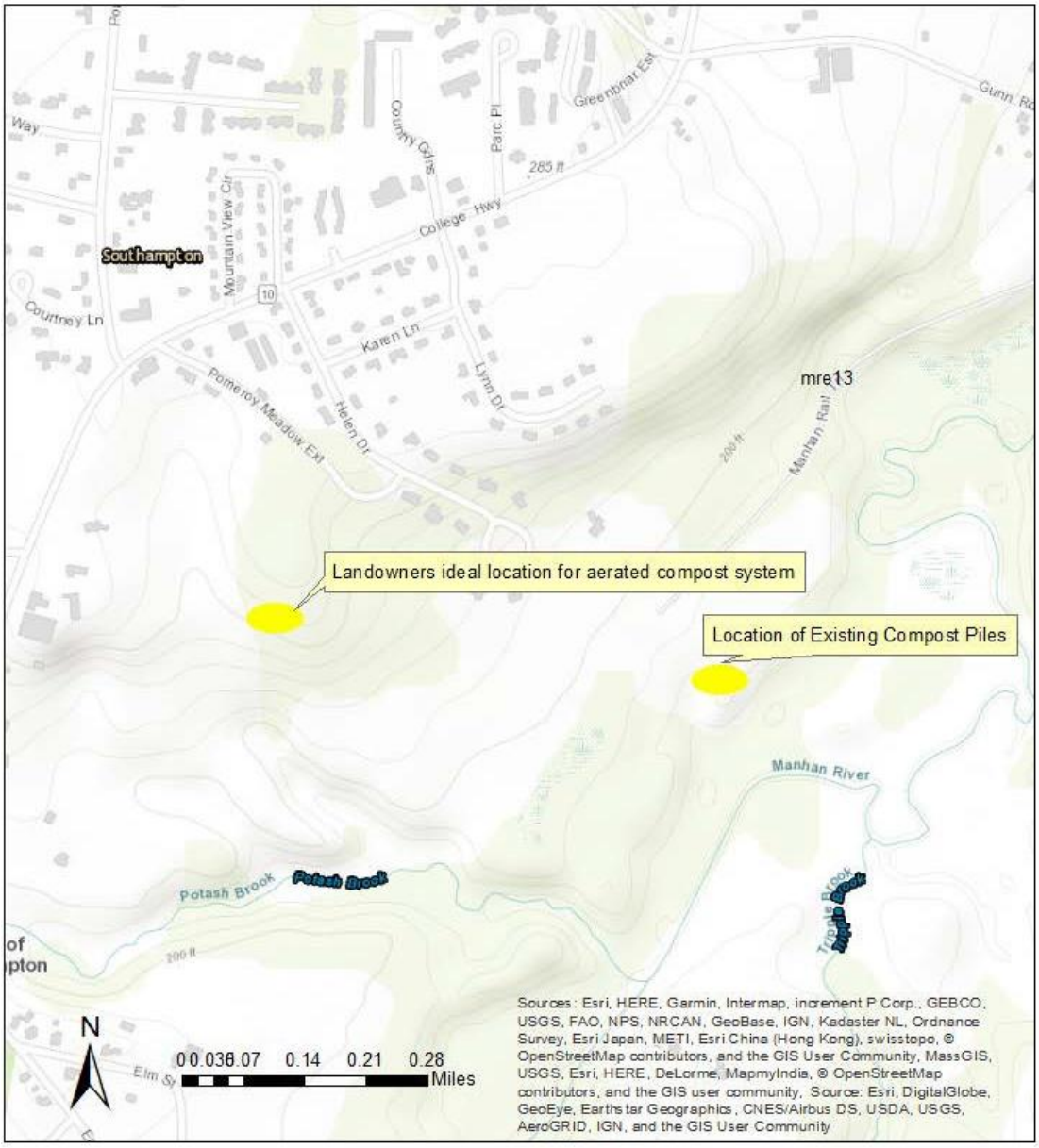
Compost System



Grindstone Mountain Farm

Potash Brook Watershed

Compost System



Manhan River

Fletcher's Farm did not have any significant resource concerns on their farm related to this project. During outreach, it was identified that they do accept horse bedding/manure from three local equine operations to line the floors of their free stall. This reduces flies, improves animal health, and is used in their compost operation. Compost is then sold or used on their farm fields to improve soil health.

The cumulative effect of manure storage from smaller hobby horse operations directly impacts watersheds. They are interested in expanding their compost pad on the end of their barn to improve the quality of the finished product and to expand the production of compost. This includes taking on more bedding/manure from local suburban horse operations in the surrounding area.

Fletcher Farm

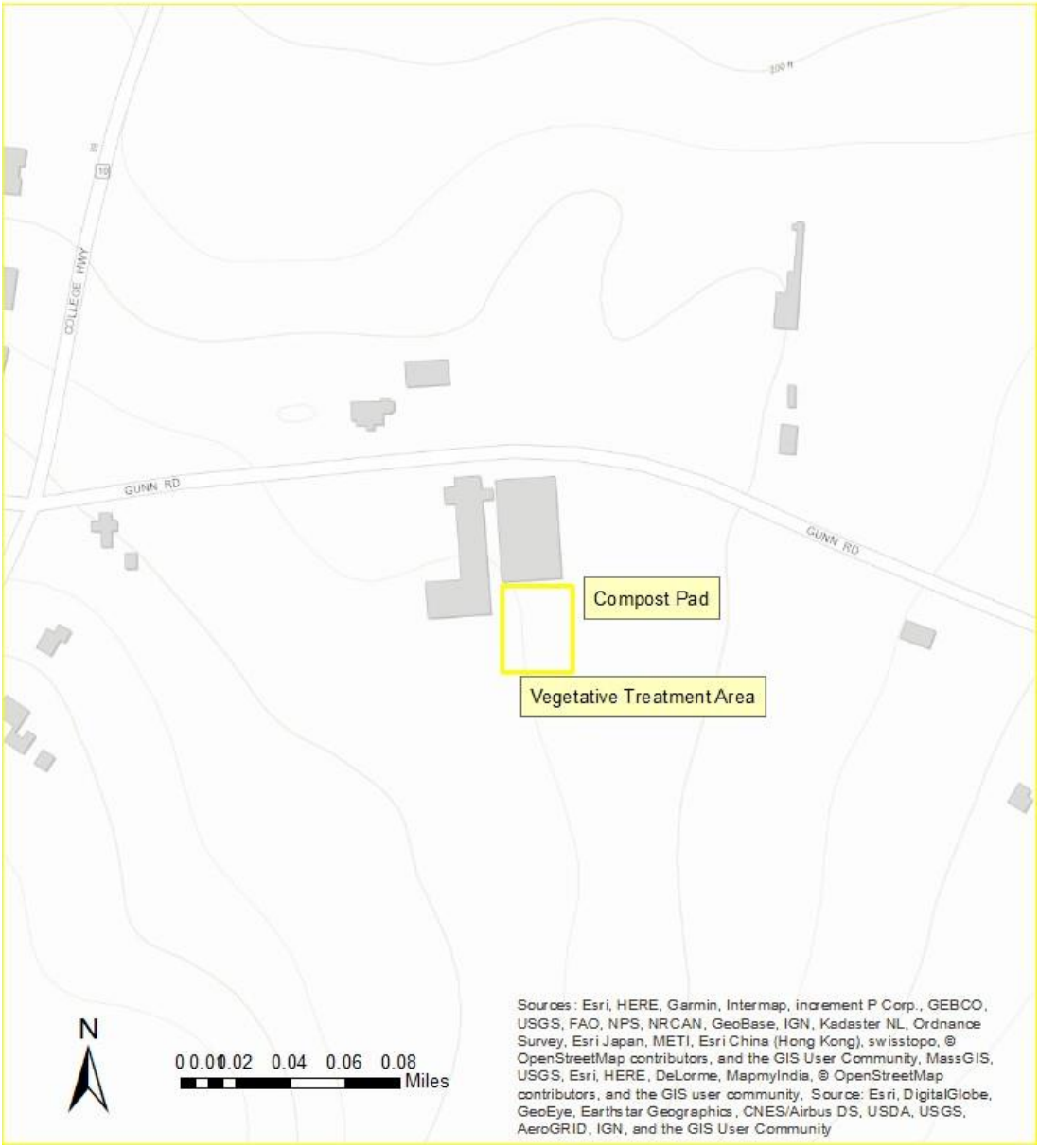
Manhan River

CompostSystem

Fletcher Farm

Manhan River

Compost System



Outreach and Education

Deliverables called for two outreach events to educate landowners and various stakeholders about BMP's and to increase uptake of voluntary implementation. Due to the short time frame and the lack of a formal project to conduct outreach in this watershed, a lot of direct farm visits, phone calls, and emails were done to gain inroads into the farm community.

A public meeting presentation was held at the Southampton Conservation Commission meeting. Members of the Agricultural Commission and stakeholders in Easthampton were also invited to attend this meeting. The goal was to present the findings of the 2016 regular Water Sampling results as well as the 2017 Source Tracking. This meeting served as an opportunity for stakeholders to have input on resource concerns and to further pin-point areas that could benefit from BMP implementation.

Stakeholders from Southampton were the only people in attendance at the meeting. Questions were asked primarily from the Conservation Commission. Comments made were that "this was the first time they saw these data," "this was a kick in the knees," "the agricultural commission needs to digest this information," and there was concern that genetic testing to identify geese, beavers, dogs, etc. should have been done to further pinpoint the source of pollution.

Before the next meeting, it was decided that direct contact with members of the Conservation Commission, Agricultural Commission, as well as key farmers and horse operations in the town would be an important first step. A few points were made that helped direct how outreach could help further improve water quality implementation in the Manhan River. These include:

- People in Southampton consider themselves rural. Our presentation was the first time that members of the Conservation Commission heard themselves referred to as rural suburban or suburban. They identified suburban sprawl as a point of conflict and having an educational program highlighting positive efforts by horse and livestock farms in the Manhan River Watershed as beneficial.
- Many farmers and equine operations have a distinct interest in not taking part in things that they think are 'political.'
- People wanted to know more about E.Coli testing. What is it, why is it used, etc. A handout was produced for the next meeting (see Appendix C).
- Farms are directly impacted by stormwater and septic issues from housing developments. This includes drainage into fields, storm water issues from roads, septic leaching, etc. This was mentioned at every direct farm visit as a significant concern.
- There is an interest in educating town officials, many of whom are volunteers, on farm v. conservation issues so that they can make informed decisions that impact both the environment and farms.
- There is not a good way to manage or to account for the beaver populations impact on EColi in this watershed.

A second meeting was done to talk to landowners and operators that would be interested in implementing BMP's and possibly forming a working group to develop outreach strategies suitable for different stakeholders in this watershed. Stakeholders include farmers/equine operations, consumers, and town officials. This group met on May 22, 2018. Grindstone Mountain Farm and

Fletcher Farm agreed to implement BMP's. They also agreed to assist in furthering outreach with the Marsioniak and Brown farms to help engage them in implementing BMP's in part or in whole.

A follow up meeting was done on May 31, 2018 with Dawn Sarafin and Janet Brown to answer more questions about Water Sampling done on Potash Brook. They were both reassured that the process is voluntary, that there was not further water testing being done as part of this grant, and that there are conservation programs available to them. They chose to maintain things with a smaller stocking density and shorten the grazing season until further water testing was done rather than implement a livestock exclusion system.

A follow up meeting with stakeholders from Easthampton will be done after this project is completed. They were not contacted with enough time to respond to the second meeting.

Appendix H –BMP Concepts from Tighe and Bond (Tighe and Bond, 2022b)

PROPERTY 2 – TRANSFER STATION

Moose Brook Road, Parcel 35_48

PROPERTY DESCRIPTION

The Transfer Station on Moose Brook Road is a 0.97 acre parcel that is located about 1,000 feet east from Moose Brook. Existing structures include a paved driveway and several containers used to store waste located along the northeast edge of the site, parallel to Moose Brook Road. The remaining area of the parcel contains a capped landfill. There are currently no formal stormwater management structures present on the site.

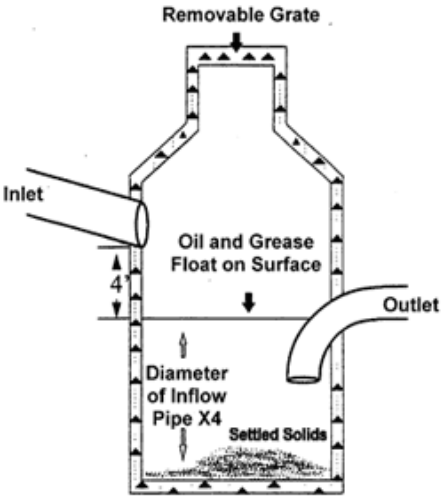
The western area of the site has potential for BMP retrofit, as it drains to a wetland area and into Moose Brook, which runs to the Manhan River, which drains to the Connecticut River, which drains to Long Island Sound, which is nitrogen impaired.

Figure 1: *Example Outlet Control Structure.*
Source: MA Clean Water Toolkit

PROPOSED RETROFIT

Stormwater from Moose Brook Road and the Southampton Transfer Station Facility area would first run into a deep sump hooded catch basin, where it would remove trash, debris, and coarse sediment from runoff and serve as a temporary spill containment device for floatables such as oil and grease. The stormwater is then proposed to undergo two types of pretreatment in order to account for the on-site landfill, which should be considered a land use with higher potential pollutant load. The water would route into a water quality unit such as a hydrodynamic separator, where the flow would be slowed for pretreatment facilitated by gravity separation of total suspended solids. From there, stormwater would flow into an infiltration basin, where it would be stored and filtered as it permeates into the soil. Overflow would outflow through the outlet control structure and toward the wetland.

Figure 2: *Location of proposed sediment forebay and infiltration basin.*
Source: Tighe & Bond



Deep Sump Catch Basin

Figure 3: *Example Deep Sump Catch Basin.*
Source: MA Clean Water Toolkit

NOTES:

-POTENTIAL TO INSTALL DEEP-SUMP HOODED CATCH BASIN, WATER QUALITY UNIT, SEDIMENT FOREBAY, AND INFILTRATION BASIN TO TREAT AND INFILTRATE RUNOFF FROM LANDFILL ACCESS ROAD.

-ESTIMATED POTENTIAL TP LOADING TO BMP: 2.24 LB P/YEAR

ASSUMPTIONS:

-GROUNDWATER DEPTH IS NOT SHALLOW

-BEDROCK DEPTH IS NOT SHALLOW

-SOILS ARE WELL-DRAINED

-THE REQUIRED SPACE FOR AN ADEQUATELY SIZED INFILTRATION BASIN IS AVAILABLE

-THE EXISTING IMPERVIOUS AREA IS PITCHED TOWARD THE PROPOSED CATCH BASIN

-SEE FULL ATTACHED MAPBOOK FOR ENVIRONMENTAL INFORMATION. ADDITIONAL PERMITTING MAY BE REQUIRED WHERE SENSITIVE ENVIRONMENTAL AREAS ARE LOCATED

DRAINAGE PIPE

PROPOSED OUTFALL

OUTLET CONTROL DEVICE

DEEP-SUMP HOODED CATCH BASIN

WATER QUALITY UNIT

SEDIMENT FOREBAY

INFILTRATION BASIN

MADELINE WAY

MOOSEBROOK RD

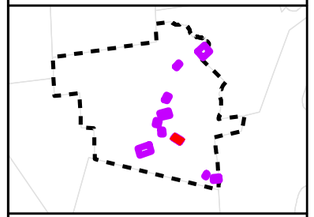
STRONG ROYD

CHERYL LANE

Areas For Index
Outfall
DrainManhole
CatchBasin
GRAVITY
Parcels
LiDAR 2ft (2015)
MassDEP 100ft Buffer

BMP RETROFIT INVENTORY-DRAFT

LOCUS MAP



N

0 110 220

Feet

1 inch = 175 feet

Mapsheet: 2

Moosebrook Rd at Southampton Transfer Station

Parcel ID:
35_48

Southampton, Massachusetts

October 2022

Tighe&Bond

Path: G:\GIS\MA\SouthamptonMA\MapDocs\Southampton_BMP_MapBook.mxd

PROPERTY 3 – GILBERT AND 180 BRICKYARD ROAD

Undeveloped Area, Parcel 34-179

PROPERTY DESCRIPTION

The 22.70 acres of undeveloped area that constitutes 180 Brickyard Road is located next to a residential area. Much of the area is comprised of wetlands. The Manhan River runs through the site, which drains to the Connecticut River, which drains to Long Island Sound, which is nitrogen impaired. BMPs in this area would filter runoff from Brickyard Road and Gilbert Road; however, the area grade may not channel sufficient stormwater to this area to be effective at removing pollutants from roadway stormwater runoff.

Figure 1: *Location of proposed sediment forebay and infiltration basin off Brickyard Road.*
Source: Tighe & Bond

PROPOSED RETROFITS

Stormwater from Brickyard Road and Gilbert Road would flow into respective deep sump hooded catch basins, where any trash, debris, and sediment would separate out and serve as a temporary spill containment device for floatables such as oil and grease. Next, the stormwater would run into sediment forebays, where stormwater would be pretreated by gravity separation of suspended solids. The pretreated stormwater would then flow into infiltration basins, where the water will be stored and filtered as it permeates the soil. Overflow would route through the outlet control devices through two separate channels and towards the wetland which surrounds the Manhan River.

Figure 2: *Location of proposed sediment forebay and infiltration basin off Gilbert Road.*
Source: Tighe & Bond

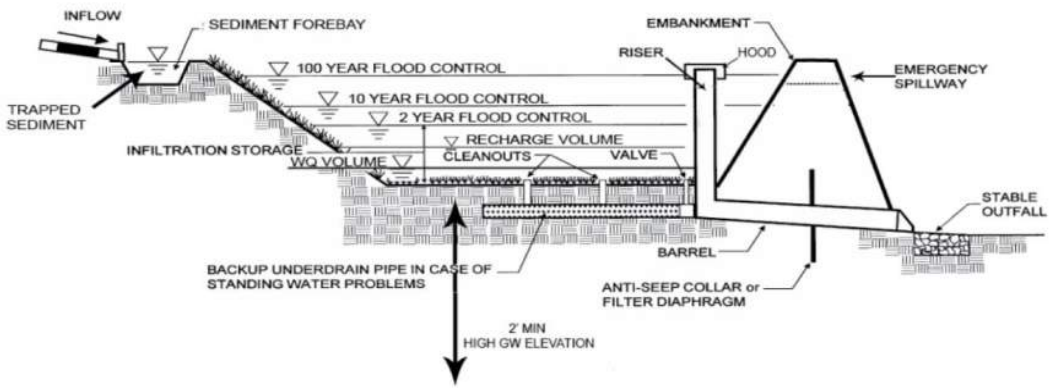


Figure 3: *Example of a pretreatment sediment forebay and infiltration basin.*
Source: MA Stormwater BMP Manual

Tighe&Bond

NOTES:

-POTENTIAL TO INSTALL 2 DEEP-SUMP HOODED CATCH BASINS, WATER QUALITY UNITS, SEDIMENT FOREBAYS, AND INFILTRATION BASINS TO TREAT AND INFILTRATE RUNOFF FROM BRICKYARD ROAD AND GILBERT ROAD.

-ESTIMATED POTENTIAL TP LOADING TO BMP: 2.88 LB P/YEAR

ASSUMPTIONS:

-GROUNDWATER DEPTH IS NOT SHALLOW

-BEDROCK DEPTH IS NOT SHALLOW

-SOILS ARE WELL-DRAINED

-THE REQUIRED SPACE FOR AN ADEQUATELY SIZED INFILTRATION BASIN IS AVAILABLE

-THE EXISTING IMPERVIOUS AREA IS PITCHED TOWARD THE PROPOSED CATCH BASIN

-SEE FULL ATTACHED MAPBOOK FOR ENVIRONMENTAL INFORMATION. ADDITIONAL PERMITTING MAY BE REQUIRED WHERE SENSITIVE ENVIRONMENTAL AREAS ARE LOCATED

PROPOSED OUTFALL

OUTLET CONTROL DEVICE

INFILTRATION BASIN

SEDIMENT FOREBAY

DEEP-SUMP HOODED CATCH BASIN

OUTLET CONTROL DEVICE

PROPOSED OUTFALL

DRAINAGE PIPE

INFILTRATION BASIN

SEDIMENT FOREBAY

DRAINAGE PIPE

DEEP-SUMP HOODED CATCH BASIN

BRICKYARD ROAD

GILBERT ROAD

CANFIELD CIRCLE

COOLIDGE DRIVE

MADISON AVENUE

BUCHANAN CIRCLE

Areas For Index
Outfall
DrainManhole
CatchBasin
GRAVITY
Parcels
LiDAR 2ft (2015)
MassDEP 100ft Buffer

BMP RETROFIT INVENTORY-DRAFT

LOCUS MAP

0 160 320
Feet

1 inch = 250 feet

Mapsheet: 3

180 Brickyard Rd

Parcel ID:
34_179

Southampton, Massachusetts

October 2022

Tighe&Bond

Path: G:\GIS\MA\SouthamptonMA\MapDocs\Southampton_BMP_MapBook.mxd

PROPERTY 4 – WHITTEMORE CONSERVATION AREA

Meadow Lane, Parcel 8_36

PROPERTY DESCRIPTION

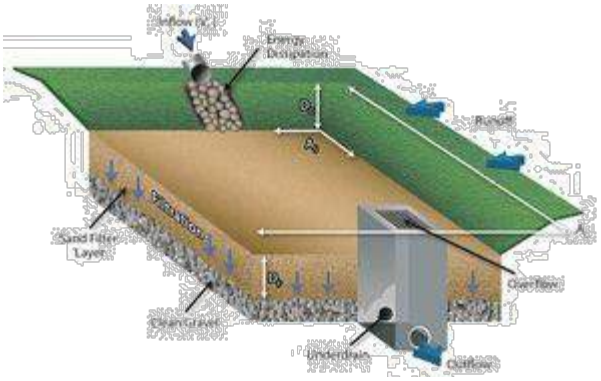


Figure 1: *Example of a sand filter.*
Source: MN Stormwater Manual

The Whittemore Conservation Area is a 34.30 acre parcel located off Meadow Lane. The property is near residential areas, but it is a public area with established hiking trails. There would be opportunities at this location for educational components, such as interpretive signs or viewing areas. The implementation of BMPs with a focus on infiltration and dissipation of stormwater may also help with existing drainage and erosion problems. However, this site may pose a challenge to work around priority resource areas. The stormwater would flow toward the Manhan River, which drains into the Connecticut River, which drains into the Long Island Sound, which is nitrogen impaired.

Figure 2: *Example of an infiltration basin.*
Source: MA Stormwater BMP Manual

PROPOSED RETROFITS

There are two existing catch basins on Meadow Lane, which each drain to separate outfalls. Each outfall would be fitted with a water quality unit such as a hydrodynamic separator to adequately treat the runoff prior to entering the infiltration basin due to available constructable space. Stormwater would then flow to an infiltration basin, where stormwater would be stored and filtered as it permeates the soil.

Figure 3: *Location of proposed infiltration basin at southernmost existing outfall.*
Source: Tighe & Bond

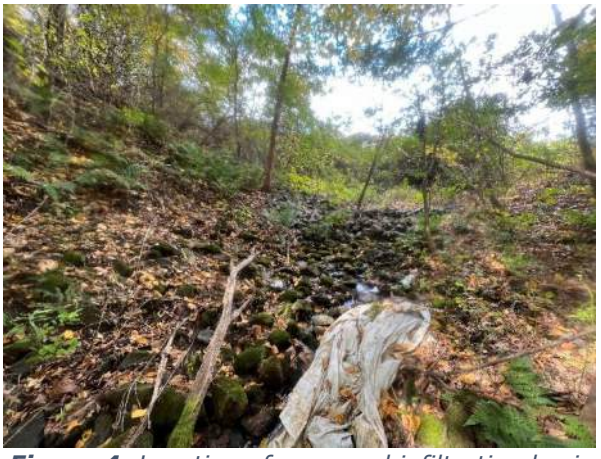


Figure 4: *Location of proposed infiltration basin at northernmost existing outfall.*
Source: Tighe & Bond

NOTES:

-POTENTIAL TO INSTALL 2 WATER QUALTY UNITS AND INFILTRATION BASINS TO TREAT AND INFILTRATE RUNOFF FROM MEADOW LANE.

-ESTIMATED POTENTIAL TP LOADING TO BMP: .09 LB P/YEAR

ASSUMPTIONS:

-GROUNDWATER DEPTH IS NOT SHALLOW

-BEDROCK DEPTH IS NOT SHALLOW

-SOILS ARE WELL-DRAINED

-THE REQUIRED SPACE FOR AN ADEQUATELY SIZED INFILTRATION BASIN IS AVAILABLE

-EXISTING UTILITIES AND DRAINAGE INFRASTRUCTURE SHOULD BE VERIFIED

-SEE FULL ATTACHED MAPBOOK FOR ENVIRONMENTAL INFORMATION. ADDITIONAL PERMITTING MAY BE REQUIRED WHERE SENSITIVE ENVIRONMENTAL AREAS ARE LOCATED

DRAINAGE PIPE

WATER QUALITY UNIT

WATER QUALITY UNIT

EXISTING OUTFALLS

INFILTRATION BASIN

MEADOW LANE

POMEROY MEADOW ROAD

DUGGAN LANE

KINGSBERRY LANE

Areas For Index
Outfall
DrainManhole
CatchBasin
GRAVITY
Parcels
LiDAR 2ft (2015)
MassDEP 100ft Buffer

BMP RETROFIT INVENTORY-DRAFT

LOCUS MAP

1

0 190 380
Feet

1 inch = 300 feet

Mapsheet: 4

Whittemore Conservation Area- Meadow Ln

Parcel ID:
8_36

Southampton, Massachusetts

October 2022

Tighe&Bond

Path: G:\GIS\MA\SouthamptonMA\MapDocs\Southampton_BMP_MapBook.mxd

PROPERTY 5 – CONANT MEMORIAL PARK

Clark Street, Parcel 23_78

PROPERTY DESCRIPTION

Conant Memorial Park, located on Clark Street, is an 18.55 acre parcel with a baseball field, tennis courts, a basketball court, and several parking areas. It also contains a wooded area to the east. There is a wetland area that runs from the northwest edge to the southeast edge of the site which follows a stream that connects to the Manhan River, which drains to the Connecticut River, which drains to Long Island Sound, which is nitrogen impaired. BMPs proposed for this site would manage stormwater runoff from Clark Street, the baseball fields, and the nearby parking area as it drains toward the wetland area. This location would provide the opportunity to include educational signage explaining the treatment of stormwater.

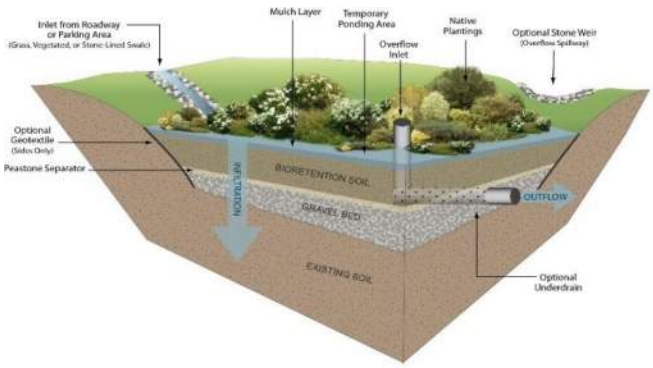


Figure 1: *Example of a bioretention basin.*
Source: MA Clean Water Toolkit

Figure 2: *Example of a deep sump hooded catch basin.*
Source: MA Stormwater BMP Manual

PROPOSED RETROFITS

The proposed retrofit would include the installation of a deep sump hooded catch basin at the parking area on the southwest corner of the site. The catch basin would route stormwater to a sediment forebay, where it would facilitate gravity separation of suspended solids and pretreat the stormwater. From there, stormwater would enter a bioretention basin and percolate through the soil for storage and removal of suspended solids, metals, and nutrients. It would also be aesthetically pleasing to park visitors. From there, the water would flow to an outlet control device and exit through the proposed outfall into a depression about 250 feet from the wetland area.

Figure 3: *Location of proposed sediment forebay and bioretention basin.*
Source: Tighe & Bond

NOTES:

-POTENTIAL TO INSTALL DEEP-SUMP HOODED CATCH BASIN, SEDIMENT FOREBAY, AND BIORETENTION BASIN TO TREAT AND INFILTRATE RUNOFF FROM BASEBALL FIELD PARKING AREA.

-ESTIMATED POTENTIAL TP LOADING TO BMP: 2.84 LB P/YEAR

ASSUMPTIONS:

-GROUNDWATER DEPTH IS NOT SHALLOW

-BEDROCK DEPTH IS NOT SHALLOW

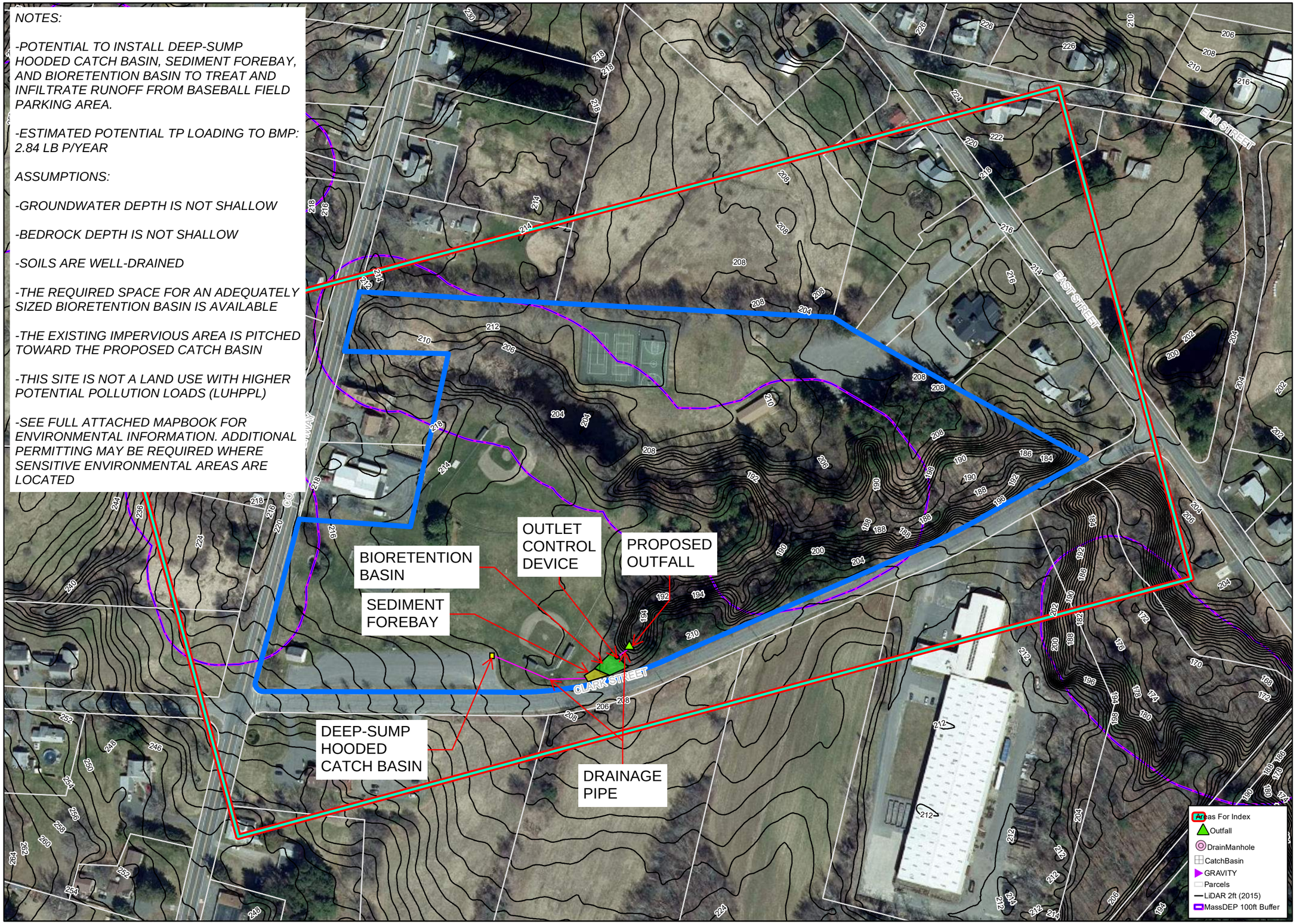
-SOILS ARE WELL-DRAINED

-THE REQUIRED SPACE FOR AN ADEQUATELY SIZED BIORETENTION BASIN IS AVAILABLE

-THE EXISTING IMPERVIOUS AREA IS PITCHED TOWARD THE PROPOSED CATCH BASIN

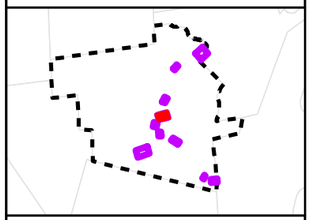
-THIS SITE IS NOT A LAND USE WITH HIGHER POTENTIAL POLLUTION LOADS (LUHPPL)

-SEE FULL ATTACHED MAPBOOK FOR ENVIRONMENTAL INFORMATION. ADDITIONAL PERMITTING MAY BE REQUIRED WHERE SENSITIVE ENVIRONMENTAL AREAS ARE LOCATED



BMP RETROFIT INVENTORY-DRAFT

LOCUS MAP



N

0 110 220

Feet

1 inch = 175 feet

Mapsheet: 5

Clark Street at Conant Park

Parcel ID:
23_78

Southampton, Massachusetts

October 2022

Tighe&Bond

Path: G:\GIS\MA\SouthamptonMA\MapDocs\Southampton_BMP_MapBook.mxd