Squamscott/Exeter River, Water Integration for Squamscott-Exeter (WISE) Integrated Plan: Stormwater Designs, Advanced Septic Systems, and Fertilizer Reduction, Exeter, New Hampshire

A Final Report to

The New Hampshire Department of Environmental Services

Submitted by

Town of Exeter, New Hampshire
10 Front Street
Exeter, NH 03833

December 2023

Funding for this project was provided in part by a Watershed Assistance Grant from the NH Department of Environmental Services with Clean Water Act Section 319 funds from the U.S. Environmental Protection Agency.

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Project Partner:

Geosyntec Consultants, Inc.

Geosyntec consultants

engineers | scientists | innovators

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1.0 EXECUTIVE SUMMARY

The Exeter-Squamscott River is a major tributary to Great Bay. The Great Bay watershed has experienced population growth and an increase in development that has threatened the water quality and health of Great Bay. Excess nitrogen loading to Great Bay is reported to be three times the threshold level reported by Latimer (2010) for sustainable eel grass populations. To Town has been working to reduce nitrogen loads from various point and non-point sources for more than a decade.

In 2021, the Town developed an Adaptive Management Framework Proposal (AMP)[1], in response to the EPA Region 1 issued Great Bay Total Nitrogen General Permit for Wastewater Facilities in New Hampshire. The proposal is part of an innovative and adaptive approach to achieve reductions in total nitrogen loads to the Great Bay estuary through a combination of mandatory load limits at the WWTFs and voluntary nonpoint source nitrogen reductions. The AMP builds upon the NCP and other planning efforts completed by the Town. In the AMP, the Town outlined programs and efforts they would consider reducing nonpoint and point source pollution. Within the AMP, the Town indicated they would explore an advanced septic system program, evaluate town-owned properties for retrofit opportunities to install structural stormwater best management practices (BMPs), and develop and implement a fertilizer outreach and education program.

The objectives of the project were to:

- Identify locations and develop designs for **structural stormwater BMPs** within the Town, where retrofit assessments have not been completed to date, to control stormwater runoff and decrease nitrogen loading.

- Develop a **fertilizer reduction program** to educate stakeholders on the use of fertilizer, best management practices, and the impacts fertilizer has on the Squamscott River and ultimately the Great Bay.

- Develop a first of its kind, **advanced septic system program framework** aiming at identifying ideal locations for maximum nitrogen reduction, resident public education and outreach, and explore financial incentives to assist private property owners with implementation of an advanced system aimed at nitrogen reduction.

Through implementation of this project, the Town anticipated the following environmental outcomes:

- Educate Town officials on the costs, benefits, and constraints of implementation of an advanced septic system program. If the Town moved forward with implementation of an advanced septic system program, the Town has the potential to remove 96 to 240 pounds of nitrogen per year, based on retrofit of six septic systems per year for four years with varying proximity to a waterbody.

[1] gbtngp_amfproposal_cover_2021_07_30_2_files_merged.pdf (exeternh.gov)

- Educate residents on impacts of fertilizer use on residential property and ways to reduce fertilizer use. Through education and outreach efforts around the fertilizer reduction program the Town could remove up to 500 pounds of nitrogen, based on a 9 percent reduction applied to the existing fertilizer load on from residential parcels.
- Develop an inventory of locations on Town-owned property where stormwater retrofits could be installed for water quality improvement. The Town would advance 10 locations to design to estimate the cost of construction, potential for nitrogen load reduction, and feasibility of construction. The Town anticipates that future construction of structural BMPs could remove approximately 70 pounds of nitrogen per year.

The project began in September 2022 and was completed in December 2023. The total project cost was $91,400 of which $45,000 was funded through a Section 319 grant from NHDES and the remaining $46,400 was cash match provided by the Town. The Town worked with Geosyntec Consultants to complete the project.

Table X summaries the efforts completed by the Town to meet the objectives of the project.

Table 1. Project Objectives and Outcomes

Objective	Project Outcome
Prepare a NHDES approved Site Specific Project Plan	▪ Developed a NHDES approved Site Specific Project Plan to detail the methodology for calculating pollutant load reductions for stormwater management practices. ▪ The SSPP was approved by NHDES, signed by all parties, and on file at NHDES.
Identify locations and develop designs for **structural stormwater BMPs** within the Town, where retrofit assessments have not been completed to date, to control stormwater runoff and decrease nitrogen loading.	▪ Identified 19 potential locations for structural stormwater BMPs on Town-owned properties. ▪ Prioritized development of structural stormwater BMP design plans for 10 locations. ▪ Conducted test pits at two of the prioritized structural stormwater BMP design locations. ▪ If constructed, the 10 structural stormwater BMP practices have the potential to remove approximately 65 pounds of total nitrogen per year.
Develop a **fertilizer reduction program** to educate stakeholders on the use of fertilizer, best management practices, and the impacts fertilizer has on the	▪ Updated the Healthy Lawns – Clean Water Initiative website with new content.

Table 1. Project Objectives and Outcomes

Objective	Project Outcome
Squamscott River and ultimately the Great Bay.	▪ Developed a flyer and brochure targeted at how private property owners can reduce nutrient loads from their property. ▪ Developed a yard sign that can be displayed on private properties that demonstrate they have made the pledge to reduce nutrient loads from their property. ▪ Developed a list of recommended updates to local regulations to support the initiative. ▪ Sponsored the Alewife Festival and set up a table advertising the program initiatives. ▪ The Town anticipates a 9 percent reduction in nutrient load from residential parcels (up to 500 pounds) through implementation of this initiative.
Develop a first of its kind, **advanced septic system program framework** aiming at identifying ideal locations for maximum nitrogen reduction, resident public education and outreach, and explore financial incentives to assist private property owners with implementation of an advanced system aimed at nitrogen reduction.	▪ Created a map of septic system parcels within the Town. ▪ Developed a list of potential suitability criteria that could be used for selecting ideal locations for retrofit. ▪ Developed a detailed list of advanced septic system technologies that could be implemented including load reduction potential and cost. ▪ Developed a list of incentive programs and funding mechanisms to support a program. ▪ Prepared a feasibility study and presented the findings to the Exeter River Advisory Committee ▪ Implementation of an advanced septic system program using future grant or Town funding, has the potential to remove 96 to 240 pounds of nitrogen per year, based on retrofit of 6 septic systems per year for 4 years with varying proximity to a waterbody.

2.0 INTRODUCTION

The Great Bay watershed has experienced population growth and an associated increase in development that has threatened the water quality and health of Great Bay. Impervious cover, residential landscaping and altered hydrology, including storm and sanitary sewer systems, have increased non-point source pollution from land runoff discharged to the Great Bay Estuary. In 2009, NHDES concluded that the Squamscott and ten other sub-estuaries in the Great Bay Estuary were impaired by nitrogen, and in 2009 the Great Bay was placed on the CWA Section 303(d) list of impaired and threatened waters (NHDES, 2009).

The 2018 State of Our Estuaries report by the Piscataqua Region Estuaries Partnership (PREP) presented a synthesis of 23 indicators of estuarine health illustrating the estuary continues to decline and is under stress. Of the 16 environmental indicators, 12 are characterized as having cautionary or negative trends. Increases in nitrogen loading continue and before recent reductions from municipal wastewater treatment facilities (WWTF), point source nitrogen loading levels had increased steadily between 1988 and 2012 with nonpoint source (NPS) nitrogen loading peaking between 2006 and 2008 due to the extreme precipitation. At 43.6 tons per square mile (of tidal estuary surface area), nitrogen levels between 2012 and 2016 were much higher than the 14 tons per square mile threshold for eelgrass health indicated in a 2010 study of 62 New England estuaries (Latimer and Rego, 2010).

From 2013 to 2015, the Town participated in an integrated planning effort with the Towns of Stratham and Newfields. As part of this integrated planning effort, the *Water Integrated for the Squamscott Exeter (WISE) Preliminary Integrated Plan*[2], a nine-element watershed based plan, was developed to establish a more cost-effective and sustainable means to meet future permitting compliance needs and improve water quality in the watersheds of the Squamscott and Exeter Rivers (HUC: 010600030806), and ultimately the Great Bay. This proposed approach, which is consistent with the *USEPA Integrated Municipal Stormwater and Wastewater Planning Approach Framework*,[3] provided implementation strategies that balanced upgrades to the WWTF with nonpoint and point source stormwater control measures to reduce existing and future nitrogen loads to the watersheds of the Squamscott and Exeter Rivers and achieve other water quality objectives.

In 2018, the Town prepared a Nitrogen Control Plan (NCP)[4] which established the land uses and sources of total nitrogen from nonpoint sources from the town. The greatest sources of nitrogen load from the Town were from residential land use, septic systems, and commercial/institutional properties. The Town developed these specific load-based estimates for the town, to allow the Town to track and account for changes in land use and application of best management practices. Understanding the developed land uses and sources of total nitrogen to the Great Bay helps the Town target what management practices and strategies

[2] 2015 WISE Preliminary Integrated Plan
[3] June 2012, USEPA Memo: Integrated Municipal Stormwater and Wastewater Planning Approach Framework
[4] 2018 Nitrogen Control Plan

would be most appropriate at improving water quality. The NCP outlined a series of point source and nonpoint source strategies that the Town would implement to improve water quality.

Additionally in 2021, the Town developed an Adaptive Management Framework Proposal (AMP)[5], in response to the EPA Region 1 issued Great Bay Total Nitrogen General Permit for Wastewater Facilities in New Hampshire. The proposal is part of an innovative and adaptive approach to achieve reductions in total nitrogen loads to the Great Bay estuary through a combination of mandatory load limits at the WWTFs and voluntary nonpoint source nitrogen reductions. The AMP builds upon the NCP and other planning efforts completed by the Town. In the AMP, the Town outlined programs and efforts they would consider reducing nonpoint and point source pollution. Within the AMP, the Town indicated they would explore an advanced septic system program, evaluate town-owned properties for retrofit opportunities to install structural stormwater best management practices (BMPs), and develop and implement a fertilizer outreach and education program. To assist with implementation of these efforts, the Town applied for grant funding.

3.0 WATERSHED MAP

Watershed map is included as Figure 1 in Appendix A.

4.0 PROJECT OBJECTIVES

The objectives of the project were to:

- Prepare a NHDES approved **SSPP** which summarizes the work proposed under this scope of work.
- Identify locations and develop designs for **structural stormwater BMPs** within the Town, where retrofit assessments have not been completed to date, to control stormwater runoff and decrease nitrogen loading.
- Develop a **fertilizer reduction program** to educate stakeholders on the use of fertilizer, best management practices, and the impacts fertilizer has on the Squamscott River and ultimately the Great Bay.
- Develop a first of its kind, **advanced septic system program framework** aiming at identifying ideal locations for maximum nitrogen reduction, resident public education and outreach, and explore financial incentives to assist private property owners with implementation of an advanced system aimed at nitrogen reduction.

[5] gbtngp_amfproposal_cover_2021_07_30_2_files_merged.pdf (exeternh.gov)

4.1 Project Objective Verification

A description is provided in Table 2 on how well each of the objectives were achieved. Also presented in a verification on how achieving the object will help control or prevent nonpoint source pollution.

Table 2. Project Objective Verification

Objective	Verification
Prepare a NHDES approved **SSPP**	The Town prepared a SSPP and submitted it to NHDES for approval. NHDES approved the SSPP, it was signed by all parties, and is on file with NHDES.
Identify locations and develop designs for **structural stormwater BMPs** within the Town, where retrofit assessments have not been completed to date, to control stormwater runoff and decrease nitrogen loading.	The Town developed designs for 10 structural stormwater BMPs, that if constructed could remove up to 65 pounds of total nitrogen per year. The Town fulfilled the objective. The Town will help control or prevent nonpoint source pollution by using these designs to seek additional grant funding in the future or incorporate into future capital improvement projects.
Develop a **fertilizer reduction program** to educate stakeholders on the use of fertilizer, best management practices, and the impacts fertilizer has on the Squamscott River and ultimately the Great Bay.	The Town updated the Healthy Lawns – Clean Water Initiative program website with fresh content and pictures. The Town presented public education and outreach materials at the Alewife Festival to residents. The Town will continue distribute the materials generated as part of the project to help control or prevent nonpoint source pollution from residential properties.
Develop a first of its kind, **advanced septic system program framework** aiming at identifying ideal locations for maximum nitrogen reduction, resident public education and outreach, and explore financial incentives to assist private property owners with implementation of an advanced system aimed at nitrogen reduction.	The Town developed a feasibility report describing how an advanced septic system program could be implemented in Exeter. The report was presented to the Exeter River Advisory Committee. The Town will consider potential grant or funding opportunities to support an advanced septic system pilot project.

5.0 PROJECT OUTCOMES & MEASURABLE RESULTS

Objective: Prepare a NHDES approved SSPP

> **Environmental Outcome:** Approved SSPP will allow the Town to complete the proposed scope of work and work towards water quality improvements.
>
> **Measures Taken to Achieve the Outcome**: Developed a NHDES approved SSPP to detail the methodology for calculating pollutant load reductions for stormwater management practices.

Objective: Identify locations and develop designs for structural stormwater BMPs within the Town, where retrofit assessments have not been completed to date, to control stormwater runoff and decrease nitrogen loading.

> **Environmental Outcome:** Develop an inventory of locations on Town-owned property where stormwater retrofits could be installed for water quality improvement. The Town would advance 10 locations to design to estimate the cost of construction, potential for nitrogen load reduction, and feasibility of construction. The Town anticipates that future construction of structural BMPs could remove approximately 70 pounds of nitrogen per year. The design drawings and pollutant load estimates can be found in Appendix B.
>
> **Measures Taken to Achieve the Outcome**: The Town conducted a retrofit assessment of all Town owned properties and identified potential locations where structural stormwater BMPs could be installed. The Town prioritized these locations and developed design plans for the 10 locations.

Objective: Develop a **fertilizer reduction program** to educate stakeholders on the use of fertilizer, best management practices, and the impacts fertilizer has on the Squamscott River and ultimately the Great Bay.

> **Environmental Outcome:** Educate residents on impacts of fertilizer use on residential property and ways to reduce fertilizer use. Through education and outreach efforts around the fertilizer reduction program the Town could remove up to 500 pounds of nitrogen, based on a 9 percent reduction applied to the existing fertilizer load on from residential parcels. Program elements can be found in Appendix C.
>
> **Measures Taken to Achieve the Outcome**: The Town updated the Healthy Lawns – Clean Water Initiative program website with fresh content and pictures. The Town presented public education and outreach materials at the Alewife Festival to residents.

Objective: Develop a first of its kind, **advanced septic system program framework** aiming at identifying ideal locations for maximum nitrogen reduction, resident public education and outreach, and explore financial incentives to assist private property owners with implementation of an advanced system aimed at nitrogen reduction.

> **Environmental Outcome:** Educate Town officials on the costs, benefits, and constraints of implementation of an advanced septic system program. If the Town

moved forward with implementation of an advanced septic system program, the Town has the potential to remove 96 to 240 pounds of nitrogen per year, based on retrofit of six septic systems per year for four years with varying proximity to a waterbody. The final feasibility study can be found in Appendix D.

Measures Taken to Achieve the Outcome: The Town developed a feasibility study and presented the findings to NHDES and the Exeter River Advisory Committee. The Town used national and regional data to support development of the feasibility study.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The objectives of the project were to:

- Prepare a NHDES approved SSPP.
- Identify locations and develop designs for **structural stormwater BMPs** within the Town, where retrofit assessments have not been completed to date, to control stormwater runoff and decrease nitrogen loading.
- Develop a **fertilizer reduction program** to educate stakeholders on the use of fertilizer, best management practices, and the impacts fertilizer has on the Squamscott River and ultimately the Great Bay.
- Develop a first of its kind, **advanced septic system program framework** aiming at identifying ideal locations for maximum nitrogen reduction, resident public education and outreach, and explore financial incentives to assist private property owners with implementation of an advanced system aimed at nitrogen reduction.

Through implementation of this project, the Town anticipated the following environmental outcomes:

- Educate Town officials on the costs, benefits, and constraints of implementation of an advanced septic system program. If the Town moved forward with implementation of an advanced septic system program, the Town has the potential to remove 96 to 240 pounds of nitrogen per year, based on retrofit of six septic systems per year for four years with varying proximity to a waterbody.
- Educate residents on impacts of fertilizer use on residential property and ways to reduce fertilizer use. Through education and outreach efforts around the fertilizer reduction program the Town could remove up to 500 pounds of nitrogen, based on a 9 percent reduction applied to the existing fertilizer load on from residential parcels.
- Develop an inventory of locations on Town-owned property where stormwater retrofits could be installed for water quality improvement. The Town would advance 10 locations to design to estimate the cost of construction, potential for nitrogen load reduction, and feasibility of construction. The Town anticipates that future construction of structural BMPs could remove approximately 70 pounds of nitrogen per year.

The Town was successful at meeting all the outcomes they set out to accomplish during the project. Recommendations for next steps include:

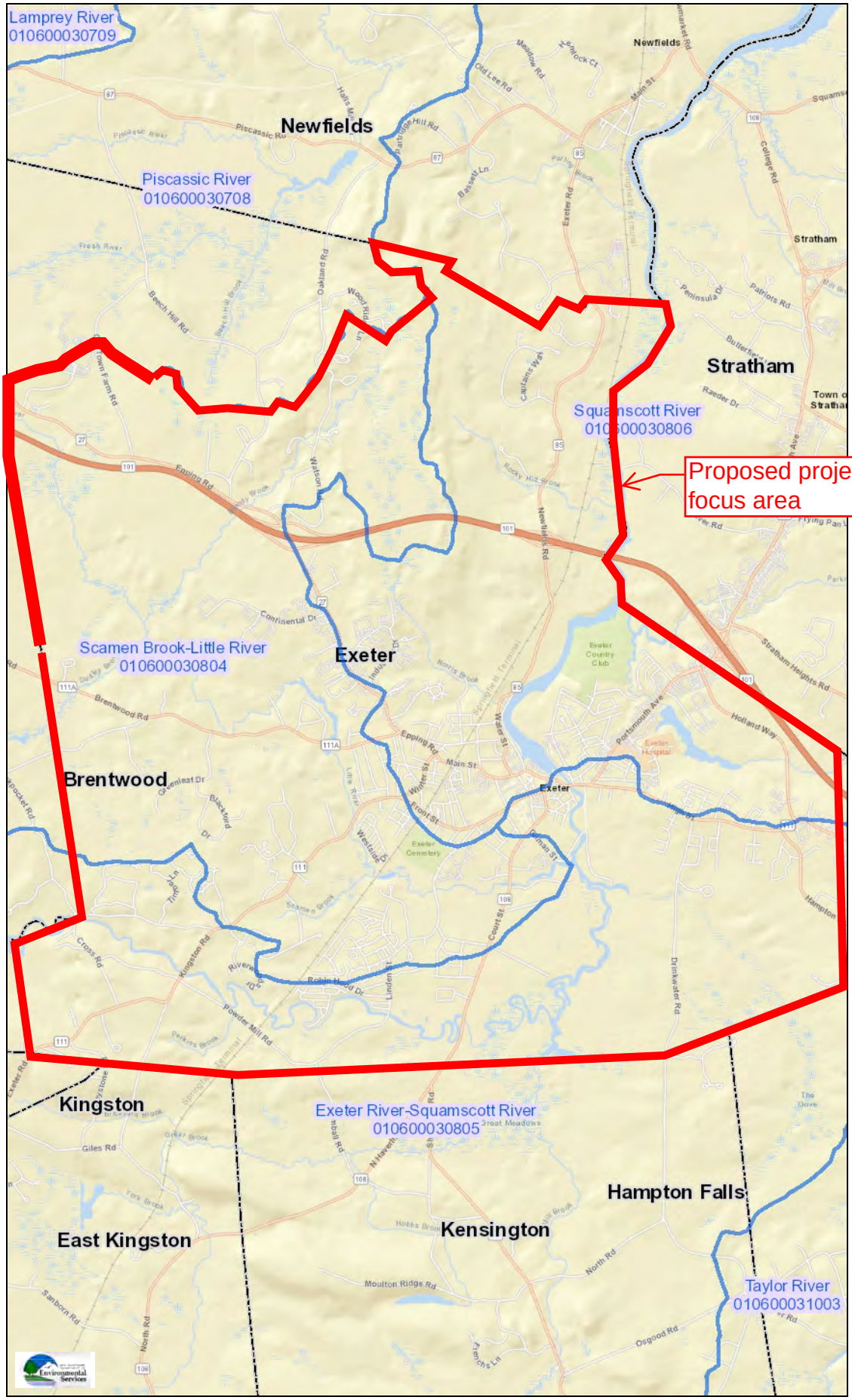
- Seek grant funding to support implementation of structural stormwater BMPs and an advanced septic system retrofit pilot study.
- Develop an education and outreach plan to continue engagement with residents and private property owners on ways to reduce their nutrient footprint.

APPENDICIES

APPENDIX A

FIGURES

Town of Exeter Subwatersheds



Legend

- Sub Watersheds - HUC 12
- Town Boundaries

Map Scale

1: 51,953

Map Generated: 9/16/2021

Notes

APPENDIX B

STRUCTURAL STORMWATER BMP DELIVERABLES

Geosyntec consultants

289 Great Road, Suite 202
Acton, Massachusetts 01720
PH 978.263.9588
FAX 978.263.9594
www.geosyntec.com

Memorandum

Date: December 30, 2023

To: Town of Exeter, New Hampshire

From: Renee Bourdeau, PE - Geosyntec Consultants

Subject: Proposed Stormwater Best Management Practices on Town-owned Property

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Geosyntec Consultants, Inc. (Geosyntec) reviewed Town owned properties where potential stormwater best management practice (BMP) retrofits could be installed. Town owned properties were targeted based on areas with high nitrogen load, areas with impervious cover, areas with underlying soil with high potential for infiltration, and feasibility for construction. Geosyntec ranked the Town owned properties prior to conducting the field visit. Geosyntec also met with the Town to discuss properties with stormwater flooding and infrastructure concerns.

Geosyntec conducted a site visit on October 24th to evaluate each of the Town-owned properties to determine locations where stormwater best management practices might be installed to improve water quality and reduce flooding. The results from the site visit are summarized in a memorandum dated November 21, 2023 (Attachment A).

Geosyntec met with the Town on November 30, 2023 to prioritize the stormwater best management practice locations to advance 10 BMP locations for development of designs. The 10 BMP locations are summarized below. Two of the locations were selected to verify underlying soil type, depth to seasonal high groundwater, and infiltration potential. These two locations are identified below.

RESULTS

The following are the 10 recommended BMP locations for design of stormwater best management practices to mitigate existing erosion and provide water quality treatment from existing impervious cover. Recommendations include various surficial and subsurface opportunities for the Town to manage stormwater and provide visible educational opportunities for the residents regarding stormwater management and improvement. The designs for each of the sites is attached to this memorandum as Attachment B.

BMP Location 1 - Swazey Parkway Roundabout

The Town has decided to no longer allow vehicular traffic to a portion of Swazey Parkway closest to Town center. The Town is proposing to install a roundabout to divert traffic from entering the closed portion of the parkway. Proposed stormwater improvements include:

- Installation of a bioretention cell with an underdrain at the center of the roundabout.

A test pit was conducted at this location to determine the depth to seasonal high groundwater and soil type to determine if infiltration is feasible. Test pit results are summarized as Attachment C.

Estimated Total Nitrogen Load Removed: 0.3 lbs/year

Estimated Stormwater BMP Construction Cost Range: $16,400 - $27,300

BMP Location 2 - Exeter Housing Authority – 277 Water Street (Parcel 064-040-0000)

Stormwater from an asphalt parking lot and sidewalks discharge to a drain inlet between the pump station and sidewalk to Swazey Parkway. Proposed stormwater improvements include:

- Divert water to the existing grassed area
- Install a filtration BMP to treat water before it overflows into the existing beehive grate
- Educational signage about stormwater management

Estimated Total Nitrogen Load Removed: 1.3 lbs/year

Estimated Stormwater BMP Construction Cost Range: $24,000 - $35,000

BMP Location 3 - Exeter Housing Authority – 277 Water Street (Parcel 064-040-0000)

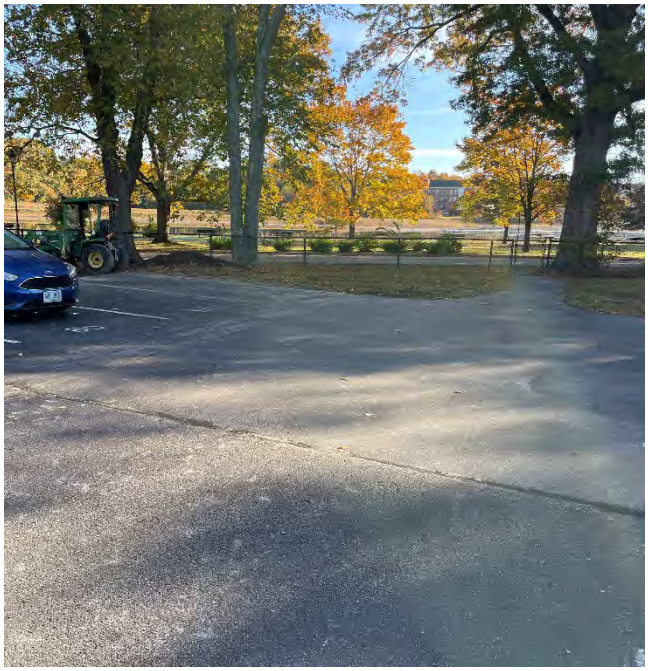
The housing authority parking area has no stormwater drainage infrastructure. It appears to run via overland flow to the grassed area in Swazey Parkway. Some stormwater makes its way into Swazey Parkway through the gate, into a grassed low spot. Proposed stormwater improvements include:

- Bioretention cell without underdrain in grassed area
- Educational signage on stormwater adjacent to the BMP in Swazey Parkway

A test pit was conducted at this location to determine the depth to seasonal high groundwater and soil type to determine if infiltration is feasible. Test pit results are summarized as Attachment C.

Estimated Total Nitrogen Load Removed: 2.0 lbs/year

Estimated Stormwater BMP Construction Cost Range: $8,000 – $13,000



BMP Location 4 - Municipal Parking Lot between Water Street and Bow Street (Parcel 072-012-0000)

Highly utilized municipal parking lot in downtown Exeter with limited space to propose surface stormwater improvements unless the Town is willing to reduce number of parking spaces. Stormwater improvements could be implemented if the Town is planning to resurface or reconstruct this parking lot in the future. Stormwater improvements include:

- Permeable asphalt parking lot in drive lanes and center parking aisles
- Install impermeable sidewalk along existing buildings with a granite curb to separate from permeable asphalt
- Educational signage about stormwater management

Estimated Total Nitrogen Load Removed: 12 lbs/year

Estimated Stormwater BMP Construction Cost Range: $345,000 - $577,000

BMP Location 5 - Municipal Parking Lot adjacent to Parcel 072-012-0000

Island in a highly utilized municipal parking lot in downtown. Tree is proposed to be cut down; however, there is a telephone pole that would need to be worked around. Stormwater improvements include:

- Bioretention cell without underdrain

Estimated Total Nitrogen Load Removed: 2.7 lbs/year

Estimated Stormwater BMP Construction Cost Range: $18,400 – $30,600

BMP Location 6 - 36 Water St – Municipal Parking Lot (Parcel 072-013-0000)

Existing landscaped area at entrance to municipal parking area downtown that could be improved with native plants and utilized stormwater management. Utilities exist in this area as well as mature trees. Stormwater improvements include:

- Bioretention cell with underdrain
- Educational signage about stormwater management

Estimated Total Nitrogen Load Removed: 14 lbs/year (if BMP Location 4 is not implemented)

Estimated Stormwater BMP Construction Cost Range: $16,500 - $27,500

BMP Location 7 - 1 Bow St – Municipal Parking Lot (Parcel 072-129-0000)

Parking lot adjacent to the police and fire station. The configuration underutilizes the available area (more impervious cover than used for parking). It is understood that a future project is to redevelop the police and fire station. If this were to happen, on-site stormwater improvements may include:

- Bioretention cell with underdrain
- Educational signage

Estimated Total Nitrogen Load Removed: 12 lbs/year

Estimated Stormwater BMP Construction Cost Range: $23,800 - $39,600

BMP Location 8 - 30-32 Court St – Senior Center (Parcel 072-132-0000)

The senior center has a large parking area with several parking island locations marked with paint. These areas could be utilized to manage stormwater from the parking area. No stormwater infrastructure was observed in the parking area.

Additionally, if the Town were to reconstruction or re-pave this parking area, subsurface options could allow for treatment of the adjacent roadways.

Stormwater improvements include:

- Bioretention parking islands with underdrains
- Educational signage about stormwater management

Estimated Total Nitrogen Load Removed: 3.7 lbs/year

Estimated Stormwater BMP Construction Cost Range: $25,900 - $43,200

BMP Location 9 - 47 Front St – Exeter Historical Society (Parcel 072-197-0000)

Downspouts at the historical society are disconnected and discharge to grassed areas around the property. During heavy rain events, it is likely that discharge from the downspouts runs on to impervious cover. Stormwater improvements would help encourage filtration and infiltration.

Stormwater improvements include:

- Rain gardens at downspout location around the building
- Educational signage about stormwater management

Estimated Total Nitrogen Load Removed: 3.3 lbs/year

Estimated Stormwater BMP Construction Cost Range: $26,600 - $44,200

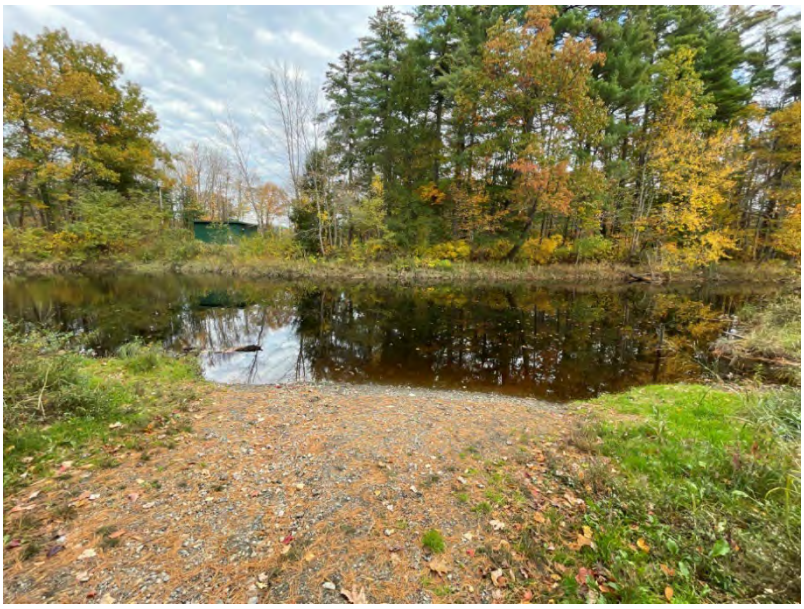
BMP Location 10 - Bell Ave – Gilman Park (Parcel 083-019-0000)

Gilman Park has an unpaved access road and boat ramp. Erosion was observed on the boat ramp which discharges directly into the Exeter River. Stormwater improvements include:

- Concrete boat ramp

Estimated Total Nitrogen Load Removed: not available using Appendix F

Estimated Stormwater BMP Construction Cost Range: $17,000 - $27,000



ATTACHMENT A

Site Visit Memorandum

Geosyntec consultants

289 Great Road, Suite 202
Acton, Massachusetts 01720
PH 978.263.9588
FAX 978.263.9594
www.geosyntec.com

Memorandum

Date: November 21, 2023

To: Town of Exeter, New Hampshire

From: Renee Bourdeau, PE - Geosyntec Consultants

Subject: Proposed Stormwater Best Management Practices on Town-owned Property

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Geosyntec Consultants, Inc. (Geosyntec) reviewed Town owned properties where potential stormwater best management practice (BMP) retrofits could be installed. Town owned properties were targeted based on areas with high nitrogen load, areas with impervious cover, areas with underlying soil with high potential for infiltration, and feasibility for construction. Geosyntec ranked the Town owned properties prior to conducting the field visit. Geosyntec also met with the Town to discuss properties with stormwater flooding and infrastructure concerns.

Geosyntec conducted a site visit on October 24th to evaluate each of the Town-owned properties to determine locations where stormwater best management practices might be installed to improve water quality and reduce flooding. The results from the site visit are summarized below. Following review of the results, the Town will work with Geosyntec to prioritize 10 BMP locations for development of designs. Of those 10 BMP locations, two will be selected to verify underlying soil type, depth to seasonal high groundwater, and infiltration potential.

RESULTS

The following are recommended sites where stormwater best management practices could be located to mitigate existing erosion and provide water quality treatment from existing impervious cover. Recommendations include various surficial and subsurface opportunities for the Town to manage stormwater and provide visible educational opportunities for the residents regarding stormwater management and improvement.

13 Newfields Road – Department of Public Works and Wastewater Treatment Facility (Parcel 049-015-0000)

BMP Location 1

Stormwater improvements could include:

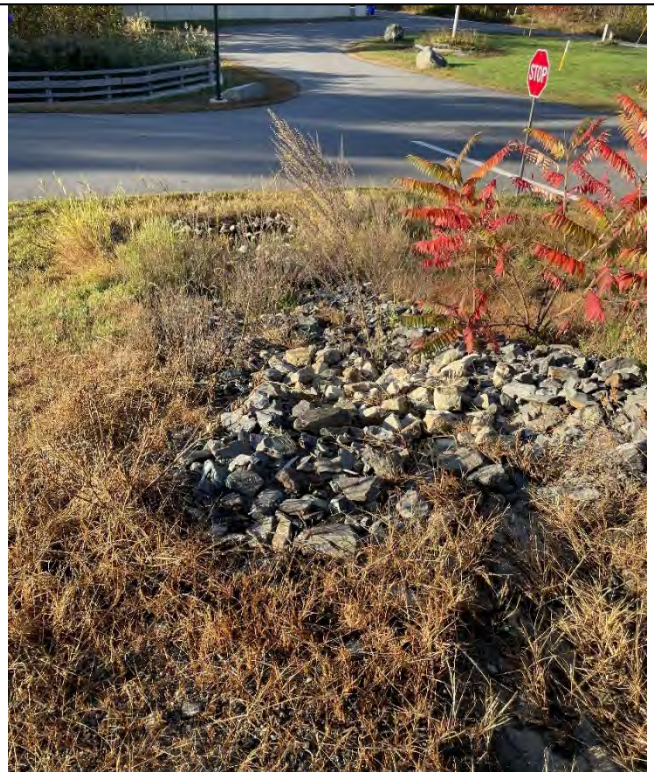
- Utilize the grassed area to infiltrate untreated stormwater from impervious area prior to entering the storm drain network

13 Newfields Road – Department of Public Works and Wastewater Treatment Facility (Parcel 049-015-0000)

BMP Location 1

Erosion observed behind the salt shed. Drainage from this area discharges into a riprap lined down chute and swale and into a culvert under the DPW entrance road. Stormwater improvements could include:

- Stabilize the area of erosion
- Install a formal down chute
- Install a filtration BMP at the outlet of the culvert to promote infiltration prior to discharging into the storm drain network



BMP Location 2 continued – additional photographs

13 Newfields Road – Department of Public Works and Wastewater Treatment Facility (Parcel 049-015-0000)

BMP Location 3

Erosion observed in grassed area and onto DPW access road. Potential groundwater seep or spring in the area that contributes water year round. Stormwater improvements could include:

- Stabilize the area of erosion
- Install a filtration or infiltration BMP in the grassed area
- Educational signage about stormwater management

Swazey Parkway

BMP Location 4

Road no longer accessible to vehicular traffic. Road will be utilized during the seasonal farmers market. Stormwater improvements could include:

- Develop a concept layout for the farmers market to remove and reduce impervious cover.
- Convert unused road impervious cover to grass or a pervious surface.
- Decommission stormwater catch basins and outfalls which often surcharge.
- Educational signage about stormwater management

Exeter Housing Authority – 277 Water Street (Parcel 064-040-0000)

BMP Location 5

Stormwater from impervious cover discharges to a catch basin inlet between the pump station and sidewalk to Swazey Parkway. Improvements could include:

- Divert water to the existing grassed area
- Install a filtration or infiltration BMP to treat water before it overflows into the existing beehive grate
- Educational signage about stormwater management

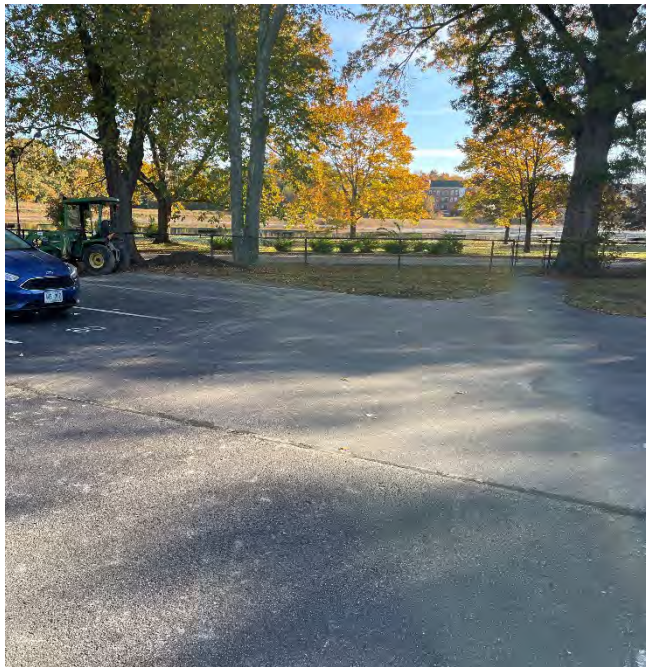
Exeter Housing Authority – 277 Water Street (Parcel 064-040-0000)

BMP Location 6

Housing authority parking area does not have any stormwater drainage infrastructure. It appears to run via overland flow to the grassed area adjacent to Swazey Parkway. Some stormwater makes its way into Swazey Parkway through the gate, into a grassed low spot.

Stormwater improvements could include:

- Filtration or infiltration practice in grassed area
- Educational signage on stormwater through parking lot towards park

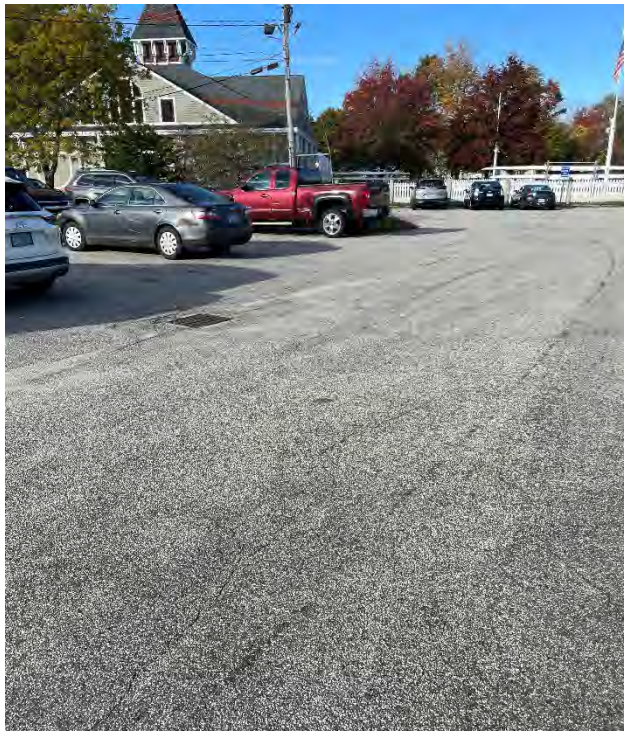


Water St – Municipal Parking Lot (Parcel 064-047-0000)

BMP Location 7

Limited space to propose surface improvements unless the Town is willing to reduce number of parking spaces. Improvements could be implemented if the Town is planning to resurface or reconstruct this parking lot in the future. Stormwater improvements could include:

- Subsurface filtration units (if depth to groundwater allows)
- Hydrodynamic separators in catch basins
- Remove parking spaces for surface infiltration or filtration BMP



Exeter Parks and Recreation (Parcel 069-004-0000)

BMP Location 8

Stormwater improvements could include:

- Convert existing mulched area to a raingarden
- Improve landscaping aesthetics at front of building by incorporating native plantings
- Educational signage about stormwater management

70 Towle Ave at Orchard Circle (Parcel 70-0)

BMP Location 9

Lots of mature trees make this location unsuitable for stormwater BMP. If the Town were to remove trees for reasons other than for stormwater. Stormwater improvements could include:

- Infiltration or filtration BMP to treat water from impervious area. Could potentially route water from Towle Avenue to the area as well.

Municipal Parking Lot between Water Street and Bow Street (Parcel 072-012-0000)

BMP Location 10

Highly utilized municipal parking lot in downtown Exeter. Limited space to propose surface improvements unless the Town is willing to reduce number of parking spaces. Improvements could be implemented if the Town is planning to resurface or reconstruct this parking lot in the future. Stormwater improvements could include:

- Subsurface filtration units (if depth to groundwater allows)
- Hydrodynamic separators in catch basins
- Remove parking spaces for surface infiltration or filtration BMP
- Educational signage about stormwater management

Municipal Parking Lot adjacent to Parcel 072-012-0000

BMP Location 11

Existing underutilized grassed area. Telephone pole could reduce usability of the site. Stormwater improvements could include:

- Surface filtration or infiltration BMP to treat existing impervious cover

36 Water St – Municipal Parking Lot (Parcel 072-013-0000)

BMP Location 12

Highly utilized municipal parking lot in downtown Exeter. Landscaped area at entrance to municipal parking area could be designed into a stormwater feature. Utilities exist in this area as well as mature trees. Stormwater improvements could include:

- Reconfigure the landscaped area at the end of the parking lot to be depressed to allow for stormwater to enter it
- Remove a section of granite curbing to allow stormwater into the depressed landscaped area

1 Bow St – Municipal Parking Lot (Parcel 072-129-0000)

BMP Location 13

Parking lot adjacent to the police and fire station. The configuration underutilizes the available area (more impervious cover than used for parking). It is understood that a future project is to redevelop the police and fire station. If this were to happen, on-site stormwater improvements could include:

- Subsurface infiltration
- Tree box filter islands
- Hydrodynamic separators
- Surface filtration or infiltration
- Educational signage

30-32 Court St – Senior Center (Parcel 072-132-0000)

BMP Location 14

The senior center has a large parking area with several non-parking locations. These areas could be utilized to manage stormwater from the parking area. No stormwater infrastructure was observed in the parking area.

Additionally, if the Town were to reconstruction or re-pave this parking area, subsurface options could allow for treatment of the adjacent roadways.

Stormwater improvements could include:

- Subsurface filtration or infiltration
- Filtration or infiltration surface parking islands
- Surface filtration or infiltration BMP, if reducing parking spaces or impervious cover were an option
- Educational signage

47 Front St – Exeter Historical Society (Parcel 072-197-0000)

BMP Location 15

Downspouts at the historical society are disconnected and discharge to grassed areas around the property. These areas are near impervious cover. During heavy rain events, it is likely that discharge from the downspouts runs on to impervious cover. Stormwater improvements would help encourage filtration and infiltration.

Stormwater improvements could include:

- Rain gardens at downspout location around the building
- Educational signage

9 Front St – Town Hall (Parcel 072-225-0000)

BMP Location 16

Town Hall property has limited opportunities for stormwater improvements. Asphalt runs directly adjacent to the building and egresses prevent removal of impervious area these locations. Stormwater improvements could include:

- Hydrodynamic separator in catch basins
- Educational signage

58 Lincoln St – Train Station Parking Lot (Parcel 073-275-0000)

BMP Location 17

Train station parking lot has limited opportunities for stormwater at the surface, as parking is highly utilized. If the Town were to reconstruction this parking area, stormwater improvements could include:

- Subsurface filtration or infiltration
- Surface filtration or infiltration if parking spaces could be reduced

Court St – Brickyard Park and Griset-Mendez Conservation Area (Parcel 082-015-0000)

BMP Location 18

The conservation areas have a gravel parking area with some low spots where water accumulates. The parking area is adjacent to a wetland area and stream. Yard clippings were observed along the tree line.

Stormwater improvements could include:

- Better management practices for yard waste collection and disposal (off-site)
- Surface filtration or infiltration BMP along the fence line with pretreatment
- Regrading of the parking area towards to stormwater BMP
- Educational signage

Bell Ave – Gilman Park (Parcel 083-019-0000)

BMP Location 19

Gilman Park has an unpaved access road and boat ramp. Erosion was observed on the boat ramp. Stormwater improvements could include:

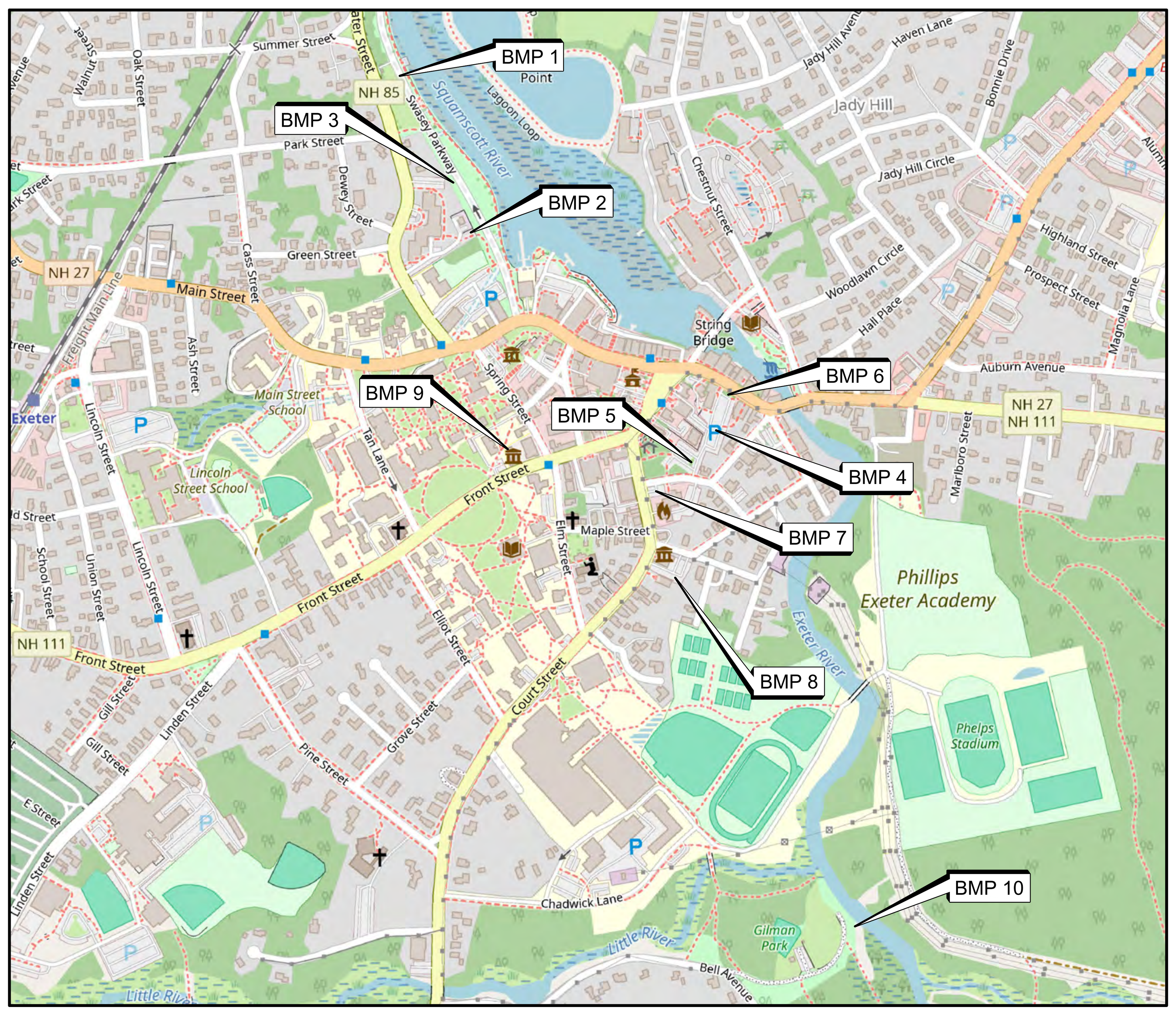
- Construct a stabilized boat ramp
- Surface filtration or infiltration BMP as a demonstration project
- Educational signage at boat ramp

ATTACHMENT B

Stormwater Improvement Design Drawings

PROPOSED STORMWATER BEST MANAGEMENT PRACTICES ON TOWN-OWNED PROPERTY EXETER, NEW HAMPSHIRE

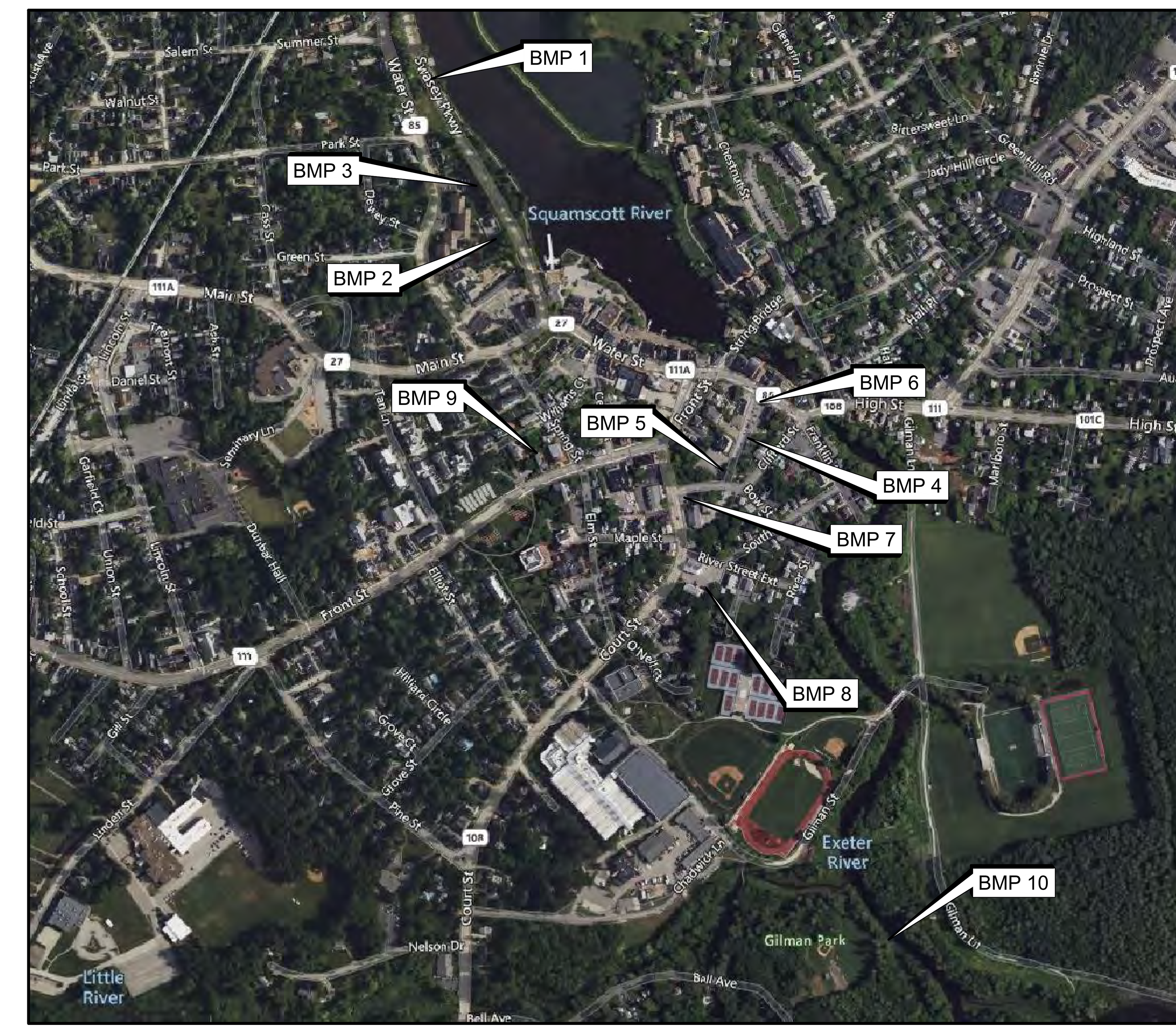
DECEMBER 2023



SOURCE: © OpenStreetMap CONTRIBUTORS

LOCATION MAP
1" = 600'

FIGURE LIST TABLE	
FIGURE NO.	FIGURE TITLE
1	COVER
2	BMP 1 - SWASEY PARKWAY CUL-DE-SAC
3	BMP 2 - 277 WATER ST. FILTRATION TRENCH
4	BMP 3 - 277 WATER ST. BIORETENTION CELL
5	BMP 4 - MUNICIPAL PARKING LOT STORMWATER UPDATES
6	BMP 5 - MUNICIPAL PARKING LOT - SOUTH BIORETENTION CELL
7	BMP 6 - MUNICIPAL PARKING LOT - NORTH BIORETENTION CELL
8	BMP 7 - 1 BOW STREET MUNICIPAL PARKING LOT BOX FILTER ISLANDS
9	BMP 8 - 30-32 COURT ST. SENIOR CENTER FILTRATION PARKING ISLANDS
10	BMP 9 - 47 FRONT ST. HISTORICAL SOCIETY RAINGARDENS
11	BMP 10 - BELL AVE. GILMAN PARK STABILIZED BOAT RAMP
12	DETAILS



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© Tom Tom

AERIAL MAP
1" = 600'

DETAIL NUMBER
SHEET ON WHICH ABOVE DETAIL IS PRESENTED

DETAIL NUMBER — 4 — DETAIL
SHEET ON WHICH ABOVE DETAIL WAS FIRST REFERENCED — 3 — TITLE OF DETAIL
SCALE: 1"=2'

EXAMPLE: DETAIL NUMBER 4 PRESENTED ON SHEET NO. 6 WAS REFERENCED FOR THE FIRST TIME ON SHEET NO.3.

ABOVE SYSTEM ALSO APPLIES TO SECTION IDENTIFICATIONS.

DETAIL IDENTIFICATION LEGEND

PREPARED FOR:
TOWN OF EXETER
PUBLIC WORKS
13 NEWFIELDS ROAD
EXETER, NH 03833

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

CONCEPTUAL DRAWINGS - NOT FOR CONSTRUCTION

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xx/xx/2023
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DRAWN BY: BEG
CHECKED BY: RLB
REVIEWED BY: RLB
APPROVED BY: RLB

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588

TITLE: COVER
PROJECT: STORMWATER BMPs 30% DESIGN
SITE: PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE: DECEMBER 2023
PROJECT NO.: BR0650
FILE: BR0650 XTB22x34
DRAWING NO.: 1 OF 12

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xx/xx/2023
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DRAWN BY:	BEG
CHECKED BY:	RLB
REVIEWED BY:	RLB
APPROVED BY:	RLB

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588

TITLE: BMP 1 - SWASEY PARKWAY CUL-DE-SAC

PROJECT: STORMWATER BMPs 30% DESIGN

SITE: PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE:	DECEMBER 2023
PROJECT NO.:	BR0650
FILE:	BR0650 XTB22x34
DRAWING NO.:	2 OF 12

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DRAWN BY: BEG
CHECKED BY: RLB
REVIEWED BY: RLB
APPROVED BY: RLB

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588

TITLE: BMP 2 - 277 WATER ST. FILTRATION TRENCH

PROJECT: STORMWATER BMPs 30% DESIGN

SITE: PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE: DECEMBER 2023
PROJECT NO.: BR0650
FILE: BR0650 XTB22x34
DRAWING NO.: 3 OF 12

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			DRN	APP
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REVIEWED BY:	RLB
APPROVED BY:	RLB

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588

TITLE:	BMP 3 - 277 WATER ST. BIORETENTION CELL
PROJECT:	STORMWATER BMPs 30% DESIGN
SITE:	PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE:	DECEMBER 2023
PROJECT NO.:	BR0650
FILE:	BR0650 XTB22x34
DRAWING NO.:	4 OF 12

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LEGEND

- EXISTING MAJOR CONTOUR (55)
- EXISTING MINOR CONTOUR (54)
- PARCEL BOUNDARY
- ST — STORM SEWER LINE
- CATCH BASIN
- MANHOLE
- OUTFALL
- BUILDING / STRUCTURE
- PERMEABLE PAVEMENT

NOTE

EXISTING CATCH BASINS AND DRAINAGE INFRASTRUCTURE IN THE PARKING LOT NOT SHOWN. THESE FEATURES WILL BE SURVEYED AND REMAIN IN PLACE.

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APPROVED BY:	RLB

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289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588

TITLE: BMP 4 - MUNICIPAL PARKING LOT STORMWATER UPDATES

PROJECT: STORMWATER BMPs 30% DESIGN

SITE: PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE: DECEMBER 2023
PROJECT NO.: BR0650
FILE: BR0650 XTB22x34
DRAWING NO.: 5 OF 12

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PARKING LOT

PROPOSED CURB CUT (TYP)

REMOVE EXISTING TREE, BUSH, AND VEGETATION

2/12 PROPOSED RAINGARDEN WITH CURB

GRASS

MUNICIPAL PARKING LOT (BMP 4)

ONE-WAY

MUNICIPAL PARKING LOT (BMP 4)

ONE-WAY

BOW STREET

ST

(3in)
(2in)
(1in)

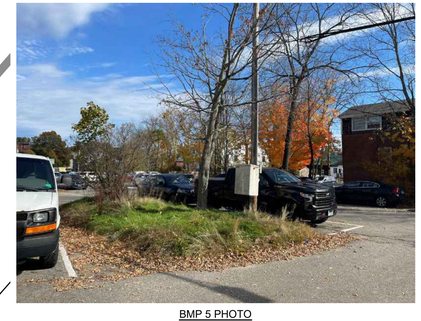
(1in) (2in) (3in) (4in)

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

0 10' 20'
SCALE IN FEET

LEGEND

- 55 EXISTING MAJOR CONTOUR
- 54 EXISTING MINOR CONTOUR
- PARCEL BOUNDARY
- ST STORM SEWER LINE
- CATCH BASIN
- UTILITY POLE
- CURB CUT
- BUILDING / STRUCTURE
- RAINGARDEN
- TREE
- BUSH



BMP 5 PHOTO

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Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588

TITLE: BMP 5 - MUNICIPAL PARKING LOT - SOUTH BIORETENTION CELL

PROJECT: STORMWATER BMPs 30% DESIGN

SITE: PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE: DECEMBER 2023
PROJECT NO.: BR0650
FILE: BR0650 XTB22x34
DRAWING NO.: 6 OF 12

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PROPOSED RAINGARDEN IN FOOTPRINT OF EXISTING PLANTER

2
12

PROPOSED CURB CUT (TYP)

BENCH (TYP)

PROPOSED EDUCATIONAL KIOSK

ONE-WAY

REMOVE EXISTING ROW OF SHRUBS

WATER STREET

ONE-WAY

MUNICIPAL PARKING LOT (BMP 4)

ONE-WAY

ONE-WAY

PARKING LOT

(3in)
(2in)
(1in)

(1in) (2in) (3in) (4in)

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

0 10' 20'
SCALE IN FEET

LEGEND

- 55 — EXISTING MAJOR CONTOUR
- 54 — EXISTING MINOR CONTOUR
- PARCEL BOUNDARY
- ST — STORM SEWER LINE
- CATCH BASIN
- MANHOLE
- UTILITY POLE
- HYDRANT
- CURB CUT
- BUILDING / STRUCTURE
- RAINGARDEN
- TREE
- BUSH

N

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289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588

TITLE: BMP 6 - MUNICIPAL PARKING LOT - NORTH BIORETENTION CELL

PROJECT: STORMWATER BMPs 30% DESIGN

SITE: PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE:	DECEMBER 2023
PROJECT NO.:	BR0650
FILE:	BR0650 XTB22x34
DRAWING NO.:	7 OF 12

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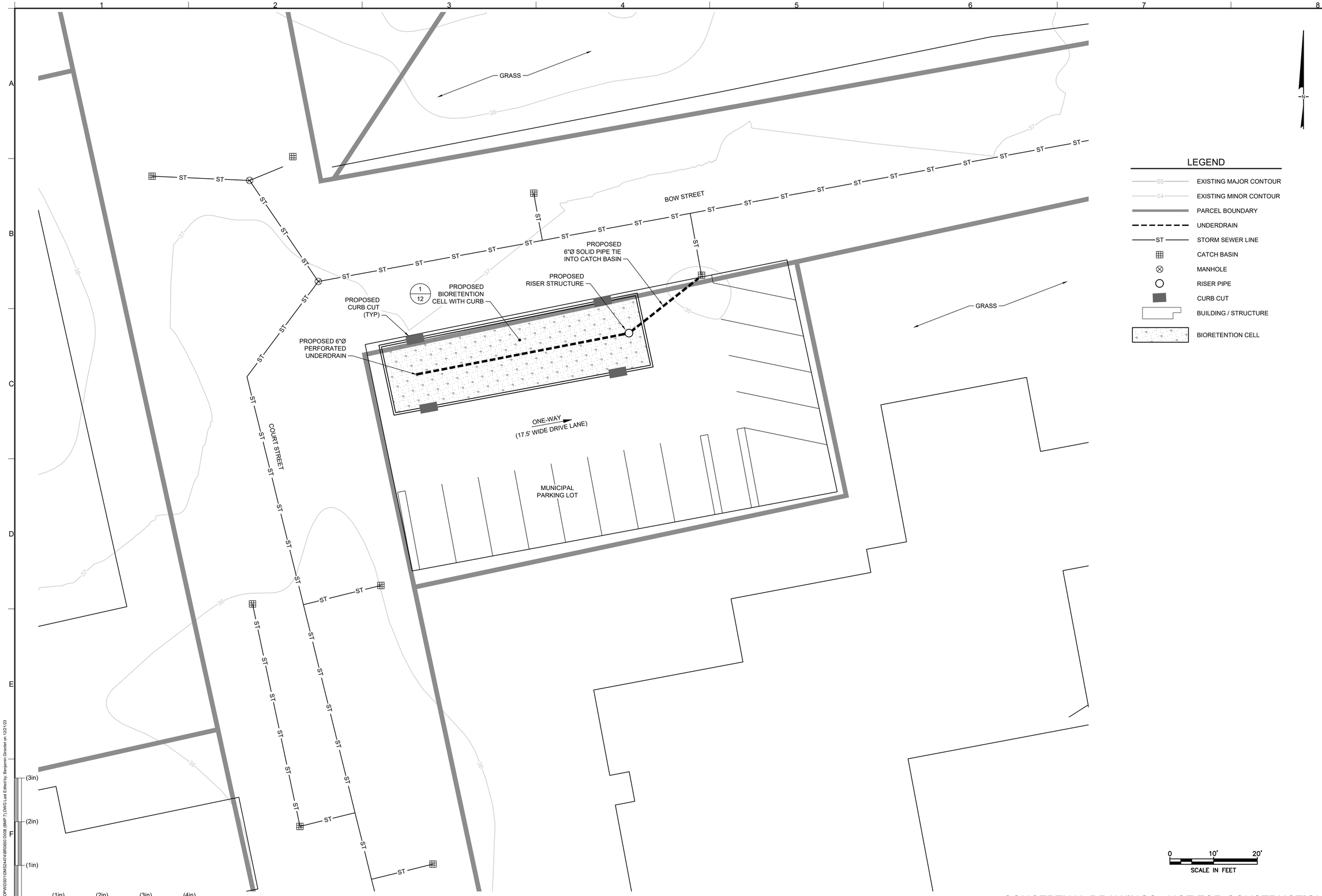

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Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588

TITLE: BMP 7 - 1 BOW STREET MUNICIPAL PARKING LOT BOX FILTER ISLANDS

PROJECT: STORMWATER BMPs 30% DESIGN

SITE: PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE:	DECEMBER 2023
PROJECT NO.:	BR0650
FILE:	BR0650 XTB22x34
DRAWING NO.:	8 OF 12

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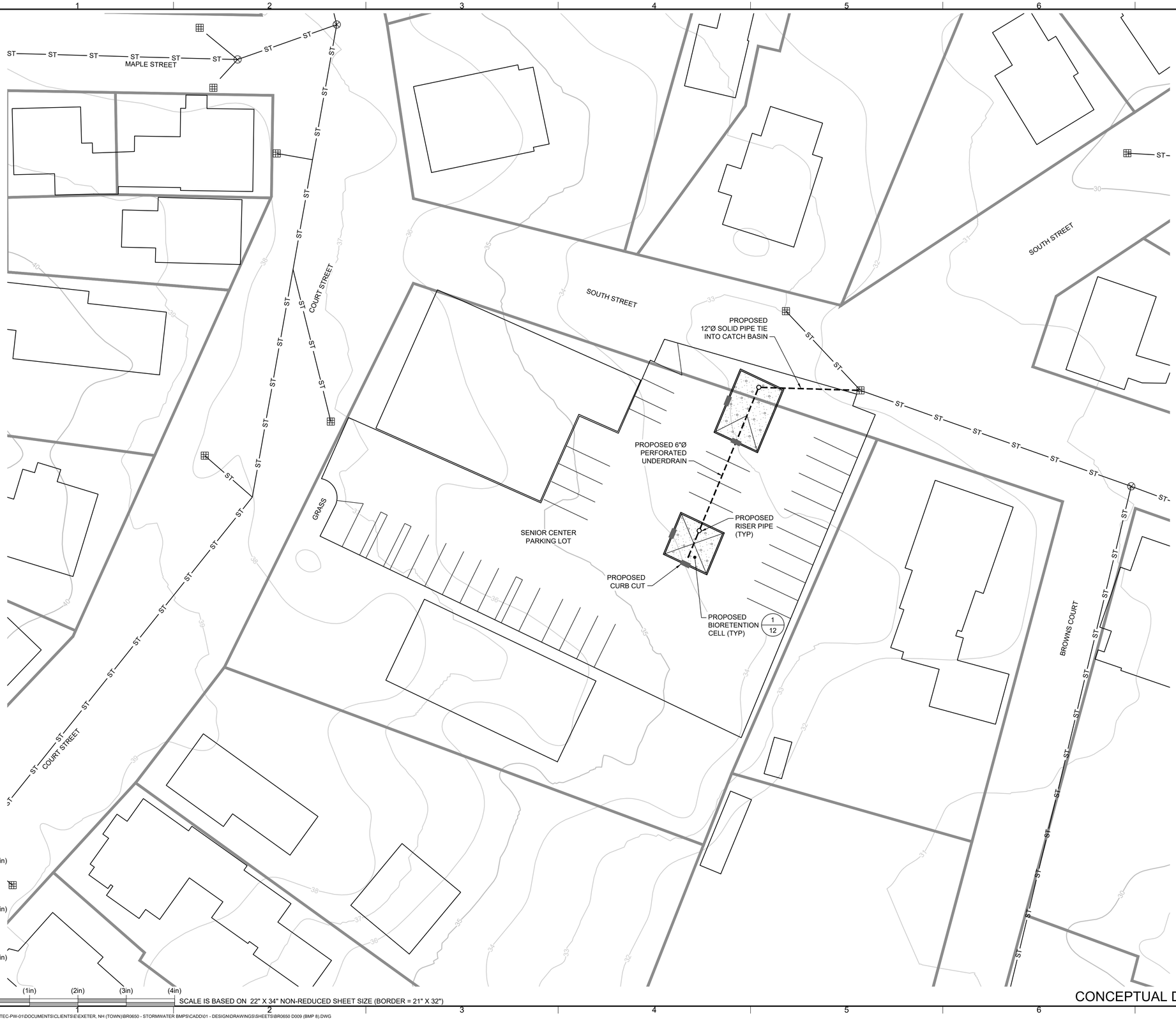

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APPROVED BY:	RLB

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9500

TITLE: BMP 8 - 30-32 COURT ST. SENIOR CENTER FILTRATION PARKING ISLANDS

PROJECT: STORMWATER BMPs 30% DESIGN

SITE: PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE:	DECEMBER 2023
PROJECT NO.:	BR0650
FILE:	BR0650 XTB22x34
DRAWING NO.:	9 OF 12

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REVIEWED BY:	RLB
APPROVED BY:	RLB

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588

TITLE: BMP 9 - 47 FRONT ST, HISTORICAL SOCIETY RAINGARDENS

PROJECT: STORMWATER BMPs 30% DESIGN

SITE: PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE:	DECEMBER 2023
PROJECT NO.:	BR0650
FILE:	BR0650 XTB22x34
DRAWING NO.:	10 OF 12

(3in)
(2in)
(1in)
(1in) (2in) (3in) (4in)

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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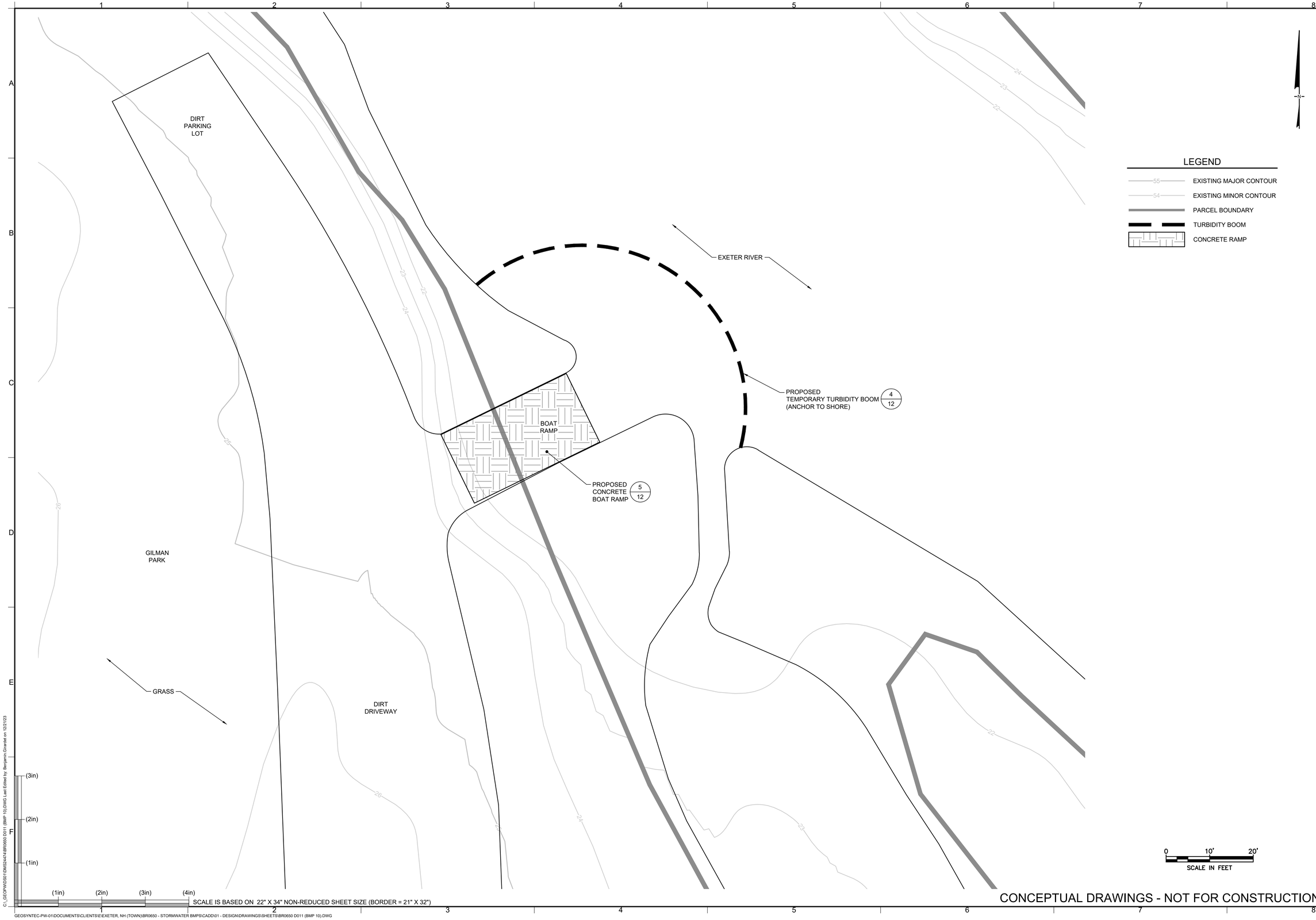

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CHECKED BY:	RLB
REVIEWED BY:	RLB
APPROVED BY:	RLB

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9588

TITLE: BMP 10 - BELL AVE. GILMAN PARK STABILIZED BOAT RAMP

PROJECT: STORMWATER BMPs 30% DESIGN

SITE: PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE: DECEMBER 2023

PROJECT NO.: BR0650

FILE: BR0650 XTB22x34

DRAWING NO.: 11 OF 12

(3in)
(2in)
(1in)

(1in) (2in) (3in) (4in)

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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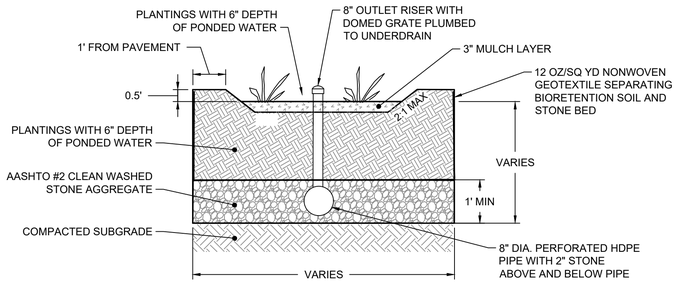
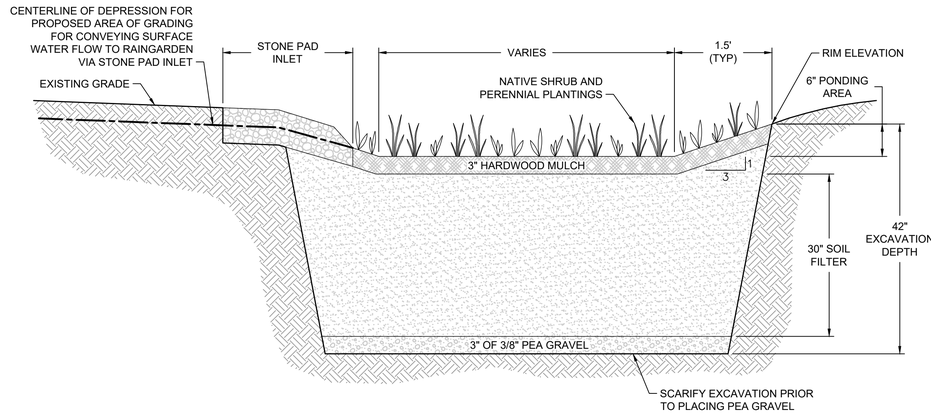


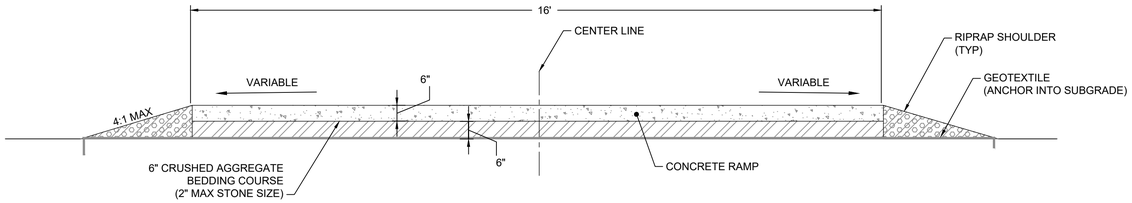
1/2 DETAIL
BIORETENTION CELL

SCALE: 1" = 2'
XREF: BR0650 DET001



2/4 DETAIL
RAINGARDEN

SCALE: 1" = 2'
XREF: BR0650 DET002



NOTES:

1. THE BOAT RAMP SHALL BE RESURFACED WITH REINFORCED PRESTRESSED CONCRETE. RAMPS SHALL HAVE A MINIMUM CONCRETE THICKNESS OF 6" WITH A 6" BEDDING COURSE OF 3/4" STONE. THE RESURFACED BOAT RAMP SHALL MAINTAIN A MIN OF 12% AND A MAX OF 16% VERTICAL GRADE.

2. SUB-GRADE PREPARATION: THE BOAT RAMP SHALL BE GRADED ACCORDING TO THE CONSTRUCTION PLANS AND PROOF ROLLED. THE CONCRETE RAMP SHALL BE PLACED ON 6" OF COMPACTED 3/4" WASHED STONE (BEDDING COURSE) WHICH IS PLACED ON NONWOVEN GEOTEXTILE FABRIC TO PREVENT WASHOUT. THE BEDDING COURSE SHALL BE COMPACTED USING A PLATE COMPACTOR USING 4 PASSES.

3. THE CONCRETE BOAT RAMP SHALL TERMINATE AT SILVER LAKE HIGH WATER LEVEL. NO PART OF THE CONCRETE PAD SHALL BE SUBMERGED. THE DOWN GRADIENT END OF THE BOAT RAMP - PAST THE EXTENTS OF THE CONCRETE PAD - SHALL BE GRADED TO PROVIDE A SMOOTH TRANSITION BETWEEN THE CONCRETE PAD AND THE BOTTOM OF THE BOAT RAMP. NOTE: THE CONCRETE PAD IS TERMINATING AT THE HIGH WATER MARK. THIS PLAN DOES NOT PROVIDE STABILIZATION FOR THE BOTTOM OF THE RAMP. IF STABILIZATION OF THE RAMP BOTTOM IS REQUIRED IN THE FUTURE THEN 10-FT WIDE CONCRETE PLANKS WITH 3-FT WIDE GRAVEL SHOULDERS ARE RECOMMENDED TO BE ADDED AND TIED INTO THE PROPOSED CONCRETE PAD.

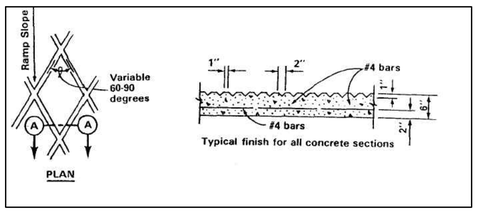
4. THE CONCRETE PAD SHALL HAVE A CHAMFORD EDGE TO PREVENT SPAULDING. THE SURFACE SHOULD BE GROOVED IN A HERRINGBONE PATTERN, DOWN SLOPED FROM THE CENTER OF THE RAMP TO THE OUTSIDE EDGE.

5. THE RAMP SURFACE SHALL BE FINISHED BY JITTERBUGGING (VIBRATING A STEEL MESH INTO THE RAMP SURFACE). WHEN THE TOOL IS REMOVED FROM THE SURFACE THE RESULTING FINISH SHALL BE A DENSE ROUGH SURFACE. THE SPACE BETWEEN PARALLEL GROOVES OF THE SURFACE FINISH SHALL NOT BE LESS THAN 2" NOR MORE THAN 3".

6. RAMP SHOULDERS SHALL BE STABILIZED WITH RIP-RAP TO PREVENT EROSION AND TO PROVIDE SUPPORT TO ERRANT VEHICLE WHEELS GOING OFF THE PAVEMENT.

3/5 DETAIL
PERMEABLE PAVEMENT

SCALE: 1" = 2'
XREF: BR0650 DET003



NOTE

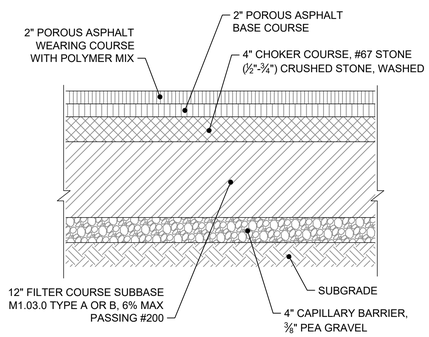
DETAIL DEVELOPED FROM THE "ENGINEERING AND DESIGN: DESIGN OF RECREATION AREAS AND FACILITIES - ACCESS AND CIRCULATION" BY THE US ARMY CORPS OR ENGINEERS, 1982.

NOTE

REQUIRED ONLY IF LAKE LEVEL AFTER DRAW DOWN IS WITHIN 10 FEET OF LIMITS OF DISTURBANCE.

4/11 DETAIL
TURBIDITY BOOM

SCALE: 1" = 2'
XREF: BR0650 DET004



5/11 DETAIL
CONCRETE BOAT RAMP

SCALE: 1" = 2'
XREF: BR0650 DET005

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

CONCEPTUAL DRAWINGS - NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	BEG	RLB
1	12/xx/23	ISSUED FOR xxxxxxxxxx		DRN APP

DRAFT

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDERING OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

xx/xx/2023
DATE

DESIGN BY:	RLB
DRAWN BY:	BEG
CHECKED BY:	RLB
REVIEWED BY:	RLB
APPROVED BY:	RLB

Geosyntec consultants
289 GREAT ROAD, SUITE 202
ACTON, MASSACHUSETTS 01720 USA
PHONE: 978.263.9688

TITLE: DETAILS

PROJECT: STORMWATER BMPs 30% DESIGN

SITE: PROPOSED STORMWATER BMPs ON TOWN-OWNED PROPERTY, EXETER, NH

DATE:	DECEMBER 2023
PROJECT NO.:	BR0650
FILE:	BR0650 XTB22x34
DRAWING NO.:	12 OF 12

C:_GEOPWD50\1\DMS2447-6\BR0650 D012 (DETAILS).DWG Last Edited by Benjamin.Grandet on 12/21/23

GEOSYNTEC-PW-01\DOCUMENTS\CLIENTS\E\EXETER, NH (TOWN)\BR0650 - STORMWATER BMPS\CADD\01 - DESIGN\DRAWINGS\SHEETS\BR0650 D012 (DETAILS).DWG

ATTACHMENT C

Test Pit Logs

Geosyntec Consultants Inc
Engineers Scientists Innovators

289 Great Road, Suite 202
Acton, Massachusetts 01720

Project #: BR0685
Address: Exeter, NH

Test Pit No: BMP Location 1
Page No: 1 of 1
File No:
Checked By:

Excavation Equipment

Geosyntec Rep: B. D'Ascoli, D Bourdeau
Weather: 25-30°, sunny

Contractor: Exeter DPW
Operator: Wayne
Make: Model:
Capacity: Reach: ft

Date: 12/14/23
Ground Elev:
Time Started: 9:30
Time Completed: 9:45

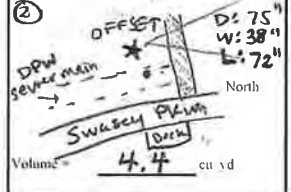
Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0						
1'	0-2" organics, grasses			E		
2'	2-12" organic horizon dark brown (Munsell 10YR 3/3) at about 4-6" seeping perched water into pit slight oxidation			E		
3'						
4'	12-18" medium dense brown sandy clay with some gravel (Munsell 10YR 5/2)			E		
5'						
6'	18-38" loose dry light brown silt with some clay (Munsell 10YR 5/3)			E		1
7'						
8'	38-75" medium dense wet plastic gray clay, wet (Munsell 10YR 5/1)			E		
9'						
10'	75" Depth to groundwater, 1.5" of water in excavation seeping in from side walls					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

X Field testing results represent total organic vapor levels, referenced to a isobutylene standard, measured in the headspace of sealed soil sample jars using a Ion Science Tiger organic vapor meter equipped with a photoionization detector (PID) and 10.6eV lamp. Results in parts per million by volume (ppmv)
ND indicates nothing detected (<0.1 ppmv)

① Sample taken from the 18-38" horizon and sent to lab for permeability testing
② offset sample location by about 5 feet southwest to avoid sewer mains & irrigation lines

Test Pit Plan



Volume = 4.4 cu yd

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR)	0 - 10%
LITTLE (LI)	10 - 20%
SOME (SO)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Groundwater
	75"

Geosyntec Consultants Inc.
Engineers Scientists Innovators

289 Great Road, Suite 202
Acton, Massachusetts 01720

Project #: BR0685
Address: Exeter, NH

Test Pit No: BM Location 3
Page No: 1 of 1
File No:
Checked By:

Excavation Equipment

Geosyntec Rep: B D'Astoli, D Bourdeau
Weather: 25-30°, sunny

Contractor: Exeter DPW
Operator: Wayne
Make: ____ Model: ____
Capacity: ____ Reach: ____ ft

Date: 12/14/23
Ground Elev.:
Time Started: 8:45
Time Completed: 9:00

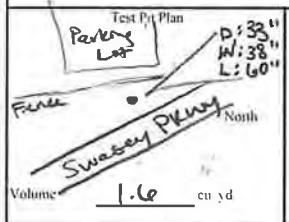
Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0						
1'	0-2" organics, grassy root mat			E		
2'	2"-12" brown sandy clay, medium density, moist, F/M with some root mat and larger roots (Munsell 10YR 3/3)			E		
3'	12-18" slight yellow brown clay (Munsell 10YR 5/4) medium density			E		
4'						
5'	18-24" medium dense gray to brown clay (Munsell 10YR 5/2)			E		
6'						
7'	24-26" medium loose brown sandy clay, moist, F/M (Munsell 10YR 3/3)			E		
8'						
9'	26" depth to ground water					1
10'	33" bottom of excavation					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

* Field testing results represent total organic vapor levels, referenced to a isobutylene standard, measured in the headspace of sealed soil sample jars using a Ion Science Tiger organic vapor meter equipped with a photoionization detector (PID) and 10 6eV lamp. Results in parts per million by volume (ppmv). ND indicates nothing detected (<0.1 ppmv)

1. No sample collected as groundwater hit at 26" below surface excavation

Test Pit Plan



Volume: 1.6 cu yd

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR)	0 - 10%
LITTLE (LI)	10 - 20%
SOME (SO)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours): ____
Depth to Groundwater: 26"

Geosyntec

Geosyntec Consultants Inc

Client:	Geosyntec Consultants		
Project Name:	Exeter		
Project Location:	Exeter, NH		
GTX #:	318331		
Start Date:	12/29/2023	Tested By:	jb
End Date:	1/3/2024	Checked By:	ank
Boring #:	---		
Sample #:	BMP Location 1		
Depth:	18"		
Visual Description:	Moist, dark grayish brown silt		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084

Constant Volume

Sample Type:	Remolded	Permeant Fluid:	De-aired Distilled water
Orientation:	Vertical	Cell #:	---

Sample Preparation: Moderate effort compaction at as received moisture content.

Assumed Specific Gravity: 2.65

Parameter	Initial	Final
Height, in	2.34	2.25
Diameter, in	2.86	2.81
Area, in^2	6.42	6.20
Volume, in^3	15.0	14.0
Mass, g	448.4	490.6
Bulk Density, pcf	113.4	133.7
Moisture Content, %	6.4	16.4
Dry Density, pcf	106.6	114.8
Degree of Saturation, %	31	99

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	89.97	Increased Cell Pressure, psi:	94.99	Cell Pressure Increment, psi:	5.02
Sample Pressure, psi:	84.99	Corresponding Sample Pressure, psi:	88.59	Sample Pressure Increment, psi:	3.60
				B Coefficient:	0.72

*B value did not increase with increase in pressure. Final degree of saturation >95%.

FLOW DATA

Date	Trial #	Pressure, psi		Manometer Readings			Elapsed Time,	Gradient	Permeability K,	Temp,		Permeability K @ 20 °C,
		Cell	Sample	Z_1	Z_2	Z_1-Z_2	sec		cm/sec	°C	R_t	cm/sec
1/2	1	90.0	85.0	8.0	7.8	0.2	49.46	17.6	1.8E-07	19.5	1.013	1.8E-07
1/2	2	90.0	85.0	8.0	7.8	0.2	50.16	17.6	1.8E-07	19.5	1.013	1.8E-07
1/2	3	90.0	85.0	8.0	7.8	0.2	49.8	17.6	1.8E-07	19.5	1.013	1.8E-07
1/2	4	90.0	85.0	8.0	7.8	0.2	49.74	17.6	1.8E-07	19.5	1.013	1.8E-07

PERMEABILITY AT 20° C: 1.8×10^{-7} cm/sec (@ 5 psi effective stress)

APPENDIX C

FERTILIZER REDUCTION PROGRAM DELIVERABLES

Geosyntec consultants

289 Great Road, Suite 202
Acton, Massachusetts 01720
PH 978.263.9588
FAX 978.263.9594
www.geosyntec.com

Memorandum

Date: December 5, 2023

To: Town of Exeter, New Hampshire

From: Renee Bourdeau, PE and Andrew Colcord, EIT; Geosyntec Consultants

Subject: Fertilizer Reduction Efforts – Update Website for Healthy Lawns – Clean Water Initiative

---

Geosyntec Consultants, Inc. (Geosyntec) has researched methods and information to positively update the existing Healthy Lawns – Clean Water Initiative Program on behalf of the Town of Exeter (Town). Recommended updates and improvements to the Healthy Lawns – Clean Water Initiative Program website are summarized below. The Town should review these recommendations and provide feedback. Geosyntec will then work on transforming the recommended website content for four topics into graphics that can be uploaded to the website as hyperlinks or images.

RECOMMENDATIONS

Geosyntec has the following recommendations which would improve the existing Healthy Lawns – Clean Water Initiative Program webpage[1].

Updates to Existing Website Content

5 Easy Steps to Healthy Lawns – Clean Water[2]

When you click on the hyperlink for the 5 Easy Steps to Healthy Lawns – Clean Water, it directs you to a PDF. The link in the 5th steps is not active. Additionally, Geosyntec recommends that we showcase these 5 easy steps directly on the homepage for easier accessibility from the public (less clicks).

Facebook Page

The link that prompts the user to the Exeter Healthy Lawns Clean Water Facebook page is active; however, the page has not been updated in over a year. As part of this effort, the Town should re-

[1] Exeter's Healthy Lawns - Clean Water Initiative | Town of Exeter New Hampshire Official Website (exeternh.gov)
[2] 5_steps_logo_final.pdf (exeternh.gov)

engage with this platform and post some of the new content prepared by the Town as part of this update.

RECOMMENDED ADDITIONS TO THE WEBSITE

Home page text

Geosyntec suggested the following updates to the Healthy Lawns – Clean Water Initiative home page. This includes the addition of the pledge for a healthier lawn and showcasing the yard sign.

> As one of the largest sources of non-point source nitrogen in Great Bay, fertilizer management is a priority for the Town of Exeter. In 2018, a committee was formed to educate the public on ways they can reduce nitrogen pollution in our water ways by managing healthy lawns with less impact to our water quality. The committee also worked to develop a zoning ordinance amendment that limits fertilizer use in our shoreland protection district and our aquifer protection districts. These amendments were supported by the voters of Exeter and adopted in 2019. Before you apply fertilizer or hire lawn care assistance, please review the maps below, content on this webpage, and the excerpt of the zoning ordinance indicating use restrictions below. If you have any questions, contact the Exeter Planning Department.
>
> We are continuing this mission and asking residents to make the pledge for healthy lawns for clean water. The voluntary pledge demonstrates you are taking steps to reduce fertilizer use, conserve water, reduce irrigation, and opting for native plants that can withstand drought, heat, and soil. If you make the pledge, you can proudly display a yard sign in your yard to demonstrate to your neighbors that you are supporting healthy lawns for clean water.
>
> 
>
>
> Please CLICK HERE to take the pledge.

New Content Recommendations

The following are new content recommendations to add to the website. The text for the topic areas could be hyperlinks from the main page that open a formatted PDF or webpage. The information below is suggested text. It will be supplemented by images related to the subject matter.

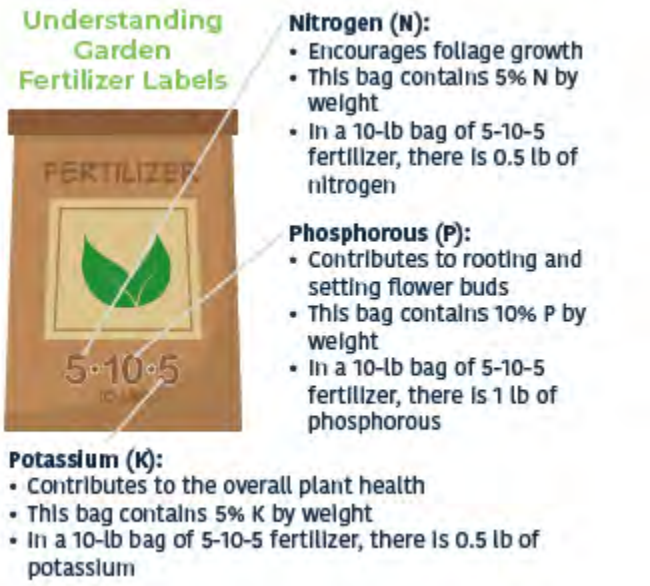
WHAT IS A SOIL TEST AND WHY DO YOU NEED ONE?

Before starting a garden or landscaping, it's important to have a soil test performed. A soil test will give you a snapshot of the pH of your soil and the level of nutrients available. This is critical for plant health. Too much or too little of any nutrient can be the difference between success or failure. Before you go out and spend money on fertilizer that you may or may not need, call your local extension office and request a soil test kit.

The University of New Hampshire (UNH) Cooperative Extension provides soil analysis and fertilizer recommendations to farmers, homeowners, and researchers. Recommendations are based on the latest research and are specific to the crop being grown. Samples can be mailed or submitted in-person. Best practices for submitting your soil sample will help guide you during the process.

CHOOSING FERTILIZER WISELY

Did you know that fertilizer application is prohibited in some areas of Town (see zoning ordinance section 9.1.7 and 9.3.4.F)? When outside the restricted areas, a soil test should be used to indicate the need for fertilizer. Choosing the correct fertilizer is so important to ensuring the long-term success of your plants and can prevent excess nutrients runoff from your property. Here are some helpful tips on how to read a fertilizer back.



Each fertilizer bag with contain three number separated by a dashed line. For example, a bag could read something as 5-10-5. The first number represent nitrogen, the second number represents phosphorous, and the last number represents potassium. All three numbers represent the percent of dry weight of each element represented in the bag. From the example mentioned above, a 10-pound bag of fertilizer would contain 0.5 pounds of potassium.

Applying Fertilizer Properly

Fertilizer should never be applied on hard ground, steep slopes, before a storm event, or in amounts greater than your lawn needs. If using a fertilizer spreader, calibrating your spreader correctly ensures the proper amount is applied and is a key step for keeping excess nutrients out of our waterways. Bonus: You'll also save money by not wasting purchased fertilizer.

For more information on how and why you would want to calibrate your spreader visit:
https://hubs.ly/Q01KqB-s0

WAYS TO REDUCE OUTDOOR WATER USAGE

Incorporate some text on ways homeowners can reduce irrigation needs and conserve rainwater on-site. We suggest the following text which we could format and add pictures and hyperlinks to additional resources:

> Of the estimated 29 billion gallons of water used daily by households in the US, nearly 9 billion gallons, or 30 percent, is devoted to outdoor water use. In the hot summer months, or in dry climates, a household's outdoor water use can be as high as 70 percent (USEPA).
>
> There are various ways to reduce outdoor water usage on your property by conserving rainwater at your home including rainwater reuse and utilizing infiltration techniques. Conserving rainwater can help reduce pollution runoff from your home. Some considerations include a using a rain barrel, adding a rain garden, installing pervious walkways and patios, adding a driveway infiltration trench, reducing the impervious area footprint, and planting native vegetation.
>
> Another way to prevent runoff from your lawn is to reduce irrigation. Some common ways to this are to make sure that you are not watering your lawn more than it needs to be and by using slow-release fertilizer. Some ways to prevent overwatering include aerating your lawn, manually checking your lawns moisture levels before watering, and adding a soil moisture sensor to previously installed automated irrigation systems.
>
> Please CLICK HERE for information about the Town's rain barrel program.

FIVE STEPS FOR A NATURAL LAWN

Take the image created from the brochure (right) and re-organize or reformat for viewing on the website. Additionally we could include the following hyperlinks which provide resources on some of these topics.

Drought Tolerant Plants for New Hampshire Landscapes [fact sheet] | Extension (unh.edu)

What are some of the best native ornamental grasses for landscapes? | Extension (unh.edu)

List of New Hampshire Native Trees | Extension (unh.edu)

Green Grass & Clean Water

HEALTHY LAWNS - CLEAN WATER INITIATIVE

Properly managed lawns keep our waterways cleaner.

5 STEPS FOR A NATURAL LAWN

Improper lawn care pollutes water bodies with nitrogen and phosphorus. Follow these tips to be lawncare smart.

1. **PLANT NATIVES** They require less water and maintenance.
2. **MOW HIGHER** Set mower blades at 3" for more vigorous roots.
3. **LET CLIPPINGS LIE** Clippings are high quality, free fertilizer.
4. **HEALTHY SOIL?** Test your soil for pH and organic matter.
5. **WATER WISELY** Lawns only need 1" of water per week from rain and/or irrigation.

HEALTHY LAWNS CLEAN WATER

KNOW YOUR LAWN'S NEEDS

TEST YOUR SOIL

Mature lawns often need a pH adjustment, not chemicals. Testing your soil is the first step in providing your lawn with the proper nutrients that it needs to maximize the potential of the growth of your lawn.

This step, while arguably the most important, is the one that is most commonly ignored.

Soil testing provides you with the pH, phosphorus, potassium, calcium, magnesium, and lead levels of your soil. The correct soil pH level is needed for your plants to access the nutrients that they need to grow.

Unnecessary fertilizer does not get used by your lawn and can make its way into our waterways.

Contact UNH Cooperative Extension to test your soil.

CHOOSE FERTILIZER WISELY

NOTE: Applying fertilizer is prohibited in some areas of town (see zoning ordinance 9.1.7 and 9.3.4.F). When outside those areas, if a soil test indicates you need fertilizer, choose the correct product. Understanding the numbers on a fertilizer bag is essential to properly apply fertilizer. Making sure you get the right fertilizer for your lawn can prevent excess nutrient runoff from your property.

Understanding Garden Fertilizer Labels

Nitrogen (N):
- Encourages foliage growth
- This bag contains 5% N by weight
- In a 10-lb bag of 5-10-5 fertilizer, there is 0.5 lb of nitrogen

Phosphorous (P):
- Contributes to rooting and setting flower buds
- This bag contains 10% P by weight
- In a 10-lb bag of 5-10-5 fertilizer, there is 1 lb of phosphorous

Potassium (K):
- Contributes to the overall plant health
- This bag contains 5% K by weight
- In a 10-lb bag of 5-10-5 fertilizer, there is 0.5 lb of potassium

KNOW YOUR LAWN'S NEEDS

APPLY FERTILIZER PROPERLY

Fertilizer should never be applied on hard ground, steep slopes, before a storm event, or in amounts greater than your lawn needs. If using a fertilizer spreader, calibrating your spreader correctly ensures the proper amount is applied and is a key step for keeping excess nutrients out of our waterways. Bonus: You'll also save money by not wasting purchased fertilizer.

For more information on how and why you would want to calibrate your spreader visit:
https://hubs.ly/Q01KqB-s0

LAWNCARE AND WEATHER

Pollution runoff happens when water flows across developed land, collecting dirt, debris and chemicals and transfers it to a nearby waterbody directly or through storm drains. Reducing irrigation and conserving rainwater can reduce pollution runoff from your lawn. Lawns only need 1" of water per week from rain or irrigation. Be sure to measure soil moisture before watering. Rain barrels collect rainwater allowing you to use it when your lawn or garden is dry. Slowing runoff by installing areas where it can soak in also helps. Common practices include:

- Pervious walkways
- Driveway infiltration trench
- Reducing impervious areas
- Rain garden

GROW NATIVE PLANTS

Recover your free time! Converting portions of lawn to native plants or meadows can be a tremendous benefit for local water quality. They require less water, improve habitat for wildlife and pollinators, air quality, and most importantly takes less of your time to maintain-giving you more time to kick-back and enjoy the summer! Consider adding native plants that are known to withstand drought, heat, and drier soil conditions. The less water your lawn needs the less likely chemicals from lawn care will make its way to waterbodies. Some plants to consider include:

- Little bluestem
- Purple love grass
- Switch grass
- Gray birch
- Common juniper
- Sweet Pepperbush
- Sweet fern

For more information about Exeter's Healthy Lawns – Clean Water Initiative visit:
https://hubs.ly/Q01KqCzk0

For more information about the University of New Hampshire Extension's soil testing services visit:
https://hubs.ly/Q01KqDgb0

5 STEPS FOR A NATURAL LAWN

Improper lawn care pollutes water bodies with nitrogen and phosphorus. Follow these tips to be lawncare smart.

1 PLANT NATIVES
They require less water and maintenance.

2 MOW HIGHER
Set mower blades at 3” for more vigorous roots.

3 LET CLIPPINGS LIE
Clippings are high quality, free fertilizer.

4 HEALTHY SOIL?
Test your soil for pH and organic matter.

5 WATER WISELY
Lawns only need 1” of water per week from rain and/or irrigation.

For more information about Exeter’s Healthy Lawns – Clean Water Initiative visit:
https://hubs.ly/Q01KqCzk0

For more information about the University of New Hampshire Extension’s soil testing services visit:
https://hubs.ly/Q01KqDgb0

HEALTHY LAWNS - CLEAN WATER INITIATIVE

Properly managed lawns keep our waterways cleaner.

KNOW YOUR LAWN'S NEEDS

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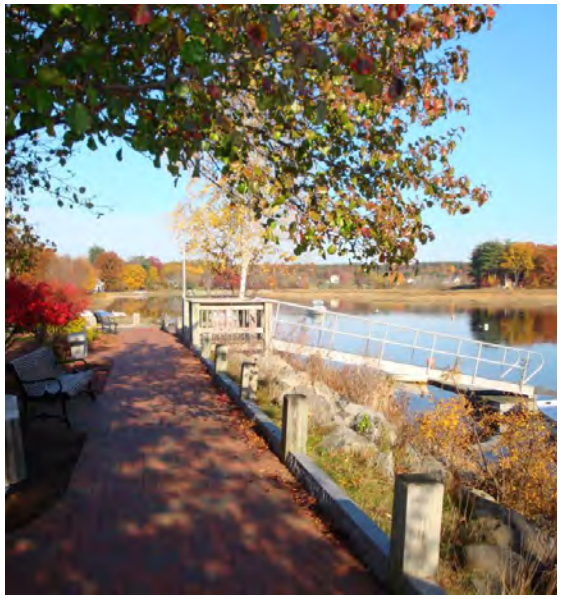
Mature lawns often need a pH adjustment, not chemicals. Testing your soil is the first step in providing your lawn with the proper nutrients that it needs to maximize the potential of the growth of your lawn.

This step, while arguably the most important, is the one that is most commonly ignored.

Soil testing provides you with the pH, phosphorus, potassium, calcium, magnesium, and lead levels of your soil. The correct soil pH level is needed for your plants to access the nutrients that they need to grow.

Unnecessary fertilizer does not get used by your lawn and can make its way into our waterways.

Contact UNH Cooperative Extension to test your soil.



CHOOSE FERTILIZER WISELY

NOTE: Applying fertilizer is prohibited in some areas of town (see zoning ordinance 9.1.7 and 9.3.4.F). When outside those areas, if a soil test indicates you need fertilizer, choose the correct product. Understanding the numbers on a fertilizer bag is essential to properly apply fertilizer. Making sure you get the right fertilizer for your lawn can prevent excess nutrient runoff from your property.

Nitrogen (N):
- Encourages foliage growth
- This bag contains 5% N by weight
- In a 10-lb bag of 5-10-5 fertilizer, there is 0.5 lb of nitrogen

Phosphorous (P):
- Contributes to rooting and setting flower buds
- This bag contains 10% P by weight
- In a 10-lb bag of 5-10-5 fertilizer, there is 1 lb of phosphorous

Potassium (K):
- Contributes to the overall plant health
- This bag contains 5% K by weight
- In a 10-lb bag of 5-10-5 fertilizer, there is 0.5 lb of potassium

APPLY FERTILIZER PROPERLY

Fertilizer should never be applied on hard ground, steep slopes, before a storm event, or in amounts greater than your lawn needs. If using a fertilizer spreader, calibrating your spreader correctly ensures the proper amount is applied and is a key step for keeping excess nutrients out of our waterways. Bonus: You'll also save money by not wasting purchased fertilizer.

For more information on how and why you would want to calibrate your spreader visit:
https://hubs.ly/Q01KqB-s0

LAWNCARE AND WEATHER

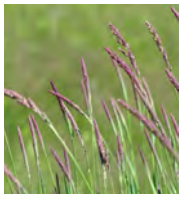
Pollution runoff happens when water flows across developed land, collecting dirt, debris and chemicals and transfers it to a nearby waterbody directly or through storm drains. Reducing irrigation and conserving rainwater can reduce pollution runoff from your lawn. Lawns only need 1" of water per week from rain or irrigation. Be sure to measure soil moisture before watering. Rain barrels collect rainwater allowing you to use it when your lawn or garden is dry. Slowing runoff by installing areas where it can soak in also helps. Common practices include:

- Pervious walkways
- Driveway infiltration trench
- Reducing impervious areas
- Rain garden

GROW NATIVE PLANTS

Recover your free time! Converting portions of lawn to native plants or meadows can be a tremendous benefit for local water quality. They require less water, improve habitat for wildlife and pollinators, air quality, and most importantly takes less of your time to maintain-giving you more time to kick-back and enjoy the summer! Consider adding native plants that are known to withstand drought, heat, and drier soil conditions. The less water your lawn needs the less likely chemicals from lawn care will make its way to waterbodies. Some plants to consider include:

- Little bluestem
- Purple love grass
- Switch grass
- Gray birch
- Common juniper
- Sweet Pepperbush
- Sweet fern



I pledged a healthier lawn!

Properly managed lawns keep our waterways cleaner.

TOWN OF EXETER FOUNDED 1638 NEW HAMPSHIRE

Scan for more information about Exeter's Healthy Lawns – Clean Water Initiative.

APPENDIX D

ADVANCED SEPTIC SYSTEM PROGRAM FRAMEWORK DELIVERABLES

Geosyntec consultants

engineers | scientists | innovators

Advanced Septic System Feasibility Study

Town of Exeter, New Hampshire

Prepared for

Town of Exeter, New Hampshire
13 Newfields Road
Exeter, NH 03833

Prepared by Renee L. Bourdeau, P.E. and Andrew Colcord, EIT (MA)

Geosyntec Consultants, Inc.
289 Great Road, Suite 202
Acton, MA 01720

Project Number: BR0650

December 2023

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EXECUTIVE SUMMARY

Nutrient pollution from septic systems is a major concern in the Piscataqua Region Watershed. Traditional septic systems primarily focus on sanitizing by eliminating or deactivating harmful organisms, and the recognition of nutrients as contaminants is a more recent development. Consequently, it's necessary to modify the design and implementation of septic systems to diminish the discharge of nutrients from these systems. One of the modifications includes the use of advanced technologies (whole systems and/or system components) aimed at removing nitrogen from septic system effluent.

This study evaluates the location, suitability, and a framework for an advanced septic system technology program for the Town of Exeter. Many septic system upgrade or advanced septic system technology programs receive funding to support implementation and administration of the program. Without incentives, many property owners would fail to pay additional money to upgrade their septic system with an advanced treatment technology. Therefore, many existing septic system upgrade programs offer incentives to property owners for their participation in the upgrade or retrofit programs.

As the Town explores the means to address nitrogen loading from septic systems and whether a Town administered advanced septic system technology program is feasible, some recommendations and next steps are outlined below.

- Establish an area of priority septic systems that would be considered if an advanced septic system technology were to be established.
- Establish suitability criteria to assist with defining the priority septic systems.
- Develop a map of the priority septic system area.
- Establish a Priority Septic System Overlay District.
- Establish regulations to encourage the use of advanced septic system technologies in the Priority Septic System Overlay District.
- Implement a pilot program to plan and install an advanced septic system in the Town.
- Coordinate with NHDES to understand what steps the state is taking to approve advanced septic system technologies for use in New Hampshire.
- Provide education and outreach to users of septic systems on advanced septic system technologies.
- Provide education and outreach to users of septic systems on steps the state and Town are taking to mitigate water quality impacts from septic systems in priority areas.

1. INTRODUCTION

Nutrient pollution from septic systems is a major concern in the Piscataqua Region Watershed. Traditional septic systems primarily focus on sanitizing by eliminating or deactivating harmful organisms, and the recognition of nutrients as contaminants is a more recent development. Consequently, it's necessary to modify the design and implementation of septic systems to diminish the discharge of nutrients from these systems. One of the modifications includes the use of advanced technologies (whole systems and/or system components) aimed at removing nitrogen from septic system effluent.

The Town of Exeter ('Town') understands that septic systems may contribute to water quality impairments in downstream water bodies. Therefore, the Town applied for a Clean Water Act (CWA) Section 319 Watershed Assistance Grant through the New Hampshire Department of Environmental Services (NHDES) to conduct a feasibility study for development of the framework for an advanced septic system technology program.

This study explores how the Town might select the optimal retrofit locations, describes different types of advanced septic system technologies, potential amendments to the Town's current zoning and health regulations, potential funding sources, and incentive programs. The Town will use this study to determine if implementing an advance septic system technology program in the Town is feasible and what the next steps would be.

The following tasks were completed to prepare this report:

- Identification of septic system users within the Town
- Development of list of suitability criteria to prioritize participation in an advanced septic system program
- Development of a list of advanced septic system technologies
- Review of current regulations within the Town and suggested amendments to those regulations that would support an advanced septic system technology program
- Identification of potential funding mechanisms that could be used to fund the program
- Identification of incentive programs the Town may consider
- Recommendations and next steps

1.1 UNH Expert Panel Process for Advanced Septic System Technologies

In 2023, the University of New Hampshire convened an expert panel to provide policy recommendations to NHDES related to using advanced septic system technologies to remove or retain nitrogen and phosphorus from wastewater[1].

The noteworthy recommendations from the expert panel report, that are applicable to the Towns' efforts targeting nitrogen, include:

- New Hampshire should provide a rapid pathway to "general approval with conditions" for advanced septic system technologies that have been approved in Massachusetts, Rhode Island, and Suffolk or Nassau counties in Long Island, New York.
- Establish an inspection, maintenance, and monitoring program for advanced septic systems.
- Establish and maintain a database of septic system inspection and/or monitoring results.
- Map nutrient sensitive areas and require adequate wastewater nutrient treatment in these areas.
- Establish a training program for advanced wastewater professionals.
- Form an advanced septic system technology pilot program in New Hampshire.
- Establish a low-interest loan program capable of offering rapid support to homeowners facing an unexpected need to replace or upgrade their septic system.
- Make nutrient reduction a factor in site evaluation and system design.

[1] Expert Panel Process for Advanced Septic System Technologies

2. USERS, SUITABILITY, AND REGULATORY AUTHORITY

2.1 Identification of Septic System Users

A map of the parcels in Town currently served by septic systems was prepared (Attachment A). To develop this, geographic information system (GIS) data was reviewed to determine what parcels were served by sanitary sewer. All parcels not served by sanitary sewer, or with a sanitary sewer line near to it if not currently developed, were determined to be served by septic systems. Based on the analysis, approximately 36% of the parcels in Town (1,489) are or could be serviced by septic systems. Of those parcels, 1,192 have impervious cover present based on review of the GIS data layers, which is an indicator of development. Based on this assumption, an estimated 1,192 septic systems existing within the Town.

2.2 Suitable Criteria

To determine the optimal locations for retrofit of existing septic system with advanced septic system treatment technologies, suitability criteria should be evaluated. Potential suitability criteria are summarized in Table 1. The suitability criteria could be weighted, scored, and ranked if a program is implemented. Scoring could assist with ensuring the projects with the greatest overall value to water quality are implemented.

Table 1. Suitability Criteria

Criteria	Description
Location	Systems close to sensitive ecological areas, such as wetlands, rivers, lakes, and ponds, and proximity to drinking water supply wells should be prioritized for upgrades due to their potential for higher impact on water quality. Establishing a sensitive area setback and incorporating this into location regulations would be necessary.
Existing Nitrogen Contribution	Areas with high nitrogen contributions from septic systems or receiving water impaired due to nitrogen contributions from septic systems, especially those exceeding public health standards.
Estimated Nitrogen Reduction	Projects with the potential for high estimated nitrogen load reductions should be prioritized.
Underlying Soil Type or High Groundwater	Areas with sandy soils and high groundwater should be prioritized.
Population Served by System	Community septic systems or septic systems serving multi-family homes, which tend to have higher loading rates, should be prioritized.
Project Readiness	Ability and timeline of a project to be built should be prioritized.
Effectiveness of Current System	Systems which are poor working condition or in failure should be prioritized.
Regulatory Compliance	Compliance with local environmental regulations and requirements for new developments or redevelopment is necessary when upgrading to advanced

Table 1. Suitability Criteria

Criteria	Description
	systems.

2.3 Regulatory Authority

Septic systems in New Hampshire are regulated to ensure proper design, installation, operation, and maintenance to prevent pollution in public and private waters. Both NHDES and the Town are responsible for ensuring this. Here's a summary of the regulations:

- **Design and Installation**: Septic systems must be designed and installed by NHDES certified designers and installers. Proposed design plans and specifications are reviewed by NHDES to ensure proper siting, construction, and operation.
- **Approvals Required**: Before construction, an Approval for Septic System Construction must be obtained from NHDES. An Approval for Operation from NHDES is required before using a septic system.
- **Local Enforcement**: Health officers have enforcement responsibilities concerning septic systems according to state laws and Administrative Rules. Towns may order the replacement of failed systems and ensure that all occupied buildings have property sanitary conditions.

These regulations are in place to protect public health and the environment from the potential hazards of improperly managed septic systems.

2.3.1 Local Ordinance Review

While NHDES is responsible for establishing design guidelines and approves the installation of septic systems, the Town can impose regulations for septic systems to improve water quality. However, if NHDES does not support the use of alternative advanced septic system technologies, it may be difficult for the Town to require these be installed in environmental sensitive areas.

If the Town were to move forward with an advanced septic system technology program, the following regulatory amendments should be considered.

Potential areas in the current zoning ordinance for an amendment include:

- Update zoning ordinance to include a septic system priority overlay district. The overlay district could be based partly on the selected suitability criteria. Different zones could be added to the overlay district based the criteria selected.
- Section 9.2.3 General Regulations for the Aquifer Protection District requirements that apply to domestic wastewater disposal systems or septic systems could be expanded to a proposed "septic system priority overlay district". Other suggested amendments include:

  - Section 9.2.3.C.4. Septic System Design and Installation: This section could be expanded to include new design and installation guidelines that would encourage or require the selection of advanced septic system treatment technologies.
  - Section 9.2.3.E. Septic systems construction guidance reference documents could be expanded to include reference to the advanced septic system technologies.
- Section 9.3.4.C Building Setbacks: In the Exeter Shoreland Protection District Ordinance, regulates the distance a septic system or leachfield can be from the shoreline. These distances currently include within 300 feet from the shoreline of the Squamscott River, Dearborn Brook, Waterworks Pond, and Fresh River; within 150 feet from the shoreline of the Exeter River or the major tributaries of the Squamscott River and Exeter River as herein defined, or within 100 feet of the shoreline of perennial brooks and streams located within the Exeter Shoreland Protection District.
  - *Suggested Amendment:* The Town should consider whether these distances are protective enough of water quality. The Town may also consider encouraging or requiring the use of advanced septic system technologies within priority zone (said distance from the shoreline). If waivers are allowed within these buffer zones, the use of advanced septic system technologies should be encouraged to achieve nitrogen effluent concentrations below specific thresholds dependent on the specific buffer zone they are within.
- Section 9.4.5 New or Replacement Water and Sewer Systems: This section states there shall be no new or expansion of existing septic systems within the Special Flood Hazard Area, except to correct malfunctions of septic systems. Where replacement of existing water and sewer systems (including on-site systems) are proposed in a special flood hazard area the applicant shall provide the Building Inspector with assurance that these systems will be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters, and on-site waste disposal systems will be located to avoid impairment to them or contamination from them during periods of flooding.
  - *Suggested Amendment:* When malfunctions or replacement of existing on-site sewer systems are encountered within this area, advanced septic system technologies are encouraged/required.

3. ADVANCED SEPTIC SYSTEM TECHNOLOGIES

A literature review of advanced septic system technologies was conducted to determine the estimated cost, nitrogen reduction performance, constructability, and operation and maintenance (O&M) of each technology. In November 2023, the State of Rhode Island Department of Environmental Management released a list of alternative or experimental onsite wastewater treatment system technologies[2] (Attachment B). The technologies on the list are approved alternatives/experimental technologies for onsite wastewater treatment that have been approved by the state. The literature review of advanced septic system technologies is summarized in Table 2.

Table 2. Advanced Septic System Technology Summary

Advanced Septic System Technologies	Description	Cost[3,4]	Nitrogen Reduction Performance	O&M
AdvanTex AX20	A prepackaged packed bed filter that significantly reduces BOD and TSS inside a waterproof container installed after a two-compartment tank prior to discharge to a leachfield which may be reduced in size by 50%. When configured in Mode 3, this system is acknowledged as an approved nitrogen reducing system.	$18,750 - $21,150	TN ≤ 19 mg/L 71-76%	$260 per year, maintenance 1 time annually
Amphidrome Single Family System	The Amphidrome® system uses a submerged attached growth bioreactor process operating in a batch mode. The Amphidrome® system utilizes two tanks and one submerged attached growth bioreactor, called the Amphidrome® reactor. The first tank, the anoxic/equalization tank, is where the raw wastewater enters the system. The tank has an equalization section, a settling zone, and a sludge storage section. It serves as a primary clarifier before the Amphidrome® reactor.	$7,500- $15,000	TN <3 mg/L 59%	Up to $1,700 - $3,000 yearly
AquaKlear AK6S245	The system utilizes a clarifying trio and more compact all-in-one design it treats household wastewaters and releases it at a rate that is 98.8% cleaner than when it entered the system while leaving it odorless.	$13,750	54%	$300 per year, maintenance 1 time annually
BioBarrier	The System incorporates a Membrane Bioreactor (MBR) and uses three-compartment tankage either as a single three-compartment tank, or a single-compartment pre-treatment tank followed by a two-compartment tank. The	Varies based on design[5]	TN ≤10 mg/L	Requires minimal operator attention which results in

[2] Rhode Island Department of Environmental Management (ri.gov)

[3] Costs vary based on the site, type of system and design of system. For accurate costs, its best to contact the system manufacturer.

[4] Costs presented include estimated cost of technology or system and materials. Design, permitting, and construction costs are not included.

Table 2. Advanced Septic System Technology Summary

Advanced Septic System Technologies	Description	Cost[3,4]	Nitrogen Reduction Performance	O&M
	BioBarrier MBR is in the last of the three compartments in both configurations. The first compartment or tank provides primary treatment and is equipped with an outlet screening device (SaniTEE®). The second and third compartments must be in the same tank. Denitrification occurs in the second compartment of the System under anoxic conditions; a mixing pump installed in this compartment recycles some of the nitrified water through a baffle wall between the second and the third compartments (the aeration/membrane zone). The third compartment contains the Membrane Bioreactor, through which water passes for additional treatment prior to discharge to a leachfield by a float-activated discharge pump.			low maintenance costs
Bioclere Model 16, 24, 30 and 36 series	The Technology consists of a modified trickling filter positioned over a clarifier. Effluent from the septic tank enters the System and is pumped up to the top of the insulated unit where it is evenly distributed over the surface of the filter media. Biochemical oxidation takes place as the water trickles through the filter and over the biological film that grows on the surface of these randomly packed pieces of PVC plastic. Oxygen is supplied to the system through a small axial fan located in the top of the housing.	$7,500-$15,000 (for 16 series model)	TN≤19 mg/L 57%	Up to $1,700 - $3,000 yearly
Fuji Clean CEN 5, 7 or 10	The System is a single fiber-reinforced plastic tank divided into three chambers. Wastewater flows in a circuitous path through the sedimentation chamber to an anoxic chamber containing media followed by an aerobic chamber containing two types of media. Media in the System provide mechanical filtration and facilitate fixed-film and suspended-growth microorganisms' anaerobic and aerobic biodegradation of wastewater constituents, including conversions of nitrogen species to nitrogen gas. Wastewater and sludge are recirculated from the third chamber back to the sedimentation chamber. One small blower, a diaphragm compressor, provides aeration, airlift recirculation and airlift pump discharge of treated effluent to a leachfield. A 50% reduction in leachfield size is allowed for conventional leachfields.	$12,250 (for 5 series model)	TN ≤ 19 mg/L 77%	$300 per year + maintenance 2 time annually
Hoot BNR	The Hoot-NR (BNR) system, also known as the Hoot Nitrogen Reduction or Hoot Basic Nitrogen Reduction system, is a wastewater treatment solution designed to	$17,500	64%	$435 per year, maintenance

[5] Cost varies based on the size of the system based on hydraulic and organic loading and model based on population equivalent.

Table 2. Advanced Septic System Technology Summary

Advanced Septic System Technologies	Description	Cost[3,4]	Nitrogen Reduction Performance	O&M
	significantly reduce nitrogen levels. The Hoot BNR system is essentially a residential-sized municipal wastewater treatment plant that can fit in a backyard. It is a complete five-stage, activated-sludge aerobic unit that uses advanced aeration and time re-circulation to effectively process and treat wastewater. It's perfect for challenging sites like small lots, steep slopes, poor soils, and high groundwater areas.			1 time annually
Hydro-Action - AN Series	The Hydro-Action AN Series is a state-of-the-art wastewater treatment system that utilizes the extended aeration activated sludge process. This advanced system is designed to not only treat wastewater but also reduce nitrogen content, making it an efficient and environmentally friendly option for on-site wastewater treatment.	$15,250	66%	$410 per year, maintenance 2 time annually
MicroFAST	The FAST (Fixed Activated Sludge Treatment) system is an aerobic wastewater treatment system that utilizes an aerobic fixed film process that is a combination of the conventional trickling filter and activated sludge processes. The FAST system is designed to be installed within a two-compartment tank where the first compartment provides a primary settling zone for incoming sewage and the second houses the actual FAST system. The system contains submerged media that provide surfaces for microbial growth. Aeration and circulation are provided by a blower that pumps air into a draft tube that extends down the center of the tank. The system is capable of significantly reducing biological oxygen demand (BOD5), total suspended solids (TSS), and total nitrogen in the effluent.	$2,995 (for 0.5 system)	TN ≤ 19 mg/L	Requires minimal operator attention which results in low maintenance costs
Nitrex Nitrogen Removal System	The Nitrex system uses a proprietary patented nitrate-reactive media that converts nitrate to inert nitrogen gas through denitrification. Wastewater contaminated with nitrate is gravitationally fed through the treatment module. The Nitrex filter is known for its passive operation and is essentially maintenance-free. It provides almost 100% nitrate removal in a low-cost, easy-to-install process.	$16,000-$22,000	94%	$2,000 per year first 3 years then $870 per year
NitROE® Waste-Water Treatment System	The NitROE wastewater treatment system is an innovative technology developed to enhance nitrogen removal from septic systems before the effluent is discharged into the soil absorption system. The NitROETM tank is placed in the gravity-flow path between a septic tank and a soil absorption system for the purpose of enhanced total nitrogen removal. This supplementary NitROETM tank can be installed as part of a new or upgraded system, or it can be installed to supplement an existing system for enhanced total nitrogen reduction. For those site specific situations where pumping is required within a system due to site topography, the NitROETM	$23,500-$29,000	TN ≤ 10 mg/L 90%	$1300 first year, $600-$1000 years 2-3, $400-$600 annually after year 3 + $210 annually for electrical usage

Table 2. Advanced Septic System Technology Summary

Advanced Septic System Technologies	Description	Cost[3,4]	Nitrogen Reduction Performance	O&M
	tank can be arranged to fit within that particular scenario as well. However, the main goal is to use gravity flow whenever possible.			
Norweco	The Singulair wastewater treatment system is a self-contained three-chambered treatment system utilizing primary treatment (settling), mechanical aeration, clarification, and flow equalization to achieve treatment. Wastewater from the building enters the primary settling chamber through an inlet tee, then enters an aeration chamber. In the aeration chamber, an aspirator at the bottom of a shaft disperses air radially as fine bubbles provide oxygen for the biomass and vertically mix chamber contents. The wastewater in the aeration chamber passes through to the clarification chamber for final settling of solids. A portion of the clarified wastewater is recirculated back to either the inlet pipe (building sewer) or into the primary chamber for denitrification. Treated wastewater passes through an effluent filter as it exits the system and is then gravity fed to the leachfield.	$13,500	TN ≤ 19 mg/L 55%	$465 per year, maintenance 2 time annually
Recirculating Sand Filter	Wastewater, having received primary treatment in a septic tank or equivalent unit, flows by gravity to a recirculation (mixing) tank. In doses controlled by both a programmable timer and float switch, the mixed fresh wastewater and partially treated filter effluent is applied to a bed of coarse sand (fine gravel) media. This mixed wastewater is dispersed over the filter surface in a PVC distribution network surrounded in pea stone. Wastewater trickles down through the sand media, where biological treatment occurs. The treated effluent is collected in an underdrain at the bottom of the filter and discharged back to the recirculation tank. There most of it mixes with incoming wastewater, a small amount gets discharged to the drainfield, and the cycle begins again. Typically, a buoyant-ball check valve is used to control discharge and recirculation. Treated wastewater is discharged to a drainfield for additional treatment. The system is capable of significantly reducing biological oxygen demand (BOD5), total suspended solids (TSS), and total nitrogen in the effluent. The technology is targeted for use in critical resource areas and is intended to be used with shallow pressurized drainfields.	Varies based on design[6]	TN ≤ 19 mg/L	Requires minimal operator attention which results in low maintenance costs
Recip RTS~500 System	The ReCip® uses a filter medium contained in two adjacent, equally dimensioned cells. The medium provides a surface for microbes to attach, live, and grow. Timers	$8,000-$15,000	58%	Up to $1,700 - $3,000 yearly

[6] Cost varies based on the size of the system based on hydraulic and organic loading and model based on population equivalent.

Table 2. Advanced Septic System Technology Summary

Advanced Septic System Technologies	Description	Cost[3,4]	Nitrogen Reduction Performance	O&M
	on each of two reciprocating pumps control the process. BioConcepts Inc. describes the basic treatment processes as follows: at the start of the cycle, the first cell of the ReCip® unit is filled nearly to the top with wastewater. The pump located in the cell then pumps the liquid into the second cell, until the first cell is nearly empty. As the liquid leaves the first cell, the void space formerly occupied by the liquid fills with air from the vent system, exposing the medium to atmospheric oxygen contained in the air. At this point, the second cell is nearly full and the first cell is nearly empty. The two cells remain in this state for a time before the second cell's pump sends the liquid back to the first cell, drawing air into the second cell. Wastewater that clings to the medium contains nutrients and organics, which are oxidized by bacteria (biofilm) that are exposed to the air. The bacteria live and grow on the medium. In the presence of oxygen, organic matter is converted to carbon dioxide and water, and ammonia nitrogen (NH3-N) is converted to nitrate nitrogen (NO3 -). Anaerobic decomposition of the contaminants continues in the wastewater that is not exposed to air (at the very bottom of the cells), converting the NO3 - to nitrogen gas. The two cells continue to fill and drain, with rest periods between the cycles, until additional wastewater flows into the first cell. When the capacity of the first cell is met, its contents are pumped into the second cell. The excess volume exits the overflow of the second cell as treated effluent. As an example, if the rated capacity of the tanks is 500 gallons and one extra gallon enters the system, a gallon of treated effluent will exit cell number two.			
Retrofast 0.375 System	The system is a submerged attached-growth treatment system designed to enhance the performance of existing septic tanks. It is inserted as a retrofit device into the outlet side of new or existing septic tanks. It provides an anerobic zone for nitrification and an anoxic zone for denitrification, improving overall treatment process. The system includes a white liner, blue media blocks, an airlift device, and a remote blower (connected to the airlift via pipe).	$4,000-$5,500	51%	Up to $1,700 - $3,000 yearly
STAAR Media Filter	The System is an aerobic biological trickling filter that is a two-tank design with a primary anoxic tank (a septic tank) followed by the aerobic trickling filter tank (the processor tank). Raw wastewater enters and passes through the primary anoxic tank to a reservoir beneath treatment media in the aerobic processor tank. The wastewater is aerated and sprayed onto the media; a programmable logic controller (PLC) controls the timing and sequence of the recirculation of wastewater in the	$11,000-$20,000	TN ≤ 19 mg/L 64%	Up to $1,700 - $3,000 yearly

Table 2. Advanced Septic System Technology Summary

Advanced Septic System Technologies	Description	Cost[3,4]	Nitrogen Reduction Performance	O&M
	lower collection reservoir. A portion of the wastewater is pumped back to the septic tank; this process is self-adjusting based on demand and is controlled by the PLC. Treated wastewater is time dosed to a leachfield. A 50% reduction of leachfield area is allowed when utilized with conventional leachfields			
Waterloo Biofilter	The Waterloo Biofilter uses a patented, highly engineered foam filtration medium that is optimized to treat wastewater passively. The foam creates an environment where naturally occurring bacteria can thrive and remove contaminants found in wastewater. The system provides both physical filtration and biological treatment of wastewater in one step – ensuring polluting elements are removed before water is returned to the natural environment.	$7,000-$17,000	62%	Up to $1,700 - $3,000 yearly

As part of the literature review, best management practice technologies were also considered. In a Final Expert Panel Report to the Wastewater Treatment Workgroup of the Chesapeake Bay Partnership[7], the technologies summarized in Table 3.

Table 3. BMP Technologies for Nitrogen Reduction

BMP Technology	Description	Nitrogen Reduction Performance (%)	O&M
Integrated Fixed-Film Activated Sludge (IFAS)	A hybrid system of an aerobic treatment unit which uses high specific surface area plastic media submerged in an aerobic unit to promote attached or fixed bacterial growth. These processes are very effective at oxidizing organics and oxidizing ammonium to nitrates. Nitrates can be converted into nitrogen gas by incorporating an anoxic denitrification step in the treatment train.	50%	Semi-annual Inspections
Subsurface Constructed Wetland	Constructed wetlands are wastewater treatment systems consisting of shallow ponds or channels that are usually less than a meter deep; have been planted with aquatic plants; and rely upon natural microbial, biological, physical, and chemical processes to treat wastewater. They typically have impervious clay or synthetic liners, as well as engineered structures to control the flow direction, liquid detention time, and water level. Depending on the type of system, they sometimes contain an	20%	Monthly Visual Inspections

[7] Recommendations of the On-Site Wastewater Treatment Systems Nitrogen Reduction Technology Expert Review Panel

Table 3. BMP Technologies for Nitrogen Reduction

BMP Technology	Description	Nitrogen Reduction Performance (%)	O&M
	inert porous media such as rock, gravel, or sand. This BMP is installed prior to the drainfield.		
Elevated Sand Mounds	Elevated sand mounds have been in use as a combination wastewater treatment and dispersal system since the 1970s. The technology was developed to address sites with shallow depth to restrictions such as seasonal water tables and bedrock. The traditional elevated sand mound is comprised of a raised sand bed, 1 to 2 feet in depth, which is overlain by a gravel layer that has pressure distribution piping imbedded in the gravel. The gravel is covered with a minimum of 1 foot of soil to protect the system from freezing. Grass or other vegetation is established on the soil to stabilize the surface of the mound. The wastewater is applied to the sand and nitrified as it passes through the sand. The sand layer essentially acts as a single-pass sand filter. When the nitrified effluent reaches the soil layer, the effluent tends to pond due to the discontinuity between the sand and the soil layer creating an anoxic zone. If the soil layer has sufficient organic matter available, denitrification occurs in the upper horizon.	50%	Annual Inspection
Intermittent Media Filter (IMF)	An intermittent or single-pass media filter is a filter packed with sand or other granular media. They support aerobic biological mechanisms and physical processes such as sedimentation, filtration, and chemical adsorption. The basic components of an IMF system include a septic tank, a dosing tank, a pump with controller (or a siphon), a distribution network, the filter bed, and an underdrain. The wastewater is periodically dosed to the filter via the distribution system, where it percolates through the media to the underdrain that carries the treated effluent from the unit process. The IMF is installed prior to the drainfield.	20%	Annual Inspection
Recirculating Media Filter (RMF)	Media with a larger ES allows for higher HLRs and smaller filter sizes (surface area). This footprint advantage is somewhat offset by the need for a recirculation tank that mixes STE with filter effluent to allow significant denitrification. These engineered systems generally use gravel or coarse natural media (e.g., sand) specifically designed for recirculating filters and readily available to the construction site. Commercially marketed RMFs generally use lightweight media that minimize shipping costs and facilitate installation. For effective nitrogen removal, the influent must first be nitrified by periodically dosing it from a recirculation tank under pressure to the surface of the filter where percolation of wastewater through the filter draws in air that promotes aerobic treatment. Denitrification is facilitated by recirculating a majority of the nitrified effluent back to a septic tank (where it mixes with influent) or separate recirculation tank (where it mixes with STE). Septic tanks or recirculation tanks generally feature conditions that promote denitrification, including a lack of DO (anoxic conditions) and enough labile carbon.	50%	Semi-annual Inspections
Shallow-Placed,	Pressure-dosed dispersal is an in situ, or soil treatment, process that allows for uniform distribution	50%	Annual

Table 3. BMP Technologies for Nitrogen Reduction

BMP Technology	Description	Nitrogen Reduction Performance (%)	O&M
Pressure-Dosed Dispersal	of effluent across the entire dispersal field. Dosing allows for the creation of fluctuating aerobic/anoxic environments, which sets up the conditions for nitrification and denitrification to occur. Numerous research studies indicate that denitrification occurs in pressure-dosed systems and that the highest rates are achieved when the dispersal is into surficial soil horizons. Dosing also promotes wetting/drying cycles, which improves soil structure, improves soil permeability, and enhances long-term wastewater disposal at the site.		inspection
Permeable Reactive Barriers (PRBs)	PRBs or denitrification walls are a remedial process for treating shallow groundwater impacted with nitrogen-rich effluent from on-site wastewater systems and other sources where the extent of the groundwater plume and its flow direction are well-defined. PRBs have historically been used for remediating groundwater impacted from mostly industrial uses. The basic process involves digging a trench of suitable depth and width to intercept the flow of impacted groundwater. PRBs for remediating groundwater impacted from septic systems are denitrification systems. Denitrification can be accomplished at each individual site or with a PRB that intercepts existing nitrate plumes from multiple sites prior to their transition to local surface waters. Individual on-site denitrification systems can be constructed as separate modules by adding carbon or sulfur reaction driver sources in the base of the dispersal field with the appropriate reactive material. If nitrate is present in the absence of DO, this reactive material intercepts and denitrifies the effluent.	Up to 100%[8]	Annual inspection, annual operations to clear clogs, visual inspection and sampling

[8] At removing nitrate in groundwater plumes provided that they are designed, installed, and maintained. One of the most important factors for success is ensuring that the entire groundwater plume is intersected and that sufficient contact time is provided in the PRB to affect complete denitrification.

4. FINANCING AND INCENTIVES

A literature review was conducted to evaluate how septic system upgrade programs in other communities or states are funded and what incentive programs exist that may be worth considering if the Town were to implement an advanced septic system technology program.

4.1 Funding Mechanisms Approaches

Many septic system upgrade or advanced septic system technology programs receive funding to support implementation and administration of the program. A literature review of existing programs in other communities or states was conducted to determine the typical sources of funding. Most of the programs identified are administered by state, county, or municipal entities. The following are the funding sources used to support those programs.

- **Federal Funding**: The EPA's Clean Water State Revolving Fund (CWSRF) offers grants to all states for water infrastructure projects, including septic system upgrades[9].
- **USDA Single Family Housing repair Loans & Grants:** Also known as the Section 04 Home Repair program, this provides loans to low income homeowners to repair, improve, or modernize their homes or grants to elderly very-low income homeowners to remove health and safety hazards[10].
- **State-Specific Funding**: Many states have programs provide low-interest loans and grants for septic system repairs or replacements.
- **Local Community Funding**: Some local municipalities offer grant and loan programs to assist homeowners with septic system upgrades, especially in areas with high nitrogen pollution.
- **User Fees:** Municipalities charge a septic system use fee to support program implementation and administration. The fees collected are used to reimburse property owners for upgrading septic systems or installation water quality mitigation measures.

Charlestown, Rhode Island Septic System Upgrade Program: Case Study

Charlestown, Rhode Island offers a program which includes regular inspections, maintenance, and a database tracking all septic systems in town.

Charlestown offers septic system repair and replacement funds in the form of a low interest (1%) $25,000 loan to the homeowner. Repair and replacement funding ensures that failing systems are attended to and replaced by reducing financial barriers. Failures can cause public health and sanitation issues and nutrient loading to nearby waterbodies.

Source: Wastewater Management - Charlestown, RI (charlestownri.gov)

[9] Funding for Septic Systems | US EPA
[10] External Septic Grants and Loans | NH Department of Environmental Services

- **Alternative Financing**: Homeowners can explore home equity loans, personal loans, or septic company financing as options to fund their septic system needs.

Local funding was also explored to determine if there are funding options outside of the mechanism above that the Town could consider.

- **New Hampshire Section 319 Grants:** The Town could apply for Clean Water Act Section 319 funds to help protect water quality and can be used for a septic system cost-share reimbursement program.
- **Piscataqua Region Environmental Planning Assessment (PREPA) Grant:** The program provided a grant opportunity in the 42 New Hampshire and 10 Maine communities within the Piscataqua Region watershed. Grant projects were associated with recommendations from the 2015 PREPA.
- **Great Bay 2030:** Funding is available to support projects aimed at protecting and improving water quality in Great Bay[11]. Applications need to be submitted to the agency that describes the type of work the Town would like to do. One-time and multi-year project funding is available.

4.2 INCENTIVE PROGRAMS

Without incentives, many property owners would fail to pay additional money to upgrade their septic system with an advanced treatment technology. Therefore, many existing septic system upgrade programs offer incentives to property owners for their participation in the upgrade or retrofit programs. The incentives provided by these programs are summarized in Table 4.

Table 4. Description of Incentive Programs

Program	Description of Incentive
Multiple counties in Florida – Septic Upgrade Incentive Program[12]	Provides a reimbursement, of up to $7,000.00 per existing home. Addresses wastewater, such as septic to sewer connections, that are not attaining standards for nutrient levels or are in a defined area of interest. Subject to funding availability with a State grant from the Florida Department of Environmental Protection (FDEP). Program is available until the $2,541,000 of FDEP grant funding is thoroughly exhausted or September 30, 2025. Per the FDEP funding agreement all sitework and inspections must be completed by August 29, 2025.

[11] Great Bay 2030 | Piscataqua Regional Estuaries Partnership (prepestuaries.org)
[12] Welcome to Citrus County (citrusbocc.com)

Table 4. Description of Incentive Programs

Program	Description of Incentive
Maryland's Nitrogen-Reducing Septic Upgrade Program[13] – Bay Restoration Fund	Grant assistance program based on income criteria. The allowable grant costs can be for capital cost of the system and up to 2-years of operation and maintenance of the system. Homeowners can receive up to 100% of funds if the household income is less than $300,000 or 50% for household income above $300,000. For new construction, the grant program only covers the cost differential between a conventional system and an advanced treatment system.
New York State Septic System Replacement Fund[14]	Septic system users can be reimbursed up to fifty percent of costs for septic system projects up to a contribution of $10,000. The grant will help cover costs towards installations, replacement, or upgrades of enhanced treatment technologies. To receive reimbursement, users must complete a reimbursement request form, design approval, all work completed, an invoice for eligible costs, and an authorization from the contractor, if applicable. To use the fund, property owners need to cover the costs upfront for any new construction or repairs to all septic system projects. Some counties have secured additional funds that can be combined with the Septic System Replacement Fund. The program relies on a reimbursement policy. • **Rensselaer County** offers an additional $25,000 under a Community Block Development Grant per household or business to repair or replace failing septic systems. • **Suffolk County Septic Improvement Program**[15] provides up to $10,000 base grant. There is also up to an additional $10,000 that can be awarded to a grantee that installs a pressurized shallow drain field leaching system ($5,000) and/or toward the unit installation for low to moderate incomes eligible applicants ($5,000). Suffolk County also has low interest loans of up to $10,000 through the Community Development Corporation of Long Island. Additionally, Southampton, East Hampton and Shelter Island provide Community Preservation Funds. • **Nassau County Septic Environmental Program to Improve Cleanliness**[16] provides grant funding of up to $20,000 to repair and replace failing septic systems with nitrogen-reducing system. Nassau County uses $10,000 of federal funds from the American Recovery Plan Act (ARPA) in conjunction

[13] Onsite Disposal Systems (maryland.gov)
[14] Septic System Replacement Fund | Environmental Facilities Corporation (ny.gov)
[15] Reclaim Our Water > Septic Improvement Program
[16] Septic Environmental Program to Improve Cleanliness (SEPTIC) | Nassau County, NY - Official Website (nassaucountyny.gov)

Table 4. Description of Incentive Programs

Program	Description of Incentive
	with $10,000 from State Septic System Replacement Grant funds.
Barnstable County, Massachusetts[17]	Barnstable County located in Massachusetts provides homeowners with low-interest loans for repairing or replacing septic systems, upgrading to alternative septic system technologies, and connecting current systems to the municipal sewers. The funding offers homeowners 0%, 2%, 4%, and 5% interest rates to homeowners for their septic system projects. To be eligible for the 0% and 2% loans homeowners must own a single-family property is not used as a business and the project must include an advanced nitrogen and phosphorus removing technology. If those two requirements are met, the homeowner must also have a household income of less than 180% of the County's medium household income. The loans are only available to residential properties with a maximum of a 20-year repayment plan.
Delaware Septic Rehabilitation Loan Program[18]	The Septic Rehabilitation Loan Program provides low-interest financing to replace failing septic systems and cesspools with on-site wastewater disposal systems that will function in an environmentally sound and cost-effective manner. The program also provides funding for new septic construction and costs associated with connecting to central sewer systems. The program is based on income guidelines based on number of people. Eligible costs for on-site systems include site evaluation, septic system design, permits, construction costs, and closing and recording charges. Eligible costs for central sewer projects include impact fees, connection fees, permit costs, electrical, and abandonment of septic systems. Property owners with on-site wastewater disposal systems that need replacement; new construction of system; and central sewer connection, are required to meet program income guidelines, and can demonstrate the ability to repay the loan.

Case Study: Bay Restoration Fund, Septic System Upgrade Program for On-site Sewage Disposal System Upgrades Using Best Available Technology for Nitrogen Removal

Maryland's program is funded by the Bay Restoration Fund1 which is an Onsite Sewer Disposal System (OSDS) grant program that considers regulatory requirements. The funding is generated by collection of a $60 annual fee from each user served by an onsite system. After all funding has been collected, sixty percent of the funding goes to septic system upgrades and the other forty percent goes to use for cover crops. The sixty percent of funding that goes to septic system upgrades are allotted to upgrades to best available technology for nitrogen removal instead of conventional technology. The Fund prioritizes upgrades to: failing systems in and outside of critical areas, non-conforming systems in and outside of critical areas, new construction of systems in and outside critical areas. The program has a series of technologies in different classes based on their proven ability reduce nitrogen concentrations in effluent. *Source:* Onsite Disposal Systems (maryland.gov)

[17] Cape Cod AquiFund - Barnstable County
[18] Septic Rehabilitation Loan Program - DNREC (delaware.gov)

5. RECOMMENDATIONS AND NEXT STEPS

As the Town explores the means to address nitrogen loading from septic systems and whether a Town administered advanced septic system technology program is feasible, some recommendations and next steps are outlined below.

- Establish an area of priority septic systems that would be considered if an advanced septic system technology were to be established.
- Establish suitability criteria to assist with defining the priority septic systems.
- Develop a map of the priority septic system area.
- Establish a Priority Septic System Overlay District.
- Establish regulations to encourage the use of advanced septic system technologies in the Priority Septic System Overlay District.
- Implement a pilot program to plan and install an advanced septic system in the Town.
- Coordinate with NHDES to understand what steps the state is taking to approve advanced septic system technologies for use in New Hampshire.
- Provide education and outreach to users of septic systems on advanced septic system technologies.
- Provide education and outreach to users of septic systems on steps the state and Town are taking to mitigate water quality impacts from septic systems in priority areas.

ATTACHMENT A

Location of Exeter Septic Systems

ATTACHMENT B

Rhode Island List of Alternative or Experimental Onsite Wastewater Treatment System Technologies

ATTACHMENT A

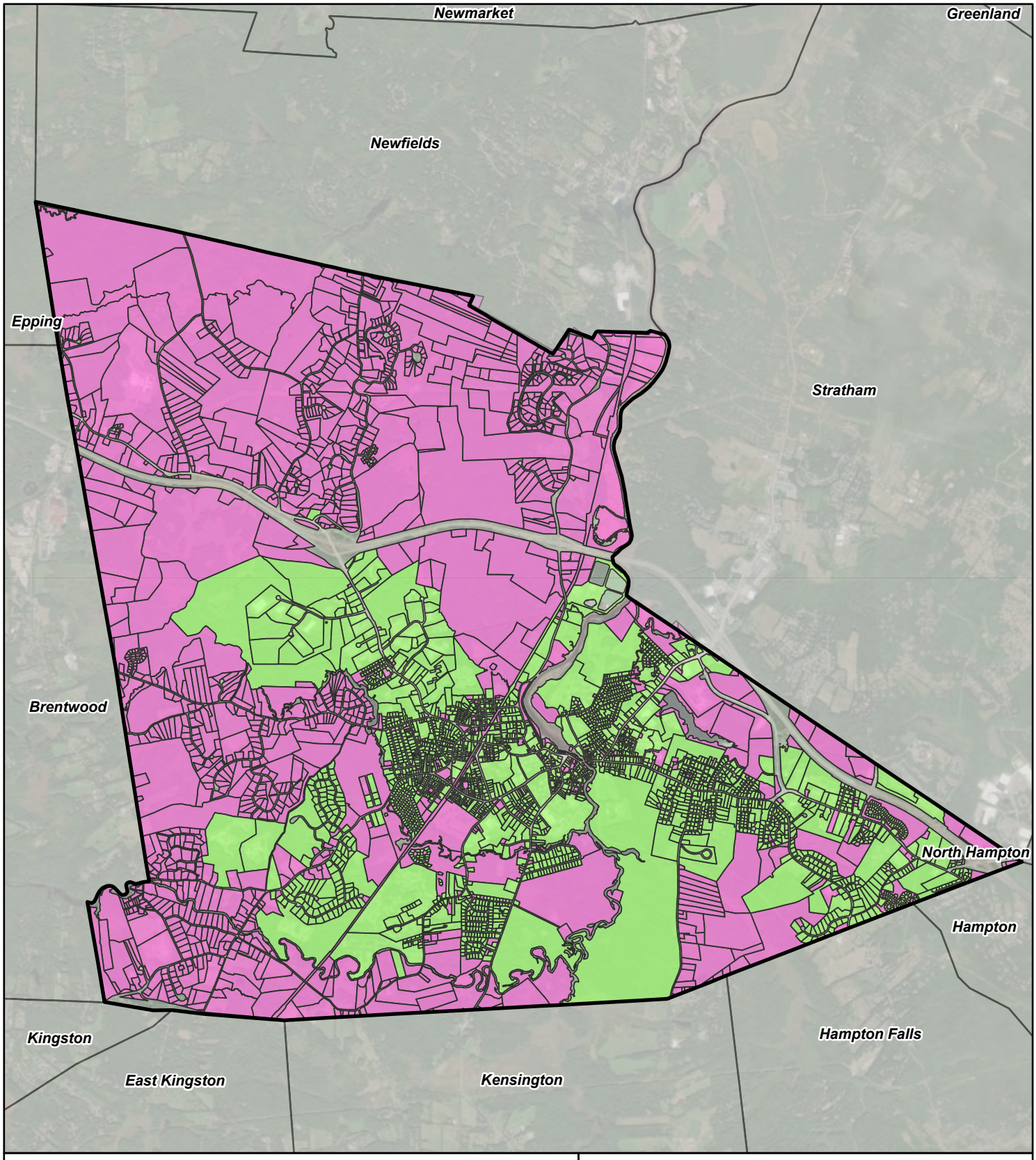
Location of Exeter Septic Systems

ATTACHMENT B

Rhode Island List of Alternative or Experimental Onsite Wastewater Treatment System Technologies

ATTACHMENT A

Location of Exeter Septic Systems



Legend

- Town Boundary
- Septic Service
- Sewer Service

N

0 4,000 Feet

Exeter Septic Systems

Exeter, New Hampshire

Geosyntec consultants

Acton, Massachusetts | December 2023

Figure 1

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ATTACHMENT B

Rhode Island List of Alternative or Experimental Onsite Wastewater Treatment System Technologies

B. NITROGEN REMOVAL SYSTEMS

Technology Name: **AdvanTex AX-20 Residential Certification**
AdvanTex Residential Design Manual – October 2019
AdvanTex Residential Installation Manual – March 2017
AdvanTex Residential O&M Manual Part 1 – March 2014
AdvanTex Residential O&M Manual Part 2 – May 2008
(Approved for TSS, BOD, and FOG removal in Mode 1, also approved for nitrogen removal in Mode 3.)

Vendor Information:
Orenco Systems Inc.
814 Airway Avenue
Sutherlin, OR 97479-9012
www.orenco.com

Vendor Contact:
Joseph Soulia
1-800-230-9580
jsoulia@orenco.com

Regional Contacts:
Atlantic Solutions, Ltd (Dealer)
436 Fish Road
Tiverton, RI 02878
Contact: Bob Johnson
(401) 293-0176
bjohnson@atlanticsolutionsltd.com

Effluential Technologies (O&M Provider)
436 Fish Road
Tiverton, RI 02878
Contact: Bob Johnson
(401) 293-0176
bjohnson@atlanticsolutionsltd.com

Green Wastewater Solutions (Dealer and O&M Provider)
80 Kilvert Street
Warwick, RI 02886
Contact: Rick Pezza
(401) 737-7600
rickp@gwsne.com

Model Numbers: AX-20

Certification: Alternative System or Technology - Class One

Technology Type: TN ≤ 19 mg/L, TSS ≤ 20 mg/L, BOD ≤ 20 mg/L, Oil & Grease ≤ 5 mg/L

Pretreatment Category: Category 1 – Timed-Dosed

Authority to Design: Cl-II & III Licensed Designers

Description: A prepackaged packed bed filter that significantly reduces BOD and TSS inside a waterproof container installed after a two-compartment tank prior to discharge to a leachfield which may be reduced in size by 50%. When configured in Mode 3, this system is acknowledged as an approved nitrogen reducing system.

Technology Name: **AdvanTex AX-20 or AX-100 Commercial Certification**
AdvanTex AX20 or AX100 Commercial Design Manual – September 2017
AdvanTex AX20 or AX100 Commercial Installation Manual – April 2019
AdvanTex AX20 or AX100 Commercial O&M Manual – May 2015
(Approved for TSS, BOD, and FOG removal in Mode 1, also approved for nitrogen removal in Mode 3.)

Vendor Information:
Orenco Systems Inc.
814 Airway Avenue
Sutherlin, OR 97479-9012
www.orenco.com

Vendor Contact:
Joseph Soulia
1-800-230-9580
jsoulia@orenco.com

Regional Contacts:
Atlantic Solutions, Ltd (Dealer)
436 Fish Road
Tiverton, RI 02878
Contact: Bob Johnson
(401) 293-0176
bjohnson@atlanticsolutionsltd.com

Effluential Technologies (O&M Provider)
436 Fish Road
Tiverton, RI 02878
Contact: Bob Johnson
(401) 293-0176
bjohnson@atlanticsolutionsltd.com

Green Wastewater Solutions (Dealer and O&M Provider)
80 Kilvert Street
Warwick, RI 02886
Contact: Rick Pezza
(401) 737-7600
rickp@gwsne.com

Model Numbers: AX-20 or AX-100
Certification: Alternative System or Technology - Class Two
Technology Type: TN ≤ 19 mg/L, TSS ≤ 20 mg/L, BOD ≤ 20 mg/L, Oil & Grease ≤ 5 mg/L
Pretreatment Category: Category 1 – Timed-Dosed
Authority to Design: Cl-II & III Licensed Designers

Description: A prepackaged packed bed filter that significantly reduces BOD and TSS inside a waterproof container installed after a two-compartment tank prior to discharge to a leachfield which may be reduced in size by 50%. When configured in Mode 3, this system is acknowledged as an approved nitrogen reducing system.

Technology Name: **Amphidrome®**
Amphidrome Design Guidance June 2020
Amphidrome Operation and Maintenance Manual June 2020
(Also approved for TSS & BOD removal)

Vendor Information:
F. R. Mahony & Associates, Inc.
273 Weymouth Street
Rockland, MA 02370

Contact:
Mike Sparks
Tel: (781) 982-9300
Fax: (781) 982-1056

Model Numbers: Amphidrome, Residential and Commercial, All Design Flows
Certification: Alternative System or Technology - Class Two
Technology Type: TN ≤19 mg/L, TSS ≤ 20 mg/L, BOD ≤ 20 mg/L, Oil & Grease ≤ 5 mg/L
Pretreatment Category: Category 1 – Timed-Dosed
Authority to Design: Cl-II & III Licensed Designers

Description: The Amphidrome® system uses a submerged attached growth bioreactor process operating in a batch mode.

The Amphidrome® system utilizes two tanks and one submerged attached growth bioreactor, called the Amphidrome® reactor. The first tank, the anoxic/equalization tank, is where the raw wastewater enters the system. The tank has an equalization section, a settling zone, and a sludge storage section. It serves as a primary clarifier before the Amphidrome® reactor.

This Amphidrome® reactor consists of the following four items: underdrain, support gravel, filter media, and backwash trough. The underdrain, constructed of stainless steel, is located at the bottom of the reactor. It provides support for the media and even distribution of air and water into the reactor. The underdrain has a manifold and laterals to distribute the air evenly over the entire filter bottom. The design allows for both the air and water to be delivered simultaneously--or separately--via individual pathways to the bottom of the reactor. As the air flows up through the media, the bubbles are sheared by the sand, producing finer bubbles as they rise through the filter. On top of the underdrain is 18" (five layers) of four different sizes of gravel. Above the gravel is a deep bed of coarse, round silica sand media. The media functions as filter, significantly reducing suspended solids and provides the surface area for which an attached growth biomass can be maintained. The Department allows a 50% reduction in conventional and approved AE "component technology" leachfield size with this System.

Technology Name: **BioBarrier Certification**

BioBarrier Installation Manual - February 2016
BioBarrier Owner's Manual – February 2016
BioBarrier Service Manual – April 2016
Monitoring Protocol, *Revised* November 27, 2019
Monitoring Protocol Notification

Vendor Information:
Bio-Microbics, Inc.
16002 West 110th Street
Lenexa, KS 66219

Tel: 913-422-0707
Fax: 913-422-0808
Web: www.biomicrobics.com/

Anna Cline, Sales & Regulatory Affairs Coordinator
Email: acline@biomicrobics.com

Regional Contact:
Lauren Usilton, President
J&R Sales and Service, Inc.
44 Commercial Street
Raynham, MA 02767

Tel: 508-823-9566

Web: www.JRSALESINC.COM

Email: laurenu@jrsalesinc.com

Model Numbers: BioBarrier 0.5N, BioBarrier 1.0N, and BioBarrier 1.5N

Certification: Alternative System or Technology - Class Two

Technology Type: TN ≤10 mg/L, TSS ≤ 30 mg/L, BOD ≤ 30 mg/L, Oil & Grease ≤ 5 mg/L

Pretreatment Category: Category 2 – Not Timed-Dosed

Authority to Design: Cl-II & III Licensed Designers

Description: The System incorporates a Membrane Bioreactor (MBR) and uses three-compartment tankage either as a single three-compartment tank, or a single-compartment pre-treatment tank followed by a two-compartment tank. The BioBarrier MBR is in the last of the three compartments in both configurations. The first compartment or tank provides primary treatment and is equipped with an outlet screening device (SaniTEE®). The second and third compartments must be in the same tank. Denitrification occurs in the second compartment of the System under anoxic conditions; a mixing pump installed in this compartment recycles some of the nitrified water through a baffle wall between the second and the third compartments (the aeration/membrane zone). The third compartment contains the Membrane Bioreactor, through which water passes for additional treatment prior to discharge to a leachfield by a float-activated discharge pump. The system is capable of significantly reducing biological oxygen demand (BOD_5), total suspended solids (TSS), and

total nitrogen in the effluent. Based on these reductions, the Department has allowed for a 45% reduction in leachfield size.

Technology Name: **Bioclere Certification Manual – September 1, 2019**

Vendor Information:
Aquapoint.3, LLC
Joe Pinto
39 Tarkiln Place
New Bedford, MA 02745
508-985-9050, extension 105
jpinto@aquapoint.com

Model Numbers: Bioclere 16-Series, 24-Series, 30-Series, and 36-Series

Certification: Alternative System or Technology - Class Two

Pretreatment Category: Category 2 – Not Timed-Dosed

Technology Type: TN ≤ 19 mg/L, TSS ≤ 30 mg/L, BOD ≤ 30 mg/L, Oil & Grease ≤ 5 mg/L

Authority to Design: Cl-II & III Licensed Designers

Description: The Technology consists of a modified trickling filter positioned over a clarifier. Effluent from the septic tank enters the System and is pumped up to the top of the insulated unit where it is evenly distributed over the surface of the filter media. Biochemical oxidation takes place as the water trickles through the filter and over the biological film that grows on the surface of these randomly packed pieces of PVC plastic. Oxygen is supplied to the system through a small axial fan located in the top of the housing. RIDEM has allowed for a 45% reduction in leachfield size as specified in the Certification.

Technology Name: FAST® Certification **FAST Manual – September 10, 2019**

Vendor Information:
Bio-Microbics, Inc.
16002 West 110th Street
Lenexa, KS 66219
Tel: 913-422-0707
Tel (toll-free): 800-753-3278
Fax: 913-422-0808
Web: www.biomicrobics.com/
Jim Bell, Executive Vice President
Email: jbell@biomicrobics.com

Regional Contact:
J&R Sales and Services
5344 Commercial Street
Raynham, MA 02767
Tel: 508-823-9566
Fax: 508-880-7232
Web: www.JRSALESINC.COM
Lauren D. Usilton, President
Email: laurenu@jrsalesinc.com

Model Numbers: MicroFAST 0.5, MicroFAST 0.625, MicroFAST 0.75 and MicroFAST 0.9

Certification: Alternative System or Technology - Class One

Pretreatment Category: Category 2 – Not Timed-Dosed

Technology Type: TN ≤ 19 mg/L; TSS ≤ 30 mg/L; BOD≤30 mg/L; O&G ≤5 mg/L

Authority to Design: Cl-II & III Licensed Designers

Description: The FAST (Fixed Activated Sludge Treatment) system is an aerobic wastewater treatment system that utilizes an aerobic fixed film process that is a combination of the conventional trickling filter and activated sludge processes. The FAST system is designed to be installed within a two-compartment tank where the first compartment provides a primary settling zone for incoming sewage and the second houses the actual FAST system. The system contains submerged media that provide surfaces for microbial growth. Aeration and circulation are provided by a blower that pumps air into a draft tube that extends down the center of the tank. The system is capable of significantly reducing biological oxygen demand (BOD_5), total suspended solids (TSS), and total nitrogen in the effluent. Based on these reductions, the Department has allowed for a 45% reduction in leachfield size.

Technology Name: **FujiClean Certification**
Category 1 Approval March 11, 2021
Monitoring Protocol, *Revised* November 27, 2019
Monitoring Protocol Approval May 14, 2020
Fuji Clean Design Manual - November 20, 2019
Fuji Clean Installation Manual – November 20, 2019
Fuji Clean O&M Manual – November 20, 2019

Vendor Information:
Fuji Clean USA, LLC
41-2 Greenwood Road, Ste 2
Brunswick, ME 04011 USA

Tel: 207-406-2927
Fax: 207-406-2929
Web: www.fujicleanusa.com

Contact:
Scott Samuelson
cell: 207-415-7885
Email: scott@fujicleanusa.com

Model Numbers: CEN5, CEN7 and CEN10

Certification: Alternative System or Technology - Class Two

Pretreatment Category: Category 1

Technology Type: TN ≤ 19 mg/L; TSS ≤ 20 mg/L; BOD≤20 mg/L; O&G ≤5 mg/L

Authority to Design: Cl-II & III Licensed Designers

Description: The System is a single fiber-reinforced plastic tank divided into three chambers. Wastewater flows in a circuitous path through the sedimentation chamber to an anoxic chamber containing media followed by an aerobic chamber containing two types of media. Media in the System provide mechanical filtration and facilitate fixed-film and suspended-growth microorganisms' anaerobic and aerobic biodegradation of wastewater constituents, including conversions of nitrogen species to nitrogen gas. Wastewater and sludge are recirculated from the third chamber back to the sedimentation chamber. One small blower, a diaphragm compressor, provides aeration, airlift recirculation and airlift pump discharge of treated effluent to a leachfield. A 50% reduction in leachfield size is allowed for conventional leachfields.

Technology Name: ****Attention OWTS Designers: Effective October 15, 2021 the DEM will not be accepting OWTS Construction Permit Applications that include this technology due to Vendor non-compliance with the RIDEM Monitoring Protocol for Nitrogen Removal Systems. ****

Hydro-Kinetic Model 600 FEU
Monitoring Protocol, *Revised* November 27, 2019
Monitoring Protocol Deadline July 30, 2021

Vendor Information:
Norweco, Inc.
220 Republic Street
Norwalk, OH 44857

Tel: 419-668-4471
Web: www.norweco.com

Scott Hetrick, Vice President of Sales
Email: shetrick@norweco.com
Tel: 419-669-4471
Fax: 419-663-5440

Technology Name & Model Numbers:
Hydro-Kinetic Model 600 FEU
(Maximum design flow 600 GPD)

Certification
Class Two

Pretreatment Category
Category 2 – Not Timed-Dosed

Technology Type:
TN ≤ 10 mg/L, TSS≤ 20 mg/L, BOD≤ 20 mg/L, O&G≤ 5 mg/L

Design Authority
Class II & III Licensed Designers

Local Contacts (Distributors/Dealers)

Siegmund Environmental Services
102 West Main Street
Norton, MA 02766

Matthew Dalton
Tel: 401-785-0130
Fax: 508-222-2499
Email: matt@seswastewater.com

Sterling Environmental Technologies
319A West Beach Road
Charlestown, RI 02813

Tel: 401-322-7669

Robert Frost
Tel: 401-523-4812
Fax: 401-315-0750
Email: bob@sterling-et.com

Description: The System uses extended aeration, attached growth, nitrification and denitrification processes to treat wastewater. It consists of four treatment chambers (pretreatment, anoxic, aeration and clarification) followed by a Hydro-Kinetic FEU filter containing filter media facilitating additional reduction of BOD and TSS by attached growth, prior to discharge to a leachfield. The clarification chamber incorporates a flow equalization unit. Aeration is controlled by a factory-programmed timer and wastewater is recirculated from the clarifier back to the anoxic chamber at factory set intervals. The system is available with both concrete and HDPE tankage and with the pre-treatment tank either integral to the other three chambers in a four-chambered tank, or as a distinct tank. Designs incorporating this System and a conventional leachfield shall be allowed a 40% reduction in the required leachfield size.

Technology Name: **Nitrex™**

Effective April 9, 2019 Nitrex is no longer an approved technology in Rhode Island; the RIDEM OWTS Program will not accept construction applications specifying Nitrex.

System owners may contact Lombardo Associates, Inc. at:

Pio Lombardo, PE
Lombardo Associates, Inc.
188 Church Street
Newton, MA 02458

Tel: (617) 964-2924

Fax: (617) 332-5477

E-mail: pio@LombardoAssociates.com

Technology Name:

Norweco Singulair DN Certification
Norweco Singulair DN Design Manual
Norweco Singulair DN Installation Manual
Norweco Singulair DN O&M Manual

Vendor Information:
Norweco, Inc.
220 Republic Street
Norwalk, OH 44857

Tel: 419-668-4471
Web: www.norweco.com

Robin Cassidy, Vice President of Customer Service
Email: rcassidy@norweco.com
Tel: 419-668-4471
Fax: 419-663-5440

Technology Name & Model Numbers:
Concrete:
Norweco Singulair Model DN 500 (600 GPD), 750 (800 GPD), 1000 (1000 GPD), 1250 (1250 GPD) & 1500 (1500 GPD)

HDPE:
Norweco Singulair Green® DN 500 (600 GPD)

Certification
Class Two

Pretreatment Category
Category 2 – Not Timed-Dosed

Technology Type:
TN ≤ 19 mg/L, TSS≤ 20 mg/L, BOD≤ 20 mg/L, O&G≤ 5 mg/L

Design Authority
Class II & III Licensed Designers

Local Contacts (Distributors/Dealers)	
Siegmund Environmental Services 102 West Main Street Norton, MA 02766 Matthew Dalton Bob Silva Tel: 401-785-0130 Fax: 508-222-2499 Email: matt@seswastewater.com	Sterling Environmental Technologies 319A West Beach Road Charlestown, RI 02813 Tel: 401-322-7669 Robert Frost Bob Frost Tel: 401-523-4812 Fax: 401-315-0750 Email: bob@sterling-et.com

Description: The Singulair wastewater treatment system is a self-contained three-chambered treatment system utilizing primary treatment (settling), mechanical aeration, clarification, and flow equalization to achieve treatment. Wastewater from the building enters the primary settling chamber through an inlet tee, then enters an aeration chamber. In the aeration chamber, an aspirator at the bottom of a shaft disperses air radially as fine bubbles provide oxygen for the biomass and vertically mix chamber contents. The wastewater in the aeration chamber passes through to the clarification chamber for final settling of solids. A portion of the clarified wastewater is recirculated back to either the inlet pipe (building sewer) or into the primary chamber for denitrification. Treated wastewater passes through an effluent filter as it exits the system and is then gravity fed to the leachfield. The RIDEM recognizes the System as capable of achieving effluent concentrations of 30 mg/L for both TSS and BOD and less than or equal to 19 mg/L TN. Based on these reductions, the RIDEM has allowed for a 40% reduction in leachfield size.

*Where site conditions and design flow accommodate, Norweco Singulair Green® 600 may be used in place of the concrete Singulair tank.

Technology Name: ****Attention OWTS Designers: Effective October 15, 2021 the DEM will not be accepting OWTS Construction Permit Applications that include this technology due to Vendor non-compliance with the RIDEM Monitoring Protocol for Nitrogen Removal Systems. ****

Singulair TNT [concrete] 600, 750, 1000, 1250 and 1500
Singulair Green TNT [HDPE] 500
Monitoring Protocol, *Revised* November 27, 2019
Monitoring Protocol Deadline July 30, 2021

Vendor Information:
Norweco, Inc.
220 Republic Street
Norwalk, OH 44857

Tel: 419-668-4471
Web: www.norweco.com

Scott Hetrick, Vice President of Sales
Email: shetrick@norweco.com
Tel: 419-669-4471
Fax: 419-663-5440

Technology Name & Model Numbers:
Concrete: Singulair TNT 600, 750, 1000, 1250, 1500

HDPE: Singulair Green TNT 500
(Maximum design flow 600 GPD)

Certification
Class Two

Pretreatment Category
Category 2 – Not Timed-Dosed

Technology Type:
TN ≤ 19 mg/L, TSS≤ 20 mg/L, BOD≤ 20 mg/L, O&G≤ 5 mg/L

Design Authority
Class II & III Licensed Designers

Local Contacts (Distributors/Dealers)

Siegmund Environmental Services
102 West Main Street
Norton, MA 02766

Matthew Dalton
Tel: 401-785-0130
Fax: 508-222-2499
Email: matt@seswastewater.com

Sterling Environmental Technologies
319A West Beach Road
Charlestown, RI 02813

Tel: 401-322-7669

Robert Frost
Tel: 401-523-4812
Fax: 401-315-0750
Email: bob@sterling-et.com

Description: The Singulair TNT and Singulair Green TNT Wastewater Treatment System
The System consists of a three-chambered tank. The first chamber provides pretreatment, the second is an aeration chamber with an infused air system: air is introduced to the aeration chamber by an aeration system, which spins a hollow aspirator shaft, drawing air into the hollow shaft through four intake ports located beneath the aerator handle; the aerator vent through which the air is drawn is integral to the access cover above the aerator. The aeration system is controlled by a factory programmed, non-adjustable timer to run a 60 minute aeration cycle followed by a 60 minute anoxic cycle, during which the aerator is not running. Settling takes place in the clarification chamber (the third chamber) following aeration and currents generated by the spinning aerator draw sludge from the clarification chamber back to the aeration chamber. The Bio-Kinetic filter within the clarification chamber filters wastewater prior to discharge to a leachfield. The system is capable of significantly reducing biological oxygen demand (BOD_5) and total suspended solids (TSS) in the effluent. Based on these reductions, the Department has allowed for a 40% reduction in leachfield size.

Technology Name: **Recirculating Sand Filter**

Vendor Information: Generic

Certification: Guidelines for the Design, Use, and Maintenance of Pressurized Drainfields - November 2013

Technology Type: TN ≤ 19 mg/L, TSS ≤ 10 mg/L, BOD ≤ 10 mg/L, Fecal Coliform ≤ 10,000 cfu/100mL

Authority to Design: Cl-II & III Licensed Designers

Description: Wastewater, having received primary treatment in a septic tank or equivalent unit, flows by gravity to a recirculation (mixing) tank. In doses controlled by both a programmable timer and float switch, the mixed fresh wastewater and partially treated filter effluent is applied to a bed of coarse sand (fine gravel) media. This mixed wastewater is dispersed over the filter surface in a PVC distribution network surrounded in pea stone. Wastewater trickles down through the sand media, where biological treatment occurs. The treated effluent is collected in an underdrain at the bottom of the filter and discharged back to the recirculation tank. There most of it mixes with incoming wastewater, a small amount gets discharged to the drainfield, and the cycle begins again. Typically, a buoyant-ball check valve is used to control discharge and recirculation. Treated wastewater is discharged to a drainfield for additional treatment. The system is capable of significantly reducing biological oxygen demand (BOD_5), total suspended solids (TSS), and total nitrogen in the effluent. The technology is targeted for use in critical resource areas and is intended to be used with shallow pressurized drainfields.

Technology Name: **Smart Trickling Anaerobic/Aerobic Recirculating (STAAR™) Media Filter (formerly known as SeptiTech)**

STAAR Design Manual – October 21, 2021

Vendor Information: SeptiTech/Bio-Microbics of Maine, Inc.
69 Holland Street
Lewiston, Maine 04240

Contacts: Tracey H. Rioux, President
69 Holland Street
Lewiston, Maine 04240

Tel: (207) 333-6940 x301
Cell: (207) 240-2855
trioux@septitech.com

Models:	STAAR 0.5/0.5D, STAAR 0.75/0.75D, STAAR 1.0/1.0D, STAAR 1.2/1.2D, STAAR 1.5/1.5D, STAAR 3.0/3.0D, STAAR 4.5/4.5D, STAAR 6.0/6.0D, STAAR 9.0/9.0D, STAAR 13.5/13.5D, STAAR 18/18D, and STAAR 24/24D
Certification:	Alternative System or Technology - Class Two
Technology Type:	Waste Strength Reduction Only – Non "D" Models: TSS ≤ 20 mg/L, BOD ≤ 20 mg/L, Oil & Grease ≤ 5 mg/L Waste Strength Reduction and Nitrogen Reduction – "D" Models: Total Nitrogen ≤ 19 mg/L, TSS ≤ 20 mg/L, BOD ≤ 20 mg/L, Oil & Grease ≤ 5 mg/L
Pretreatment Category:	Category 1 – Timed-Dosed
Authority to Design:	Cl-II & III Licensed Designers

Description: The System is an aerobic biological trickling filter that is a two-tank design with a primary anoxic tank (a septic tank) followed by the aerobic trickling filter tank (the processor tank). Raw wastewater enters and passes through the primary anoxic tank to a reservoir beneath treatment media in the aerobic processor tank. The wastewater is aerated and sprayed onto the media; a programmable logic controller (PLC) controls the timing and sequence of the recirculation of wastewater in the lower collection reservoir. A portion of the wastewater is pumped back to the septic tank; this process is self-adjusting based on demand and is controlled by the PLC. Treated wastewater is time dosed to a leachfield. A 50% reduction of leachfield area is allowed when utilized with conventional leachfields.