TOWN OF MASHPEE
DEPARTMENT OF NATURAL RESOURCES
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MEMORANDUM

November 05, 2021

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

FROM: Ashley Fisher, Director of Natural Resources

RE: State of Mashpee Waters

State of Mashpee Estuaries :

"Both Waquoit and Popponesset Bays support impaired habitats throughout their tidal reaches and remain below the water quality levels set by the MassDEP/EPA. This is consistent with the fact that the Threshold Nitrogen Level specified in the TMDL was not attained within any basin in 2019 and 2020, indicating that the impairments are caused by nitrogen enrichment." Howes et. al.

Waquoit Bay – No high water quality areas remain (See Figure 1)

Jehu Pond: Declining. One of the last known areas in the eastern basins of Waquoit Bay to be suitable for eel grass. All areas where eel grass once was (2018 ish) has since disappeared. Shellfish habitat is now scarce. The DNR's seeding acreage has severely reduced over the past 5 years. Treatment – sewering, shellfish aquaculture, and stormwater improvements.

Quashnet River: Unchanging. Severely degraded. Prohibited to shell fishing. Area cannot support high species diversity. Treatment – Sewering and stormwater improvements

Main Basin: Declining. There is no longer any high water quality in the lower reaches of Waquoit Bay. Treatment-Sewering , stormwater improvements, and shellfish aquaculture.

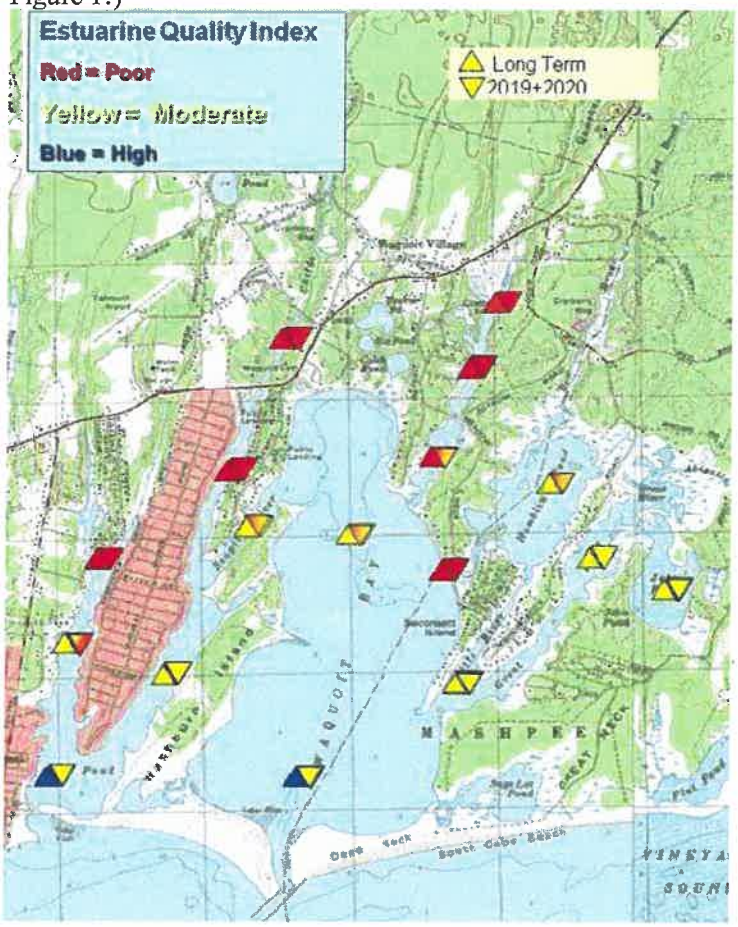
Little River: Declining. Past shellfish seeding showed initial improvements in the area for the 2019 testing period, however nutrient inputs were too high to show improvements in 2020 even though seeding efforts were similar. Treatment-Sewering , stormwater improvements, and shellfish aquaculture.

Great River: Declining. In 2021 areas of Great River ar4e now classified as conditionally approved (seasonal) to shellfishing, which will reduce shellfishing harvesting in the area. Treatment-Sewering , stormwater improvements, and shellfish aquaculture.

Hamblin Pond: Declining Shellfish seeding was increased in 2019 and 2020 within Hamblin Pond, but no major improvements were seen. 2019 data results also showed initial improvements, but were not displayed in 2020 water quality results. Hamblin Pond, along with Little River, Jehu Pond, and Hamblin

Pond show the most hope for short-term improvements. Treatment-Sewering , stormwater improvements, and shellfish aquaculture.

Figure 1.)



Popponesset Bay– No high water quality areas remain. (See Figure 2) All areas are unchanging due to lack of remedial action above and beyond shellfish aquaculture.

Ockway Bay : Significantly impaired and conditions are unchanging. 2016-2020 chlorophyll-a levels are generally higher than the long-term historical data. No other years have been higher, and conditions continue to decline on a yearly basis. Treatment-Sewering , stormwater improvements, and shellfish aquaculture

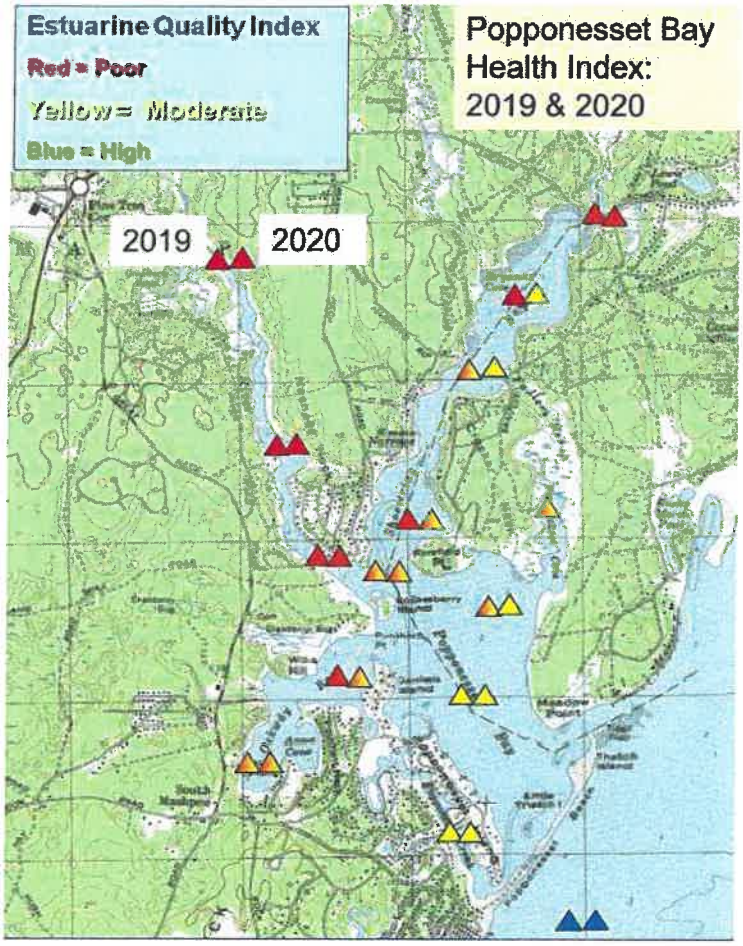
Mashpee River: Impaired and the trend is unchanging and declining in areas. TN decline noted due to shellfish aquaculture. Continued decline due to nitrogen pollution. Total nitrogen levels continue to increase yearly. The levels are now almost 3 times the acceptable levels or TMDL (Total Maximum Daily Load) required for target restoration.
Dissolved oxygen (DO) levels are below 4 mg/L for long periods of time, causing stress and loss of benthic animals. 2021 should be noted for a reported blue crab die off within the River. Due to declining conditions, The Shellfish Division was forced to move millions of oysters out of the area to ensure their survival. As you move away from the head of the river, water conditions slightly improve. Accumulation

of bottom muck from thick algal blooms continues to suffocate the benthos. DO levels dropped to 0-4 mg/L 50% of the time this summer.
Chlorophyll levels and other water quality parameters classify this area as hypertrophic or extremely eutrophic. Algal blooms are increasing as a direct result of nutrient pollution resulting in little to no water clarity. Secchi Depths are continuously less than 0.25 meters or 0.8 feet during the months of July and August. Treatment-Sewering , stormwater improvements, and shellfish aquaculture (now limited due to increasing impairment and reduced oxygen levels).

Shoestring Bay : Increased levels of total nitrogen were evident in Shoestring Bay for 2020. Species diversity has declined substantially over the past 6 years due to poor conditions. Some of the largest blooms were seen in Shoestring Bay this past year (highest bloom concentrations seen this year out of the 20 years of data collection). Treatment-Sewering , stormwater improvements, and shellfish aquaculture. Treatment-Sewering , stormwater improvements, and shellfish aquaculture (now limited due to increasing impairment and reduced oxygen levels).

Main Basin: Showing decline. No good water quality is left in Popponesset Bay. Chlorophyll –a levels are generally high than the long-term historical mean supporting that the area is now nitrogen enriched and the conditions are steadily on the decline. Treatment-Sewering , stormwater improvements, and shellfish aquaculture (now limited due to increasing impairment and reduced oxygen levels).

Figure 2.)



State of Mashpee Ponds:

Nutrient Sampling through the PALS (Ponds and Lakes Stewardship) Program 2018 and 2020 results presented, along with Mashpee / APCC Cyanobacteria (Blue Green Algae) Sampling from 2021: Most recent data shows a continuing negative trend in all ponds. All ponds are becoming increasingly impaired due to groundwater and surface water discharge containing excess nutrients and contaminants.

Lakes are classified by Trophic State Index:

Oligotrophic : "good" water quality
Mesotrophic : "Fair" water quality
Eutrophic / Hypereutrophic : "Poor" water quality

Ashumet Pond:

Surface Water (0.5 meters):

2018: 17.25 uM Total Nitrogen, 0.51 uM Total Phosphorus

2020: 23.49 uM Total Nitrogen, 1.05 uM Total Phosphorus **high external input from surface runoff

Mid Water (9 meters):
2018: 20.79 uM Total Nitrogen, 0.65 uM Total Phosphorus
2020: 22.30 uM Total Nitrogen, 0.69 uM Total Phosphorus

Bottom water (18 meters):
2018: 47.93 uM Total Nitrogen, 6.31 uM Total Phosphorus
2020: 17.81 uM Total Nitrogen, 0.73 uM Total Phosphorus

*** Ashumet has been treated with nutrient inactivation – Aluminum Sulfate. Bottom water will see a decrease in total phosphorus from the treatment.

Cyanobacteria 2021: Average cyano species cell count between 5/30- 11/3 – 3,459 cells/ ml
1 posted advisory based on DPH guidelines (7/15-8/2): presence of a scum layer and high cell counts
*** See attachment A

Trophic State: Mesotrophic / Eutrophic – nutrient inactivation when eutrophic reduces nutrient availability and will remain mesotrophic until the inactivation treatment becomes ineffective due to continued external nutrient input.

Contaminants: Mercury – No fish consumption for largemouth bass. Phosphorus load from septic systems addressed with nutrient inactivation treatment. Chlorinated solvents – PRB . Abnormal Fish Deformities, Erosions, Lesions, Tumors (DELTS)

John's Pond: Data presented shows unchanging conditions in nutrient concentrations, although more sampling is needed.

Surface Water (0.5 meters):
2018: 16.87 uM Total Nitrogen, 0.36 uM Total Phosphorus
2020: 20.50 uM Total Nitrogen, 0.58 uM Total Phosphorus

Mid Water (9 meters):
2018: 26.12 uM Total Nitrogen, 0.65 uM Total Phosphorus
2020: 21.10 uM Total Nitrogen, 0.46 uM Total Phosphorus

Bottom Water (16 meters):
2018: 73.57 uM Total Nitrogen, 0.65 uM Total Phosphorous
2020: 30.67 uM Total Nitorgen, 0.54 uM Total Phosphorous

Cyanobacteria 2021: Average cyano species cell count between 5/30- 11/3 – 1,984 cells/ ml
No advisories posted for cyanobacteria, except for 1 E.coli swimming advisory
Cyanobacteria scum layer presence near the shoreline seen by residents this summer in and around the fish ladder.

Trophic State: Eutrophic. Poor oxygen conditions noted during the summer months.

Invasive Species: Coy fish, and milfoil (treated in 2021 with algaecide)

Contaminants: PFAS and Mercury – No consumption of fish order issued my Mass. DPH. Chlorinated solvents – extraction well. Mercury in Fish Tissue.

Mashpee Wakeby : (Treated as Two Ponds for Profile Sampling Purposes)

Mashpee: Continued Total Phosphorus and Total Nitrogen Increase

Surface Water (0.5 meters):

2018: 19.34 uM Total Nitrogen, 0.51 uM Total Phosphorus
2020: 23.49 uM Total Nitrogen, 0.54 uM Total Phosphorus

Mid Water (9 meters):

2018: 19.05 uM Total Nitrogen, 0.99 uM Total Phosphorus
2020: 25.29 uM Total Nitrogen, 0.80 uM Total Phosphorus

Bottom Water (16 meters):

2018: 75.64 uM Total Nitrogen, 6.09 uM Total Phosphorous
2020: 146.30 uM Total Nitrogen, 8.28 uM Total Phosphorus

Cyanobacteria 2021: Average cyanobacteria species cell count between 5/30- 11/3 – 105 cells/ ml
1 advisory posted due to the presence of a scum layer (6/24- 7/7)

Trophic State: Mesotrophic – Generally has moderate nutrient concentrations throughout the pond. Secchi Depth (water clarity) is greater than 8 feet. Note- high phosphorous from groundwater infiltration.

Wakeby : Continued Total Phosphorus and Total Nitrogen Increase

Surface Water (0.5 meters):

2018: 23.88 uM Total Nitrogen, 0.65 uM Total Phosphorus
2020: 29.18 uM Total Nitrogen, 0.73 uM Total Phosphorus

Mid Water (9 meters):

2018: 22.23 uM Total Nitrogen, 0.58 uM Total Phosphorus
2020: 27.08 uM Total Nitrogen, 0.69 uM Total Phosphorus

Bottom Water (10 meters):

2018: 52.06 uM Total Nitrogen, 2.26 uM Total Phosphorous
2020: 52.51 uM Total Nitrogen, 2.65 uM Total Phosphorous

Cyanobacteria: Average cyano species cell count between 5/30- 11/3 – 717 cells/ ml
1 advisory posted due to the presence of a scum layer (6/24- 7/7)

Trophic State: Mesotrophic / Eutrophic – Generally has moderate nutrient concentrations. Secchi Depth (water clarity) is reduced in comparison to Mashpee side, at roughly 5 feet throughout the summer months. Note- also seeing higher phosphorous concentrations from groundwater infiltration.

Contaminants: Recent PFAS/Mercury. Fishing advisory posted.

Santuit Pond :

Surface Water (0.5 meters):

2018: 58.54 uM Total Nitrogen, 1.53 uM Total Phosphorus
2020: 80.63 uM Total Nitrogen, 1.34 uM Total Phosphorus

Mid Water (2 meters):

2018: 71.51 uM Total Nitrogen, 0.65 uM Total Phosphorus
2020: 87.21 uM Total Nitrogen, 1.38 uM Total Phosphorus

Bottom Water (2.5-3 meters): Mid Water is for all intensive purposes considered bottom water due to the overall depth of the pond.

Cyanobacteria: Average cyano species cell count between 5/30- 11/3 – 70,475 cells/ ml.
Advisory posted all summer

Trophic State: Eutrophic / Hypertrophic – Heavy algal blooms possible throughout the summer, extensive macrophyte issues, often under hypertrophic conditions.

Contaminants/ Toxins: Toxins present from HAB species (Cyanobacteria – microcystin). Abnormal Fish Deformities, Erosions, Lesions, Tumors (DELTS).

Ponds listed by rank of impairment from most to least taking all supporting data into consideration:

1.) Santuit Pond
2.) Ashumet Pond
3.) John's Pond
4.) Wakeby side of Mashpee Wakeby
5.) Mashpee side of Mashpee Wakeby

Attachment A :

Water Body	Location	Date	Cell count Total Cells/mL
Ashumet Pond	Landing	7/21/2021	821
John's Pond	Town Beach	7/21/2021	707
	Landing	7/21/2021	2,954

Mashpee Lake	Landing	7/21/2021	263
Santuit Pond	Bryant's Neck	7/21/2021	13,443
	Landing	7/21/2021	20,817
Wakeby Lake	Bog	7/21/2021	1,456
Ashumet Pond	Landing	7/28/2021	192
John's Pond	Town Beach	7/28/2021	1,921
Mashpee Lake	Landing	7/28/2021	401
Sanuit Pond	Landing	7/28/2021	73,003
Wakeby Lake	Bog	7/28/2021	535
Ashumet Pond	Landing	8/4/2021	103
John's Pond	Town Beach	8/4/2021	531
Mashpee Lake	Landing	8/4/2021	71
Sanuit Pond	Bryant's Neck	8/4/2021	43,115
Wakeby Lake	Bog	8/4/2021	153
Ashumet Pond	Landing	8/11/2021	19,995
John's Pond	Town Beach	8/11/2021	2,402
Mashpee Lake	Landing	8/11/2021	4
Sanuit Pond	Bryant's Neck	8/11/2021	47,488
Wakeby Lake	Bog	8/11/2021	6
Ashumet Pond	Landing	8/18/2021	759
John's Pond	Town Beach	8/18/2021	390
Mashpee Lake	Landing	8/18/2021	11
Sanuit Pond	Bryant's Neck	8/18/2021	21,063
Wakeby Lake	Bog	8/18/2021	7
Ashumet Pond	Landing	8/25/2021	639
John's Pond	Town Beach	8/25/2021	1,397
Mashpee Lake	Landing	8/25/2021	83
Sanuit Pond	Bryant's Neck	8/25/2021	80,646
Santuit Pond	Town Landing	8/25/2021	169,288
Wakeby Lake	Bog	8/25/2021	1,558
Santuit Pond	Bryant's Neck	8/26/2021	79,702
Ashumet Pond	Landing	9/1/2021	1,709
John's Pond	Town Beach	9/1/2021	1,027
Mashpee Lake	Landing	9/1/2021	84
Sanuit Pond	Bryant's Neck	9/1/2021	75,516
Santuit Pond	Town Landing	9/1/2021	110,834

Wakeby Lake	Bog	9/1/2021	204
Ashumet Pond	Landing	9/8/2021	11,265
John's Pond	Town Beach	9/8/2021	1,110
Mashpee Lake	Landing	9/8/2021	63
Sanuit Pond	Bryant's Neck	9/8/2021	93,597
Santuit Pond	Town Landing	9/8/2021	70,529
Wakeby Lake	Bog	9/8/2021	127
Ashumet Pond	Landing	9/15/2021	2,060
John's Pond	Town Beach	9/15/2021	3,448
Mashpee Lake	Landing	9/15/2021	138
Sanuit Pond	Bryant's Neck	9/15/2021	89,692
	Town Landing	9/15/2021	74,050
Wakeby Lake	Bog	9/15/2021	131
Ashumet Pond	Landing	9/22/2021	1,019
John's Pond	Town Beach	9/22/2021	5,263
Mashpee Lake	Landing	9/22/2021	202
Sanuit Pond	Bryant's Neck	9/22/2021	41,092
Santuit Pond	Town Landing	9/22/2021	36,694
Wakeby Lake	Bog	9/22/2021	37
Ashumet Pond	Landing	9/29/2021	1,895
John's Pond	Town Beach	9/29/2021	3,337
Mashpee Lake	Landing	9/29/2021	31
Sanuit Pond	Bryant's Neck	9/29/2021	71,325
Santuit Pond	Town Landing	9/29/2021	45,937
Wakeby Lake	Bog	9/29/2021	311
Ashumet Pond	Landing	10/6/2021	2,231
John's Pond	Town Beach	10/6/2021	1,948
Mashpee Lake	Landing	10/6/2021	26
Sanuit Pond	Bryant's Neck	10/6/2021	121,451
Santuit Pond	Town Landing	10/6/2021	91,139
Wakeby Lake	Bog	10/6/2021	491
Ashumet Pond	Landing	10/14/2021	3,582
John's Pond	Town Beach	10/14/2021	5,116
Mashpee Lake	Landing	10/14/2021	39
Sanuit Pond	Bryant's Neck	10/14/2021	81,820
Wakeby Lake	Bog	10/142021	5,515

Sanuit Pond	Bryant's Neck	10/16/2021	33,512
Ashumet Pond	Landing	10/20/2021	3,009
John's Pond	Town Beach	10/20/2021	588
Mashpee Lake	Landing	10/20/2021	59
Sanuit Pond	Bryant's Neck	10/20/2021	3,995
Santuit Pond	Town Landing	10/20/2021	3,529
Wakeby Lake	Bog	10/20/2021	102
Ashumet Pond	Landing	10/28/2021	2,552
John's Pond	Town Beach	10/28/2021	432
Mashpee Lake	Landing	10/28/2021	60
Sanuit Pond	Bryant's Neck	10/28/2021	6,090
Santuit Pond	Town Landing	10/28/2021	3,678
Wakeby Lake	Bog	10/28/2021	31
Ashumet Pond	Landing	11/3/2021	41
John's Pond	Town Beach	11/3/2021	137
Mashpee Lake	Landing	11/3/2021	36
Sanuit Pond	Bryant's Neck	11/3/2021	3,954
Santuit Pond	Town Landing	11/3/2021	4,860
Wakeby Lake	Bog	11/3/2021	84