



**AGENDA  
SELECT BOARD  
MONDAY, FEBRUARY 12, 2024  
WAQUOIT MEETING ROOM  
MASHPEE TOWN HALL  
16 GREAT NECK ROAD NORTH  
MASHPEE, MA 02649**

**\*Broadcast Live on Local Cable Channel 8\***

**Streamed Live on the Town of Mashpee Website: <https://www.mashpeema.gov/channel-8>**

**6:30 p.m. Convene Meeting in Open Session**

**PLEDGE OF ALLEGIANCE**

**MOMENT OF SILENCE**

**MINUTES**

Discussion and Approval of the Following Minutes: Monday, January 22, 2024 Regular Session

**APPOINTMENTS & HEARINGS**

- Discussion and Approval of the Following Special Event:  
Annual Easter Egg Hunt: Mashpee Community Park; Saturday, March 30, 2024 10 am – 12 pm:  
*Recreation Department*
- Discussion and Approval of Non-Renewal of Aquaculture Grant #014; Michael Ronhock:  
*Department of Natural Resources*
- Mashpee Water Quality Monitoring Program Update: *Ed Eichner, TMDL Solutions, School of Marine Science and Technology (SMAST) University of Massachusetts Dartmouth*
- Community Development Block Grant Update: *Michaela Wyman-Colombo*
- Discussion and Possible Approval of the Waquoit Bay Nitrogen Load Allocation Intermunicipal Agreement between the Towns of Falmouth, Mashpee, and Sandwich
- Public Comment

**COMMUNICATIONS & CORRESPONDENCE**

**NEW BUSINESS**

- Town Manager's Fiscal Year 2025 Budget Recommendations
- Discussion and Approval of Accepting the Following Resignation:  
Zoning Board of Appeals; Associate Member (Term Expires June 30, 2025): *Bradford Pittsley*

**ADDITIONAL TOPICS**

(This space is reserved for topics that the Chair did not reasonably anticipate would be discussed)

**LIAISON REPORTS**

**WATER QUALITY UPDATES**

**TOWN MANAGER UPDATES**

**EXECUTIVE SESSION**

**ADJOURNMENT**

**MASHPEE TOWN CLERK  
FEB 8 '24 PM 1:33**



**AGENDA**  
**SELECT BOARD**  
**MONDAY, JANUARY 22, 2024**  
**WAQUOIT MEETING ROOM**  
**MASHPEE TOWN HALL**  
**16 GREAT NECK ROAD NORTH**  
**MASHPEE, MA 02649**

**\*Broadcast Live on Local Cable Channel 8\***

**Streamed Live on the Town of Mashpee Website: <https://www.mashpeema.gov/channel-8>**

**6:30 p.m. – Convene Meeting in Open Session**

**PLEDGE OF ALLEGIANCE**

**MOMENT OF SILENCE**

**MINUTES**

Discussion and Approval of the Following Minutes: Monday, January 8, 2024 Regular Session

**APPOINTMENTS & HEARINGS**

- 6:35 pm Public Hearing – Application of Dune Brothers LLC dba Dune Brothers, 2 North Street, Space 28A.101, Mashpee, MA 02649, Nicholas Gillespie, Manager, for a new §12 Annual All Alcoholic Beverages Restaurant License.
- Discussion and Approval of Application of Dune Brothers LLC dba Dune Brothers, 2 North Street, Space 28A.101, Mashpee, MA 02649, Nicholas Gillespie, Manager, for a new §12 Annual All Alcoholic Beverages Restaurant License.
- *Department of Public Works Director Catherine Laurent:*
  - Stormwater Management Update
  - Discussion and Approval of Rescinding the Regulatory Speed Limit on Quinaquisset Avenue
- Presentation and Update on Status of the Construction of the Wastewater Treatment Facility: *GHD, Weston & Sampson*
- Discussion and Approval of License Agreement between the Town of Mashpee and NStar Electric Company d/b/a Eversource Energy at 380 Asher's Path – UG#10341/010-020, Mashpee, MA (WO#12451684 – Riser Pole #283/1.5)
- Discussion and Approval Appointment of Alternate Member of the Cape Cod Municipal Health Group: *Benefits Administrator Robin Callaghan (Replaces Tracy Scalia)*
- Certification of the Hiring Process of Police Officer: *Hugh Ahearn*
- Discussion and Approval of Select Board Policy #082 – Flag Policy
- Public Comment

**COMMUNICATIONS & CORRESPONDENCE**

**NEW BUSINESS**

- Interviews, Discussion and Possible Approval of Appointments to the Following:
  - Council on Aging:  
*Elizabeth Kugell (Term Expires June 30, 2026)*
  - Community Preservation Committee:  
*Judith MacDougall, Edward Schmuhl, Karen Yetra*  
*Three (3) candidates for Two (2) Member at Large Positions Expiring June 30, 2024*
- Discussion and Approval of the Following Resignation: Capital Improvement Program Committee:  
*Edmund Sarno (Member at Large, Term Expires June 30, 2024)*

**ADDITIONAL TOPICS**

(This space is reserved for topics that the Chair did not reasonably anticipate would be discussed)

**LIAISON REPORTS**

**WATER QUALITY UPDATES**

**TOWN MANAGER UPDATES**

**EXECUTIVE SESSION/ADJOURNMENT**

Mashpee Select Board  
Minutes  
January 22, 2024

---

Present: Selectman John J. Cotton, Selectman Thomas F. O'Hara, Selectman Carol A. Sherman,  
Selectman David W. Weeden, Selectman Michaela A. Wyman-Colombo  
Town Manager Rodney C. Collins  
Assistant Town Manager Wayne E. Taylor

Meeting Called to Order by Chairman Cotton at 6:31 p.m.  
Mashpee Town Hall, Waquoit Meeting Room

## MINUTES

Monday, January 8, 2024 Regular Session:

**Motion made by Selectman Weeden to approve the Regular Session minutes of Monday, January 8, 2024 as presented.**

**Motion seconded by Selectman Sherman.**

**VOTE: 5-0. Unanimous.**

**Roll Call Vote:**

Selectman Cotton, yes

Selectman O'Hara, yes

Selectman Sherman, yes

Selectman Weeden, yes

Selectman Wyman-Colombo, yes

Opposed, none

## APPOINTMENTS & HEARINGS

Application of Dune Brothers LLC dba Dune Brothers, 2 North Street, Space 28A.101, Mashpee, MA 02649, Nicholas Gillespie, Manager, for a new §12 Annual All Alcoholic Beverages Restaurant License;  
Discussion and Approval of Application of Dune Brothers LLC dba Dune Brothers, 2 North Street, Space 28A.101, Mashpee, MA 02649, Nicholas Gillespie, Manager, for a new §12 Annual All Alcoholic Beverages Restaurant License;

The Select Board acting as the Licensing Authority for the Town of Mashpee opened the Public Hearing on the application of Dune Brothers, LLC d/b/a Dune Brothers, 2 North Street, Space 28A.101, Mashpee, Nicholas Gillespie, Manager, for a new §12 Annual All Alcoholic Beverages Restaurant license.

The premise is described as 1,152 sq. ft., one floor located within the Mashpee Commons shopping plaza. The interior includes (8) bar seats, twenty table seats, and (5) window seats for outdoor dining. Thirty-four (34) seats for outdoor dining, two bathrooms, kitchen and walk-in cooler. Two entrances and two egresses.

In accordance with posting procedures, the Hearing notice was read into the record. Nicholas Gillespie, Manager was in attendance with representing counsel Christopher Kirrane to review the license request with the Select Board and interested public.

Mashpee Select Board  
Minutes  
January 22, 2024

---

## **APPOINTMENTS & HEARINGS**

Application of Dune Brothers LLC dba Dune Brothers, 2 North Street, Space 28A.101, Mashpee, MA 02649, Nicholas Gillespie, Manager, for a new §12 Annual All Alcoholic Beverages Restaurant License; Discussion and Approval of Application of Dune Brothers LLC dba Dune Brothers, 2 North Street, Space 28A.101, Mashpee, MA 02649, Nicholas Gillespie, Manager, for a new §12 Annual All Alcoholic Beverages Restaurant License; (continued)

Attorney Kirrane indicated Mr. Gillespie is well qualified for the restaurant business. Mr. Gillespie operates a similar restaurant; a raw bar concept in the City of Providence, RI. All servers would be tipped certified. Mashpee Commons is a desirable area for another restaurant. Outdoor seating is planned in the front of the building and along the side area of the former Color Me Mine site.

Leah Gillespie, a resident of the Town of Mashpee will be the designated on-site manager in the absence of Nicholas Gillespie.

Schematics of the proposed layout of the facility was reviewed. Discussion followed with respect to the outdoor seating as it relates to safety and handicap access and egress. The design depicts an array of planters along the boundary of the building serving as a barrier for safety and to delineate the seating array defining the entrance and egress. The outdoor dining concept is noted to be like that of Estia, the nearby Greek restaurant.

When asked if the owner would be hiring locally it was affirmed. In addition to local hires, Mr. Gillespie will be working with small boat fishermen, and the Cape Cod Alliance to ensure all seafood is caught on Cape Cod. With final approval from the ABCC it is anticipated the restaurant would open in late spring. Being no public comment, the Select Board motioned as follows;

**Motion made by Selectman Sherman to close the Public Hearing.**

**Motion seconded by Selectman O'Hara.**

**VOTE: 5-0. Unanimous.**

**Roll Call Vote:**

Selectman Cotton, yes	Selectman O'Hara, yes	Selectman Sherman, yes
Selectman Weeden, yes	Selectman Wyman-Colombo, yes	Opposed, none

**Motion made by Selectman Sherman to approve the application of Dune Brothers, LLC d/b/a Dune Brothers, 2 North Street, Nicholas Gillespie, Manager for a new Annual All Alcoholic Beverages Restaurant License.**

**Selectman Weeden motioned to amend the license to address the Select Board's concerns with regards to defining the entrance/egress along the handicap area outside.**

**Selectman Wyman-Colombo seconded the amendment.**

**VOTE: 5-0. Unanimous.**

**Roll Call Vote:**

Selectman Cotton, yes	Selectman O'Hara, yes	Selectman Sherman, yes
Selectman Weeden, yes	Selectman Wyman-Colombo, yes	Opposed, none



Mashpee Select Board  
Minutes  
January 22, 2024

---

## **APPOINTMENTS & HEARINGS**

Department of Public Works Director Catherine Laurent:

Stormwater Management Update:

Catherine Laurent, Director of Public Works was in attendance with Garbielle Belfit of Tighe & Bond to review the Town's Asset Management Plan, a part of the EPA's Small MS4 Stormwater Program. The MS4 refers to Municipal Separate Storm Sewer System which includes all drainage within municipally owned areas. Stormwater is one of the fastest types of pollution in Massachusetts.

Mashpee's Stormwater Program (SWMP) consists of 5 Minimum Control Measures (MCMs). This includes public education and outreach, public involvement and participation, illicit discharge detection and elimination program, construction site stormwater runoff control, stormwater management in new development and redevelopment and good housekeeping and pollution prevention. The Town in permit year 5 is required to address the MCMs each year. Ms. Belfit indicated the Town of Mashpee has successfully addressed the permit year requirements.

Ms. Belfit stated there is one additional area that needs to be addressed by the Town of Mashpee. There is a need to address water quality; Total Maximum Daily Loads (TMDLs) and the number of water bodies impaired. The TMDL and impaired water body requirements and supplemental BMPs include; annual timed messages on nutrient pollution related topics, stormwater management Best Management Practices (BMPs) optimized for nitrogen and phosphorus removal, good housekeeping SOPs for Town properties and street sweeping twice per year. All base are requirements have been met.

A map of the TMDL waterbodies was reviewed to depict the discharge outfalls, areas of impairment, and TMDL assignments. Ms. Belfit indicated there is need to specifically focus efforts on nutrient pollution, leaf litter, fertilizer and the management of house, waste distributed.

Activities completed in permit year 5 include; annual requirements, impaired waters/TMDL requirements and good housekeeping requirements.

The BMP Retrofit Inventory Report, an activity completed in PY5 included phosphorus source ID requirements, pollutant load optimization for new and redevelopment and Ashumet & Santuit Pond impairment requirements. Five sites are selected for conceptual retrofit design. This includes the Attaquin Park deep sump catch basin, the Quashnet elementary bioretention basin, the Town Archive sediment forebays, the DPW and the Mashpee Kids Klub. As the Town moves forward to PY6 it is required the list of 5 sites selected for the conceptual retrofit design be ongoing. If one is implemented, another project from the inventory would be added to the list.

It was noted that Town owned sites have been identified on Ashumet Pond and within the Santuit Pond watershed. Additionally, all culverts have been inspected and analyzed for risk of failure and expense to develop the top retrofit locations.

Mashpee Select Board  
Minutes  
January 22, 2024

---

## **APPOINTMENTS & HEARINGS**

Department of Public Works Director Catherine Laurent:

Stormwater Management Update: (continued)

Discussion followed with respect to the 5 sites selected for conceptual retrofit design. The designs at present are conceptual, and not final. It was noted the Attaquin Park deep sump catch basin would capture the contaminants within the stormwater to eliminate runoff in the outflow. The design in a solid structure would capture, remove and dispose of contaminants with the cleaner water moving in the process for release or for infiltration.

The Town is also looking at large parking areas leaching into catch basins to obtain the most benefit from treatment options tying into public education. This includes the Quashnet Elementary and the DPW listed in the 5 sites, as well as the DNR building and other Town owned properties.

Santuit Pond through the Department of Natural Resources and its MVP grant has been reviewing projects for retrofit.

Activities planned for permit year 6 include; annual MS4 general permit reporting, complete the AM program, BMP nutrient removal, tracking and annual DPW staff training.

The expiration of this program in 2022 does not affect the Town's ability to apply for grants. The permit is valid, and it is administratively continually as it carries over in a 10-year compliance. Participation can leverage grant funding. The Town is working with the state to finalize designs for the parking lots. Permits are anticipated to be filed in the early spring. With grant funds it is anticipated that work would begin in the summer or early fall.

There is concern with respect to the significant rain events, as it relates to runoff from private properties. There is a need to further educate the public. Practices to curb water flow may include French drains, bio-retention, snow removal control and options for grading. Not washing leaves off a driveway would reduce pollution. The Town has information with respect to this regard on their website. In managing stormwater, new developments can be addressed with conditioned permits. General bylaws could be imposed for private areas to include parking sites and road designs, barriers in critical areas of concern.

With regards to the Mashpee River, the Town has received funding in collaboration with the Tribe and NOAA to design a restoration project as it involves this historic location. This would include engineering and review of sedimentation, improvement of flow and analysis of the culvert. Work in segments is anticipated to start at the head waters of the Mashpee River.

As the Town applies for grant funding the designation of Mashpee as an Environmental Justice community may have leverage and assist in the remediation of impaired waters.

Mashpee Select Board  
Minutes  
January 22, 2024

---

## **APPOINTMENTS & HEARINGS**

Department of Public Works Director Catherine Laurent:

Stormwater Management Update: (continued)

Of noted concern is the depression located in the front of the DPW property that could be rectified with added vegetation and a leaching system. Currently, there are leaching catch basins in this area. Although, it is not a part of the present conceptual design the vehicle parking, wash areas and fuel depot are being reviewed.

Next Monday there is a remote public meeting on the Cape Cod Commission project/MVP grant. The public is invited to participate at the January 29, 2024 meeting which begins at 6:00 p.m. Two outfall locations are being reviewed at Jehu Pond on Great Oak Road and in Monomoscoy on Amy Brown Road, the two southernmost outfalls.

Discussion and Approval of Rescinding the Regulatory Speed Limit on Quinaquisset Avenue:

Correspondence was received from Catherine Laurent, Director of Public Works dated January 16, 2024 recommending the Select Board vote to remove the speed limit of 45 mph established for Quinaquisset Avenue adopted in 1972. The Mashpee Police Department agrees with this recommendation. Town Manager Rodney C. Collins highly recommended rescinding the regulatory speed limit on Quinaquisset Avenue.

With the Select Board's approval, the road would default to the statutory speed limit of 30 mph.

**Motion made by Selectman Sherman to rescind the special Speed Regulation No. 309-A adopted on January 14, 1972 to the statutory speed limit of 30 mph (thickly settled).**

**Motion seconded by Selectman Wyman-Colombo.**

**VOTE: 5-0. Unanimous.**

**Roll Call Vote:**

<b>Selectman Cotton, yes</b>	<b>Selectman O'Hara, yes</b>	<b>Selectman Sherman, yes</b>
<b>Selectman Weeden, yes</b>	<b>Selectman Wyman-Colombo, yes</b>	<b>Opposed, none</b>

Presentation and Update on Status of the Construction of the Wastewater Treatment Facility:  
GHD, Weston & Sampson:

Members of the Select Board met with representatives from Weston & Sampson and GHD, engineers to review the progress of construction associated to the Water Resource Reclamation Facility. Due to the supply-chain issue there are anticipated delays. The project is an estimated 7.5 months off-schedule.

The original schedule of substantial completion was October 2, 2024. The timeline has been rescheduled to May 20, 2025. The delay has altered the properties to connect to system from January into April 2025 with final payment/completion to July 17, 2025. Therefore, property owners would not be required to hook up to the system until 2025. It was recommended the citizens be notified of the new lead time for connection.

Mashpee Select Board  
Minutes  
January 22, 2024

---

## **APPOINTMENTS & HEARINGS**

### Presentation and Update on Status of the Construction of the Wastewater Treatment Facility: GHD, Weston & Sampson: (continued)

The largest change order to the budget is the added process tanks. Realizing that Phase II that includes a portion of Phase I is ready for approval, the plant should be up and running before Phase II goes to bid. Phase II is intended to handle some equipment upgrades from Phase I. The equipment will be placed in areas to be constructed now. There should be no construction disruption with the added process tanks.

There is concern with respect to the equipment that is being installed in Phase I as it relates to lack of use, cold weather conditions and warranty. It was requested the contractor obtain guidance from the manufacturer to ensure the validity of the warranty. Is it two years from delivery or one year from substantial completion? It was noted the equipment/pumps would not sit idle, and would be circulated periodically in water to maintain its function.

There is disappointment the project is behind schedule. However, this is not a financial issue. Of the (3) contracts, Contract 02 and 03 are on schedule and should be completed on time. Contract 01 encountered the supply-chain delays due to major electrical gear. The contract time is approximately 60% expended.

### Discussion and Approval of License Agreement between the Town of Mashpee and NStar Electric Company d/b/a Eversource Energy at 380 Asher's Path – UG#10341/010-020, Mashpee, MA (WO#12451684 – Riser Pole #283/1.5):

A License Agreement between the Town of Mashpee and NSTAR Electric Company d/b/a Eversource Energy for electric service facilities located at 380 Asher's Path, Mashpee was presented to the Select Board for approval. The License Agreement is required for the Wastewater Treatment Plant.

It was noted that an article would be drafted for the May 2024 Town Meeting warrant for the permit.

**Motion made by Selectman Weeden to approve the License Agreement between the Town of Mashpee and NStar Electric Company d/b/a Eversource Energy at 380 Asher's Path – UG#10341/010-020, Mashpee, MA (WO#12451684 – Riser Pole #283/1.5) as presented.**

**Motion seconded by Selectman O'Hara.**

**VOTE: 5-0. Unanimous.**

**Roll Call Vote:**

<b>Selectman Cotton, yes</b>	<b>Selectman O'Hara, yes</b>	<b>Selectman Sherman, yes</b>
<b>Selectman Weeden, yes</b>	<b>Selectman Wyman-Colombo, yes</b>	<b>Opposed, none</b>

Mashpee Select Board  
Minutes  
January 22, 2024

---

## **APPOINTMENTS & HEARINGS**

### Discussion and Approval Appointment of Alternate Member of the Cape Cod Municipal Health Group: Benefits Administrator Robin Callaghan (Replaces Tracy Scalia):

Correspondence was received from Kimberly Landry, Human Resources Director dated January 10, 2024 requesting the Select Board appoint Robin Callaghan as the Alternate Board Member for the Cape Cod Municipal Health Group. This action is related to a change in roles and responsibilities. Tracy Scalia, Assistant HR Director/Payroll Administrator would thus be removed from this role.

The Cape Cod Municipal Health Group requires a letter from the Select Board, the governing authority naming the alternate voting member. Town Manager Rodney C. Collins is currently designated as the primary voting member to the Cape Cod Municipal Health Group.

**Motion made by Selectman Sherman to appoint Robin Callaghan as the Alternate Board Member to the Cape Cod Municipal Health Group.**

**Motion seconded by Selectman O'Hara.**

**VOTE: 5-0. Unanimous.**

**Roll Call Vote:**

Selectman Cotton, yes	Selectman O'Hara, yes	Selectman Sherman, yes
Selectman Weeden, yes	Selectman Wyman-Colombo, yes	Opposed, none

### Certification of the Hiring Process of Police Officer: Hugh Ahearn:

The Select Board was in receipt of communication from Captain Thomas Rose dated January 2, 2024 relative to the hiring process that was initiated and posted for an entry level police officer position to fill a vacancy in the Mashpee Police Department.

Town Manager Rodney C. Collins attested that all policies and procedures have been followed relative to the hiring process of Hugh Ahearn as Police Officer. The process has also been monitored and reviewed by the Human Resources Department.

**Motion made by Selectman Sherman to certify the Hiring Process of Hugh Ahearn as Police Officer as presented.**

**Motion seconded by Selectman O'Hara.**

**VOTE: 5-0. Unanimous.**

**Roll Call Vote:**

Selectman Cotton, yes	Selectman O'Hara, yes	Selectman Sherman, yes
Selectman Weeden, yes	Selectman Wyman-Colombo, yes	Opposed, none

Mashpee Select Board  
Minutes  
January 22, 2024

---

## **APPOINTMENTS & HEARINGS**

### Discussion and Approval of Select Board Policy #082 – Flag Policy:

Town Manager Rodney C. Collins presented Flag Policy No. 082 to the Select Board for review and approval. Policy No. 82 is intended to address flags allowed to be flown on the Town of Mashpee flag poles. In accord with procedures of the Flag Policy, the following is included as an expression of the town's government speech;

1. The official flag of the United States of America.
2. The official flag of the Commonwealth of Massachusetts.
3. The official flag of the Town of Mashpee.
4. The official flag of the Mashpee Wampanoag Tribe.
5. The official MIA-POW flag may be flown, with prior approval of the Select Board and/or Town Manager, on the Town-owned flagpole at Veterans Park.

As clearly stated, there are (5) recognized flags. No other flags shall be allowed to be flown on Town-owned flag poles. There is no intent to remove any flag that is currently flying.

It was requested the Select Board make a conscious effort to accommodate the Mashpee Wampanoag Tribe flag. If there are (3) poles, the Tribal flag would be raised as it is customarily flown.

The Select Board agreed to amend the draft under section IV. Standards;

#### A. Federal, State and Local Flags

1. To add language to the last sentence, to read: Flag poles that exist will continue to accommodate the Mashpee Wampanoag flag.

#### B. Flags at Half-Staff

To Add 5. Where there is a Tribal flag, the Tribal Chair or a designee shall be authorized to notify the Town.

It was agreed if additional adoptions are recommended for Policy No. 082 would be considered later.

**Motion made by Selectman Sherman to adopt Select Board Policy No. 082 as amended.**

**Motion seconded by Selectman Wyman-Colombo.**

**VOTE: 5-0. Unanimous.**

#### **Roll Call Vote:**

Selectman Cotton, yes

Selectman Weeden, yes

Selectman O'Hara, yes

Selectman Wyman-Colombo, yes

Selectman Sherman, yes

Opposed, none

Mashpee Select Board  
Minutes  
January 22, 2024

---

## **APPOINTMENTS & HEARINGS**

### Public Comment:

Susan Dangel, a member of Save Mashpee/Wakeby Pond Alliance and a resident of Cotuit Road presented her hopes for 2024. Of note is the importance to support and educate residents on the water quality of the Town along with the need to be present and involved. This includes the weighted presence of the DPW Director, the DNR and Conservation Department.

Ms. Dangel indicated she is pleased with the good news on the Mashpee/Wakeby boat ramp. The Coastal Zone Management (CZM) is fully funding the boat ramp permitting. It is also good news the Mashpee/Wakeby Pond Diagnostic Study is completed. The Select Board was urged to place this topic on the agenda with a management plan when ready.

Of disappointment is the delay in the sewerage. However, Mashpee has moving forward with its State Revolving Fund (SRF) application and an article is planned for the May warrant for funding authorization. Ms. Dangel state that education needs to start now, and the Town should incentivize and not penalize. Commenting on the stormwater management presentation Ms. Dangel indicated that residents should be educated to see what occurs when water is going down their driveway.

In closing, Ms. Dangel recommended the Town review the website links of the Sewer Commission and DPW. Some of the recommended links do not activate, and are outdated. It would be helpful if there is a more coordinated effort to make the websites more user friendly for the public.

## **NEW BUSINESS**

### Interviews, Discussion and Possible Approval of Appointments to the Following: Council on Aging: Elizabeth Kugell (Term Expires June 30, 2026):

The Select Board interviewed Elizabeth Kugell for engagement to the Council on Aging. The Council voted unanimously for this appointment. Ms. Kugell has work experience with the elderly since 2008 and has the time and training to devote to this position. This is also a chance to be a part of the community in Mashpee.

**Motion made by Selectman Weeden to appoint Elizabeth Kugell to the Council on Aging with a term to expire; June 30, 2026.**

**Motion seconded by Selectman Wyman-Colombo.**

**VOTE: 5-0. Unanimous.**

**Roll Call Vote:**

Selectman Cotton, yes  
Selectman Weeden, yes

Selectman O'Hara, yes  
Selectman Wyman-Colombo, yes

Selectman Sherman, yes  
Opposed, none

Mashpee Select Board  
Minutes  
January 22, 2024

---

## NEW BUSINESS

Community Preservation Committee: Judith MacDougall, Edward Schmuhl, Karen Yetra, Three (3) candidates for Two (2) Member at Large Positions Expiring June 30, 2024:

With two vacant positions on the Community Preservation Committee (CPC) for Members At-Large, expiring on June 30, 2024, the Select Board interviewed (3) candidates for this position in accord with Select Board Policy No. 01. For uniformity, each applicant responded to five questions.

Judith MacDougall:

When asked why she would like to serve on the CPC Ms. MacDougall indicated this is an overarching mission that touches on every aspect of what is important to maintain a town. Ms. MacDougall works for a regional school district and has experience with budgets, planning and school buildings. Ms. MacDougall resides in proximity to Santuit Pond and pays close attention to this matter of importance.

Ms. MacDougall is available to attend the monthly meetings of the CPC and would bring a fresh perspective to the areas funded; open space, recreation, historic and affordable housing. Reviewing applications, progress, plans and permitting is a huge part of her job serving the Superintendent of Schools and the School Committee. Ms. MacDougall indicated she has the lens to adhere to timelines, compliance with state laws and what is good for the town.

All the areas of CPC funding dovetail into one another. All is cohesive to compliment and protect the town we live in. Ms. MacDougall stated she would bring a skillset. However, there is a lot to learn as some members have been on the CPC Committee for some time.

In closing Ms. MacDougall indicated she has lived in the Town of Mashpee for the past 24 years. The Town has done well, and with family, Mashpee is welcoming. Ms. MacDougall desires to be a part of the community and would like to be a part of the Town's development bringing a new perspective to this committee.

Interest to give back to a town that has given so much for my family. Road run off, identified a problem on our street, in two weeks we have a berm, the response is immediate a lot to be thankful for. Children moved and have come back, grandchildren growing in this town.

Edward Schmuhl:

The Select Board interviewed Mr. Schmuhl remotely by telephone conference. Mr. Schmuhl indicated he has a keen interest in affordable housing and has served on the affordable housing committee in the Town of Falmouth. Of interest is open space and its preservation.

The Community Preservation Committee has opportunities to conduct projects. This is a major opportunity for a town to allocate funds from the CPC for solutions. Experience with an affordable housing committee and involvement in town activities bring an interest in serving on this committee. Mr. Schmuhl noted he was a water steward, and is familiar with environmental issues and open space issues in Mashpee.



Mashpee Select Board  
Minutes  
January 22, 2024

---

## NEW BUSINESS

Community Preservation Committee: Judith MacDougall, Edward Schmuhl, Karen Yetra, Three (3) candidates for Two (2) Member at Large Positions Expiring June 30, 2024: (continued)

Edward Schmuhl:

Mr. Schmuhl works as an appraiser, and has familiarity and experience in reading documents and plans and other building issues. Of the areas supported by the CPC, Mr. Schmuhl gave high priority to affordable housing, stating the largest need is the lack of affordable housing.

Having worked extensively with town committees Mr. Schmuhl indicated he would be comfortable and able to contribute and support the needs of the Community Preservation Committee in all defined areas.

Karen Yetra:

Karen Yetra a serial volunteer indicated she has volunteered for the PTA, for various fundraising, override campaigns and foundations for education. Ms. Yetra previously worked for a national data base consulting firm ending her career in management. During this time Ms. Yetra indicated she had to learn quickly as the clients varied. This experience has given Ms. Yetra the skillset the listen and analyze while maintaining equitability. Ms. Yetra currently volunteers for Habitat for Humanity of Cape Cod. When asked of the CPC and areas of involvement Ms. Yetra indicated that open space, recreation, affordable housing and historic are all in need of attention, are extremely important, and very intertwined. Ms. Yetra can commit to this position and bring sustenance to the committee. Ms. Yetra indicated she likes to solve problems that help people. This position would give her the satisfaction, and curiosity to learn about this great town.

Members of the Select Board agreed the candidates for appointment to the CPC are very outstanding and it is difficult to name the appointments with three strong applicants with only two vacancies. There are other Town vacancies and it is hopeful the contender would have an interest in serving the Town of Mashpee on another vacant position.

**Motion made by Selectman Sherman to appoint Judy MacDougall to the Community Preservation Committee as an At-Large Member for a term to expire; June 30, 2024.**

**Motion seconded by Selectman O'Hara.**

**VOTE: 5-0. Unanimous.**

**Roll Call Vote:**

Selectman Cotton, yes	Selectman O'Hara, yes	Selectman Sherman, yes
Selectman Weeden, yes	Selectman Wyman-Colombo, yes	Opposed, none

**Motion made by Selectman Wyman-Colombo to appoint Ted Schmuhl to the Community Preservation Committee as an At-Large Member for a term to expire; June 30, 2024.**

**Motion seconded by Selectman O'Hara.**

**VOTE: 4-1. Motion carries.**

**Roll Call Vote:**

Selectman Cotton, yes	Selectman O'Hara, yes	Selectman Sherman, no
Selectman Weeden, yes	Selectman Wyman-Colombo, yes	Opposed, (1)

Mashpee Select Board  
Minutes  
January 22, 2024

---

## **NEW BUSINESS**

Community Preservation Committee: Judith MacDougall, Edward Schmuhl, Karen Yetra, Three (3) candidates for Two (2) Member at Large Positions Expiring June 30, 2024: (continued)

Citing the need for experience to assist the Affordable Housing Committee Selectman Sherman revealed the reason for her vote in opposition of this appointment.

Discussion and Approval of the Following Resignation: Capital Improvement Program Committee: Edmund Sarno (Member at Large, Term Expires June 30, 2024):

The Select Board was in receipt of a letter of resignation from Edmund Sarno dated January 2, 2024 From the Capital Improvement Program (CIP) Committee.

**Motion made by Selectman Sherman to accept the resignation of Edmund Sarno from the Capital Improvement Program Committee with regret sending a letter of appreciation for his service.**

**Motion seconded by Selectman O'Hara.**

**VOTE: 5-0. Unanimous.**

**Roll Call Vote:**

**Selectman Cotton, yes**

**Selectman O'Hara, yes**

**Selectman Sherman, yes**

**Selectman Weeden, yes**

**Selectman Wyman-Colombo, yes**

**Opposed, none**

## **LIAISON REPORTS**

MA Municipal Association Handbook: At the MMA Conference a new handbook was introduced. Through the MMA membership page, the informative booklet can be accessed online.

Intermunicipal Agreement: The IMA for the shared watersheds is currently being reviewed by the respective Town Counsel's.

Joint Watershed Groups: The Waquoit Working Group and the Popponesset Working Groups are preparing to submit joint watershed plans to continue shared clean-water initiatives in Waquoit Bay and Shoestring Bay.

## **WATER QUALITY UPDATES**

Cape & Islands Water Protection Fund: Efforts continue to secure the 25% loan forgiveness.

Mashpee Select Board  
Minutes  
January 22, 2024

---

## **TOWN MANAGER UPDATES**

Beach Nourishment: Another storm event has caused further damage to South Cape beach. The Finance Committee will be requested to authorize a Reserve Fund Transfer to help the Town recoup funds.

Select Board Meeting: Time sensitive is a potential award of the K.C. Coombs HVAC contract. A special meeting may be called on Monday, February 26, 2024 at 6:00 p.m. to authorize the appropriation.

Town Seal Project: A stained-glass rendering of the Town Seal is on display at the Mashpee Library. The project received support from the Cultural Council and authorization from the Library Board of Trustees for its display. John Miller was recognized for his generous donation and guidance to provide the framing for the artwork.

## **ADJOURNMENT**

**Motion made by Selectman Sherman to adjourn at 9:00 p.m.**

**Motion seconded by Selectman Wyman-Colombo.**

**VOTE: 5-0. Unanimous.**

**Roll Call Vote:**

**Selectman Cotton, yes**

**Selectman O'Hara, yes**

**Selectman Sherman, yes**

**Selectman Weeden, yes**

**Selectman Wyman-Colombo, yes**

**Opposed, none**

Respectfully submitted,

Kathleen M. Soares

Secretary to the Select Board



# TOWN OF MASHPEE

## OFFICE OF THE SELECT BOARD

16 Great Neck Road North  
Mashpee, Massachusetts 02649  
Telephone – (508) 539-1401  
[bos@mashpeema.gov](mailto:bos@mashpeema.gov)

### MEMORANDUM

Date: February 8, 2024

To: Rodney C. Collins, Town Manager and  
Honorable Members of the Select Board

From: Stephanie A. Coleman, Administrative Secretary

Re: Annual Special Event Applications

---

#### Background

Discussion and approval of the following Special Event Application:

***Easter Egg Hunt: Mashpee Community Park; Saturday, March 30, 2024 10 am – 12 pm: Mary Bradbury***

#### Department Recommendation/ Requirements

Board of Health: Approved. No food.

Building: Approved

DPW: Approved. The Recreation Department shall coordinate with the DPW for any assistance required. They will also be responsible for picking up after the event.

Fire: Approved.

Police: Approved. No details will be required for this event.

# SPECIAL EVENT PERMIT APPLICATION

Application packet must be received no later than **45 days prior to the event.**

## APPLICATION DETAILS

Application #:	<i>SE-24-120316</i>	Date Issued:		Permit #:		Date Paid :	
Fee Payable: (\$)	<i>0.00</i>	Fee Paid: (\$)	<i>0.00</i>	Receipt # :			

## SECTION 1 - SITE INFORMATION

Street Name	<i>MAIN ST</i>	Map Block Lot	<i>27-0-25</i>
Street Number	<i>520</i>	Zone	<i>C2</i>
Unit No.			

## SECTION 2 - BUSINESS OWNER INFORMATION

Business Owner Name	<i>TOWN OF MASHPEE/RECREATION DEPARTMENT</i>				
Street Number	<i>16</i>	Street Name	<i>GREAT NECK ROAD NORTH</i>		
City	<i>MASHPEE</i>	State	<i>MA</i>	Zip Code	<i>02649</i>
Telephone	<i>508-539-1416</i>	Email	<i>mbradbury@marshpeema.gov</i>		

## SECTION 3 - APPLICANT INFORMATION

Applicant Name	<i>Mary K. Bradbury</i>				
Street Number	<i>520</i>	Street Name	<i>Main Street</i>		
City	<i>Mashpee</i>	State	<i>MA</i>	Zip Code	<i>02673</i>
Business Telephone	<i>508-539-1416</i>	Email	<i>mbradbury@marshpeema.gov</i>		

## SECTION 4 - MAILING ADDRESS

Street Number		Street Name			
City	<i>Mashpee</i>	State	<i>MA</i>	Zip Code	<i>02649</i>

Telephone \_\_\_\_\_

**SECTION 5 - PRIMARY CONTACT INFORMATION**

Primary Contact Name Mary K. Bradbury

Non-Profit Organization / Event ☐ Yes ☐ No

Day Phone 508-539-1416

Email mbradbury@mashpeema.gov

Cell Phone \_\_\_\_\_

Website \_\_\_\_\_

**SECTION 6 - EVENT INFORMATION**

Event Name Annual Easter Egg Hunt

Event Producer Mashpee Recreation

Physical location if no address and description of area being used Mashpee Community Park

Starting Date 03/23/24 Time 10:00 AM Ending Date 03/30/24 Time 12:00 noon

Total Attendance Expected 145-150 total Rain Plan 3/31/2024

List any streets to be closed for special event N/A

Summary of Event - Please describe in full detail the special features of the event within the box below. After application is submitted, you may attach a flyer to your application from the home page.

**Annual Easter Egg Hunt to be compliant with all current COVID guidelines issued by the Governor's Office and described in the event proposal attached. 12 children per area per time slot, pre-registered, 1 adult per child, 3 distinct age groups, 3 distinct parking and activity areas, 4 time slots (11, 12, 1 and 2 PM).**

Applicant to confirm they are applying for an event on city property ☐ Yes ☐ No

Will Food be served? ☐ Yes ☐ No

**SECTION 7 - RELEASE/HOLD HARMLESS/INDEMNIFICATION AGREEMENT (REQUIRED FOR USE OF TOWN PROPERTY ONLY)**

We/I, Mary K. Bradbury (name of individual[s], partnership, or corporation) hereby agree and promise to release, hold harmless and indemnify the Town of Mashpee, including employees, officials, board members, etc., from all liability of any kind or nature arising or resulting from the activity entitled Annual Easter Egg Hunt (name of event) to be held on 03/23/24

The undersigned represents that he/she has the authority to execute this Agreement.

Signed on 01/05/23 on behalf of Mashpee Recreation the event's

director

X Mary K. Bradbury

**SECTION 8 - DECLARATION**

☒ I do hereby certify under the pains & penalties of perjury that the information provided above is true and correct.

Date 01/19/24

**Please contact the Selectmen's Office at (508) 539-1401 if you have any question regarding this application form.**



**TOWN OF MASHPEE**  
**DEPARTMENT OF NATURAL RESOURCES**

31 Mercantile Way Unit 6/7  
Mashpee, Massachusetts 02649  
Telephone – (508) 539-1410



**MEMORANDUM**

**February 12, 2024**

**TO:** Select Board  
Rodney C. Collins, Town Manager

**FROM:** Christopher J. Avis, Town of Mashpee Shellfish Constable

**Cc:** Ashley Fisher, Director of the Department of Natural Resources

**RE:** Non-renewal of Michael Ronhock's aquaculture grant #014

---

Description:

Mr. Ronhock has decided to not renew his aquaculture grant. Letter attached from Mr. Ronhock explaining such.

Background:

Mr. Ronhock has decided to not renew his grant. His production levels have not met the minimum requirements for the past several years. He has removed all cages, bags, anchors and marker floats.

Recommendation:

As the Town's Shellfish Constable, I respectfully recommend not renewing Mr. Ronhock's grant #014. The grant will be offered to the next applicant for an aquaculture grant.



November 6, 2023

Chris Avis

Town of Mashpee Shellfish Warden

After careful consideration, I have decided to relinquish my aquaculture grant #014 in the Great River by non-renewal for 2024.

All cages, bags, anchors, and marker floats have been removed from the site.

Respectfully,

Michael Ronhock

Mashpee, Ma

CC: Mashpee Selectboard

CC: Ashley Fisher Natural Resource



11/6/2023

# **Mashpee Water Quality Monitoring Program Summary of Nutrient Related Health of Mashpee's Estuaries (summer 2022)**

***Town of Mashpee  
Mashpee Wampanoag Tribe  
SMAS-UMASSD Collaboration  
For Estuarine Restoration***

**Ed Eichner, Adjunct Professor  
Coastal Systems Program  
School of Marine Science & Technology  
University of Massachusetts – Dartmouth**

**February 12, 2024**



University of Massachusetts Dartmouth  
**The School for Marine Science and Technology**





# Major Anthropogenic Problem Facing Estuaries Globally

## *Habitat Degradation:*

- increased nitrogen loading is the major threat to estuaries, world-wide;
- Today nitrogen enrichment is causing significant impairments to Waquoit and Poppoinesset Bays and portions of most Cape Cod Estuaries.



# *How do we restore and protect our estuaries?*

Nitrogen management is the only way to restore degraded estuarine habitat, primarily through:

- Increased tidal exchange
- Control of watershed nitrogen sources
- Increased Nitrogen removal in transport



# *Mashpee Water Quality Monitoring Program*

## **Goals:**

- to assess current nutrient related water quality of each estuary within the Town of Mashpee to support management**
- to track short & long-term changes in embayment health**
- to yield validation of the effectiveness of Nitrogen Management Alternatives and regulatory TMDL compliance**



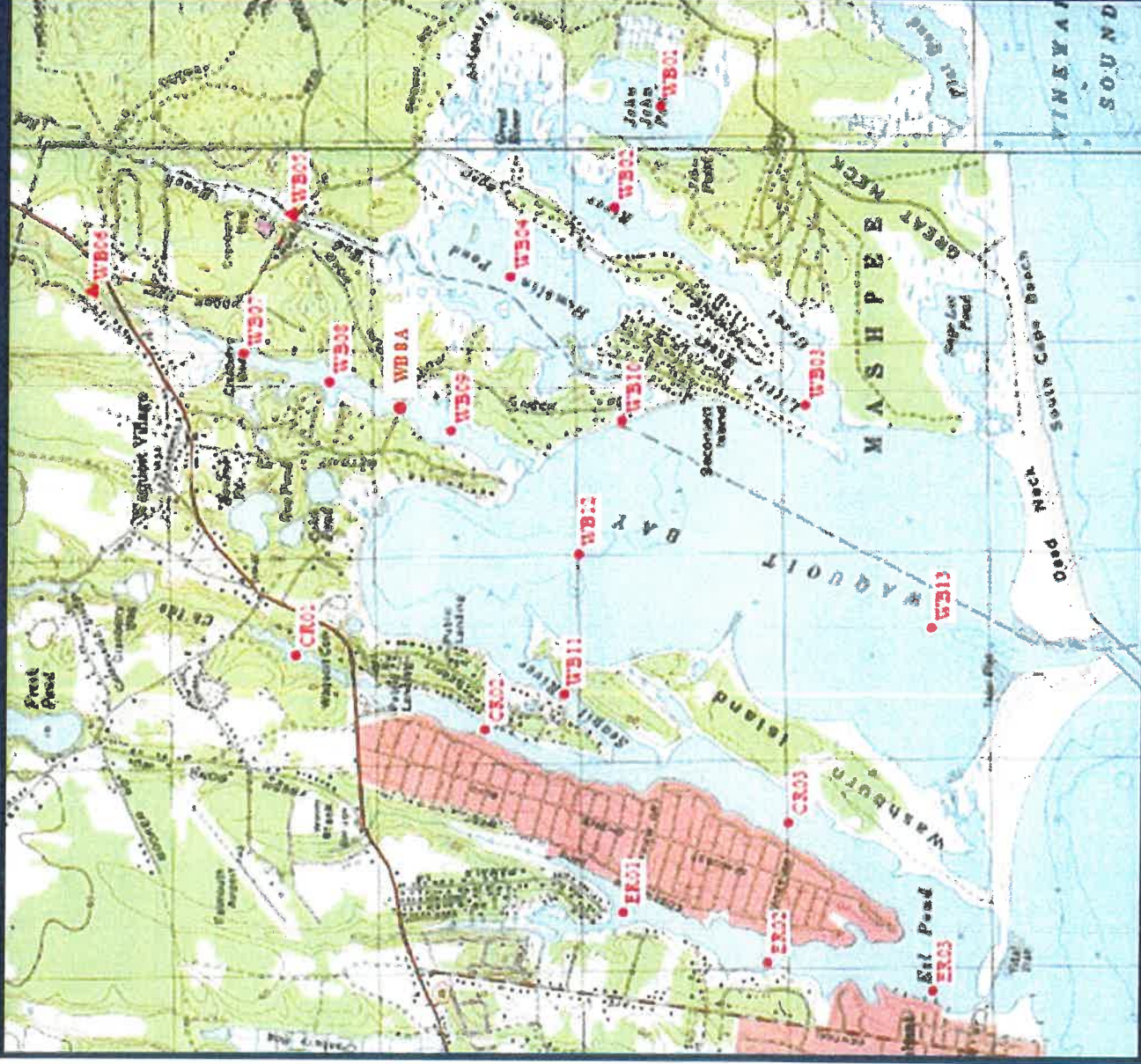
# Estuarine Monitoring: Town of Mashpee

Waquoit Bay Water  
Quality Stations

2010-2022

18 estuarine stations  
monitored

4 sampling events (2  
in July + 2 in August)



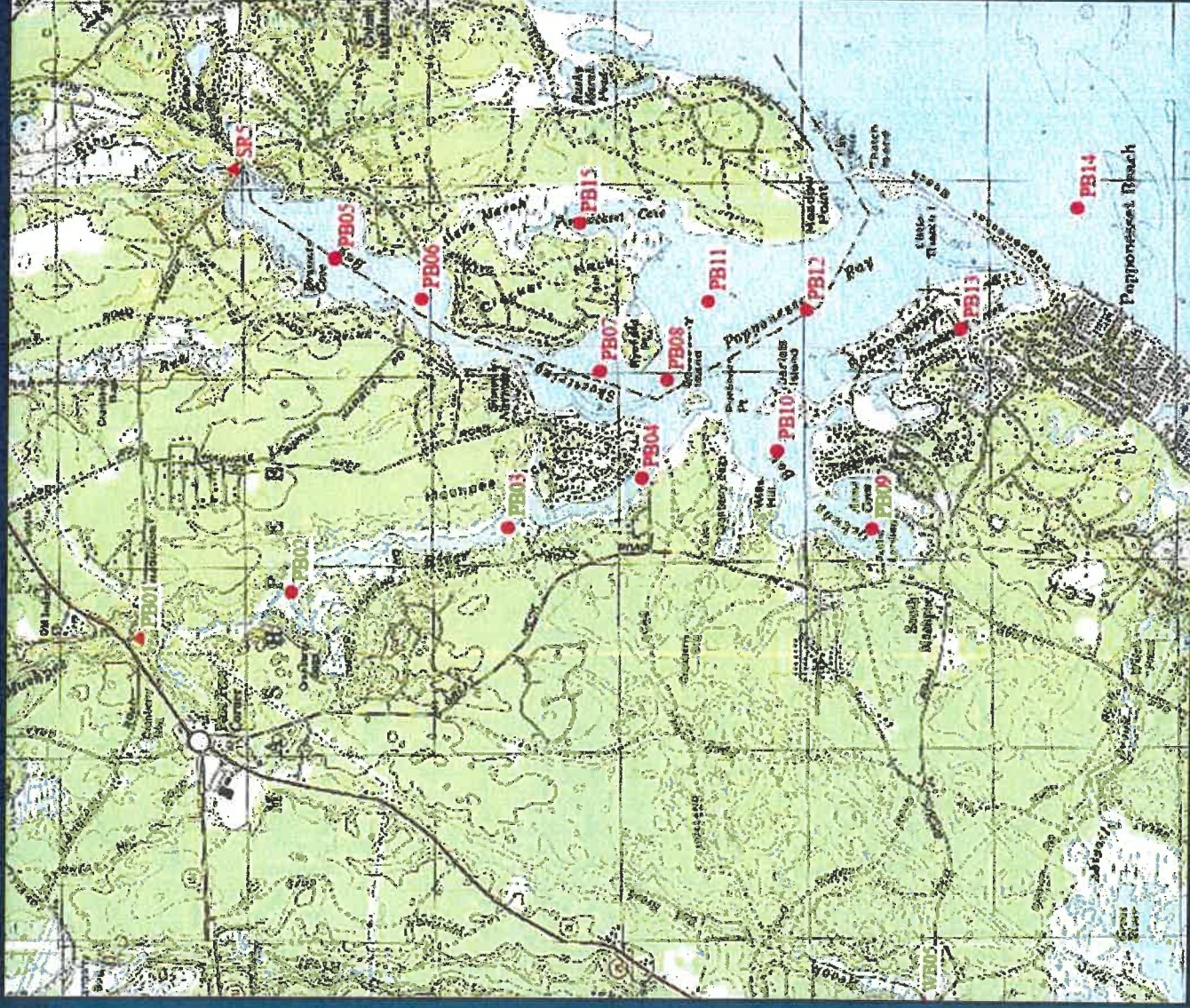


# Estuarine Monitoring: Town of Mashpee

Popponesset Bay  
Water Quality Stations

2010-2022

16 estuarine stations  
4 sampling events (2  
in July + 2 in August)





# *MEP Assessments: Popponesset 2004 Waquoit 2013*

- Water column monitoring data: Popponesset 1997-2003  
Waquoit 2002-2010
- Sediment collection to measure N input to water column
- Streamflow measurements weekly to biweekly over at least 1 year
- Benthic infauna sampling: measurement of quality of sediment ecosystems
- Continuous bottom dissolved oxygen and chlorophyll readings over at least one month; multiple locations
- Eelgrass and macroalgae surveys: historical eelgrass loss
- Tidal hydrodynamic model based on system bathymetry and tidal measurements throughout the system
- Linked Watershed-Water Quality Models: Validated to be used for predictions and evaluation of management alternatives



# MassDEP N TMDLs:

## *Poppoinesset 2008 Waquoit 2020*

### Poppoinesset:

5 restoration TMDLs for nitrogen

### Waquoit:

9 restoration nitrogen TMDLs;  
3 protective nitrogen TMDLs  
(freshwater segments of Childs River,  
Quashnet River, and Red Brook)

### MassDEP N thresholds:

0.38 mg/L N threshold conc

### MassDEP N thresholds :

Main Bay, Hamblin Pond, Mid-Childs R

0.38 mg/L N threshold

Jehu Pond 0.45 mg/L N threshold

Mid-Quashnet R, Upper Eel R

0.50 N mg/L threshold

### Common MassDEP Recommendations:

- Reduce watershed N loads to threshold loads
- Threshold loads not only way to attain concentrations, must demonstrate success of alternatives
- Detailed monitoring plan



# Status: Mashpee Waquoit Bay

Upper regions of each estuary showing the greatest level of nutrient related water quality decline. Eelgrass lost from both systems.

Estuary	Type	Habitat	TMDL	Status	Long Term Status	Change from 2021	Remedial Actions
Jehu Pond	Basin	Marine	In Place	TN Rebound	> Long Term Mean	=	Shellfish Seeding
Hamblin Pond	Basin	Marine	In Place	TN Rebound	> Long Term Mean	↑ (+23%)	Shellfish Seeding
Great River	Tidal River	Marine	In Place	TN Rebound	> Long Term Mean	↑ (+30%)	Shellfish Seeding
Little River	Tidal River	Marine	In Place	TN Rebound	> Long Term Mean	↑ (+26%)	Shellfish Seeding
Upper Quashnet	Tidal River	Fresh/Brackish	In Place	Severely Degraded	> Long Term Mean	↓ (-44%)	None
Lower Quashnet	Tidal River	Brackish	In Place	Severely Degraded	> Long Term Mean	↓ (-51%)	None
Upper Childs River	Tidal River	Brackish	In Place	Severely Degraded	> Long Term Mean	↑ (+54%)	None
Lower Childs River	Channel	Marine	In Place	Moderately Impaired	> Long Term Mean	↑ (+5%)	None
Upper Eel River	Tidal River	Brackish	In Place	Significantly Impaired	> Long Term Mean	↑ (+43%)	None
Lower Eel River	Basin	Marine	In Place	Moderately Impaired	> Long Term Mean	↑ (+15%)	None
Upper Main Basin	Basin	Marine	In Place	Impaired	> Long Term Mean	↑ (+8%)	None
Lower Main Basin	Basin	Marine	In Place	Moderately Impaired	= Long Term Mean	↓ (-5%)	None

-17% TN offshore

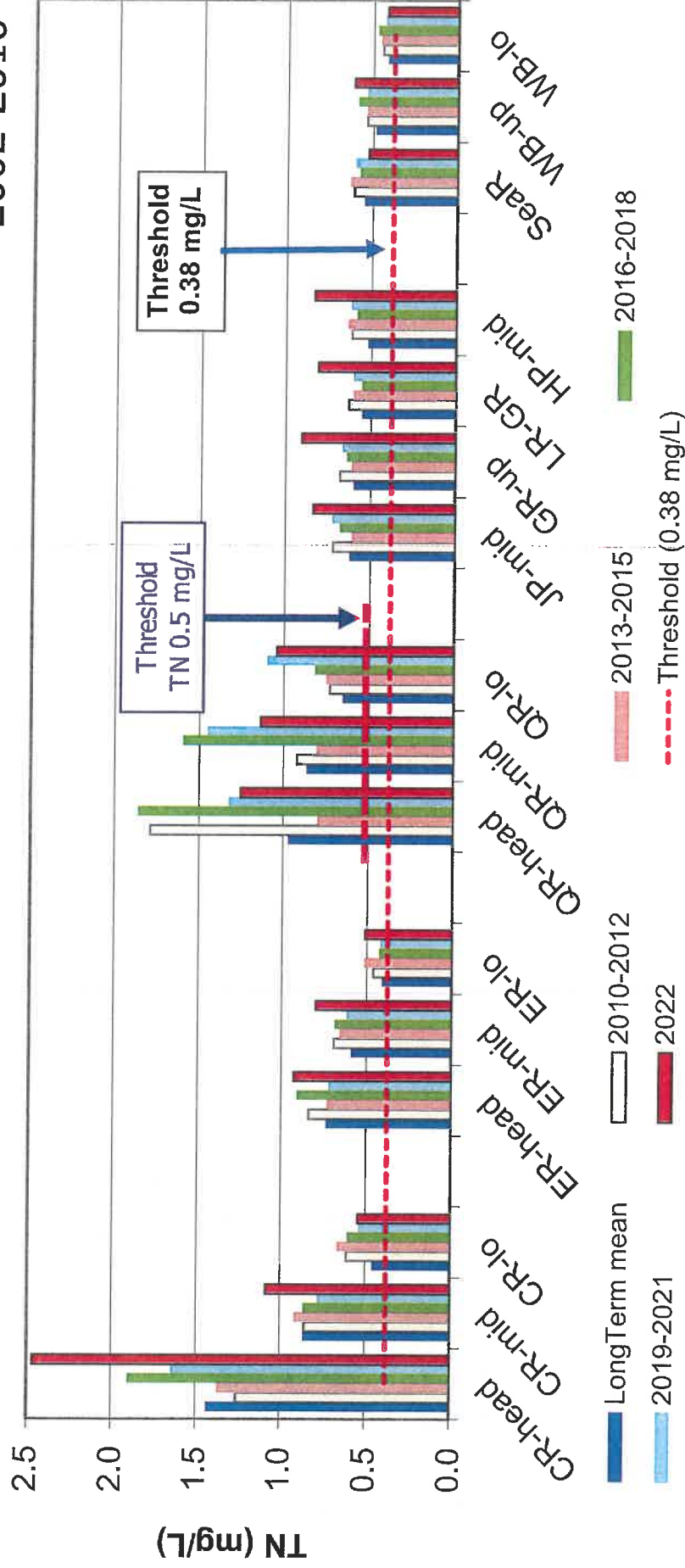


# Waquoit Bay Monitoring Results: Total N

**All Sites Over TMDL Nitrogen Threshold in All Years**

Waquoit Bay TN: Long-Term vs 2010 - 2022

MEP:  
2002-2010



CR: Childs River, ER: Eel River, QR: Quashnet River, JP: Jehu Pond, HP: Hamblin Pond, WB: Waquoit Bay main basin

# Waquoit Bay Monitoring Results: Phytoplankton Biomass (Chlorophyll)

Waquoit Bay Total Chla Pigment: Long-Term vs 2010 - 2022



CR: Childs River, ER: Eel River, QR: Quashnet River, JP: Jehu Pond, HP: Hamblin Pond, WB: Waquoit Bay main basin



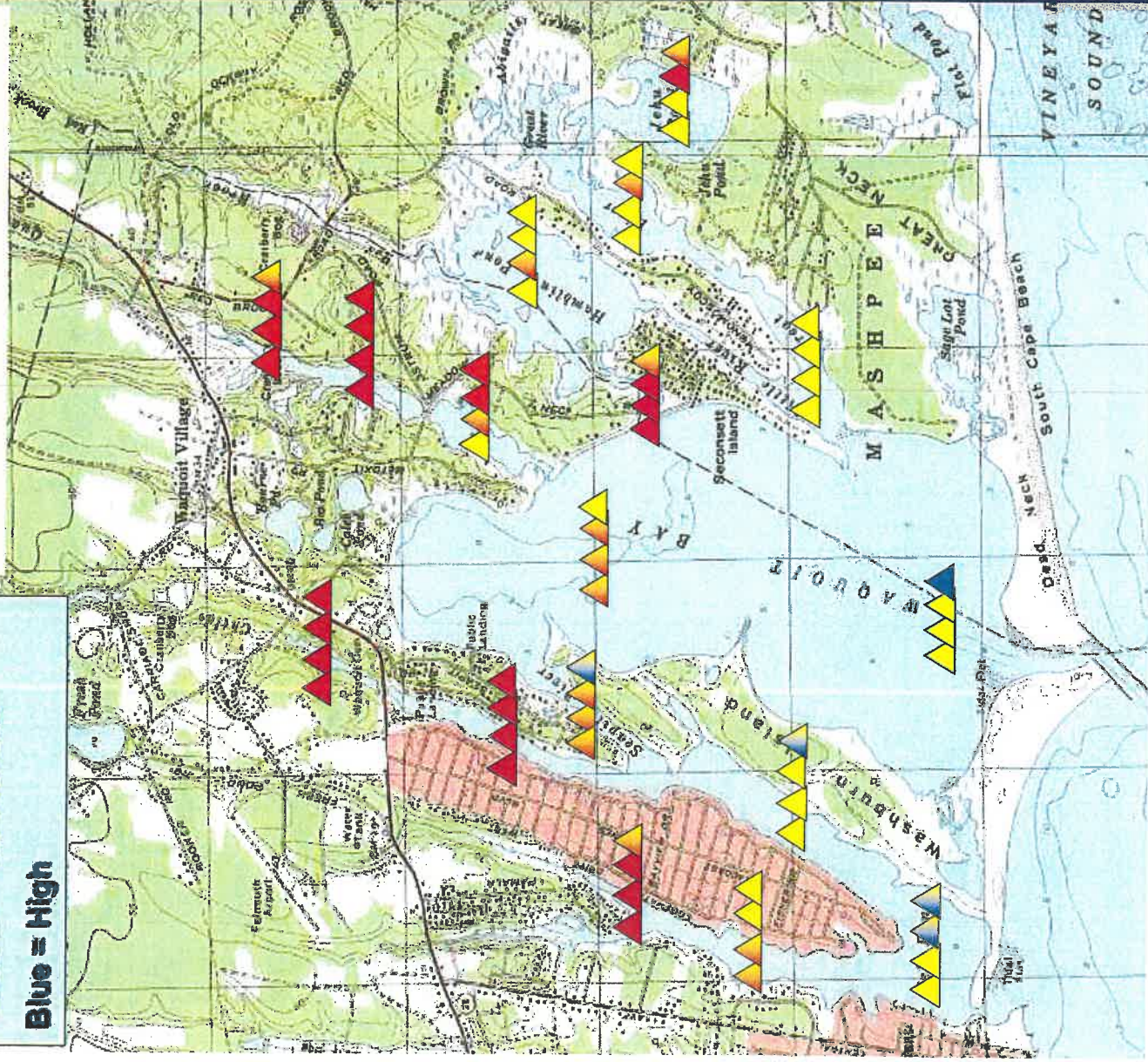
## Estuarine Quality Index

**Red = Poor**

**Yellow = Moderate**

**Blue = High**

Waquoit Bay Health Index:  
2019, 2020, 2021, 2022

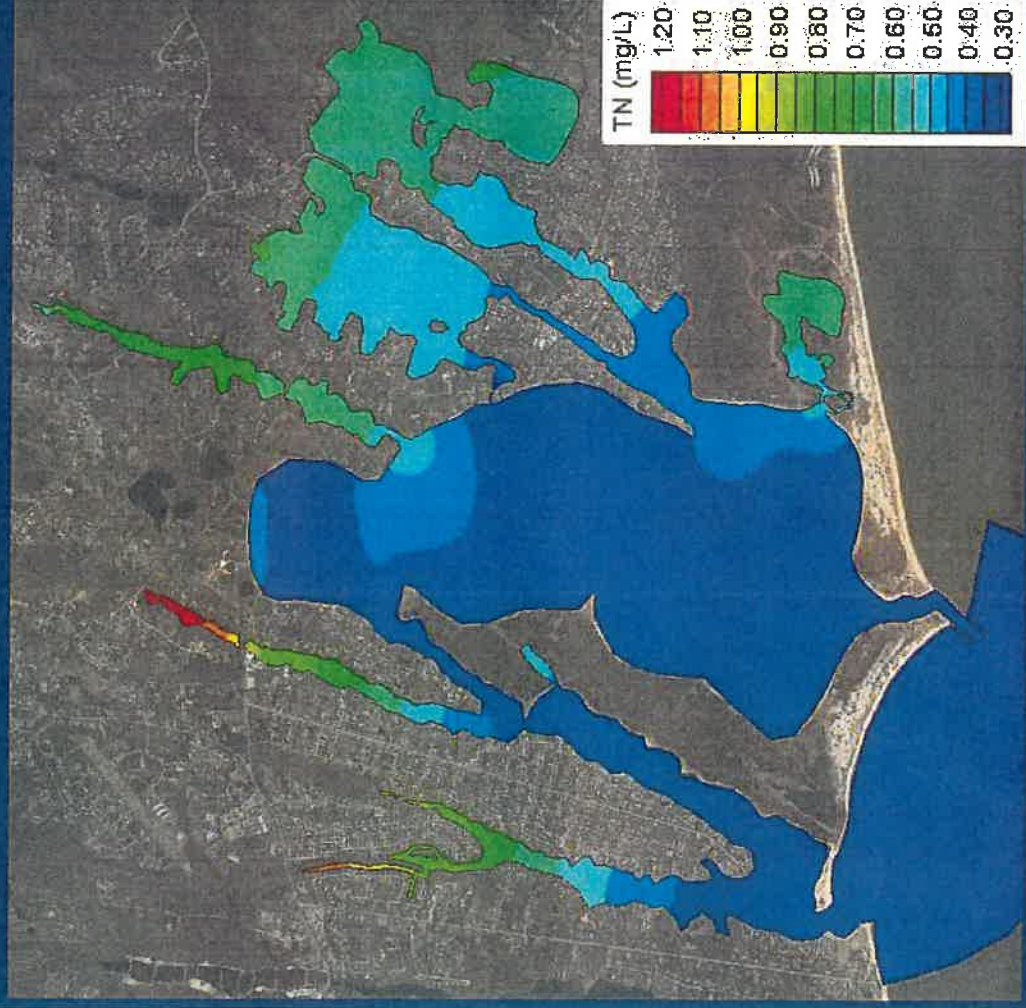


# Waquoit Bay Water Quality

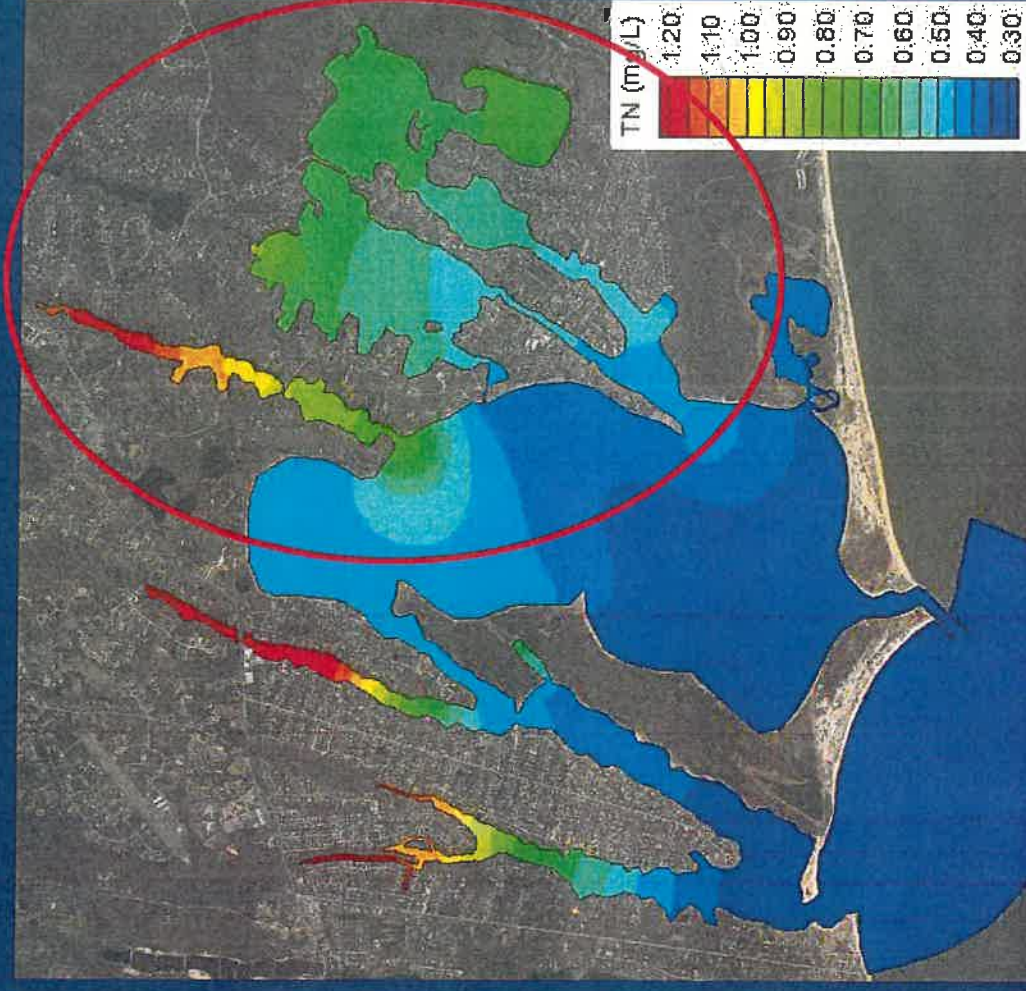
2019-2022

- Continued significant N enrichment in upper tributaries
- Eastern embayments moderately N enriched
- Quashnet and Childs continue to have poor water quality
- 2019-2022 terminal pond water continue to be degraded (Hamblin, Jehu).





2010 N Loading



Build-out Loading

*Tidally Averaged Total Nitrogen (mg/L) Gradient*



# Status: Mashpee Popponesset Bay

Upper regions of each estuary showing the greatest nutrient related impairments. No Eelgrass remains.

2022 Summary of Present Status and Trends of Water Quality in Mashpee's Estuaries							
Estuary	Type	Habitat	TMDL	Status	Long Term Status	Change from 2021	Remedial Actions
Upper Mashpee River	Tidal River	Fresh/Brackish	In Place	Impaired	> Long Term Mean	↓ (-7%)	none
Lower Mashpee River	Tidal River	Brackish	In Place	Impaired	> Long Term Mean	↑ (+38%)	Shellfish Culture
Inner Shoestring Bay	Basin	Marine	In Place	Severely Degraded	> Long Term Mean	↑ (+18%)	None
Outer Shoestring Bay	Basin	Marine	In Place	Significantly Impaired	> Long Term Mean	↑ (+19%)	None
Upper Ockway Bay	Basin	Marine	In Place	Significantly Impaired	= Long Term Mean	↑ (+4%)	None
Lower Ockway Bay	Basin	Marine	In Place	Significantly Impaired	= Long Term Mean	↓ (-10%)	None
Pinquissett Cove	Tidal River	Marine	In Place	Significantly Impaired	> Long Term Mean	↓ (-12%)	None
The Creeks	Channel	Marine	In Place	High Quality Waters	> Long Term Mean	↓ (-2%)	None
Upper Main Basin	Basin	Marine	In Place	Moderately Impaired	> Long Term Mean	↑ (+19%)	None
Lower Main Basin	Basin	Marine	In Place	Moderately Impaired	> Long Term Mean	↑ (+44%)	None

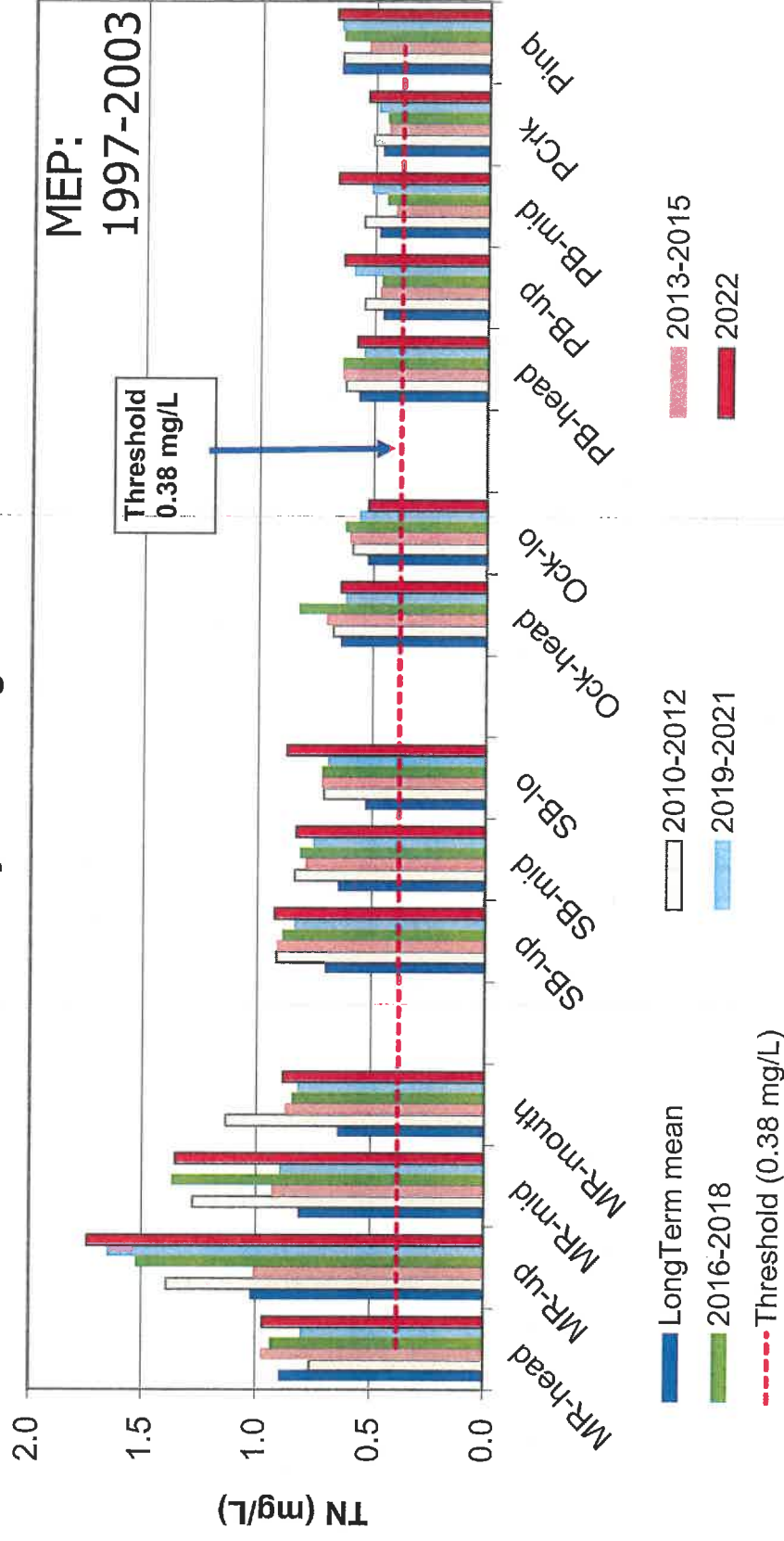
-17% TN offshore



# Estuarine Monitoring Results: TN

**All Stations Exceed TMDL TN Threshold in all Years**

Popponesset Bay TN: Long-Term vs 2010 - 2022

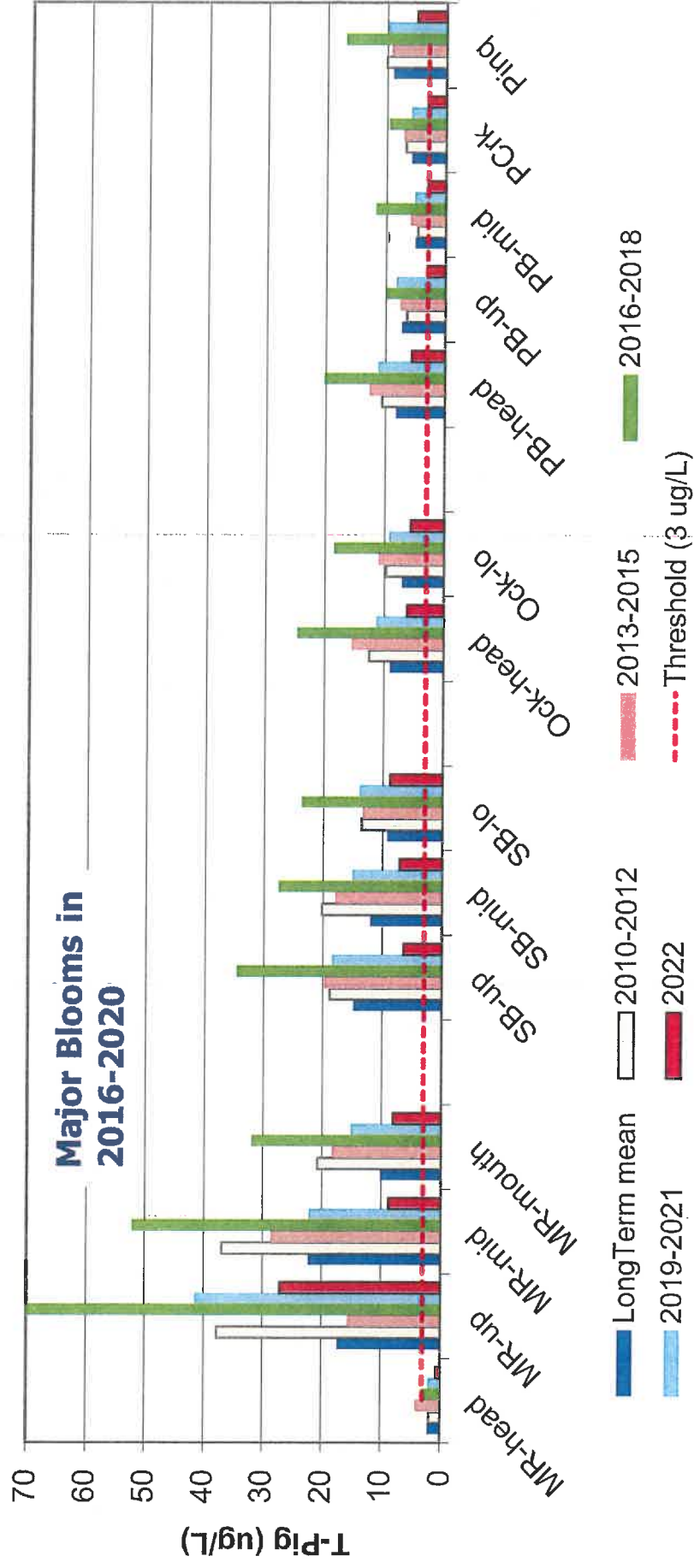


MR: Mashpee River, SB: Shoestring Bay, Ock: Ockway Bay, Ping: Pinquisset Cove, PCrk: Popponesset Creek, PB: Popponesset Bay



# Popponesset Bay Monitoring Results: Phytoplankton Biomass (Chlorophyll)

Popponesset Bay Total Chla Pigment: Long-Term vs 2010 - 2022



MR: Mashpee River, SB: Shoestring Bay, Ock: Ockway Bay, Ping: Pinquicket Cove, PCrk: Popponesset Creek, PB: Popponesset Bay



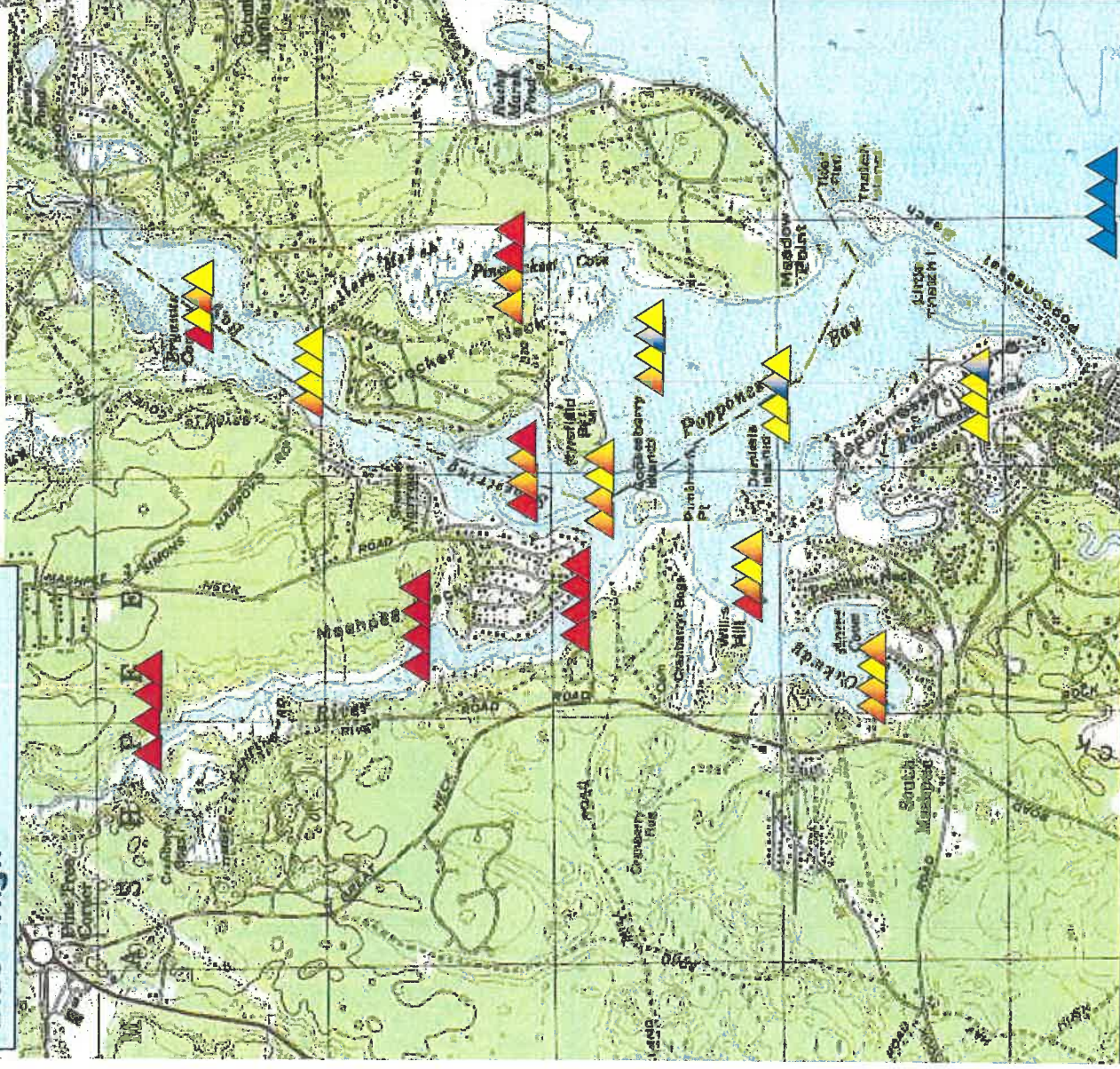
## Estuarine Quality Index

**Red = Poor**

**Yellow = Moderate**

**Blue = High**

Popponesset Bay Health  
Index: 2019, 2020, 2021,  
2022

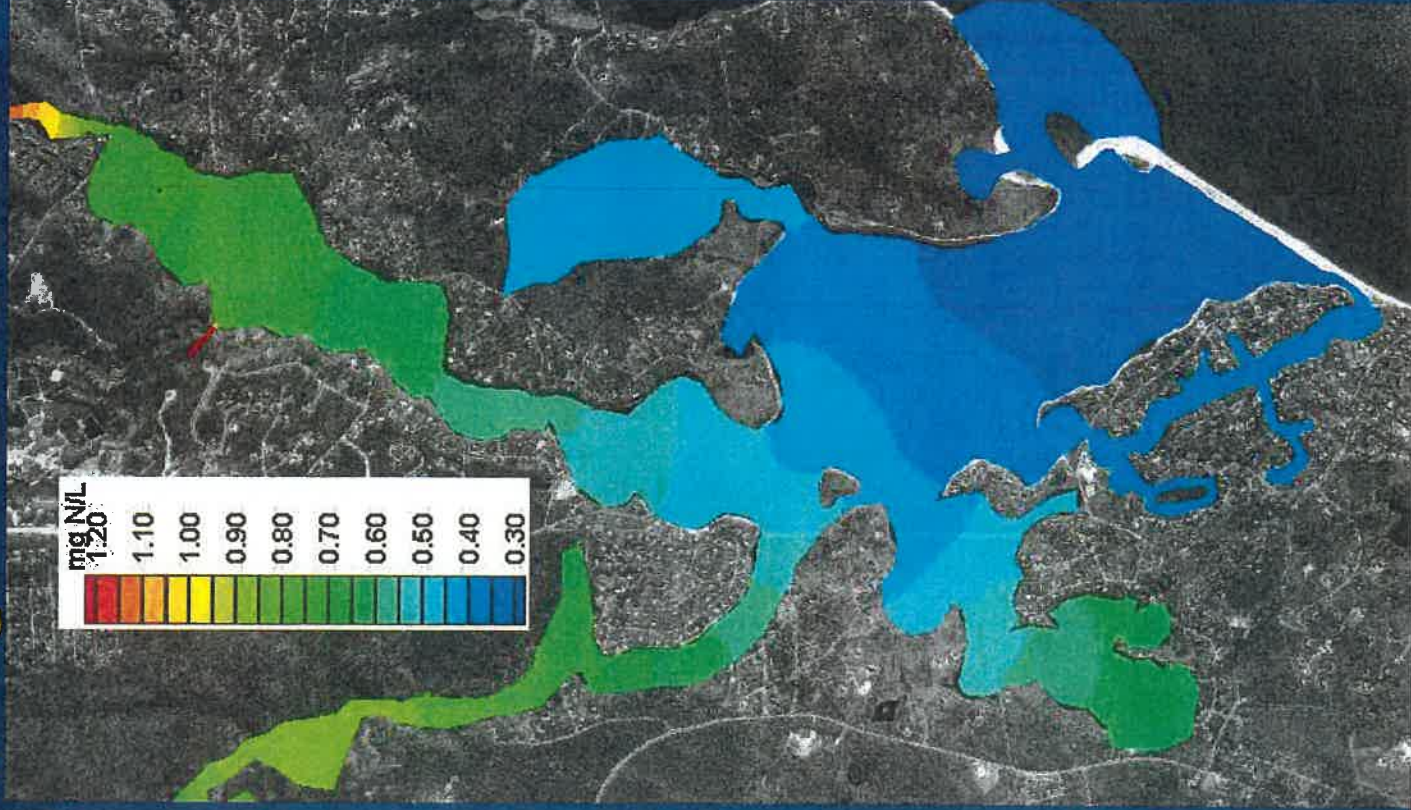


## Popponesset Bay Water Quality

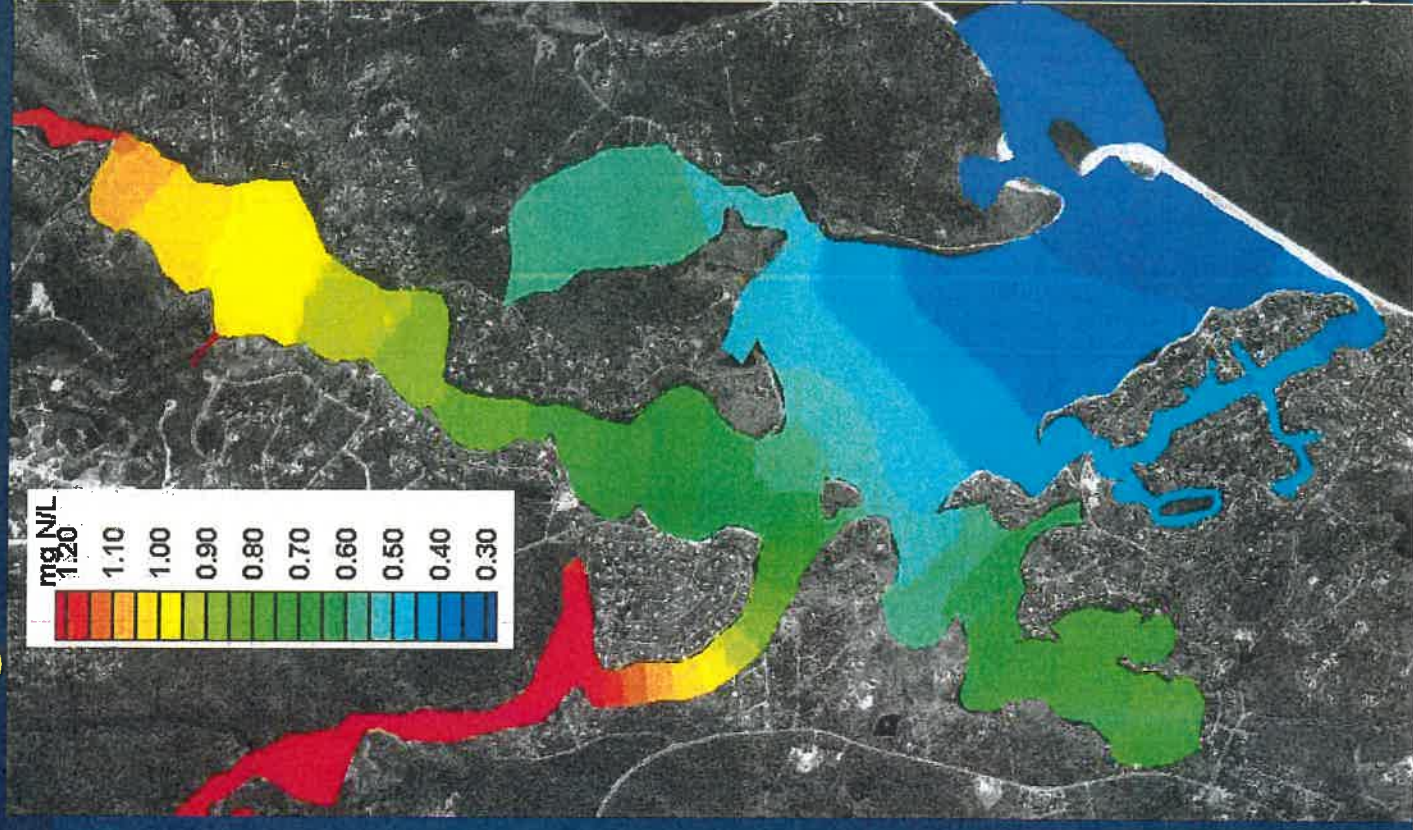
- Significant N enrichment in upper tributaries; nutrient impairments throughout
- Increasing Large phytoplankton blooms each summer
- No High water quality areas remaining
- 100% eelgrass loss
- Benthic Habitat impaired through most of system.



Nitrogen Levels: 2008



Nitrogen Levels: Build-Out





# *Poppoinesset and Waquoit Bays*

## Findings:

- **Impairments** throughout both estuaries, only high water quality areas are near inlets.
- All Poppoinesset Bay and Waquoit Bay stations have TN concentrations greater than the respective MassDEP TMDLs.
- Oxygen depletion in bottom waters continues to be a persistent impairment in both systems.
- Clear evidence that declines due to nitrogen enrichment within the bay waters



# *Estuarine Monitoring: Poppoinesset Bay and Waquoit Bay*

## Findings:

- Results indicate that Monitoring Program is detecting fluctuations in systems; will detect responses to implementation of management alternatives.
- Town should consider updated baseline of MEP assessments parameters, such as benthic infauna, tidal ranges, DO/CHL moorings, etc. Should help with future regulatory discussions.





# Coastal Systems Program University of Massachusetts Dartmouth *Science for Management*

## *Questions & Discussion*

### Coastal Systems Program:

Ed Eichner  
Roland Samimy  
David Schlezinger  
David White  
Dale Toner  
Sara Sampieri  
Jen Benson



Contact:  
Ed Eichner  
TMDL Solutions LLC  
[eichner@tmdl solutions.net](mailto:eichner@tmdl solutions.net)  
Cell: 508-737-5991



University of Massachusetts Dartmouth  
The School for Marine Science and Technology



# **Water Quality Monitoring Program for the Popponesset Bay and Waquoit Bay Estuaries**

*(summary of summer 2022 results)*

***By:***

Eduard Eichner, Principal, TMDL Solutions  
Roland Samimy, Ph.D.  
Sara Sampieri Horvet, M.S.

Coastal Systems Program  
School of Marine Science and Technology (SMAST)  
University of Massachusetts – Dartmouth

***For:***

**Mashpee Water Quality Monitoring Consortium:**

**Mashpee Wampanoag Tribe  
&  
Town of Mashpee Waterways Commission  
&  
Coastal Systems Program SMAST-UMD**

***February 6, 2024***

## TABLE OF CONTENTS

BACKGROUND AND OVERVIEW.....	1
SITE DESCRIPTION .....	3
ESTUARINE MONITORING PROGRAM.....	9
MONITORING RESULTS .....	15
NUTRIENT RELATED WATER QUALITY INDEX.....	17
CONCLUSIONS AND RECOMMENDATIONS .....	18
FIGURES AND TABLES .....	20-34



## **BACKGROUND AND OVERVIEW:**

The Mashpee Water Quality Monitoring Program is an on-going collaborative effort between the Mashpee Wampanoag Tribe, the Town of Mashpee and the Coastal Systems Program, School of Marine Science and Technology at the University of Massachusetts – Dartmouth (CSP/SMAST). The Monitoring Program has a two-fold goal: 1) sustain a continuing assessment of the nutrient related water quality of the Waquoit Bay and Popponesset Bay estuaries relative to regulatory standards (TMDLs<sup>1</sup>) and 2) monitor improvements in water quality resulting from restoration efforts (*e.g.*, oyster propagation, dredging, N removals by freshwater systems, improvements in wastewater treatment) as undertaken by the Town, Tribe and others. The Monitoring Program goals are achieved through the regular collection and analysis of water samples and associated field parameters relevant to assessing the health of estuarine habitats within both Bay Systems, Cape Cod, MA. (Figure 1). These monitoring data form the basis for: 1) gauging short and long-term trends in water quality, 2) validating the Massachusetts Estuaries Project (MEP) threshold modeling approach for Waquoit Bay + Popponesset Bay, and 3) determining compliance with USEPA and MassDEP TMDL nitrogen targets set under the Clean Water Act by TMDL analysis that has been previously formalized for all of Mashpee's estuarine waters.

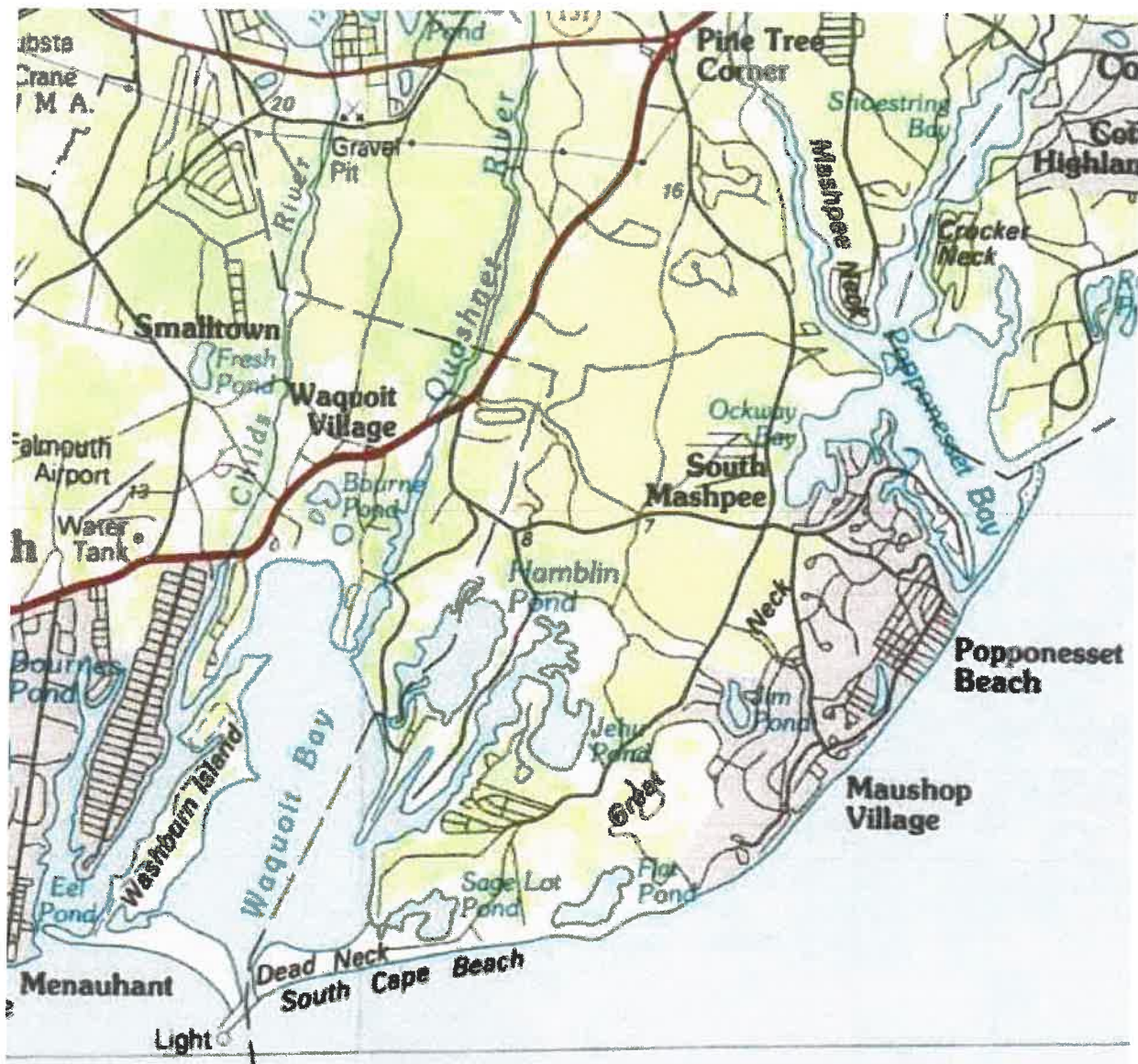
In order to develop a sustainable long-term program, a consortium was created whereby sample collection is completed by volunteers recruited by each consortium partner and by public participants, with equipment and analytical costs distributed between the Mashpee Wampanoag Tribe and the Town of Mashpee. The Mashpee Water Quality Consortium was developed under a 2009 Memorandum of Understanding between the Mashpee Wampanoag Tribe, the Town of Mashpee and the Coastal Systems Program (CSP/SMAST). The Consortium is managed through the Mashpee Waterways Commission.

It is an important part of the ongoing efforts to develop nitrogen management plans for the restoration of these systems and to determine the level of "success" through the consistent collection of key habitat quality metrics throughout each system in the most cost-effective manner possible. This program is the only method for providing a cross comparable baseline for gauging long-term changes in water quality, as the Towns of Mashpee, Falmouth and Barnstable implement their nitrogen management alternatives for the restoration of the Waquoit Bay and Popponesset Bay systems.

Nutrient related water quality decline continues to represent one of the most serious threats to the ecological health of nearshore coastal waters in southeastern MA and nationally. Coastal embayments, because of their enclosed basins, shallow waters and large shoreline area, are generally the first indicators of nutrient loading from terrestrial sources. Although each embayment system maintains a capacity to assimilate watershed nitrogen inputs without degradation, as loading increases, a point is reached at which the assimilative capacity is exceeded and nutrient related water quality degradation begins to occur. Continuing increases in nitrogen inputs beyond this threshold level result in further declines in habitat quality. Because nearshore coastal salt ponds and embayments are the primary recipients of nutrients carried via surface and groundwater transport from terrestrial sources, it is clear that activities within the watershed, often miles from the water body itself, can have chronic and long lasting impacts on these fragile coastal environments.

---

<sup>1</sup> TMDL = Total Maximum Daily Loads. Required provision in the federal Clean Water Act for all impaired waters.



**Figure 1. Regional locus map of Waquoit Bay and Popponesset Bay.** The two bays source waters are Vineyard Sound and Nantucket Sound, respectively.

Both the Waquoit Bay and Popponesset Bay Estuarine Systems are highly nitrogen enriched and show impaired nutrient related water quality throughout most of their component basins over the past decade. The MEP assessments and regular reports to the monitoring consortium for both systems documented high nitrogen and chlorophyll concentrations, loss of historical eelgrass, severe degradation of infauna communities, etc. The reports also showed that impairments were diverse with greater impairments in the tidal rivers (Mashpee River, Childs River, Quashnet River) and major tributary basins (Eel Pond/River, Shoestring Bay and Ockway Bay) and less impairments in the main basins. As predicted by the MEP watershed buildout scenarios, conditions have worsened with time as time lags caused by groundwater flow have gradually brought more nitrogen to the bays. Through the annual reviews of collected water quality after the MEP assessments were completed, CSP/SMASST has provided the Mashpee Water Quality Consortium with regular updates in changing conditions in the two bays. The present Technical Report is an update to the water quality baseline to include the results of each summer's sampling program, 2010-2022.

Nitrogen levels are elevated throughout both systems and as watershed development continues, estuarine conditions are projected to decline further until nitrogen management is implemented. The result is that nitrogen management of these estuaries is aimed at restoration, not protection or maintenance of existing conditions. Nitrogen management within Popponesset Bay has already begun with the consistent annual maintenance of the flow through the tidal inlet, capping of the Town of Mashpee landfill, and implementation of Phase I of the CWMP in Mashpee.

## ***SITE DESCRIPTION***

### ***Popponesset Bay***

The Popponesset Bay Estuarine System is shared by the Towns of Mashpee and Barnstable, on Cape Cod, Massachusetts. The Bay's watershed is primarily distributed among the same two towns, with a small portion of the upper-most region of the watershed located in the Town of Sandwich. The Popponesset Bay Estuarine System exchanges tidal water with Nantucket Sound through a single maintained inlet at the tip of Popponesset Spit. The Popponesset Bay estuarine system consists of five tributary sub-embayments: 1) Popponesset Bay (main basin + Popponesset Creek), 2) Pinquisset Cove, 3) Ockway Bay, 4) Mashpee River (lower or tidal region) and 5) Shoestring Bay (Figure 2).

Within the Popponesset Bay System, the tidal portion of the Mashpee River functions as a Cape Cod tidal river, with extensive bordering salt marsh, tidal flats and large salinity fluctuations. In contrast, Popponesset Bay, Shoestring Bay and Ockway Bay are typical embayments, dominated by open water areas, having only fringing salt marshes, relatively stable salinity gradients and large basin volumes relative to the tidal prism (*i.e.*, the volume of water entering on a flooding tide). Although Shoestring Bay, Ockway Bay, Mashpee River and Pinquisset Cove and the main basin of Popponesset Bay have different hydrologic characteristics, tidal forcing for all of these component systems is generated from Nantucket Sound. Nantucket Sound, exhibits a moderate to low tide range, with a mean range (high to low tide) of about 2.5 ft. Since the water elevation difference between Nantucket Sound and Popponesset Bay is the primary driving force for tidal exchange (flushing), the local tide range naturally limits the volume of nutrient enriched water flushed from the system during each tidal cycle. It should be noted that the Popponesset Bay System is more sensitive to water quality declines from nitrogen enrichment than estuaries bordering Cape Cod Bay or the outer Cape, where the tide range is much higher (*e.g.*, tide range off Stage Harbor Chatham is ~4.5 ft, Wellfleet Harbor is ~10 ft).





**Figure 2. Popponesset Bay System component basins.** Tidal waters enter the Bay through the single inlet from Nantucket Sound. Freshwaters enter from the watershed primarily through 3 surface water discharges (Mashpee River, Santuit River, Quaker Run) and direct groundwater discharge.

In addition to the offshore tide range, tidal damping (reduction in tidal amplitude) within the embayment itself from a constricted tidal inlet or internal channels can further reduce tidal flushing. Fortunately, within the Popponesset Bay System, only minimal tidal damping has been observed. Tidal damping further magnifies the effects of watershed nitrogen inputs. It appears that the tidal inlet continues to operate efficiently due to the Town of Mashpee's active and consistent inlet maintenance program. Given the present hydrodynamic characteristics of the Popponesset Bay System, it appears that estuarine habitat quality is primarily dependent on the level of nitrogen loading to bay waters rather than restrictions to tidal flows within the component sub-embayments.

Nitrogen loading to the Popponesset Bay System was assessed during the Massachusetts Estuaries Project and partitioned relative to its five (5) component basins: Pinquisset Cove, Ockway Bay, Mashpee River (lower or tidal region), Shoestring Bay, and Popponesset Bay. The watershed for this estuarine system contains approximately 13,000 acres dominated by single-family residences. The nitrogen loading from the more heavily populated areas of the Town of Mashpee is focused on the northern reaches of the estuarine system. System-wide, approximately three quarters of the nitrogen load from single-family dwellings enters the Shoestring Bay and Mashpee River basins before entering the main basin of Popponesset Bay.

In evaluating management alternatives, it is important to note that Popponesset Bay is a relatively dynamic system. Popponesset Spit is continually expanding and eroding, once nearly extending to the inlet channel to the Three Bays System to the north. The spit frequently experiences periodic overwash (Aubrey and Gaines 1982). The present inlet position is relatively new, resulting from a breach of the spit in the hurricane of 1954. Similarly, within the main Bay, several islands apparent 50 -100 years ago have been incorporated into other landforms with unquantifiable effects on the circulation of Bay waters. Thatch Island and Little Thatch Island within the lower main Bay have "joined" with the spit, most likely due to a combination of the natural processes of overwash of the barrier beach and shoreline retreat. Daniels Island, at the entrance to Ockway Bay, has been joined to the mainland by filled causeways, apparently filling salt marshes and changing the local circulation pattern. Hydrodynamics have also been altered within Popponesset Creek due to dredging and channelization of wetlands.

Within the watershed to Popponesset Bay there have been changes to the freshwater systems which attenuate nitrogen during transport to bay waters. Most notable of the changes has been the modification to riparian zones either through channelization, restriction, or filling of freshwater wetlands and, in some cases, transformation of portions of the watershed to cranberry agriculture. Most of the alterations have reduced the nutrient buffering capacity of these systems, thus magnifying the nitrogen loading to the bay. However, the predominant watershed alteration has been the shifting of fields and pine-oak forest to residential and commercial development, with its resultant increasing nitrogen input to the watershed, aquifer and ultimately bay waters. This recent shift in land-use has likely resulted in this estuary receiving its highest rates of nitrogen loading than at any period over the past 400 years. Previous large shifts in land-use, primarily from forest to agriculture did not have the same resultant enhancement in nitrogen loading. Historically, agriculture practice generally recycled nitrogen (as opposed to modern practice of using commercial fertilizers) and the population

was <10% of today. The present year-round population per square mile is greater than the entire town population of 50 years ago (total population based on 2020 census for the Towns of Mashpee, Sandwich, and Barnstable are 15,061, 20,261 and 48,912 respectively). It appears that the nitrogen attenuation capacity of the freshwater systems has been reduced, as the need to intercept the nitrogen loading to the watershed has increased. While this may be a partial cause of the present estuarine decline, it may also represent a potential opportunity for restoration of bay systems.

### *Waquoit Bay*

The Waquoit Bay embayment system is located within the Towns of Falmouth and Mashpee, Massachusetts on Cape Cod. Like Popponesset Bay, the Waquoit Bay watershed is primarily distributed among the Towns of Falmouth and Mashpee, with a small portion of the upper-most region of the watershed located in Sandwich. The southern shore is a barrier beach that separates the Waquoit Bay System from adjacent Nantucket Sound (Figure 3). Waquoit Bay is composed of a main bay with multiple associated sub-embayments (Quashnet River, Hamblin Pond, Jehu Pond, Eel River/Pond, Childs River). These sub-embayments constitute important components of the region's natural and cultural resources. In addition, like for Popponesset Bay, the large number of sub-embayments greatly increases the shoreline of the system and decreases the travel time of groundwater from the watershed recharge areas to bay regions of discharge. The main bay has two primary openings to Nantucket Sound, a historically open inlet in the main bay and a relatively dynamic inlet that connects Eel Pond to Nantucket Sound. More recently, Hurricane Bob in 1991 created a third inlet immediately east of the Eel Pond entrance; however, this inlet has closed over the past few years. The inlet to the main bay has been fixed with jetties initially in 1918 (east) and 1937 (west), with subsequent lengthening and enhancements. The second inlet has been generally open over the past 50 years. The opening of the second inlet significantly increased the tidal range and flows within the Waquoit Bay System and caused important ecological shifts to its tidal wetlands and possibly other estuarine habitats (Orson and Howes, 1992). Overall, these important "natural and unnatural" hydrodynamic shifts, coupled to anthropogenic alteration of the watershed, supports a highly altered estuarine habitat.

The Waquoit Bay system is located within the Mashpee Pitted Outwash Plain that supports numerous kettle ponds (Oldale 1992). The Quashnet River Estuary is a drowned river valley estuary resulting from rising sea-level flooding the lower reaches of the Quashnet River. Hamblin and Jehu Pond appear to be drowned kettle ponds currently exchanging tidal flows with Waquoit Bay through tidal rivers, Little River and Great River respectively. Both the Hamblin Pond and Jehu Pond subsystems support significant saltwater wetland resources. The tidal reach of the Quashnet River Estuary is located within the Town of Falmouth while much of the freshwater region of the Quashnet River and its watershed is found in the Town of Mashpee.

The Quashnet River is one of the two major surface water inflows to the Waquoit Bay System and originates in John's Pond. Hamblin Pond is divided between the Towns of Falmouth and Mashpee, while Jehu Pond is entirely situated within the Town of Mashpee. Within the Quashnet River, Hamblin Pond, and Jehu Pond sub-embayments geomorphic and hydrologic





**Figure 3. Waquoit Bay and its component sub-embayments.** Tidal waters from Nantucket Sound enter the main Bay through a single armored inlet in the barrier beach and an unarmored inlet to the Eel Pond sub-embayment. Freshwaters enter the estuary primarily through two major surface water discharges (Childs River to Eel Pond and Quashnet River to the main basin), several smaller streams (*e.g.* Red Brook), and direct groundwater discharge.

of riparian zone for cranberry agriculture, as well as the creation of roadways altering tidal circulation around Monomascot Island. However, the over-riding change affecting these sub-systems appears to have been the shift from pine/oak forest to farming to current residential land-uses, with its associated large increases in watershed nitrogen loading to the estuarine system. Most of the main basin of Waquoit Bay, as well as Eel Pond and Childs River lie within the Town of Falmouth. Their shorelines are highly developed, particularly in the area of Seacoast Shores. As a result of nitrogen entering from its watershed, Childs River is among the more highly impaired estuarine habitats within the region.

The nature of enclosed embayments in populous regions brings two opposing elements together: 1) as protected marine shorelines they are popular regions for boating, recreation, and land development; 2) as enclosed bodies of water, they may not be readily flushed of the pollutants that they receive due to the proximity and density of development near and along their shores. In particular, the Waquoit Bay system and its sub-embayments along the Falmouth and Mashpee shores are eutrophying from high nitrogen loads in the groundwater and runoff from their watersheds. Much of the Waquoit Bay System is currently beyond its nitrogen loading threshold and is currently showing various levels of nitrogen related habitat impairment.

The eastern Waquoit Bay basins, Quashnet River, Hamblin Pond/Little River, Jehu Pond/Great River, and Sage Lot Pond, show clear estuarine characteristics, with extensive salt marsh area, tidal flats and large salinity fluctuations. In contrast, the open water portions of Waquoit Bay and Eel Pond show more typical characteristics of open water areas, having only fringing salt marshes, relatively stable salinity gradients and a large basin volume relative to tidal prism. The tidal forcing for these subsystems, as for Popponesset Bay, is generated from Nantucket Sound. Nantucket Sound adjacent the inlets through South Cape Beach and the southern shore of Washburn Island, exhibits a moderate to low tide range, with a mean range of about 2.5 ft. Since the water elevation difference between Nantucket Sound and Waquoit Bay is the primary driving force for tidal exchange, the local tide range naturally limits the volume of water (and its entrained nutrients) that can flush into and out of the Bay System during a tidal cycle. Similar to Popponesset Bay, its relatively small tide range makes Waquoit Bay proportionally more sensitive to nitrogen related water quality impairments than estuaries on Cape Cod Bay and on the outer Cape with significantly larger tidal ranges, typically 10 ft to 4.5 ft, respectively.

Fortunately, there is minimal tidal damping through the Waquoit Bay inlet. It appears that the main tidal inlet is operating efficiently, possibly due to the active inlet maintenance program and the dual inlet configuration of the overall system. Similarly, within the eastern Waquoit Bay System, the tide generally propagates through the three focal sub-embayments with little attenuation, consistent with relatively unrestricted tidal exchanges. Given the present hydrodynamic characteristics of the Waquoit Bay System, it appears that estuarine habitat quality is primarily dependent on nitrogen loading to bay waters rather than tidal characteristics within the component sub-embayments. Due to the relatively well flushed conditions observed in these three sub-embayment systems, habitat degradation is mostly a result of the high nutrient loads currently being documented in these systems, not restricted tidal flows.

The watershed for this estuarine system contains approximately 10,250 acres, the predominant



land-use based on area being public service/government, including the Massachusetts Military Reservation and protected open space along the Quashnet River. Public service occupies 48% of the total watershed area to Waquoit Bay. In contrast, while single-family residences occupy approximately 25% of the total watershed area to eastern Waquoit Bay, this land use class represents 74% of all the parcels. Commercial properties are fairly limited within the watershed. Relative to the Waquoit Bay System, residential land-uses create the major nutrient load.

## ***ESTUARINE MONITORING PROGRAM***

The Mashpee Water Quality Monitoring Partnership was established to collect baseline nutrient related water quality data and to track restoration and management "success" in Popponesset Bay and Waquoit Bay relative to the benchmarks established in the MassDEP/USEPA TMDLs for Popponesset Bay<sup>2</sup> and Waquoit Bay.<sup>3</sup> The monitoring program was first established to support the Massachusetts Estuaries Project (MEP) analysis for all of Mashpee's estuarine waters and focuses on the two estuaries within the Town, which provide significant recreational, fisheries and aesthetic resources to the Town's citizenry:

- Popponesset Bay
  - Mashpee River
  - Shoestring Bay
  - Ockway Bay
  - Main Bay
  - Pinquisset Cove
  - Santuit River
  - Off Shore Station
- Waquoit Bay
  - Hamblin Pond – Little River
  - Jehu Pond – Great River
  - Main Bay
  - Childs River
  - Eel Pond
  - Quashnet River
  - Red Brook

As stated above, the concept underlying the establishment of the Monitoring Program by the Mashpee Wampanoag Tribe and the Town of Mashpee was to establish a long-term water quality monitoring effort for Popponesset Bay and Waquoit Bay relative to the TMDL process under the Clean Water Act, and compliance monitoring associated with the TMDLs. The present monitoring effort is significantly reduced over prior sampling efforts for these estuaries. This reduction in sampling intensity was acceptable as the prior high frequency sampling was required to support the MEP analysis, while the present effort is to track long-term changes due to the implementation of management alternatives for restoration of these nitrogen impaired bays. By establishing a stable, low frequency monitoring program and by using trained volunteers, costs of compliance

---

<sup>2</sup> Massachusetts Department of Environmental Protection. 2006. FINAL Popponesset Bay Total Maximum Daily Loads For Total Nitrogen (Report # 96-TMDL-4, Control #217.0). 31 pp.

<sup>3</sup> Massachusetts Department of Environmental Protection. 2020. FINAL Waquoit Bay System; including Eel Pond, Quashnet River, Hamblin Pond, and Jehu River Total Maximum Daily Loads for Total Nitrogen (Control #378.1). 88 pp.

monitoring to the Town have been significantly lowered making the program sustainable over the long-term. The stream-lined program builds upon the more intensive efforts conducted previously.

The Mashpee Waterways Commission (Steve Pinard 2009-2013; Don McDonald 2014-2021) has been responsible for overall program organization with assistance from Rick York (now retired) and Ashley Fisher (Natural Resources), including the recruiting of volunteers. The Mashpee Wampanoag Tribe Natural Resources Staff have been full partners in this effort and participated in each of the sampling events. The structure of the program relies on volunteers, with each estuary having a "Bay Captain" who oversees the sampling teams for each sampling event and ensures proper sample transfers and submittal of chain of custody forms. The technical aspects of the project were formerly under the direction of Dr. Brian Howes, Director of the Coastal Systems Program at SMAST-UMD and Sara Sampieri Horvet, the Coastal Systems Analytical Facility Manager (ssampieri@umassd.edu).<sup>4</sup> Volunteers were enlisted from each of the three Towns bordering the two estuaries: Falmouth, Mashpee and Barnstable. All field team members are volunteers, regardless of their other affiliations, as all members are dedicated to the restoration and protection of Mashpee's culturally and economically valuable estuarine resources.

Volunteer sampling teams were supplied with the necessary sampling equipment to conduct field measurements of physical parameters as well as to collect water samples for subsequent nutrient analysis by the SMAST Analytical Facility. The physical parameters included: total depth, Secchi depth (light penetration), temperature, estuary state, weather, wind speed and direction, and oxygen content. Laboratory analyses include: salinity, nitrate + nitrite, ammonium, dissolved organic nitrogen, particulate organic nitrogen, total nitrogen, chlorophyll-a pigments and orthophosphate (Table 1). All analytical methodologies have been previously approved for use in the SMAST Analytical Facility by EPA, Mass. CZM, NOAA and NSF and the Massachusetts Estuaries Project.

**Table 1. Summary of estuarine sampling and parameters analyzed.**

Location	Dissolved Nutrients	Particulate Nutrients	Chlorophyll /Pheophytin	Field Parameters
<b>Waquoit Bay</b>				
<b>All CR, ER and WB</b>	X	X	X	X
<b>Popponesset Bay</b>				
<b>All PB and SR</b>	X	X	X	X

As was the case with the prior year's (2021) monitoring effort, the 2022 Mashpee Water Quality Monitoring Program was very successful in its organizational aspects (and % sample capture). The success of the program relative to meeting the sampling goals showed once again that properly implemented volunteer sampling efforts can provide cost effective, high quality data for tracking the status of water quality in both Waquoit and Popponesset Bay Systems, and can support compliance monitoring with the USEPA/MassDEP TMDLS for these systems. In addition, under the recently upgraded program structure, it should be possible to track short-term changes in nutrient related water quality with greater certainty than in previous years.

<sup>4</sup> Dr. Howes passed away in December 2022 and Sara Horvet has continued to provide sampling coordination at CSP/SMAST.

Each volunteer water sampling team was trained/re-trained and outfitted with sampling equipment for collection of water samples at assigned sampling stations. Staff from the Coastal Systems Laboratory within SMAST conducted the training sessions and took part in the field sampling, both to assist the effort, as part of QA/QC procedures, and to insure proper transport and delivery of samples to the Coastal Systems Analytical Facility.<sup>5</sup>

As in previous years, sampling focused on the warmer summer period when nutrient related water quality conditions are the poorest. Sampling of both bays was completed on the same days in 2022: July 15, July 29, August 15 and August 30. Samples were collected at each station at mid-water depth on an ebbing tide for nutrients and surface, mid and bottom for physical parameters including temperature, salinity and dissolved oxygen (depending on the station depth).

The Water Quality Monitoring Program occupied the same sampling sites as in previous sampling years to allow for direct comparisons and track any changes in nutrient related water quality within each of the different basins of each bay. The major change in the 2010-2022 program from the prior effort that was implemented to support the MEP analysis, is the reduction in the overall sampling effort (number of dates/year) while providing the same spatial coverage. This approach allows for incorporation of all historical data, provides the necessary spatial distribution required for management analysis, while also providing a continuing solid assessment of the current nutrient related water quality within the Town's estuaries. Monitoring locations for water quality sample collection were established in order to generate a well distributed network of sampling stations that would yield data at a high enough density with sufficient spatial distribution to ultimately resolve estuarine gradients (Station Maps, Figures 4 and 5). Stations were confirmed by GPS prior to sampling.

The monitoring approaches and parameters assayed are fully consistent with the Quality Assurance Project Plan (QAPP) of the Massachusetts Estuaries Project.<sup>6</sup> Samples and field data were collected at 16 locations within the Popponesset Bay system (inclusive of offshore boundary station) and 19 locations within the Waquoit Bay system.

Monitoring stations are of three types: (1) embayment stations (2) offshore-boundary condition station and freshwater inflow stations. As in previous seasons, a total of 148 water samples for nutrients (including QA samples) were collected in the 2022 field seasons: 80 in the Waquoit Bay system and 68 in the Popponesset Bay system. The offshore station is used as one gauge of the boundary conditions in nearshore Nantucket Sound (Tables 2 and 3).

---

<sup>5</sup> The Coastal Systems Analytical Facility is within the School for Marine Science and Technology, UMASS-Dartmouth at 706 S. Rodney French Blvd, New Bedford, MA. 02744 (Sara Sampieri, 508-910-6325; ssampieri@umassd.edu). The laboratory supports a full range of environmental assays, with detection limits suited for natural waters. The laboratory data is accepted for both research and regulatory (USEPA, MassDEP, MCZM, NOAA) projects.

<sup>6</sup> Quality Assurance Project Plan is reviewed and must be accepted by MassDEP and USEPA for the information generated by a study to be seamlessly incorporated into regulatory planning or proof of compliance studies under the Clean Water Act. All of the approaches, protocols and analytical methods are part of the MEP's QAPP as well as other QAPP's for water quality monitoring in southeastern Massachusetts.

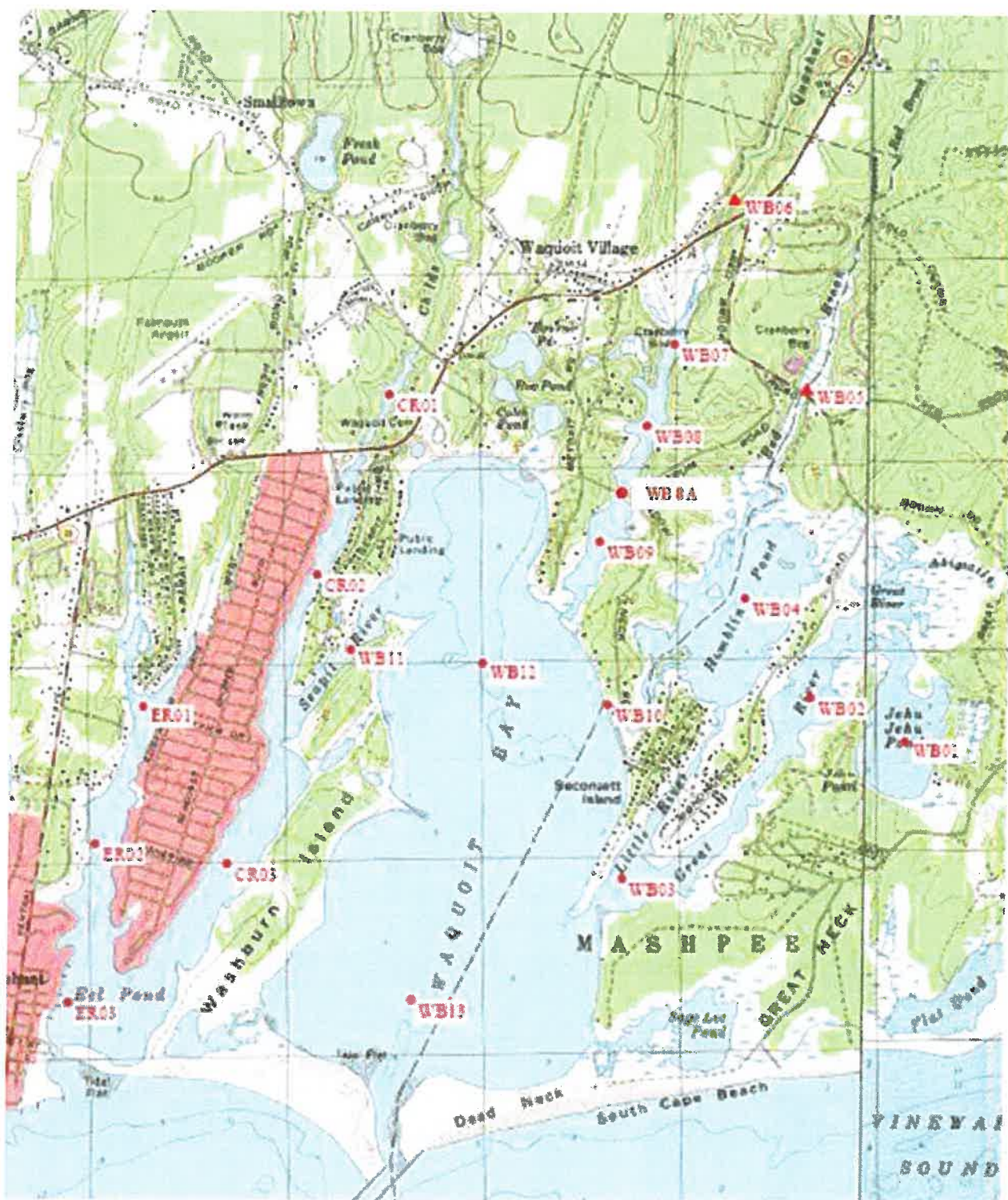


Table 2. Summary of sampling sites and schedule for the Popponesset Bay and Waquoit Bay systems, summer 2021\* Samples include one QA sample

Waquoit Bay Sub-Systems and Sampling Stations											
Date	Waquoit Bay WB12, 13	Childs River CR01, 02, 03	Eel River ER01, 02, 03	Quashnet River WB06, 07, 08, 09	Hamblin Pond WB04, 10	Jehu Pond WB01	Great River WB02, 03	Red Brook WB05	Seapit River WB11	Total	
July 13	3*	3	3	4	2	1	2	1	1	20	
July 27	3*	3	3	4	2	1	2	1	1	20	
Aug 12	3*	3	3	4	2	1	2	1	1	20	
Aug 26	3*	3	3	4	2	1	2	1	1	20	
Total	12	12	12	16	8	4	8	4	4	80	
Popponesset Bay Sub-Systems and Sampling Stations											
Date	Mashpee River PB01, 02, 03, 04	Shoestring Bay PB05,06, 07	Ockway Bay PB09, 10	Popp Bay PB08, 11, 12, 13	Off Shore PB 14	Pinquicket Cove PB15	Santuit River SR05	Total			
July 13	4	3	2	5*	1	1	1	17			
July 27	4	3	2	5*	1	1	1	17			
Aug 12	4	3	2	5*	1	1	1	17			
Aug 26	4	3	2	5*	1	1	1	17			
Total	16	12	8	20	4	4	4	68			

Table 3. Summary of sampling sites and schedule for the Popponesset Bay and Waquoit Bay systems, summer 2022; \* Samples include one QA sample

Waquoit Bay Sub-Systems and Sampling Stations											
Date	Waquoit Bay WB12, 13	Childs River CR01, 02, 03	Eel River ER01, 02, 03	Quashnet River WB06, 07, 08, 09	Hamblin Pond WB04, 10	Jehu Pond WB01	Great River WB02, 03	Red Brook WB05	Seapit River WB11	Total	
July 15	3*	3	3	4	2	1	2	1	1	20	
July 29	3*	3	3	4	2	1	2	1	1	20	
Aug 15	3*	3	3	4	2	1	2	1	1	20	
Aug 30	3*	3	3	4	2	1	2	1	1	20	
Total	12	12	12	16	8	4	8	4	4	80	
Popponesset Bay Sub-Systems and Sampling Stations											
Date	Mashpee River PB01, 02, 03, 04	Shoestring Bay PB05,06, 07	Ockway Bay PB09, 10	Popp Bay PB08, 11, 12, 13	Off Shore PB 14	Pinquicket Cove PB15	Santuit River SR05	Total			
July 15	4	3	2	5*	1	1	1	17			
July 29	4	3	2	5*	1	1	1	17			
Aug 15	4	3	2	5*	1	1	1	17			
Aug 30	4	3	2	5*	1	1	1	17			
Total	16	12	8	20	4	4	4	68			





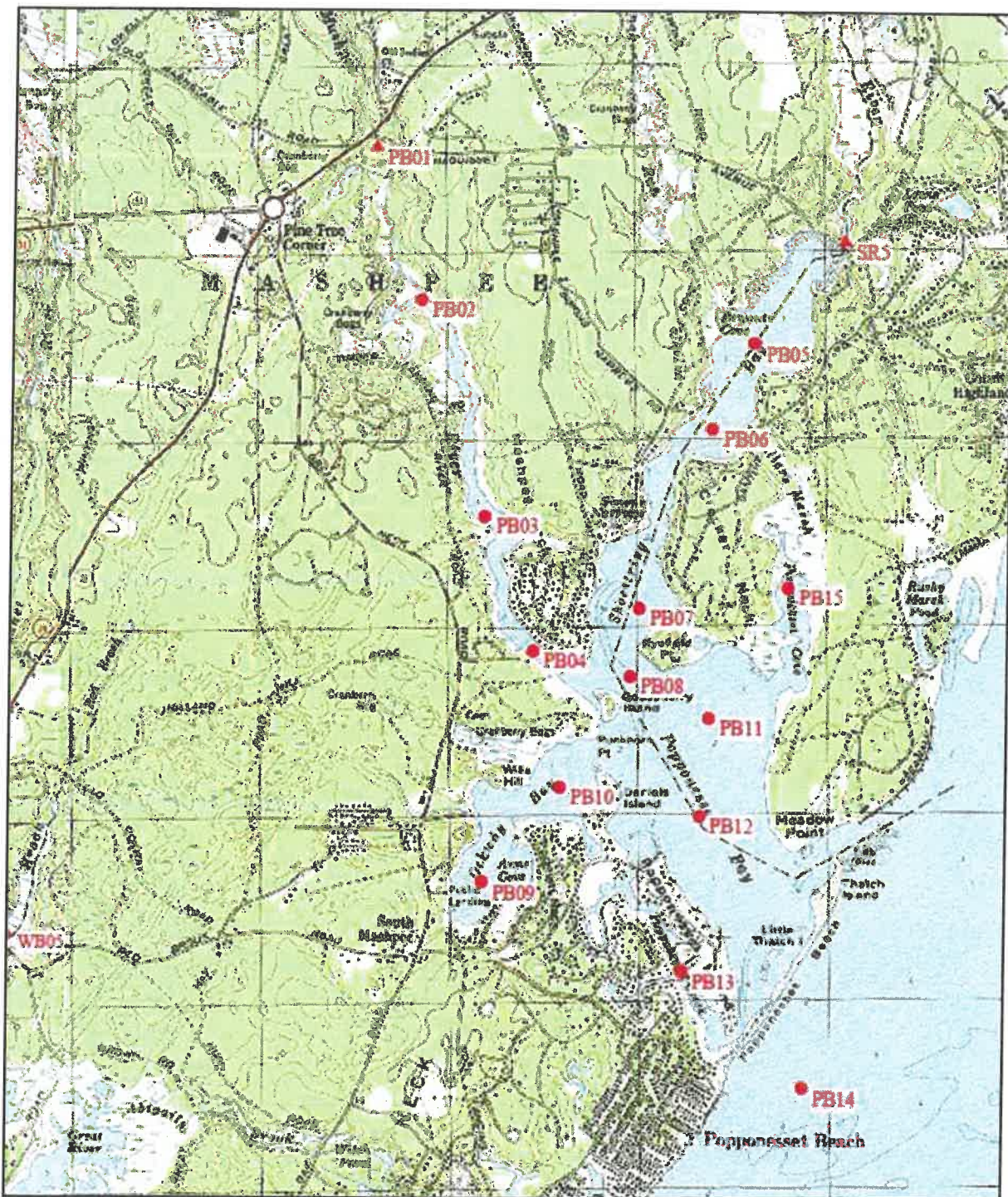


Figure 5. Mashpee Water Quality Monitoring Program: Popponesset Bay Sampling Stations (2001-2022). Samples were collected synoptically between 5:30 - 8:30 AM on ebbing tides.



## MONITORING RESULTS

In regard to the Popponesset Bay and Waquoit Bay Systems, nutrient-related water quality decline continues to represent the primary environmental problem facing the citizens of Mashpee, Falmouth, Barnstable and Sandwich. Nitrogen management planning and implementation are underway and the Mashpee Water Quality Monitoring Partnership is tracking short and long term changes resulting from continued watershed nitrogen loading increases, variation in tidal flushing, and implementation of nitrogen management alternatives (including propagation of oysters). As implementation is still in its early stages, it is not surprising that the results of the 2022 Mashpee Water Quality Monitoring Program indicate that both Popponesset Bay and Waquoit Bay continue to show poor nutrient related water quality throughout most of their tidal reaches, particularly in the upper portions of each system.

During 2022, both systems had total nitrogen (TN) concentrations that were above their long term average TN concentrations at most stations [Figures 6 (Waquoit) and 10 (Popponesset)]. This finding would be consistent with the general expected trend predicted by the MEP modeling. Both systems had watershed buildout scenarios completed and both systems had projections of higher TN concentrations as all buildable lots were developed and associated populations continued to increase. Past reviews showed that TN concentrations fluctuate from year to year, but this general trend has continued on multi-year timeframes. For example, review of data through 2015 appeared to show some improved water quality in both Popponesset Bay and Waquoit Bay. Unfortunately both bays experienced large blooms and an associated decline in water quality in summers of 2016 - 2018, and both estuaries have impaired habitats and have TN levels that remain greater than the water quality levels set by the MassDEP/EPA.

Compared to 2021 levels, most of the 2022 TN levels in both systems increased. In 2022, TN levels in Popponesset were 4% to 44% higher than 2021 levels at 10 of the 14 individual stations. Waquoit TN levels increased at 11 of 16 monitoring stations with increases of 5% to 54%. Most of the stations in both systems where TN levels decreased were closer to the system inlet; the offshore station TN level decreased by 17% compared to 2021. These type of changes show that year-to-year fluctuations can be significant, something to keep in mind as the system improves after CWMP implementation.

The overall salinity gradients within each estuary in 2010-2022 are generally consistent with historical patterns with increases of 1% to 10% [Figures 7 (Waquoit) and 11 (Popponesset)]. There are notable exceptions at the uppermost tidal portions of the rivers flowing into both estuaries. At MR02 (Mashpee River), WB8 (Childs River), and WB7 (Quashnet River), 2022 salinities were 55% to 112% higher than the long-term mean (1997-2009). These higher levels continue general trends that have occurred since 2009, although preliminary 2023 data shows decreases, perhaps indicating normal fluctuations driven by unmeasured factors. Further data evaluation of streamflow and tidal water levels would be necessary to evaluate why salinity readings increase, but it would be consistent with an increasing tidal range. Another option would be decreasing streamflows and/or groundwater levels, but evaluations in other systems have found that groundwater levels are generally increasing at a faster rate than sea level rise.<sup>7</sup> Groundwater and

---

<sup>7</sup> Eichner, E., B. Howes, and D. Schlezinger. 2022. Cedar Pond Adaptive Management Monitoring Program: Annual Technical Report, January 2021 to December 2021. Town of Orleans. Coastal Systems Program, School for Marine Science and Technology, University of Massachusetts Dartmouth. New Bedford, MA. 47 pp.

stream discharge is likely happening at the same or a higher rate, but it has likely moved further inland from the long-term sampling stations.

The 2022 chlorophyll pigments in both bays generally showed decreases compared to 2021 concentrations [Figures 8 (Waquoit) and 12 (Popponesset)]. All station concentrations in both bays were greater than the long-term 3 µg/L impairment threshold established in previous monitoring reporting, but concentrations were 9% to 80% lower than 2021 levels. While these decreases are system-wide in both bays, they are largely lower than previous years, which suggest conditions in 2022 were exceptional for some reason. A more detailed review and review of available complementary data (*e.g.*, precipitation, temperature, winds) would be necessary to try to evaluate when 2022 levels were lower.

In contrast to TN, salinity, and chlorophyll pigments, DO levels were different in the two systems in 2022 [Figures 9 (Waquoit) and 13 (Popponesset)]. In Waquoit, the 20% lowest DO concentrations increased from 2021 levels in Childs River, Eel River, Quashnet River, Jehu Pond, and Seapuit River stations. The mid-Quashnet River station (WB08) concentration exceeded the MEP minimum of 6 mg/L. Preliminary data from 2023 generally showed decreases back to 2021 at 4 stations, but reinforced the fluctuations often seen in DO readings. In Popponesset, in contrast, 12 of the 14 stations had decreases in 2022 DO levels compared to 2021 levels. Preliminary review of 2023 data generally showed increases compared to 2022 levels; this will be evaluated further when all 2023 data is available. The average 2022 DO concentration across all stations was 3.6 mg/L while the 2023 average was 3.8 mg/L. Factors that impact DO levels are photosynthesis/plant levels, sediment oxygen demand, winds, and temperature. With the decreases in chlorophyll pigments, photosynthesis additions would have to come from macroalgae. As with the chlorophyll pigments, additional information would be necessary to determine why the changes may have occurred and why there were differences from year to year.

In general, the 2010-2022 sampling results are consistent with the prior years in showing that the Waquoit Bay and Popponesset Bay systems are still well above their assimilative capacity with total nitrogen levels well above their TMDL designated thresholds. The threshold total nitrogen level for all of Popponesset Bay is 0.38 mg/L, while Waquoit Bay has a TN threshold limit of 0.5 mg/L for Quashnet River, 0.446 mg/L for Jehu Pond, and 0.38 mg/L for the rest of the Bay. It should be noted that Hamblin and Jehu Pond had only recently lost their eelgrass habitat at the time of the MEP and therefore may be able to be restored more quickly than other larger basins that are much farther beyond their acceptable nitrogen thresholds. The MEP team also noted that Childs River and Quashnet River show more TN variability due to annual hydrologic variability and, as such, continued monitoring is critical to account for the variability. The consequences of the elevated TN levels can be seen in the high amounts of phytoplankton biomass (measured as chlorophyll-a pigments) and associated depletion of bottom water oxygen.



## NUTRIENT RELATED WATER QUALITY INDEX

Past reviews have integrated the key nutrient related parameters collected as part of the monitoring program into a single eutrophication index. The Bay Health Index was developed for Buzzards Bay embayments based upon levels of nitrogen (inorganic and organic), total chlorophyll-a, bottom water oxygen and the depth of light penetration (Secchi depth). **Table 4** show the index reference values; based on measured water quality in a bay, each parameter is rated on a 0% to 100% score and then the scores are average across the parameters. Higher scores (*e.g.*, >70%) indicate high quality conditions. The “Health Index” provides a convenient tool for comparing regions within an estuary and between estuaries, but does not provide a quantitative assessment of habitat health and is not suitable for salt marsh dominated estuaries or freshwater. Nevertheless, it does give a useful general picture of estuarine water quality and spatial gradients within estuaries and may be used to assess temporal trends.

The Bay Health Index has been used previously for the Waquoit Bay and Popponesset Bay estuarine systems based on the multi-year monitoring results [long-term (1997-2009), 2010-2012, 2013-2015, 2016-2018, 2019-2021]. In this report, the 2022 Index results for both systems were compared to both the long term results and the most recent three year period (2019-2021). Average summer conditions throughout the Waquoit Bay and Popponesset Bay Systems were used to parameterize the Index. The scores for each parameter were calculated and the average score for each station (across the five parameters) were calculated for the long-term baseline, 2019-2021, and 2022. It should be understood that the resulting Index and the designation of acceptable ranges for each parameter are approximate and provide less certainty than site-specific analysis which include habitat assessments (*e.g.*, eelgrass, benthic infauna).

In Popponesset, the recent Index results generally showed improvements at all stations. The comparison of long-term baseline, 2019-2021, and 2022 Health Index scores at the monitoring stations shows that there was slight improvement 2022 compared to the baseline, but a larger improvement comparing the 2019-2021 average to the baseline (**Figure 14**). Overall 12 of the 15 stations showed improvements over baseline conditions in 2022, but all stations showed improvements when comparing 2019-2021 averages to baseline conditions. Review of the Index results to the general health status at the individual stations show 5 of the 15 stations have Fair/Poor scores with most of these stations in the Mashpee River. Another 8 stations are in the Moderate or Moderate/Fair categories. Only one station had a 2022 score in the High quality range and that was PB14, the offshore station. Input values are shown in **Table 5**. A summary of Health Index categories of Popponesset Bay stations from 2019 through 2022 is shown in **Figure 15**.

In Waquoit, the improvements were less consistent. Comparison of 2019-2021 index results to long-term baseline showed 9 of the 18 stations showed improvements, but the net score across the system was only +1 (**Figure 16**). Comparison of 2022 index results to baseline conditions showed a slight improvement: 14 of the 18 stations had improvements. Review of the Index results to the general health status at the individual stations show 6 of the 18 stations have Fair/Poor scores and that all of these stations are the estuary portions of the rivers feeding into the system: Childs River, Quashnet River, and Red Brook. Another 8 stations are in the Moderate or Moderate/Fair categories. Only one station had a 2022 score in the High quality range and that was WB13, the main bay station closest to the inlet; the 2022 score was approximately the same as the long-term baseline average. Input values are shown in **Table 6**. A summary of Health Index categories of Popponesset Bay stations from 2019 through 2022 is shown in **Figure 17**.

## MONITORING CONCLUSIONS AND RECOMMENDATIONS

Overall, both the Waquoit Bay and Popponesset Bay Estuarine Systems continue to be highly nitrogen enriched and show impaired nutrient related water quality in 2022, similar to the long-term pattern. The tidal rivers (Mashpee River, Childs River, Quashnet River) and major tributary basins (Eel Pond/River, Shoestring Bay and Ockway Bay) are all showing poor to moderate impaired water quality as evidenced by the Bay Health Index. All basins show nitrogen levels above their TMDL thresholds, periodic oxygen depletions below the state water quality standard and levels shown to be stressful to estuarine organisms, paired with periodic major phytoplankton blooms. The main basin of Waquoit Bay continues to show high water quality, but the main basin of Popponesset Bay continues to show TN concentrations greater than the TMDL limit of 0.38 mg/L.

As water development continues, it is anticipated that TN concentrations will continue to increase and Health Index scores will decrease, though it is also anticipated that there will be year-to-year fluctuations. Nitrogen management steps will be implemented soon and the Town should consider whether an updated baseline assessment of key MEP would be beneficial for comparison of anticipated improvements. Updated baseline information would include many of the measurements collected during the MEP, including benthic infauna, tidal elevation, streamflow monitoring, and watershed nitrogen loads. The water column data collected through the Mashpee Water Quality Monitoring Partnership is an important component of a baseline, but these other information are important for assessing the ecosystem conditions prior to the impacts of Phase I sewerage.

### *Specific findings:*

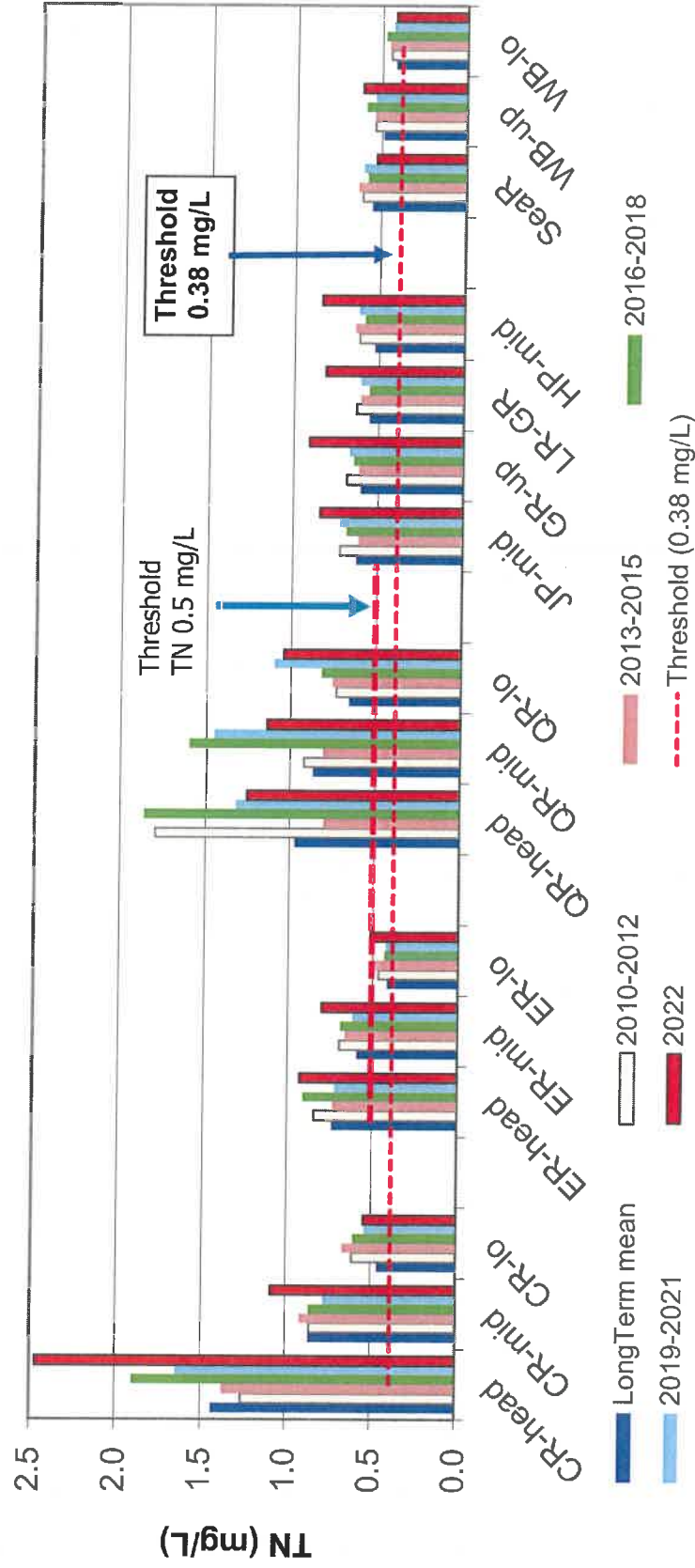
- (1) Both Waquoit Bay and Popponesset Bay show continuing impairments. All Popponesset Bay and Waquoit Bay stations have TN concentrations greater than the respective MassDEP TMDLs.
- (2) Both Waquoit Bay and Popponesset Bay have many individual monitoring stations with Fair/Poor scores on the Bay Health Index. There have been some recent improvements (2019-2021) compared to baseline conditions (1997-2009), but these scores only show high quality scores either near the inlet (Waquoit Bay) or outside of the system (Popponesset Bay).
- (3) Oxygen depletion in bottom waters continues to be a persistent impairment in both systems. All Popponesset Bay stations and all but one Waquoit Bay station had 2022 20% lowest dissolved oxygen concentrations less than the MassDEP minimum for SA waters (*i.e.*, 6 mg/L DO).
- (4) All Popponesset Bay stations and all but one Waquoit Bay stations also had 2022 total chlorophyll pigment concentrations greater than the 3 µg/L impaired threshold. It is notable, however, that pigment concentrations in 2022 were lower than the long-term baseline.
- (5) The monitoring program has become sufficiently robust to be able to detect changes within the estuaries in response to implementation of management alternatives, as well as year-to-year variations. Natural variation in year to year changes is overcome by continued long-term monitoring.



### *Recommendations:*

As the Town moves forward with CWMP implementation, water quality and ecosystem monitoring will become even more important for both assessing improvements and regulatory compliance with MassDEP. With this in mind, it is recommended that the Town consider collecting some of the ecosystem assessment parameters measured during the MEP so that the Town has an update baseline as improvements begin to the measured in water column data through the continuing Mashpee Water Quality Monitoring Partnership activities. These activities would include strategic collection and incubation of sediment cores, collection and assessment of benthic infauna populations, continuous DO and chlorophyll moorings, streamflow readings and water quality, and tidal elevation readings. These dataset could be compared to MEP findings and provide an updated baseline of current impaired conditions. The Town may also want to consider updating watershed nitrogen loads for comparisons to MEP buildout estimates and looking at other refined factors that could impact eelgrass regrowth, such as water column and bottom light recordings. The Town could then have information for discussions with MassDEP about TMDL compliance and current conditions that exist in the system.

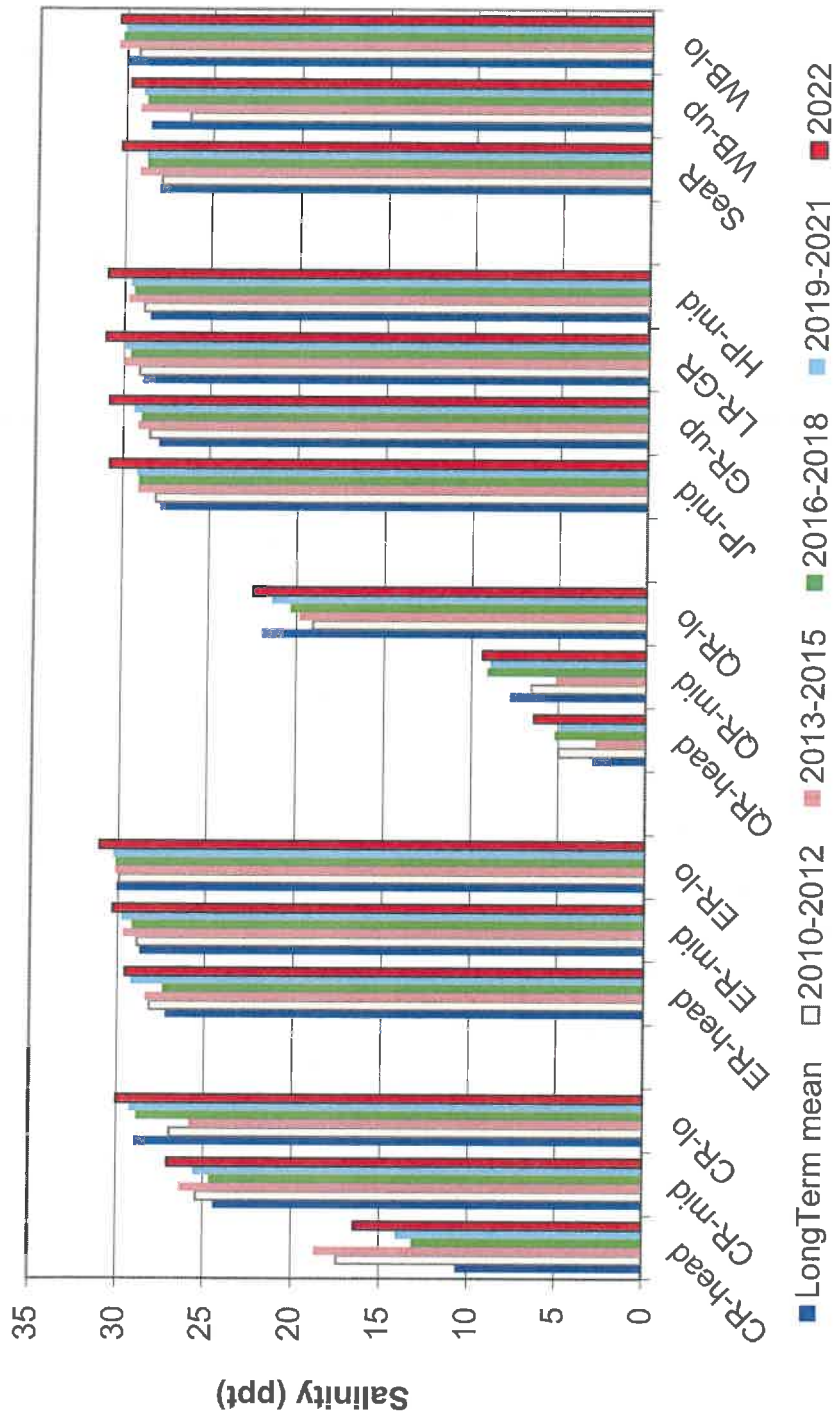
## Waquoit Bay TN: Long-Term vs 2010 - 2022



**Figure 6.** Distribution of Total Nitrogen within the Waquoit Bay Estuarine System, long-term and during the summers of 2010 through 2022. Nitrogen enters through groundwater inflows all along the shoreline, with additional "point" loads from the upper regions of the watershed via Moonakis River, Childs River, and Red Brook. These nitrogen loads plus recycling within the estuary mix with the low nitrogen waters of Nantucket Sound entering through the tidal inlets to create the observed gradient. CR - Childs River, ER - Eel River, QR - Quashnet River, JP - Juhu Pond, GR - Great River, LR-GR - Little River-Great River confluence, HP - Hamblin Pond, Sear - Seapit River, WB - Waquoit Bay main basin; head - uppermost reach, mid - middle reach, lo - lower basin near mouth or inlet. The red lines shows the TMDL threshold TN concentrations (0.38 mg/L for most of the system; 0.5 mg/L for Quashnet River & Upper Eel River) for restoration as adopted by MassDEP. TN levels in 2010-2021 are compared to the long-term averages (1997-2009).

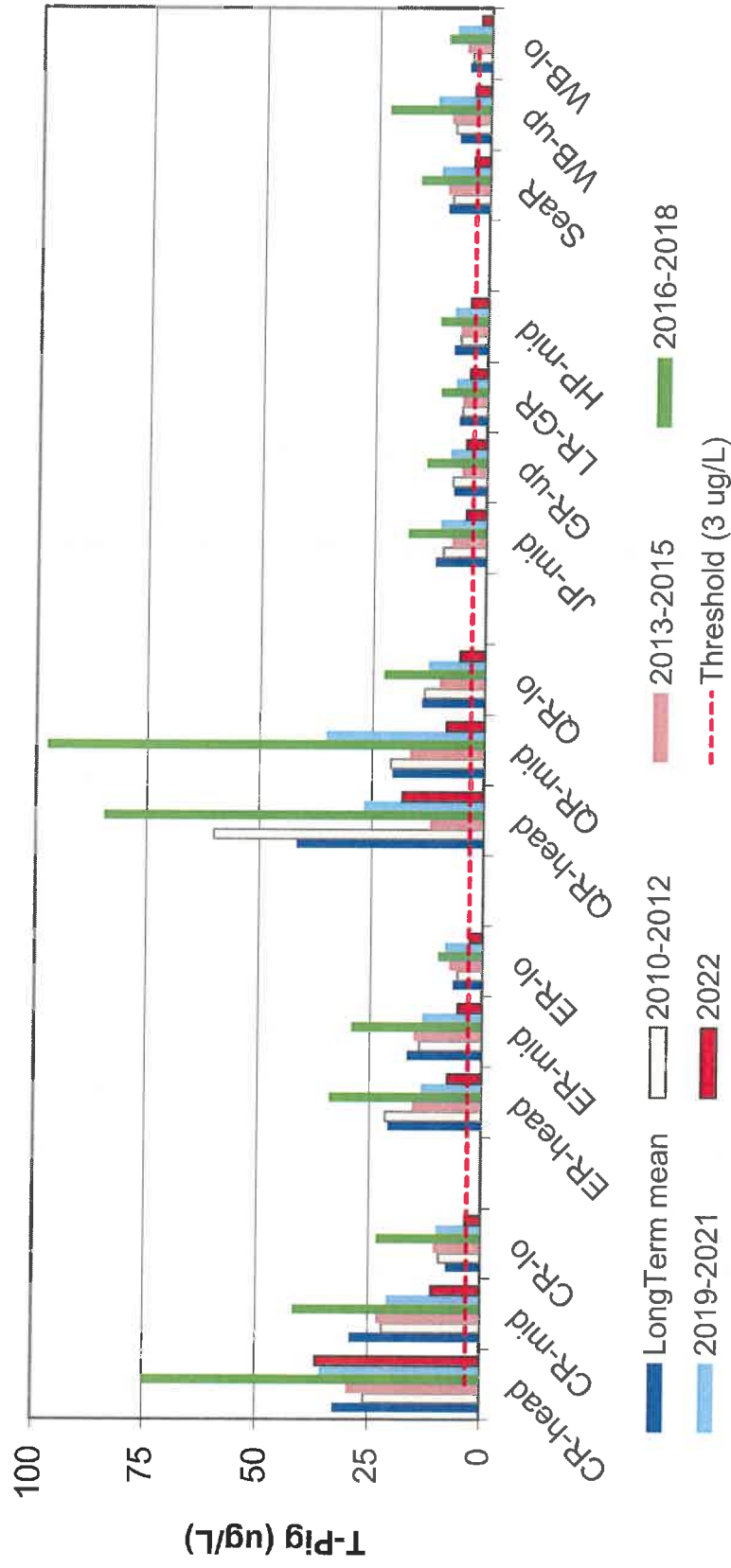


## Waquoit Bay Salinity: Long-Term vs 2010 - 2022



**Figure 7.** Salinity Distribution throughout the Waquoit Bay Estuarine System long-term and in the summers of 2010-2022. Freshwater enters through groundwater all along the shoreline, with additional "point" inflows from the Moonakis River, Childs River, and Red Brook. These freshwaters mix with the saline waters of Nantucket Sound entering through the tidal inlets. CR - Childs River, ER - Eel River, QR - Quashnet River, JP - Jehu Pond, GR - Great River, LR-GR - Little River- Great River confluence, HP - Hamblin Pond, Sear - Seapit River, WB - Waquoit Bay main basin; head - uppermost reach, mid - middle reach, lo - lower basin near mouth or inlet.

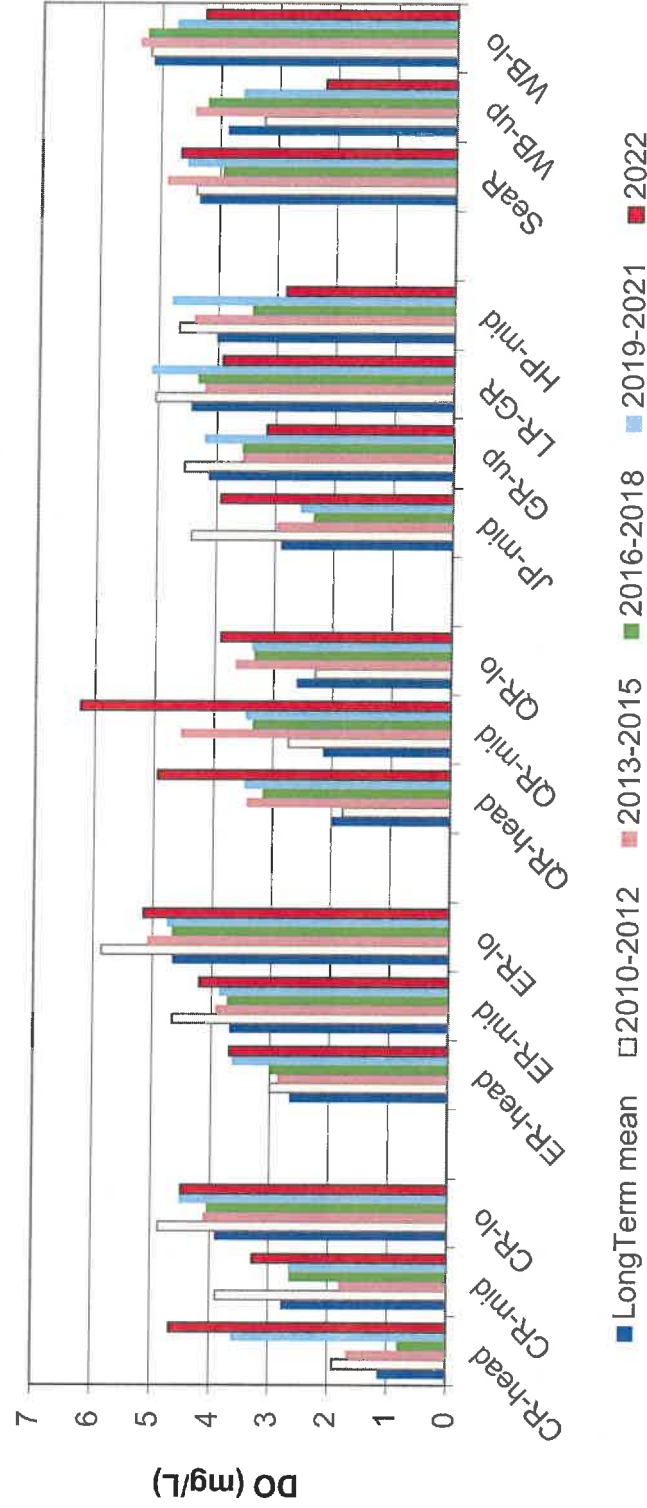
## Waquoit Bay Total Chla Pigment: Long-Term vs 2010 - 2022



**Figure 8.** Total Chlorophyll-a pigment levels throughout the Waquoit Bay Estuarine System over the long-term and in summers of 2009 through 2021. Phytoplankton pigment levels are a gauge of phytoplankton biomass, which is a response to nitrogen loading. Values over 10 indicate nitrogen enrichment, values  $\leq 3$  represent low nitrogen enriched waters (red line). CR - Childs River, ER - Eel River, QR - Quashnet River, JP - Jethu Pond, GR - Great River, LR-GR - Little River-Great River confluence, HP - Hamblin Pond, Sear - Seapit River, WB - Waquoit Bay main basin; head - uppermost reach, mid - middle reach, lo - lower basin near mouth or inlet.

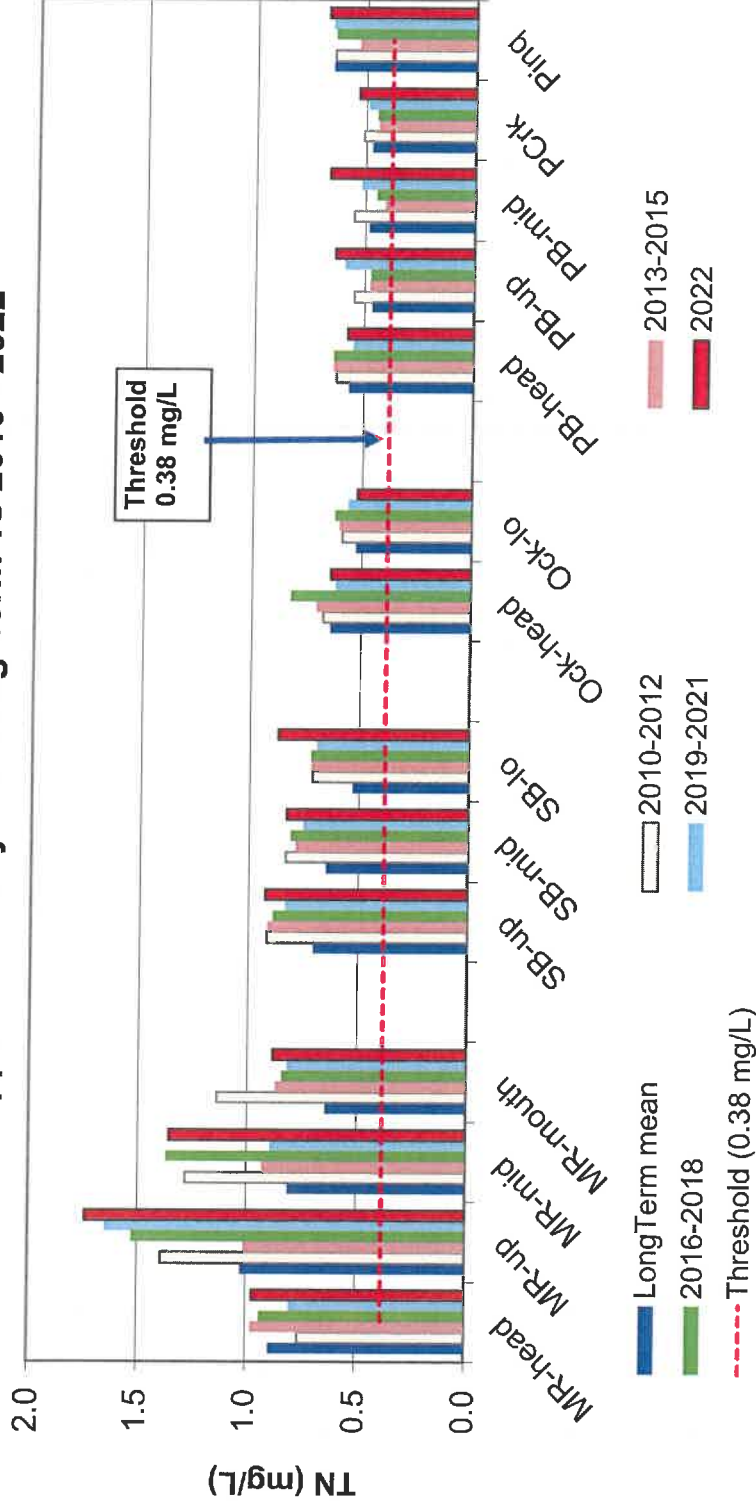


## Waquoit Bay 20% low DO : Long-Term vs 2010 - 2022



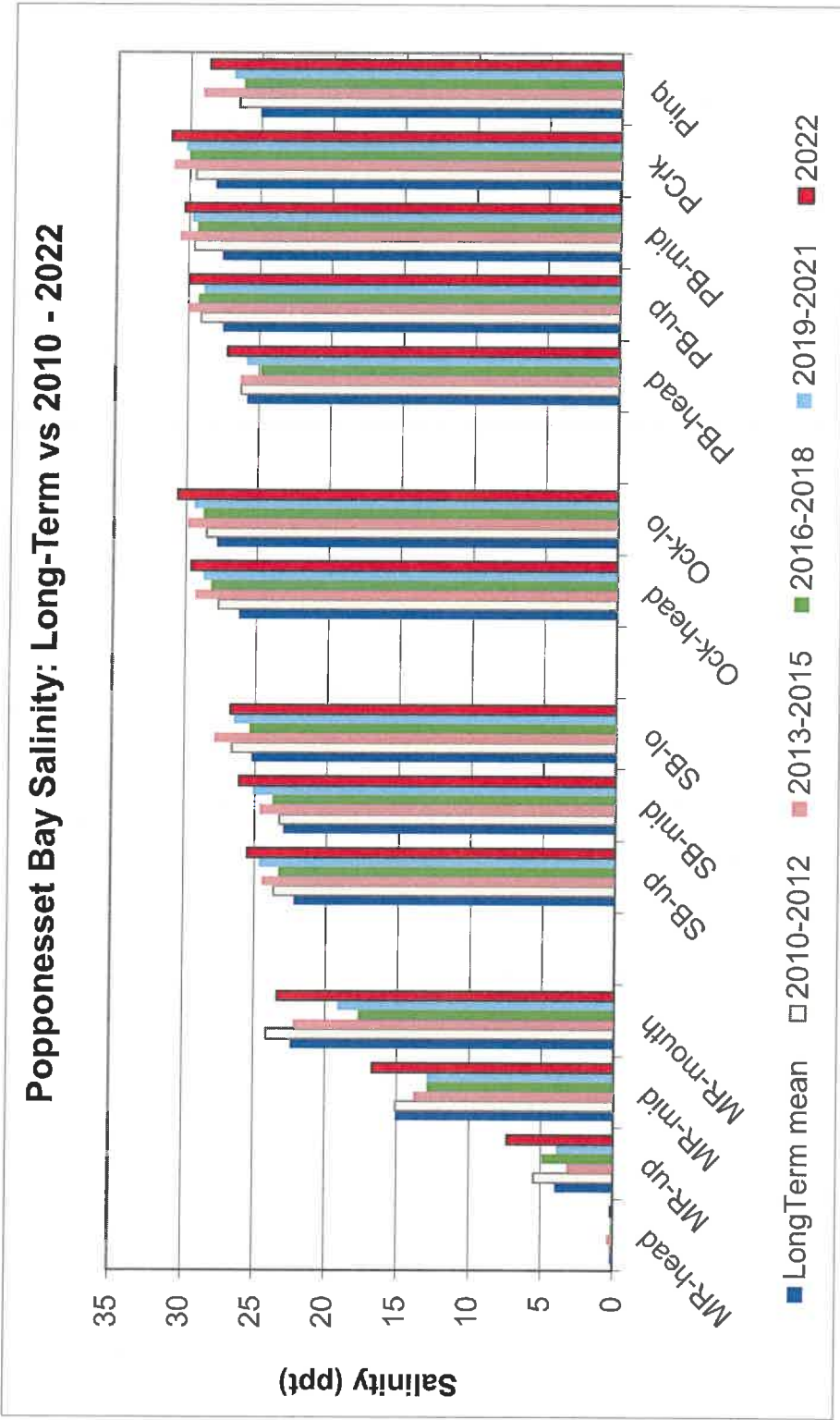
**Figure 9.** Minimum Dissolved Oxygen (DO) levels throughout the Waquoit Bay Estuarine System over the long-term and in the summers of 2010-2022. CR - Childs River, ER - Eel River, QR - Quashnet River, JP - Jehu Pond, GR - Great River, LR- GR - Little River-Great River confluence, HP - Hamblin Pond, SeaR - Seapit River, WB - Waquoit Bay main basin; head - uppermost reach, mid - middle reach, lo - lower basin near mouth or inlet. Massachusetts Surface Water Regulations administered by MassDEP have a minimum DO concentration of 6 mg/L in Class SA coastal waters (314 CMR 4).

## Popponesset Bay TN: Long-Term vs 2010 - 2022

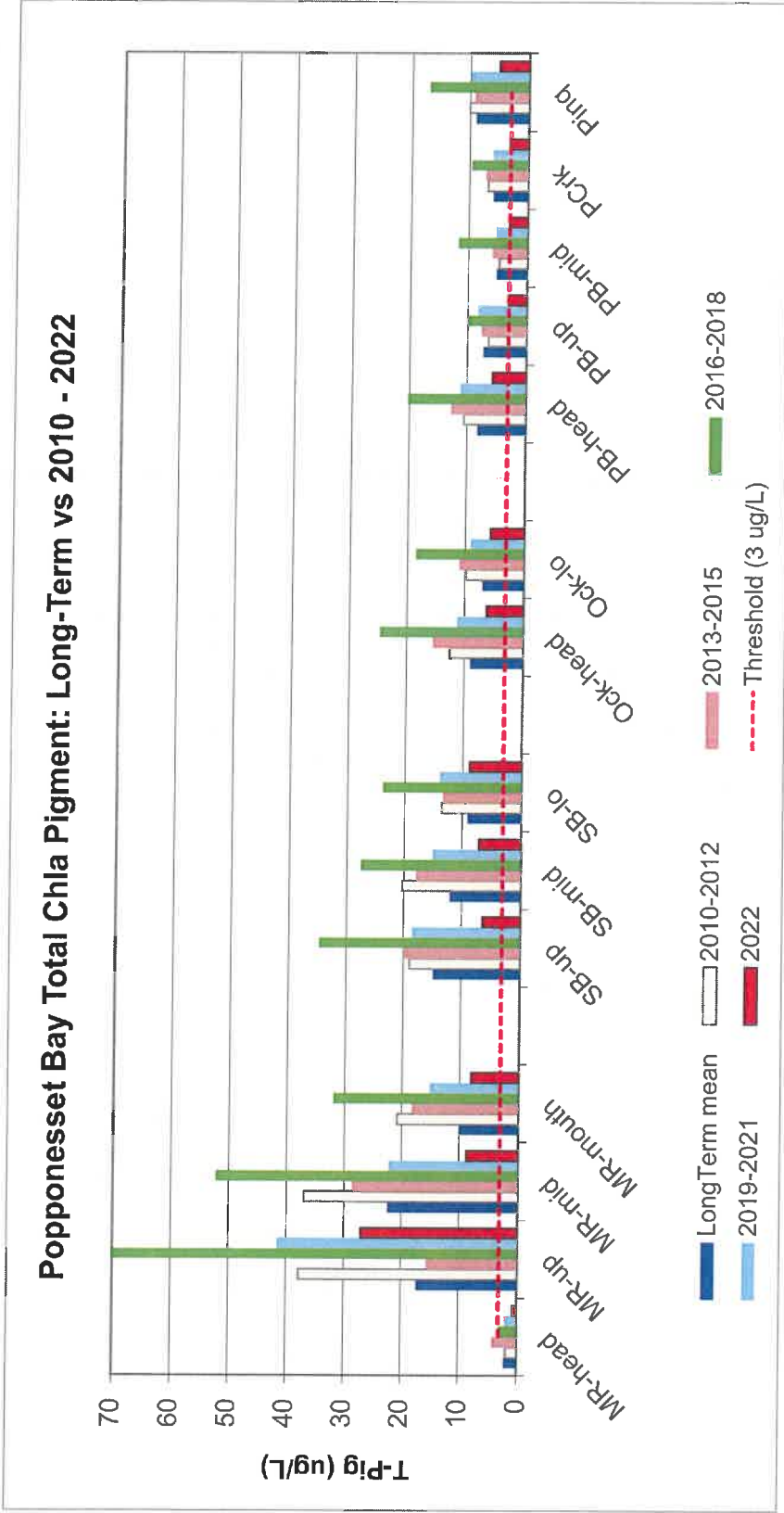


**Figure 10.** Distribution of Total Nitrogen within the Popponesset Bay Estuarine System. Nitrogen enters through groundwater inflows all along the shoreline, with additional "point" loads from the upper regions of the watershed via the Mashpee River and Santuit River to Shoestring Bay. These nitrogen loads plus recycling within the estuary mix with the low nitrogen waters of Nantucket Sound entering through the single tidal inlet to create the observed gradient. MR - Mashpee River, SB - Shoestring Bay, Ock - Ockway Bay, PB - Popponesset Bay, PCrk - Popponesset Creek, Pinq - Pinquisset Cove. The red line shows the TMDL threshold TN concentration (0.38 mg/L) for restoration as adopted by MassDEP. TN levels in 2010-2021 are compared to the long-term averages (1997-2009).





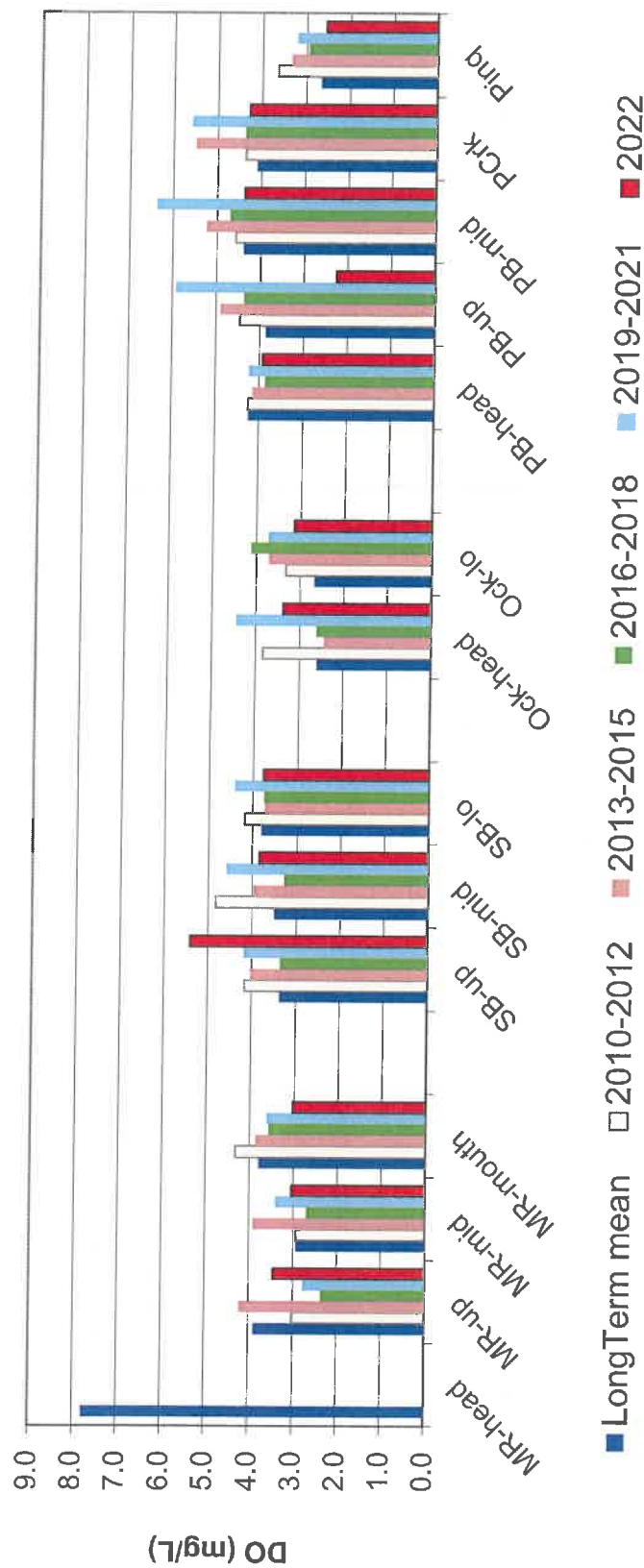
**Figure 11. Salinity Distribution throughout the Popponesset Bay Estuarine System (2010-2022).** Freshwater enters through groundwater all along the shoreline, with additional "point" inflows from the freshwater reach of the Mashpee River and from the Santuit River to Shoestring Bay. These freshwaters mix with the saline waters of Nantucket Sound entering through the single tidal inlet. MR - Mashpee River, SB - Shoestring Bay, Ock - Ockway Bay, PB - Popponesset Bay, PCrk - Popponesset Creek, Pinq - Pinquicket Cove.



**Figure 12.** Total Chlorophyll-a pigment levels throughout the Popponesset Bay Estuarine System over the long-term and in summer 2010-2022. Phytoplankton pigment levels are a gauge of phytoplankton biomass, which is a response to nitrogen loading. Values over 10 indicate nitrogen enrichment, values  $\leq 3$  represent low nitrogen enriched waters (red line). MR - Mashpee River, SB - Shoestring Bay, Ock - Ockway Bay, PB - Popponesset Bay, PCrk - Popponesset Creek, Pinq - Pinquisset Cove.

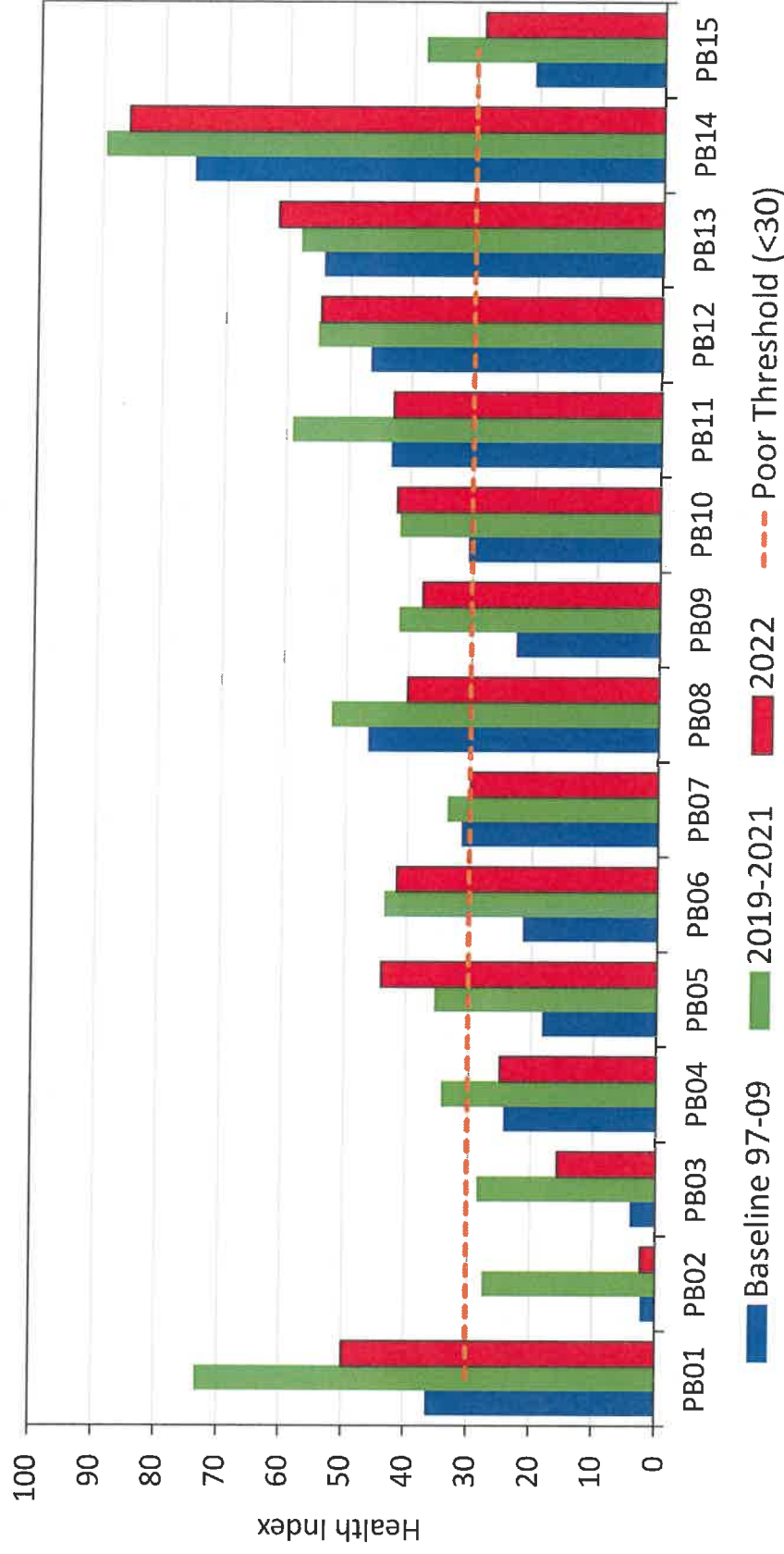


## Popponesset Bay 20% low DO : Long-Term vs 2010 - 2022

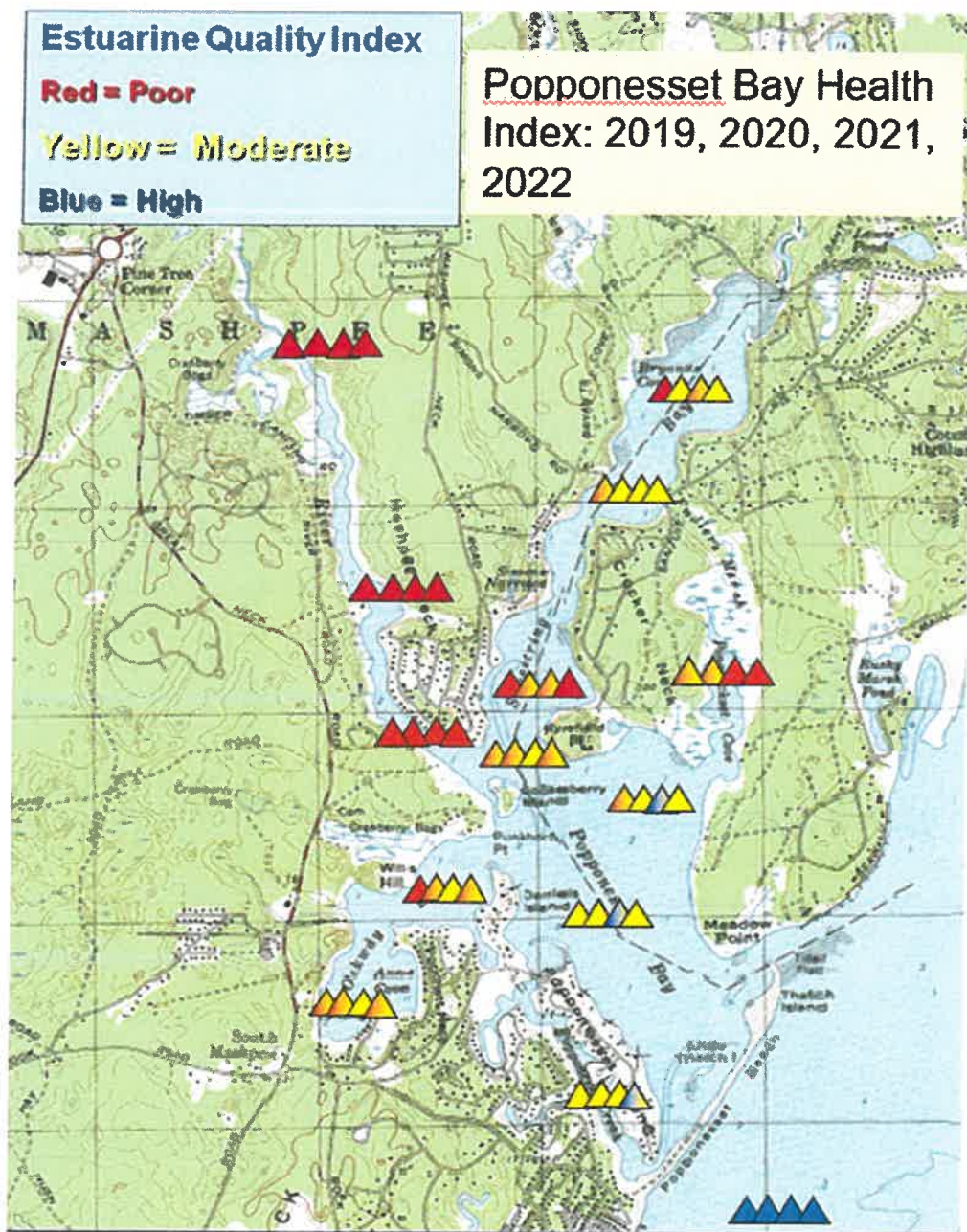


**Figure 13.** Minimum Dissolved Oxygen levels throughout the Popponesset Bay Estuarine System over the long-term and in the summers of 2010 through 2022. MR - Mashpee River, SB - Shoestring Bay, Ock - Ockway Bay, PB - Popponesset Bay, PCrk - Popponesset Creek, Pinq - Pinquisset Cove. Massachusetts Surface Water Regulations administered by MassDEP have a minimum DO concentration of 6 mg/L in Class SA coastal waters (314 CMR 4).

## Popponesset Bay Health Index



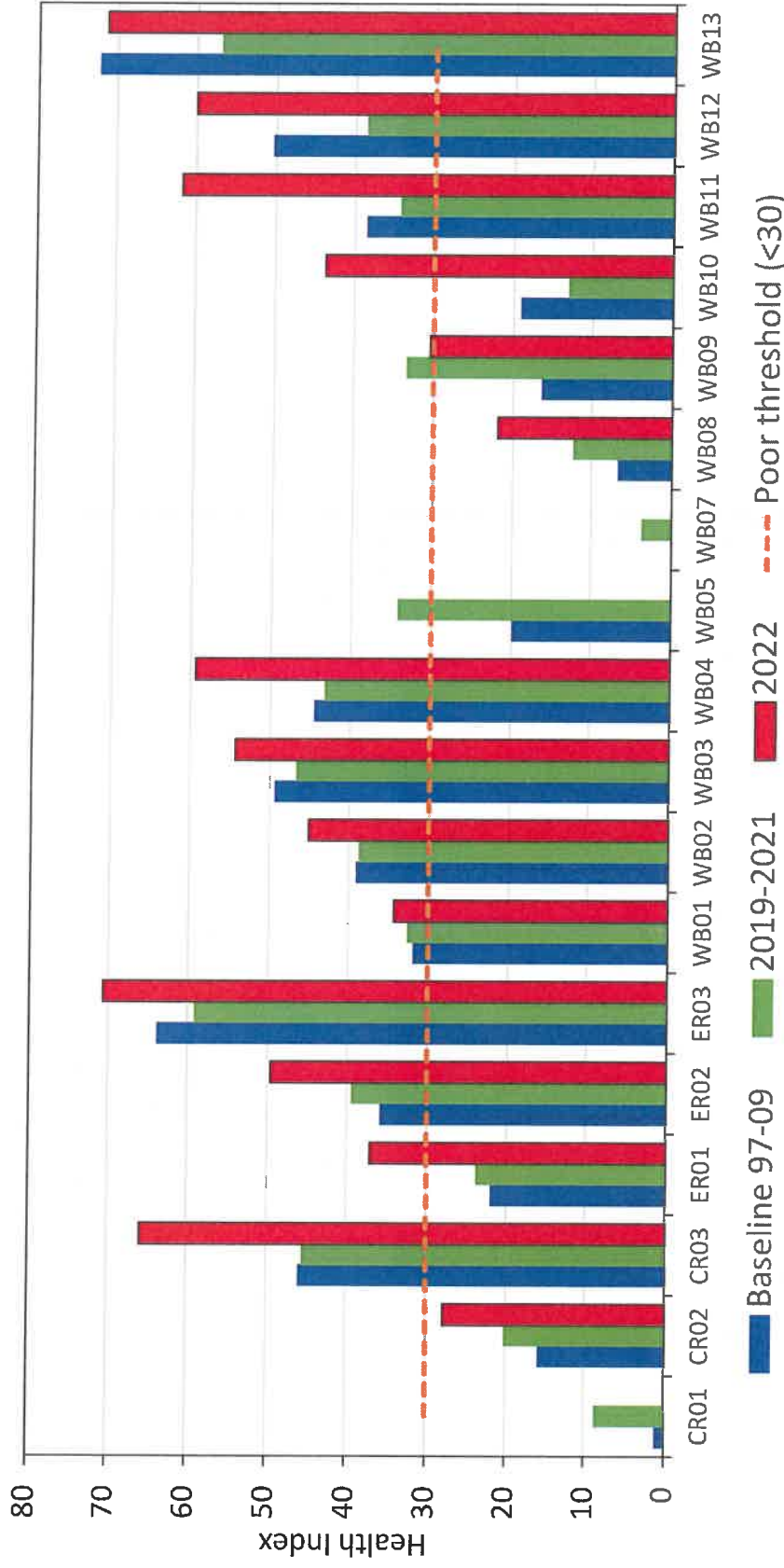
**Figure 14. Popponesset Bay Health Index: 1997-2009 (Baseline), 2019-2021, and 2022.** The comparison of long-term baseline, 2019-2021, and 2022 Health Index scores at the monitoring stations shows that there was slight improvement 2022 compared to the baseline, but a larger improvement comparing the 2019-2021 average to the baseline. Review of the Index results to the general health status at the individual stations show 5 of the 15 stations have Fair/Poor scores with most of these stations in the Mashpee River. Another 8 stations are in the Moderate or Moderate/Fair categories. Only one station had a 2022 score in the High quality range and that was PB14, the offshore station.



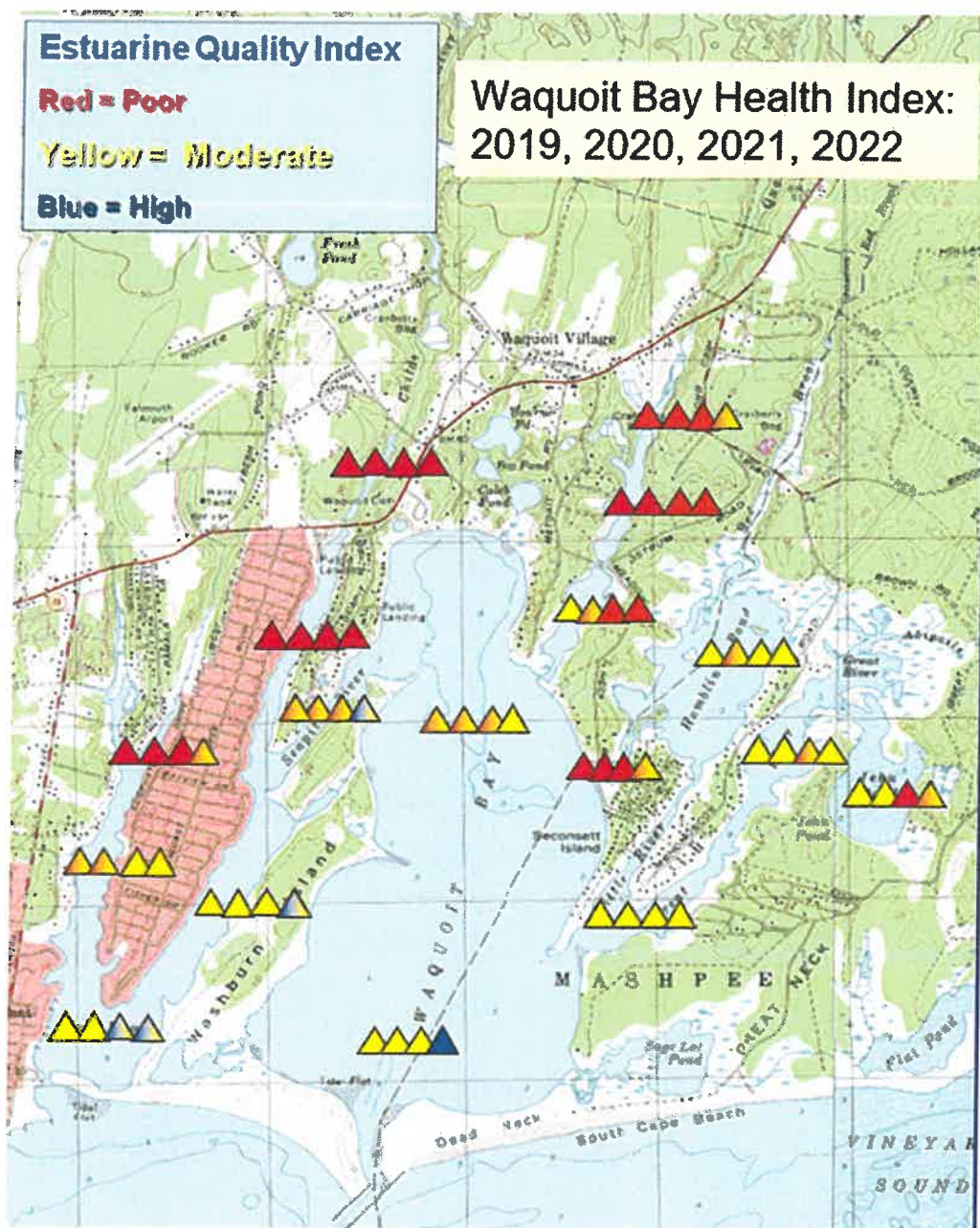
**Figure 15. Popponesset Bay Health Index Summary: 2019, 2020, 2021, and 2022.** Poor health index scores occur at stations in or near the Mashpee River and Pinquisset Cove. The only location with high quality health index score in 2022 is station PB14, which is just outside the system inlet.



## Waquoit Bay Health Index



**Figure 16. Waquoit Bay Health Index: 1997-2009 (Baseline), 2019-2021, and 2022.** Comparison of 2019-2021 index results to long-term baseline showed 9 of the 18 stations showed improvements, but the net score across the system was only +1. Comparison of 2022 index results to baseline conditions showed a slight improvement: 14 of the 18 stations had improvements. Review of the Index results to the general health status at the individual stations show 6 of the 18 stations have Fair/Poor scores and that all of these stations are the estuary portions of the rivers feeding into the system: Childs River, Quashnet River, and Red Brook. Another 8 stations are in the Moderate or Moderate/Fair categories. Only one station had a 2022 score in the High quality range and that was WB13, the main bay station closest to the inlet; the 2022 score was approximately the same as the long-term baseline average.



**Figure 17. Waquoit Bay Health Index Summary: 2019, 2020, 2021, and 2022.** Poor health index scores generally occur at stations in or near the Childs River and Quashnet River. The only location with high quality health index score in 2022 is station WB13, which is just inside the system inlet.

**Table 4.** Reference values used in the Bay Health Index. Scores are generated for each parameter and the mean score computed. In some cases where Secchi data is not available, the mean of the other 4 parameters may be used.

<b>Score</b>	<b>Secchi Depth M</b>	<b>Oxygen Saturation %</b>	<b>Inorganic N mg/L</b>	<b>Total N mg/L</b>	<b>Total Chlorophyll-a Pigments ug/L</b>
0%	0.6	0.40	0.140	0.600	10.0
100	3.0	0.90	0.014	0.280	3.0
The relationship between 0% to 100% for each parameter is logarithmic.					



**Table 5.** Summary of Summer 2022 water quality parameters in Popponesset Bay used in Bay Health Index.

2022 Station	Secchi Depth (m)	Total Depth (m)	Secchi as % W.C.	Salinity (ppt)	20% Low D.O. (mg/L)	20% Low D.O. (% Sat)	PO4 (mg/L)	NH4 (mg/L)	NOx (mg/L)	DIN (mg/L)	DON (mg/L)	PON (mg/L)	TON (mg/L)	TN (mg/L)	DIN/DIP Molar	T-Pig (ug/L)
<b>Mashpee River/Popponesset Bay</b>																
PB01	0.27	0.33	0.78	0.15	ND	ND	0.007	0.039	0.720	0.759	0.167	0.045	0.212	0.971	242.55	0.80
PB02	0.55	0.64	0.89	7.38	3.46	44.00	0.008	0.020	0.134	0.154	0.347	1.240	1.588	1.742	44.98	27.12
PB03	0.72	0.75	0.96	16.73	3.06	41.65	0.015	0.008	0.034	0.042	0.377	0.936	1.313	1.355	6.30	8.80
PB04	0.73	0.85	0.89	23.36	3.04	49.10	0.010	0.012	0.015	0.028	0.334	0.521	0.855	0.883	6.26	8.12
PB05	0.69	0.78	0.85	25.53	5.40	92.40	0.008	0.021	0.003	0.024	0.407	0.491	0.899	0.923	7.03	6.50
PB06	0.87	1.10	0.84	26.13	3.85	64.10	0.008	0.004	0.002	0.005	0.338	0.487	0.825	0.831	1.38	7.20
PB07	0.73	0.77	0.96	26.75	3.78	62.40	0.009	0.022	0.004	0.027	0.320	0.525	0.845	0.872	6.63	8.83
PB09	0.90	1.19	0.76	29.62	3.39	49.16	0.004	0.002	0.002	0.003	0.236	0.401	0.637	0.641	1.69	6.25
PB10	0.94	0.99	0.95	30.58	3.15	45.55	0.009	0.004	0.002	0.005	0.203	0.313	0.517	0.522	1.32	5.65
PB08	1.03	1.46	0.77	27.20	3.93	57.84	0.008	0.030	0.004	0.034	0.189	0.353	0.542	0.576	9.06	5.68
PB11	0.99	1.27	0.88	29.98	2.26	36.60	0.015	0.017	0.003	0.020	0.367	0.259	0.616	0.636	2.91	3.07
PB12	1.54	1.63	0.94	30.31	4.37	77.50	0.016	0.029	0.005	0.033	0.388	0.242	0.630	0.664	4.68	3.10
PB13	1.79	2.11	0.87	31.30	4.28	56.20	0.015	0.019	0.002	0.022	0.330	0.181	0.511	0.533	3.18	3.12
PB15	0.55	0.62	0.91	28.62	2.55	34.36	0.013	0.016	0.003	0.019	0.314	0.340	0.655	0.674	3.35	5.01
PB14	1.43	1.48	1.00	32.02	5.43	95.90	0.017	0.005	0.001	0.006	0.194	0.146	0.340	0.346	0.78	1.57
<b>Santuit River</b>																
SR5	btm	0.45	0.93	9.63	ND	ND	0.019	0.052	0.452	0.504	0.382	0.620	1.003	1.507	59.71	6.89

Table 6. Summary of Summer 2022 water quality parameters in Waquoit Bay used in Bay Health Index.

2022 Station	Secchi Depth (m)	Total Depth (m)	Secchi as % W.C.	Salinity (ppt)	20% Low D.O. (mg/L)	20% Low D.O. (% Sat)	PO4 (mg/L)	NH4 (mg/L)	NOx (mg/L)	DIN (mg/L)	DON (mg/L)	PON (mg/L)	TON (mg/L)	TN (mg/L)	DIN/DIP Molar	T-Pig (ug/L)
<b>Chilids River</b>																
CR01	0.60	0.82	0.71	13.17	0.90	13.60	0.01	0.03	0.21	0.23	0.36	1.88	2.23	2.47	43.94	36.61
CR02	1.03	1.54	0.67	25.73	2.60	42.50	0.01	0.01	0.01	0.01	0.46	0.61	1.07	1.09	3.82	10.88
CR03	1.29	2.18	0.61	29.60	4.21	74.60	0.01	0.01	0.00	0.01	0.31	0.22	0.54	0.55	2.14	3.39
<b>Eel River</b>																
ER01	0.94	1.34	0.70	30.76	3.22	53.10	0.01	0.00	0.00	0.01	0.47	0.45	0.92	0.93	1.71	7.57
ER02	1.13	1.35	0.83	30.55	3.67	63.10	0.01	0.01	0.00	0.01	0.38	0.41	0.79	0.80	2.88	5.30
ER03	btm	1.33	1.00	30.55	4.60	78.80	0.01	0.00	0.00	0.00	0.34	0.17	0.51	0.51	0.72	2.80
<b>Waquoit Bay</b>																
WB01	1.20	1.70	0.70	29.98	1.53	25.30	0.01	0.03	0.00	0.03	0.51	0.30	0.81	0.84	5.87	4.51
WB02	1.18	1.39	0.85	30.19	3.55	57.00	0.01	0.02	0.00	0.02	0.58	0.31	0.88	0.91	3.72	4.63
WB03	1.33	1.60	0.87	30.58	4.49	79.70	0.02	0.03	0.00	0.03	0.51	0.26	0.78	0.81	3.89	3.96
WB04	1.23	1.28	0.96	30.27	4.64	82.30	0.02	0.02	0.00	0.02	0.53	0.29	0.82	0.84	1.94	3.87
WB05	btm	0.20	1.00	0.15	NS	ND	0.03	0.43	0.69	1.11	0.28	0.80	1.08	2.19	76.44	19.32
WB06	btm	0.30	1.00	0.10	NS	ND	0.01	0.02	0.25	0.27	0.17	0.06	0.23	0.50	71.83	2.02
WB07	btm	0.41	1.00	6.61	1.88	38.20	0.01	0.02	0.15	0.17	0.27	0.81	1.08	1.25	57.51	18.19
WB08	0.83	0.88	0.94	11.47	4.16	51.60	0.02	0.01	0.04	0.05	0.36	0.73	1.09	1.14	6.26	8.52
WB09	btm	0.33	1.00	22.78	3.48	48.50	0.03	0.01	0.01	0.02	0.52	0.50	1.02	1.04	1.79	5.57
WB10	ND	ND	ND	29.73	NS	ND	0.02	0.03	0.00	0.03	0.38	0.42	0.80	0.83	3.27	4.64
WB11	1.75	2.35	0.76	29.74	3.83	53.00	0.01	0.01	0.00	0.01	0.31	0.20	0.51	0.53	2.35	3.53
WB12	1.84	2.02	0.91	29.88	4.03	57.10	0.02	0.00	0.00	0.01	0.40	0.20	0.61	0.61	0.83	3.53
WB13	1.89	2.21	0.86	31.08	4.10	60.50	0.02	0.02	0.00	0.02	0.26	0.13	0.40	0.42	3.13	2.19
Secchi as % of WC is the % of the watercolumn above the secchi depth, values of 100% means that the Secchi was at or below the bottom.																
Lowest 20% of D.O. records for a site over the project period.																
Btm means that Secchi Disk as on bottom and therefore the depth of disk disappearance could not be determined (never disappears)																

# Waquoit Bay Nitrogen Load Allocation Intermunicipal Agreement Between The Towns of Falmouth, Mashpee, and Sandwich

This Intermunicipal Agreement ("Agreement") is entered into as of \_\_\_\_\_, 2024 (the "Effective Date") by and among the Towns of Falmouth, Mashpee, and Sandwich, each one a municipal corporation acting through their respective chief executive officers (collectively, with their successors and assigns, the "Parties").

## RECITALS

WHEREAS, municipalities are authorized in accordance with G.L. c. 40, § 4A to enter into intermunicipal agreements for the purpose of performing jointly, or on behalf of each other, activities or undertakings which any of the municipalities are authorized by law to perform; and

WHEREAS, Falmouth, Mashpee and Sandwich have been authorized to enter into this Agreement as evidenced by the execution of this Agreement by their respective Select Boards; and

WHEREAS, the Commonwealth of Massachusetts has, pursuant to the Federal Clean Water Act § 208(b)(3) and 40 C.F.R. 130.6(e), prepared and certified the Cape Cod Water Quality Management Plan Update ("208 Plan Update") developed by the Cape Cod Commission, which was certified by the Governor of the Commonwealth on June 10, 2015, and submitted to the United States Environmental Protection Agency, Region 1 ("USEPA"); and

WHEREAS, USEPA approved the 208 Plan Update on September 15, 2015; and

WHEREAS, the MassDEP developed a watershed permitting approach to address and optimize nitrogen management measures intended to restore water quality to meet applicable water quality standards in watersheds included in an approved area wide nitrogen management plan, recently codified as 314 CMR 21.00; and

WHEREAS, the estuaries and embayments of the Waquoit Bay system have experienced greatly increased anthropogenic loads of nitrogen delivered to the water through surface and groundwater sources from the increasingly developed watershed, and that this increase in nitrogen has increased the rate of eutrophication of the waters causing adverse aesthetic, water quality and habitat impacts that result in violation of state water quality standards, all as documented in the Massachusetts Estuary Project ("MEP") report entitled, "Linked Watershed-Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and Eel Pond Embayment System Towns of Falmouth and Mashpee, Massachusetts, March, 2013"; and



WHEREAS, Mashpee, Falmouth, and Sandwich recognize that increased nitrogen loads to the embayment come from surface and groundwater sources in the watershed shared by the Parties; and

WHEREAS, the MassDEP has developed and the USEPA has approved the Total Maximum Daily Load ("TMDL") limitations for nitrogen discharges to Waquoit Bay; and

WHEREAS, the Parties agree that wastewater, fertilizer, and stormwater are the prime source of controllable nitrogen causing impairment of the embayment and that, as a result, a joint effort is required to restore and protect beneficial uses and aquatic resources of the Bay and its tributaries; and

WHEREAS, the Parties each wish to share a percentage of the aggregate pollutant reduction responsibility and jointly administer a Watershed Management Plan for Waquoit Bay, including a plan for the receipt and expenditure of funds for such administration.

NOW, THEREFORE, in consideration of the promises and mutual benefits to be derived by the Parties hereto, the Parties agree as follows:

1. The Parties agree that the most cost-effective means in terms of total cost, of meeting the TMDL requirements and attaining water quality and beneficial use goals may be a regional, watershed-based approach to mitigate the nitrogen at locations within the watershed where the contributing loads are the greatest and the methods useful for nitrogen reduction are the most effective.

2. Each Party will continue to develop and/or implement its own MassDEP approved CWMP or Targeted Watershed Management Plan, but shall include in their respective plan, if appropriate, any joint efforts undertaken by the Parties pursuant to this Agreement.

3. The Parties shall collectively determine and appoint one Town to serve as the fiscal agent under this Agreement. The fiscal agent shall receive, hold, and expend any funds appropriated by the Parties for joint actions required in the implementation of this Agreement. Unless otherwise provided, capital projects undertaken individually by any one of the Parties pursuant to an approved CWMP or Targeted Watershed Management Plan shall be the sole responsibility of that Party. The fiscal agent shall provide an accounting of the expenditure of funds at regular intervals as may be determined by the Parties. Any Party to this Agreement may request the fiscal agent to conduct an audit of the funds held under this Agreement as part of the fiscal agent's regular annual audit.

4. The Parties hereby establish a Waquoit Bay Watershed Working Group ("Working Group"), comprised of three members from each Town. The three members from each Town shall consist of a member of the Board of Selectmen from each town, the Town Manager from each Town or designee, and a technical representative appointed by the Town Manager in each Town. Appointments shall be made in accordance with any

applicable local Charter and bylaw provisions. The purposes of the Working Group will be to:

- a. Administer the day-to-day joint activities of the Parties under this Agreement.
- b. Share or develop engineering and economic studies and evaluations to define means of meeting the Parties' respective nitrogen reduction targets and to develop cost-performance relationships that define most cost-effective technologies and practices for the removal of nitrogen.
- c. The Working Group has no authority to bind one or more of the Parties. Its role shall be solely advisory and administrative in nature and to make recommendations to the Parties for actions required to implement such recommendations. The incurrence of any obligation under this Agreement by any Party shall be subject to the approval of the chief executive officer of each Party and the legislative body, if required, to implement such recommendations.
- d. The Working Group shall be considered a public body subject to the Open Meeting Law and the public records laws. The Working Group shall assign responsibility to one Town to post meeting agendas and to prepare and post meeting minutes.

5. The Parties have determined that it is in their mutual best interests to establish a nitrogen allocation formula for the purpose of allocating certain costs in a fair and reasonable manner. The parties believe that the watershed permitting responsibilities should be allocated on the basis of unattenuated and attenuated nitrogen loadings. Unattenuated loads consist of the nitrogen load from the watershed contributed by septic systems, wastewater effluent, fertilizer application, storm water runoff, golf course operations, landfill activities, and natural sources. Attenuated loads are the nitrogen loadings that reach Waquoit Bay after natural attenuation in wetlands, ponds or streams, as measured at the Sentinel Testing Station. The Technical Memorandum, attached hereto as Attachment A, sets forth the technical basis agreed to by the parties for establishing the nitrogen loading allocation formulas for both unattenuated and attenuated loads as follows:

	Unattenuated	Attenuated
Falmouth	43%	50%
Mashpee	45%	44%
Sandwich	12%	6%
Total	100%	100%

The unattenuated load percentages will be used to calculate each Party's responsibility for TMDL compliance and for the tracking and accounting of implementation measures. The attenuated load percentages will be used to calculate watershed-based shared expenses including administrative costs, sentinel station monitoring costs, MEP

confirmatory model runs, and such other watershed-based costs that the Parties may agree to in the future.

The allocation formula shall be reviewed every at least every five years, or more frequently as needed, to reflect any changes made by the state to the TMDL or to reflect any changes in development within any of the three Towns which significantly affect the nitrogen load to Waquoit Bay, or in accordance with a revised formula that the Towns mutually determine to be appropriate.

6. The Parties agree to adopt a fair and practical methodology for implementing the most cost-effective watershed-wide approach in order to comply with any permits issued by MassDEP. If the Parties determine that a regional, watershed-based wastewater and/or nutrient management system is required to meet the TMDL, the Parties also agree to share the capital, operating, administrative, legal, operational, and other ancillary costs associated therewith on a fair and equitable basis. The Towns further agree to individually fund those measures expected to achieve control of their respective share of the load identified in Paragraph 5, as may be amended, above unless they mutually agree to joint efforts to mitigate nitrogen.

7. The Parties agree to develop, if deemed mutually beneficial based on comparison of other wastewater management options of each Town, a fair and practical methodology for a reasonable nitrogen trading mechanism, including metrics for determining a nitrogen credit trading "currency" in terms of dollars per pound or other trading metric, as a means to implement a watershed-based plan.

8. The Parties agree to adopt, as a fair and practical methodology for monitoring the water quality of the watershed following the implementation of regional, watershed-based wastewater and/or nutrient management approaches, and the allocation of costs as agreed to in Paragraph 5 above, as may be amended.

9. Each Party shall cooperate with the other Parties and other entities as appropriate to identify, apply for, secure, manage and fairly allocate federal, state and other funding sources, as such may become available, to finance the planning and implementation of any multi-town or regional nutrient management plans resulting from the cooperative efforts of the Parties under this Agreement.

10. Effective Date of Agreement — The effective date of this Agreement shall be the date upon which this Agreement is entered into as first written above.

11. Term of Agreement — Pursuant to G.L. c. 40, § 4A, the maximum term of this Agreement shall be 25 years.

Notwithstanding the foregoing, this Agreement will be reassessed at intervals of five years, and may be modified by mutual agreement of the Parties at any time through an amendment of this Agreement, if necessary, to achieve permit renewal and compliance.



12. Termination — This Agreement may be terminated by any one Party upon sixty (60) days notice to the other Parties.

13. Dispute Resolution — In the event of a dispute arising out of or in relation to the terms of this Agreement, representatives of the Parties shall meet and endeavor to settle the dispute in an amicable manner through mutual consultation. If such persons are unable to resolve the dispute in a satisfactory manner within thirty (30) calendar days, either party may seek assistance of an independent third party, mutually-agreeable to both or all Parties.

14. Assignment - Any Party may assign to another governmental entity established for the purpose of addressing wastewater issues in the Town the responsibility in whole or in part for implementing the watershed permitting activities contemplated in the Agreement.

15. Amendment of this Agreement — This Agreement may be changed or modified through a mutually agreed upon written Amendment executed by each and all of the Parties to this Agreement. Any Amendment shall be attached to and shall become part of this Agreement.

16. Mutual Indemnification — Each party to this Agreement shall hold harmless each and all other Parties to this Agreement, their officers, agents, consultants, employees and assigns for all liability arising out of the activities under this Agreement.

17. Subject to Appropriation — The obligations of each of the Parties shall be subject to appropriation and the availability of funds.

18. No Remuneration — Parties to this Agreement shall be solely responsible for any and all costs incurred by themselves, their agents, their employees, committee members, consultants or other persons or entities resulting from activities undertaken pursuant to this Agreement.

19. Governance — This Agreement shall be governed by, construed under and enforced in accordance with the laws of the Commonwealth of Massachusetts.

20. Severability — If any provision of this Agreement is determined to be illegal, unenforceable, or void, then all Parties shall be relieved of their obligations under that provision, provided, however, that the remainder of the Agreement shall remain in full effect.

21. Entire Agreement - This Agreement constitutes the entire agreement between the Parties and may be executed in counterparts.

IN WITNESS THEREOF, the Parties hereto have executed this Agreement as of the first date written above.

Town of Mashpee  
By its Select Board

Town of Falmouth  
By its Select Board

---

---

---

---

---

---

---

---

---

---

Town of Sandwich,  
By its Select Board

---

---

---

---

---

# ATTACHMENT A





# Memorandum

February 5, 2020

To:	Town of Falmouth, MA; Town of Mashpee, MA	Ref. No.:	11202987;11110988
From:	J. Jefferson Gregg, P.E., BCEE	Tel:	774-470-1640
cc:	Marc Drainville, P.E., BCEE		GHD Inc

**Subject: DRAFT - Waquoit Bay Nitrogen Load Allocation Approach**

## 1. Background

The Towns of Mashpee and Falmouth contracted with GHD, as part of a joint effort, to identify a nitrogen loading allocation for Waquoit Bay. Similar to efforts for Popponesset Bay, the intent of this project is to identify an allocation based on existing data sets and/or methods used, namely by:

- The Massachusetts Estuaries Project (MEP)
- The Cape Cod Commission (CCC)
- GHD (as part of Mashpee's Planning Efforts)

The purpose is to identify an allocation that could be used by Mashpee, Falmouth, and Sandwich as a basis of an Inter-Municipal Agreement (IMA) or Memorandum of Understanding (MOU) for the management of nitrogen loading to Waquoit Bay.

With the agreement of both Falmouth and Mashpee, GHD developed a scope to evaluate Waquoit Bay similar to the approach taken for Popponesset Bay, with the exception that in this case there is no "DEP Pilot Project" that established a nitrogen loading allocation by town using the MEP data.

As part of the contract(s), GHD was asked to review the existing data and/or approaches of the following three documents as they relate to nitrogen loading allocation and percent contribution (by town) of nitrogen to the Waquoit Bay watershed. Those documents are:

- **Massachusetts Estuaries Project (MEP):** Linked Watershed – Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and Eel Pond Embayment System Towns of Falmouth and Mashpee, Massachusetts, Final Report March 2013.
- **Watershed Nitrogen Management Plan (WNMP):** Final Recommended Plan/Final Environmental Impact Report, Town of Mashpee, MA, May 2015. (Eastern Embayments only)
- **CCC 208 Plan:** Cape Cod Area Wide Water Quality Management Plan Update, Cape Cod Commission, June 2015.

Because no town-by-town allocation is listed as part of the 2013 MEP report, GHD analyzed the MEP data sets and created an estimate based on segregating, to the extent practicable, each town's individual data.

This approach uses the MEP data analysis spreadsheets to estimate this allocation. Whereas, a town-by-town estimated load contribution or allocation is stated in the other two documents. However, the 2015 WNMP Report only focused on the eastern embayments of Waquoit. Therefore, a direct comparison of all three documents, as was done for Popponesset Bay, could not be done for the Waquoit System.

The purpose of this document is to provide a brief summary of the analysis approach and identify variations of each, and provide recommendations. This information, following review with Falmouth and Mashpee, will be transmitted to Sandwich and their consultant for a Peer Review. The intent is that this allocation could be used as the foundation for possible future Inter-Municipal Agreements (IMA) or Memorandums of Understanding (MOU) among the three communities.

## **2. Evaluations**

Each of the reports identified above includes estimated nitrogen loading contributions for each of the Waquoit Bay watershed communities. Although each approach on allocating load is developed based on a different data set, this review considers the conditions under which each data set is used or developed and looks for similarities in the overall contribution attributed to each community. In the case of the 2013 MEP Report, since no town-by-town allocation is made, their original data is used to generate a town-by-town allocation by breaking out contributions from each individual community and comparing them to the composite results for the entire system as a check.

As stated previously, due to the complexities of the Waquoit Bay system, only portions of the various analyses could be directly compared.

## **3. Comparison of Approaches**

### **3.1 General**

Three approaches are identified as methods for load allocation. Those approaches are as follows:

1. Approach 1: "2013 MEP Data Approach"; uses 2013 Massachusetts Estuaries Project Data and original "Rainbow Spreadsheets".
2. Approach 2: "2015 WNMP Approach", uses the Mashpee Watershed Nitrogen Management Report approach developed by GHD in 2013-2014.
3. Approach 3: "CCC 208 Plan Approach", uses Cape Cod Commission 208 Plan Update as developed in 2015 and documented in their Appendix 8C.

Since the MEP Technical Report for Waquoit Bay did not partition the loads by community, Approach 1 is used to generate that allocation.

In addition, each "Approach's" data set has slight variations and these are briefly identified in the following section.

### **3.2 Data Sets**

#### Existing Wastewater Data: (years)

- Approach 1: 2013 MEP Report: (1997-1999 Mashpee, 2008-2010 Falmouth, 2007-2009 Sandwich)
- Approach 2: 2015 WNMP: (1997-1999) – Eastern embayments only.
- Approach 3: CCC 208 Plan: (2008-2011)

#### Existing Landuse Data:

Each of the various data sets used relied on a range of base assessor and parcel data for each of the various communities.

- Approach 1: 2013 MEP Report: (2000 Sandwich, 2001 Mashpee, 2009 Falmouth)
- Approach 2: 2015 WNMP: (2001 updated 2007) – Eastern embayments only.
- Approach 3: CCC 208 Plan: (2010-2012)

In addition, Appendix 5A of the CCC 208 Plan documented differences and limitations in the data used in the WatershedMVP tool compared to the data used as part of the Massachusetts Estuaries Project. The WatershedMVP data set helped form the basis for the 208 Planning document. A summary of these differences are provided below:

- WatershedMVP uses updated water data.
- WatershedMVP used a different methodology to estimate water use (wastewater generation) for parcels without water use data. WNMP used the approach used by MEP/Pilot Project.
- WatershedMVP uses the centroid approach to assigning water use (as did WNMP project) whereas the MEP used a more detailed distribution.
- WatershedMVP did not address all cases of duplication of private sewer users. This was addressed in the WNMP.
- WatershedMVP did not adjust WWTF performance to match reported performance. This was addressed in the WNMP.
- WatershedMVP data set was not calibrated. WNMP was not calibrated, but the data set was run through the MEP model multiple times.
- WatershedMVP indicated the potential for database errors. This is a case for all data sets; however extensive work was done as part of the WNMP and MEP to address errors in the data set when identified.

#### Watershed Delineations

The 2015 WNMP uses the original watershed delineations developed for the original MEP reports in 2005 for the Eastern Embayments of Quashnet River, Hamblin Pond, and Jehu Pond in the Waquoit System. The 2013 MEP Report for the entire Waquoit Bay System and the CCC 208 Plan use updated watershed delineations.



### **3.3 Approach and Findings**

#### **3.3.1 Approach 1: 2013 MEP Data Method**

This approach starts with using the MEP Waquoit Bay Final Technical Report (2013) data set for the entire system. Using this data, town-by-town breakdowns are generated by extracting Town-specific data and recreating each of MEP's spreadsheets to only include data from one Town. This is done for the landuse analysis spreadsheets which are the basis for developing the Waquoit Bay N Loads presented in Table 1V-3 of the 2013 MEP Report.

- Step 1 – identify each subwatershed that is “shared.” Each subwatershed that is “shared” is identified, and then the associated landuse data was distributed into Town-specific data sets.
- Step 2 – recreate each subwatershed spreadsheet so it only includes data from one community (Falmouth, Mashpee, or Sandwich).
- Step 3 – recreate Table 1V-3 (Rainbow Spreadsheet) for each individual community. It should be noted that the original MEP Data Disk had minor variations from data presented in Table 1V-3, but it is not considered significant enough to significantly impact the load allocations.
- Step 4 – aggregate the individual “Rainbow Spreadsheets” and compare to the original data set. Each Town's individual “Rainbow Spreadsheet” was retotaled to compare against the original Load Inputs (in kg/y), with the goal of being less than 1% different for the entire system, and no greater than 5% different in any individual watershed for the attenuated loads under “Present” conditions. The largest variations are found in watersheds with nitrogen loads less than 70 kg/y, therefore small variations of one or two kgs have larger impacts. The variation on the entire system was less than 0.1%; and individual subwatersheds varied less than 4%, and those were in watersheds with a total load less than 150 kg/y.
- Step 5 – establish estimated percent contribution for each town by each subwatershed.
- Step 6 – using Draft TMDL Table 5 and 2013 MEP Report Table IV-3, create load allocations for the subembayments presented in the Draft TMDL Table 6.

Nine of the 48 watersheds were identified as being shared by two or more of the communities; (# represents the MEP “Shed ID” number):

- Childs River N GT10 (#3) – Falmouth and Mashpee
- Childs River N LT10 (#6) – Falmouth and Mashpee
- Waquoit Bay Main (#12) – Falmouth and Mashpee
- Red Brook LT10 (#22) – Falmouth and Mashpee
- Lower Red Brook LT10 (#24) – Falmouth and Mashpee
- Hamblin Pond LT10 (#26) – Falmouth and Mashpee
- Upper Quashnet River LT10 (#33) – Falmouth and Mashpee
- Upper Quashnet River QT10N (#35) – Mashpee and Sandwich
- Ashumet Pond LT10 (#40) – Falmouth, Mashpee, and Sandwich

The remaining were either all within one community, or the associated loads were all from one community. Fourteen watersheds were in Falmouth, 17 in Mashpee, and eight in Sandwich. The following table identifies each watershed and the communities contributing load to those watersheds for this analysis.

**Table 3.1 Subwatersheds by Town**

MEP Shed ID	Watershed	Falmouth	Mashpee	Sandwich
1	Eel Pond W	X		
2	Grassy Pond	X		
<u>3</u>	<u><b>Childs River N GT10</b></u>	<u>X</u>	<u>X</u>	
4	Fresh Pond Well	X		
5	Fresh Pond	X		
<u>6</u>	<u><b>Childs River N LT10</b></u>	<u>X</u>	<u>X</u>	
7	Childs River South	X		
8	Bournes Pond	X		
9	Seapuit River	X		
10	Eel Pond E	X		
11	Eel Pond S	X		
<u>12</u>	<u><b>Waquoit Bay Main</b></u>	<u>X</u>	<u>X</u>	
13	Sage Lot Pond		X	
14	Flat/Sage Lot Ponds Transition		X	
15	Flat Pond LT10		X	
16	Flat Pond GT10		X	
17	Jehu Pond LT10		X	
18	Jehu Pond GT10		X	
19	Great River LT10		X	
20	Great River GT10		X	
21	Lower Great River		X	
<u>22</u>	<u><b>Red Brook LT10</b></u>	<u>X</u>	<u>X</u>	
23	Red Brook GT10		X	
<u>24</u>	<u><b>Lower Red Brook LT10</b></u>	<u>X</u>	<u>X</u>	
25	Lower Red Brook GT10		X	
<u>26</u>	<u><b>Hamblin Pond LT10</b></u>	<u>X</u>	<u>X</u>	

27	Hamblin Pond GT10E		X	
28	Hamblin Pond GT10W	X		
29	Little River		X	
30	Lower Quashnet River	X		
31	Middle Quashnet River LT10	X		
32	Middle Quashnet River GT10	X		
<b><u>33</u></b>	<b><u>Upper Quashnet River LT10</u></b>	<b><u>X</u></b>	<b><u>X</u></b>	
34	Upper Quashnet River GT10W		X	

**Table 3.1 Subwatersheds by Town**

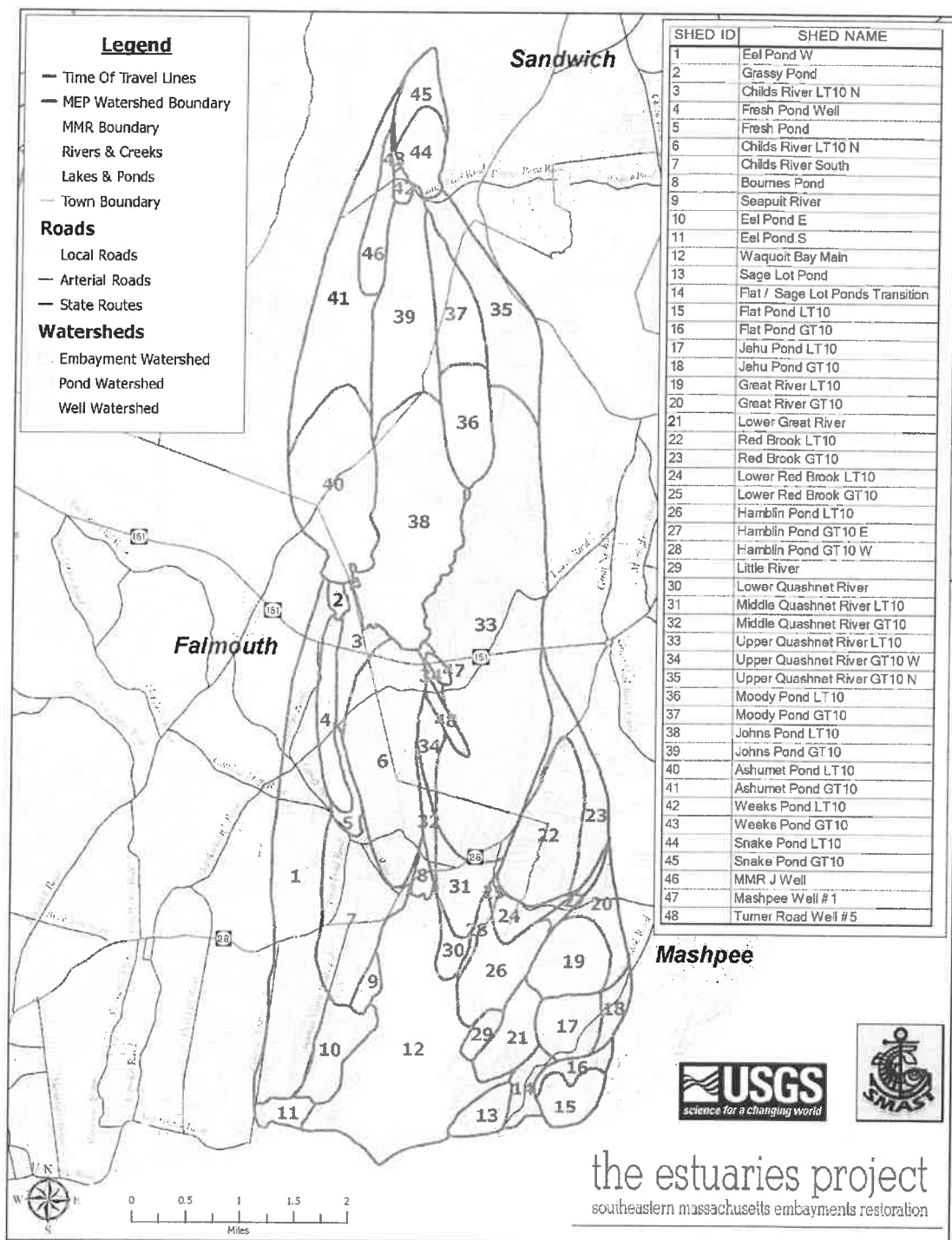
MEP Shed ID	Watershed	Falmouth	Mashpee	Sandwich
<b><u>35</u></b>	<b><u>Upper Quashnet River GT10N</u></b>		<b><u>X</u></b>	<b><u>X</u></b>
36	Moody Pond LT10		X	
37	Moody Pond GT10			X
38	Johns Pond LT10		X	
39	Johns Pond GT10			X
<b><u>40</u></b>	<b><u>Ashumet Pond LT10</u></b>	<b><u>X</u></b>	<b><u>X</u></b>	<b><u>X</u></b>
41	Ashumet Pond GT10			X
42	Weeks Pond LT10			X
43	Weeks Pond GT10			X
44	Snake Pond LT10			X
45	Snake Pond GT10			X
46	MMR J Well			X
47	Mashpee Well No. 1		X	
48	Turner Road Well No. 5		X	

The analysis was initially run with "Water Body Surface Area" loadings included; however, because the Draft TMDL document deliberately separates out this loading, it was not used in the subsequent analysis. Town's percent contribution is calculated based on "controllable" nitrogen loads as defined by MEP and MassDEP.

(continued)



The following figure from the 2013 MEP Technical Report for Waquoit Bay shows the subwatersheds as listed above.



### 3.3.2 Approach 1: 2013 MEP Data Findings

As shown on the following two tables, the extraction of each Town's data and recalculation of each Town's loading contributions using the MEP "Rainbow Spreadsheet" allows for an estimation of both unattenuated

and attenuated loads and percent contribution. From this, data can be compared directly with the nitrogen TMDLs being established by MassDEP.

Data presented is based on each major subwatershed, however it should be noted that both the Cape Cod Commission and MassDEP's TMDLs use different groupings of subwatersheds. Therefore these tables are simply presented to demonstrate approximate load allocations for each major system and present data as extracted from the Original MEP Datadisks as provided by MEP. In Section 4 the loads and percent contributions are presented for each Subembayment as identified in the Draft TMDL.

These tables also present the data with the major Water Body Surface Area nitrogen loads removed, to represent the "Present Controllable Watershed Load" as defined by MEP and MassDEP.

**Table 3.2 Estimated Unattenuated Load Allocation – Waquoit Bay System**

Data Set	MEP N Load (kg/y)	Falmouth (kg/y)	Mashpee (kg/y)	Sandwich (kg/y)
Waquoit Bay System	41,352	17,530 (42%)	18,739 (45%)	5,126 (12%)
Childs River Total	10,438	7,381 (70%)	2,461 (24%)	665 (6%)
Eel Pond Total	6,864	6,711 (98%)	67 (1%)	92 (1%)
Quashnet River Total	14,571	1,7661 (11%)	8,582 (59%)	4,370 (30%)
Hamblin Pond / Little River Total	4,923	1,214 (25%)	3,701 (75%)	0 (0%)
Jehu Pond / Great River Total	2,769	0 (0%)	2,769 (100%)	0 (0%)
Flat Pond / Sage Lot Pond Total	1,005	0 (0%)	1,005 (100%)	0 (0%)

Notes:

1. Totals of Falmouth, Mashpee, and Sandwich will not equal the MEP Total Load because not all data sets used by MEP clearly defined the distribution by Town. However, values were between 0.0% and 0.5% of the total.
2. Total percentages do not always equal 100% based on rounding.

**Table 3.3 Estimated Attenuated Load Allocation – Waquoit Bay System**

Data Set	MEP N Load (kg/y)	Falmouth (kg/y)	Mashpee (kg/y)	Sandwich (kg/y)
Waquoit Bay System	33,236	16,639 (50%)	14,537 (44%)	2,031 (6%)
Childs River Total	8,493	6,580 (77%)	1,705 (20%)	198 (2%)



Eel Pond Total	6,769	6,704 (99%)	29 (0%)	39 (1%)
Quashnet River Total	8,497	1,515 (18%)	5,175 (61%)	1,794 (21%)
Hamblin Pond / Little River Total	4,923	1,214 (25%)	3,701 (75%)	0 (0%)
Jehu Pond / Great River Total	2,769	0 (0%)	2,769 (100%)	0 (0%)
Flat Pond / Sage Lot Pond Total	1,005	0 (0%)	1,005 (100%)	0 (0%)

**Notes:**

1. Totals of Falmouth, Mashpee, and Sandwich will not equal the MEP Total Load because not all data sets used by MEP clearly defined the distribution by Town. However, values were between 0.0% and 0.5% of the total.

### 3.3.3 Approach 2: 2015 WNMP Method

The WNMP only focused on the eastern embayments related to Waquoit Bay—Hamblin Pond, Jehu Pond, Quashnet River, Little River, and Great River—it is not complete enough for use as an approach to load allocation for the entire system. In addition, the allocation was only applied to the unattenuated nitrogen load.

This approach also did not remove the “Surface Water Body Area” nitrogen load from the total.

For the purposes of the WNMP Report, an overall estimated percent contribution by Town was generated. The allocation was developed based on wastewater load contributions from each Town using the GIS data set developed for that project. The estimated allocation percentage was then applied to the non-wastewater loads, carried from the work of MEP. Therefore, the percent contribution of Town’s non-wastewater loads were based on their percent contribution of wastewater which differs from the other two approaches.

### 3.3.4 Approach 2: 2015 WNMP Findings

The load allocation developed for the WNMP, for the combined eastern embayment systems, equated to 65% Mashpee, 20% Sandwich, and 14% Falmouth for the “unattenuated” nitrogen loading.

The following table compares the percentages generated as part of the WNMP to calculations using the 2013 MEP data for Hamblin Pond/Red Brook, Little River, Great River, Sage Lot Pond, Jehu Pond, and Quashnet River for total unattenuated loads for those systems.

**Table 3.4 Unattenuated Load Estimated Allocation – Waquoit Bay East**

Data Set	Total Load (kg/y)	Falmouth	Mashpee	Sandwich
Waquoit Bay East (MEP 2013 Data - kg/y)	24,812	3,065	17,122	4,660
% Distribution of controllable load		12%	69%	19%
2015 WNMP (kg/y)	24,000	3,400	15,700	4,900
% Distribution of controllable load		14%	65%	20%

Notes:

1. Data from the Hamblin Pond/Red Brook, Little River, Great River, Sage Lot Pond, Jehu Pond, and Quashnet River used for both data sets.
2. MEP 2013 data distribution for total unattenuated nitrogen (i.e. Includes Surface Water Body Area loads).
3. 2015 WNMP used total nitrogen load based on estimated existing wastewater flows for each Town.

Percentages were then applied to the total load for the watershed.

This approach for nitrogen loading allocation is not recommended as it only covers the eastern embayments, only looked at unattenuated nitrogen loading, and included nitrogen load from atmospheric deposition falling directly on the main embayment systems ("Water Body Surface Area").

### 3.3.5 Approach 3: 2015 CCC 208 Plan Method

As part of the 208 Plan update process, the Cape Cod Commission outlined their subembayment watershed contributions for each Town in Appendix 8C of their document. CCC 208 loads were based on data provided from the CCC MVP tool and their estimates for wastewater and other controllable sources.

The CCC 208 approach established a "Percent Contribution" of each Town of the attenuated load to the watershed. Since, in most cases, the data used for the CCC is newer than that used by the MEP, their estimated attenuated loads were higher than those presented in the MEP technical report.

Because of the differences in load calculations between the MEP approach and the CCC 208 approach, there are some significant differences in the estimated contribution percentages of "Attenuated" load by Town.

### 3.3.6 Approach 3: CCC 208 Plan Findings

The following tables present the comparison of each load distribution developed using 2013 MEP data versus CCC 208 findings. It should be noted that the WNMP data was not used in these comparisons, as it only covered the eastern embayments; however for reference those percentages are discussed in Section 3.3.4.

**Table 3.5 – Comparison of Estimated Attenuated Nitrogen Contribution Percentages**

Embayment	Percent of Attenuated Nitrogen Contribution by Town					
	Falmouth		Mashpee		Sandwich	
	CCC	MEP Data	CCC	MEP Data	CCC	MEP Data
Childs River	71%	78%	24%	20%	5%	2%
Eel Pond East	100%	100%	0%	0%	0%	0%
Eel Pond South	100%	100%	0%	0%	0%	0%
Eel Pond West	95%	99%	1%	0%	4%	1%
Hamblin Pond and Red Brook Fresh	31%	27%	69%	73%	0%	0%
Quashnet River	22%	18%	61%	61%	17%	21%
Waquoit Bay	82%	80%	18%	20%	0%	0%
Jehu Pond/Great River	0%	0%	100%	100%	0%	0%

Little River	0%	0%	100%	100%	0%	0%
Sage Lot Pond	0%	0%	100%	100%	0%	0%

Notes:

1. Percentages rounded to nearest one's place.
2. Percent of Attenuated Nitrogen Contribution by Town (CCC Columns) based on 2015 CCC 208 Plan Appendix 8C values (by community).
3. Percent of Attenuated Nitrogen Contribution by Town (MEP Data Columns) based on 2013 MEP Dataset Approach to allocate load between towns using MEP 2013 Dataset for Technical Reports, with Water Body Surface Area removed (calculated on "controllable" loads).

The CCC 208 plan approach is not recommended as it only provided percent allocation for the attenuated load, and it is important for each community to understand both its unattenuated and attenuated contributions to the watershed loads so that it can manage those values appropriately. In addition, breakout of the subembayments is different than those used as part of the Draft nitrogen TMDL developed for Waquoit Bay, making it difficult to make an equal comparison of load allocation.

#### 4. Summary and Recommendations

Towns will have to consider multiple issues as they address nitrogen; how they do that will be influenced by the physical makeup of the multiple subwatersheds, each with different natural attenuations and landuse and wastewater flow characteristics. The selection of areas to target for nitrogen removal will affect how each Town's nitrogen reaches and impacts the downgradient receiving waters, and will depend on Town-specific needs and also feasibility of applying various nitrogen mitigation approaches. Therefore, communities will need to consider the nitrogen load before it reaches the watershed (unattenuated) and the nitrogen load after it reaches the embayment (attenuated).

It is recommended that the 2013 MEP Data Approach (Approach 1) be used as the basis for nitrogen load allocation. This approach used data derived from the original data set in order to establish nitrogen loading by subwatershed for the Waquoit System. This dataset is also the most consistent with the existing and proposed nitrogen TMDLs.

Loading percentages are calculated using the MEP model data sets, with the "Water Body Surface Area" loads (on embayments only) removed to remain consistent with the MassDEP TMDL development approach. Therefore, "Present Controllable Watershed Loads" (as defined by MEP and MassDEP) and their associated threshold loads will be used as the basis for allocation.

The following table summarizes the "total system" contributions by Town for both unattenuated and attenuated loads.

**Table 4.1 – Average Contributions by Town for Entire Waquoit Bay System**

Existing	Falmouth	Mashpee	Sandwich
Unattenuated	43%	45%	12%
Attenuated	50%	44%	6%

Notes:

1. Percentages rounded to one's place.
2. Total Waquoit Bay System % Contributions calculated using MEP 2013 Dataset and removal of all main estuary surface area contributions, similar to TMDL approach.

However, due to the complexity of this embayment system, GHD proposes to establish loading allocation by subwatershed consistent with those identified in Table 7 of the Draft Waquoit Bay System; including Eel



Pond, Quashnet River, Hamblin Pond, and Jehu {Pond} Total Maximum Daily Loads for Total Nitrogen, MassDEP, dated August 2019. These are presented in the following table.

**Table 4.2 – Recommended Load Allocations by Town and Subwatershed**

Embayments / Towns <sup>(7)</sup>	Unattenuated				Attenuated			
	(Baseline MEP 2013 Tech Report)				(Baseline MEP 2013 Tech Report)			
	Controllable Load <sup>(1)</sup>	TMDL Load to Sustain <sup>(2)</sup> Calculated	Load to Remove <sup>(3)</sup>	% Load <sup>(4)</sup>	Controllable Load <sup>(5)</sup>	TMDL Load to Sustain <sup>(6)</sup>	Load to Remove <sup>(3)</sup>	% Load <sup>(4)</sup>

**Waquoit Bay (Bournes Pond/Seapuit River/Waquoit Bay Main)**

Falmouth	611	611	-	80%	611	611	-	80%
Mashpee	150	150	-	20%	150	150	-	20%
Sandwich	-	-	-	0%	-	-	-	0%

**Childs River - Upper**

Falmouth	4,715	1,599	3,116	98%	4,377	1,484	2,893	100%
Mashpee	35	12	23	1%	4	1	3	0%
Sandwich	48	16	32	1%	6	2	4	0%

**Eel Pond - East**

Falmouth	792	299	493	100%	792	299	493	100%
Mashpee	-	-	-	0%	-	-	-	0%
Sandwich	-	-	-	0%	-	-	-	0%

**Eel Pond - South**

Falmouth	191	191	-	100%	191	191	-	100%
----------	-----	-----	---	------	-----	-----	---	------

Embayments / Towns <sup>(7)</sup>	Unattenuated				Attenuated			
	(Baseline MEP 2013 Tech Report)				(Baseline MEP 2013 Tech Report)			
	Controllable Load <sup>(1)</sup>	TMDL Load to Sustain <sup>(2)</sup> Calculated	Load to Remove <sup>(3)</sup>	% Load <sup>(4)</sup>	Controllable Load <sup>(5)</sup>	TMDL Load to Sustain <sup>(6)</sup>	Load to Remove <sup>(3)</sup>	% Load <sup>(4)</sup>

Mashpee	-	-	-	0%	-	-	-	0%
Sandwich	-	-	-	0%	-	-	-	0%

**Eel Pond - West**

Falmouth	5,900	3,181	2,719	97%	5,896	3,179	2,717	99%
Mashpee	70	38	32	1%	30	16	14	0%
Sandwich	95	51	44	2%	40	22	19	1%

**Quasnet River**

Falmouth	1,012	546	466	100%	1,012	546	466	100%
Mashpee	-	-	-	0%	-	-	-	0%
Sandwich	-	-	-	0%	-	-	-	0%

**Hamblin Pond (without Red Brook)**

Falmouth	608	132	476	38%	608	132	476	38%
Mashpee	988	215	773	62%	988	215	773	62%
Sandwich	-	-	-	0%	-	-	-	0%

**Little River**

Falmouth	-	-	-	0%	-	-	-	0%
Mashpee	400	77	323	100%	400	77	323	100%
Sandwich	-	-	-	0%	-	-	-	0%

**Jehu Pond**

Falmouth	-	-	-	0%	-	-	-	0%
Mashpee	1,428	374	1,054	100%	1,428	374	1,054	100%
Sandwich	-	-	-	0%	-	-	-	0%

**Great River (and Lower Great River)**

Falmouth	-	-	-	0%	-	-	-	0%
Mashpee	1,340	364	976	100%	1,340	364	976	100%
Sandwich	-	-	-	0%	-	-	-	0%

**Sage Lot Pond**

Falmouth	-	-	-	0%	-	-	-	0%
Mashpee	1,005	592	413	100%	1,005	592	413	100%
Sandwich	-	-	-	0%	-	-	-	0%

Embayments / Towns <sup>(7)</sup>	Unattenuated				Attenuated			
	(Baseline MEP 2013 Tech Report)				(Baseline MEP 2013 Tech Report)			
	Controllable Load <sup>(1)</sup>	TMDL Load to Sustain <sup>(2)</sup> Calculated	Load to Remove <sup>(3)</sup>	% Load <sup>(4)</sup>	Controllable Load <sup>(5)</sup>	TMDL Load to Sustain <sup>(6)</sup>	Load to Remove <sup>(3)</sup>	% Load <sup>(4)</sup>

**Childs River - Freshwater**

Falmouth	2,413	935	1,478	45%	2,023	784	1,239	52%
Mashpee	2,373	919	1,454	44%	1,657	642	1,015	43%
Sandwich	602	233	369	11%	187	72	114	5%

**Quasnet River - Freshwater**

Falmouth	649	426	223	5%	503	330	173	7%
Mashpee	8,582	5,637	2,945	63%	5,175	3,399	1,776	69%

Sandwich	4,370	2,870	1,500	32%	1,794	1,178	616	24%
----------	-------	-------	-------	-----	-------	-------	-----	-----

**Red Brook - Freshwater**

Falmouth	606	158	448	21%	606	158	447	21%
Mashpee	2,314	605	1,709	79%	2,314	605	1,709	79%
Sandwich	-	-	-	0%	-	-	-	0%

**Waquoit Bay System Total**

Falmouth	17,486	8,140	9,346	42%	16,604	7,729	8,874	50%
Mashpee	18,693	8,702	9,991	45%	14,506	6,753	7,753	44%
Sandwich	5,114	2,381	2,733	12%	2,027	943	1,083	6%

**Notes:**

1. Controllable Loads as presented in Table 1V-3 "Waquoit Bay Embayment Watershed Nitrogen Loads" from MEP Technical Report 2013 times "% Load".
2. Back-calculated based on "attenuation" difference between unattenuated and attenuated loads presented in this table.
3. Load to remove is difference between Controllable Loads and TMDL Load to Sustain Values.
4. Percent Load based on 2013 MEP Dataset Approach to allocate load between Towns using MEP 2013 Dataset for Technical Reports, with Water Body Surface Area removed (calculated on "controllable" loads).
5. Controllable Loads as presented in Tables 5 and 6 of MassDEP Draft N - TMDLs for Waquoit Bay (August 2019) multiplied by the "% Load".
6. TMDL Load to sustain as presented in Tables 5 and 6 of MassDEP Draft N - TMDLs for Waquoit Bay (August 2019) multiplied by the "% Load".
7. Subwatersheds aggregated based on "MEP Component Watersheds" column of Table 5 of the MassDEP Draft N - TMDLs for Waquoit Bay (August 2019).





# TOWN OF MASHPEE

## OFFICE OF THE SELECT BOARD

16 Great Neck Road North  
Mashpee, Massachusetts 02649  
Telephone – (508) 539-1401  
[bos@mashpeema.gov](mailto:bos@mashpeema.gov)

### MEMORANDUM

Date: February 7, 2024

To: Rodney C. Collins, Town Manager and  
Honorable Members of the Select Board

From: Stephanie A. Coleman, Administrative Secretary

Re: Board, Committee and Commission: Resignation

---

#### Description

Discussion and approval of the following resignation:

\*Zoning Board of Appeals: Associate Member (Term Expires June 30, 2025) *Bradford H. Pittsley*

Attached is the letter of resignation.



Bradford Pittsley

---

## Zoning board of appeals

---

Bradford Pittsle,  
Draft

Tue, Jan 23, 2024 at 4:25 PM

It is with regret that I must tender my resignation from the zoning board of appeals, I am no longer able to attend meetings.

Thank you

Bradford H Pittsley

A handwritten signature in black ink that reads 'Bradford H. Pittsley'.

TOWN MANAGERS OFFICE  
JAN 24 '24 PM 12:48