

## 0. Executive Summary

Green Hill Pond is a place for shellfishing, wildlife habitats and recreation. The pond has a surface area of approximately 380 acres and is found within a 3,400-acre watershed. The Pond is identified as Category 5 in the Rhode Island 303(d) List of Impaired Waters due to low dissolved oxygen and high bacteria levels. Human water contact can be risky at times in the northern part of the Pond as a result of bacterial contamination. Additionally, water quality sampling by the Salt Ponds Coalition from 2003 to present has shown consistently high total nitrogen levels indicative of a mesotrophic system with seasonal spikes in the summer months making it a seasonally eutrophic system.

In November 2020, with support from SNEP, the Town solicited and received bids from qualified Engineers to perform an Attenuation Study for the Green Hill Pond and to design and permit water quality structures within the watershed. Friends of Green Hill Pond, a local environmentally aware and motivated homeowner organization, became an active member of our team, helping with advocacy and financial support. In February 2021, with the Friends help, the Town awarded the contract for a TMDL analysis to Woodard & Curran, Inc (W&C) and the Stormwater Attenuation and Source Reduction Study was finalized in December 2021.

Through the analysis and plan preparation, W&C isolated places with higher concentrated flow for treatment. These locations generally provide high rates of treatment and address larger catchment areas. The difficulty with these locations can be that the structures necessary for treatment are large and require larger land area. W&C provided a cost-benefit analysis to better isolate feasible treatment locations. Ownership has a significant effect on the overall cost-benefit of treatment locations. Town ownership is highly preferred; therefore, Town roadways and infrastructure were prioritized for structural retrofits.

Based on a cost-benefit analysis, ownership, and environmental considerations, it was determined that three (3) sites were found feasible for catch basin retrofits and trench systems and a single site worked well with a Wet Vegetated Treatment System. Additionally, catch basin retrofits installed at existing conveyance sites throughout the catchment areas were found to be effective and suitable and with additional funding from the Narragansett Bay Estuary Program (NBEP) additional designs for retrofits were included. Design plans were developed and a submission to CRMC for permitting was made. A CRMC Assent was issued in April 2024.

Funding provided from NBEP also helped add a public outreach component to the scope. W&C and Town staff met with the Friends of Green Hill Pond at their annual meeting in June 2023. At that meeting, the design team invited residents to volunteer their homes for design services and allow W&C to prepare site-specific rain garden plans for their property. Eleven sites were offered, and one home was selected for an installation planned as a community hands-on demonstration. On a Saturday in October 2023, Town staff, W&C staff, and nearby residents gathered at a home in Green Hill to install a rain garden. Additionally, W&C prepared several informative flyers to better address the preventative measures that the Town can continue to support.

The next step for the Town is to complete the installation. An RFP was issued in November 2024, and a contractor was approved in January 2026. The work has commenced and is expected to be complete in late summer 2025. The Town will continue to pursue opportunities to address our water quality and TMDL site and to improve our critical environmental resources.

SNEP WATERSHED GRANT

# FINAL REPORT

Town of South Kingstown

**Green Hill Pond Watershed**

**Stormwater Attenuation Plan, Design and Permitting**

SNEP Contract Number: **SNEPWG20-5-SK**

October 19, 2020 (Start Date) – March 31, 2025



**Town of South Kingstown**

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## 2. Project Report Narrative

Green Hill Pond is a place for shellfishing, wildlife habitats and recreation. The pond has a surface area of approximately 380 acres and is found within a 3,400-acre watershed. Green Hill Pond is identified as Category 5 in the Rhode Island 303(d) List of Impaired Waters due to low dissolved oxygen and high bacteria levels. No other coastal lagoon in the Salt Ponds Region is on this list. [Bradley \(2012\)](#)<sup>1</sup> conducted a submerged aquatic vegetation (SAV) survey of Narragansett Bay and coastal ponds focused primarily on eelgrass and found that the “site with the largest overall decline in SAV was Green Hill Pond.” The loss of eelgrass beds negatively impacts bay scallops, winter flounder, and several crab species. According to the Rhode Island Coastal Resources Management Council (CRMC) [Salt Pond SAMP](#)<sup>2</sup>, Green Hill Pond and other nearby salt ponds are home to “over 100 species of finfish and shellfish,” including species of concern such as alewife, blueback herring and rainbow smelt; all impacted by the low dissolved oxygen conditions. Noted by [Lapin \(1981\)](#)<sup>3</sup>, “Green Hill Pond is currently the best area in Rhode Island for collecting oyster spat.” However, subsequent studies indicated concentrations of fecal coliform that exceeded shellfishing standards and in 1994 the Pond was permanently closed to shellfishing. Although oyster beds are still present, their number has declined, and current conditions remain unsafe for consumption.

According to Rhode Island Department of Environmental Management (RIDEM) records, during dry-weather conditions, 36% of bacteria monitoring stations currently fail to meet 90 percentile National Shellfish Sanitation Program (NSSP) standards. In wet-weather conditions, the rate more than doubles to 82%, clearly indicating the powerful impact of stormwater runoff. Human water contact can also be risky at times in the northern part of the Pond as a result of bacterial contamination. Additionally, water quality sampling by the Salt Ponds Coalition from 2003 to present has shown consistently high total nitrogen levels indicative of a mesotrophic system with seasonal spikes in the summer months making it a seasonally eutrophic system.

In the RIDEM [2006 TMDL study](#)<sup>4</sup>, the watersheds of the two main tributary streams, Factory Brook Stream and Teal Pond Stream, were measured at a combined size of 295 ha or 720 acres. While smaller than the 3,400 acres of the Green Hill Pond watershed, the contribution from these tributaries is considered by RIDEM as the hotspot of bacteria and nitrogen loading. Thus, by addressing not only direct discharge outfalls but additional public and private sources within the tributaries, we expect to make substantial progress towards achieving state water quality standards.

In November 2020, with support from SNEP, the Town solicited and received bids from qualified Engineers to perform an Attenuation Study for the Green Hill Pond and to design and permit water quality structures within the watershed. [Friends of Green Hill Pond](#) (Friends), a local environmentally aware and motivated homeowner organization, became an active member of our team, helping with advocacy and financial support.

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<sup>1</sup> Bradley, Michael, et al, “2012 Mapping Submerged Aquatic Vegetation (SAV) in Rhode Island Coastal Waters,” University of Rhode Island, April 2013.

<sup>2</sup> Rhode Island Coastal Resources Management Council, “Rhode Island’s Salt Pond Region: A Special Area Management Plan,” April 12, 1999.

<sup>3</sup> Lapin, William J., “An Aquiculture Management Plan for Rhode Island Coastal Waters,” November 1981.

<sup>4</sup> Rhode Island Department of Environmental Management, “Total Maximum Daily Load Analysis for Green Hill Pond, Ninigret Pond, Factory Pond Stream, and Teal Pond Stream,” February 9, 2006.

In February 2021, with the Friends help, the Town awarded the contract for a TMDL analysis to Woodard & Curran, Inc (W&C). Shortly thereafter, W&C prepared a Quality Assurance Project Plan (QAPP) and began its investigation, finalizing the [Stormwater Attenuation and Source Reduction Study](#)<sup>5</sup> in December 2021. Also, during December 2021, the Town received additional grant dollars from [Narragansett Bay Estuary Program](#) (NBEP) to perform public outreach and add additional sites for final design and permitting. The project slowed through COVID but W&C continued working, finalizing final designs for available sites, performing public outreach, and submitting, and receiving permits through CRMC.

This project is part of an ongoing holistic approach to improving water quality in Green Hill Pond. Past restoration activities pursued over the years include reconstructing existing stormwater outfalls, policing pet waste, discouraging waterfowl from hatching, upgrading septic systems, reducing impervious surfaces, and conducting public outreach and education.

## 2.A. Project Results

**Attenuation Study:** W&C performed many site visits and developed GIS mapping to help to identify impervious area, land use, roads, soils, stormwater infrastructure, and stream hydrography. The key components to identifying suitable sites for treatment are land cover, land use, soils, watershed hydrography, and existing infrastructure. Study shows that the Green Hill Pond watershed is approximately 87% pervious and 13% impervious. Much of the impervious conditions are due to the more than 22 miles of roads and structures (primarily single-family residential). The location of stormwater treatment and retrofits are highly affected by soil types. Generally, Hydrologic Soil Groups A and B are better drained and serve well for infiltration practices. These soils were prioritized when locating stormwater treatment structures.

W&C also looked to isolate places with higher concentrated flow for treatment. These locations generally provide high rates of treatment and address larger catchment areas. The difficulty with these locations can be that the structures necessary for treatment are large and require larger land area. W&C provided a cost-benefit analysis to better isolate feasible treatment locations. Ownership has a significant effect on the overall cost-benefit of treatment locations. Town ownership is highly preferred; therefore, Town roadways and infrastructure were prioritized for structural retrofits. Four catchment areas were prioritized for concept design of stormwater retrofits:

Catchment 1	Elm and Balsam Road
Catchment 2	Dawley Way
Catchment 3	Matunuck School House Road and Green Hill Beach Road
Catchment 4	Twin Peninsula Avenue

Each catchment was analyzed for pervious vs impervious conditions and pollutant load estimates were determined based on coverage and land use.<sup>6</sup>

Generated Total Nitrogen Loads:

Catchment 1	569.1 lbs/year
Catchment 2	55.8 lbs/year
Catchment 3	33.6 lbs/year
Catchment 4	30.8 lbs/year

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<sup>5</sup> Woodard & Curran, "Stormwater Attenuation and Source Reduction Study," December 2021.

<sup>6</sup> *ibid.*

Generated Bacteria Loads:

- Catchment 1 7,849.3 billion colonies/year
- Catchment 2 844.5 billion colonies/year
- Catchment 3 357.4 billion colonies/year
- Catchment 4 466.9 billion colonies/year

Structural stormwater retrofits were evaluated for each of the catchments based on pollutant reduction, physical constraints (groundwater), maintenance, constructability, cost, area of impact, and recharge capacity. W&C considered two types of systems, gravel wet vegetated treatment and catch basin retrofits and prepared load reduction estimates based on storm intensity. Total Nitrogen (TN) and Bacterial Load Reduction tabulation for Gravel Wet Vegetated Treatment Systems (WVTS) provided below are extracted from the Attenuation study:

**Table 6-1: TN Load Reduction Estimates (lbs/year)**

		Treatment Depth (inch) (Reduction Efficiency)	0.1 (22%)	0.2 (33%)	0.4 (48%)	0.6 (57%)	0.8 (64%)	1.0 (68%)
TN Load Reduction (lbs/year)	Catchment 1		125.2	187.8	273.1	324.4	364.2	387.0
	Catchment 2		12.3	18.4	26.8	31.8	35.7	37.9
	Catchment 4		6.8	10.2	14.8	17.6	19.7	21.0

**Table 6-2: Bacteria Load Reduction Estimates (billion colonies/year)**

		Treatment Depth (inch) (Reduction Efficiency)	0.1 (30%)	0.2 (47%)	0.4 (66%)	0.6 (73%)	0.8 (75%)	1.0 (76%)
Bacteria Load Reduction (billion colonies/year)	Catchment 1		2,377.6	3,705.7	5,142.1	5,701.0	5,871.3	5,971.0
	Catchment 2		255.8	398.7	553.2	613.4	631.7	642.4
	Catchment 4		141.4	220.4	305.8	339.1	349.2	355.1

Total Nitrogen (TN) and Bacterial Load Reduction tabulation for Catch Basin Retrofit/Infiltration Trench Systems provided below are extracted from the Attenuation study:

**Table 6-3: TN Load Reduction Estimates (lbs/year)**

		Treatment Depth (inch) (Reduction Efficiency)	0.1 (59%)	0.2 (76%)	0.4 (90%)
TN Load Reduction (lbs/year)	Catchment 1		<b>335.7</b>	432.5	512.2
	Catchment 2		32.9	<b>44.4</b>	50.2
	Catchment 3		19.8	<b>26.7</b>	30.3

**Table 6-4: Bacteria Load Reduction Estimates (billion colonies/year)**

		Treatment Depth (inch) (Reduction Efficiency)	0.1 (24%)	0.2 (45.5%)	0.4 (61%)
Bacteria Load Reduction (billion colonies/year)	Catchment 1		<b>1,916.8</b>	3,130.3	4,763.8
	Catchment 2		206.2	<b>384.3</b>	512.5
	Catchment 3		87.3	<b>162.6</b>	216.9

W&C also performed an evaluation to determine the potential load reduction if every catch basin within the Watershed were retrofitted. The per catch basin analysis, using 3,000 cf per retrofit

catch basin, concluded with a potential 170 lbs/year load reduction for Nitrogen and 2,020 billion colonies/year load reduction for Bacteria.

A cost benefit analysis helped to further define efficiency and load reduction compared to treatment depth. W&C's data showed that the most beneficial treatment depth is 0.1-inch based on unit costs and diminishing return for greater depths. W&C provided data showing that infiltration trench systems perform better than end-of-pipe systems for nitrogen reduction. End-of-pipe systems are shown to be more effective for bacterial removal.

Based on a cost-benefit analysis, ownership, and environmental considerations, it was determined that Catchment 1, 2, and 3 are best addressed with catch basin retrofits and trench systems while Catchment 4 works well with a WVTs. W&C developed conceptual designs for each of the Catchment sites. Additionally, they prepared a catch basin retrofit detail that could be installed at existing conveyance sites throughout any of the catchment areas. Further exploration helped determine that the point discharge leading from Catchment 1 (Elm and Balsam) and Catchment 2 (Dawley Way) are particularly difficult due to lack of available public land. Catchment 1 is located fully within private property and access to the site would be affected by the proposed basin. Therefore, W&C finalized plans and specifications for the Catchment 3 and Catchment 4 concepts. Included in the final design effort were site specific catch basin retrofits that would provide infiltration and treatment at the source. Final plans were submitted to CRMC for approval and an Assent (CRMC Permit No. A2024-03-105) was issued in April 2024.

W&C also provided useful prevention measures that should be added to our overall programmatic approach to water quality management within the Green Hill Pond watershed. These items include Public Education, Landscape Management (fertilizer use etc.), Animal Waste, Rain Barrels and Gardens, Land Use Planning, and Erosion Control. Many of the items are addressed at the Town level by operational practices or within the Town Ordinances. Town information is somewhat fragmented, therefore, more work is necessary to better address gaps and to further develop the Public Education component.

As mentioned above, NBEP provided grant funding for public outreach and to permit a greater number of structures with CRMC. W&C with Town staff met with the Friends of Green Hill Pond at their annual meeting in June 2023. At that meeting, the design team invited residents to volunteer their homes for design services and allow W&C to prepare site-specific rain garden plans for their property. Eleven sites were offered, and one home was selected for an installation planned as a community hands-on demonstration. On a Saturday in October 2023, Town staff, W&C staff, and nearby residents gathered at a home in Green Hill to install a rain garden. The event was well attended and productive. Additionally, W&C prepared several informative flyers to better address the preventative measures that the Town can continue to support. Information regarding the rain garden designs and information flyers can be found on the Town website and can be accessed with the links provided in a section below.

## **2.B. Next Steps & Recommendation**

All design and planning work for the Green Hill Pond watershed TMDL as defined in the Attenuation Study is complete. In August 2024, the Town received an additional \$250,000 from Restore America's Estuaries (RAE) under the SNEP Watershed Implementation Grants (SWIG24) to install the water quality structures as permitted. Therefore, the next step for the Town is to complete the installation. An RFP was issued in November 2024, and a contractor was approved in January 2026. Skurka Construction has begun to mobilize, and construction should be complete toward the end of summer 2025. The Town will continue to promote the preventative measures

that were discussed in our Attenuation Study and is preparing to spread the information Town wide.

## **2.C. Compliance**

A CRMC Assent (CRMC Permit No. A2024-03-105) was issued in April 2024. As the Town and contractor move through construction, permit requirements will have to be met. No additional permits are required.

## **2.D. Project Partners**

[Friends of Green Hill Pond](#), a local environmentally aware and motivated homeowner organization, became an active member of our team, helping with advocacy and financial support. They will continue to be involved as this project moves to construction and will remain a partner in the future.

Additionally, this very critical work to address our most sensitive environmental resources is not possible without the Southeast New England Program Network and the Narragansett Bay Estuary Program help. Financial support and continued assistance with information and technical advice is invaluable to communities like South Kingstown that struggle with daily operational requirements while attempting to improve our most sensitive environments.

## **2.E. Volunteer and Community Involvement**

Community interaction came through the Friends organization as noted above. Also, the rain garden designs and demonstration helped to promote the project very efficiently and built a foundation that allowed this to move to construction seamlessly and without any concerns from the public. Often these types of projects will require a large amount of explanation, but the process that was established for this work helped build on the resident knowledge of the importance of the work, the type of work, and the general schedule.

## **2.F. Outreach & Communications**

As discussed, Outreach included site designs for rain gardens within the watershed at residential homes and an installation of a rain garden. W&C also prepared informational material pertaining to the preventative measures that residents can use to help to further the efforts of water quality treatment in these critical resource areas. The following link to the Town website helps to identify the work that the Town has performed to address TMDL's and the supporting information represented in this final report:

<https://www.southkingstownri.gov/1357/Water-Quality-Treatment-TMDL>

### 3. Project Budget Report

**Summary Budget Table 1: Expenditures by Federal Cost Category**

Budget Category	Total Budgeted Funds	Total Budgeted Match	Grant Funds Expended This Period	Grant Funds Expended Cumulative	Match Funds Expended This Period	Match Funds Expended Cumulative	Match Source
Personnel	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Fringe	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Travel	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Equipment	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Supplies	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Contractual	\$100,000.00	\$74,750.00	\$0.00	\$94,020.00	\$0.00	\$70,280.00	Town
Other	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
<b>Total Direct</b>	<b>\$100,000.00</b>	<b>\$74,750.00</b>	<b>\$0.00</b>	<b>\$94,020.00</b>	<b>\$0.00</b>	<b>\$70,280.00</b>	
Indirect	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
<b>Total</b>	<b>\$100,000.00</b>	<b>\$74,750.00</b>	<b>\$0.00</b>	<b>\$94,020.00</b>	<b>\$0.00</b>	<b>\$70,280.00</b>	

### 4. Supporting Materials

The following links are applicable:

Town of South Kingstown TMDL Website:

<https://www.southkingstownri.gov/1357/Water-Quality-Treatment-TMDL>

Stormwater Attenuation and Source Reduction Study:

<https://www.southkingstownri.gov/DocumentCenter/View/18380/Green-Hill-Pond-Attenuation-Study---Final-Report?bidId=>

Site Plans:

<https://www.southkingstownri.gov/DocumentCenter/View/18381/Green-Hill-Pond-Construction-Plans?bidId=>

Information Flyers – Ways to Help

<https://www.southkingstownri.gov/1392/Informational-Flyers---Ways-to-Help>

Residential Rain Gardens – Design and Installation:

<https://www.southkingstownri.gov/1393/Residential-Rain-Garden---Design-and-Ins>

Friends of Green Hill Pond: <https://foghp.org/>

South County Independent 7/1/2026 Article:

[https://www.independentri.com/news/article\\_4f838918-15ef-11ee-ba89-9b5c2db5eb1c.html](https://www.independentri.com/news/article_4f838918-15ef-11ee-ba89-9b5c2db5eb1c.html)

Providence Journal 10/11/2023 Article:

<https://www.providencejournal.com/story/news/local/2023/10/11/green-hill-pond-neighbors-turn-to-rain-gardens-to-fight-bacteria/71100355007/>

## 5. Certification

The undersigned verifies that the descriptions of activities and expenditures in this progress report are accurate to the best of my knowledge; and that the activities were conducted in agreement with the grant contract. I also understand that matching fund levels established in the grant contract must be met.

Grantee Signature: 

Name: Richard J. Bourbonnais, II, RLA, PE

Title: Director of Public Services

Date: June 10, 2025

Organization: Town of South Kingstown