State of the Waters: Cape Cod

2019 Cape Cod Water Health Report

Association to Preserve Cape Cod

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1. Introduction

The **State of the Waters: Cape Cod** is an assessment of the Cape's water quality, designed to help you understand the water quality problems that we face and the actions that are needed to address these problems. The Association to Preserve Cape Cod (APCC) launched this project in 2019 in order to answer the question: "How healthy are Cape Cod's waters?" This website is the place to find out about the Cape's water quality and what can be done to address water pollution and achieve clean water.

For this multi-year project, APCC collected existing data on water quality on Cape Cod for the purpose of determining the health of Cape Cod's waters. APCC evaluated water quality in coastal waters (saltwater), freshwater ponds and lakes, and public drinking water supplies. APCC used existing methods to score water quality and used the scores to distinguish between degraded surface waters where immediate action is needed to improve water quality vs. surface waters with acceptable quality where ongoing protection is needed to avoid any decline in quality. The results are summarized in this annual water health report. To guide public action, APCC prepared a Water Action Plan that contains recommendations for changes in policies, actions, and regulations to improve and protect our waters.

2. Why this project is needed

APCC is well-positioned to provide this Cape-wide assessment of our water quality. Since our inception in 1968, APCC has worked with numerous partners to protect and improve the Cape's water resources and aquatic habitat through policy, science, and education. APCC's successes include:

- Designation of Cape Cod's groundwater as a sole source aquifer to protect our drinking water;
- Designation of the ocean waters around Cape Cod as state ocean sanctuaries;

- Designation of Stellwagen Bank as a National Marine Sanctuary;
- Passage of the Cape Cod Land Bank Act to preserve open space;
- Creation of the Cape Cod Water Protection Collaborative to address water pollution due to wastewater;
- Passage of the Cape Cod Commission Act to create a regional planning agency and promote regional planning;
- Designation of the ocean waters surrounding Cape Cod as a No Discharge Area for boat sewage;
- Coordination of Congressional approval and funding of the Cape Cod Water Resources Restoration Project, a 10-year Cape-wide restoration program to restore impaired salt marsh and fish runs and shellfish beds;
- Assistance to towns on efforts to restore salt marsh and fish runs and remediate stormwater runoff throughout the Cape;
- Coordination of a regional stormwater partnership;
- Establishment of programs to monitor salt marsh, herring runs and harmful cyanobacteria blooms;
- Evaluation of the effect of future sea level rise on the Cape's aquifer; and
- Passage of legislation creating and funding the Cape and Islands Water Protection Trust Fund.

APCC recognized that while the Cape's waters are well-studied and pollution issues are well-documented, this wealth of information on water quality is usually buried in reports, studies and websites and is not readily available in one place. More importantly, the data are often not translated into clear, easily understood results. Too often, reports that contain gold nuggets of information are mired in complex terminology understood only by experts.

3. Goals

APCC's first annual State of the Waters: Cape Cod is intended to plainly and clearly inform the public about the conditions of our waters. APCC collected water quality data from credible sources and translated the data into clear, easily understood terms to identify water quality problems that need to be addressed. Our goals are to: 1) Help people to understand the health of our waters and the need to protect and improve water quality; 2) Identify the actions needed to protect and improve water quality; and 3) Motivate public action to achieve clean water.

4. Products

APCC has produced the following products for the State of the Waters, available through this website:

- Interactive maps of water quality scores and grades for coastal embayments, ponds, and drinking water supplies;
- Information on how water quality data were evaluated, scored and graded;
- 2019 Water Health Report summarizing findings;

- Water Action Plan containing recommendations for actions to protect and improve water quality;
- Frequently Asked Questions (FAQs); and
- References and sources of information.

5. Partners and collaboration

Collaboration with partners is an essential feature of the State of the Waters: Cape Cod, as the project involves a gathering-in and summation of water quality data from many organizations. Partners also provide advice, support, funding, information, and networking.

Advisory Committee: To help advise this project, APCC convened an Advisory Committee composed of experts in Cape Cod's water pollution issues, water monitoring, drinking water, aquatic ecosystems, fisheries, natural resource management and municipal management. Members represent local, regional and state agencies, environmental non-profit organizations, and partnerships. Advisory Committee members provide advice, guidance, and data used in this project. Members of the Advisory Committee are listed below:

- Rachel Jakuba, Ph.D., Science Director, Buzzards Bay Coalition
- Erin Perry, Deputy Director, Cape Cod Commission
- Tim Pasakarnis, Ph.D., Water Resources Analyst, Cape Cod Commission
- Richard Delaney, President, Center for Coastal Studies
- Amy Costa, Ph.D., Director of Cape Cod Bay Monitoring Program, Center for Coastal Studies
- Robert Duncanson, Ph.D., Director, Department of Natural Resources, Town of Chatham
- Jane Crowley, Director, Department of Health and Environment, Town of Eastham
- Ivan Valiela, Ph.D., Distinguished Scientist, Ecosystems Center, Marine Biological Laboratory
- Javier Lloret, Ph.D., Research Scientist, Ecosystems Center, Marine Biological Laboratory
- Andrew Marks, Supervisor, Mashpee Water District
- Pam DiBona, Executive Director, Massachusetts Bays National Estuary Program
- Prassede Vella, Staff Scientist, Massachusetts Bays National Estuary Program
- Todd Callaghan, Coastal and Marine Scientist, Massachusetts Office of Coastal Zone Management
- Brad Chase, Diadromous Fisheries Project Leader, Massachusetts Division of Marine Fisheries
- Brian Howes, Ph.D., Chancellor Professor, School for Marine and Atmospheric Sciences and Technology (SMAST), University of Massachusetts at Dartmouth
- Ed Eichner, TMDL Solutions
- Jordan Mora, Research Technician, Waquoit Bay National Estuarine Research Reserve
- R. Max Holmes, Ph.D., Deputy Director and Senior Scientist, Woods Hole Research Center

Sources of data: For this project, APCC relies upon water quality data collected by other organizations (see Sources of Water Quality Data, below).

Funding: APCC received funding for this project from a number of sources. They include the Massachusetts Environmental Trust (MET), an important supporter of environmental projects and funded by the sale of environmental license plates through the Registry of Motor Vehicles. Additional funding was provided by a U.S. Environmental Protection Agency Southeast New England Coastal Watershed Restoration Program (SNEP) grant to the Cape Cod Commission, the Friendship Fund, the Cape Cod 5 Foundation, and APCC dues and donations.

6. About APCC

The Association to Preserve Cape Cod (APCC) is a 501(c)3 environmental non-profit organization founded in 1968 to promote policies and programs that foster preservation of Cape Cod's natural resources. APCC is a Cape-wide organization with members representing all 15 towns on the Cape. Our goals include protection of water and wetlands; preservation of open space; promotion of responsible, planned growth; and the achievement of an environmental ethic. To achieve these goals, we provide technical assistance, outreach, advocacy, science-based policies and partnership-building. APCC has emerged as the Cape's environmental leader, earning a reputation for effective policies and actions to protect our precious natural resources (http://www.apcc.org).

7. Why we need clean water

Clean water is central to the health of the Cape's natural ecosystems. Our coastal waters, estuaries, and embayments support valuable shellfish such as oysters and clams, as well as important finfish such as winter flounder and striped bass. Waterbirds, migrating waterfowl, raptors and wildlife feed on fish, shellfish and aquatic plants. Freshwater ponds and streams support numerous fish and wildlife species, including important diadromous species such as river herring and American eels which live in both fresh water and the ocean. The Cape's ecosystems and food web depend upon clean water.

Clean water is also important for our economy. The Cape's economy is a "blue economy" where our residents, visitors and businesses rely upon clean water and healthy natural resources. The economic benefits of clean water and healthy ecosystems are demonstrated by the fact that coastal tourism and commercial and recreational fishing and shellfishing and their supporting industries bring in more than $1 billion to the local economy. For example, in 2017 tourists visiting Cape Cod spent $1.1 billion that supported 10,300 tourism-related jobs and $317.5 million in wages, and generated $122 million in state and local taxes (Cape Cod Chamber of Commerce, http://www.whycapecod.org/stats.html).

Commercial and recreational fishing and shellfishing also bring in additional millions of dollars each year. For example, from 2000 – 2004, the average annual value of commercial and recreational shellfishing was $11.4 million. In 2009 alone the value of commercial fishing was $19 million, while the value of commercial fishing for species that eat river herring was over $37 million (NRCS, Cape Cod Water Resources Restoration Project, Why It Matters to

Massachusetts Economy, https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_013852.pdf). These numbers do not include water-focused organizations such as oceanographic institutions and businesses, non-governmental organizations, educational institutions and laboratories which employ people and provide services and products.

Finally, clean drinking water is critically important for our health. The water we drink comes from Cape Cod's sole-source aquifer, a vast underground natural reservoir of groundwater. Federal, state and local laws are designed to protect a sole-source aquifer from pollution. However, as we discuss below, our groundwater, ponds, lakes, estuaries and embayments are all interconnected.

8. Waters of the Cape

Cape Cod enjoys a wealth of water resources. These include salt water and fresh water resources. Each major resource is summarized below. More information can be obtained at the Cape Cod Commission's website on water resources (http://www.capecodcommission.org/departments/technicalservices/water).

Coastal waters (saltwater) surround most of the Cape, creating over 559 miles of coastline bordering the Atlantic Ocean, Nantucket Sound, Vineyard Sound, Buzzards Bay, and Cape Cod Bay. This long coastline contains 53 distinct saltwater **embayments**, places where there is a recess or indentation in the coastline that forms a bay bordering the ocean. **Estuaries** are places where rivers meet the sea. Estuaries typically contain a range of wetlands including freshwater, brackish and tidal wetlands (aka salt marshes) and tidal channels. On Cape Cod, rivers, streams and groundwater flow into estuaries and embayments which border the ocean.

Freshwater ponds and lakes: Few people know that the Cape is the land of (nearly) a thousand lakes. At least 996 freshwater ponds and lakes cover nearly 11,000 acres and individual ponds and lakes range in area from less than one acre to 735 acres and include 166 "great ponds" of 10 acres or greater in size. Because the Cape's ponds and lakes are fed by groundwater, they are often referred to as "windows on our aquifer". The sandy soils of the Cape allow groundwater to flow into and out of ponds. For this reason, pollution of ponds will likely also pollute groundwater, and vice versa.

Groundwater: Groundwater is the lifeblood of the Cape. Rain and melting snow quickly soak into our sandy soils where it collects to form a huge underground reservoir of groundwater that lies beneath most of the Cape. Water seeks the lowest elevation, so groundwater continues to move, seeking sea level, flowing into and out of ponds, feeding streams and flowing towards the coast, finding sea level when it enters our estuaries and embayments.

Groundwater is also the sole source of our **drinking water** and for that reason it is designated as Cape Cod's **sole-source aquifer**. Most public water suppliers use groundwater wells for drinking water. Even the Cape's only surface water source (Long Pond in Falmouth) is fed by groundwater. Cape Cod's groundwater has been designated by the U.S. EPA as a sole-source drinking water aquifer to be protected from pollution.

Watersheds connect our waters: Nearly all of the Cape's waters are connected by watersheds that collect water and discharge it into the ocean. Watersheds are the land areas that collect rain and snow which drains into ponds, lakes, streams, and groundwater, which in turn discharge into estuaries, embayments and the ocean. Cape Cod has a total of 101 watersheds that discharge to the ocean. Of these, 53 discharge to embayments which are susceptible to nitrogen pollution, and the remainder discharge directly to the ocean. The Cape Cod Commission has developed descriptions of the Cape's **watersheds** and what is being done to protect and improve water quality **(http://www.capecodcommission.org/index.php?id=625&maincatid=491).**

Hydrological cycle: The Cape receives about 45 inches per year of rain and melting snow. About 60 per cent of this precipitation soaks into the ground to replenish groundwater. Most of the remaining 40 per cent evaporates into the atmosphere where it provides moisture for storms that provide rain and snow (see below). A small amount runs off as stormwater runoff along the surface of the land (aka stormwater runoff). Due to the sandy soils, this runoff generally soaks into the sand and replenishes the aquifer. However, when runoff flows from roads, parking areas and fertilized lawns directly into wetlands or water, pollutants from these developed areas can enter the water. Stormwater pollutants can include fertilizers, bacteria, soil particles, metals, and de-icing compounds.

Groundwater is used up (depleted) when we withdraw it for drinking water and when it flows into ponds, streams, embayments and into the ocean. Ponds, streams and wetlands lose water due to evaporation, and trees also "breathe" water back into the air in a process called "evapotranspiration". All of this evaporated water is not truly "lost"; instead it is critically important for feeding water back into the atmosphere to grow storms that produce rain and snow. Groundwater is replenished by rain and melting snow which soak into the ground, beginning the hydrological cycle all over again.

9. Water pollution

Most of the Cape's coastal embayments and many freshwater ponds and lakes are suffering from water pollution, based on years of studies and reports on water quality and water pollution. These studies and reports indicate that the Cape's waters suffer from pollution due to the following pollutants and pollution sources.

Nutrient pollution: Excess nutrients (nitrogen in coastal waters and phosphorus in fresh water) have caused severe eutrophication and severe ecological damage. **Eutrophication** refers to the harmful effects of excess nutrients on an aquatic ecosystem, resulting in increased growth of phytoplankton and depletion of oxygen. Excess nutrients in water stimulates the growth of phytoplankton (microscopic algae), which depletes the water of oxygen. Oxygen depletion leads to fish kills and impacts on shellfish and other aquatic life. Excess phytoplankton also causes water to become cloudy, reducing the amount of light in the water column, which impacts the growth of other beneficial aquatic plants such as eelgrass. When algae die their remains settle to the bottom and decompose, causing more oxygen depletion and releasing nutrients back into the water, feeding the nutrient cycle. Also, the buildup of decaying organic matter on the bottom of

ponds, lakes, and embayments often results in thick muck that is unhealthy for shellfish, fish and other aquatic organisms.

Many of the Cape's estuaries and embayments are suffering from eutrophication caused by excess nitrogen, as demonstrated by the Massachusetts Estuaries Project **[https://www.mass.gov/guides/the-massachusetts-estuaries-project-and-reports** and http://www.smast.umassd.edu/Coastal/research/estuaries/estuaries.html] and by the 208 Water Quality Management Plan for Cape Cod [http://www.capecodcommission.org/index.php?id=506&maincatid=491].

Ponds and lakes are also suffering from eutrophication caused by excess phosphorus (Cape Cod Commission, Ponds and Lakes website at: http://www.capecodcommission.org/index.php?id=171&maincatid=49)

On Cape Cod, excess nutrients originate largely from human sources and activities. Excess nitrogen comes from poorly treated wastewater (e.g., Title 5 septic systems) as well as fertilizers used on lawns, gardens, golf courses and farms. Some nitrogen also falls out from the atmosphere in precipitation, and this atmospheric nitrogen largely originates from burning fossil fuels. Excess phosphorus comes from septic systems that discharge phosphorus into groundwater that enters ponds and lakes, as well as fertilizers used on lawns, gardens, golf courses and farms which is carried into ponds and lakes in stormwater runoff.

Harmful bacteria include bacteria that originate from fecal wastes (humans and/or animals). Examples of fecal bacteria are *Escherichia coli (E. coli)*, and enteric bacteria. Fecal bacteria can cause illness in both humans and animals. On Cape Cod, most fecal bacteria contamination originates from domestic animals and wildlife. Failed septic systems (including flooded septic systems) are another source of bacteria. Bacteria are carried into water by stormwater runoff. State and federal water quality standards limit the amount of fecal bacteria that can be present in waters where swimming and shellfishing are conducted. Swimming beach water quality is monitored by Barnstable County [https://www.barnstablecountyhealth.org/health-topics/recreational-water-quality]. The Massachusetts Division of Marine Fisheries monitors water quality in shellfish beds and limits shellfishing to waters that meet a stringent water quality standard for fecal bacteria [https://www.mass.gov/shellfish-sanitation-and-management].

Harmful algal blooms include toxic red tides in coastal waters and toxic cyanobacteria blooms in freshwater ponds and lakes. Red tide is the common name for several species of phytoplankton, including toxic dinoflagellates. Shellfish that ingest such toxic phytoplankton become toxic themselves, posing a threat to humans who eat contaminated shellfish and impacting the shellfishing industry. In fresh water, toxic cyanobacteria thrive in nutrient-rich and warm waters. APCC's **cyanobacteria monitoring program** [https://www.apcc.org/cyano/index.html] has documented cyanobacteria blooms in dozens of ponds throughout the Cape, and we anticipate this will be an increasing problem as the climate warms.

Mercury pollution occurs in waters throughout the Northeast. On the Cape the Massachusetts Department of Public Health has listed at least 24 ponds and lakes where there are fish

consumption advisories that warn people (pregnant mothers) to limit or avoid eating fish from that lake due to mercury pollution [https://www.mass.gov/info-details/eating-fish-safely-in-massachusetts]. Mercury pollution is caused by fallout of mercury from the atmosphere, which originates from combustion of coal in coal-burning fuel plants. Incineration of medical wastes and municipal wastes also contributes mercury to the atmosphere.

Emerging contaminants and pharmaceutical compounds have been found in groundwater near septic systems and in coastal waters of the Cape. This group of pollutants contains a wide variety of compounds including endocrine-disrupting compounds, pharmaceutical drugs (including antibiotics), insect repellant, flame retardant, fluorinated compounds, and PFAS Silent Spring Institute has been monitoring the Cape's waters (https://silentspring.org/news/contaminants-pervasive-cape-cods-drinking-water-supply/faqs-emerging-contaminants-cape-cod). The Center for Coastal Studies and Silent Spring Institute also found pharmaceutical compounds were also found in Cape Cod Bay and in groundwater near septic systems (-program/monitoring-projects/contaminants-of-emerging-concern/pharmaceuticals-in-the-waters-of-cape-cod-bay-and-nantucket-sound/).

PFAS (per- and polyfluoroacetate substances) are manmade chemicals used widely in diverse items (e.g., fireproof clothing, non-stick pans, stain-and-waterproof fabrics, fire-fighting foam, dental floss, cleaning products, paints, electronics manufacturing, and other industries and household products). PFAS are long-lasting compounds that have been found worldwide in humans, wildlife, water, soil, and the air. They have been linked to human health impacts such as developmental disorders, immune system disorders, thyroid hormone disruption, and cancer Information on PFAS can be found at EPA's website (https://www.epa.gov/pfas) and the Commonwealth of Massachusetts website (https://www.mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas).

10. How we graded water quality

To help people understand where water quality is acceptable vs. unacceptable, APCC has created this project and website to collect existing information on water quality and translate it into easily understood terms by grading water quality. This website is a key means of collecting and distributing information to the public. In doing so, we hope to guide public policy and investment in restoration efforts.

Using existing data, APCC graded the following water resources:

- Coastal waters in embayments and estuaries,
- Freshwater ponds and lakes, and
- Public water supplies for drinking water (i.e., drinking water after it is treated by the public water supplier and before it is distributed to consumers).

APCC used three grading systems, one system for grading coastal waters, a second system for grading ponds and lakes, and a third system for grading drinking water. Each of the grading systems scores water quality parameters, and the scores were then translated into grades. APCC chose grading systems that meet the following criteria:

- Are scientifically sound;
- Have been used before to evaluate water quality;
- Use key water quality parameters to evaluate water quality problems;
- Are easily understood and can be replicated by others (e.g., it does not require complex methods, modeling or software); and
- Evaluates the most pressing water quality problems.

The grading systems are explained below.

10.1. Grading coastal waters: the Buzzards Bay Eutrophic Index

APCC chose an existing method of grading the severity of nitrogen pollution of coastal waters. The method is called the Buzzards Bay Eutrophic Index (aka "Bay Health Index"), developed in 1992 by the Buzzards Bay National Estuary Program (http://buzzardsbay.org/technical-data/status-trends/citizen-wq-monitoring/eutroindex/). The Eutrophic Index was based on an earlier method developed by Hillsborough County, Florida, to evaluate coastal water quality.

The Buzzards Bay Eutrophic Index was developed to help the Buzzards Bay Coalition (BBC) evaluate citizen water quality monitoring data for Buzzards Bay embayments and to help rank each embayment with respect to its relative health for the purpose of prioritizing remedial management measures (https://www.savebuzzardsbay.org/bay-health/). The goal was to evaluate nitrogen loading inputs and to provide accurate and reliable water quality data for most of the major embayments around Buzzards Bay to assist environmental managers to:

- Establish baseline water quality;
- Characterize and identify sources of pollution;
- Document long-term environmental trends in water quality;
- Evaluate the relative success of cleanup efforts;
- Facilitate implementation of management efforts in the CCMP, and
- Evaluate the appropriateness of the Buzzards Bay Project's recommended nitrogen limits.

Since then, the Eutrophic Index has been used not only by the Buzzards Bay Coalition (https://www.savebuzzardsbay.org/bay-health/), but also by the Center for Coastal Studies (https://coastalstudies.org/cape-cod-bay-monitoring-program/), the Pleasant Bay Alliance, and the town of Chatham to evaluate nitrogen pollution in Buzzards Bay, Cape Cod Bay and coastal waters around the Cape, Pleasant Bay, and Chatham, and is considered by practitioners to be a well-tested method.

The Eutrophic Index scores parameters that measure the degree of eutrophication: dissolved oxygen saturation, water clarity (measured using either Secchi disk or a turbidity meter), chlorophyll, dissolved inorganic nitrogen (DIN), and total organic nitrogen (TON). Water quality data for these parameters is used to calculate a numerical score that indicates the degree of eutrophication. To translate scores into an assessment of water quality, the BBC uses three categories to "grade" scores: scores of 65 to 100 indicate Good water quality; scores between 35 and 65 indicated Fair water quality; and scores below 35 indicate Poor water quality.

Following the BBC's method, APCC calculated numerical Eutrophic Index scores for water quality from stations in coastal embayments and coastal waters around Cape Cod. However, APCC "graded" the numerical scores in a manner that differs from the BBC. APCC assigned scores to two categories based on whether they indicate acceptable water quality or unacceptable water quality. The two grading categories were chosen to indicate the type of action needed to protect or restore water quality:

> **Scores of 66 or greater are graded as: Acceptable: requires ongoing protection;**
> **Scores of 65 and below are graded as: Unacceptable: needs immediate restoration.**

Waters that are graded as "**Acceptable: requires ongoing protection**" are waters that are healthy and free of excess nutrients. These waters need ongoing protection to remain healthy and free of pollution.

Waters that are graded as "**Unacceptable: requires immediate restoration**" are waters that are suffering from excess nutrients. These waters need immediate restoration in order to improve water quality.

APCC also took the additional step of **identifying embayments where at least one monitoring station had Unacceptable water quality and graded these embayments as "Unacceptable: requires immediate restoration". Embayments where all monitoring stations had Acceptable water quality were graded as "Acceptable: requires ongoing protection".** This approach provides a clear summary of which embayments have portions with poor water quality that requires restoration vs. embayments with good water quality which requires protection.

Note: Embayments and estuaries often contain aquatic habitats that range from freshwater to brackish to salt marsh to open water bays bordering the ocean. For coastal embayments that contain salt marshes, the Buzzards Bay Coalition developed a variation of their scoring system. APCC's scoring of salt marsh systems follows the approach used by the Buzzards Bay Coalition. There is disagreement among practitioners in the field about the best system for characterizing salt marsh quality. This report relies on the method most commonly used in reporting on Cape Cod and APCC will work toward building a consensus on the best way to report on salt marshes by the time this report is updated in 2020.

10.2. Grading freshwater ponds and lakes: the Carlson Trophic Index

To grade freshwater ponds and lakes, APCC chose a scoring method that evaluates the trophic state of the water body in terms of nutrients, chlorophyll and water transparency. The **Carlson Trophic Index** was developed in 1996 to assess the trophic state of a freshwater pond or lake, where trophic state refers to the ecological response (algal biomass) to nutrients (Carlson, 1977) https://aslopubs.onlinelibrary.wiley.com/doi/epdf/10.4319/lo.1977.22.2.0361 and https://www.nalms.org/secchidipin/monitoring-methods/trophic-state-equations/).

Using the Carlson Trophic Index, a pond with high nutrient concentrations (**eutrophic to hypereutrophic**) would be characterized by high concentrations of algae, algal scums, poor water clarity due to dense algae, and low to no dissolved oxygen. A eutrophic to hypereutrophic

pond would have scores from 50 to 100. At the opposite end of the spectrum, a pond with low nutrient concentrations (**oligotrophic**) would be characterized by clear well-oxygenated water, healthy aquatic plants, and little to no algal growth. An oligotrophic pond would have scores from 0 to 40. A pond with intermediate nutrient concentrations (**mesotrophic**) would be characterized by moderately clear water, intermediate amounts of aquatic plants and algae, and low dissolved oxygen during the summer. A mesotrophic pond would have scores from 40 to 50. The Carlson Trophic Index is analogous to the Buzzards Bay Eutrophic Index in that it can be used to evaluate the degree of eutrophication in fresh water.

APCC adopted a grading system that assigns the following grades to Carlson Trophic Index scores:

> **Scores of 40 or less are graded as: Acceptable: requires ongoing protection;**
> **Scores of 41 and above are graded as: Unacceptable: needs immediate restoration.**

Waters that are graded as "**Acceptable: requires ongoing protection**" are waters that are healthy and free of excess nutrients. These waters need ongoing protection to remain healthy and free of pollution.

Waters that are graded as "**Unacceptable: requires immediate restoration**" are waters that are suffering from excess nutrients. These waters need immediate restoration in order to improve water quality.

10.3. Grading public water supplies of drinking water

The grading system for drinking water uses a method developed by the Natural Resources Defense Council (NRDC) to grade drinking water (https://www.nrdc.org/sites/default/files/whatsontap.pdf). The NRDC grading system evaluates three areas of drinking water: water quality and compliance, source water protection, and right-to-know compliance. APCC chose to evaluate water quality and compliance of public water supplies after treatment and before distribution to consumers, the so-called "finished water". This represents the underlying quality of the public water supply before it is distributed to customers, not the quality of the water as it comes out of your tap which can be affected by pipes and plumbing in the distribution system and your homes and businesses. APCC chose to evaluate public water supplies in this manner because underlying water quality represents the first line of defense in ensuring safe drinking water supplies and because many water protection measures are aimed at protecting source water quality.

11. Sources of water quality data

Cape Cod is fortunate to have many environmental organizations and agencies which have monitored water quality for many years. Over the years, hundreds of citizen scientists, local, state and federal government agencies, scientists, environmental organizations, consulting firms, and APCC interns and volunteers have collected water samples for different water quality monitoring programs. With the assistance of our Advisory Committee and partners, our sources of water quality data include the following:

- Barnstable Clean Water Coalition: Three Bays coastal water quality data, pond water quality data;
- Buzzards Bay Coalition: Eutrophic Index scores for Buzzards Bay coastal stations;
- Cape Cod Commission and University of Massachusetts at Dartmouth, School of Marine and Atmospheric Science and Technology (SMAST): PALS data for pond water quality;
- Cape Cod Commission: Center for Coastal Studies coastal water quality data collected as part of an EPA-funded program to collect and make available all water quality monitoring data for the Cape;
- Center for Coastal Studies: coastal water quality data collected by the Center's coastal monitoring program;
- Pleasant Bay Alliance: Eutrophic Index scores for Pleasant Bay coastal stations;
- Town of Eastham, Massachusetts: coastal water quality data from SMAST, PALS pond water quality data;
- Town of Chatham, Massachusetts: coastal water quality data, Eutrophic Index scores for Chatham coastal stations;
- Waquoit Bay National Estuarine Research Reserve (WBNERR): coastal water quality data for Waquoit Bay.

Types of water quality data are summarized below.

Water quality data for coastal embayments: For the 2019 report, APCC collected coastal water quality data from seven different sources: Center for Coastal Studies, Buzzards Bay Coalition, Barnstable Clean Water Coalition, Town of Chatham, Town of Eastham, Pleasant Bay Alliance, and Cape Cod Commission.

Water quality data for ponds and lakes: Since 2000 the Cape Cod Pond and Lake Stewardship program (PALS) has worked with volunteers and organizations who monitor many ponds across the Cape [http://www.capecodcommission.org/departments/technicalservices/water/ponds]. The PALS program was developed by the Cape Cod Commission, APCC, and SMAST, in coordination with organizations and towns that monitor water quality on an annual snapshot basis. Other pond associations and organizations have gathered a considerable amount of data with their member volunteers. For the 2019 report, APCC collected PALS pond water quality data collected by SMAST (provided by the Cape Cod Commission), Barnstable Clean Water Coalition, and Town of Eastham (See the **Data / Ponds tab** for the PALS database used in this assessment.

Water quality data for public water supplies: For the 2019 report, APCC collected each town's public-right-to-know reports, also known as the Consumer Confidence Reports (CCRs) for drinking water. CCRs were used to grade water quality and compliance with existing drinking water regulations. CCRs are posted on each town's website.

12. Results

Our scores and grades for coastal stations, coastal embayments, ponds and lakes, and public water supplies are provided as maps (Figures 1 through 5), tables (Tables 1 through 9) and as

read-only spreadsheets provided at APCC's State of the Waters webpage. Our findings are provided below.

Summary

More than two-thirds of coastal embayments and more than one-third of ponds are suffering from unacceptable water quality due to excess nutrients (Figures 1, 2 and 3). As most of the Cape is served by Title 5 septic systems and only small areas are served by publicly-owned wastewater treatment facilities (Figure 5), the main cause of unacceptable water quality in both coastal embayments and fresh water ponds is excess nutrients due to inadequately treated wastewater, followed by poorly treated stormwater runoff and fertilizers.

More water quality monitoring data are needed for most ponds. Only 149 (15 percent) of the 996 ponds and lakes on Cape Cod are monitored for water quality (Figure 3). APCC's Cyanobacteria Monitoring Program has been monitoring 30+ ponds and lakes for harmful cyanobacteria blooms, and most of these ponds have experienced cyanobacteria blooms this summer. Harmful cyanobacteria blooms occur in ponds when there are excess nutrients and warm temperatures, conditions which are likely to occur more frequently as climate change continues.

In contrast, 20 public water supplies in 15 towns across the Cape were all graded as excellent based on existing drinking water quality standards (Figure 4). However, emerging contaminants are of concern and need to be monitored. It is important to note that for most of these contaminants, no drinking water standards have been established. Examples include PFAS, endocrine-disrupting compounds, pharmaceuticals, and microplastics.

Detailed findings:

Embayments:

- Of the 48 embayments for which data were available, more than two-thirds (33 embayments or 69%) had Unacceptable water quality in at least a portion of the embayment and less than one-third (15 embayments or 31%) had Acceptable water quality.
- Most of the embayments with Unacceptable water quality in at least a portion of the embayment are located along the western, southern and eastern coasts of Cape Cod (Figure 2). These are generally areas where the watershed contains densely developed areas served by Title 5 septic systems and where embayments have low flushing rates.
- Most of the embayments with Acceptable water quality are located on Cape Cod Bay (a few are located on Buzzards Bay). These are generally areas where the population density is lower resulting in relatively fewer septic systems, and there is relatively more protected open space (Figure 5). Also, Cape Cod Bay has a greater tidal range (e.g., 13+ feet) than Buzzards Bay (e.g., 6+ feet) or Nantucket Sound (e.g., 5+ feet) . Greater tidal range enables more tidal flushing which means that seawater flows into and out of embayments more quickly. If pollutants are present, they will be dispersed more quickly.

Embayment stations (these are monitoring stations where water quality monitoring data were available):

- Of the 152 embayment stations which were scored, nearly two-thirds (98 stations or 64%) had Unacceptable water quality and over one-third (54 stations or 36%) had Acceptable water quality.
- In most embayments with more than one monitoring station, the stations closest to land often had lower scores (worse water quality) than stations further out to sea which tended to have higher scores (better water quality) (Figure 1).

Ponds and lakes:

- Of the 996 ponds on Cape Cod, PALS monitoring data were available for only 15% of ponds (149 ponds). Of these 149 monitored ponds, over one-third (58 ponds or 39%) had Unacceptable water quality and less than two-thirds (91 ponds or 61%) had Acceptable water quality.
- Ponds with Unacceptable water quality included both large and small ponds (Figure 3).
- Unacceptable pond grades reflect the impact of excess nutrients (phosphorus) from septic systems, fertilized lawns, and stormwater runoff.

Public water supplies (this does not include private wells):

- Drinking water grades for 20 public water supplies were Excellent, based on published Consumer Confidence Reports. These grades indicate that drinking water sources meet existing drinking water standards and that source water protection methods (e.g., wellhead area protection, watershed protection, open space protection) are working to protect water quality in terms of regulated contaminants (Figure 4).
- Consumer tap water quality was not evaluated and would require testing of the water coming out of consumers' taps as well as monitoring data from water distribution systems. Water quality coming out of the tap will be affected by the age and type of pipes in the distribution system and in consumers' homes and businesses.
- Drinking water consumers and regulators alike need to consider that there may be other unregulated contaminants affecting drinking water quality. These include:
    - PFAS in drinking water and in aquatic ecosystems, from a wide variety of sources;
    - Emerging contaminants in surface water and/or groundwater:
        - Endocrine-disrupting compounds and pharmaceuticals from inadequately treated wastewater
        - Microplastics from wastewater, stormwater runoff, and atmospheric fallout;
    - Cyanobacteria (aka blue-green algae) in freshwater ponds produce toxins that are harmful to humans and animals if ingested. Public water supplies can be contaminated by cyanotoxins, and public water suppliers elsewhere are taking precautions to guard against cyanotoxins in drinking water. APCC has been monitoring cyanobacteria since 2017 and next year we anticipate that cyanobacteria will be added to the grading system for ponds and drinking water.

Other issues of concern for water quality:

- Harmful bacteria in coastal waters and freshwater ponds, lakes and streams. These include fecal coliform bacteria and enteric bacteria that are indicators of human and/or wildlife fecal matter. Bacteria can impact swimming beach water quality and water quality in shellfish beds. Beach water quality and shellfish bed water quality are monitored by the County and state, respectively.
- Mercury contamination of surface water is of concern, based on the fact that 24 ponds and lakes on the Cape have fish consumption advisories due to the high levels of mercury. Mercury originates from atmospheric fallout of mercury emissions from fossil-fuel-burning power plants.
- Climate change is paramount. Climate change predictions for the Northeast include warmer air and water temperatures year-round; more precipitation; more intense storms; longer and warmer growing seasons coupled with shorter and warmer winters; shifts in populations of fish, wildlife and invertebrates; rising sea level; changes in groundwater elevations; more flooding; and changes in dynamic landforms such as those found on the Cape (e.g., dunes, beaches, floodplains). Many of these climate change predictions will impact water quality and exacerbate the harmful effects of existing pollutants.

"Filling the Gaps" - Recommendations for monitoring:

- Monitoring of at least five more coastal embayments is needed (Chase Garden Creek in Yarmouth, Red River in Harwich, Hatches Harbor in Provincetown, and Little Pond and Great Sippewissett Marsh in Falmouth). These embayments are listed in the 208 Water Quality Plan as coastal embayments receiving nutrients from their watersheds;
- Only 15 percent of the 996 ponds and lakes on the Cape are being monitored through the PALS program. This means that water quality in 85 percent of ponds is unknown. Pond monitoring should be expanded to many more ponds and lakes throughout the Cape, particularly those where there is public access or where sensitive living resources (e.g., diadromous fish, rare species, wildlife) are located. Pond monitoring should be conducted more frequently than the once-a-year snapshot that is typically provided by the PALS program.
- The PALS program is useful as a "screening tool" to identify ponds where more in-depth monitoring and assessment is needed to determine extent and severity of problems.
- Monitoring of pond water quality and cyanobacteria blooms should be coordinated so that water quality data can be used to help predict where serious cyanobacteria blooms may occur.
- Public water suppliers should expand their monitoring of PFAS, emerging contaminants and cyanobacteria to help safeguard public health.
- See APCC's **Water Action Plan** for more recommendations.

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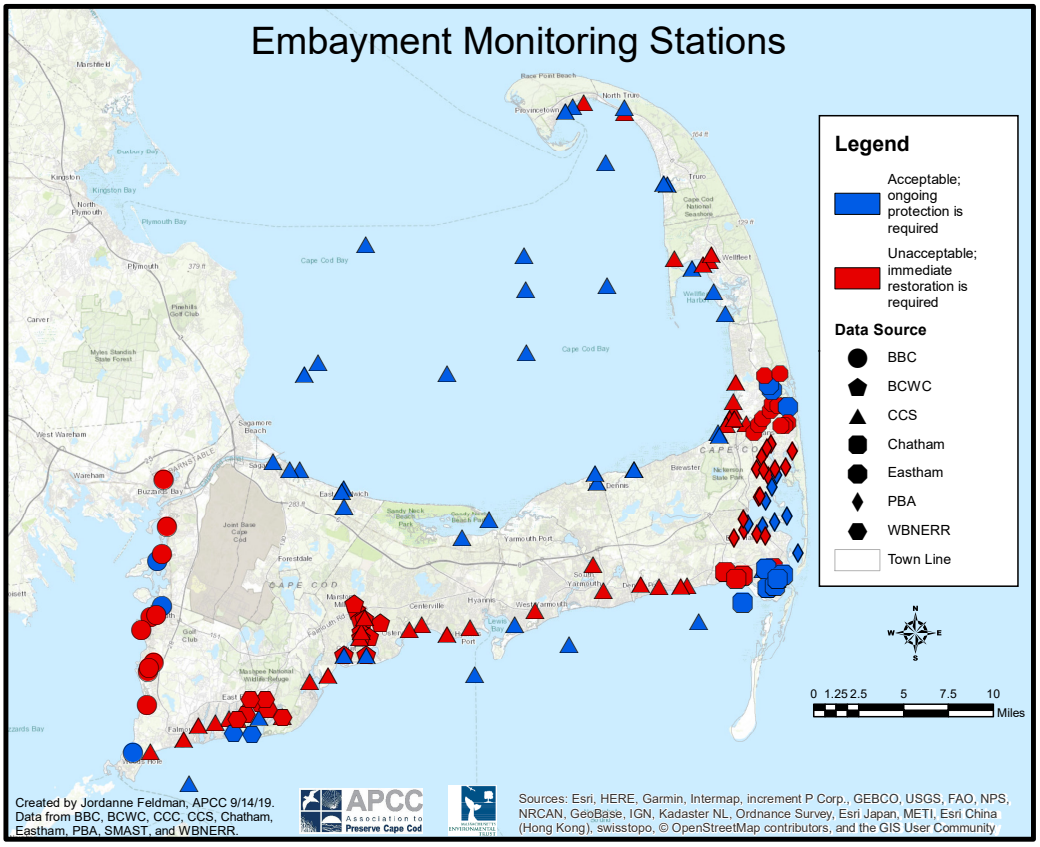

Figure 1. Water quality grades for coastal embayment stations. Water quality data were scored using the Buzzards Bay Eutrophication Index and scores were converted into grades as described in Section 10.

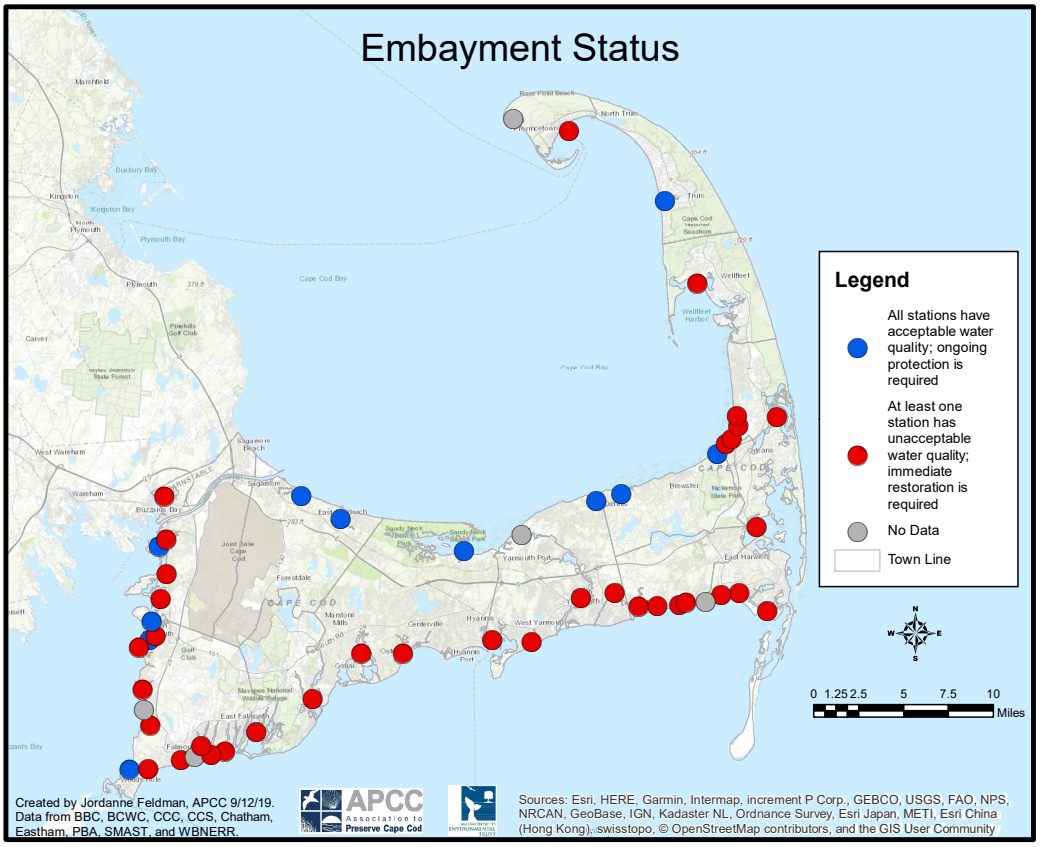

Figure 2. Water quality grades for coastal embayments. Water quality grades for individual stations in embayments were reviewed. If there was at least one station in the embayment with Unacceptable water quality, the embayment received a grade of Unacceptable: requires immediate restoration. If all stations in an embayment had Acceptable water quality, the embayment received a grade of Acceptable: requires ongoing protection.

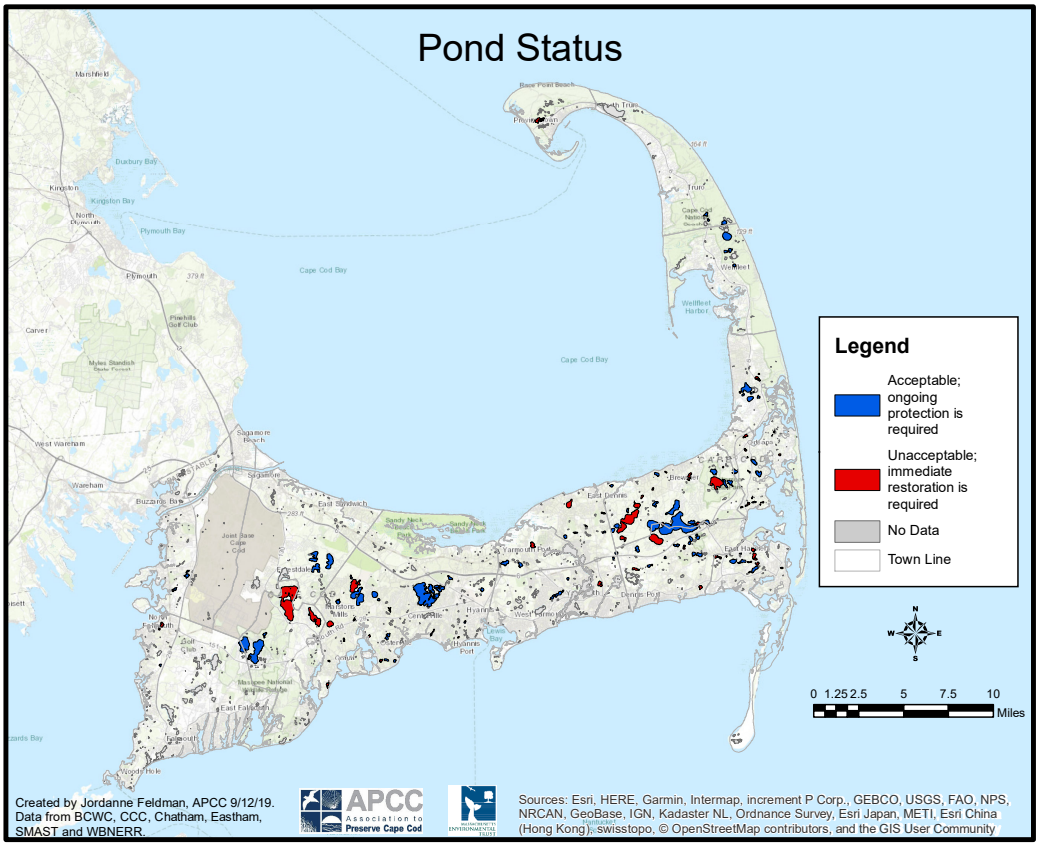

Figure 3. Water quality grades for ponds and lakes. Pond water quality data from the PALS program were scored using the Carlson Trophic Index and scores were converted into grades as described in Section 10.

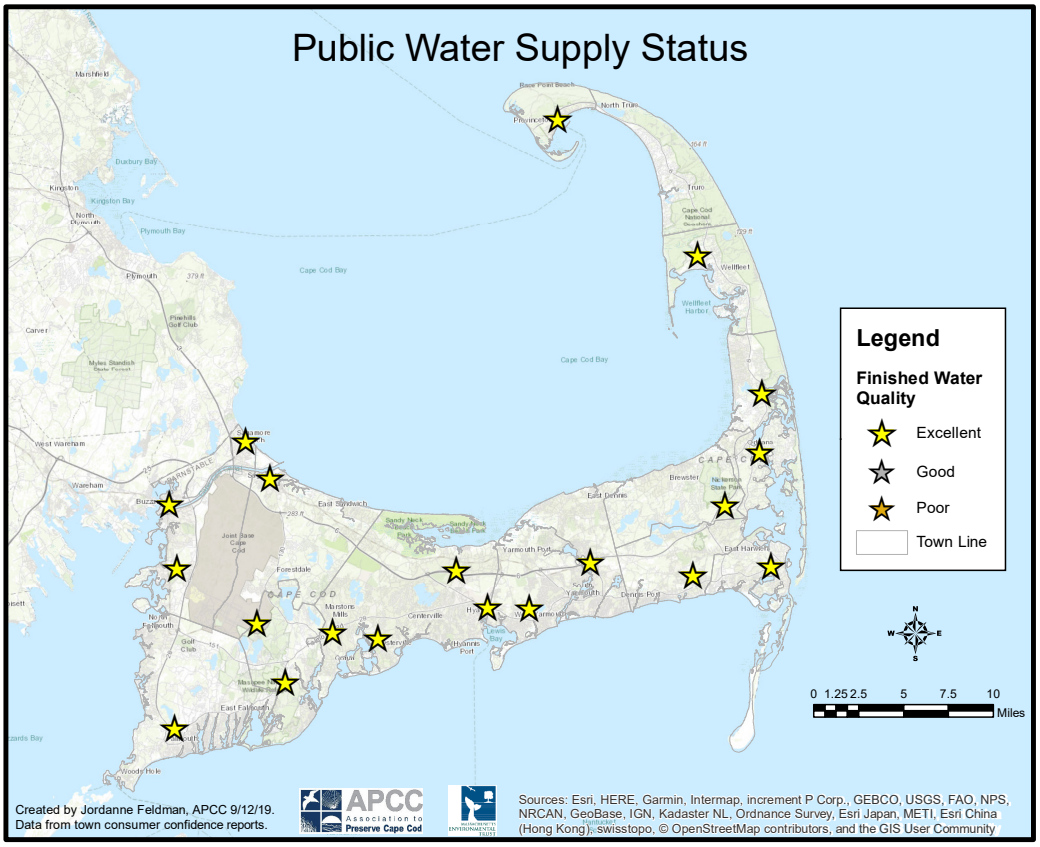

Figure 4. Water quality grades for public water supplies before distribution to consumers. Consumer Confidence Reports were used to evaluate water quality in public water supplies prior to distribution to consumers.

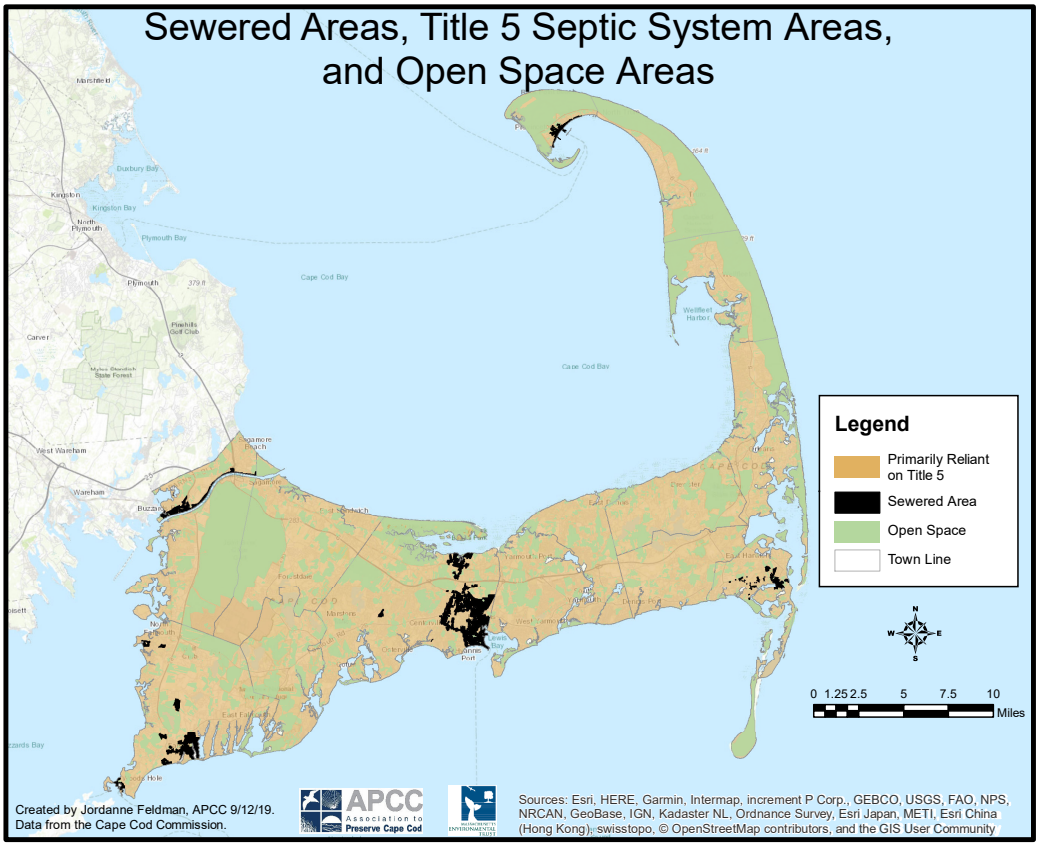

Figure 5. Map of areas served by Title 5 septic systems and publicly-owned wastewater treatment facilities and open space.

Table 1. Coastal water quality scores and grades for Cape Cod monitoring stations. Data from Center for Coastal Studies.

EUTROPHIC INDEX SCORES AND GRADES Updated: 9/26/19

Water quality data from Center for Coastal Studies

BBC Grading System Score	APCC Status
66 to 100	Acceptable; Ongoing Protection is Required
35 to 65	Unacceptable; Immediate Restoration is Required
< 35	Unacceptable; Immediate Restoration is Required

Notes: BDL (below detection limit) is assumed zero

Number	Station	Score	BBC Grading System	APCC Status	No. of Years	Years Covered	QC
535	PBh-Popponesset Bay	56.5	Fair	Unacceptable;	4	2014-2017	QC
1	5N Outer Provincetown Hbr	99.4	Excellent	Acceptable; O	5	2013-2017	QC
553	West Bay	78.3	Excellent	Acceptable; O	3	2015-2017	QC
510	Cotuit Bay	69.3	Excellent	Acceptable; O	4	2014-2017	QC
28	Inner Wellfleet Harbor	46.6	Fair	Unacceptable;	5	2013-2017	QC
2	5S Inner Boat Meadow	99.2	Excellent	Acceptable; O	5	2013-2017	QC
5	7S Herring River, Welfleet	99.5	Excellent	Acceptable; O	5	2013-2017	QC
511	CR-2 Childs River	35.4	Fair	Unacceptable;	4	2014-2017	QC
7	9N Little Namskaket	99.9	Excellent	Acceptable; O	5	2013-2017	QC
8	9S Inner Namskaket	99.5	Excellent	Acceptable; O	5	2013-2017	QC
500	B3 Bournes Pond	51.6	Fair	Unacceptable;	4	2014-2017	QC
9	Barnstable Harbor	99.3	Excellent	Acceptable; O	5	2007-2015	QC
501	BC14 Hall's Creek	64.4	Fair	Unacceptable;	4	2014-2017	QC
502	BCT-1 Centerville-E	31.0	Poor	Unacceptable;	4	2014-2017	QC
503	BCT-2 Centerville-W	45.9	Fair	Unacceptable;	4	2014-2017	QC
504	BHY-3 Lewis Bay	71.6	Excellent	Acceptable; O	4	2014-2017	QC
10	Blackfish Creek	67.5	Excellent	Acceptable; O	4	2014-2017	QC
101	Boardwalk - Sandwich	79.9	Excellent	Acceptable; O	5	2013-2017	QC
11	Boat Meadow	56.5	Fair	Unacceptable;	5	2013-2017	QC
102	Inner Boat Meadow	30.7	Poor	Unacceptable;	5	2013-2017	QC
505	BR-7 Bass River	56.2	Fair	Unacceptable;	4	2014-2017	QC
15	Canal	86.6	Excellent	Acceptable; O	5	2013-2017	QC
506	CM-10 Taylor's Pond	60.0	Fair	Unacceptable;	4	2014-2017	QC
507	CM-1A Oyster Pond, CH	76.6	Excellent	Acceptable; O	4	2014-2017	QC
508	CM-5A Mitchell River, CH	71.1	Excellent	Acceptable; O	4	2014-2017	QC
509	CM-8 Sulfur Spring, CH	65.5	Excellent	Acceptable; O	4	2014-2017	QC
16	Coast Guard	100.0	Excellent	Acceptable; O	5	2006-2010	QC
21	First Encounter	61.8	Fair	Unacceptable;	5	2013-2017	QC
129	Cole Road Brook	44.5	Fair	Unacceptable;	5	2013-2017	QC
127	Duck Creek	36.4	Fair	Unacceptable;	5	2013-2017	QC
302	Dyer Prince	50.6	Fair	Unacceptable;	5	2013-2017	QC
520	G4-Green Pond, Falmouth	47.7	Fair	Unacceptable;	4	2014-2017	QC
22	Great Island Channel	72.4	Excellent	Acceptable; O	5	2013-2017	QC
522	HAR-2 Saquatucket Harbor	41.6	Fair	Unacceptable;	4	2014-2017	QC
523	HAR-3 Wychmere Harbor, HA	46.7	Fair	Unacceptable;	4	2014-2017	QC
524	HAR-4 Allen Harbor, HA	47.1	Fair	Unacceptable;	4	2014-2017	QC
525	HAR-7 Herring River, HA	62.8	Fair	Unacceptable;	4	2014-2017	QC
105	Herring River, Welfleet	43.9	Fair	Unacceptable;	4	2013-2017	QC
23	Holiday Inn, Provincetown Hbr	58.5	Fair	Unacceptable;	5	2013-2017	QC
517	ER-2 Eel River, Falmouth	48.3	Fair	Unacceptable;	4	2014-2017	QC
24	Ice House, Provincetown Hbr	99.5	Excellent	Acceptable; O	4	2007-2010	QC
25	Inner Pamet, Pamet River, TR	78.4	Excellent	Acceptable; O	5	2013-2017	QC
26	Inner Rock Harbor	34.1	Poor	Unacceptable;	5	2013-2017	QC
27	Inner Sesuit Harbor	82.6	Excellent	Acceptable; O	5	2013-2017	QC
107	Little Namskaket	64.8	Fair	Unacceptable;	5	2013-2017	QC
30	MacMillan	96.5	Excellent	Acceptable; O	5	2013-2017	QC
131	Millway Beach	71.9	Excellent	Acceptable; O	5	2013-2017	QC
31	Namskaket	76.9	Excellent	Acceptable; O	5	2012-2016	QC
32	Old Harbor, Sandwich	91.5	Excellent	Acceptable; O	4	2007-2010	QC
36	Pamet, TR	91.1	Excellent	Acceptable; O	4	2007-2010	QC
39	Rock Harbor	53.1	Fair	Unacceptable;	5	2013-2017	QC
40	Scorton	92.7	Excellent	Acceptable; O	4	2007-2010	QC
41	Sesuit Harbor	92.7	Excellent	Acceptable; O	5	2007-2011	QC
42	Sunken Meadow	82.5	Excellent	Acceptable; O	5	2013-2017	QC
43	Wellfleet Harbor	54.6	Fair	Unacceptable;	5	2013-2017	QC
108	Namskaket	81.3	Excellent	Acceptable; O	5	2013-2017	QC
109	North Sunken Medow	46.1	Fair	Unacceptable;	3	2008-2010	QC
110	Paines Creek	69.0	Excellent	Acceptable; O	5	2012-2017	QC
114	Scorton Creek	80.1	Excellent	Acceptable; O	5	2013-2017	QC
115	Upper Namskaket, OR	40.1	Fair	Unacceptable;	5	2013-2017	QC
117	Pamet River	57.6	Fair	Unacceptable;	5	2013-2017	QC
118	Pilgrim Lake	60.3	Fair	Unacceptable;	5	2013-2017	QC
119	East Harbor	70.5	Excellent	Acceptable; O	5	2013-2017	QC
121	Old Harbor - 6A	57.8	Fair	Unacceptable;	4	2010-2013	QC
123	Old Harbor Dewey	69.8	Excellent	Acceptable; O	5	2012-2017	QC
124	Scorton Creek 6A	77.9	Excellent	Acceptable; O	5	2012-2017	QC
125	Scorton Creek Jones Lane	39.5	Fair	Unacceptable;	5	2013-2017	QC
128	Quivet Marsh	36.5	Fair	Unacceptable;	5	2013-2017	QC
130	Sesuit Creek	20.3	Poor	Unacceptable;	5	2013-2017	QC
134	Old Harbor PD	46.9	Fair	Unacceptable;	3	2015-2017	QC
303	RH-Culvert	32.6	Poor	Unacceptable;	5	2012-2017	QC
304	RH-Bend	31.6	Poor	Unacceptable;	5	2012-2017	QC
518	Falmouth Inner Habor	45.6	Fair	Unacceptable;	4	2014-2017	QC

Table 2. Coastal water quality scores and grades for Buzzards Bay. Eutrophic Index scores from the Buzzards Bay Coalition.

Buzzards Bay Eutrophic Index scores
Scores provided by Buzzards Bay Coalition

BBC Grading System Score	APCC Status
66 to 100	Acceptable; Ongoing Protection is Required
35 to 65	Unacceptable; Immediate Restoration is Required
< 35	Unacceptable; Immediate Restoration is Required

	2014	2015	2016	2017	2018	BBC	APCC Status
Back River	44	45	45	51	60	Fair	Unacceptable
Briarwood Harbor	43	47	47			Excellent	Acceptable
Buttermilk Bay	59	62	60	64	67	Excellent	Acceptable
Eel Pond, Bourne	42	42	45	46	48	Fair	Unacceptable
Fiddlers Cove	60	61	64	66	67	Excellent	Acceptable
Flume Pond	28	25				Excellent	Acceptable
Gunning Point Pond	32	30	29	29	28	Poor	Unacceptable
Hen Cove	48	51	58	67	64	Fair	Unacceptable
Herring Brook	50	52	51	53	54	Fair	Unacceptable
Little Buttermilk Bay	55	57	55	56	58	Fair	Unacceptable
Little Sippewisset Marsh	60	60	61	64	64	Fair	Unacceptable
Mashapaquit Creek	13	9	12	9	3	Poor	Unacceptable
Megansett Harbor	69	72	74	81	83	Excellent	Acceptable
Phinneys Harbor	67	66	70	75	74	Excellent	Acceptable
Pocasset Harbor Inner	58	62	58	60	60	Fair	Unacceptable
Pocasset Harbor Outer	77	77	73	76	76	Excellent	Acceptable
Pocasset River	49	52	53	57	59	Fair	Unacceptable
Quissett Harbor Inner	81	80	81	84	86	Excellent	Acceptable
Quissett Harbor Outer	86	86	85	88	90	Excellent	Acceptable
Rands Harbor	42	45	44	43	44	Fair	Unacceptable
Red Brook Harbor Inner	42	43	49	60	58	Fair	Unacceptable
Red Brook Harbor Outer	50	56	63	80	79	Excellent	Acceptable
Squeteague Harbor	55	57	57	59	59	Fair	Unacceptable
West Falmouth Harbor Head	38	37	45	50	51	Fair	Unacceptable
West Falmouth Harbor Outer	61	64	69	76	78	Excellent	Acceptable
West Falmouth Harbor Town Dock	53	56	54	59	61	Fair	Unacceptable
West Falmouth Mid-Harbor	60	61	63	67	68	Excellent	Acceptable
West Falmouth Oyster Pond	36	37	38	41	40	Fair	Unacceptable
West Falmouth Snug Harbor	26	25	26	24	24	Poor	Unacceptable
Wild Harbor Inner	53	46	48	51	55	Fair	Unacceptable
Wild Harbor Outer	75	75	77	85	87	Excellent	Acceptable
Wild Harbor River	51	57	61	67	69	Excellent	Acceptable

Table 3. Coastal water quality scores and grades for Three Bays, Barnstable. Data from Barnstable Clean Water Coalition.

Three Bays water quality Data provided by Barnstable Clean Water Coalition	BBC Grading System Score	APCC Status
	66 to 100	Acceptable; Ongoing Protection is Required
	35 to 65	Unacceptable; Immediate Restoration is Required
	< 35	Unacceptable; Immediate Restoration is Required

Name	Site Numb	Score	BBC	APCC Status	No. Years	Years	QC
Mill Pond	Site 1	26.592726	Poor	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC
South Prince's Cove	Site 2	29.14345	Poor	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC
North Prince's Cove	Site 3	33.174921	Poor	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC
Warren's Cover	Site 4	29.872517	Poor	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC
North N. Bay	Site 5	28.923454	Poor	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC
South N. Bay	Site 6	37.574417	Fair	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC
South West Bay	Site 9	50.917762	Fair	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC
South Cotuit Bay	Site 13	46.162274	Fair	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC
Cotuit Sentinel	Site 18	37.624955	Fair	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC
Old Mill	Site E	39.944449	Fair	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC
	Site RM3	30.914161	Poor	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC
	Site RM4	28.698016	Poor	Unacceptable; Immediate Restoration is Required	5	2013-2017	QC

Table 4. Coastal water quality scores and grades for Waquoit Bay. Data from Waquoit Bay National Estuarine Research Reserve (WBNERR).

Waquoit Bay Water Quality Data provided by WBNERR	BBC Grading System Score	APCC Status
	66 to 100	Acceptable; Ongoing Protection is Required
	35 to 65	Unacceptable; Immediate Restoration is Required
	< 35	Unacceptable; Immediate Restoration is Required

Site Name	Site #	Score	BBC	APCC Status	No. Years	Years	QC
Seapit River	Site 1	55.4469932	Fair	Unacceptable; Imı	5	2013-2017	QC
North Basin-WB*	Site 2	60.3130381	Fair	Unacceptable; Imı	5	2013-2017	QC
Hamblin Pond	Site 3	58.5657406	Fair	Unacceptable; Imı	5	2013-2017	QC
Jehu Pond	Site 4	63.6504929	Fair	Unacceptable; Imı	5	2013-2017	QC
Quashnet River	Site 5	43.1337535	Fair	Unacceptable; Imı	5	2013-2017	QC
Menauhant	Site 6	84.1214626	Excellent	Acceptable; Ongoi	5	2013-2017	QC
Childs River	Site 7	31.2339258	Poor	Unacceptable; Imı	5	2013-2017	QC
Eel River	Site 8	59.2342449	Fair	Unacceptable; Imı	5	2013-2017	QC
South Basin-WB*	Site 9	84.0031446	Excellent	Acceptable; Ongoi	5	2013-2017	QC

Table 5. Coastal water quality scores and grades for Nauset Estuary. Data from the Town of Eastham.

Nauset Estuary Water Quality Provided by Town of Eastham	**BBC Grading System Score**	**Status**
	66 to 100	Acceptable; Ongoing Protection is Required
	35 to 65	Unacceptable; Immediate Restoration is Required
	< 35	Unacceptable; Immediate Restoration is Required

Station ID	Score	BBC	APCC Statu	No. Years	Years	QC?
WMO25	30.92704	Poor	Unacceptal	2	2016-2017	QC
WMO26	39.41544	Fair	Unacceptal	2	2016-2017	QC
WMO27	40.45253	Fair	Unacceptal	5	2012-2017	QC
WMO28	33.54059	Poor	Unacceptal	2	2016-2017	QC
WMO29	50.72196	Fair	Unacceptal	2	2016-2017	QC
WMO30	57.23614	Fair	Unacceptal	2	2016-2017	QC
WMO31	32.71558	Poor	Unacceptal	2	2016-2017	QC
WMO32	71.6958	Excellent	Acceptable	2	2016-2017	QC
WMO33	47.08565	Fair	Unacceptal	2	2016-2017	QC
WMO34	17.9645	Poor	Unacceptal	5	2012-2017	QC
WMO35	42.29812	Fair	Unacceptal	2	2016-2017	QC
WMO36	76.17902	Excellent	Acceptable	2	2016-2017	QC
WMO37	73.45356	Excellent	Acceptable	2	2016-2017	QC
WMO38	25.39246	Poor	Unacceptal	5	2012-2017	QC
WMO39	71.11561	Excellent	Acceptable	2	2016-2017	QC
Total Average =	47.34627	Fair				

Table 6. Coastal water quality scores and grades for Pleasant Bay. Eutrophic Index scores from the Pleasant Bay Alliance.

Pleasant Bay water quality Eutrophic Index scores provided by Pleasant Bay Alliance	BBC Grading System Score	Status
	66 to 100	Acceptable; Ongoing Protection is Required
	35 to 65	Unacceptable; Immediate Restoration is Required
	< 35	Unacceptable; Immediate Restoration is Required

Station	Name	2013	2014	2015	2016	2017	Average	BBC	APCC Status
PBA-3	Inner Ryder's Cove	49.8	64.4	54.2	45.6	63.1	55.42188	Fair	Unacceptable
PBA-4	Crows Pond	64.6	71.2	60.6	61.5	85.4	68.65461	Excellent	Acceptable
PBA-5	Muddy Creek	28.4	52.9	40.3	31.8	64.1	43.50906	Fair	Unacceptable
PBA-5A	Muddy Creek - Upper	6.8	9.1	28.6	10	77.9	26.48795	Poor	Unacceptable
PBA-6	Big Bay - SW	71.6	77.3	81.6	65.6	88.1	76.83211	Excellent	Acceptable
PBA-8	Big Bay - NE	53.2	78.9	66.3	73.9	86.1	71.67857	Excellent	Acceptable
PBA-9	Round Cove	46.1	40.9	42.9	41	57.2	45.61836	Fair	Unacceptable
PBA-10	Quanset Pond	44.7	52.3	58.6	44.5	66.6	53.33521	Fair	Unacceptable
PBA-11	Paw Wah Pond	25.2	37.3	43.3	40	54.5	40.06916	Fair	Unacceptable
PBA-12	Namequoit Point - South	67.3	63.8	71	65.6	70.5	67.64048	Excellent	Acceptable
PBA-13	Namequoit Point - North	51.5	61.1	67.1	64.1	71.4	63.03134	Fair	Unacceptable
PBA-14	Areys Pond	31.9	34.9	25	19.9	43.6	31.0604	Poor	Unacceptable
PBA-15	Kescayo Gansett Pond	51.2	44.8	48.6	27.2	49.5	44.25673	Fair	Unacceptable
PBA-16	Pochet-mouth	30.7	41.3	27.1	11.7	34.0	28.95852	Poor	Unacceptable
PBA-19	Strong Island - NE	95	59.2	70.1	75.1	81.2	76.12281	Excellent	Acceptable
PBA-20	Nickerson's Neck	79.6	60.5	84.2	77.9	91.8	78.80193	Excellent	Acceptable
PBA-21	Little Pleasant Bay	69.3	74.6	69.7	72.3	79.2	73.02373	Excellent	Acceptable
WMO-3	Pochet-mouth	57.4	51.3	56.7	54.3	61.5	56.24535	Fair	Unacceptable
WMO-5	Pochet-Upper	26.9	27.6	24.6	23.2	26.7	25.80571	Poor	Unacceptable
WMO-6	Namequoit River-Upper	40.6	42.5	53.9	23.3	50.3	42.12687	Fair	Unacceptable
WMO-8	Lower River	54.9	45.3	48.5	43.7	60.4	50.55757	Fair	Unacceptable
WMO-10	Meetinghouse-Rattles dock	44.7	53.4	55.3	30.6	55.8	47.96374	Fair	Unacceptable
WMO-12	Little Quanset Pond	35.1	37.8	47.1	35.3	48.1	40.67358	Fair	Unacceptable
CM-13	Outer Ryder's Cove	38.9	59.1	72.4	63.5	76.7	62.11828	Fair	Unacceptable
					Total Average =		52.91642	Fair	Unacceptable; Immediate Restoration is Required

Table 7. Coastal water quality scores and grades for the Town of Chatham. Data from the Town of Chatham.

Town of Chatham water quality
Provided by Town of Chatham

BBC Grading System Score	APCC Status
66 to 100	Acceptable; Ongoing Protection is Required
35 to 65	Unacceptable; Immediate Restoration is Required
<35	Unacceptable; Immediate Restoration is Required

Station	Name	2013	2014	2015	2016	2017	Average	BBC	APCC Status
CM-1	Oyster Pond	58.3	60.3	48.8	47.0	63.2	55.5286	Fair	Unacceptable; Immediate Restoration is Required
CM-1A	Oyster Pond-Outer	57.8	82.5	88.3	72.0	75.5	75.21564	Excellent	Acceptable; Ongoing Protection is Required
CM-3	Outer Stage Harbor	62.8	72.4	80.7	78.4	72.2	73.28533	Excellent	Acceptable; Ongoing Protection is Required
CM-4	Inner Stage Harbor	66.9	78.2	62.4	74.3	73.0	70.95122	Excellent	Acceptable; Ongoing Protection is Required
CM-5	Mill Pond - Inner	67.3	75.6	68.1	62.1	71.3	68.8716	Excellent	Acceptable; Ongoing Protection is Required
CM-5A	Mill Pond - Outer	64.6	72.9	75.4	56.6	72.9	68.4811	Excellent	Acceptable; Ongoing Protection is Required
CM-7	Nantucket Sound	84.9	87.6	84.3	84.1	89.2	86.0315	Excellent	Acceptable; Ongoing Protection is Required
CM-8	Upper Bucks Creek	34.4	31.4	34	35.9	29.1	32.94618	Poor	Unacceptable; Immediate Restoration is Required
CM-10	Taylors Pond	23.5	36	30.4	49.0	49.0	37.57957	Fair	Unacceptable; Immediate Restoration is Required
CM-12	Lower Cockle Cove Cree	20	20.8	23.2	21.9	23.0	21.77589	Poor	Unacceptable; Immediate Restoration is Required
CM-13	Outer Ryder's Cove	38.9	59.1	72.5	63.5	76.7	62.14741	Fair	Unacceptable; Immediate Restoration is Required
PBA-1	Chatham Harbor	84.7	66.3	76.8	87.2	80.5	79.09958	Excellent	Acceptable; Ongoing Protection is Required
PBA-3	Inner Ryder's Cove	49.6	64.4	54.3	45.6	63.1	55.39194	Fair	Unacceptable; Immediate Restoration is Required
PBA-4	Crows Pond	64.4	71.2	60.7	61.5	85.4	68.63389	Excellent	Acceptable; Ongoing Protection is Required
PBA-5	Muddy Creek	28.4	53	40.4	31.8	64.1	43.54357	Fair	Unacceptable; Immediate Restoration is Required
PBA-5A	Muddy Creek - Upper	6.8	9	28.6	10.0	46.8	20.24605	Poor	Unacceptable; Immediate Restoration is Required
					Total Average =		57.48307	Fair	Unacceptable; Immediate Restoration is Required

Table 8. Pond water quality scores and grades. PALS data from SMAST and the Cape Cod Commission.

CCC_GIS_ID	Town	Pond	Years Covered	5-YEAR_AVG_TSI	APCC Status
BA-411	Barnstable	Hinckley Pond	2013-2017	58.4	Unacceptable
BA-510	Barnstable	Garretts Pond	2013-2017	42.7	Acceptable
BA-564	Barnstable	Stoney Pond	2011-2015	37.7	Acceptable
BA-565	Barnstable	Hathaway	2013-2017	36.4	Acceptable
BA-584	Barnstable	Mystic Lake	2012-2016	50.0	Unacceptable
BA-605	Barnstable	Wequaquet Lake	2007-2011	42.6	Acceptable
BA-617	Barnstable	Bearse Pond	2013-2017	45.3	Acceptable
BA-626	Barnstable	Shallow Pond	2013-2017	40.8	Acceptable
BA-640	Barnstable	Middle Pond	2012-2016	42.4	Acceptable
BA-646	Barnstable	Mary Dunn Pond	2013-2017	38.3	Acceptable
BA-664	Barnstable	Shubael Pond	2013-2017	42.7	Acceptable
BA-668	Barnstable	Hamblin Pond	2012-2016	44.7	Acceptable
BA-691	Barnstable	Round Pond	2013-2017	46.3	Acceptable
BA-694	Barnstable	Muddy Pond	2009-2013	45.4	Acceptable
BA-719	Barnstable	Lumbert Mill Pond	2013-2017	38.1	Acceptable
BA-746	Barnstable	Mill Pond	2013-2017	47.1	Acceptable
BA-756	Barnstable	Aunt Bettys Pond	2009-2013	40.6	Acceptable
BA-759	Barnstable	Lovells Pond	2013-2017	52.1	Unacceptable
BA-782	Barnstable	Red Lily Pond	2009-2013	50.4	Unacceptable
BA-795	Barnstable	Lake Elizabeth	2013-2017	45.2	Acceptable
BA-797	Barnstable	Micah Pond	2011-2015	32.0	Acceptable
BA-802	Barnstable	Bog Pond	2012-2016	50.3	Unacceptable
BA-806	Barnstable	Schoolhouse Pond	2013-2017	65.7	Unacceptable
BA-807	Barnstable	Joshua Pond	2013-2017	31.4	Acceptable
BA-815	Barnstable	Eagle Pond	2013-2017	36.3	Acceptable
BA-874	Barnstable	Neck Pond	2013-2017	34.7	Acceptable
BA-875	Barnstable	Parker Pond	2013-2017	57.6	Unacceptable

BA-878	Barnstable	Crystal Lake	2013-2017	44.1	Acceptable
BA-881	Barnstable	Lewis Pond	2013-2017	53.2	Unacceptable
BA-914	Barnstable	Rushy Marsh Pond	2011-2015	59.6	Unacceptable
BO-538	Bourne	Lily Pond	2004-2008	45.9	Acceptable
BO-556	Bourne	Flax Pond	2004-2008	31.0	Acceptable
BO-644	Bourne	Red Brook Pond	2004-2008	46.2	Acceptable
BR-1028	Brewster	Cliff Pond	2012-2016	51.6	Unacceptable
BR-162	Brewster	Owl Pond	2009-2013	57.5	Unacceptable
BR-168	Brewster	Flax Pond	2012-2016	40.8	Acceptable
BR-177	Brewster	Myricks Pond	2012-2016	60.0	Unacceptable
BR-179	Brewster	Cobbs Pond	2012-2016	47.2	Acceptable
BR-180	Brewster	Blueberry Pond	2012-2016	52.8	Unacceptable
BR-189	Brewster	Sols Pond	2012-2016	52.7	Unacceptable
BR-192	Brewster	Little Cliff Pond	2012-2016	38.2	Acceptable
BR-194	Brewster	Higgins Pond	2012-2016	36.4	Acceptable
BR-202	Brewster	Eel Pond	2005-2009	48.9	Acceptable
BR-205	Brewster	Schoolhouse Pond	2012-2016	58.8	Unacceptable
BR-225	Brewster	Smith Pond	2012-2016	54.7	Unacceptable
BR-240	Brewster	Sheep Pond	2012-2016	39.7	Acceptable
BR-245	Brewster	Lower Mill Pond	2012-2016	61.0	Unacceptable
BR-248	Brewster	Griffiths Pond	2012-2016	46.2	Acceptable
BR-269	Brewster	Canoe Pond	2012-2016	42.3	Acceptable
BR-272	Brewster	Upper Mill Pond	2012-2016	54.8	Unacceptable
BR-279	Brewster	Long Pond	2010-2014	49.5	Acceptable
BR-299	Brewster	Cahoon Pond	2012-2016	35.4	Acceptable
BR-305	Brewster	Greenland Pond	2012-2016	37.7	Acceptable
BR-313	Brewster	Walkers Pond	2012-2016	64.8	Unacceptable
BR-314	Brewster	Smalls Pond	2012-2016	51.9	Unacceptable
BR-316	Brewster	Black Pond	2012-2016	50.2	Unacceptable

BR-321	Brewster	Slough Pond	2012-2016	41.2	Acceptable
BR-335	Brewster	Pine Pond	2012-2016	38.0	Acceptable
BR-357	Brewster	Elbow Pond	2012-2016	52.7	Unacceptable
HA-306	Brewster	Seymour Pond	2012-2016	49.3	Acceptable
CH-396	Chatham	Stillwater Pond	2012-2016	52.7	Unacceptable
CH-425	Chatham	Trout Pond	2004-2008	36.4	Acceptable
CH-428	Chatham	Lovers Lake	2012-2016	51.2	Unacceptable
CH-439	Chatham	Minister Pond	2012-2016	55.8	Unacceptable
CH-440	Chatham	Mill Pond	2012-2016	52.0	Unacceptable
CH-458	Chatham	Goose Pond	2012-2016	40.2	Acceptable
CH-463	Chatham	Schoolhouse Pond	2012-2016	38.1	Acceptable
CH-479	Chatham	Barclay Pond	2004-2008	60.8	Unacceptable
CH-481	Chatham	Ryders Pond	2012-2016	46.5	Acceptable
CH-484	Chatham	Marys Pond	2004-2008	53.2	Unacceptable
CH-491	Chatham	Emery Pond	2012-2016	51.3	Unacceptable
CH-516	Chatham	White Pond	2012-2016	48.2	Acceptable
CH-524	Chatham	Black Pond East	2004-2008	59.6	Unacceptable
CH-543	Chatham	Blue Pond	2004-2008	42.7	Acceptable
CH-550	Chatham	Black Pond West	2004-2008	42.0	Acceptable
DE-201	Dennis	Coles Pond	2012-2016	36.3	Acceptable
DE-236	Dennis	Scargo Lake	2012-2016	50.2	Unacceptable
DE-281	Dennis	Cedar Pond	2010-2014	43.8	Acceptable
DE-325	Dennis	Northern Simmons Pond	2012-2016	35.7	Acceptable
DE-342	Dennis	Bakers Pond	2010-2014	33.8	Acceptable
DE-348	Dennis	Run Pond	2012-2016	47.8	Acceptable
DE-355	Dennis	Flax Pond	2012-2016	42.5	Acceptable
DE-447	Dennis	Eagle Pond	2012-2016	39.4	Acceptable
DE-597	Dennis	Fresh Pond	2012-2016	60.7	Unacceptable
EA-100	Eastham	Jemima Pond	2011-2015	42.7	Acceptable

EA-101	Eastham	Widow Harding Pond	2012-2016	46.2	Acceptable
EA-102	Eastham	Muddy Pond	2011-2015	50.0	Acceptable
EA-103	Eastham	Herring Pond	2012-2016	45.3	Acceptable
EA-91	Eastham	Molls Pond	2012-2016	47.5	Acceptable
EA-92	Eastham	Ministers Pond	2012-2016	55.4	Unacceptable
EA-93	Eastham	School House Pond	2012-2016	57.9	Unacceptable
EA-95	Eastham	Great Pond	2012-2016	47.1	Acceptable
EA-98	Eastham	Bridge Pond	2012-2016	54.0	Unacceptable
EA-99	Eastham	Depot Pond	2012-2016	47.0	Acceptable
FA-761	Falmouth	Cedar Lake	2003-2007	52.3	Unacceptable
FA-780	Falmouth	Trout Pond	2003-2007	50.2	Unacceptable
FA-893	Falmouth	Crocker Pond	2010-2014	48.3	Acceptable
HA-353	Harwich	Hinckleys Pond	2008-2012	59.2	Unacceptable
HA-354	Harwich	Hawksnest Pond	2008-2012	34.6	Acceptable
HA-358	Harwich	Walkers Pond	2008-2012	42.7	Acceptable
HA-376	Harwich	Aunt Edies Pond	2004-2008	39.1	Acceptable
HA-381	Harwich	Cornelius Pond	2004-2008	51.9	Unacceptable
HA-386	Harwich	Robbins Pond	2008-2012	42.2	Acceptable
HA-414	Harwich	White Pond	2004-2008	39.0	Acceptable
HA-416	Harwich	John Josephs Pond	2008-2012	36.6	Acceptable
HA-420	Harwich	Bucks Pond	2008-2012	46.4	Acceptable
HA-442	Harwich	Andrews Pond	2004-2008	37.1	Acceptable
HA-507	Harwich	Flax Pond East	2008-2012	39.2	Acceptable
HA-525	Harwich	Sand Pond	2008-2012	51.5	Unacceptable
HA-629	Harwich	Skinequit Pond	2008-2012	67.6	Unacceptable
MA-1039	Mashpee	Mashpee-Wakeby Pond	2012-2016	53.2	Unacceptable
MA-634	Mashpee	Mashpee-Wakeby Pond	2012-2016	56.5	Unacceptable
MA-718	Mashpee	Santuit Pond	2012-2016	58.2	Unacceptable
MA-793	Mashpee	Moody Pond	2009-2013	37.8	Acceptable

MA-808	Mashpee	Ashumet Pond	2012-2016	46.0	Acceptable
MA-818	Mashpee	Johns Pond	2012-2016	44.7	Acceptable
OR-113	Orleans	Ice House Pond	2012-2016	43.9	Acceptable
OR-122	Orleans	Cedar Pond	2012-2016	71.2	Unacceptable
OR-123	Orleans	Reubens Pond	2012-2016	78.3	Unacceptable
OR-136	Orleans	Bolands Pond	2012-2016	62.4	Unacceptable
OR-142	Orleans	Uncle Harveys Pond	2012-2016	60.9	Unacceptable
OR-147	Orleans	Kettle Pond	2010-2014	69.1	Unacceptable
OR-153	Orleans	Crystal Lake	2012-2016	45.2	Acceptable
OR-167	Orleans	Bakers Pond	2012-2016	38.3	Acceptable
OR-174	Orleans	Gould Pond	2012-2016	46.4	Acceptable
OR-176	Orleans	Pilgrim Lake	2012-2016	46.3	Acceptable
OR-203	Orleans	Wash Pond	2005-2009	58.2	Unacceptable
OR-228	Orleans	Uncle Israels Pond	2012-2016	66.2	Unacceptable
OR-247	Orleans	Twinings Pond	2012-2016	44.4	Acceptable
OR-249	Orleans	Sarahs Pond	2012-2016	62.4	Unacceptable
OR-253	Orleans	Shoal Pond	2012-2016	59.8	Unacceptable
OR-256	Orleans	Meadow Bog Pond	2012-2016	58.5	Unacceptable
OR-262	Orleans	Deep Pond	2012-2016	52.9	Unacceptable
OR-264	Orleans	Uncle Seths Pond	2012-2016	52.6	Unacceptable
PR-28	Provincetown	Clapps Pond	2006-2010	54.6	Unacceptable
SA-409	Sandwich	Spectacle Pond	2006-2010	40.6	Acceptable
SA-431	Sandwich	Lawrence Pond	2008-2012	39.9	Acceptable
SA-504	Sandwich	Triangle Pond	2008-2012	43.9	Acceptable
TR-48	Truro	Great Pond	2009-2013	34.0	Acceptable
TR-52	Truro	Snow Pond	2009-2013	39.3	Acceptable
TR-53	Truro	Slough Pond	2005-2009	36.2	Acceptable
WE-59	Wellfleet	Gull Pond	2005-2009	39.5	Acceptable
WE-65	Wellfleet	Long Pond	2007-2011	34.0	Acceptable

WE-76	Wellfleet	Duck Pond	2012-2016	37.8	Acceptable
YA-371	Yarmouth	Tom Matthews Pond	2005-2009	56.4	Unacceptable
YA-472	Yarmouth	Dennis Pond	2012-2016	40.0	Acceptable
YA-492	Yarmouth	Greenough Pond	2012-2016	43.8	Acceptable
YA-569	Yarmouth	Flax Pond	2012-2016	42.2	Acceptable
YA-657	Yarmouth	Long Pond	2012-2016	42.8	Acceptable

Table 9. Public water supply scores and grades.

Public water supply grades

ID	Year	Grade	Score	Latitude	Longitude	Consumer Confidence Report
Barnstable	2018	Excellent	95	41.637364	-70.390412	https://tobweb.town.barnstable.ma.us/Departments/watersupply/News_and_Updates/C.O.M.M-Drinking-Water-Quality-Report.pdf
Barnstable F	2018	Excellent	95	41.691585	-70.305312	http://www.barnstablefiredistrict.com/wp-content/uploads/CCR-2018-1.pdf
Bourne	2018	Excellent	95	41.695299	-70.60582	http://bournewaterdistrict.com/reports/BWD_CCR2018.pdf
Buzzards Ba	2018	Excellent	95	41.747107	-70.613397	https://www.buzzardsbaywaterdistrict.com/student-life?lightbox=dataItem-j2vwm4bw
North Sagarr	2017	Excellent	95	41.797504	-70.530402	https://docs.wixstatic.com/ugd/3cea34_7200362c486c45b6b12f0e2c2d21ce99.pdf
Otis	2017	Excellent	95	41.65091	-70.520445	https://www.dcms.uscg.mil/Portals/10/DOL/BaseCapeCod/BCC%20Environmental/2018%20Water%20Quality%20Report.pdf?ver=2019-07-16-135712-553
Brewster	2018	Excellent	95	41.740402	-70.015269	http://records.brewster-ma.gov/weblink/0/doc/106026/Page1.aspx
Chatham	2018	Excellent	95	41.690799	-69.966547	https://www.chatham-ma.gov/sites/chathamma/files/uploads/ccr_-_2018.pdf
Cotuit	2017	Excellent	95	41.642862	-70.438897	http://3wu0r2vavr91ojzun2xnfoc4-wpengine.netdna-ssl.com/waterdepartment/files/2018/02/CCR-2017.pdf
Dennis	2018	Excellent	95	41.696396	-70.160876	https://www.denniswater.org/sites/dennismawater/files/uploads/ccr2018_for_annual_report.pdf
Eastham	2018	Excellent	95	41.83035	-69.973168	https://www.eastham-ma.gov/sites/easthamma/files/pages/2018-townofeastham-web.pdf
Falmouth	2018	Excellent	95	41.566794	-70.609927	http://www.falmouthmass.us/DocumentCenter/View/6183/2018-Consumer-Confidence-Report---Falmouth
Harwich	2018	Excellent	95	41.68413	-70.050651	http://www.harwichwater.com/assets/CCR/2018%20Harwich%20CCR.pdf
Hyannis	2017	Excellent	95	41.661114	-70.272168	https://town.barnstable.ma.us/Departments/watersupply/Reports_and_Regulations/Hyannis-Water-System-Quality-Report-2017.pdf?tm=9/10/2019%2011:08:15%20PM
Mashpee	2018	Excellent	95	41.602791	-70.490523	http://www.mashpeewaterdistrict.com/waterquality/Mashpee%20Water%20Qual%20Rpt%201-16%20REV.pdf
Orleans	2018	Excellent	95	41.782569	-69.97669	https://www.town.orleans.ma.us/sites/orleansma/files/pages/ma001033-1_wr.pdf
Provincetowr	2018	Excellent	95	42.054058	-70.188757	https://www.provincetown-ma.gov/ArchiveCenter/ViewFile/Item/21954
Sandwich	2017	Excellent	95	41.76764	-70.504489	https://www.sandwichwater.com/SANDWICH-CCR-2018.pdf
Truro	2018	Excellent	95			Shares with Provincetown
Wellfleet	2016	Excellent	95	41.941909	-70.03993	https://www.wellfleet-ma.gov/sites/wellfleetma/files/file/file/2016-wellfleetmunicipal.pdf
Yarmouth	2018	Excellent	95	41.659972	-70.227188	http://www.yarmouth.ma.us/DocumentCenter/Home/Index/50