

**2020-2022 TRIENNIAL
SHELLFISH MANAGEMENT AREA UPDATE
FOR THE GREAT BAY, NEW HAMPSHIRE**

December 2023

New Hampshire Department of Environmental Services
Water Division
Watershed Management Bureau



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FOR THE GREAT BAY, NEW HAMPSHIRE**

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Introduction

The New Hampshire Department of Environmental Services (NHDES), under the authority granted by RSA 143:21 and 143:21-a, is responsible for classifying shellfish growing waters in the State of New Hampshire. The purpose of conducting shellfish water classifications is to determine if growing waters meet standards for human consumption of molluscan shellfish. The primary concern with the safety of shellfish growing waters is contamination from human sewage, which can contain a variety of disease-causing microorganisms. Shellfish pump large quantities of water through their bodies during normal feeding and respiration processes. During this time shellfish also concentrate microorganisms that may include pathogens, and a positive relationship between sewage pollution of shellfish growing areas and disease has been demonstrated many times (ISSC, 2019).

Though testing shellfish growing waters and/or shellfish meats for the pathogenic microorganisms themselves would seem to be the most direct method of determining whether or not growing waters are safe, several factors preclude this approach. Perhaps the most important is that the number of pathogens that may be in sewage is large, and laboratory methods that are practical, reliable and cost-effective are not available for all of the pathogens that may be present. Therefore, shellfish water classifications are based on evidence of human sewage contamination, which may include direct evidence (identification of actual pollution sources) or indirect evidence (elevated or highly variable indicator bacteria levels in the growing waters). If such evidence is found, then pathogens may be present, and the area is closed to harvesting. Areas may also be closed if contamination from animal waste or poisonous/toxic substances is found.

Under the authority granted by RSA 143:21 and 143:21-a, NHDES uses a set of guidelines and standards known as the National Shellfish Sanitation Program (NSSP) for classifying shellfish growing waters. These guidelines were collaboratively developed by state agencies, the commercial shellfish industry, and the federal government in order to provide uniform regulatory standards for the commercial shellfish industry. The NSSP is used by NHDES to classify all growing waters, whether used for commercial or recreational harvesting, because these standards provide a reliable methodology to protect public health. Furthermore, RSA 485-A:8 (V) states that “Those tidal waters used for growing or taking of shellfish for human consumption shall, in addition to the foregoing requirements, be in accordance with the criteria recommended under the National Shellfish Program Manual of Operation, United States Food and Drug Administration.”

The sanitary survey is the process by which the shellfish management areas are accurately classified. The sanitary survey includes an evaluation of the pollution sources that may affect the areas, an evaluation of the meteorological and hydrographic factors that may affect distribution of pollutants throughout the area, and an assessment of water quality. A sanitary survey for the Great Bay was originally published in December 2004 (Nash and Wood, 2004). Every 12 years a new sanitary survey must be completed. Field work for this effort was completed in 2016, and a new sanitary survey was published in 2017 (Nash 2017). The last triennial report for the Great Bay covered the 2017-2019 time period (Nash 2020).

The NSSP requires that in addition to an annual review of the classification of the area, the management area classification and the supporting data from the sanitary survey be reviewed at least every three years. This triennial re-evaluation shall include the following:

- A review of the water quality samples.
- Documentation of any new pollution sources and an evaluation of their effect on the management area.
- Reevaluation of all pollution sources, including the sources previously identified in the sanitary survey, as necessary to fully evaluate any changes in the sanitary conditions of the management area. The reevaluation may or may not include a site visit.
- A comprehensive report which analyzes the sanitary survey data and makes a determination that the existing management area classification is correct or needs to be revised.

If the triennial reevaluation determines that conditions have changed based on the information and data collected during the triennial review and that the management area classification is incorrect, immediate action shall be initiated to reclassify the area. If an emergency condition or situation is identified, then the management area will be immediately placed (within 24 hours) in the closed status.

The NSSP notes that work to complete a triennial reevaluation may include a number of activities, including:

- Inspection of wastewater treatment plants or collection of additional effluent samples to determine their impact on the management area.
- Hydrodynamic studies.
- Additional field work to determine the actual impact of pollution sources.
- Collection of additional water samples.

When a written triennial reevaluation report is not completed, the shellfish management area must be placed in the closed status.

This document presents the data and analyses for the 2020-2022 Great Bay triennial report.

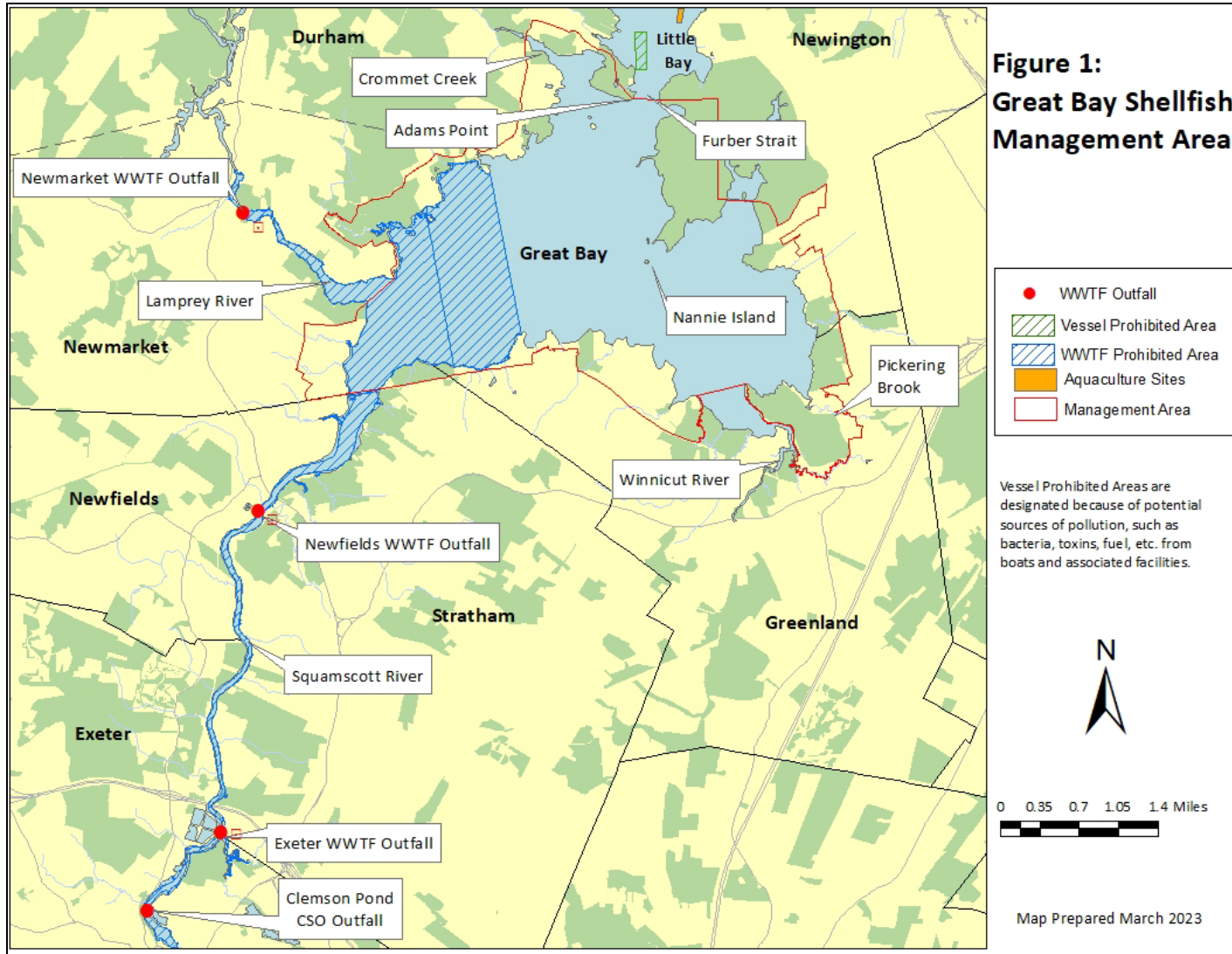
Management Area

Great Bay, along with Little Bay and the Piscataqua River, are part of the Great Bay Estuary, which is the largest estuary in New Hampshire. The management area includes the waters of Great Bay, which begin just south of Furber Strait near Adams Point in Durham, New Hampshire, and portions of the Squamscott and Lamprey Rivers (Figure 1). Water depths in the Bay are relatively shallow, with deeper channels bordered by mudflats. More than half of Great Bay is exposed as mudflat at low tide. Great Bay has an average depth of nine feet, with deeper channels of nearly 60 feet in some locations. At Furber Strait, the channel is 40 feet deep nearly the entire width of the strait. The main channel of the Bay stretches northeast from the mouths of the Lamprey and Squamscott Rivers toward Furber Strait. The Great Bay Shellfish Management Area includes approximately 4,339 acres of tidal waters, with approximately 38 miles of tidal shoreline.

Land surrounding Great Bay is lightly developed or undeveloped. Developed areas along the shoreline are primarily large lot, single family residential, although there are some areas along the southern and southwestern shoreline with relatively higher densities of residential development. Sewage disposal for all developed properties is by septic systems/leach fields. Most of these denser developments, some of which are served by municipal sewer, lie just outside of the management area. Of the 214 properties in the Great Bay Management Area, 42 (20%) are conservation lands. Most of these are part of the Great Bay National Estuarine Reserve system or the Great Bay National Wildlife Sanctuary.

There is very little commercial development around Great Bay, and the most prominent development is the Portsmouth Country Club. Much of the eastern and western shorelines are permanently protected from development by the Great Bay National Estuarine Research Reserve or by the Great Bay National Wildlife Refuge. There are several parcels around the Bay that are used for agricultural production of hay, as well as one property operated as a horse-riding farm that is not immediately adjacent to growing waters. There are currently no commercial shellfish aquaculture operations in Great Bay, due to restrictions on such commercial activities within the boundaries of the Great Bay National Estuarine Research Reserve.

Figure 1: Great Bay Shellfish Management Area



Follow-Up From Recent Reports

The most recent annual update for the Great Bay Management Area presented a number of recommendations to improve the classification of the area. These recommendations were developed from the results of previous recommendations presented in the original sanitary survey and subsequent annual/triennial updates. The italicized text describes how each recommendation has been addressed.

1. The location of the Exeter and Newmarket WWTF Prohibited area boundary should be reevaluated after construction of the new Exeter WWTF is complete. The re-evaluation should begin with a new characterization of pre-disinfection effluent fecal coliform levels, as well as male-specific coliphage concentration in influent, pre-disinfection effluent and final effluent.

Ambient monitoring data continues to show that GB81, located within the Prohibited area, meets Conditionally Approved criteria. The current boundary is appropriate to protect public health. It would be inappropriate to move the boundary until an updated dye study establishing steady state 1,000:1 dilution area is done at each facility. Now that construction of both facilities is complete, updated dye studies can be considered. Regarding effluent monitoring for male-specific coliphage and (pre-disinfection) fecal coliform, sampling at the new Exeter facility began in January 2020, but was discontinued after March 2020 due to the COVID-19 pandemic. Sampling resumed in 2021 with effluent samples collected at Exeter on 1/21/21, 4/13/21 and 10/19/21. Effluent samples were collected from Newmarket on 4/27/21 and 10/19/21. 2022 effluent samples were collected on 1/24/22.

2. In concert with Recommendation #1, consider updating the hydrographic studies of the Exeter and Newmarket WWTFs, using new procedures recommended by the USFDA to delineate the steady state 1,000:1 zone of dilution around the outfalls. The updated hydrographic studies should be done after construction is complete.

These studies will be done if/when resources can be secured to complete the studies. These are considered lower priority as compared to other facilities, based on proximity to recreational and commercial harvest areas.

3. Continue with event-based sampling at the inflow and outflow of Clemson Pond in Exeter to better understand how/if CSO events actually impact water quality in the Squamscott River.

One discharge event during the triennial review period occurred on 7/9/21. This discharge of 10,000 gallons or less was caused by human error (manual disabling of the pump station's wet well pump to perform a test, but done so during a heavy rain event). This volume of discharge would not typically trigger sampling of Clemson Pond. No sampling was performed.

4. As time and resources allow, additional information on water quality impacts to Great Bay should be performed on some of the more significant fecal coliform sources, including the unnamed stream and cove just south of Fabyan Point, Pickering Brook and the Winnicut River. Ambient monitoring on the boundaries of these sources' Restricted areas will continue to confirm the adequacy of existing classifications, but the additional water quality impact information, particularly wet weather information, may reveal opportunities to reduce the size of the existing Restricted areas.

Ambient monitoring on the boundaries of these sources shows mostly low fecal coliform levels. GB83 and GB85 each showed one elevated fecal coliform sample when rainfall was under 1.5 inches (Great Bay conditional closure threshold is 1.5 inches). All sites show low fecal coliform and NSSP statistics that confirm the adequacy of the current Restricted area boundaries.

4-Day Rain Total (in)	Collection Date	GB4A	GB5	GB7C	GB16	GB81	GB82	GB83	GB84	GB85
1.05	1/19/22	23	33	no data	no data	no data	no data	no data	no data	17
0.31	2/22/22	2	4	<2	2	2	7.8	<2	<2	2
0.13	3/2/22	no data	no data	<2	no data	no data	no data	no data	no data	<2
0.29	4/4/22	no data	no data	no data	no data	no data	no data	no data	no data	<2
0.00	4/26/22	<2	<2	no data	<2	<2	2	13	<2	no data
1.46	4/11/22	1.8	4.5	4.5	17	no data	33	2	no data	no data
0.52	5/16/22	2	<2	7.8	<2	2	7.8	33	17	4.5
0.15	6/8/22	<2	<2	6.8	<2	23	4.5	2	13	2
0.52	7/13/22	2	4.5	7.8	<2	<2	4.5	49	7.8	2
0.63	8/10/22	7.8	2	7.8	2	11	9.3	6.8	<2	2
0.13	9/19/22	<2	2	4.5	1.8	2	7.8	2	4.5	<2
0.00	10/3/22	2	2	2	<2	2	2	7.8	13	<2
0.00	11/7/22	2	2	17	11	6.8	7.8	13	17	11
0.24	12/6/22	22	11	6.8	11	23	17	27	14	49
	Count	46	46	47	45	42	39	37	37	48
	Geomean	4.0	3.1	4.1	3.5	4.4	5.2	6.4	6.9	3.4
	Est 90th	11.6	6.7	12.2	10.4	16.0	15.1	22.5	30.9	9.1
	Water Quality	A	A	A	A	A	A	A	A	A
	Classification	CA	CA	R	CA	P	R	R	R	CA

5. As time and resources allow, conduct water quality studies to assess impacts of rainfall events on Great Bay. These studies should focus on rainfall events in the range of one to two inches. Particular emphasis should be placed on such events in late fall and winter, when fecal coliform levels appear to persist longer than in other seasons.

Date	4-Day Rain	Range of FC/100ml
31-Aug-20	1.1	2 - 11
14-Oct-20	1.56	2 - 13
19-Oct-20	1.71	4.5 - 17
01-Dec-20	1.74	23
02-Jul-20	3.12	49 - 170

Date	4-Day Rain	Range of FC/100ml
3/30/21	1.01	4.5
4/19/21	1.30	2 - 110
7/6/21	2.15	2 - 17
7/8/21	1.16	6.8
9/3/21	2.35	240 - >1600
11/14/21	1.54	46 - 540
11/17/21	1.61	49

Date	4-Day Rain	Range of FC/100ml
1/19/22	1.05	17 - 33
4/11/22	1.46	2 - 17
9/7/22	1.94	<2 - 17
10/17/22	2.54	7.8 - 23
10/19/22	1.15	23 - 49
12/19/22	1.96	23
12/27/22	1.89	70

6. Conduct dry and wet weather sampling and site visits to prepare for the 2020-2022 triennial report.

Activities are described and summarized in the “Non-permitted Pollution Sources” section of this report.

Review of Water Quality Samples

Much of western Great Bay is classified as a Prohibited area (safety zone for the Newmarket, Newfields and Exeter WWTFs). Much of eastern Great Bay is classified as Conditionally Approved with the exception of Restricted areas around the Winnicut River, Pickering Brook and the cove just south of Fabyan Point. All of Crommet Creek is also classified as Restricted. These areas are sampled by boat for fecal coliform bacteria under the Systematic Random Sampling strategy (Table 2 and Figure 2).

Table 1: Great Bay Ambient Sampling Stations

Site	Latitude	Longitude	General Description	Rationale for Selection
GB4A	43°04'04" N	70°53'12" W	Located on the main channel of Great Bay, between Vols Island and Brackett Point	Document general water quality, possible impact of Exeter, Newfields and Newmarket WWTFs; sited on Open/Closed line
GB5	43°04'07" N	70°51'48" W	Located just south of Nannie Island	Document general water quality
GB7C	43°05'38" N	70°52'33" W	Mouth of Crommet Creek, just west of Adams Point	Document general water quality, impact of Crommet Creek
GB16	43°03'38" N	70°51'09" W	Located in eastern Great Bay	Document general water quality.
GB81	43°03'59" N	70°53'57" W	In Great Bay, on the Prohibited/Safety zone line proposed by the Newmarket dye study	Document general water quality, possible impact of Exeter, Newfields and Newmarket WWTFs; sited on proposed new Open/Closed line
GB82	43°03'09" N	70°50'58" W	In Great Bay, on the Restricted/Conditionally Approved line at Winnicut River mouth near Pierce Point	Document general water quality, impact of Winnicut River
GB83	43°03'28" N	70°50'22" W	In Great Bay, on the Restricted/ Conditionally Approved line near mouth of Pickering Brook (vicinity of Pierce Point)	Document general water quality, impact of Pickering Brook
GB84	43°04'02" N	70°50'19" W	In Great Bay, on the Restricted/ Conditionally Approved line near Fabyan Point	Document general water quality, impact of unnamed tributary south of Fabyan Point
GB85	43°05'02" N	70°51'57" W	In Great Bay near red navigational buoy #6	Document general water quality, use in openings and closures of the area when samples indicate that the sanitary quality differs from that of the rest of Great Bay

Per the NSSP guidelines for systematic random sampling, a monitoring schedule was established at the start of the year to ensure sample collection under a variety of environmental (seasonal, tidal, meteorological, etc.) conditions. Runs are scheduled to begin between 7 AM and 10 AM to randomize the tidal stage at which samples are collected. Sampling runs were rescheduled as a result of extenuating circumstances or when conditions were deemed unsafe. During this review period, several sampling runs needed to be rescheduled (Table 2). All samples were analyzed for fecal coliform MPN/100ml (5-tube method) by the New Hampshire Department of Health and Human Services/Public Health Laboratory.

Table 2: Systematic Random Sampling Schedule Modifications

Date Originally Scheduled	Actual Date Sampled	Justification
1/6/20	1/12/20	The run was rescheduled due to ice/snow.
2/19/20	2/24/20	The run was rescheduled due to hazardous/high wind conditions
3/3/20	3/5/20	The run was rescheduled due to DHHS Water Lab staff availability (FDA proficiency testing)
4/7/20	4/8/20	The run was rescheduled to accommodate offshore sampling
11/3/20	11/4/20	The run was rescheduled due to hazardous/high wind conditions
12/9/20	12/14/20	The run was rescheduled due to hazardous/high wind conditions and to accommodate post rainfall sampling in other growing areas.
2/10/2021	2/23/2021	The run was rescheduled due to hazardous conditions (snow/ice/wind)
1/18/2022	1/19/2022	Run rescheduled from 1/18/22 due to high winds and cold air temperatures.
2/1/2022	2/22/2022	Run rescheduled from 2/1/22 due to boat ramp blocked with ice.
3/1/2022	3/2/2022	Run rescheduled from 3/1/22 due to freezing temps and extensive ice cover.
4/5/2022	4/4/2022	Run rescheduled from 4/5/22 to accommodate offshore sampling.
6/7/2022	6/8/2022	Run rescheduled from 6/7/22 due to FDA training.
7/11/2022	7/13/2022	Run rescheduled from 7/11/22 to accommodate offshore Atlantic sysrandom run.
12/7/2022	12/6/2022	Run rescheduled from 12/7/22 due to hazardous wind forecast.

Because the Great Bay Conditional Area Management Plan (Appendix I) is based on the operation and performance of a wastewater treatment facility, monthly water samples are required when the growing area is in the open status. Table 3 summarizes the status of the growing area for each month (if it was open part or all, of the month) when samples were collected.

Hazardous conditions during the March and April 2022 systematic random sampling runs were not fully completed due to high winds and hazardous conditions that developed during the sampling run. The missed sites were visited on supplemental runs in April 2022.

Table 3: Conditional Area Sampling Verification

2020	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Open for a portion of the month	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date samples were collected in the open status	1/12	2/24	3/5	4/8	5/18	6/16	7/13	8/11	9/15	10/12	11/4	12/14
2021	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Open for a portion of the month	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date samples were collected in the open status	1/11	2/23	3/9	4/19	5/19	6/7	7/6	8/9	9/1	10/13	11/8*	12/1
2022	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Open for a portion of the month	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date samples were collected in the open status	1/19	2/22	3/2, 4/26	4/4, 4/11	5/16	6/8	7/13	8/10	9/19	10/3	11/7	12/6

*Per NSSP, two runs used to reopen a closed area may be used for stats

Systematic random and open status samples collected from 2019-2022, and the relevant NSSP statistics are presented in Table 4. All routine monitoring stations meet the NSSP criteria for Approved waters (geometric means not exceeding 14/100ml and the estimated 90th percentile statistic not exceeding 43/100ml); however, an Approved classification would be inappropriate because all Great Bay ambient sites can be adversely affected by conditions such as heavy rainfall, poor wastewater treatment facility performance, and others. Thus, the highest classification that Great Bay can have is Conditionally Approved. When the conditions specified in the Great Bay Conditional Area Management Plan are applied to the data (i.e., exclusion of samples collected during times when the area was in the closed status), the routine monitoring stations meet NSSP criteria for Approved waters. This is discussed in greater detail in the “Conditional Area Data Review” section of this report.

Figure 2: Great Bay Ambient Sampling Stations

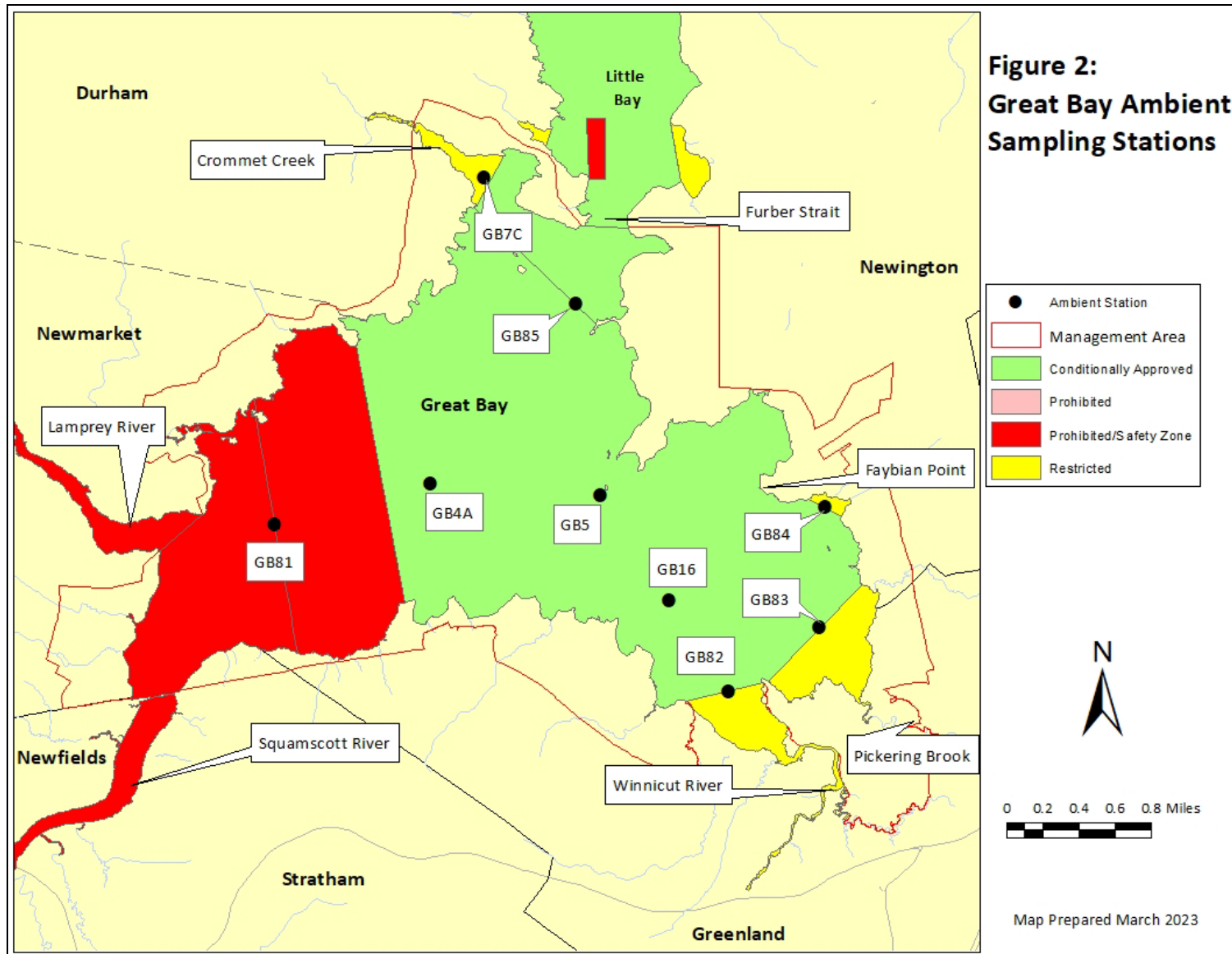


Table 4: 2019-2022 Fecal Coliform (per 100ml) Samples for Great Bay Sampling Stations

Fecal coliform (MPN/100ml) data for samples collected under the Systematic Random Sampling program. Samples over 43 MPN/100ml are in bold font. Samples collected during the Closed status are shaded.

4-Day Rain Total (in)	Collection Date	GB4A	GB5	GB7C	GB16	GB81	GB82	GB83	GB84	GB85
0.59	1/9/19	13	1.8	no data	<2	no data	no data	no data	no data	2
0.29	3/19/2019*	<2	4.5	<2	1.8	<2	no data	no data	no data	1.8
0.00	3/21/19	7.8	<2	<2	<2	no data	no data	no data	no data	2
0.21	4/2/19	2	4.5	<2	<2	<2	2	2	6.1	2
1.59	5/1/19	13	4.5	22	11	6.8	13	17	49	13
1.10	6/10/19	2	2	13	2	23	4.5	4	<2	6.1
1.41	7/15/19	2	<2	33	7.8	<2	no data	no data	no data	4.5
1.52	8/12/19	4.5	1.8	<2	<2	4.5	1.8	4	2	2
0.01	9/10/19	2	4	<2	2	<2	4.5	4.5	11	<2
0.68	10/9/19	2	<2	<2	2	1.8	7.8	7.8	1.8	4.5
0.07	11/6/19	no data	7.8	7.8	no data	no data	no data	no data	no data	4.5
0.78	11/25/19	23	no data	no data	17	7.8	17	14	130	no data
0.00	12/9/19	7.8	17	6.1	4.5	13	4	4.5	14	17
0.25	1/12/20	no data	no data	4.5	no data	no data	no data	no data	no data	4.5
0.00	2/24/20	<2	<2	<2	2	1.8	<2	no data	no data	<2
0.05	3/5/20	no data	no data	4.5	no data	no data	no data	no data	no data	2
0.00	4/8/20	2	<2	<2	2	<2	<2	<2	<2	2
0.37	5/18/20	<2	<2	4.5	2	2	<2	4.5	13	<2
0.00	6/16/20	<2	<2	<2	4.5	2	<2	<2	2	<2
0.21	7/13/20	4.5	1.8	2	<2	<2	4.5	<2	<2	<2
0.03	8/11/20	4.5	2	2	<2	<2	2	4.5	23	4.5
0.00	9/15/20	<2	2	<2	1.8	<2	13	13	7.8	2
0.00	10/12/20	<2	<2	2	<2	<2	2	4.5	<2	<2
0.44	11/4/20	4.5	2	1.8	33	11	7.8	17	6.8	1.8
0.49	12/14/20	12	7.8	2	4	4	13	13	17	4.5
0	1/11/21	4.5	<2	<2	<2	2	no data	no data	no data	2
0.15	2/23/21	<2	<2	<2	<2	<2	no data	no data	no data	2
0	3/9/21	<2	<2	<2	<2	<2	<2	no data	<2	<2

4-Day Rain Total (in)	Collection Date	GB4A	GB5	GB7C	GB16	GB81	GB82	GB83	GB84	GB85
1.3	4/19/21	40	11	4.5	7.8	17	13	6.8	110	2
0	5/19/21	7.8	<2	4	<2	4.5	2	7.8	2	2
0.01	6/7/21	2	1.8	33	2	1.8	7.8	49	no data	2
2.15	7/6/21	6.8	2	17	11	7.8	17	6.8	13	4.5
0.61	8/9/21	13	4.5	7.8	33	33	no data	no data	no data	23
0	8/16/21	no data	no data	no data	no data	no data	4.5	1.8	2	no data
0	9/1/21	<2	4.5	2	4.5	49	2	2	14	4
0	10/13/21	1.8	7.8	7.8	4	23	13	7.8	7.8	<2
0	11/8/21*	7.8	2	13	4.5	7.8	11	23	13	7.8
0.02	12/1/21	13	11	<2	7.8	6.8	4	4.5	7.8	17
1.05	1/19/22	23	33	no data	no data	no data	no data	no data	no data	17
0.31	2/22/22	2	4	<2	2	2	7.8	<2	<2	2
0.13	3/2/22	no data	no data	<2	no data	no data	no data	no data	no data	<2
0.29	4/4/22	no data	no data	no data	no data	no data	no data	no data	no data	<2
0.00	4/26/22	<2	<2	no data	<2	<2	2	13	<2	no data
1.46	4/11/22	1.8	4.5	4.5	17	no data	33	2	no data	no data
0.52	5/16/22	2	<2	7.8	<2	2	7.8	33	17	4.5
0.15	6/8/22	<2	<2	6.8	<2	23	4.5	2	13	2
0.52	7/13/22	2	4.5	7.8	<2	<2	4.5	49	7.8	2
0.63	8/10/22	7.8	2	7.8	2	11	9.3	6.8	<2	2
0.13	9/19/22	<2	2	4.5	1.8	2	7.8	2	4.5	<2
0.00	10/3/22	2	2	2	<2	2	2	7.8	13	<2
0.00	11/7/22	2	2	17	11	6.8	7.8	13	17	11
0.24	12/6/22	22	11	6.8	11	23	17	27	14	49
	Count	46	46	47	45	42	39	37	37	48
	Geomean	4.0	3.1	4.1	3.5	4.4	5.2	6.4	6.9	3.4
	Est 90th	12.5	7.8	12.2	10.4	16.0	15.1	22.5	30.9	9.7
	Water Quality Classification	A	A	A	A	A	A	A	A	A
		CA	CA	R	CA	P	R	R	R	CA

*Per NSSP, two runs used to reopen a closed area may be used for stats.

Statistics for the ambient sampling sites are calculated on an annual basis and are published in Annual Shellfish Management Area Updates. Table 5 presents these annual statistics for the Great Bay ambient station samples collected during Open Status only, and Table 6 presents the annual statistics for samples collected during the Open and Closed status.

Table 5a: Summary of the Ambient Sampling Station Fecal Coliform Geometric Mean (Open Status Only)

Year	GB4A	GB5	GB7C	GB16	GB81	GB82	GB83	GB84	GB85
2020	4.7	4.2	4.0	3.7	5.4	4.6	6.6	6.7	3.7
2021	4.5	3.4	4.2	3.7	4.7	4.6	6.1	6.7	3.3
2022	4.0	3.1	4.1	3.5	4.4	5.2	6.4	6.9	3.4

Table 5b: Summary of the Ambient Sampling Station Fecal Coliform Estimated 90th Percentile Statistics (Open Status Only)

Year	GB4A	GB5	GB7C	GB16	GB81	GB82	GB83	GB84	GB85
2020	15.5	15.1	14.9	11.1	25.7	16.1	25.1	36.0	9.5
2021	15.1	8.1	14.7	10.8	17.9	14.4	20.4	33.0	8.1
2022	11.6	6.7	12.2	10.4	16.0	15.1	22.5	30.9	9.1

Table 6a: Summary of the Ambient Sampling Station Fecal Coliform Geometric Mean (Open and Closed Status)

Year	GB4A	GB5	GB7C	GB16	GB81	GB82	GB83	GB84	GB85
2020	5.3	4.8	4.9	4.6	6.1	5.5	7.8	8.2	4.3
2021	4.9	3.7	4.6	4.1	5.3	5.2	6.7	7.2	3.8
2022	4.0	3.1	4.1	3.5	4.4	5.2	6.4	6.9	3.4

Table 6b: Summary of the Ambient Sampling Station Fecal Coliform Estimated 90th Percentile Statistic (Open and Closed Status)

Statistics highlighted in gray shading indicate exceedance of NSSP bacteriological criteria for approved waters.

Year	GB4A	GB5	GB7C	GB16	GB81	GB82	GB83	GB84	GB85
2020	21.1	22.1	26.8	21.3	33.6	25.1	40.7	60.1	16.1
2021	18.2	11.6	19.4	16.1	22.8	19.5	25.0	36.8	12.9
2022	12.5	7.8	12.2	10.4	16.0	15.1	22.5	30.9	9.7

Tables 5a, 5b, 6a and 6b show generally stable or improving water quality over the triennial period.

Documentation and Evaluation of New Pollution Sources

Land Use Changes

During the 2020-2022 field seasons, NHDES Shellfish Program staff noted land use changes in the Great Bay Shellfish Management Area during both routine field work and annual drive-through surveys. In addition to the field investigations, NHDES staff examined the NHDES Wetlands and Subsurface Permit databases to find if any permits were given in the last three years to properties within the Great Bay Shellfish Management Area.

The drive-through surveys and permit database queries identified many property modifications (Table 7), none of which are anticipated to adversely affect water quality in the Atlantic Coast shellfish growing waters.

Table 7: Great Bay Management Area Property Modifications

Town	Tax Map	Tax Lot	Description
Greenland	R-13	5	(2020) Great Bay Discovery Center/NHFG. Expedited Minimum (permit approved): Temporarily impact 16 square feet within the previously-developed 100-foot tidal buffer zone for the installation a 20-foot wooden pole on which an osprey platform and camera will be installed. One pollution source: 10-inch black plastic pipe (GBPS040). The permitted land use alterations are not anticipated to change fecal coliform loading to the previously-identified pollution sources.
Greenland	R-13	15	(2020) 97 Waters Edge. Standard Dredge and Fill (G&C Approval): Impact 346 square feet of tidal wetland and 48 square feet of previously-developed 100-foot tidal buffer zone for the construction of tidal docking structure, resulting in a 4-foot by 4-foot access landing, 4-foot by 8-foot access stairway, 4-foot by 20-foot fixed pier connected to a 3-foot by 46-foot ramp connected to an 8-foot by 16-foot float. The overall structure length seaward of the highest observable tide line is 82-feet, providing one slip on 112-feet of frontage along Great Bay. No pollution sources previously identified by NHDES Shellfish on property.
Greenland	R-14	4	(2020) 19 Birch Point. Septic system construction approval date 12/23/20. Operational approval date N/D. Flow 300 gpd. No pollution sources previously identified by NHDES Shellfish on property.
Greenland	R22	7A	(2020) 188 Newington Road. Septic system construction approval date N/D. Flow 600 gpd. No pollution sources previously identified by NHDES Shellfish on property.
Newington	47	47-6	(2020) 34 Fabyan Point Road. Subdivision approval date 11/16/20 for two lots, each lot approved for flow 600 gpd. No pollution sources previously identified by NHDES Shellfish on property.

Town	Tax Map	Tax Lot	Description
Newmarket	R1	36	(2020) 230 Bay Road. Shoreland Standard (permit approved): Impact 2,490 square feet of protected shoreland in order to construct a new concrete outlet structure and outlet pipe for an existing manmade pond. Three pollution sources: an intermittent stream (GBPS020 and GBPS021), and a 4 inch white PVC pipe (GBPS022). The permitted land use alterations are not anticipated to change fecal coliform loading to the previously-identified pollution sources.
Durham	20	3-2	(2021) 573 and 575 Bay Road. Subsurface construction approval for a septic system (5 bedrooms, 1050 GPD) issued on 6/9/2021. No operational approval date issued. Two pollution sources: 6-inch foundation drain (GBPS092) and an 8-inch outlet/overflow pipe for a man-made pond (GBPS009).
Durham	20	8-6	(2021) 395 Bay Road. Subsurface construction approval for a septic system issued on 4/9/2021. Approved as collection system tie-in for the installation of a 1250 gallon and 500 GPD pump chamber compartment tank; serving a garage with convenience bathroom - no increase in flow. The tank will tie into a previously State approved EDA - CA#186714. No operational approval date issued. One pollution source previously identified by NHDES shellfish: 4-foot wide intermittent stream (GBPS004).
Greenland	R14	3	(2021) 15 Birch Point. Subsurface construction approval for a septic system (300 GPD) issued on 6/11/2021. Operational approval issued 7/26/2021. No pollution sources previously identified by NHDES Shellfish on the property.
Greenland	R14	3A	(2021) 11 Birch Point Road. Subsurface construction approval for a septic system (600 GPD) issued on 3/18/2021. No operational approval date issued. No pollution sources previously identified by NHDES Shellfish on the property.
Greenland	R14	3A	(2021) 11 Birch Point Road. Shoreland Standard (permit approved): Impact 1,720 square feet of protected shoreland in order to replace existing septic system. Impervious Surface Percentage Approved: 21.4% Natural Woodland Area Required per RSA 483-B:9,V, (b): 1,850 square feet.
Greenland	R14	2A	(2021) 20 Waters Edge. Shoreland PBN (accepted): Impact 4 square feet of protected shoreland to replace existing helical posts under deck.

Town	Tax Map	Tax Lot	Description
Greenland	R22	3, 3A	(2022) Great Bay. Shoreland standard permit (approved). Impact 2,920 square feet of protected shoreland in order to relocate an existing cottage and removal of another cottage. Impervious Surface Percentage Approved: 0.97% Natural Woodland Area Required per RSA 483-B:9,V, (b): 20,951 square feet. No pollution sources previously identified by NHDES Shellfish on the property.
Newington	N/A	N/A	(2022) Eastern Great Bay. Expedited minimum permit (under technical review). Proposed 6.8 AC oyster reef restoration area is located within the Great Bay National Estuarine Research Reserve. A Division of the New Hampshire Fish and Game Department. No pollution sources previously identified by NHDES Shellfish on the property.
Greenland	22	3, 3A	(2022) Emery Ln. Expedited minimum permit (approved). Impact 2,157 square feet of palustrine wet meadow to improve and widen Emery Lane to include replacing an existing culvert to provide safe access for emergency vehicles. No pollution sources previously identified by NHDES Shellfish on the property.

Re-Evaluation of Existing Pollution Sources

Exeter Wastewater Treatment Facility

The Town of Exeter completed construction of a new wastewater treatment facility in 2020. The new 3.0 mgd facility (6.6 mgd peak flow) actually went online in summer 2019, with some additional construction finalized in 2020. The new WWTF utilizes an advanced activated sludge system (4-stage Bardenpho) that is expected to substantially reduce effluent nitrogen, TSS and BOD as compared to the old 3.0 mgd lagoon system. The disinfection system was changed from chlorine to ultraviolet light. A significant change to the overall infrastructure is construction of a larger pump station with two larger force mains (capacity of 11 million gallons). The increased conveyance capacity is expected to reduce the frequency and volume of CSO discharges to Clemson Pond. The facility continues to discharge to the Squamscott River through a 40-foot diffuser with eight ports. CORMIX modeling by NHDES Wastewater Engineering Bureau determined a dilution factor of 25.2:1 for this multiport diffuser (H. Franz, personal communication). Cost of the new facility was \$53.5 million, including infrastructure upgrades.

The Exeter WWTF has a design flow of 3.0 mgd, and its Monthly Operations Reports (MORs) show that average monthly flows ranged as follows:

2020: 0 – 2.68 mgd
2021: 0.86 – 4.58 mgd
2022: 0.12 – 3.44 mgd

The zero value for 2020 was noted in November 2020. The next lowest value was 0.57 mgd in August 2020.

The most recent NPDES permit for the Exeter WWTF (NH0100871) was signed by the U.S. Environmental Protection Agency on August 5, 2022, became effective on the first day of the calendar month immediately following 60 days after signature (11/1/22), and expires five years from the last day of the month preceding the effective date (10/31/27). The most recent compliance inspection report by the NHDES Wastewater Engineering Bureau (August 2022) shows no significant deficiencies regarding effluent bacteria concentrations, plant flow levels or operation of the disinfection system. NHDES Wastewater Engineering Bureau inspection tracking data indicate one “effluent violation” relating to an instance when the operator did not sign off on an effluent sample chain-of-custody form.

A joint NHDES/U.S. Environmental Protection Agency (EPA) dye/dilution study of the Exeter wastewater treatment facility effluent’s impact on the Squamscott River was conducted in April 2000 (Nash and Bridges, March 2004). The study simulated a hypothetical disinfection system failure at the plant and recommended boundaries for a Prohibited/Safety Zone and an adjacent Conditionally Approved area, using assumptions of WWTF flow of 2.6 mgd during injection (daily flow of 3.7 mgd for the day of study), effluent bacteria concentration of 300,000 FC/100ml, a four to six-hour plant failure notification time, and a worst-case scenario of a discharge beginning 1-1.5 hours prior to slack high tide. At four to five hours after injection, a leading edge was observed between the Rt. 108 crossing and the railroad bridge adjacent to Great Bay. In the following hour, the dye moved farther into Great Bay, near the mouth of the Lamprey River, although by this time the tidal stage had dropped such that all dye was confined in the channel, thus preventing dye migration onto adjacent flats. This study suggested that the southwest corner of Great Bay, near the mouth of the Squamscott River, could exhibit high bacteria levels within four to five hours of a WWTF failure occurring at slack high tide. The area affected within this time frame, including all of the Squamscott River to the head-of-tide dam, was classified as Prohibited/Safety Zone.

The National Shellfish Sanitation Program (ISSC, 2019) recommends that a Prohibited area around a WWTF outfall, for plants using chlorine disinfection, provide a minimum 1000:1 steady-state dilution to protect against viral contamination. Less dilution is permissible when WWTF viral removal efficiency is demonstrated. Sampling to demonstrate viral removal efficiency at the new Exeter facility, which uses ultraviolet light for disinfection, is ongoing. Although a hydrographic dye study for the Exeter facility was conducted in 2000, that study utilized a slug injection of dye. New procedures recommended under the NSSP call for a 12.4 hour injection of dye, with mobile and fixed-station dye measurements over multiple days, in order to estimate steady-state dilution at various distances from the outfall. Such a study should be pursued for the Exeter facility, as time and available resources allow.

Table 8: Summary of Exeter WWTF Exceeding Reporting Thresholds for Bacteria and Effluent Flow, 2020-2022

Date	Parameter	Facility	Reporting Limit	Result	NHDES Response
4/3/20, 4/4/20	Flow	Exeter	3 mgd	3.72 mgd, 3.22 mgd	Determined no significant impact to harvest area per previous dye studies and available data.
1/10/20	Fecal Coliform	Exeter	43/100ml	108/100ml	Determined sufficient dilution within outfall Prohibited zone and event lasted one day.
1/29/20	Fecal Coliform	Exeter	43/100ml	58/100ml	Determined sufficient dilution within outfall Prohibited zone and event lasted one day.
7/6/20	Fecal Coliform	Exeter	43/100ml	44/100ml	Determined sufficient dilution within outfall Prohibited zone and event lasted one day.
8/10/20	Fecal Coliform	Exeter	43/100ml	46/100ml	Determined sufficient dilution within outfall Prohibited zone and event lasted one day.
8/12/20	Fecal Coliform	Exeter	43/100ml	55/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
10/10/20	Fecal Coliform	Exeter	43/100ml	55/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
7/12/21	Flow	Exeter	3 mgd	3.46 mgd	Determined no significant impact to harvest area per previous dye studies and available data.
7/26/21	Fecal Coliform	Exeter	43/100ml	280/100ml	Determined sufficient dilution within outfall

Date	Parameter	Facility	Reporting Limit	Result	NHDES Response
					Prohibited zone and event lasted one day.
10/3/21	Fecal Coliform	Exeter	43/100ml	173/100ml	Determined sufficient dilution within outfall Prohibited zone and event lasted one day.
10/31/21	Flow	Exeter	3 mgd	4.58 mgd	Determined no significant impact to harvest area per previous dye studies and available data.
11/1/21	Flow	Exeter	3 mgd	3.13 mgd	Determined no significant impact to harvest area per previous dye studies and available data.
4/19/22	Flow	Exeter	3 mgd	3.4 mgd	Determined no significant impact to harvest area per previous dye studies and available data.
8/15/22	Fecal Coliform	Exeter	43/100ml	47/100ml	Determined sufficient dilution within outfall Prohibited zone and event lasted one day.
9/25/22	Fecal Coliform	Exeter	43/100ml	435.2/100ml	Determined sufficient dilution within outfall Prohibited zone and event lasted one day.
9/25/22	Flow	Exeter	3 mgd	5.8 mgd	Determined no significant impact to harvest area per previous dye studies and available data.
10/9/22	Fecal Coliform	Exeter	43/100ml	50	Determined sufficient dilution within outfall Prohibited zone and event lasted one day.

Several effluent-related incidents were reported by Exeter in 2020. The facility experienced brief (<15 minutes) interruption in UV disinfection due to power loss while the backup generator came online. These instances occurred on 1/29/20, 3/24/20, 6/21/20, 8/15/21. None resulted in harvest closures. A significant loss of disinfection from 6pm on 4/20/20 through 6am on 4/21/20 resulted in ~800,000 gallons of undisinfecting effluent being released to the estuary. The facility was under construction at the time and staff were unaware that their notification systems and backup systems were disabled, so they were unaware of the overnight discharge. Great Bay, Little Bay, Bellamy River and Oyster River were placed in the closed status on 4/21/23. Sampling conducted at several sites on 4/21/23 showed low fecal coliform (collected late pm 4/21/20, submitted to lab 4/22/20). All areas were reopened per lab results on 4/23/20.

One effluent-related incident was reported by Exeter in 2021. The facility experienced a 4-minute interruption in UV disinfection due to power loss while the backup generator came online. This occurred on 5/28/21 and did not require harvest closure.

Three other effluent-related incidents were reported by Exeter in 2022. The facility experienced brief (<15 minutes) interruption in UV disinfection due to power loss while the backup generator came online. These instances occurred on 7/22/22 and 12/23/22. Neither resulted in harvest closures. A third effluent incident was reported when the 12/15/22 fecal coliform result was declared invalid when it was discovered that the lab bench sheet had not been properly filled out.

Newfields Wastewater Treatment Facility

The Newfields Municipal Wastewater Treatment Facility (NPDES No. NH0101192) provides secondary treatment to wastewater from residents and businesses to a portion of the Town of Newfields. The treatment plant is designed for a flow of 0.12 MGD, and typically receives 0.045 mgd. Treated sewage is retained at the facility and batch-released at periodic intervals by the operator, 3-5 days per week depending on flow conditions. Chlorine is used for effluent disinfection. The outfall is located in the Squamscott River, just upstream of the Route 108 bridge. CORMIX modeling of dilution at the outfall, using the facility's design flow, indicates a dilution of >100:1. Because NHDES policy only allows for mixing zones with dilution of up to 100:1, a dilution of 100:1 is assumed for NPDES permitting (H. Franz, personal communication).

The most recent NPDES permit became effective on March 1, 2007 and expired on February 29, 2012. Application for a new permit has been pending since that time. On 4/1/2022 coverage for regulating the Newfield WWTF was transferred by USEPA to the Small WWTF General Permit. The new NPDES permit number is NHG580011, and authorization for operation under the new permit will begin 6/1/2023. The most recent compliance inspection report by the NHDES Wastewater Engineering Bureau (August 2022) shows no significant deficiencies in regards to effluent bacteria concentrations, plant flow levels or operation of the disinfection system. Review of the facility's Monthly Operations Reports shows the facility routinely achieves suitable disinfection (Table 9). Plant flows are not included in Table 9 because they do not show typical flow pattern during treatment, but rather, show flow values during periodic decants of treated/stored effluent.

A simple dye study/slug release of Rhodamine Wt was performed in May 2001 to develop information on available dilution around the outfall in the Squamscott River. The Newfields facility has such low flow in comparison to Exeter, that performance standards for the Great Bay Conditional Area Management Plan are not developed for this facility. The Prohibited/Safety Zone established for Exeter and for Newmarket WWTF is more than adequate to dilute any issues emanating from the Newfields WWTF.

Table 9: Summary of Newfields WWTF Exceeding Reporting Thresholds for Bacteria and Effluent Flow, 2020-2022*

Date	Parameter	Facility	Reporting Limit	Result	NHDES Response
7/7/21	Fecal Coliform	Newfields	43/100ml	86/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
8/4/21	Fecal Coliform	Newfields	43/100ml	115.3/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
11/4/21	Fecal Coliform	Newfields	43/100ml	2419.6/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
2/16/22	Fecal Coliform	Newfields	43/100ml	686.7 100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.

*No exceedances of flow or fecal coliform reporting thresholds in 2020

Newmarket Wastewater Treatment Facility

The Newmarket WWTF finished construction of a new facility in 2017. It has a similar flow design (0.85 mgd) as the old facility, but utilizes a four-stage Bardenpho treatment process (advanced activated sludge, to achieve nitrogen removal). Chlorine is still used for effluent disinfection, and the existing multiport diffuser outfall in the Lamprey River is still in use. The 65.6-foot long diffuser was constructed in 2002. It has 20 “T” shaped risers, each with two ports, for a total of 40 ports. CORMIX modelling, using the 0.85 mgd design flow, indicates a dilution factor of 55:1 (H. Franz, personal communication).

The Newmarket WWTF has a design flow of 0.85 mgd, and its Monthly Operations Reports (MORs) show that average monthly flows ranged as follows:

2020: 0.145 – 0.977 mgd
 2021: 0.211 – 1.282 mgd
 2022: 0.264 – 1.18 mgd

The most recent Newmarket WWTF NPDES permit (NH0100196) was signed by the U.S. Environmental Protection Agency on November 16, 2012, and became effective on the first day of the calendar month immediately following sixty days after signature. The permit has since expired and application for a new permit has been pending since that time. On 4/1/2022 coverage for regulating the Newmarket WWTF was transferred by USEPA to the Small WWTF General Permit. The new NPDES permit number is NHG580013, and authorization for operation under the new permit will begin 6/1/2023. The most recent compliance inspection report by the NHDES Wastewater Engineering Bureau (June 2022) shows no significant deficiencies in regards to effluent bacteria concentrations, plant flow levels or operation of the disinfection system.

A joint NHDES/EPA dye/dilution study of the Newmarket wastewater treatment facility effluent’s impact on the Lamprey River and Great Bay was conducted in November 2003, and again in April 2004 (Nash and Bridges, August 2004). The study simulated a hypothetical disinfection system failure at the plant and recommended boundaries for a Prohibited/Safety Zone, using assumptions of WWTF flow of 0.71 mgd during injection (daily flow of 1.16 mgd for the day of the study), effluent bacteria concentration of 500,000 FC/100ml, a four to six-hour plant failure notification time, and a worst-case scenario of a discharge beginning 1-1.5 hours prior to slack high tide. At four to five hours after injection, a leading edge developed, with somewhat diffuse concentrations in the channel of Great Bay and a well-defined and concentrated plume located at the mouth of the Lamprey River. At that point in time, the tide was at mid-ebb and tidal currents at their maximum. No significant dye concentrations were observed over the mudflats to the south, which were beginning to become exposed as the tide was falling. The study suggested that the southwest corner of Great Bay, near the mouth of the Lamprey River, could exhibit high bacteria levels within four to five hours of a WWTF failure occurring at slack high tide. The area affected within this time frame, including all of the Lamprey River to the head-of-tide dam, was classified as Prohibited/Safety Zone.

Table 10: Summary of Newmarket WWTF Exceeding Reporting Thresholds for Bacteria and Effluent Flow, 2020-2022

Date	Parameter	Facility	Reporting	Result	NHDES Response
1/30/20	Fecal Coliform	Newmarket	43/100ml	77/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
2/10/21	Fecal Coliform	Newmarket	43/100ml	102/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
2/17/20, 2/18/20, 2/19/20	Fecal Coliform	Newmarket	43/100ml	56/100ml, 109/100ml, 94/100ml	Determined sufficient dilution within outfall Prohibited zone.
2/21/20, 2/22/20	Fecal Coliform	Newmarket	43/100ml	95/100ml, 68/100ml	Determined sufficient dilution within outfall Prohibited zone.
3/9/20	Fecal Coliform	Newmarket	43/100ml	53/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
3/12/20	Fecal Coliform	Newmarket	43/100ml	43/100ml	Determined sufficient dilution

Date	Parameter	Facility	Reporting Limit	Result	NHDES Response
					within outfall Prohibited zone, and event lasted one day.
3/14/20	Fecal Coliform	Newmarket	43/100ml	50/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
3/16/20	Fecal Coliform	Newmarket	43/100ml	112/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
3/18/20	Fecal Coliform	Newmarket	43/100ml	46/100ml	Determined sufficient dilution within outfall Prohibited zone, and it was a two day event.
3/20/20	Fecal Coliform	Newmarket	43/100ml	70/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
3/23/20	Fecal Coliform	Newmarket	43/100ml	46/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
3/30/20, 3/31/20	Fecal Coliform	Newmarket	43/100ml	102/100ml, 66/100ml	Determined sufficient dilution within outfall Prohibited zone, and it was a two day event
8/4/20, 8/5/20	Fecal Coliform	Newmarket	43/100ml	>2419/100ml, 77.6/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
8/10/20	Fecal	Newmarket	43/100ml	>2419/100ml	Determined

Date	Parameter	Facility	Reporting Limit	Result	NHDES Response
	Coliform				sufficient dilution within outfall Prohibited zone, and event lasted one day.
8/13/20	Fecal Coliform	Newmarket	43/100ml	54.6/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted two days.
9/4/20, 9/5/20	Fecal Coliform	Newmarket	43/100ml	83.3/100ml, 2419.6/100ml	Determined sufficient dilution within outfall Prohibited zone.
11/1/20	Fecal Coliform	Newmarket	43/100ml	2420/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
11/3/20	Fecal Coliform	Newmarket	43/100ml	124/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
6/8/21	Fecal Coliform	Newmarket	43/100ml	2,419.6/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
6/21/21	Fecal Coliform	Newmarket	43/100ml	333.3/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
9/30/21	Fecal Coliform	Newmarket	43/100ml	360.9/100ml	Determined sufficient dilution within outfall Prohibited zone.
10/2/21	Fecal Coliform	Newmarket	43/100ml	58.6/100ml	Determined sufficient dilution within outfall Prohibited zone.

Date	Parameter	Facility	Reporting Limit	Result	NHDES Response
10/31/21	Flow	Newmarket	1 mgd	1.282 mgd	Determined no significant impact to harvest area per previous dye studies and available data.
4/19/22	Flow	Newmarket	1 mgd	1.012 mgd	Determined no significant impact to harvest area per previous dye studies and available data.
7/13/22	Fecal Coliform	Newmarket	43/100ml	>1600/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
8/10/22	Fecal Coliform	Newmarket	43/100ml	80/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.
11/17/22	Fecal Coliform	Newmarket	43/100ml	80/100ml	Determined sufficient dilution within outfall Prohibited zone, and event lasted one day.

Wastewater Infrastructure

The Town of Exeter has a NPDES permit for the discharge of Combined Sewer Overflow (CSO) to Clemson Pond, which is a manmade waterbody on the banks of the Squamscott River. During heavy rainfall events, Clemson Pond can receive CSO discharges, typically from CSO structures on Water Street and on Spring Street. Water from Clemson Pond is discharged to the Squamscott River via two tide gates, which are located approximately 700 feet from the CSO inflow.

In 2020 there were no CSO events to Clemson Pond, presumably demonstrating the effectiveness of the infrastructure improvements/capacity expansion in the new pump station and force mains.

In 2021 there was one CSO event to Clemson Pond on 7/9/21, involving 4,301 gallons. Although it was raining at the time, the cause of the event was identified as “operator error” when a town technician decided to take the pump station offline to perform a test. During the test the wet well quickly filled and overflowed. It was immediately put back online. No other CSO events were reported in 2021. This is a relatively low number of events as compared to years past, especially in light of the heavy rainfall events in July and October 2021. Presumably the low number of CSO events demonstrates the effectiveness of the infrastructure improvements/capacity expansion in the new pump station and force mains.

Exeter had three instances of sewage discharge from infrastructure in 2020. Issues from the same private system near Lindenshire Avenue were reported to town staff on 10/20/20 and 11/23/20. A pump replacement for this system was installed after town staff inspected the area on 11/23/20. A third instance of 70 gallons discharged (none to surface waters) at Court Street and Crawford Avenue in Exeter on 12/17/20 was caused by lines blocked with rags.

Exeter had one instance of sewage discharge from infrastructure in 2021, involving a broken 8-inch force main on Ash Street. A contractor installing a pool hit the line accidentally on 7/8/21. He was told the line was abandoned, and no sewage flow was evident. The next day the homeowner noticed sewage coming from the break and called the town. The town had no record of this line, which connected to a four-unit development. The town fixed the break. Total sewage released was estimated to be 780 gallons.

Exeter had one instance of sewage discharge from infrastructure in 2022, involving ~150 gallons from Exeter Hospital pump station over approximately one hour on 7/17/22. Sanitary wipes were found to have bound the floats in the hospital's sewage pump station wet well (despite regular maintenance to capture such debris). When staff noticed water seeping from the pavement, they inspected the pump station and found it to be in alarm. The issue was cleaned and the pumps were manually turned on.

The Town of Newmarket reported no sewage overflow events in 2020, 2021 or 2022.

The Town of Newfields reported no sewage overflow events in 2020, 2021 or 2022.

All instances of sewage release are listed in Appendix I.

Non-permitted Pollution Sources

For this review period, the evaluation of the significant actual and/or potential sources of pollution previously identified in the Great Bay Shellfish Management Area focused mainly on conducting site visits, and examining nearby ambient monitoring stations' sampling data. The results of this work did not prompt any changes in classification.

Four streams were identified during the original sanitary survey to be actual direct pollution sources. The initial sanitary survey and subsequent triennial reports describe the data used to delineate Restricted areas (Figure 2) around the streams, including:

- The streams and cove just south of Fabyan Point (9.13 acres).
- All of Pickering Brook and the cove area north of Pierce Point (132.80 acres).
- All of the Winnicut River and the cove south of Pierce Point (123.50 acres).
- All of Crommet Creek to a point approximately 2500 feet downstream of the Bay Road bridge (40.58 acres).

Pollution sources in the Conditionally Approved and Restricted areas of Great Bay were sampled on six different dates during the review period. Previous triennial reports include recommendations for dry weather monitoring at these pollution source sites during the harvest season to develop more data under such conditions. During the site visits, it could not be determined if these sources were flowing due to the high tide at the time required to access these sites. However, many of these pollution sources are in close proximity to ambient monitoring stations. During this triennial period the ambient sites were sampled multiple times in dry and wet weather, and all meet Approved criteria as long as rainfall does not exceed 1.5 inches. Pollution sources were sampled in dry weather conditions. Locations of the pollution source sites and the nearby ambient stations are illustrated in Figure 3, and pollution source sampling results are presented in Table 11.

Table 11: Fecal Coliform Results from 2020-2022 Pollution Source Sampling

Station ID	5/20/20 FC/100ml	7/17/20 FC/100ml	11/12/20 FC/100ml	10/19/21 FC/100ml	4/6/22 FC/100ml	10/6/22 FC/100ml
GBPS001	13	no data	33	no data	no data	no data
GBPS002	2	no data	6.8	no data	no data	no data
GBPS006	no data	no data	no data	no data	no data	7.8
GBPS011	no data	no data	no data	no data	<10	no data
GBPS012	no data	no data	no data	No Flow	100	no data

Station ID	5/20/20 FC/100ml	7/17/20 FC/100ml	11/12/20 FC/100ml	10/19/21 FC/100ml	4/6/22 FC/100ml	10/6/22 FC/100ml
GBPS013	no data	no data	no data	no data	<10	no data
GBPS013A	no data	no data	no data	no data	60	no data
GBPS014	no data	no data	flow <10 gpm	no data	no data	no data
GBPS014A	no data	no data	no data	no data	no data	49
GBPS015	no data	no data	no data	no data	<10	no data
GBPS020	no data	no data	no data	no data	<10	no data
GBPS022	no data	no data	no data	no data	no data	13
GBPS023	no data	no data	no data	no data	no data	17
GBPS031	no data	no data	no data	no data	no data	13
GBPS032	no data	no data	no data	no data	no data	7.8
GBPS041	no data	no flow	no data	no data	no data	no data
GBPS041A	no data	no flow	no data	no data	no data	no data
GBPS042	no data	no flow	no data	no data	no data	no data
GBPS042A	no data	no flow	no data	no data	no data	no data
GBPS043	no data	no data	no data	no data	no data	no data
GBPS043A	no data	no data	no data	no data	no data	no data
GBPS044	no data	no data	no data	no data	no data	no data

Station ID	5/20/20 FC/100ml	7/17/20 FC/100ml	11/12/20 FC/100ml	10/19/21 FC/100ml	4/6/22 FC/100ml	10/6/22 FC/100ml
GBPS044A	no data	flow <10 gpm	no data	no data	no data	no data
GBPS046	no data	no flow	no data	no data	no data	no data
GBPS048	no data	flow <10 gpm	no data	no data	no data	no data
GBPS049	no data	no data	no data	no flow	no data	no data
GBPS053	no data	no data	no data	no data	no data	no data
GBPS054	no data	no data	no data	flow <10 gpm	no data	no data
GBPS055	no data	no data	no data	no data	no data	no data
GBPS061	2	no data	no data	no data	no data	no data
GBPS062	<2	no data	no data	no data	no data	no data
GBPS066	no data	flow <10 gpm	no data	no data	no data	no data
GBPS066A	no data	flow <10 gpm	no data	no data	no data	no data
GBPS078	6.8	no data	no data	no data	no data	no data
GBPS081	4	no data	350	no data	no data	no data
GBPS082	22	no data	350	no data	no data	no data
GBPS084	49	no data	no data	no data	no data	no data
GBPS085	79	no data	no data	no data	no data	no data
GBPS086	2	no data	no data	no data	no data	no data
GBPS087	<2	no data	no data	no data	no data	no data

Station ID	5/20/20 FC/100ml	7/17/20 FC/100ml	11/12/20 FC/100ml	10/19/21 FC/100ml	4/6/22 FC/100ml	10/6/22 FC/100ml
GBPS090	no data	no data	no data	no data	<10	no data
GBPS091	no data	no data	no data	no data	no data	4.5
GBPS094	no data	no data	no data	no data	no data	no data

Boating Activities

During the summer months, the northern portion of the growing area near Adams Point experiences increased recreational boating activity. Power boats and sailing vessels of various sizes begin to occupy moorings in mid-May, but recreational activity does not typically get underway in earnest until early June. By the end of September, boats are beginning to leave the water for the winter, and this process is typically complete by mid/late October. For the period of June through September each year, the discharge of sewage from these boats is considered to be a potential direct pollution source. There is currently one mooring field in the Great Bay Shellfish Management Area, and one mooring field north of Adam’s Point and just outside of the management area. Location and maximum occupancy figures for these areas are summarized in Table 12 and Figure 4.

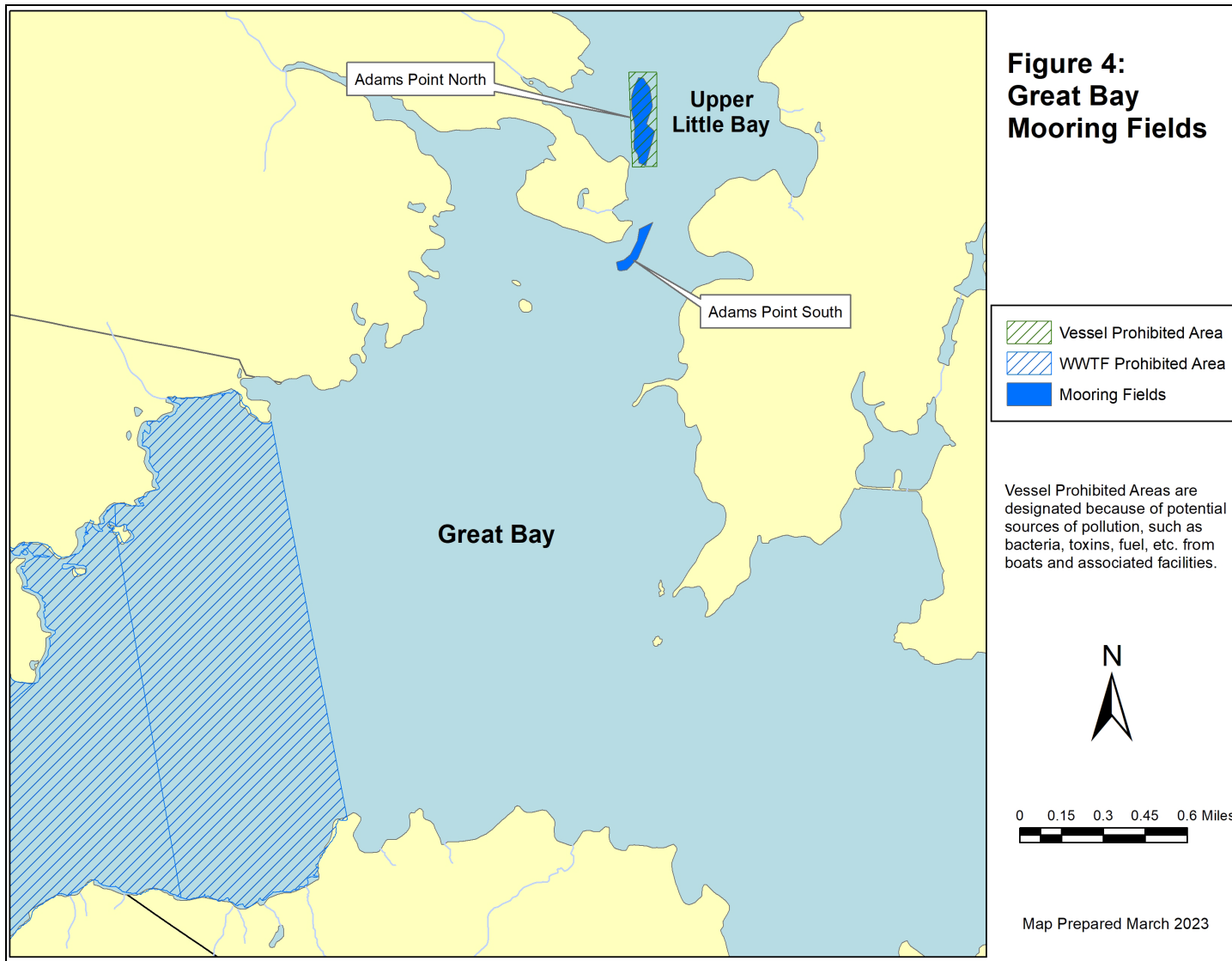
The Adams Point South Mooring Field straddles the border between the Great Bay and Little Bay Shellfish Management Areas. This mooring field is of particular importance because it lies adjacent to one of only two major oyster beds in New Hampshire. If the potential risk of sewage discharge from the mooring field becomes a significant threat, a Prohibited area would need to be delineated around the mooring field. Such a reclassification would effectively exclude harvest from the oyster bed. To ensure that the risk of sewage contamination is minimal during the harvest season, regular counts/observations are made of the mooring fields during the boating season. The Adams Point South mooring field contained no boats during all of the boat counts performed in 2020 and 2022, and the maximum number of boats observed during all 2021 surveys was one; therefore, the mooring field does not currently pose a significant public health risk from sewage discharge.

In recent years, mooring fields have become more populated than in previous years, particularly in comparison to low usage in 2020 during the COVID pandemic. There was an uptick in mooring field occupancy in 2021, followed by reduced usage in 2022. Shellfish Program staff will continue to work with the New Hampshire Division of Ports and Harbors to see if new moorings can be located away from shellfish harvest areas. Shellfish Program staff will also continue to monitor existing mooring fields in case additional moorings are added in subsequent years or the number of vessels with sanitary facilities increases. If either of these situations occurs, the affected area will require further evaluation, which may result in a closure.

Table 12: Great Bay Mooring Fields

Area	Adjacent Avg. Mid-Tide Water Depth (ft)	Maximum Number of Slips or Moorings	Maximum Number of Boats Observed 2020-2022	Maximum Number of Boats with Facilities 2020-2022	Estimated Number of Boats Discharging (25% for mooring fields)	Comments
Adams Point South Mooring Field	20	16	1	1	0.25	<10 boats total
Adams Point North Mooring Field	18	56	27	14	3.5	None

Figure 4: Great Bay Mooring Fields



Marine Biotoxins

The waters of the Gulf of Maine are prone to “blooms” of phytoplankton that can produce potent neurotoxins, and filter-feeding shellfish can accumulate concentrations of these toxins such that the shellfish themselves become a public health threat to consumers. For this reason, the NHDES maintains monitoring programs focused on the phytoplankton and associated toxins causing Paralytic Shellfish Poisoning (PSP), Amnesic Shellfish Poisoning (ASP) and Diarrhetic Shellfish Poisoning (DSP). The biotoxin management program consists of weekly phytoplankton monitoring for harmful algal bloom species at four primary stations, including one in Lower Little Bay, and weekly sampling of blue mussel tissue for PSP toxin at two primary stations in Hampton Harbor and Isles of Shoals (Gosport Harbor). Phytoplankton sampling and shellfish tissue biotoxin testing are generally not performed in Great Bay unless data from Little Bay indicate a bloom in the estuary could be developing.

The 2020 season showed generally low *Alexandrium* cell abundances throughout coastal New Hampshire. No toxicity in any of the weekly blue mussel samples collected from Hampton or from Gosport Harbor was detected in 2020. Therefore, no sampling of more inland estuarine waters, such as the Great Bay, was necessary.

Offshore and Hampton/Seabrook showed an unprecedented bloom of small-cell *Pseudo-nitzschia* in late spring and summer 2020. Little Bay seawater samples never showed the extremely high *Pseudo-nitzschia* cell counts seen offshore, but they did approach the 15,000 cell/liter threshold that prompts precautionary shellfish tissue testing for domoic acid in late May through mid June. Little Bay oysters and blue mussels were tested for domoic acid on 5/27/20, 6/9/20 and 6/17/20. All tests were below the detection limit; thus, no additional sampling (such as sampling in Great Bay) was necessary.

Calendar year 2021 was a relatively quiet year for PSP in all growing areas, including Little Bay, with no samples showing toxicity above the mandatory closure threshold of 80 µg/100g. *Alexandrium* cells were observed in weekly Little Bay phytoplankton samples in April, May, June and July 2021. Shellfish tissue samples were tested for PSP toxin on each of those occasions, and all showed low toxicity levels. Because of these Little Bay results, there was no reason to extend PSP sampling activities into Great Bay.

Calendar year 2021 was a relatively quiet year for ASP in all growing areas, including Little Bay. There were no exceedances of the 2,000 large PN cells/liter, and the 15,000 small PN cells/liter, thresholds from weekly phytoplankton samples in Little Bay, and therefore no shellfish tests for domoic acid were run for Little Bay shellfish. Because of these Little Bay results, there was no reason to extend ASP sampling activities into Great Bay.

Calendar year 2021 was a relatively quiet year for DSP in all growing areas, including Little Bay. Monitoring for DSP (Diarrhetic Shellfish Poisoning) conducted by quantifying populations of the phytoplankton *Dinophysis* spp (specifically, *D. acuminata*, *D. fortii*, *D. norvegica* and *D. tripos*), which produce potentially toxic levels of okadaic acid. Additionally, *Prorocentrum* lima is another species of concern for DSP. Currently the program does not have a method for DSP toxin screening of phytoplankton. Therefore, once a cell count threshold of 15,000 cells per liter (sum of all five species previously mentioned) is reached, shellfish tissue samples are collected and analyzed at Bigelow Laboratory in Boothbay, Maine. At no time in 2021 did the sum of the five species of concern exceed the tissue-testing threshold of 15,000 cells per liter; thus, no shellfish tests for okadaic acid were run for Little Bay shellfish. Because of these Little Bay results, there was no reason to extend DSP sampling activities into Great Bay.

Calendar year 2022 was an active year for PSP in many growing areas. PSP and other harmful algal blooms do not typically cause shellfish toxicity in Little Bay or in Great Bay, but it did occur in Little Bay in 2022. When high PSP toxicity levels are observed in the nearshore Atlantic area, and/or when *Alexandrium* cells are observed in Little Bay seawater samples, shellfish tissue biotoxin testing is initiated in Little Bay, specifically at Great Bay Marine and at a commercial oyster farm in Lower Little Bay (station LBDP1; see Figure 5). The 2022 PSP bloom in Little Bay got underway in May, intensified through June, and then began to subside in late June and July. One mussel sample at Great Bay Marine did exceed the mandatory closure threshold of 80 µg/100g on 6/13/22, but sampling farther into Little Bay, in the Conditionally Approved areas, showed PSP toxin levels below the 80 µg/100g threshold (Table 9). Furthermore, American oyster samples never showed toxicity above the 80 µg/100g threshold. Although harvest closures for PSP toxicity were issued in areas such as Hampton/Seabrook and the Atlantic Coast in late May 2022, no such closures were needed in Little Bay in 2022. Because the oyster tissue PSP toxin results in Little Bay remained low, there was no reason to extend shellfish toxicity testing into Great Bay.

Table 13: 2022 Little Bay Shellfish Tissue Tests for PSP Toxin

Station	Date	Species	PSP ug/100g	PSP Neogen Screening Test
LBDP1	04/04/22	BLUE MUSSEL	no data	NEG
GB-MARINE	05/18/22	BLUE MUSSEL	no data	NEG
GB-MARINE	05/23/22	BLUE MUSSEL	no data	NEG
GB-MARINE	05/31/22	BLUE MUSSEL	no data	NEG
LBDP1	06/08/22	AMERICAN OYSTER	no data	NEG
LBDP1	06/08/22	BLUE MUSSEL	no data	NEG
GB-MARINE	06/10/22	AMERICAN OYSTER	<44	POS
LBDP1	06/10/22	BLUE MUSSEL	no data	NEG
GB-MARINE	06/13/22	BLUE MUSSEL	57.6	POS
GB-MARINE	06/13/22	AMERICAN OYSTER	<44	POS
GB-MARINE	06/16/22	BLUE MUSSEL	85.5	POS
LBDP1	06/16/22	AMERICAN OYSTER	<44	POS
LBDP1	06/20/22	BLUE MUSSEL	46.1	POS
LBDP1	06/20/22	AMERICAN OYSTER	<44	POS
LBDP1	06/22/22	AMERICAN OYSTER	no data	NEG
LBDP1	06/27/22	AMERICAN OYSTER	no data	NEG
LBDP1	06/28/22	BLUE MUSSEL	no data	NEG

Station	Date	Species	PSP ug/100g	PSP Neogen Screening Test
LBDP1	07/06/22	BLUE MUSSEL	no data	NEG
LBDP1	07/14/22	BLUE MUSSEL	no data	NEG
LBDP1	07/21/22	BLUE MUSSEL	no data	NEG
LBDP1	07/27/22	BLUE MUSSEL	no data	NEG

Calendar year 2022 was a relatively quiet year for ASP in all growing areas, including Little Bay. There were no exceedances of the 2,000 large PN cells/liter, and the 15,000 small PN cells/liter, thresholds from weekly phytoplankton samples in Little Bay; thus, no shellfish tests for domoic acid were run for Little Bay shellfish.

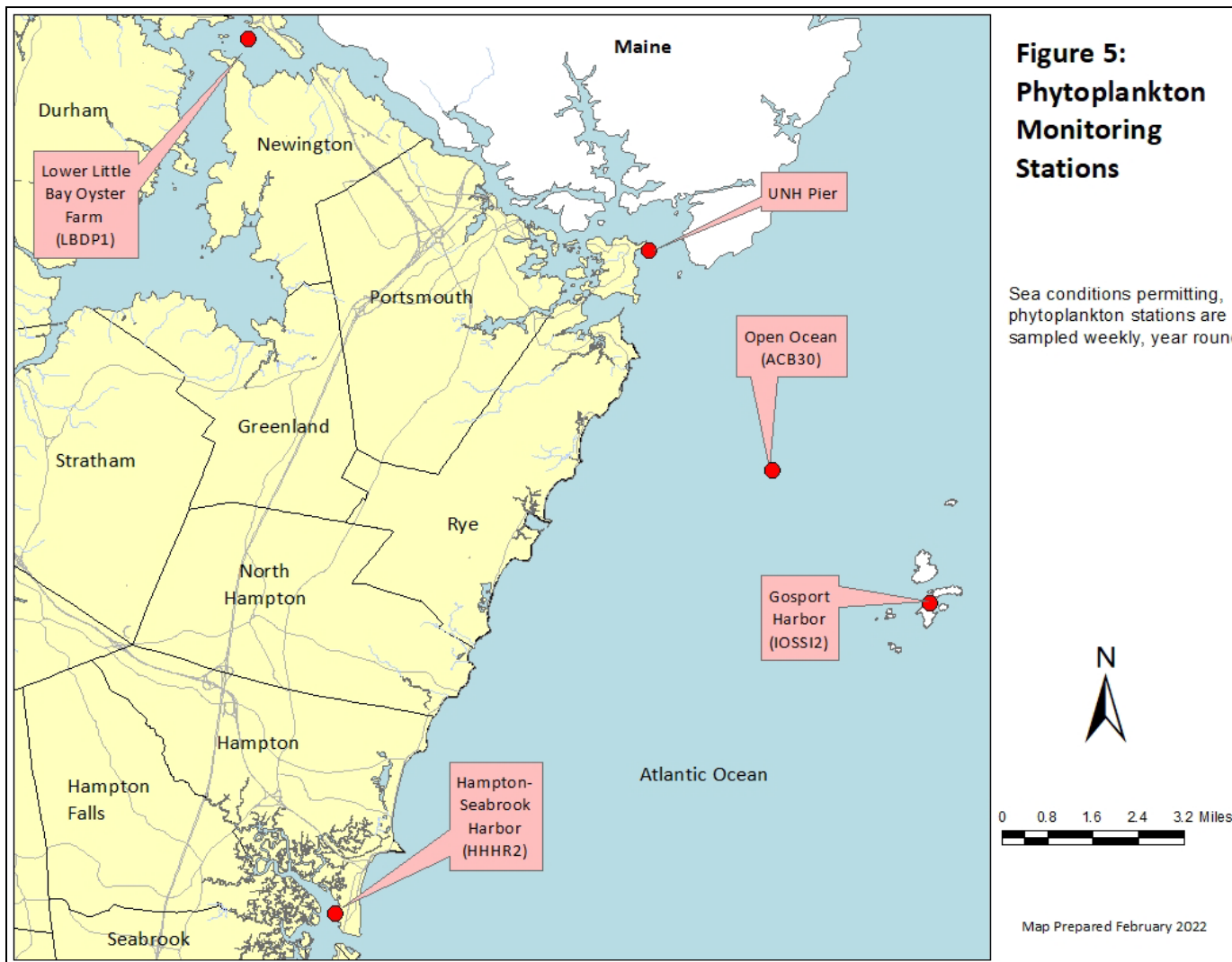
Calendar year 2022 was a relatively quiet year for DSP in all growing areas, including Little Bay. Monitoring for DSP (Diarrhetic Shellfish Poisoning) conducted by quantifying populations of the phytoplankton *Dinophysis spp* (specifically, *D. acuminata*, *D. fortii*, *D. norvegica* and *D. tripos*), which produce potentially toxic levels of okadaic acid. Additionally, *Prorocentrum lima* is another species of concern for DSP. Currently the program does not have a method for DSP toxin screening of phytoplankton. Therefore, once a cell count threshold of 15,000 cells per liter (sum of all five species previously mentioned) is reached, shellfish tissue samples are collected and analyzed at Bigelow Laboratory in Boothbay, Maine. At no time in 2022 did the sum of the five species of concern exceed the tissue-testing threshold of 15,000 cells per liter; thus, no shellfish tests for okadaic acid were run for Little Bay shellfish.

Alexandrium cell count data for seawater samples at all monitoring stations shown in Figure 5 are presented in Appendix III.

Pseudo-nitzschia large cell count data for all sites are presented in Appendix IV. *Pseudo-nitzschia* small cell count data for all sites are presented in Appendix V.

Dinophysis spp. and *Prorocentrum lima* cell count data for all sites are presented in Appendix VI.

Figure 5: 2022 Phytoplankton and PSP Shellfish Tissue Monitoring Stations



Discussion and Conclusions

After review of the relevant information collected over the past three years for the Great Bay Shellfish Management Area, it was determined that no changes need to be made to its current classification (Figure 2). This determination was based in part on the fact that there were no changes to the existing pollution sources and there were no new sources identified that would negatively affect the growing area.

Recommendations

1. The location of the Exeter and Newmarket WWTF Prohibited area boundary should be reevaluated after construction of the new Exeter WWTF is complete. The re-evaluation should begin with a new characterization of pre-disinfection effluent fecal coliform levels, as well as male-specific coliphage concentration in influent, pre-disinfection effluent and final effluent.
2. In concert with Recommendation #1, consider updating the hydrographic studies of the Exeter and Newmarket WWTFs, using new procedures recommended by the USFDA to delineate the steady state 1,000:1 zone of dilution around the outfalls. The updated hydrographic studies should be done after construction is complete.
3. Continue with event-based sampling at the inflow and outflow of Clemson Pond in Exeter to better understand how/if CSO events actually impact water quality in the Squamscott River.
4. As time and resources allow, additional information on water quality impacts to Great Bay should be performed on some of the more significant fecal coliform sources, including the unnamed stream and cove just south of Fabyan Point, Pickering Brook and the Winnicut River. Ambient monitoring on the boundaries of these sources' Restricted areas will continue to confirm the adequacy of existing classifications, but the additional water quality impact information, particularly wet weather information, may reveal opportunities to reduce the size of the existing Restricted areas.
5. As time and resources allow, conduct water quality studies to assess impacts of rainfall events on Great Bay. These studies should focus on rainfall events in the range of one to two inches. Emphasis should be placed on such events in late fall and winter, when fecal coliform levels appear to persist longer than in other seasons.

References

Interstate Shellfish Sanitation Conference. *National Shellfish Sanitation Program: Guide for the Control of Molluscan Shellfish, 2019 Revision*.

Ao, Yaping, G. Goblick, K. Calci, and W. Nash (March 2017). *Hydrographic Study of Peirce Island Wastewater Treatment Plant Effluent in the Piscataqua River of Portsmouth, New Hampshire; Report of Findings from the December 10 – 14, 2012 Study Period*. FDA Technical Assistance and Training Project Report. 57 pages.

Nash, C. (December 2020). *2017-2019 Triennial Management Area Update for Great Bay, New Hampshire*. NHDES Report R-WD-20-24. 54 pp.

Nash, C. (December 2017). *New Hampshire Department of Environmental Services Shellfish Program: Sanitary Survey Report for Great Bay, New Hampshire*. 80 pp.

Nash, C. (December 2022). *2021 Annual Shellfish Management Area Update for Great Bay, New Hampshire*. 35 pp.

Nash, C. and T. Bridges (August 2004). *Dilution, Dispersion, and Transport of Newmarket, New Hampshire Wastewater Treatment Plant Effluent in the Lamprey River*. NHDES Report Number R-WD-04-13. 58 pages.

Nash, C. and T. Bridges (March 2004). *Dilution, Dispersion, and Transport of Exeter, New Hampshire Wastewater Treatment Plant Effluent in the Squamscott River*. NHDES Report Number R-WD-04-11. 60 pages.

Nash, C. and M. Wood (December 2004). *New Hampshire Department of Environmental Services Shellfish Program: Sanitary Survey Report for Great Bay, New Hampshire*. NHDES Report R-WD-04-22. 54 pp.

Appendix I
Wastewater Collection Infrastructure Discharges

Exeter (2020)

Town	Date	Gallons	Comments
Exeter	10/20/20	undetermined	Discharge from private sewer system (not near tidal waters), possibly 10-20 homes, estimated up to 2,000 gallons per day for undetermined amount of time. Unclear if there was discharge to surface waters.
Exeter	11/23/20	undetermined	Overflowing manhole from private system that needed a pump replacement. Not near tidal waters.
Exeter	12/17/20	70	Sewer line blockage (rags) at Court Street and Crawford Ave. No discharge to surface waters evident

Exeter (2021)

Town	Date	Gallons	Comments
Exeter	7/8/21	780	Contract hit line during pool construction on Ash Street. Was told line was abandoned and no flow was evident. Flow began next day. Town was called and fixed the line.

Exeter (2022)

Town	Date	Gallons	Comments
Exeter	7/17/22	~150	Exeter Hospital pump station disabled by accumulation of sanitary wipes. Crews noticed water on pavement, investigated and found pump station floats were bound by the wipes. Issue cleared and pumps restarted manually. Discharge lasted about one hour.

Appendix II

Alexandrium Cell Abundance Data

(Table entries are *Alexandrium* cells per liter)

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	UNH Pier	LBDP1
03-Feb-20	no data	no data	no data	no data	0	no data
04-Feb-20	no data	no data	0	no data	no data	no data
10-Feb-20	no data	no data	no data	no data	0	no data
12-Feb-20	no data	no data	0	no data	no data	no data
17-Feb-20	no data	no data	no data	no data	0	no data
18-Feb-20	no data	no data	0	no data	no data	no data
24-Feb-20	no data	no data	no data	no data	0	no data
25-Feb-20	no data	no data	0	no data	no data	no data
02-Mar-20	no data	no data	no data	no data	0	no data
04-Mar-20	no data	no data	0	no data	no data	no data
09-Mar-20	no data	no data	0	no data	0	0
15-Mar-20	no data	no data	0	no data	30	no data
23-Mar-20	no data	no data	0	no data	22.5	no data
24-Mar-20	no data	no data	no data	no data	no data	52.5
30-Mar-20	no data	no data	0	no data	0	no data
06-Apr-20	no data	no data	0	no data	no data	0
07-Apr-20	0	no data	no data	0	0	no data
12-Apr-20	no data	no data	no data	no data	0	no data
13-Apr-20	no data	no data	0	no data	no data	no data
20-Apr-20	0	no data	0	0	no data	no data
23-Apr-20	no data	no data	no data	no data	0	0
27-Apr-20	no data	no data	0	no data	no data	no data
29-Apr-20	0	no data	no data	no data	0	no data
04-May-20	no data	no data	0	no data	no data	0
06-May-20	187.5	no data	no data	135	15	no data
11-May-20	no data	no data	no data	no data	0	no data
13-May-20	no data	no data	30	no data	no data	no data
14-May-20	15	no data	no data	37.5	no data	no data
18-May-20	15	no data	no data	no data	7.5	7.5
21-May-20	no data	no data	0	no data	no data	no data
25-May-20	no data	no data	no data	no data	0	no data
26-May-20	no data	no data	0	no data	no data	no data
27-May-20	no data	no data	no data	no data	no data	37.5
30-May-20	no data	no data	no data	no data	no data	7.5
01-Jun-20	no data	no data	0	no data	0	15
02-Jun-20	0	no data	no data	0	no data	no data
05-Jun-20	no data	no data	no data	no data	no data	0

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	UNH Pier	LBDP1
08-Jun-20	0	no data	0	0	15	no data
09-Jun-20	no data	no data	no data	no data	no data	0
15-Jun-20	no data	no data	0	no data	0	0
17-Jun-20	0	no data	no data	0	no data	no data
19-Jun-20	no data	no data	no data	no data	no data	0
22-Jun-20	no data	no data	0	no data	0	0
24-Jun-20	no data	no data	no data	no data	no data	0
29-Jun-20	no data	no data	0	22.5	0	no data
30-Jun-20	no data	no data	no data	no data	no data	0
06-Jul-20	no data	no data	0	no data	0	no data
07-Jul-20	no data	no data	no data	no data	no data	0
13-Jul-20	no data	no data	0	0	0	0
20-Jul-20	no data	no data	0	no data	0	0
21-Jul-20	0	no data	no data	0	no data	no data
27-Jul-20	no data	no data	0	no data	0	0
28-Jul-20	0	no data	no data	0	no data	no data
03-Aug-20	no data	no data	0	no data	0	0
10-Aug-20	0	no data	0	0	0	no data
11-Aug-20	no data	no data	no data	no data	no data	0
17-Aug-20	no data	no data	0	no data	0	no data
19-Aug-20	0	no data	no data	0	no data	no data
24-Aug-20	0	no data	0	0	0	0
31-Aug-20	no data	no data	0	no data	0	no data
01-Sep-20	0	no data	no data	0	no data	no data
10-Sep-20	no data	no data	no data	no data	no data	0
11-Sep-20	no data	no data	0	no data	0	no data
14-Sep-20	no data	no data	0	no data	0	no data
15-Sep-20	no data	no data	no data	no data	no data	0
21-Sep-20	no data	no data	0	no data	0	no data
24-Sep-20	0	no data	no data	0	no data	0
28-Sep-20	no data	no data	0	no data	0	no data
29-Sep-20	no data	no data	no data	no data	no data	0
05-Oct-20	no data	no data	0	no data	0	no data
12-Oct-20	no data	no data	0	no data	0	no data
19-Oct-20	0	no data	0	no data	no data	no data
20-Oct-20	no data	no data	no data	no data	0	no data
21-Oct-20	no data	no data	no data	no data	no data	0
26-Oct-20	no data	no data	0	no data	0	no data
02-Nov-20	no data	no data	0	no data	0	no data
04-Nov-20	no data	no data	no data	no data	no data	0
09-Nov-20	no data	no data	0	no data	0	no data

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	UNH Pier	LBDP1
10-Nov-20	0	no data	no data	0	no data	no data
16-Nov-20	no data	no data	0	no data	0	no data
17-Nov-20	no data	no data	no data	no data	no data	0
24-Nov-20	no data	no data	0	no data	0	no data
29-Nov-20	no data	no data	0	no data	0	no data
01-Dec-20	no data	no data	no data	no data	no data	0
07-Dec-20	no data	no data	0	no data	0	no data
14-Dec-20	no data	no data	0	no data	0	no data
21-Dec-20	no data	no data	0	no data	0	no data
28-Dec-20	no data	no data	0	no data	0	no data
03-Jan-21	no data	no data	0	no data	0	no data
05-Jan-21	no data	no data	no data	no data	no data	0
11-Jan-21	no data	no data	0	no data	0	0
13-Jan-21	no data	no data	no data	no data	no data	no data
18-Jan-21	no data	no data	0	no data	0	no data
25-Jan-21	no data	no data	0	no data	0	no data
26-Jan-21	no data	no data	no data	no data	no data	0
01-Feb-21	no data	no data	0	no data	0	no data
10-Feb-21	no data	no data	0	no data	0	no data
15-Feb-21	no data	no data	0	no data	0	no data
22-Feb-21	no data	no data	0	no data	0	no data
23-Feb-21	no data	no data	no data	no data	no data	0
01-Mar-21	no data	no data	0	no data	0	0
08-Mar-21	no data	no data	0	no data	0	no data
09-Mar-21	no data	no data	no data	no data	no data	0
15-Mar-21	no data	no data	0	no data	0	no data
22-Mar-21	0	no data	0	0	0	0
29-Mar-21	no data	no data	0	no data	0	no data
06-Apr-21	no data	no data	7.5	no data	0	no data
07-Apr-21	0	no data	no data	0	no data	no data
12-Apr-21	no data	no data	7.5	no data	no data	no data
13-Apr-21	no data	no data	no data	no data	22.5	22.5
19-Apr-21	no data	no data	0	no data	22.5	7.5
20-Apr-21	15	no data	no data	22.5	no data	no data
22-Apr-21	no data	0	no data	no data	no data	no data
26-Apr-21	no data	no data	0	no data	0	no data
28-Apr-21	15	no data	no data	7.5	no data	7.5
03-May-21	7.5	0	no data	7.5	15	no data
04-May-21	no data	no data	no data	no data	no data	0
10-May-21	no data	0	no data	no data	0	no data
12-May-21	0	no data	no data	0	no data	7.5

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	UNH Pier	LBDP1
17-May-21	0	no data	no data	7.5	no data	no data
19-May-21	no data	no data	no data	no data	no data	52.5
21-May-21	no data	0	no data	no data	22.5	no data
24-May-21	no data	no data	0	no data	no data	no data
25-May-21	no data	no data	no data	no data	no data	22.5
27-May-21	no data	no data	no data	no data	0	no data
31-May-21	no data	0	no data	no data	0	no data
01-Jun-21	0	no data	no data	60	no data	7.5
07-Jun-21	no data	30	no data	no data	0	15
08-Jun-21	0	no data	no data	30	no data	no data
14-Jun-21	no data	30	no data	no data	0	no data
15-Jun-21	no data	no data	no data	no data	no data	0
21-Jun-21	22.5	15	no data	15	7.5	no data
22-Jun-21	no data	no data	no data	no data	no data	15
28-Jun-21	no data	22.5	no data	no data	7.5	52.5
30-Jun-21	157.5	no data	no data	1462.5	no data	no data
05-Jul-21	no data	37.5	no data	no data	0	no data
06-Jul-21	no data	no data	no data	no data	no data	37.5
07-Jul-21	15	no data	no data	150	no data	no data
13-Jul-21	165	30	no data	0	0	0
19-Jul-21	no data	30	no data	no data	0	0
20-Jul-21	0	no data	no data	0	no data	no data
26-Jul-21	no data	37.5	no data	no data	0	15
27-Jul-21	0	no data	no data	0	no data	no data
02-Aug-21	no data	no data	no data	no data	no data	0
03-Aug-21	0	0	no data	0	7.5	no data
09-Aug-21	no data	0	no data	no data	0	0
10-Aug-21	0	no data	no data	0	no data	no data
16-Aug-21	no data	0	no data	no data	0	0
17-Aug-21	0	no data	no data	0	no data	no data
23-Aug-21	no data	0	no data	no data	0	no data
30-Aug-21	no data	0	no data	no data	0	0
06-Sep-21	no data	0	no data	no data	0	no data
07-Sep-21	no data	no data	no data	no data	no data	0
13-Sep-21	no data	0	no data	no data	0	0
14-Sep-21	0	no data	no data	0	no data	no data
20-Sep-21	no data	no data	0	no data	no data	no data
21-Sep-21	0	no data	no data	0	0	no data
22-Sep-21	no data	no data	no data	no data	no data	0
27-Sep-21	no data	no data	0	no data	no data	no data
28-Sep-21	no data	no data	no data	no data	no data	0

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	UNH Pier	LBDP1
30-Sep-21	no data	no data	no data	no data	0	no data
05-Oct-21	no data	0	no data	no data	0	no data
06-Oct-21	no data	no data	no data	no data	no data	0
11-Oct-21	no data	0	no data	no data	0	no data
18-Oct-21	no data	0	no data	no data	0	no data
25-Oct-21	0	0	no data	no data	0	0
01-Nov-21	no data	0	no data	no data	0	0
03-Nov-21	0	no data	no data	0	no data	no data
08-Nov-21	no data	0	no data	no data	0	0
15-Nov-21	no data	0	no data	no data	0	
16-Nov-21	no data	no data	no data	no data	no data	0
17-Nov-21	0	no data	no data	0	no data	no data
22-Nov-21	no data	no data	no data	no data	no data	0
23-Nov-21	no data	no data	0	no data	no data	no data
30-Nov-21	no data	no data	0	no data	0	no data
01-Dec-21	no data	no data	no data	no data	no data	0
06-Dec-21	no data	no data	0	no data	no data	
08-Dec-21	no data	no data	no data	no data	0	0
13-Dec-21	no data	no data	0	no data	no data	no data
15-Dec-21	0	no data	no data	0	no data	0
16-Dec-21	no data	no data	no data	no data	0	no data
20-Dec-21	no data	no data	0	no data	0	no data
27-Dec-21	no data	no data	0	no data	no data	no data
29-Dec-21	no data	no data	no data	no data	0	no data

Week Of	ACB30	ACBSW2	HHHR2	IOSSI2	LBDP1	UNH Pier
02-Jan-22	no data	no data	7.5	no data	7.5	0
09-Jan-22	no data	no data	0	no data	no data	0
16-Jan-22	no data	no data	0	no data	0	0
23-Jan-22	no data	no data	0	no data	no data	0
30-Jan-22	no data	no data	0	no data	no data	0
06-Feb-22	no data	no data	0	no data	no data	0
13-Feb-22	no data	no data	0	no data	no data	0
20-Feb-22	0	no data	0	0	0	0
27-Feb-22	no data	no data	0	no data	0	0
06-Mar-22	no data	no data	0	no data	no data	0
13-Mar-22	0	no data	7.5	0	no data	0
20-Mar-22	15	no data	0	0	0	0
27-Mar-22	45	no data	22.5	no data	7.5	7.5
03-Apr-22	0	0	7.5	0	0	0
10-Apr-22	0	no data	0	0	0	0
17-Apr-22	15	no data	0	0	0	7.5

Week Of	ACB30	ACBSW2	HHR2	IOSSI2	LBDP1	UNH Pier
24-Apr-22	0	no data	0	0	0	0
01-May-22	7.5	no data	7.5	0	0	0
08-May-22	no data	no data	0	no data	0	22.5
15-May-22	142.5	no data	105	97.5	7.5	30
22-May-22	420	90	75	457.5	22.5	67.5
29-May-22	no data	7.5	22.5	no data		no data
05-Jun-22	no data	127.5	37.5	no data	232.5	no data
12-Jun-22	1830	1042.5	5902.5	345	420	no data
19-Jun-22	300	2115	1147.5*	30	945	no data
26-Jun-22	840	255	675	292.5	142.5	no data
03-Jul-22	217.5	75	82.5	60	82.5	no data
10-Jul-22	2198	37.5	742.5	45	0	no data
17-Jul-22	37.5	135	45	195	127.5	no data
24-Jul-22	982.5	45	210	210	60	no data
31-Jul-22	45	90	180	7.5	0	no data
07-Aug-22	0	7.5	15	0	0	no data
14-Aug-22	0	0	0	0	0	no data
21-Aug-22	0	no data	0	0	0	no data
28-Aug-22	no data	no data	0	no data	0	no data
04-Sep-22	no data	no data	0	no data	0	no data
11-Sep-22	0	0	0	no data	0	no data
18-Sep-22	no data	no data	0	no data	0	no data
25-Sep-22	no data	no data	0	no data	0	no data
02-Oct-22	no data	no data	0	no data	0	no data
09-Oct-22	0	no data	0	0	0	no data
16-Oct-22	no data	no data	0	no data	0	no data
23-Oct-22	no data	no data	0	no data	0	no data
30-Oct-22	no data	no data	0	no data	0	no data
06-Nov-22	0	no data	0	no data	0	no data
13-Nov-22	no data	no data	0	no data	0	no data
20-Nov-22	no data	no data	0	no data	0	no data
27-Nov-22	no data	no data	0	no data		no data
04-Dec-22	no data	no data	0	no data	0	no data
11-Dec-22	no data	no data	0	no data	no data	no data
18-Dec-22	0	no data	0	no data	no data	no data
25-Dec-22	no data	no data	0	no data	no data	no data

Appendix III

Large-Cell *Pseudo-nitzschia* Cell Abundance Data

(Table entries are large-cell *Pseudo-nitzschia* cells per liter; samples >2,000 cells per liter highlighted and boldfaced)

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	LBDP1	UNH Pier
03-Feb-20	no data	no data	no data	no data	no data	0
04-Feb-20	no data	no data	180	no data	no data	no data
10-Feb-20	no data	no data	no data	no data	no data	0
12-Feb-20	no data	no data	30	no data	no data	no data
17-Feb-20	no data	no data	no data	no data	no data	0
18-Feb-20	no data	no data	180	no data	no data	no data
24-Feb-20	no data	no data	no data	no data	no data	0
25-Feb-20	no data	no data	0	no data	no data	no data
02-Mar-20	no data	no data	no data	no data	no data	0
04-Mar-20	no data	no data	405	no data	no data	no data
09-Mar-20	no data	no data	0	no data	0	0
15-Mar-20	no data	no data	0	no data	no data	0
23-Mar-20	no data	no data	0	no data	no data	105
24-Mar-20	no data	no data	no data	no data	0	no data
30-Mar-20	no data	no data	0	no data	no data	0
06-Apr-20	no data	no data	0	no data	0	no data
07-Apr-20	0	no data	no data	0	no data	0
12-Apr-20	no data	no data	no data	no data	no data	0
13-Apr-20	no data	no data	0	no data	no data	no data
20-Apr-20	0	no data	0	0	no data	no data
23-Apr-20	no data	no data	no data	no data	0	0
27-Apr-20	no data	no data	0	no data	no data	no data
29-Apr-20	0	no data	no data	no data	no data	0
04-May-20	no data	no data	0	no data	67.5	no data
06-May-20	0	no data	no data	0	no data	0
11-May-20	no data	no data	no data	no data	no data	0
13-May-20	no data	no data	0	no data	no data	no data
14-May-20	0	no data	no data	0	no data	no data
18-May-20	37.5	no data	no data	no data	0	0
21-May-20	no data	no data	4605	no data	no data	no data
25-May-20	no data	no data	no data	no data	no data	1980
26-May-20	no data	no data	0	no data	no data	no data
27-May-20	no data	no data	no data	no data	0	no data
30-May-20	no data	no data	no data	no data	0	no data
01-Jun-20	no data	no data	2025	no data	0	6202.5
02-Jun-20	495	no data	no data	240	no data	no data
05-Jun-20	no data	no data	no data	no data	0	no data
08-Jun-20	60	no data	120	450	no data	630
09-Jun-20	no data	no data	no data	no data	60	no data

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	LBDP1	UNH Pier
15-Jun-20	no data	no data	0	no data	0	0
17-Jun-20	22.5	no data	no data	75	no data	no data
19-Jun-20	no data	no data	no data	no data	0	no data
22-Jun-20	no data	no data	0	no data	0	0
24-Jun-20	no data	no data	no data	no data	0	no data
29-Jun-20	no data	no data	0	0	no data	0
30-Jun-20	no data	no data	no data	no data	90	no data
06-Jul-20	no data	no data	0	no data	no data	0
07-Jul-20	no data	no data	no data	no data	0	no data
13-Jul-20	no data	no data	0	90	0	0
20-Jul-20	no data	no data	750	no data	0	157.5
21-Jul-20	885	no data	no data	60	no data	no data
27-Jul-20	no data	no data	705	no data	262.5	1170
28-Jul-20	1507.5	no data	no data	112.5	no data	no data
03-Aug-20	no data	no data	517.5	no data	105	240
10-Aug-20	37.5	no data	1530	0	no data	435
11-Aug-20	no data	no data	no data	no data	30	no data
17-Aug-20	no data	no data	82.5	no data	no data	90
19-Aug-20	435	no data	no data	30	no data	no data
24-Aug-20	495	no data	337.5	412.5	0	90
31-Aug-20	no data	no data	90	no data	no data	105
01-Sep-20	90	no data	no data	0	no data	no data
10-Sep-20	no data	no data	no data	no data	67.5	no data
11-Sep-20	no data	no data	795	no data	no data	1530
14-Sep-20	no data	no data	4942.5	no data	no data	4485
15-Sep-20	no data	no data	no data	no data	105	no data
21-Sep-20	no data	no data	3172.5	no data	no data	6952.5
24-Sep-20	3060	no data	no data	1380	555	no data
28-Sep-20	no data	no data	540	no data	no data	855
29-Sep-20	no data	no data	no data	no data	112.5	no data
05-Oct-20	no data	no data	20887.5	no data	no data	6472.5
12-Oct-20	no data	no data	10905	no data	no data	9787.5
19-Oct-20	13552.5	no data	6787.5	no data	no data	no data
20-Oct-20	no data	no data	no data	no data	no data	960
21-Oct-20	no data	no data	no data	no data	165	no data
26-Oct-20	no data	no data	1320	no data	no data	3630
02-Nov-20	no data	no data	82.5	no data	no data	67.5
04-Nov-20	no data	no data	no data	no data	37.5	no data
09-Nov-20	no data	no data	1470	no data	no data	82.5
10-Nov-20	1327.5	no data	no data	682.5	no data	no data
16-Nov-20	no data	no data	8400	no data	no data	5595
17-Nov-20	no data	no data	no data	no data	1072.5	no data
24-Nov-20	no data	no data	26767.5	no data	no data	2992.5

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	LBDP1	UNH Pier
29-Nov-20	no data	no data	22605	no data	no data	4575
01-Dec-20	no data	no data	no data	no data	585	no data
07-Dec-20	no data	no data	1560	no data	no data	630
14-Dec-20	no data	no data	1792.5	no data	no data	202.5
21-Dec-20	no data	no data	187.5	no data	no data	60
28-Dec-20	no data	no data	352.5	no data	no data	30
03-Jan-21	no data	no data	292.5	no data	no data	45
05-Jan-21	no data	no data	no data	no data	217.5	no data
11-Jan-21	no data	no data	180	no data	172.5	90
13-Jan-21	7.5	no data	no data	no data	no data	no data
18-Jan-21	no data	no data	0	no data	no data	0
25-Jan-21	no data	no data	300	no data	no data	0
26-Jan-21	no data	no data	no data	no data	45	no data
01-Feb-21	no data	no data	45	no data	no data	0
10-Feb-21	no data	no data	0	no data	no data	0
15-Feb-21	no data	no data	0	no data	no data	0
22-Feb-21	no data	no data	0	no data	no data	0
23-Feb-21	no data	no data	no data	no data	0	no data
01-Mar-21	no data	no data	7.5	no data	0	0
08-Mar-21	no data	no data	0	no data	no data	0
09-Mar-21	no data	no data	no data	no data	0	no data
15-Mar-21	no data	no data	0	no data	no data	0
22-Mar-21	0	no data	105	0	0	105
29-Mar-21	no data	no data	225	no data	no data	0
06-Apr-21	no data	no data	0	no data	no data	0
07-Apr-21	0	no data	no data	0	no data	no data
12-Apr-21	no data	no data	0	no data	no data	no data
13-Apr-21	no data	no data	no data	no data	0	0
19-Apr-21	no data	no data	0	no data	0	0
20-Apr-21	0	no data	no data	0	no data	no data
22-Apr-21	no data	0	no data	no data	no data	no data
26-Apr-21	no data	no data	0	no data	no data	0
28-Apr-21	0	no data	no data	0	0	no data
03-May-21	0	187.5	no data	30	no data	0
04-May-21	no data	no data	no data	no data	0	no data
10-May-21	no data	0	no data	no data	no data	0
12-May-21	0	no data	no data	0	0	no data
17-May-21	0	no data	no data	0		no data
19-May-21	no data	no data	no data	no data	0	no data
21-May-21	no data	0	no data	no data	no data	0
24-May-21	no data	no data	0	no data	no data	no data
25-May-21	no data	no data	no data	no data	0	no data
27-May-21	no data	no data	no data	no data	no data	0

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	LBDP1	UNH Pier
31-May-21	no data	0	no data	no data	no data	0
01-Jun-21	210	no data	no data	127.5	0	no data
07-Jun-21	no data	405	no data	no data	0	0
08-Jun-21	877.5	no data	no data	360	no data	no data
14-Jun-21	no data	1072.5	no data	no data	no data	172.5
15-Jun-21	no data	no data	no data	no data	0	no data
21-Jun-21	5842.5	1507.5	no data	1980	no data	3022.5
22-Jun-21	no data	no data	no data	no data	232.5	no data
28-Jun-21	no data	17047.5	no data	no data	307.5	3247.5
30-Jun-21	26550	no data	no data	6060	no data	no data
05-Jul-21	no data	4912.5	no data	no data	no data	645
06-Jul-21	no data	no data	no data	no data	90	no data
07-Jul-21	1740	no data	no data	5565	no data	no data
13-Jul-21	2550	4537.5	no data	270	0	7.5
19-Jul-21	no data	847.5	no data	no data	0	0
20-Jul-21	487.5	no data	no data	412.5	no data	no data
26-Jul-21	no data	337.5	no data	no data	45	37.5
27-Jul-21	90	no data	no data	150	no data	no data
02-Aug-21	no data	no data	no data	no data	0	no data
03-Aug-21	1995	1222.5	no data	1567.5	no data	0
09-Aug-21	no data	780	no data	no data	0	127.5
10-Aug-21	15	no data	no data	142.5	no data	no data
16-Aug-21	no data	0	no data	no data	0	0
17-Aug-21	30	no data	no data	0	no data	no data
23-Aug-21	no data	0	no data	no data	no data	0
30-Aug-21	no data	0	no data	no data	0	0
06-Sep-21	no data	0	no data	no data	no data	0
07-Sep-21	no data	no data	no data	no data	0	no data
13-Sep-21	no data	0	no data	no data	0	0
14-Sep-21	0	no data	no data	0	no data	no data
20-Sep-21	no data	no data	0	no data	no data	no data
21-Sep-21	405	no data	no data	0	no data	30
22-Sep-21	no data	no data	no data	no data	0	no data
27-Sep-21	no data	no data	0	no data	no data	no data
28-Sep-21	no data	no data	no data	no data	0	no data
30-Sep-21	no data	no data	no data	no data	no data	97.5
05-Oct-21	no data	37.5	no data	no data	no data	165
06-Oct-21	no data	no data	no data	no data	0	no data
11-Oct-21	no data	172.5	no data	no data	no data	15
18-Oct-21	no data	0	no data	no data	no data	0
25-Oct-21	45	0	no data	no data	0	0
01-Nov-21	no data	0	no data	no data	0	0
03-Nov-21	0	no data	no data	0	no data	no data

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	LBDP1	UNH Pier
08-Nov-21	no data	0	no data	no data	0	0
15-Nov-21	no data	15	no data	no data	no data	30
16-Nov-21	no data	no data	no data	no data	0	no data
17-Nov-21	0	no data	no data	0	no data	no data
22-Nov-21	no data	no data	no data	no data	0	no data
23-Nov-21	no data	no data	82.5	no data	no data	no data
30-Nov-21	no data	no data	165	no data	no data	30
01-Dec-21	no data	no data	no data	no data	37.5	no data
06-Dec-21	no data	no data	487.5	no data	no data	no data
08-Dec-21	no data	no data	no data	no data	0	300
13-Dec-21	no data	no data	0	no data	no data	no data
15-Dec-21	97.5	no data	no data	307.5	0	no data
16-Dec-21	no data	no data	no data	no data	no data	90
20-Dec-21	no data	no data	52.5	no data	no data	7.5
27-Dec-21	no data	no data	105	no data	no data	no data
29-Dec-21	no data	no data	no data	no data	no data	60

Week Of	ACB30	ACBSW2	HHHR2	IOSSI2	LBDP1	UNH Pier
01/02/22	no data	no data	173	no data	0	75
01/09/22	no data	no data	188	no data	no data	68
01/16/22	no data	no data	578	no data	0	0
01/23/22	no data	no data	300	no data	no data	60
01/30/22	no data	no data	15	no data	no data	8
02/06/22	no data	no data	0	no data	no data	0
02/13/22	no data	no data	30	no data	no data	0
02/20/22	23	no data	0	0	38	0
02/27/22	no data	no data	0	no data	0	8
03/06/22	no data	no data	113	no data	no data	23
03/13/22	1,508	no data	0	128	no data	45
03/20/22	8,520	no data	0	330	0	0
03/27/22	11,820	no data	315	no data	945	1,710
04/03/22	0	45	383	15	443	330
04/10/22	0	no data	8	0	0	0
04/17/22	0	no data	0	0	0	0
04/24/22	0	no data	0	0	0	0
05/01/22	0	no data	0	0	0	0
05/08/22	no data	no data	0	no data	0	0
05/15/22	0	no data	0	0	0	0
05/22/22	15	0	128	0	0	0
05/29/22	no data	0	0	no data	no data	no data
06/05/22	no data	0	30		0	no data
06/12/22	0	90	53	0	0	no data

Week Of	ACB30	ACBSW2	HHHR2	IOSSI2	LBDP1	UNH Pier
06/19/22	435	0	83	0	23	no data
06/26/22	0	45	0	15	0	no data
07/03/22	0	0	0	0	0	no data
07/10/22	38	60	83	0	0	no data
07/17/22	105	143	0	75	0	no data
07/24/22	0	180	105	15	0	no data
07/31/22	0	0	0	0	0	no data
08/07/22	75	0	0	0	0	no data
08/14/22	45	0	0	0	0	no data
08/21/22	0	no data	0	0	0	no data
08/28/22	no data	no data	0	no data	0	no data
09/04/22	no data	no data	0	no data	0	no data
09/11/22	0	0	0	no data	0	no data
09/18/22	no data	no data	0	no data	0	no data
09/25/22	no data	no data	0	no data	0	no data
10/02/22	no data	no data	0	no data	0	no data
10/09/22	0	no data	0	30	0	no data
10/16/22	no data	no data	0	no data	0	no data
10/23/22	no data	no data	0	no data	0	no data
10/30/22	no data	no data	0	no data	0	no data
11/06/22	0	no data	60	no data	0	no data
11/13/22	no data	no data	0	no data	0	no data
11/20/22	no data	no data	0	no data	0	no data
11/27/22	no data	no data	0	no data	no data	no data
12/04/22	no data	no data	60	no data	0	no data
12/11/22	no data	no data	210	no data	no data	no data
12/18/22	0	no data	0	no data	no data	no data
12/25/22	no data	no data	495	no data	no data	no data

Appendix IV

Small-Cell *Pseudo-nitzschia* Cell Abundance Data

(Table entries are small-cell *Pseudo-nitzschia* cells per liter; samples >15,000 cells per liter highlighted and boldfaced)

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	LBDP1	UNH Pier
03-Feb-20	no data	no data	no data	no data	no data	67.5
04-Feb-20	no data	no data	277.5	no data	no data	no data
10-Feb-20	no data	no data	no data	no data	no data	0
12-Feb-20	no data	no data	397.5	no data	no data	no data
17-Feb-20	no data	no data	no data	no data	no data	37.5
18-Feb-20	no data	no data	1372.5	no data	no data	no data
24-Feb-20	no data	no data	no data	no data	no data	0
25-Feb-20	no data	no data	3247.5	no data	no data	no data
02-Mar-20	no data	no data	no data	no data	no data	15
04-Mar-20	no data	no data	5362.5	no data	no data	no data
09-Mar-20	no data	no data	457.5	no data	0	0
15-Mar-20	no data	no data	1597.5	no data	no data	0
23-Mar-20	no data	no data	397.5	no data	no data	127.5
24-Mar-20	no data	no data	no data	no data	337.5	no data
30-Mar-20	no data	no data	532.5	no data	no data	292.5
06-Apr-20	no data	no data	0	no data	0	no data
07-Apr-20	0	no data	no data	120	no data	0
12-Apr-20	no data	no data	no data	no data	no data	0
13-Apr-20	no data	no data	22.5	no data	no data	no data
20-Apr-20	330	no data	30	37.5	no data	no data
23-Apr-20	no data	no data	no data	no data	0	0
27-Apr-20	no data	no data	37.5	no data	no data	no data
29-Apr-20	30	no data	no data	no data	no data	90
04-May-20	no data	no data	817.5	no data	0	no data
06-May-20	1170	no data	no data	75	no data	412.5
11-May-20	no data	no data	no data	no data	no data	0
13-May-20	no data	no data	150	no data	no data	no data
14-May-20	442.5	no data	no data	495	no data	no data
18-May-20	5677.5	no data	no data	no data	0	75
21-May-20	no data	no data	8475	no data	no data	no data
25-May-20	no data	no data	no data	no data	no data	2962.5
27-May-20	no data	no data	1150000	no data	11595	no data
30-May-20	no data	no data	no data	no data	4635	no data
01-Jun-20	no data	no data	520000	no data	6795	13162.5
02-Jun-20	2100000	no data	no data	1360000	no data	no data
05-Jun-20	no data	no data	no data	no data	12060	no data
08-Jun-20	5630000	no data	420000	605000	no data	320000
09-Jun-20	no data	no data	no data	no data	667.5	no data

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	LBDP1	UNH Pier
15-Jun-20	no data	no data	8670	no data	15585	5287.5
17-Jun-20	16417.5	no data	no data	2287.5	no data	no data
19-Jun-20	no data	no data	no data	no data	1470	no data
22-Jun-20	no data	no data	66562.5	no data	97.5	13965
24-Jun-20	no data	no data	no data	no data	225	no data
29-Jun-20	no data	no data	85087.5	1435000	no data	53325
30-Jun-20	no data	no data	no data	no data	3255	no data
06-Jul-20	no data	no data	2032.5	no data	no data	982.5
07-Jul-20	no data	no data	no data	no data	0	no data
13-Jul-20	no data	no data	285	1687.5	345	1162.5
20-Jul-20	no data	no data	6915	no data	0	930
21-Jul-20	10215	no data	no data	855	no data	no data
27-Jul-20	no data	no data	16567.5	no data	337.5	892.5
28-Jul-20	18360	no data	no data	2002.5	no data	no data
03-Aug-20	no data	no data	1237.5	no data	60	187.5
10-Aug-20	11805	no data	3442.5	12300	no data	202.5
11-Aug-20	no data	no data	no data	no data	112.5	no data
17-Aug-20	no data	no data	97.5	no data	no data	60
19-Aug-20	2167.5	no data	no data	397.5	no data	no data
24-Aug-20	3810	no data	615	3427.5	22.5	60
31-Aug-20	no data	no data	390	no data	no data	225
01-Sep-20	1147.5	no data	no data	525	no data	no data
10-Sep-20	no data	no data	no data	no data	292.5	no data
11-Sep-20	no data	no data	12802.5	no data	no data	32580
14-Sep-20	no data	no data	9337.5	no data	no data	10890
15-Sep-20	no data	no data	no data	no data	577.5	no data
21-Sep-20	no data	no data	2032.5	no data	no data	750
24-Sep-20	997.5	no data	no data	120	292.5	no data
28-Sep-20	no data	no data	270	no data	no data	30
29-Sep-20	no data	no data	no data	no data	315	no data
05-Oct-20	no data	no data	15	no data	no data	67.5
12-Oct-20	no data	no data	307.5	no data	no data	592.5
19-Oct-20	0	no data	637.5	no data	no data	no data
20-Oct-20	no data	no data	no data	no data	no data	22.5
21-Oct-20	no data	no data	no data	no data	0	no data
26-Oct-20	no data	no data	390	no data	no data	0
02-Nov-20	no data	no data	45	no data	no data	7.5
04-Nov-20	no data	no data	no data	no data	0	no data
09-Nov-20	no data	no data	210	no data	no data	22.5
10-Nov-20	405	no data	no data	7.5	no data	no data
16-Nov-20	no data	no data	0	no data	no data	75
17-Nov-20	no data	no data	no data	no data	82.5	no data
24-Nov-20	no data	no data	0	no data	no data	0

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	LBDP1	UNH Pier
29-Nov-20	no data	no data	2220	no data	no data	615
01-Dec-20	no data	no data	no data	no data	525	no data
07-Dec-20	no data	no data	0	no data	no data	0
14-Dec-20	no data	no data	3000	no data	no data	0
21-Dec-20	no data	no data	0	no data	no data	75
28-Dec-20	no data	no data	555	no data	no data	82.5
03-Jan-21	no data	no data	457.5	no data	no data	127.5
05-Jan-21	no data	no data	no data	no data	0	no data
11-Jan-21	no data	no data	157.5	no data	0	52.5
13-Jan-21	15	no data	no data	no data	no data	no data
18-Jan-21	no data	no data	720	no data	no data	52.5
25-Jan-21	no data	no data	67.5	no data	no data	0
26-Jan-21	no data	no data	no data	no data	22.5	no data
01-Feb-21	no data	no data	0	no data	no data	0
10-Feb-21	no data	no data	0	no data	no data	0
15-Feb-21	no data	no data	0	no data	no data	0
22-Feb-21	no data	no data	0	no data	no data	0
23-Feb-21	no data	no data	no data	no data	0	no data
01-Mar-21	no data	no data	0	no data	0	0
08-Mar-21	no data	no data	0	no data	no data	0
09-Mar-21	no data	no data	no data	no data	0	no data
15-Mar-21	no data	no data	0	no data	no data	0
22-Mar-21	0	no data	0	60	0	0
29-Mar-21	no data	no data	0	no data	no data	0
06-Apr-21	no data	no data	0	no data	no data	0
07-Apr-21	0	no data	no data	0	no data	no data
12-Apr-21	no data	no data	0	no data	no data	no data
13-Apr-21	no data	no data	no data	no data	0	0
19-Apr-21	no data	no data	0	no data	0	0
20-Apr-21	0	no data	no data	0	no data	no data
22-Apr-21	no data	0	no data	no data	no data	no data
26-Apr-21	no data	no data	0	no data	no data	0
28-Apr-21	0	no data	no data	0	0	no data
03-May-21	0	0	no data	0	no data	0
04-May-21	no data	no data	no data	no data	0	no data
10-May-21	no data	0	no data	no data	no data	0
12-May-21	30	no data	no data	0	0	no data
17-May-21	0	no data	no data	0	no data	no data
19-May-21	no data	no data	no data	no data	0	no data
21-May-21	no data	0	no data	no data	no data	0
24-May-21	no data	no data	0	no data	no data	no data
25-May-21	no data	no data	no data	no data	0	no data
27-May-21	no data	no data	no data	no data	no data	0

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	LBDP1	UNH Pier
31-May-21	no data	0	no data	no data	no data	0
01-Jun-21	232.5	no data	no data	232.5	0	no data
07-Jun-21	no data	0	no data	no data	0	0
08-Jun-21	0	no data	no data	0	no data	no data
14-Jun-21	no data	165	no data	no data	no data	37.5
15-Jun-21	no data	no data	no data	no data	0	no data
21-Jun-21	59557.5	3187.5	no data	42630	no data	1350
22-Jun-21	no data	no data	no data	no data	60	no data
28-Jun-21	no data	4477.5	no data	no data	67.5	877.5
30-Jun-21	370230	no data	no data	558030	no data	no data
05-Jul-21	no data	3997.5	no data	no data	no data	22.5
06-Jul-21	no data	no data	no data	no data	982.5	no data
07-Jul-21	997.5	no data	no data	1207.5	no data	no data
13-Jul-21	3172.5	652.5	no data	450	90	90
19-Jul-21	no data	1335	no data	no data	795	22.5
20-Jul-21	1860	no data	no data	1770	no data	no data
26-Jul-21	no data	15	no data	no data	127.5	30
27-Jul-21	112.5	no data	no data	45	no data	no data
02-Aug-21	no data	no data	no data	no data	67.5	no data
03-Aug-21	2355	1530	no data	2025	no data	112.5
09-Aug-21	no data	9157.5	no data	no data	75	0
10-Aug-21	60	no data	no data	532.5	no data	no data
16-Aug-21	no data	30	no data	no data	0	0
17-Aug-21	90	no data	no data	7.5	no data	no data
23-Aug-21	no data	15	no data	no data	no data	0
30-Aug-21	no data	0	no data	no data	0	30
06-Sep-21	no data	0	no data	no data	no data	0
07-Sep-21	no data	no data	no data	no data	0	no data
13-Sep-21	no data	0	no data	no data	0	0
14-Sep-21	30	no data	no data	0	no data	no data
20-Sep-21	no data	no data	37.5	no data	no data	no data
21-Sep-21	615	no data	no data	0	no data	52.5
22-Sep-21	no data	no data	no data	no data	0	no data
27-Sep-21	no data	no data	0	no data	no data	no data
28-Sep-21	no data	no data	no data	no data	0	no data
30-Sep-21	no data	no data	no data	no data	no data	0
05-Oct-21	no data	60	no data	no data	no data	15
06-Oct-21	no data	no data	no data	no data	0	no data
11-Oct-21	no data	30	no data	no data	no data	0
18-Oct-21	no data	0	no data	no data	no data	0
25-Oct-21	75	0	no data	no data	0	0
01-Nov-21	no data	0	no data	no data	0	0
03-Nov-21	0	no data	no data	15	no data	no data

Week Of	ACB30	HAMPTON-SD	HHHR2	IOSSI2	LBDP1	UNH Pier
08-Nov-21	no data	0	no data	no data	0	0
15-Nov-21	no data	0	no data	no data	no data	37.5
16-Nov-21	no data	no data	no data	no data	0	no data
17-Nov-21	0	no data	no data	0	no data	no data
22-Nov-21	no data	no data	no data	no data	0	no data
23-Nov-21	no data	no data	0	no data	no data	no data
30-Nov-21	no data	no data	0	no data	no data	0
01-Dec-21	no data	no data	no data	no data	0	no data
06-Dec-21	no data	no data	0	no data	no data	no data
08-Dec-21	no data	no data	no data	no data	0	0
13-Dec-21	no data	no data	0	no data	no data	no data
15-Dec-21	0	no data	no data	0	0	no data
16-Dec-21	no data	no data	no data	no data	no data	0
20-Dec-21	no data	no data	0	no data	no data	0
27-Dec-21	no data	no data	0	no data	no data	no data
29-Dec-21	no data	no data	no data	no data	no data	0

Week Of	ACB30	ACBSW2	HHHR2	IOSSI2	LBDP1	UNH Pier
02-Jan-22	no data	no data	0	no data	0	0
09-Jan-22	no data	no data	0	no data	no data	0
16-Jan-22	no data	no data	0	no data	0	0
23-Jan-22	no data	no data	0	no data	no data	0
30-Jan-22	no data	no data	0	no data	no data	0
06-Feb-22	no data	no data	30	no data	no data	758
13-Feb-22	no data	no data	233	no data	no data	878
20-Feb-22	105	no data	60	338	60	105
27-Feb-22	no data	no data	398	no data	150	1,215
06-Mar-22	no data	no data	2,978	no data	no data	953
13-Mar-22	3,113	no data	13,425	668	no data	1,478
20-Mar-22	1,125	no data	15,173	14,438	1,215	3,113
27-Mar-22	218	no data	525	no data	113	608
03-Apr-22	0	0	8	0	30	0
10-Apr-22	0	no data	0	0	135	8
17-Apr-22	30	no data	0	0	0	0
24-Apr-22	0	no data	0	0	0	0
01-May-22	0	no data	0	0	0	0
08-May-22	no data	no data	0	no data	0	0
15-May-22	15	no data	0	0	0	23
22-May-22	0	23	0	30	0	0
29-May-22	no data	30	0	no data	no data	no data
05-Jun-22	no data	0	0	no data	0	no data
12-Jun-22	870	1,965	0	3,870	0	no data

Week Of	ACB30	ACBSW2	HHHR2	IOSSI2	LBDP1	UNH Pier
19-Jun-22	817,050	2,970	30,127.5*	2,055	968	no data
26-Jun-22	833	45	0	218	15	no data
03-Jul-22	390	0	1,155	120	0	no data
10-Jul-22	1,320	3,788	233	0	0	no data
17-Jul-22	8,970	1,020	0	7,110	0	no data
24-Jul-22	150	5,543	5,850	60	23	no data
31-Jul-22	0	23	0	15	0	no data
07-Aug-22	15	0	0	0	0	no data
14-Aug-22	15	0	0	0	0	no data
21-Aug-22	30	no data	30	30	0	no data
28-Aug-22	no data	no data	0	no data	0	no data
04-Sep-22	no data	no data	98	no data	0	no data
11-Sep-22	0	248	0	no data	0	no data
18-Sep-22	no data	no data	0	no data	0	no data
25-Sep-22	no data	no data	0	no data	0	no data
02-Oct-22	no data	no data	0	no data	0	no data
09-Oct-22	555	no data	465	0	0	no data
16-Oct-22	no data	no data	0	no data	0	no data
23-Oct-22	no data	no data	0	no data	0	no data
30-Oct-22	no data	no data	15	no data	0	no data
06-Nov-22	120	no data	0	no data	0	no data
13-Nov-22	no data	no data	0	no data	0	no data
20-Nov-22	no data	no data	75	no data	0	no data
27-Nov-22	no data	no data	75	no data	no data	no data
04-Dec-22	no data	no data	30	no data	0	no data
11-Dec-22	no data	no data	60	no data	no data	no data
18-Dec-22	300	no data	0	no data	no data	no data
25-Dec-22	no data	no data	0	no data	no data	no data
*Collected at Hampton State Dock						

APPENDIX V

Dinophysis Cell Abundance Data

(Table entries are sum of all *Dinophysis* cells per liter)

Week of	HHHR2/ HAMPTON-SD	ACB30	IOSSI2	UNH Pier	LBDP1
5-Jan-20	no data	no data	no data	0	no data
12-Jan-20	no data	no data	no data	7.5	no data
19-Jan-20	no data	no data	no data	0	no data
26-Jan-20	no data	no data	no data	7.5	no data
02-Feb-20	7.5	no data	no data	7.5	no data
09-Feb-20	0	no data	no data	22.5	no data
16-Feb-20	0	no data	no data	0	no data
23-Feb-20	0	no data	no data	105	no data
01-Mar-20	0	no data	no data	22.5	no data
08-Mar-20	0	no data	no data	90	15
15-Mar-20	0	no data	no data	127.5	no data
22-Mar-20	0	no data	no data	37.5	0
29-Mar-20	0	no data	no data	232.5	no data
05-Apr-20	22.5	0	0	210	0
12-Apr-20	0	no data	no data	0	no data
19-Apr-20	0	0	7.5	45	0
26-Apr-20	0	0	no data	30	no data
03-May-20	135	82.5	112.5	105	0
10-May-20	67.5	0	15	0	no data
17-May-20	15	7.5	no data	90	7.5
24-May-20	37.5	no data	no data	30	30, 0
31-May-20	7.5	22.5	45	15	30, 112.5
07-Jun-20	255	22.5	67.5	52.5	37.5
14-Jun-20	15	0	112.5	165	30, 45
21-Jun-20	247.5	no data	no data	0	60, 37.5
28-Jun-20	375	no data	322.5	7.5	97.5
05-Jul-20	15	no data	no data	7.5	15
12-Jul-20	7.5	no data	15	0	45
19-Jul-20	495	52.5	7.5	0	15
26-Jul-20	135	0	7.5	37.5	15
02-Aug-20	75	no data	no data	7.5	30
09-Aug-20	45	22.5	7.5	7.5	15
16-Aug-20	7.5	7.5	0	0	no data
23-Aug-20	7.5	0	15	7.5	0
30-Aug-20	45	0	0	0	no data
06-Sep-20	7.5	no data	no data	0	0
13-Sep-20	52.5	no data	no data	7.5	0
20-Sep-20	0	0	0	0	0
27-Sep-20	15	no data	no data	7.5	22.5

Week of	HHHR2/ HAMPTON-SD	ACB30	IOSSI2	UNH Pier	LBDP1
04-Oct-20	15	no data	no data	7.5	no data
11-Oct-20	0	no data	no data	0	no data
18-Oct-20	37.5	30	no data	0	0
25-Oct-20	0	no data	no data	0	no data
01-Nov-20	22.5	no data	no data	0	7.5
08-Nov-20	0	15	75	0	no data
15-Nov-20	0	no data	no data	0	0
22-Nov-20	22.5	no data	no data	0	no data
29-Nov-20	0	no data	no data	0	0
06-Dec-20	0	no data	no data	0	no data
13-Dec-20	7.5	no data	no data	0	no data
20-Dec-20	15	no data	no data	0	no data
27-Dec-20	0	no data	no data	0	no data
03-Jan-21	0	no data	no data	0	0
10-Jan-21	0	15	no data	30	22.5
17-Jan-21	0	no data	no data	7.5	no data
24-Jan-21	15	no data	no data	0	7.5
31-Jan-21	7.5	no data	no data	7.5	no data
07-Feb-21	0	no data	no data	no data	no data
14-Feb-21	0	no data	no data	no data	no data
21-Feb-21	0	no data	no data	no data	0
28-Feb-21	0	no data	no data	no data	30
07-Mar-21	0	no data	no data	no data	15
14-Mar-21	0	no data	no data	no data	no data
21-Mar-21	0	0	0	no data	0
28-Mar-21	0	22.5	no data	no data	no data
04-Apr-21	7.5	no data	112.5	no data	no data
11-Apr-21	135	no data	no data	no data	7.5
18-Apr-21	15	15	0	no data	0
25-Apr-21	22.5	15	7.5	no data	7.5
02-May-21	0	15	15	no data	0
09-May-21	30	0	15	0	0
16-May-21	0	0	30	7.5	7.5
23-May-21	7.5	no data	no data	0	7.5
30-May-21	37.5	67.5	322.5	0	7.5
06-Jun-21	442.5	0	52.5	75	15
13-Jun-21	240	no data	no data	82.5	7.5
20-Jun-21	877.5	60	427.5	97.5	82.5
27-Jun-21	1770	150	345	52.5	82.5
04-Jul-21	67.5	7.5	390	22.5	7.5
11-Jul-21	97.5	75	367.5	0	15
18-Jul-21	45	45	90	0	0
25-Jul-21	7.5	0	30	7.5	0

Week of	HHHR2/ HAMPTON-SD	ACB30	IOSSI2	UNH Pier	LBDP1
01-Aug-21	67.5	0	7.5	0	0
08-Aug-21	82.5	45	337.5	0	30
15-Aug-21	60	7.5	7.5	30	7.5
22-Aug-21	30	no data	no data	7.5	no data
29-Aug-21	0	no data	no data	0	0
05-Sep-21	37.5	no data	no data	22.5	0
12-Sep-21	82.5	30	37.5	45	0
19-Sep-21	7.5	7.5	90	60	0
26-Sep-21	52.5	no data	no data	30	15
03-Oct-21	52.5	no data	no data	0	7.5
10-Oct-21	157.5	no data	no data	15	no data
17-Oct-21	15	no data	no data	0	no data
24-Oct-21	22.5	37.5	no data	0	0
31-Oct-21	30	30	82.5	15	7.5
07-Nov-21	67.5	no data		0	37.5
14-Nov-21	0	7.5	90	0	0
21-Nov-21	0	no data	no data	no data	7.5
28-Nov-21	30	no data	no data	0	7.5
05-Dec-21	7.5	no data	no data	0	0
12-Dec-21	0	0	7.5	0	0
19-Dec-21	0	no data	no data	0	no data
26-Dec-21	0	no data	no data	0	no data

Week Of	ACB30	HHHR2	IOSSI2	LBDP1	UNH Pier
02-Jan-22	no data	7.5	no data	0	7.5
09-Jan-22	no data	0	no data	no data	0
16-Jan-22	no data	0	no data	0	0
23-Jan-22	no data	0	no data	no data	0
30-Jan-22	no data	0	no data	no data	0
06-Feb-22	no data	0	no data	no data	0
13-Feb-22	no data	0	no data	no data	0
20-Feb-22	0	0	0	0	0
27-Feb-22	no data	0	no data	0	0
06-Mar-22	no data	0	no data	no data	0
13-Mar-22	0	0	0	no data	0
20-Mar-22	0	0	0	0	0
27-Mar-22	30	0	no data	0	0
03-Apr-22	15	7.5	22.5	15	0
10-Apr-22	7.5	90	30	15	22.5
17-Apr-22	0	7.5	7.5	15	15
24-Apr-22	0	37.5	30	0	0
01-May-22	0	15	0	0	7.5

Week Of	ACB30	HHHR2	IOSSI2	LBDP1	UNH Pier
08-May-22	no data	0	no data	0	7.5
15-May-22	120	120	157.5	15	0
22-May-22	135	202.5	135	0	52.5
29-May-22	no data	300	no data	no data	no data
05-Jun-22	no data	157.5	no data	135	no data
12-Jun-22	292.5	450	120	112.5	no data
19-Jun-22	210	105*	30	412.5	no data
26-Jun-22	15	37.5	0	37.5	no data
03-Jul-22	0	90	75	0	no data
10-Jul-22	0	2,070	0	7.5	no data
17-Jul-22	7.5	45	0	22.5	no data
24-Jul-22	0	765	45	45	no data
31-Jul-22	0	607.5	15	37.5	no data
07-Aug-22	7.5	615	75	15	no data
14-Aug-22	22.5	67.5	22.5	15	no data
21-Aug-22	0	30	37.5	0	no data
28-Aug-22	no data	7.5	no data	0	no data
04-Sep-22	no data	7.5	no data	0	no data
11-Sep-22	15	0	no data	0	no data
18-Sep-22	no data	0	no data	0	no data
25-Sep-22	no data	0	no data	0	no data
02-Oct-22	no data	0	no data	0	no data
09-Oct-22	30	0	7.5	0	no data
16-Oct-22	no data	0	no data	0	no data
23-Oct-22	no data	7.5	no data	0	no data
30-Oct-22	no data	37.5	no data	0	no data
06-Nov-22	0	0	no data	0	no data
13-Nov-22	no data	0	no data	0	no data
20-Nov-22	no data	0	no data	0	no data
27-Nov-22	no data	0	no data	no data	no data
04-Dec-22	no data	0	no data	0	no data
11-Dec-22	no data	0	no data	no data	no data
18-Dec-22	0	0	no data	no data	no data
25-Dec-22	no data	0	no data	no data	no data

*Collected at Hampton State Dock

Appendix VI

Conditional Area Management Plan for Great Bay
Revision 18: February 15, 2023

Description of Conditionally Approved Area

The eastern two-thirds of the Great Bay growing area is classified as Conditionally Approved. This area is defined as the waterbody bounded to the west by a Prohibited line extending from the shore between Vols Island and Crommet Creek, to the shore just west of Bracketts Point, to the north by the boundary between Great Bay and Little Bay at Adams Point, and to the east by Prohibited boundaries near Fabyan Point, Pickering Brook and the Winnicut River near Pierce Point.

Factors Indicating Suitability of Portions of Great Bay as Conditionally Approved

1. The major pollution sources with the capacity to adversely affect water quality in Great Bay are point source in origin, including the wastewater treatment facilities in Exeter and Newmarket and the Combined Sewer Overflow discharging to the Squamscott River via Clemson Pond in Exeter. Hydrographic studies have also demonstrated that the Portsmouth WWTF has the potential to adversely affect Great Bay water quality. The Conditionally Approved area is separated spatially from the wastewater treatment facility outfalls by a Prohibited/Safety Zone. National Pollutant Discharge Elimination System (NPDES) permit requirements for the facilities require the plant operators to immediately notify NHDES when discharges of improperly treated sewage occur, and experience to date has shown the plants do provide timely notification to NHDES. Prohibited zones are around other significant pollution sources adjacent to the Conditionally Approved area (Fabyan Point, Pickering Brook, Winnicut River and Crommet Creek). There are no other significant point sources in the Conditionally Approved area.
2. The waters of Great Bay can be affected by nonpoint sources of pollution following heavy (>1.50 inches) rainfall events. Weather information is available in real-time from the Pease airport weather tower in Portsmouth, which is staffed 24 hours a day.
3. Great Bay exhibits a tidal range that indicates substantial exchange with coastal ocean waters.

Pollution Events That May Trigger Conditional Area Closure

Newmarket Wastewater Treatment Facility

(186 Main Street, Newmarket, NH 03857. Sean Grieg, Operator, 603-659-8810)

The following performance standards may be used to trigger a closure of the Conditionally Approved areas in Great Bay. Violation of any of the following shall trigger immediate notification of the NHDES Shellfish Program by the Town of Newmarket:

- *Effluent flow*: total daily flow shall not exceed a flow of 1.0 MGD.
- *Bacteriological quality of the effluent*: shall not exceed 43 fecal coliform/100ml after disinfection.
- *Bypasses*: any discharge of raw sewage or partially treated sewage from the WWTF or from any part of the sewage collection system. For the purposes of this performance standard, “partially treated sewage” means sewage/effluent that has been released to

the environment before undergoing all aspects of treatment required by the most recent NPDES permit.

- Failure of the WWTF to complete its required effluent monitoring, such that the biological, physical and/or chemical quality of the effluent is unknown.

Exeter Wastewater Treatment Facility

(10 Front Street, Exeter, NH 03833. Chris Goodwin, Operator, 603-773-6168)

The following performance standards may be used to trigger a closure of the Conditionally Approved areas in Great Bay. Violation of any of the following shall trigger immediate notification of the NHDES Shellfish Program by the Town of Exeter:

- *Effluent flow*: total daily flow shall not exceed the design flow of 3.0 MGD.
- *Bacteriological quality of the effluent*: shall not exceed 43 fecal coliform/100ml after disinfection.
- *Bypasses*: any discharge of raw sewage or partially treated sewage from the WWTF or from any part of the sewage collection system. For the purposes of this performance standard, “partially treated sewage” means sewage/effluent that has been released to the environment before undergoing all aspects of treatment required by the most recent NPDES permit.
- Failure of the WWTF to complete its required effluent monitoring, such that the biological, physical and/or chemical quality of the effluent is unknown.

Exeter Combined Sewer Overflows

- *Any discharge* of the CSOs may be used to trigger a closure of the Conditionally Approved areas in Great Bay. Dye dilution/dispersion studies of the Squamscott River indicate that discharges of 100,000 gallons per hour and FC concentrations of 500,000/100ml could adversely affect Great Bay’s water quality. Discharges with lower rates but higher bacterial concentrations may also adversely affect Great Bay.

Meteorological or Hydrological Events

Rainfall events of more than 1.50 inches total precipitation shall trigger a closure of the Conditionally Approved areas in Great Bay. The 1.50-inch criterion is intended to generally apply to a 24-hour period; however, rainfall events that occur over a longer period of time may also warrant closure. Analysis of precipitation records from Portsmouth, NH suggests that on average, such events will occur approximately 5-10 times per year. An analysis of the relationship between rainfall and bacteria levels is presented in the sanitary survey report.

For the purpose of this performance standard, rainfall data will be obtained from the meteorological observation station at the Pease International Tradeport Airport in Portsmouth, New Hampshire. Real-time checks of rainfall data are made via phone calls to the weather observation station at the airport tower. Data from other coastal New Hampshire weather stations (e.g., Seabrook) may also be used to institute a closure.

Closures will be instituted for precipitation events that fall primarily as rainfall. Precipitation that falls primarily as snow and/or ice will generally not trigger a closure, as these events do not produce the runoff that transports bacterial contamination to the growing waters. However, precipitation events that fall as a mix of rain and snow/ice, or snow/ice events that are immediately followed by a significant melting period, may trigger a closure. The potential for

growing area contamination by such events will be evaluated by NHDES Shellfish Program staff on a case-by-case basis, and closure decisions will be made accordingly.

Implementation of a Conditionally Approved Area Closure

Notification of Management Plan Violation

The Newmarket and Exeter WWTFs are responsible for immediately notifying NHDES in the event of a violation of the aforementioned performance standards. The response time between management plan violation and notification of NHDES can vary, depending on the sewage discharge. However, historical experience with these WWTFs indicates notification can be expected within four-to-six hours of the management plan violation. Notification time is shortened by the availability of a pager maintained by NHDES staff (Chris Nash, Shellfish Program Manager, 222 International Drive, Suite 175, Pease Tradeport, Portsmouth, New Hampshire 03801). The Shellfish Program pager is to be used for notification (603-771-9826). The Shellfish Program also maintains a cell phone (603-568-6741) to be used by WWTF as needed (if direct contact with Shellfish staff is not made via cellphone, a page must be sent).

The Prohibited/no-harvest zone around each outfall is based in part on the time of travel notification time (response time) by each WWTF. WWTF response times will be reviewed annually to determine if a change in the size of the zone is warranted.

NHDES Shellfish Program staff are responsible for monitoring weather forecasts and conditions, and acquiring real-time rainfall data from the Pease Airport or other sources for the purposes of determining when a rainfall closure is necessary.

Implementation of Closure

Response time between management plan violation notification and legal closure by NHDES is relatively short for all facilities, typically within four to six hours. The short response times are aided by the automated alarm systems at the facilities and the fact that the NHDES Shellfish Program staff are on call (cellphone and pager) every day, 6am-9pm. Rainfall closures are also implemented quickly, as NHDES maintains direct contact with the Pease airport weather observation station. Notification of NHF&G (patrol agency) by NHDES typically occurs immediately following NHDES notification. Implementation of closure by NHF&G is often immediate as well, and typically occurs immediately after notification by NHDES. The following notification protocol is followed for each closure:

Initiation of Closure: Each week, the NHDES Shellfish Program calls the NHF&G Law Enforcement Division and sends a "Clam Hotline update" email to NHF&G Marine Fisheries Division/Durham, NHF&G Law Enforcement Division/Durham and NHF&G Public Affairs Division in Concord. The email makes note of any management plan violations that have occurred, as well as any necessary closures. These emails typically outline the more common types of temporary closures, such as those occurring after rainfall events. For the more rare management plan violations that could involve prolonged closures (e.g., significant discharges of improperly treated waste from a WWTF), an informational email is sent not only to NHF&G Marine Fisheries Division/Durham, NHF&G Law Enforcement Division/Durham and NHF&G Public Affairs Division in Concord, but also to the DHHS/Bureau of Food Protection, the DHHS Public Health Laboratory in Concord and the NHDES Public Information Office in Concord.

NHF&G will enforce provisions of Fis 606.02(b) once NHDES has placed the area in the closed status.

Public Dissemination of Closure Information: NHF&G will serve as the lead agency to inform recreational harvesters and the general public of any closures and subsequent re-openings. Procedures to inform the public may include such vehicles as the Clam Hotline, press releases and website updates, and alerting the public during patrol activities. NHHDES will assist with informing the general public via updates to the NH Coastal Atlas. DHHS will serve as the lead agency to inform the commercial shellfish industry of any closures and subsequent re-openings.

Enforcement of Closure

The New Hampshire Fish and Game Department is the agency responsible for patrolling waters closed for public health reasons. The frequency of patrols will be at the discretion of NH Fish and Game Department/Law Enforcement Division staff (Lt. Delayne Brown, Sgt. Jeremy Hawkes, Conservation Officer Ryan Harris, Conservation Officer Cole Letourneau, Conservation Officer Graham Courtney), NHF&G Region 3 Office, 225 Main Street, Durham, New Hampshire 03824, 603/868-1095).

Reopening a Conditionally Approved Area After Closure

Wastewater Treatment Plant/Collection System-Related Closures: Following closures triggered by discharges of raw or partially treated sewage from a wastewater treatment facility and/or any part of its sewage collection system, NHDES will be the lead agency for identifying necessary sampling locations and frequency needed to reopen the shellfish beds. At a minimum, water sampling will be conducted at monitoring sites GB4A, GB5 and GB16. If site access is limited by ice cover or other conditions, alternative shoreline sites will be used. Because access to shellfish tissue sampling sites can vary with tide stage, ice and daylight considerations, shellfish tissue sampling sites will be determined on a case-by-case basis. NHDES will be the lead agency in collecting water and shellfish tissue samples and will notify the DHHS lab of its intention to sample. All samples will be held on ice and will be delivered to the DHHS Laboratory in Concord by the collecting agency as soon as practical, but always within 24 hours of collection. Upon completion of the laboratory tests, DHHS laboratory personnel will promptly inform the NHDES Shellfish Program of the results. NHDES will then decide whether or not the sample results support a reopening of the area and will notify NHF&G/Law Enforcement Division of the decision. Sampling will continue until meat samples show a FC MPN of 230/100g or less (or a different baseline value established for a particular site) and confirmatory water samples show FC of 43/100ml or less. When sampling demonstrates that the area was in fact impacted by a significant sewage discharge, the area will remain closed for a period of at least three weeks, per U.S. FDA recommendations relating to the time required for viral pathogens to be purged from shellfish. Reopening may alternatively be driven by sampling of shellfish meats for male-specific coliphage, per NSSP guidelines (<50 pfu/100g tissue, or higher if documented background levels dictate). Reopening after the three week closure will be done in concert with water and meat samples that show sufficiently low fecal coliform results.

Rainfall-Related Closure Periods: Because water quality impacts can vary among storms of the same size, NHDES may elect to conduct an initial round of sampling, involving water samples only, of the Conditionally Approved area in the day(s) following closures from rainfall events. The purpose of such sampling is to determine if the rainfall event did in fact cause bacterial contamination of the growing area, and therefore to determine if a closure was warranted. At a

minimum, water sampling will be conducted at monitoring sites GB4A, GB5 and GB16. If site access is limited by ice cover or other conditions, alternative shoreline sites will be used. If these water samples show low fecal coliform levels (i.e., the samples indicate that there was no water quality impact from the storm to begin with), then the closure may be lifted with no additional sampling of waters or shellfish meats. If high FC levels are observed, then the area will remain in the closed status until post-rainfall meat samples show a FC MPN of 230/100g or less (or a different baseline value established for a particular site) and confirmatory water samples show FC of 43/100ml or less, or until fourteen consecutive days with no storms >1.50 inches have elapsed and confirmatory water samples show FC of 43/100ml or less, whichever is less.

NHDES will be the lead agency in collecting samples from sites in the Conditionally Approved area and will notify the DHHS laboratory, as well as the NHF&G Law Enforcement Division of its intention to sample. All samples will be collected as soon as practical after the rainfall event has ended, will be held on ice and will be delivered to the DHHS Laboratory in Concord, or an appropriate contracting laboratory, by the collecting agency within 24 hours of collection. Upon completion of the laboratory tests, DHHS laboratory personnel will promptly inform the NHDES Shellfish Program of the results. NHDES will then decide whether or not to close the area for harvesting and will notify NHF&G/Law Enforcement Division of the decision.

Notification of Reopening: NHDES will promptly rescind the closure after it is determined that the shellfish growing waters meet NSSP standards. Upon this determination, NHDES will email a reopening notice to the NHF&G Marine Fisheries Division/Durham, NHF&G Law Enforcement Division/Durham and the NHF&G Public Affairs Division, as well as to the other individuals/organizations that received a closure notice. NHF&G will serve as the lead agency to inform recreational harvesters and the general public of any closures and subsequent re-openings. Procedures to inform the public may include such vehicles as the Clam Hotline and press releases. NHDES will assist with informing the general public via updates to the NH Coastal Atlas. DHHS will serve as the lead agency to inform the commercial shellfish industry of any closures and subsequent re-openings.

Closed Status

While in closed status the area may not meet criteria for restricted classification and is not available for relay or depuration.

Management Plan Evaluation

This plan shall be evaluated once per year as part of the NHDES Shellfish Program's annual report.