



Mare Brook Watershed Management Plan 2022-2032

DRAFT

[Date]



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Steering Committee Members and Affiliations

This Plan also pulls together findings and recommendations from previous studies within the Mare Brook Watershed. These studies and the credits for them are acknowledged within this Plan and can also be found in **Appendix ZZ References**.

This Plan will be implemented under the direction of the Town of Brunswick with continued local community involvement.



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Contents

Executive Summary and Purpose.....	5
EPA’s 9 Elements for Watershed Management Plans	6
Mare Brook and Watershed	8
Watershed Features.....	8
Location	8
Hydrology	8
Topography and Soils	8
Surficial Geology	8
Climate	8
Habitat and Ecosystems	9
Development Trends and Land Use	9
Demographics.....	9
Historical Land Uses.....	9
Current Land Uses and Development Rates.....	9
Land Use Effects on Mare Brook	9
Water Quality	9
Standard Parameters	9
Residual Contaminants	9
Aquatic Macroinvertebrate Sampling	9
Mare Brook’s Water Quality Impairments	10
Stream Class and Criteria.....	10
Impairments.....	10
Watershed Assessments.....	12
Baseline Watershed Data.....	12
Data Gathered as Part of Watershed Management Plan Development.....	12
Geomorphic Assessment.....	13
Culvert and Outfall Ground Truthing	13



Stormwater Retrofit Review 14

Proximate Stressor Identification 21

Water Chemistry 21

Data Gaps 21

Impairment Causes, Stressors, and Solutions 21

Preventing Future Stressors 23

Education and Outreach 23

Ordinance and Policy Changes 23

Design Standards 23

Land Preservation 23

Action Plan and Timeline 24

Evaluating Project Success 24

 Pollutant Load Reduction Targets 24

 Indicators and Measurable Milestones 25

Implementing the Plan 25

 Ownership and Community Involvement 25

 Funding 26

 Monitoring and Adaptive Management 26

References 26

Acronyms 26

Executive Summary and Purpose

Brief background and info on watershed...

Designated as impaired for macros since...

Purpose of plan... stakeholders, to be implemented over 10 years with feedback loop [HH2]{Plan to hopefully complement Town of Brunswick’s Comprehensive Plan. Date for completion?}

The primary goal of this plan is to is for Mare Brook, including Merriconeag Brook, to meet its State-designated Class B standards by 2037.



The Mare Brook Watershed Management Plan (WMP) is primarily geared towards Brunswick, Maine community members:

- Who have a basic knowledge of watershed management concepts;
- Want to better understand the proposed actions needed to restore Mare Brook and the methodology used to determine those actions; and/or
- Are interested in taking an active role in restoring Mare Brook.

EPA's 9 Elements for Watershed Management Plans

This Mare Brook Watershed Management Plan (Plan) incorporates the US Environmental Protection Agency's 9 elements in creating a watershed management plan. **Table 1** lists EPA's 9 elements and where these elements are included within this Plan. For more information on EPA's 9 elements, please refer to their [website](#) "_____"

Table 1.

EPA's 9 Elements [HH3]		Location included in this Plan
1.	Identification of causes that will need to be controlled to achieve the load reductions described in (2.)	
2.	Estimates of load reductions expected for the management measures described in (3.)	
3.	Description of management measures that will need to be implemented to achieve load reductions described in (2.)	
4.	Estimate of technical and financial assistance needed to implement this plan	
5.	Information/education component that will be used to enhance public understanding of this plan	
6.	Schedule for implementing management measures described in (3.)	
7.	Description of interim, measurable milestones for determining whether management measures described in (3.) are being implemented	



8.	Set of criteria that can be used to determine whether load reductions described in (2.) are being achieved	
9.	Water quality monitoring component to evaluate effectiveness of implementation measured against the established criteria described in (8.)	

Figure 1. Mare Brook Watershed (Map)



Mare Brook and Watershed

Watershed Features

Location

Mare Brook (also referred to as Mere Brook) is a 1.4-mile [HH4] stream with a 5.8 square mile drainage area located entirely within the Town of Brunswick, Maine (**Figure 1**). The watershed includes the area of land draining into Mare Brook (also referred to as Mere Brook) and its main tributary, Merriconeag Stream. The headwaters of Mare Brook begin in the northwest corner of the watershed above Baribeau Drive in a dense residential area. The brook flows east through Bowdoin College's athletic fields (Pickard Fields) on Harpswell Road and into Coffin Ice Pond, a dammed portion of the brook just upstream of Harpswell Road. The brook then flows through land owned by the Midcoast Regional Redevelopment Authority (MRRRA) which includes flowing through a $\frac{3}{4}$ mile long culvert under the runway of MRRRA's Brunswick Executive Airport. The brook then connects with Merriconeag Stream less than a mile downstream of the airport. Merriconeag Stream begins at Beaver Road in the northeast corner of the watershed and into Picnic Pond, a dammed portion of the stream just upstream of the Purinton Road crossing, before flowing into Mare Brook. A tributary comprised of three ponds (Pond A, B, and C) along the developed area of MRRRA's property also flows into Picnic Pond. Head of tide is located downstream of the confluence of Mare Brook and Merriconeag Stream near the Liberty Road crossing [HH5] where it becomes part of the Harpswell Cove estuary [HH6]. This section of the brook passes through land owned by the U.S. Navy and the Town of Brunswick's Kate Furbish Preserve [HH7].

Hydrology

Mare Brook receives water from tributaries, freshwater wetlands, precipitation (rain and snow) including stormwater runoff from developed and undeveloped land, and discharged groundwater. The percentage and amount of receiving water from these sources is unknown but can vary depending on soil types, land cover, and precipitation.

{Any groundwater aquifer maps?}

Topography and Soils

Surficial Geology

Climate



Habitat and Ecosystems

A variety of fish live in Mare Brook and Merriconeag Stream including brook trout, ninespine stickleback, American eel, and lake chub

Brook trout habitat; Sea run brook trout seasonally fished by locals up to the outlet at Picnic Pond's dam

Historically supported native brook trout

Invasive plants

Development Trends and Land Use

Demographics

Historical Land Uses

Current Land Uses and Development Rates

The Mare Brook Watershed is approximately 61% urban and 39% forest and wetland complexes. Urban uses include transportation corridors, commercial properties, single family residences, urban recreation and open space, and the Brunswick Executive Airport.

Fishing and ice skating at Coffin Ice Pond which is easily accessible by the public by vehicle

Land Use Effects on Mare Brook

The watershed has an 18% impervious cover. {Info on when water quality declines}

Roads and their contribution to IC plus other pollutants and need for maintenance

Mare Brook drains into Harpswell Cove, an economically significant resource to the Town of Brunswick as an important shellfish growing area with 2,500 bushels of softshell clams are harvested annually. Unfortunately, NPS pollution has restricted harvesting in certain areas of the cove in recent [HH8]years past.

Water Quality

Standard Parameters

Residual Contaminants

Aquatic Macroinvertebrate Sampling



Mare Brook's Water Quality Impairments

Stream Class and Criteria

Mare Brook is listed by the State as a Class B waterbody. Class B waters are the third highest classification for fresh surface waters out of four class options. Class B waters must meet the following parameters:

- Suitable for:
 - o Drinking water supply after treatment
 - o Fishing, agriculture, recreation in and on the water
 - o Industrial process and cooling water supply
 - o Hydroelectric power generation (except as prohibited under Title 12, Section 403)
 - o Navigation
 - o Habitat for fish and other aquatic life / habitat must be characterized as unimpaired
- Water quality conditions such that:
 - o Dissolved oxygen may not be less than 7 parts per million or 75% of saturation (whichever is higher) outside of October 1st – May 14th
 - o 7-day mean dissolved oxygen concentration may not be less than 9.5 parts per million
 - o 1-day minimum dissolved oxygen concentration may not be less than 8.0 parts per million in identified fish spawning areas
 - o Escherichia coli bacteria may not exceed a geometric mean of 64 CFU per 100 milliliters over a 90-day interval or 236 CFU per 100 milliliters in more than 10% of samples in any 90-day interval between April 15th and October 31st
- Discharges may not cause adverse impact to aquatic life; Receiving waters must be able to support all indigenous aquatic species

In specific regards to macroinvertebrates, Class B streams are to have a variety of sensitive species yet species that are a little more tolerant to pollutions may be more common than that of Class AA and Class A streams. There also tends to be more algae and macroinvertebrates in Class B streams than AA and A streams. In contrast, Class AA and A streams have natural habitat, very clean water, and many different macroinvertebrate species with many sensitive species. No dams and discharges of pollution are allowed in AA streams. For Class C streams, there is a variety of algae and macroinvertebrates, some of which are sensitive with tolerance of pollution or poor habitat being more common than macroinvertebrates of a Class B stream.

Impairments

Mare Brook is currently listed by the Maine Department of Environmental Protection as an Urban Impaired Stream as it does not meet currently designated Class B standards. Mare Brook



is listed as impaired due to benthic-macroinvertebrate bioassessments and habitat assessment¹[HH9].

2016 Integrated Report: "Lead in clam tissue in 2012 at Mare Brook, Brunswick and Presumpscot River, Falmouth/Portland exceeded the MDCDC FTAL for lead in finfish. These four sites are considered problematic for human shellfish consumption based on these lead concentrations. • Mercury in mussel tissue"

Mare Brook is one of only a few dozen in the State of Maine to be designated as an Urban Impaired Stream. DEP 303(d) 2016 Integrated report "A stream is considered impaired if it fails to meet water quality standards because of effects of stormwater runoff from developed land. Additional stormwater treatment controls are necessary in urban watersheds of impaired streams because proposed stormwater sources in urban and urbanizing areas contribute to the further degradation of stream water quality. Urban impaired streams are listed in Appendix B of this rule and include all streams where violations of water quality classification standards have been documented for which urban stormwater has been identified as a significant cause. Urban impaired streams are considered "degraded, sensitive or threatened regions or watersheds" as described in 38 M.R.S. §420-D(4)."[HH10]

Maine's impaired and threatened waterbodies are listed in the State's 303(d) list under five main categories with three subcategories under Category 4 (a-c) and four subcategories under Category 5 (a-d) that help detail the status of each waterbody's assessment. Through the U.S. Clean Water Act, States must develop Total Maximum Daily Load (TMDL) for all waters identified on a State's 303(d) list according to their priority ranking on that list. TMDLs calculate the maximum amount of a pollutant allowed into the waterbody while allowing the waterbody to continue to meet water quality standards for that pollutant. The TMDL also provides a pollutant reduction target and allocates load reductions for the source(s) of the pollutant. Pollutant sources are either point sources which require a Maine Pollution Discharge Elimination System (MEPDES) permit (such as wastewater treatment facilities) or non-point sources (NPS). Over the past decade, Maine has worked with EPA to develop statewide TMDL approaches for 303(d) listed waters with the same NPS impairments. To-date this has resulted in following approved Statewide NPS TMDLs:

- 2009 EPA-approved Maine Statewide Bacteria TMDL
- 2012 EPA-approved Maine Statewide Impervious Cover TMDL (with a 2014 addendum)
- 2016 Maine Statewide NPS Pollution TMDL
-

Category 4-a (2012-2016)

¹ In Maine, all fresh waters are considered impaired for Fish Consumption Use due to levels of mercury found in fish from sources beyond the New England region. As this is a given for all of Maine's freshwaters and because the impairment is not able to be solved within Maine's jurisdiction, this impairment is not typically called out when impaired waterbodies are discussed.



Watershed Assessments

Baseline Watershed Data

A significant number of studies and projects have occurred in the Mare Brook Watershed. In [HH11] 2015, the Town of Brunswick was awarded a Maine Coastal Communities Grant to fund preliminary assessment of impacts to Mare Brook's water quality. This assessment provided baseline data on water quality including bacteria readings, fish passage, geomorphic conditions, and riparian habitat. Based on the assessment results, recommendations were made for additional monitoring and assessment work with some preliminary restoration recommendations provided. This baseline assessment provided the foundation for the Town to engage the public in a facilitated and locally-guided planning process to determine next steps in addressing Mare Brook's water quality impairments.

The following information was obtained from this baseline assessment:

- Most of the riparian corridor of Mare Brook contained intact floodplains and vegetative buffers
- A variety of fish live in Mare Brook and Merriconeag Stream including brook trout, ninespine stickleback, American eel, and lake chub
- Poor aquatic macroinvertebrate populations were suspected to be as a result of an influx of sand and mass movement of sandy substrate
- Fish passage was limited by existing culverts and dams
- Legacy pollutants remained in areas around the former Brunswick Naval Air Station.

Overall, the baseline assessment recommended the need for habitat restoration, education and outreach, watershed surveys, and an action plan were important for improving Mare Brook's water quality. These recommendations suggested that a watershed-based management plan was the needed next step to bring all these recommendations together with a planned approach for improving Mare Brook [HH12].

Data Gathered as Part of Watershed Management Plan Development

Based on the findings and recommendations from the baseline assessment in 2015/2016, the Town of Brunswick applied for and was awarded grant funds from Maine DEP to supplement the previously collected data and develop a watershed-based management plan in 2020/2021 to guide future watershed restoration and protection efforts. Working with Maine DEP, needed supplemental data included:

- Assessment work above extending to areas upstream of Baribeau Drive
- Additional geomorphic assessment work to determine required in-stream restoration recommendations
- Detailed review of road crossing and culvert outfall impacts and restoration recommendations



- Identification of proximate stressors along specific stream reaches to target impairment causes

To gather additional supplemental data needed to compile a watershed-based management plan and to complete the plan, the Town of Brunswick applied for and was awarded grant funds through Maine DEP. This project, the Mare Brook Watershed-based Plan Development Project (#20190012), served as the base in gathering supplemental data and continuing community and stakeholder momentum in developing this Mare Brook Watershed Management Plan.

The following is an overview of the supplemental assessments conducted with supporting documentation included in **Appendix ZZ**^[HH13].

Geomorphic Assessment

Through a request for qualifications, the Town of Brunswick selected and hired Field Geology Services, Inc. to conduct

- Broke stream into "reaches"
- Summary
- Table of findings^[HH14]

Culvert and Outfall Ground Truthing

CCSWCD's Engineer worked with the Town of Brunswick's Engineering Department to...

- Looked at all main stem crossings and known public outfalls
- Summary
- Table of findings



**Summary of Culvert Inspections on
Mare Brook**

Culvert #	Location	Length (ft) / Size (in)	Material/Shape	Condition	Recommendation	Requirements	Estimated Cost [†]
1	Thornton Oaks Trail Network	Twin 78' / 30"	Reinforced Concrete Pipe / Round	Pipe condition = good Inlet condition = poor, restrictive to flow Outlet condition = good	1) Remove culverts, restore channel 2) Replace with footbridge	1) Local permitting 2) Private landowner coordination	Low with landowner labor \$4 - 5K
2	Thornton Oaks Trail Network	6' / 36"	Corrugated Metal Pipe Round	Pipe condition = poor, undersized rusted Inlet condition = poor, restrictive to flow Outlet condition = poor, deflected	1) Remove culverts, restore channel 2) Replace with footbridge	1) Local permitting 2) Private landowner coordination	Low with landowner labor \$4 - 5K
3	Thornton Oaks, Matthew Drive	Twin 35' / 48"	Reinforced Concrete Pipe / Round	Pipe condition = good Inlet condition = good, slightly undersized Outlet condition = good, minimal scour	None	Not applicable	None at this time



H&H	4	Baribeau Drive Crossing Flood Control	72' / 30"	Corrugated Metal Pipe Round	Pipe condition = good Inlet condition = fair Outlet condition = poor, obstructions present	1) Remove culvert along with Culvert 5, 2) Restore channel, 3) Replace with open bottom culvert	1) Federal, State permitting, 2) Hydrologic and Hydraulic (H&H) Model needed	High \$175 - 200K
H&H	5	Baribeau Drive Crossing Main Pipe	Twin 47' / 30"	Reinforced Concrete Pipe Round	Pipe condition = good, undersized with ponding Inlet condition = fair, restrictive to flow Outlet condition = good, some incision	1) Remove culverts along with Culvert 4, 2) Restore channel, 3) Replace with open bottom culvert	1) Federal, State permitting, 2) Hydrologic and Hydraulic (H&H) Model needed	High \$175 - 200K
	6	Baribeau Drive Southern Tributary Crossing	Two 35' / 18"	Reinforced Concrete Pipe / Round	Pipe condition = good Inlet condition = fair, some obstructions Outlet condition = poor, onstructed flow	1) Remove vegetation at inlet & outlet 2) Add riprap armor as needed	1) None	Low with Town labor \$1,000 - 1,500K
	7	Mid Coast Regional Health Property - Southern Trubutary	69' / 24"	Corrugated Metal Pipe / Round	Pipe condition = poor, deflected Inlet condition = fair, concrete wingwall Outlet condition = fair, riprap apron	None	Not Applicable	Not Applicable



	8	Mid Coast Senior Health Grounds	66' / 15"	Reinforced Concrete Pipe / Round	Pipe condition = good Inlet condition = armored, limited flow Outlet condition = armored	none	Not Applicable	Not Applicable
	9	Western Thornton Oaks Property - Southern Tributary	21' / 18"	Plastic at one end and PE N-12 Pipe at other end Round	Pipe condition = fair Inlet condition = poor, vegetation blocking flow Outlet condition = poor, vegetation blocking flow	1) Upgrade inlet/outlet 2) Replace culvert	1) Local/Private landowner coordination	Low with landowner/Town labor \$2,000 - 2,500K
H&H	10	Barrows Street Crossing	Twin 31' / 24" & 48"	Corrugated Metal Pipes / Round	Pipe condition = poor, rusted bottoms Inlet condition = poor, restrictive to flow Outlet condition = poor with scouring	1) Remove undersized culverts, restore channel 2) Replace with larger opening	1) Federal, State permitting, 2) Hydrologic and Hydraulic (H&H) Model needed	Moderate with Town labor \$65 - 80K
	13	Colonial Drive Tributary Crossing	35' / 60"	PE N-12 Pipe / Round	Pipe condition = good Inlet condition = good, riprap apron Outlet condition = good, riprap w/slight erosion	1) Add riprap at outlet	1) Town labor	Low with Town labor \$500



H&H	14	Macmillan Drive Crossing	Twin 31' / 24" & 48"	Corrugated Metal Pipe Round	Pipe condition = poor, undersized rusted Inlet condition = fair, restrictive to flow Outlet condition = fair	1) Remove culverts, restore channel 2) Replace with open bottom culvert	1) Federal, State permitting, 2) Hydrologic and Hydraulic (H&H) Model needed	Moderate with Town labor \$75 - 100K
	15	Richards Drive Tributary Crossing	31' / 36"	Corrugated Metal Pipe Round	Pipe condition = poor, undersized rusted Inlet condition = poor, restrictive to flow Outlet condition = poor, obstructed	1) Remove culverts, restore channel 2) Upsize culvert	1) Local permitting 2) Town labor	Moderate with Town labor \$25 - 35K
	16	Maine Street Crossing	27' / 84"	Corrugated Metal Pipe / Elliptical	Pipe condition = fair, undersized Inlet condition = fair, restrictive to flow Outlet condition = fair, failing cribstone	1) Remove culverts, restore channel 2) Replace with open bottom culvert	1) Federal, State permitting, 2) Hydrologic and Hydraulic (H&H) Model needed	High \$200 - 225K
H&H	17	Meadowbrook Road Crossing	40' / 48"	Corrugated Metal Pipe Round	Pipe condition = fair, undersized Inlet condition = poor, restrictive to flow with ponding Outlet condition = fair, deflected	1) Remove culvert, restore channel 2) Upsize culvert	1) Federal, State permitting, 2) Hydrologic and Hydraulic (H&H) Model needed	High \$100 - 125K



H&H	18	Sparwell Lane Tributary Crossing	29' / 30"	Corrugated Metal Pipe Round	Pipe condition = poor, undersized rusted Inlet condition = poor, restrictive to flow Outlet condition = poor, heavy sediment	1) Upsize culvert 2) Rebuild road	1) Federal, State permitting, 2) Hydrologic and Hydraulic (H&H) Model needed	High \$100 - 125K
	19	Shulman Park Entrance Tributary Crossing	20' / 24"	PE N-12 Pipe / Round	Pipe condition = good, new install Inlet condition = good Outlet condition = good	None	Not applicable	None at this time
	20	Alder Dive Tributary Crossing	24' / 36"	Corrugated Metal Pipe Round	Pipe condition = good Inlet condition = good, no flow restriction Outlet condition = good	None	Not applicable	None at this time
	21	Parkview Hospital Circle - Tributary	33' / 24"	PE N-12 Pipe Round	Pipe condition = good Inlet condition = good, some damage Outlet condition = good	None	Not applicable	None at this time



H&H	22	Parkview Hospital Circle 2 - Tributary	19' / 24"	Reinforced Concrete Pipe Round	Pipe condition = good Inlet condition = good Outlet condition = good, outlet control structure for pond	None	Not applicable	None at this time
	23	Harpswell Road Crossing	32' / 60"	Corrugated Metal Pipe Round	Pipe condition = poor, undersized rusted Inlet condition = poor, restrictive to flow Outlet condition = poor, scoured	1) Remove culvert, restore channel 2) Replace with open bottom culvert	1) Federal, State permitting, 2) Hydrologic and Hydraulic (H&H) Model needed	High \$200 - 225K
	27	Puritan Road Tributary Crossing	23' / 24"	Corrugated Metal Pipe Round	Pipe condition = good Inlet condition = fair, vegetation removal Outlet condition = good	None	Not applicable	None at this time
	28	Puritan Road Tributary Crossing (2)	23' / 36"	PE N-12 Pipe Round	Pipe condition = fair Inlet condition = fair, some pipe damage Outlet condition = good	None	Not applicable	None at this time

Date Inspection =
11/18-20/2020



† - Categorized as low (\$500-\$10,000), moderate (\$10,000-\$100,000), high (\$>100,000)

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Stormwater Retrofit Review

CCSWCD's Engineer reviewed the watershed and previously identified hotspots and recommended stormwater retrofits for key areas of the watershed.

- Summary
- Table of recommendations

Proximate Stressor Identification

Following Maine DEP's Guide to Identifying Stream Stressors (October 2019), Maine DEP staff led project staff and stakeholders through identifying the most likely proximate stressors contributing to Mare Brook's impairment. Using this guide was particularly beneficial for Mare Brook given that its impairments are due to benthic-macroinvertebrate bioassessments and habitat assessment. Because of these impairments, traditional sources of NPS pollution runoff (i.e. impervious cover, land surface erosion, sewer/manure hotspots) may not be the primary stressor. Although some may think that addressing all water quality stressors is important to current and future water quality conditions, it is not always feasible. Addressing the exact cause(s) of a stream's impairment is the most effect way for a waterbody to attain designated Class standards and can greatly help in targeting limited time and funding resources.

- Watershed split into subwatersheds for manageable reaches
- Pathway diagram used for stressor analysis
- Summary
- Table of findings

Water Chemistry

{Carol White's summary - reference back to "Water Quality" section}

Data Gaps

Impairment Causes, Stressors, and Solutions

Through the watershed management plan process, impairment causes, stressors, and potential solutions were combined and analyzed by watershed specialist and the project's steering committee. Using Maine DEP's Guide to Identifying Stream Stressors (October 2019), stressors



identified were linked to likely causes. These causes were then used to determine solutions / action items to reduce and eliminate the identified stressors. Stressor causes and solutions were looked at per subwatershed and watershed-wide. Solutions were then prioritized based on their effectiveness of directly targeting the proximate stressor and on what the steering committee felt was needed to best achieve overall goal of this plan. Solutions/action items and their priority rankings were presented to the public for additional information and feedback to consider. **See XX for Table of Identified Problems and Recommendations**^[HH16].

Common factors that influence stream habitat include:

1. Impervious cover
2. Altered riparian zones: Includes area of land next to a stream which are valuable in shading streams and keeping water cool, filtering pollutants, and providing habitat. Tree and shrub debris also provide the base of food webs.
3. Loss of floodplains: Flat areas of land in the riparian zone that allow the stream to spread out during floods helping to minimize damage to the stream and adjacent property.
4. Temperature increase: Lack of trees and shrubs and increase in impervious surfaces such as parking lots and roads increases stream temperature (along the stream itself and from the heated stormwater flowing into the stream). This can impact native cold water fish such as trout and other aquatic life.
5. Altered channels: Urban streams have often been intentionally altered (straightened, channelized, armored) for anthropomorphic benefits and also become unintentionally altered due to misaligned and sized stream crossings and impoundments, and increased impervious cover causing a flash flooding scenario.
6. Loss of wetlands: Wetlands, including marshes, bogs, wet meadows, and forested swamps, help protect streams for floods, pollutants, and nutrient enrichment as well as providing habitat and ecological services.
7. Salt: Road salt contaminates streams and groundwater when snow melts with no mechanical nor financially feasible way to remove it from freshwater systems once it has dissolved in stormwater. Excess salt can kill many aquatic organisms and cause problems for well water / drinking water supplies.
8. Culverts: Improperly placed and sized culverts can cause stream channel alterations and bank erosion and provide barriers to fish and other aquatic life migration.
9. Nutrients: Phosphorus and nitrogen are common nutrients found in fertilizer, pet waste, sewage, manure, and decomposing plants. An excess of these nutrients in the stream can cause filamentous algae blooms and low/poor dissolved oxygen readings.
10. Bare soil: Bare soil can easily wash away into nearby waterbodies resulting in excess streambed sedimentation and the transport of nutrients that readily bind to sediment from also washing into the stream.



11. Livestock: Livestock (including cows, sheep, chickens, pigs, as well hobby farm animals such as horses, can damage stream banks and riparian zone, cause erosion and the washing of gravel material into the stream and increase nutrients washing into the stream from manure.
12. Legacy pollutants: Some streams, such as Mare Brook, have legacy pollutants / toxic chemicals in the groundwater that feed streams and affect their water quality.

Addressing existing impervious cover...

Preventing Future Stressors

In addition to clear on-the-ground actions needing to occur for stream restoration, there are other actions to incorporate to assist in creating successful on-the-ground implementation and the prevention of future stressors on Mare Brook.

Education and Outreach

- Benefits of woody debris left in stream
- Benefits of vegetated buffers and tree canopy cover
- Proper disposal of yard waste
- Reduced pesticides and fertilizer use (YardScaping program)
- Reduced winter salt use particularly in crucial areas

Ordinance and Policy Changes

- Ordinance reviews to increase stream and aquifer protection and to encourage low impact development (LID). Specific recommendations include:
 - o Expanding stream protection zones
 - o Incentives for implementing LID (references include 'Urban Street Stormwater Guide' by National Association of City Transportation Officials)
 - o Consideration of impacts of stormwater infiltration that could increase groundwater contamination or seasonal mobility of legacy pollutants

Design Standards

- Enhance floodplain protection and restoration
-

Land Preservation



Action Plan and Timeline

As stated in this plan's Executive Summary, the **primary goal of this plan is to is for Mare Brook, including Merriconeag Brook, to meet its State-designated Class B standards.** An estimated time to achieve this goal is 2037 which allows for 10 years of restoration work to occur and an addition 5 years for improved macroinvertebrate readings to occur. This goal is to be accomplished by directly addressing the identified proximate stressors impacting Mare Brook's impairment while incorporating a number of additional strategies to support directly addressing proximate stressors and preventing future stressors to macroinvertebrates and other key water quality parameters.

Working with recommendations and potential solutions provided by watershed specialists, the plan's steering committee, and the public, this plan combined restoration actions into 6 main objectives needed for Mare Brook to attain its Class B standards:

1. Establish support for implementing the WMP
2. Address known stressors
3. Continue exploring additional stressors
4. Prevent future stressors
5. Create an Education and Outreach Plan to assist in addressing known stressors and preventing future stressors
6. Monitor WMP's Effectiveness and Investigate New Stressors and Actions as Needed

Detailed action items (or Management Measures) for these 6 objectives are listed in **Table XYZ** and include an approximate schedule, involved parties, potential funding sources, and estimated costs. **Over the next 10 years, x culverts to be replaced, x stream bank.....to be accomplished...** A timeline summary for accomplish is as follows:

Years 2022-2024

Years 2025-2028

Years 2029-2032

Evaluating Project Success

Pollutant Load Reduction Targets



Indicators and Measurable Milestones^[HH17]

Since it may take longer than 10 years for Mare Brook to meet is State-designated water quality standards, interim targets are recommended to determine if restoration actions are helping to meet the overall water quality goals. **Table ZZ.** below lists interim targets/measurable milestones to be used when assessing the effectiveness of implementing this plan’s action items.

Table ZZ.

	2026	2029	2032
Water Quality Benchmarks			
Enhance macroinvertebrate type, abundance, and distribution Goal: Meet Class B Standards for Macroinvertebrate sampling	20%	40%	60%

Implementing the Plan

Ownership and Community Involvement

The Town of Brunswick and other Mare Brook watershed stakeholders provided invaluable guidance and input into determining this plans objectives and action items and continued community involvement will be crucial to successfully implementing this plan.

Through a series of three Town of Brunswick public meetings, proposed stressors and recommended actions were presented. Feedback from the public was then seriously considered and included where feasible into this final plan. Public involvement in the planning stage is imperative to a successful implementation. Those living and working within the watershed are likely to have the best insight into ongoing problems and realistic solutions that may even be willing to help implement. The Mare Brook Watershed has been fortunate to have a large

number of stakeholders from a variety of organizations, who are very eager and willing to help restore and protect Mare Brook's water quality. [HH18]

Funding[HH19]

Monitoring and Adaptive Management[HH20]

References

Acronyms

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Goal Objectives and Action Items / Management Measures

		Actions/ Management Measures ^[HH21]	Schedule	Involved Parties	Potential Funding Sources	Estimated Cost (10 years)
1. Establish Support for Implementing the Watershed Management Plan						
1.a.	Create a 'Mare Brook Leadership Team' or other formal committee to oversee the implementation of the WMP					
	1.a.i.	Appoint membership and establish charge: Use representative membership to determine specific timing and logistics overall watershed improvements and increased communication among watershed stakeholders/groups and the public.	Year 1	Brunswick Town Council with community stakeholder input	In-kind: Brunswick Town Council, Community Stakeholders	\$1K (in-kind)
	1.a.ii.	Hold a minimum of one committee meeting per year	Years 1-10	Mare Brook Leadership Team (Town of Brunswick and Community Stakeholders)	In-kind: Mare Brook Leadership Team (Town of Brunswick and Community Stakeholders)	
	1.a.iii.	Establish a 'Coffin Ice Pond Stakeholder Working Group' with a definitive charge and timeline to weigh benefit of dam removal and/or restoration to stream health versus community and ecological benefits to provide a recommendation to the Mare Brook Leadership Team (If dam is removed, how do we mitigate stressors? / If dam is kept, how do we mitigate stressors?)				
1.b.	Determine how to fund the WMP's action items					



	Actions/ Management Measures ^[HH21]	Schedule	Involved Parties	Potential Funding Sources	Estimated Cost (10 years)
1.b.i.	Mare Brook Leadership Team to advise / work through Town of Brunswick’s Capital Improvement Program (CIP) process working with Brunswick’s Finance Committee	Years 1-10	Mare Brook Leadership Team	In-kind: 1-3 Mare Brook Leadership Team Members, Town of Brunswick’s Finance Committee	\$8K (in-kind)
1.b.ii.	Schedule at least 1 meeting per year to determine yearly funding objectives (Requests for Town of Brunswick versus grants and other funding sources to pursue)	Years 1-10	Mare Brook Leadership Team	In-kind: Mare Brook Leadership Team	\$20K (in-kind)
1.b.iii.	Apply for EPA Clean Water Act Section 319 grant funds to assist with the start of implementation efforts in 2023 (Additional 319 grants likely to applied for based on review of needs and funding sources in 1.b.ii)	Year 1 (Spring 2022)	Town of Brunswick with assistance from CCSWCD	Cash: Town of Brunswick	\$5K
1.c.	Garner continued support for the WMP’s actions				
1.c.i.	Establish and maintain a website page within Town of Brunswick’s website with up-to-date information on WMP’s implementation efforts	Years 1-10	Town of Brunswick	In-kind: Town of Brunswick	\$5K (in-kind)
1.c.ii.	Provide yearly public updates in the form of Town Council presentations, newspaper articles, social media outlets, etc. on the happening of the WMP’s implementation and successes	Years 1-10	Mare Brook Leadership Team	In-kind: Mare Brook Leadership Team	\$5K (in-kind)



		Actions/ Management Measures ^[HH21]	Schedule	Involved Parties	Potential Funding Sources	Estimated Cost (10 years)
2. Address Known Stressors						
2.a.	Address stream culverts impacting Mare Brook					
	2.a.i.	Conduct a Hydrologic and Hydraulic (H&H) study to assist in prioritizing stream culverts recommended for upsizing	Year 1	Town of Brunswick	Cash and in-kind: Town of Brunswick Grant funds: Maine Coastal Community Grant	\$100K
	2.a.ii.	Determine timing and logistics of recommended culvert upgrades listed in Table Z2a based on H&H study along with town paving schedule, available funding, collaboration with other adjacent improvement projects, etc.	Years 1 and 2 (revisiting Years 3-9)	Town of Brunswick Planning, Engineering and Public Works, CCSWCD	In-kind: Town of Brunswick In-kind: CCSWCD	\$1,200 (in-kind)
	2.a.iii.	Address culverts not requiring an H&H study based on water quality improvement priorities listed in Table Z2a , town paving schedule, available funding, collaboration with other adjacent improvement projects, etc. ^[HH22] .	Years 1-10	Town of Brunswick Planning, Engineering, and Public Works, CCSWCD Engineer	Cash and in-kind: Town of Brunswick Grant funds: EPA Section 319 grant funds	\$62K
	2.a.iv.	Upgrade culverts based on determined schedule after H&H study completed	Years 2-10	Town of Brunswick Planning, Engineering, and Public Works, CCSWCD Engineer	Cash and in-kind: Town of Brunswick Grant funds: Municipal Stream Crossing Upgrade Grant Program,	\$1.6M



		Actions/ Management Measures ^[HH21]	Schedule	Involved Parties	Potential Funding Sources	Estimated Cost (10 years)
					Section 319 grant funds	
2.b.	Implement geomorphological recommendations					
	2.b.i.	Determine timing and logistics of installing geomorphic recommendations based on water quality improvement priorities listed in Table Z2b , collaboration with other adjacent improvement projects (such as culvert replacements), feasibility/landowner cooperation, and funding	Year 2 (revisiting Years 3-9)	Town of Brunswick Planning, Engineering, and Public Works, CCSWCD	In-kind: Town of Brunswick In-kind: CCSWCD	\$1,200 (in-kind)
	2.b.ii.	Install geomorphological recommendations listed in Table Z2b (apart from removing Coffin Ice Pond Dam) according to the to-be-determined timeline with a fluvial geomorphologist's oversight	Years 2-10	Town of Brunswick Planning, Engineering, and Public Works, CCSWCD Engineer, Professional Geomorphologist, Possibly Hired Contractors	In-kind: Town of Brunswick Cash: Town of Brunswick Grant funds: Section 319 grant funds	\$675,000
	2.b.iii.	Determine and implement short-term plans to address failing Coffin Ice Pond dam to prevent water quality impacts	Year 1 and 2	Mare Brook Leadership Team, Town of Brunswick Planning, Engineering, Public	Cash and in-kind: Town of Brunswick	\$25K?



	Actions/ Management Measures ^[HH21]	Schedule	Involved Parties	Potential Funding Sources	Estimated Cost (10 years)
			Works, and Town Council		
2.b.iv.	Implement long-term improvements to improve or minimize water quality impacts of Coffin Ice Pond dam (following Coffin Ice Pond Stakeholder Working Group recommendations to MBLT)				
2.b.v.	Address erosion at Coffin Ice Pond’s gravel access road during short-term and long-term fixes				
2.c.	Address all public outfall upgrade recommendations				
2.c.i.	Review all public outfall upgrade recommendations in Table Z2c and determine schedule and funding to address	Year 1 and 2			
2.c.ii.	Implement all public outfall upgrade recommendations in Table Z2c	Years 1-10			\$83K
2.c.iii.	Review the existing closed drainage system and where appropriate install sediment hoods such as Snouts™ to prevent sediment and debris from entering Mare Brook from the closed drainage system.				
2.d.	Implement stormwater retrofits and site-specific BMP improvements				



	Actions/ Management Measures ^[HH21]	Schedule	Involved Parties	Potential Funding Sources	Estimated Cost (10 years)
2.d.i.	Determine timing and logistics of installing stormwater retrofit recommendations based on water quality improvement priorities in Table Z2d , collaboration with other adjacent improvement projects, feasibility/landowner cooperation, and funding				
2.d.ii.	Install stormwater retrofit recommendations in Table Z2d according to the to-be-determined timeline with engineering oversight				
2.d.iii.	Work with private properties to detach impervious cover from stormwater conveyances, with particular focus on "Above Baribeau Drive" subwatershed				
2.d.iv.	Determine and implement long-term solution for bus washing at the Coffin School				
2.d.v.	Explore maintenance needs of installed BMPs throughout the watershed and establish system to encourage education of and ongoing maintenance.				
3. Continue Exploring Additional Stressors					
3.a.	Explore opportunities to identify the impact of the ¾-mile culvert under the Brunswick Executive Airport and possible improvements				



	Actions/ Management Measures ^[HH21]	Schedule	Involved Parties	Potential Funding Sources	Estimated Cost (10 years)
3.b.	Continue to investigate impacts of groundwater contamination to the stream from the former Brunswick Naval Air Station				
3.c.	Investigate Picnic Pond’s impact to Merriconeag Stream’s water quality				
3.d.	Explore impact of trails and recreational uses within Mare Brook’s floodplain and work to minimize impacts				
4. Prevent Future Stressors ^[HH23]					
4.a.	Review ordinances for opportunities of updating to increase stream protection ^[HH24]				
4.a.i.	Update stream protection standards (explore 100-foot native plant no cut zone on each side of stream)				
4.a.ii.	Update impervious surface standards for future development (i.e. parking standards, percent lot coverage)				
4.a.iii.	Adopt new culvert sizing standards that comply with Maine StreamSmart/improved aquatic organism passage recommendations for all new and replaced stream crossing structures (public roads and private developments) ²				

² Consider including language on caddisfly migration in culvert designs for future Mare Brook watershed projects recommended by Jeff Dennis, DEP



	Actions/ Management Measures ^[HH21]	Schedule	Involved Parties	Potential Funding Sources	Estimated Cost (10 years)
4.a.iv.	Amend zoning ordinance to include treatment for urban impaired watershed stressors				
4.a.v.	Include requirements and/or incentives for reduced chloride use on new developments				
	LID - and caution				
4.b.	Provide incentives for practices that improve and protect stream water quality				
4.b.i.	Provide incentives to preserve and restore natural riparian woody vegetation			319 grant, other grants	
4.b.ii.	Provide incentives to remove/restore unneeded existing pavement				
4.d.	Increase non-compliance response of existing stream protection regulations				
4.e.	Explore land purchasing and/or conservation easements for stream protection				
4.f.	Create and implement a watershed-wide maintenance plan				
4.f.i.	Compile stormwater protection maintenance needs of entire watershed and develop plan for conducting				



	Actions/ Management Measures ^[HH21]	Schedule	Involved Parties	Potential Funding Sources	Estimated Cost (10 years)
	ongoing maintenance for both structural (installed BMPs) and non-structural (i.e. winter sand sweeping) applications ^[HH25]				
4.f.ii.	Determine maintenance needs budget and work through Town of Brunswick’s Capital Improvement Program (CIP) process working with Brunswick’s Finance Committee to assist in funding				
4.f.iii.	Implement identified maintenance needs				
5. Create an Education and Outreach Plan (to assist in addressing known stressors and preventing future stressors)					
5.a.	Create a Mare Brook Education and Outreach Committee under the Mare Brook Leadership Team to develop and implement a Mare Brook Education and Outreach Plan				
5.a.i.	<p>Appoint membership and establish charge: Use membership to determine specific topics, timing, and logistics of conducting education throughout the watershed.</p> <p>Potential topics to include:</p> <ul style="list-style-type: none"> • Increase education efforts on existing stream protection regulations • Stormwater BMP’s landowners can implement (i.e. rain gardens to retain and treat stormwater onsite) • Importance of BMP maintenance for town infrastructure and private BMPs 				



		Actions/ Management Measures ^[HH21]	Schedule	Involved Parties	Potential Funding Sources	Estimated Cost (10 years)
	5.a.ii.	Start implementation of the Mare Brook Education and Outreach Plan				
	5.a.iii.	Hold a minimum of four committee meetings per year				
6. Monitor WMP’s Effectiveness and Update Plan as Needed ^[HH26]						
6.a.	Continue to collect and review water quality data and macroinvertebrate data					
6.b.	Based on collected data, determine if additional water quality sampling is needed					
		Consider implementing bacteria testing in “Above Baribeau Drive” and “Above Maine Street” subwatersheds				
6.c.	Formally amend WMP’s action items as new information is gathered					
	6.c.i.	Review WMP’s action items at least once per year	Years 1-10			
	6.c.ii.	Establish method for formally updating the WMP	Year 1			
	6.c.iii.	Notify public of WMP updates	Years 1-10			



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