MASSACHUSETTS
watershed·based plans

WATERSHED-BASED PLAN

West Branch of the Housatonic River including Onota and Pontoosuc Lakes

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MassDEP
Commonwealth of Massachusetts
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Contents

Executive Summary

The West Branch of the Housatonic Watershed extends 23,355 acres and is a sub-watershed in the upper Housatonic River watershed in Berkshire County, western Massachusetts. The watershed includes portions of the City of Pittsfield and the Towns of Lanesborough and Hancock and two Great Ponds. Onota Lake is 662 acres with a watershed just over 6720 acres and Pontoosuc Lake is 500 acres with a watershed of 13,754 acres. The City of Pittsfield (population 43,927) and the Town of Lanesborough (population 3037) are designated MS4 communities (Municipal Separate Storm Sewer System) and are regulated by the Massachusetts MS4 general permit under the Clean Water Act.

There are three waterbodies in this watershed that are designated as impaired in the Massachusetts Integrated List of Waters for the Clean Water Act 2022 Reporting Cycle (Mass DEP, 2023)[1]. The West Branch of the Housatonic River (WB) is designated Category 5 and impaired with *E. coli, Fecal Coliform,* trash, debris, and temperature. As of July 2024, a state-wide total maximum daily load (TMDL) for pathogens is in draft form. The Housatonic watershed is included in the Long Island Sound TMDL for nitrogen Impairments and requires a 10% nitrogen reduction. The impairments for both Onota and Pontoosuc Lakes include four non-native aquatic plant species: Brittle naiad, *Najas minor,* Eurasian water milfoil, *Myriophyllum spicatum,* and curly leaf pondweed, *Potamogeton crispus*. While not impaired for it, water chestnut, *Trapa natans,* is also present and being managed. A Total Maximum Daily Load (TMDL) is not required for these impairments. Onota Lake is also impaired for dissolved oxygen (DO) for which a TMDL is required but not yet drafted. More recently, routine monitoring of Lake Onota by the Department of Conservation and Recreation in the fall 2023 detected eDNA of the invasive zebra mussels, *Dreissena polymorpha*. Follow-up monitoring is being conducted and the city, with the support of MassDEP, will adopt an aggressive approach to remediation, if zebra mussel presence is confirmed. Pontoosuc Lake is identified as one of the water bodies impaired by mercury and is regulated by EPA's northeast mercury TMDL 33880 for inland waters which encompasses seven states (CT, ME, MA, NH, NY, RI and VT) impaired by mercury primarily from atmospheric deposition. The full list of Massachusetts impairments is provided in Table A-9.

Berkshire Regional Planning Commission (BRPC) developed the West Branch Watershed Based Plan (WB WBP) through the Regional NPS Coordinator program which was funded through a Clean Water Act (CWA) s. 319 implementation grant. The WB WBP includes conceptual design plans for several Best Management Practices (BMPs) developed by UNH Stormwater Center, Kleinfelder, Comprehensive Environmental Inc. (CEI) and BRPC. Meetings with stakeholders including city and town officials and representatives of Berkshire Housing Development Corporation (BHDC), Pittsfield Housing Authority (PHA), Central Berkshire Habitat for Humanity, Lake Onota Preservation Association (LOPA), Friends of the Pontoosuc Lake, and Berkshire Environmental Action Team (BEAT) helped identify potential locations for stormwater BMPs, both structural and non-structural, in order to address the identified impairments. BRPC's Gray to Green project funded by Massachusetts Healthy Community Fund supported neighborhood audits conducted by residents. These audits also provided information that helped identify locations and programs for reducing stormwater pollution.

[1] https://www.mass.gov/doc/final-massachusetts-integrated-list-of-waters-for-the-clean-water-act-2022-reporting-cycle/download

A draft WB WBP was shared with key stakeholders and their comments have been integrated into this final plan. For more information, questions, or to provide input, please contact Courteny Morehouse, Energy & Environmental Senior Planner at Berkshire Regional Planning Commission at cmorehouse@berkshireplanning.org.

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 (EPA'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.[2]

EPA 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 includes nine elements (a through i) in accordance with EPA 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 (NPS) 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 and Conservation Reserve Program,

[2] https://www.mass.gov/info-details/grants-financial-assistance-watersheds-water-quality

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 NPS management measures that will be implemented.

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

g) A description of **interim, measurable milestones** for determining whether NPS 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 toward attaining water quality standards and, if not, the criteria for determining whether this WBP needs to be revised or, if a NPS 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 plan would not have been possible without the funding support of the MassDEP Clean Water Act 319 Regional NPS Coordinator Program.

As BRPC worked to complete the WB WBP, information and input was gathered at meetings held with key stakeholders including the City of Pittsfield, Town of Lanesborough, Berkshire Environmental Action Team, Lake Onota Preservation Association (LOPA), Friends of Pontoosuc Lake, Pittsfield Housing Authority, Berkshire Housing Services and Central Berkshire Habitat for Humanity, and Gray to Green Coalition – a collection of community based organizations in the environmental justice communities of Pittsfield.

BMP siting, conceptual designs, and alternative BMP considerations were compiled from existing conceptual designs included in the *Nitrogen and Phosphorous Identification Report* prepared for the City of Pittsfield by Kleinfelder, conceptual designs prepared by the University of New Hampshire (UNH) Stormwater Center for the Massachusetts Department of Environmental Protection (MassDEP) *Technical and Planning Support for the Implementation of Pathogen and Total Nitrogen Pollution Reduction in the Housatonic River Watershed* project and by engineering consultants Comprehensive Environmental (CEI), Inc. and BRPC with input from the City of Pittsfield's City Engineer and Conservation Agent and the Town of Lanesborough's Department of Public Works (DPW).

Data Sources

- This WBP was developed using the framework and data sources provided by MassDEP's WBP Tool[3].
- Project areas for high-priority structural stormwater BMPs were selected through site reconnaissance and design plans funded by the MassDEP Clean Water Act 319 Regional NPS Coordinator position.

[3] http://prj.geosyntec.com/MassDEPWBP

- Water quality data was provided by HVA, City of Pittsfield and the Friends of Pontoosuc Lake and Onota Lake Association. LAPA West provided cyanobacteria counts through their annual lakes and ponds monitoring program.
- Resources used to support the development of stormwater BMP conceptual designs include the Massachusetts Stormwater Handbook Volume 2 and the New England Stormwater Retrofit Manual (July 2022)[4][5]

[4] https://www.mass.gov/doc/massachusetts-stormwater-handbook-vol-2-ch-2-stormwater-best-management-practices/download
[5] https://www3.epa.gov/region1/npdes/stormwater/tools/snep-stormwater-retrofit-manual-july-2022-508.pdf

Summary of Completed Work

1. Structural BMPs

Table 1 provides a summary of the known stormwater BMPs in the WB watershed. Clean Water Act Section 319 funding has supported the implementation of BMPs in Burbank Park to support the water quality of Onota Lake and in Lanesborough to support the water quality of Pontoosuc Lake. MassDOT funding that supported the "Green Street" initiative on North Street resulted in the construction of ten rain gardens.

Table 1: Existing Stormwater BMPs in the West Branch Watershed

Ownership	Location	BMP	Installation Date	Notes
Bishop of Springfield	St. Joseph's Cemetery	Riparian Buffer	2024	A proposed Riverfront Improvement Plan includes a 334 square foot riparian buffer planting in St. Joseph's Cemetery along Onota Brook (Plans provided in Appendix E.)
City of Pittsfield	Churchill Brook/Churchill Street road-stream crossing, Pittsfield	Sediment forebays and rain gardens	2021	Plans to rebuild using NRD funds in 2024 as the existing rain gardens are not capturing all the stormwater runoff.
City of Pittsfield	Churchill Brook/Hancock Road-stream crossing, Pittsfield	Rain gardens at the inlet and outlet sides of the road-stream crossing	2018	Plans to rebuild/retrofit as just sediment traps using NRD funds in 2024 as much of the stormwater bypasses the rain gardens and the rain gardens quickly fill with sediment and are difficult to maintain.
City of Pittsfield	First Street	Underground infiltration tank	2020	The city maintains in accordance with the maintenance manual.
City of Pittsfield	North Street	10 rain gardens	2012 – 2014	Located on the section of North Street from the intersection with East Street to Wahconah Street. Maintained by HVA from 2012 to 2021. Now maintained by Pittsfield Beautiful. (Plans provided in Appendix F.)
City of Pittsfield	East Street	Rain garden	2012 – 2014	Located east of 44 Bank Row on East Street – infiltrates parking lot runoff.
City of Pittsfield	Southeast corner of Elizabeth and West Housatonic Street intersection	Rain garden	approx. 2017	Original design resulted in multiple eroded pathways with piles of sediment overwhelming the plantings. Rain garden rebuilt to create a sediment forebay (2022). Now maintained by Pittsfield Beautiful.

Table 1: Existing Stormwater BMPs in the West Branch Watershed

Ownership	Location	BMP	Installation Date	Notes
Town of Lanesborough	Lanesborough Elementary School,	Detention Pond	1999-2000	Locate the existing MOU between the town and the school that outlines maintenance. Currently the DPW is not providing maintenance services for this detention basin.
City of Pittsfield	Burbank Park, Onota Lake	Stormceptor © drop-inlet catch basins with sumps and oil hoods	2006	Stormceptor©at the boat access is cleaned out every two years by City of Pittsfield DPW. Included is an in-line stormwater treatment system, trench drain system and energy dissipaters with slope protection.
City of Pittsfield	Burbank Park, Onota Lake	Bank stabilization and access points	2011 - 12	Banks were stabilized and access to the lake was provided by installing three stairways and stabilized using Geoblock access pathways. These pedestrian access areas provide a stable location for visitors to access the water, preventing bank erosion.
Town of Lanesborough	Profile Street, Pontoosuc Lake	Stormceptor® 450 & Infiltration tank & Plunge pool	2003	Funded by a Clean Water Act Section 319 project. (Phase I) The new "treatment train" on Profile Street of catch basins, Stormceptor® units and infiltration tanks are expected to remove > 80% of total suspended solids and significant percentages of other pollutants, especially phosphorous and bacteria. The Stormceptor BMP system designed for the project settles sediments and discharges to an infiltration tank that will reduce bacteria and phosphorous loading into the lake. Before the BMP was installed all runoff went directly into the lake. Lanesborough DPW has the Stormceptor cleaned out every two years at a cost of 7K.
Town of Lanesborough	National and East Street, Pontoosuc Lake	Deep sump catch basins; Stormceptor® 900 & 2 Infiltration tanks	2004 & 2005	319 Project (Phase II) funded the installation of the National Street Stormceptor® system and a smaller, less complex solution to treat runoff being contributed by E Street, a connecting dirt road between National and Imperial Streets. The E Street BMP redirected road runoff away from the lake to be treated by the National Street Stormceptor© Lanesborough DPW has the Stormceptor® cleaned out every two years at a cost of $7,000 a year.
Private, Lanesborough	Former Pontoosuc Lodge site	Rain garden	2003 or 2004	Rain garden installed east of outfall (site ID PL3), in the location of the former Pontoosuc Lodge swimming pool (Lanesborough). Maintenance and function are unknown as it is on private property.

Table 1: Existing Stormwater BMPs in the West Branch Watershed

Ownership	Location	BMP	Installation Date	Notes
City of Pittsfield, School Department	Taconic High School	Multiple bioinfiltration sites and green roof	2018	Maintained by the school department's maintenance staff.
City of Pittsfield	Multiple locations	Tree plantings	2016 - 19	Greening the Gateway Program planted 3,000 trees in the most urbanized areas of Pittsfield. These trees will help reduce energy use and the volume of stormwater generated.
Town of Lanesborough	Multiple locations	Deep sump catch basins	Various	Approx 60% of storm drains in Lanesborough are deep sump catch basins. Including storm drains on Bridge Street (4x4 ft deep-sump - poured in place). In 2005, catch basins on Opeechee Street were upgraded to deep sumps. All Sunrise Street catch basins are deep sump.

2. Non-Structural BMPs – Ongoing

a. Outreach and Engagement:

MS4 Education: Both the City of Pittsfield and Town of Lanesborough are Municipal Separate Storm Sewer System (MS4) Communities governed by the EPA under the Clean Water Act National Pollution Detection and Elimination System (NPDES). As MS4 communities, the City of Pittsfield and the Town of Lanesborough are required to reduce and track nitrogen pollution. Appendix F and H of the MS4 General Permit (2016) outlines the required public messaging that targets nitrogen as well as phosphorous.[6] [7] The municipalities provide annual messaging to residents and businesses that includes:

(i) Proper disposal of pet waste (City of Pittsfield and Town of Lanesborough have pet waste laws.)
(ii) Proper operation and maintenance of septic systems.
(iii) Proper management of grass clippings and leaves.
(iv) Minimize fertilizer usage and never before storms.

Lake Outreach:

(i) *Monitors at Boat Access Sites on Pontoosuc and Onota:* The monitoring program is key to reducing the risk of invasives being introduced to the lakes. The City of Pittsfield hires monitors for each of the lake's boat access sites to educate boat owners about the risk of aquatic invasive plants and animals and how to properly clean their boats and gear. The goal is to provide staff for seven days a week (7am – 6pm) from Memorial Day weekend to Labor Day weekend but the city has struggled to hire monitors. There is also a need to continue having boat monitors at these sites into the fall as lake use continues well after Labor Day weekend. The city budgets about $30K/year to fund the boat monitoring program at both lakes. The city receives support from the Massachusetts Department of Conservation and Recreation's Lakes and Ponds program with an annual grant of about $18,000.
(ii) *Signage at Onota and Pontoosuc Lake Boat Accesses* provides information to residents and visitors about proper boat washing and where they can go to get their boat washed. This will be updated for the 2024 season.
(iii) *Website Information*
    a. *Lake Onota:*
        - Lake Onota Preservation Association's website is a key outreach mechanism for its members and visitors.
        - City of Pittsfield's website: (https://www.cityofpittsfield.org/departments/community_development/open_space_program/onota_lake.php)
    b. Pontoosuc Lake

[6] Mass MS4 General Permit - Appendix F: https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/appendix-f-2016-ma-sms4-gp-mod.pdf
[7] Mass MS4 General Permit - Appendix H: https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/appendix-h-2016-ma-sms4-gp-mod.pdf

- City of Pittsfield's website: https://www.cityofpittsfield.org/departments/community_development/open_space_program/pontoosuc_lake.php
- Town of Lanesborough's website has a webpage for the Friends of Pontoosuc Lake: https://www.lanesborough ma.gov/departments/friends_of_pontoosuc_lake.php

(iv) Lake Onota Preservation Association (LOPA) publishes a best practices brochure and distributes it a variety of places including:
   a. At the boat ramp.
   b. Mailed to all paid members (200 members in 2023 – mostly residents around the lake but also people that use the lake).
   c. LOPA expects to initiate a membership outreach committee in 2024 to increase membership.

(v) LOPA meets regularly throughout the year.
   a. Membership includes representatives for the private residential developments: Thomas Island, Blythewood, Onota Heights and Lakewood.

Kids in Kayaks – at Westside Riverway Park: BEAT, in conjunction with the Westside Legends, has been leading "Kids in Kayaks" since 2022 to introduce children to kayaking and a new way of exploring their local river. It is also an avenue to connect with the families and share information about the river, its health, issues and solutions. The most recent event was held during Memorial Day weekend during the Westside Block Party.

Water Chestnut Removal has been identified on both Pontoosuc and Onota Lakes. Volunteers conduct hand removal events annually to manage this invasive plant.

b. Street Sweeping Protocols

City of Pittsfield

The entire City is swept at least twice a year, once in the fall and once in the spring. Main streets and parking lots are swept at a higher frequency (1-2 times a month). The city has increased street sweeping frequency of all municipal-owned streets and parking lots which have potential for high pollutant loads.[8]

Town of Lanesborough

Street Sweeping is contracted out and is conducted in the spring and fall on all streets.

c. Catch basin Cleaning Protocols

City of Pittsfield

The City of Pittsfield has established catch basin cleaning protocols in accordance with the MS4 regulations. The City prioritizes inspection and maintenance of the municipally managed catch basins located in the West Branch watershed to ensure that no sump shall be more than 50 percent full. Cleaning of catch basins is completed more frequently if inspection and maintenance activities indicate excessive sediment or debris loadings. The city has a list of low-

[8] https://cms2.revize.com/revize/pittsfieldma/city_hall/public_works_and_utilities/docs/Pittsfield%20MS4%20SWMP%20Compiled%20Report_DRAFT_2022.06.21.pdf

lying catch basins that are prone to flooding. These catch basins are more routinely inspected and maintained to ensure proper drainage.

Town of Lanesborough

Catch basin cleanouts are completed annually. The town contracts this work out and has used the same contractor (Maintenance Man) for over 30 years. Approximately 60 – 65% of Lanesborough's storm drains are deep sump catch basins. If any storm drains are found to be more than 50% full, these are flagged and cleaned more frequently.

d. Lake Drawdowns

Both lakes are drawn down 3 feet annually in the fall under an existing Order of Conditions issued by the Lanesborough and Pittsfield Conservation Commissions (Pontoosuc Lake) and Pittsfield Conservation Commission (Onota Lake). This serves to remediate invasive plant species on the lake edge and reduce bank erosion during the winter months.

e. River Cleanups

HVA, BEAT, and the City of Pittsfield have partnered together to combat the impairment of trash on the West Branch of the Housatonic River conducting up to three West Branch River cleanups each year for over 15 years. Several tons of trash have been removed and, in recent years, the volume of trash removed has diminished. The size of the trash items has also grown smaller. Initially, appliances, mattresses, carpets, tires, and shopping carts were common and now it is mostly bottles and cans and other smaller items. Fewer shopping carts and tires are part of the trash pile. BEAT has worked tirelessly with the local supermarkets, including the Big Y supermarket to encourage them to only use shopping carts that cannot be removed from the lot making it more difficult for the cart to end up in the river. The Big Y supermarket is the key food store for the Westside Neighborhood, an Environmental Justice Community. Residents have used shopping carts to carry their groceries home and may continue to need support to do that. Volunteers for river cleanups come from all over Berkshire County. Efforts to engage the local neighborhood residents have been less successful.

Photos of West Branch River Cleanups (photo credit BEAT)

f. Stormwater Regulations

The following stormwater regulations in the City of Pittsfield and Town of Lanesborough support implementation of stormwater BMPs and encourage residents to pick up their dog's waste.

- City of Pittsfield Stormwater Management Ordinance: https://ecode360.com/30744151
- City of Pittsfield Pet Waste Ordinance: https://ecode360.com/15966545
- Town of Lanesborough Stormwater Management bylaw: https://ecode360.com/34365606
- Town of Lanesborough Removal of Pet Waste bylaw: https://ecode360.com/34365232#34365232

Pittsfield Gray to Green

Gray to Green is an environmental and climate focused initiative driven by an inclusive community process that centers the vision and experience of residents of the Morningside and Westside Neighborhoods in Pittsfield. The Gray to Green Partnership is committed to removing barriers to health (including structural and institutional racism, poverty, and other power imbalances) through community-centered policies, systems and environmental changes. The Pittsfield Gray to Green Project engages the community and prioritizes green planning in a social and racial justice context. Partners include Habitat for Humanity and Working Cities, 18 Degrees and the City of Pittsfield. This five-year project is funded by the Massachusetts Healthy Community Fund.

In 2023, residents of the Morningside and Westside neighborhoods volunteered to complete neighborhood audits that provided information about neighborhood issues including broken sidewalks, poor lighting, flooding, trash and more. These audits were reviewed to inform this Plan about localized stormwater issues. An outcome of Gray to Green was the development of the St. Francis and Circular Avenue conceptual designs included in Element C.

3. Completed Projects

a. Pontoosuc Lake Watershed Resource Restoration Project. CWA Project #: 99-03/319 (1999 – 2003)

- The Stormceptor ® Unit and associated deep sump catch basins were installed on Profile Street, reducing the volume of pollutants and sediment entering Pontoosuc Lake (Lanesborough). Construction costs resulted in the additional Stormceptor's® proposed for National and Imperial Street to be delayed.
- BRPC provided technical assistance for unpaved road maintenance problems. One significant dirt road problem in the Pontoosuc drainage area was addressed by installing water bars on the road to direct drainage to grassy and wooded areas. Residents found the water bars were difficult to drive over and complained about sediment being directed toward their yards. Following the installation, a new home was built, and utility lines were installed underneath the road and these caused more (temporary) drainage problems on the road.
- BRPC trained the Friends of Pontoosuc Board of Directors in nonpoint source pollution education and worked with them to develop an outreach strategy to use with their association and local stakeholders. At the 2002 annual meeting, BRPC delivered its "Lake NEMO" outreach program. Lake NEMO explains the concept and realities of nonpoint source pollution – especially as it impacts lakes and lake watersheds. NEMO recognizes that local land use decisions regarding water quality protection are under the control of municipal officials.
- A QAPP was developed by HVA to conduct post-installation water quality monitoring. Monitoring results were delayed due to significant delays in construction.
- A pamphlet about the project was prepared for future distribution to other towns and lake associations interested in s319 funding for implementation projects.
- BRPC provided substantial assistance to lake associations in Berkshire County. Information gathered at Pontoosuc provided support to similar efforts at Onota Lake, Lake Buel, and Lake Ashmere. These lakes have taken the assistance and initiated watershed resource restoration projects of their own.

b. Implementing the Diagnostic / Feasibility Study Recommendations for Onota Lake CWA Project #: 00-01/319 (April 2000 – June 2006) Grantee: BRPC

- Structural BMPs to treat stormwater runoff were designed, permitted, and installed along Lakeway Drive and an adjacent boat ramp and parking area in Burbank Park.
- A comprehensive weed control program was conducted, decreasing the density and distribution of aquatic weeds.
- A comprehensive stormwater management plan was prepared to decrease the contribution of stormwater related pollutants and sediments through stormwater retention / detention basins.
- An erosion control program was conducted to eliminate sedimentation from highly used areas in Burbank Park.
- A public education / involvement / outreach program was conducted that included a mailing, lake user survey and installation of an informational kiosk at the Burbank Park boat ramp.

c. Pontoosuc Lake Watershed Resource Restoration Project Phase II CWA Project #: 01-14/319 (2001-2005)

- Stormceptor installed on National Street (begun in Phase I, Project #: 99-03/319)
- Post BMP installation monitoring conducted.
- Installed an erosion control at a stormwater outfall on Profile Street,
- Shoreline survey completed,
- Treated stormwater runoff from E Street with installation of deep sump catch basins
- Outreach program conducted that educated local residents from the North Cove neighborhood, local school children and the Friends of Pontoosuc Lake about the stormwater issue. This final task involved education programs, stormwater monitoring and storm drain labeling.

d. Pontoosuc Lake Watershed Based Plan Development CWA Project #: 04-10/319

This project developed a 9-step watershed based plan, in accordance with EPA requirements, for Pontoosuc Lake. Recommendations for pollutant load reductions included structural BMPs for the unpaved roads, bank stabilization of tributaries, agricultural BMPs for farmlands and outreach and education to lake-side residents.

e. Onota Lake Preservation Program -CWA Project #: 07-08/319 (March 2008 – June 2012) Grantee: City of Pittsfield

According to the report titled, *Diagnostic / Feasibility Study for Onota Lake* (IT Corp. 1991), the most pervasive cause of Onota Lake's problems stem from excessive sediment and nutrient loading. Watershed urbanization, agricultural practices and stormwater runoff have contributed to increased nutrient and sediment loading resulting in a decline in water quality, loss of fish habitat, and impaired use of the lake.

The goal of this project was to implement the recommendations of the *Onota Lake Long-Range Management Plan* by addressing the highest priority water quality impairments and the major sources of NPS within a Category 4c water body. Tasks included:

- *Increase the Capacity of Drawdown through Structural Modifications to the Onota Lake Dam*: The Onota Lake dam is owned and operated by the City of Pittsfield. The City of Pittsfield has been authorized to conduct drawdowns up to 6 ft to improve the effectiveness of the weed control. The project completed the construction of an additional low-level outlet pipe dam to augment existing drawdown capabilities.
- *Install Stormwater BMPs at Burbank Park:* Priority sites for stormwater management at Burbank Park were identified through prior projects conducted in partnership between the city, the Lake Onota Preservation Association (LOPA) and the Berkshire Regional Planning Commission (BRPC). This project built on prior efforts by improving the quality of the existing drainage system at Burbank Park and further reduces pollutants, sedimentation, and erosion at the lake.
- *Shoreline Stabilization, Erosion Controls and Bank Revegetation:* The City installed shoreline stabilization measures at Burbank Park, a priority nonpoint source pollution mitigation site between the large boat launch and the public beach that was undermined and eroded. These shoreline stabilization measures provide formal stabilized access points designed for boat launching, fishing and swimming and provide more natural buffers and stabilized banks which will be less susceptible to both foot traffic damage and wave action erosion.

- *Monitoring & Project Evaluation:* LOPA volunteers continued to conduct water quality monitoring pursuant to the QAPP approved by EPA/MassDEP under 00-01/319.
- *Education & Outreach:* The City partnered with LOPA and BRPC to conduct a three-pronged outreach and education approach aimed at homeowners, visitors and boaters. The project partners utilized a variety of different media including newsletters, websites, signs and television/radio.

RESULTS: It is estimated that each linear foot of shoreline results in approximately 110 pounds (approximately 1 cubic foot) of sediment deposited into the lake each year based on field visits and best engineering judgment. As the project stabilized approximately 480 linear feet of shoreline, a total of 52,800 pounds (26.4 tons) of sediment is prevented from entering Onota Lake.

f. Churchill Brook: Installation of Infiltration Basins

Churchill Street/Churchill Brook (2021)
The City of Pittsfield in partnership with HVA and BEAT and with funding support from the Executive Office of Energy and Environmental Affairs Municipal Vulnerability Preparedness program, the City of Pittsfield and the Natural Resources Damages Fund, replaced an undersized, perched culvert with a bridge (19 feet x 8.5 feet precast concrete box bridge) allowing aquatic and terrestrial wildlife passage. Bioinfiltration basins were constructed at the outlet end on both sides of Churchill Brook. With this replacement, all barriers to aquatic passage have been removed from Churchill Brook. Electrofishing conducted by MassWildlife following the replacement has confirmed that even larger stocked trout are able to access this brook.

Photo of Trout captured during Mass Wildlife Electroshocking Survey of Churchill Brook (Photo credit: HVA)

Hancock Road/Churchill Brook (2018)
The City of Pittsfield in partnership with HVA and BEAT and with funding support from the Natural Resources Damages Fund, Massachusetts Environmental Trust and the City of Pittsfield replaced this undersized, perched, multi-pipe culvert with a bridge allowing fish and terrestrial wildlife passage. Bioinfiltration basins were constructed at the inlet and outlet to infiltrate stormwater from Hancock Road

g. Tel-Electric (a.k.a. Mill Street) Dam Removal (2020)

After 20 years of planning, with support from numerous partners and $4.2 million funding, the Tel-Electric dam, a hazardous dam on the West Branch, was removed in the spring 2020. The coalition of partners included: the National Fish and Wildlife Foundation, the Massachusetts Sub Council of the Housatonic River Trustees Committee, the Massachusetts Office of Energy and Environmental

Affairs Dam and Sea Wall Repair and Removal Program, the Massachusetts Division of Ecological Restoration, the Massachusetts Department of Environmental Protection, Pittsfield Mills Corporation and Seth and Mitch Nash, and the U.S. Department of the Interior Office of Restoration and Damage Assessment. The project eliminated a public safety risk associated with the aging dam, protected surrounding infrastructure, reduced the likelihood of localized flooding, and removed polluted sediments from the river. It reconnects nearly five miles of river, improves water quality, and repairs natural river processes in the West Branch. The City of Pittsfield plans to expand its Westside Riverway vision, a greenway along the West Branch, into the area of the former dam.

h. MassDEP Upper Housatonic TMDL Project (2022)

In collaboration with local stakeholders including the municipalities of Pittsfield, Dalton, and Lanesborough, BEAT, HVA, BRPC, MassDEP conducted the Upper Housatonic TMDL project to support the reduction of stormwater pollution in the upper Housatonic River Watershed. The conceptual designs developed for any West Branch locations have been included in this plan.

The project was designed to: (1) Build capacity for integrating green infrastructure and other stormwater controls into municipal decision making. (2) Provide tools that can be used as part of watershed planning to prioritize stormwater controls going forward. (3) Achieve innovative and cost-effective management of stormwater to help meet MS4 requirements while realizing other co-benefits. Mass DEP and the UNH Stormwater Center worked with the stakeholders to complete the following tasks:

A. Develop an approach, using EPA's Opti-Tool, to prioritize and rank watersheds for implementing stormwater controls.[9]

B. Conduct a stormwater management assessment to inform cost-effective opportunities within the built landscape with a focus on reducing pathogen and total nitrogen pollution.

C. Work with local partners to identify stormwater controls, conduct site visits to evaluate opportunities, and develop conceptual stormwater management designs.

i. Lenox MVP Regional Action Grant (2022 – 2023)

The City of Pittsfield was one of the partners in this grant project which was funded by EOEEA's MVP program. The project provided the city with a Road-Stream Crossing Management Plan that includes an inventory of all the road-stream crossings and prioritizes their replacement based on aquatic connectivity, flood risk and condition of the crossing. In addition, the crew assessing the culverts completed a nature-based observations data form at culverts where significant erosion or stormwater issues were observed. These collected observations were designed to help inform nature-based solutions for each sub-watershed. Trout Unlimited completed the report of the nature-based findings and identified segments of streams on Onota Brook and the West Branch that could benefit from restoration projects that would reduce bank erosion.

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[9] https://www.epa.gov/tmdl/opti-tool-epa-region-1s-stormwater-management-optimization-tool

Invasive plants such as Japanese knotweed (Reynoutria japonica) are proliferating in the Housatonic watershed including the West Branch watershed especially at the road-stream crossings.

j. Dry Weather Screening of Stormwater Outfalls in MS4 designated areas (2022)

The City of Pittsfield is in the process of completing and the Town of Lanesborough has completed the dry weather screening of the stormwater outfalls in the West Branch watershed. Outfalls observed discharging in dry weather (defined as more than 0.1 inches of precipitation in 24 hours) are sampled. The *Stormwater Outfall Sampling Summary* in **Table A-7** of Element A provides information about the sampling results.

k. Educational Outreach Materials

a. *River Smart brochure*: HVA worked with Pittsfield and Lanesborough to develop a brochure to educate and inform residents about stormwater and provide suggestions for minimizing stormwater impacts. These brochures were printed in both English and Spanish and are distributed at multiple public places and tabling events.
b. *Educational Yard and Pet waste messaging*: The City of Pittsfield included inserts in the utility bills to inform residents about proper management of yard and pet waste. In addition, HVA created slides that were included in the advertisements shown at the local cinema on North Street, Pittsfield.
c. *Tri-fold stormwater display* developed by HVA for use at tabling events in the City of Pittsfield shared the message about the impacts of stormwater and tips for people to reduce their impact.

l. Storm Drain Labeling – City of Pittsfield

The HVA has worked with the Housatonic watershed communities to glue labels adjacent to storm drains to inform people not to dump anything down the storm drain. In the City of Pittsfield, the focus was to decal neighborhoods where they are most visible. HVA's volunteers, interns and students labeled the main streets of the downtown Pittsfield. These decals need to be replaced every 1 – 3 years and currently are in need of replacing.

m. Fifth Grade Watershed Education – Lanesborough and Pittsfield (2020 – 2023)

From 2020 - 2023, HVA and Mass Audubon provided watershed focused education programs to fifth grade classes in the West Branch watershed including Lanesborough Elementary School and Pittsfield's Capeless Elementary School. Fifth grade students learned about the water cycle, water quality, the impact of polluted stormwater, green infrastructure, and nature-based solutions in multiple hands-on engaging programs. These school programs were primarily funded by the Natural Resources Damages Fund for the Housatonic River.

n. West Branch Stream Assessments (2014 and 2000)

HVA developed, with support of volunteers, the West Branch Stream Assessment Report and Recommended Action Plan. The list of recommendations includes (1) the implementation of green infrastructure and (2) education programs that will improve awareness of water quality issues, foster appreciation for the West Branch and provide information about ways to support and improve water quality including yard debris and pet waste management.

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

The West Branch of the Housatonic River Watershed is a sub-watershed of the Housatonic River located in Berkshire County and encompasses portions of three municipalities: the City of Pittsfield (population 43,461), the Town of Lanesborough (population 3,308), and a minor portion of primarily forested land in the Town of New Ashford (population 250).[10]

The West Branch Housatonic River (MA21-18) drains an area of 37 square miles, of which 2.3 square miles (6%) is impervious and 1.3 square miles (3%) is directly connected impervious area (DCIA). The watershed is partially served by public sewer and 19% is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA 2016). There are no NPDES permits on file governing point source discharges of pollutants to surface waters and no MassDEP discharge to groundwater permits for on-site wastewater discharge within the watershed. There are two inactive landfills and one closed landfill in the watershed: (1) King Street Dump, Pittsfield, inactive since 1971; (2) Sacco Dump on Turner Avenue, Pittsfield, inactive since 2005; (3) The town of Lanesborough landfill on Old Orebed Road, was in operation from 1971 to 1986 and is officially closed and was capped in 1998.[11] [12]

The watershed is mostly forested (69%), especially the mountainous western side. The developed areas are concentrated around the West Branch of the Housatonic River as it flows through Pittsfield from the Pontoosuc Dam to the confluence with the Southwest Branch of the Housatonic River. These developed areas comprise medium to high density residential neighborhoods, commercial developments with parking areas, the local hospital known as Berkshire Medical Center and downtown Pittsfield with businesses centered along North Street. There are active agricultural operations in the watershed that are mostly in Lanesborough along Town and Daniels Brooks. The West Branch river corridor has few sections of wooded buffer, for example where it flows through the cemetery, WahconahPark, and the Atwood Avenue neighborhood but mostly the roads and buildings are within a few meters of the river.

[10] Source: 2020 Census Data
[11] Soure: https://www.mass.gov/lists/total-maximum-daily-loads-by-watershed
[12] Source: https://www.mass.gov/files/documents/2017/01/vt/inactlf.pdf

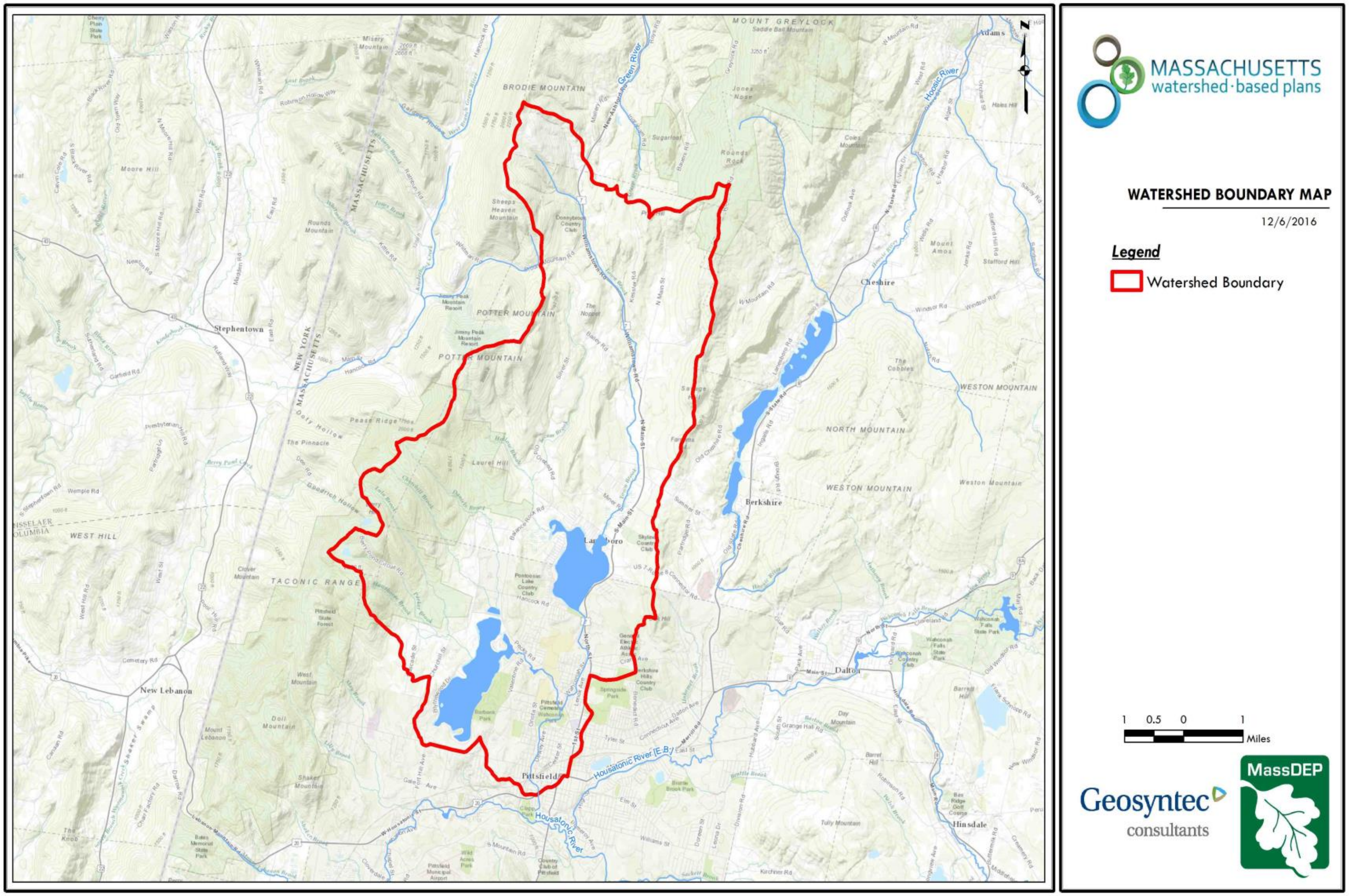


Figure A-1 West Branch Watershed Boundary Map (MassGIS, 2007; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Ctrl + Click on the map to view a full-sized image in your web browser

Table A-1: West Branch of the Housatonic River General Watershed Information

Watershed Name (Assessment Unit ID):	Churchill Brook (MA21-34) ; Daniels Brook (MA21-65) ; Hawthorne Brook ; Hollow Brook (MA21-67) ; Lulu Brook (MA21-64) ; Onota Brook (MA21-80) ; Parker Brook (MA21-63) ; Secum Brook (MA21-66) ; Town Brook (MA21-36) ; Unnamed Tributary (MA21-68) ; West Branch Housatonic River (MA21-18)
Major Basin:	Housatonic River
Watershed Area (within MA):	23355.3 acres

The 4.1-mile main stem of the West Branch of the Housatonic River is located entirely in Pittsfield, Massachusetts and originates at the dammed outlet of Pontoosuc Lake. It is abutted by occupied and unoccupied historic mill buildings and flows through the urbanized environment of Pittsfield ending at the confluence with the East Branch of the Housatonic. The West Branch of the Housatonic River (MA21-18) is classified as a Class B, Cold Water Fishery (CFR) by MassDEP as are the tributaries to the West Branch of the Housatonic River which include: Churchill Brook (MA21-34) ; Daniels Brook (MA21-65) ; Hawthorne Brook; Hollow Brook (MA21-67) ; Lulu Brook (MA21-64) ; Onota Brook (MA21-80) ; Parker Brook (MA21-63) ; Secum Brook (MA21-66) ; Town Brook (MA21-36) ; and Unnamed Tributary (MA21-68). All of these tributaries are listed as Class B, cold water fish resources (CFRs). CFRs are important habitats for a number of cold-water species, including trout. Coldwater species are typically more sensitive than other species to alterations to stream flow, water quality and temperature within their aquatic habitat. Identification of CFRs is based on fish samples collected annually by MassWildlife staff biologists and technicians.[13]

Two "Great Ponds," Onota and Pontoosuc Lakes are located within the West Branch watershed. Under Massachusetts law (MGL Chapter 131, Section 45), Great Ponds are defined as ponds or lakes at least 10 acres in size. Both lakes are heavily used for recreational activities including swimming, boating and fishing and have well-developed shorelines. Onota Lake, 662 acres in size with a watershed of 6720 acres, is located entirely within Pittsfield and is managed by the City and the Lake Onota Preservation Association whereas Pontoosuc Lake, 500 acres in size with a watershed of 13,754 acres, is in both Lanesborough and Pittsfield. The two municipalities co-manage the lake with the support of the Friends of Pontoosuc Lake. Both lakes are dammed with 3-foot drawdowns occurring every year. Active Order of Conditions (OOCs) issued by the local Conservation Commissions regulate their weed management and drawdowns. Both lakes are stocked by MassWildlife in spring and fall.

[13] Source: https://maps.massgis.digital.mass.gov/MassMapper/MassMapper.html and https://www.mass.gov/info-details/massgis-data-ma-wildlife-coldwater-fisheries-resources

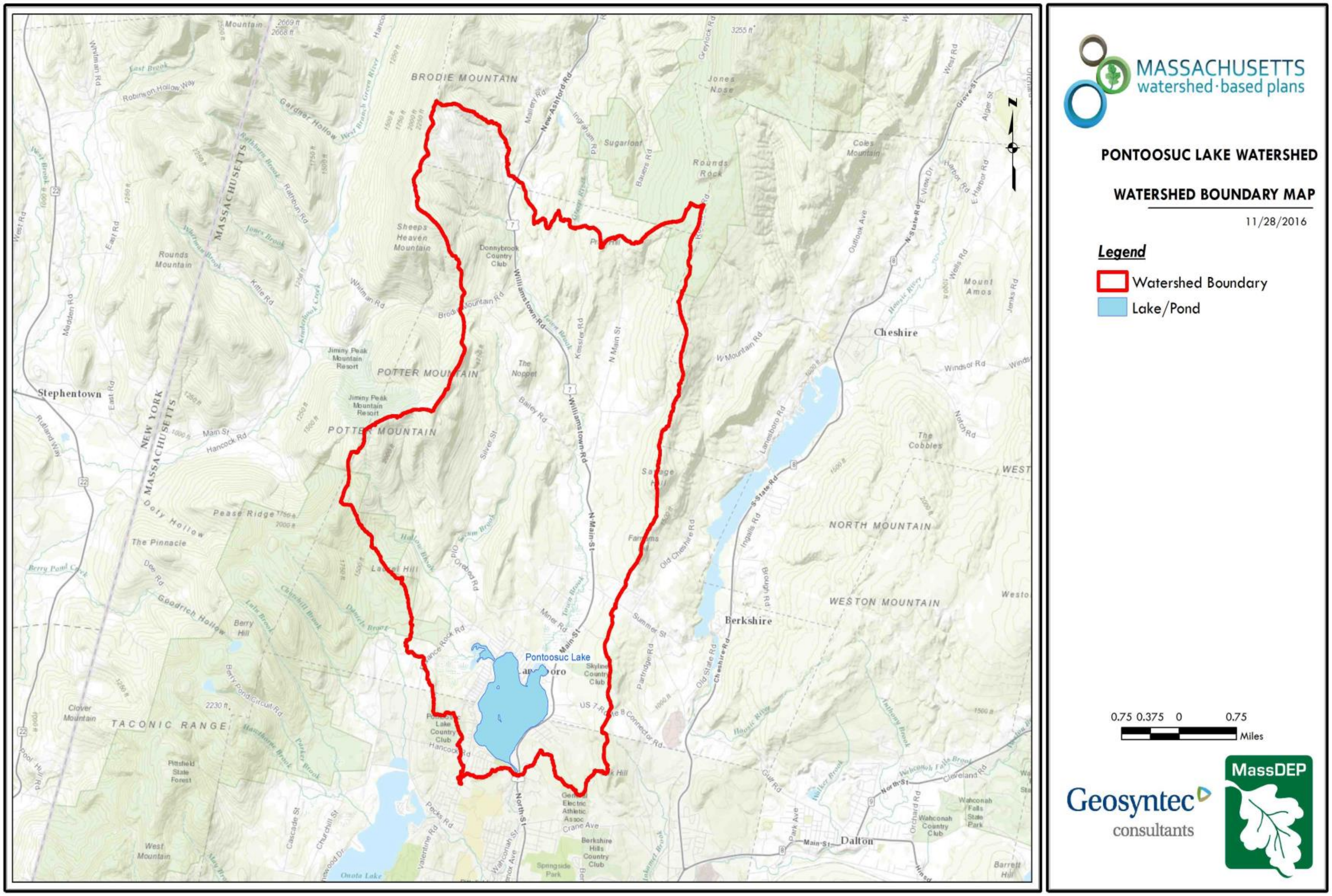


Figure A 2 Pontoosuc Watershed Boundary Map (MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Ctrl + Click on the map to view a full-sized image in your web browser

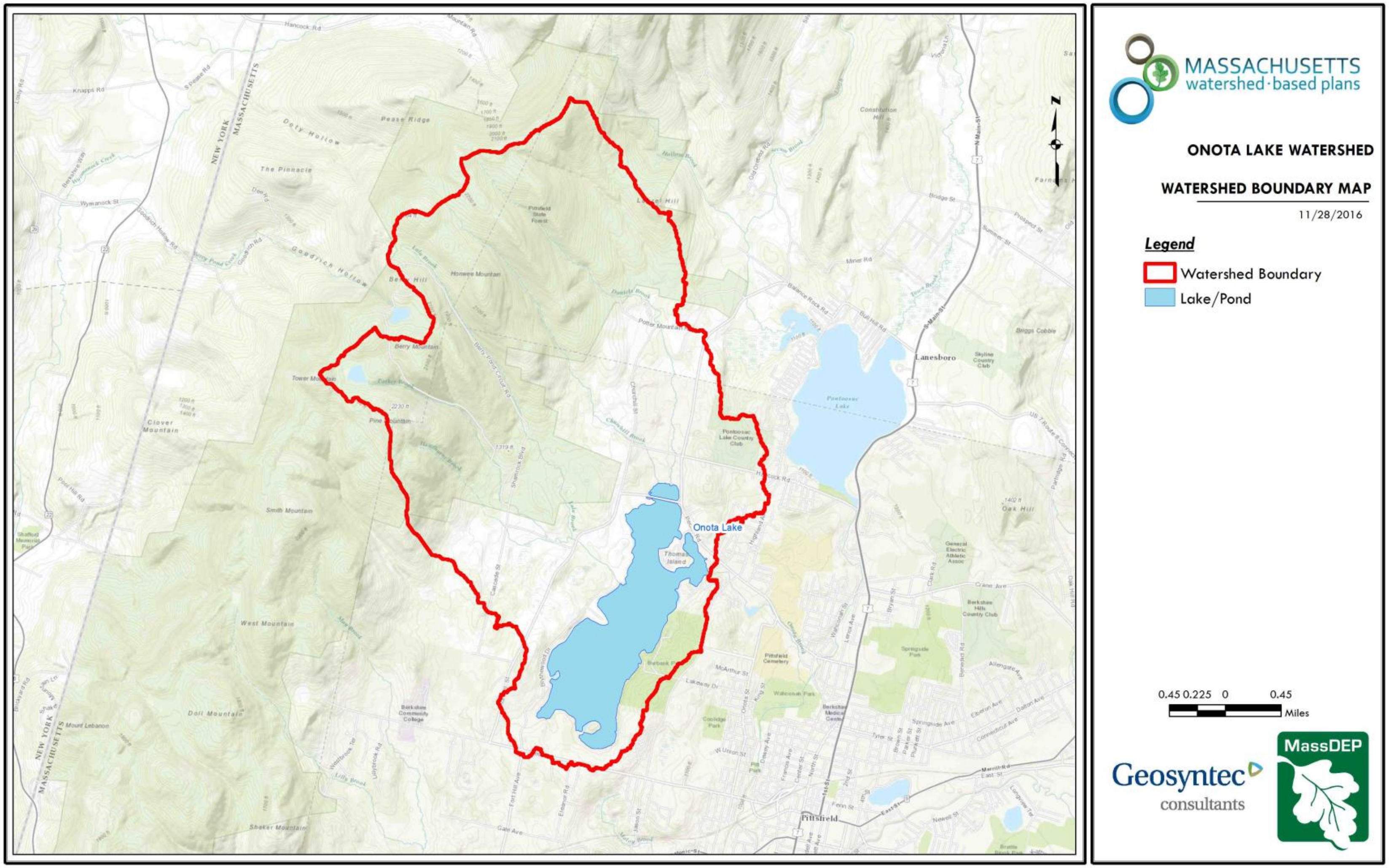


Figure A-3: Onota Lake Watershed Boundary Map (MassGIS, 2007; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Ctrl + Click on the map to view a full-sized image in your web browser

Table A-2: Pontoosuc Lake General Watershed Information

Watershed Name (Assessment Unit ID):	Pontoosuc Lake (MA21083)
Major Basin:	HOUSATONIC
Watershed Area (within MA):	13754.3 acres
Water Body Size:	500 acres

Table A-3: Onota Lake General Watershed Information

Watershed Name (Assessment Unit ID):	Onota Lake (MA21078)
Major Basin:	HOUSATONIC
Watershed Area (within MA):	6720.1 acres
Water Body Size:	662 acres

Parcels of protected land within the West Branch include state owned and managed properties: Pittsfield State Forest, Balance Rock State Park, Barton's Ledge Wildlife Management Area and a portion of Mount Greylock State Reservation. The City of Pittsfield Department of Parks and Recreation own and manage Burbank Park on Onota Lake (188 acres), Coolidge Park (28 acres) Pontoosuc Lake Park (23 acres) and Wahconah Park located on the West Branch (102 acres). The Town of Lanesborough owns and manages the Bill Laston Memorial Field (66 acres) and the Town Park on Bridge Street. Berkshire Natural Resources Council, a land trust operating in Berkshire County, owns and manages approximately 300 acres in the West Branch watershed. The two golf courses, Donny Brook and Skyline, are no longer in operation and the properties are for sale.

In the West Branch Housatonic River (MA21-18) watershed, under the Natural Heritage and Endangered Species Program, there are 814 acres (3%) of Priority Habitats of Rare Species and 61 acres (<1%) of Priority Natural Vegetation Communities. See **Figure A-4**.

Portions of the West Branch watershed within the City of Pittsfield and Town of Lanesborough are regulated by the EPA Municipal Separate Storm Sewer System (MS4) 2016 Nonpoint Discharge Elimination System (NPDES) General Permit.[14]

The state has identified the West Branch of the Housatonic River as impaired for *E. coli* and a *Draft State Pathogen TMDL* is currently in public comment period.

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

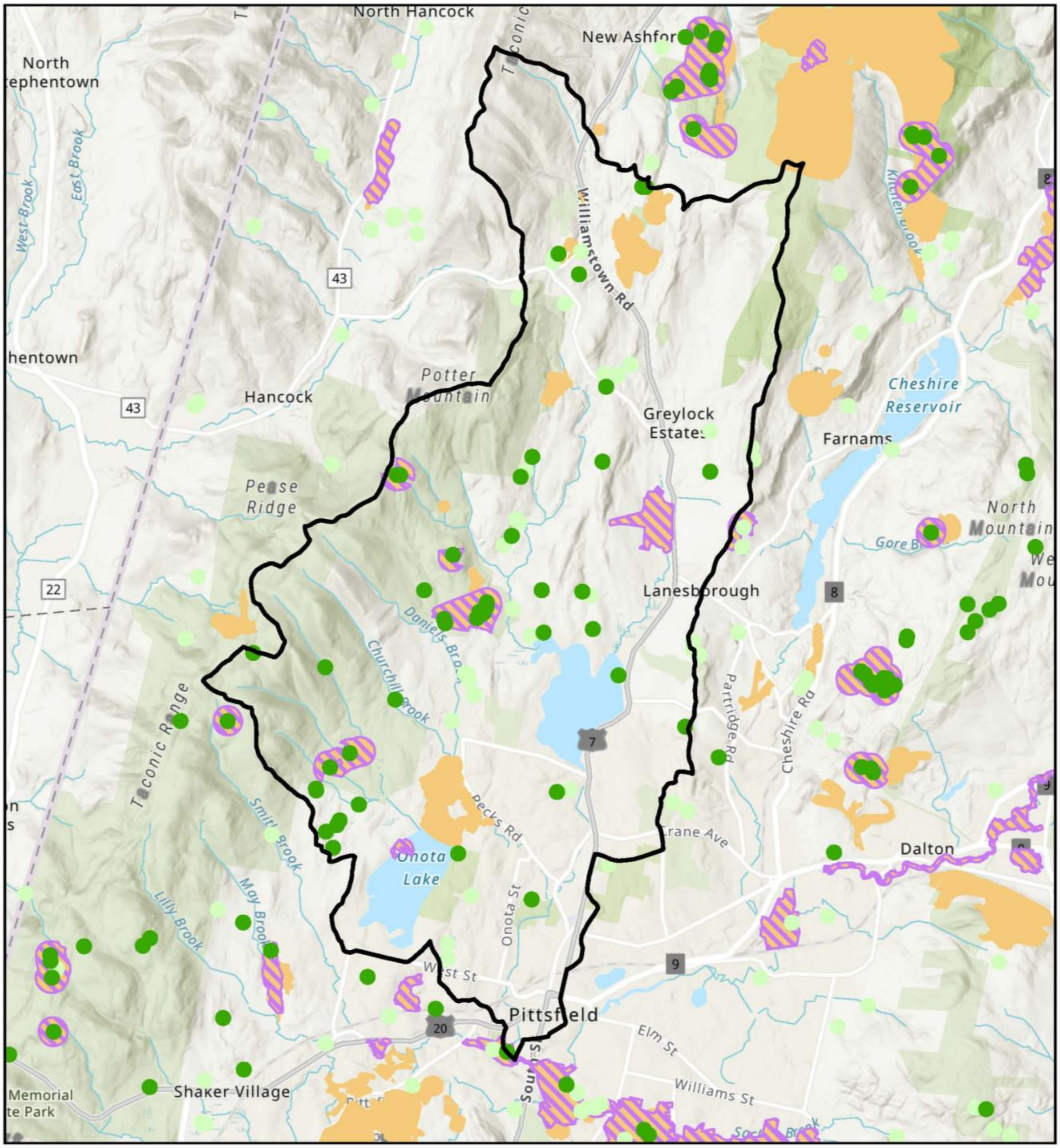
The *Long Island Sound Nitrogen TMDL* regulates nitrogen loading in the Housatonic River watershed, which includes the West Branch and its tributaries. For the Housatonic watershed, there is a requirement to reduce nitrogen input by 10%.[15]

A major concern for the municipalities in the watershed is climate resilience. Berkshire County is experiencing more frequent and intense storms resulting in flooding, loss, or threat of loss to road infrastructure. The Town of Lanesborough and the City of Pittsfield have both completed Municipal Vulnerability Preparedness (MVP) Plans and have updated Hazard Mitigation Plans.[16] The City of Pittsfield replaced the only two crossings on Churchill Brook and integrated stormwater management into the final design. The replaced crossings help reduce bank erosion and scouring and the rain gardens adjacent to the brook capture many pounds of sediment. Churchill Brook is an inlet tributary to Onota Lake, and these projects have reduced the amount of sedimentation and nutrient input to Onota Lake. With support from HVA and other partners, the City of Pittsfield has completed a Road-Stream Crossing Management Plan (RSCMP). This plan assesses the aquatic connectivity and climate resilience of public and most private road-stream crossings and prioritizes their replacement. Recommendations for nature-based solution locations were included.

[15] https://neiwpcc.org/wp-content/uploads/2020/08/LIS-TMDL_MA-State-Section.pdf

[16] More information about Massachusetts Municipal Vulnerability Preparedness program is available at this website: https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program

Figure A-4: West Branch Housatonic Watershed Natural Heritage Data Map



BRPC
Berkshire Regional Planning Commission

This map was created by the Berkshire Regional Planning Commission and is intended for general planning purposes only. This map shall not be used for engineering, survey, legal, or regulatory purposes. MassGIS, MassDOT, or BRPC may have supplied portions of this data.

West Branch Watershed
Certified Vernal_Pools
Potential Vernal Pools
Estimated Habitats of Rare Wildlife
Priority Habitats of Rare Species

0 0.5 1 2 Miles

N

MassDEP Water Quality Assessment Report and TMDL Review

The following reports for the West Branch of the Housatonic River watershed are available:

West Branch Watershed reports:

- Housatonic River Watershed 2002 Water Quality Assessment Report

Onota Lake specific reports:

- DIAGNOSTIC FEASIBILITY STUDY FOR ONOTA LAKE, PITTSFIELD, MASSACHUSETTS
- ENVIR. IMPACT REVIEW AND MANGT IMPLICATIONS FOR A PROPOSED DRAWDOWN OF ONOTA LAKE, PITTSFIELD, MA
- FIELD STUDY AND ACTION PLAN ONOTA LAKE RESTORATION PROJECT
- RESULTS OF THE ONOTA LAKE MONITORING PROGRAM-1997

Pontoosuc Lake specific reports:

- DIAGNOSTIC FEASIBILITY STUDY OF PONTOOSUC LAKE PITTSFIELD MASS.
- Northeast Regional Mercury Total Maximum Daily Load

The section below summarizes the findings of any available Water Quality Assessment Report and/or TMDL that relate to water quality and water quality impairments. Select excerpts from these documents relating to the water quality in the watershed are included below (note: relevant information is included directly from these documents for informational purposes and has not been modified).

Housatonic River Watershed 2002 Water Quality Assessment Report (MA21-18 - WEST BRANCH HOUSATONIC RIVER)
AQUATIC LIFE USE Habitat and Flow Water flows from Pontoosuc Lake via one of two ways--either over the dam into the main channel of the river or by diversion into a bypass channel, or “sluiceway”, on the west end of the dam. This bypass channel runs parallel to the main riverbed for approximately 100 yards before joining with it. This 100-yard stretch of the main riverbed is often dry or very nearly dry since much more water leaves the lake via the bypass channel instead of flowing over the dam (HVA 2003c). The Housatonic Valley Association (HVA), in cooperation with the Riverways Instream Flow Stewards (RIFLS) program, has documented issues with flows over the outlet of Pontoosuc Lake Dam (HVA 2002b). At times there has been no flow coming over the dam, resulting in recently stocked trout being stranded in isolated pools. Flows in this section of river do not correlate well with rainfall data or other flow data (e.g., flow is high when all others are low or vice versa). Downstream, near Wahconah Park, there are problems with the river flooding every time it rains. In 2000 HVA conducted a shoreline survey of the West Branch Housatonic River from the outlet of Pontoosuc Lake to the confluence with the East Branch Housatonic River (HVA 2000). In the section from the outflow of Pontoosuc Lake to Wahconah Street, the river was channelized with “rocked-in or bricked-in walls or banks”. In the section from Pecks Brook confluence to the Linden Street bridge, an active beaver dam impounds the river. Additionally, in-stream sedimentation is problematic in the vicinity of King Street. DWM performed a habitat assessment at Station HW01 (B0021) on 10 September 2002, approximately 300 meters downstream from Route 20 in Pittsfield, MA (Appendix C). The habitat at station HW01 received the lowest habitat score of the 15 Housatonic Watershed stations examined in 2002 (94/200) due to poor in-stream fish cover, lack of deep pools or deep runs, sparse vegetation along the stream banks, and small industrial facilities, residences, roads, and parking areas impacting the riparian zone width. The sampled reach was channelized, with stone walls containing the flows for approximately half of the 100 meter reach. There were no aquatic macrophytes within the reach, and green filamentous algal coverage was estimated at less than 5%. Canopy cover was estimated at 65% (Appendix C). Biology

Housatonic River Watershed 2002 Water Quality Assessment Report (MA21-18 - WEST BRANCH HOUSATONIC RIVER)

MA DFG conducted fish population sampling at one station (Site 617, at Route 20, Pittsfield, near Clapp Park) on 11 July 2002. A total of 81 fish representing 13 species were collected, including: 29 white sucker, 18 fallfish, nine bluegill, six pumpkinseed, six rock bass, three blunt nose minnows, three black crappie, two common shiner, one blacknose dace, one creek chub, one golden shiner, one largemouth bass, and one yellow perch (Richards 2006). The fish community was composed of pollution tolerant or moderately tolerant species, with a complete absence of pollution intolerant species. Few fluvial specialist species were present.

DWM sampled the benthic macroinvertebrate community in the river downstream from Route 20 (Station HW01) in September 2002 (Appendix C). RBP III analysis indicated this station was slightly impacted when compared to the regional reference station on the East Branch Housatonic River (Station EB01B). It should be noted that highly pollution tolerant worms dominated the community (37%); these organisms are indicative of organic enrichment. Additionally, this sampling reach exhibited the most degraded benthic community structure encountered during the 2002 Housatonic River watershed survey. Habitat quality was only 53% comparable to the reference station condition.

Chemistry-water
HVA conducted monthly water quality sampling at three sites along this segment between June and October 2002 and April and October 2003 (HVA 2002b and 2003c). In 2004 HVA sampled five sites on the West Branch (HVA 2004b). These stations were called: Pontoosuc Lake Dam, Taconic Park Drive, West Branch above Peck's, Jimmy's & Route 20, and Atwood Avenue. Parameters measured included dissolved oxygen, pH, temperature, alkalinity, total phosphorus, and total suspended solids. Dissolved oxygen data were not collected during worst-case, pre-dawn conditions.

The majority of water quality data collected by HVA in the West Branch Housatonic River met criteria. Elevated levels of total phosphorous, temperatures exceeding 20°C, and two high concentrations of total suspended solids were recorded. Total phosphorous concentrations ranged from <0.01 to 0.13 mg/L (n=31). The highest measurements of total phosphorous and TSS were associated with wet-weather sampling. Water temperatures exceeding 20°C were frequently observed during the summer months.

The Aquatic Life Use is assessed as impaired based upon the examination of the collective data available for this segment. The RBP III analysis indicated that the benthic community was only slightly impacted. However, pollution tolerant worms dominated the sample, the biotic index was the highest (worst) and the EPT index was the lowest (worst) of any of the sites monitored. These community attributes were considered to be strong indicators of organic enrichment. Furthermore, the in-stream habitat quality was degraded and pollution intolerant cold-water fish species were absent. HVA water quality corroborates these findings, as they recorded elevated summer temperatures and elevated total phosphorous concentrations.

FISH CONSUMPTION
In 1982 the Massachusetts Department of Public Health (MA DPH) issued a fish consumption advisory for the Housatonic River because of PCB contamination associated with the General Electric site. In 1995 MA DPH updated their advisory to include a recommendation that fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking.

Because there are no barriers to migration for fish between the West Branch Housatonic River and the GE site, the Fish Consumption Use is identified with an Alert Status.

PRIMARY CONTACT RECREATION, SECONDARY CONTACT RECREATION AND AESTHETICS
HVA collected monthly fecal coliform and E. coli bacteria samples from the five water quality stations described above (HVA 2002b, 2003c,and 2004b). Fecal coliform counts at these five stations ranged from 5 to >20,000 cfu/100mL (n=50). In 2002 a leaking sewer line was discovered due to these extremely high bacteria counts in the vicinity of the Jimmy's Restaurant & Rt. 20 site. The City of Pittsfield repaired the line that summer. Since that time the highest count was 3,960 cfu/100mL, recorded by HVA in 2003 at the Atwood Avenue station. Three of 19 samples collected at the Jimmy's and Atwood Ave stations in 2003 and 2004 exceeded 2000 cfu/100mL. Seven of these 19 exceeded 400 cfu/100mL.

In 2000 HVA conducted a shoreline survey of the West Branch Housatonic River (HVA 2000). Multiple crews noted trash throughout this reach, with one volunteer describing the river as "trashy, dangerous and aesthetically very unappealing". Volunteers noted a milky discharge from a storm drain in the West Street to Atwood Avenue section. Sewage odors were documented at Wahconah Park and the Mill Street Dam.

Housatonic River Watershed 2002 Water Quality Assessment Report (MA21-18 - WEST BRANCH HOUSATONIC RIVER)

DWM field biologists recorded field observations at Station HW01 (B0021) on 10 September 2002. They noted that the sediment smelled musty and there was an abundance of trash and debris in-stream (i.e., broken glass, bricks, etc). The water was also described as slightly turbid with a musty smell. No sedimentation or water oils were noted (MassDEP 2002b).

The Primary and Secondary Contact Recreation and Aesthetics uses are assessed as impaired for this segment due to the objectionable deposits of trash and odors throughout this segment noted by DWM biologists and shoreline survey observations made by HVA volunteers. In addition, the fecal coliform bacteria counts are sufficiently high to impair the Primary Contact Use downstream from the Peck's station and the Secondary Contact Recreation Use downstream from the Jimmy's station.

Report Recommendations:
Monitor bacteria counts and conduct bacteria source tracking to identify and address point sources.

Monitor summer water temperatures with deployed probes. Investigate flow alterations or other actions that could improve the cold water habitat of this designated cold water fishery.

Control pollutant loading from storm drains by implementing Phase II stormwater permit requirements in the city of Pittsfield. Develop a monitoring plan and conduct bacteria sampling to evaluate effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities in Pittsfield and to assess the status of the Primary and Secondary Contact Recreational uses. Conduct bacteria source tracking as needed to identify undocumented sources.

Due to the no flow occurrence documented by HVA volunteers, local regulatory authorities are encouraged to establish a flow management strategy to protect in-stream biota in the West Branch Housatonic River downstream from Lake Pontoosuc.

Housatonic River Watershed 2002 Water Quality Assessment Report (MA21083 - Pontoosuc Lake)

Four non-native aquatic macrophytes (Myriophyllum spicatum, Najas minor, Potamogeton crispus, and Trapas natans) were documented in Pontoosuc Lake (Kennedy and Weinstein 2000 and Robinson 2006b). The Aquatic Life Use is assessed as impaired because of the presence of the non-native aquatic macrophytes.

In 1994 EPA funded an agricultural waste management project to reduce nonpoint source inputs to Pontoosuc Lake from five farms in the watershed. A diagnostic assessment of conditions in Pontoosuc Lake was conducted in 1997 as a follow-up to evaluate the effectiveness the project. No methods or quality assurance data are provided in this report, so the information was not used to make Aquatic Life Use assessments. According to ENSR, "summer anoxia was observed in the small hypolimnion and appeared to promote internal recycling of phosphorus during the growing season, algal blooms in the lake were reported to be common but not severe, and rooted plant growths were dominated by non-native species with high nuisance potential but appeared to be adequately managed with drawdown and harvesting" (ENSR 2000). It was determined that pollutant inputs of nutrients from storm drain systems were problematic because of their proximity and rapid discharge to the lake. As part of projects 99-03/319 and 01-14/319 priority storm drain problems were corrected by the installation of innovative stormwater infiltration technologies at three locations. These systems were designed to capture the "first flush" of storm runoff and infiltrate it into the ground. It should be noted that a newly funded project, 04-10/319, is underway. Water quality monitoring under an approved quality assurance project plan will be conducted as part of this project.

In 1993 DWM conducted fish toxics monitoring in Pontoosuc Lake that resulted in MA DPH issuing a site-specific fish consumption advisory for the lake due to elevated concentrations of mercury in fish tissue. On 20 June 2002 DWM resampled the fish in Pontoosuc Lake (Appendix E, Table E1). Although the data generated in 2002 indicate that mercury is below the MA DPH "trigger level" in all samples (including one composite sample of three largemouth bass), MA DPH took the data point for largemouth bass in 2002 and combined it with the 1993 largemouth bass data and calculated an average concentration. As a result MA DPH decided to re-issue the previous advisory (Maietta et al. 2004, MA DPH 2005b). The current MA DPH fish consumption advisory recommends that due to elevated concentrations of mercury "Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant and nursing mothers should not eat any largemouth

Housatonic River Watershed 2002 Water Quality Assessment Report (MA21083 - Pontoosuc Lake)

bass from this waterbody and the general public should limit consumption of largemouth bass to two meals per month". Because of this site-specific advisory, the Fish Consumption Use is assessed as impaired due to mercury contamination. Although the source of mercury is unknown, atmospheric deposition is suspected.

Pontoosuc Lake was sampled weekly for E. coli bacteria at the Lanesborough town beach off Sunrise Street in 2002, 2003, and 2004 (n=34) (MA DPH 2003, 2004, 2005a). The lake was also sampled from the beach at Memorial Park in 2002 (n=8). The beaches were never posted. In 2002 the City of Pittsfield tested the water at their bathing beach on Pontoosuc Lake for E. coli bacteria on a weekly basis (n=11). The beach was never posted. Currently, there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no Primary Contact Recreational Use assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

Algal blooms in the lake were reported to be common but not severe, and rooted plant growths were dominated by non-native species with high nuisance potential but appeared to be adequately managed with drawdown and harvesting" (ENSR 2000).

The Aesthetics Use is assessed as support based on the documentation provided by ENSR that algal blooms are not severe and the non-native aquatic macrophyte populations appear to be adequately managed.

Housatonic River Watershed 2002 Water Quality Assessment Report (MA21078 - Onota Lake)

Three non-native aquatic macrophytes Myriophyllum spicatum, Najas minor, and Potamogeton crispus were documented in Onota Lake during the 1997-1998 DWM synoptic survey (Kennedy and Weinstein 2000). Two of these species (Myriophyllum spicatum and/or Potamogeton crispus, were also identified in a recent applications submitted to the Department to apply herbicides to the lake (MassDEP 2003b and MassDEP 2005b). A fourth non-native aquatic macrophyte, Trapas natans, was also recently reported to be in this waterbody (MA DFG 2005).

Lake Onota Preservation Association (LOPA) volunteers have conducted water quality monitoring at several Lake Onota stations during 2001-2004. Low dissolved oxygen concentrations were measured in all years at the two deep hole stations (D2 northern deep hole and D6 southern deep hole)(LOPA Annual Report 2001, 2002, 2003, 2004). The low DO conditions affect approximately 25% of the lake area. Despite not being covered under an approved QAPP, these DO data corroborate a 1987 diagnostic study for Onota Lake (ITC 1987), which demonstrated low DO conditions in a significant portion of the lake during the summer months.

The Aquatic Life Use is assessed as impaired because of the presence of the non-native aquatic macrophytes and the low dissolved oxygen levels. In the fall of 2006, zebra mussels (an invasive non-native organism) were found in boats brought to Onota Lake (NALMS 2006).

LOPA volunteers also measured Secchi disk depth at the deep hole stations at regular intervals during 2001-2004. The Secchi disk measurements are included within a MassDEP approved QAPP. Secchi disk depth ranged from 2.1 to 5.6 m at Station D2 and 2.6 to 7.5 m at Station D6 (D2 northern deep hole and D6 southern deep hole)(LOPA Annual Report 2001, 2002, 2003, 2004).

The Primary and Secondary Contact Recreation and Aesthetics uses are assessed as support based upon the acceptable water clarity as measured by the Secchi disk depths.

Fish from Onota Lake were sampled for toxics in fish tissue as part of an Office of Research and Standards managed research project in 2002 and 2004. Samples were analyzed for mercury and selenium (Maietta undated). Since no site-specific fish consumption advisory was issued for this waterbody, the Fish Consumption Use is not assessed.

Camp Witawentin tested the water at their bathing beach on Onota Lake weekly during 2002 for E. coli bacteria (n=10) (MA DPH 2003). The beach was never posted. The City of Pittsfield also tested the water at their bathing beach on Onota Lake

Housatonic River Watershed 2002 Water Quality Assessment Report (MA21078 - Onota Lake)
weekly during 2002 for E. coli. The City beach was also never posted. Camp Winadu also maintains a beach on Onota Lake, no data were reported. Currently, there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no Primary Contact Recreational Use assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody. There were two grant projects which received funding as listed below: 00-01/319: Implementing the Diagnostic/ Feasibility Study Recommendation for Onota Lake. The overall goal of abating the accelerated eutrophication of Onota Lake will be accomplished through the continued implementation of in-lake restoration and watershed management measures to reduce nutrient and sediment loading. Implementation of these measures will improve water quality, improve fish habitat, and improve recreational use of the lake. 03-15/MWI Onota Lake Watershed Assessment This project will perform an assessment of current and past aquatic vegetation and nutrient control practices at Onota Lake and develop a lake and watershed management plan targeted at controlling nuisance aquatic vegetation. Tasks include: conducting two qualitative and quantitative aquatic macrophyte surveys; training volunteers from the Lake Onota Preservation Association in macrophyte identification and mapping; conducting a lake watershed assessment. **Report Recommendations:** NA

Historical and current Technical Memoranda (TM) produced by the MassDEP Watershed Planning Program are available here: Water Quality Technical Memoranda | Mass.gov and are organized by major watersheds in Massachusetts. Most of these TMs present the water chemistry and biological sampling results of WPP monitoring surveys. The TMs pertaining primarily to biological information (e.g., benthic macroinvertebrates, periphyton, fish populations) contain biological data and metrics that are currently not reported elsewhere. The data contained in the water quality TMs are also provided on the "Data" page (Water Quality Monitoring Program Data | Mass.gov). Many of these TMs have helped inform Clean Water Act 305(b) assessment and 303(d) listing decisions.

Mass DEP conducted sampling in the West Branch Watershed in 2007. Two sites were sampled on Town Brook:

- W1562 - On Town Brook, upstream of unnamed tributary confluence at Miner Road, Lanesborough
- W1723 - On Town Brook, downstream at Miner Road, Lanesborough
- W1575 – On the West Branch of the Housatonic River approximately 630 feet downstream from Route 20, Pittsfield.

Results are available in the Mass DEP Technical Memorandum: *Housatonic River Watershed 2007 DW Water Quality Monitoring Data (2013)*[17]

[17] https://www.mass.gov/doc/technical-memorandum-cn-2891-housatonic-river-watershed-2007-dwm-water-quality-monitoring-data/download

Additional Watershed Reports

Additional reports and studies that helped inform this watershed-based plan are summarized in **Table A-4**. Links are provided where available. For information about the other reports, please contact BRPC.

Table A-4: Additional West Branch Watershed Reports

Year	Title	Prepared by	Description	Link
2003	Final Report for the Pontoosuc Lake Watershed Resource Restoration Resource Project CWA Project #: 99-03/319[18]	BRPC	Overall project goal was implementation of specific recommendations contained in Diagnostic/Feasibility study of Pontoosuc Lake. Project conducted 1999 - 2003	Contact BRPC for a digital copy.
2000	Final Report for Implementing the Diagnostic / Feasibility Study Recommendations for Onota Lake CWA Project # 00-01/319	BRPC	Overall project goal was to continue to abate the accelerated eutrophication of Onota Lake through implementation of specific recommendations contained in Diagnostic/Feasibility study. Project conducted 2000 – 2006.	Contact BRPC for a digital copy.
2001	Final Report for the Pontoosuc Lake Watershed Resource Restoration Resource Project CWA Project #: 01-14/319	BRPC	Overall project goal was the continued implementation of specific recommendations contained in Diagnostic/Feasibility study of Pontoosuc Lake. Project conducted 2001 – 2005.	Contact BRPC for a digital copy.
2002	2002 Water Quality Report for the East, West and Southwest Branches of the Housatonic River	HVA	Report includes results and summary for five sites monitored on the West Branch. The sites included downstream of the Onota Lake and Pontoosuc dams, as well as sites near West Housatonic Street on the West Branch and the confluence of Pecks/Onota Brook and the West Branch.	https://hvatoday.org/wp-content/uploads/2018/04/2002WQReport.pdf

[18] CWA indicates Clean Water Act Section 319 funded

Table A-4: Additional West Branch Watershed Reports

Year	Title	Prepared by	Description	Link
2004	Long Range Management Plan for Onota Lake	BRPC with LOPA and City of Pittsfield	This plan provides background information on the lake and its watershed, a brief review of past and current lake preservation initiatives, a review of previous lake management recommendations, and a brief description of local authorities and "stakeholders". BRPC, LOPA and the City of Pittsfield facilitated a Technical Advisory Group to: a) identify the problems and concerns experienced by lake users; b) explore alternative feasible management approaches c) develop management goals and objectives; and d) draft a proposed five year action plan to present to the City of Pittsfield Administration and City Council.	https://onotalake.com/wp-content/uploads/2018/07/1237924847.pdf
2005	Pontoosuc Lake Watershed Based Plan CWA Project #: 04-10/319	BRPC	Overall project goal was to conduct a combination of research, monitoring, planning, and education activities that built upon previous studies and 319 projects (99-03/319, 01-14/319 and develop a watershed-based plan consistent with EPA requirements that will lay the groundwork for development and implementation of effective remediation techniques.	Contact BRPC for a digital copy.
2005	Invasive Species Management Plan for Onota Lake	ENSR and BRPC	Plan to protect and restore native aquatic plants and minimize the impacts of non-native, invasive plants.	https://onotalake.com/wp-content/uploads/2018/07/1237925293.pdf
2006	Comprehensive Site Assessment of the King Street Dump	Mass DEP Solid Waste Bureau	Site assessment results for King Street Dump located in Pittsfield on the West Branch.	https://www.thebeatnews.org/BeatTeam/Issues/GE/GEissues/westb/KSD/images/KSDCSAFP.pdf
2009	City of Pittsfield's Master Plan	City of Pittsfield	Describes a vision of Pittsfield's growing and revitalized future.	https://www.cityofpittsfield.org/city_hall/community_development/planning_and_development/master_plan.php
2012	Final Report for the Onota Lake Preservation Program CWA Project #: 07-08/319	City of Pittsfield	Final Report for the Clean Water Act Section 319 grant to stabilize sections of bank and install BMPs at Burbank Park, Lake Onota.	Contact BRPC for a digital copy.

Table A-4: Additional West Branch Watershed Reports

Year	Title	Prepared by	Description	Link
2014	West Branch Assessment Report & Recommended Action Plan	HVA	Conducted by HVA, this assessment provided an update of the report completed in 2000. It provides a summary of observations and recommendations for the West Branch of the Housatonic River.	Contact BRPC for a copy.
2017	Town of Lanesborough's Economic Development Plan	Town of Lanesborough, Lanesborough Economic Development Committee and BRPC	To guide the town's economic development over a period of 5 years.	https://www.mass.gov/doc/lanesborough-economic-development-plan/download
2018	Lanesborough Community Resilience Building Workshop – Summary of Findings	Town of Lanesborough	A climate resilience study and action plan.	https://www.mass.gov/doc/2017-2018-mvp-planning-grant-report-lanesborough/download
2019	Town of Lanesborough's Stormwater Management Plan	Town of Lanesborough	Required of MS4 regulated communities, this outlines how the town is and will meet the requirements of the MS4 NPDES General Permit requirements.	SWMP links can be found at the bottom of this website page: https://www.lanesborough-ma.gov/departments/building_inspection/stormwater_management.php#outer-63sub-65
2019	City of Pittsfield Hazard Mitigation Update	Jamie Caplan Consulting, LLC	This plan is part of an ongoing effort to reduce the negative impacts and costs from damage associated with natural hazards, such as nor'easters, floods, and hurricanes. (To be updated every 5 years.)	Link to Pittsfield's Hazard Mitigation plan is available at this website: https://www.cityofpittsfield.org/departments/community_development/mvp.php
2019	City of Pittsfield Municipal Vulnerability Preparedness Plan	Fuss & O'Neill	A climate resilience study and action plan.	Link to Pittsfield's Hazard Mitigation plan is available at this website: https://www.cityofpittsfield.org/departments/community_development/mvp.php
2019	Town of Lanesborough Multi-Hazard Mitigation Plan	Town of Lanesborough with BRPC assistance	This plan is part of an ongoing effort to reduce the negative impacts and costs from damage associated with natural hazards, such as nor'easters, floods, and hurricanes. (To be updated every 5 years).	https://cms5.revize.com/revize/lanesboroughma/Document%20Center/Department/Emergency%20Management/lanesborough_hazard_mitigation_plan_final_fema_approved_3-26-19.pdf
2021	Town of Lanesborough MS4 Annual Report	Town of Lanesborough	Provides information and updates about the City's stormwater management tasks completed to be in compliance with the Clean Water Act Small MS4 requirements	https://www3.epa.gov/region1/npdes/stormwater/ma/reports/2021/LANESBOROUGH_MA_AR21.pdf

Table A-4: Additional West Branch Watershed Reports

Year	Title	Prepared by	Description	Link
2021	City of Pittsfield MS4 Annual Report	Kleinfelder for the City of Pittsfield	Provides information and updates about the City's stormwater management tasks completed to be in compliance with the Clean Water Act Small MS4 requirements.	https://www.epa.gov/npdes-permits/regulated-ms4-massachusetts-communities
2022	City of Pittsfield's Stormwater Management Plan	Kleinfelder with the City of Pittsfield	Required of MS4 regulated communities, this outlines how the city is and will meet the requirements of the MS4 NPDES General Permit requirements.	https://cms2.revize.com/revize/pittsfieldma/city_hall/public_works_and_utilities/docs/Pittsfield%20MS4%20SWMP%20Compiled%20Report_DRAFT_2022.06.21.pdf
2022	Pontoosuc Water Quality and Cyanobacteria Report 2022	LAPA – West	Provides a summary of the "Deep Hole" water quality monitoring results.	Contact BRPC for a digital copy. Currently this Plan is not available on the internet.
2022	2022_FINAL_Berkshire County Water Quality Monitoring Coalition Summary Report.pdf	HVA	Summarizes the water quality monitoring completed in 2022 in both the Housatonic and Hoosic watersheds.	https://hvatoday.sharepoint.com/:b:/s/test_sharepoint/ETCXeMvU_ORPlsz2bxlEu-kBq3xsunwhJSesX2Nz90nNzA?e=4feIRL
2022	Pontoosuc Lake 2022 Aquatic Plant Survey Report	Northeast Aquatic Survey, prepared for Pittsfield Conservation Commission	Summarizes the results of the plant survey.	https://cms5.revize.com/revize/lanesboroughma/Document%20Center/Community/Pontoosuc%20Lake%20Aquatic%20Plant%20Survey%20Report_final.pdf
2022 - 2001	Lake Onota Annual Monitoring Program Report	Karen R. Murray, Ph.D. LOPA Volunteer Monitoring Program Coordinator	Summarizes the water quality sampling, results and analysis for Lake Onota in 2022.	Access all annual reports at this link: https://onotalake.com/resources/documents/
2022	Lanesborough Stormwater Outfall Dry Weather Screening Report	HVA	Summarizes the results of the dry weather sampling of stormwater outfalls.	Contact BRPC for a digital copy. This report is not available on the internet.
2023	City of Pittsfield Road Stream Crossing Management Plan	HVA and Trout Unlimited	Includes an inventory of public and private road-stream crossings and prioritization of culvert replacement projects based on condition, climate resilience and aquatic connectivity.	Contact BRPC for a digital copy. Currently this Plan is not available on the internet.

Table A-4: Additional West Branch Watershed Reports

Year	Title	Prepared by	Description	Link
2023	City of Pittsfield's Nitrogen and Phosphorous Identification Report	Kleinfelder	Identifies and provides conceptual designs of BMPs for city owned properties within the MS4 designated area based on the phosphorous and nitrogen loading catchment area analysis. *No sites in the West Branch were identified.*	Contact BRPC for a digital copy. Currently this Plan is not available on the internet.
2024	Draft Massachusetts Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies	Watershed Planning Program Division of Watershed Management, Bureau of Water Resources Massachusetts Department of Environmental Protection	Provides a framework to address bacterial and other pathogenic pollutants in the impaired waterbodies of Massachusetts including the Housatonic watershed.	https://www.mass.gov/lists/total-maximum-daily-loads-by-watershed

Additional Water Quality Information

1. Surface Water Quality Sampling Programs:

Housatonic Valley Association (HVA) has conducted water quality monitoring programs in the upper Housatonic watershed since about 2000. From 2019 to 2023, HVA sampled sites on the West Branch and its tributaries primarily for *E. coli.* A summary of the results is provided in the section "Stakeholder Water Quality Information" and **Table A-6** with the full results provided in Appendix B. Refer to **Figure A-5** for a map of the sampling sites. Sampling was conducted under a Mass DEP approved Quality Assurance Project Plan. Sampling was typically conducted once every two weeks from June to September and the samples were analyzed by the laboratory at Berkshire Community College using the Colilert test by IDEXX.

HVA also conducted water quality monitoring at multiple sites on the West Branch in 2006 and 2007. Parameters measured included Nitrogen (nitrate) and Fecal coliform. The results of this sampling are also provided in Appendix B.

LOPA conducts water quality monitoring on Lake Onota and LAPA conducts cyanobacteria monitoring on both Lake Onota and Pontoosuc Lakes. A summary of the surface water quality monitoring programs conducted and links to reports available is provided in **Table A-5**

Table A-5: Summary of Water Quality Monitoring Programs

**Sampling completed under a MassDEP approved Quality Assurance Project Plan*

Year	Program Description	Site Locations	Program Coordinator	Funding / Protocols /Results
2019-2023	**E. coli* surface water sampling in the Upper Housatonic Watershed	Multiple sites sampled.	HVA	Partially funded by a MassDEP Water Quality Grant/From June through September, sites were sampled every other week six or eight times in wet and dry weather under a state approved QAPP. / Table A-6 provides a summary of results. Refer to Appendix B for complete results.
2021-22	Stormwater outfall dry weather sampling	228 outfalls in the WB watershed 21 outfalls analyzed for dry weather discharge.	City of Pittsfield and BRPC for Town of Lanesborough	MS4 requirement funded by the City of Pittsfield and Town of Lanesborough/Dry weather discharge from stormwater were analyzed for *E. coli*, Total Nitrogen, surfactants, etc./ Results indicated elevated levels of *E. coli* and Total Nitrogen at 9 outfalls. (Refer to Table A-6.)
2022	Onota Lake Water Quality Monitoring	The "Deep Hole" (54ft) was sampled 7 times from June – September.	Karen Murray, PhD LOPA Volunteer Monitoring Program Coordinator	Parameters included cyanobacteria counts, dissolved oxygen and temperature. Reports from 2001 – 2022 available at: https://onotalake.com/resources/documents/
2013 and 2014	*Benthic Macroinvertebrate Investigation	One sample site located on the Onota Brook downstream of the Onota Lake dam. Two sample sites on the West Branch (below Pontoosuc Dam and downstream of Wahconah Street bridge (adjacent to the Pittsfield Cemetery).	HVA	Results analyzed indicated a 'slightly impacted' for the West Branch sites and the Onota Brook site was 'moderately impacted' rating for Biological Condition/Degree Impact.
2006 and 2007	*Surface water sampling in the West Branch of the Housatonic River (Fecal Coliform, Nitrogen, Temperature)	Nine sites on the West Branch of the Housatonic River.	HVA	Various funding sources / Sampling conducted once a month from May – September under a state approved QAPP. Samples analyzed by certified lab/ Fecal coliform results were above state standards in multiple locations. (Appendix B)

2. Stakeholder Water Quality Information:

A. Pathogens

The West Branch and its tributaries are likely impacted by stormwater runoff from impervious surfaces and agricultural operations. In addition, multiple stormwater outfalls discharge directly into the rivers. Illicit connections which result in non-stormwater discharges, including sewage, may also be causing an impairment to the watershed. The following information and **Table A-6** summarizes the water quality information conducted in the West Branch by HVA and will inform projects that can aid in the reduction of bacteria levels in the watershed.

Table A-6 – Summary of HVA's *E. coli* sampling results (2019 – 2023)

Year	Site ID	Waterbody	Site Description	# of sampling events	% of sampling events exceeding *E. coli* state standard (126 cfu/100ml)	% of sampling events exceeding the 410 cfu/100ml *E. coli* threshold	GEOMEAN of all events (cfu/100ml)	Notes
2023	DAN400	Daniels Brook	Upstream of Hancock Road Bridge, Pittsfield	8	100%	50%	440.7	No prior sampling conducted by HVA on this brook. Active agricultural operations upstream of this site.
2023	WEB350	West Branch	Westside Riverway Park boat access (downstream of WEB300), Pittsfield	8	75%	13%	114.74	36" stormwater outfall pipe discharges just upstream of the sample site. Residents access river at this site.
2022	WEB300	West Branch	Upstream of Linden Street Bridge, Pittsfield	8	75%	38%	319.5	Upstream of recreational site (Westside Riverway Park
2021	WEB300	West Branch	Upstream of Linden Street Bridge, Pittsfield	6	50%	17%	184.4	Site selected as it was upstream of the boat access at Westside Riverway Park
2019	WEB100	West Branch	Below the Pontoosuc Lake dam	6	0%	0%	11.2	
2019	WEB300	West Branch	Upstream of Linden Street Bridge, Pittsfield	6	100%	50%	409.2	All sampling conducted during dry weather (less than 0.1 inches within 24, 48 and 72 hours).
2019	WEB400	West Branch	Downstream of the Southwest and West Branches confluence	6	83%	33%	287.2	All sampling conducted during dry weather (less than 0.1 inches within 24, 48 and 72 hours). Two highest samples occurred on 8/13 (816 cfu/100ml) and 9/10 (>2419.6)
2019	CHB200	Churchill Brook	Upstream of Hancock Road bridge, Pittsfield	6	0%	0%	36.6	Churchill Brook is a high quality coldwater resource with a healthy trout population. This stream had not been previously assessed.

Daniels Brook:

HVA conducted *E. coli* samples at one site on Daniels Brook (DAN400) downstream of agricultural operations. Out of the eight samples collected, 0% met the state standard of 126 cfu/100 ml and 50% of the samples were above the 410 cfu/100ml threshold.[19] These samples ranged from 461.1 – 1011.2 cfu/100ml. The geometric mean for the season's sampling was 410.7 cfu/100ml. The most elevated reading of 1011 cfu/100ml occurred after a 1.13 precipitation fell within 24 hours of sampling. Additional elevated results occurred in both wet and dry conditions. Further investigation is needed to determine the impairment of this stream. Additional sampling of other parameters such as nitrogen, ammonia and phosphates may be helpful. Refer to **Table A-7** for the results.

Table A-7: Daniel Brook *E. coli* sampling results and precipitation amounts (2023)

Station ID	Result	Precipitation Amounts (24, 48 and 72 hours)
DAN400	1011.2	Precipitation: 24hr 1.13"; 48hr 1.13"; 72hr 1.35"
DAN400	235.9	Precipitation: 24hr 0.0"; 48hr 0.19"; 72hr 0.37"
DAN400	461.1	Precipitation: 24hr 0.16"; 48hr 0.16"; 72hr 1.3"
DAN400	579.4	Precipitation: 24hr 0.04"; 48hr 0.04"; 72hr 0.04"
DAN400	689.3	Precipitation: 24hr 0.38"; 48hr 0.62"; 72hr 0.62"
DAN400	325.5	Precipitation: 24hr 0"; 48hr 0"; 72hr 0"
DAN400	365.4	Precipitation: 24hr 0"; 48hr 0"; 72hr 0"
DAN400	272.3	Precipitation: 24hr 0.1"; 48hr 0.7"; 72hr 0.72"

West Branch of the Housatonic River:

i. Westside Riverway Park (WEB350) and Linden Street bridge (WEB300).

HVA has conducted *E. coli* sampling on the West Branch at the Westside Riverway Park (WEB350) and at a site just upstream of the park at the Linden Street bridge (WEB300). The sampling site at the Westside Riverway Park is about 8 feet downstream of an outfall pipe that exceeded the testing limit of 2419 cfu/100 ml for *E. coli.* In addition, dog waste was observed by water quality monitors as being prevalent in the park and could be impacting the runoff. Contributing to impairment is the outfall pipe with site ID WB1040 and its associated stormwater discharge. No investigations for additional bacteria sources have been completed.

[19] ***Inland Waters E coli standards:*** "concentrations for: 1. *E. coli* shall (i) not exceed 126 colony-forming units (cfu) per 100 mL, calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and (ii) no more than 10% of all such samples shall exceed 410 cfu per 100 mL (a statistical threshold value)"

- In 2023, the samples exceeded the state standard of 126 cfu/100 ml 6 out of 8 sampling events and exceeded the 41cfu/100 ml threshold once when sampling occurred in wet weather (1.13” of precipitation had fallen in the previous 24 hours).
- In 2022, the highest E. coli sample (>2419 cfu/100ml) occurred after a precipitation event of 0.38” in 24 hours (0.72 in 72 hours). An elevated reading of 410 cfu/100ml occurred in dry weather.
- In 2019, all sampling was conducted during dry weather (less than 0.1” in 72 hours). All 8 samples exceeded 126 cfu/100ml (Range was from 178.2 – 770.1 cfu/100ml) with four samples exceeding 410 cfu/100 ml.

ii. Southwest Branch and West Branch confluence (WEB400)

In 2019, HVA sampled the West Branch below the confluence of the Southwest Branch and West Branch rivers (WEB400). Six samples were collected in dry weather. Only one sample met the state standard of 126 cfu/100ml with the remaining samples ranging from 228.2 -.>2419.6 cfu/100ml. The two highest readings were 816 cfu/100ml on August 13 and >2419.6 on September 10. No investigation as to the sources of bacteria has been completed.

Appendix B provides the full results and sampling locations of HVA’s West Branch water quality sampling from 2019 – 2023 and its fecal coliform sampling in 2006 and 2007.

B. *Nitrogen:*

Watershed Wide: Nonpoint source pollution from urban areas and the agricultural operations which are mostly located in the northern area of the West Branch watershed are likely sources of nitrogen. Developing relationships with the farmers and providing support to implement appropriate BMPs could support the reduction in nitrogen inputs.

In 2006 and 2007, HVA conducted nitrate sampling of surface waters at multiple sites on the West Branch watershed. The highest reading in 2006 was 0.19 mg/l which was at the confluence of Onota Brook and West Branch. In 2007 nitrate readings ranged from 0.08 mg/l to 0.26 mg/l. The full results are available in Appendix B.

City of Pittsfield: Under the MS4 regulations, the City of Pittsfield has completed sampling dry weather discharge from stormwater outfalls. The six outfalls with elevated total nitrogen (TN) are provided in **Table A-7.** These outfalls discharge to the West Branch and had TN samples above the EPA threshold of 2 mg/l with the outfall at the Westside Riverway Park being the most elevated at 23 mg/l. Additional sampling would help confirm if these outfalls are consistently have elevated TN levels. Further investigation to determine and mitigate this the nitrogen input is recommended.

C. *Phosphorous*

*Rivers***:** Phosphorous levels in the rivers of the West Branch watershed have not been sampled recently.

Lakes: Phosphorus is the most important nutrient in freshwater lakes because its natural concentrations in freshwaters are typically in limited supply. Thus, any phosphorus additions to lake waters can be readily consumed by algae and rooted plants (macrophytes), potentially resulting in undesirable outcomes such as algal blooms, dense plant growth, and shifts to overall greater biological productivity and lake 'aging'. Potentially harmful cyanobacteria (formerly called 'blue-green algae') are particularly sensitive to phosphorus inputs. Inputs of phosphorus can include runoff from the surrounding landscape (e.g., lawn fertilizers, sediment inputs, animal waste), point discharges, and release from sediments at the lake bottom under conditions of low oxygen. Phosphorus in lake waters occurs in organic and inorganic forms that are either suspended as particles or are dissolved in the water.

LOPA's volunteer monitoring program, coordinated by Dr. Murray, measures phosphorous levels in Lake Onota three times a year at two places in the water column, one in the deep water and one near the surface. The Onota Lake samples are analyzed for both dissolved phosphorus and total phosphorus (TP), the latter include both particulate and dissolved forms.

D. *Sediment*

Watershed -Wide: While no definitive studies have been conducted, the most obvious source of sediment entering the tributaries and the mainstem rivers in the West Branch watershed is due to sediment-laden stormwater runoff as well as stream bank erosion.

Pontoosuc Lake: Many of the roads in Lanesborough on the west side of Pontoosuc lake were gravel and rainstorms resulted in eroded sediment entering the lake. In 2023, the Lanesborough DPW used reclaimed asphalt to harden the road surface and reduce erosion. This reportedly has reduced the sediment load, but this solution does not reduce the stormwater volume and sediment in other locations around the lake may still be an issue.

3. Stormwater Outfall Sampling Summary:

In the West Branch watershed, 228 stormwater outfalls have been mapped. In accordance with EPA's MS4 permit requirements, any outfalls observed with dry weather discharge (less than 0.1" of rainfall in 24 hours) are sampled and the sample analyzed for *E. coli*, ammonia, total nitrogen (TN) and phosphates. To date, nine outfalls with dry weather discharge have been identified to have elevated levels of *E. coli* or nitrogen. A summary of the significant sampling results is shown in **Table A-8**. An on-line map of the Pittsfield and Lanesborough stormwater outfalls which includes information about the outfall including the latest sampling results is available at this link:
https://berkshire.maps.arcgis.com/apps/webappviewer/index.html?id=ded45f5daaee412db24afc34500cd0c6

City of Pittsfield: 199 stormwater outfalls have been identified in the West Branch with most discharging into the West Branch of the Housatonic River and Onota or Pontoosuc Lake. Of the 199 outfalls 61 have been observed that may discharge in dry weather. Thirty-six (36) of the sixty-one (61) outfalls observed in 2022 had dry weather discharge that was sampled. Of the outfalls sampled, five outfalls which discharge to the West Branch, have been designated as “high priority” or “problem” outfall due to the sampling results. The discharge from these outfalls contribute to the West Branch impairments. Four of the outfalls had TN levels greater than the EPA threshold of 2 milligrams/liter (mg/l). Three outfalls had *E. coli* levels around 300 colony forming units/100 milliliters (cfu/100ml) and two outfalls (WB1040 and WB680) had *E. coli* levels greater than the upper measurable limit (>2419.6 cfu/100 ml). The City of Pittsfield is in the process of investigating problem outfalls for illicit connections and resolving issues found.

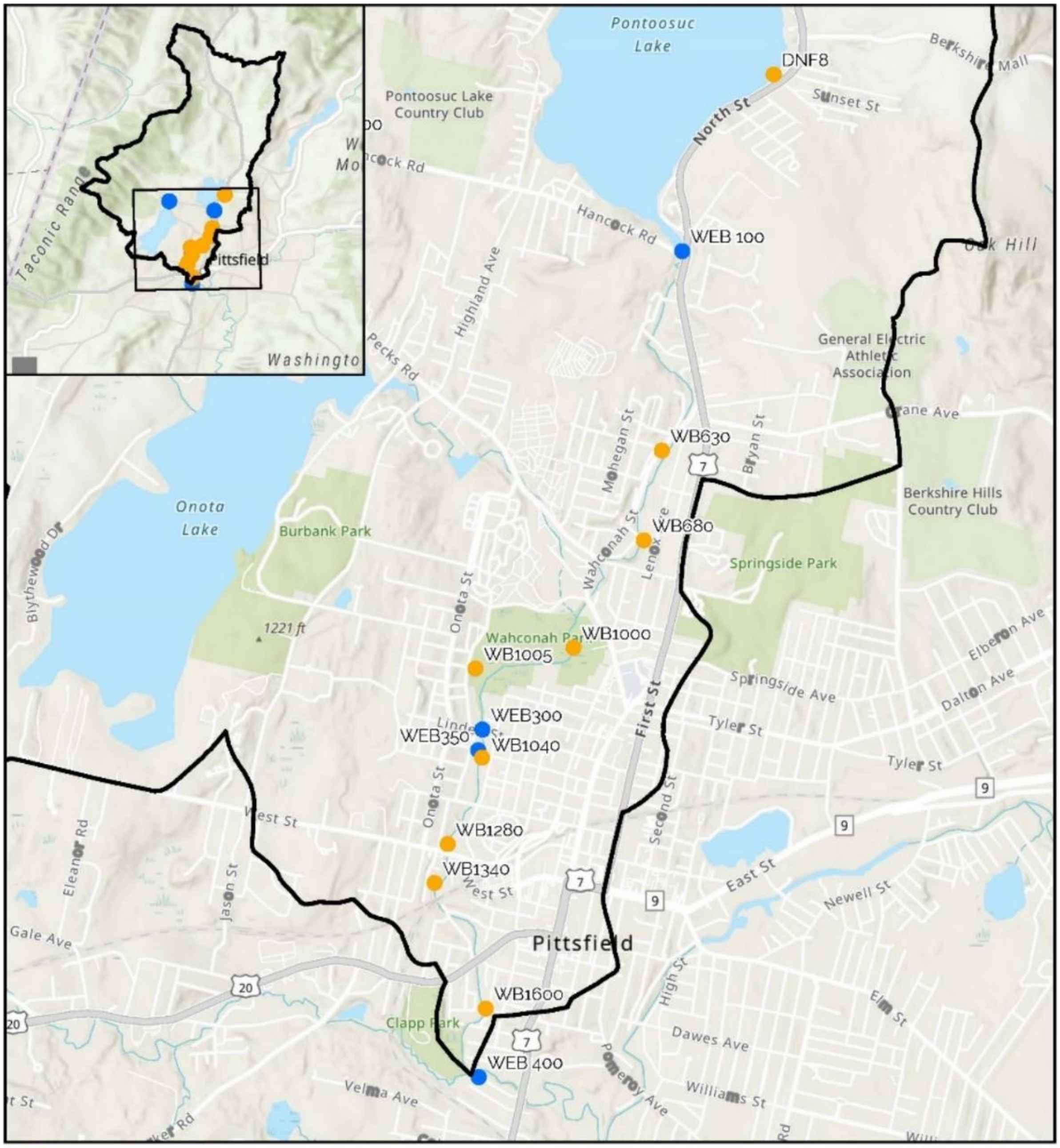
The outfall with the site ID WB1040 had *E. coli* and ammonia levels that were over the detection limits. This 36” stormwater outfall discharges at Westside Riverway Park, a new recreational space in the Westside neighborhood. A boat access just downstream of this outfall encourages residents to use this space and access the river. This is a priority outfall for investigation and mitigation.

Town of Lanesborough: In 2022, HVA was contracted to complete the dry weather discharge sampling for the town. HVA conducted site visits to eighty-two (82) points and their immediate neighborhoods and identified thirty (30) stormwater outfalls. Out of the 30 outfalls observed, 27 were dry and three were partially or fully submerged. These storm drains and access ports were investigated “upstream” of the submerged pipes. Significant flow was observed in one access port located upstream of an outfall at the end of Lakeview Street (site ID: DNF8) all others were dry. The discharge observed for DNF8 appears to flow from storm drains on Lakeview Street, not Route 7. Further investigation of this discharge was recommended as this discharge contributes *E. coli* to Pontoosuc Lake.

Table A8: Significant Dry Weather Outfall Sampling Results

ID	Latitude	Longitude	Diameter	Municipality	Conductivity	Salinity	Ammonia	Chlorine	Surfactants	E.coli	TN	Fecal_ Coliform
DNF8	42.49423	-73.23959	24	Lanesborough	422		0.1	0.15	0.1	1299.7	0.995	NA
WB1000	42.461662	-73.25395	48	Pittsfield	1320	0.8	2.22	0.226	0.75	307.6	6.97	78.4
WB630	42.472884	-73.24752	18	Pittsfield	495	0.3	0.116	0.268	0.25	290.9	3	4.1
WB680	42.4678	-73.24876	16	Pittsfield	500	0.3	0.21	0.067	0.25	>2419.6	2.4	27.9
WB1040	42.455531	-73.26079	36	Pittsfield	1100	0.7	Over Detection Limit	0.368	3	>2419.6	23	>2419.6
WB1005	42.460378	-73.26139	38	Pittsfield	860	0.5	0.045	0.043	0.25	30	3.68	9.2
WB1280	42.450441	-73.26322	18	Pittsfield	1447	1	0.065	0.013	0.25	21.3	4.82	19.7
WB1340	42.448236	-73.26416	36	Pittsfield	1220	0.8	0.019	0.031	0.25	307.6	3.43	179.3
WB1600	42.441207	-73.26006	50	Pittsfield	1126	0.8	0.276	0.179	0.5	150	3.07	2

Figure A-5: Map of Surface Water and Outfall Sampling Locations



BRPC

- Surface Water
- Outfalls
- West Branch Watershed

0 0.17 0.35 0.7 Miles

N

This map was created by the Berkshire Regional Planning Commission and is intended for general planning purposes only. This map shall not be used for engineering, survey, legal, or regulatory purposes. MassGIS, MassDOT, or BRPC may have supplied portions of this data.

Water Quality Impairments

MassDEP Information:

Known water quality impairments, as documented in the Massachusetts Department of Environmental Protection (MassDEP) 2018/2020 Massachusetts Integrated List of Waters (MassDEP, 2021), are listed in **Table A-10**. Impairment categories from the Integrated List are provided in **Table A-9** below:

Table A-9: 2018/2020 MA 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.

Table A-10: Water Quality Impairments (MassDEP 2021)

Assessment Unit ID	Waterbody	Integrated List Category	Designated Use	Impairment Cause	Impairment Source
MA21-18	**West Branch Housatonic River**	**5**	Aesthetic	Debris	Illegal Dumps Or Other Inappropriate Waste Disposal
MA21-18	**West Branch Housatonic River**	**5**	Aesthetic	Debris	Municipal (urbanized High Density Area)
MA21-18	**West Branch Housatonic River**	**5**	Aesthetic	Trash	Illegal Dumps Or Other Inappropriate Waste Disposal
MA21-18	**West Branch Housatonic River**	**5**	Aesthetic	Trash	Municipal (urbanized High Density Area)
MA21-18	**West Branch Housatonic River**	**5**	Fish, other Aquatic Life and Wildlife	Habitat Assessment	Municipal (urbanized High Density Area)
MA21-18	**West Branch Housatonic River**	**5**	Fish, other Aquatic Life and Wildlife	Lack Of A Coldwater Assemblage	Dam Or Impoundment
MA21-18	**West Branch Housatonic River**	**5**	Fish, other Aquatic Life and Wildlife	PCBs In Sediment	Illegal Dumps Or Other Inappropriate Waste Disposal
MA21-18	**West Branch Housatonic River**	**5**	Fish, other Aquatic Life and Wildlife	Temperature	Dam Or Impoundment

Table A-10: Water Quality Impairments (MassDEP 2021)

Assessment Unit ID	Waterbody	Integrated List Category	Designated Use	Impairment Cause	Impairment Source
MA21-18	**West Branch Housatonic River**	**5**	Primary Contact Recreation	Debris	Illegal Dumps Or Other Inappropriate Waste Disposal
MA21-18	**West Branch Housatonic River**	**5**	Primary Contact Recreation	Debris	Municipal (urbanized High Density Area)
MA21-18	**West Branch Housatonic River**	**5**	Primary Contact Recreation	Escherichia Coli	Discharges From Municipal Separate Storm Sewer Systems (ms4)
MA21-18	**West Branch Housatonic River**	**5**	Primary Contact Recreation	Escherichia Coli	Source Unknown
MA21-18	**West Branch Housatonic River**	**5**	Primary Contact Recreation	Fecal Coliform	Discharges From Municipal Separate Storm Sewer Systems (ms4)
MA21-18	**West Branch Housatonic River**	**5**	Primary Contact Recreation	Fecal Coliform	Source Unknown
MA21-18	**West Branch Housatonic River**	**5**	Primary Contact Recreation	Trash	Illegal Dumps Or Other Inappropriate Waste Disposal
MA21-18	**West Branch Housatonic River**	**5**	Primary Contact Recreation	Trash	Municipal (urbanized High Density Area)
MA21-18	**West Branch Housatonic River**	**5**	Secondary Contact Recreation	Debris	Illegal Dumps Or Other Inappropriate Waste Disposal
MA21-18	**West Branch Housatonic River**	**5**	Secondary Contact Recreation	Debris	Municipal (urbanized High Density Area)
MA21-18	**West Branch Housatonic River**	**5**	Secondary Contact Recreation	Trash	Illegal Dumps Or Other Inappropriate Waste Disposal
MA21-18	**West Branch Housatonic River**	**5**	Secondary Contact Recreation	Trash	Municipal (urbanized High Density Area)
MA21-80	**Onota Brook**	**4C**	Fish, other Aquatic Life and Wildlife	Habitat Assessment	Loss Of Riparian Habitat
MA21083	**Pontoosuc Lake**	**4A**	Fish Consumption	Mercury In Fish Tissue	Atmospheric Deposition - Toxics
MA21083	**Pontoosuc Lake**	**4A**	Fish Consumption	Mercury In Fish Tissue	Source Unknown
MA21083	**Pontoosuc Lake**	**4A**	Fish, other Aquatic Life and Wildlife	Brittle Naiad, *Najas minor*	Introduction Of Non-native Organisms (accidental Or Intentional)
MA21083	**Pontoosuc Lake**	**4A**	Fish, other Aquatic Life and Wildlife	Curly-leaf Pondweed	Introduction Of Non-native Organisms (accidental Or Intentional)

Table A-10: Water Quality Impairments (MassDEP 2021)

Assessment Unit ID	Waterbody	Integrated List Category	Designated Use	Impairment Cause	Impairment Source
MA21083	**Pontoosuc Lake**	**4A**	Fish, other Aquatic Life and Wildlife	Eurasian Water Milfoil, *Myriophyllum spicatum*	Introduction Of Non-native Organisms (accidental Or Intentional)
MA21078	**Onota Lake**	**5**	Fish, other Aquatic Life and Wildlife	Brittle Naiad, *Najas minor*	Introduction Of Non-native Organisms (accidental Or Intentional)
MA21078	**Onota Lake**	**5**	Fish, other Aquatic Life and Wildlife	Curly-leaf Pondweed	Introduction Of Non-native Organisms (accidental Or Intentional)
MA21078	**Onota Lake**	**5**	Fish, other Aquatic Life and Wildlife	Dissolved Oxygen	Source Unknown
MA21078	**Onota Lake**	**5**	Fish, other Aquatic Life and Wildlife	Eurasian Water Milfoil, *Myriophyllum spicatum*	Introduction Of Non-native Organisms (accidental Or Intentional)
MA21078	**Onota Lake**	**5**	Fish, other Aquatic Life and Wildlife	Water Chestnut, *Trapa Napans*	Introduction Of Non-native Organisms (accidental Or Intentional)

Potential Sources of Pathogen Impairments:[20]

The indicator bacteria data [2007 sampling at site W1575] for the West Branch Housatonic River (MA21-18) were elevated during both wet and dry weather. Elevated indicator bacteria during wet weather are consistent with urban stormwater, pet waste, and wildlife pathogen sources. Certain types of septic system malfunctions, such as rainwater infiltration or saturated disposal fields which overflow during precipitation, may also result in elevated wet weather indicator bacteria levels. Elevated indicator bacteria during dry weather suggest that baseflow sources, such as leaking pipes, illegal cross connections, other illicit discharges, and failing septic systems, are likely to be major sources of pathogens. Given the relatively small sample set, additional sampling under both wet and dry conditions, ideally at more than one location, would likely help to identify pollutant sources.

Urban Stormwater: Portions of the watershed are heavily developed. The watershed has 19% of land area in MS4 and 3% as directly connected impervious area (DCIA). The developed areas within the watershed include medium to high density mixed residential, commercial, industrial, and transportation development. Stormwater runoff from urban areas is likely a significant source of pathogens.

[20] https://www.mass.gov/doc/appendix-b-housatonic-river-basin/download

Illicit Sewage Discharges: Most of the downstream portion of the watershed along the segment is served by public sewer. Sewer related risks include leaking infrastructure (pipes, pump stations, etc.) and sanitary sewer overflows, which may be caused by undersized infrastructure, blockages, or excessive infiltration of groundwater or rainwater into pipes, exceeding system capacity. Illicit connections of wastewater to stormwater drains are also a risk.

On-Site Wastewater Disposal Systems: Most development in the upstream and northeastern portions of the watershed rely on septic systems for wastewater treatment. It is likely that a portion of septic systems are not being properly maintained and are discharging untreated effluent to groundwater.

Agriculture: Agricultural activities account for 7% of the total land use area within the watershed, though most are well upstream of the segment. Those visible on recent aerial photos within the watershed include open fields, hayfields, row crops, and pastureland. Agricultural activities related to manure storage and spreading, if not well managed, are a possible source of pathogens to waterbodies.

Pet Waste: The segment flows through many dense residential neighborhoods, and several recreational lands are adjacent to the segment, such as Wahconah Park (ballfield), Carrie Bak Park, and Dorothy Amos Park. Conservation and recreational lands, parks, ballfields, and residential neighborhoods near or along the segment which may be popular for dog-walking, especially where paths are adjacent to rivers, ponds, or wetlands, represent a possible source of pathogens.

Wildlife Waste: Most of the segment benefits from at least some wooded buffer along its banks, though there are a few isolated mowed areas close to the river's edge. Large open mowed areas such as conservation and recreational lands, fields, golf courses, and wetlands with a clear sightline to a waterbody may attract excessive waterfowl and elevate indicator bacteria counts in the water.

Water Quality Goals

Water quality goals may be established for a variety of purposes, including the following:

For **water bodies with known impairments**, a Total Maximum Daily Load (TMDL) is established by MassDEP and the United States Environmental Protection Agency (USEPA) as the maximum amount of the target pollutant that the waterbody can receive and still safely meet water quality standards. If the waterbody has a TMDL for total phosphorus (TP) or total nitrogen (TN), or total suspended solids (TSS), that information is provided below and included as a water quality goal.

For **water bodies without a TMDL for total phosphorus** (TP), a default water quality goal for TP is based on target concentrations established in the Quality Criteria for Water (USEPA, 1986) (also known as the "Gold Book"). The Gold Book states that TP should not exceed 50 ug/L in any stream at the point where it enters any lake or reservoir, nor 25 ug/L within a lake or reservoir. For the purposes of developing WBPs, MassDEP has adopted 50 ug/L as the TP target for all streams at their downstream discharge point, regardless of which type of water body the stream discharges to.

Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2013) prescribe the minimum water quality criteria required to sustain a waterbody's designated uses. This watershed is a Class 'B' waterbody. The water quality goal for fecal coliform bacteria is based on the Massachusetts Surface Water Quality Standards.

Table A-11: Surface Water Quality Classification by Assessment Unit

Assessment Unit ID	Waterbody	Class
MA21-18	West Branch Housatonic River	B
MA21-34	Churchill Brook	B
MA21-36	Town Brook	B
MA21-63	Parker Brook	B
MA21-64	Lulu Brook	B
MA21-65	Daniels Brook	B
MA21-66	Secum Brook	B
MA21-67	Hollow Brook	B
MA21-68	Unnamed Tributary	B
MA21-80	Onota Brook	B
MA21083	Pontoosuc Lake	B
MA21078	Onota Lake	B

Other water quality goals set by the community (e.g., protection of high quality waters, in-lake phosphorus concentration goal to reduce recurrence of cyanobacteria blooms, etc.).

Table A-12: Water Quality Goals

Pollutant	Goal	Source
Total Phosphorus (TP)	Total phosphorus should not exceed: --50 ug/L in any stream --25 ug/L within any lake or reservoir	Quality Criteria for Water (USEPA, 1986)
Bacteria	**Class B Standards** ***Inland Waters:*** Concentrations of bacteria concentrations for: 1. *E. coli* shall (i) not exceed 126 colony-forming units (cfu) per 100 mL, calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and (ii) no more than 10% of all such samples shall exceed 410 cfu per 100 mL (a statistical threshold value); 2.*enterococci*: (i) concentrations shall not exceed 35 cfu per 100 mL, calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and (ii) no more than 10% of all such samples shall exceed 130 cfu per 100 mL (the statistical threshold value). ***Public Bathing Beaches:*** The geometric mean and statistical threshold value used for calculating the minimum criteria for bacteria set forth as above shall be calculated and assessed, respectively, over a 30-day or smaller interval in *lieu* of any otherwise applicable longer interval	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2022)
Sedimentation/Siltation	https://neiwpcc.org/our-programs/pollution-control/water-quality-standards/wqs-matrix/ No applicable goal: It is difficult to measure the amount of sediment entering the waterbodies and how much sedimentation is reduced by implemented stormwater management measures. The proposed stormwater BMPs are designed, for the most part, to capture sediment which will reduce the volume of sediment entering the waterbodies overall.	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2021)
Nitrogen	Total Nitrogen should not exceed 2 mg/l in any stream or river or stormwater outfall	Community goal based on EPA MS4 stormwater threshold
Cyanobacteria	No algal blooms	Community Goal
Aquatic Non-native Invasive plants	Invasive species coverage reduced and maintained at healthy levels that do not impede recreation.	Community Goal
Trash	Very little to no trash can be seen especially in the West Branch	Community Goal

Note: *There may be more than one water quality goal for bacteria due to different Massachusetts Surface Water Quality Standards Classes for different Assessment Units within the watershed.*

Land Use and Impervious Cover Information

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

Watershed Land Uses

Table A-13: West Branch Watershed Land Uses

Land Use	Area (acres)	% of Watershed
Forest	15,961.61	68.3
Agriculture	1,829.21	7.8
High Density Residential	1,267.65	5.4
Water	1,264.45	5.4
Open Land	1,193.76	5.1
Low Density Residential	962.2	4.1
Commercial	454.64	1.9
Medium Density Residential	267.8	1.1
Industrial	136.77	0.6
Highway	17.17	0.1
TOTAL	**23,355.26**	**100%**

Table A-14: Pontoosuc Lake Watershed Land Uses

Land Use	Area (acres)	% of Watershed
Forest	10,121.20	73.6
Agriculture	1,279.64	9.3
Open Land	644.58	4.7
Low Density Residential	561.22	4.1
Water	561.13	4.1
High Density Residential	305.07	2.2
Medium Density Residential	147.42	1.1
Commercial	104.11	0.8
Industrial	24.91	0.2
Highway	5.03	0
TOTAL	**23,355.26**	**100%**

Table A-15: Onota Lake Watershed Land Uses

Land Use	Area (acres)	% of Watershed
Forest	4,855.21	72.2
Water	676.00	10.1
Agriculture	495.54	7.4
Low Density Residential	327.16	4.9
Open Land	186.13	2.8
High Density Residential	92.63	1.4
Medium Density Residential	29.56	0.4
Industrial	28.79	0.4
Commercial	27.21	0.4
Highway	1.84	0
TOTAL	**23,355.26**	**100%**

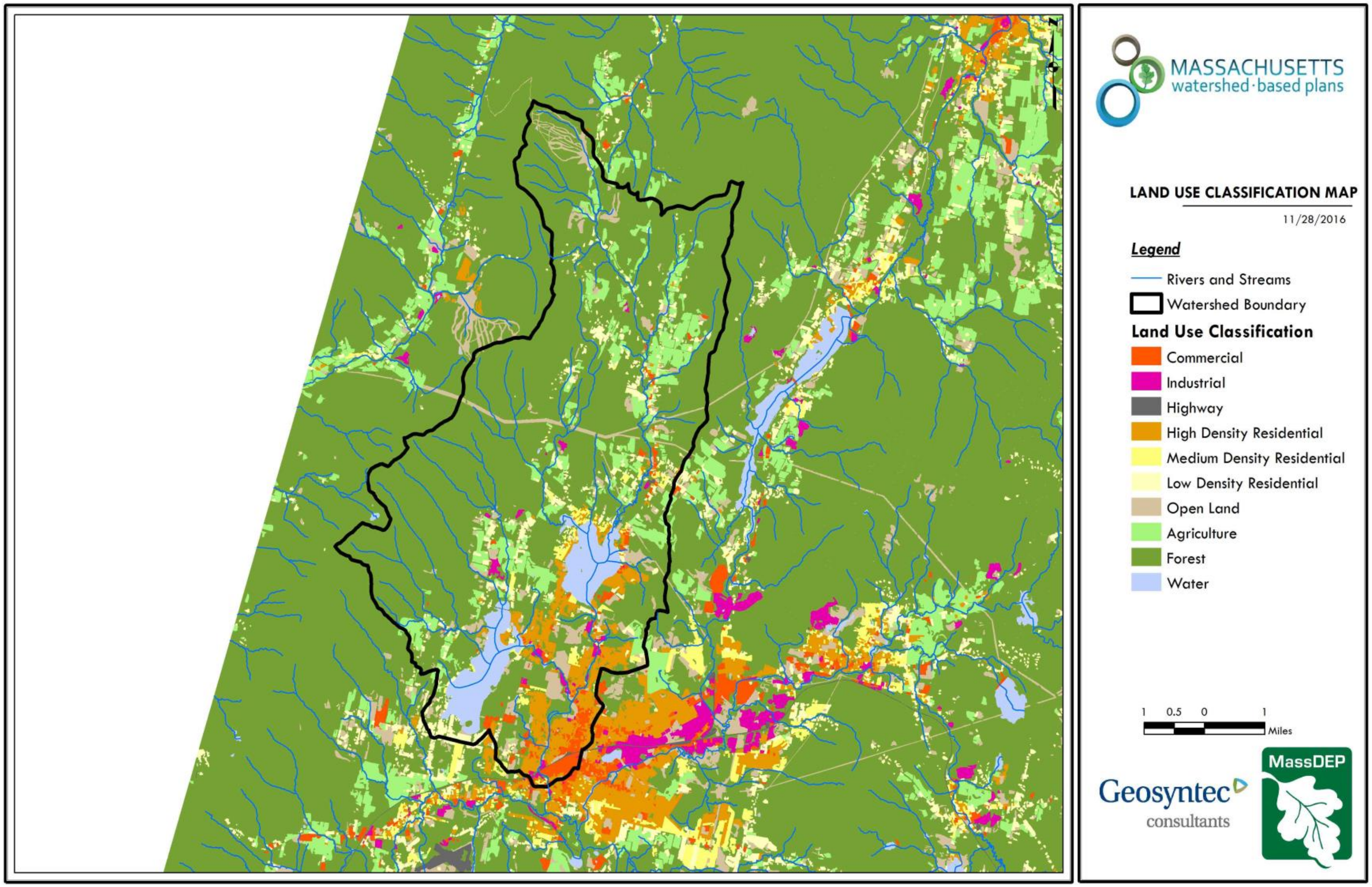


Figure A-5: West Branch Watershed Land Use Map (MassGIS, 2007; MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

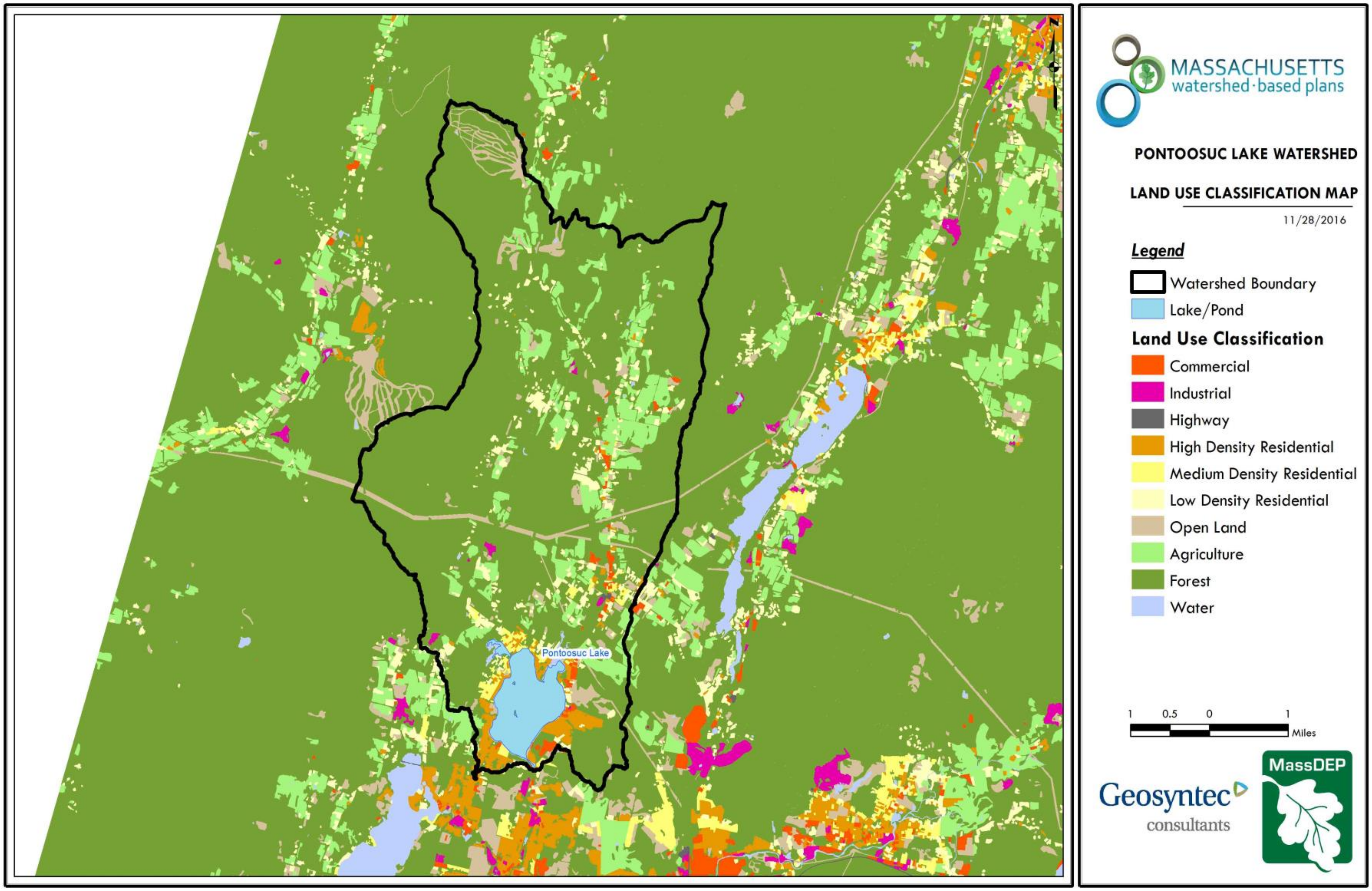


Figure A-6: Pontoosuc Lake Watershed Land Use Map (MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

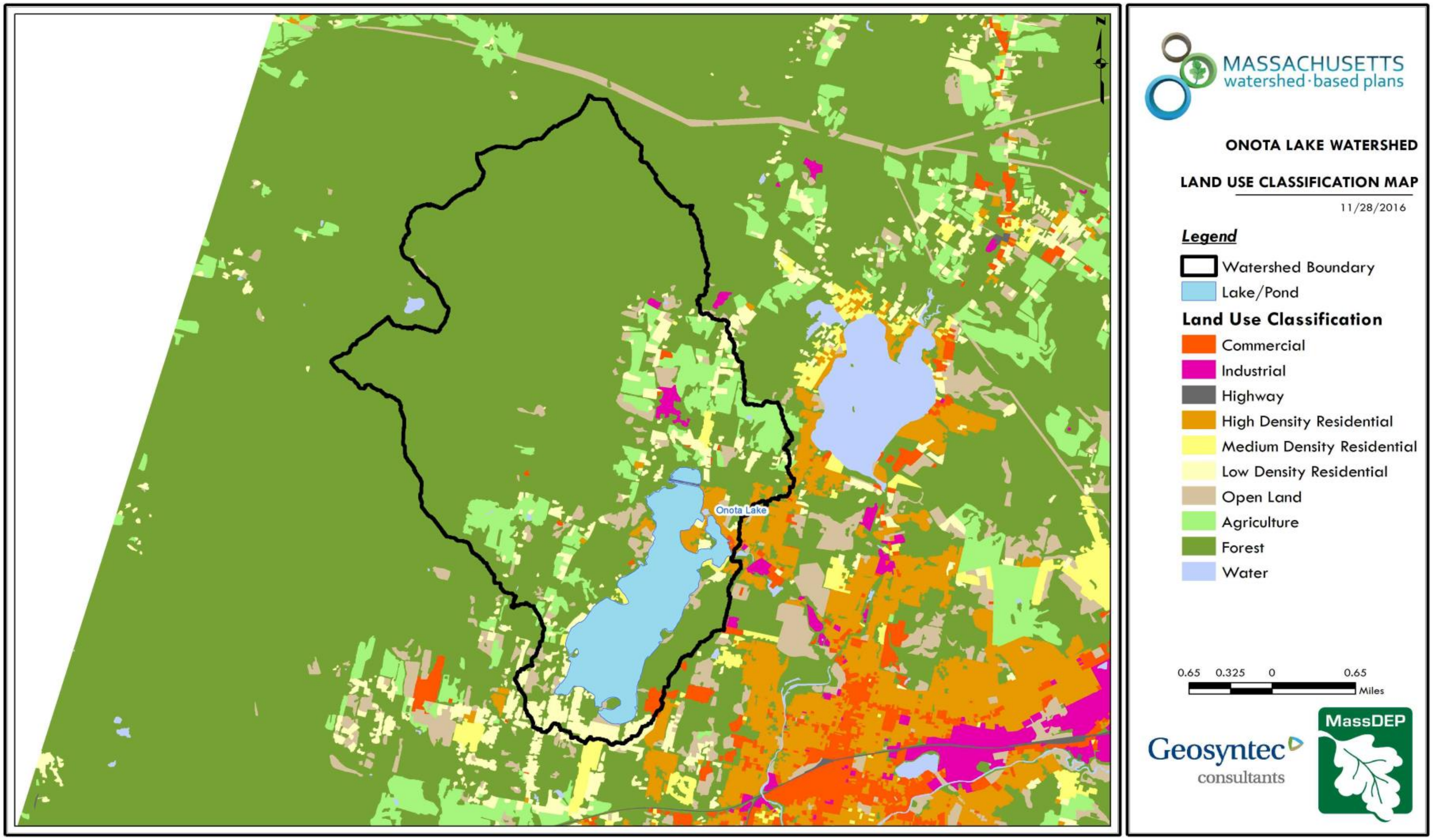


Figure A-7: Onota Lake - Watershed Land Use Map (MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

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 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. Within each subwatershed, the total area of each land use was summed and used to calculate the percent TIA.

Table A-16: TIA and DCIA Values for the Watershed and Sub-watersheds

Watershed	Estimated TIA (%)	Estimated DCIA (%)
West Branch of the Housatonic River	5.6	4.9
Pontoosuc Lake	3.6	2.7
Onota Lake	2.9	2.1

The relationship between TIA and water quality can generally be categorized as shown in **Table A-17**(Schueler et al. 2009):

Table A-17: Relationship between Total Impervious Area (TIA) and water quality (Schueler et al. 2009)

% Watershed Impervious Cover	Stream Water Quality
0-10%	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.
11-25%	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.
26-60%	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.

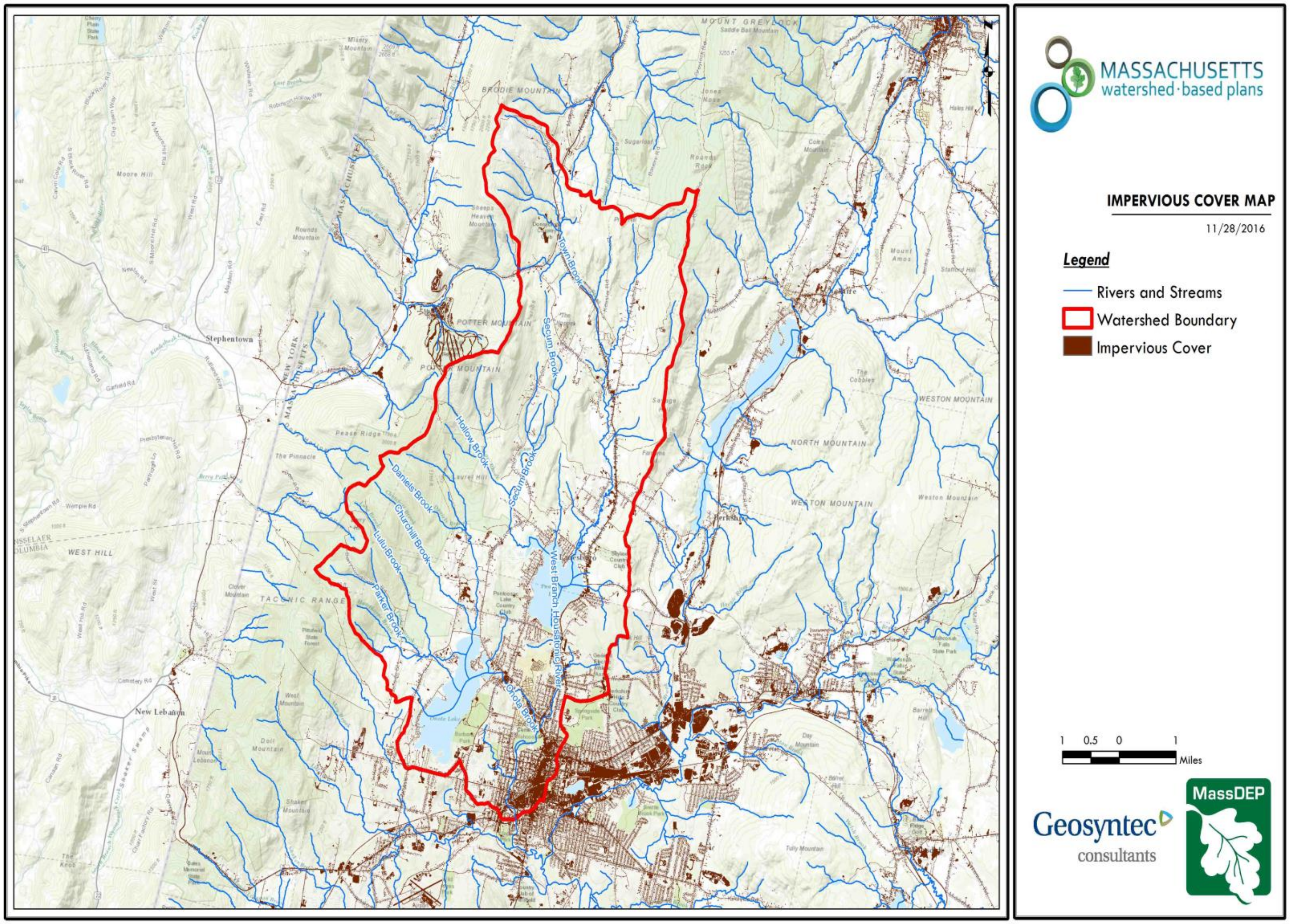


Figure A-8: West Branch Watershed Impervious Surface Map (MassGIS, 2007; MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

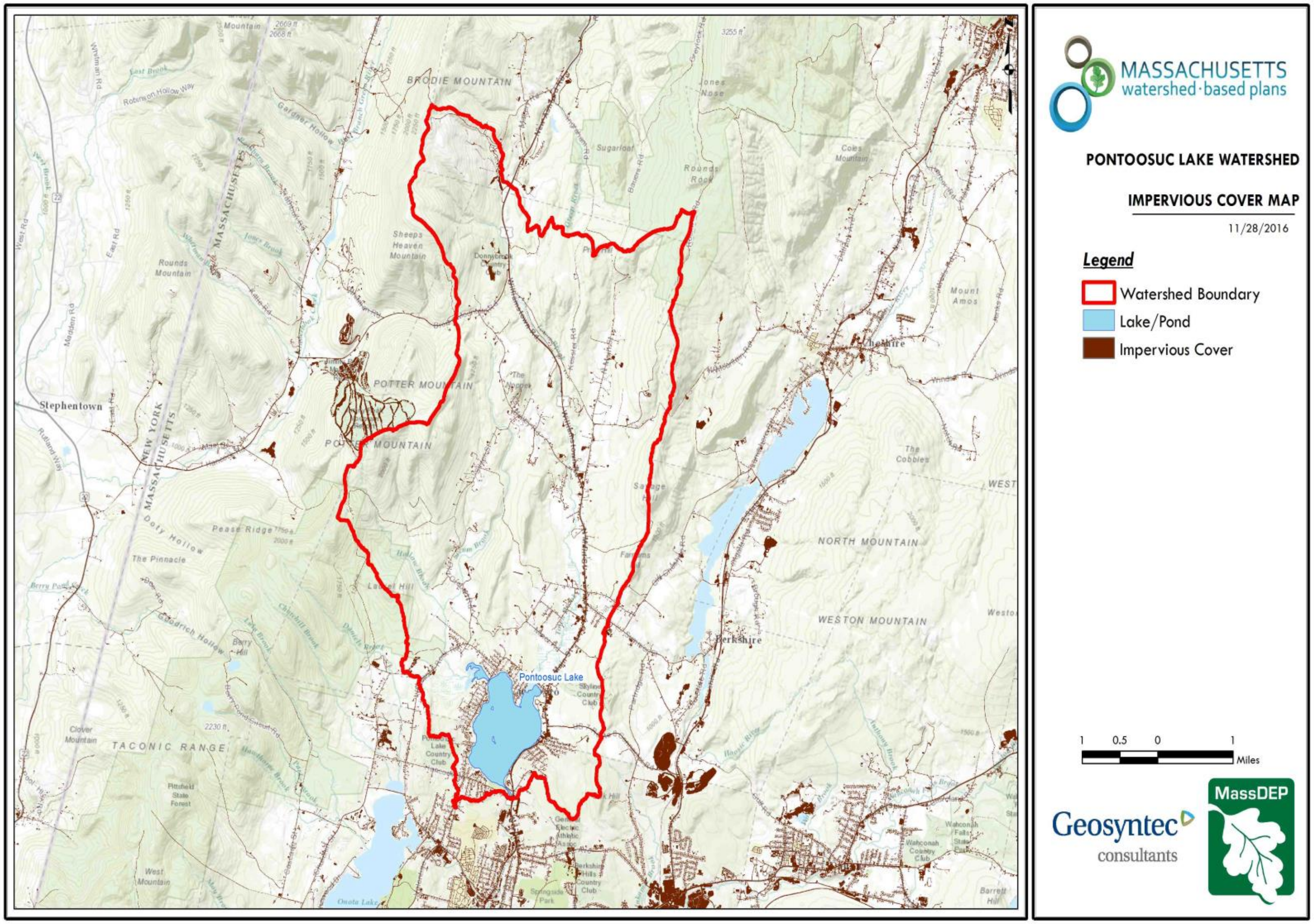


Figure A-9: Pontoosuc Lake Watershed Impervious Surface Map (MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

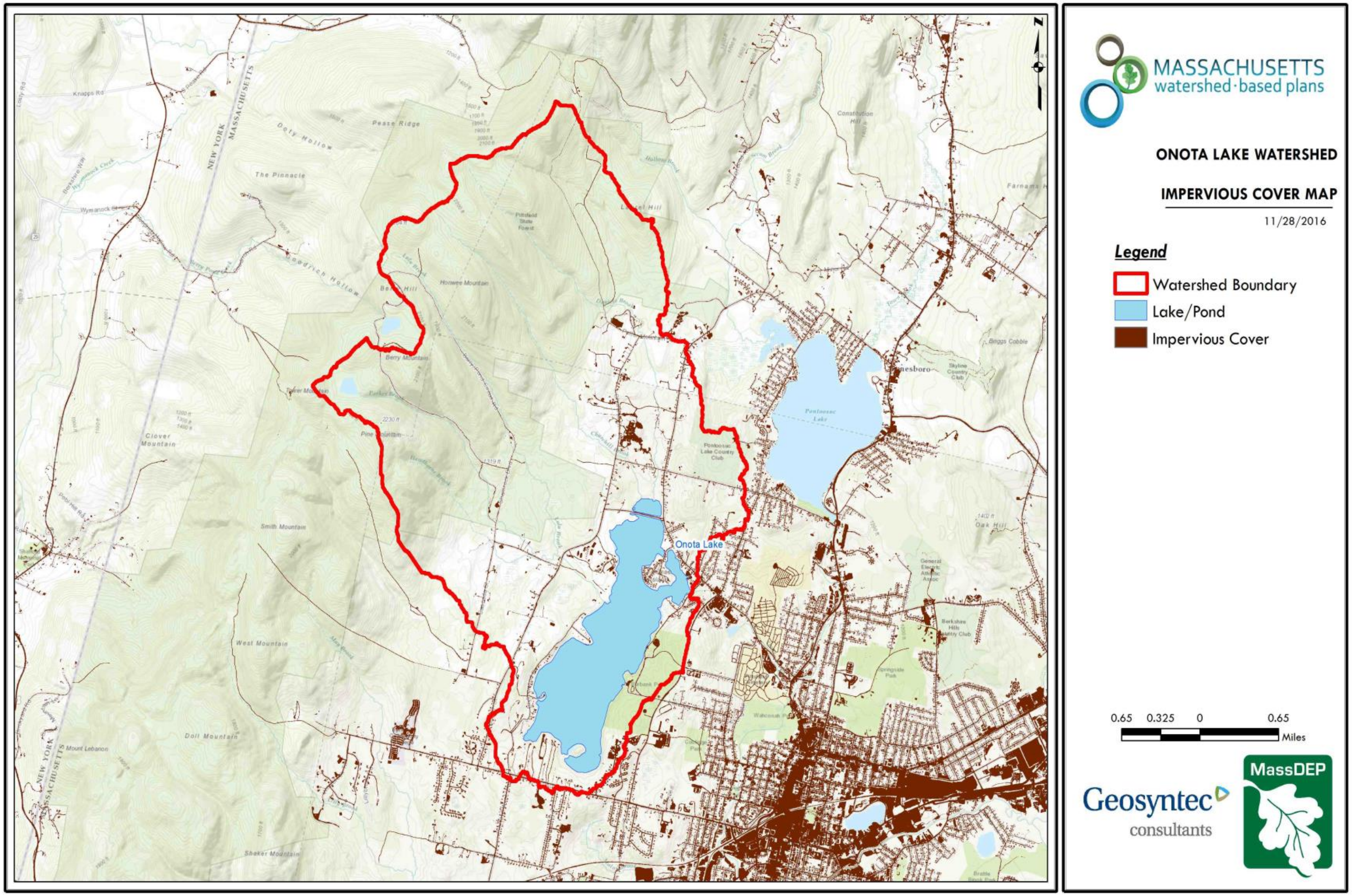


Figure A-10: Onota Lake Watershed Impervious Surface Map (MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Pollutant Loading

A Geographic Information System (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. [21]

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 (lb/yr); A_n = area of land use/cover type n (acres); P_n = pollutant load export rate of land use/cover type n (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, TP and TSS were obtained from USEPA (USEPA, 2020; UNHSC, 2018, Tetra Tech, 2015) (see values provided in Appendix A). **Table A-18** presents the estimated land-use based TN, TP and TSS pollutant loading in the whole West Branch watershed and **Tables 19 and 20** present this information in separate tables for Pontoosuc and Onota Lakes.

[21] The Sutherland equations are a set of empirical equations used to calculate the percentage of directly connected impervious areas (DCIA) in urban watersheds. The equations were developed by R.C. Sutherland in 1995 and are based on USGS data. The EPA uses the equations to estimate DCIA based on land use types.

Pollutant loading information:

Table A-18: West Branch (Housatonic) Watershed
Estimated Pollutant Loading for Key Nonpoint Source Pollutants

Land Use Type	Pollutant Loading[1]					
	Total Phosphorus (TP)	% TP	Total Nitrogen (TN)	% TN	Total Suspended Solids (TSS)	% TSS)
	(lbs/yr)		(lbs/yr)		(tons/yr)	
Forest	2,121	40	10,626	31	596.25	63
High Density Residential	918	17	6,139	18	91.36	10
Agriculture	885	17	5,295	15	63.32	7
Commercial	513	10	4,398	13	55.05	6
Open Land	403	8	3,600	10	68.79	7
Low Density Residential	247	5	2,458	7	32.99	4
Industrial	130	2	1,128	3	14.11	2
Medium Density Residential	86	2	740	2	10.27	1
Highway	16	0	129	0	7.82	1
TOTAL	5,320	100	34,514	100	939.95	100

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

Table A-19: Pontoosuc Lake Watershed
Estimated Pollutant Loading for Key Nonpoint Source Pollutants

Land Use Type	Pollutant Loading[1]					
	Total Phosphorus (TP)	% TP	Total Nitrogen (TN)	% TN	Total Suspended Solids (TSS)	% TSS)
	(lbs/yr)		(lbs/yr)		(tons/yr)	
Forest	1,334	50	6,650	41	384.9	73
Agriculture	620	23	3,713	23	47.19	9
Open Land	212	8	1,959	12	34.41	7
High Density Residential	190	7	1,286	8	19.02	4
Low Density Residential	157	6	1,568	10	20.94	4
Commercial	75	3	655	4	8.2	2
Medium Density Residential	48	2	405	2	5.65	1
Industrial	15	1	138	1	1.72	0
Highway	5	0	37	0	2.38	0
TOTAL	2,655	100	16,411	100	524.42	100

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

Table A-20: Onota Lake Watershed
Estimated Pollutant Loading for Key Nonpoint Source Pollutants

Land Use Type	Pollutant Loading1					
	Total Phosphorus (TP)	% TP	Total Nitrogen (TN)	% TN	Total Suspended Solids (TSS)	% TSS)
	(lbs/yr)		(lbs/yr)		(tons/yr)	
Forest	637	57	3,167	48	182.29	80
Agriculture	236	21	1,402	21	13.79	6
Low Density Residential	71	6	708	11	9.54	4
High Density Residential	53	5	364	5	5.35	2
Open Land	53	5	482	7	8.99	4
Industrial	30	3	257	4	3.22	1
Commercial	18	2	159	2	1.99	1
Medium Density Residential	10	1	88	1	1.19	1
Highway	1	0	12	0	0.69	0
TOTAL	1,109	100	6,639	100	227.06	100

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

Table B-1 lists estimated pollutant loads for the following primary nonpoint source (NPS) pollutants: total phosphorus (TP), total nitrogen (TN), total suspended solids (TSS). These estimated loads are based on the pollutant loading analysis presented in Section 4 of Element A.

Water Quality Goals

Water quality goals for primary NPS pollutants are listed in **Table B-1** based on the following:

- TMDL water quality goals (if a TMDL exists for the water body);
- For all water bodies, including impaired waters that have a pathogen TMDL, the water quality goal for bacteria is based on the Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2021) that apply to the Water Class of the selected water body.[22]
- If the water body does not have a TMDL for TP, a default target TP concentrations is provided which is based on guidance provided by the USEPA in Quality Criteria for Water (1986), also known as the "Gold Book". Because there are no similar default water quality goals for TN and TSS, goals for these pollutants are provided in **Table B-1** only if a TMDL exists or alternate goal(s) have been optionally established by the WBP author.
- According to the USEPA Gold Book, total phosphorus 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 phosphorus concentration (50 ug/L) by the estimated annual watershed discharge for the selected water body. 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

[22] https://www.mass.gov/regulations/314-CMR-4-the-massachusetts-surface-water-quality-standards#current-regulation

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. This method includes the following assumptions/limitations:

a. For lakes and ponds, the estimate of annual TP loading is averaged across the entire watershed. However, a given lake or reservoir may have multiple tributary streams, and each stream may drain land with vastly different characteristics. For example, one tributary may drain a highly developed residential area, while a second tributary may drain primarily forested and undeveloped land. In this case, one tributary may exhibit much higher phosphorus concentrations than the average of all streams in the selected watershed.

b. The estimated existing loading value only accounts for phosphorus due to stormwater runoff. Other sources of phosphorus may be relevant, particularly phosphorus from on-site wastewater treatment (septic systems) within close proximity to receiving waters. Phosphorus does not typically travel far within an aquifer, but in watersheds that are primarily unsewered, septic systems and other similar groundwater-related sources may contribute a significant load of phosphorus that is not captured in this analysis. As such, it is important to consider the estimated TP loading as "the expected TP loading from stormwater sources."

c. If the calculated water quality goal is higher than the existing estimated total load; the water quality goal is automatically set equal to the existing estimated total load.

Pollutant Load Reduction Information:

The approved *Long Island Sound TMDL* has set requirements for the Housatonic watershed which provides a nitrogen reduction goal of 10% for the Housatonic watershed. But there are not specific goals for total phosphorous (TP) or total suspended sediments (TSS). The decision was made to reduce all three parameters, TN, TP and TSS, by 10% and set that as the goal for the West Branch watershed and the watersheds for Onota and Pontoosuc Lakes. The Opti-Tool calculations conducted by the UNH Stormwater Center for the Mass TMDL project in 2022 indicated that BMP implementation cost effectiveness significantly decreased at the 20% TN reduction level. Opti-Tool calculations for TP and TSS were not completed as the focus was on nitrogen reduction.

Water Quality Goal Calculation: To calculate the 10% pollutant load reduction goals for TN, TP and TSS, the following steps were used. The calculations are presented in Appendix C.

1. Pre-development pollutant loads were calculated using the pollutant load export rates in Appendix A.
2. Post-development pollutant loading totals are provided in Tables A-18 – 20. However, pollutant loading from the forested land use is natural and is not expected to be mitigated. We calculated a post-development pollutant loading without the forest land use value for the watershed.

3. Now we were able to calculate the estimated pollutant loads due to development by comparing the pre- and post-development (without forest) pollutant loads. We subtracted pre-development from post-development pollutant loads.
4. Using the values obtained in #3, the 10% estimated pollutant load reduction goals for TN, TP and TSS were calculated.

West Branch Watershed Pollutant Load Reduction Goals

Table B-1: Pollutant Load Reduction Goals – West Branch

Pollutant	Existing Estimated Total Load	Load Reduction Goals	Required Load Reduction
Total Phosphorus	5,320 lbs/yr	10% reduction of post development pollutant loads (without forest) **46 lbs/year**	None required
Total Nitrogen	34,514 lbs/yr	10% reduction of post development pollutant loads (without forest) **1235 lbs/year**	10% of pollutant load
Total Suspended Solids	940 ton/yr	10% reduction of post development pollutant loads (without forest) **25 tons/year**	None required
Bacteria	*MSWQS for bacteria are concentration standards (e.g., colonies of fecal coliform bacteria per 100 ml), which are difficult to predict based on estimated annual loading.*	**Class B Standards** ***Inland Waters:*** Concentrations of bacteria concentrations for: 1. *E. coli* shall (i) not exceed 126 colony-forming units (cfu) per 100 mL, calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and (ii) no more than 10% of all such samples shall exceed 410 cfu per 100 mL (a statistical threshold value); 2.*enterococci*: (i) concentrations shall not exceed 35 cfu per 100 mL, calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and (ii) no more than 10% of all such samples shall exceed 130 cfu per 100 mL (the statistical threshold value). ***Public Bathing Beaches:*** The geometric mean and statistical threshold value used for calculating the minimum criteria for bacteria set forth as above shall be calculated and assessed, respectively, over a 30-day or smaller interval in *lieu* of any otherwise applicable longer interval	DRAFT TMDL load reduction: 60% of the geomean calculated from 2007 Mass DEP sampling (Target is 126 cfu/100ml)[23]

[23] https://www.mass.gov/doc/appendix-b-housatonic-river-basin/download

TMDL Pollutant Load Criteria

MassDEP has completed a DRAFT Statewide Pathogen TMDL with appendices for affected watersheds including the Housatonic Watershed[24]. The target reduction for pathogens is 60% with the goal of the West Branch to meet the state standards of *E. coli* which is not to exceed 126 cfu/100ml as presented in **Table B-1**.

The approved *Long Island Sound TMDL* has set requirements for the Housatonic watershed including a nitrogen reduction goal of 10% for the Housatonic watershed. As MS4 communities, the City of Pittsfield and the Town of Lanesborough, are required to reduce and track nitrogen pollution. Appendix F and H of the MS4 General Permit (2016) outlines the required public messaging that targets nitrogen as well as phosphorous.[25] [26]

The impairments for both Onota and Pontoosuc Lakes include four non-native aquatic plant species: Brittle naiad, *Najas minor* Eurasian water milfoil, *Myriophyllum spicatum* and curly leaf pondweed, *Potamogeton crispus*, and one not mentioned but present, water chestnut, *Trapa natans*. A TMDL is not required for these impairments. Onota Lake is also impaired for dissolved oxygen (DO) for which a TMDL is required but not yet drafted.

Pontoosuc Lake is identified as one of the water bodies impaired by mercury and is regulated by EPA's northeast mercury TMDL 33880 for inland waters which encompasses seven states (CT, ME, MA, NH, NY, RI, and VT) impaired by mercury primarily from atmospheric deposition. The full list of Massachusetts impairments is provided in **Table A-8**.

[24] https://www.mass.gov/lists/total-maximum-daily-loads-by-watershed#statewide-pathogen-tmdl-

[25] Mass MS4 General Permit - Appendix F: https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/appendix-f-2016-ma-sms4-gp-mod.pdf

[26] Mass MS4 General Permit - Appendix H: https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/appendix-h-2016-ma-sms4-gp-mod.pdf

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.

BMP Hotspot Map:

The following GIS-based analysis was performed within the watershed to identify high priority parcels for best management practice (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-1 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-1** presents the resulting BMP Hotspot Map for the watershed. The following link includes a Microsoft Excel file with information for all parcels that have a score above 60: hotspot spreadsheet.[27]

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.

GIS data used for the BMP Hotspot Map analysis included:

- MassGIS (2015a);
- MassGIS (2015b);
- MassGIS (2017a);
- MassGIS (2017b);
- MassGIS (2020);

[27] http://prj.geosyntec.com/prjMADEPWBP_Files/DataTbl/Hotspot/Hotspot_Tbl_MWBP_210127.xlsx

- MA Department of Revenue Division of Local Services (2016);
- MassGIS (2005);
- ArcGIS (2020);
- MassGIS (2009b);
- MassGIS (2012); and
- ArcGIS (2020b).

Municipal Commitment to Stormwater Management

City of Pittsfield: In the West Branch watershed, as in the remainder of the city, the City of Pittsfield has made a commitment to incorporate stormwater management BMPs wherever feasible.

As a high priority for climate resilience, the ***City of Pittsfield*** established a goal in their MVP Plan that the City will *"Assess cost-effective green infrastructure opportunities for stormwater management to develop a list of specific priority projects where reduction of stormwater runoff could mitigate flooding risk without the need to conduct expensive culvert replacement and resizing projects. Assess feasibility and cost, rank priority projects in terms of climate resilience potential, and develop concept designs for key projects. Review City regulations and update as necessary to support green infrastructure and low-impact development approaches."* (Source: Pittsfield MVP report).

As a part of the City of Pittsfield's MS4 requirements, the city's community development department has committed to the:

1. Review of existing regulations to determine the feasibility of making green infrastructure practices allowable when appropriate site conditions exist.
2. Regarding street design and parking lot guidelines, the city has committed to developing a report assessing requirements that affect the creation of impervious cover. The assessment will help determine if changes to design standards for streets and parking lots can be modified to support low impact design options. (Source: Pittsfield Stormwater Management Plan[28])

The Town of Lanesborough has outlined its stormwater management in the *Stormwater Management Plan* (SWMP) as required by the MS4 NPDES General Permit (2016).[29]

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[28] https://cms2.revize.com/revize/pittsfieldma/city_hall/public_works_and_utilities/docs/Pittsfield%20MS4%20SWMP%20Compiled%20Report_DRAFT_2022.06.21.pdf

[29] https://www.lanesborough-ma.gov/departments/building_inspection/stormwater_management.php#outer-63sub-65

Table C-1: 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

Note 1: **X** denotes that parcel is excluded

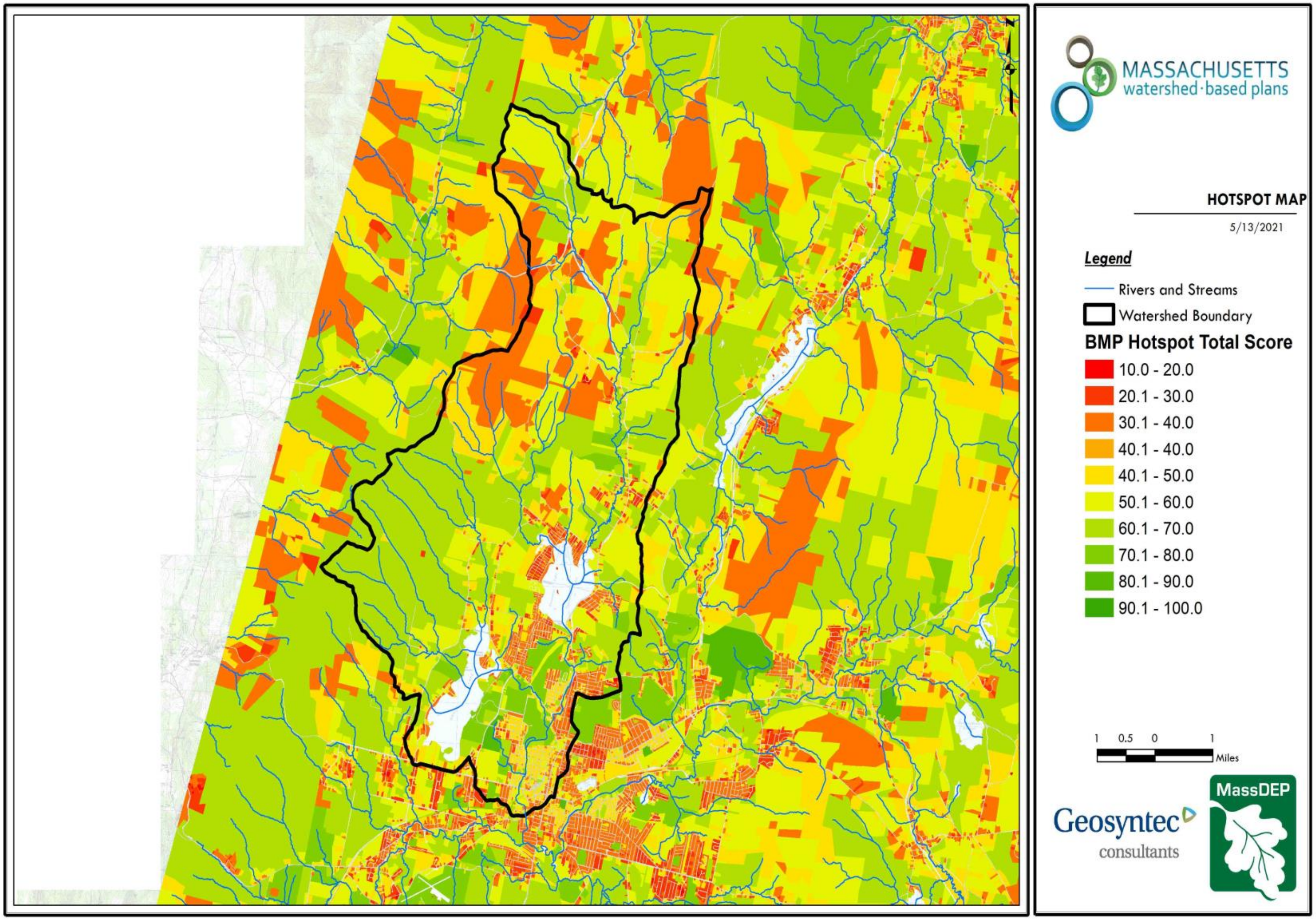


Figure C-1: BMP Hotspot Map (MassGIS (2015a), MassGIS (2015b), MassGIS (2017a), MassGIS (2017b), MassGIS (2020), MA Department of Revenue Division of Local Services (2016), MassGIS (2005), ArcGIS (2020), MassGIS (2009b), MassGIS (2012), ArcGIS (2020b))

Proposed Management Measures:

Table C-2 presents a summary of the proposed management measures as well as the estimated pollutant load reductions and costs. Conceptual designs were developed by

(1) the UNH Stormwater Center under the MassDEP TMDL project (2022)
(2) CEI Inc, consulting engineers for BRPC, under a Clean Water Act Section 319 Regional Nonpoint Source Pollution Coordinator Section 319 grant.
(3) BRPC staff using the Massachusetts Watershed Based Plan Template developed conceptual designs which include planning level cost estimates, pollutant load reduction estimates and estimates of BMP footprint which were based off information obtained in the following sources and were also adjusted to 2016 values using the Consumer Price Index (CPI) (United States Bureau of Labor Statistics, 2016)
(4) Waterstone completed a conceptual design for the St. Francis and Circular Avenue project with funding for the Gray to Green project

- Geosyntec Consultants, Inc. (2014);
- Geosyntec Consultants, Inc. (2015);
- King and Hagen (2011);
- Leisenring, et al. (2014);
- King and Hagen (2011);
- MassDEP (2016a);
- MassDEP (2016b);
- University of Massachusetts, Amherst (2004);
- USEPA (2020);
- UNHSC (2018);
- Tetra Tech, Inc. (2015);

The various stakeholders will collaborate to implement the proposed measures. Consideration will be given to whether a formal collaborative with one stakeholder taking the lead to track the progress and keep the plan moving forward as well as revising it periodically. These stakeholders include HVA, BRPC, BEAT, the City of Pittsfield .

Proposed Structural BMPs

Table C-2: Summary of Proposed Structural BMPs

Location	Proposed Stormwater BMPs	Capital Costs	Operation & Maintenance Costs (Annual)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/yr)
Wahconah Park, Pittsfield	Subsurface Gravel Filter and Bioswale	$1,125,000	$15,000	63.2	7.5	0.8
Pecks Road/Onota Street Intersection, Pittsfield	Modified Leaching Catch Basin	$5,000	$200	0.2	0	0.005
St Francis and Circular Avenue, Pittsfield	Leaching Catch Basin and Subsurface Gravel Filter	$141,500	$3,500	12.1	1.1	0.2
Park Street Park, Pittsfield	Trash Grate and Subsurface Gravel Wetland	$130,000	$10,000	29.2	3.1	0.85
Lanesborough DPW, Lanesborough	Drop Inlet and a Subsurface Gravel Wetland	$82,500	$3,000	13.4	1.1	0.2
Algonquin Street & Narragansett Avenue, Lanesborough	Deep Sump Catch Basins and Subsurface Gravel Wetland	$50,000	$3,600	7	0.8	0.12
Town Park, Lanesborough	Subsurface Gravel Filter	$85,000	$5,000	25.5	3	0.43
Dorothy Amos Park, Pittsfield	Bioretention Basin with Sediment Forebay	$37,000	$3,500	5.72	0.78	0.12
Columbus Avenue, Pittsfield	Bioretention Basins and Deep Sump Catch Basins	$66,000	$3,300	2.1	0.29	0.04
Linden Street, Pittsfield	Bioretention Basin and Improved Riparian Buffer	$49,000	$3,500	9.35	1.26	0.19
John T. Reid Middle School, Pittsfield	Water Quality Swale and Settling Basin	$29,000	$1,700	0.69	0.14	0.11
John T. Reid Middle School, Pittsfield	Bioretention Basin and Permeable Pedestrian Path	$47,000	$7,800	4.45	0.55	0.14
John T. Reid Middle School, Pittsfield	Deep Sump Catch Basin, Improved riparian buffer	$27,000	$200	1.91	0.96	1.02

Table C-2: Summary of Proposed Structural BMPs

Location	Proposed Stormwater BMPs	Capital Costs	Operation & Maintenance Costs (Annual)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/yr)
Bull Hill Road, Lanesborough	Water Quality Swale with check dams and Deep Sump Catch Basins	$71,000	$5,800	0.5	0.09	0.23
Burbank Park, #1 Pittsfield	Bioinfiltration Basin	$33,000	$7,000	3.3	0.44	0.13
Burbank Park, #2 Pittsfield	Riparian Buffer	$75,000	$0	unknown		
Burbank Park, #3 Pittsfield	Water Quality Swales	$31,035	$3,500	0.9	0.19	0.14
Pecks Road Fire House, Pittsfield	Bioinfiltration Basins	$43,750	$4,200	5.83	0.69	0.09
Melville Municipal Parking lot, Pittsfield	Subsurface System	$185,660	$15,000	19.75	3.06	0.31
Melville Municipal Parking lot, Pittsfield	Bioinfiltration Basins	$118,000	$4,000	15	2.5	0.28
George B. Crane Memorial Center, Pittsfield	Bioinfiltration Basin and French Drain	$64,000	$500	2.67	0.32	0.04
Polish Falcons of America, Bel Air Avenue	Riparian Buffer and grassed filter strip	$38,000	$500	0.84	0.22	0.07
Wilson Park, Pittsfield	Bioinfiltration Basins	$21,500	$2,500	2.6	0.36	0.05
Dower Square, Pittsfield	Bioinfiltration Basins	$56,560	$4,200	4.6	0.66	0.08
Central Berkshire Habitat for Humanity - Parking Area	Porous Pavement with Grassed Filter Strip	$62,640	Unknown	1.3	0.2	0.02
	TOTALS	**$2,674,145**	**$107,500**	**232.11**	**29.31**	**5.7**

Wahconah Park, Pittsfield

Location: 105 Wahconah Avenue, Pittsfield (42.46233165, -73.2524018)
Property Ownership: City of Pittsfield
Conceptual Design Prepared By: UNH Stormwater Center as part of the Mass DEP Upper Housatonic TMDL project (2022). The complete conceptual design is provided in Appendix D.

Site description: The parking lot at Wahconah Park is an area of significant flooding following any rain event. The outlet toward the wetland to the west of the lot has accumulated sediment and mounded such that water cannot leave the lot. The gravel lot has little slope, so a small increase in flooding depth covers a large area of the lot. Sediment has accumulated along the western edge of the lot and is growing wetland plant species, indicating that the soil is mostly saturated. There was a large (about 36-in) stormwater pipe under the road with the outfall west of the park. It was not observed, but it was thought to back up during runoff events. This site also serves as the emergency landing area for local medivac helicopters for the local hospital.

Photo C-1: Looking toward the West where the constant flooding in the parking lot is a major concern.

Photo C-2: From the West, looking at the flooded parking lot.

Wahconah Park Improvements' Summary

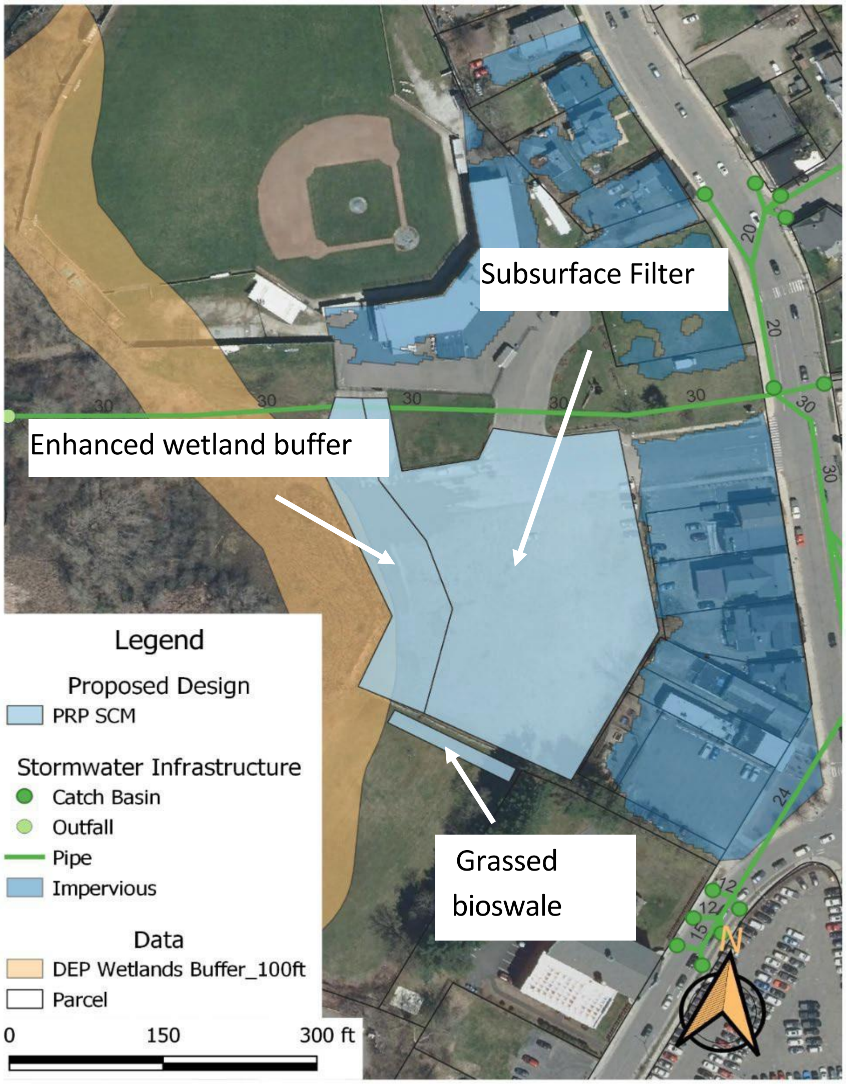
Proposed BMPs: Subsurface Gravel Filter, Improved Parking Area, Bioswale

Estimated Nutrient Load Reduction:

Total Nitrogen:	63.2 lbs/year
Total Phosphorous:	7.5 lbs/year
Total Suspended Solids:	0.8 tons/year
Estimated Cost:	$1,125,000
Estimated O & M Costs:	$15,000
Required Permits:	Notice of Intent

Figure C-2: Existing site conditions at Wahconah Park

Figure C-3: Wahconah Park Proposed BMPs in Plan Layout



Proposed Improvements:

- Elevate the northwest corner of the proposed paved parking area up 2 ft. This would allow drainage to the southwest corner of the new lot where the overland flow will be conveyed through a
- Grassed treatment swale.
- To prevent flooding from elevated river flows and backwater coming up the existing drainage line, install a one-way valve such as a Tideflex® on the existing outfall.
- Additional treatments: (a) subsurface storage and infiltration area and (b) wetland buffer to offset the wetland and wetland setback impacts.

Pecks Road and Onota Street, Pittsfield

Location: 222 Pecks Road, Pittsfield (42.47099786, -73.2582812)
Property Ownership: City of Pittsfield
Conceptual design prepared by: UNH Stormwater Center as part of the Mass DEP Upper Housatonic TMDL project (2022). The complete conceptual design is provided in Appendix D.

Site description: There are multiple curb cuts along the road that allow stormwater to flow directly into the stream untreated. There are undercutting, erosion, and sediment/trash deposition areas that are in disrepair and in need of maintenance (Figure 12 and Figure 13). The bridge just north of these curb cuts is scheduled for replacement in 2024.

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Photo C-3: Curb cut on Pecks Road

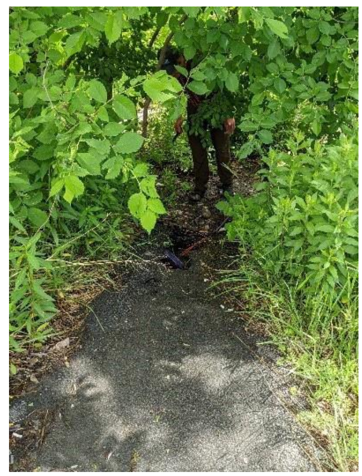


Photo C-4: Paved swale from curb cut draining directly into Onota Brook

Pecks Road/Onota Street Improvements' Summary

Proposed BMPs: Modified Leaching Catch Basin

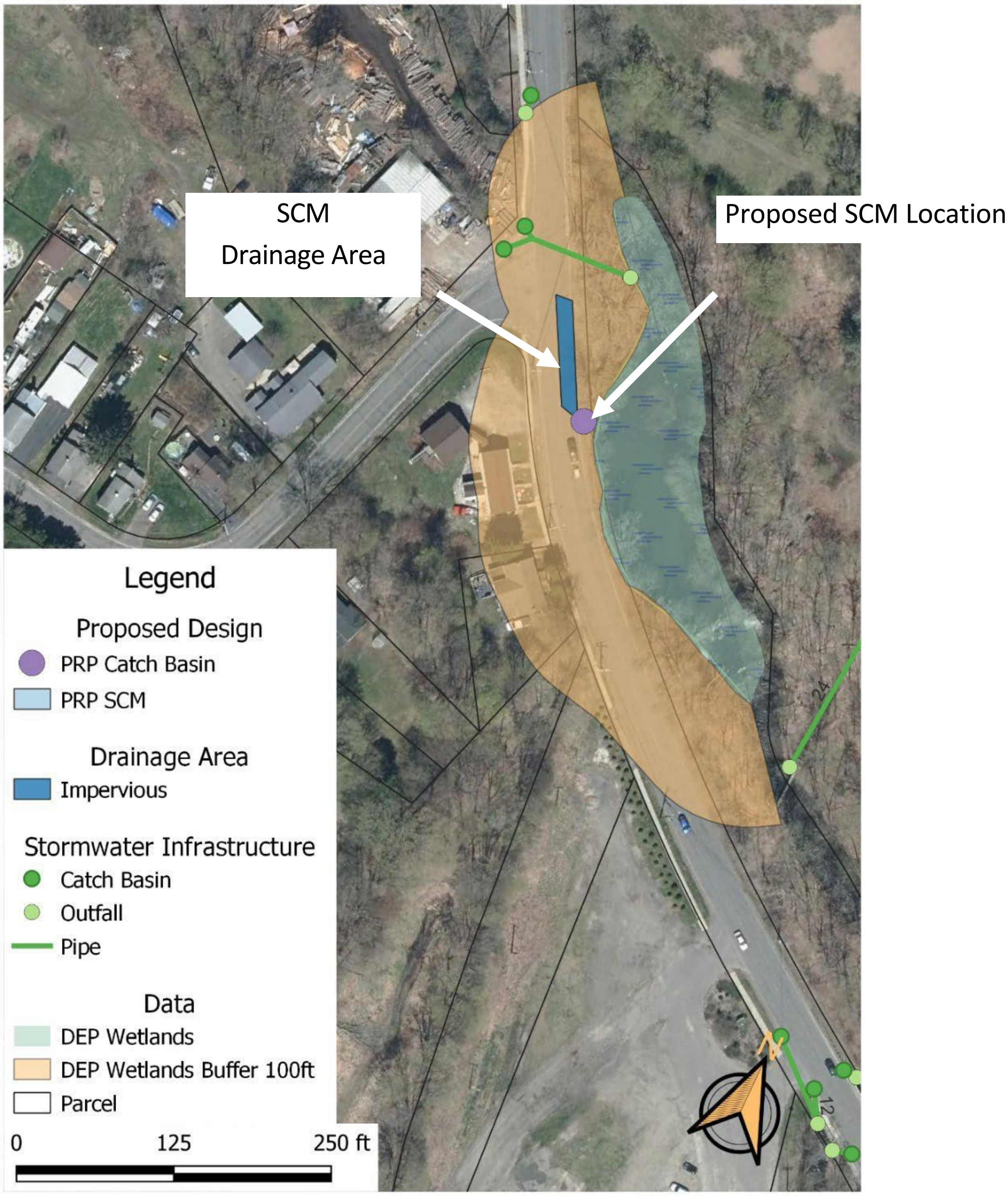
Estimated Nutrient Load Reduction:

Total Nitrogen:	0.2 lbs/year
Total Phosphorous:	0 lbs/year
Total Suspended Solids:	10 lbs/year

Estimated Cost:	$5,000
Estimated O & M Costs:	$200

Required Permits: Notice of Intent

Figure C-4: Proposed design plan layout



Proposed Improvements:

Install a modified leaching catch basin design. The modifications include an expanded stone envelope and a small internal storage reservoir or saturated zone that will mimic the function of a subsurface gravel wetland. The inlet will be grated and the outlet will occur over a stabilized internal clay berm. There is no secondary outlet as excess flow will level spread through the stone over the internal berm. The existing curb cuts would need to be removed.

St Francis and Circular Avenue, Pittsfield

Location: Adjacent to 22 Francis Avenue, Pittsfield (42.449905, -73.2593136)
Property Ownership: City of Pittsfield
Conceptual design prepared by: Waterstone Engineering prepared the conceptual design (2024).

Site description: The existing drainage appears hydraulically inefficient resulting in high flow bypassing the existing catch basins (**Photo C-5**) and flowing down to the end of the road where there is significant sediment deposition (**Photo C-6**). Nearby are a set of stairs leading to College Way that the community uses frequently but are in severe disrepair. A stormwater main line drains through the parklet and presents a tremendous opportunity for treatment.

Photo C-5 (left): At the intersection with two shallow catch basins that drain toward 17 Francis Avenue

Photo C-6 (right): The end of the road near 17 Francis Ave showed signs of high sediment deposition, vegetation, and a clogged catch basin (not found).

St. Francis and Circular Avenue Improvements' Summary

Proposed BMPs: Leaching Catch Basin and Subsurface Gravel Filter

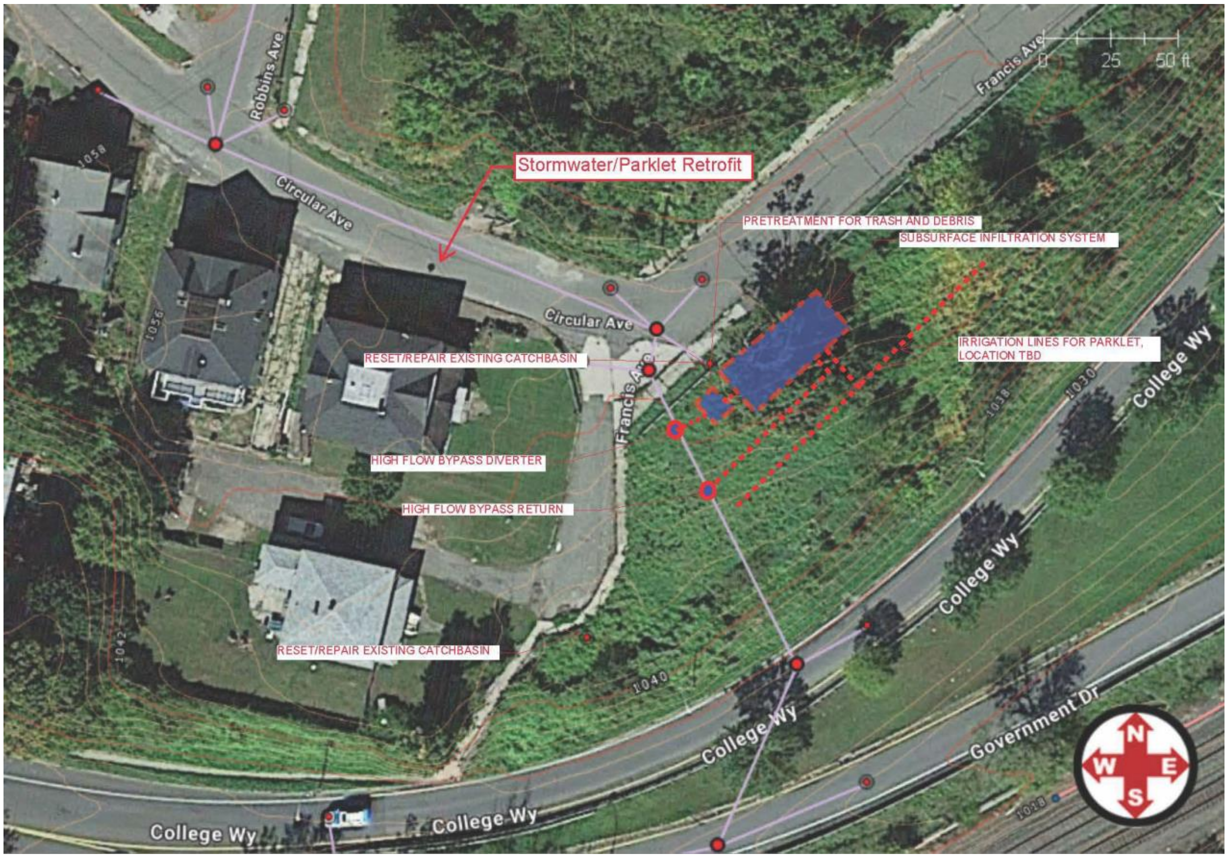
Estimated Nutrient Load Reduction:

Total Nitrogen:	12.1 lbs/year
Total Phosphorous:	1.1 lbs/year
Total Suspended Solids:	0.2 tons/year

Estimated Cost:	$141,500
Estimated O & M Costs:	$3,500

Required Permits: Notice of Intent

Figure C-5: St Francis and Circular Avenue Proposed BMPs in Plan Layout



Proposed Improvements:
Stormwater runoff will be routed to a pretreatment system, then into a subsurface infiltration trench and irrigation lines that will feed the proposed parklet and envisioned walkway vegetation. Stormwater management will also include the repair of two catch basins to address flooding and drainage problems at the Francs Avenue stairway. The BMP will remove 93% of Phosphorous, 98% of Nitrogen, 100% of TSS and Zinc, and 93% of bacteria.

The system would be expected to reduce 1.33 million gallons per year of stormwater runoff. The pretreatment will consist of a system that will remove trash and debris in a large access port that can be simply cleaned and maintained with a vactor truck, as are the rest of the city's catch basins. The intention is for the maintenance of the stormwater management system to be compatible with existing staff and equipment and require no special training.

Park Street Park, Pittsfield

Location: 105 Wahconah Avenue, Pittsfield (42.459666, -73.254292)
Property Ownership: City of Pittsfield
Conceptual design prepared by: UNH Stormwater Center as part of the Mass DEP Upper Housatonic TMDL project (2022). The complete conceptual design is provided in Appendix D.

Site description: The existing condition is an operational drainage feature that has some performance issues. Treatment may be adequate but long-term performance and maintenance could be improved. The trash grate at the outlet of the culvert (**Photo C-7**) creates deposition in the hard-to-access culvert (**Photo C-8**) as the front clogs with organic debris and trash.

Photo C-7: The box culvert outlet had a grate clogged with organic debris and trash. Behind the grate, the sediment buildup can be estimated at 1 foot deep.

Photo C-8: The sediment deposit at the outlet of the box culvert. Some larger riprap can be seen in the plunge pool while the mounding and rest of the swale are filled with fine sands and finer sediment.

Park Street Improvements' Summary

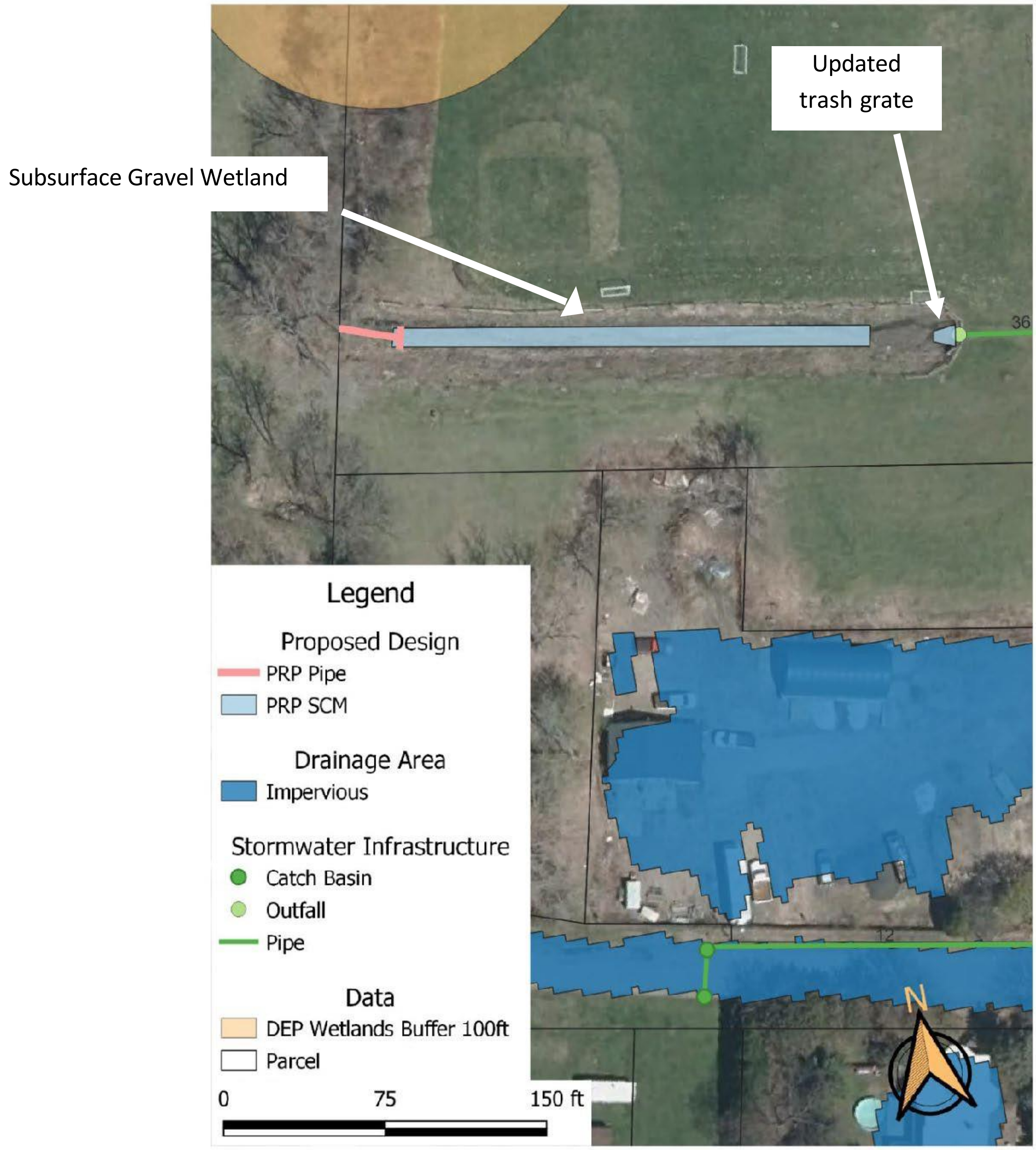
Proposed BMPs: Trash Grate and Subsurface Gravel Wetland

Estimated Nutrient Load Reduction:

Total Nitrogen:	12.1 lbs/year
Total Phosphorous:	1.1 lbs/year
Total Suspended Solids:	0.2 tons/year
Estimated Cost:	$130,000
Estimated O & M Costs:	$10,000

Required Permits: Notice of Intent

Figure C-6: Park Street Park Proposed BMPs in Plan Layout



Proposed Improvements:

Replace existing trash grate with a 3-dimensional trapezoidal structure that could be relocated to the upstream inlet. Improve the nutrient load reduction of the existing drainage swale by converting it to a gravel wetland. This gravel wetland design will be a single cell as opposed to the two-cell system depicted in the cross section. The inlet will be an at-grade inlet downstream of the trash rack and there is sufficient grade to daylight the primary outlet over a stabilized area downstream of the SCM. The secondary outlet will be a stone berm at the end of the SCM profile area.

Figure C-7: Trash guard which has a high surface area to retain high flow rates as trash debris accumulates.(Source: [www.trashracks.com)](http://www.trashracks.com)

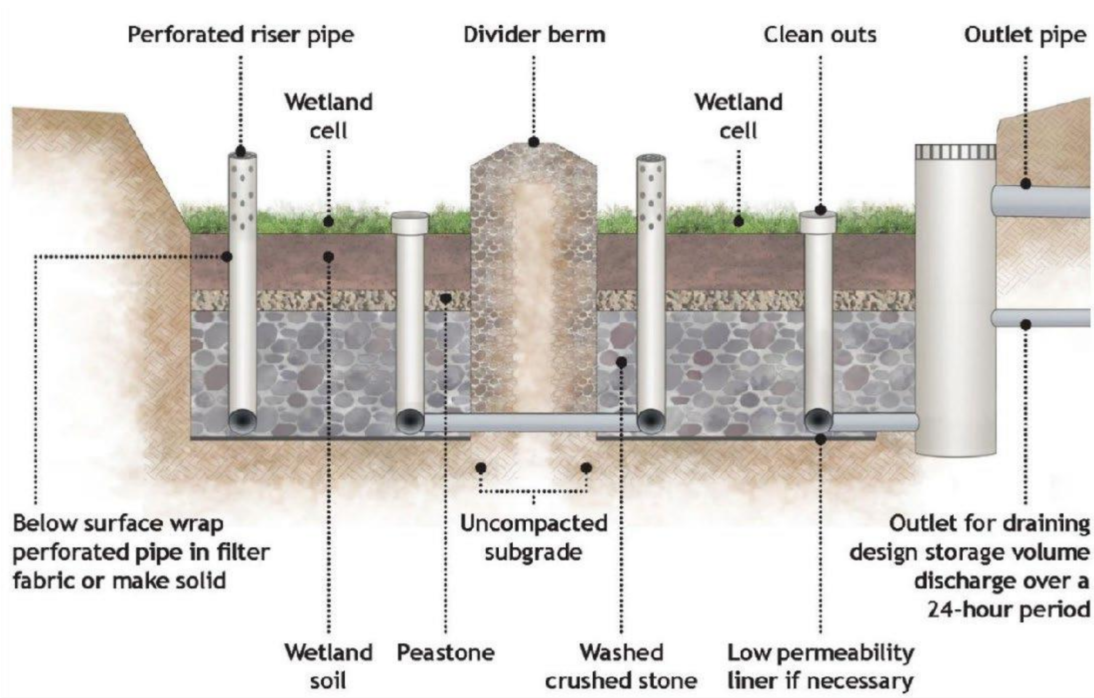


Figure C-8: SCM cross-section of a subsurface gravel wetland (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

Department of Public Works, Lanesborough

Location: 10 Maple Court, Lanesborough (42.516753, -73.2294)
Property Ownership: Town of Lanesborough
Conceptual design prepared by: UNH Stormwater Center as part of the Mass DEP Upper Housatonic TMDL project (2022). The complete conceptual design is provided in Appendix D.

Site description: The town property used by the DPW borders Town Brook. The southwest corner of the DPW's paved lot behind the dumpsters showed considerable deposition of fine sediment which overflowed into the wetland to the south. A drainage pipe led from the gravel lot to the wetland area. The outlet into the wetland area from the drainage pipe also showed significant mounding and sediment deposition. Runoff is directed to a wetland area but there is sufficient space to meet wetland setback requirements if a stormwater control measure is implemented.

Photo C-9: Standing at the end of the untreated drainage area.

Photo C-10: Standing at the proposed SCM showing the pipe outfall to the left (covered) and the direct runoff point to the right.

Lanesborough DPW Yard Improvements' Summary

Proposed BMPs: Drop Inlet and a Subsurface Gravel Wetland

Estimated Nutrient Load Reduction:

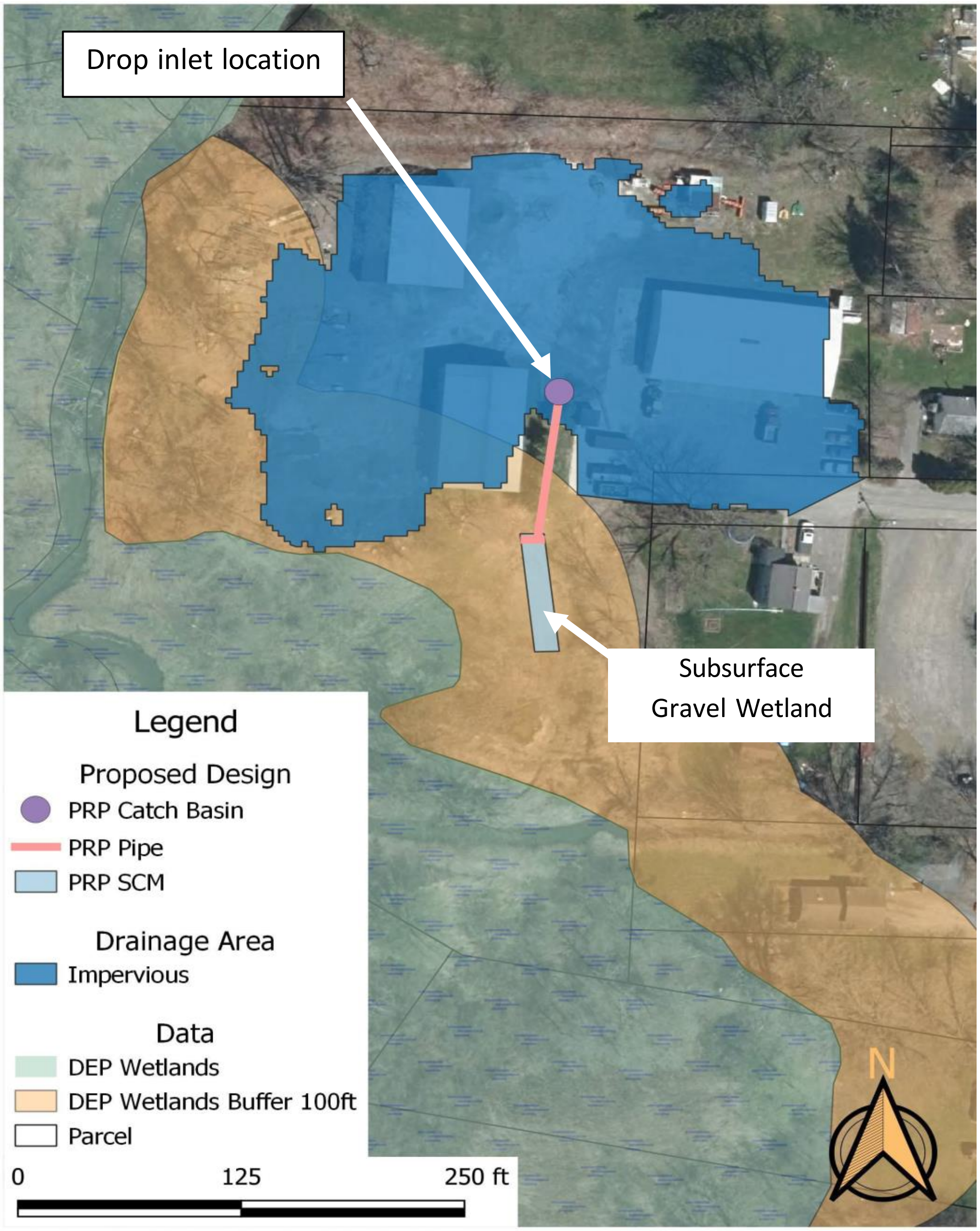
Total Nitrogen: 13.4 lbs/year
Total Phosphorous: 1.1 lbs/year
Total Suspended Solids: 0.2 tons/year

Estimated Cost: $82,500

Estimated O & M Costs: $3,000

Required Permits: Notice of Intent

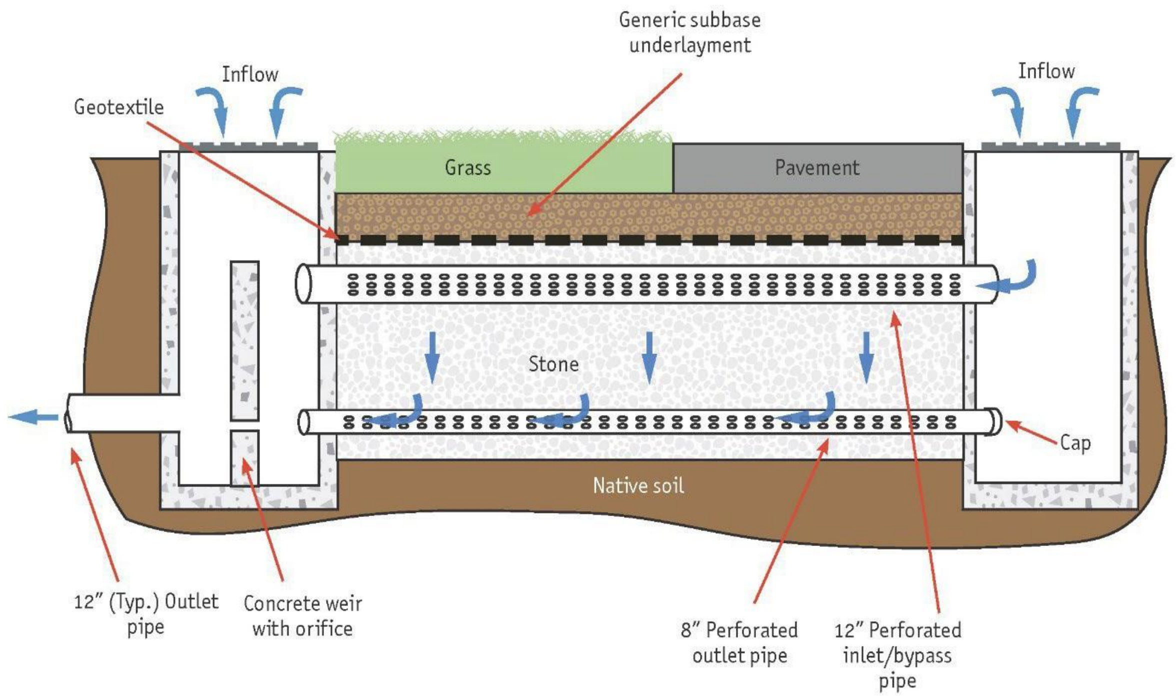
Figure C-9: Lanesborough DPW Proposed BMPs in Plan Layout



Proposed Improvements:

This is a combined SCM design consisting of a leaching catch basin to intercept the upland drainage area to a lower gravel wetland system in the adjacent town-owned property. The inlet into the leaching catch basin will be a grated inlet that discharges to the gravel wetland system. The overflow will be through an armored spillway over the existing grade. The proposed BMP area is within the wetland setback but improves the existing condition which conveys untreated runoff from the DPW yard into the existing wetland and setback. The gravel wetland system proposed will be a single cell gravel wetland as opposed to the two-cell version depicted in the graphic. This will simplify the design and minimize the wetland setback impacts.

Figure C-10: Typical Gravel Wetland cross-section (not to scale).
Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)



Algonquin Street & Narragansett Avenue

Location: Adjacent to 249 Narragansett Avenue, Lanesborough (42.496646, -73.257291)
Property Ownership: Town of Lanesborough
Conceptual design prepared by: UNH Stormwater Center as part of the Mass DEP Upper Housatonic TMDL project (2022). The complete conceptual design is provided in Appendix D.

Site Description: Algonquin Street runs perpendicular to Narragansett Avenue which runs along the western edge of Pontoosuc Lake. Algonquin Street is steeply sloped and runoff has resulted in eroded road edges on both sides resulting in areas of flooding at the corners with Narragansett Avenue. There is a mowed path in the right of way continuing east toward the lake directly from Algonquin Street.

Photo C-11: Looking east from the gravel road catchment toward the route of runoff.

Photo C-12: Town easement sloped toward the lake - the location of the proposed bioinfiltration basin.

Algonquin Street & Narragansett Avenue Improvements' Summary

Proposed BMPs: 3 Deep sump catch basins connected to a Subsurface Gravel Wetland

Estimated Nutrient Load Reduction:

Total Nitrogen:	7.0lbs/year
Total Phosphorous:	0.8 lbs/year
Total Suspended Solids:	239 lbs/year

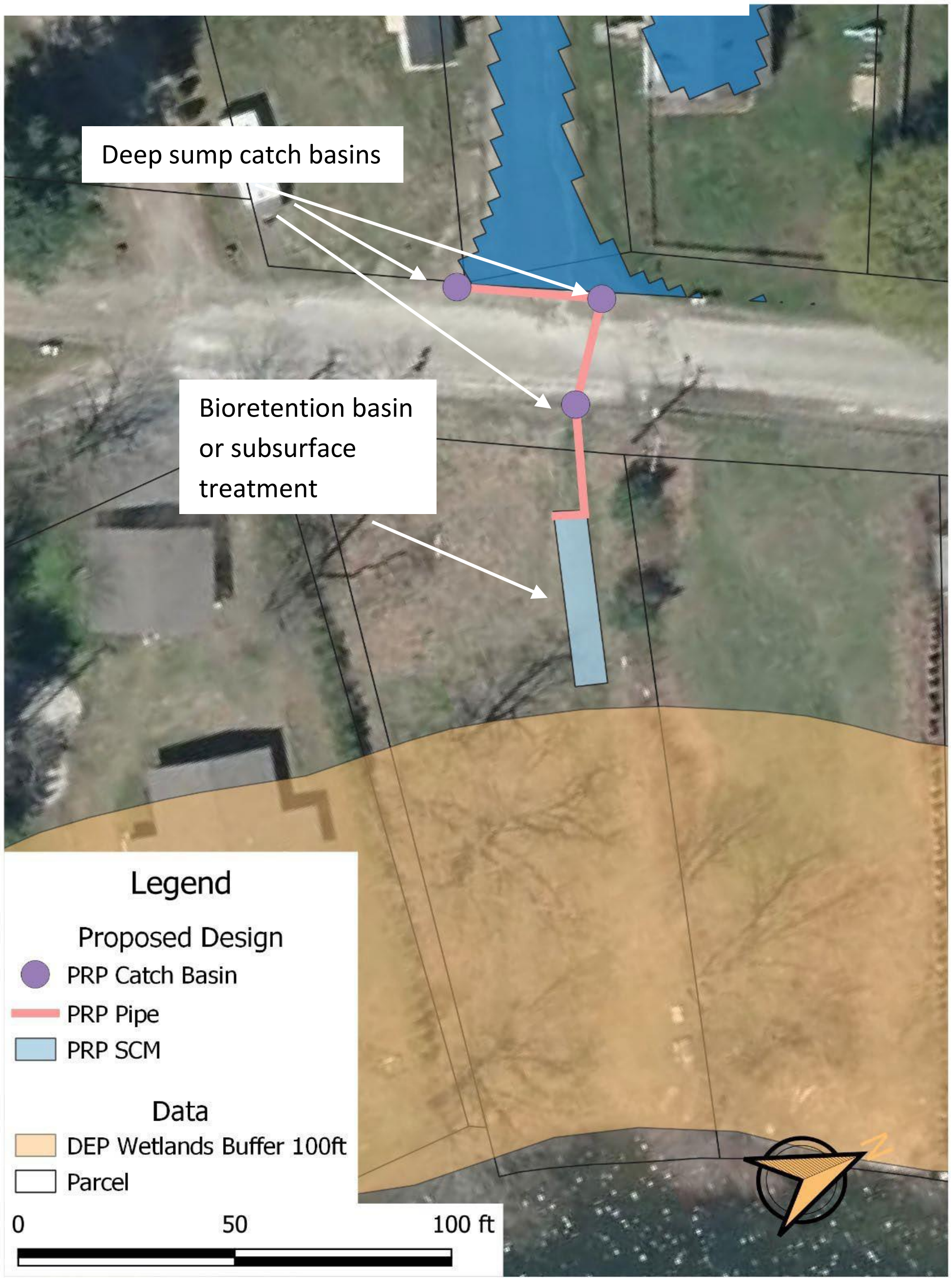
Estimated Cost: $50,000

Estimated O & M Costs: $3,600

Required Permits: Notice of Intent

Figure C-11: Algonquin Street/Narragansett Avenue existing site conditions.

Figure C-12: Algonquin Street/Narragansett Avenue Proposed BMPs in Plan Layout



Proposed Improvements:

Install three catchbasins to intercept the existing drainage on Algonquin Street to a bioretention/infiltration SCM to filter and infiltrate the runoff. The inlet to the bioretention system will be from the connected drainage network in between the catch basins. There is sufficient grade to daylight the catch basin outlet into the bioretention system. The high flow bypass will be over a stone berm at the end of the SCM.

Town Park, Lanesborough

Location: 11 Bridge Street, Lanesborough (42.520024, -73.228968)
Property Ownership: Town of Lanesborough
Conceptual design prepared by: UNH Stormwater Center as part of the Mass DEP Upper Housatonic TMDL project (2022). The complete conceptual design is provided in Appendix D.

Photo C-13: Looking toward the west over the storm pipe in the road.

Site description: Bridge Street has a significant grade that conveys water along the road from east to west. All of the storm drains on Bridge Street are deep sump catch basins. The existing 30-inch drainage line in the road requires further confirmation to determine the exact size of the pipe and drainage area serviced by the drainage network. The culvert under Bridge Street drains untreated to Town Brook (west of the basketball court). The site offers enough gradient and space for a potential disconnection and treatment of the pipe.

Photo C-14: In the park the proposed BMP would be placed to the left in the open grass area. Town Brook is to the right.

Town Park Improvements' Summary

Proposed BMPs: Subsurface Gravel Filter

Estimated Nutrient Load Reduction:

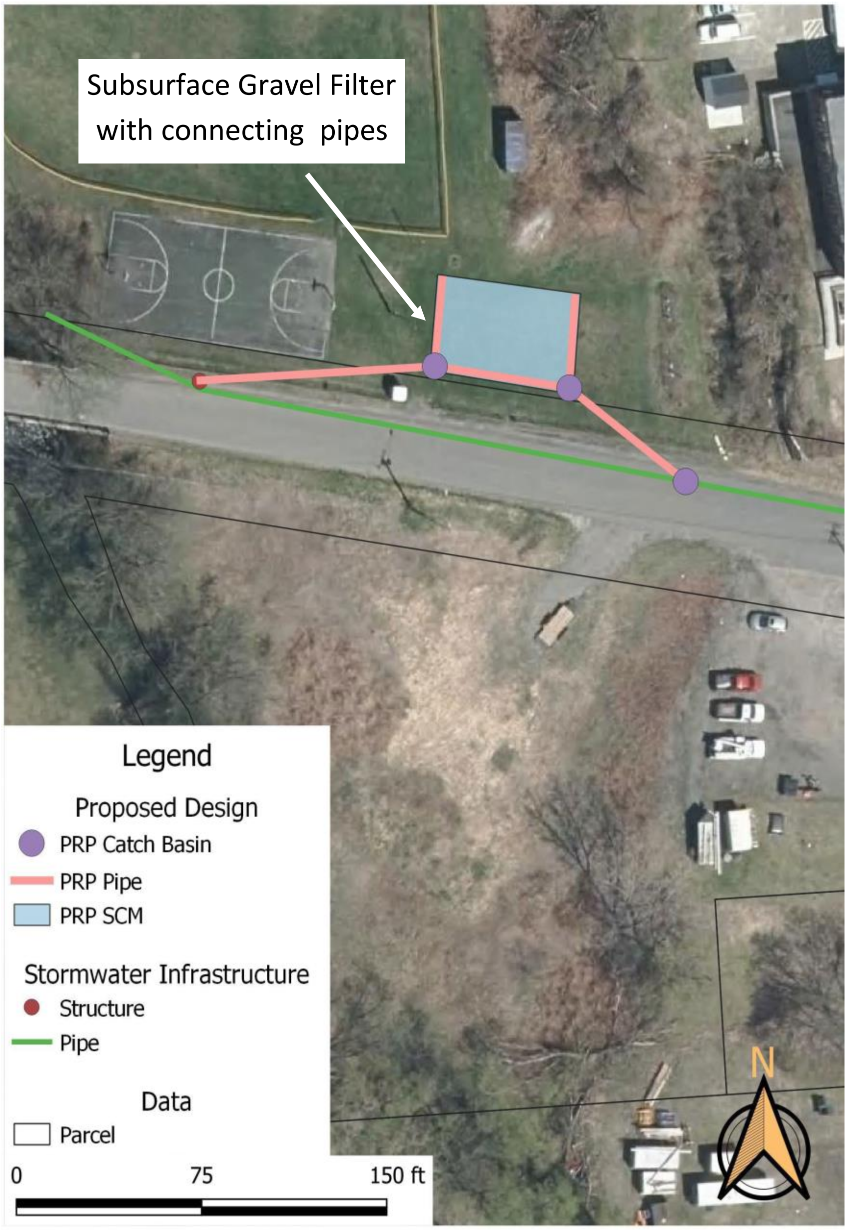
Total Nitrogen:	25.5 lbs/year
Total Phosphorous:	3.0 lbs/year
Total Suspended Solids:	855 lbs/year

Estimated Cost: $85,000

Estimated O & M Costs: $5,000

Required Permits: Notice of Intent

Figure C-13: Town Park, Lanesborough Proposed BMPs in Plan Layout



Proposed Improvements:

Disconnect the stormwater pipe and divert it into a subsurface gravel filter design at the east of the basketball court which will be reconnected to the culvert for high-flow bypass. This design will preserve the existing recreational use of the fields while including treatment for a large regional drainage system prior to discharge. The concept is to provide for a flow diversion from the existing untreated drainline such that when design flows are surpassed the original conveyance now handling the existing flow discharges the remaining stormwater flows. The infiltration system will be grassed over and the primary outlet will be exfiltration into native soils. The secondary outlet or bypass will be conveyed back to the existing drainline.

Dorothy Amos Park, Pittsfield

Location: 320 West Street, Pittsfield (42.45151, -73.26216)
Property Ownership: City of Pittsfield
Conceptual design prepared by: CEI, Inc. Engineering consultant for BRPC (2024).

Site description: There is an existing drainage pipe that crosses the northern portion of Dorothy Amos Park. The existing pipe is a 12" pipe that directs runoff from a section of Division Street towards the West Branch. The northern portion of Dorothy Amos Park has a steep hill to the east with a level area that immediately abuts the West Branch River to the west. There is an existing manhole at the bottom of the steep hill along Dorothy Amos. The grassed area to the south was wet and saturated during the field visit.

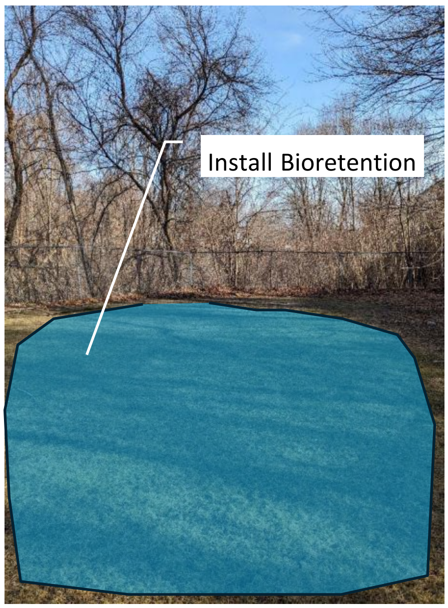


Photo C-15: Grassed area at the northern end of Dorothy Amos Park.

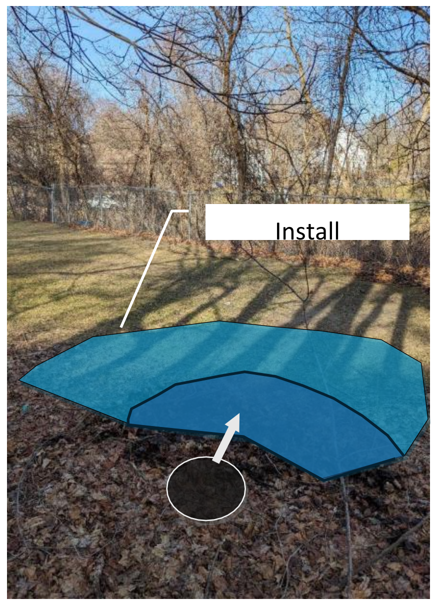


Photo C-16: Existing manhole at the north end of Dorothy Amos Park.

Dorothy Amos Park Improvements' Summary

Proposed BMPs: Bioretention Basin with Sediment Forebay (2000 sq.ft)

Estimated Nutrient Load Reduction:

Total Nitrogen: 5.72lbs/year
Total Phosphorous: 0.78 lbs/year
Total Suspended Solids: 240 lbs/year

Estimated Cost: $37,000

Estimated O & M Costs: $3,500

Required Permits: Notice of Intent

Figure C-14: Dorothy Amos Park Project Drainage area of existing stormwater infrastructure.

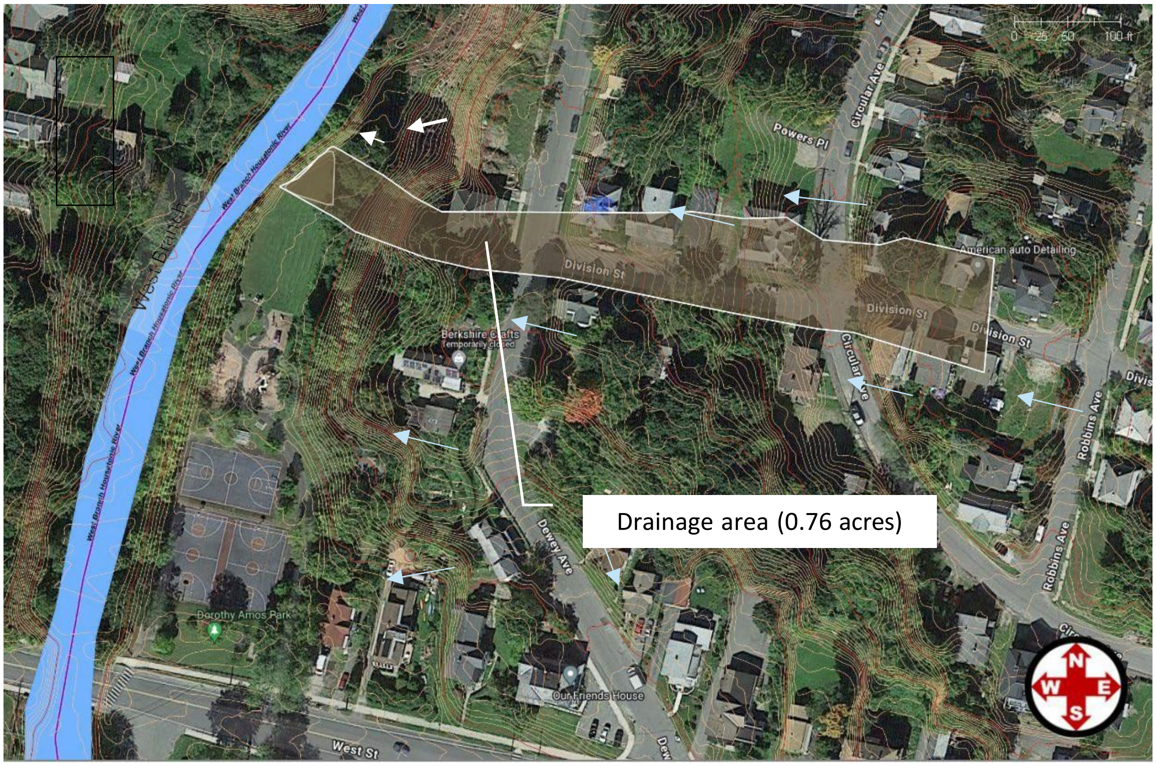
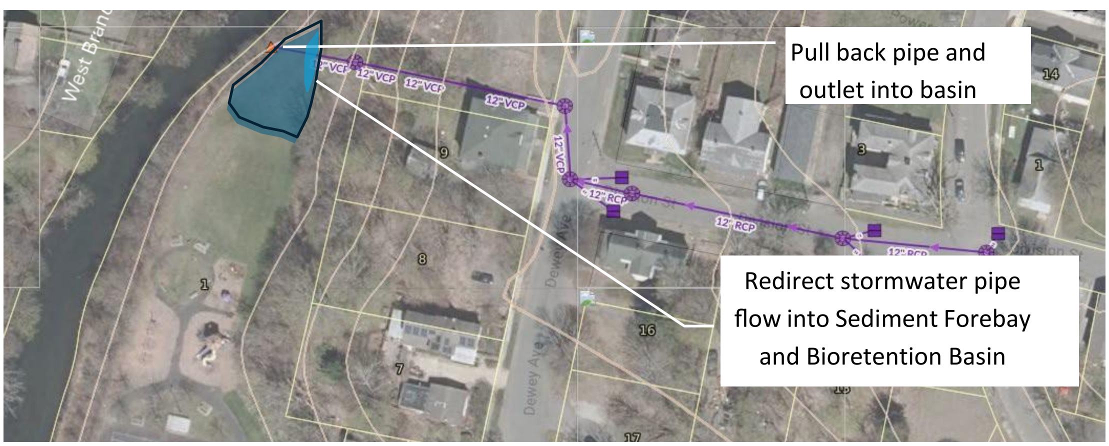


Figure C-15: Existing stormwater infrastructure from Division Street to Dorothy Amos Park.



Proposed Improvements:

- Install a 2000 square foot bioretention basin with forebay in the northern end of Dorothy Amos Park.
- Pullback the drainage pipe that collects runoff from Division Street and direct it to the bioretention basin.
- Raise the pipe outlet of the existing manhole to have it act as a pretreatment manhole.
- Improve the riparian buffer south of the project area.

Columbus Avenue, Pittsfield

Location: Columbus Avenue segment (#314 – #362), Pittsfield (42.45302, -73.26284)
Property Ownership: City of Pittsfield
Conceptual design prepared by: CEI, Inc. Engineering consultant for BRPC (2024).

Site Description: Runoff from Columbus Avenue channelizes along the northern shoulder. Runoff is eroding the shoulder and transporting sediment downstream towards the West Branch. There is an 18” pipe on Columbus Avenue between Onota Street and John Street that conveys flow from an upstream tributary. This pipe turns into a 22” pipe at the intersection of John Street and splits into a 27” and an 18” pipe before its outlets to the West Branch. There is accumulated sediment around and in the catch basins in front of the Habitat for Humanity offices (314 Columbus Avenue). There is reported flooding in this area during storm events. These catch basins discharge directly to the West Branch.

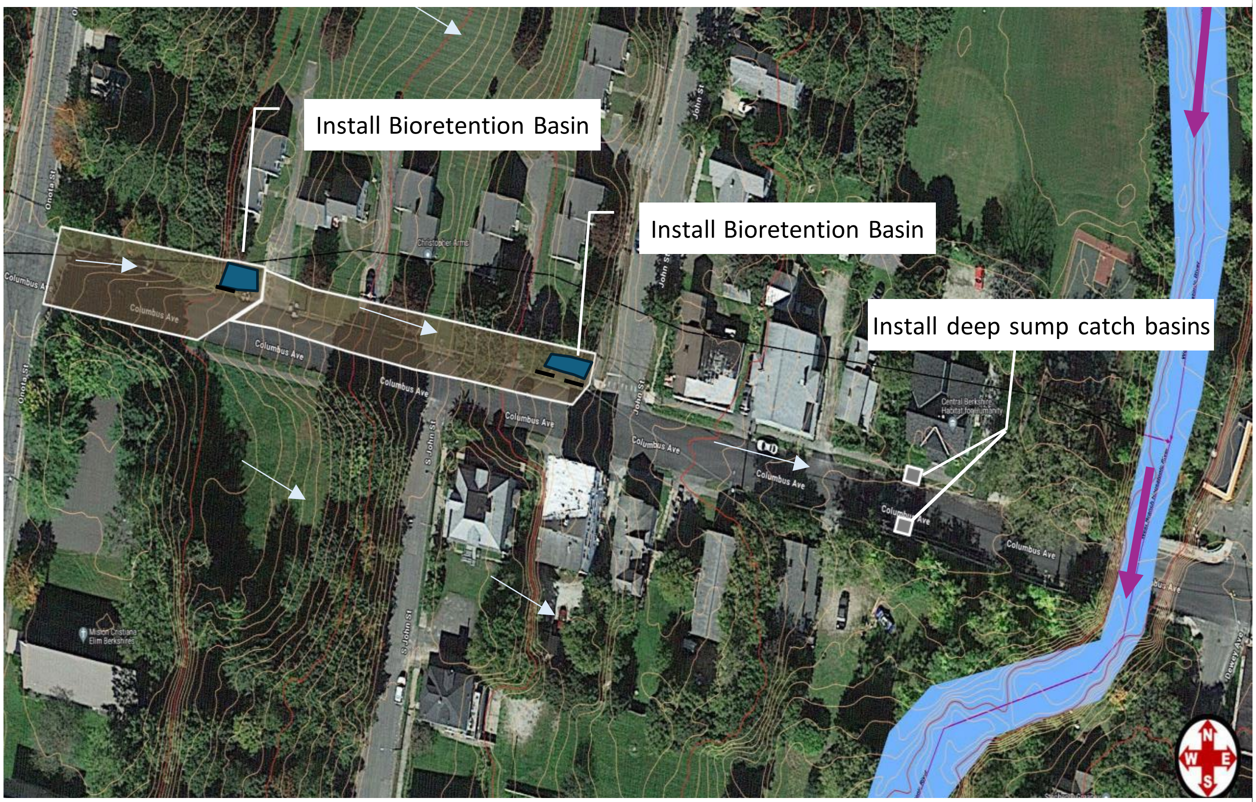
Photo C-17: Grassed area at the corner of Columbus and John Streets.

Photo C-18: Grassed area along shoulder close to the intersection of Onota and Columbus Avenue.

Proposed Improvements:

- Install a bioretention basin about 120 feet east of the intersection of Columbus Avenue and Onota Street (approx. 325 square feet for a drainage area of approx. 0.2 acres).
- Install bioretention basin at the northwest intersection of John Street and Columbus Avenue (approx. 450 square feet for a drainage area of approx. 0.26 acres.).
- Clean out existing catch basins and remove excess sediment on the roads.
- Install two deep sump catch basins in front of the 314 Columbus Avenue.

Figure C-16: Drainage areas and proposed BMPs along Columbus Avenue.



Columbus Avenue Improvements' Summary

Proposed BMPs: Bioretention Basins and 2 deep sump catch basins

Estimated Nutrient Load Reduction:

Total Nitrogen:	2.10lbs/year
Total Phosphorous:	0.29 lbs/year
Total Suspended Solids:	80 lbs/year

Estimated Cost: $66,000

Estimated O & M Costs: $3,300

Required Permits: Notice of Intent

Linden Street, Pittsfield

Location: Southeast corner of the intersection of Linden and John Streets, Pittsfield (42.45675, -73.26108)
Property Ownership: City of Pittsfield
Conceptual design prepared by: CEI, Inc. Engineering consultant for BRPC (2024).

Site Description: There is an empty grass lot bordering the West Branch at the southeast corner of John Street and Linden Street. The existing catch basins collect stormwater runoff from John and Linden Streets discharging it to the West Branch via a drainage pipe. The lot has a limited vegetated buffer along the riverbank. An informal pedestrian path has formed diagonally across the grassed lot.

Photo C-19: Grassed area at the corner of John and Linden Streets.

Photo C-20: View of BMP location from Linden Street
.

Proposed Improvements:

- Install bioretention basin at the corner of Linden Street and John Street (approx. 2800 square feet).
- Redirect runoff from existing drainage system to the bioretention basin.
- Improve the riparian buffer by planting native trees and shrubs along the river's edge (approx. 1500 square feet)

Figure C-17: Linden Street Drainage area and BMPs

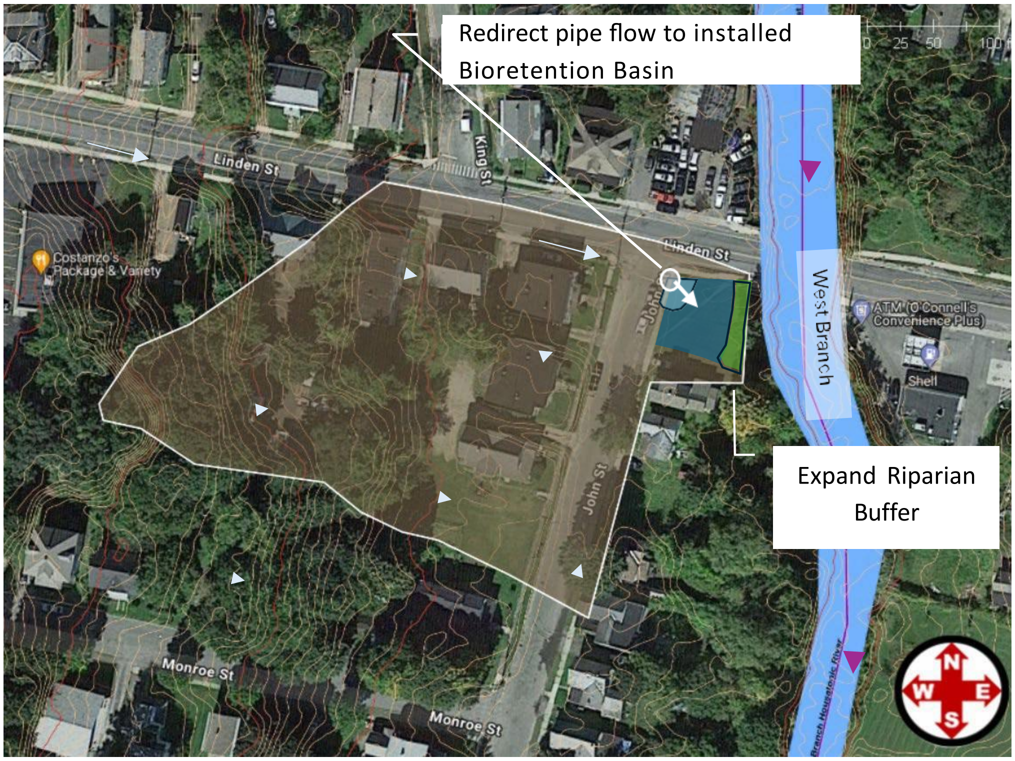
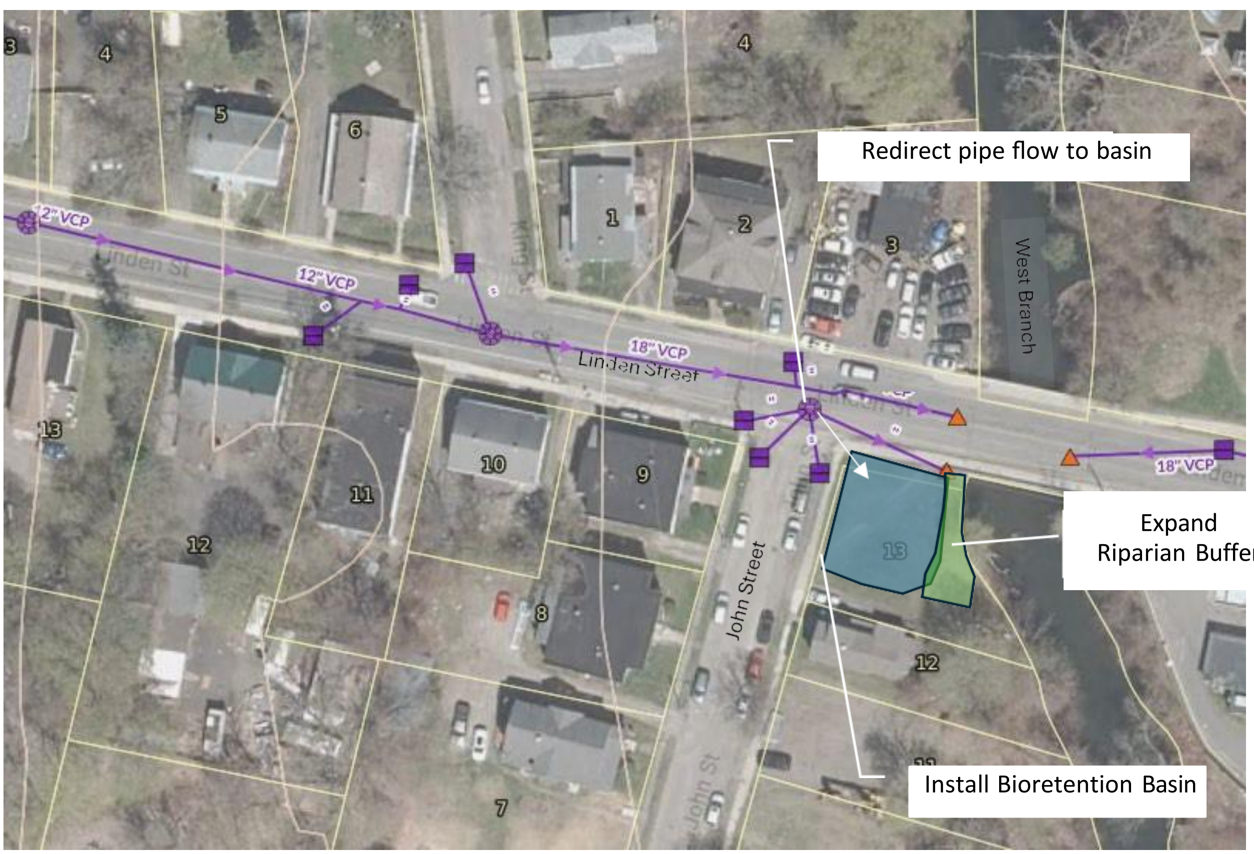


Figure C-18: Existing drainage infrastructure along Linden Street with BMP layout



Linden Street Improvements' Summary

Proposed BMPs: Bioinfiltration Basin and Improved Riparian Buffer

Estimated Nutrient Load Reduction:

Total Nitrogen:	9.35 lbs/year
Total Phosphorous:	1.26 lbs/year
Total Suspended Solids:	380 lbs/year

Estimated Cost: $49,000

Estimated O & M Costs: $3,500

Required Permits: Notice of Intent

John T. Reid Middle School, Pittsfield

Location: 950 North Street, Pittsfield (42.46718, -73.24438)
Property Ownership: City of Pittsfield
Conceptual design prepared by: CEI, Inc. Engineering consultant for BRPC (2024).

Project #1 Site Description: Runoff from the Reid Middle School parking lot currently sheds to the northwest. Runoff sheds across loose sediment and debris towards a small drainage swale that flows to an existing catch basin. The existing catch basin is clogged and covered by debris and sediment, causing localized flooding. There is loose sediment along the edge of the parking lot and there are signs of sediment transport along the existing drainage swale. Flooding in the area has caused damage to the pedestrian pathway and sediment build-up along the path.

Photo C-21: Existing ditch and crumbling pedestrian accessway.

Photo C-22: Loose sediment and erosion occurring at the edge of the parking lot

Project #1 - Proposed Improvements:

- Stabilize loose sediment along the edge of the parking lot.
- Install a settling basin at the low point of the edge of the parking lot (approx. 300 SF).
- Convert the existing drainage ditch to a water quality swale (approx. 1500 SF).
- Clean and maintain the existing catch basin.

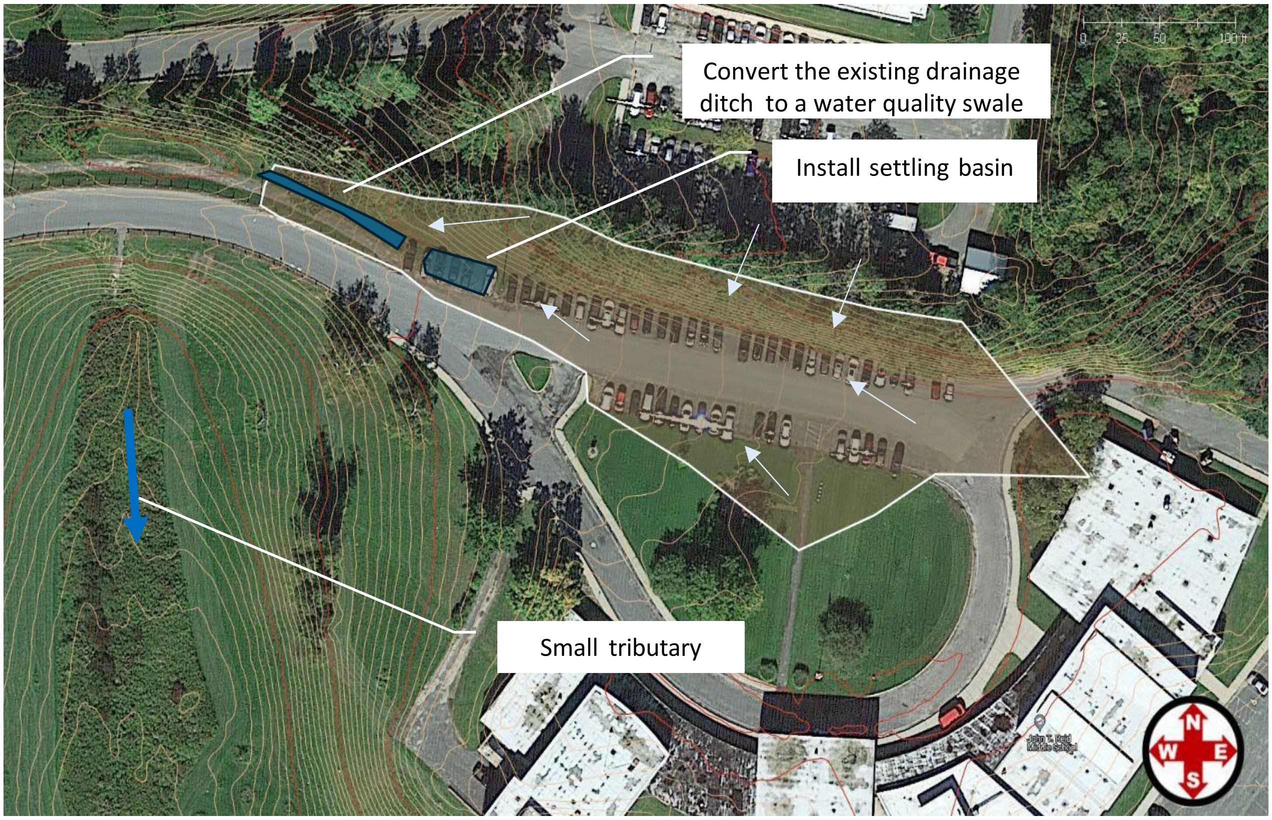


Figure C-19: Project #1 Drainage area and proposed BMPs at Reid Middle School parking lot.

John T. Reid Middle School Project #1 Improvements' Summary

Proposed BMPs: Water Quality Swale and Settling Basin

Estimated Nutrient Load Reduction:

Total Nitrogen: 0.69 lbs/year
Total Phosphorous: 0.11 lbs/year
Total Suspended Solids: 242.5 lbs/year

Estimated Cost: $29,000

Estimated O & M Costs: $1,700

Required Permits: Notice of Intent

Reid Middle School - Project #2 Site Description:

runoff from the Reid Middle School parking lot currently sheds to the northwest. Runoff sheds across loose sediment and debris towards a small drainage swale that flows to an existing catch basin. The existing catch basin is clogged and covered by debris and sediment, causing localized flooding. There is loose sediment along the edge of the parking lot and there are signs of sediment transport along the existing drainage swale. Flooding in the area has caused damage to the pedestrian pathway and sediment build-up along the path.

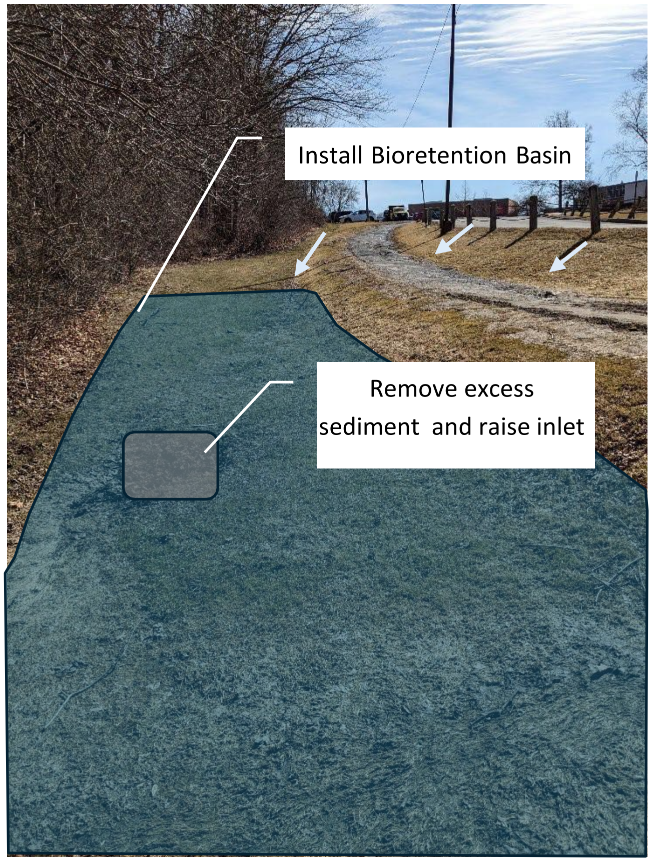


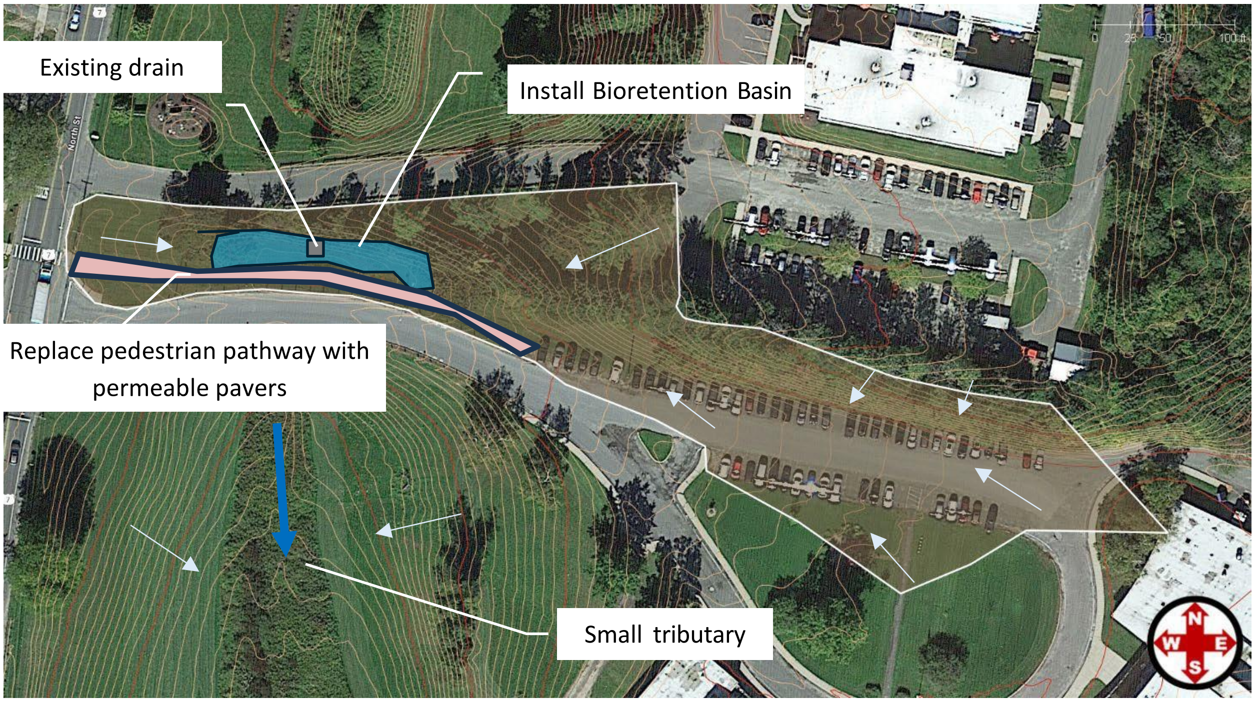
Photo C-23: Grassed area with deposited sediment at low point along the accessway to Reid Middle School.

Photo C-24: Pedestrian accessway to Reid Middle School.

Project #2 - Proposed Improvements:

- Install a bioretention basin at the low point along the pedestrian pathway (approx. 2250 square
- Raise the existing catch basin to create a raised outlet for the basin.
- Reconstruct pedestrian pathway with permeable pavers.

Figure C-20: Project #2 - Drainage area and proposed BMPs at Reid Middle School



John T. Reid Middle School Project #2 Improvements' Summary

Proposed BMPs: Bioretention Basin (2200 sq. ft.) and Permeable Pedestrian Pathway (340 ft.)

Estimated Nutrient Load Reduction:

Total Nitrogen:	4.45 lbs/year
Total Phosphorous:	0.55 lbs/year
Total Suspended Solids:	220 lbs/year

Estimated Cost: $47,000

Estimated O & M Costs: $7,800

Required Permits: Notice of Intent

Reid Middle School - Project #3 Site Description

Runoff from the Reid Middle School access road currently sheds to the south towards a small tributary. Runoff drains towards the center of the road and is outlet through a curb cut that leads to an asphalt swale. The asphalt swale is crumbling, exposing loose sediment that is being transported by runoff. There are signs of erosion occurring along the swale and in the areas the asphalt has crumbled away. There are areas of exposed soil along the grassed embankment with signs of erosion.

Photo C-25: Erosion at the asphalt swale along the south side of the entrance road to the school.

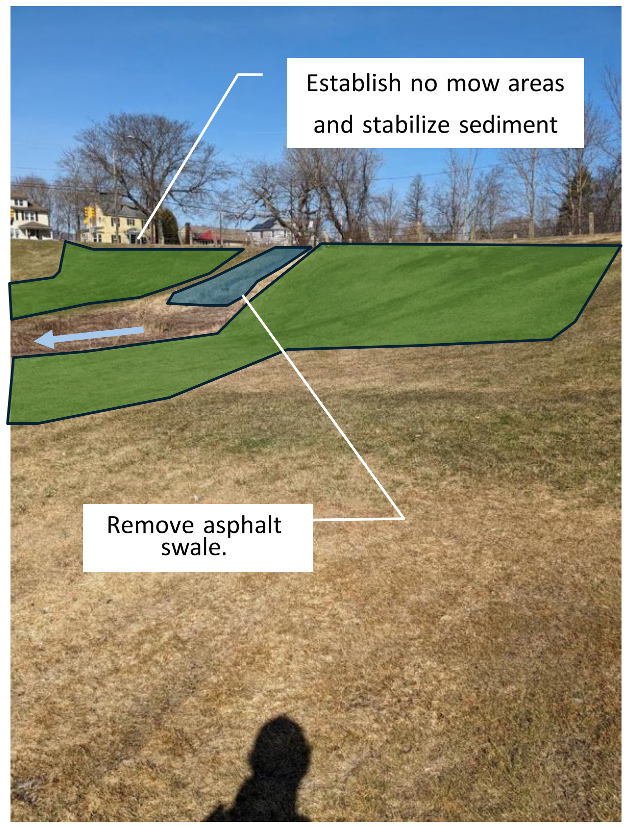
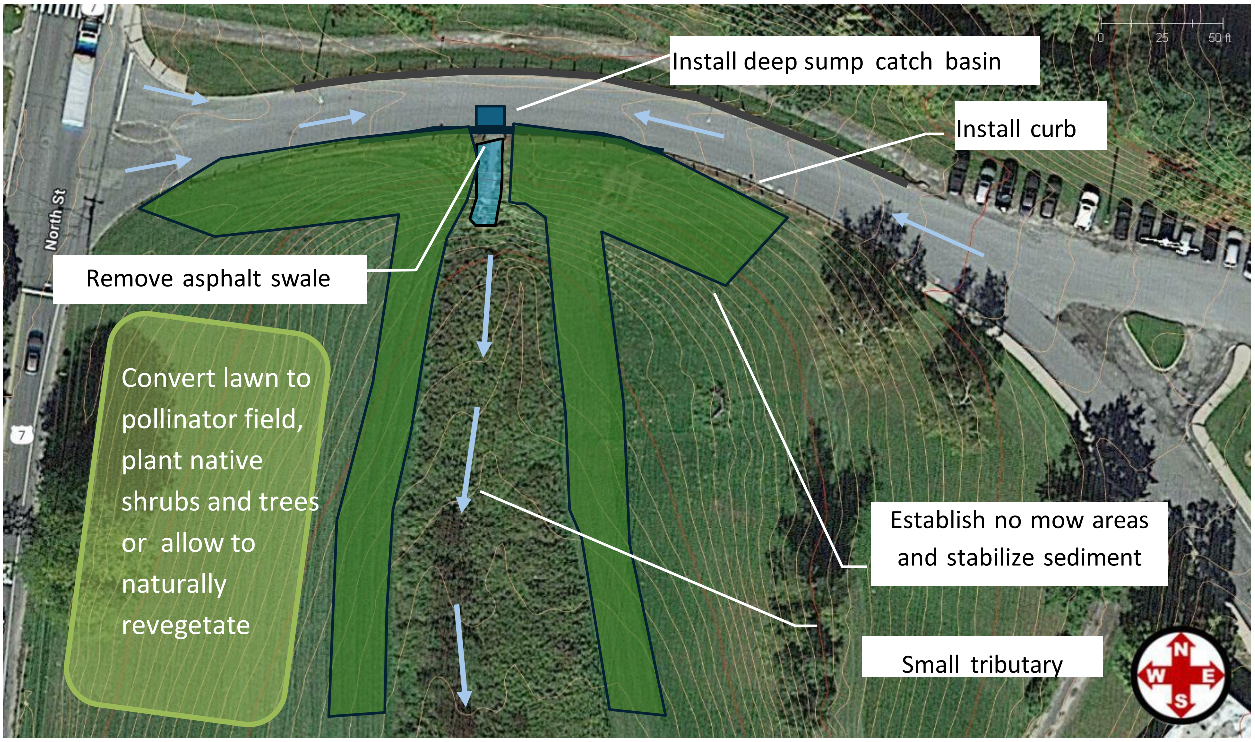


Photo C-26: Southern embankment of access road to the school.

Project #3 - Proposed Improvements

- Install curb and a deep sump catch basin along the access road.
- Remove asphalt swale and stabilize slope with vegetation.
- Expand no mow areas along the tributary to improve riparian buffer.
- The mowed area to the west of the unnamed tributary could be converted to a pollinator meadow, mowed less frequently, or have native trees and shrubs planted to reduce the mowing necessary.

Figure C-21: Project #3 - Proposed stabilization and improvements at Reid Middle School.



John T. Reid Middle School Project #3 Improvements' Summary

Proposed BMPs: Deep Sump Catch Basin and Improved Riparian Buffer

Estimated Nutrient Load Reduction:

Total Nitrogen:	1.91 lbs/year
Total Phosphorous:	0.96 lbs/year
Total Suspended Solids:	2249 lbs/year

Estimated Cost: $27,000

Estimated O & M Costs: $200

Required Permits: Notice of Intent

Bull Hill Road, Lanesborough

Location: Bull Hill Road, from the corner to Aqua Street (42.507425, -73.2474197)
Property Ownership: Town of Lanesborough – Right-of-Way
Conceptual design prepared by: CEI, Inc. Engineering consultant for BRPC (2024).

Site Description: Bull Hill Road is a steep road with existing drainage infrastructure. Stormwater from the southern half of Bull Hill Road is collected via a series of drop inlets and asphalt swales. The westernmost swale is buried under sediment and leaf debris with a potentially buried catch basin. The runoff is scouring an erosion channel in the gravel road, Spring Street. Two outfalls discharge the stormwater in unnamed tributaries. An eroded channel has formed on the bend of Bull Hill Road where the stormwater is directed off the road towards the tributary. This channel was recently reinforced with riprap by the DPW.

Photo C-27: Erosion at the intersection of Spring Street and Bull Hill Road.

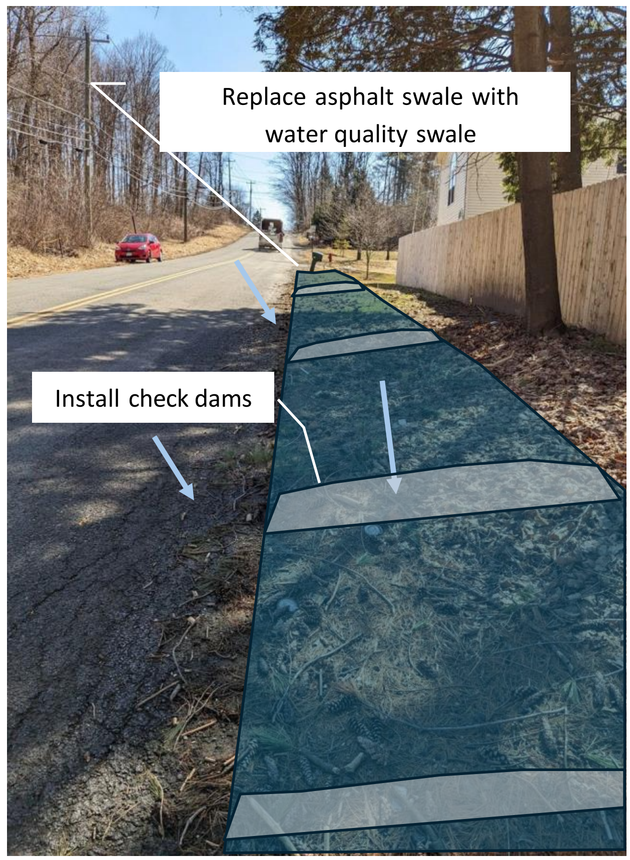


Photo C-28: Asphalt swale exists under sediment along the southwest shoulder of Bull Hill Road.

Proposed Improvements:

- Remove asphalt swale and remove excess sediment.
- Install water quality swale with check dams (approx. 1800 SF).
- Replace the drop inlets with five deep sump catch basins along Bull Hill Road.

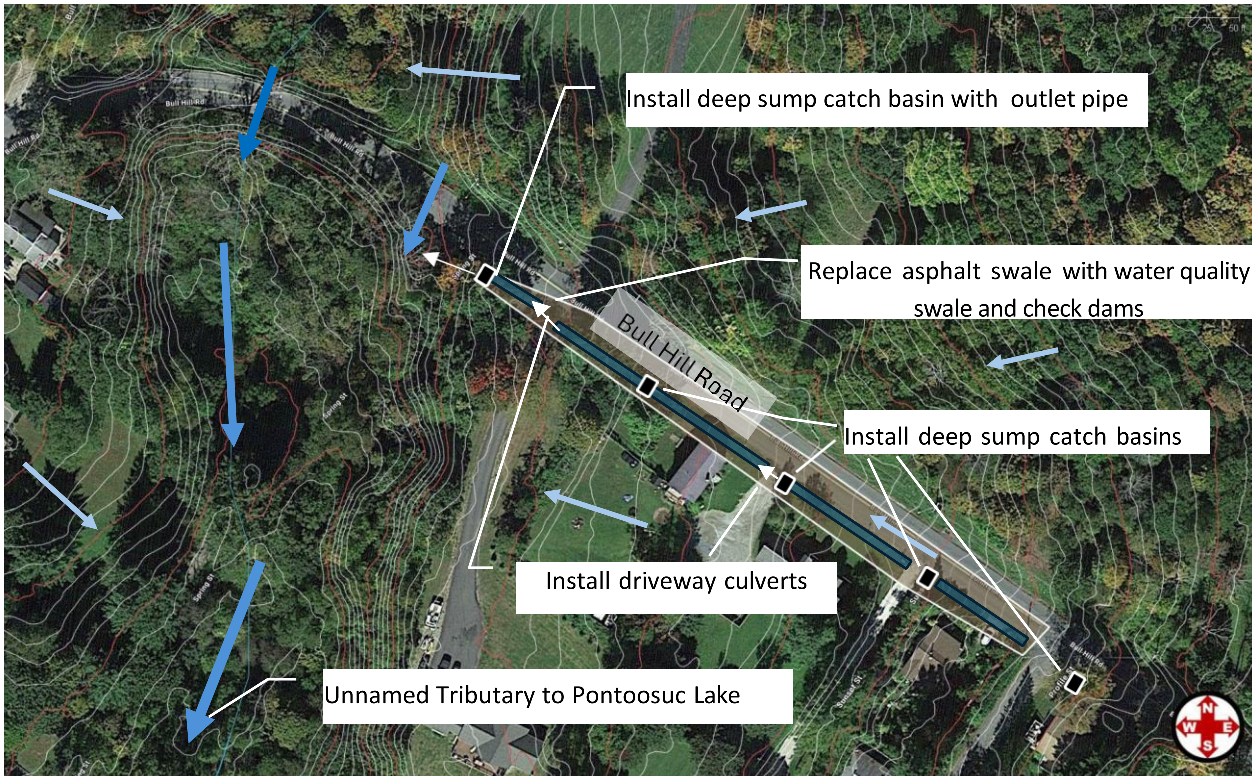


Figure C-22: Existing asphalt swales and drop inlets with proposed BMPs along Bull Hill Road.

Bull Hill Road Improvements' Summary

Proposed BMPs: Water Quality Swale (1800 ft) with Check Dams; Deep Sump Catch Basins (5)

Estimated Nutrient Load Reduction:

Total Nitrogen: 0.5 lbs/year
Total Phosphorous: 0.09 lbs/year
Total Suspended Solids: 507 lbs/year

Estimated Cost: $71,000

Estimated O & M Costs: $5,800

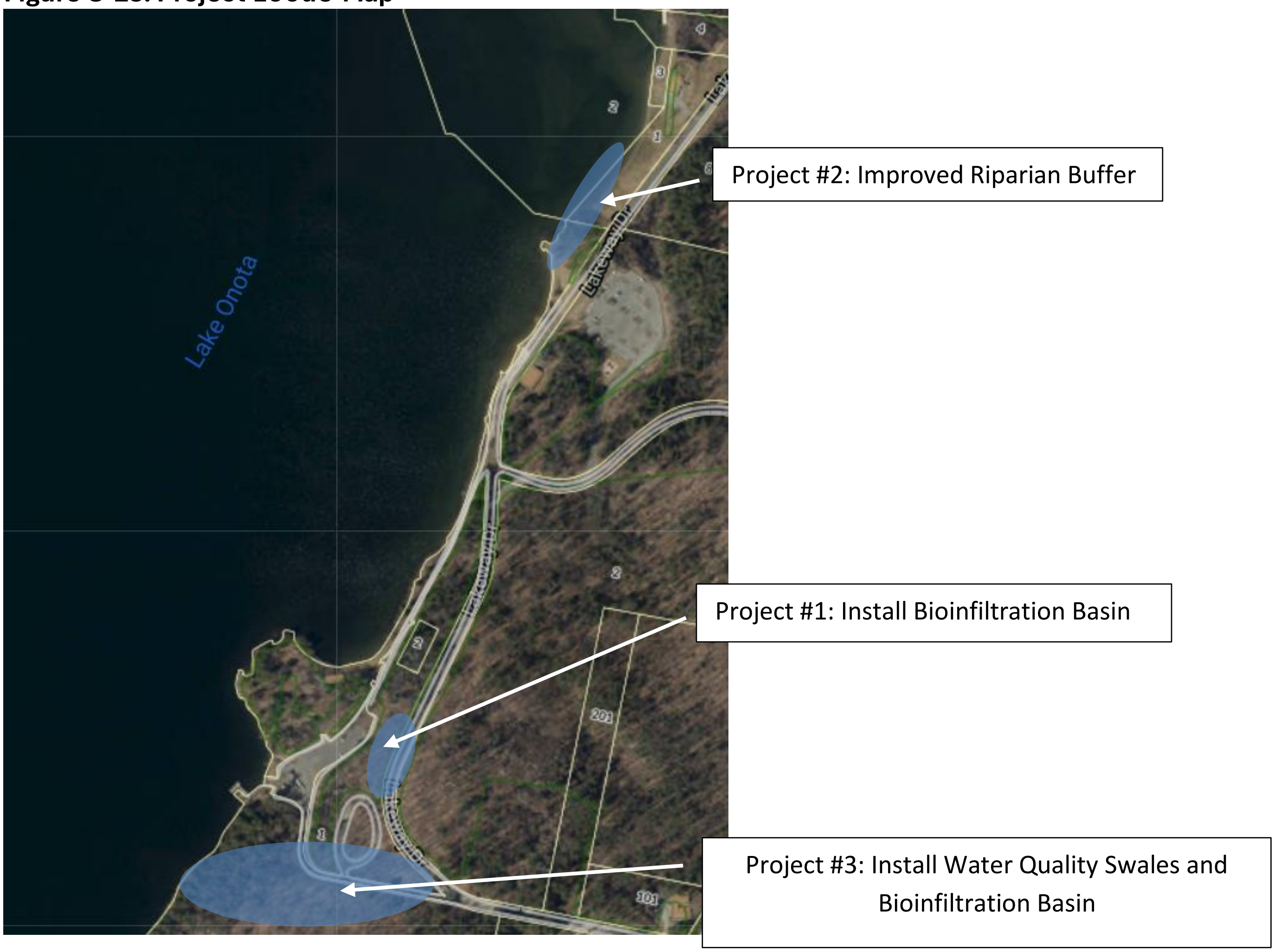
Required Permits: Notice of Intent

Burbank Park on Onota Lake

Location: Burbank Park, Pittsfield (42.468393, -73.276642)
Property Ownership: City of Pittsfield
Conceptual design prepared by: CEI, Inc. Engineering consultant for BRPC (2024).

Site description: Burbank Park is located on the banks of Onota Lake. It is a well- used park that includes trails, beaches and a boat access. The proposed improvements would build upon previous Section 319 Clean Water Act grant projects which allowed deep sump catch basins and the installation of a Stormceptor© and riparian buffer.

Figure C-23: Project Locus Map



Burbank Park Improvements' Summary

Proposed BMPs: Bioinfiltration Basins, Water Quality Swales and Improved Riparian Buffer

Estimated Nutrient Load Reduction:

	Project #1	*Project #2	Project #3
Total Nitrogen:	3.1 lbs/year	Unknown	0.9 lbs/year
Total Phosphorous:	0.4lbs/year	Unknown	0.19 lbs/year
Total Suspended Solids:	232.7 lbs/year	Unknown	305.5 lbs/year

*[Riparian Buffer] that includes grass and woody vegetation with a buffer width of 30 - 65 feet may achieve 85%–97% TSS removal, 72%–94% TP removal and 40%–91% TN removal. [16]

Estimated Cost:	$33,000	$75,000	$31,035
Estimated O & M Costs:	$1,000	$0	$2,500

Required Permits: Notice of Intent

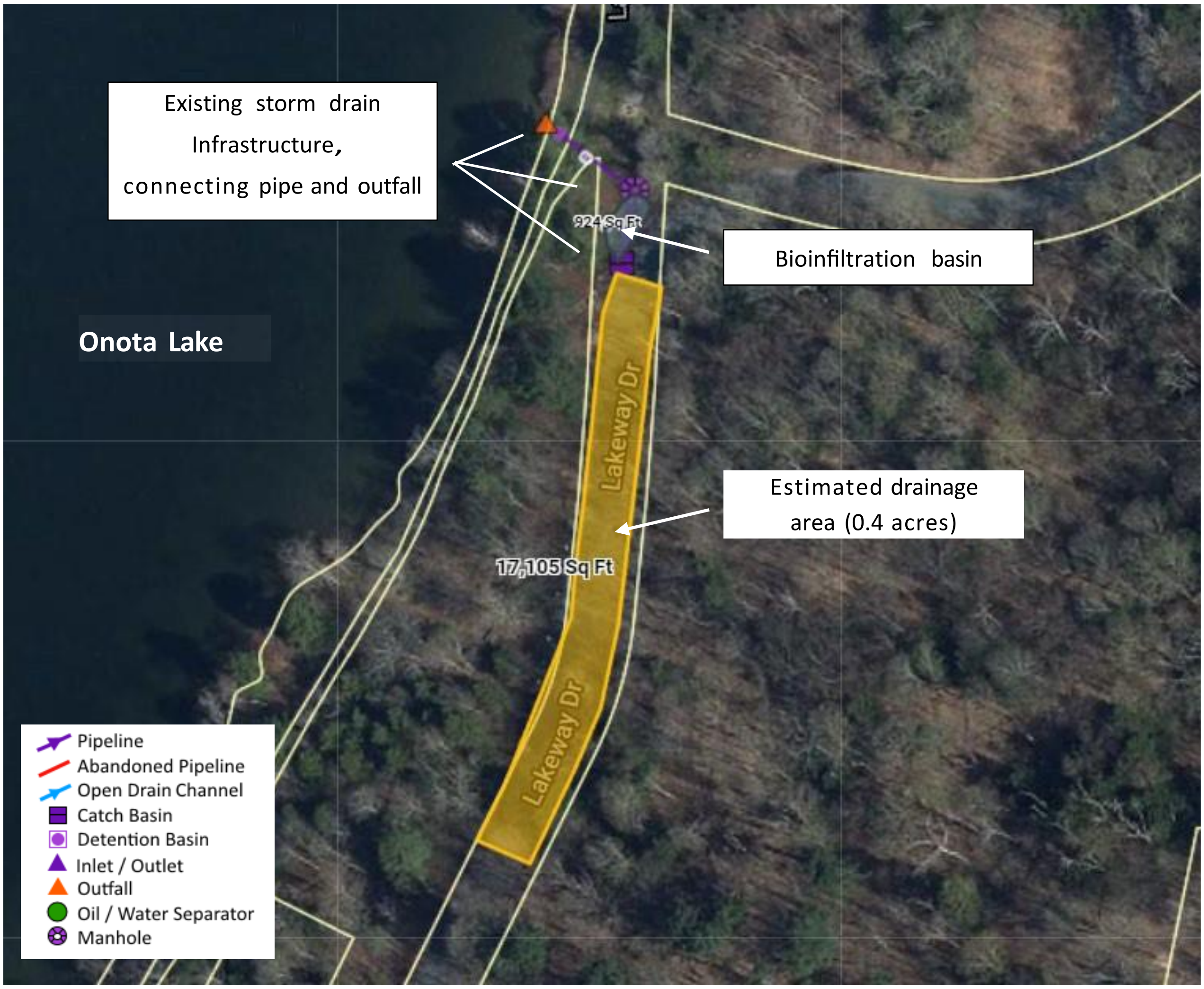
30

[30] https://www.epa.gov/system/files/documents/2021-11/bmp-riparian-forested-buffer.pdf

Burbank Park - Project #1

Site Description: A storm drain currently directs stormwater from Lakeway Drive within Burbank Park to an outfall at the lake edge. There is sufficient room to disconnect the outfall infrastructure and instead direct the stormwater to an infiltration basin. The bioinfiltration basin could be sized larger to ensure that sufficient volume exists to accommodate larger storms. The proposed basin size is about 200 square feet larger than the estimated footprint for this size drainage area.

Figure C-24: Burbank Park Project #1 Proposed BMP with existing infrastructure



Proposed Improvements:

Construct a grassed bioretention basin (about 900 square feet) in the open area adjacent to the existing Lakeway Drive storm drain. As is evident by **Photo C-29,** rocks will need to be removed. If possible, retain the existing storm drain to act as a sediment forebay. Direct the existing stormwater pipe leading from the storm drain into the bioretention basin. Disconnect the pipe leading to the outfall. (If necessary, a raised inlet that would connect to the existing storm drain system could be built to capture overflow.) The existing storm drain will serve as a pre-treatment and can be cleaned out annually as is done now. A grassed bioinfiltration basin will be allow for easy maintenance by park staff.

Photo C-29: – Burbank Park Project #1 Proposed BMP Layout

BMP TYPE (edit)

BIORETENTION AND RAIN GARDENS

BMP SIZE (design storm depth; inches)	**DRAINAGE AREA** (acres)
1.00	0.40

BMP LOCATION

Burbank Park-Project #1

LAND USE/COVER TYPE (in drainage area)	**% OF DRAINAGE AREA**
FOREST, Impervious	90
FOREST, Pervious	10

+ land use/cover

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr)			**ESTIMATED FOOTPRINT (sf)**	**ESTIMATED COST ($)**
TN: 3.05566	TP: 0.41139	TSS: 232.65038	705.8	13,197

Burbank Park - Project #2

Site Description: An approximate 300 foot stretch of lake edge between the parking area and the Conroy Pavilion on Onota Lake lacks a riparian buffer. There is a maintained lawn up to the lake edge encouraging the Canada goose population to frequent the area. Visitors use this area for accessing the lake and it is where the audience picnics during lawn concerts.

Figure C-25: Burbank Park Project #2 Proposed BMP with existing infrastructure

Proposed Improvements:

The section of lakefront between the parking area and the Conroy Pavilion is mostly mowed lawn up to the lake's edge. The proposal would be to create a 25–50-foot riparian buffer with planting native trees and shrubs and creating a no-mow area to naturally revegetate the area. Stabilized access points to the lake will be built to ensure continued lake access. Weston, Massachusetts Conservation Commission's buffer planting resource recommends the following: One (1) sapling, 6-8' tall, for every 150 square feet; One (1) shrub, at least 24" tall, for every 80 square feet; One (1) herbaceous or groundcover plant for every 25 square feet, OR a native plant seed mix at the recommended coverage rate. If the full 12,750 square foot area was to be planted, the cost of plantings is estimated at $40,000.

Burbank Park - Project #3

Site Description: The spur road off of Lakeway Drive leading to the Onota Lake public boat access is relatively steep with stormwater directed to existing deep sump catch basins which lead to an outfall at the lake. There is existing space along the road and at the bend to install stormwater management measures. Evidence of eroded road edge and the existing informal curb cut indicates a significant volume of runoff is generated on the boat access road.

Figure C-26: Burbank Park Project #3 Proposed BMP with existing stormwater infrastructure

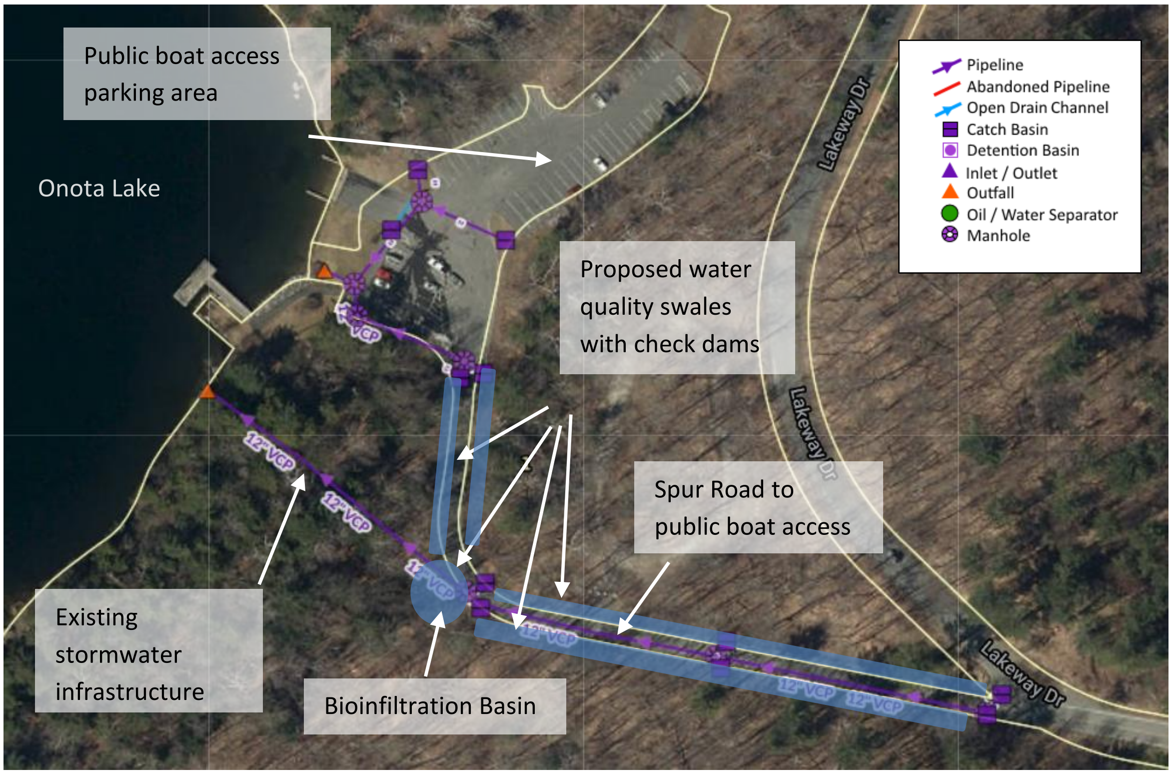
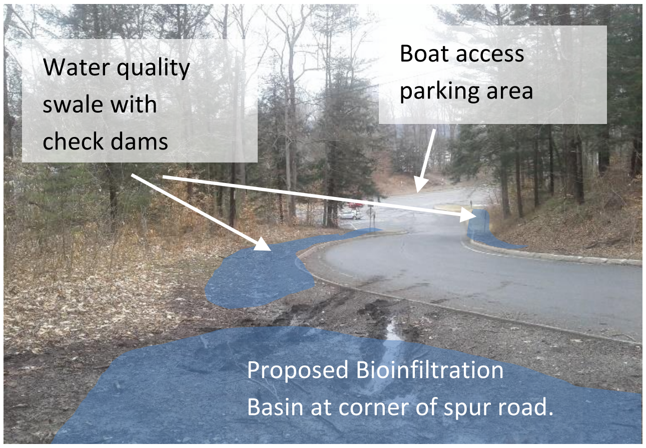


Photo C-30: An existing curb cut allows stormwater to enter the grassed edge. (North side of the access road east of the curve.)

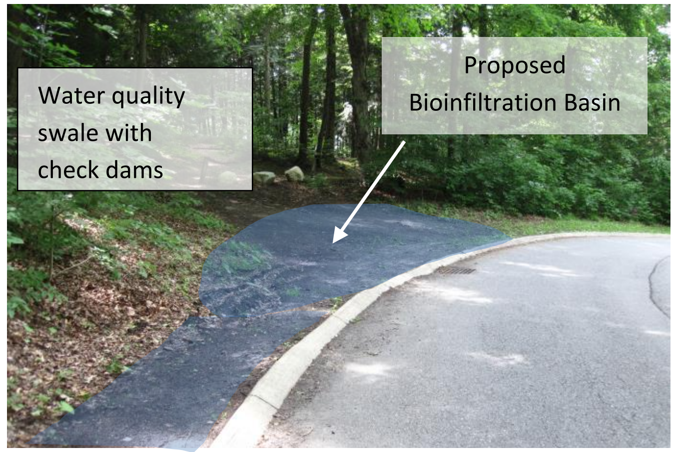
Proposed Improvements:

The goal of this project is to reduce the volume of stormwater entering the lake through the existing stormwater infrastructure by installing water quality swales with check dams along both sides of the boat access road. Curb cuts will be required to allow the stormwater to enter the water quality swales. The swale on the south side of the road would lead to a bioinfiltration basin at the corner of the spur road. The existing stormwater infrastructure would be left in place. Stormwater overflow would be directed from the infiltration basin to the water quality swale that leads to the boat access parking area where there are existing deep sump catch basins.

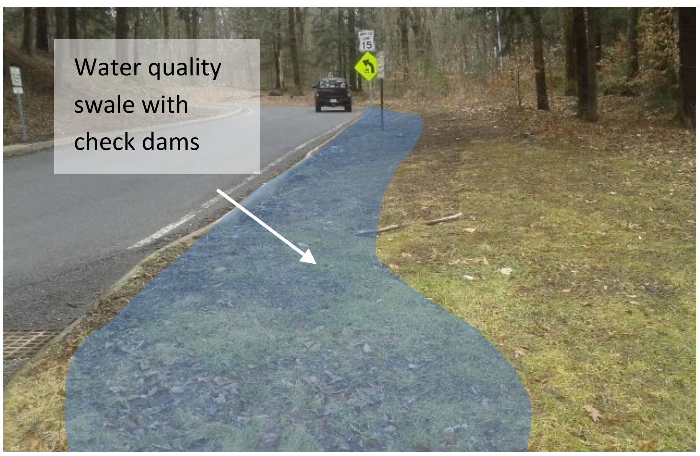
Photo C-31: Potential Improvements for the Onota Lake Boat Access Road



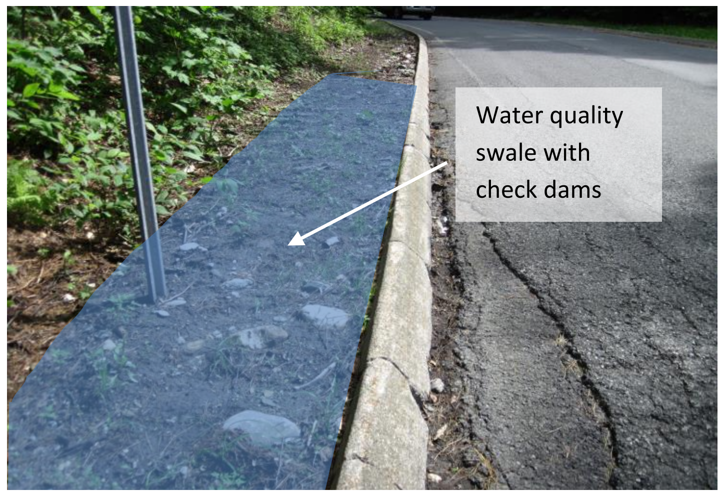
Corner on western side of the boat access spur road looking to the parking area.



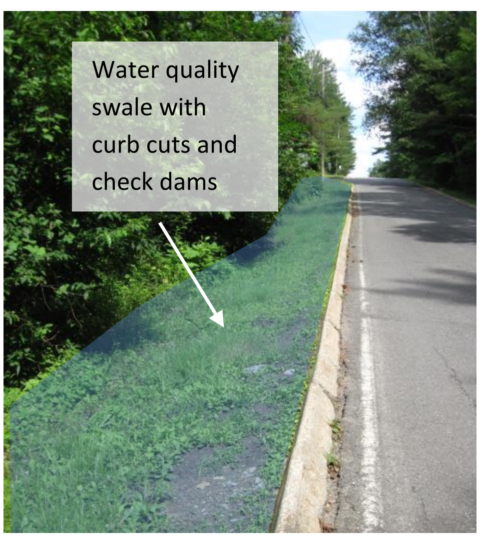
Corner on western side of the boat access spur road looking towards the lake.



West side of Onota Lake boat access spur road



East side of Onota Lake boat access spur road



North side of spur road east of the curve.

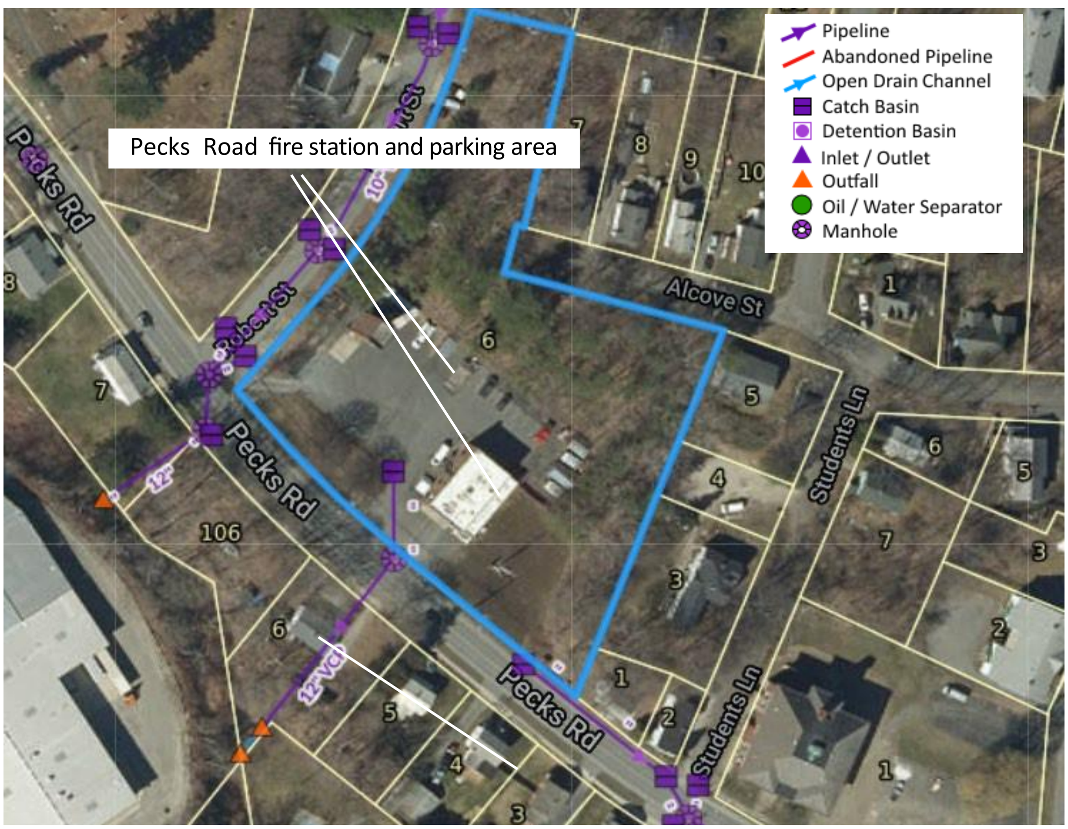
North side of spur road east of the curve.

Pecks Road Fire Station

Location: 54 Pecks Road**,** Pittsfield (42.468146, -73.254819)
Property Ownership: City of Pittsfield
Conceptual design prepared by: BRPC (2024)

Site description: The Pecks Road fire station site includes impervious parking area and buildings (approximately 30,000 square feet). Runoff from this site collects primarily at a single storm drain located in the southern portion of the site. The remaining runoff flows down to Pecks Road from the access road. Storm drains in this vicinity discharge to Onota Brook. The storm drain located within the parking lot discharges at an outfall located about 25 feet from the brook into an open channel. On site is a building used for fire practice. A vegetated area along the road frontage provides an opportunity for stormwater improvements. :Limitations include two mature trees, a fire hydrant and chain link fence.

Figure C-27: Pecks Road Fire House Project Locus Map with Existing Stormwater Infrastructure



Proposed Improvements: Infiltrate the stormwater from the fire house parking lot into two bioretention basins. The estimated footprint for the bioretention basins are about 60 square feet and 934 sq.ft which would be located in existing lawn area. A proposed raised inlet in the larger basin would connect to the existing storm drain system to capture overflow. The existing fence would have to be raised and curb cuts made to allow stormwater to flow into the larger bioretention basin. The Bioretention basins would be installed outside of the root structure of the two existing trees.

BMP TYPE (edit)

BIORETENTION AND RAIN GARDENS

BMP SIZE (design storm depth; inches)	DRAINAGE AREA (acres)	LAND USE/COVER TYPE (in drainage area)	% OF DRAINAGE AREA
1.00	0.50	COMMERCIAL, Impervious	98
		COMMERCIAL, Pervious	2

Project #1

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr)			ESTIMATED FOOTPRINT (sf)	ESTIMATED COST ($)
TN: 0.33086	TP: 0.03925	TSS: 11.00187	56.6	989

Project #2

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr)			ESTIMATED FOOTPRINT (sf)	ESTIMATED COST ($)
TN: 5.51429	TP: 0.65408	TSS: 183.36453	942.8	16,496

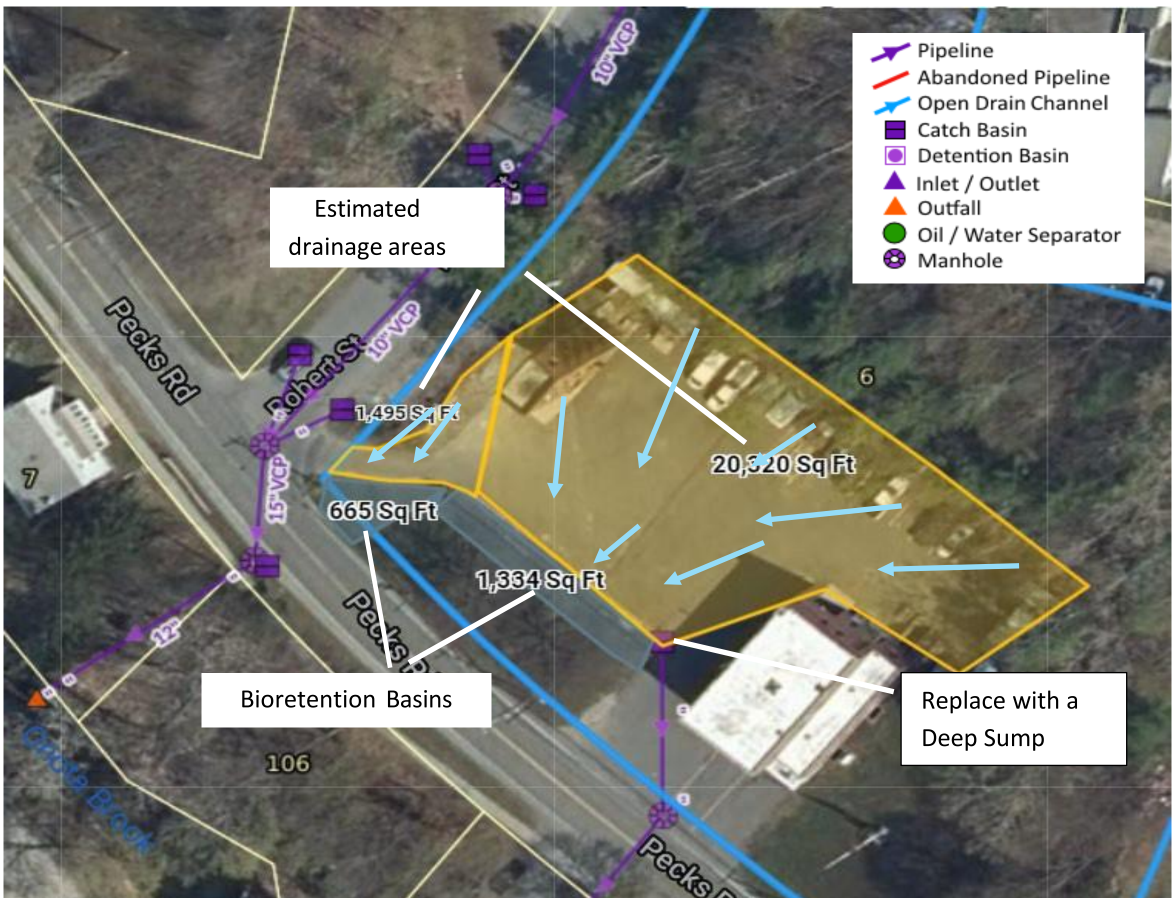


Figure C-28: Pecks Road Fire House Proposed BMPs with drainage areas

Photo C-32: Fire House entrance with Bioinfiltration basins locations

Pecks Road Fire Station Improvements' Summary

Proposed BMPs: Bioretention Basins (2); Deep Sump Catch Basin (1)

Estimated Nutrient Load Reduction:

	Project #1	Project #2
Total Nitrogen:	0.33 lbs/year	5.5 lbs/year
Total Phosphorous:	0.04 lbs/year	0.65 lbs/year
Total Suspended Solids:	11 lbs/year	183.3 lbs/year
Estimated Cost:	$2,500	$41,250
Estimated O & M Costs:	$1,200	$3,000

Required Permits: Notice of Intent

Melville Street Parking Area, Pittsfield

Location: 330 North Street, opposite Boys and Girls Club, 16 Melville Street) (42.4530626, -73.2513961)
Property Ownership: City of Pittsfield
Conceptual design prepared by: BRPC (2024)

Site Description: This is a city-owned and managed parking area of approximately 1.4 acres that is in disrepair. It provides overnight parking for people living in nearby and 3-hour parking for people using downtown businesses including the Senior Center, the Boys and Girls Club and the Berkshire Family YMCA.

Redevelopment of this parking lot provides an opportunity for stormwater improvements. While this site is located in the West Branch watershed, the existing stormwater infrastructure appears to be directed to Silver Lake in the East Branch watershed. The parking lot tends to drain towards the eastern side and southeast corner.

Figure C-29: Melville Street Municipal Parking lot Project Existing Stormwater Infrastructure

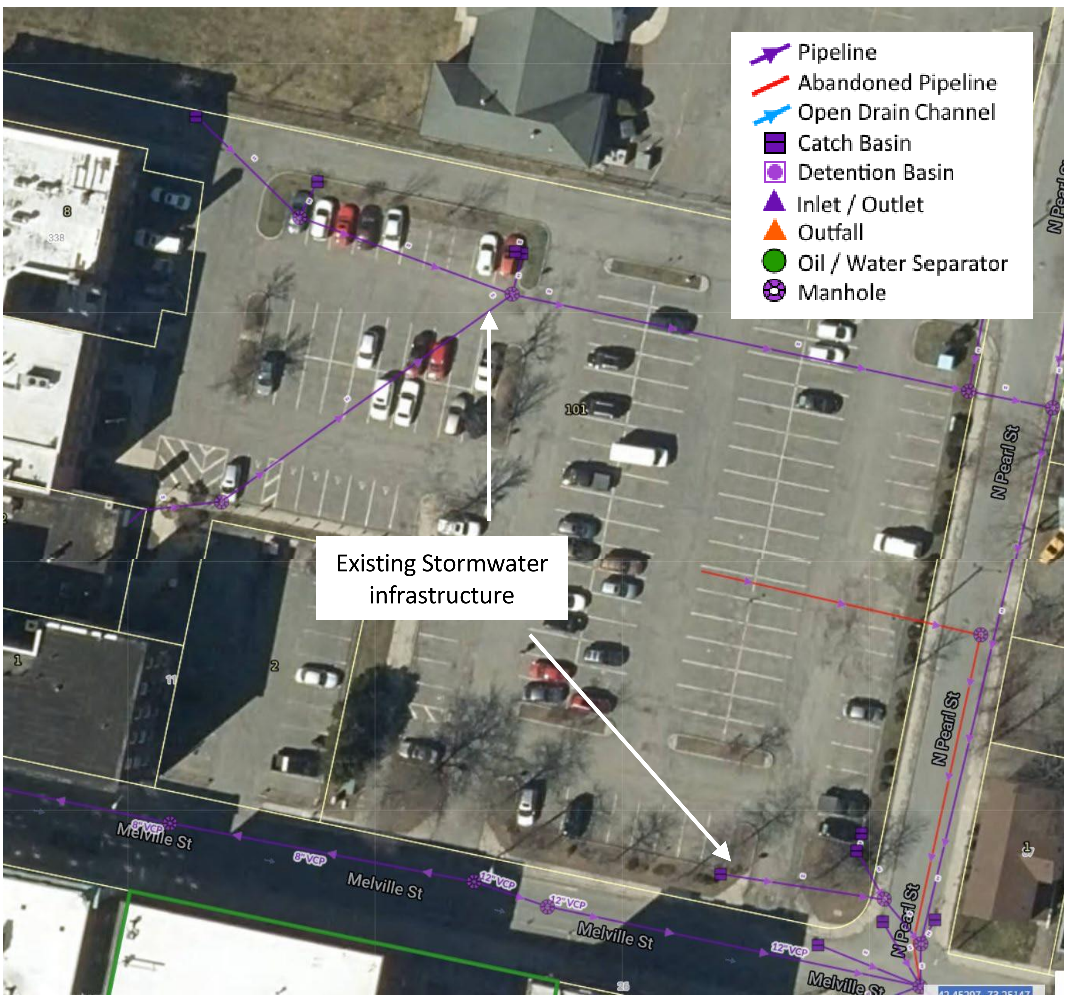
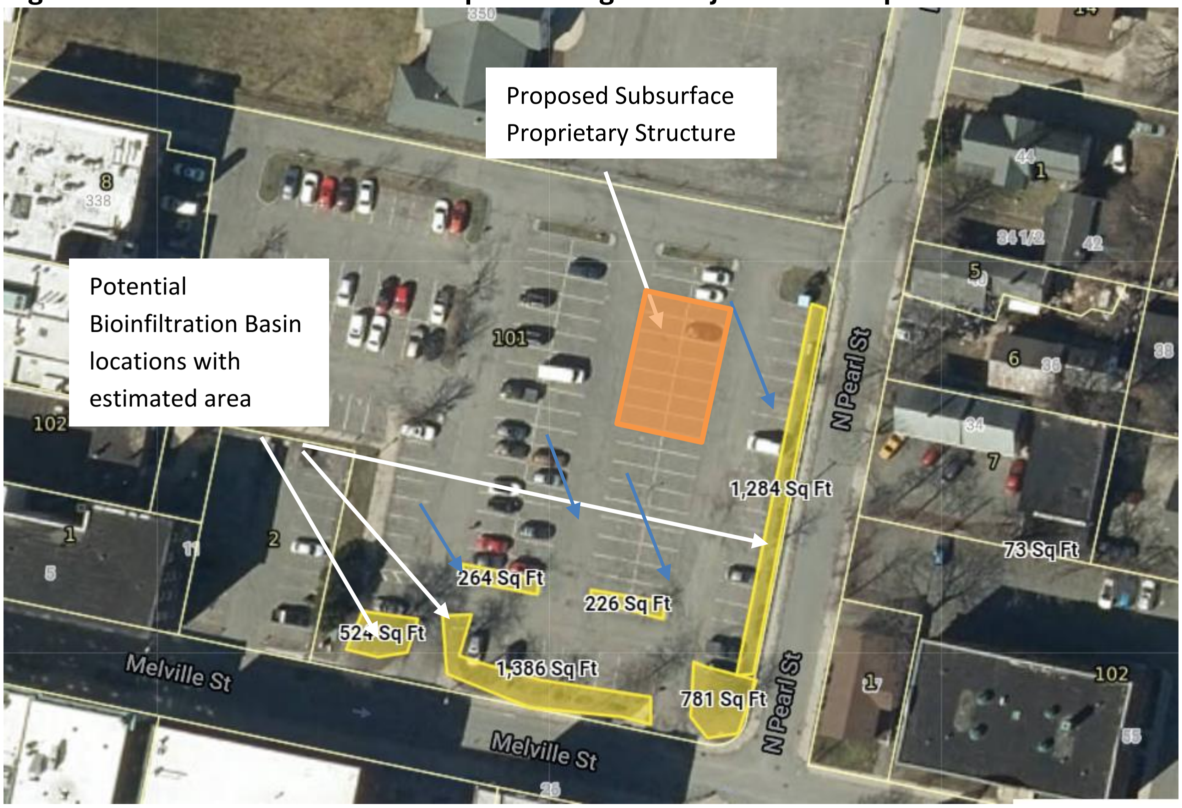


Figure C-30: Melville Street Municipal Parking lot Project with Proposed BMPs



Proposed Improvements:

Construct a subsurface proprietary structure to contain the stormwater and reduce pollutant load. Sizing is estimated at about 2,000 square feet. The existing layout of the parking lot includes several green islands. Consideration could be given to installing one or more bioinfiltration sites to reduce the stormwater volume and infiltrate pollutants. The size of the bioretention areas would need to be about 2700 square feet. Figure C-28 shows that an estimated 4,000 square foot area is available for bioinfiltration areas.

Melville Street Parking Area Pollutant Load Reduction Estimates

Subsurface Proprietary Structure

BMP TYPE (edit)
SUBSURFACE STRUCTURE

BMP SIZE (design storm depth; inches)	DRAINAGE AREA (acres)
1.00	1.43

BMP LOCATION
Melville Street Parking lot, Pittsfield

LAND USE/COVER TYPE (in drainage area)	% OF DRAINAGE AREA
HIGH DENSITY RESIDENTIAL, Impervious	100

+ land use/cover

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr)			ESTIMATED FOOTPRINT (sf)	ESTIMATED COST ($)
TN: 19.75477	TP: 3.05176	TSS: 627.70261	1,972.5	74,264

Bioretention areas

BMP TYPE (edit)
BIORETENTION AND RAIN GARDENS

BMP SIZE (design storm depth; inches)	DRAINAGE AREA (acres)
1.00	1.43

BMP LOCATION
Melville Street Parking lot, Pittsfield

LAND USE/COVER TYPE (in drainage area)	% OF DRAINAGE AREA
HIGH DENSITY RESIDENTIAL, Impervious	100

+ land use/cover

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr)			ESTIMATED FOOTPRINT (sf)	ESTIMATED COST ($)
TN: 15.02169	TP: 2.47823	TSS: 621.42558	2,739.6	47,179

Melville Street Parking Area Improvements' Summary

Proposed BMPs: Subsurface (Proprietary) Structure and Bioinfiltration Basins

Estimated Nutrient Load Reduction:

	Project #1	Project #2
Total Nitrogen:	19.75 lbs/year	15.0 lbs/year
Total Phosphorous:	3.06 lbs/year	2.5 lbs/year
Total Suspended Solids:	627.7 lbs/year	621.4 lbs/year
Estimated Cost:	$185,660	$118,000
Estimated O & M Costs:	$6,000	$4,000

Required Permits: Local city permits

George B. Crane Memorial Center

Location: 81 Linden Street, Pittsfield (42.455907, -73.255435)
Property Ownership: Sioga Club of Berkshire County, Inc.
Conceptual design prepared by: BRPC (2024)

Site Description: The George B Crane Memorial Center is in the planning stages of asphalting its parking lot (approximately 8000 square feet) which is currently gravel with eroded and flooded areas. The organization is interested in managing the stormwater that will be generated from the asphalt surface and infiltrating it into the ground. A residence adjacent to the parking area experiences flooding and the roof runoff contributes stormwater to the parking area.

Photo C-33: View of proposed BMP locations with respect to the parking area

Proposed Improvements:

1. Convert the gravel parking lot to an asphalt surface and have the surface graded towards the rear of the lot.
2. Install a bioinfiltration basin of approximately 795 square feet.
3. Install a French drain (approximately 37 feet long) in front of the residence to direct the roof runoff towards the bioinfiltration basin.

Figure C-31: George B. Crane Memorial Center Proposed BMP Solutions

Photo C-34: View of George B Crane Memorial parking area and location of rain garden

Photo C-35: View of proposed rain garden location

George B. Crane Memorial Center Proposed Pollutant Load Reduction Estimates

BMP TYPE (edit)

BIORETENTION AND RAIN GARDENS

BMP SIZE (design storm depth; inches)	DRAINAGE AREA (acres)
1.50	0.18

BMP LOCATION

Crane Center, Linden Street

LAND USE/COVER TYPE (in drainage area)	% OF DRAINAGE AREA
COMMERCIAL, Impervious	100

+ land use/cover

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr)

TN:	TP:	TSS:	ESTIMATED FOOTPRINT (sf)	ESTIMATED COST ($)
2.22496	0.27137	67.93063	517.3	8,853

BMP TYPE (edit)

INFILTRATION TRENCH

BMP SIZE (design storm depth; inches)	DRAINAGE AREA (acres)
1.50	0.03

BMP LOCATION

Crane Center, Linden Street

LAND USE/COVER TYPE (in drainage area)	% OF DRAINAGE AREA
COMMERCIAL, Impervious	100

+ land use/cover

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr)

TN:	TP:	TSS:	ESTIMATED FOOTPRINT (sf)	ESTIMATED COST ($)
0.44781	0.05192	11.32177	64.7	610

George B. Crane Center Parking Area Improvements' Summary

Proposed BMPs: Bioninfiltration Basin and Infiltration Trench

Estimated Nutrient Load Reduction:

Total Nitrogen:	2.67 lbs/year
Total Phosphorous:	0.32 lbs/year
Total Suspended Solids:	79.3 lbs/year

Estimated Cost: $64,000

Estimated O & M Costs: $500

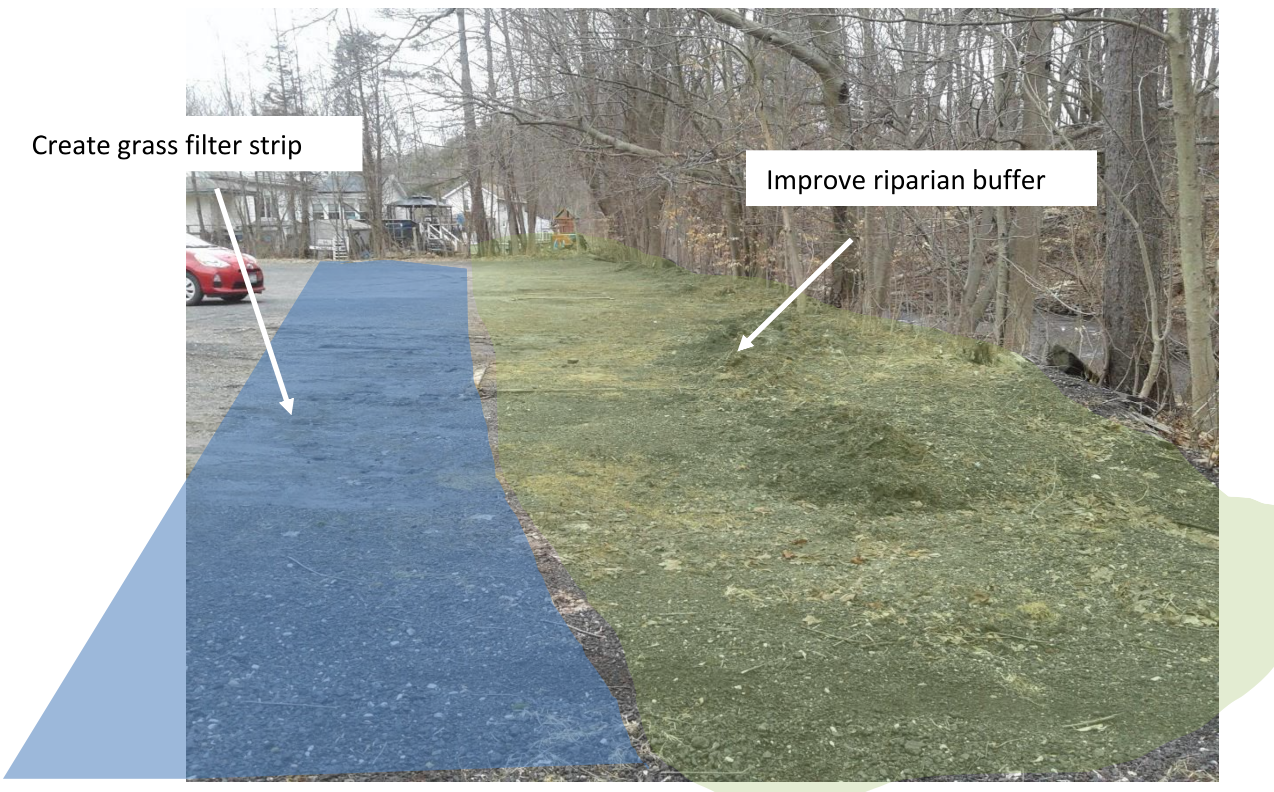
Required Permits: Local city permits

Polish Falcons of America

Location: 32 Bel Air Avenue, Pittsfield (42.46702, -73.24979)
Property Ownership: Polish Falcons of America Nest 580
Conceptual design prepared by: BRPC (2024)

Site description: The Polish Falcon Club is located on a fairly level lot on the bank of the West Branch. There is a gravel parking lot which is approximately 20,000 square feet in size located either side of the building. The roof area is approximately 7,000 square feet. There is a narrow (10 – 15 foot) riparian buffer which consists mostly of invasive Norway maple trees. Winter plowing pushes snow and gravel towards the river's edge and resulting in sediment, snow, and potentially salt migrating over the stream bank and into the river.

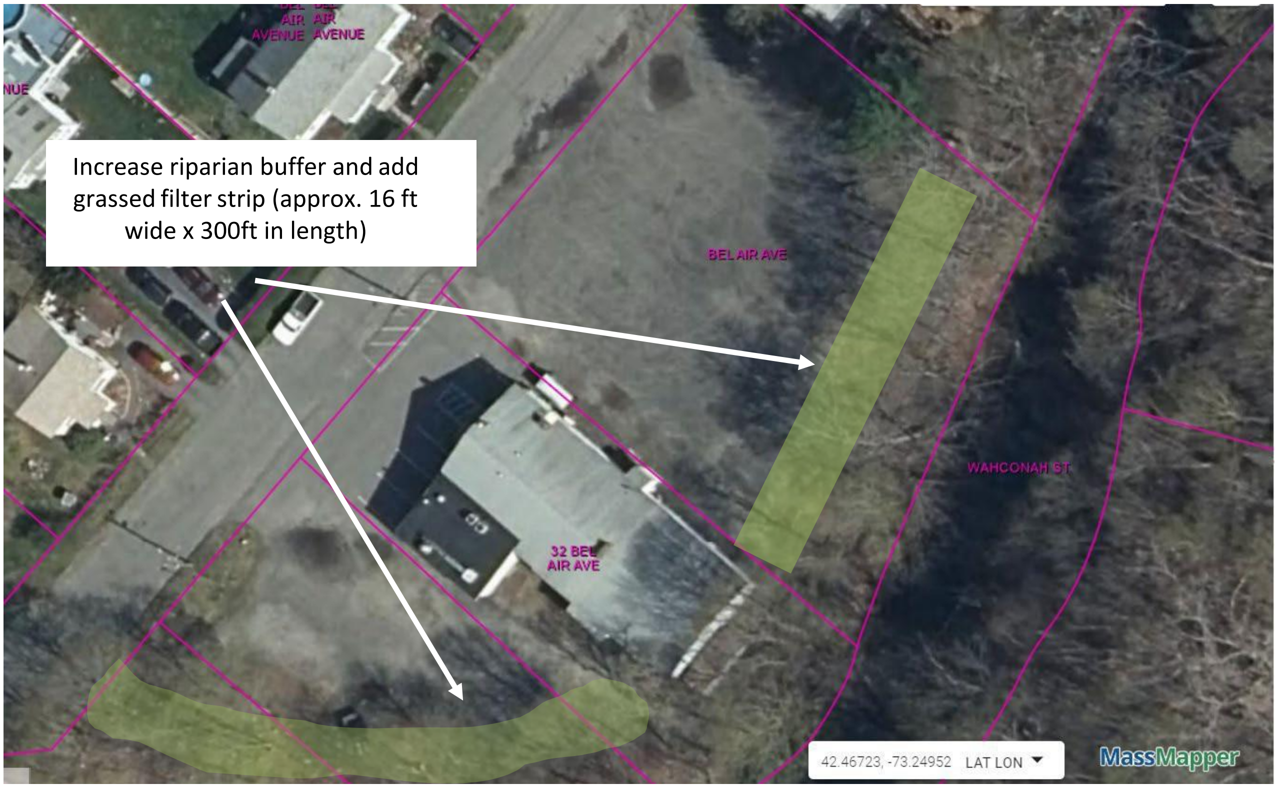
Photo C-36: Polish Falcon Club parking lot showing edge next to West Branch (north side of building lot).



Proposed Improvements:

- Remove existing piles of sediment.
- Pull back parking area from river, add 10 feet to the buffer by planting native trees and shrubs (two areas north (130 feet) and south (180 feet) of the building)
- Plant grassy filter strip (6-8 ft width)at edge of buffer for snow storage.

Figure C-32: Polish Falcon Club Proposed BMPs in Plan Layout



Polish Falcons Club Improvements' Summary

Proposed BMPs: Improved Riparian Buffer with Grass Filter Strip

***Estimated Nutrient Load Reduction:**

Total Nitrogen:	0.84lbs/year
Total Phosphorous:	0.22 lbs/year
Total Suspended Solids:	162 lbs/year

*Based on water quality swale/grassed channel PLERs and drainage area 20,000 square feet

Estimated Cost: $38,000

Estimated O & M Costs: $500

Required Permits: Notice of Intent

Wilson Park

Location: Adjacent to 2 Doyle Drive, Pittsfield (42.47570, -73.24959)
Property Ownership: Managed by Pittsfield Housing Authority
Conceptual design prepared by: BRPC (2024)

Site description: The proposed project is located within the Wilson Park, a development area managed by Pittsfield Housing Authority. The project sites are opposite the maintenance building and adjacent to the playground/park area which is in the conceptual stages of redevelopment.

Doyle Drive slopes gradually and then steeply to the east and runoff from the asphalt road flows to two existing storm drains near the bottom of the hill. It is unclear where the storm drains outfall and if they connect to the city infrastructure. The goal is to capture the stormwater runoff from Doyle Drive and adjacent residential properties and driveways and the maintenance buildings and yard and infiltrate it in two locations. Soil is well-drained and loamy. The site is located near the top of a hill.

Wilson Park Improvements' Summary

Proposed BMPs: Bioretention Basins (2)

Estimated Nutrient Load Reduction:

	Project #1	Project #2
Total Nitrogen:	0.95 lbs/year	2.21 lbs/year
Total Phosphorous:	0.13 lbs/year	0.26 lbs/year
Total Suspended Solids:	39.4 lbs/year	73.4 lbs/year
Estimated Cost:	$8,250	$16,500
Total Estimated O & M Costs:	$2,500	

Required Permits: None known

Wilson Park Project #1

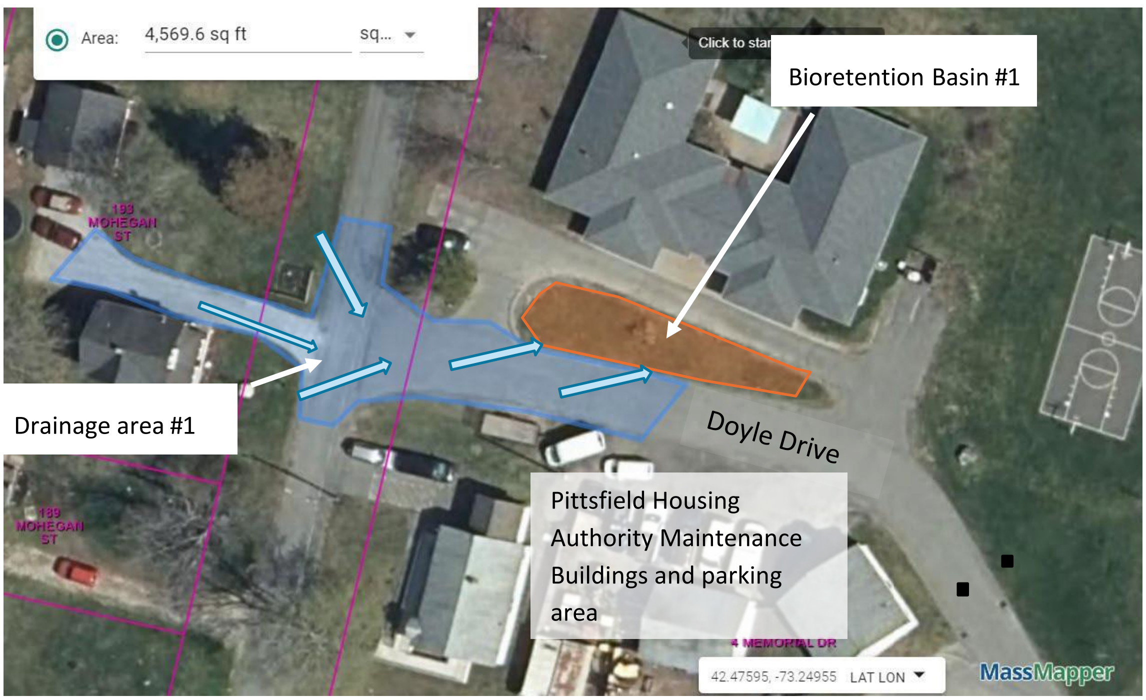
BMP TYPE (edit)	BIORETENTION AND RAIN GARDENS
BMP SIZE (design storm depth; inches)	1.00
DRAINAGE AREA (acres)	0.10
BMP LOCATION	Wilson Park, Pittsfield

LAND USE/COVER TYPE (in drainage area)	% OF DRAINAGE AREA
MEDIUM DENSITY RESIDENTIAL, Impervious	90
MEDIUM DENSITY RESIDENTIAL, Pervious	10

+ land use/cover

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr) TN:	TP:	TSS:	ESTIMATED FOOTPRINT (sf)	ESTIMATED COST ($)
0.95406	0.13284	39.40218	176.5	3,299

Figure C-33: Wilson Park Project #1 Proposed BMPs in Plan Layout



Proposed Improvements:

Construction of a 1000 square foot bioretention basin / rain garden in the existing grassed median would more than handle the volume of run off from the approximately 0.1 acre drainage area as shown in **Figure C-33**. The area of the existing median is approximately 1500 square feet. There is evidence of water ponding occurring in the central part of the northern edge of the existing grassed median. A rock lined infiltration strip along the southern and western edges of the basin will allow stormwater to enter and help capture sediment. The infiltration basin could be planted with pollinator friendly plants to beautify the area or be a grass-lined basin which would allow for easy maintenance by mowing. Sediment would have to be periodically removed.

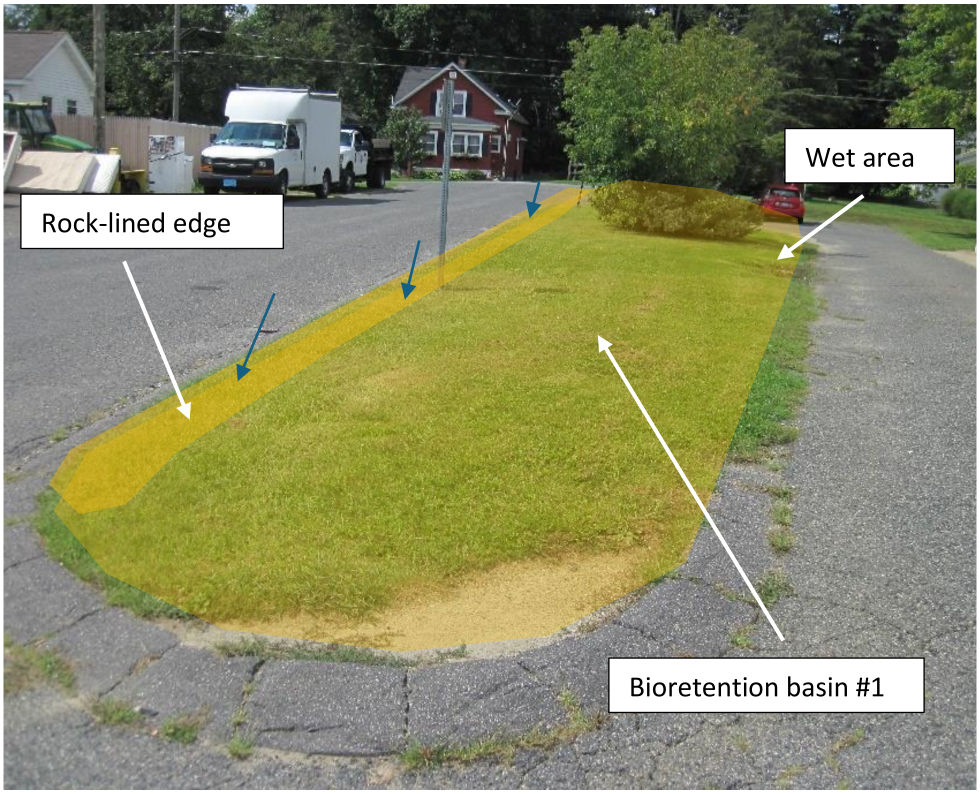


Photo C-37: Wilson Park Site photo of grassed median on Doyle Drive with location of Bioretention Basin #1 looking west. (*Blue arrows indicate direction of stormwater flow.*)

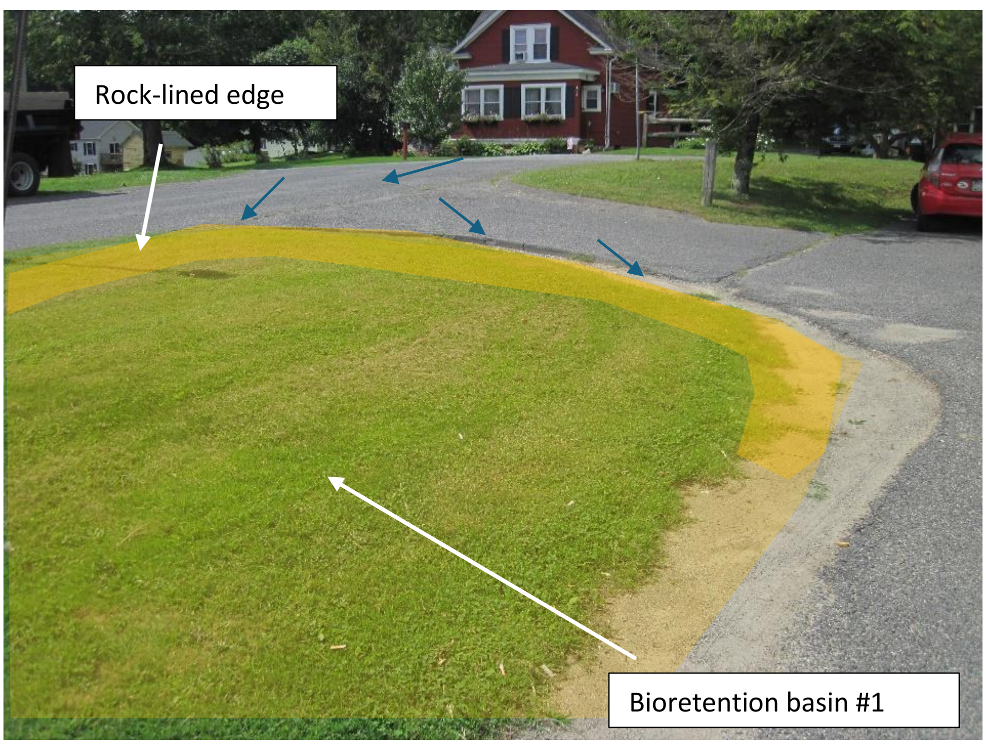


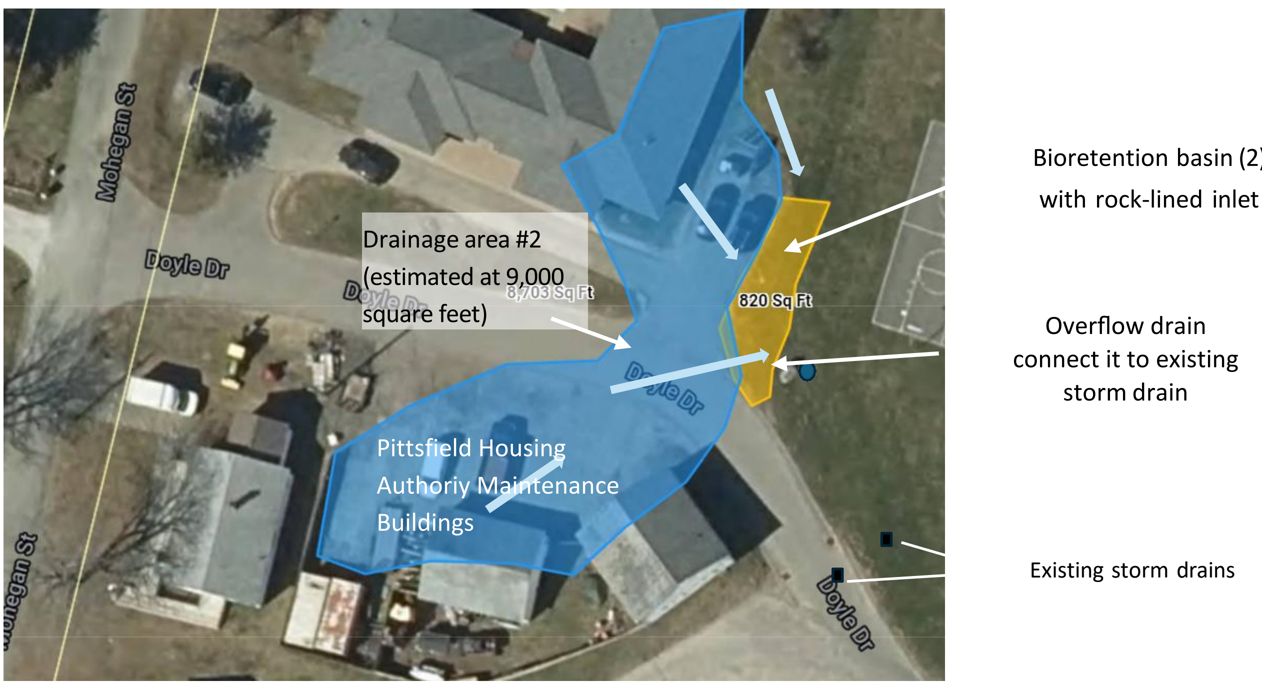
Photo C-38: Wilson Park Site photo of the western portion of the grassed median on Doyle Drive with location of Bioretention Basin #1. *(Blue arrows indicate direction of stormwater flow.)*

Wilson Park Project #2

BMP TYPE (edit)		LAND USE/COVER TYPE (in drainage area)	% OF DRAINAGE AREA
BIORETENTION AND RAIN GARDENS		COMMERCIAL, Impervious	98
BMP SIZE (design storm depth; inches)	DRAINAGE AREA (acres)	MEDIUM DENSITY RESIDENTIAL, Pervious	2
1.00	0.20	+ land use/cover	
BMP LOCATION			
Wilson Park, Pittsfield			

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr)			ESTIMATED FOOTPRINT (sf)	ESTIMATED COST ($)
TN: 2.20572	TP: 0.26163	TSS: 73.34581	377.1	6,598

Figure C-34: Wilson Park Project #2 Proposed BMPs in Plan Layout



Proposed Improvements:

Construct a bioretention basin (approx. 400 square feet) within the existing lawn area which is estimated at 800 square feet as shown in **Figure C-34**. This bioretention basin would be located between the accessible parking areas as shown in the Wilson Park Playground Conceptual (**Figure C-36**). A rock-lined inlet along the road edge would allow the stormwater to enter and capture sediment. Overflow would be captured with a raised inlet which would connect with the existing stormwater infrastructure. Refer to **Photo C-39** for a site view of the conceptual.

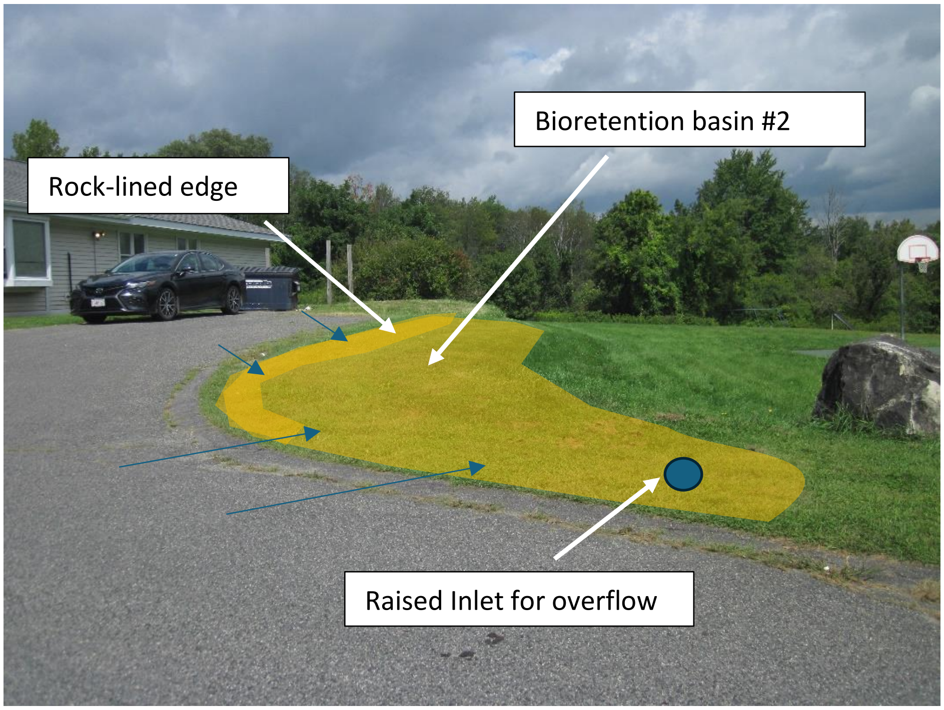


Photo C-39: Wilson Park Site photo of the location of Bioretention Basin #2 ***(Blue arrows indicate direction of stormwater flow.)***

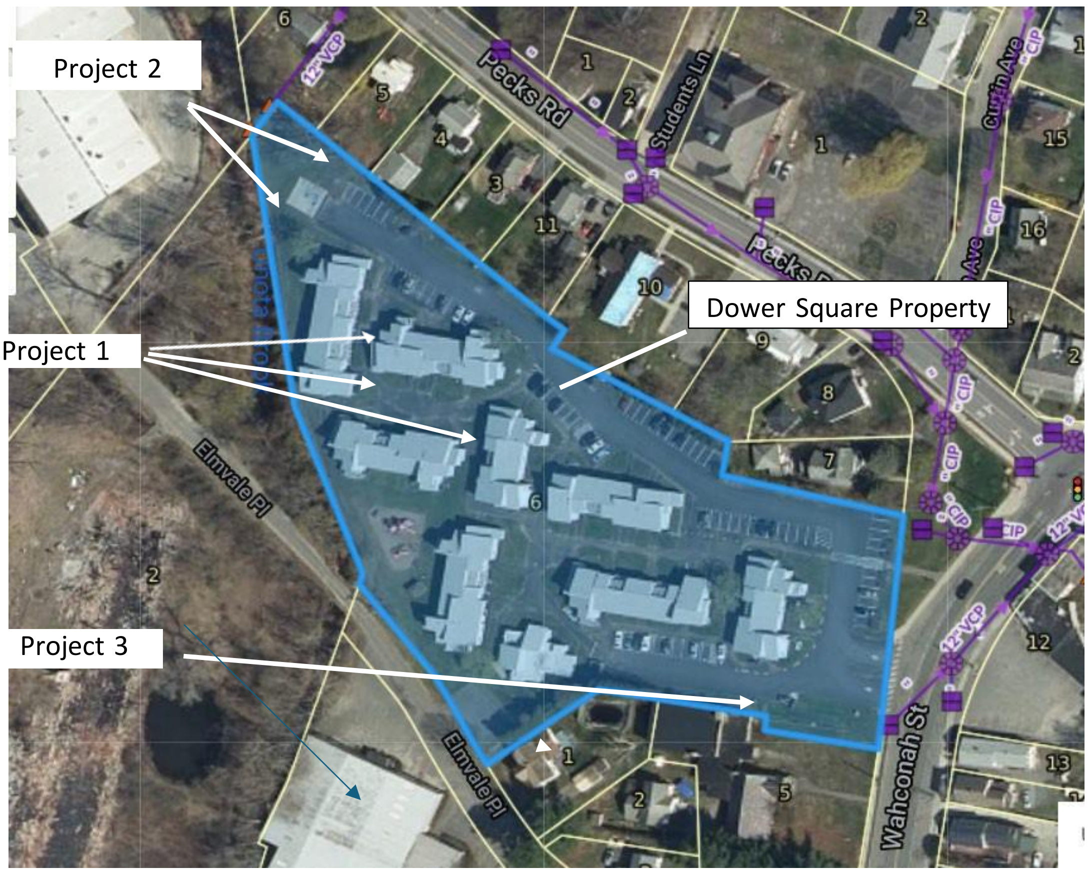
Figure C-35: Wilson Park Proposed BMPs in Playground Conceptual

Dower Square

Location: 253 Wahconah Street, Pittsfield (42.46647, -73.254727)
Property Ownership: Pittsfield Housing Authority 65 Columbus Avenue, Pittsfield
Conceptual design prepared by: BRPC (2024)

Site description: Dower Square is a multifamily housing area located on the banks of Onota Brook, a tributary of West Branch. Multiple storm drains exist on the property to collect runoff from buildings parking and lawn areas. The stormwater is discharged primarily to Onota Brook. The storm drains on the eastern section of the property may connect with the city's infrastructure and discharge to the West Branch. Several storm drains are located on the property with some in lawn areas and some were observed to be severely clogged.

Figure C-36: Dower Square Project Locus Map



Dower Square- Project #1

Site Description: There are five locations on the property where storm drains are located in the pedestrian pathways or lawn. These storm drains most probably outfall to Onota Brook. Some of the storm drains were observed to be partially filled with sediment and in need of cleaning. The catchment area for each storm drain was estimated to be approximately 2000 square feet.

Figure C-37: Locations of storm drains in pedestrian pathway/lawn areas

Proposed Improvements:

1. Set up a maintenance program to clean out all existing catch basins once a year.
2. Map the stormwater infrastructure.
3. At the six locations where the storm drains are located in the lawn, convert to bioinfiltration basins with raised inlets that connect with the existing storm drain system to capture overflow. These basins could be grass-lined to facilitate maintenance.

Photos C-40: Dower Square Project #1 Storm drain locations

In front of Unit #29

In front of Unit #22

In front of Unit #11

In front of Unit #13

Near Unit #44

Dower Square- Project #2

Site Description: At the northwestern corner of Dower Square is a small fenced in basketball area at the end of a parking area. On the southwest corner of this parking area, an existing storm drain discharges the stormwater generated by the parking area to Onota Brook. The southern side of the parking lot has a sidewalk with curb. The northwest corner is a low spot where runoff seems to also collect.

Photo C-41: Existing catch basin with Bioinfiltration basin

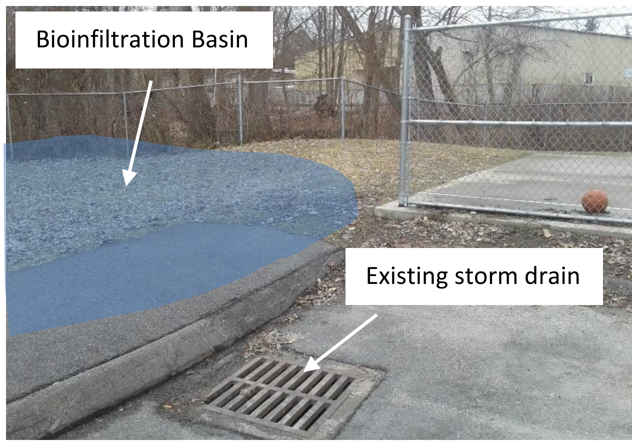
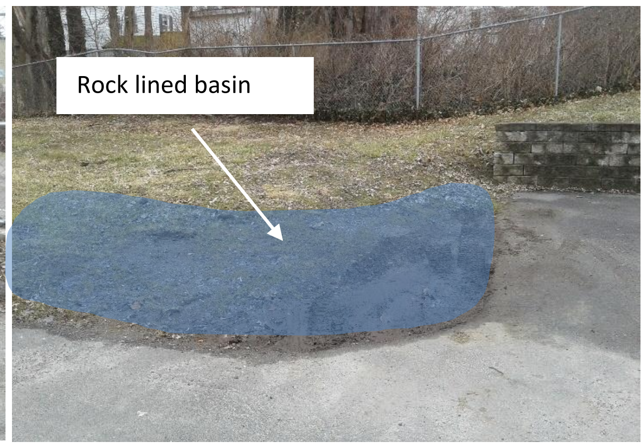


Photo C-42: Northwest corner



Proposed Improvements:

- Disconnect the existing storm drain and remove a portion of the curb and sidewalk.
- Install a bioinfiltration basin with a raised inlet for overflow which would connect to the existing outfall pipe.
- At the edge of the asphalt on the northwest corner of the parking area, create a rock-lined basin to capture stormwater.

Dower Square- Project #3

Site Description: Near the dumpster at the southeastern corner of Dower Square is a grassed area with an existing storm drain. It is unclear where this storm drain discharges, but it may connect with the city infrastructure and discharge to the nearby West Branch of the Housatonic River. There are existing grassed areas that could be used for a stormwater BMP installation.

Photo C-43: Existing grassed area

Photo C-44: Existing storm drain

Proposed Improvements:

- Disconnect the existing storm drain
- Direct stormwater into a bioretention basin (approximately 600 square feet) in the existing grassed area behind the dumpster.
- Install a raised inlet/overflow drain that connects with existing stormwater infrastructure.

Dower Square Improvements' Summary

Proposed BMPs: Multiple Bioinfiltration Basins with raised inlets

Estimated Nutrient Load Reduction:

	Project #1	Project #2	Project #3
Total Nitrogen:	0.3 lbs/year	3.46 lbs/year	0.84 lbs/year
Total Phosphorous:	0.04lbs/year	0.5 lbs/year	0.12 lbs/year
Total Suspended Solids:	11.7 lbs/year	131.3 lbs/year	31.8 lbs/year
Estimated Cost:	$6,150	$40,575	$9,835
Estimated O & M Costs:	$1,200	$2,000	$1,000

Required Permits: Notice of Intent

Dower Square Pollutant Load Reduction Estimates:

BMP TYPE (edit)

BIORETENTION AND RAIN GARDENS

BMP SIZE (design storm depth; inches): 1.50

DRAINAGE AREA (acres): 0.05

BMP LOCATION

Dower Square - Project 1

LAND USE/COVER TYPE (in drainage area)	% OF DRAINAGE AREA
LOW DENSITY RESIDENTIAL, Pervious	50
MEDIUM DENSITY RESIDENTIAL, Impervious	50

+ land use/cover

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr) TN:	TP:	TSS:	ESTIMATED FOOTPRINT (sf)	ESTIMATED COST ($)
0.31268	0.04391	11.70987	87	2,459

BMP TYPE (edit)

BIORETENTION AND RAIN GARDENS

BMP SIZE (design storm depth; inches): 1.50

DRAINAGE AREA (acres): 0.33

BMP LOCATION

Dower Square - Project 2

LAND USE/COVER TYPE (in drainage area)	% OF DRAINAGE AREA
MEDIUM DENSITY RESIDENTIAL, Impervious	90
MEDIUM DENSITY RESIDENTIAL, Pervious	10

+ land use/cover

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr) TN:	TP:	TSS:	ESTIMATED FOOTPRINT (sf)	ESTIMATED COST ($)
3.46361	0.49577	131.34059	873.5	16,230

BMP TYPE (edit)

BIORETENTION AND RAIN GARDENS

BMP SIZE (design storm depth; inches): 1.50

DRAINAGE AREA (acres): 0.08

BMP LOCATION

Dower Square #3

LAND USE/COVER TYPE (in drainage area)	% OF DRAINAGE AREA
MEDIUM DENSITY RESIDENTIAL, Impervious	90
MEDIUM DENSITY RESIDENTIAL, Pervious	10

+ land use/cover

ESTIMATED POLLUTANT LOAD REDUCTIONS (lbs/yr) TN:	TP:	TSS:	ESTIMATED FOOTPRINT (sf)	ESTIMATED COST ($)
0.83966	0.12019	31.84014	211.8	3,934

Central Berkshire Habitat for Humanity, Parking lot

Location: 314 Columbus Avenue, Pittsfield (42.45304, -73.26173)
Property Ownership: Central Habitat for Humanity
Conceptual design prepared by: BRPC (2024)

Site description: The parking area for the Central Berkshire Habitat for Humanity offices needs upgrading. It is currently a dirt parking lot which has developed several puddling spots and can be difficult to maintain especially in the winter. Sediment from plowing the lot has accumulated in the back of the lot which shares the border with Durant Park.

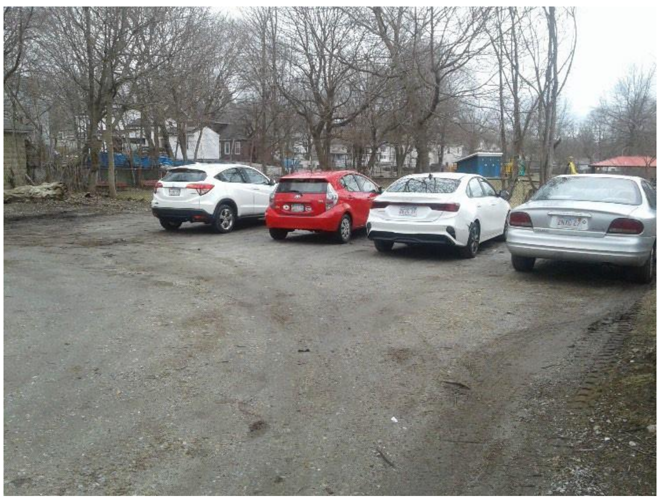


Photo C-45: Parking area view

Photo C-46: Driveway view

Central Berkshire Habitat for Humanity Improvements' Summary

Proposed BMPs: Porous Pavement with Grass Filter Strip

***Estimated Nutrient Load Reduction:**

Total Nitrogen:	1.3 lbs/year
Total Phosphorous:	0.2 lbs/year
Total Suspended Solids:	50.6 lbs/year
Estimated Cost:	$62,640
Estimated O & M Costs:	Unknown

Required Permits: Notice of Intent

Central Berkshire Habitat for Humanity Parking Area Pollutant Load Reduction Estimates

Figure C-38: Proposed BMPs in Plan Layout

Proposed Improvements:

- Remove accumulated sediment from the back of the lot
- Install porous pavement on the parking lot (2364 square feet) and the 30-foot driveway (400 square feet)
- Create a grassed filter strip between pavement and boundary for snow storage.

Proposed Non-Structural BMPs

1. Boat Wash Station, Onota Lake, Pittsfield *(Estimated Cost: $74,500):*

A local car wash had provided a boat wash station for the lakes in Pittsfield, but that is no longer an option. The city and LOPA jointly submitted a Community Preservation Act grant proposal and has received funding for a basic boat wash station at Onota Lake. If zebra mussels sampling confirms an established presence, the city and LOPA will pursue funding to upgrade this boat wash station at an estimated cost of $200,000.

2. Lake Weed Management

Onota Lake, Pittsfield (Estimated Cost: $10 - 15,000): An Order of Conditions (MassDEP 263-1012) was issued in 2014. The current OOC expires April 2027.

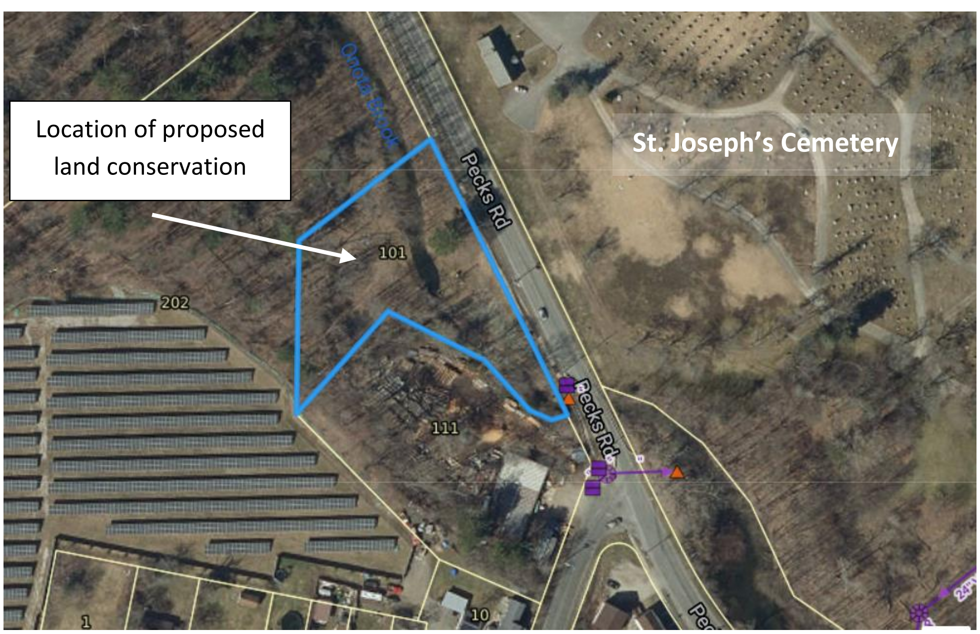
Pontoosuc Lake, Pittsfield and Lanesborough (Estimated Cost: $10 - 15,000):
Lake management costs and activities continue to be shared jointly by the City of Pittsfield and the Town of Lanesborough in a beneficial cooperative arrangement. State Agencies play a major role and contribute significantly, as do the volunteers supporting many organizations.

The municipalities continue the limited use of herbicides to keep the lake useable for recreational users (swimmers, paddlers, waders, as well as people who fish, boat, and water-ski,). This is the major cost element in Pontoosuc lake management.

3. Pecks Road Land Conservation *(Estimated Cost: $25,000):*

The City of Pittsfield has identified this property as a key property to conserve. It is located on Onota Brook (a.k.a. Peck's Brook) and would protect the riparian buffer along this segment of the brook and provide an opportunity to implement BMPs to infiltrate Pecks Road stormwater. The city requires funding to complete the purchase.

Figure C-39: Location of Proposed Pecks Road Land Conservation



4. Storm Drain Decaling (Estimated Cost: $5,000):

Reinitiate a program to decal storm drains that have high public visibility in the City of Pittsfield. Existing decals and glue are housed at HVA. Funding is needed to organize storm drain decaling by interns and volunteers with the support of paid staff. The estimated annual cost of this management measure is for the purchase of any additional supplies and contractor costs.

5. Develop a Green Infrastructure Workforce Training Program (Estimated Cost: $190,000):

Develop a program that would train youth about watershed health and issues and include training in installing simple BMPs such as rain gardens, rain barrels and cisterns, and riparian buffers as well as proper maintenance of existing BMPs. This work force could provide support to municipalities and private property owners with simple BMP implementation such as installing rain gardens, rain barrels, and redirecting roof downspouts towards rain gardens. Trained personnel could also provide much needed GI maintenance and may also be able to assist with water quality monitoring to ensure BMP effectiveness. Trained youth would be an asset to the area and provide much needed employment training. Potential partners include Berkshire Community College, Greenagers, and Mass Hire Berkshire.

Programs that may be helpful in developing this concept include the California Watershed Stewards Program (WSP) and the Rutgers Cooperative Extension Green Infrastructure Championship Program [31][32] Materials already developed such as the *Easthampton Resident's Guide to Stormwater Management* available in English and Spanish is a great resource.[33]

6. Develop an Agricultural Outreach Program (Estimated Cost: $30,000):

HVA has begun outreach to farmers, but more funding will be needed to further develop and continue this work into the West Branch of the Housatonic watershed.

7. Water Quality Monitoring (Estimated Cost: $15,000):

Sampling is recommended to continue approximately once per month from May through October to understand the water quality in the West Branch of the Housatonic Watershed, including determining sources for pollution and tracking achievements toward water quality goals. At a minimum, parameters tested should include analysis of *E. coli,* TSS and TN. Additional parameters such as TP, dissolved oxygen, temperature, conductivity, pH, and flow rate could provide additional data to support BMP implementation and track if BMPs are having a positive impact on water quality.

8. Develop a West Branch Working Group (Estimated Cost $6000):

There are several stakeholders in the West Branch that could be brought together as an informal coalition led by BRPC to implement the plan. At a minimum, the goal would be to meet annually, develop a work plan to prioritize implementation, develop a tracking mechanism to coordinate implementations by partners, evaluate actions annually to assess progress, adjust plan implementation.

[31] https://ccc.ca.gov/what-we-do/conservation-programs/wsp-watershed-stewards-program/

[32] http://water.rutgers.edu/Projects/GreenInfrastructureChampions/2022%20Sessions/Class_1_01142022.pdf

[33] https://easthamptonma.gov/DocumentCenter/View/3891/Residential-Guide-to-Stormwater-Management---English?bidId=

Until this is in place, BRPC will serve as the coordinator and through regular meetings with the various stakeholders continue to advance the West Branch Watershed Based Plan.

Additional Potential Projects (Structural BMPs):

Pontoosuc Lake Park (1447 North Street), City of Pittsfield

The city is in the process of improving Pontoosuc Lake Park located on the southeastern end of the lake. There is existing stormwater infrastructure in the park area adjacent to "The Pines", a condominium development. This includes storm drains to handle parking lot runoff as well as a few storm drains in lawn areas and an existing grassed swale. The stormwater runoff collected discharges to outfalls on the West Branch below the Pontoosuc Lake dam. Redeveloping the park provides an opportunity to consider stormwater improvements that could reduce the volume of stormwater and associated pollutants to the West Branch. A meeting with the City of Pittsfield municipal staff indicated a willingness to include stormwater management improvements in this project. Conceptual designs are currently being developed by Berkshire Design Group. For example:

Repave parking lot and pitch it towards a water quality swale:

Photo 1: Parking area with storm drains

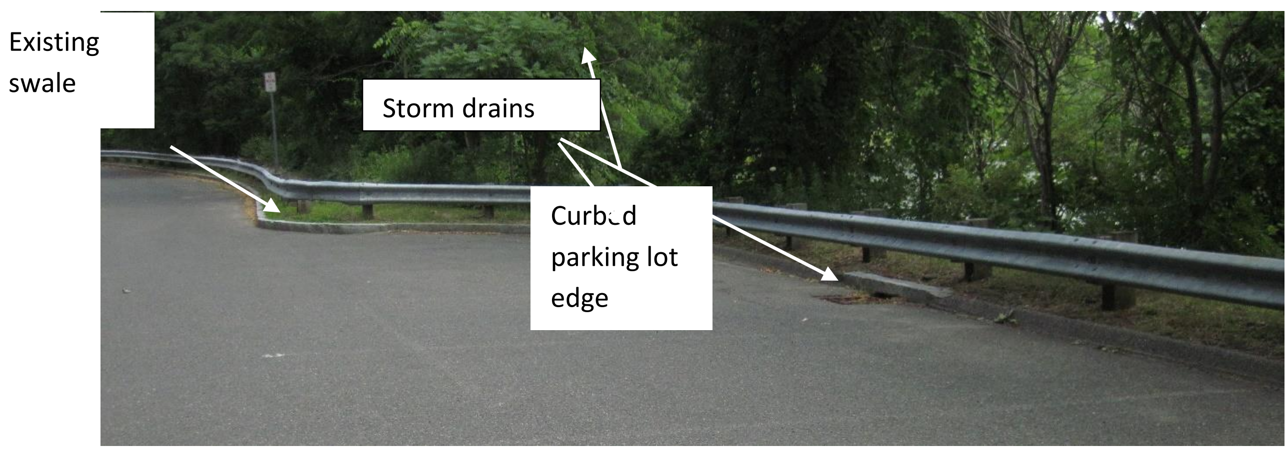


Photo 2: Existing swale with curbed parking area

Photo 3: Existing grassed area and drain

If the parking lot is repaved, it could be pitched away from the lake front and existing drains, Photo 1, towards the existing grassed area which in some places is already “swaled.” Remove the parking lot curb and improve the existing grassed area/swale to a water quality swale adjacent to the parking area to allow runoff to flow into the swale, Photo 2. Replace the existing drain, Photo 3, with a raised drain to act as an overflow outlet. The proposed concrete pedestrian path, provided it is flush with the parking area and grassed swale, would not impede sheet flow from the parking area into the water quality swale.

Remove Asphalt Swale. Replace with Bioinfiltration Basin with a Raised Inlet

Photos 4 and 5: Asphalt swale leading to storm drain

Improve the infiltration of the stormwater by removing the asphalt swale and installing a bioinfiltration basin with a rock-lined inlet serving as a sediment forebay in place of the asphalt. Convert the existing storm drain to a raised inlet to serve as an overflow drain so that any stormwater is allowed to collect and then infiltrate.

Install infiltration basins where existing stormwater drains are located in lawn areas

Photo 6: Storm drains located in existing lawn (1)

Photo 7: Storm drains located in existing lawn (2)

Where feasible, install infiltration basins where existing stormwater drains are located in lawn areas. Convert the storm drains to raised inlets to allow stormwater to collect and infiltrate. Plant “thirsty plants” such as willow shrubs to absorb water. Alternatively consider converting the existing drains to leaching catch basins or a gravel wetland.

Improve stormwater management of runoff from the "The Pines" driveway

Photo 8: Intersection of "The Pines" driveway and parking area entrance

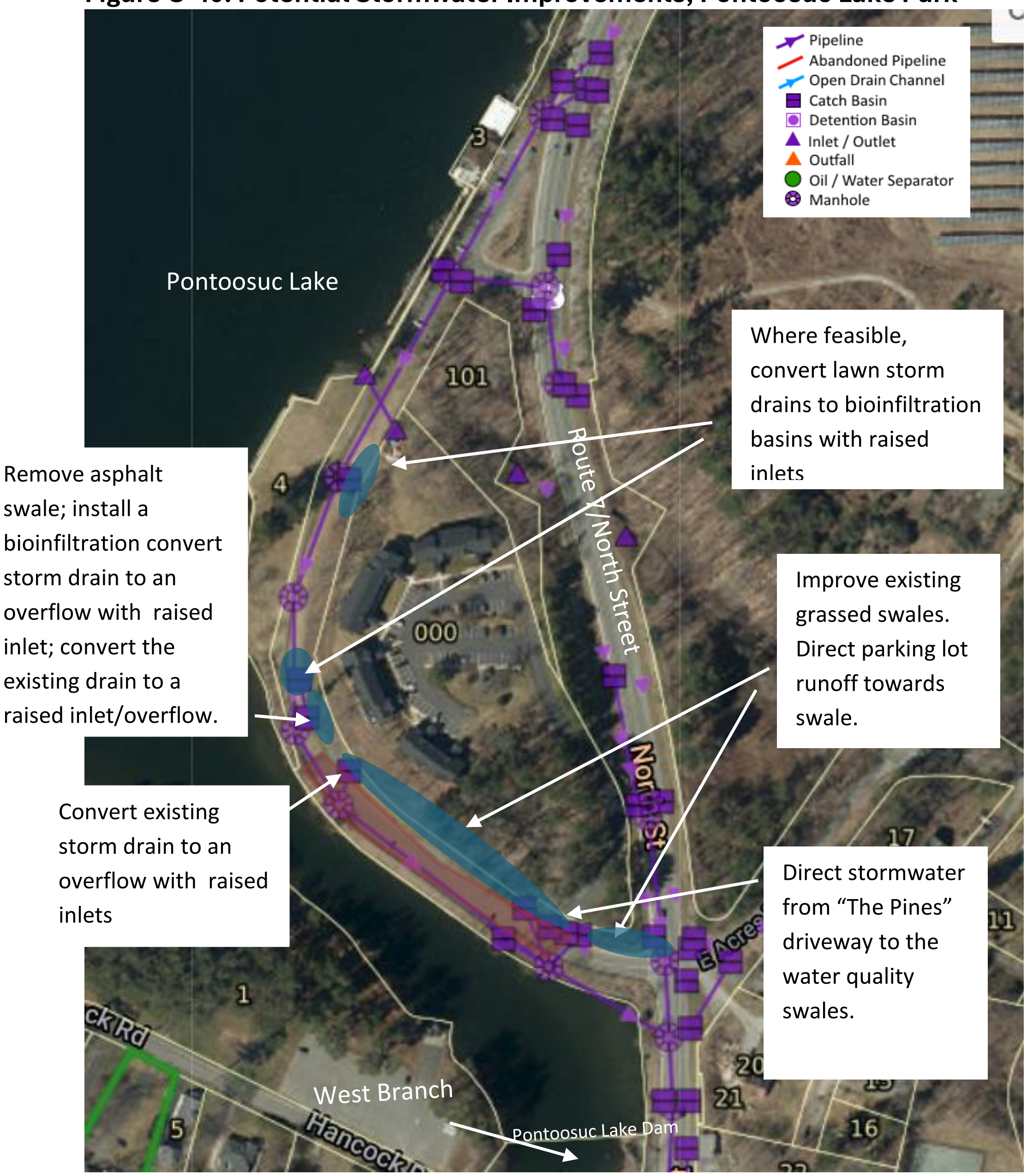
At the southern parking lot entrance there are storm drains at the base of "The Pines" driveway. Working with "The Pines" condominium development, improve the management of the stormwater runoff from the access road. Stormwater runoff could be redirected into the improved water quality swale along the parking lot.

Improve Lakefront Riparian Buffer

Photo 9: Lakefront edge of Pontoosuc Park North

Where feasible, plant native plants and shrubs to reduce shoreline erosion

Figure C-40: Potential Stormwater Improvements, Pontoosuc Lake Park

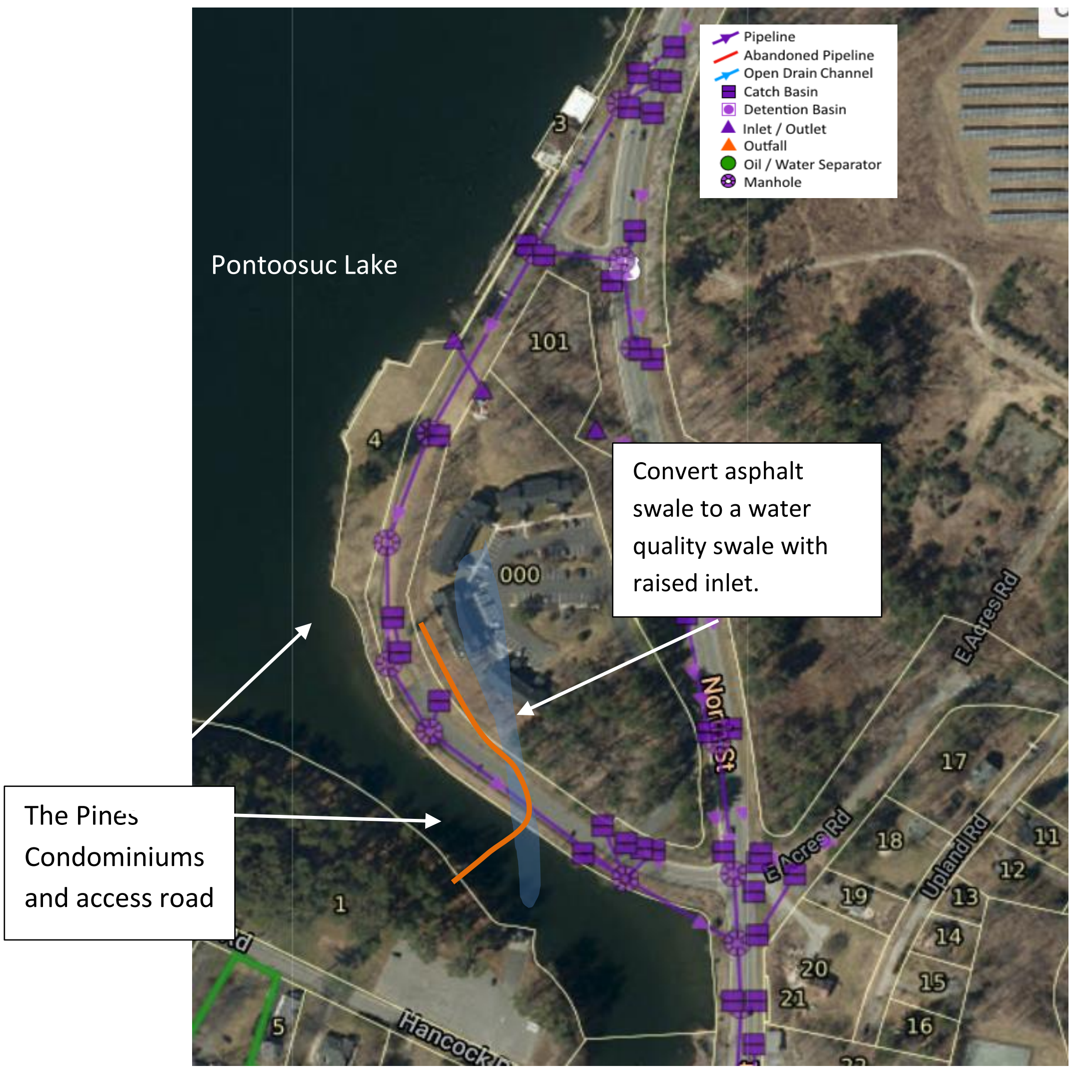


Route 7 /1450 North Street:

Along Route 7/North Street adjacent to the "The Pines" condominium development, there is an asphalt swale leading to a storm drain. There is potential to allow infiltration of the stormwater by converting the asphalt swale to a water quality swale and raising the storm drain. While there is potential for this project based on a site visit, implementation will require willingness of the Massachusetts Department of Transportation, which manages this section of North Street.

The access road to The Pines is relatively steep and the stormwater runoff from the road and parking area contributes stormwater to the city infrastructure located in the park. Working with the condominium association to develop a water quality swale along the length of the access road and locating stormwater BMPs within the parking area of the condominium development would reduce the volume of stormwater entering the system. A site visit indicated potential, but conversations with the property owners have not been conducted.

Figure C-41: Potential Stormwater Improvements, Route 7/1450 North Street



Wahconah Green Streets Amendment

The City of Pittsfield has expressed interest in amending the Wahconah Green Streets project to include green infrastructure but requires funding to move forward.

Lanesborough Town Hall

Opportunities exist for implementing stormwater BMPs in the green spaces around the Town. Currently roof runoff is being directed to a storm drain on the southeast corner of the building.

Bill Laston Memorial Field, Lanesborough

a. *Project 1 – Improve riparian buffer along Town Brook and create stabilized access points:* There is a walking path, picnic tables and grills along the banks of Town Brook within this community park. The riparian buffer is minimal in places along the brook as this allows access to the river, including students from the local elementary school. Lack of a riparian buffer and repeated trampling of the bank is resulting in eroded banks. Recommended improvements include planting native trees and shrubs to hold the banks and creating stabilized access points to the river.

Photo C-47: View of Town Brook stream bank in Bill Laston Memorial

b. *Project 2 – Reduce mowing along the entrance road*

The Conservation Commission and DPW could review the mowing protocols at the park. Areas currently mowed might be converted to pollinator meadows and mowed once a year while maintaining the line of sight necessary at the entrance to the park. Areas that are adjacent to wetlands could be left unmown and revegetate naturally.

Figure C-42: Bill Laston Memorial Fields Project #2 - Proposed BMP Plan Layout

North Street, Pittsfield

Parking area for Capitol Square Apartments: A city-owned parking area, this parking lot is in need of improvement and the city will have an opportunity to determine if any stormwater improvements are feasible.

Cigarette waste is common on the main street of Pittsfield, North Street and cigarette ends are commonly observed during the cleanups in the West Branch. Providing cigarette waste receptacles at key locations on North Street may encourage smokers to dispose their cigarette in the proper place of rather than on the ground coupled with an ad campaign to “put your butts where they belong” may reduce the volume of this kind of trash.

Pet Waste - Volunteers maintaining the rain gardens on North Street have observed pet waste dumped into the garden on a regular basis, a couple of strategically placed pet waste stations may encourage proper disposal.

Mitigate Stormwater Outfalls of Concern

Pittsfield and Lanesborough (1 outfall) need to further investigate the outfalls (**Table C-3)** with results that exceeded *E. coli*, ammonia, and total nitrogen (TN) thresholds, determine the source of the problem, and resolve discovered issues. In Pittsfield, for example, the outfall that discharges on the banks of Westside Riverway Park (site ID WB1040) tested at >2419 cfu/100 ml during dry weather screening and surface water samples collected just downstream of this outfall have often been elevated. Refer to **Table A-6** for sampling results of these outfalls. Some of the flagged outfalls accept runoff from sizeable drainage areas. *The city* *needs to develop a program to sample from manholes in dry weather conditions to assist tracking down illicit connections.*

Table C-3: Priority Stormwater Outfalls

Site ID	Latitude	Longitude	Diameter	Municipality
DNF8	42.49423	-73.23959	24	Lanesborough
WB1000	42.461662	-73.25395	48	Pittsfield
WB1040	42.455531	-73.26079	36	Pittsfield
WB1005	42.460378	-73.26139	38	Pittsfield
WB1280	42.450441	-73.26322	18	Pittsfield
WB1340	42.448236	-73.26416	36	Pittsfield
WB1600	42.441207	-73.26006	49	Pittsfield
WB630	42.472884	-73.24752	18	Pittsfield
WB680	42.4678	-73.24876	16	Pittsfield

Disconnect Outfalls and Implement BMPs:

There are many outfall pipes that discharge stormwater into the West Branch and Onota Brook. Similar to the Dorothy Amos Park conceptual design that pulls back a stormwater outfall and infiltrates the stormwater, there are additional locations where stormwater outfalls could be pulled back and infiltrated or where locations for BMPs could implemented “upstream” of the outfall to reduce the volume discharging to the West Branch and its tributaries. **Table C-4** provides a list of outfall locations for project consideration. While not exhaustive, the list provides outfall locations that are mostly adjacent to city owned properties or ROWs that could facilitate BMP installation. Locations where an outfall pipe’s infrastructure is buried under private property, the property is not developed. These undeveloped properties may provide an opportunity for stormwater BMP implementation with property owner permission or following the city’s purchase of the property.

Priority outfall locations to consider include:

Bel Air Dam Site: Removal of the Bel Air dam is underway and expected to be completed in 2026. Once removed, opportunities to improve stormwater management on this segment of the West Branch will exist. For example, there are several stormwater outfalls located at the end of Fairview Avenue (Site ID: WB636) and along Wahconah Street (Stormwater Site IDs: WB635, WBNO1, WB630, WB620, WB610, WB530) that could potentially be pulled back and much of the stormwater infiltrated.

Westside Riverway Car-top Boat Access (Stormwater Site ID: WB1040):

a. This outfall is a 36” with a large catchment area that could be as much as 35 acres. Initial review by CEI indicated that it would be challenging and likely not cost effective to pull back the pipe and have the sizeable volume of stormwater infiltrate into a subsurface infiltration system using existing space at the Westside Riverway Park. Additional challenges include a suspected high-water table and the pipe leading to the outfall may be deeply buried. The alternative is to fully delineate the outfall catchment area and locate multiple smaller BMPs within it.

b. On multiple occasions, numerous dog waste piles left in the park have been observed. While there is a dog waste station located at the perimeter of the park, it seems to be under-utilized. Additional education and considering moving the location of the dog waste station and waste receptacle or adding additional stations may be necessary. Initiating a discussion with pet owners and those that frequent the park may help figure out the best solution.

West Branch at Atwood (Stormwater Site ID: WB1600): The infrastructure for this 49" outfall pipe runs under an undeveloped private property (3 acres) along Atwood Street before discharging to the West Branch. Total Nitrogen results in 2022 were 3.07 mg/l and, at the time of sampling, there was a sewage odor and toilet paper and floatables observed. The outfall pipe serves a dense residential and commercial neighborhood and a segment of Route 20 near downtown Pittsfield. If not already completed, the city will be investigating this problem outfall to determine and mitigate any illicit connections. Following that, the location of this outfall pipe adjacent to an undeveloped private property presents an opportunity to pull back this outfall and infiltrate the stormwater especially where additional infiltration locations in the catchment area are not readily available. Additional outfall pipes in this vicinity that have adjacent undeveloped properties include WB1590 and WB1610. All of the undeveloped properties mentioned are owned by the same person.

Lenox Avenue (*Stormwater Site ID: WB680*): During dry weather screening and previously sampling conducted by BEAT *E coli* levels have been high. During dry weather screening, the *E. coli* levels were above the measurable limit at >2419.6 cfu/100ml and TN was 2.4 mg/l. Significant algal growth below the outfall and in the flow-line was observed. In addition to investigating the source of contamination, this outfall provides an opportunity to pull it back and infiltrate as city owns the property adjacent to the outfall (Property ID: H120012012)

Onota Brook Outfalls along Pecks Road

a. *(Stormwater Site ID: ObThing)* The catchment area for this outfall is about 8-10 acres. The pipe leading to the outfall runs underground close to the border of an undeveloped private property (0.27 acres) which has a natural bowl-like form. It is conceivable that this outfall pipe could be disconnected, and the stormwater infiltrated on this property with additional infiltration sites located within the neighborhood of the catchment area which includes the lower portion of Roberts Street, Plinn Street and part of Mohegan Street.

b. *(Stormwater Site ID: OB230)* The stormwater infrastructure that serves the upper portions of Roberts and Mohegan Streets as well as Watson and Clarendon Streets drains roughly 10 acres of medium density residential neighborhood. The discharge is directed to the intersection of Watson and Davis Streets where there is a city right-of-way (approximately 7,000 square feet). The stormwater pipe continues under St Joseph's Cemetery discharging into Onota Brook at outfall with the site ID, OB230, a 24" pipe. Locating infiltration sites within the city ROW as well as multiple locations in this neighborhood would reduce the volume of stormwater and associated pollutants to Onota Brook.

Table C-4: Outfall locations which offer potential stormwater BMP implementation

PIPE SIZE (inches)	SITE NAME	Waterbody	ADDRESS	PROPERTY OWNER	LATITUDE	LONGITUDE
18	WB1280	West Branch	350 West Street	Owner 1: Christian Center Housing Corp; Owner 2: Berkshire Housing Authority	42.45044142	-73.26322345
12	WB1060	West Branch	Durant Park, 30 John Street	City of Pittsfield - Parks & Rec	42.45378369	-73.26114009
36	WB1040	West Branch	Westside Riverway Park, Dewey Avenue	City of Pittsfield	42.45551	-73.260748
15	WB430	West Branch	New Road	City of Pittsfield	42.47832152	-73.24787233
no size	WB560	West Branch	Lenox Ave/Wahconah Street	City of Pittsfield	42.4744274	-73.24596684
20	WB610	West Branch	Lenox Avenue	City of Pittsfield	42.47397973	-73.24621841
18	WB636	West Branch	Fairview Avenue	City of Pittsfield	42.47118977	-73.24802182
20	WB630	West Branch	Wahconah/Wilson Street Intersection	City of Pittsfield	42.472852	-73.24755
16	WB635	West Branch	Wahconah/Wilson Street Intersection	City of Pittsfield	42.472739	-73.24791
18	WB530	West Branch	Wahconah/Mohawk	City of Pittsfield	42.473648	-73.246693
16	WB680	West Branch	Lenox Avenue	City of Pittsfield	42.4676334	-73.2486951
12	Obthing	West Branch	Pecks Road (opposite Roberts Street)	City of Pittsfield	42.468	73.2553
15	DNF6	West Branch	Taylor Street	City of Pittsfield	42.43760585	-73.2609812
16	WB1640	West Branch	Bay State Road	City of Pittsfield	42.43936517	-73.26160787
49	WB1600	West Branch	50 East Mill Road	Private	42.44120698	-73.26005561
12	WB1605	West Branch	50 East Mill Road	Private	42.44116247	-73.2600222
12	WB1590	West Branch	Harris Street	Private	42.442657	-73.260739
12	WB1610	West Branch	Holly/Fern Street	Private	42.44096733	-73.26026993
24	OB230	Onota Brook	Pecks Road	Private/City	42.4703	-73.2573

Integrate Stormwater BMPs into Road-Stream Crossings Replacements

There are numerous road-stream crossings in the West Branch watershed and often stormwater runoff, laden with sediment and pollutants from the road, is directed to the waterbody at the crossing location. Each crossing when replaced presents an opportunity to include stormwater BMPs in the project design.

In line with the goal of incorporating stormwater BMPs whenever feasible, the City of Pittsfield will consider options and include stormwater BMPs when reviewing and permitting culvert replacement projects, if cost effective and feasible. Priority culvert replacement projects located in the City of Pittsfield portion of the watershed are identified in Pittsfield's Road-Stream Crossing Management Plan prepared by HVA. **Table C-5** provides a list of these priority crossing locations.

Table C-5: Pittsfield Priority Road-Stream Crossings Scheduled for Replacement

Pittsfield Priority Road-Stream Crossings Scheduled for Replacement					
Road	Waterbody	Latitude	Longitude	Comments	NAACC Crossing Code[34]
Pontoosuc Avenue	West Branch of the Housatonic River	42.466534	-73.251845	Scheduled for replacement by MassDOT in FY2026	xy4246653473251845
Pecks Road	Onota Brook	42.471564	-73.258752	Replacement by City scheduled (2024). Bridge is currently one lane.	xy4247156473258752
Dan Casey Memorial Boulevard	Onota Lake	42.484668	-73.276833	Replacement by City scheduled (2024).	xy4248466873276833
Hancock Road	Daniels Brook	42.489884	-73.275005	Goal is to replace in 2025. Still requires funding. No design completed. High priority	xy4248988473275005
Route 7/North Street	Unnamed Tributary	42.477227	-73.245045	This urban crossing floods which may be due to upstream hydrology rather than the under-sized culvert. This is also a site of public safety concern. Two additional road-stream crossings exist upstream *High Priority*	xy4247722773245045
Wahconah Street	West Branch of the Housatonic River	42.4643	-73.252835	Scheduled for replacement by MassDOT in FY2026	xy4246430073252835

Gravel Road Maintenance and Upgrades

Stabilizing gravel roads provide long-term maintenance and public safety benefits and benefits the water quality of our rivers and lakes by minimizing the sediment deposits which can carry pollutants to the waterbody.

In the Town of Lanesborough, there are several gravel roads in the vicinity of Pontoosuc Lake. Some of these roads were hardened with reclaimed asphalt, but stormwater runoff is still a concern. The roads that run perpendicular to Pontoosuc's lakefront are the key concern. Stormceptors© installed on Profile and National Streets have made a difference and are still working. Similar projects, in addition to the Algonquin/Narragansett Avenue conceptual designs included in this plan should be developed to reduce the sediment and pollutant load entering Pontoosuc Lake.

Stormwater BMPs on Private Properties

Private properties provide additional locations for effective stormwater control measures and may also reduce existing flooding and erosion issues. Working with private property owners to remediate and infiltrate stormwater on-site can reduce the volume of stormwater entering, and often overwhelming, the municipally managed stormwater infrastructure. The two site locations provided below are examples of additional potential opportunities implementing stormwater BMPs:

St. Joseph's Cemetery, Pittsfield: A riverfront improvement plan approved by the Conservation Commission will be implemented in 2024. This includes native plantings along Onota Brook. (Appendix E)

Former Polish Community Club, 55 Linden Street, Pittsfield: This property has been recently sold. This sizable property (1.5 acres) includes a dirt parking area (0.3 acres) and building (3,000 square foot roof) and open space of approximately 1.2 acres. Stormwater from the parking area and building could be infiltrated on site. This site will not be reviewed by the Conservation Commission as it is not near a resource area. However, development of this lot may trigger the city's stormwater ordinance requirements as the lot size is over 1 acre.

Pittsfield Cemetery, 203 Wahconah Street, Pittsfield: This is a privately owned and managed cemetery a portion of which abuts the West Branch of the Housatonic River and has Onota Brook flowing through it.

a. Project #1 – The cemetery access road, Campbell Road, has experienced flooding and cemetery staff resolved the ponding by digging an outfall channel to the West Branch of the Housatonic River. The Conservation Commission required them to remove the channel and reseed it and discussed an alternative solution - a rain garden in the green space next to the road. This has yet to be designed and built and remains a possibility. This project location appears to be under city ownership.

Figure C-43: Pittsfield Cemetery – Project #1 BMP Plan Layout

b. Project #2 – Onota Brook (a.k.a. Peck's Brook) flows through the cemetery property. There is a segment that is mowed lawn up to the river's edge. Delimiting mowing and planting native trees and shrubs will improve the riparian buffer and will reduce erosion and nutrient input to Onota Brook.

Figure C-44: Pittsfield Cemetery – Project #2 BMP location

Recommended Solutions for Agricultural Impacts[35]*:*

A watershed-wide initiative to implement farm conservation practices and agricultural BMPs is recommended to reduce the pollutant loading from agricultural land uses within the West Branch of the Housatonic watershed.

[35] For hobby farms good resources to encourage best practices to protect water quality are available such as *https://treecanopybmp.org/* which has several web pages focused on BMPs for Hobby farms.

After forested land, most of the acreage in this watershed is used for agriculture. According to **Tables A-18 , A-19 and A-20** pollutants from these agricultural operations have the greatest impact on the water quality of the rivers, streams and lakes in this watershed. For example, results of *E. coli* samples collected on tributaries with agricultural operations, such as Daniels Brook have indicated probable agricultural impact as the downstream *E. coli* levels consistently exceeded the state standards. Daniels Brook sample results were typically elevated with readings of about 400 cfu /100 ml. (Note: this was only one season of sampling and additional sampling would indicate if these results are typical for the brook.)

It will be important to work with farmers and property owners (where farmers are leasing land) to identify locations and the willingness to install and adapt best management practices that will reduce agricultural non-point source pollution. HVA, the watershed organization for the Housatonic watershed, has initiated an agricultural nonpoint source pollution program and will work closely with NRCS to support implementation of BMPs to improve water quality. A good source of information is the Massachusetts Department of Agricultural Resources which provides a "Best management Practices" website for the various types of farming:[36]

- Backyard Poultry Keepers BMPs
- Cranberry best Management Practices
- Dairy Best Management Practices
- Greenhouse Best Management Practices
- Livestock and Poultry
- MA Beekeepers Association Best Beekeeping Practices
- Maple Best Management Practices
- Nursery Best Management Practices
- Orchard Best Management Practices
- Shellfish Best Management Practices
- Small Fruit Best Management Practices
- Small Livestock Best Management Practices
- Turf Best Management Practices
- Vegetable Best Management Practices

Examples of Agricultural BMPs that could be implemented include[37]:

- **Adopting Nutrient Management Techniques:** Farmers can improve nutrient management practices by applying nutrients (fertilizer and manure) in the right amount, at the right time of year, with the

[36] https://www.mass.gov/info-details/agricultural-best-management-practices-bmps
[37] *Source: https://www.epa.gov/nutrientpollution/sources-and-solutions-agriculture*

right method and with the right placement through the development of Comprehensive Nutrient Management Plans (CNMP).

- **Using Conservation Drainage Practices:** Subsurface tile drainage is an important practice to manage water movement on and through many soils, typically in the Midwest. Drainage water can carry soluble forms of nitrogen and phosphorus. Strategies are needed to reduce nutrient loads while maintaining adequate drainage for crop production. Conservation drainage describes practices including modifying drainage system design and operation, woodchip bioreactors, saturated buffers, and modifications to the drainage ditch system.
- **Ensuring Year-Round Ground Cover:** Farmers can plant cover crops or perennial species to prevent periods of bare ground on farm fields where the soil and nutrients it contains are most susceptible to erosion and loss into waterways.
- **Planting Field Buffers:** Farmers can plant trees, shrubs, and grasses along the edges of fields; this is especially important for a field that borders water bodies. Planted buffers can help prevent nutrient loss from fields by absorbing or filtering out nutrients before they reach a water body. An added benefit is the added shade to keep streams cool and reduce evaporation.
- **Implementing Conservation Tillage:** Farmers can reduce how often and how intensely the fields are tilled. Doing so can help to improve soil health, and reduce erosion, runoff, and soil compaction, and therefore the chance of nutrients reaching waterways through runoff.
- **Managing Livestock Access to Streams:** Farmers and ranchers can install fences along streams, rivers, and lakes to block access from animals to help restore stream banks and prevent excess nutrients from entering the water.

Another source of information about agricultural BMPs which includes effectiveness, impacts to surface waters, advantages for farms, cost and operation and maintenance considerations, estimated system lifespan, and NRCS Standards that could be used is available at https://extapps.dec.ny.gov/docs/water_pdf/agriculturebmp.pdf

Retrofit Dry Detention Basins[38]

The New Jersey Agricultural Experiment Station (Rutgers University) has had success with retrofitting existing dry detention basins to improve pollutant load reduction and stormwater infiltration. Typically these dry detention basins were built prior to the mid-1980s and were designed with the single purpose of providing flood control. These basins function by capturing stormwater from rain events and snowmelts, and then slowly release this water to a receiving stream or stormwater channel. This action effectively mitigates flooding by both decreasing peak flows downstream and delaying the timing of those peaks.

The desired result of a successful detention basin retrofit is to slow down stormwater runoff and provide the time and space for the water to infiltrate into the ground, while providing necessary flood protection. The existing high maintenance turf is replaced with native vegetation. Alterations to ensure that the stormwater flows across the entire basin are made. The final retrofitted basin can serve as a place for environmental education while providing the local community with increased ecosystem diversity.

An additional benefit of the basin retrofits is the potential maintenance cost savings due to reduced mowing schedules and reduced consumption of resources for mowing. These savings can be substantial for local

[38] https://njaes.rutgers.edu/fs1195/

municipal governments. Some public works directors have reported savings of up to $4,000 per year in reduced maintenance costs for each basin retrofitted.

Photos C-48 and C-49: Pre- and Post photos of a retrofit stormwater basin at Laird Terrace, Franklin Township, New Jersey

Additional Potential Projects (Non-Structural BMPs):

Pontoosuc Lake – Residential Septic System Replacement Program:

The Lanesborough community expressed concern about private septic systems in the vicinity of Pontoosuc Lake contaminating the water quality of the lake. Failing septic systems are only likely to be discovered and replaced when the property is sold due to the Massachusetts Title V program which requires septic systems to be inspected when the property changes hands and replaced if necessary. A program that helped identify suspected failing systems and provided partial funding to support inspection and costly replacement in the absence of a property ownership change could reduce this contamination.

Maintenance of septic systems is also important. Reminders to property owners to empty their septic tanks every 3 years can be helpful.

Westside and Morningside Neighborhood Improvements:

a. Improve the effectiveness of street sweeping in Morningside and Westside Neighborhoods: The Pittsfield Gray to Green Morningside and Westside neighborhood audits included many reports of trash. In addition, the streets do not appear to have been swept for more than a year despite the annual street sweeping and at multiple locations curbs and drainage structures are in disrepair. The effectiveness of the street sweepers may be reduced by the amount of leaf debris on the road edges as well as these broken drainage structures and curbs. Upgrading the streets and making the necessary repairs as well as manually removing excessive street debris would improve the removal of debris and increase the effectiveness of street sweeping.
b. Install porous pavement sidewalks as streets are upgraded: While the maintenance of porous pavement must be considered, any time the municipalities are upgrading streets, porous pavement sidewalks could be considered. (https://www.porouspaveinc.com/products/porous-pave-xl)

Work with MassDOT to improve stormwater management:

a. Several stormwater outfalls are located on Route 7 and discharge to Pontoosuc Lake. Mass DOT could implement appropriate BMPs to reduce the pollutant load into the lake.
b. Mass DOT could integrate stormwater BMPs into road-stream crossing replacements where possible. MassDOT is in the process of replacing the bridge over the West Branch on Pontoosuc Avenue. While there is limited room for BMP implementation several outfalls discharge at the bridge and Mass DOT support to infiltrate stormwater in the catchment area could help reduce the volume of stormwater discharging.

Develop a Rain Barrel /Cistern Program[39]

In urbanized areas, where space is limited and a water source is desirable especially where there is a community garden or landscaped areas such as along North Street, installing cisterns and rain barrels can reduce the volume of stormwater and, if a first flush device is installed, can be used to irrigate flower and vegetable gardens. Rain barrels may be most appropriate for residential properties while the larger cisterns would be for community garden locations.

a. Similar to the compost bin program, municipalities could provide rain barrels to residents at reduced cost.
b. Install cisterns and rain barrels in the vicinity of community gardens and at downtown locations **(Table C-5).** These cisterns collect roof water which can be used for watering gardens. Adding a first flush diverter will ensure the ability to water vegetables as well as pollinator gardens and rain gardens. This is especially useful when there is no other water access available or access to water is difficult. Locating one or more cisterns in the North Street area would provide access to water for downtown gardens. This may be appreciated by groups such as the volunteer run organization, *Pittsfield Beautiful,* whose volunteers help maintain city landscapes.

Table C-5: Community Garden locations for potential Cistern Installment

SITE NAME	ADDRESS	Town/City	OWNER
Capitol Square Apartments	369 North Street	Pittsfield	Capitol Square Assoc/Berkshire Housing/City of Pittsfield owns parking lot
Silvio Conte Community School	200 West Union	Pittsfield	City of Pittsfield
Robbins Avenue Christian Center Community Garden	193 Robbins Avenue	Pittsfield	Christian Center

Develop an Incentive Program for RiverSmart Property Owners[40]

Investigate programs where municipalities reward residents to install and maintain effective stormwater BMPs on their property such as providing a tax abatement or by paying for the whole or partial cost of the BMP installation. Such a program might encourage lakefront owners to improve their riparian buffer.

[39] https://www.mapc.org/wp-content/uploads/2017/11/LID_Fact_Sheet_-_Cisterns_and_Rain_Barrels.pdf

Development of this program should also consider how to increase BMP implementation on rental properties especially EJ neighborhoods. As the effectiveness of the BMP is often dependent on regular maintenance this must be well thought out as part of the program.

These residential stormwater BMPs could include rain gardens, porous pavers for driveways, redirecting roof runoff to infiltrate, planting and maintaining river and lakefront buffers. **Figure C-43** outlines additional small BMPs for homeowners:

Figure C-45: Small BMPs for Homeowners

Develop a Tree Planting Program

Trees play a significant role in the urban environment in absorbing water and even preventing stormwater from reaching the ground, which can support both climate resilience and water quality. Neighborhoods could be targeted for a tree planting program, similar to the Greening of the Gateway program, to increase the number of trees in the urban landscape of Pittsfield.

BMP Maintenance Oversight

The effectiveness of pollutant load reduction of the installed BMPs is reduced if they are not properly maintained. Operations & Maintenance Plans (O&M) will be developed for all BMPs, and the parties responsible for BMP maintenance will be clearly stated and trained to conduct proper maintenance according to the O&M Plan.

Whether private or municipally owned, it would benefit the stakeholders to maintain a database of implemented BMPs and the maintenance schedule. An organization or municipality will need to take responsibility for oversight.

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.

Table D-1 presents the funding needed to implement the management measures presented in this watershed plan. The table includes costs for structural and non-structural BMPs, operation and maintenance activities, information/education measures, and monitoring/evaluation activities. A guide for funding sources is available at the MassDEP Watershed Based Plan template website.[41]

Structural and Non-Structural BMP Funding Needed

Table D-1: Summary of Funding Needed to Implement the Watershed Based Plan: Structural and Non-Structural BMPs

Management Measures	Location	Capital Costs	Operation & Maintenance Costs (/yr)	Relevant Authorities	Technical Assistance Needed	Funding Needed
Structural BMPs (from Element C)						
Subsurface Gravel Filter and Bioswale	Wahconah Park, Pittsfield	$1,125,000	$15,000	City of Pittsfield	Engineering Consultant	$1,125,000
Modified Leaching Catch Basin	Pecks Road/Onota Street Intersection, Pittsfield	$5,000	$200	City of Pittsfield	Engineering Consultant	$5,000
Leaching Catch Basin and Subsurface Gravel Filter	St Francis and Circular Avenue, Pittsfield	$141,500	$3,500	City of Pittsfield	Engineering Consultant	$141,500
Trash Grate and Subsurface Gravel Wetland	Park Street Park, Pittsfield	$130,000	$10,000	City of Pittsfield	Engineering Consultant	$130,000
Drop Inlet and a Subsurface Gravel Wetland	Lanesborough DPW, Lanesborough	$82,500	$3,000	Town of Lanesborough	Engineering Consultant	$82,500

[41] http://prj.geosyntec.com/prjMADEPWBP_Files/Guide/Element%20D%20-%20Funds%20and%20Resources%20Guide.pdf)

Table D-1: Summary of Funding Needed to Implement the Watershed Based Plan: Structural and Non-Structural BMPs

Management Measures	Location	Capital Costs	Operation & Maintenance Costs (/yr)	Relevant Authorities	Technical Assistance Needed	Funding Needed
Structural BMPs (from Element C)						
Deep Sump Catch Basins and Subsurface Gravel Wetland	Algonquin Street & Narragansett Avenue, Lanesborough	$50,000	$3,600	Town of Lanesborough	Engineering Consultant	$50,000
Subsurface Gravel Filter	Town Park, Lanesborough	$85,000	$5,000	Town of Lanesborough	Engineering Consultant &BRPC	$85,000
Bioretention Basin with Sediment Forebay	Dorothy Amos Park, Pittsfield	$37,000	$3,500	City of Pittsfield	Engineering Consultant	$37,000
Bioretention Basins and Deep Sump Catch Basins	Columbus Avenue, Pittsfield	$66,000	$3,300	City of Pittsfield	Engineering Consultant	$66,000
Bioretention Basin and Improved Riparian Buffer	Linden Street, Pittsfield	$49,000	$3,500	City of Pittsfield	Engineering Consultant	$49,000
Water Quality Swale and Settling Basin	John T. Reid Middle School, Pittsfield	$29,000	$1,700	City of Pittsfield	Engineering Consultant	$29,000
Bioretention Basin and Permeable Pedestrian Path	John T. Reid Middle School, Pittsfield	$47,000	$7,800	City of Pittsfield	Engineering Consultant	$47,000
Deep Sump Catch Basin, Improved riparian buffer	John T. Reid Middle School, Pittsfield	$27,000	$200	City of Pittsfield	Engineering Consultant	$27,000
Water Quality Swale with check dams and Deep Sump Catch Basins	Bull Hill Road, Lanesborough	$71,000	$5,800	Town of Lanesborough	Engineering Consultant	$71,000
Bioinfiltration Basin and Improved Riparian Buffer	Burbank Park, Pittsfield	$139,035	$10,500	City of Pittsfield	Engineering Consultant	$139,035

Table D-1: Summary of Funding Needed to Implement the Watershed Based Plan: Structural and Non-Structural BMPs

Management Measures	Location	Capital Costs	Operation & Maintenance Costs (/yr)	Relevant Authorities	Technical Assistance Needed	Funding Needed
Structural BMPs (from Element C)						
Bioinfiltration Basins	Pecks Road Fire Station, Pittsfield	$43,750	$4,200	City of Pittsfield	Engineering Consultant	$43,750
Bioinfiltration Basins	Melville Municipal Parking lot, Pittsfield	$118,000	$4,000	City of Pittsfield	Engineering Consultant	$118,000
Subsurface System	Melville Municipal Parking lot, Pittsfield	$185,660	$15,000	City of Pittsfield	Engineering Consultant	$185,660
Bioinfiltration Basin and French Drain	George B. Crane Memorial Center, Pittsfield	$64,000	$500	Sioga Club of Berkshire County	Engineering Consultant and BRPC	$64,000
Riparian Buffer and grassed filter strip	Polish Falcons of America, Bel Air Avenue	$38,000	$500	Polish Falcons of America	Engineering Consultant and BRPC	$38,000
Bioinfiltration Basins	Wilson Park, Pittsfield	$21,500	$2,500	Pittsfield Housing Authority	Engineering Consultant and BRPC	$21,500
Bioinfiltration Basins	Dower Square	$56,560	$4,200	Pittsfield Housing Authority	Engineering Consultant and BRPC	$56,560
Porous pavement	Central Berkshire Habitat for Humanity	$62,640	Unknown	Central Berkshire, Habitat for Humanity	Engineering Consultant and BRPC	$62,640
TOTAL FUNDING STRUCTURAL BMPS						**$2,674,145**
Non-Structural BMPs (from Element C)						
Boat Wash Station	Onota Lake	*74,500	$5,000	City of Pittsfield	Consultant/Contractor	$0
Weed Management	Onota and Pontoosuc Lakes	$30,000		City of Pittsfield/LOPA/ Town of Lanesborough/Friends of Pontoosuc Lake	Pittsfield and Lanesborough Conservation Commissions	$18,000
Pecks Road Land Conservation	Pecks Road	$25,000	Unknown	City of Pittsfield/Property Owner	Pittsfield Conservation Commission	$25,000
Storm Drain Decaling	Various		$5,000	City of Pittsfield	HVA/BRPC	$5,000

Table D-1: Summary of Funding Needed to Implement the Watershed Based Plan: Structural and Non-Structural BMPs

Management Measures	Location	Capital Costs	Operation & Maintenance Costs (/yr)	Relevant Authorities	Technical Assistance Needed	Funding Needed
Structural BMPs (from Element C)						
GI Workforce Training	Various	$40,000	$150,000	BRPC	BRPC/MassHire/ Greenagers	$190,000
Develop an Agricultural Outreach Program	N/A	N/A	$30,000	HVA &BRPC	NRCS/MassDEP	$30,000
Develop a West Branch Coalition	N/A	N/A	$5,000	City of Pittsfield, Town of Dalton	HVA/BRPC/BEAT/Community Organizations	$6,000
Water Quality Monitoring	N/A		$15,000	City of Pittsfield, Town of Dalton	HVA/BRPC/BEAT/Community Organizations	Included in Monitoring
					TOTAL FUNDING NON-STRUCTURAL BMPS	**$274,000**
					TOTAL FUNDING FOR STRUCTURAL AND NON-STRUCTURAL BMPS	**$2,948,145**

*The current boat wash installation plan is fully funded. If the presence of zebra mussels is confirmed additional funding will be sought to upgrade the boat wash station.

Information/Education Funding Needed

Table D-2: Summary of Funding Needed to Implement the Watershed Plan: Information/Education (Element E)

Management Measures	Location	Capital Costs	Operation & Maintenance Costs	Relevant Authorities	Technical Assistance Needed	Funding Needed
Watershed Education for 5th and 7th Grades	Elementary Schools in Pittsfield and Lanesborough		$40,000	Conte Community, Crosby Elementary and Reid Middle Schools	Mass Audubon	$40,000
Signage at Constructed BMPs	Various		Estimated at $1000/sign	Respective Property Owners or Municipality	Graphic Artist, BRPC	$3,000
River Smart - Residential Outreach Program	Watershed-wide	$8,000	$15,000	Conservation Commissions City of Pittsfield and Town of Lanesborough	HVA, BRPC, Gray to Green	$23,000
Website Information	Watershed-wide		$15000	Municipalities and all stakeholders	BRPC	$5,000
MS4 Education			$7,500	City of Pittsfield and Town of Lanesborough	BRPC	$0
Be Lake Smart Education and Outreach	Lakefront property owners and		$15,000	City of Pittsfield, Town of Lanesborough,	HVA, BEAT or BRPC	$15,000
Keep Boat Access Signage updated	Pontoosuc and Lake Onota			City of Pittsfield	None	$0
Boat Monitors	Onota Lake and Pontoosuc Lake Boat	$0	$30,000	City of Pittsfield	Trained Monitors	18,000
INFORMATION/EDUCATION TOTAL						**$104,000**

Monitoring and Evaluation Funding Needed

Table D-3: Summary of Funding Needed to Implement the Watershed Plan: Monitoring and Evaluation (Elements H & I)

Management Measures	Location	Capital Costs	Operation & Maintenance Costs (Annual)	Relevant Authorities	Technical Assistance Needed	Funding Needed
Water Quality Monitoring	Onota and Pontoosuc Lakes		$7,000	LOPA, Friends of Pontoosuc Lake, City of Pittsfield	MassDEP, LOPA Volunteer Monitoring Coordinator	$7,000
Cyanobacteria/Algal Bloom Monitoring	Onota and Pontoosuc Lakes		$4,000	City of Pittsfield	Lakes and Ponds Association - West	$4,000
Water Quality Monitoring (N, P, *E. coli*, DO) West Branch and Tributaries	Watershed-wide		$25,000	HVA, BEAT, Municipalities	MassDEP	$15,000
Stormwater Outfall Monitoring	Watershed-wide		$10,000	HVA, BEAT, Municipalities	MassDEP	$10,000
MONITORING AND EVALUATION TOTAL:						**$36,000**

Summary of Funding Needed to Implement the Watershed Based Plan

Table D-4: Summary of Total Funding Needed

Proposed Management Measure	Total Funding Needed
Structural BMPs	$2,674,145
Non- Structural BMPs	$274,000
Information/Education	$104,000
Monitoring and Evaluation	$36,000
Total Funding Needed:	**$3,088,145**

Potential Funding Sources:

- DEP-319: MassDEP Clean Water Act Section 319 Grant Program
- DEP-604b: MassDEP Clean Water Act Section 604b Grant Program
- MADEP-WQ: MassDEP Water Quality Grant Program
- EOEEA-MVP: EOEEA Municipal Vulnerability Program (MVP) Action Grant
- BTCF-Crane: Crane Family Fund, Berkshire Taconic Community Foundation Grants
- MET: Massachusetts Environmental Trust
- LISFF: National Wildlife's Long Island Sound Futures Fund
- MADER-BCCC: MA DER - Berkshires Clean Cold and Connected Partnership
- MA-BIG: Massachusetts Boating Infrastructure Grant Program
- LAPA-West: Western Massachusetts Lakes and Ponds Association

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.

Step 1: Goals and Objectives

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

Watershed - Wide

1. Provide information about proposed stormwater improvements and their anticipated water quality benefits.
2. Provide information to promote watershed stewardship including:
   - Proper pet waste removal and disposal
   - Proper yard debris management (for example not raking leaves into the river or washing lawn trimmings down the drain
   - Simple LID implementation
   - Minimizing use of fertilizers and pesticides and not applying before a rainstorm
   - Storm drain awareness and not dumping anything down storm drains
3. Develop relationships with the farmers to provide education and assistance with improving their crop and livestock waste management.
4. Ensure that stormwater management practices are being properly maintained at commercial businesses. Create avenues to educate staff about stormwater runoff issues and solutions.

Onota and Pontoosuc Lakes

1. Promote the reduced use of fertilizers and pesticides.
2. Promote the planting of lake-front vegetation buffers.
3. Continue to mitigate, manage, and reduce the prevalence and spread of aquatic plant invasives: Brittle naiad, *Najas minor* Eurasian water milfoil, *Myriophyllum spicatum*, curly leaf pondweed, *Potamogeton crispus*, and water chestnut, *Trapa natans*. comprehensive weed management program.
4. Continue to manage the threat of zebra mussels.

Step 2: Target Audience

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

Watershed Wide:

1. All watershed residents
2. Lakefront/riverfront property owners – especially those with expansive waterfront lawns
3. Larger businesses within the watershed.
4. Farm operators and owners, both commercial and hobby farmers
5. Municipal staff, especially highway staff and conservation commission members and clients of environmental non-profit organizations: 18 Degrees, Berkshire Environmental Action Team, Central Berkshire Habitat for Humanity, HVA, Mass Audubon, Taconic Chapter of Trout Unlimited, UpSide 413 (formerly Berkshire County Regional Housing) and Westside Legends.

Onota and Pontoosuc Lakes

The primary target audiences for these lakes are residents and seasonal homeowners, especially waterfront property owners. The list below includes the specific groups, organizations, and membership that will reach this audience along with additional audiences targeted through education efforts:

1. Lake Onota Preservation Association
2. Friends of Pontoosuc Lake
3. Lakefront property owners
4. Western Massachusetts Lakes and Ponds Association Members
5. Recreational users of Onota and Pontoosuc Lakes (boaters, beachgoers)
6. Second homeowners/Seasonal residents
7. Camp owners, operators, administrative staff, and campers.
8. Lakeside Homeowner's Associations

Step 3: Outreach Products and Distribution

Outreach to residents regarding the Housatonic watershed and water quality related issues have been underway for many years as outlined in Element A. The activities listed below include these ongoing efforts to educate West Branch watershed residents as well as the wider community in the City of Pittsfield and Town of Lanesborough.

Watershed – Wide:

1. **Watershed Education for Fifth and Seventh Grades:** Stakeholders such as HVA and Mass Audubon will work with the Mount Greylock Regional School District, which includes Lanesborough Elementary School, and the City of Pittsfield School District to present a watershed-based curriculum that aligns with the Massachusetts Curriculum Framework and is developed for 5th graders and 7th graders. This series of lessons teaches 5th grade students about stormwater runoff, nonpoint source pollution and green infrastructure solutions through stormwater modeling and 7th grade students about climate change impacts and nature-based solutions. Whenever possible, students will visit implemented BMPs.

2. **Signage at BMP locations:** For notably public locations, including the city-owned lands at Pontoosuc Lake, Burbank Park on Lake Onota and the Bill Laston Memorial Park in Lanesborough, interpretive signage explaining the stormwater practices that have been installed will help further educating the public about stormwater and stormwater control measures.

3. **River Smart program**: This program would be designed to reach river-front residents with various messages using multiple avenues and social media platforms.:
    a. Review existing outreach materials such as the ***Pittsfield River Smart*** brochure and the ***Landscaping for Climate Change fact sheet, and the City of Pittsfield's utility inserts*** and develop outreach materials that include practicable suggestions and designs for small stormwater BMPs that property owners can implement on their property as well as climate resilient solutions. These will need to be printed in Spanish as well as English. Work on messaging multiple times a year. Key messages include proper pet waste disposal; proper yard waste management; proper use of fertilizers and encouraging minimal use of fertilizers.
    b. Distribute developed materials:
        i. Work with *Pittsfield Gray to Green* to identify effective methods for distribution of outreach materials.
        ii. Pass out brochures and other materials at public events such as farmers markets and neighborhood block parties to reach people that may not normally receive this information.
        iii. Complete a direct mailing to stream-side property owners.
        iv. Include information notices in utility inserts.
        v. Create or locate existing ad slides or short videos that can be used on websites at the local Beacon Cinema and social media platforms to educate residents.

4. **Website Information:** the watershed-plan and water quality improvement efforts will be posted and linked to websites hosted by but not limited to LOPA, Friends of Pontoosuc Lake, Lakes and Ponds Association of Western Massachusetts, HVA, Central Berkshire Habitat for Humanity and the City of Pittsfield's and Town of Lanesborough's websites when appropriate.

5. **Agricultural Outreach:** The Housatonic Valley Association has begun an agricultural outreach program with an initial Clean Water Act Section 319 project implementation grant for a Regional Agricultural NonPoint Source Pollution (NPS) Coordinator. While this grant is concluding, HVA has identified working with farmers to reduce nonpoint source pollution as a priority. The active agricultural operations in the West Branch is significant compared to other parts of the Housatonic watershed headwaters, and should be considered a high priority. Agricultural Outreach would be conducted where and when funding allows.

6. **MS4 Education:** Both Pittsfield and Lanesborough are MS4 Communities governed by the EPA under the Clean Water Act NPDES Program. The municipalities, with support from stakeholders such as HVA and BRPC, will continue to provide annual messaging to residents and businesses using outreach methods outlined above. These messages will focus on:
    1. Proper disposal of pet waste
    2. Proper operation and maintenance of septic systems
    3. Proper management of grass clippings and leaves
    4. Minimizing fertilizer usage and not applying before storms

Onota and Pontoosuc Lakes:

1. **Be Lake Smart Education and Outreach** – Stakeholders such as LOPA, Friends of Pontoosuc Lake and the city of Pittsfield will continue to work on reaching lakefront residents and visitors with providing information about how they can help improve water quality through structural and non-structural BMPs such as riparian buffers, rain gardens, reducing fertilizer use and picking up animal waste.

2. **Boat Access Signage -** The boat launches on Pontoosuc and Onota Lakes have kiosks in place and includes signage informing visitors who pass by or recreate at the lake of the risk of invasives and how to prevent spread. The signage is regularly reviewed and updated.

3. **Boat monitors educate** and distribute flyers on proper boat washing techniques that will reduce / prevent aquatic invasive dispersal via boat management. Pittsfield is working on the installation of a boat wash station on Onota Lake.

Step 4: Evaluate Information/Education Program

Information and education efforts and how they will be evaluated.

Watershed – Wide:

1. **Watershed Education for Fifth Grades:** Watershed Education: Number of classrooms reached and # of student hours.
2. **Signage at BMP locations:** number of watershed signs installed.
3. **River Smart program:**
    a. Number of brochures distributed at local events.
    b. Number of people who have engaged in River Smart Activities
    c. Number of hits on any social media postings.
    d. Number of property owners who have installed BMPs and are successfully maintaining.
4. **Websites**: number of website visitors to water quality specific pages and information
5. **Create outreach materials supporting structural BMPs:** number of flyers distributed, number of people reached.

Onota and Pontoosuc Lakes:

4. **Be Lake Smart Education & Outreach** - number of outreach events, materials distributed and social media posts. The number of property owners that move towards implementation.
5. **Boat Monitoring Program**: number of boaters engaged; number of flyers distributed.

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.

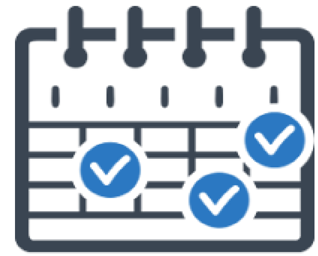


Table FG-1: Implementation Schedule and Interim Measurable Milestones

STRUCTURAL BMPs					
Proposed Stormwater BMPs	**Interim Milestone #1**	**Interim Milestone #2**	**Interim Milestone #3**	**Interim Milestone #4**	**Interim Milestone #5**
Subsurface Gravel Filter and Bioswale	Apply for Funding, Gather Project Team	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and maintenance	
Wahconah Park, Pittsfield	Within 1 year	Within 4 years	Within 6 years	Ongoing	
Modified Leaching Catch Basin	Apply for Funding, Gather Project Team	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance	
Pecks Road/Onota Street Intersection, Pittsfield	Within 3 years	Within 4 years	Within 6 years	Ongoing	
Leaching Catch Basin and Subsurface Gravel Filter	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance
St Francis and Circular Avenue, Pittsfield	Within 1 year	Within 3 years	Within 4 years	Within 6 years	Ongoing
Trash Grate and Subsurface Gravel Wetland	Apply for Funding, Gather Project Team	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance	
Park Street Park, Pittsfield	Within 1 year	Within 3 years	Within 5 years	Ongoing	
Drop Inlet and a Subsurface Gravel Wetland	Apply for Funding, Gather Project Team	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance	
Lanesborough DPW, Lanesborough	Within 2 years	Within 4 years	Within 6 years	Ongoing	

STRUCTURAL BMPs					
Proposed Stormwater BMPs	**Interim Milestone #1**	**Interim Milestone #2**	**Interim Milestone #3**	**Interim Milestone #4**	**Interim Milestone #5**
Deep Sump Catch Basins and Subsurface Gravel Wetland	Apply for Funding, Gather Project Team	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance	
Algonquin Street & Narragansett Avenue, Lanesborough	Within 2 years	Within 4 years	Within 6 years	Ongoing	
Subsurface Gravel Filter	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance
Town Park, Lanesborough	Within 3 years	Within 4 years	Within 4 years	Within 5 years	Ongoing
Bioretention Basin with Sediment Forebay	Apply for Funding, Gather Project Team	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance	
Dorothy Amos Park, Pittsfield	Within 2 years	Within 4 years	Within 6 years	Ongoing	
Bioretention Basins and Deep Sump Catch Basins	Apply for Funding, Gather Project Team	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance	
Columbus Avenue, Pittsfield	Within 3 years	Within 4 years	Within 6 years	Ongoing	
Bioretention Basin and Improved Riparian Buffer	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance
Linden Street, Pittsfield	Within 2 years	Within 3 years	Within 4 years	Within 6 years	Ongoing
Water Quality Swale and Settling Basin	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance
John T. Reid Middle School, Pittsfield	Within 2 years	Within 3 years	Within 4 years	Within 6 years	Ongoing
Bioretention Basin and Permeable Pedestrian Path	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance
John T. Reid Middle School, Pittsfield	Within 2 years	Within 3 years	Within 4 years	Within 6 years	Ongoing

STRUCTURAL BMPs					
Proposed Stormwater BMPs	**Interim Milestone #1**	**Interim Milestone #2**	**Interim Milestone #3**	**Interim Milestone #4**	**Interim Milestone #5**
Deep Sump Catch Basin, Improved Riparian Buffer	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance
John T. Reid Middle School, Pittsfield	Within 2 years	Within 3 years	Within 4 years	Within 6 years	Ongoing
Water Quality Swale with Check Dams and Deep Sump Catch Basins	Apply for Funding, Gather Project Team	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance	
Bull Hill Road, Lanesborough	Within 1 year	Within 4 years	Within 6 years	Ongoing	
Bioinfiltration Basin and Improved Riparian Buffer	Apply for Funding, Gather Project Team	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance	
Burbank Park, Pittsfield	Within 1 year	Within 4 years	Within 6 years	Ongoing	
Subsurface (Proprietary) Structure	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance
Melville Municipal Parking lot, Pittsfield	Within 2 years	Within 3 years	Within 4 years	Within 6 years	Ongoing
Bioinfiltration Basin and French Drain	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance
George B. Crane Memorial Center, Pittsfield	Within 1 year	Within 2 years	Within 3 years	Within 3 years	Ongoing
Riparian Buffer	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance
Polish Falcons of America, Pittsfield	Within 2 years	Within 3 years	Within 4 years	Within 6 years	Ongoing
Bioinfiltration Basins	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance
Wilson Park, Pittsfield	Within 2 years	Within 3 years	Within 4 years	Within 6 years	Ongoing

STRUCTURAL BMPs					
Proposed Stormwater BMPs	**Interim Milestone #1**	**Interim Milestone #2**	**Interim Milestone #3**	**Interim Milestone #4**	**Interim Milestone #5**
Bioinfiltration Basins	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction Develop Maintenance plan	Monitoring and Maintenance
Dower Square, Wahconah Street, Pittsfield	Within 2 years	Within 3 years	Within 4 years	Within 6 years	Ongoing
Porous Pavement	Apply for Funding, Gather Project Team	Develop Preliminary Designs with Community Input	Final Engineering and Permitting	Complete Construction, Develop Maintenance Plan	Monitoring and Maintenance
Central Berkshire Habitat for Humanity, Columbus Avenue, Pittsfield	Within 2 years	Within 3 years	Within 4 years	Within 5 years	Ongoing

Table FG-2: Implementation Schedule and Interim Measurable Milestones

Non-Structural BMPs				
Proposed Stormwater BMPs	**Interim Milestone #1**	**Interim Milestone #2**	**Interim Milestone #3**	**Interim Milestone #4**
Boat Wash Station	Funding received	Permitting complete	Construction completed	
Onota and Pontoosuc Lakes	2024	2024	2024	
Implement Weed Management Plan	Permit updated	Implementation		
Onota and Pontoosuc Lakes	2024	Annual-Ongoing		
Pecks Road Land Conservation	Funding received	Purchase complete		
Pecks Road, Pittsfield	2025	2025		
Develop an Agricultural Outreach Program	Develop a plan to conduct outreach to West Branch agricultural operations	Obtain funding	Implement program	
	2026	2027	2027-2029	

Non-Structural BMPs				
Proposed Stormwater BMPs	**Interim Milestone #1**	**Interim Milestone #2**	**Interim Milestone #3**	**Interim Milestone #4**
Water Quality Monitoring	Work together to formulate a water quality monitoring plan	Obtain funding to support water quality monitoring	Implement water quality monitoring	
	By August 2025	By January 2026	June-October 2026	
Develop a West Branch Working Group	Have conversations with various stakeholders and formulate a plan	Formulate Working Group and Fundraise to Implement Plan		
	2025	2026		
GI Champion Work Force Training	Develop program framework with partners	Create business plan and budget	Obtain funding	Implement program
Watershed-wide	2024-25	2024-25	2025-26	2026-27

Table FG-3: Implementation Schedule and Interim Measurable Milestones

Non-Structural BMPs				
Proposed Stormwater BMPs	**Interim Milestone #1**	**Interim Milestone #2**	**Interim Milestone #3**	**Interim Milestone #4**
Watershed Education for 5th and 7th Grades *Elementary Schools in Pittsfield and Lanesborough*	Funding for school programs obtained on a sustainable basis	Programs conducted in Pittsfield and Lanesborough Elementary schools (3 total), and Reid Middle School		
	Within a year	Annually – Ongoing as funding allows		
Signage at Constructed BMPs *Various*	3 signs installed			
	within 5 years			
River Smart - Residential Outreach Program *Watershed-wide*	Develop advisory group and develop program idea and solicit funding	Funding received	Implement program	
	Within 1 year	within 2 years	Within 3 years	
Website Information *Watershed-wide*	Obtain funding	Develop web page	Stakeholder webpage includes link	Update webpage as necessary
	2025	2025-26	2026	Ongoing
MS4 Education *Watershed-wide*	Distribute required messaging			
	Annually – Ongoing			
Be Lake Smart Education and Outreach Program *Lakefront property owners and residents*	Develop advisory group and develop program idea and solicit funding	Funding received	Implement program	
	Within 1 year	within 2 years	Within 3 years	
Boat Access Signage	Review and update at the beginning of each season			

Non-Structural BMPs				
Proposed Stormwater BMPs	**Interim Milestone #1**	**Interim Milestone #2**	**Interim Milestone #3**	**Interim Milestone #4**
Pontoosuc and Lake Onota	Annually – Ongoing			
Boat Monitors *Onota and Pontoosuc Lakes*	Hire seasonal monitors			
	Annually/Ongoing			

Table FG-4: Implementation Schedule and Interim Measurable Milestones

Monitoring and Evaluation				
Proposed Stormwater BMPs	**Interim Milestone #1**	**Interim Milestone #2**	**Interim Milestone #3**	**Interim Milestone #4**
Water Quality Monitoring *Onota and Pontoosuc Lakes*	Implement developed water quality program each season			
	Ongoing			
Cyanobacteria/Algal Bloom Monitoring *Onota and Pontoosuc Lakes*	Implement developed water quality program each season			
	Ongoing			
Water Quality Monitoring (N, P, *E. coli*, DO) West Branch and Tributaries *Watershed-wide*	Develop program with stakeholders to support BMP implementation	Obtain funding	Implement program and review results	Review and update program at the end of each season
	2024	2024-25	2025	Annually

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 target concentration(s) is presented under Element A of this plan. To achieve this target concentration, the annual loading must be reduced to the amount described in Element B. Element C of this plan describes the various management measures that will be implemented to achieve this targeted load reduction. The evaluation criteria and monitoring program described below will be used to measure the effectiveness of the proposed management measures (described in Element C) in improving the water quality of the West Branch of the Housatonic River Watershed.

Indirect Indicators of Load Reduction

Street Sweeping and Catch Basin Cleaning

Potential load reductions from these nonstructural BMPs can be estimated from indirect indicators, such as the number of miles of streets swept or the number of catch basins cleaned. Attachment 2 to Appendix F of the 2016 Massachusetts Small MS4 General Permit provides specific guidance for calculating nitrogen and phosphorus removal from these practices.

It is recommended that ongoing activities be evaluated to determine potential improvements that would help achieve higher pollutant load reductions such as increased maintenance frequency or improved technology.

Beach/Lake Advisories

Reduction in recordings of beach closures due to E. coli, algal bloom advisories and reduction of invasive plants from aquatic plant surveys conducted will serve as an indirect indicator of load reductions.

Project-Specific Indicators

Water quality monitoring data will provide up-to-date information on the effectiveness of the BMPs installed and the educational efforts towards improving the health of the West Branch. All implemented BMPs will include a planned evaluation and monitoring program where appropriate.

Stormwater Outfall Monitoring

At key sites where stormwater outfall pipes are being "pulled back" and the stormwater infiltrated, such as the project described for Dorothy Amos Park, the stormwater discharge at the outfall will be tested 2 – 3 times before and after BMP installation in wet weather to determine their effectiveness. Additional annual monitoring will be conducted, if deemed necessary.

TMDL Criteria

The West Branch of the Housatonic River (MA21-18) is included in the draft "Massachusetts Statewide TMDL for Pathogen-Impaired Inland Freshwater Rivers," which is currently in the public comment period.

Direct Measurements

Direct measurements are generally expected to be performed as described below. Prior to implementing a direct measurement program, the Berkshire County Water Quality Coalition's current quality assurance project plan (QAPP) and/or standard operating procedures (SOPs) will be reviewed and amended as necessary to ensure best practices for sample collection and analysis. Water quality monitoring will be performed through a volunteer training program similar to the one HVA has conducted for many years and which is fashioned after MassDEP's environmental monitoring for volunteers.

River Sampling

Sampling is recommended to continue approximately once per month from May through October to understand the water quality in the West Branch of the Housatonic Watershed, including determining sources for pollution and tracking achievements toward water quality goals. At a minimum, parameters tested should include analysis of *E. coli,* TSS and TN. Additional parameters such as TP, dissolved oxygen, temperature, conductivity, pH, and flow rate could provide additional data to support BMP implementation and track if BMPs are having a positive impact on water quality.

The sampling would be focused on the mainstem and key tributaries such as Daniels and Town Brooks. Monitoring locations will be selected following installation of stormwater BMPs based on accessibility and representativeness and shall be appropriate to quantify water quality improvements in the watershed.

Onota and Pontoosuc Lake Cyanobacteria Monitoring

Water quality monitoring of the "Deep Hole" in each lake will be continued to assess for cyanobacteria and the potential for algal blooms. Parameters measured will include temperature, cyanobacteria cell counts, dissolved oxygen and phosphorous.

Beach Bacteria (*E. coli)* Sampling: There are 8 public and semi-public beaches located on Onota and Pontoosuc Lakes that are monitored weekly during the bathing season. **(Table HI-1)**

Table HI-1: Freshwater Beaches monitored for *E. coli (2023)*

Community	Beach Location Name	Testing Frequency	Indicator	Tests	Single Sample Exceedances	Minimum Exceedance (cfu/100mL)	Maximum Exceedance (cfu/100mL)	Days Posted
Pittsfield	Camp Stevenson/Witawentin (Onota Lake)	Weekly	E. coli	13				0
Pittsfield	Camp Winadu (Onota Lake)	Weekly	E. coli	15				0
Pittsfield	Lulu Pond Beach (DCR)	Weekly	Enterococci	17	3	151.5	344.8	22
Pittsfield	Onota Lake - Conroy Pavilion	Weekly	E. coli	14				0
Pittsfield	Onota Lake - Decom Beach	Weekly	E. coli	14				0
Pittsfield	Onota Lake - Public Beach at Burbank Park	Weekly	E. coli	15				0
Pittsfield	Pontoosuc Lake - Decom Beach	Weekly	E. coli	15				0
Pittsfield	The Pines (Pontoosuc Lake)	Weekly	E. coli	14				0

Adaptive Management

The various stakeholders and municipalities will discuss the health of the West Branch, progress of implementation, education and monitoring and develop appropriate actions for the upcoming year. These stakeholders include representatives of Central Berkshire Habitat for Humanity, 18Degrees, Westside Legends, BEAT, HVA, BRPC, the Town of Lanesborough and City of Pittsfield.

Consideration will be given to bringing the stakeholders together as an informal coalition led by BRPC to implement the plan. At a minimum, the goal would be to meet annually, develop a work plan to prioritize implementation, develop a tracking mechanism to coordinate implementations by partners, evaluate actions annually to assess progress, adjust plan implementation and add new projects. Until this is in place, and another point organization has been identified, BRPC will serve as the point organization to monitor and track the projects' progress and through regular meetings with the various stakeholders continue to advance the West Branch Watershed Based Plan.

Post-construction testing will give continuous data on whether the BMPs are functioning as intended. If the BMPs are not reducing pollutants as intended, communication about the BMP will help address any issues early on and lead to more constructive and permanent solutions.

The watershed-based plan will be reviewed and updated every three to five years based on monitoring results, additional information, BMP performance and progress toward water quality goals.

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Water Quality Assessment Reports

"*Housatonic River Watershed 2002 Water Quality Assessment Report*"

TMDL

Draft Massachusetts Statewide TMDL for Pathogen Impaired Waterbodies: *https://www.mass.gov/doc/draft-massachusetts-statewide-tmdl-for-pathogen-impaired-waterbodies/download* and Appendix B – Housatonic River *https://www.mass.gov/doc/appendix-b-housatonic-river-basin/download*

Long Island Sound TMDL for Nitrogen (Housatonic River Section) https://neiwpcc.org/wp-content/uploads/2020/08/LIS-TMDL_MA-State-Section.pdf

Appendices

Appendix A – Pollutant Load Export Rates (PLERs)

Land Use & Cover[1]	PLERs (lb/acre/year)		
	(TP)	(TSS)	(TN)
AGRICULTURE, HSG A	0.45	7.14	2.6
AGRICULTURE, HSG B	0.45	29.4	2.6
AGRICULTURE, HSG C	0.45	59.8	2.6
AGRICULTURE, HSG D	0.45	91	2.6
AGRICULTURE, IMPERVIOUS	1.52	650	11.3
COMMERCIAL, HSG A	0.03	7.14	0.3
COMMERCIAL, HSG B	0.12	29.4	1.2
COMMERCIAL, HSG C	0.21	59.8	2.4
COMMERCIAL, HSG D	0.37	91	3.7
COMMERCIAL, IMPERVIOUS	1.78	377	15.1
FOREST, HSG A	0.12	7.14	0.5
FOREST, HSG B	0.12	29.4	0.5
FOREST, HSG C	0.12	59.8	0.5
FOREST, HSG D	0.12	91	0.5
FOREST, HSG IMPERVIOUS	1.52	650	11.3
HIGH DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
HIGH DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
HIGH DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
HIGH DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
HIGH DENSITY RESIDENTIAL, IMPERVIOUS	2.32	439	14.1
HIGHWAY, HSG A	0.03	7.14	0.3
HIGHWAY, HSG B	0.12	29.4	1.2
HIGHWAY, HSG C	0.21	59.8	2.4
HIGHWAY, HSG D	0.37	91	3.7
HIGHWAY, IMPERVIOUS	1.34	1,480	10.5
INDUSTRIAL, HSG A	0.03	7.14	0.3
INDUSTRIAL, HSG B	0.12	29.4	1.2

Land Use & Cover[1]	PLERs (lb/acre/year)		
	(TP)	(TSS)	(TN)
INDUSTRIAL, HSG C	0.21	59.8	2.4
INDUSTRIAL, HSG D	0.37	91	3.7
INDUSTRIAL, IMPERVIOUS	1.78	377	15.1
LOW DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
LOW DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
LOW DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
LOW DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
LOW DENSITY RESIDENTIAL, IMPERVIOUS	1.52	439	14.1
MEDIUM DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
MEDIUM DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
MEDIUM DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
MEDIUM DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
MEDIUM DENSITY RESIDENTIAL, IMPERVIOUS	1.96	439	14.1
OPEN LAND, HSG A	0.03	7.14	0.3
OPEN LAND, HSG B	0.12	29.4	1.2
OPEN LAND, HSG C	0.21	59.8	2.4
OPEN LAND, HSG D	0.37	91	3.7
OPEN LAND, IMPERVIOUS	1.52	650	11.3
[1]HSG = Hydrologic Soil Group			

	WaterBody	StationID	Station Description	Latitude	Longitude	Sample Date	Result (MPN or CFU/100ml)	Season Geomean (MPN or CFU/100ml)	Precipitation Amounts (24, 48 and 72 hours)
2023	Daniel's Brook	DAN400	Upstream of Hancock Road Bridge	42.490096	-73.27515	06/15/2023	1011.2	440.7	Precipitation: 24hr 1.13"; 48 hr 1.13"; 72hr 1.35"
	Daniel's Brook	DAN400	Upstream of Hancock Road Bridge	42.490096	-73.27515	07/06/2023	235.9		Precipitation: 24hr 0.0"; 48 hr 0.19"; 72hr 0.37"
	Daniel's Brook	DAN400	Upstream of Hancock Road Bridge	42.490096	-73.27515	07/13/2023	461.1		Precipitation: 24hr 0.16"; 48 hr 0.16"; 72hr 1.3"
	Daniel's Brook	DAN400	Upstream of Hancock Road Bridge	42.490096	-73.27515	07/27/2023	579.4		Precipitation: 24hr 0.04"; 48 hr 0.04"; 72hr 0.04"
	Daniel's Brook	DAN400	Upstream of Hancock Road Bridge	42.490096	-73.27515	08/09/2023	689.3		Precipitation: 24hr 0.38"; 48 hr 0.62"; 72hr 0.62"
	Daniel's Brook	DAN400	Upstream of Hancock Road Bridge	42.490096	-73.27515	08/24/2023	325.5		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	Daniel's Brook	DAN400	Upstream of Hancock Road Bridge	42.490096	-73.27515	09/07/2023	365.4		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	Daniel's Brook	DAN400	Upstream of Hancock Road Bridge	42.490096	-73.27515	09/20/2023	272.3		Precipitation: 24hr 0.1"; 48 hr 0.7"; 72hr 0.72"
	West Branch of the Hous	WEB350	At the car-top boat access at the West-side Riverway Park	42.45565	-73.26096	06/15/2023	461.1		Precipitation: 24hr 1.13"; 48 hr 1.13"; 72hr 1.35"
	West Branch of the Hous	WEB350	At the car-top boat access at the West-side Riverway Park	42.45565	-73.26096	07/06/2023	45.9		Precipitation: 24hr 0.0"; 48 hr 0.19"; 72hr 0.37"
	West Branch of the Hous	WEB350	At the car-top boat access at the West-side Riverway Park	42.45565	-73.26096	07/13/2023	137.4		Precipitation: 24hr 0.16"; 48 hr 0.16"; 72hr 1.3"
	West Branch of the Hous	WEB350	At the car-top boat access at the West-side Riverway Park	42.45565	-73.26096	07/27/2023	57.1		Precipitation: 24hr 0.04"; 48 hr 0.04"; 72hr 0.04"
	West Branch of the Hous	WEB350	At the car-top boat access at the West-side Riverway Park	42.45565	-73.26096	08/09/2023	139.6		Precipitation: 24hr 0.38"; 48 hr 0.62"; 72hr 0.62"
	West Branch of the Hous	WEB350	At the car-top boat access at the West-side Riverway Park	42.45565	-73.26096	08/24/2023	56.3		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Hous	WEB350	At the car-top boat access at the West-side Riverway Park	42.45565	-73.26096	09/07/2023	128.7		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Hous	WEB350	At the car-top boat access at the West-side Riverway Park	42.45565	-73.26096	09/20/2023	178.9	114.7	Precipitation: 24hr 0.1"; 48 hr 0.7"; 72hr 0.72"
2022	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	06/16/2022	410.6		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	06/30/2022	87.2		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0.23"
	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	07/14/2022	261.3		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	07/28/2022	140.1		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0.08"
	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	8/11/2022	228.2		Precipitation: 24hr 0"; 48 hr 0.07"; 72hr 0.15"
	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	8/25/2022	461.1		Precipitation: 24hr 0"; 48 hr 0.47"; 72hr 0.47"

	WaterBody	StationID	Station Description	Latitude	Longitude	Sample Date	Result (MPN or CFU/100ml)	Season Geomean (MPN or CFU/100ml)	Precipitation Amounts (24, 48 and 72 hours)
2022	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	09/08/2022	325.5		Precipitation: 24hr 0"; 48 hr 0.2"; 72hr 2.07"
	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	9/22/2022	2419.6	319.5	Precipitation: 24hr 0.38"; 48 hr 0.38"; 72hr 0.72"
2021	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	6/3/2021	79.4		Precipitation: 24hr 0.08"; 48 hr 0.08"; 72hr 0.13"
	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	6/17/2021	344.8		Precipitation: 24hr 0.0"; 48 hr 0.03"; 72hr 0.16"
	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	7/1/2021	613.1		Precipitation: 24hr 1.5"; 48 hr 2.64"; 72hr 2.64"
	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	7/29/2021	113.7		Precipitation: 24hr 0"; 48 hr 1.52"; 72hr 1.52"
	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	8/12/2021	108.1		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB300	Upstream of Linden Street Bridge	42.45694	-73.26076	9/1/2021	190.4	184.4	Precipitation: 24hr 0"; 48 hr 0.83"; 72hr 0.83"
2019	West Branch of the Housatonic River	WEB 100	upstream of the Hancock Road Bridge	42.48416	-73.24629	7/11/2019	21.3		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 100	upstream of the Hancock Road Bridge	42.48416	-73.24629	08/05/19	45		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 100	upstream of the Hancock Road Bridge	42.48416	-73.24629	08/13/19	9.7		Precipitation: 24hr 0.02"; 48 hr 0.03"; 72hr 0.03"
	West Branch of the Housatonic River	WEB 100	upstream of the Hancock Road Bridge	42.48416	-73.24629	08/13/19	16.8		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 100	upstream of the Hancock Road Bridge	42.48416	-73.24629	6/10/2019	2		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 100	upstream of the Hancock Road Bridge	42.48416	-73.24629	6/25/2019	6.3	11.2	Precipitation: 24hr 0"; 48 hr 0"; 72hr 0.05"
	West Branch of the Housatonic River	WEB 300	Just upstream of the Linden Street Bridge, Linden Street	42.45694	-73.26076	7/11/2019	248.1		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 300	Just upstream of the Linden Street Bridge, Linden Street	42.45694	-73.26076	6/10/2019	178.2		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 300	Just upstream of the Linden Street Bridge, Linden Street	42.45694	-73.26076	6/25/2019	648.8		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0.05"
	West Branch of the Housatonic River	WEB 300	Just upstream of the Linden Street Bridge, Linden Street	42.45694	-73.26076	08/05/19	488.4		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 300	Just upstream of the Linden Street Bridge, Linden Street	42.45694	-73.26076	08/13/19	435.2		Precipitation: 24hr 0.02"; 48 hr 0.03"; 72hr 0.03"
	West Branch of the Housatonic River	WEB 300	Just upstream of the Linden Street Bridge, Linden Street	42.45694	-73.26076	09/10/19	770.1	409.2	Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 400	West of Fairfield Street (at the end of Fairfield Street)	42.4373315	-73.260493	7/11/2019	325.5		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 400	West of Fairfield Street (at the end of Fairfield Street)	42.4373315	-73.260493	08/05/19	290.9		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 400	West of Fairfield Street (at the end of Fairfield Street)	42.4373315	-73.260493	08/13/19	816.4		Precipitation: 24hr 0.02"; 48 hr 0.03"; 72hr 0.03"
	West Branch of the Housatonic River	WEB 400	West of Fairfield Street (at the end of Fairfield Street)	42.4373315	-73.260493	09/10/19	>2419.6		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 400	West of Fairfield Street (at the end of Fairfield Street)	42.4373315	-73.260493	6/10/2019	228.2		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	West Branch of the Housatonic River	WEB 400	West of Fairfield Street (at the end of Fairfield Street)	42.4373315	-73.260493	6/25/2019	110.7	287.2	Precipitation: 24hr 0"; 48 hr 0"; 72hr 0.05"
	Churchill Brook	CHB 200	Just downstream of the Hancock Road/Churchill Brook road crossing	42.490528	-73.279754	6/10/2019	27.2		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	Churchill Brook	CHB 200	Just downstream of the Hancock Road culvert - recently replaced	42.490528	-73.279754	6/25/2019	101.9		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0.05"

	WaterBody	StationID	Station Description	Latitude	Longitude	Sample Date	Result (MPN or CFU/100ml)	Season Geomean (MPN or CFU/100ml)	Precipitation Amounts (24, 48 and 72 hours)
	Churchill Brook	CHB 200	Just downstream of the Hancock Road culvert - recently replaced	42.490528	-73.279754	7/11/2019	21.8		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	Churchill Brook	CHB 200	Just downstream of the Hancock Road culvert - recently replaced	42.490528	-73.279754	08/05/19	19.7		Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"
	Churchill Brook	CHB 200	Just downstream of the Hancock Road culvert - recently replaced	42.490528	-73.279754	08/13/19	73.8		Precipitation: 24hr 0.02"; 48 hr 0.03"; 72hr 0.03"
	Churchill Brook	CHB 200	Just downstream of the Hancock Road culvert - recently replaced	42.490528	-73.279754	09/10/19	27.5	36.6	Precipitation: 24hr 0"; 48 hr 0"; 72hr 0"

West Branch Watershed Sample Site Location Information

Site ID	Waterbody	Latitude	Longitude	Sampling Manager	Year Last Sampled
DAN400	Daniels Brook	42.490096	-73.27515	HVA	2023
WEB350	West Branch	42.45565	-73.26096	HVA	2023
WEB300	West Branch	42.45694	-73.26076	HVA	2022
WEB 100	West Branch	42.48416	-73.24629	HVA	2019
WEB 400	West Branch	42.4373315	-73.260493	HVA	2019
CHB 200	Churchill Brook	42.490528	-73.279754	HVA	2019

Appendix B (continued)

2006-2007 HVA Water Quality Data

West Branch of the Housatonic River

Nitrogen (Nitrate) and Fecal Coliform Results

2006 West Branch - Fecal Coliform Bacteria in colonies per 100 ml*

Site	May 23, '06	June 27, '06	July 25, '06	Aug. 22, '06	Sept. 26, '06	# samples	swim # met	swim % met	fish/boat # met	fish/boat % met
Taconic Park Dr.	40	70	120	40	150	5	5	100%	5	100%
WB, Above Peck's	80	420	380	310	200	5	1	20%	5	100%
Peck's Confluence (Peck's Brook)	30	130	460	650	100	5	3	60%	5	100%
Linden Street	90	520	380	320	440	5	1	20%	5	100%
Columbus Ave.	70	290	400	280	470	5	1	20%	5	100%
West Street	50	150	1,400	800	350	5	2	40%	4	80%
Mill Street	150	240	700	1,600	270	5	1	20%	4	80%
Jimmy's & Rt. 20	50	270	600	450	350	5	1	20%	5	100%
Boylston Street	80	250	800	380	320	5	1	20%	5	100%
Number of Measurements/Data Collected	9	9	9	9	9	45	16	33%	43	97%

2006 West Branch - Nitrate-Nitrogen in mg/l

Site	May 23, '06	June 27, '06	July 25, '06	Aug. 22, '06	Sept. 26, '06	# samples	# met state standards	% met state standards
Taconic Park Drive	0.05	0.02	0.04	0.04	0.04	5	5	100%
WB, Above Peck's	0.07	0.05	0.07	0.05	0.05	5	5	100%
Peck's Confluence (Onota Brook)	0.05	0.09	0.14	0.19	0.10	5	4	80%
Linden Street	0.04	0.05	0.07	0.07	0.06	5	5	100%
Columbus Avenue	0.05	0.06	0.07	0.07	0.06	5	5	100%
West Street	0.06	0.06	0.07	0.08	0.06	5	5	100%
Mill Street	0.06	0.06	0.07	0.08	0.06	5	5	100%
Jimmy's & Rt. 20	0.06	0.07	0.08	0.08	0.07	5	5	100%
Boylston Street	0.07	0.08	0.09	0.10	0.08	5	5	100%
Number of Measurements/Data Collected	9	9	9	9	9	45	44	92%

Draft **2007 West Branch - Fecal Coliform Bacteria** in colonies per 100 ml*

Site	May '07	June '07	July '07	Aug. '07	Sept. '07
Taconic Park Dr.	30	60	20	30	110
WB, Above Peck's	60	840	310	900	700
Peck's Confluence (Peck's Brook)	30	260	410	100	90
Columbus Ave.	120	560	250	350	300
West Street	470	850	550	210	480
Mill Street	100	640	150	170	290

Draft **2007 West Branch - Nitrate-Nitrogen** in mg/l

Site	May '07	June '07	July '07	Aug. '07	Sept. '07
Taconic Park Dr.	0.24	0.10	0.04	0.11	0.08
WB, Above Peck's	0.26	0.20	0.07	0.18	0.14
Peck's Confluence (Onota Brook)	0.10	0.16	0.09	0.25	0.22
Columbus Ave.	0.20	0.14	0.09	0.10	0.10
West Street	0.21	0.15	0.09	0.11	0.11
Mill Street	0.21	0.15	0.26	0.13	0.12

APPENDIX C

Pollutant Load Reduction Water Quality Goal Calculations

The West Branch watershed acreage (23,355 acres) was obtained from **Table A-13** of this plan. To obtain pre-development PLERs, the percentage of each land use was estimated based on the historical understanding that pre-development land use was primarily forested (97%) with a small percentage of open or barren land (3%). The percentage of forested land use in each hydrological soil group was estimated based on the Hydrologic Soil Group[1] GIS layer available on MassMapper.[2]

Table 1: Pre-development Pollutant Load Export Rates based on Appendix A PLERs

West Branch Land Use	% land use	Total Acres	TP (lbs/acre)	TP (lbs)	TSS (lbs/acre)	TSS (lbs)	TN (lbs/acre)	TN (lbs)
Forested (HSG A)	95%	22,187	0.12	2662.47	7.14	158,416.97	0.5	11093.63
Forested (HSG C)	2%	467	0.12	56.052	59.8	27932.58	0.5	233.55
Open Land (Barren) (HSG-A)	3%	701	0.03	21.0195	7.14	5002.641	0.3	210.195
Totals	100%	23,355	0.27	2739.542	74.08	191352.19	1.3	11537.37

****Table 2: Calculations to obtain post-development pollutant loading reduction goals.**

	Pollutant Loading		
	TP (lbs)	**TSS (tons)**	**TN (lbs)**
Pre-development	2740	96	11,537
Post-development (including forest land use)	5,320	940	34,514
Post-development Estimated PLERs (minus the forest land use)	3,199	344	23,888
Pre- and Post- Development (minus the forest land use) PLER difference. (Column C - Column A)	459	248	12,351
10% reduction goal	46	25	1,235
PL Reductions, if all BMPs installed	29.3	5.7	232

** Post development PLERs were obtained from **Table A-18** of this plan.

[1] https://www.mass.gov/info-details/massgis-data-soils-ssurgo-certified-nrcs

[2] https://maps.massgis.digital.mass.gov/MassMapper/MassMapper.html

Appendix D

UNH Conceptual Designs
completed for the
Mass DEP TMDL project (2022)

Grass Swale Concept Design
Site 7: Wahconah Park
Version 1
8/19/2022

Prepared for:

Town of Pittsfield, MA

Prepared by:

University of New Hampshire Stormwater Center

1 SITE OVERVIEW

Existing Site Observations

The parking lot at Wahconah Park is an area of significant flooding following any rain event. There was about 0.5 inches of rain the night before the visit. The outlet toward the wetland to the west of the lot has accumulated sediment and mounded such that water cannot leave the lot. The gravel lot has little slope, so a small increase in flooding depth covers a large area of the lot. Sediment has accumulated along the western edge of the lot and is growing wetland plant species, indicating that the soils are mostly saturated. There was a large (about 36-in) stormwater pipe under the road with the outfall west of the park. It was not observed, but it was thought to back up during runoff events. This site also serves as the emergency landing area for local medivac helicopters for the local hospital. Stormwater Recommendations

The parking lot is providing the hydrologic function of a floodplain. There is shallow depth to groundwater and the adjacent wetland is migrating into the existing parking area. The recommendation is to combine wetland restoration and parking area elevation coupled with permeable pavement or other subsurface storage systems to enhance wetland function and maintain parking free of flooding. There is sufficient green space to accommodate lost parking for wetland expansion/restoration.

Site Photos

Figure 1: Looking toward the West where the constant flooding in the parking lot is a major concern.

Figure 2: From the West, looking at the flooding in the parking lot.

2 BMP SIZING

The proposed stormwater control measure (SCM) designs were developed using the EPA Region I Performance Curves. Generally, the target SCM size of the Physical Storage Capacity (PSC) is greater than 0.1-inch. The cost-optimized PSC is at the "knee" of the curve and generally around the value of 0.4-inch although this varies depending on the SCM and infiltration rate. Figure 3 shows the performance curve for a grass swale (BMP Performance Fact Sheets, UNH Stormwater Center, 2019).

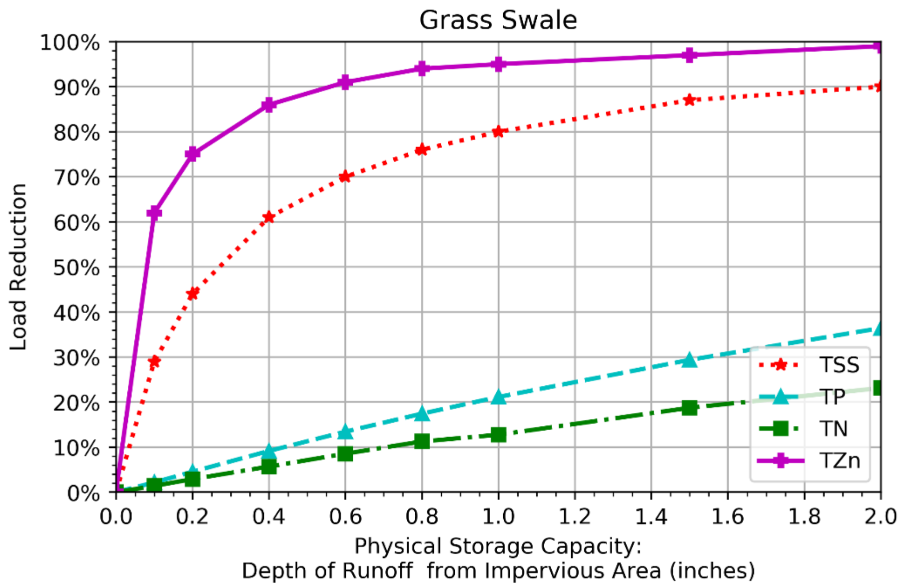


Figure 3: EPA Region I Performance Curve for retrofit SCM

The cost-optimized size would occur at the knee of the line when there are diminishing returns of performance for an increase in PSC. This can be estimated quickly to be about between 0.2-0.6-inch for all parameters. It may also be calculated by finding the root of the second derivative of the line (as done here).

The PSC is the depth of runoff from the impervious drainage area which the SCM hold in the void space. The optimized sizing of 0.4-inch means the SCM is sized to have voids capable of holding 0.4-inches of precipitation on the impervious area. Although the static sizing is 40% of the 1-inch sizing, the load reductions range from 70% to 100% so there is little penalty in performance for building a smaller system. Conversely, there is little performance benefit for building a much larger 1-inch system while the construction and real-estate costs increase substantially. The Load Reduction on the y-axis is the annual reduction modelled using a rainfall record of a couple decades to simulate the full range of typical rainfall events and antecedent conditions.

3 PROPOSED DESIGNS

The proposed designs shown here are optimized to fit within the existing swale currently conveying flow from the large urban drainage area. This is a retrofit targeted at improving water quality treatment for nitrogen, bacteria, and gross solids. These concepts did not investigate site specific geotechnical details such as depth to groundwater or hydrologic soil group that could require design modifications.

The following generic design detail shows the plan view of the existing drainage area and proposed system area and components. There are also associated cross-sections of typical SCM construction and components. These details can change and be customized with advanced site-specific survey and design information.

This design represents the lowest cost upgrade possible to reduce flooding and restore parking lot use as an emergency landing area for the hospital. Initial survey results demonstrate the need to elevate the northwest corner of the new proposed paved parking area up 2 ft. This would make the northern edge of the new proposed parking area to an elevation to drain the southwest corner of the new lot where the overland flow will be conveyed through a grassed treatment swale. To prevent flooding from elevated river flows and backwater up the existing drainage line a one-way valve such as a tideflex is proposed to be installed on the existing outfall.

It should be noted that additional treatment could be added within the new proposed parking area through additional inlet structures to a subsurface storage and infiltration area. To offset the wetland and wetland setback impacts an enhanced wetland buffer area is proposed.

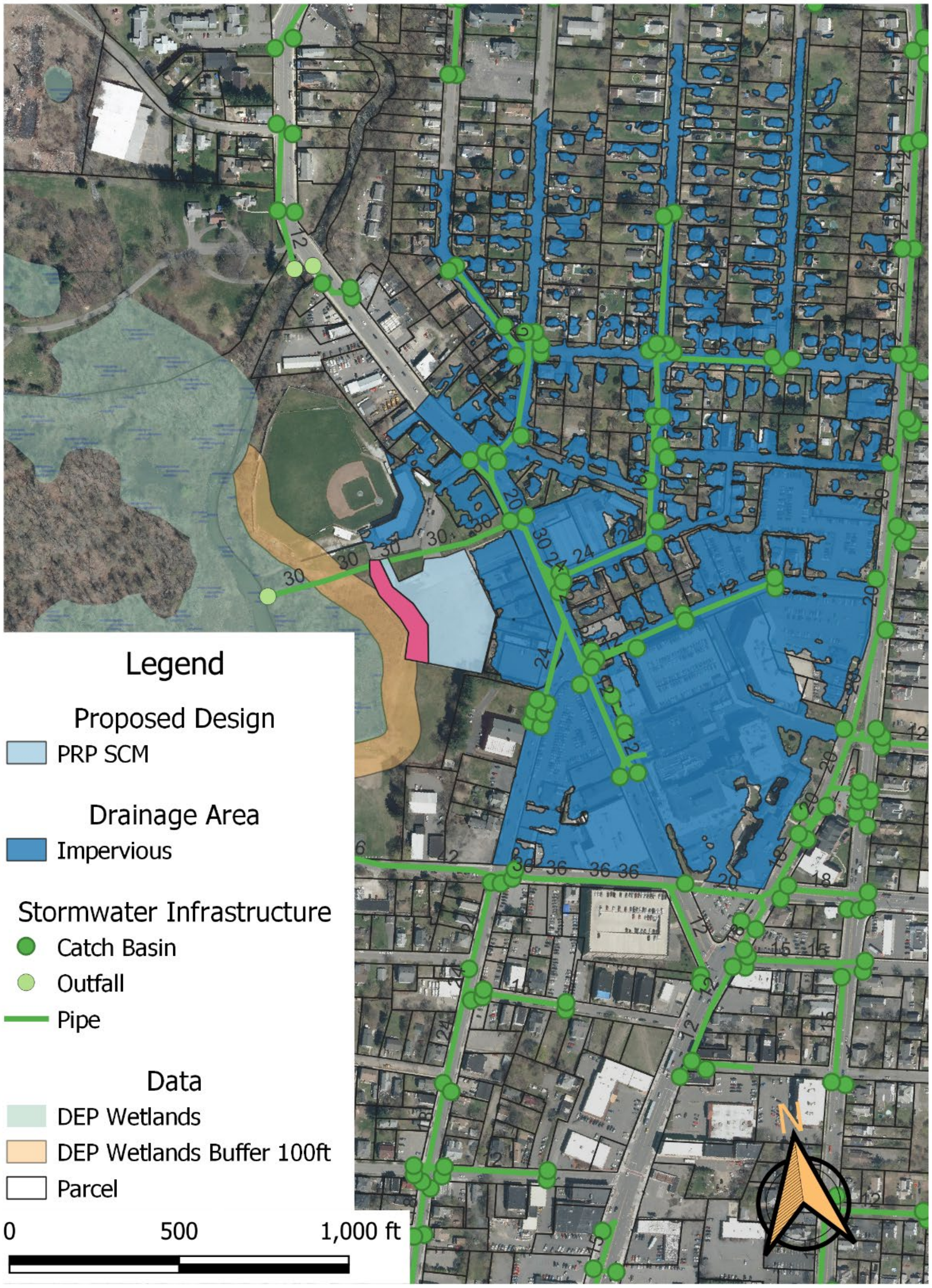


Figure 4: Plan layout 1

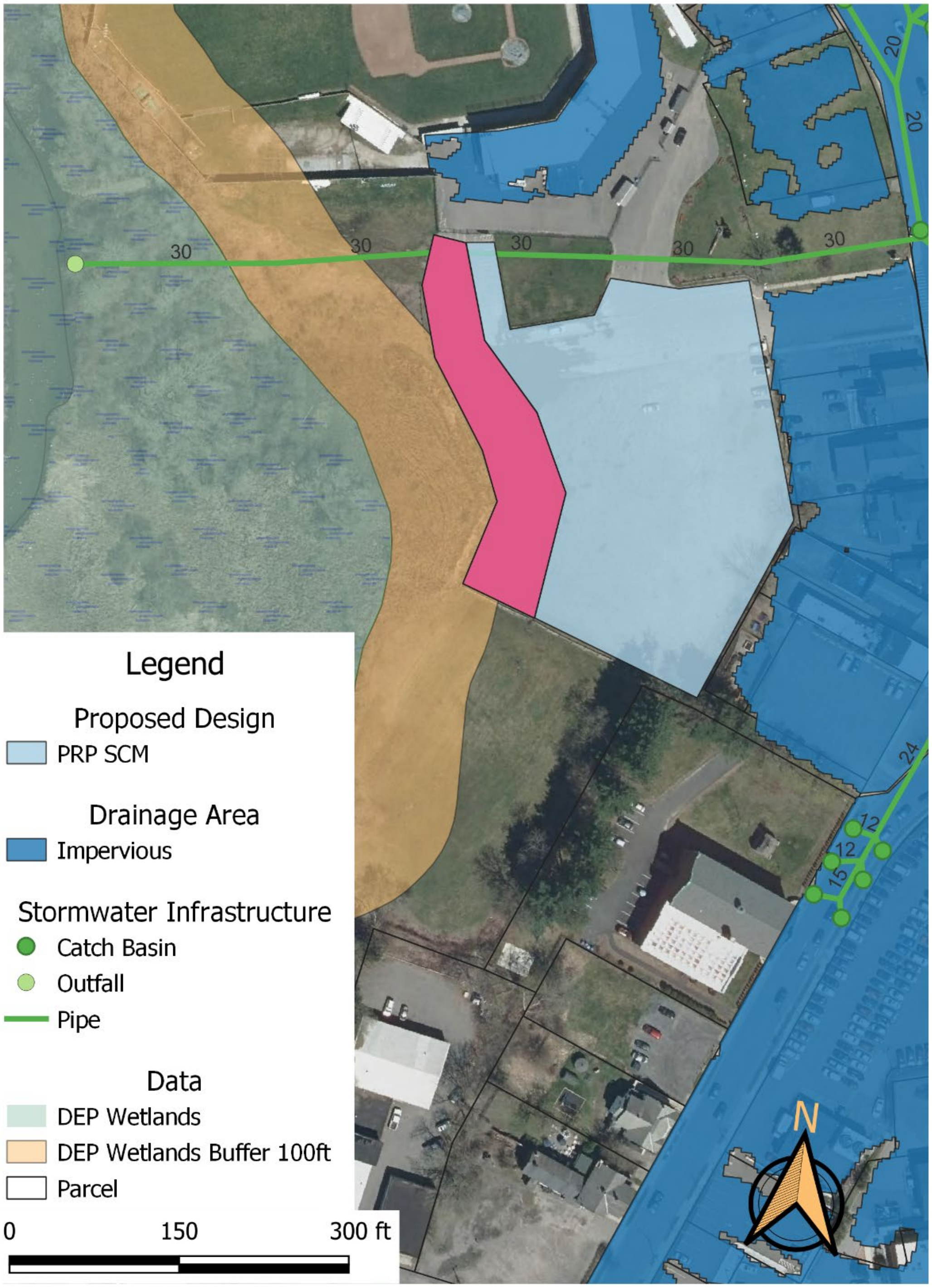


Figure 5: Plan layout 2

Figure 6: Typical Linear Bioswale cross-section (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

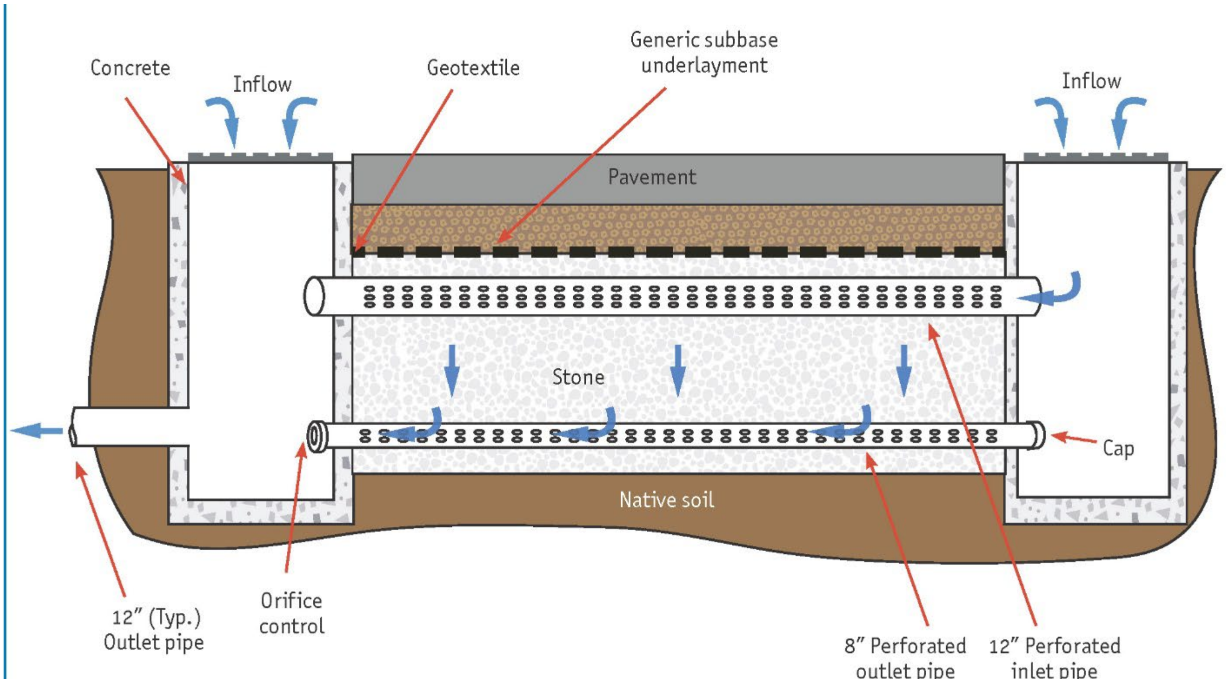


Figure 7: Typical Subsurface Gravel Filter cross-section (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

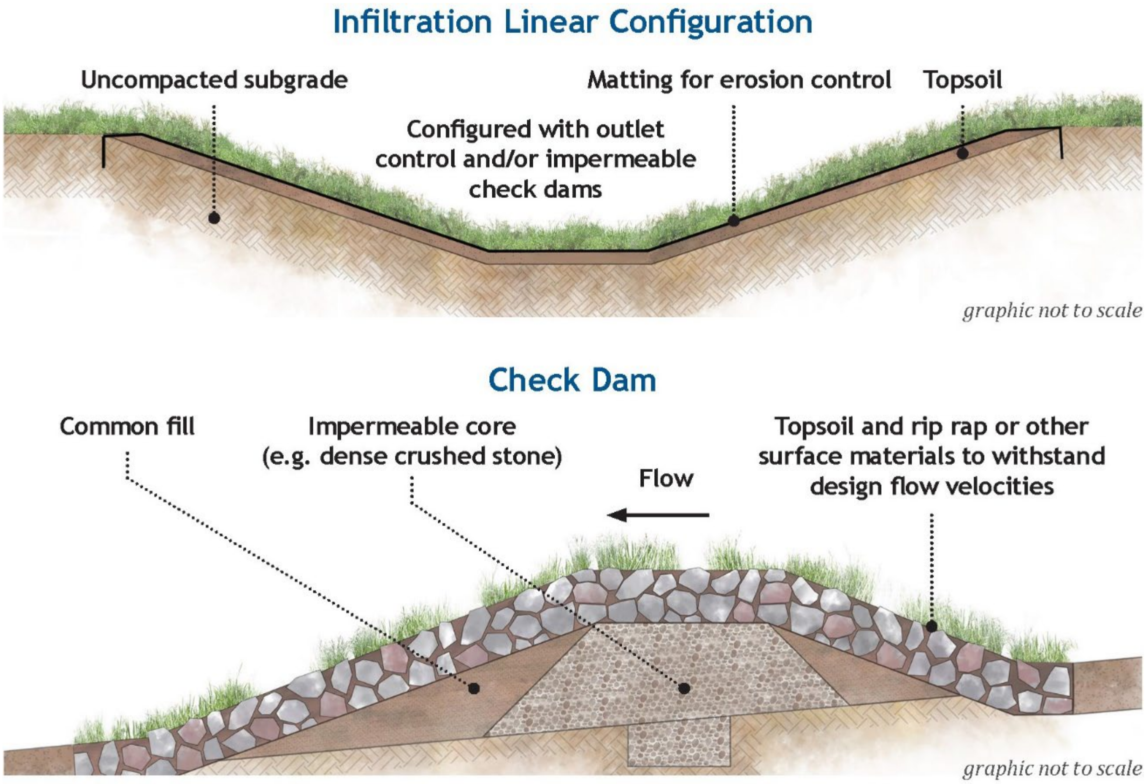


Figure 8: Typical Linear Bioswale cross-section (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

Table 1: Summary of site parameters, design summary, performance curve efficiencies and load reductions.

	Parameter	Units	SCM 1	SCM 2	Total in Series
Watershed	Impervious Drainage Area	ac			4.21
	Land Use	-	Comm. / Ind.	Comm. / Ind.	
SCM	Stormwater Control Measure	-	Subsurface Gravel Filter	Bioswale	
	Applicable Performance Curve	-	Infiltration Basin	Grass Swale	
	Infiltration Rate	in/hr	0.52		
Intermediate Calculations	Design Storage Volume	cf	33,000	2,200	
	Physical Storage Capacity	in	2.2	0.1	
Performance Curve Removal Efficiencies	Volume	%	97%	0%	97%
	P	%	99%	3%	99%
	N	%	100%	2%	100%
	TSS	%	100%	37%	100%
	Zn	%	100%	72%	100%
	Bacteria	%	100%	0%	100%
Load Export Rates	Volume	Mgal/yr			4.41
	P	lb/yr			7.5
	N	lb/yr			63.2
	TSS	lb/yr			1,590
	Bacteria	Billion MPN/yr			27
SCM Annual Performance	Volume	Mgal/yr			4.26
	P	lb/yr			7.4
	N	lb/yr			63.2
	TSS	lb/yr			1590
	Bacteria	%/yr			100%
Costs	Total SCM Costs	$	$424,000	$26,000	$450,000
	Volume	$/Mgal-yr			$105,520
	P	$/lb-yr			$60,611
	N	$/lb-yr			$7,123
	TSS	$/lb-yr			$283
	Bacteria	$/%-yr			$450,496
O&M	Estimated O&M Hours	hr/yr	87	40	127

GRAVEL WETLAND CONCEPT DESIGN
SITE 10: PECKS RD & ONOTA ST
VERSION 1
8/19/2022

Prepared for:

Town of Pittsfield, MA

Prepared by:

UNIVERSITY OF NEW HAMPSHIRE
STORMWATER CENTER

University of New Hampshire Stormwater Center

1 SITE OVERVIEW

Existing Site Observations

There are multiple curb cuts along the road that allow stormwater to flow directly into the stream untreated. There are undercutting, erosion, and sediment/trash deposition areas that are in disrepair and in need of maintenance (Figure 1 and Figure 2). The bridge just north of these curb cuts is scheduled for renovation in the near future. Stormwater Recommendations

New catch basin outfalls could be implemented that stabilize conveyance to the river, provide stormwater treatment, and allow for easy maintenance access along the roadway. These deepsunk catch basins could include a stone apron.

Site Photos

Figure 1: Curb cut on Pecks Rd.

Figure 2: Paved swale from curb cut draining directly to Onota brook.

UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER

2 BMP SIZING

The proposed stormwater control measure (SCM) designs were developed using the EPA Region I Performance Curves. Generally, the target SCM size of the Physical Storage Capacity (PSC) is greater than 0.1-inch. The cost-optimized PSC is at the “knee” of the curve and generally around the value of 0.4-inch although this varies depending on the SCM and infiltration rate. Figure 3 shows the performance curve for a subsurface gravel wetland (BMP Performance Fact Sheets, UNH Stormwater Center, 2019).

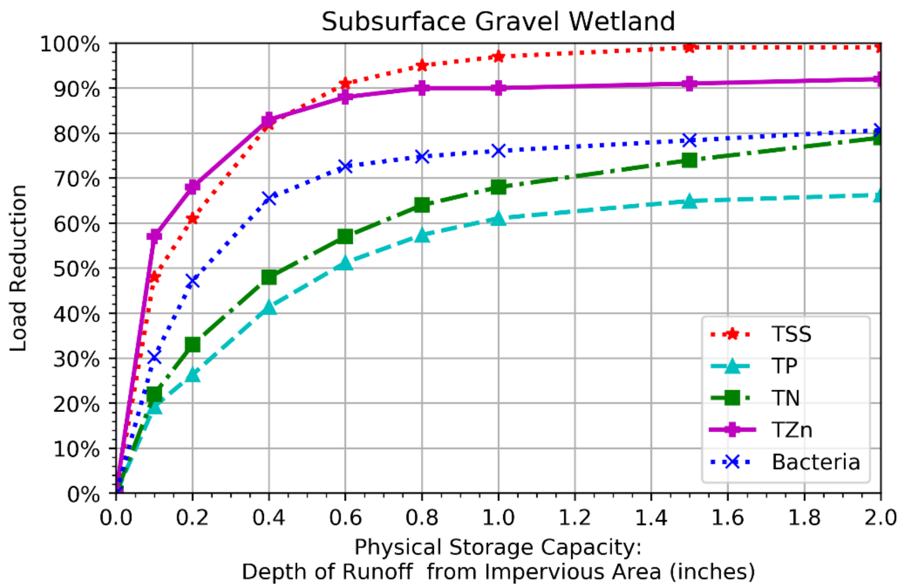


Figure 3: EPA Region I Performance Curve for retrofit SCM

The cost-optimized size would occur at the knee of the line when there are diminishing returns of performance for an increase in PSC. This can be estimated quickly to be about between 0.2-0.6-inch for all parameters. It may also be calculated by finding the root of the second derivative of the line (as done here).

The PSC is the depth of runoff from the impervious drainage area which the SCM hold in the void space. The optimized sizing of 0.4-inch means the SCM is sized to have voids capable of holding 0.4-inches of precipitation on the impervious area. Although the static sizing is 40% of the 1-inch sizing, the load reductions range from 70% to 100% so there is little penalty in performance for building a smaller system. Conversely, there is little performance benefit for building a much larger 1-inch system while the construction and real-estate costs increase substantially. The Load Reduction on the y-axis is the annual reduction modelled using a rainfall record of a couple decades to simulate the full range of typical rainfall events and antecedent conditions.

3 PROPOSED DESIGNS

The proposed designs shown here are undersized to fit within the existing swale currently conveying flow from the large urban drainage area. This is a retrofit targeted at improving water quality treatment for nitrogen, bacteria, and gross solids. These concepts did not investigate site specific geotechnical details such as depth to groundwater or hydrologic soil group that could require design modifications.

The following generic design detail shows the plan view of the existing drainage area and proposed system area and components. There are also associated cross-sections of typical SCM construction and components. These details can change and be customized with advanced site-specific survey and design information.

This leaching catchbasin design has been modified with an expanded stone envelope and a small internal storage reservoir or saturated zone that will mimic the function of a subsurface gravel wetland. The inlet will be a grated inlet and the outlet will occur over a stabilized internal clay berm. There is no secondary outlet as excess flow will level spread through the stone over the internal berm.

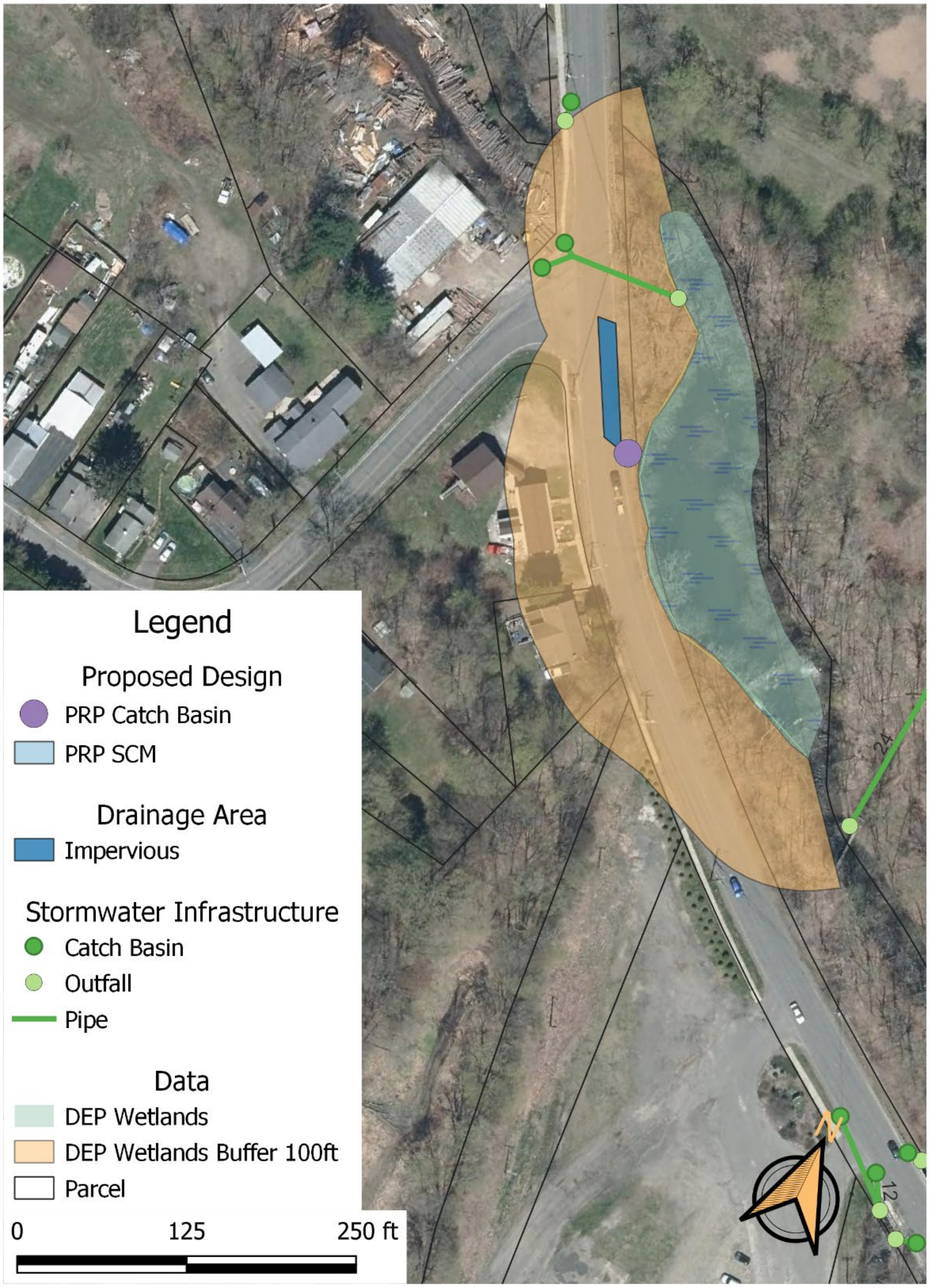


Figure 4: Plan layout

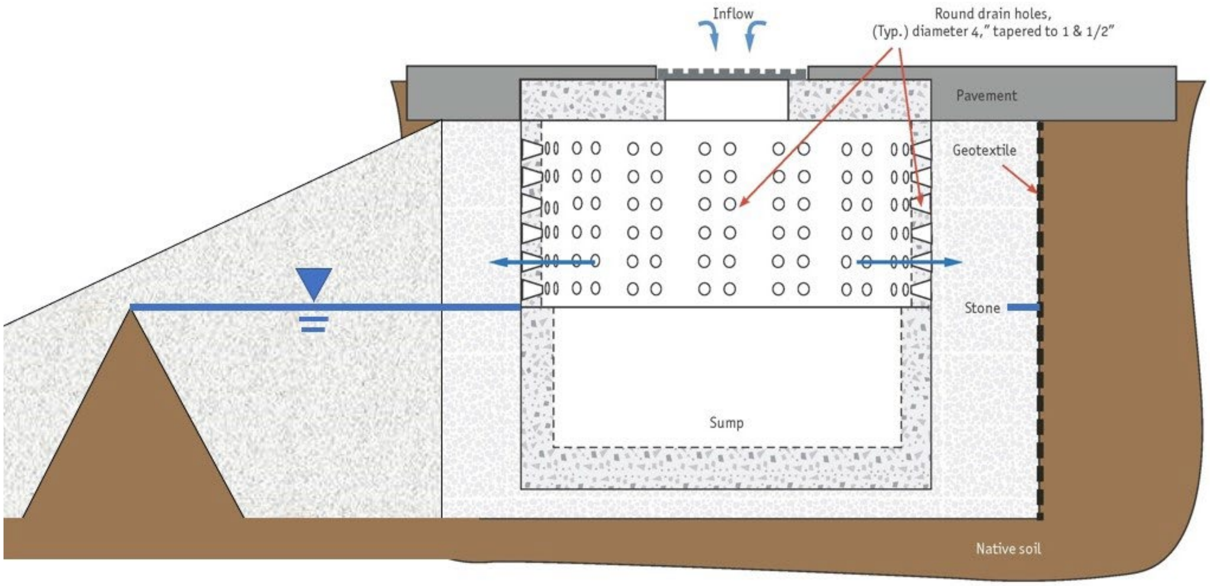


Figure 5: Typical SCM cross-section (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

Table 1: Summary of site parameters, design summary, performance curve efficiencies and load reductions.

	Parameter	Units	SCM 1
Watershed	Impervious Drainage Area	ac	0.03
	Land Use	-	Med Res.
SCM	Stormwater Control Measure	-	Enhanced Leaching Basin
	Applicable Performance Curve	-	Subsurface Gravel Wetland
	Infiltration Rate	in/hr	
Intermediate Calculations	Design Storage Volume	cf	58
	Physical Storage Capacity	in	0.6
Performance Curve Removal Efficiencies	Volume	%	0%
	P	%	52%
	N	%	57%
	TSS	%	91%
	Zn	%	88%
	Bacteria	%	73%
Load Export Rates	Volume	Mgal/yr	0.03
	P	lb/yr	0.1
	N	lb/yr	0.4
	TSS	lb/yr	11
	Bacteria	Billion MPN/yr	0
SCM Annual Performance	Volume	Mgal/yr	0.00
	P	lb/yr	0.0
	N	lb/yr	0.2
	TSS	lb/yr	10
	Bacteria	%/yr	73%
Costs	Total SCM Costs	$	$2,000
	Volume	$/Mgal-yr	N/A
	P	$/lb-yr	$76,030
	N	$/lb-yr	$9,510
	TSS	$/lb-yr	$190
	Bacteria	$/%-yr	$30
O&M	Estimated O&M Hours	hr/yr	1

INFILTRATION BASIN CONCEPT DESIGN
SITE 14: FRANCIS AVE & CIRCULAR AVE
VERSION 1
8/19/2022

Prepared for:

Town of Pittsfield, MA

Prepared by:

University of New Hampshire Stormwater Center

1 SITE OVERVIEW

Existing Site Observations

The existing drainage appears hydraulically inefficient resulting in high flow bypassing the existing catch basins (Figure 1) and flowing down to the end of the road where there is significant sediment deposition (Figure 2). Nearby are a set of stairs leading to College Way that the community uses frequently but are in severe disrepair. Stormwater Recommendations

The catch basins on Francis Ave should be reinstalled and relocated and a bioretention area is proposed in the adjacent field on the south side of Francis Ave. This area was reported to be slated for a park or seating area which could enhance the recommended drainage improvements. A speed bump or some other conveyance structure could be implemented to direct water into the proposed bioretention area.

Site Photos

Figure 1: At the intersection with two shallow catch basins that drain toward 17 Francis Ave.

Figure 2: The end of the road near 17 Francis Ave showed signs of high sediment deposition, vegetation, and a clogged catch basin (not found).

2 BMP SIZING

The proposed stormwater control measure (SCM) designs were developed using the EPA Region I Performance Curves. Generally, the target SCM size of the Physical Storage Capacity (PSC) is greater than 0.1-inch. The cost-optimized PSC is at the "knee" of the curve and generally around the value of 0.4-inch although this varies depending on the SCM and infiltration rate. A conservative infiltration rate of 0.52 in/hr was assumed for this site without having performed in-situ soil tests. Figure 3 shows the performance curve for an infiltration basin (BMP Performance Fact Sheets, UNH Stormwater Center, 2019).

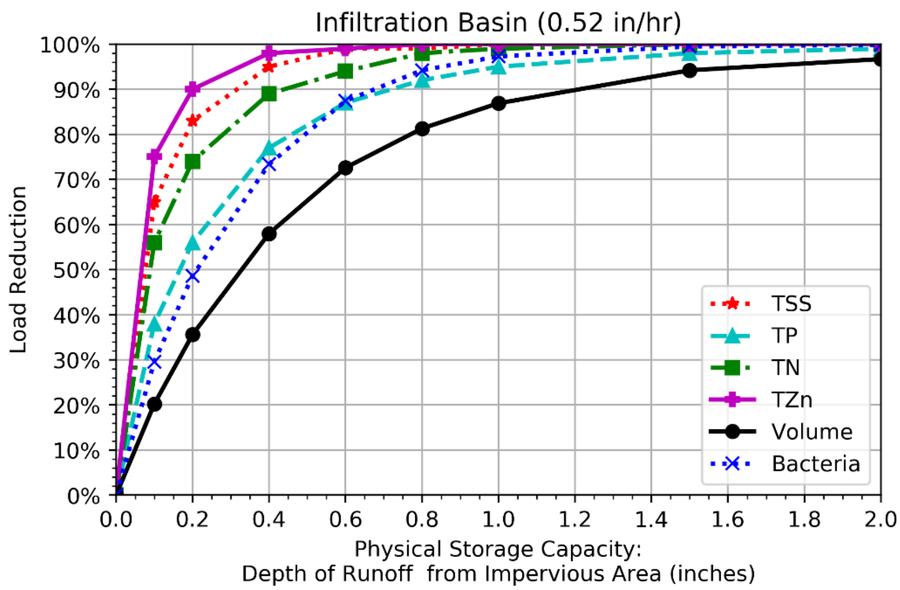


Figure 3: EPA Region I Performance Curve for retrofit SCM

The cost-optimized size would occur at the knee of the line when there are diminishing returns of performance for an increase in PSC. This can be estimated quickly to be about between 0.2-0.6-inch for all parameters. It may also be calculated by finding the root of the second derivative of the line (as done here).

The PSC is the depth of runoff from the impervious drainage area which the SCM hold in the void space. The optimized sizing of 0.4-inch means the SCM is sized to have voids capable of holding 0.4-inches of precipitation on the impervious area. Although the static sizing is 40% of the 1-inch sizing, the load reductions range from 70% to 100% so there is little penalty in performance for building a smaller system. Conversely, there is little performance benefit for building a much larger 1-inch system while the construction and real-estate costs increase substantially. The Load Reduction on the y-axis is the annual reduction modelled using a rainfall record of a couple decades to simulate the full range of typical rainfall events and antecedent conditions.

3 PROPOSED DESIGNS

The proposed designs shown here are optimized to fit within the existing green space on site. This is a retrofit targeted at improving water quality treatment for nitrogen, bacteria, and gross solids. These concepts did not investigate site specific geotechnical details such as depth to groundwater or hydrologic soil group that could require design modifications.

The following generic design detail shows the plan view of the existing drainage area and proposed system area and components. There are also associated cross-sections of typical SCM construction and components. These details can change and be customized with advanced site-specific survey and design information.

This design includes two SCMs. The first is a leaching catchbasin that will treat the lower southern drainage area to reduce the erosive attack on the existing community stairway. The second design consists of a surface infiltration area that will intercept the current stormwater pipe from the road and filter/infiltrate the design storage volume. The bypasses from both systems will be conveyed over existing drainage pathways once the system is at capacity.

Figure 4: Plan layout 1

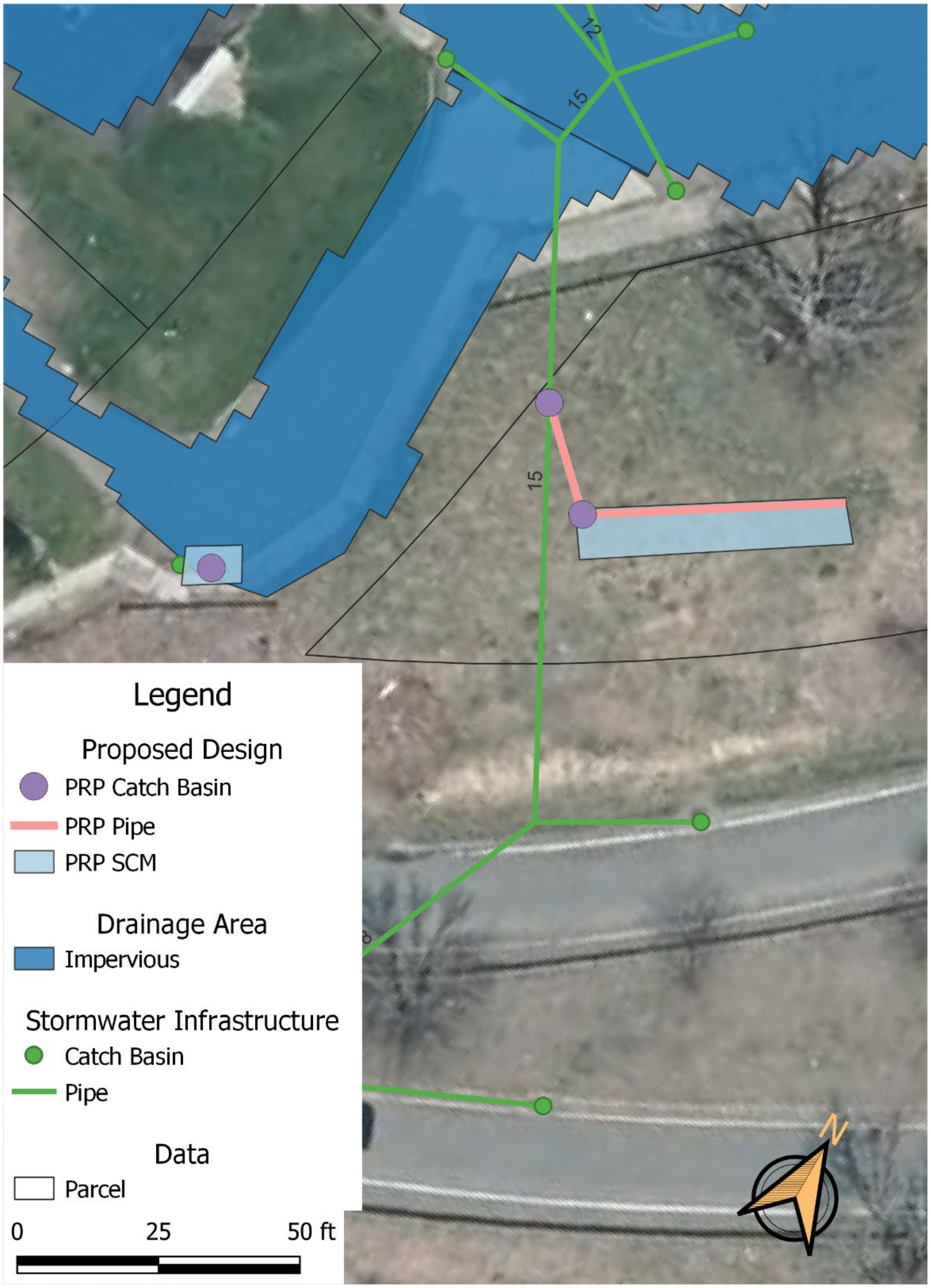


Figure 5: Plan layout 2

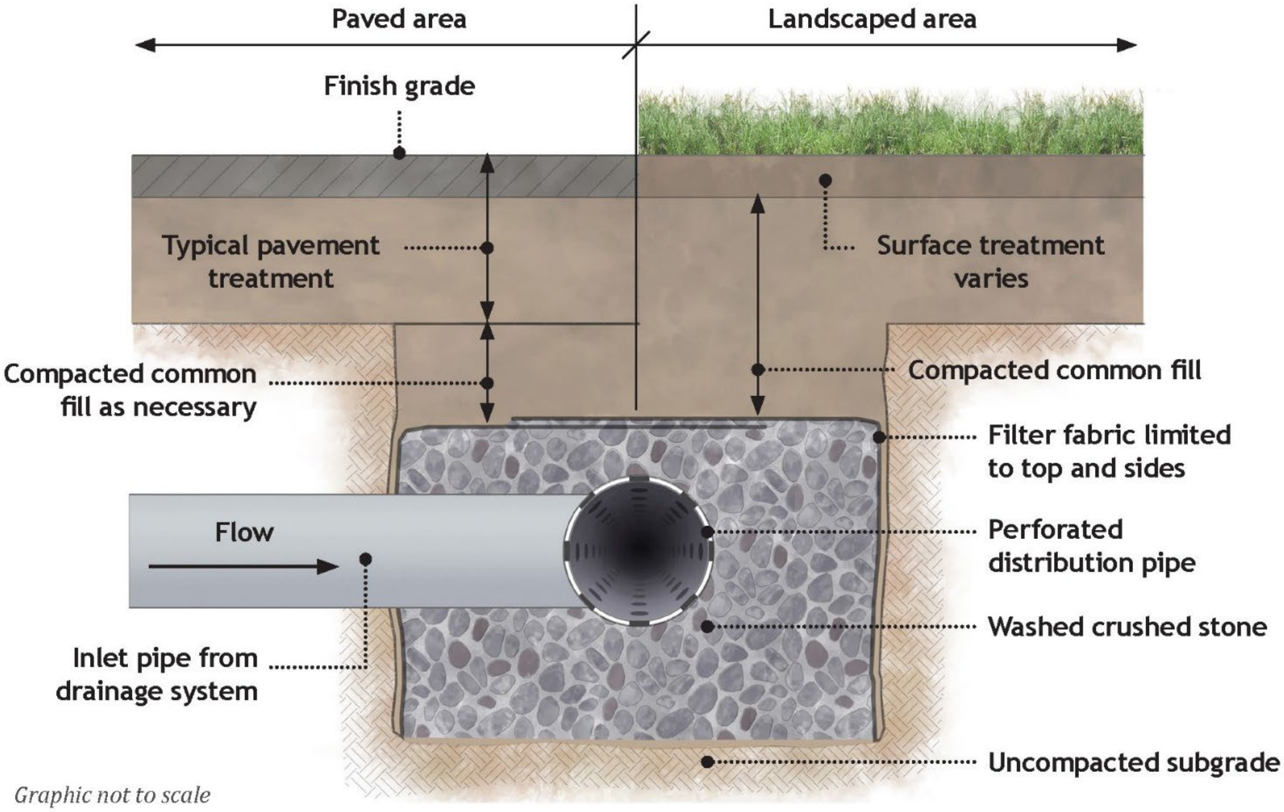


Figure 6: Typical SCM cross-section (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

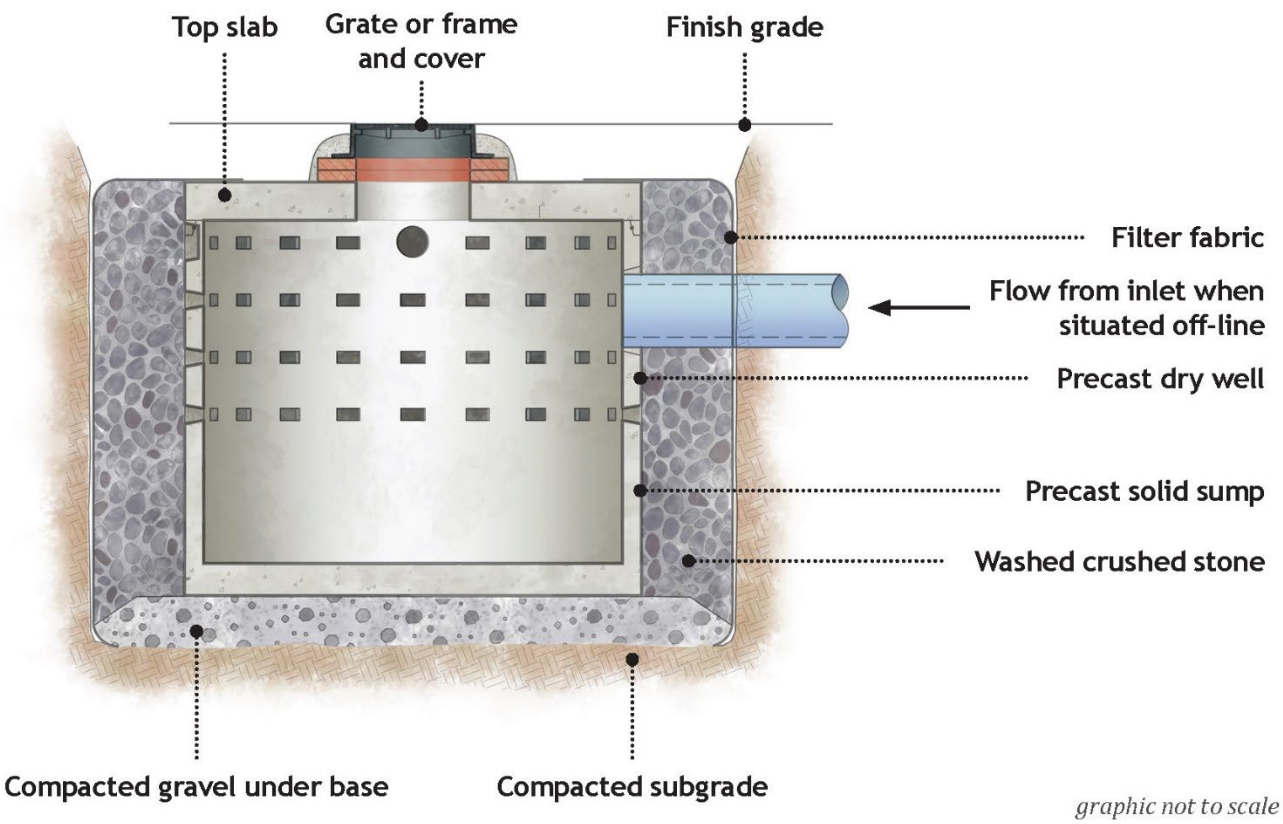


Figure 7: Typical SCM cross-section (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

Table 1: Summary of site parameters, design summary, performance curve efficiencies and load reductions.

	Parameter	Units	SCM 1	SCM 1	Site Total
Watershed	Impervious Drainage Area	ac	1.30	0.24	1.36
	Land Use	-	Med Res.	Med Res.	Comm. / Ind.
SCM	Stormwater Control Measure	-	Subsurface Gravel Filter	Leaching Basin	
	Applicable Performance Curve	-	Infiltration Basin	Infiltration Trench	
	Infiltration Rate	in/hr	0.52	0.52	
Intermediate Calculations	Design Storage Volume	cf	396	280	
	Physical Storage Capacity	in	0.1	0.3	
Performance Curve Removal Efficiencies	Volume	%	17%	54%	
	P	%	34%	59%	
	N	%	50%	87%	
	TSS	%	58%	85%	
	Zn	%	68%	99%	
	Bacteria	%	26%	54%	
Load Export Rates	Volume	Mgal/yr	1.36	0.25	1.61
	P	lb/yr	2.5	0.5	3.0
	N	lb/yr	18.3	3.4	21.7
	TSS	lb/yr	571	105	676
	Bacteria	Billion MPN/yr	8	2	10
SCM Annual Performance	Volume	Mgal/yr	0.24	0.14	0.37
	P	lb/yr	0.9	0.3	1.1
	N	lb/yr	9.2	2.9	12.1
	TSS	lb/yr	334	89	423
	Bacteria	%/yr	26%	54%	79%
Costs	Total SCM Costs	$	$6,000	$5,000	$11,000
	Volume	$/Mgal-yr	$25,460	$36,846	$62,306
	P	$/lb-yr	$7,020	$17,871	$24,891
	N	$/lb-yr	$650	$1,703	$2,353
	TSS	$/lb-yr	$20	$56	$76
	Bacteria	$/%-yr	$230	$9,304	$9,534
O&M	Estimated O&M Hours	hr/yr	27	2	29

GRAVEL WETLAND CONCEPT DESIGN
SITE 15: PARK ST PARK
VERSION 1
8/19/2022

Prepared for:

Town of Pittsfield, MA

Prepared by:

UNIVERSITY OF NEW HAMPSHIRE
STORMWATER CENTER

University of New Hampshire Stormwater Center

1 SITE OVERVIEW

Existing Site Observations

The existing condition is an operational drainage feature that has some performance issues. Treatment may be adequate but long-term performance and maintenance could be improved. The trash grate at the outlet of the culvert (Figure 1) creates deposition in the hard-to-access culvert (Figure 2) as the front clogs with organic debris and trash. Stormwater Recommendations

The trash grate should be replaced with a 3-dimensional trapezoidal structure and could be relocated to the upstream inlet. The downstream treatment area could be enhanced for greater bacteria and nitrogen reductions (i.e. transitioned to a subsurface gravel wetland). Site Photos

Figure 1: The box culvert outlet had a grate clogged with organic debris and trash. Behind the grate, the sediment buildup can be estimated at 1 foot deep.

Figure 2: The sediment deposit at the outlet of the box culvert. Some larger riprap can be seen in the plunge pool while the mounding and rest of the swale are filled with fine sands and finer sediment.

2 BMP SIZING

The proposed stormwater control measure (SCM) designs were developed using the EPA Region I Performance Curves. Generally, the target SCM size of the Physical Storage Capacity (PSC) is greater than 0.1-inch. The cost-optimized PSC is at the "knee" of the curve and generally around the value of 0.4-inch although this varies depending on the SCM and infiltration rate. Figure 3 shows the performance curve for a subsurface gravel wetland (BMP Performance Fact Sheets, UNH Stormwater Center, 2019).

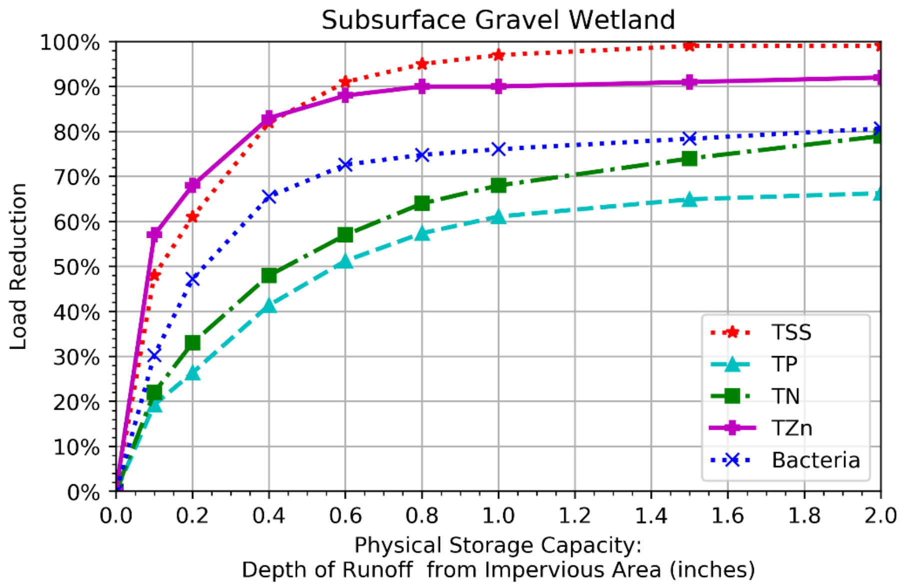


Figure 3: EPA Region I Performance Curve for retrofit SCM

The cost-optimized size would occur at the knee of the line when there are diminishing returns of performance for an increase in PSC. This can be estimated quickly to be about between 0.2-0.6-inch for all parameters. It may also be calculated by finding the root of the second derivative of the line (as done here).

The PSC is the depth of runoff from the impervious drainage area which the SCM hold in the void space. The optimized sizing of 0.4-inch means the SCM is sized to have voids capable of holding 0.4-inches of precipitation on the impervious area. Although the static sizing is 40% of the 1-inch sizing, the load reductions range from 70% to 100% so there is little penalty in performance for building a smaller system. Conversely, there is little performance benefit for building a much larger 1-inch system while the construction and real-estate costs increase substantially. The Load Reduction on the y-axis is the annual reduction modelled using a rainfall record of a couple decades to simulate the full range of typical rainfall events and antecedent conditions.

3 PROPOSED DESIGNS

The proposed designs shown here are undersized to fit within the existing swale currently conveying flow from the large urban drainage area. This is a retrofit targeted at improving water quality treatment for nitrogen, bacteria, and gross solids. These concepts did not investigate site specific geotechnical details such as depth to groundwater or hydrologic soil group that could require design modifications.

The following generic design detail shows the plan view of the existing drainage area and proposed system area and components. There are also associated cross-sections of typical SCM construction and components. These details can change and be customized with advanced site-specific survey and design information.

This gravel wetland design will be a single cell as opposed to the two-cell system depicted in the cross section. The inlet will be an at-grade inlet downstream of the trash rack and there is sufficient grade to daylight the primary outlet over a stabilized area downstream of the SCM. The secondary outlet will be a stone berm at the end of the SCM profile area.

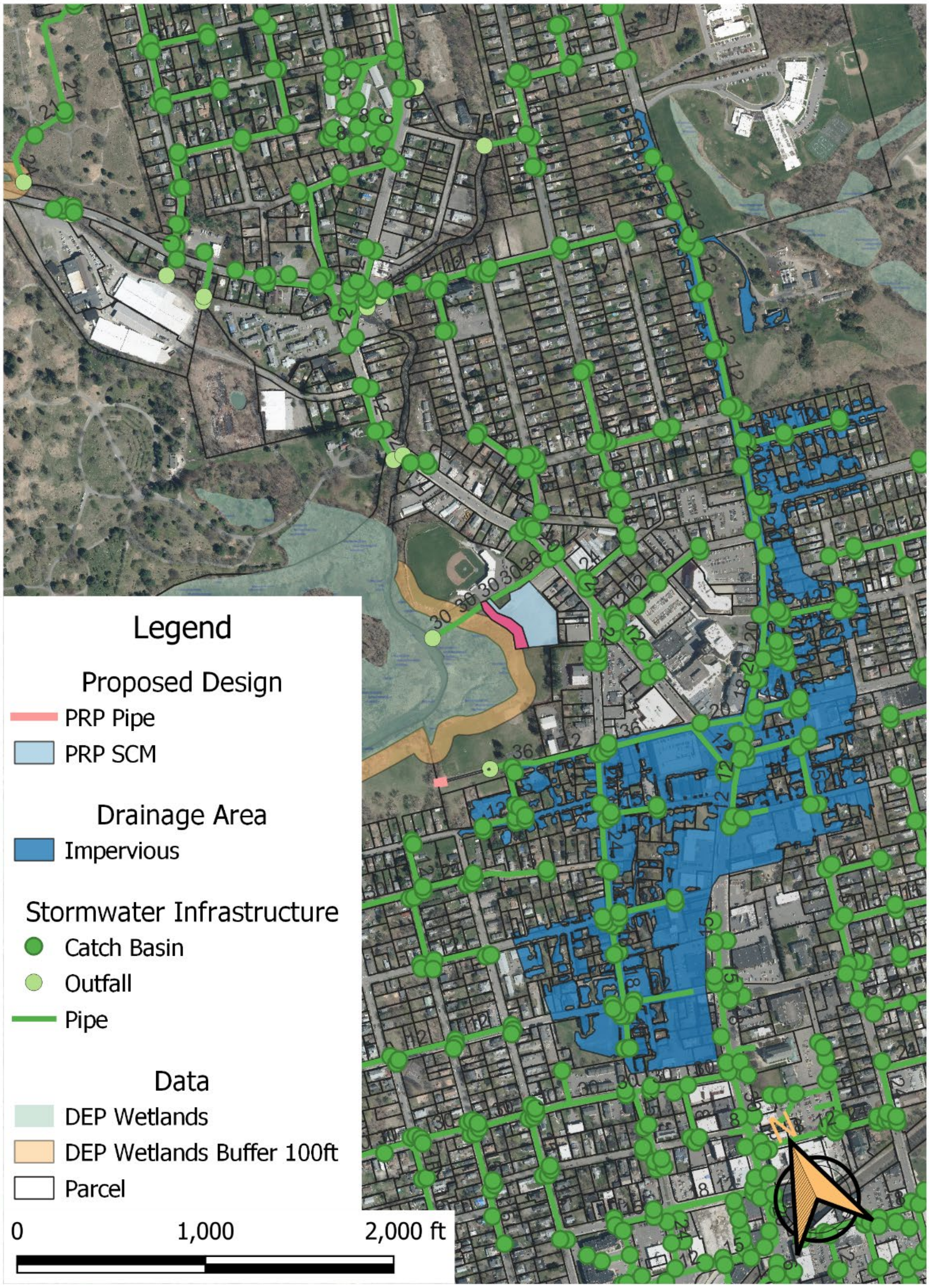


Figure 4: Plan layout 1

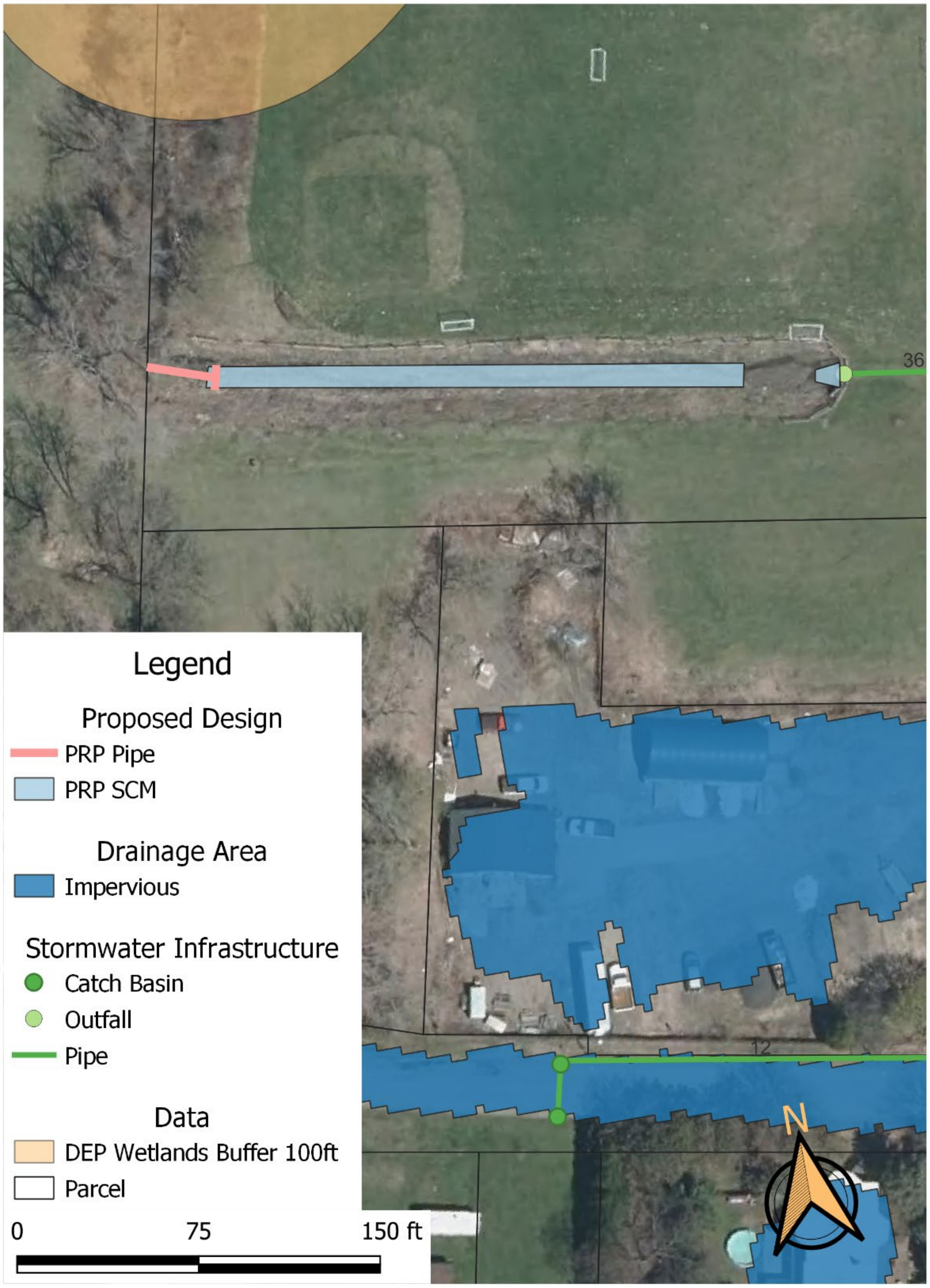


Figure 5: Plan layout 2

Figure 6: Trash guard which has a high surface area to retain high flow rates as trash debris accumulates. (Source: www.trashracks.com)

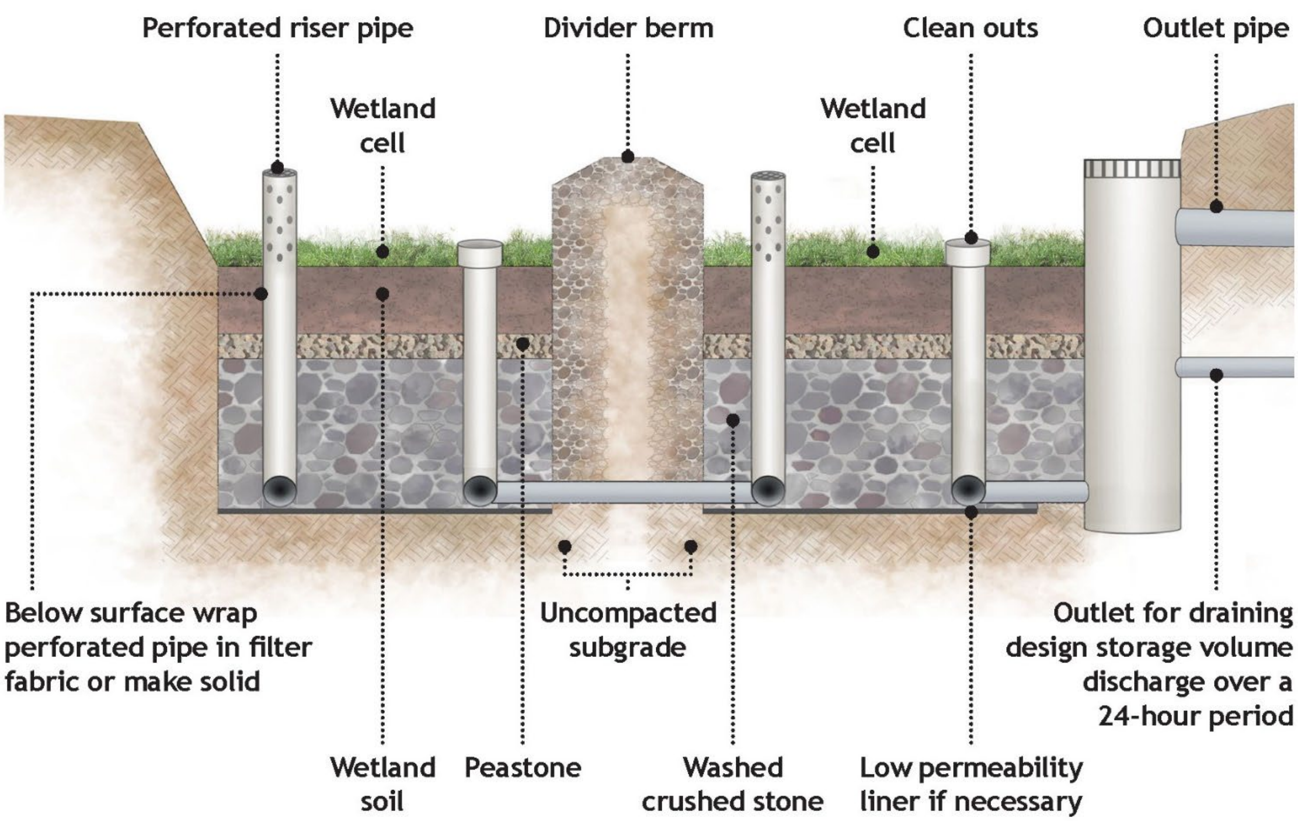


Figure 7: Typical SCM cross-section (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

Table 1: Summary of site parameters, design summary, performance curve efficiencies and load reductions.

	Parameter	Units	SCM 1
Watershed	Impervious Drainage Area	ac	51.00
	Land Use	-	Comm. / Ind.
SCM	Stormwater Control Measure	-	Linear Gravel Wetland
	Applicable Performance Curve	-	Subsurface Gravel Wetland
	Infiltration Rate	in/hr	N/A
Intermediate Calculations	Design Storage Volume	cf	2,860
	Physical Storage Capacity	in	0.0
Performance Curve Removal Efficiencies	Volume	%	0%
	P	%	3%
	N	%	4%
	TSS	%	9%
	Zn	%	11%
	Bacteria	%	5%
Load Export Rates	Volume	Mgal/yr	53.40
	P	lb/yr	90.8
	N	lb/yr	765.0
	TSS	lb/yr	19,247
	Bacteria	Billion MPN/yr	326
SCM Annual Performance	Volume	Mgal/yr	0.00
	P	lb/yr	3.1
	N	lb/yr	29.2
	TSS	lb/yr	1692
	Bacteria	%/yr	5%
Costs	Total SCM Costs	$	$52,000
	Volume	$/Mgal-yr	N/A
	P	$/lb-yr	$16,520
	N	$/lb-yr	$1,780
	TSS	$/lb-yr	$30
	Bacteria	$/%-yr	$10,080
O&M	Estimated O&M Hours	hr/yr	1,107

GRAVEL WETLAND CONCEPT DESIGN
SITE 2: LANESBOROUGH DPW, 10 MAPLE CT.
VERSION 1
8/19/2022

Prepared for:

Town of Lanesborough, MA

Prepared by:

University of New Hampshire Stormwater Center

1 SITE OVERVIEW

Existing Site Observations

The southwest corner of the pavement behind the dumpsters showed considerable deposition of fine sediment which overflowed into the wetland to the south. The outlet into the wetland area from the drainage pipe from the gravel lot also showed significant mounding and sediment deposition. Runoff is directed to a wetland area but there is sufficient space to meet wetland setback requirements if a SCM is implemented.

Stormwater Recommendations

We recommend the installation of a bioretention system with a precast pretreatment system for the collection of sediment/solids from the high-use DPW yard. The bioretention would be located off the corner of the pavement, as close to the outfall as possible, to capture the sediments and treat other pollutants from the heavily used public garage. The inlet of the pipe in the gravel lot is another area where a small SCM to capture sediment such as a deep sump catch basin could be installed. Site Photos

Figure 1: Standing at the end of the untreated drainage area.

Figure 1: Standing at the proposed SCM showing the pipe outfall to the left (covered) and the direct runoff point to the right.

2 BMP SIZING

The proposed stormwater control measure (SCM) designs were developed using the EPA Region I Performance Curves. Generally, the target SCM size of the Physical Storage Capacity (PSC) is greater than 0.1-inch. The cost-optimized PSC is at the "knee" of the curve and generally around the value of 0.4-inch although this varies depending on the SCM and infiltration rate. A conservative infiltration rate of 0.52 in/hr was assumed for this site without having performed in-situ soil tests. Figure 3 shows the performance curve for an infiltration trench and a subsurface gravel wetland (BMP Performance Fact Sheets, UNH Stormwater Center, 2019).

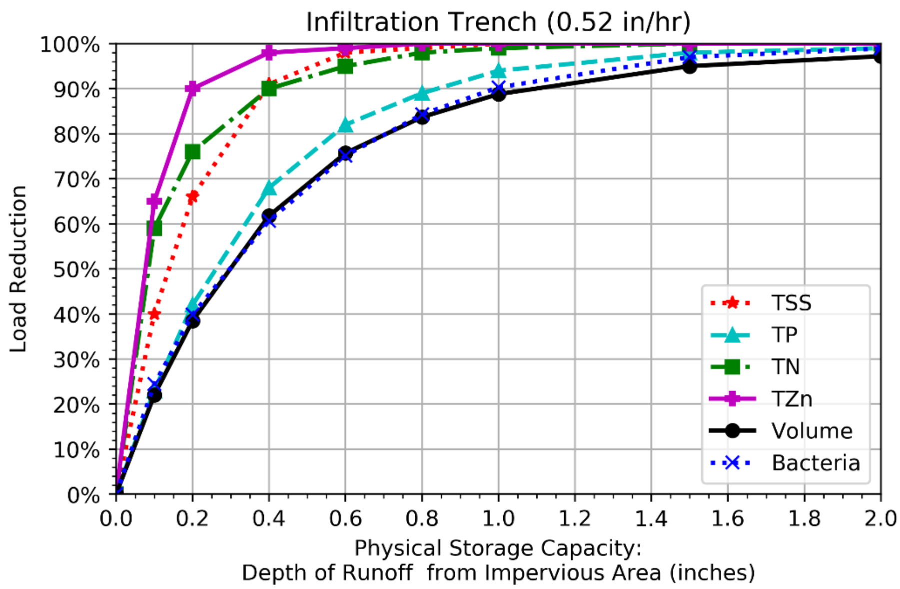


Figure 2: EPA Region I Performance Curve for retrofit SCM

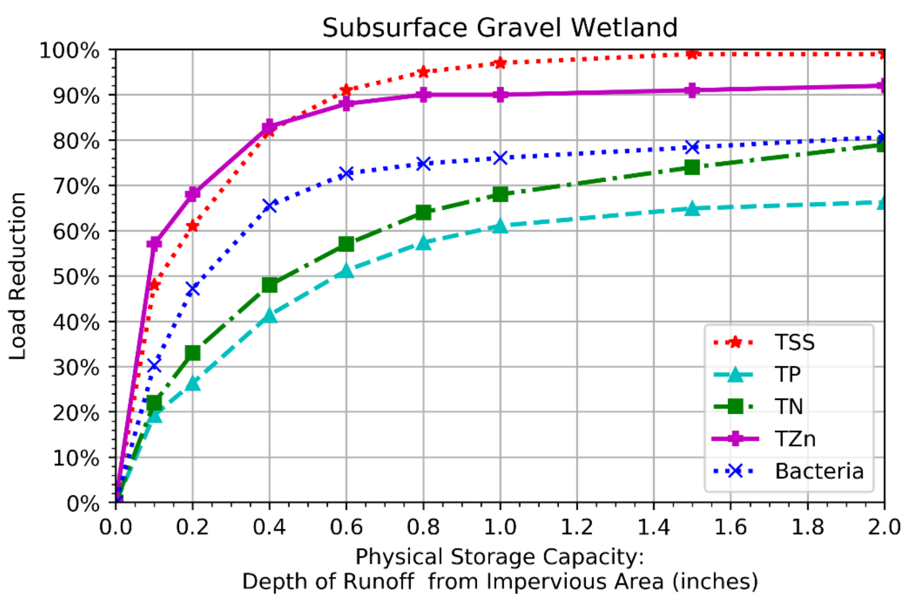


Figure4: EPA Region I Performance Curve for retrofit SCM

The cost-optimized size would occur at the knee of the line when there are diminishing returns of performance for an increase in PSC. This can be estimated quickly to be about between 0.2-0.6-inch for all parameters. It may also be calculated by finding the root of the second derivative of the line (as done here).

The PSC is the depth of runoff from the impervious drainage area which the SCM hold in the void space. The optimized sizing of 0.4-inch means the SCM is sized to have voids capable of holding 0.4-inches of precipitation on the impervious area. Although the static sizing is 40% of the 1-inch sizing, the load reductions range from 70% to 100% so there is little penalty in performance for building a smaller system. Conversely, there is little performance benefit for building a much larger 1-inch system while the construction and real-estate costs increase substantially. The Load Reduction on the y-axis is the annual reduction modelled using a rainfall record of a couple decades to simulate the full range of typical rainfall events and antecedent conditions.

3 PROPOSED DESIGNS

The proposed designs shown here are optimized to fit within the site and associated drainage area. This is a retrofit targeted at improving water quality treatment for nitrogen, bacteria, and gross solids. These concepts did not investigate site specific geotechnical details such as depth to groundwater or hydrologic soil group that could require design modifications.

The following generic design detail shows the plan view of the existing drainage area and proposed system area and components. There are also associated cross-sections of typical SCM construction and components. These details can change and be customized with advanced site-specific survey and design information.

This is a combined SCM design consisting of a leaching catch basin to intercept the upland drainage area to a lower gravel wetland system in the adjacent town-owned property. The inlet into the leaching catchbasin will be a grated inlet that discharges to the gravel wetland system. The overflow will be through an armored spillway over the existing grade. The proposed BMP area is within the wetland setback but improves the existing condition which conveys untreated runoff from the DPW yard into the existing wetland and setback. The gravel wetland system proposed will be a single cell gravel wetland as opposed to the two-cell version depicted in the graphic. This will simplify the design and minimize the wetland setback impacts.

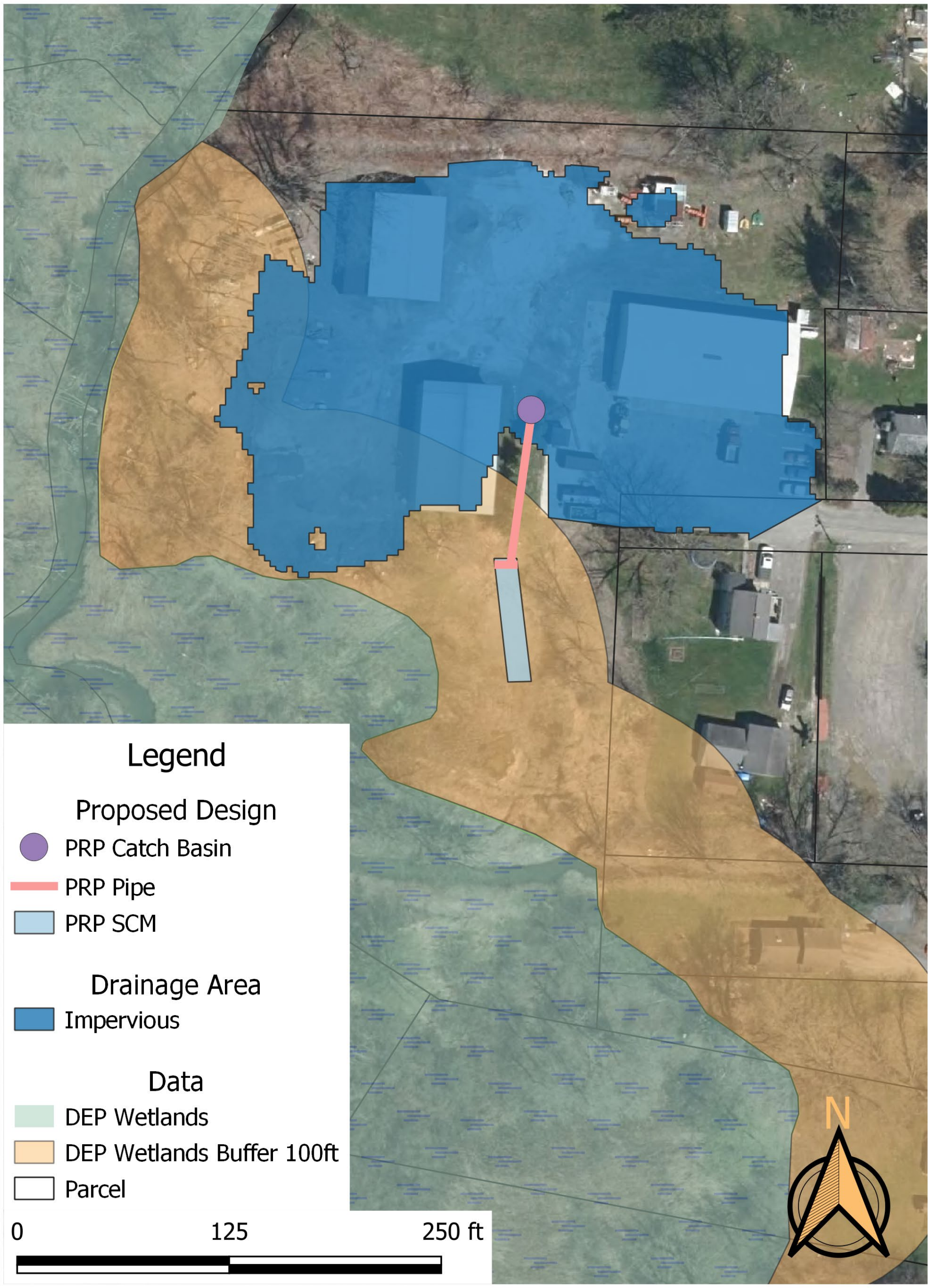


Figure 3: Plan Layout

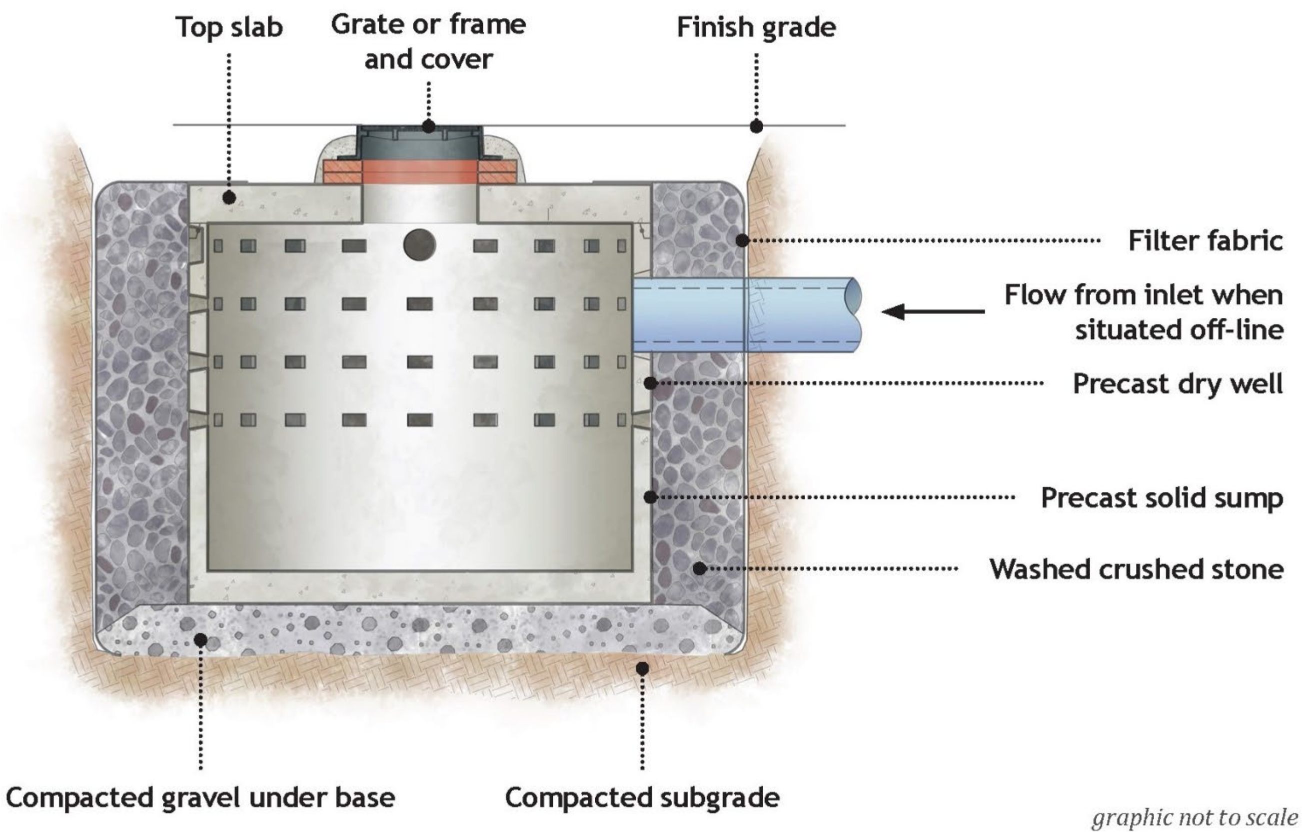


Figure 4: Typical SCM cross-section (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

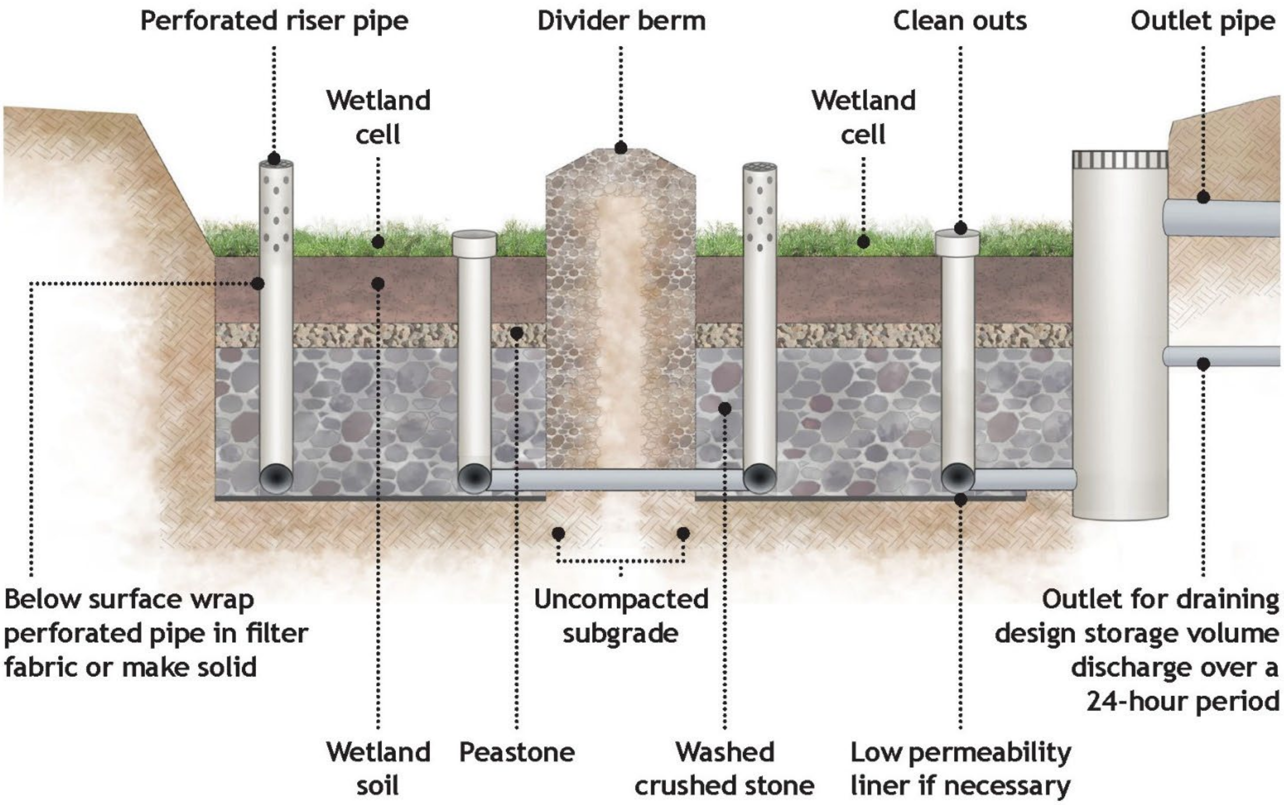


Figure 5: Typical SCM cross-section (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

Table 1: Summary of site parameters, design summary, performance curve efficiencies and load reductions.

	Parameter	Units	SCM 1	SCM 1	Total in Series
Watershed	Impervious Drainage Area	ac			1.36
	Land Use	-			Comm. / Ind.
SCM	Stormwater Control Measure	-	Leaching Catch Basin	Gravel Wetland	
	Applicable Performance Curve	-	Infiltration Trench	Subsurface Gravel Wetland	
	Infiltration Rate	in/hr	0.52		
Intermediate Calculations	Design Storage Volume	cf	280	1,560	
	Physical Storage Capacity	in	0.1	0.3	
Performance Curve Removal Efficiencies	Volume	%	13%	0%	13%
	P	%	14%	35%	44%
	N	%	40%	42%	65%
	TSS	%	25%	73%	79%
	Zn	%	43%	76%	86%
	Bacteria	%	15%	59%	66%
Load Export Rates	Volume	Mgal/yr			1.43
	P	lb/yr			2.4
	N	lb/yr			20.4
	TSS	lb/yr			514
	Bacteria	Billion MPN/yr			9
SCM Annual Performance	Volume	Mgal/yr			0.19
	P	lb/yr			1.1
	N	lb/yr			13.4
	TSS	lb/yr			409
	Bacteria	%/yr			66%
Costs	Total SCM Costs	$	$5,000	$29,000	$34,000
	Volume	$/Mgal-yr			$180,130
	P	$/lb-yr			$32,190
	N	$/lb-yr			$2,543
	TSS	$/lb-yr			$83
	Bacteria	$/%-yr			$51,887
O&M	Estimated O&M Hours	hr/yr	Varies	30	30

BIORETENTION CONCEPT DESIGN
SITE 3: ALGONQUIN ST & NARRAGANSETT AVE
VERSION 1
8/19/2022

Prepared for:

Town of Lanesborough, MA

Prepared by:

UNIVERSITY OF NEW HAMPSHIRE
STORMWATER CENTER

University of New Hampshire Stormwater Center

1 SITE OVERVIEW

Existing Site Observations

Algonquin St runoff had caused erosion at the edges of the gravel on both sides of the road ending in areas of flooding at the corners with Narragansett Ave. There is a mowed path in the right of way continuing East toward the lake directly from Algonquin St.

Stormwater Recommendations

We recommend the installation of a bioretention system in the low area in the right of way in the tall grass with pretreatment via deep sump catch basins at both corners of the intersection connected by a pipe under the road.

Site Photos

Figure 1: Looking East from the gravel road catchment toward the route of runoff.

Figure 2: Town easement sloped toward the lake where the proposed SCM would be.

2 BMP SIZING

The proposed stormwater control measure (SCM) designs were developed using the EPA Region I Performance Curves. Generally, the target SCM size of the Physical Storage Capacity (PSC) is greater than 0.1-inch. The cost-optimized PSC is at the "knee" of the curve and generally around the value of 0.4-inch although this varies depending on the SCM and infiltration rate. A conservative infiltration rate of 0.52 in/hr was assumed for this site without having performed in-situ soil tests. Figure 3 shows the performance curve for an infiltration basin (BMP Performance Fact Sheets, UNH Stormwater Center, 2019).

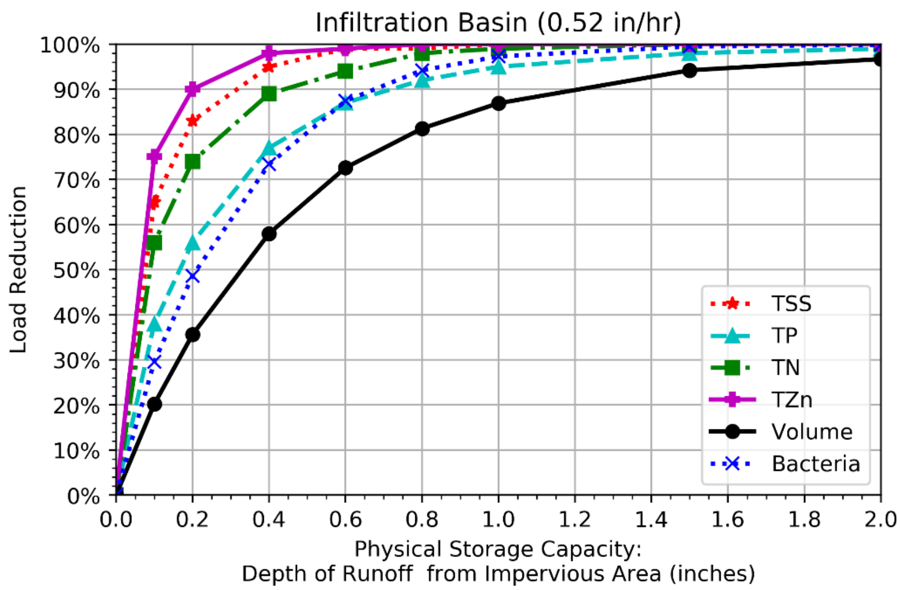


Figure 3: EPA Region I Performance Curve for retrofit SCM

The cost-optimized size would occur at the knee of the line when there are diminishing returns of performance for an increase in PSC. This can be estimated quickly to be about between 0.2-0.6-inch for all parameters. It may also be calculated by finding the root of the second derivative of the line (as done here).

The PSC is the depth of runoff from the impervious drainage area which the SCM hold in the void space. The optimized sizing of 0.4-inch means the SCM is sized to have voids capable of holding 0.4-inches of precipitation on the impervious area. Although the static sizing is 40% of the 1-inch sizing, the load reductions range from 70% to 100% so there is little penalty in performance for building a smaller system. Conversely, there is little performance benefit for building a much larger 1-inch system while the construction and real-estate costs increase substantially. The Load Reduction on the y-axis is the annual reduction modelled using a rainfall record of a couple decades to simulate the full range of typical rainfall events and antecedent conditions.

3 PROPOSED DESIGNS

The proposed designs shown here are optimized to fit within the existing green space on site. This is a retrofit targeted at improving water quality treatment for nitrogen, bacteria, and gross solids. These concepts did not investigate site specific geotechnical details such as depth to groundwater or hydrologic soil group that could require design modifications.

The following generic design detail shows the plan view of the existing drainage area and proposed system area and components. There are also associated cross-sections of typical SCM construction and components. These details can change and be customized with advanced site-specific survey and design information.

This is combined SCM design consisting of a three catchbasins to intercept the existing drainage down the gravel road to a bioretention/infiltration SCM to filter and infiltrate the runoff. The inlet to the bioretention system will be from the connected drainage network in between the catchbasins. There is sufficient grade to daylight the catchbasin outlet into the bioretention system. The high flow bypass will be over a stone berm at the end of the SCM.

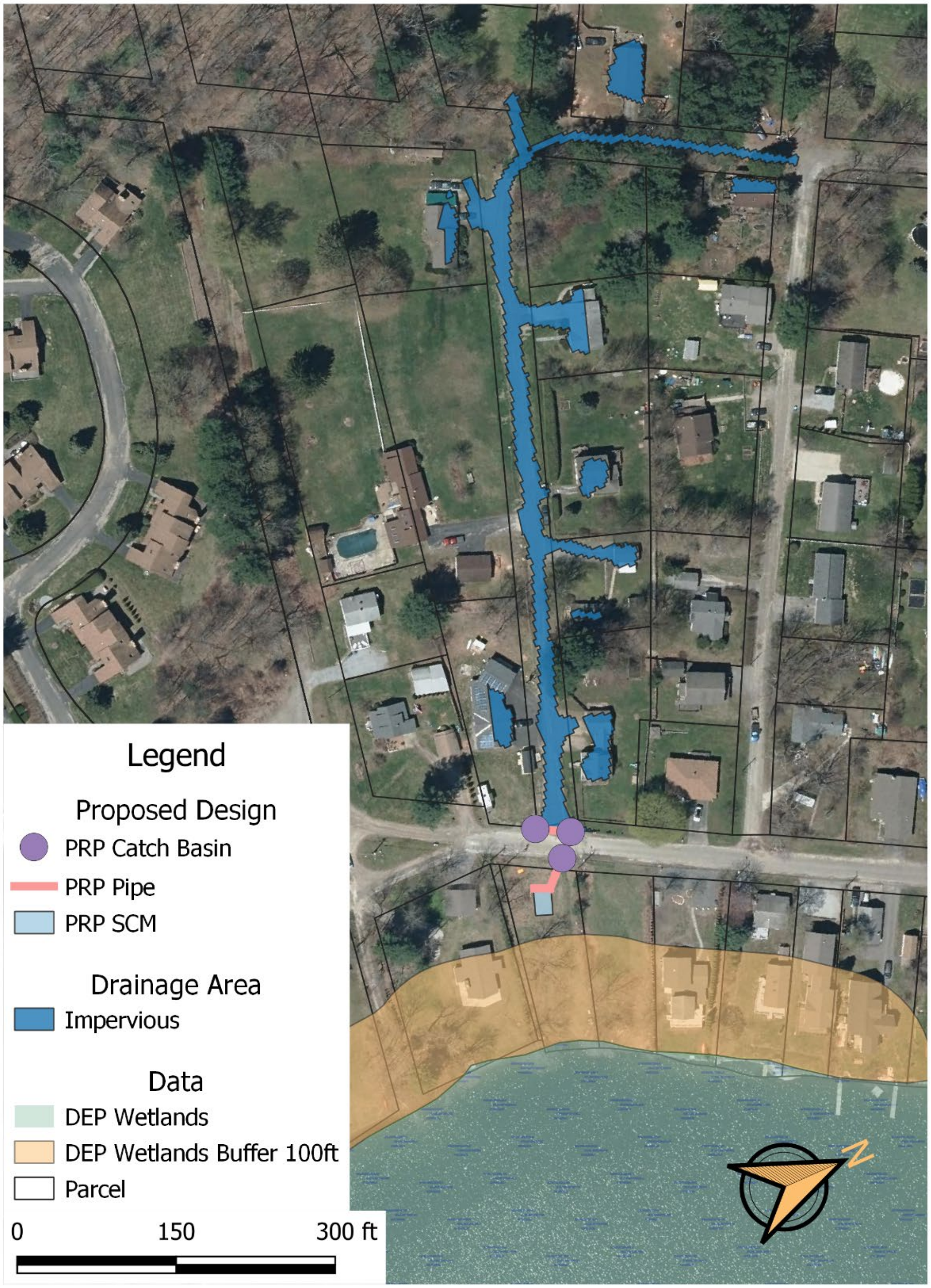


Figure 4: Plan layout 1

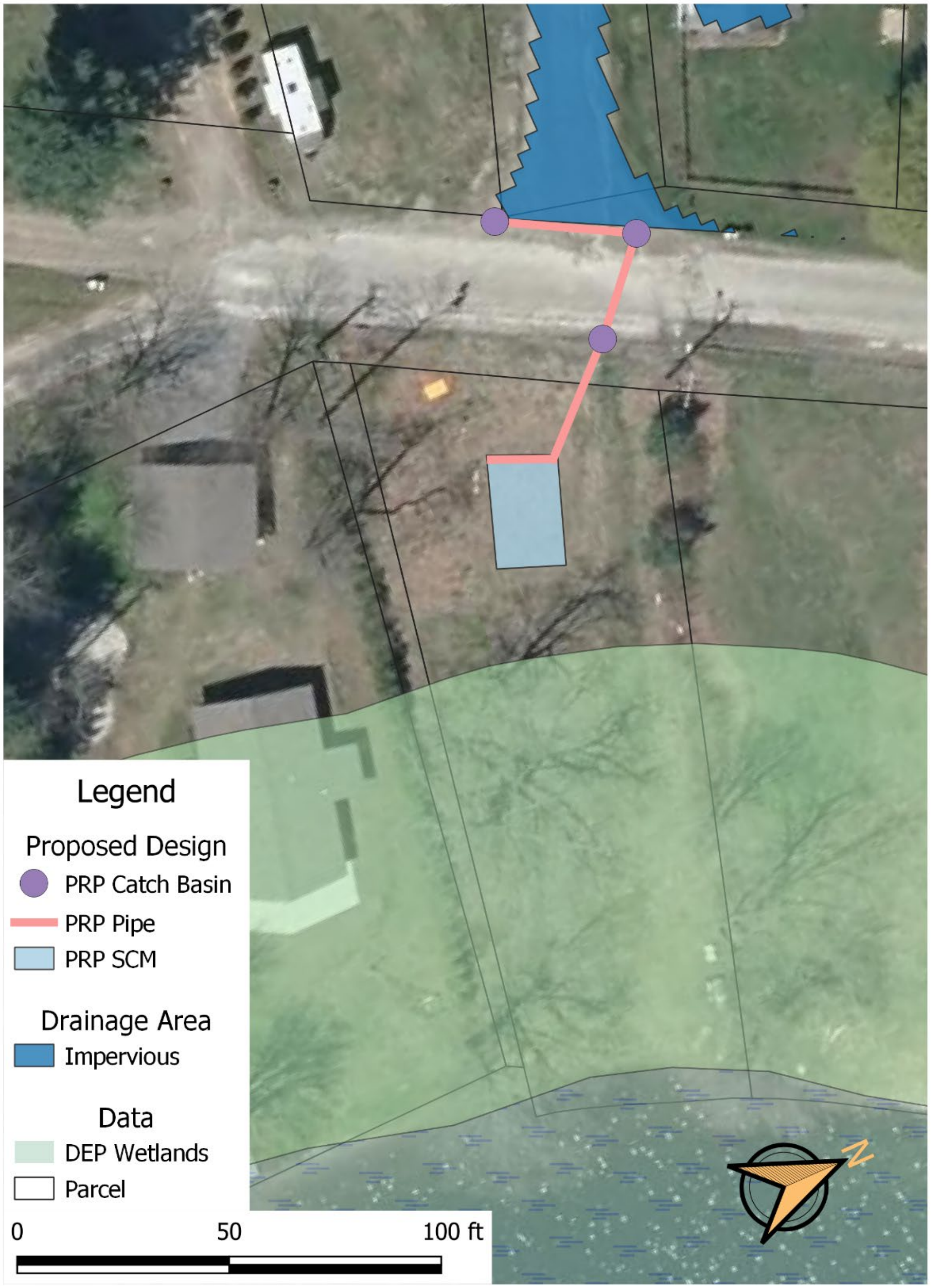


Figure 5: Plan layout 1

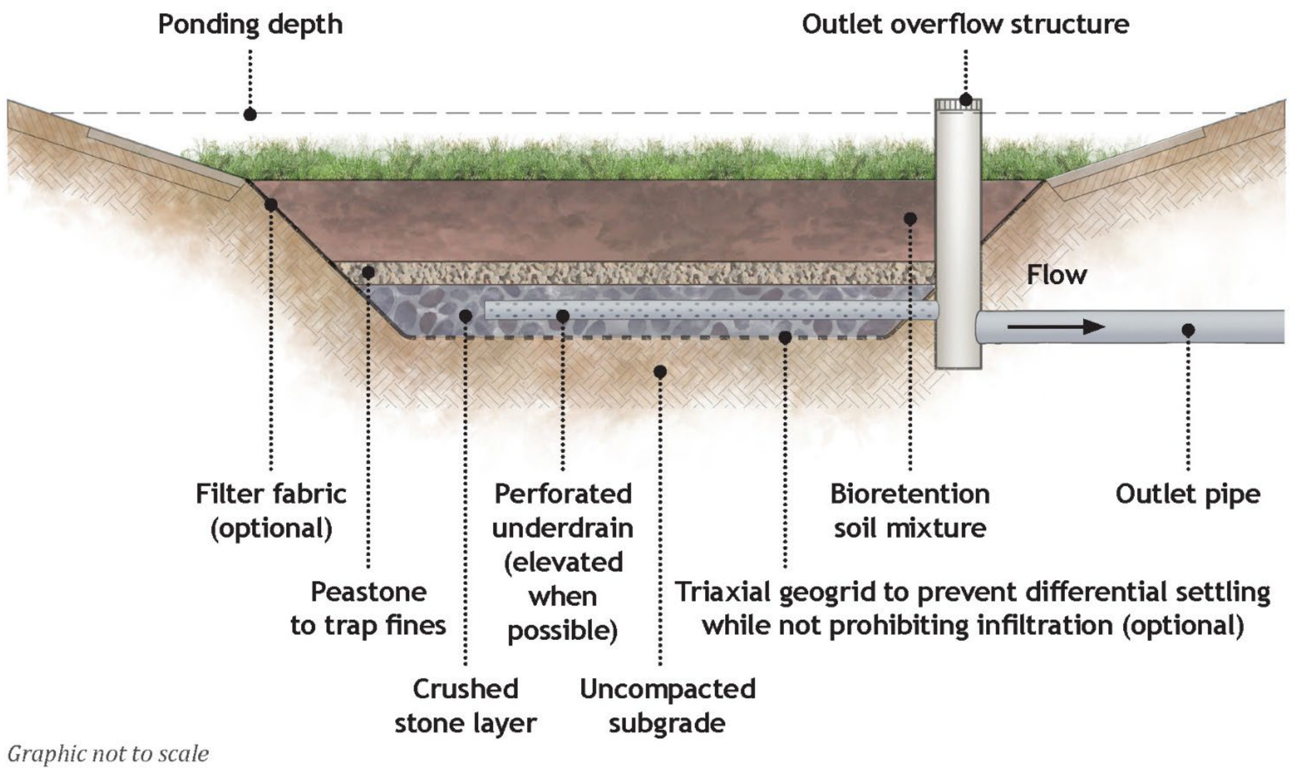


Figure 6: Typical SCM cross-section (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

Table 1: Summary of site parameters, design summary, performance curve efficiencies and load reductions.

	Parameter	Units	SCM 1
Watershed	Impervious Drainage Area	ac	0.60
	Land Use	-	Med Res.
SCM	Stormwater Control Measure	-	Bio-Filtration
	Applicable Performance Curve	-	Infiltration Basin
	Infiltration Rate	in/hr	0.52
Intermediate Calculations	Design Storage Volume	cf	600
	Physical Storage Capacity	in	0.3
Performance Curve Removal Efficiencies	Volume	%	45%
	P	%	66%
	N	%	82%
	TSS	%	90%
	Zn	%	95%
	Bacteria	%	60%
Load Export Rates	Volume	Mgal/yr	0.63
	P	lb/yr	1.2
	N	lb/yr	8.5
	TSS	lb/yr	265
	Bacteria	Billion MPN/yr	4
SCM Annual Performance	Volume	Mgal/yr	0.28
	P	lb/yr	0.8
	N	lb/yr	7.0
	TSS	lb/yr	239
	Bacteria	%/yr	60%
Costs	Total SCM Costs	$	$20,000
	Volume	$/Mgal-yr	$70,280
	P	$/lb-yr	$25,740
	N	$/lb-yr	$2,870
	TSS	$/lb-yr	$80
	Bacteria	$/%-yr	$340
O&M	Estimated O&M Hours	hr/yr	12

INFILTRATION BASIN CONCEPT DESIGN
SITE 6: TOWN PARK, 11 BRIDGE ST
VERSION 1
8/19/2022

Prepared for:

Town of Lanesborough, MA

Prepared by:

UNIVERSITY OF NEW HAMPSHIRE
STORMWATER CENTER

University of New Hampshire Stormwater Center

1 SITE OVERVIEW

Existing Site Observations

Bridge St has a significant grade that conveys water along the road from east to west. The existing 30-inch drainage line in the road requires further confirmation to determine the exact size of the pipe and drainage area serviced by the drainage network. The culvert under Bridge St drains untreated to Town Brook (west of the basketball court). The site offers enough gradient and space for a potential disconnection and treatment of the pipe. Stormwater Recommendations

We recommend building a treatment SCM in the park. This would involve disconnecting the stormwater pipe in Bridge St and diverting the pipe into the newly constructed SCM. The pipe would be diverted at the east end of the park, diverted into the park's SCM for treatment and infiltration located east of the basketball court, and then reconnected to the culvert for high-flow bypass.

Site Photos

Figure 1: Looking toward the west over the pipe in the road.

Figure 2: In the park – the SCM would be placed to the left in the open grass area. Town Brook is to the right.

2 BMP SIZING

The proposed stormwater control measure (SCM) designs were developed using the EPA Region I Performance Curves. Generally, the target SCM size of the Physical Storage Capacity (PSC) is greater than 0.1-inch. The cost-optimized PSC is at the "knee" of the curve and generally around the value of 0.4-inch although this varies depending on the SCM and infiltration rate. A conservative infiltration rate of 0.52 in/hr was assumed for this site without having performed in-situ soil tests. Figure 3 shows the performance curve for an infiltration basin (BMP Performance Fact Sheets, UNH Stormwater Center, 2019).

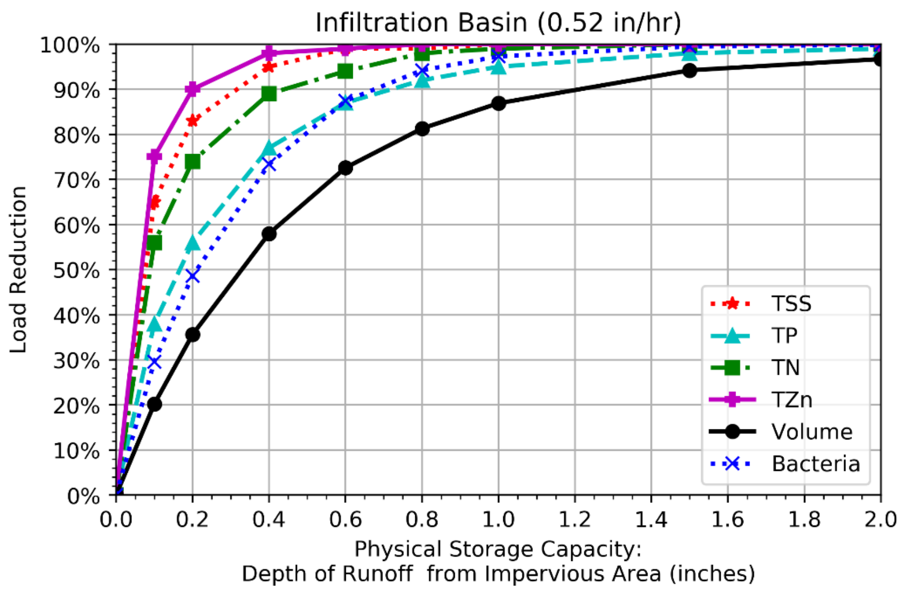


Figure 3: EPA Region I Performance Curve for retrofit SCM

The cost-optimized size would occur at the knee of the line when there are diminishing returns of performance for an increase in PSC. This can be estimated quickly to be about between 0.2-0.6-inch for all parameters. It may also be calculated by finding the root of the second derivative of the line (as done here).

The PSC is the depth of runoff from the impervious drainage area which the SCM hold in the void space. The optimized sizing of 0.4-inch means the SCM is sized to have voids capable of holding 0.4-inches of precipitation on the impervious area. Although the static sizing is 40% of the 1-inch sizing, the load reductions range from 70% to 100% so there is little penalty in performance for building a smaller system. Conversely, there is little performance benefit for building a much larger 1-inch system while the construction and real-estate costs increase substantially. The Load Reduction on the y-axis is the annual reduction modelled using a rainfall record of a couple decades to simulate the full range of typical rainfall events and antecedent conditions.

3 PROPOSED DESIGNS

The proposed designs shown here are optimized to fit within the existing swale currently conveying flow from the large urban drainage area. This is a retrofit targeted at improving water quality treatment for nitrogen, bacteria, and gross solids. These concepts did not investigate site specific geotechnical details such as depth to groundwater or hydrologic soil group that could require design modifications.

The following generic design detail shows the plan view of the existing drainage area and proposed system area and components. There are also associated cross-sections of typical SCM construction and components. These details can change and be customized with advanced site-specific survey and design information.

This subsurface gravel filter design will enable the existing recreational us of the fields be preserved while including treatment for a large regional drainage system prior to discharge. The concept is to provide for a flow diversion from the existing untreated drainline such that when design flows are surpassed the original conveyance now handling the existing flow discharges the remaining stormwater flows. The infiltration system will be grassed over and the primary outlet will be exfiltration into native soils. The secondary outlet or bypass will be conveyed back to the existing drainline.

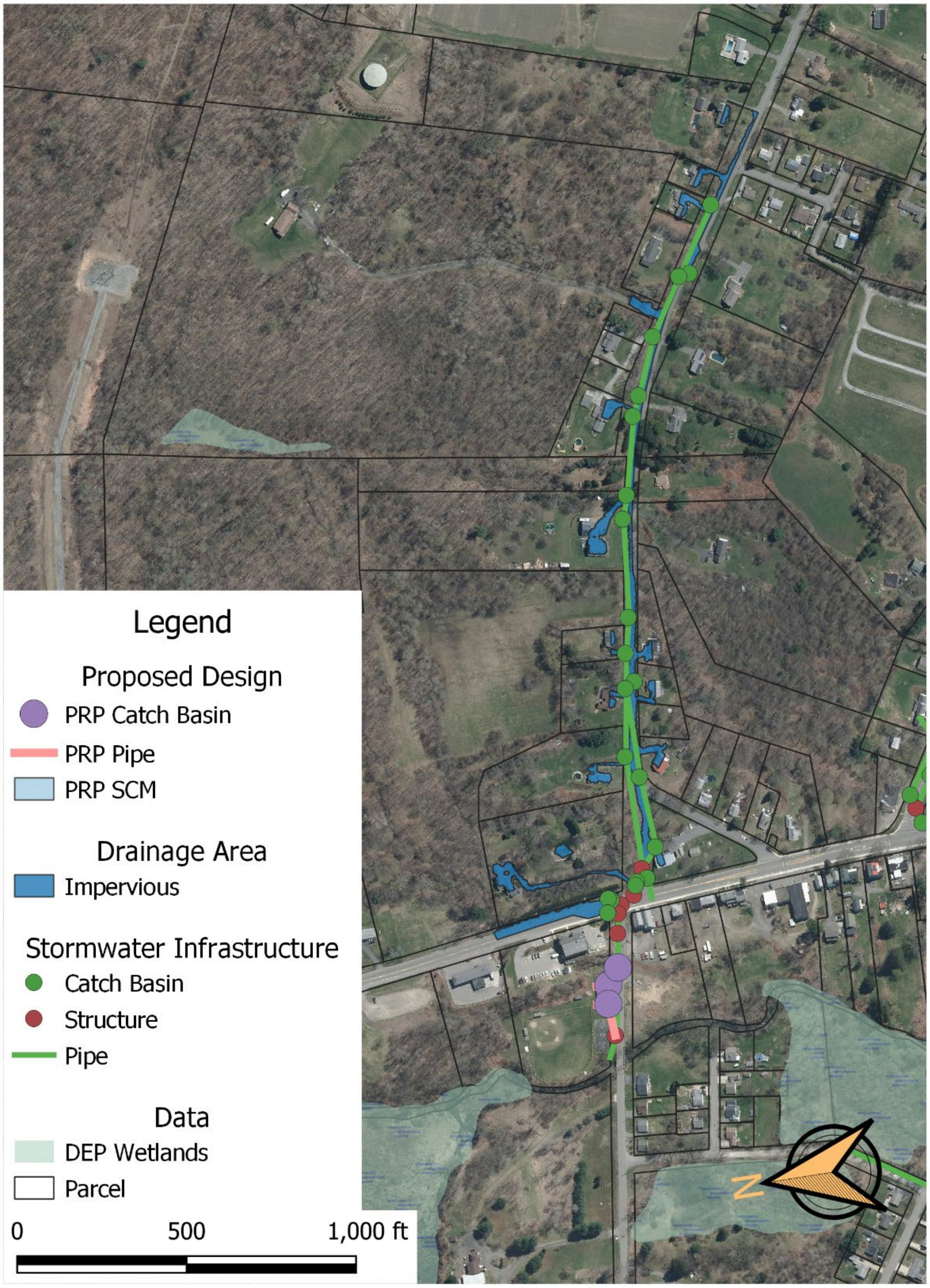


Figure 4: Plan layout 1.

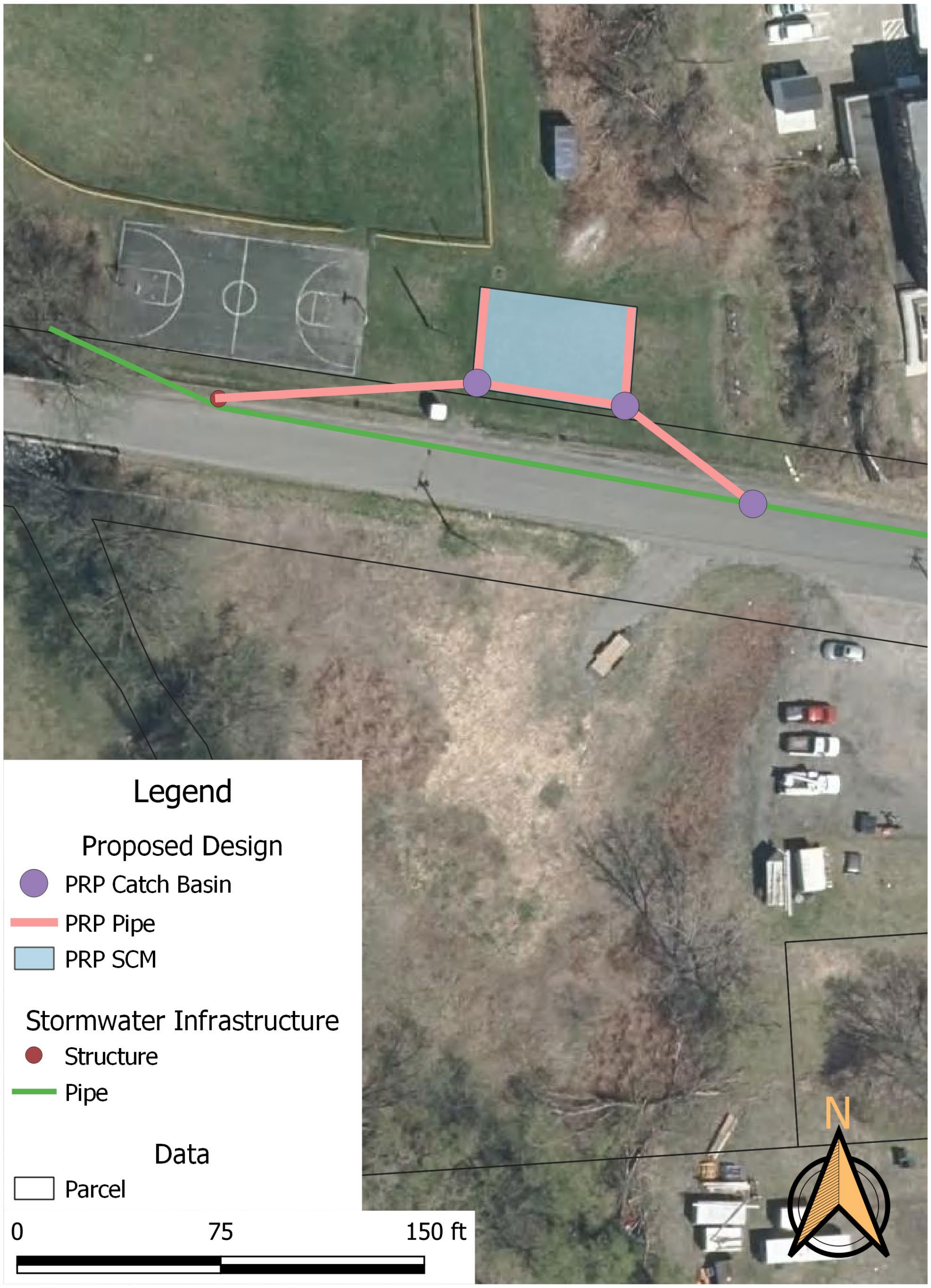


Figure 5: Plan layout 2.

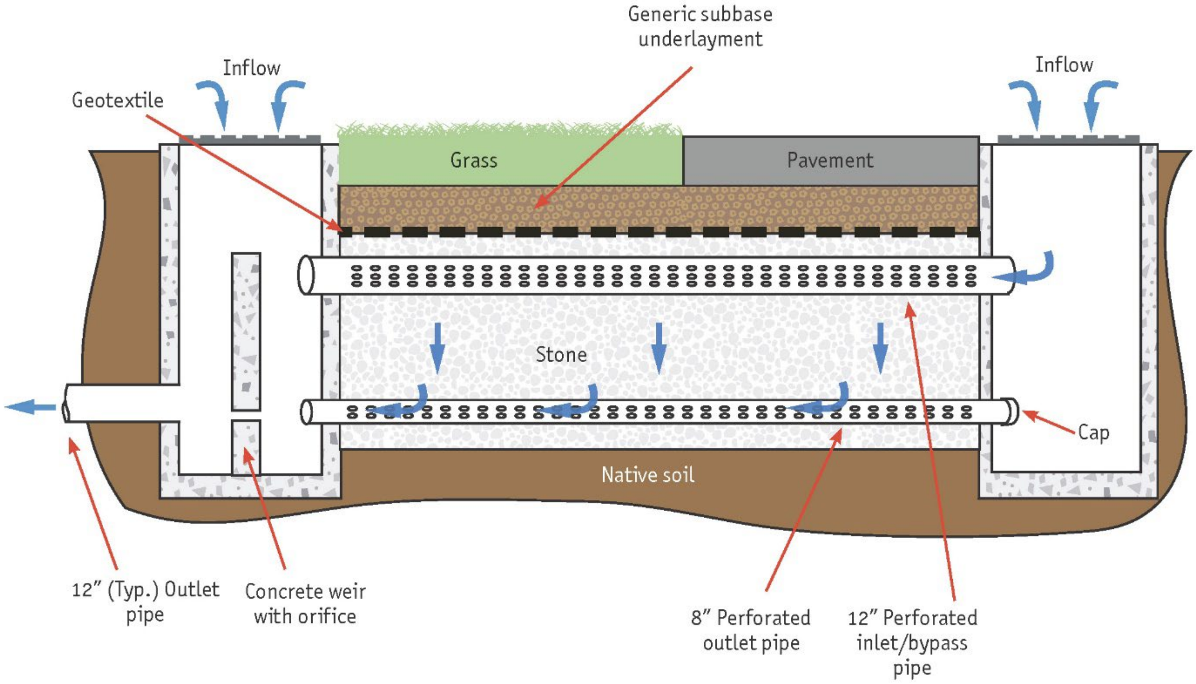
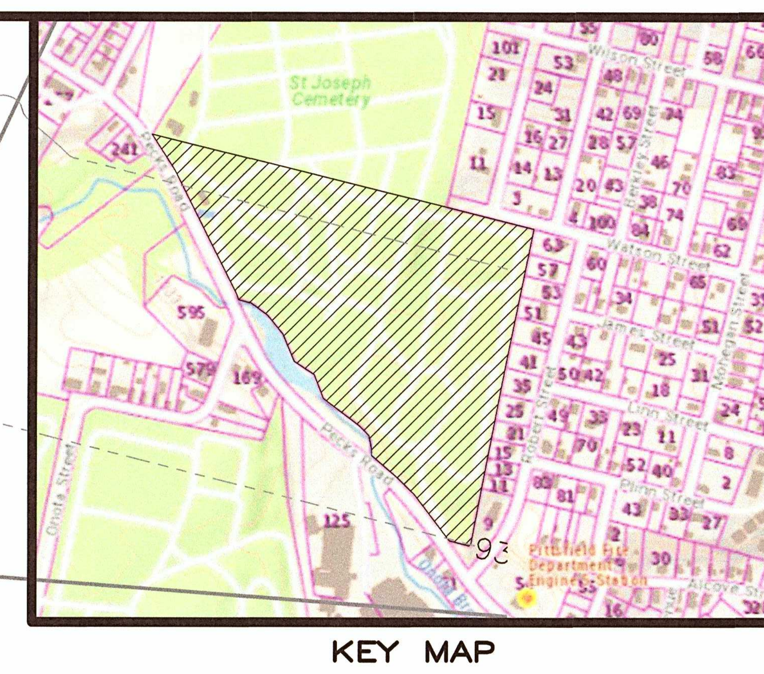
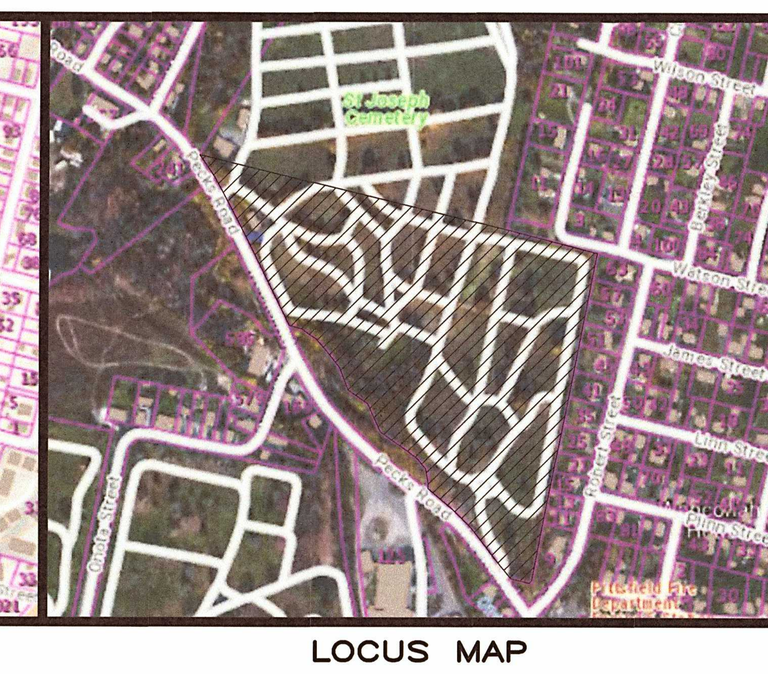


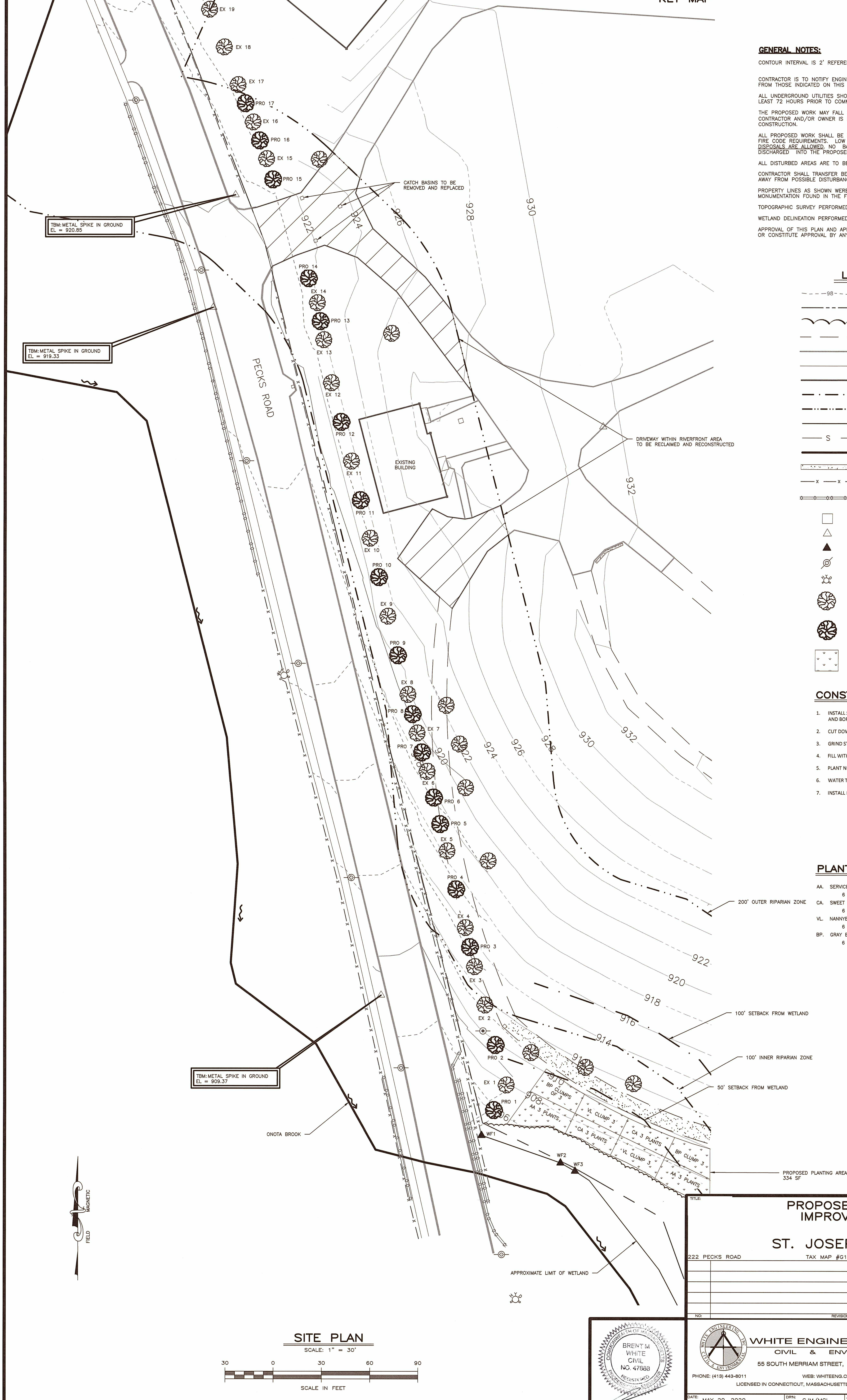
Figure 6: Typical SCM cross-section (not to scale). Source: New England Stormwater Retrofit Manual (VHB, UNHSC 2022)

Table 1: Summary of site parameters, design summary, performance curve efficiencies and load reductions.

	Parameter	Units	SCM 1
Watershed	Impervious Drainage Area	ac	2.07
	Land Use	-	Med Res.
SCM	Stormwater Control Measure	-	Subsurface Gravel Filter
	Applicable Performance Curve	-	Infiltration Basin
	Infiltration Rate	in/hr	0.52
Intermediate Calculations	Design Storage Volume	cf	2,640
	Physical Storage Capacity	in	0.4
Performance Curve Removal Efficiencies	Volume	%	53%
	P	%	73%
	N	%	87%
	TSS	%	94%
	Zn	%	98%
	Bacteria	%	69%
Load Export Rates	Volume	Mgal/yr	2.17
	P	lb/yr	4.1
	N	lb/yr	29.2
	TSS	lb/yr	910
	Bacteria	Billion MPN/yr	13
SCM Annual Performance	Volume	Mgal/yr	1.16
	P	lb/yr	3.0
	N	lb/yr	25.5
	TSS	lb/yr	855
	Bacteria	%/yr	69%
Costs	Total SCM Costs	$	$34,000
	Volume	$/Mgal-yr	$29,340
	P	$/lb-yr	$11,420
	N	$/lb-yr	$1,340
	TSS	$/lb-yr	$40
	Bacteria	$/%-yr	$500
O&M	Estimated O&M Hours	hr/yr	43







GENERAL NOTES:

CONTOUR INTERVAL IS 2' REFERENCED TO A LOCAL ARBITRARY DATUM.

CONTRACTOR IS TO NOTIFY ENGINEER BEFORE PROCEEDING IF SUBSURFACE CONDITIONS DIFFER FROM THOSE INDICATED ON THIS PLAN.

ALL UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR SHALL NOTIFY DIG SAFE AT LEAST 72 HOURS PRIOR TO COMMENCEMENT OF WORK.

THE PROPOSED WORK MAY FALL UNDER THE JURISDICTION OF THE WETLANDS PROTECTION ACT. CONTRACTOR AND/OR OWNER IS RESPONSIBLE TO OBTAIN ALL REQUIRED PERMITS PRIOR TO CONSTRUCTION.

ALL PROPOSED WORK SHALL BE IN COMPLIANCE WITH MASSACHUSETTS PLUMBING, BUILDING, AND FIRE CODE REQUIREMENTS. LOW VOLUME PLUMBING FIXTURES ARE TO BE USED. NO GARBAGE DISPOSALS ARE ALLOWED. NO BACKWASH OF WATER PURIFICATION OR FILTRATION DEVICES SHALL DISCHARGED INTO THE PROPOSED SYSTEM.

ALL DISTURBED AREAS ARE TO BE SEEDED AND MULCHED.

CONTRACTOR SHALL TRANSFER BENCHMARK TO A PERMANENT SUITABLE LOCATION AWAY FROM POSSIBLE DISTURBANCE UPON COMMENCEMENT OF CONSTRUCTION.

PROPERTY LINES AS SHOWN WERE ESTABLISHED FROM AVAILABLE MAPS AND MONUMENTATION FOUND IN THE FIELD AND ARE REPRESENTED AS APPROXIMATE ONLY.

TOPOGRAPHIC SURVEY PERFORMED BY WHITE ENGINEERING, INC. ON MARCH 11, 2020

WETLAND DELINEATION PERFORMED BY WHITE ENGINEERING, INC. ON MARCH 11, 2020

APPROVAL OF THIS PLAN AND APPLICATION BY A BOARD OF HEALTH DOES NOT IMPLY OR CONSTITUTE APPROVAL BY ANY OTHER BOARD OF AGENCY.

LEGEND

- 98 EXISTING CONTOURS
- APPROXIMATE PROPERTY LINE
- EDGE OF TREELINE(CANOPY)
- EXISTING GRAVEL ROAD
- EDGE OF PAVED ROAD
- EDGE OF SIDEWALK
- EXISTING STRUCTURES
- SETBACKS
- BUFFER ZONE
- LIMIT OF BORDERING VEGETATED WETLAND
- S EXISTING SEPTIC PIPE
- EXISTING BROOK
- EXISTING CONCRETE STRUCTURE
- x x EXISTING FENCE
- EXISTING GUARD RAIL
- CATCH BASIN
- TEMPORARY BENCH MARK (TBM)
- WETLAND FLAG
- UTILITY POLE
- EXISTING HYDRANT
- DECIDUOUS TREE
- PROPOSED DECIDUOUS TREE
- PROPOSED PLANTING AREA

CONSTRUCTION NOTES:

1. INSTALL STAKED STRAW WATTLE BETWEEN PLANTING AREA AND BORDERING VEGETATED WETLAND.
2. CUT DOWN TREES.
3. GRIND STUMPS TO 2-3 INCHES BELOW GRADE.
4. FILL WITH TOP SOIL, SEED AND MULCH.
5. PLANT NEW TREES AND WOOD CHIP MULCH AROUND THE BASE.
6. WATER TREES ON A REGULAR BASIS DEPENDING ON TIME OF YEAR.
7. INSTALL PLANTINGS PER PLANTING PLAN.

PLANTING LIST

AA. SERVICEBERRY (AMELANCHER ARBOREA)
6 PLANTS 3'-4' HEIGHT
CA. SWEET PEPPER BUSH (CLETHRA ALNIFOLIA)
6 PLANTS 3'-4' HEIGHT
VL. NANNYBERRY (VIBURNUM LENTAGO)
6 PLANTS (3 PER CLUMP) 3'-4' HEIGHT
BP. GRAY BIRCH (BETULA POPULIFOLIA)
6 PLANTS (3 PER CLUMP) 3'-4' HEIGHT

SITE PLAN

SCALE: 1" = 30'

30 0 30 60 90
SCALE IN FEET

TITLE:
PROPOSED RIVERFRONT IMPROVEMENT PLAN
for
ST. JOSEPH CEMETERY

222 PECKS ROAD | TAX MAP #G13, BLOCK #2, LOT #3 | PITTSFIELD, MA

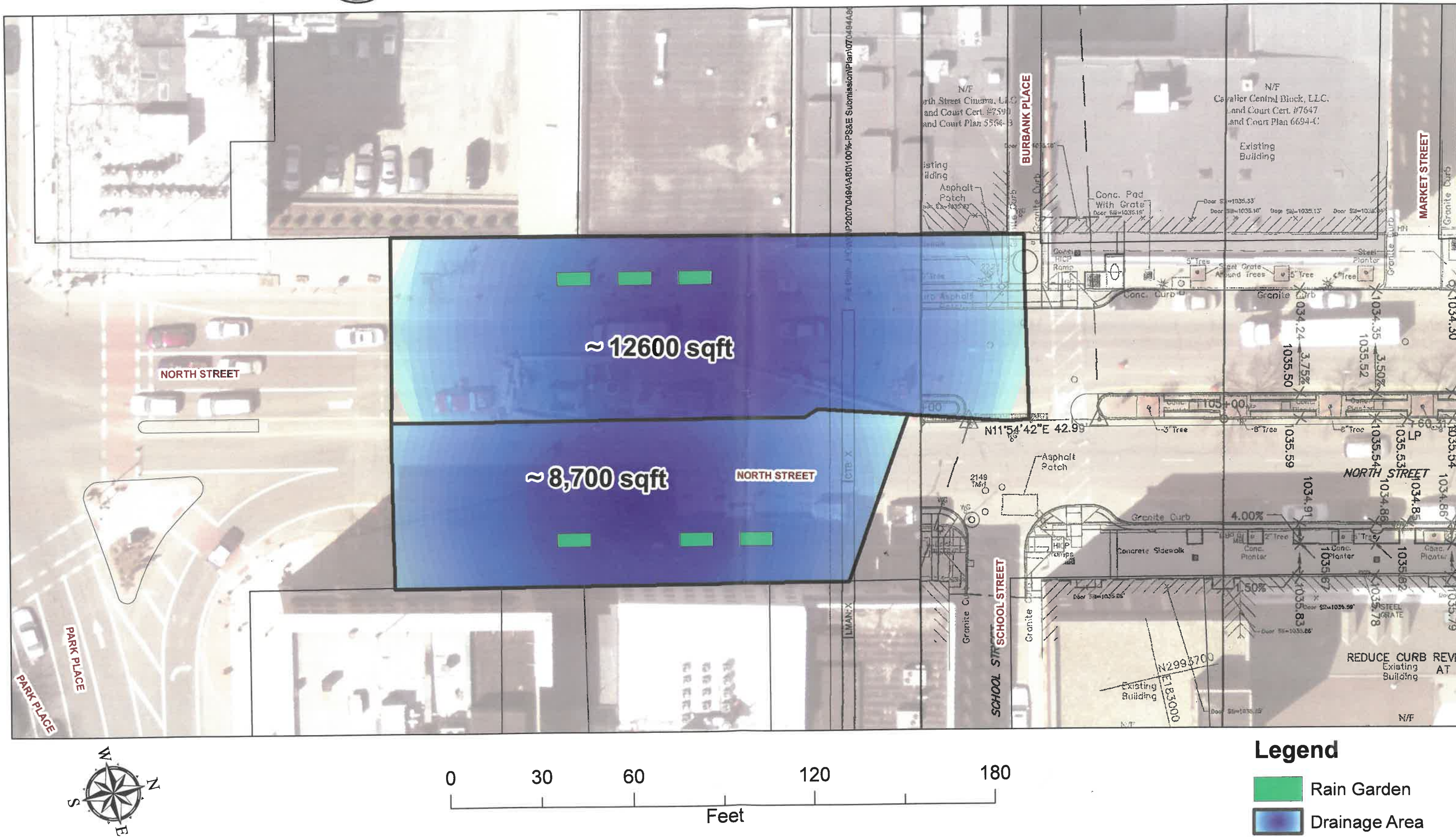
NO.	REVISION:	BY:	DATE:

BRENT M. WHITE CIVIL NO. 47688 REGISTERED PROFESSIONAL ENGINEER

WHITE ENGINEERING INC.
CIVIL & ENVIRONMENTAL
55 SOUTH MERRIAM STREET, PITTSFIELD, MA 01201
PHONE: (413) 443-8011 WEB: WHITEENG.COM FAX: (413) 443-8012
LICENSED IN CONNECTICUT, MASSACHUSETTS, NEW YORK AND VERMONT

DATE: MAY 20, 2020	DRN: CJM/MCL	APVD: BMW	DWG NO: 15—08—13
DSGN: BMW	CHKD: CJM/BMW	SCALE: AS NOTED	SHEET 1 OF 1

North Street - Rain Gardens



North Street - Rain Gardens