



Integrated Water Resource Management Plan

2022 Update



Town of Brewster
Brewster Town Hall
2198 Main Street
Brewster, Massachusetts 02631



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BREWSTER'S INTEGRATED WATER RESOURCE MANAGEMENT PLAN - 2022 UPDATE

Introduction

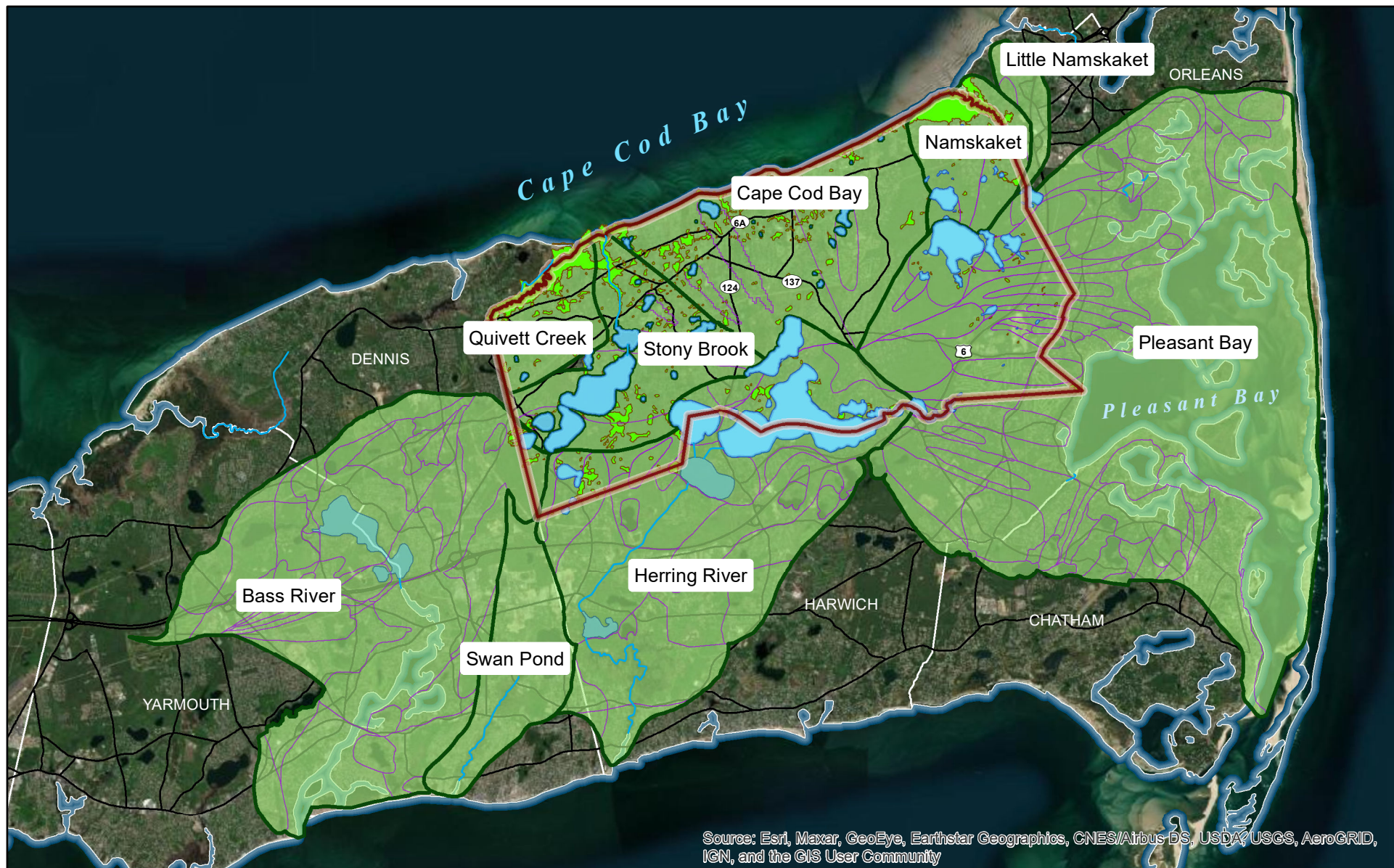
Since the 1980's, Brewster has actively focused on protecting and restoring the Town's water resources. This includes significant investments to protect undeveloped land to prevent the pollution of groundwater and surface waters associated with residential and commercial development.

In 2009, the Town of Brewster began a detailed study (known as the Integrated Water Resource Management Plan or IWRMP) to identify the issues associated with the Town's water systems and propose strategies to protect and restore water quality. This planning process led to a series of recommendations related to groundwater, freshwater ponds, stormwater management and coastal estuaries, with a focus on Pleasant Bay. In the last 10 years, significant work has been done to advance these recommendations. The purpose of this updated report is to summarize the goals of the Town's planning process, describe the actions that have been taken to date and present the current plans for continued water management in Brewster, including the costs needed to implement these plans. As will be described throughout this report, the Town's investments in protecting open space have preserved drinking water quality throughout Brewster and have significantly reduced the future investments needed to restore the quality of freshwater ponds as well as Pleasant Bay and other coastal estuaries.

Integrated Water Resource Management

Groundwater and surface waters, throughout Brewster, are interconnected. Rainfall is the source of Brewster's groundwater and surface waters. Rainwater lands on the ground surface and either infiltrates through the soil into groundwater or flows over the ground surface to a freshwater pond, Cape Cod Bay or one of the coastal estuaries in or near Brewster.

These interrelationships led to the decision to develop the IWRMP to evaluate the quality of the groundwater that provides drinking water to Brewster's residents, as well as the quality of the Town's many freshwater ponds and coastal estuaries. This planning process recognized that individual plans or actions are needed for specific watersheds in town; those areas that contribute groundwater or surface water to freshwater ponds, or coastal estuaries (Figure 1). The IWRMP process also recognizes ongoing planning is needed for those areas that contribute groundwater to the Town's public drinking water wells. These areas are known in Massachusetts as Zone II's, or wellhead protection areas, and are shown in Figure 2. In

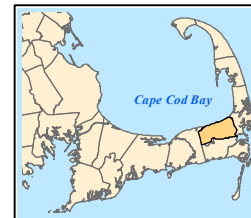


Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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|------------------|---------------|
| Town of Brewster | Watersheds |
| Streams | Subwatersheds |
| Ponds | Wetlands |

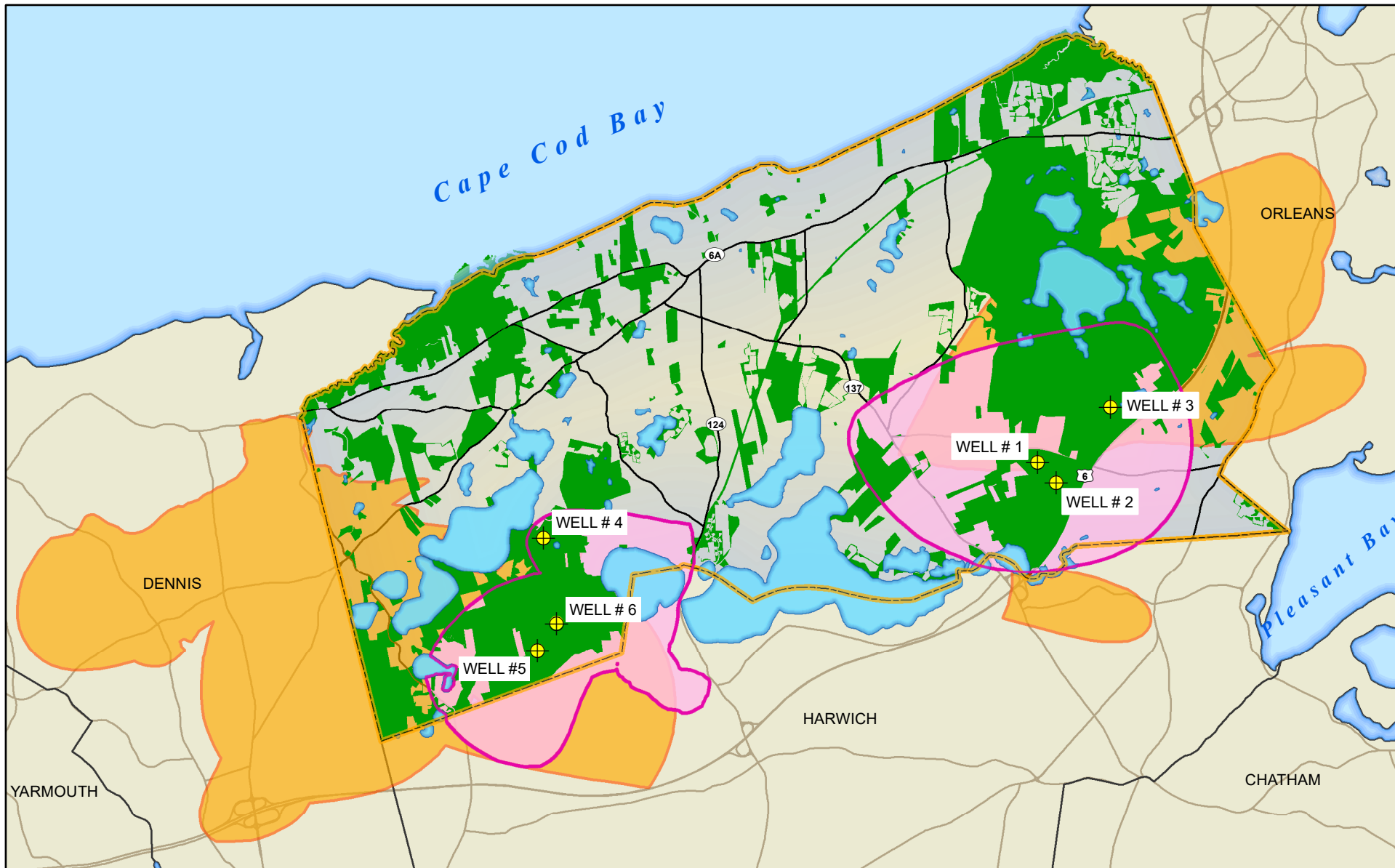


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Figure 1. Brewster's Water Resources

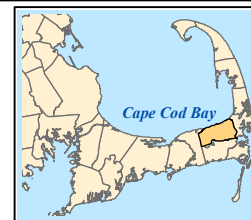
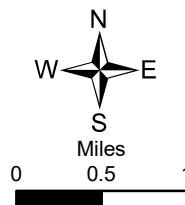
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| Town of Brewster | Public Wells |
| Conservation Lands | Brewster Zone II |
| Ponds | Other Zone II |



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**Figure 2. Brewster
Conservation Lands and
Zone II Areas**

Date: 1/26/2022

addition, the areas contributing groundwater and surface water to freshwater ponds must also be assessed and the sources of pollution to these ponds managed.

The interrelationships between groundwater, surface water and different sources of pollutants can be seen in Figure 3. The graphic shows how day-to-day activities of town residents impact the quality of drinking water and the quality of freshwater ponds and coastal estuaries. What is flushed down a toilet into a septic system can impact water quality in downgradient wells, ponds or coastal estuaries. Pollutants on town roadways (e.g., automobiles, fertilizers, and pet wastes) are collected in stormwater runoff that flows into waterways or soaks into the ground and impacts groundwater quality.

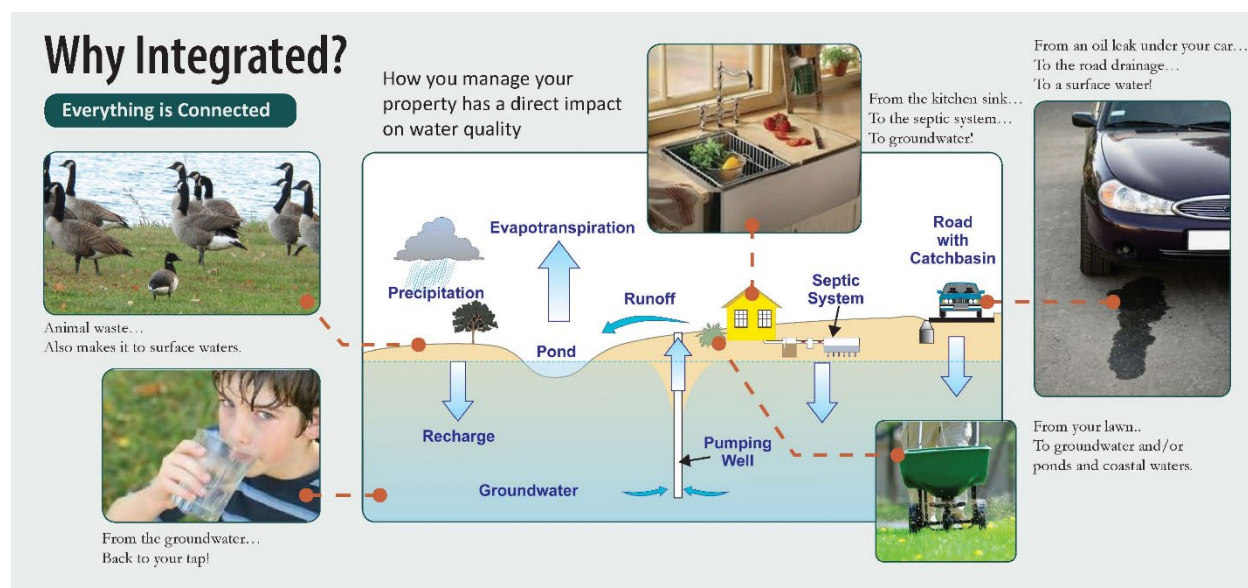


Figure 3 – Integrated Connections Between Water Resources and Pollutants

Overview of Water Quality in Brewster

Brewster is fortunate to have a public water system that provides high quality drinking water. However, there are ongoing issues with the water quality in many of the freshwater ponds in town, in Pleasant Bay and in Herring River in the adjacent town of Harwich. While Brewster only has frontage on a small portion of Pleasant Bay, and none on the Herring River, a portion of the watersheds that contribute pollutants to them are located in Brewster and the Town has a regulatory obligation to manage these watersheds. An overview of the regulatory requirements for managing the Town's water resources, and the protection and restoration strategies the Town is currently evaluating, are summarized below. The status of the Town's actions to restore these waters is then discussed in the following report sections.

Brewster's Public Drinking Water Supply

Most Brewster residents get their drinking water from the Town's public water supply system. Brewster's public water supply provides high quality drinking water pumped from six wells withdrawing groundwater from the area surrounding each well. The Zone II protection areas to these wells are shown on Figure 2. The protection of undeveloped open space around the Town's wells serves to minimize the potential for contaminants to impact drinking water quality. In 2012, 40% of the Town's Zone II areas were protected open space (See IWRMP Phase II Report). The extent of protected open space has grown since then, with further acquisitions by the Town and the Brewster Conservation Trust.

Public supply wells using groundwater are typically threatened by nitrogen from septic systems, lawn fertilizers, road runoff, hazardous material releases from fuel storage tanks, and accidental spills from roadway accidents. The open space protection in Brewster has significantly reduced the number of onsite septic systems potentially affecting drinking water quality. The Town's Water Quality Review Bylaw also prohibits hazardous materials use, or storage at volumes above those typically used in a household, in the Zone II areas. The Town's wells are tested regularly, and the tests confirm there are no contaminants exceeding federal and state drinking water standards. This data is reported annually in the Consumer Confidence Report, which the Water Department is required to produce. As can be seen in the 2020 report (Town of Brewster Water Department, June 2021), the nitrogen concentration in the Town's drinking water averaged less than 1 part per million (mg/L). The drinking water standard for nitrogen is 10 mg/L. Nitrogen is an indicator of contamination from septic systems, fertilizers and runoff. The low value is reflective of the extent of protected open space in the Zone II areas around the town wells.

Emerging contaminants are an ongoing concern for every drinking water system. One of the emerging contaminants of concern for many drinking water systems is per- and polyfluoroalkyl substances (PFAS). PFAS compounds are found in firefighting foams, a variety of personal care products, food wrappings, Teflon coated cookware, and clothing. The recently updated state drinking water standard for six of these PFAS compounds is now 20 parts per trillion. Note, this drinking water standard is six orders of magnitude lower than the standard for nitrogen. Small releases of these compounds to soil and groundwater can create issues for public water systems, so ongoing testing and evaluation is needed. Tests conducted in 2021 showed no PFAS compounds have been detected in the Town's public water supplies.

There are properties in Brewster that use private wells for drinking water, and they are located in various locations across the Town. These wells face the same water quality issues as the Town wells and often also benefit from nearby protected open space. One issue with private wells is their placement relative to an onsite septic system on the same property or an abutting property. Even if a septic system is outside the required 100-foot setback from a private well, if groundwater is flowing from the septic system towards the well it can bring nitrogen and other contaminants to the well. For this reason, it is important for residents to test the water quality in their private wells on a regular basis.

Pleasant Bay Watershed

The majority of the IWRMP implementation work over the last four years has focused on Brewster's portion of the Pleasant Bay watershed. Nitrogen inputs from the land uses within the watershed that contributes groundwater to the bay is the major water quality concern. Excess concentrations accelerate the growth of algae and invasive plants leading to the loss of fish and shellfish habitat. A main concern is the loss of eelgrass that provides habitat for fish to lay eggs and threatens protection of bay scallops. Brewster occupies approximately 25% of the overall watershed shared by Orleans, Harwich, and Chatham, but only contributes to 13% of the total nitrogen load entering the Bay. Brewster still needs to reduce its load by 981 kg/year and has agreed to do this under the Watershed Permit issued by the Massachusetts Department of Environmental Protection (DEP) to the four Pleasant Bay Towns.

Herring River and Bass River Watersheds

Portions of the watersheds to Herring River in Harwich and Bass River in Dennis and Yarmouth are located in Brewster. Like Pleasant Bay, nitrogen is the pollutant of concern for these estuaries. Brewster's portion of the Bass River Watershed is quite small, at 160 acres (Univ of MA Dartmouth, April 2011). Given this small area and the fact most of the watershed land within Brewster is protected open space there are no nitrogen management requirements for this watershed. For the Herring River watershed there is likewise no need to reduce the existing nitrogen load within Brewster. However, any additional load resulting from new development in the watershed will need to be managed to minimize the extent of additional nitrogen entering the Herring River system (Univ of MA Dartmouth, May 2013). Recent open space acquisitions in the watershed have reduced the potential for additional nitrogen impacts and the Town will be updating the quantity of nitrogen that needs to be managed in this watershed in the future.

Other Coastal Estuaries

Nitrogen management for the Namskaket Creek and Quivett Creek watersheds has also been evaluated in Brewster. These estuaries are located on the north shore of Brewster and drain into Cape Cod Bay. Namskaket Creek is different from the estuaries discussed above as the current and future nitrogen load to this estuary is lower than the threshold established by DEP. So, there is no current need to develop a management plan for this system (Univ of MA Dartmouth, December 2008). The Quivett Creek watershed was evaluated by the Cape Cod Commission (October 2018), and it determined there is no need for nitrogen management at this time. Recent data for Quivett Creek developed by the Association to Preserve Cape Cod (APCC) is currently being reviewed by the Brewster Natural Resource Advisory Commission to determine if water quality has changed. The tidal range in Cape Cod Bay and within these

estuaries is much higher than in Pleasant Bay, Herring River or Bass River. Therefore, nitrogen entering these systems is quickly flushed out into Cape Cod Bay and does not have the same impact on the health of the estuaries.

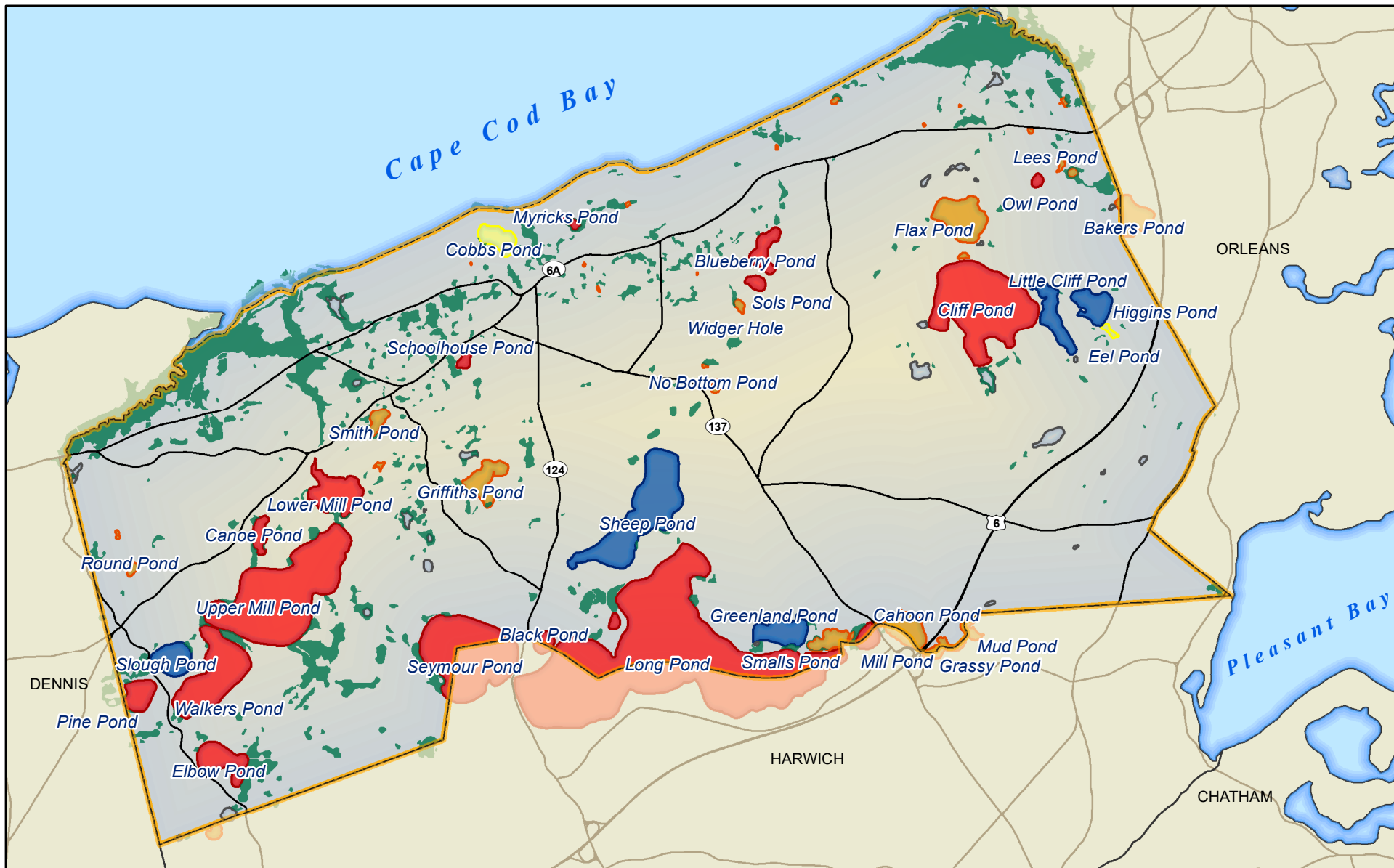
Fresh Water Ponds

Brewster is home to over 80 freshwater ponds located throughout the Town. Unlike coastal waters, pond water quality is impacted by both phosphorus and nitrogen. Excess inputs of these nutrients fuel the growth of algae which, when they die and decay, reduce the oxygen level in the water. Fish kills can result if algae blooms get too big and result in anoxic conditions in the water. In addition, the mixture of nitrogen and phosphorus can promote the growth of toxic organisms like cyanobacteria which were found in three ponds in the summer of 2021 based on testing conducted by APCC. Warmer temperatures and drought conditions over the last year have extended the growing season in the ponds, exacerbating some of these water quality issues. Many ponds are experiencing water quality impairment as shown in Figure 4. The main sources of these nutrients to ponds are septic systems, lawn fertilizers and road runoff. Since phosphorus does not travel extensive distances in groundwater, the concern with septic system discharges is only related to those within approximately 300 feet of the pond shore, especially on the upgradient side of the pond, as mapped on the Water Resource Atlas described later in this report.

IWRMP Summary

As mentioned above, Brewster's IWRMP development began in 2009. Since then, a series of reports specific to Brewster have been prepared to outline specific water quality issues and recommend actions to address them. The majority of them can be viewed on the Town's Website at www.brewster-ma.gov (click on the Water Planning button on the home page). A summary of the main reports that continue to direct the IWRMP process is provided below.

- **Integrated Water Resource Management Plan Phase II Report, January 2013.** This report provided a review of the regulatory process governing water quality management in Brewster and made specific recommendations for restoring and protecting water quality for drinking water, freshwater ponds and coastal estuaries.
- **Pleasant Bay Nitrogen Management Alternatives Analysis Report, March 2015.** This report focused on strategies to reduce nitrogen loading from Brewster's portion of the Pleasant Bay Watershed to help achieve the nitrogen reduction goals to restore water quality in the Bay. The alternatives considered included a neighborhood sewer system, changes in fertilization practices at the Captain's Golf Course, the use of innovative septic treatment systems and other potential solutions.
- **Pleasant Bay Watershed Permit and Targeted Watershed Management Plan, 2018.** Brewster entered into an agreement with the DEP and the three other Pleasant Bay



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Town of Brewster

MassDOT Major Roads

Wetlands

Ponds Health Assessment

Water Quality Category

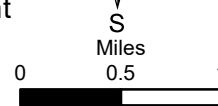
1 - High Quality

2 - Meets Most Uses

3 - Some Impairment

4 - Impaired

No Data



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**Figure 4. Water Quality
in Brewster's Ponds**

Date: 1/14/2022

Watershed towns to restore water quality in Pleasant Bay (DEP, August 2018). The Permit specifies specific requirements to reduce nitrogen loading to the bay. The Pleasant Bay Alliance prepared a companion report, the Targeted Watershed Management Plan, outlining the strategies proposed by each town to meet the nitrogen reduction goals in the Permit. (Pleasant Bay Alliance, March 2018)

- **Meeting the Nitrogen Reduction Goals for Pleasant Bay, October 2020.** This report provides an update to the Pleasant Bay Nitrogen Management Alternatives Analysis Report mentioned above. The update was prepared for the Select Board and incorporates updated information on the nitrogen management alternatives available to Brewster based on the requirements of the DEP Permit issued in 2018.
- **Mill Ponds Management Plan, November 2014.** This report, prepared by the School for Marine Science and Technology (SMAST) at the University of Massachusetts, provided recommendations for the restoration of Upper Mill, Lower Mill and Walkers Pond. Based on these recommendations, the Town purchased a weed harvester to help manage Walkers Pond. They also conducted an alum treatment in Upper Mill Pond to reduce water quality impacts from phosphorus historically discharged to the pond, which is now contained in the sediment on the pond bottom.
- **Water Resource Atlas – Fresh Water Ponds.** This Atlas provide maps of the surface watersheds and groundwater recharge areas to each pond in Brewster, and provides the areas proposed for additional septic system management within 300 feet on the upgradient side of each pond, and 100 feet on the downgradient side of the pond.

Additional reports have been prepared as part of the Massachusetts Estuaries Project and on behalf of the Pleasant Bay Alliance and these are referenced in the following section of this report.

Implementation of the IWRMP

The Town's actions to implement recommendations in the IWRMP are currently focused on the following topics:

- Nitrogen reduction in the Pleasant Bay Watershed, as required in the watershed permit issued by DEP.
- Actions to protect and restore water quality in the Town's freshwater ponds.
- Implementation of the recently adopted stormwater management bylaw to protect water quality.
- Plans to reduce future nitrogen loading in the Herring River watershed.

An update on the status of each of these topics is provided below, summarizing the actions being considered, the associated costs, and the work needed to make final decisions.

Pleasant Bay Watershed

Brewster has collaborated on managing nitrogen in Pleasant Bay with the other towns in the watershed through the Pleasant Bay Alliance. This has included documenting the nitrogen removal responsibilities for each town and establishing the Pleasant Bay Watershed Permit with DEP that provides a framework to meet these nitrogen reduction goals over a 20-year period. The details of these plans are summarized in the Pleasant Bay Targeted Watershed Management Plan, prepared by the Alliance and referenced in the DEP Permit.

Much of the data in this plan was obtained from the 2006 Linked Watershed Model, developed by SMAST, as part of the Massachusetts Estuaries Program (Univ of MA Dartmouth, May 2006). It documents the existing nitrogen loading from each town, divided up by the watersheds contributing groundwater to the Bay. It then establishes the nitrogen reduction requirements for each town in each watershed.

The Permit requires Brewster to remove of 2,262 kg N/year from the watershed and to address nitrogen impacts from future development. At the time it was issued, the Town had already removed 56% of this load, taking advantage of fertilizer and irrigation management at Captains Golf Course as well as the adoption of a town-wide fertilizer management bylaw (Table -1). This was done with minimal cost to the Town.

Total Nitrogen Reduction Required	2,262 kg N/year
Golf Fertilization Reduction	-930 kg N/year
Golf Irrigation Recapture	-230 kg N/year
Town-wide Fertilizer Bylaw	-121 kg N/year
Total Nitrogen Removed to Date	-1,281 kg N/year
Remaining Reduction Needed	981 kg/N/year

Table -1 Pleasant Bay Nitrogen Load Summary

The permit also requires that the Town address nitrogen inputs from future development in the watershed. Based on an assessment in 2018 (HW, April 2018), this could include an additional 1,209 kg N/year. The Pleasant Bay Alliance will be working over the next year to update this buildout number to assist with the planning needed to manage this additional load. Any future load created will have to be offset by further reductions in existing loads.

The Pleasant Bay Alliance is currently working with SMAST to evaluate and revise the nitrogen reduction requirements for each Town based on updated land use information since the initial report was prepared in 2006 and considering the changes in hydrology in Pleasant Bay given the new inlet that was formed in 2007 that increases the tidal flushing in the estuary.

The extent of nitrogen entering Pleasant Bay from the Tar Kiln portion of the watershed is currently being reviewed and is an important issue for the Town. If groundwater containing

nitrogen enters a freshwater pond or wetland, some of the nitrogen is attenuated, or taken up by the algae and plants, and less is transferred back into groundwater which then flows to Pleasant Bay. No attenuation was attributed to the Tar Kiln watershed in the initial SMAST Model, but recent studies by SMAST led them to conclude that there is attenuation in this marsh system. As such, the existing nitrogen impact from this watershed is reduced, meaning that septic systems, lawns and stormwater in this area of the watershed do not have as much impact on Pleasant Bay. However, a portion of Captains Golf Course lies in this watershed, and the plans for managing further nitrogen reductions may be somewhat offset by the new attenuation attributed to the Tar Kiln Marsh. The Town is working with the Pleasant Bay Alliance to quantify how this affects Brewster's requirements under the Watershed Permit. However, the effects should not be significant enough to require major changes in the plans developed to date.

The options to fully comply with the Watershed Permit are summarized below. One major opportunity is continued fertilizer management at Captains Golf Course. The extent to which this will reduce nitrogen loading will affect the scale and cost of the other options the Town is considering. Each option is discussed below, with an initial estimate of the cost for implementation.

Golf Course Fertilizer and Wastewater Management

In 2020, the Town has collaborated with the U.S. Golf Association to identify additional strategies to further reduce nitrogen inputs at Captains Golf Course. Proposed changes at the golf course include:

- Changes in fertilization practices to reduce applications on the fairways and roughs, incorporating sprayed applications of liquid fertilizers that can be readily adsorbed by the turf. These new practices began in 2020.
- Reductions in the size of fairways by a total of approximately 2.5 acres by converting this turf to rough and reducing fertilizer demand. The areas selected are based on an inspection by the U.S. Golf Association and would not hinder the way the course is used.
- Installation of a nitrogen treatment system to the septic system at the course that would reduce the nitrogen concentration in the effluent to 10 mg/L or less.

If implemented, these actions would further reduce nitrogen loading by 458 kg/year, such that the Town will only need to manage the remaining current nitrogen load of 523 kg/year. There would be little to no cost for changes in fertilization applications, the cost for the adjustments to the size of the fairways would cost about \$20,000 and the septic system upgrades would cost approximately \$200,000. The golf course has already begun to implement the sprayed applications of fertilizer at reduced rates and this process will continue moving forward.

Nitrogen Reduction	458 kg/year
Estimated Cost	\$220,000 – Current Estimate

Golf Course Fertilizer Leaching Rate Evaluation

Separate from the reduced amount of fertilizer applied to the golf course turf, the Town could receive a nitrogen reduction credit related to the amount of fertilizer that actually leaches into groundwater and flows to Pleasant Bay. Currently the DEP watershed permit assumes that 20% of the nitrogen in fertilizers leaches into groundwater. The proposed management practices will likely reduce this leaching rate. If so, additional nitrogen reduction credits can be obtained.

The Town has begun a study to evaluate the fertilizer leaching rate that involves the testing of water in the soil and the underlying groundwater for nitrogen. A series of six lysimeters have been installed in the golf course fairways that capture water infiltrating through the upper 1-2 feet of soil. Six monitoring wells located near the lysimeters have also been installed.

Quarterly testing of nitrogen concentrations will be conducted for two years to document how much nitrogen applied in fertilizer actually enters groundwater below the golf course. Based on this data, an updated leaching rate for fertilizers will be documented and used to determine the remaining nitrogen load that must be managed by Brewster. This option is attractive because the only expense is the cost for a study to document this leaching rate. If the leaching rate is substantially lower, the nitrogen reduction requirements for both existing and future loads could be reduced.

Nitrogen Reduction	To be determined
Cost (for leaching rate study)	\$140,000 – funded in 2021 and underway

Install a Neighborhood Wastewater Treatment and Collection System

A traditional wastewater system could be installed in the upper, western portion of the watershed to treat effluent prior to its discharge to groundwater. This area was selected based on the concentration of development that reduces the length, and therefore the cost, of sewer lines needed to collect wastewater. There are two options for this, either site the wastewater disposal field in the watershed or locate it outside the watershed. If the disposal field is not within the watershed, all the nitrogen from the homes connected to the system is removed, and therefore fewer homes need to be connected to reach the required nitrogen load reduction. The siting of a disposal field outside the Pleasant Bay watershed needs to account of other potential impacts to drinking water supplies or other sensitive watersheds. The sizing of the system assumes no change in the golf course leaching rate. Both of these options could be expanded to accommodate additional nitrogen from future development. The costs listed below are broken out into those needed to design and permit the system and those needed for construction and a long term (20-year) operation.

Disposal in the watershed

Disposal outside the watershed

No. of Homes	152	No. of Homes	100
Nitrogen removed	523 kg/yr.	Nitrogen reduction	523 kg/yr.
Planning Cost	\$450,000	Planning Cost	\$400,000
20-year cost	\$10,000,000-\$15,000,000	20-year cost	\$9,000,000

Onsite Septic System Treatment Upgrades

Septic systems serving individual properties could be upgraded to provide additional nitrogen treatment. Currently, it may be possible to utilize an innovative treatment system to treat nitrogen to about 12 mg/L, well below the typical system which discharges nitrogen at a concentration of about 35 mg/L. There are innovative systems that could meet this goal, but they are still being evaluated. Based on the best, currently available data, approximately 320 septic systems would need to be upgraded to this relatively new technology to provide the necessary nitrogen reduction. This number may change based on the results from the golf course leaching rate study and the nitrogen attenuation attributed to the Tar Kiln Marsh watershed. More septic systems could be upgraded with nitrogen treatment to help accommodate future nitrogen loads from buildout.

The Pleasant Bay Alliance evaluated the cost for the design, construction and long-term operation of these systems and reported that the price for an individual system could run as high as \$33,900 with annual operation and maintenance costs of \$2,360 (HW, 2020, Appendix C). Over 20 years this results in a total cost for 320 properties of \$26,000,000. This cost makes this option more expensive than the neighborhood system described above. The Town is continuing to evaluate these costs, based in part on a pilot program led by the Barnstable Clean Water Coalition documenting actual construction costs for 15-20 systems which are somewhat lower than that estimated by the Alliance. The use of these systems could be beneficial if the leaching rate study at the golf course shows fewer of them are needed. They may also be useful for managing future development not just in the Pleasant Bay watershed but in watersheds adjacent to freshwater ponds as well.

No. of Homes	320
Nitrogen reduction	523 kg/yr.
20-year cost	\$26,000,000

Nitrogen Trading

The Town can negotiate a “nitrogen trade” with another Pleasant Bay town by financing nitrogen removal actions they are taking. As an example, if a neighborhood treatment plant would cost \$10,000,000 to remove 523 kg N/year, the Town could negotiate an agreement with Harwich, Orleans, or Chatham to fund wastewater treatment in their community to remove the same amount of nitrogen, taking advantage of economies of scale and excess nitrogen removal in their new wastewater systems. The size and cost of the trade could be adjusted to accommodate future nitrogen impacts from buildout. This would eliminate the long-term management of a facility in Brewster.

Buildout Nitrogen Management

Under the Watershed Permit, Brewster needs to develop a plan to ensure future development is managed to keep the nitrogen loading in the Town's portion of the watershed within the levels allowed for Pleasant Bay. Part of this can be accomplished through the strategies discussed above. In addition, there are regulatory options that the Town can evaluate to make sure that the loading from future development is minimized to the extent possible.

The Water Quality Review Bylaw currently in place limits the amount of nitrogen from development within the Pleasant Bay watershed. For any new project, or for an expansion of an existing development, the applicant must demonstrate the overall nitrogen load is limited to an average of 5 mg/L in groundwater underneath the site. Several changes to this bylaw were approved by Town Meeting in November 2021 and the Board of Health recently approved related nitrogen loading calculation regulations pending town counsel review. This 5 mg/L limit applies to both residential properties and to commercial/industrial areas also located within the Pleasant Bay watershed. The Town is considering changing the 5mg/L limit for commercial and industrial properties to 3 mg/L. If this change is made, the overall nitrogen load from buildout is reduced by 25-30% in this watershed.

New data from the Pleasant Bay Alliance's ongoing buildout assessment will refine the actual benefit of this change. Preliminary calculations suggest that most commercial/industrial uses allowed in the watershed could comply with the 3 mg/L threshold. If not, a project may need to install an innovative septic system technology to treat nitrogen in wastewater effluent to meet this goal. Given any new development increases the overall nitrogen management load, it is worthwhile to consider having some limitations on the extent of additional load that could be allowed.

Other buildout options include limiting the extent of development allowed on town-owned properties within the watershed and further limiting the allowable nitrogen load from residential properties. Further discussion and public input are needed on these options. These discussions will benefit from the ongoing collection of data from the golf course study discussed above.

In summary, there are several viable options to fully comply with Brewster's obligations under the Pleasant Bay Watershed Permit. The proposed leaching rate study will document potential additional nitrogen reductions at the golf course with minimal cost. This would further reduce the costs for the remaining actions the town will have to take. The neighborhood wastewater treatment options could be used to manage the remaining nitrogen or as a basis for a nitrogen trade with another Pleasant Bay town. Each of these options can also be expanded, if needed, to accommodate future development. The Town is required to provide annual updates to DEP under the Watershed Permit and coordinates these updates with the other Pleasant Bay Towns. The Cape Cod Commission also reviews ongoing work in the watershed as part of its

implementation of the Section 208 Area Wide Water Quality Management Plan. Its most recent review is provided in Appendix A.

Fresh Water Ponds

As discussed above, if too much phosphorus enters a pond, it will accelerate the growth of algae. When algae dies it decays, and as this happens the oxygen in the water column is depleted. In extreme situations, this results in fish kills as there is not enough oxygen to keep the fish alive. Phosphorus does not travel far in groundwater as it readily binds to the iron and manganese in the subsurface soils and sediments. This means that, for phosphorus, the primary concerns with septic systems are those located within 300 feet of a pond on the upgradient side where groundwater is traveling towards the pond. Recent studies have shown that nitrogen is also a concern in ponds, as the combination of nitrogen and phosphorus can create conditions that support the growth of cyanobacteria, a toxic organism that can affect people and wildlife.

Water Quality Data

The Town has conducted regular water quality monitoring of many of the larger ponds in Brewster and used that information to support restoration projects in Long Pond, Walkers Pond, and Upper Mill Pond. A summary of this water quality data was last published in 2009. An update on the current water quality status based on the data collected since 2009 would be useful and the Town is working to review ongoing monitoring data and develop a new status report. The cost for this update report is estimated at \$50,000. It should be noted that bacteria testing of pond water quality is also conducted by the Board of Health monitoring water quality at the public beaches at ponds in Town.

Board of Health Septic Regulations

The Board of Health currently has a regulation prohibiting septic system leaching facilities within 300 feet of a pond. This serves to minimize phosphorus impacts from future development. However, there are approximately 600 properties either fully or partially within the 300-foot buffer to the ponds in Brewster. Applicants looking to update or expand their septic system are regularly asking for a variance to this regulation as they cannot move their leaching facility outside the 300-foot buffer.

HW prepared a draft revision to this Board of Health regulation in 2016. The draft requires septic systems within 300 feet upgradient and 100 feet downgradient of a pond to install a leaching facility or alternative technology that will provide phosphorus treatment. This regulation was discussed at a public Board of Health Hearing in 2016. There were questions related to the cost of the treatment systems and the performance of the technologies available at that time for phosphorus treatment. Further evaluation of the draft regulation is needed to advance the process to restore pond water quality. In part, it needs to consider the treatment for nitrogen as well as phosphorus given concerns about cyanobacteria. Along with evaluating

the technologies available, it will be important to consider the cost of implementing a new regulation and the process for funding it.

Innovative/Alternative Septic Pilot Program

In 2018, a charrette was held with members of the Board of Health, Town staff, local design engineers and a representative from the MA Septic System Test Center to evaluate the proposed phosphorus treatment technologies then available and associated costs. The installation of pilot systems within 300 feet of one or more ponds in Brewster to test the technology and document the costs was recommended at each session.

Newer technologies are now being tested to document their performance for treating both nutrients and these could be incorporated into a pilot project in Brewster. A pilot project testing 6 innovative septic systems would cost approximately \$300,000.

Based on recent work conducted in the Shubael Pond neighborhood by the Barnstable Clean Water Coalition (December 2021), the cost to design, permit and install an alternative treatment system is approximately \$20,000-\$25,000. Note, this cost is lower than the estimate for similar systems developed by the Pleasant Bay Alliance. This is in part due to the need for a greater amount of monitoring of the systems under the Pleasant Bay Permit. The cost for each site will vary based on the size of the property, the slope of the land and the operational status of the existing septic tank and leaching facility (if they can be maintained). There may be more affordable technologies, but this provides an initial estimate for implementing this regulation.

Large-Scale Innovative/Alternative Septic Upgrades

The overall cost if all 600 properties within the proposed setback to ponds were upgraded would be approximately \$12,000,000 to \$15,000,000. There would also be annual operation, maintenance and monitoring fees for these systems.

Further discussion on who should pay for some or all of these upgrades is needed. Not all ponds in Brewster are accessible by the public, as the shoreline at some locations is all privately owned. A question that has been raised is whether the town should provide funding for system upgrades if there is no public access. The next steps for implementing actions for ponds include:

- Updating information available on the technologies that can provide phosphorus and nitrogen treatment, including their performance and cost.
- Revising the draft health regulation.
- Evaluating other sources of nutrient pollution to ponds and develop strategies to minimize these threats.

As discussed below, the stormwater bylaw adopted in November 2021 will help with pond water quality management. Additional outreach and public discussion will be needed to achieve consensus on the best approach for pond management.

Neighborhood Sewer Systems

It should be noted that there was discussion about providing neighborhood sewer systems around ponds in Brewster at the public meeting in 2016 and at the charrette in 2018. This option seems to be significantly more costly than using individual onsite systems. It would not be feasible to construct one system to sewer all the areas around Brewster's ponds. There would be a need to construct sewer lines around each pond as well as multiple treatment facilities. In addition, a location for each neighborhood system would also have to be selected and acquired by the owner of the facility, be it the Town or a neighborhood association. Further analysis comparing neighborhood sewer systems to individual systems will need to be part of future technical evaluation and public policy discussions.

Stormwater Management

Stormwater management has been a key part of the IWRMP process since the beginning. During the development of Phase II of the IWRMP, a series of proposed stormwater improvements were identified to limit the direct discharge of stormwater to surface waters in Town. One location was the town-owned boat ramp for Long Pond on Crowells Bog Road. Currently stormwater runs directly down the access road into the Pond. However, the Town is redesigning the boat ramp, parking area, and incorporating updated stormwater practices to prevent direct discharge of untreated runoff into Long Pond. Other stormwater improvements at Breakwater Landing, Crosby Landing and Paine's Creek have been completed and the Walker's Pond boat ramp upgrade is planned for this spring.

Brewster adopted a new stormwater management bylaw at its November 2021 Town Meeting. This bylaw is required under the federal Municipal Separate Storm Sewer (MS4) regulation under the federal Clean Water Act. The bylaw requires both minor and major projects to design and build stormwater management systems to prevent the overland flow of water directly to ponds and coastal waters. It also incorporates treatment requirements to protect groundwater quality where stormwater is infiltrated into the ground. Over time it will help improve water quality, especially in areas where stormwater is currently flowing directly to a surface water.

Projects creating less than 500 square feet of impervious cover or disturbing less than 10,000 square feet of land are required to apply for a minor permit. As part of the application the runoff volume from the project must be calculated and one or more stormwater management practices, such as a rain garden or vegetated swale must be sized and installed. Larger projects must apply for a major permit to be reviewed by either the Planning Board or the Conservation Commission if the Conservation Commission has jurisdiction under the state Wetlands Protection Act. These larger projects must document that the stormwater will be managed in accordance with the state's stormwater management regulations.

The Planning Board is now finalizing a set of implementation regulations for the bylaw. They are also working with Town staff to develop application forms and instructions for both the major and minor permits. These new requirements for stormwater will help improve water quality through Brewster.

Herring River Watershed

As mentioned above, the Town's obligations for nitrogen management in the Herring River watershed involve limiting the nitrogen load from future development. The strategies considered for future development in the Pleasant Bay watershed could be applied for the Herring River watershed as well. Further work is needed to quantify the extent of buildout possible in this watershed given recent open space acquisitions by the Town to refine the management strategies for Herring River.

Summary of Potential Costs & Funding Sources

Based on the information provided above, the overall cost for implementing the primary components of the IWRMP as of 2022 is approximately \$22,970,000 - \$31,070,000. Table 2 shows a breakdown of costs for the Pleasant Bay watershed and freshwater pond management which are the two issues with significant management costs. For Pleasant Bay, the overall cost includes the neighborhood wastewater treatment plant option as this is less expense than using individual septic treatment systems.

In most towns, the implementation of wastewater management strategies includes funding from the property owner and the town. How the funding is managed in Brewster still needs to be evaluated. The extent of town funding is often based on the benefits received by all residents in the town. For example, the restoration of water quality in a pond or coastal estuary can benefit all resident who have access to the water.

Table 2 also provides information on the potential for the Town to obtain a State Revolving Fund (SRF) loan to finance the costs or to get funding from the recently created Cape Cod and Islands Water Protection Fund (CCIWPF). Funding for CCIWPF is through taxes on hotels and short-term rental facilities. To receive an SRF Loan, the Town must apply through the MA Clean Water Trust. If the Trust approves a project, it is then eligible for funding from the CCIWPF. The CCIWPF funds are used to repay a portion of the SRF loan.

For a project to be eligible for SRF funding, the Trust requires DEP approval of a comprehensive wastewater management plan, IWRMP, targeted watershed plan or project specific plan. Cape Cod Commission Clean Water Act Section 208 approval is also required for a project to be eligible for SRF funding. Proposed project(s) must be submitted to the Clean Water Trust for inclusion on the annual Intended Use Plan. If a project is included on the plan, it is then eligible for SRF funding. Funding is provided as a 20-year loan with a maximum interest rate of 2%. Some projects can qualify for a lower interest rate as well. Projects demonstrating their

Table 2: Summary of IWRMP Costs and Funding Options

Pleasant Bay Watershed Project

Golf Course Fertilizer Adjustment and Fairway Size Refinements

Cost:	\$20,000
SRF Funding Eligibility	No
CCIWPF Eligibility	No

Construction of Captains Golf Course I/A Treatment System.

Cost:	\$200,000
SRF Funding Eligibility	Possible
CCIWPF Eligibility	Possible at 50% of SRF cost

WWTP Planning.

Cost:	\$200,000 - \$225,000
SRF Funding Eligibility	Possible
CCIWPF Eligibility	Possible – At about 50%

WWTP Design and Permitting.

Cost:	\$200,000 - \$225,000
SRF Funding Eligibility	No
CCIWPF Eligibility	No

Construction of a Neighborhood WWTP*.

Cost:	\$10,000,000 - \$15,000,000
SRF Funding Eligibility	Possible
CCIWPF Eligibility	Possible –at 25%

Fresh Water Ponds Project

Development of an Updated Report on Pond Water Quality

Cost:	\$50,000
SRF Funding Eligibility	Possible
CCIWPF Eligibility	Possible – At about 50%

Development of a Pilot Program for Septic Upgrades Near Freshwater Ponds.

Cost:	\$300,000 - \$350,000
SRF Funding Eligibility	Possible
CCIWPF Eligibility	Possible – At about 50%

Installation of I/A Septic Systems Adjacent to Fresh Water Ponds.

Cost:	\$12,000,000 - \$15,000,000
SRF Funding Eligibility	Unlikely
CCIWPF Eligibility	Unlikely

Total Cost:	\$22,970,000 - \$31,070,000
Total SRF Funding Eligibility	\$10,750,000 - \$15,825,000
Total CCIWPF Eligibility	\$2,875,000 - \$4,162,500

** Note: The WWTP cost is for the larger system serving approximately 150 homes. The costs for onsite septic treatment systems for Pleasant Bay are not included here as the neighborhood WWTP is currently the more cost effective option.*

implementation will not result in any growth in development can qualify for a 0% interest rate. In 2021, 75% of the projects that requested SRF support were awarded a loan by the Clean Water Trust.

The CCIWPF provides separate funds, as grants to the Towns that participate in the program. The funds are provided only for projects approved for an SRF loan. Each year the grants are provided based on the funds available and the number of projects eligible for funding. This data is used to select a subsidy percentage for each project. For the first round of funding through the CCIWPF, awards for projects on the Intended Use Plan were provided at a rate of 25% of the project cost. Small projects, below \$1,000,000, are eligible for twice the percentage awarded to other projects. Awards for all projects are paid out in equal installments over four years after they are awarded.

Per correspondence with DEP officials in Summer 2021, based on the information provided in Table 2, Brewster could potentially receive SRF funding on one or more 20-year loans, for the planning projects, the installation of the septic treatment system at Captains Golf Course, and the construction of the neighborhood wastewater facility. A total of \$10,750,000 - \$15,825,000 could be funded. If awarded SRF funding, there would then be funds available from the CCIWPF to support the repayment of the SRF loans. Assuming a 25% payment of the cost of each project (and 50% for projects under \$1,000,000 in cost) a total of \$2,875,000 - \$4,162,500 could be financed through the CCIWPF.

Conclusions – Summary of Next Steps

Reducing the nitrogen load to Pleasant Bay and developing a plan to restore pond water quality are the two main water resource issues for Brewster. For Pleasant Bay, the extent of nitrogen reduction that can be achieved at Captains Golf Course will determine the extent of wastewater management needed in the watershed, either through a neighborhood wastewater treatment plant, the use of nitrogen treatment technologies for onsite septic systems or a nitrogen trade with another town in the watershed. For freshwater ponds, the Town is planning to develop updated information on their water quality status. With that information, the primary goal is to develop a program to upgrade septic systems along the pond shores to minimize impacts from nitrogen and phosphorus.

Following additional data collection and technical analysis, decisions on these topics will need to be made in the next 1-3 years and ongoing outreach is planned to obtain input from town residents to help inform these critical policy decisions.

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the Herring River System, Harwich, Massachusetts.

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Appendix A - 208 Compliance Reports 2021

Town of Brewster

208 COMPLIANCE REPORT | 2021

CUMULATIVE TOWN SNAPSHOT SINCE 208 PLAN APPROVAL

\$612K

TOWN MEETING
APPROVED
FUNDING

\$482K*

GRANT
FUNDING
RECEIVED

3

NON-
TRADITIONAL
PROJECTS
UNDERWAY

-

TOTAL FLOW
COLLECTED BY
CENTRALIZED
SYSTEMS

-

ALL PROPERTIES
SERVED BY
CENTRALIZED
SYSTEMS

TEAM

Team members engaged in water quality planning efforts.

Town Team:

- Comprehensive Water Planning Committee (dissolved 2015)
- Water Quality Review Committee
- Town Planner
- Health Agent
- Natural Resources Director
- Horsley Witten Group

Collaborations:

- Pleasant Bay Alliance
- Town of Chatham
- Town of Harwich
- Town of Orleans
- MassDEP
- Cape Cod Commission
- SNEP Network

MS4 COMPLIANCE

12 Cape Cod towns are required to address stormwater discharge under the MS4 Permit. Towns with nitrogen impaired waters must meet additional permit requirements.

☑ Subject to MS4 Permit

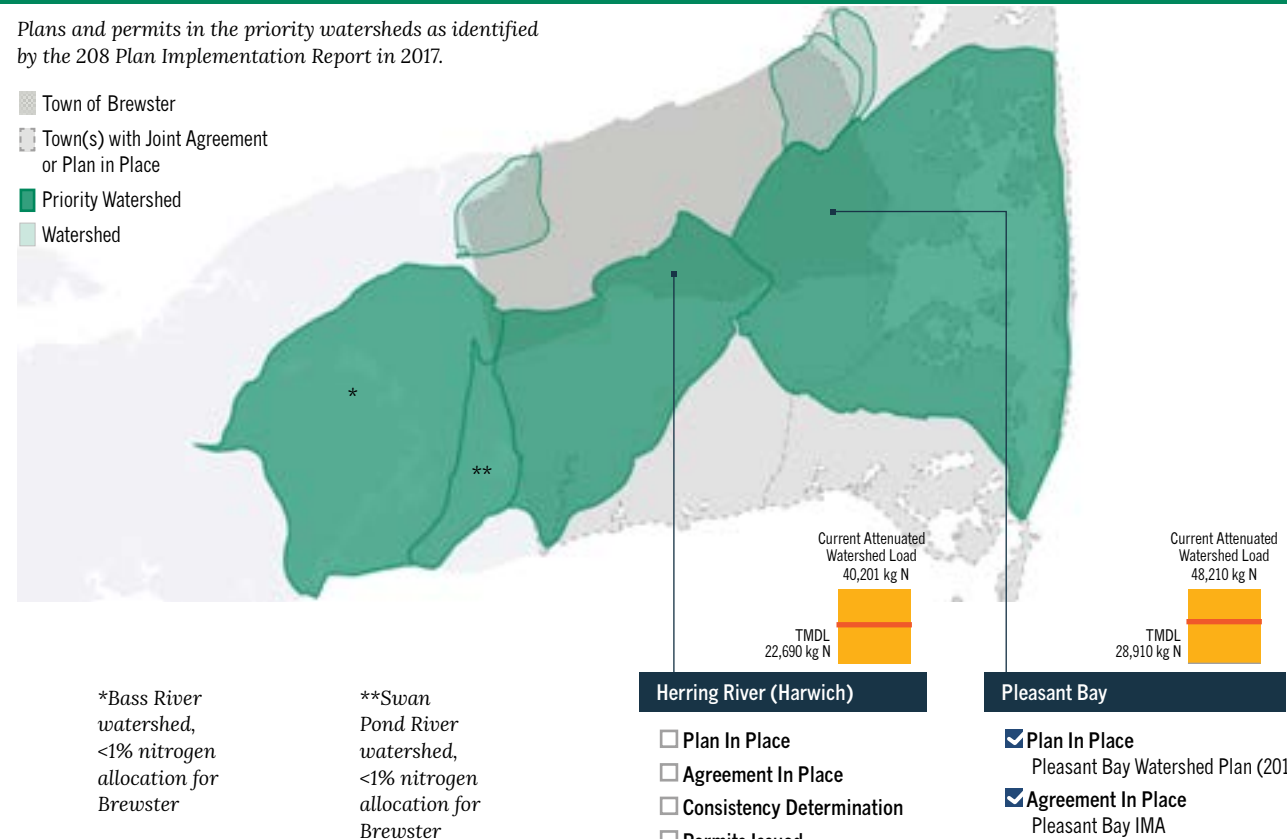
No Additional nitrogen related requirements

☑ In compliance with MS4 Permit requirements

PRIORITY WATERSHED PROGRESS

Plans and permits in the priority watersheds as identified by the 208 Plan Implementation Report in 2017.

- Town of Brewster
- Town(s) with Joint Agreement or Plan in Place
- Priority Watershed
- Watershed



Herring River (Harwich)

- ☐ Plan In Place
- ☐ Agreement In Place
- ☐ Consistency Determination
- ☐ Permits Issued

Pleasant Bay

- ☒ Plan In Place
Pleasant Bay Watershed Plan (2018)
- ☒ Agreement In Place
Pleasant Bay IMA
- ☒ Consistency Determination
208 Consistency Determination (2018)
- ☒ Permits Issued
Watershed Permit (2018)

SYMBOL LEGEND

- ☒ Complete or Approved
- ☐ Partial
- ☒ Not Shared or Not Approved
- ☐ Not Available

OTHER LEGEND

Progress shown is for the period from November 2020 through November 2021

The Cumulative Town Snapshot section summarizes the funding snapshot categories since 2015

Town of Brewster

208 COMPLIANCE REPORT | 2021

TOWN REGIONAL DATA SHARING STATUS

✓ 2019
PARCEL
DATA

✓ 2019
ASSESSOR
DATA

✓ 2016
WATER
USE

✓ 2017
EMBAYMENT
MONITORING

IMPLEMENTATION

Actions taken relative to plan and project implementation and regulatory and town meeting actions.

PROJECT STATUS

Reduction Project Remediation Project Restoration Project Pilot project

Project Stage

Captains Golf Course Fertilizer Reduction

IMPLEMENTATION

Captains Golf Course Fertigation

IMPLEMENTATION

On-site Denitrification Systems

FEASIBILITY

LOCAL REGULATORY ACTIONS

✓ Fertilizer By-Law in Place

Zoning Changes

None in reporting period

Adoption of Regulations

None in reporting period

TOWN IMPLEMENTATION ACTIONS

Implementation Actions reflect unfunded municipal actions such as, inter-municipal agreements, procedural approvals, and committee actions.

None in reporting period

FUNDING

Actions taken during the reporting period to secure funding for water quality improvement plans and projects.

✓ Cape Cod and Islands Water Protection Fund Member Community

Town Funding Actions

- ✓ 2021 Professional services for MS4 stormwater permitting and compliance (\$80,000 Approved)
- ✓ 2021 Walkers Pond Water Quality Evaluation (\$40,000 Approved)
- ✓ 2021 Pleasant Bay Fertilizer Impact Assessment at Captains Golf Course (\$140,000 Approved)
- ✓ 2021 Integrated Water Resources Planning and Implementation (\$75,000 Approved)

Grant Funding

None in reporting period

* From Town Snapshot: grant funds reflect a decrease of \$20k from the 2020 report, as a grant was previously duplicated.

SYMBOL LEGEND

✓ Complete or Approved Partial Not Shared or Not Approved Not Available

OTHER LEGEND

Progress shown is for the period from November 2020 through November 2021

Text color indicates that data made available is 5 years or older