

# FY19 Cape Cod Comprehensive Coastal Water Quality Monitoring Program

## Introduction

On behalf of the Cape Cod Water Protection Collaborative (Collaborative), the Cape Cod Commission (Commission) seeks funding to continue to support a comprehensive water quality monitoring program for Cape Cod. The requested funds will support the continued collection of water quality monitoring data in Cape Cod Bay, Nantucket Sound, Vineyard Sound and eastern Buzzards Bay, further develop the monitoring database and user interface, automate data analysis and illustrate trends on regular intervals, and support data interpretation and integration into local water quality plans.

This request is directly related to the mission of the Collaborative, which is to protect Cape Cod's shared water resources by promoting and supporting coordinated, cost effective and environmentally sound development and implementation of local water quality initiatives, including, but not limited to watershed management plans required by section 208 of the Federal Clean Water Act. The Commission is responsible for updating and maintaining the Area Wide Water Quality Management Plan (Cape Cod 208 Plan) pursuant to section 208.

The Cape Cod 208 Plan recommended establishment of a regional water quality monitoring program and data warehouse and identifies the Cape Cod Commission as the agency responsible for monitoring and maintaining regionally-consistent data sets that are freely accessible to the public. Since 2014, Barnstable County, through the Collaborative, has supported monitoring – first in Nantucket Sound and subsequently expanded, in 2016, to Buzzards Bay and Cape Cod Bay. The data collected as part of this program provides valuable baseline data on nutrients, water temperature, salinity, dissolved oxygen concentration, chlorophyll and turbidity for Cape Cod's surrounding coastal waters. The Commission utilized funds provided by the State to develop the infrastructure and web-based interface needed to support the monitoring database.

As identified in the Cape Cod 208 Plan, monitoring is key to decision-making and adaptive management, as Cape Cod communities pursue solutions for managing nitrogen from wastewater and improving coastal water quality. Groundwater, ponds, streams, estuaries and coastal waters are all showing signs of degradation. Groundwater carries nitrogen and other nutrients and contaminants, primarily from septic systems that are used by 85% of Cape Cod's residential and commercial development, to coastal embayments. Excess nitrogen causes algae growth and depletes dissolved oxygen, resulting in loss of eelgrass, degraded fish and shellfish habitat and visibly unpleasant conditions in most of the region's most treasured coastal resource areas.

Cape Cod will need to spend billions of dollars in the coming years on new wastewater and water quality management projects to reduce the flow of nitrogen into its surrounding waters. While it is necessary to maintain and make available information on the efficacy of the range of technologies and approaches communities might use to improve water quality, it is also essential to monitor the waters to track change over time. A continuous database of monitoring data will allow for trend analyses and the evaluation of the overall condition of the coastal waters surrounding Cape Cod. By collecting and maintaining this data, the region establishes baseline conditions in the water bodies and can better

determine if the projects implemented are resulting in positive change and a better understanding of technology performance. Both technology performance data and embayment water quality data are necessary for decision making. It is also essential to provide the database infrastructure necessary to maintain data and make it easily understood and publicly accessible. More work is needed to translate data into trends and interpret and integrate monitoring results into local planning efforts. Investing in a monitoring program will support local planning efforts and help communities and the region better understand the impact of both traditional and non-traditional technologies on the health of coastal ecosystems.

## Purpose and Goals

The Commission and Collaborative are seeking funds to continue collecting, maintaining, analyzing and interpreting data needed for local water quality planning and decision-making. The water quality monitoring that requires continued support has been conducted by the Center for Coastal Studies (CCS) pursuant to a contract with Barnstable County and in collaboration with partner agencies and organizations. The Center and their partners collect data on nutrients (nitrogen and phosphorus), water temperature, salinity, dissolved oxygen concentrations, chlorophyll and turbidity for the waters of Nantucket Sound, Cape Cod Bay, and Buzzards Bay. The data provides a basis for the long-term assessment of the efficacy of wastewater and water quality management efforts across Cape Cod, supporting each of the 15 communities of Barnstable County.

The Commission maintains an estuarine water quality monitoring database that includes historical data collected by CCS, Buzzards Bay Coalition (BBC), and UMass Dartmouth School for Marine Science and Technology (SMAST). This database must be used hand-in-hand with technology performance data, which the Commission maintains and makes available in a water quality technologies database.

The goals and objectives of the project are to:

- Conduct a water quality monitoring program in Nantucket Sound, Cape Cod Bay and Buzzards Bay that provides baseline data on hydrography, nutrients, and other elements.
- Support technology projects that will result in additional and better data and an improved understanding of performance.
- Provide data that will enable scientists and decision makers to track changes, analyze trends, and evaluate the overall condition of coastal embayments in Nantucket Sound, Cape Cod Bay and Buzzards Bay.
- Contribute accurate, unbiased science that can be used to guide decision-makers in cleaning up coastal waters.
- Network with Cape and Islands organizations with similar interests in water quality to promote data sharing and education and outreach.
- Increase public awareness of the importance of preserving water quality and the actions they can take to help eliminate pollution.

## Project Tasks

CCS, in partnership with BBC, and in collaboration with the Waquoit Bay National Estuarine Research Reserve (WBNERR), Barnstable Clean Water Coalition (BCWC), Harwich Natural Resources Department, Jones River Watershed Association, and trained citizen scientists, will collect water samples and in-situ water quality data from 185 stations located in the coastal waters of Cape Cod Bay, Nantucket Sound, and eastern Buzzards Bay. Twenty-seven stations are located in offshore waters and the remaining are

located in the coastal embayments, ponds and estuaries on Cape Cod. Thirty-six stations are identified sentinel stations by the Massachusetts Estuaries Project. Most stations will be sampled bi-weekly, May-October, with a select subset sampled year-round. The samples will be analyzed for key indicators of environmental health, including total nitrogen, nitrate, nitrite and ammonia, phosphorus, chlorophyll, turbidity, temperature, salinity and dissolved oxygen, consistent with previous years of the program. Sample Analyses will be conducted by the Center's Water Quality Laboratory and the Marine Biological Laboratory in Woods Hole.

To support a better understanding of technology performance and inform annual updates to the water quality technologies database, the Commission and the Collaborative will support studies, pilot projects and monitoring related to a range of reduction, remediation and restoration technologies. Data will be collected in a format that can be utilized in a publicly accessible database and will be made available through the water quality technologies database.

### Sample Collection and Analysis

#### *Preparation of Volunteers and Collaborating Institutions*

CCS will provide training in field safety and sampling protocols to volunteers and staff from collaborating organizations that will be involved in the Cape Cod Bay and Nantucket Sound field work. Sampling supplies (sample containers, filters, field equipment) will be distributed at this time. BBC will provide a similar service for the volunteers working in Buzzards Bay and Vineyard Sound.

#### *Water Quality Sample Collection*

Water quality data and samples for analyses of water quality parameters will be collected from stations located throughout Cape Cod Bay, Buzzards Bay and Nantucket Sound and the embayments, creeks, and ponds along the shoreline of Cape Cod from stations that have historically been sampled by CCS and BBC as well as sentinel stations established by the Massachusetts Estuaries Project (MEP).

CCS staff will sample all offshore stations in Cape Cod Bay and Nantucket Sound using one of their research vessels. Stations located closer to the shoreline will be sampled either by kayak or by small boat. Many stations are accessible from shore by wading in or sampling from a dock. CCS staff will work with volunteers to cover these locations. CCS will also partner with the Natural Resources Department of the Town of Harwich to sample the four designated sentinel stations within Harwich Town waters; with Three Bays Preservation to sample five stations within the Three Bays system including the one identified as a sentinel station; with Waquoit Bay National Estuarine Research Reserve to sample ten stations located within Waquoit Bay and its surrounding watershed; and with the Jones River Watershed Association to sample two stations within the Jones River watershed.

BBC will sample the stations located on the eastern shore of Buzzards Bay and within Vineyard Sound, including those identified as sentinel stations by the MEP. These stations will be sampled by BBC staff and trained volunteers.

Sampling Schedule: Samples from tidal embayments, harbors, coastal ponds, creeks, and estuaries will be collected during the outgoing tide, targeting mid to late ebb flow (3-5 hours after high tide). Sampling of the offshore waters of Cape Cod Bay, Nantucket Sound and Vineyard Sound is not tidal dependent. Sampling frequency and duration will, at a minimum, reflect what has been done historically at these stations. (Details on sampling schedule and parameters for each monitoring station are part of an agreement between CCS and Barnstable County, dated May 3, 2017)

## Deliverables

- Coordinated effort among CCS, BBC and other Cape and Islands organizations to conduct water quality monitoring
- Network of trained volunteers and staff in proper field collection protocols
- Collection of environmental data and water samples for analysis (approximately 2000 total samples collected)

## *Water Quality Sample Analyses*

The methods for analysis of water quality parameters are discussed in detail in the CCS Laboratory Quality Assurance (QA) Plan, which has been approved by DEP, CZM, and EPA. The BBC will work in close partnership with the Ecosystems Center at the Marine Biological Laboratory (MBL) for sample analyses also using a QA Project Plan that is approved by DEP and EPA. Methods of analysis used by CCS and MBL are similar, ensuring that the laboratory results for all samples will be comparable.

## Deliverables

- Analysis of all water samples using standardized protocols approved by DEP (approximately 2000 samples analyzed)

## *Project Management, Data Synthesis and Reporting*

Reporting of water quality data that has gone through a quality assurance/ quality control protocol will be submitted to the County point of contact in spreadsheet format for use and review following the format outlined in the County's 2017 Request for Proposals and consistent with the CCS contract with Barnstable County dated May 3, 2017. A Water Quality Technical Memorandum will be submitted along with the data. The Tech Memo will include data synthesis, summary graphics and comparisons to existing TMDLs previously established by the Massachusetts Estuaries Project for the sentinel stations included in this monitoring effort. All data collected and analyzed by CCS will also be made available online in both graphic and tabular format via the website [www.capecodbay-monitor.org](http://www.capecodbay-monitor.org).

## Deliverables

Data Sets will be annotated and aggregated as follows:

- A notes page with the following documentation:
  - GPS coordinates for all sampling stations;
  - Definitions for all terms; and
  - Conversion of micro-Moles (p.M.) to milligrams per liter (mg/L) for nitrogen species (nitrate+nitrite, ammonium, total nitrogen), phosphorus species (ortho-phosphate and total phosphorus) and particulate organic carbon (POC).
- Confirmation of the standard conversion factors currently being used for the overall water quality monitoring programs:
- Summarization of the source data in each column, including:
  - If the value is a direct measurement;
  - Where measurement is made (field/lab);
  - Field sampling equipment and technique (particularly for DO), laboratory used for analysis, laboratory method and instrumentation used, and the instrument's limit of detection;
  - Filter size and standard method used for particulates;

- If the value is calculated, what calculations are performed; and
- If applicable, comments as to why SOPs were not utilized and details concerning alternative methodology used.
- Aggregation of data into existing data sets provided under a previous contract with the County
- Publication of all data on the publicly accessible website [www.capecodbay-monitor.org](http://www.capecodbay-monitor.org).

### Data Management and Analysis

The Commission and the Collaborative will continue to support the efforts of municipalities and other monitoring organizations to collect additional water quality monitoring data in locations not sampled as part of the CCS effort and performance monitoring data on non-traditional technologies. Ongoing data management and maintenance will allow for the best available information to be publicly accessible.

#### *Water Quality Data Integration*

Water quality data collected from across Cape Cod will continue to be inventoried and entered into the established regional water quality monitoring database. Support for sample collection at stations in embayments that have historically been sampled will be provided to communities currently planning or implementing water quality improvement projects.

#### *Deliverables*

- An update-to-date monitoring database
- Collection and analysis of environmental data and water samples delivered consistent with the data collected and delivered by CCS

#### *Technology Performance Data*

Investigation and implementation of a range of reduction, remediation and restoration technologies will result in performance data that will be integrated into the water quality technologies matrix in future annual updates. Support for hydrogeologic investigations, pilot project implementation, and associated performance data collection will be provided to communities considering the use of non-traditional technologies.

#### *Deliverables*

- Technical memos documenting results of investigations and project implementation
- Technology specific performance data
- An up-to-date water quality technologies matrix

#### *Compliance Reports*

Data described above, in combination with other relevant data sources, will be incorporated into annual compliance reports, per the recommendations of the 2017 208 Plan Implementation Report. One report will be developed for each town and will serve as a progress update on water quality initiatives, including status of project implementation, funding, collaborative efforts, impact on water quality, and other factors.

#### *Deliverables*

- 15 town-specific compliance reports

## Funding Request

State funds totaling \$250,000 will be utilized to fund the water quality data collection component of the monitoring program, as outlined below. Also outlined below is a match in the amount of \$250,000 to continue work on the data management and analysis tasks as well as dissemination of information to local officials and the public.

Task	Requested Funds	Match
Preparation of Volunteers and Collaborating Institutions	\$5,572	
Water Quality Sample Collection	\$114,863	
Water Quality Sample Analyses	\$55,130	
Project Management, Data Synthesis and Reporting	\$33,768	
Subcontract to BBC (includes 5% contracted overhead)	\$40,667	
Water Quality Data Integration		\$100,000
Technology Performance Data		\$150,000
<b>Total</b>	<b>\$250,000</b>	<b>\$250,000</b>