STATE OF NEW HAMPSHIRE

Impairments Removed (i.e. Delisted) from the 2020/2022 303(d) List of Threatened or Impaired Waters (i.e. Category 5)

February 18, 2022

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

R-WD-20-16

STATE OF NEW HAMPSHIRE

Impairments Removed (i.e. Delisted) from the 2020/2022 303(d) List of Threatened or Impaired Waters (i.e. Category 5)

STATE OF NEW HAMPSHIRE
DEPARTMENT OF ENVIRONMENTAL SERVICES
29 HAZEN DRIVE
CONCORD, N.H. 03301

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February 18, 2022

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Introduction

In accordance with Section 303(d) of the federal Clean Water Act, States must prepare a list of impaired waters that require a Total Maximum Daily Load study every two years (i.e., the 303(d) List). The last approved 303(d) List was prepared by the New Hampshire Department of Environmental Services (NHDES) in 2018. Downloadable copies of the past lists as well as the 303(d) 2020/2022 list are available on the NHDES website for review. This document provides a list of all surface waters and parameter combinations that were removed as impairments on the 2020/2022 303(d) List and the reasons why they were removed.

Assessment outcomes cover a spectrum from very good to very bad coded as an alpha numeric scale that provides additional distinctions in cases where an impairment exists. In each of the new impairments detailed within this document the 2018 and 2020/2022 assessment status is highlighted applying the categories in the table below.

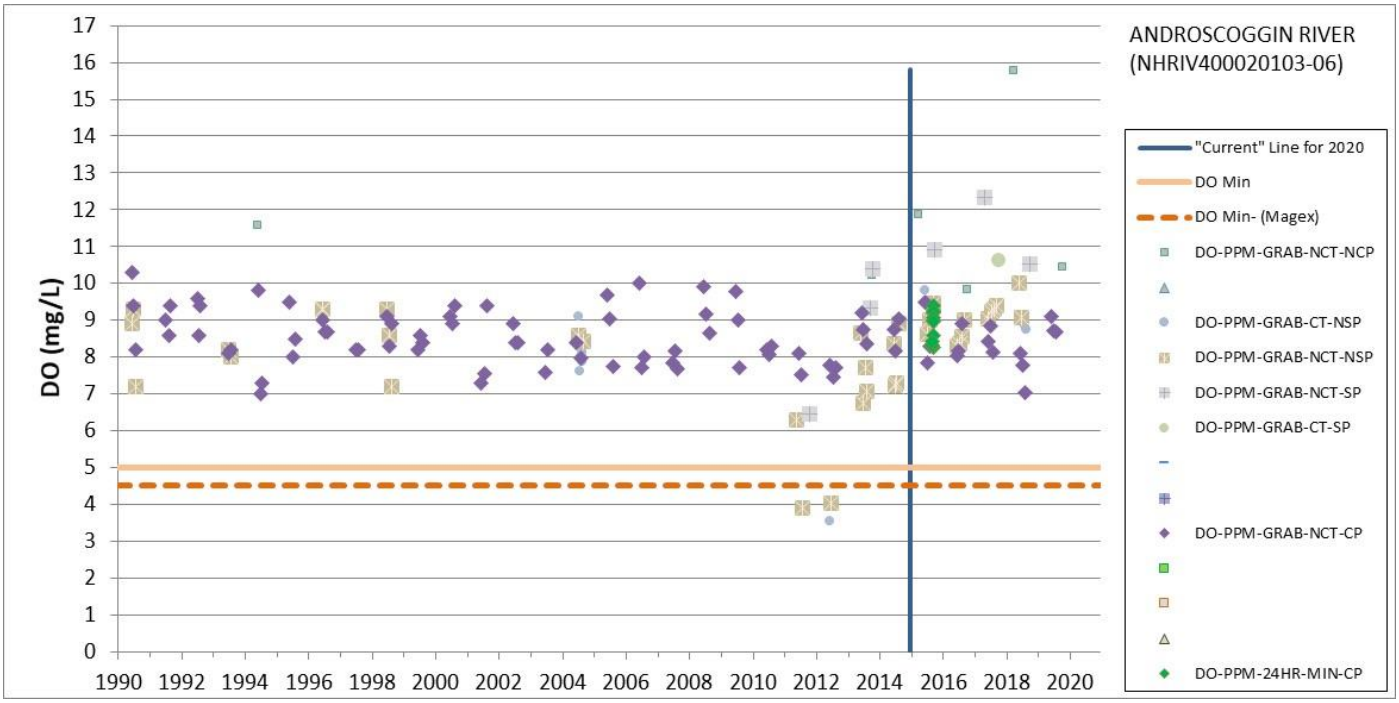
		Severe Not Supporting, Severe	**Poor** Not Supporting, Marginal	**Likely Bad** Insufficient Information – Potentially Not Supporting	**No Data** No Data	**Likely Good** Insufficient Information – Potentially Full Supporting	**Marginal** Full Support, Marginal	**Good** Full Support, Good
CATEGORY	**Description**							
Category 2	Meets standards						2-M or 2-OBS	2-G
Category 3	Insufficient Information			3-PNS	3-ND	3-PAS		
Category 4	Does not Meet Standards;							
4A	TMDL Completed	4A-P	4A-M or 4A-T					
4B	Other enforceable measure will correct the issue.	4B-P	4B-M or 4B-T					
4C	Non-pollutant (i.e. exotic weeds)	4C-P	4C-M					
Category 5	TMDL Needed	5-P	5-M or 5-T					

Dissolved Oxygen Concentration for Aquatic Life Integrity

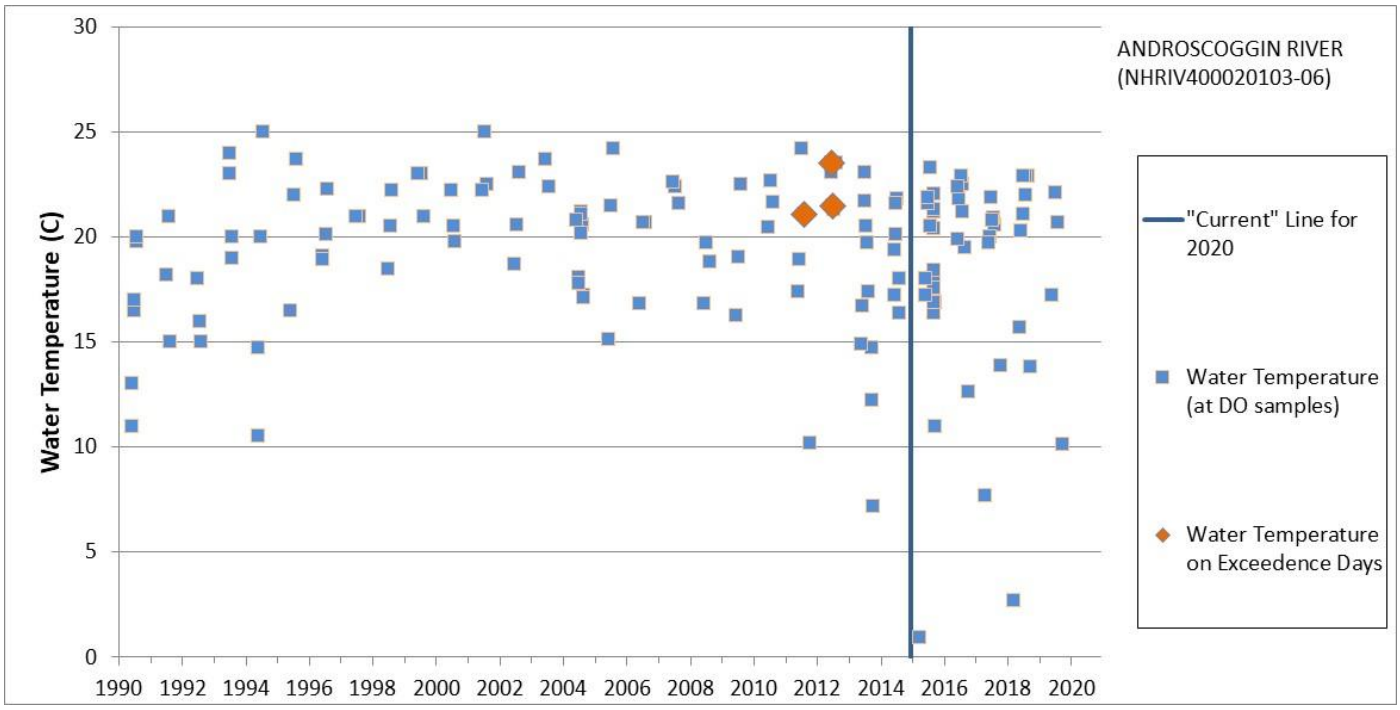
ANDROSCOGGIN RIVER (NHRIV400020103-06)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
ANDROSCOGGIN RIVER	NHRIV400020103-06	DISSOLVED OXYGEN (MG/L)	SHELBURNE	5-P	2-G

The Androscoggin River (NHRIV400020103-06) was originally impaired during the 2012 assessment cycle using data collected at station 02-AND. Since 1990, three of 157 (1.9%) grab samples and 24-hr min datalogger values collected at stations 02-AND and 01-AND were below the dissolved oxygen threshold of 5 mg/L. The low dissolved oxygen samples were collected at flows ranging from 1,280-2,210 cfms on the Androscoggin River gage (01054000), water temperatures ranging from 21.1-23.5 degrees C and three-day rainfall totals ranging from 0.00-0.27 inches. Two of the three of these samples were collected during NSP. In the current assessment period (2015-2020), all samples (n=52) collected at stations 02-AND and 01-AND were above the dissolved oxygen threshold of 5 mg/L. The 52 dissolved oxygen samples were collected at a wide variety of flows ranging from 887-9,390 cfms on the Androscoggin River gage (01054000), water temperatures ranging 0.9-23.3 degrees C, and three-day rainfall totals ranging from 0.00-3.34 inches. The current data was collected at the same station (with the addition of data collected at 01-AND) and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of the Androscoggin River in the 2020/2022 cycle. The Androscoggin River (NHRIV400020103-06) has been moved from 5-P to 2-G for dissolved oxygen (mg/L) for the aquatic life integrity designated use based on data collected in the current assessment period.




Gage CFSM on Sample Days
USGS 01054000 Androscoggin River near Gorham, NH
Gage CFSM
CFSM from Gage
Gage on Exceedence Days
"Current" Line for 2020
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)
Rainfall Preceding Grab Sample Days
Jefferson
Total Rain (days 0, -1, -2)
Previous 3 Days Rain
Exceedence Days - Previous 3 Days Rain
"Current" Line for 2020

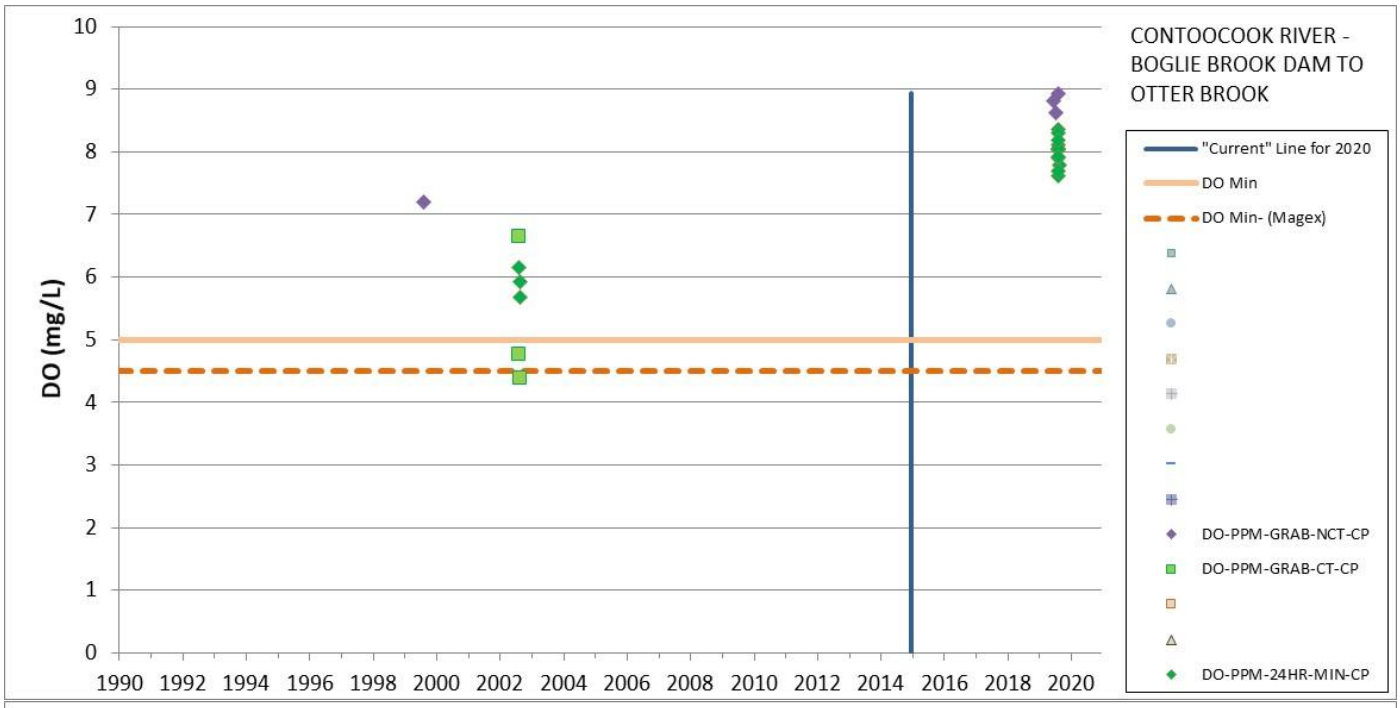


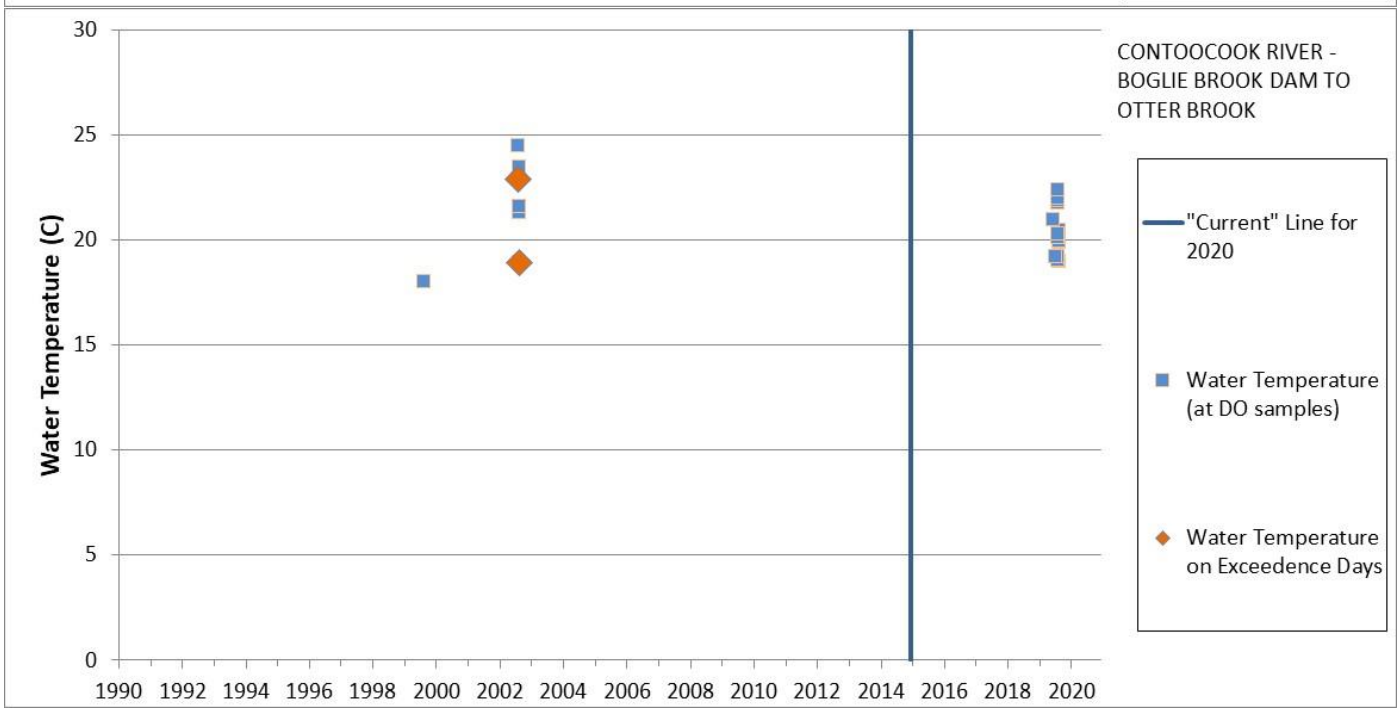
Notes:
DO-PPM-GRAB-NCT-CP = Grab samples of dissolved oxygen not in the early morning hours of the summer critical period.
DO-PPM-GRAB-CT-SP = Grab samples of dissolved oxygen during the early morning hours of the critical spawning period.
DO-PPM-GRAB-CT-NSP = Grab samples of dissolved oxygen during the early morning hours and not during the critical spawning period.
DO-PPM-GRAB-NCT-SP = Grab samples of dissolved oxygen not in the early morning hours of the critical spawning period.
DO-PPM-GRAB-NCT-NSP = Grab samples of dissolved oxygen not in the early morning hours and outside the critical spawning period.
DO-PPM-24HR-MIN-CP = 24-hour minimum dissolved oxygen concentration from a datalogger deployed during the summer critical period.
"Current" Line for 2020 – Per the methodology outlined in the CALM, all data from this referenced data is considered "current" unless available older data is provided for context. See the 2020 CALM for addition details.

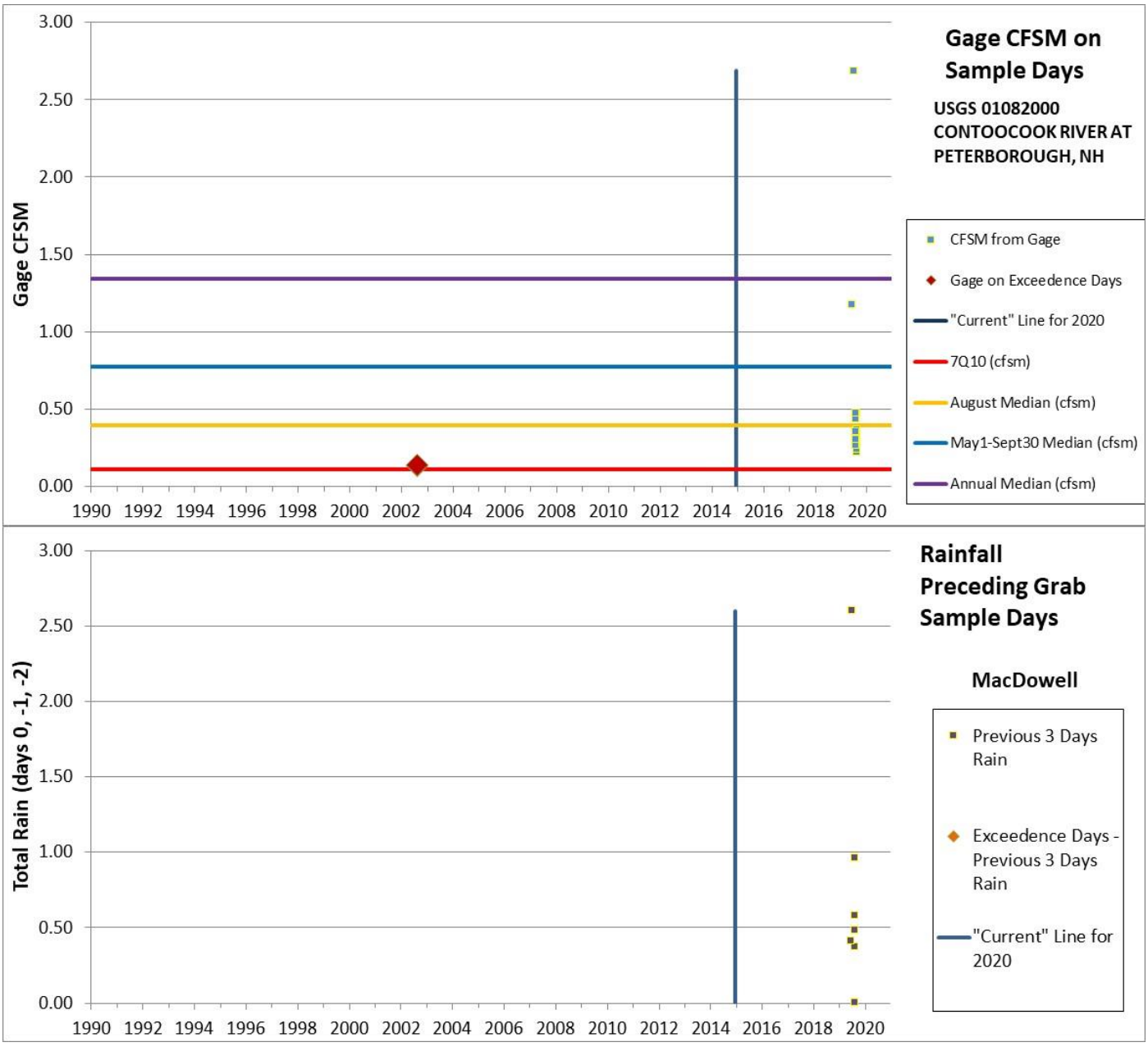
CONTOOCOOK RIVER - BOGLIE BROOK DAM TO OTTER BROOK (NHRIV700030104-23)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
CONTOOCOOK RIVER - BOGLIE BROOK DAM TO OTTER BROOK	NHRIV700030104-23	DISSOLVED OXYGEN (MG/L)	PETERBOROUGH	5-P	2-G

The Contoocook River- Boglie Brook Dam to Otter Brook (NHRIV700030104-23) was originally impaired during the 2006 assessment cycle using data collected at station 25X-CTC. Since 1999, two of 22 (9.1%) grab samples and 24-hr min datalogger values collected at stations 25X-CTC were below the dissolved oxygen threshold of 5 mg/L. The low dissolved oxygen samples were collected at a flow of 0.14 cfms on the Contoocook River gage (01082000) and water temperatures of 18.9 and 24.5 degrees C. These two samples were grab samples collected during the critical period and time, but were at 4.38 and 4.77 mg/L. In the current assessment period (2015-2020), all samples (n=15) collected at station 25X-CTC were above the dissolved oxygen threshold of 5 mg/L. The 15 dissolved oxygen samples were collected at a wide variety of flows ranging from 0.22-2.69 cfms on the Contoocook River gage (01082000), water temperatures ranging 19.0-22.4 degrees C, and three-day rainfall totals ranging from 0.00-2.60inches. The current data was collected at the same station and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of the Contoocook River in the 2020/2022 cycle. Although the data was only collected in 2019, 12 of the samples were collected from a datalogger during the critical period. The Contoocook River- Boglie Brook Dam to Otter Brook (NHRIV700030104-23) has been moved from 5-P to 2-G for dissolved oxygen (mg/L) for the aquatic life integrity designated use based on data collected in the current assessment period.


CONTOOCOOK RIVER - BOGLIE BROOK DAM TO OTTER BROOK
DO (mg/L)
"Current" Line for 2020
DO Min
DO Min- (Magex)
DO-PPM-GRAB-NCT-CP
DO-PPM-GRAB-CT-CP
DO-PPM-24HR-MIN-CP


CONTOOCOOK RIVER - BOGLIE BROOK DAM TO OTTER BROOK
Water Temperature (C)
"Current" Line for 2020
Water Temperature (at DO samples)
Water Temperature on Exceedence Days



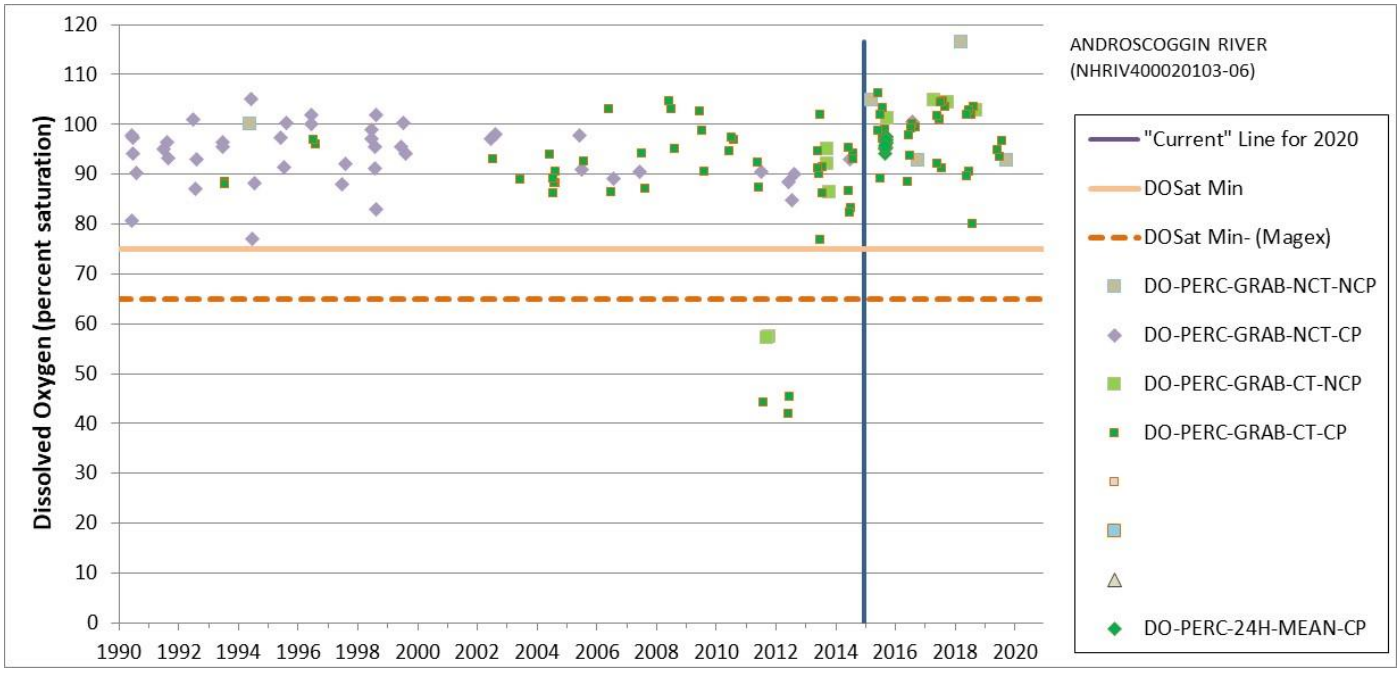
Notes:
DO-PPM-GRAB-CT-CP = Grab samples of dissolved oxygen during the early morning hours of the summer critical period.
DO-PPM-GRAB-NCT-CP = Grab samples of dissolved oxygen not in the early morning hours of the summer critical period.
DO-PPM-24HR-MIN-CP = 24-hour minimum dissolved oxygen concentration from a datalogger deployed during the summer critical period.
"Current" Line for 2020 – Per the methodology outlined in the CALM, all data from this referenced data is considered "current" unless available older data is provided for context. See the 2020 CALM for addition details.

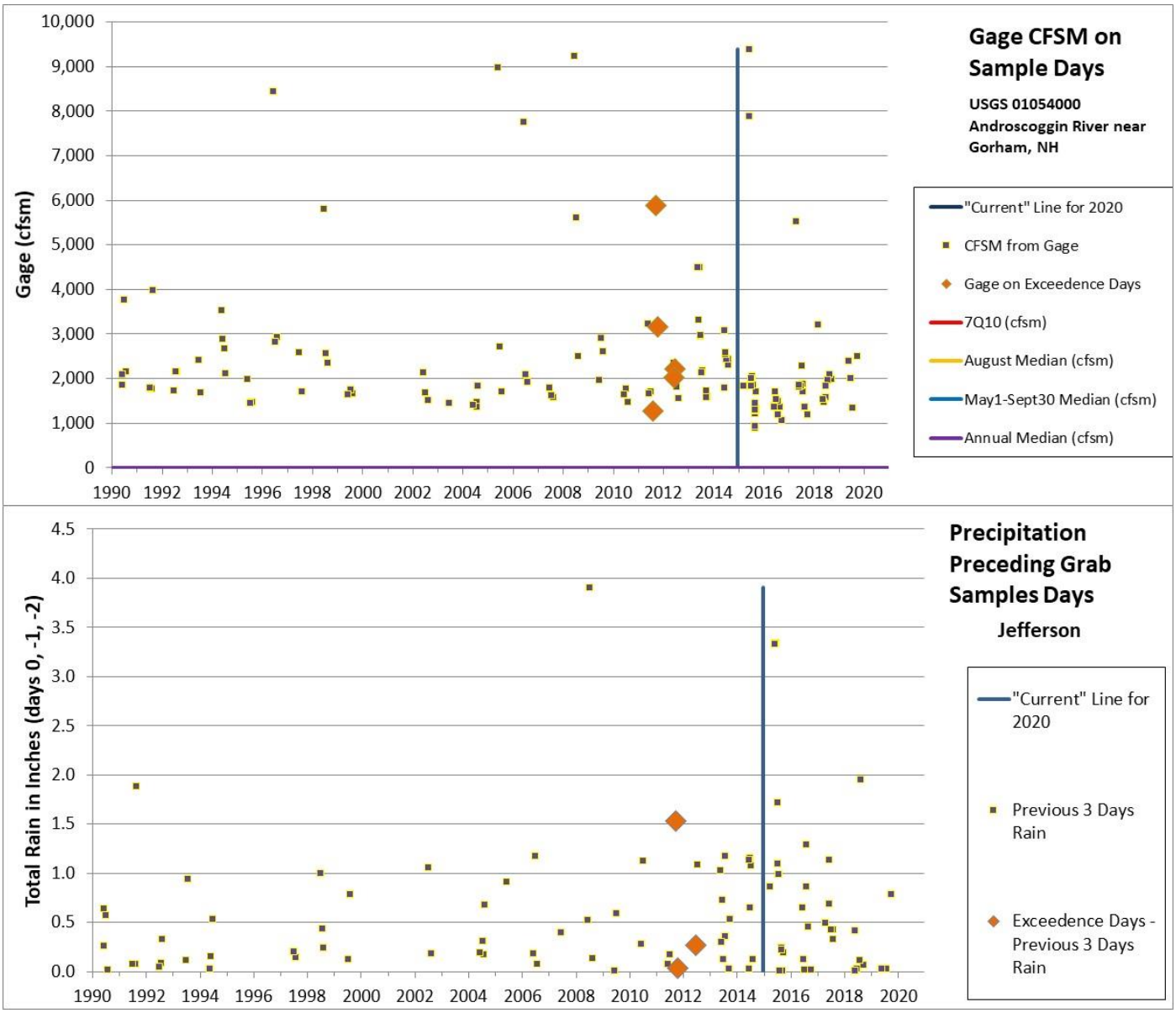
Dissolved Oxygen Saturation for Aquatic Life Integrity

ANDROSCOGGIN RIVER (NHRIV400020103-06)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
ANDROSCOGGIN RIVER	NHRIV400020103-06	Dissolved Oxygen (Percent Saturation)	SHELBURNE	5-M	2-G

The Androscoggin River (NHRIV400020103-06) was originally impaired in the 2012 assessment cycle based on 5 grab samples collected that were below the dissolved oxygen (percent saturation) criteria of 75% (24-hour average). These low samples were collected at station 02-AND in 2012, at flows ranging from 1,280-5,880 cfsm on the Androscoggin River gage (01054000) and during three-day rainfall totals of 0.00-1.51 inches. All samples taken (n=50) in the current assessment period (2015-2020) were above the dissolved oxygen (percent saturation) threshold of 75%. These samples were taken at station 01-AND and 02-AND at flows ranging from 887-9,390 cfsm on the Androscoggin River gage (01054000) and during three-day rainfall totals of 0.00-3.34 inches. Thirty of the 50 samples were taken within the critical period and critical time. The current data were collected at the same station (with the addition of 01-AND) and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of the Androscoggin River in the 2020/2022 cycle. The Androscoggin River (NHRIV400020103-06) has been moved from 5-M to 2-G for dissolved oxygen (percent saturation) for the aquatic life integrity designated use based on data collected in the current assessment period.





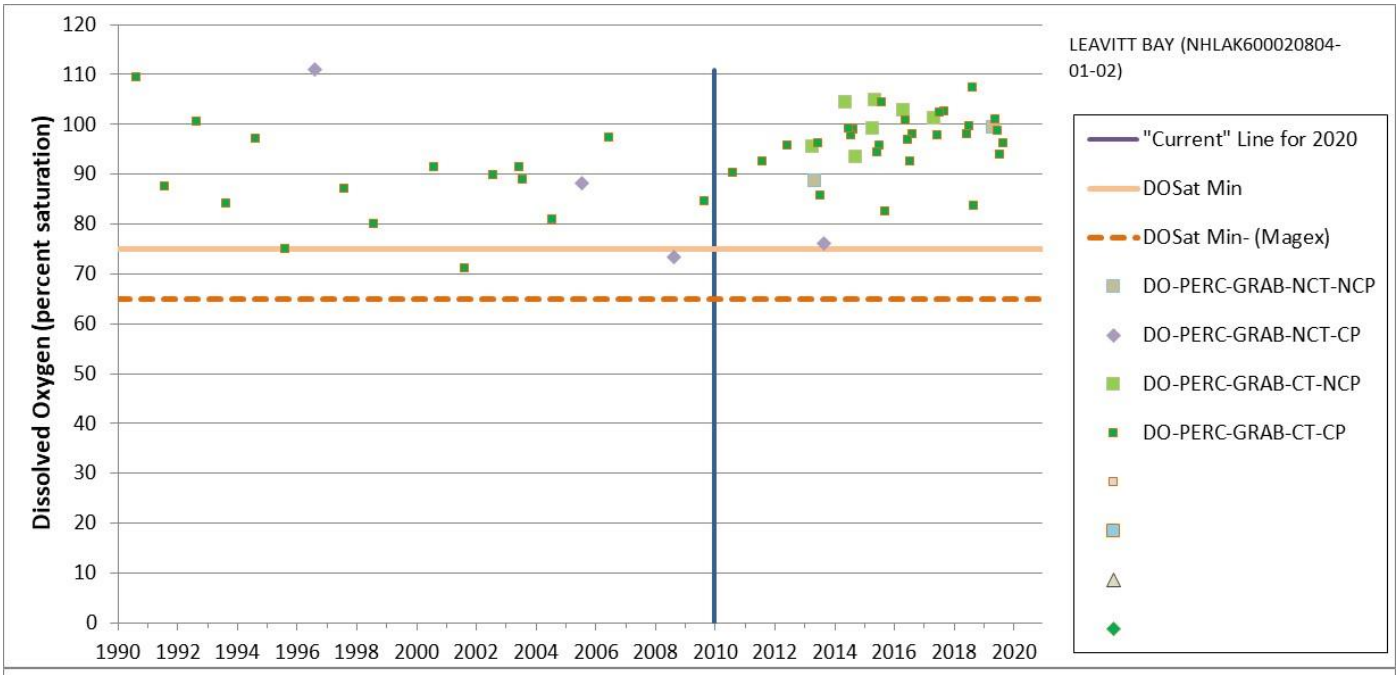
Notes:
DO-PERC-GRAB-CT-CP = Grab samples of dissolved oxygen during the early morning hours of the summer critical period.
DO-PERC-GRAB-CT-NCP = Grab samples of dissolved oxygen during the early morning hours and not during the summer critical period.
DO-PERC-GRAB-NCT-CP = Grab samples of dissolved oxygen not in the early morning hours of the summer critical period.
DO-PERC-GRAB-NCT-NCP = Grab samples of dissolved oxygen not in the early morning hours and outside the summer critical period.
DO-PERC-24HR-MEAN-CP = 24-hour average dissolved oxygen saturation from a datalogger deployed during the summer critical period.
"Current" Line for 2020 – Per the methodology outlined in the CALM, all data from this referenced data is considered "current" unless available older data is provided for context. See the 2020 CALM for addition details.

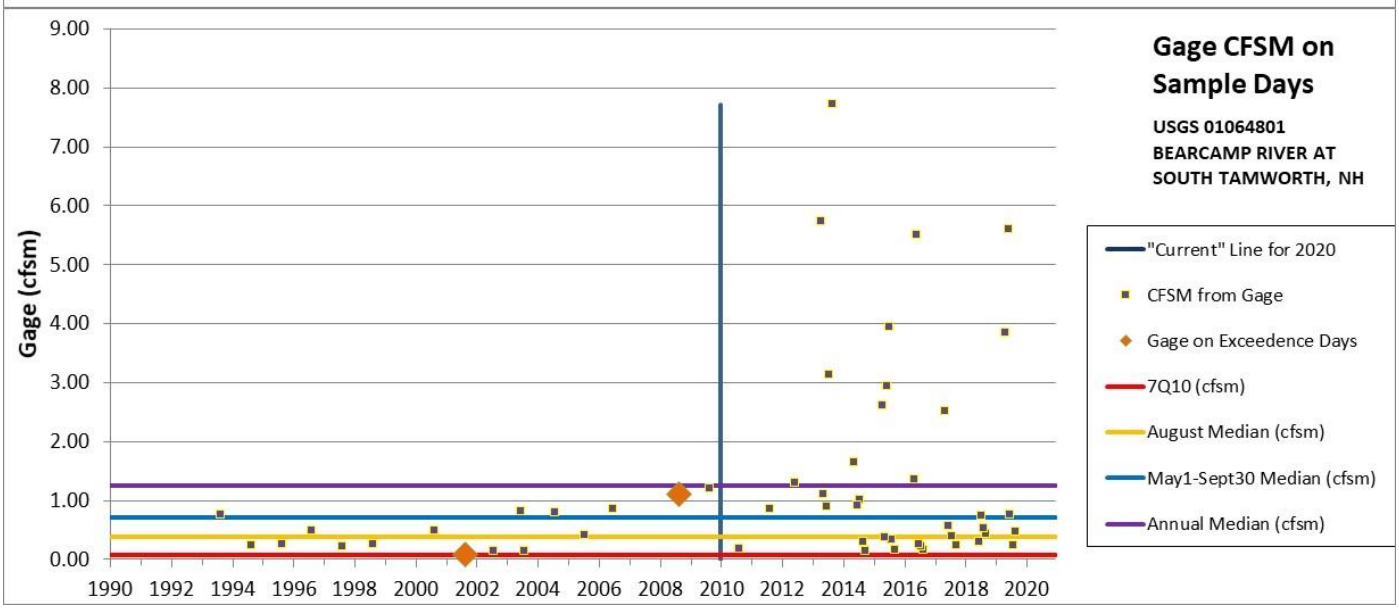
LEAVITT BAY (NHLAK600020804-01-02)

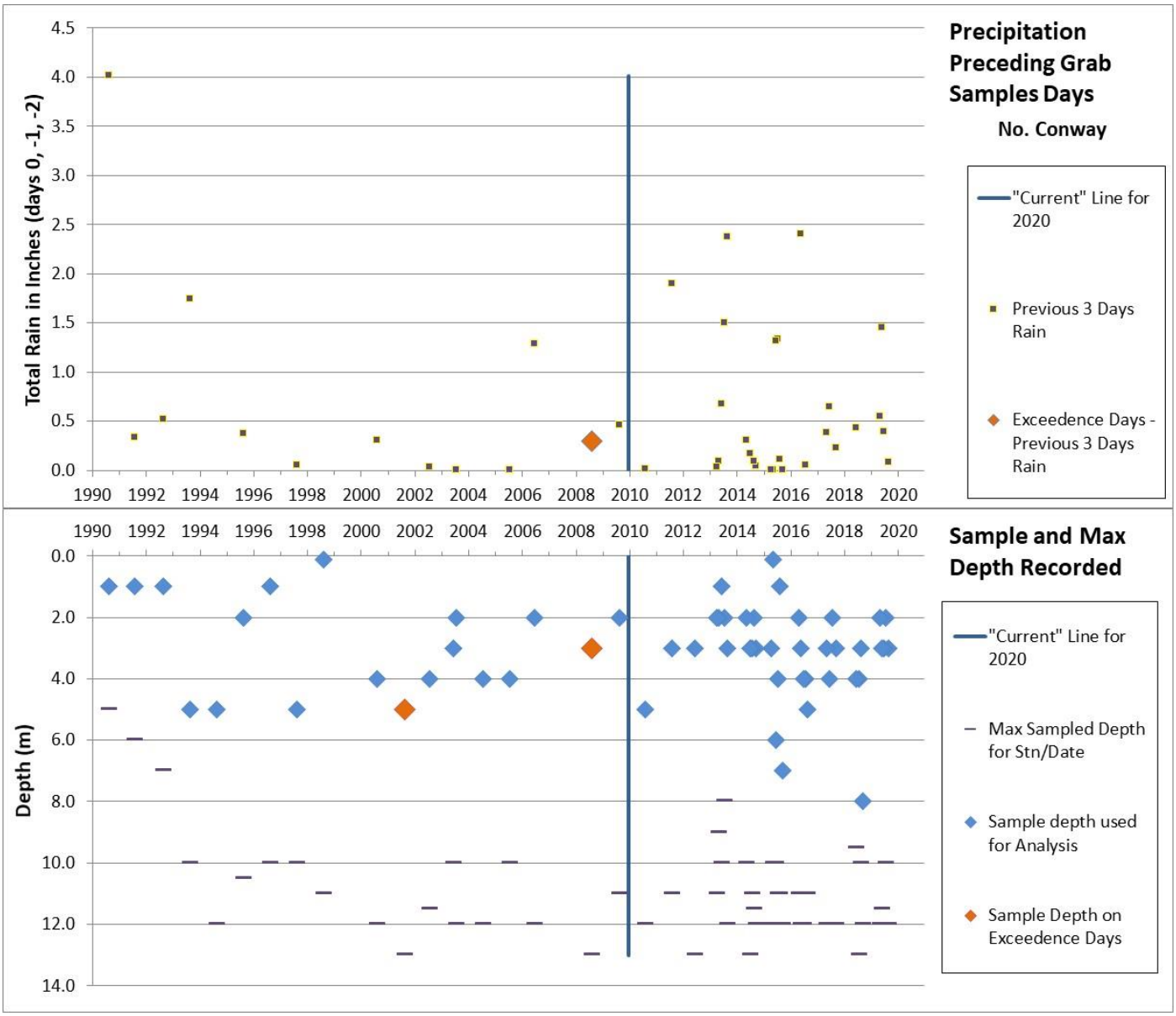
Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
Leavitt Bay	NHLAK600020804-01-02	Dissolved Oxygen (Percent Saturation)	EFFINGHAM, FREEDOM, OSSIPEE	5-M	2-M

Leavitt Bay (NHLAK600020804-01-02) was originally impaired in the 2010 assessment cycle based on 2 grab samples collected that were below the dissolved oxygen (percent saturation) criteria of 75% (24-hour average). These low samples were collected at

station LEAOSSD, in mid-late August, when water temperatures were between 21.4 and 24.5 degrees C. Grab samples collected in the last 10 years indicate that Leavitt Bay is attaining water quality standards for DO %sat, with all samples above the dissolved oxygen (percent saturation) threshold of 75%, including those collected under similar conditions to those that led to the initial impairment (same station, similar time of year and similar and even higher water temperatures). Based on the data that are available, Leavitt Bay (NHLAK600020804-01-02) has been moved from 5-M to 2-G for dissolved oxygen (percent saturation) for the aquatic life integrity designated use based on data collected in the current assessment period.







Notes:
DO-PERC-GRAB-CT-CP = Grab samples of dissolved oxygen during the early morning hours of the summer critical period.
DO-PERC-GRAB-CT-NCP = Grab samples of dissolved oxygen during the early morning hours and not during the summer critical period.
DO-PERC-GRAB-NCT-CP = Grab samples of dissolved oxygen not in the early morning hours of the summer critical period.
DO-PERC-GRAB-NCT-NCP = Grab samples of dissolved oxygen not in the early morning hours and outside the summer critical period.
"Current" Line for 2020 – Per the methodology outlined in the CALM, all data from this referenced data is considered "current" unless available older data is provided for context. See the 2020 CALM for addition details.

MERRIMACK RIVER (NHRIV700060802-14-02)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
MERRIMACK RIVER	NHRIV700060802-14-02	Dissolved Oxygen (Percent Saturation)	HOOKSETT, MANCHESTER	5-P	2-G

During the current assessment period (2015-2019) a datalogger was deployed at station P1893-05 in NHRIV700060802-14-02 from September 1st through September 19th. There were 19 days of full 24-hour data and during all of these the daily average dissolved oxygen (% saturation) was above 94%. Flows during the deployment ranged from below the August median to above the May 1st –

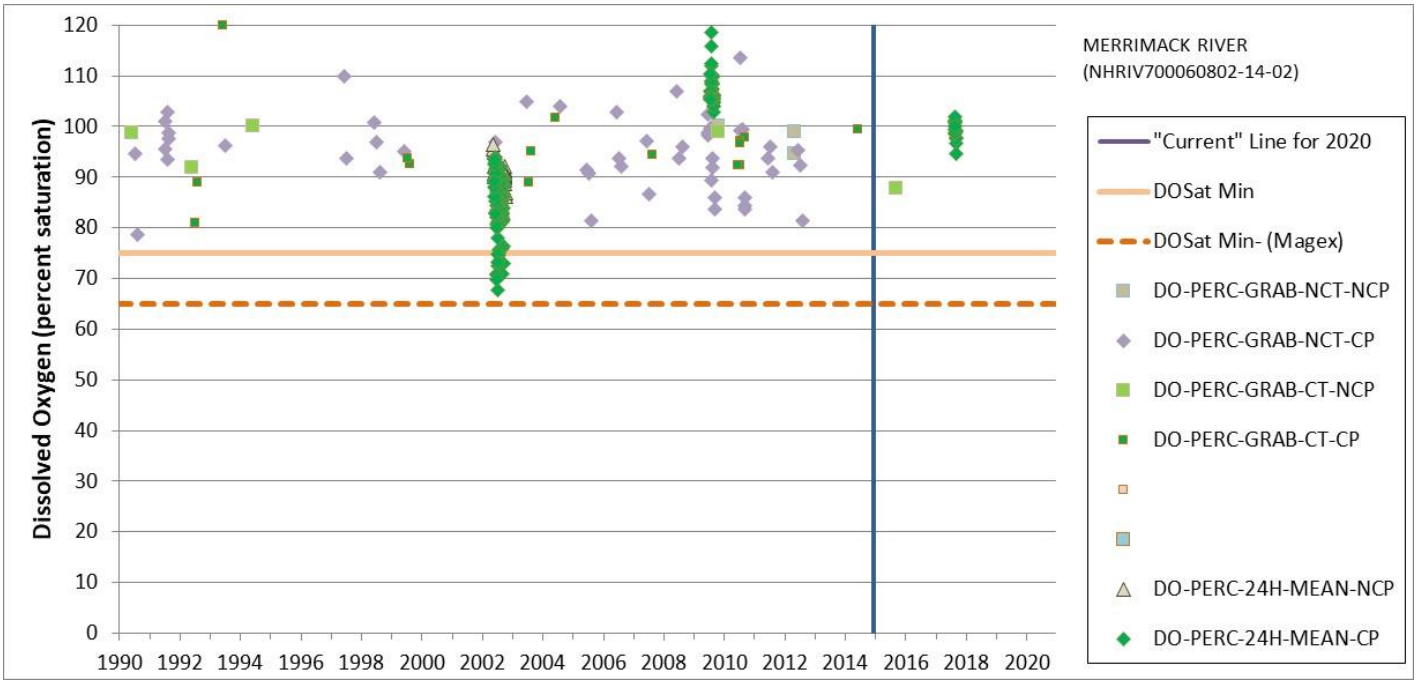
September 30th median. Precipitation conditions varied from no rain in the prior three days to greater than 1 inch of rain. The water temperature daily average during the deployment ranged from below 18.8 degrees C. to above 22.5 degrees C.

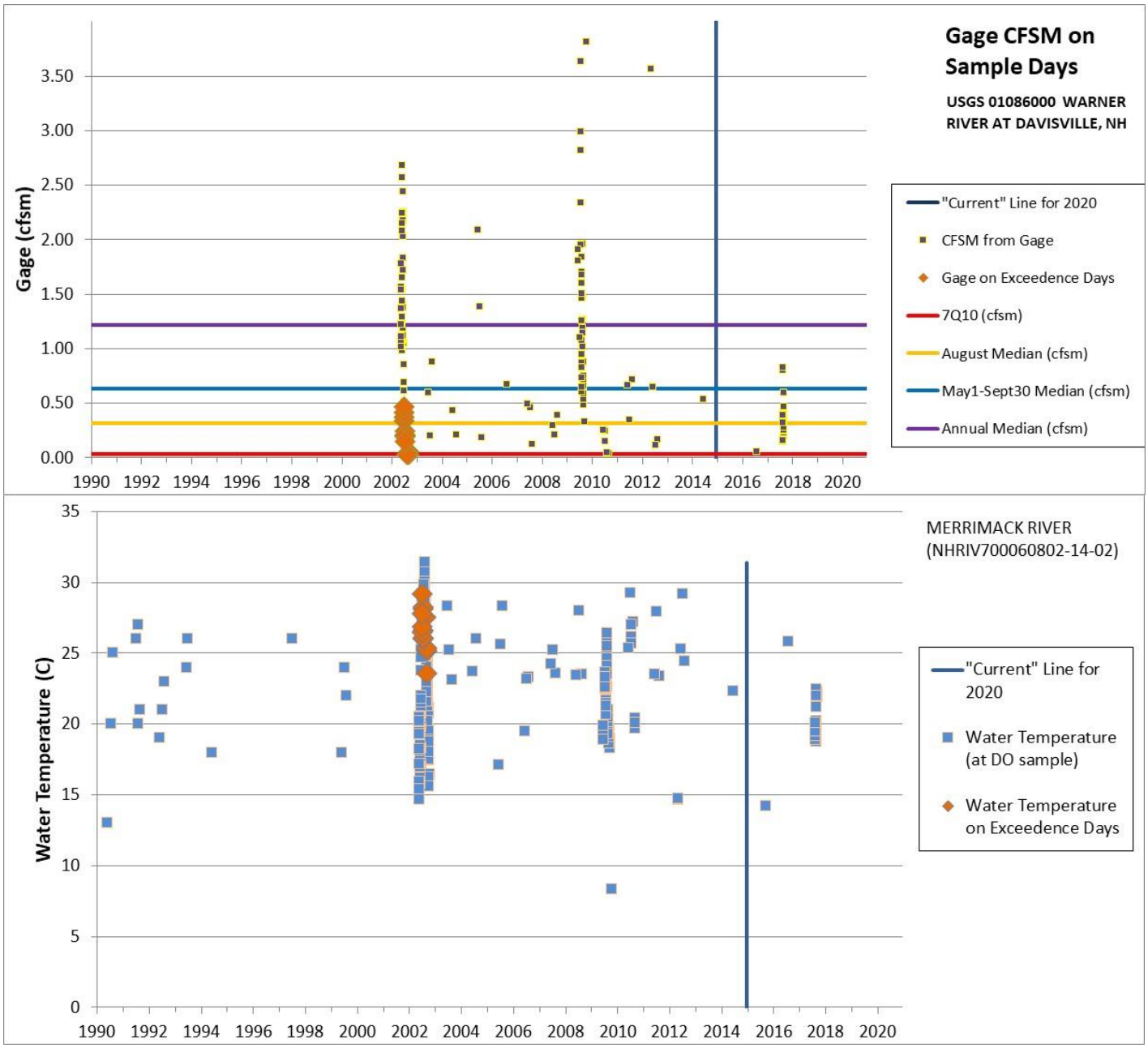
In 2009 a datalogger was deployed at station 16C-MER in NHRIV700060802-14-02 from July 30th through September 14th. Station 16C-MER is approximately 250 feet downstream from station P1893-05. Both stations are just downstream of the Hooksett Hydroelectric dam. There were 39 days of full 24-hour data and during all of these the daily average dissolved oxygen (% saturation) was above 102%. Flows during the deployment ranged from the August median to above the annual median. Precipitation conditions varied from no rain in the prior three days to greater than 1 inch of rain. The water temperature daily average during the deployment ranged from below 18.3 degrees C. to above 26.4 degrees C.

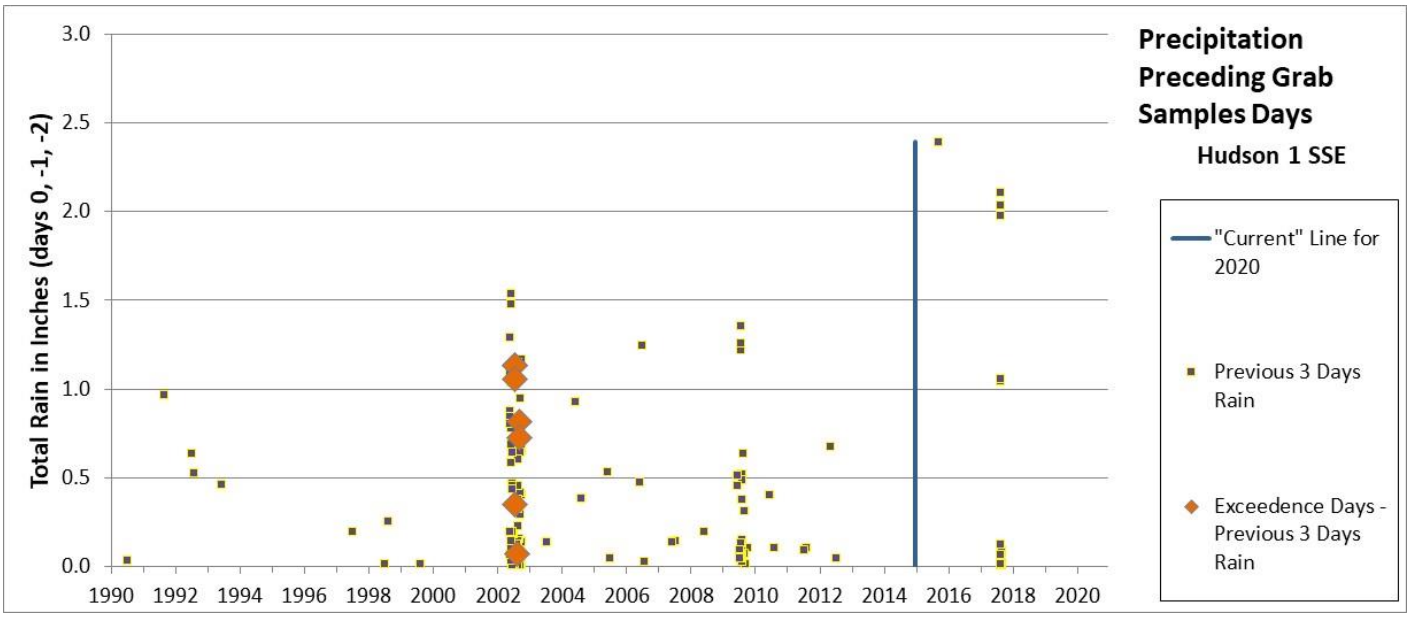
This assessment unit was listed as impaired due to a datalogger deployment in 2002 at station P1893-05. The 2002 datalogger deployment was done from May 25th through October 14th. There were 126 days of full 24-hour data and for 9.5% (n=12) days the daily average dissolved oxygen (% saturation) was below the water quality criteria of 75%. Table 3-13 in the 2020/2022 CALM lists the minimum number of exceedances needed to assess a waterbody as impaired compared to the total number of samples collected. As per Table 3-13 for a samples size of 126 there would need to be 13 exceedances for NHRIV700060302-25-02 to be considered impaired. The total number of exceedances in during the 2020 datalogger deployment was 12.

The 2002 datalogger was deployed to collect data for the FERC relicensing process of the Hooksett hydroelectric dam. As per the 2005 renewed FERC license new minimum flow requirements were implements. The 2005 FERC license requires a minimum flow release of 819 cfs or inflow, whichever is lower. In addition, the 2005 FERC license implemented minimum flow releases of 64 cfs in the fish bypass channel.

The datalogger deployments from 2009 and 2017 indicate that stations P1893-05 and 16C-MER in NHRIV700060802-14-02 are meeting the water quality criteria for dissolved oxygen (% saturation). Merrimack River (NHRIV700060802-14-02) has been moved from 5-P to 2-G for dissolved oxygen (% saturation) for the aquatic life integrity designated use based on data collected in the current and past assessment periods. It should be noted that this is a delisting that is tied to an assessment unit that falls within EPA's 2017 MS4 General Permit Area.




Gage CFSM on Sample Days
USGS 01086000 WARNER RIVER AT DAVISVILLE, NH
Gage (cfsm)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)
MERRIMACK RIVER (NHRIV700060802-14-02)
Water Temperature (C)
35
30
25
20
15
10
5
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
Water Temperature (at DO sample)
Water Temperature on Exceedence Days



Notes:
DO-PERC-GRAB-CT-CP = Grab samples of dissolved oxygen during the early morning hours of the summer critical period.
DO-PERC-GRAB-CT-NCP = Grab samples of dissolved oxygen during the early morning hours and not during the summer critical period.
DO-PERC-GRAB-NCT-CP = Grab samples of dissolved oxygen not in the early morning hours of the summer critical period.
DO-PERC-GRAB-NCT-NCP = Grab samples of dissolved oxygen not in the early morning hours and outside the summer critical period.
DO-PERC-24HR-MEAN-CP = 24-hour average dissolved oxygen saturation from a datalogger deployed during the summer critical period.
DO-PERC-24HR-MEAN-NCP = 24-hour average dissolved oxygen saturation from a datalogger not deployed during the summer critical period.
"Current" Line for 2020 – Per the methodology outlined in the CALM, all data from this referenced data is considered "current" unless available older data is provided for context. See the 2020 CALM for addition details.

MERRIMACK RIVER (NHRIV700060302-25-02)

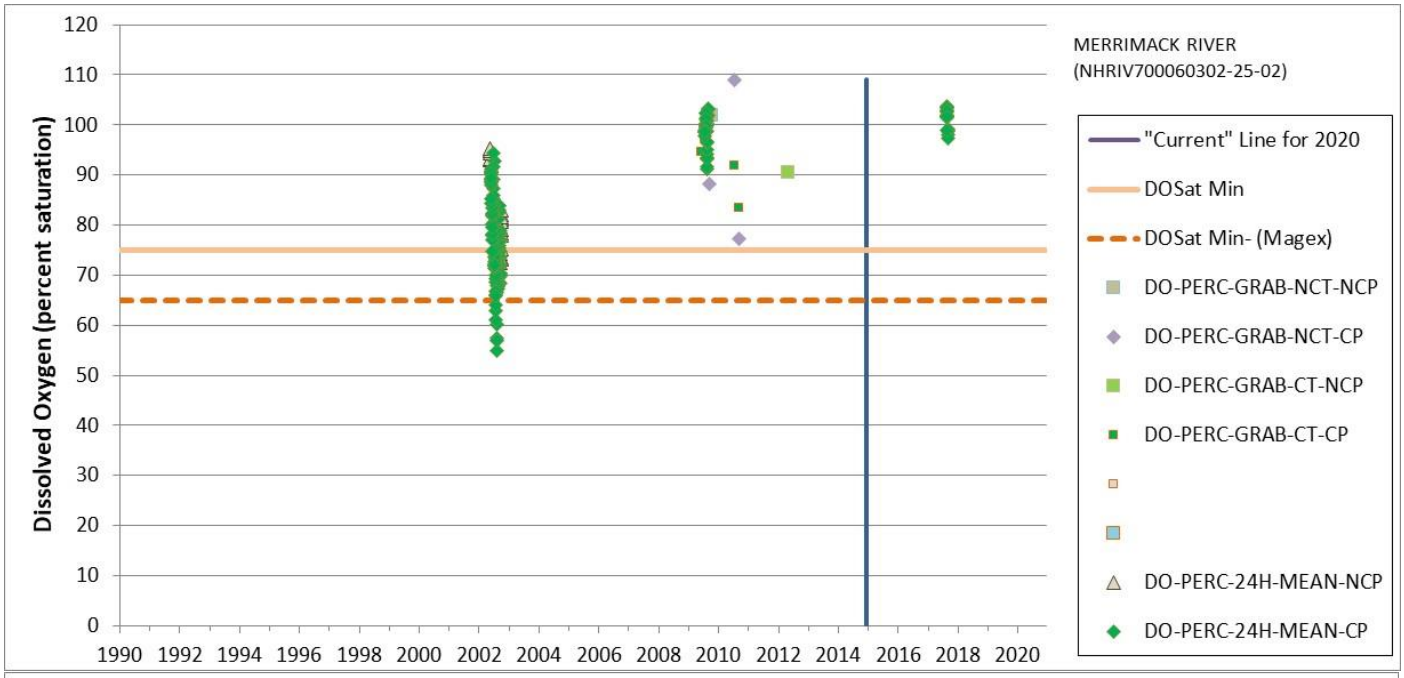
Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
MERRIMACK RIVER	NHRIV700060302-25-02	Dissolved Oxygen (Percent Saturation)	BOW, CONCORD, PEMBROKE	5-P	2-M

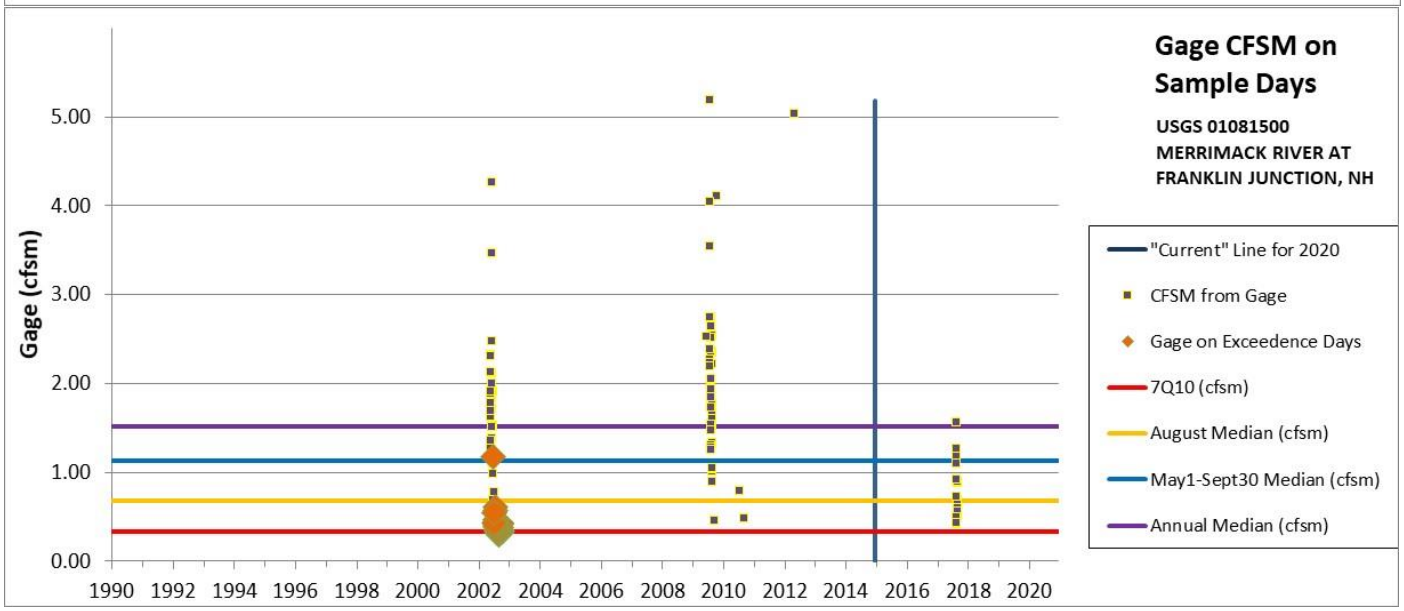
During the current assessment period (2015-2019) a datalogger was deployed at station P1893-03 in NHRIV700060302-25-02 from September 1st through September 19th. There were 19 days of full 24-hour data and during all of these the daily average dissolved oxygen (% saturation) was above 95%. Flows during the deployment ranged from below the August median to above the annual median. Precipitation conditions varied from no rain in the prior three days to greater than 1 inch of rain. The water temperature daily average during the deployment ranged from below 18 degrees C. to above 22 degrees C.

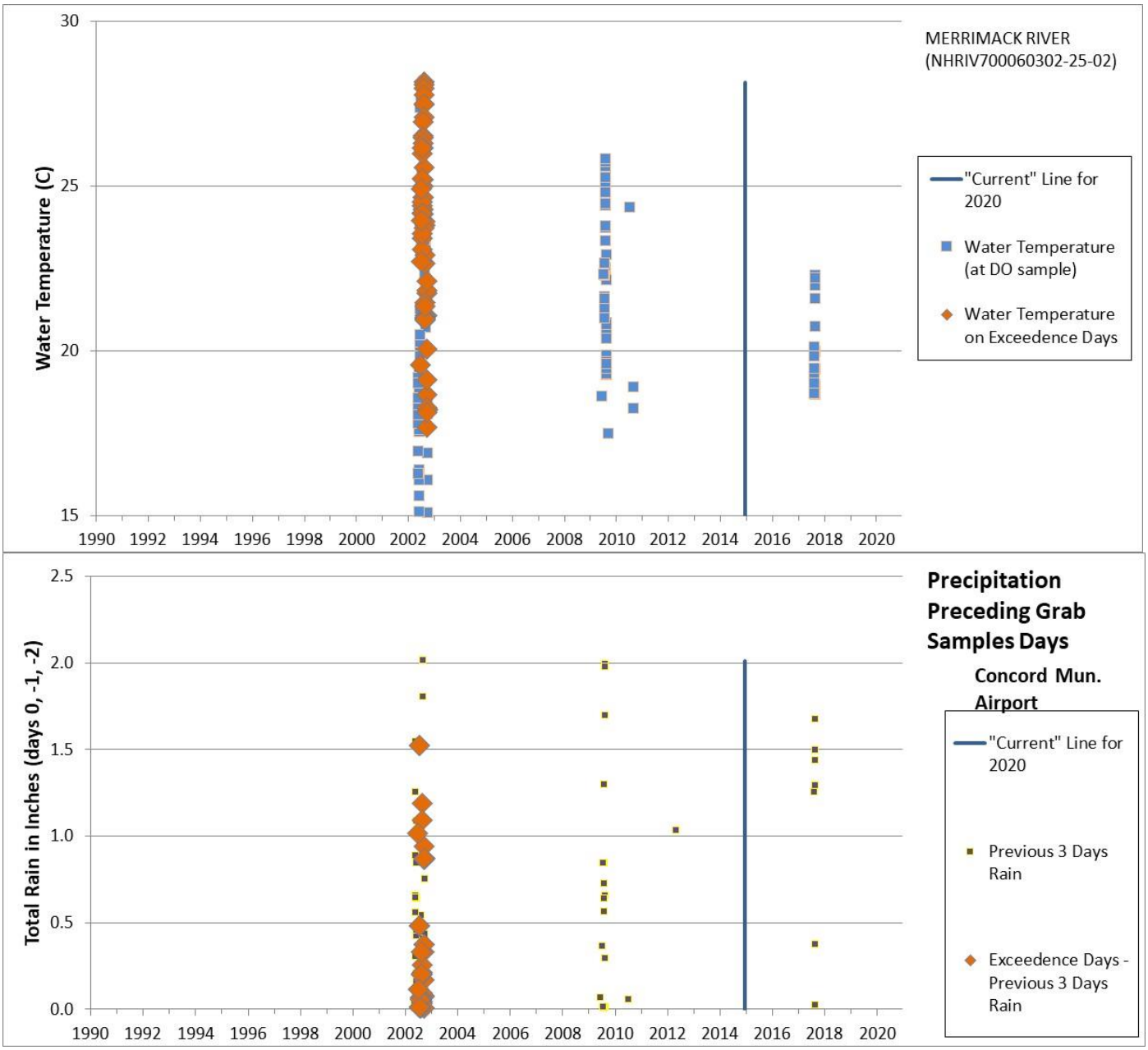
In 2009 a datalogger was deployed at station 19B-MER in NHRIV700060302-25-02 from August 4th through September 7th. Station 19B-MER is approximately 2000 feet downstream from station P1893-03. Both stations are just downstream of the Garvin Falls Hydroelectric dam. There were 36 days of full 24-hour data and during all of these the daily average dissolved oxygen (% saturation) was above 90%. Flows during the deployment ranged from below the August median to above the annual median. Precipitation conditions varied from no rain in the prior three days to greater than 1 inch of rain. The water temperature daily average during the deployment ranged from below 17 degrees C. to above 25 degrees C.

This assessment unit was listed as impaired due to a datalogger deployment in 2002 at station P1893-03. The 2002 datalogger deployment was done from May 25th through October 14th. There were 126 days of full 24-hour data and for 42% (n=58) days the daily average dissolved oxygen (% saturation) was below the water quality criteria of 75%. The 2002 datalogger was deployed to collect data for the FERC relicensing process of the Garvin Falls hydroelectric dam. As per the 2005 renewed FERC license new minimum flow requirements were implements. The 2005 FERC license requires a minimum flow release of 719 cfs or inflow, whichever is lower. In addition, the 2005 FERC license implemented minimum flow releases of 55 cfs in the main stem bypass and 23 cfs in the downstream fish bypass channel.

The datalogger deployments from 2009 and 2017 indicate that stations P1893-03 and 19B-MER in NHRIV700060302-25-02 are meeting the water quality criteria for dissolved oxygen (% saturation). Merrimack River (NHRIV700060302-25-02) has been moved from 5-P to 2-M for dissolved oxygen (% saturation) for the aquatic life integrity designated use based on data collected in the current and past assessment periods. It should be noted that this is a delisting that is tied to an assessment unit that falls within EPA's 2017 MS4 General Permit Area.





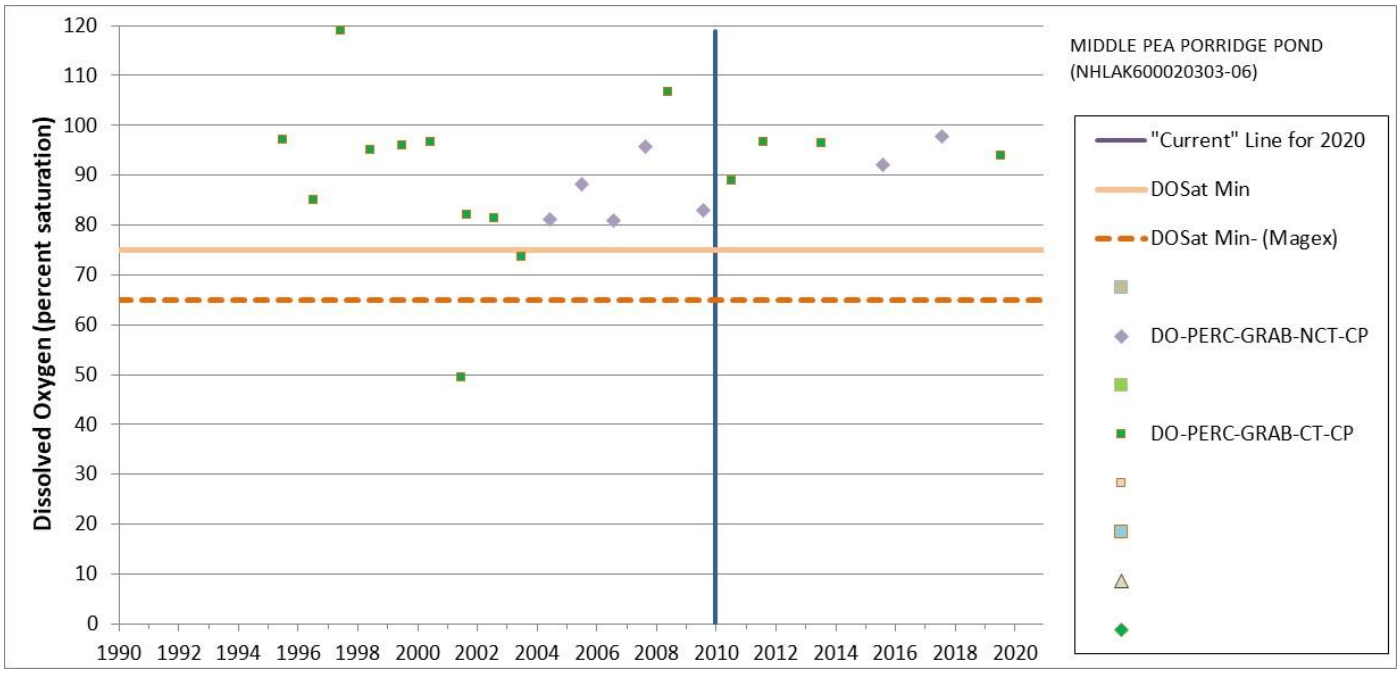


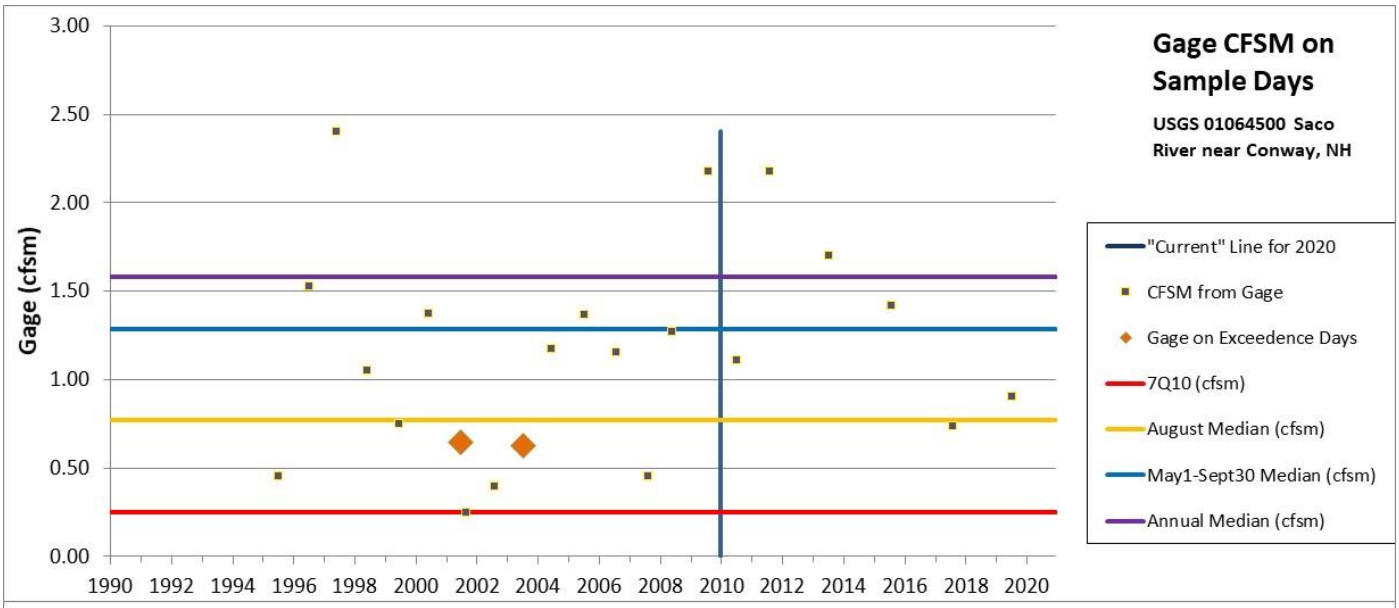
Notes:
DO-PERC-GRAB-CT-CP = Grab samples of dissolved oxygen during the early morning hours of the summer critical period.
DO-PERC-GRAB-CT-NCP = Grab samples of dissolved oxygen during the early morning hours and not during the summer critical period.
DO-PERC-GRAB-NCT-CP = Grab samples of dissolved oxygen not in the early morning hours of the summer critical period.
DO-PERC-GRAB-NCT-NCP = Grab samples of dissolved oxygen not in the early morning hours and outside the summer critical period.
DO-PERC-24HR-MEAN-CP = 24-hour average dissolved oxygen saturation from a datalogger deployed during the summer critical period.
DO-PERC-24HR-MEAN-NCP = 24-hour average dissolved oxygen saturation from a datalogger not deployed during the summer critical period.
"Current" Line for 2020 – Per the methodology outlined in the CALM, all data from this referenced data is considered "current" unless available older data is provided for context. See the 2020 CALM for addition details.

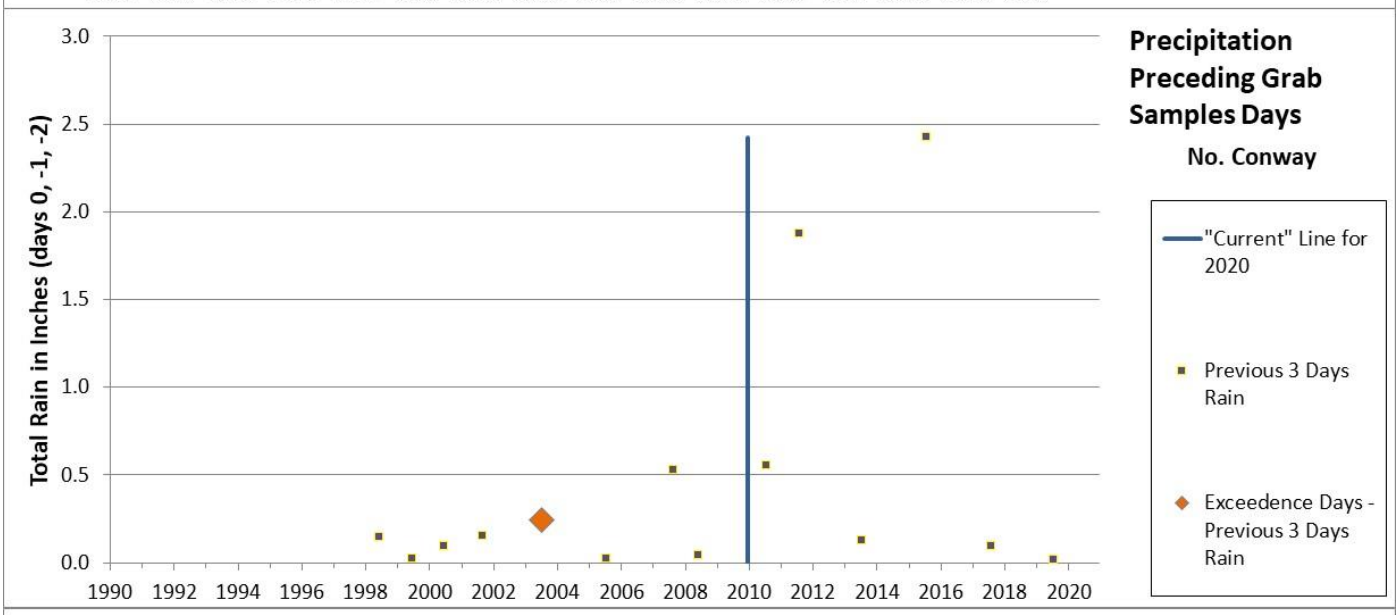
MIDDLE PEA PORRIDGE POND (NHLAK600020303-06)

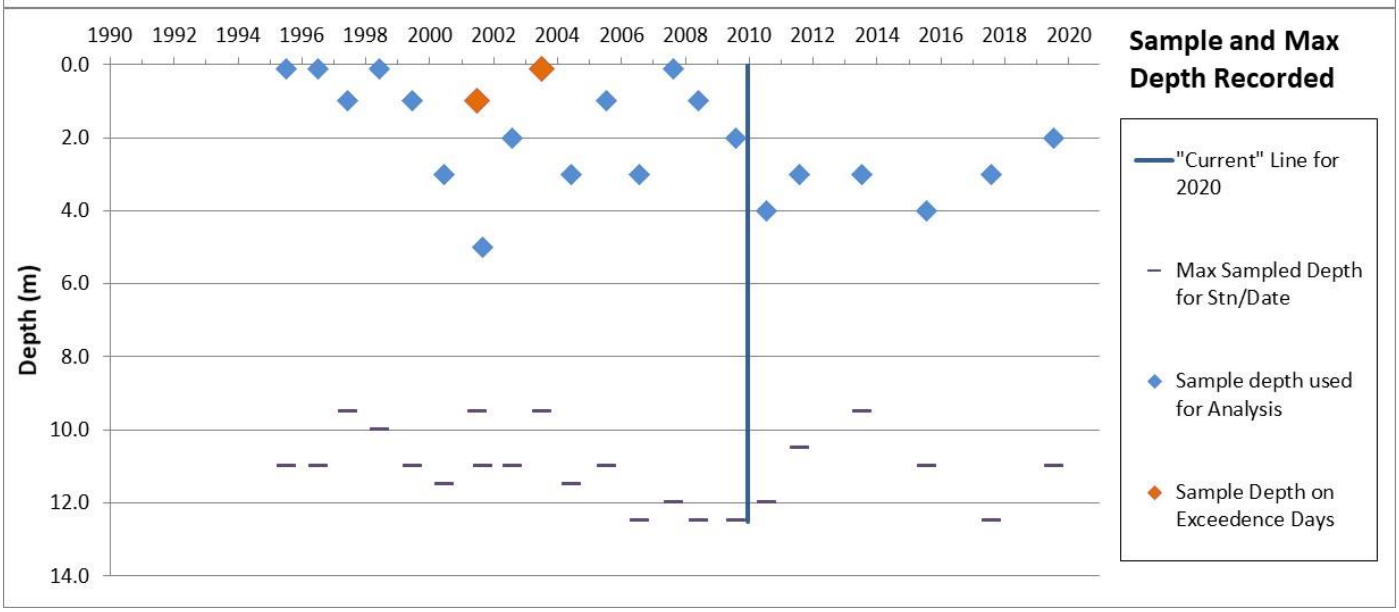
Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
Middle Pea Porridge Pond	NHLAK600020303-06	Dissolved Oxygen (Percent Saturation)	Madison	5-M	3-PAS

Middle Pea Porridge Pond has been listed as 5-M for dissolved oxygen percent saturation for the last few assessment cycles, based on one standard exceedance (2003) and one magex result (June 2001). The bulk of the data (n=20) from station PEAMMADD were collected under a range of flow conditions, in mostly warmer water conditions, and indicate that Middle Pea Porridge Pond is attaining standards for dissolved oxygen percent saturation. Evaluation of the low dissolved oxygen result (49.4%) collected on June 29, 2001 indicates that the meter used to conduct the survey may have been faulty or not calibrated correctly. Investigations revealed that the values collected throughout the whole water column were abnormally low. Values collected two months later in the season (August 2001) during a lake trophic survey, showed dissolved oxygen percent saturation levels were much higher (> 75%) at a later time in the growing season when we would typically expect lower dissolved oxygen than values collected a month prior. Based on this new information it appears that Middle Pea Porridge Pond (NHLAK600020303-06) was mistakenly impaired in 2006. Although the remainder of the data from 1995 through 2019 indicates that Middle Pea Porridge Pond is meeting water quality standards, there are less than 10 samples in the current period (2010-2020), which are needed to make a full assessment determination. Therefore, Middle Pea Porridge Pond (NHLAK600020303-06) has been moved from 5-M to 3-PAS for dissolved oxygen (percent saturation) for the aquatic life integrity designated use based on data collected in the current assessment period and the fact that the low dissolved oxygen saturation value (49.4%) used to make the initial impairment determination was deemed questionable.




Gage CFSM on Sample Days
USGS 01064500 Saco River near Conway, NH
Gage (cfsm)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)


Precipitation Preceding Grab Samples Days
No. Conway
Total Rain in Inches (days 0, -1, -2)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
Previous 3 Days Rain
Exceedence Days - Previous 3 Days Rain


Sample and Max Depth Recorded
Depth (m)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
Max Sampled Depth for Stn/Date
Sample depth used for Analysis
Sample Depth on Exceedence Days

Notes:
DO-PERC-GRAB-CT-CP = Grab samples of dissolved oxygen during the early morning hours of the summer critical period.
DO-PERC-GRAB-NCT-CP = Grab samples of dissolved oxygen not in the early morning hours of the summer critical period.
"Current" Line for 2020 – Per the methodology outlined in the CALM, all data from this referenced data is considered "current" unless available older data is provided for context. See the 2020 CALM for addition details.

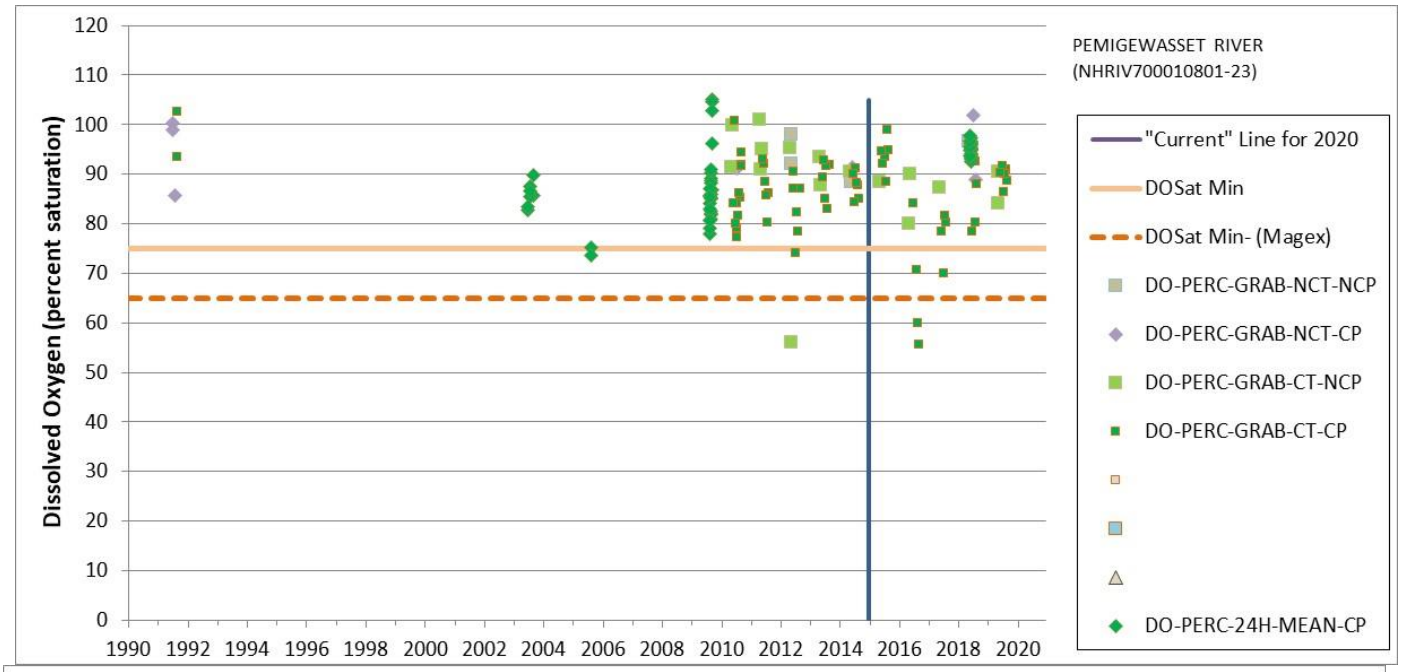
PEMIGEWASSET RIVER (NHRIV700010801-23)

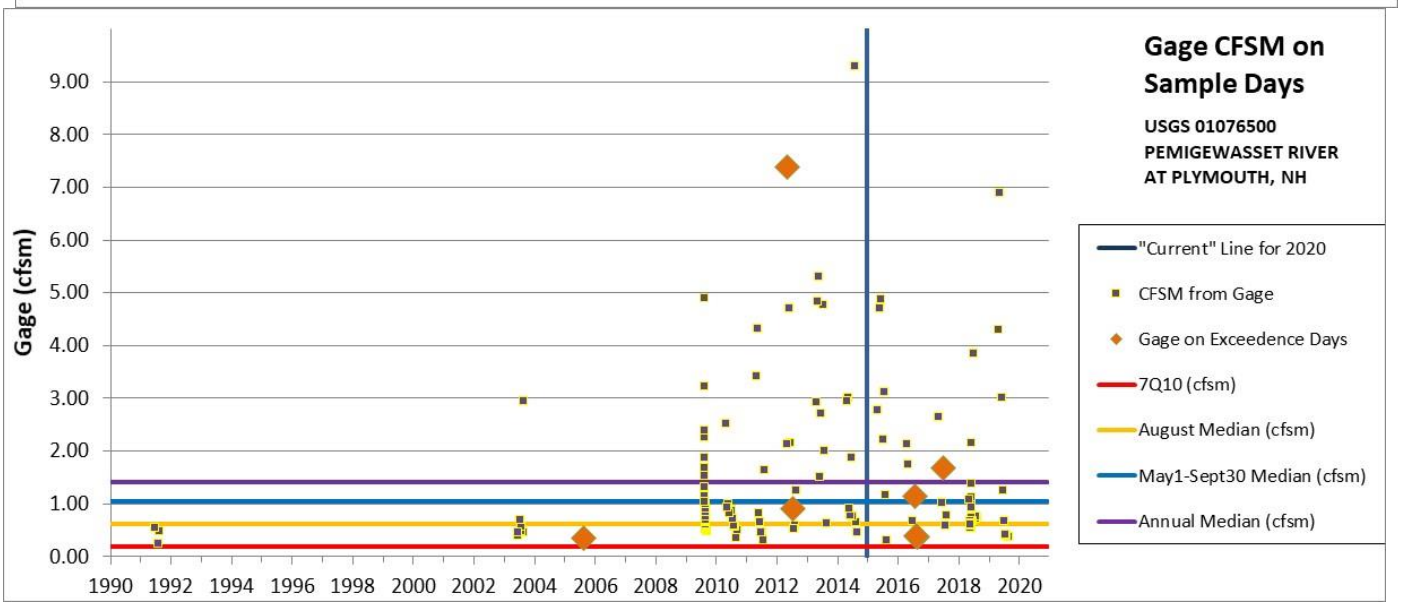
Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
PEMIGEWASSET RIVER	NHRIV700010801-23	Dissolved Oxygen (Percent Saturation)	BRISTOL, NEW HAMPTON	5-P	2-M

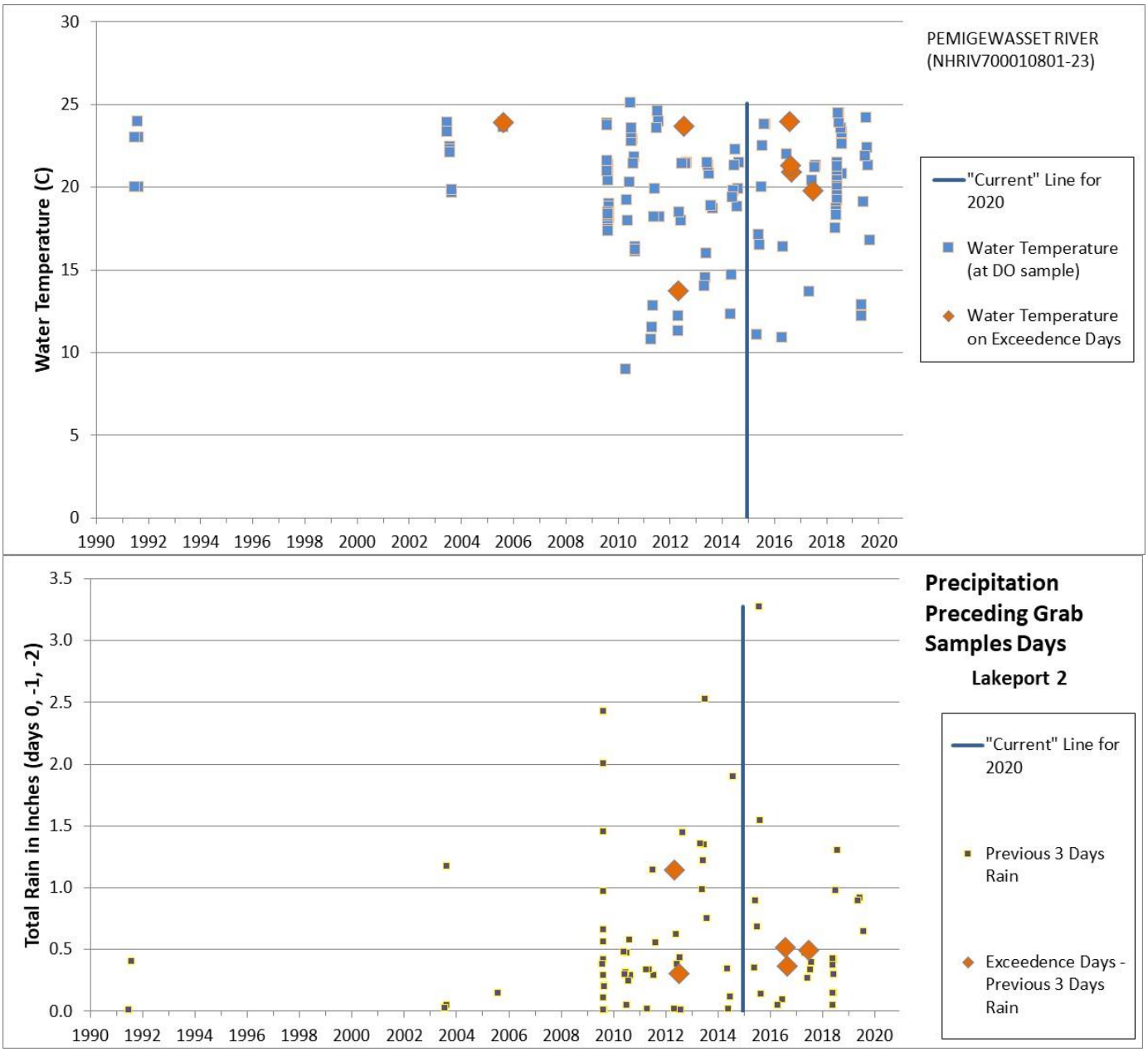
During the current assessment period (2015-2020) there were 34 instantaneous measurements of dissolved oxygen (% saturation) taken at stations 07-PMI and 07R-PMI in NHRIV700010801-23. Of these, four were below the water quality criteria threshold of 75% and two were also below the MAGEX threshold of 65%. In 2018 there was also a 14-day deployment of a datalogger at stations 07-PMI and 07R-PMI from June 12 – 25. The dissolved oxygen (% saturation) daily 24-hour average was above 90% at both stations on all days. The datalogger deployment was done during days that captured the same flow, water temperature, and precipitation conditions during which prior instantaneous measurements were taken that were below the 75% criteria. During the 2018 datalogger deployments flow conditions ranged from well below the August median to above the annual median. Precipitation conditions ranged from almost no rain in the prior three days to greater than 0.5 inches during the deployments. Water temperatures ranged from above to below those seen during any prior instantaneous measurements below 75%.

From 2009 – 2015 there were 51 instantaneous measurements of dissolved oxygen (% saturation) taken at stations 07-PMI and 07R-PMI in NHRIV700010801-23. Of these two were below the water quality criteria threshold of 75% one of which was also below the MAGEX threshold of 65%. In 2009 there was also a 28-day deployment of a datalogger at station 07R-PMI from August 20 – September 17. The dissolved oxygen (% saturation) daily 24-hour average was above 75% water quality criteria for dissolved oxygen (% saturation) on all days. The 2009 datalogger deployment was done during days that captured the same flow, water temperature, and precipitation condition during which instantaneous measurements were taken that were below the 75% criteria. During the 2009 datalogger deployments flow conditions ranged from well below the August median to above the annual median. Precipitation conditions ranged from almost no rain in the prior three days to greater than one inch during the deployments. Water temperatures ranged from above to below those seen during any instantaneous measurements below 75%.

The datalogger daily averages provide a more thorough and accurate assessment of the dissolved oxygen (% saturation) and indicate that stations 07-PMI and 07R-PMI in NHRIV700010801-23 are meeting the water quality criteria for dissolved oxygen (% saturation). As per Table 3-13 in the CALM, the minimum number of exceedances needed to list this waterbody as impaired using the "10% rule" and given the number of samples (n=48) is five. As there were only four exceedances this waterbody should not be listed as impaired. Pemigewasset River (NHRIV700010801-23) has been moved from 5-P to 2-M for dissolved oxygen (% saturation) for the aquatic life integrity designated use based on data collected in the current and past assessment periods.


Dissolved Oxygen (percent saturation)
120
110
100
90
80
70
60
50
40
30
20
10
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
PEMIGEWASSET RIVER
(NHRIV700010801-23)
"Current" Line for 2020
DOSat Min
DOSat Min- (Magex)
DO-PERC-GRAB-NCT-NCP
DO-PERC-GRAB-NCT-CP
DO-PERC-GRAB-CT-NCP
DO-PERC-GRAB-CT-CP
DO-PERC-24H-MEAN-CP


Gage (cfsm)
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Gage CFSM on Sample Days
USGS 01076500
PEMIGEWASSET RIVER
AT PLYMOUTH, NH
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)



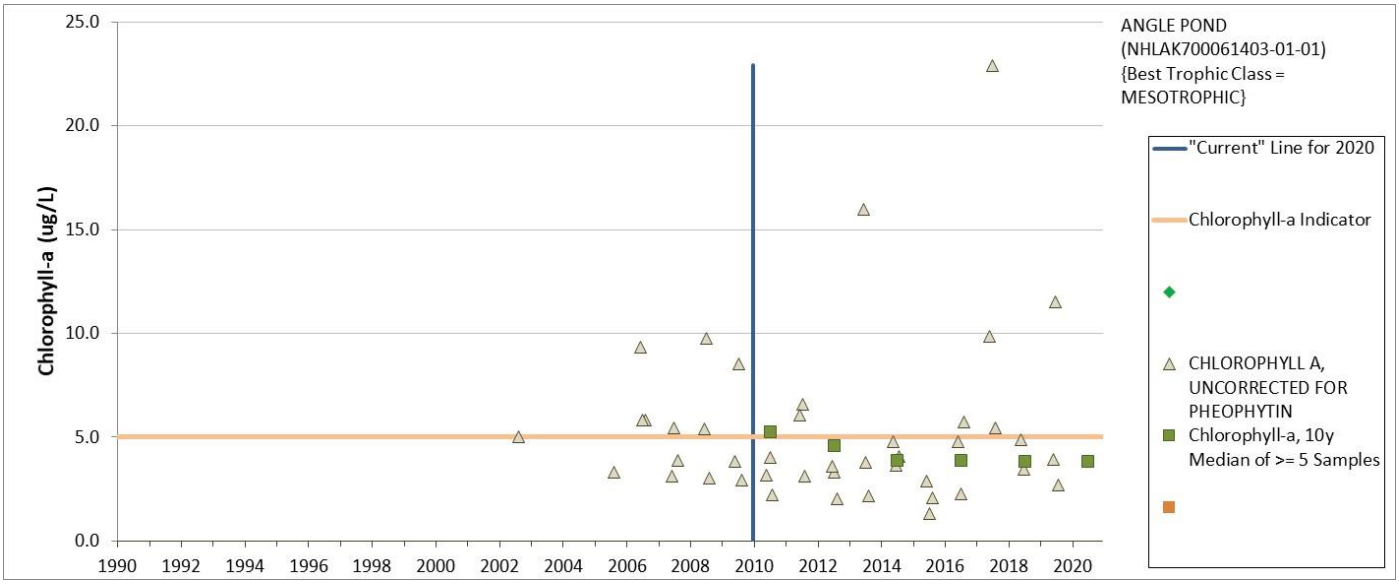
Notes:
DO-PERC-GRAB-CT-CP = Grab samples of dissolved oxygen during the early morning hours of the summer critical period.
DO-PERC-GRAB-CT-NCP = Grab samples of dissolved oxygen during the early morning hours and not during the summer critical period.
DO-PERC-GRAB-NCT-CP = Grab samples of dissolved oxygen not in the early morning hours of the summer critical period.
DO-PERC-GRAB-NCT-NCP = Grab samples of dissolved oxygen not in the early morning hours and outside the summer critical period.
DO-PERC-24HR-MEAN-CP = 24-hour average dissolved oxygen saturation from a datalogger deployed during the summer critical period.
"Current" Line for 2020 – Per the methodology outlined in the CALM, all data from this referenced data is considered "current" unless available older data is provided for context. See the 2020 CALM for addition details.

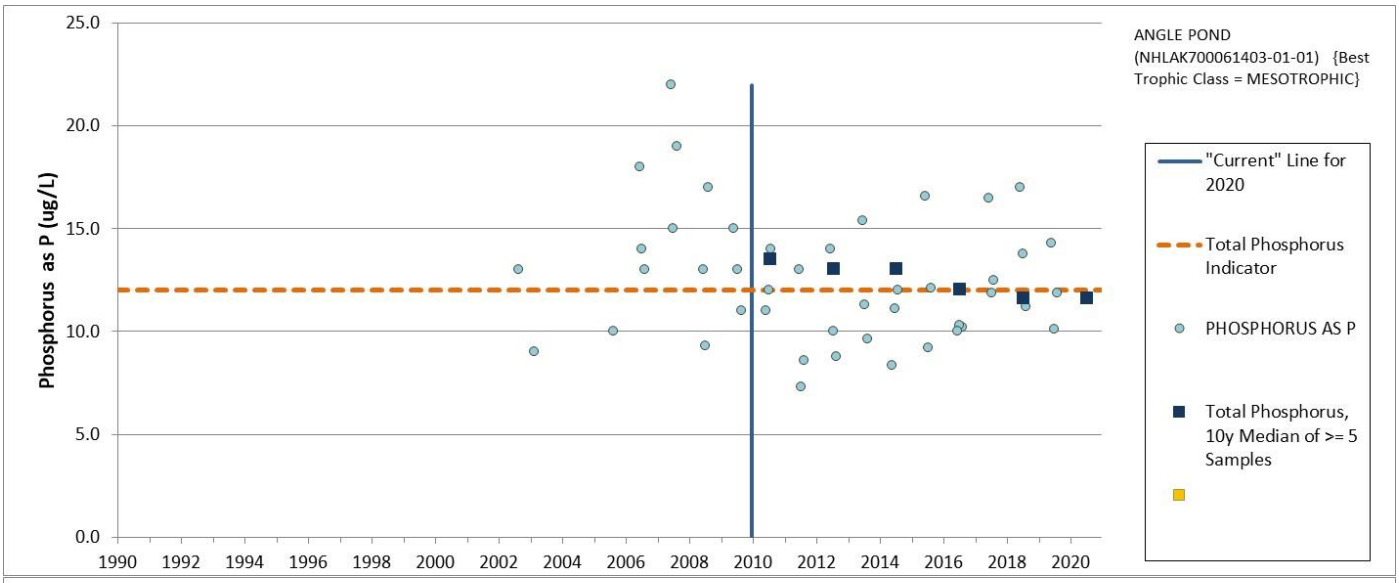
Chlorophyll-a & Total Phosphorus for Aquatic Life Integrity

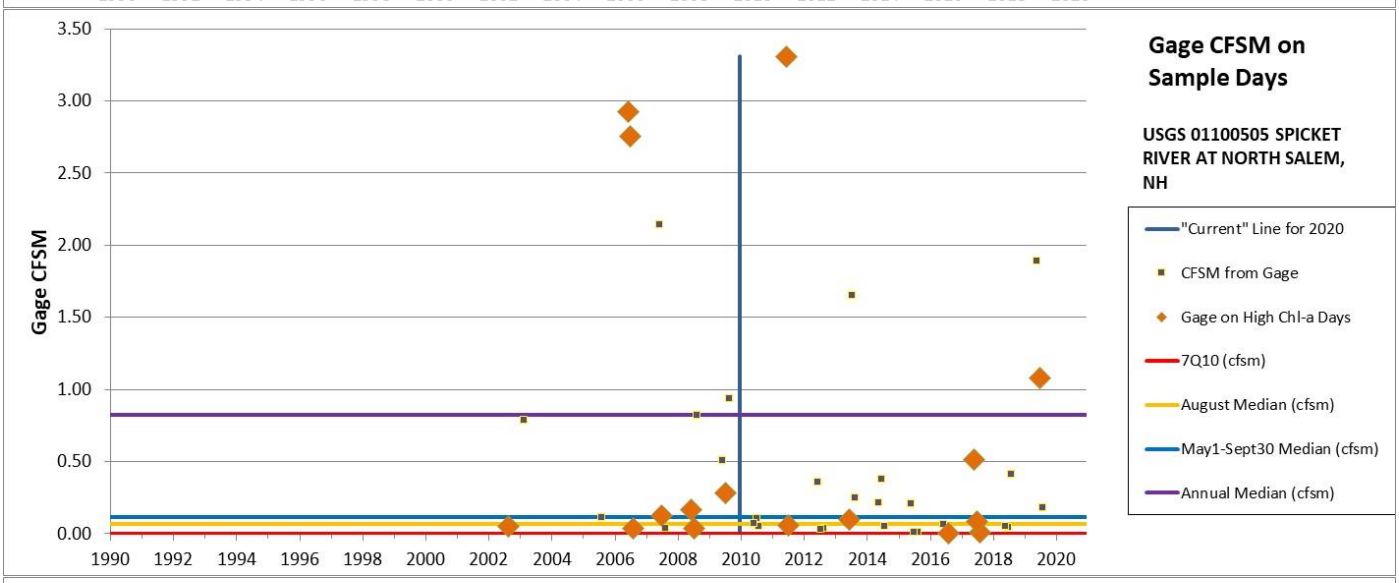
ANGLE POND (NHLAK700061403-01-01)

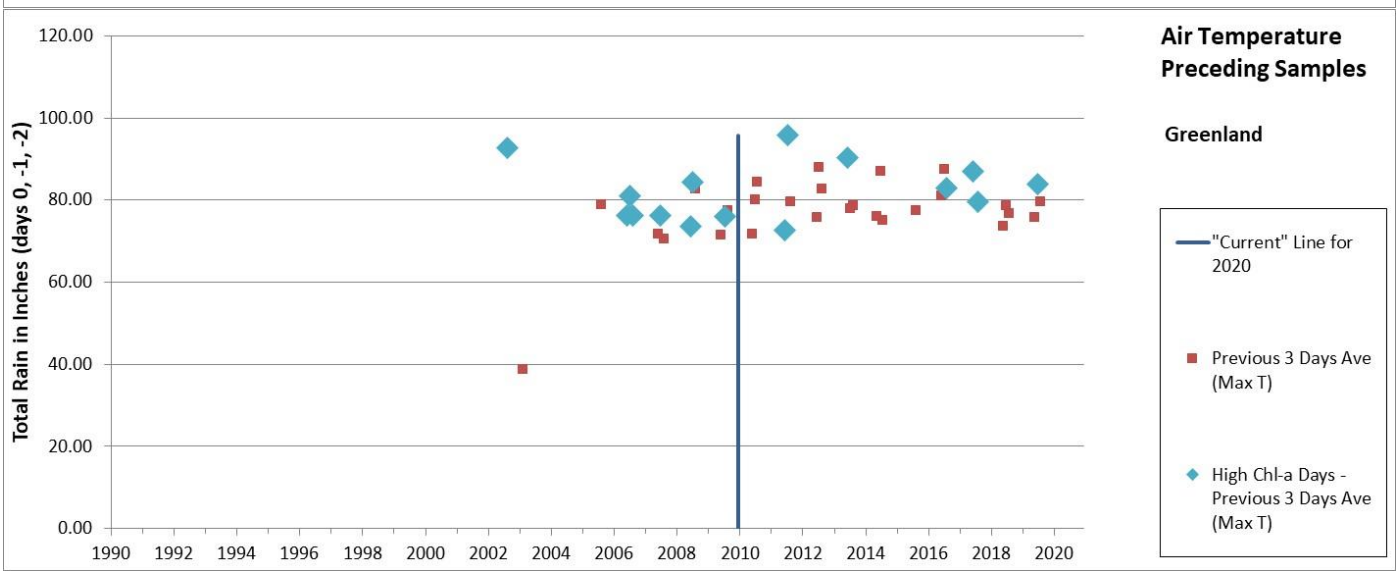
Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
ANGLE POND	NHLAK700061403-01-01	Chlorophyll-a	HAMPSTEAD, SANDOWN	5-M	2-M
ANGLE POND	NHLAK700061403-01-01	Phosphorus (Total)	HAMPSTEAD, SANDOWN	5-M	3-PNS

Chlorophyll-a median has remained below threshold for mesotrophic lakes since 2012 assessment cycle. Total phosphorus levels have decreased and median value has remained approximately equal to the threshold for mesotrophic lakes since 2016. Decrease in phosphorus levels combined with an increase in dissolved organic matter that imparts a “tea” color to the water have resulted in limiting nutrients and light availability for algal growth. An active lake association and education/outreach efforts on best practices within the watershed since joining VLAP also help to limit nutrients entering the pond. Angle Pond (NHLAK700061403-01-01) has been moved from 5-M to 2-M for chlorophyll-a for the aquatic life integrity designated use based on data collected in the current assessment period. Total phosphorus levels remain elevated, however following the stressor-response matrix it has been moved from 5-M to 3-PNS for the aquatic life integrity designated use based on data collected in the current assessment period. It should be noted that this is a delisting that is tied to an assessment unit that falls within EPA’s 2017 MS4 General Permit Area.




ANGLE POND
(NHLAK700061403-01-01) {Best Trophic Class = MESOTROPHIC}
Phosphorus as P (ug/L)
"Current" Line for 2020
Total Phosphorus Indicator
PHOSPHORUS AS P
Total Phosphorus, 10y Median of >= 5 Samples

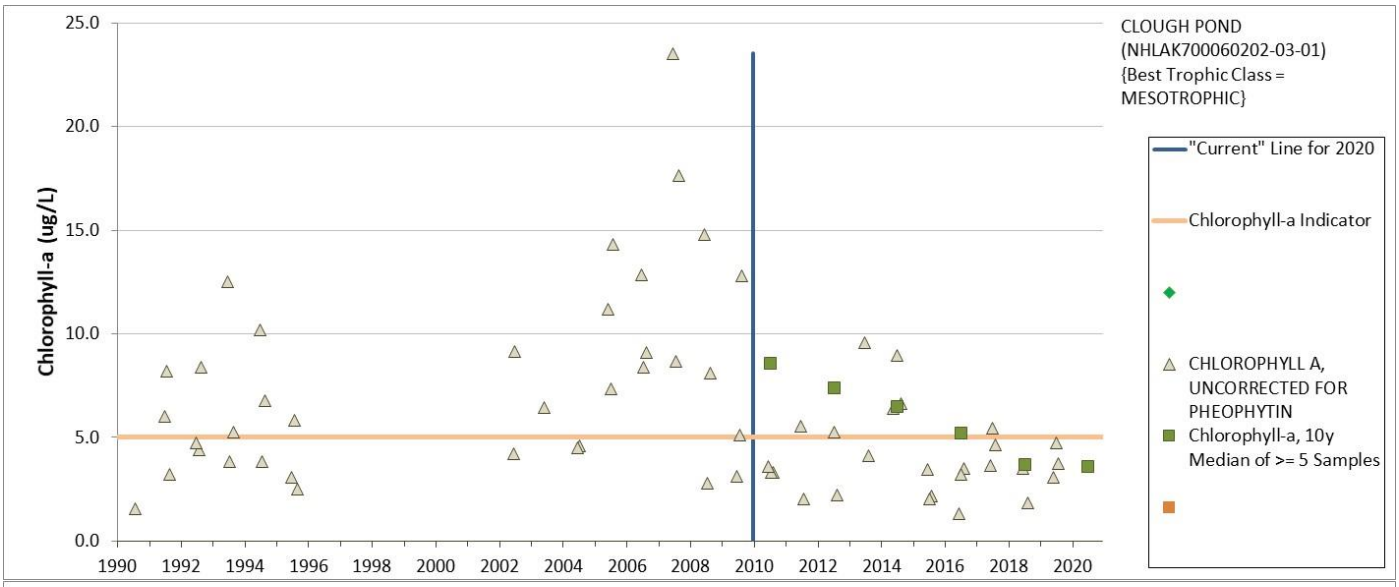

Gage CFSM on Sample Days
USGS 01100505 SPICKET RIVER AT NORTH SALEM, NH
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on High Chl-a Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)

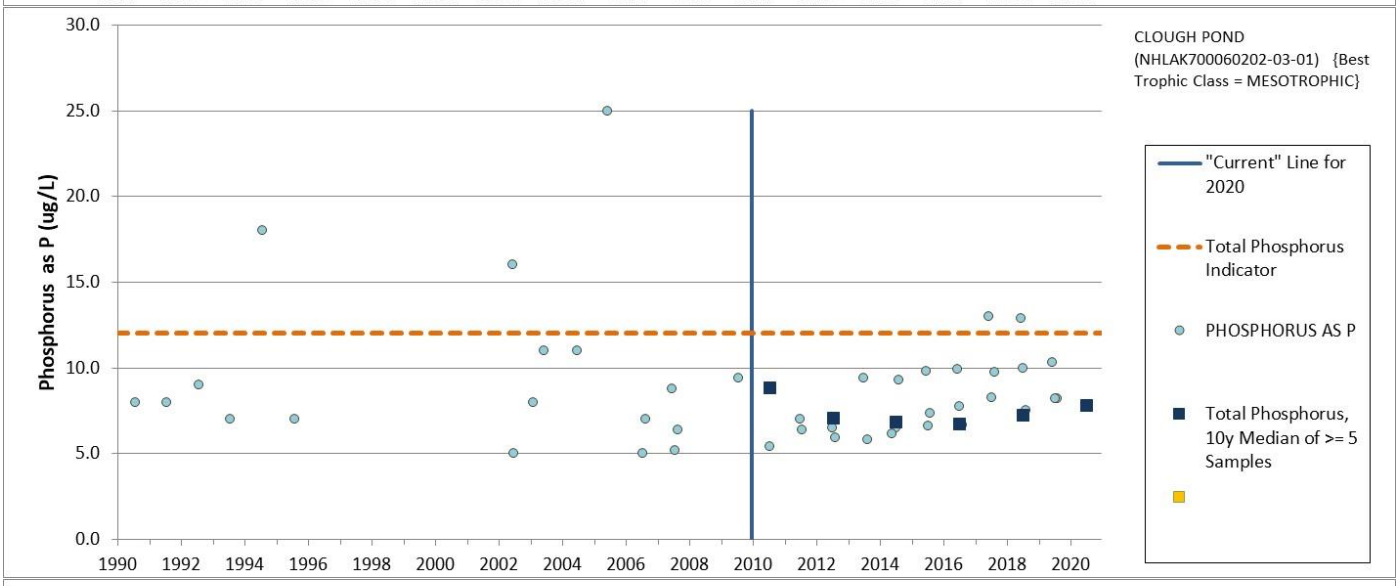

Air Temperature Preceding Samples
Greenland
Total Rain in Inches (days 0, -1, -2)
"Current" Line for 2020
Previous 3 Days Ave (Max T)
High Chl-a Days - Previous 3 Days Ave (Max T)

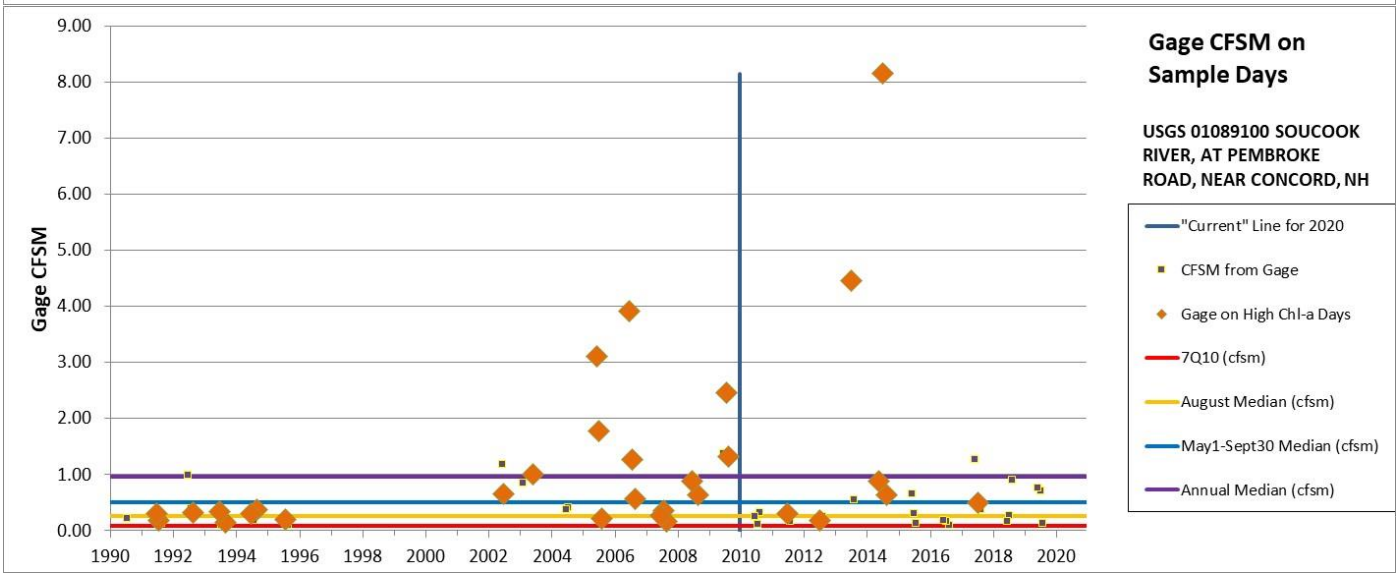
CLOUGH POND (NHLAK700060202-03-01)

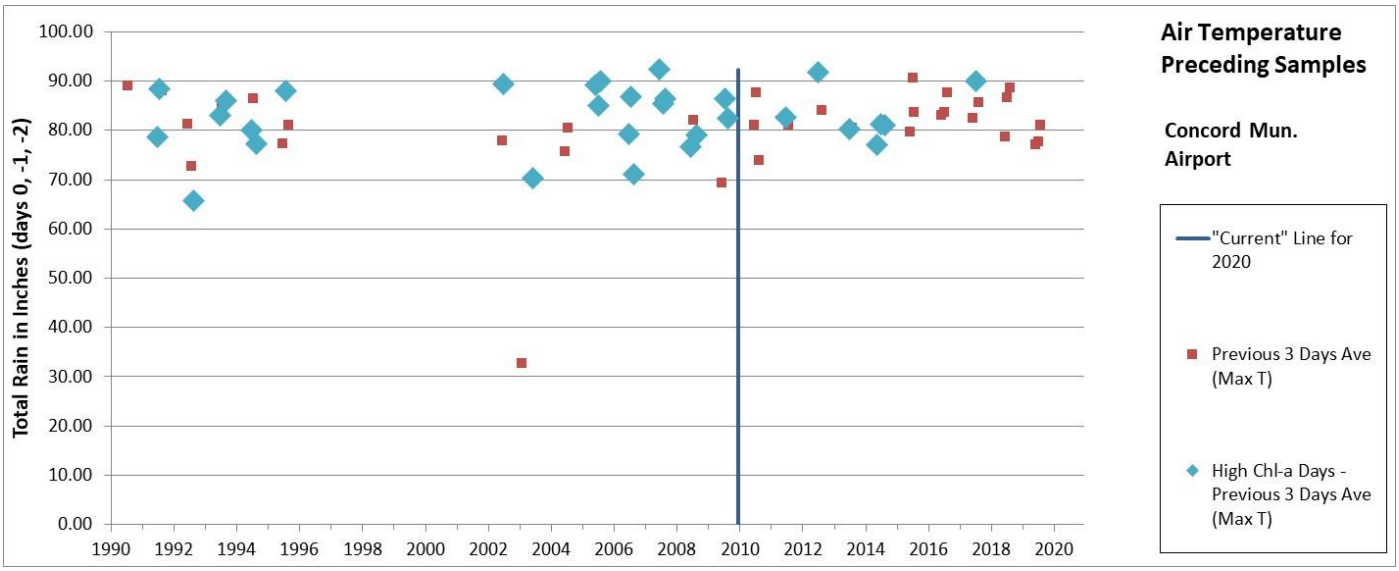
Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
CLOUGH POND	NHLAK700060202-03-01	Chlorophyll-a	CANTERBURY, LOUDON	5-M	2-M
CLOUGH POND	NHLAK700060202-03-01	Phosphorus (Total)	CANTERBURY, LOUDON	5-M	2-M

Chlorophyll-a median has steadily declined from 8.53 ug/L in 2010 assessment cycle to 3.55 ug/L in 2020/2022 assessment cycle. The median chlorophyll-a level has remained below the threshold for mesotrophic lakes for two cycles now with data clearly showing significantly decreasing chlorophyll-a levels since 2002. A multitude of stormwater management activities have occurred within the watershed and direct drainage area of the pond. The most recent was the perching of the Town Beach and implementation of stormwater runoff BMPs at the beach area. Residents are actively implementing stormwater management as well as maintaining septic systems and vegetative buffers along the shoreline. In response to these management efforts, pond phosphorus levels have remained stable and less than the threshold for mesotrophic lakes and algal growth has significantly decreased. The pond does occasionally experience cyanobacteria blooms, and VLAP data suggest cyanobacteria presence in the metalimnion, however this has not affected chlorophyll-a levels. The pond does have an internal loading of phosphorus that likely feeds the cyanobacteria growth, but again has not affected chlorophyll-a levels in recent years, and hypolimnetic phosphorus levels are not increasing, rather show signs of slow improvement as well. Clough Pond (NHLAK700060202-03-01) has been moved from 5-M to 2-M for both chlorophyll-a and total phosphorus for the aquatic life integrity designated use based on data collected in the current assessment period.


Chlorophyll-a (ug/L)
25.0
20.0
15.0
10.0
5.0
0.0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
CLOUGH POND (NHLAK700060202-03-01) {Best Trophic Class = MESOTROPHIC}
"Current" Line for 2020
Chlorophyll-a Indicator
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN
Chlorophyll-a, 10y Median of >= 5 Samples


Phosphorus as P (ug/L)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
CLOUGH POND (NHLAK700060202-03-01) {Best Trophic Class = MESOTROPHIC}
"Current" Line for 2020
Total Phosphorus Indicator
PHOSPHORUS AS P
Total Phosphorus, 10y Median of >= 5 Samples


Gage CFSM
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Gage CFSM on Sample Days
USGS 01089100 SOUCOOK RIVER, AT PEMBROKE ROAD, NEAR CONCORD, NH
"Current" Line for 2020
CFSM from Gage
Gage on High Chl-a Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)



DANIELS LAKE (NHLAK700060605-01-01)

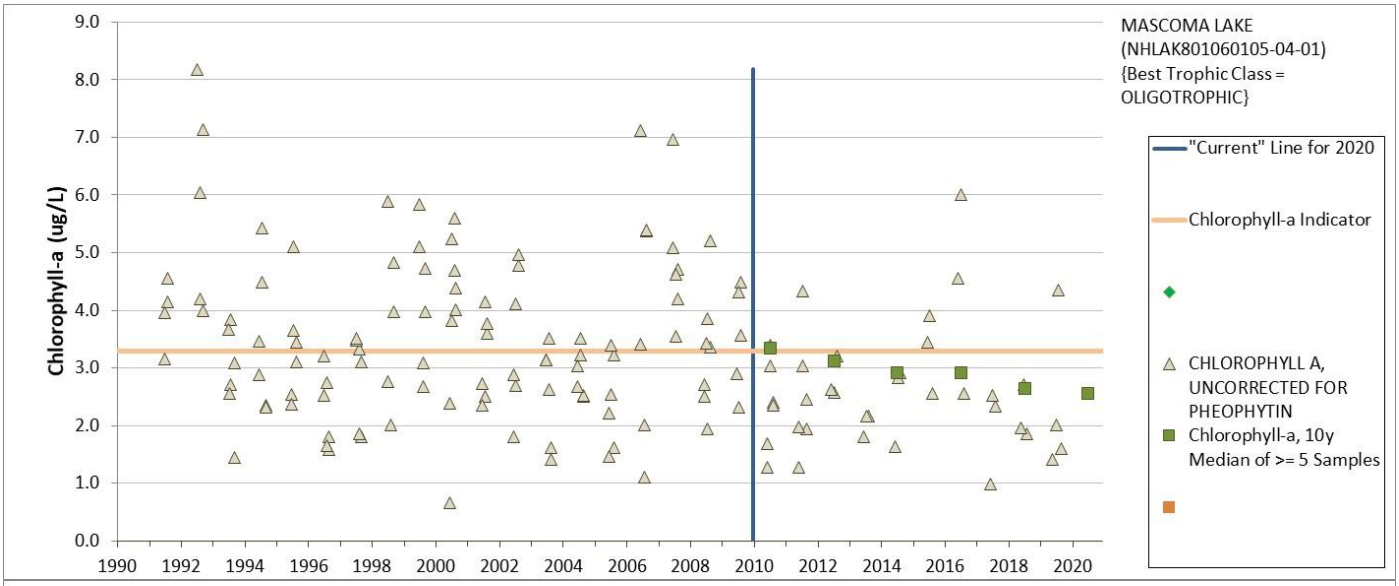
Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
DANIELS LAKE	NHLAK700060605-01-01	Chlorophyll-a	WEAR	5-M	4A-M
DANIELS LAKE	NHLAK700060605-01-01	Phosphorus (Total)	WEAR	5-M	4A-M

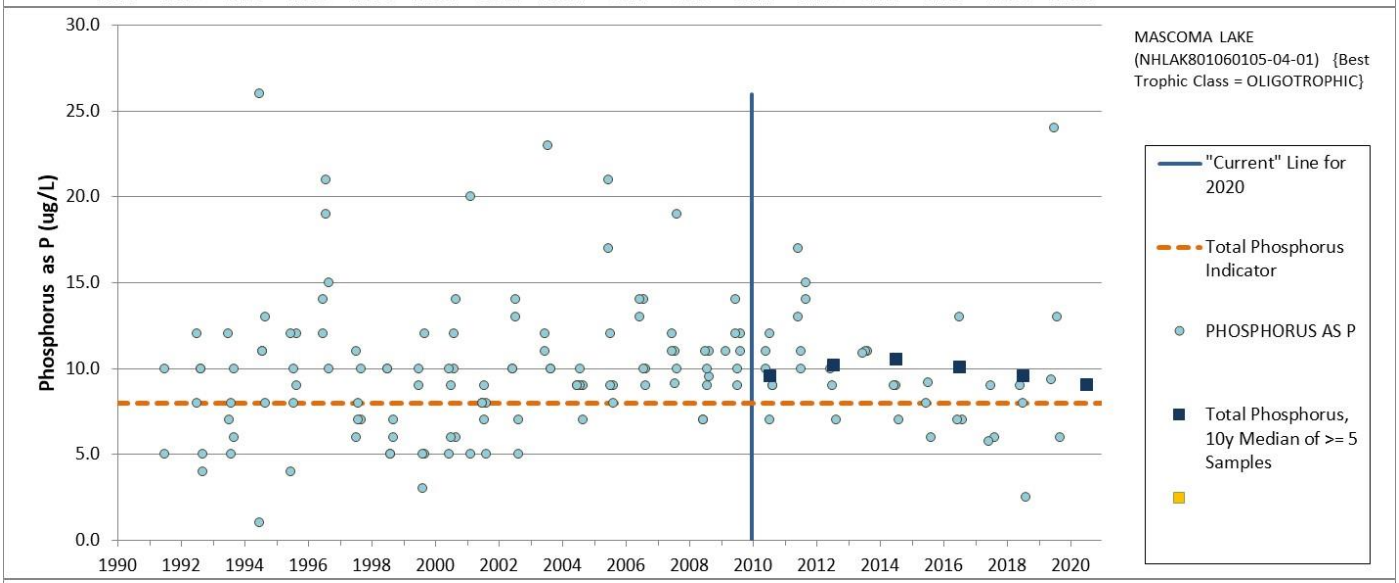
On September 28, 2021 EPA approved the Total Maximum Daily Load for Phosphorus for Daniels Lake, Wear, NH. The purpose of the TMDL is to address impairments of the aquatic life integrity designated use due to total phosphorus and chlorophyll-a. These impairments were due to atmospheric deposition, internal loading, septic systems (within 250 feet of the lake), waterfowl and watershed loads. The TMDL will result in attainment of surface water quality criteria and thresholds for total phosphorus, chlorophyll-a, dissolved oxygen, as well as cyanobacteria. A copy of the EPA TMDL approval letter and additional detail documents may be found in NHDES' TMDL Webpage. Since the TMDL has been approved by EPA, Daniels Lake (NHLAK700060605-01-01) has been moved from 5-M to 4A-M for Phosphorus (Total) and Chlorophyll-a for the aquatic life integrity designated use.

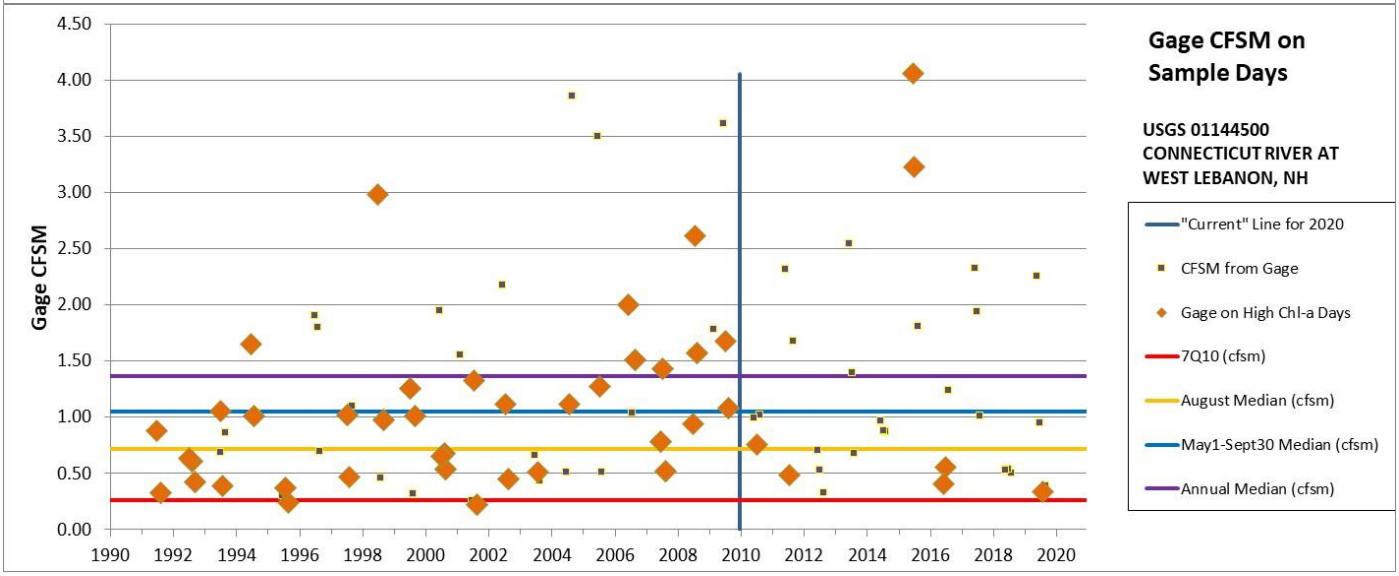
MASCOMA LAKE (NHLAK801060105-04-01)

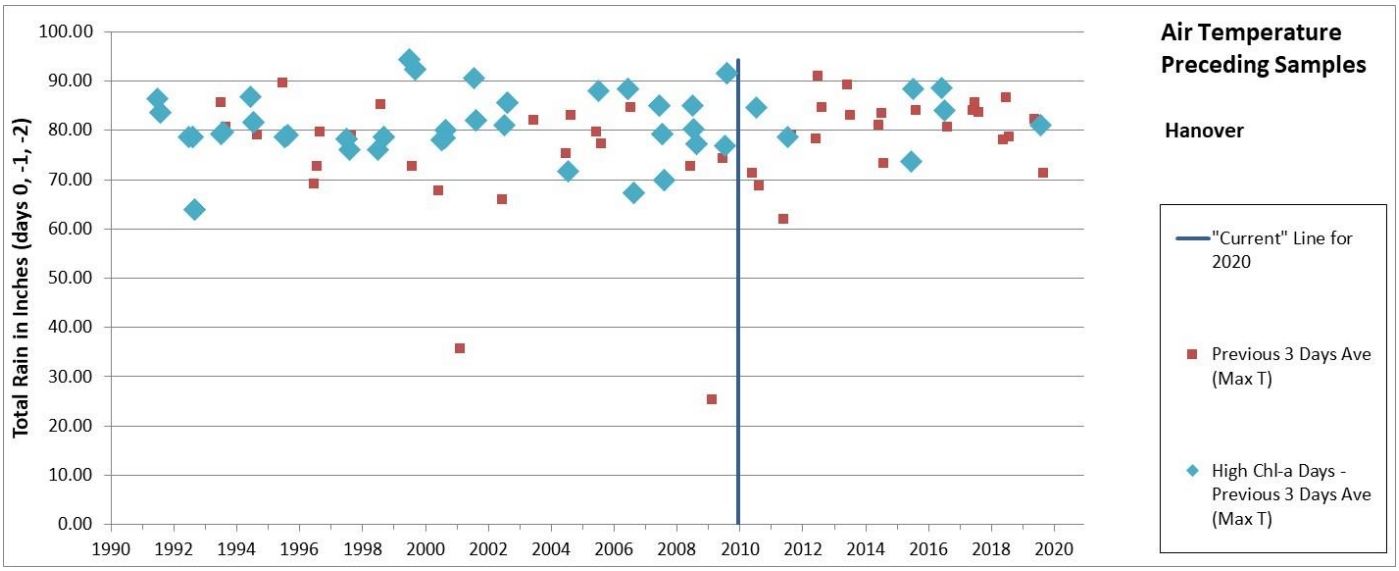
Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
MASCOMA LAKE	NHLAK801060105-04-01	Chlorophyll-a	ENFIELD, LEBANON	5-M	2-M
MASCOMA LAKE	NHLAK801060105-04-01	Phosphorus (Total)	ENFIELD, LEBANON	5-M	3-PNS

The chlorophyll-a as median value has remained below threshold for oligotrophic lakes for 5 assessment cycles and continues to decrease. Elevated chlorophyll-a in August, 2019 has been attributed to flooding a month earlier. Total phosphorus median remains above threshold for oligotrophic lakes by a small margin. Elevated phosphorus concentration observed in July, 2019 was attributed to flooding. The lake association has made great progress in addressing stormwater runoff and due to several flooding events in the area, the resulting management actions have likely contributed to improved water quality. Mascoma Lake (NHLAK801060105-04-01) has been moved from 5-M to 2-M for chlorophyll-a for the aquatic life integrity designated use based on data collected in the current assessment period. Median total phosphorus levels remain above the threshold for oligotrophic lakes, however following the stressor-response matrix it has been moved from 5-M to 3-PNS for the aquatic life integrity designated use based on data collected in the current assessment period.


MASCOMA LAKE
(NHLAK801060105-04-01)
{Best Trophic Class =
OLIGOTROPHIC}
Chlorophyll-a (ug/L)
"Current" Line for 2020
Chlorophyll-a Indicator
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN
Chlorophyll-a, 10y Median of >= 5 Samples


MASCOMA LAKE
(NHLAK801060105-04-01) {Best Trophic Class = OLIGOTROPHIC}
Phosphorus as P (ug/L)
"Current" Line for 2020
Total Phosphorus Indicator
PHOSPHORUS AS P
Total Phosphorus, 10y Median of >= 5 Samples


Gage CFSM on Sample Days
USGS 01144500
CONNECTICUT RIVER AT
WEST LEBANON, NH
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on High Chl-a Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)



WEBSTER STREAM - LOCKE LAKE (NHIMP700060402-02)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
WEBSTER STREAM - LOCKE LAKE	NHIMP700060402-02	Chlorophyll-a	BARNSTEAD	5-M	4A-M
WEBSTER STREAM - LOCKE LAKE	NHIMP700060402-02	Phosphorus (Total)	BARNSTEAD	5-M	4A-M

On September 29, 2020 EPA approved the Total Maximum Daily Load for Phosphorus for Locke Lake, Barnstead, NH. The purpose of the TMDL is to address impairments of the aquatic life integrity designated use due to total phosphorus, chlorophyll-a, pH and for the primary contact recreation designated use due to cyanobacteria hepatotoxic microcystins. These impairments were due to atmospheric deposition, internal loading, septic systems (within 125 feet of the pond), waterfowl and watershed loads. The TMDL will result in attainment of surface water quality criteria and thresholds for total phosphorus, chlorophyll-a, dissolved oxygen, as well as cyanobacteria. A copy of the EPA TMDL approval letter and additional detail documents may be found in NHDES' TMDL Webpage. Since the TMDL has been approved by EPA, Webster Stream - Locke Lake (NHIMP700060402-02) has been moved from 5-M to 4A-M for Phosphorus (Total) and Chlorophyll-a for the aquatic life integrity designated use.

Cyanobacteria for Primary Contact Recreation (i.e. swimming)

LAKE WINNIPESAUKEE (NHLAK700020110-02-19)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
Lake Winnipesaukee	NHLAK700020110-02-19	Cyanobacteria hepatotoxic microcystins	ALTON, CENTER HARBOR, GILFORD, LACONIA, MEREDITH, MOULTONBOROUGH, TUFTONBORO, WOLFEBORO	5-M	2-M

Lake Winnipesaukee (NHLAK700020110-02-19) was listed as impaired for the primary contact recreation designated use due to cyanobacteria hepatotoxic microcystins in 2012. There is a consistent population of the cyanobacteria taxon, primarily Gloeotrichia, in Lake Winnipesaukee. This type of cyanobacteria does not form typical green surface scums and is often observed in very low concentrations in all towns that the lake resides in. Elevated levels are sometimes observed in late summer, near Labor Day but still do

not exceed the threshold. However, since 2011 there has only been one advisory for cyanobacteria issued, in Winter Harbor (Wolfeboro), in 2018. Although an advisory was issued the cell counts were only slightly over the 70,000 total cells/mL threshold, ranging between 73,000 - 80,000 cells/ml on 9/5/2018. It should also be noted that due to the overall size of Lake Winnipesaukee (44,315 acres) compared to the localized area in which the bloom took place, that NHDES does not consider this to be a significant interference with the primary contact recreational use of the lake in its entirety. Although cyanobacteria cell concentrations are rarely high enough to form surface blooms on this lake, likely since it is oligotrophic and also due to the large area and depth of the lake, NHDES has noted the presence of Anabaena/Dolichospermum, Microcystis, Woronichinia, Oscillatoria, Pseudoanabaena, Stigonematales, Picocyanobacteria, and Snowella over the years. With the exception of the bloom reported in 2018, the last reported bloom was in 2011. The Lake Winnipesaukee Association (LWA) facilitates and coordinates the monitoring program on Winnipesaukee; partnering with the UNH LLMP to recruit, train, and support the local volunteers. The LWA has expanded the monitoring program to include cyanobacteria, and has created a weekly Winni Bloom Watch report and map. The Lake Winnipesaukee Association collaborates with multiple towns, organizations and associations to continue this work, including The Town of Wolfeboro who has developed a response protocol for future cyanobacterial blooms, and follows the EPA's Cyanobacteria Monitoring Collaborative. Therefore, Lake Winnipesaukee (NHLAK700020110-02-19) has been moved from category 5-M to 2-M for cyanobacteria hepatotoxic microcystins for the primary contact recreation designated use at this time.

ROCHESTER RESERVOIR (NHLAK600030602-03)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
Rochester Reservoir	NHLAK600030602-03	Cyanobacteria hepatotoxic microcystins	ROCHESTER, BARRINGTON	5-M	2-M

Rochester Reservoir (NHLAK600030602-03) was listed as impaired for the primary contact recreation designated use due to cyanobacteria hepatotoxic microcystins in 2008. There have been no blooms reported for Rochester Reservoir and no exceedances of the threshold (70,000 total cells/mL of water) since 2006 (14 years). However, there is still a persistent population of cyanobacteria in this waterbody. In recent years, they have found low cell counts of Anabaena/Dolichospermum. There have been no recent advisories, but further monitoring should continue for this system. The operators of this public water system are participating in the NHDES DWGB grant program for monitoring cyanobacteria, and they have not reported any new bloom to NHDES as part of these efforts. Therefore, Rochester Reservoir (NHLAK600030602-03) has been moved from 5-M to 2-M for cyanobacteria hepatotoxic microcystins for the primary contact recreation designated use at this time.

WEBSTER STREAM - LOCKE LAKE (NHIMP700060402-02)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
WEBSTER STREAM - LOCKE LAKE	NHIMP700060402-02	Cyanobacteria hepatotoxic microcystins	BARNSTEAD	5-M	4A-M

On September 29, 2020 EPA approved the Total Maximum Daily Load for Phosphorus for Locke Lake, Barnstead, NH. The purpose of the TMDL is to address impairments of the aquatic life integrity designated use due to total phosphorus, chlorophyll-a, pH and for the primary contact recreation designated use due to cyanobacteria hepatotoxic microcystins. These impairments were due to atmospheric deposition, internal loading, septic systems (within 125 feet of the pond), waterfowl and watershed loads. The TMDL will result in attainment of surface water quality criteria and thresholds for total phosphorus, chlorophyll-a, dissolved oxygen, as well as cyanobacteria. A copy of the EPA TMDL approval letter and additional detail documents may be found in NHDES' TMDL Webpage. Since the TMDL has been approved by EPA, Webster Stream - Locke Lake (NHIMP700060402-02) has been moved from 5-M to 4A-M for Cyanobacteria hepatotoxic microcystins for the aquatic life integrity designated use.

WHITE LAKE - STATE PARK BEACH (NHLAK600020605-02-02)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
White Lake - State Park Beach	NHLAK600020605-02-02	Cyanobacteria hepatotoxic microcystins	TAMWORTH	5-M	2-M

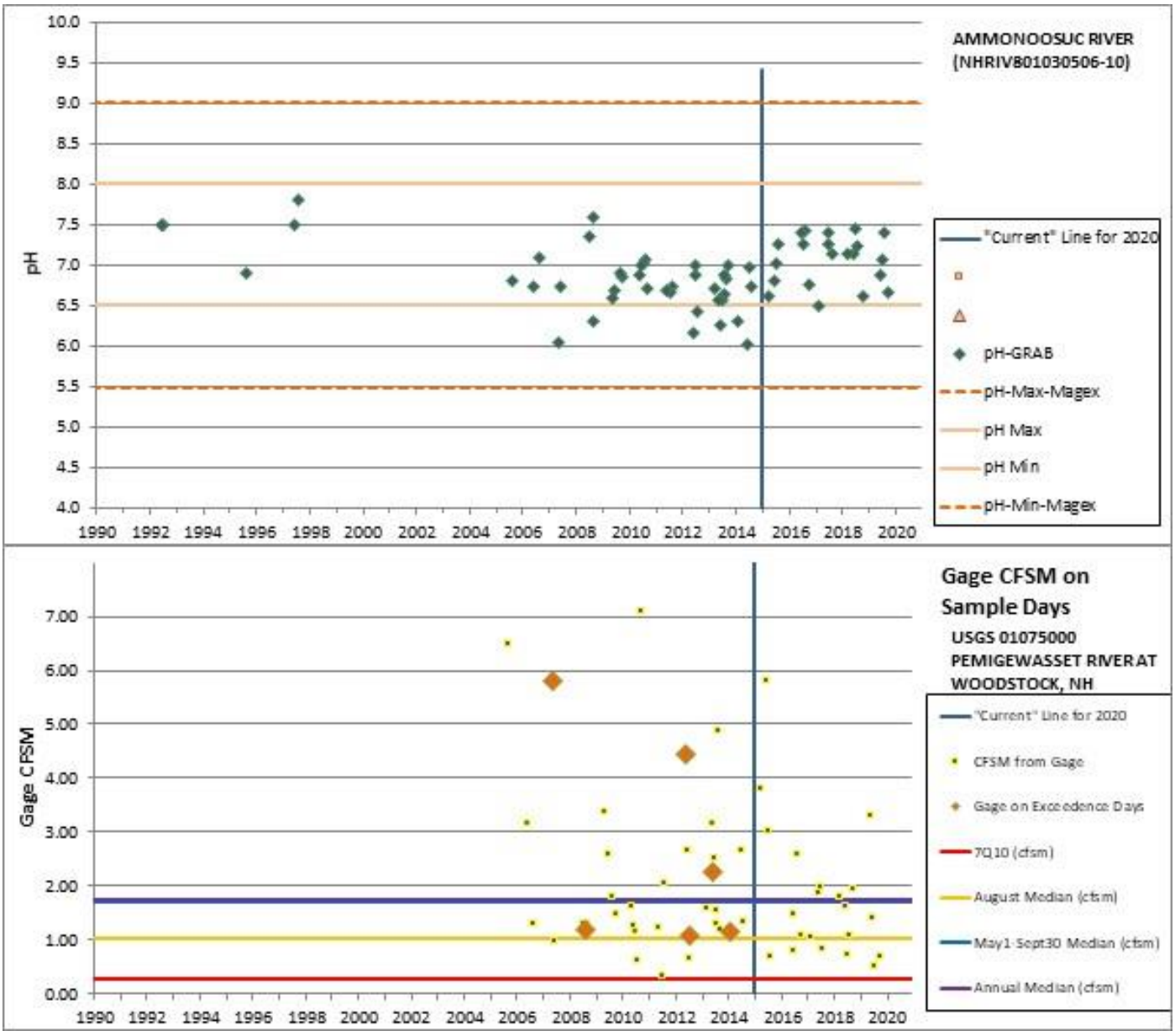
White Lake - State Park Beach (NHLAK600020605-02-02) was listed as impaired for the primary contact recreation designated use due to cyanobacteria hepatotoxic microcystins in 2012. There have not been any bloom sightings reported to NHDES since 2010. Although the waterbody has been monitored routinely over the years, because no blooms have been reported, no samples have been collected since 2011. In 2019 the NHDES Beach Program sampled during a routine beach inspection just to check and see if any cyanobacteria were present in the waterbody. There was only one colony of Aphanizomenon (cyanobacteria taxon) present in the sample. Since no blooms have been reported since 2010 and no cyanobacteria has been present in concentrations above the threshold (70,000 total cells/mL of water), it is NHDES' conclusion that this beach and waterbody are attaining standards. Therefore, White Lake State Park Beach (NHLAK600020605-02-02) has been moved from 5-M to 2-M for cyanobacteria hepatotoxic microcystins for the primary contact recreation designated use for the 2020/2022 assessment cycle.

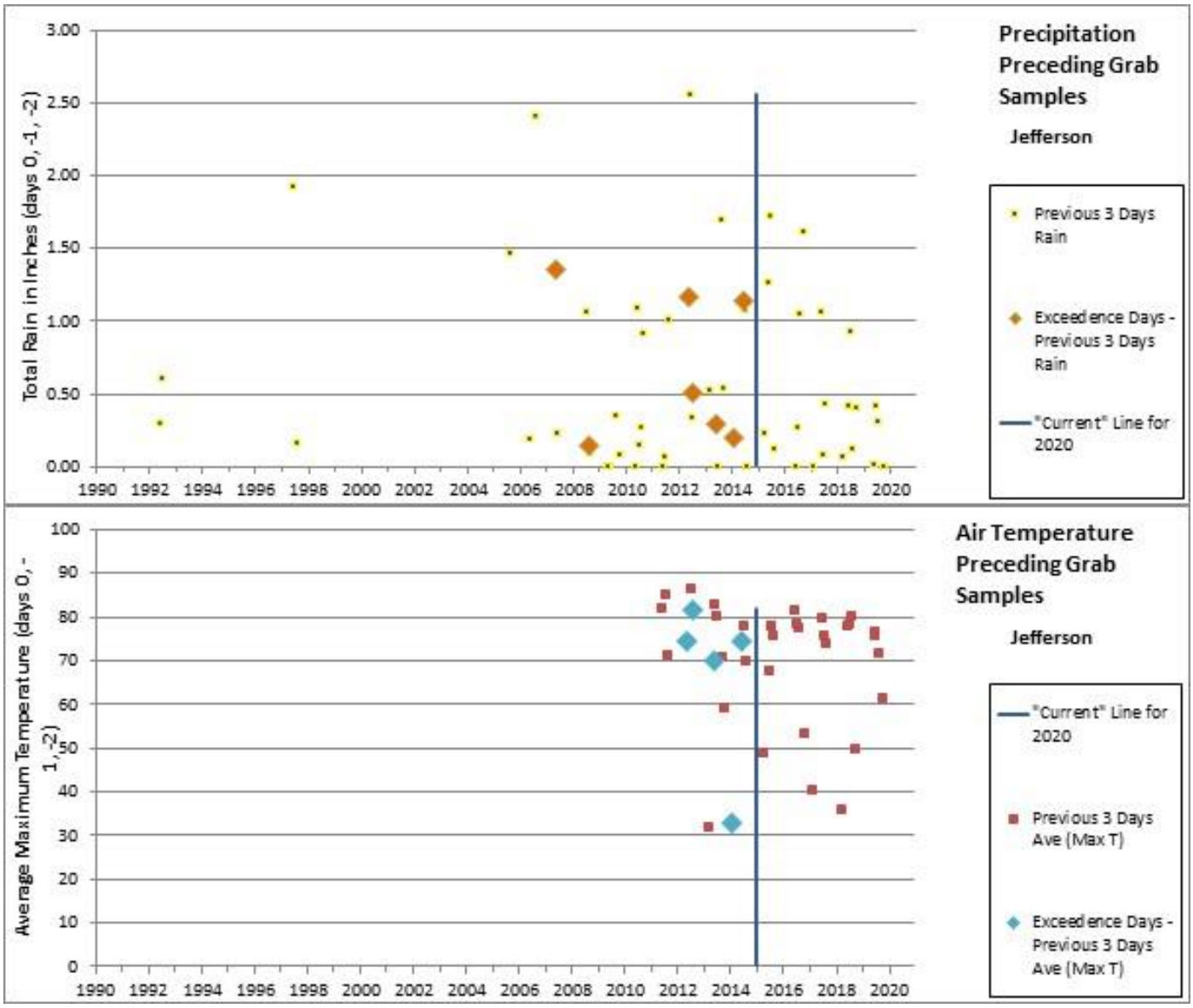
pH for Aquatic Life Integrity

AMMONOOSUC RIVER (NHRIV801030506-10)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
Ammonoosuc River	NHRIV801030506-10	pH	Bath	5-M	2-M

The Ammonoosuc River Dam Pond (NHRIV801030506-10) was originally impaired during the 2010 assessment cycle using data collected at station 03-AMM. During the current assessment cycle (2015-2020) none of the 21 (0%) grab samples collected at station 03-AMM were below the lower pH threshold of 6.5 or above the upper pH threshold of 8.0. Samples were collected during flows ranging from 0.51 to 5.80 cfsm at the Pemigewasset River gauge (01075000) and under variable weather conditions (0.00 to 1.72 inch 3-day rainfall total). The current data was collected at the same station and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of the Ammonoosuc River in the 2020/2022 assessment cycle. The Ammonoosuc River (NHRIV801030506-10) has been moved from 5-M to 2-M for pH for the aquatic life integrity designated use based on data collected in the current assessment period.

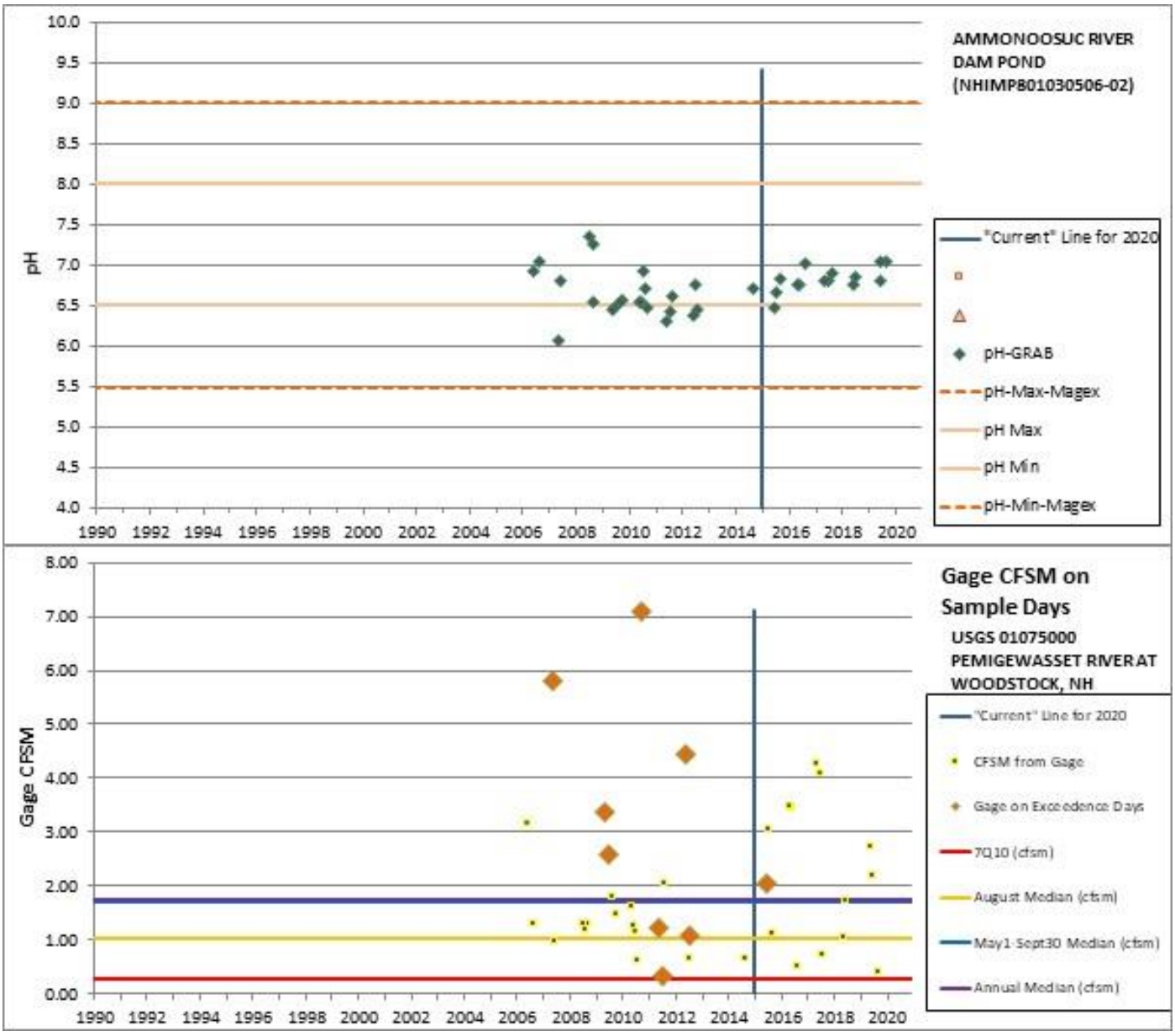

AMMONOOSUC RIVER
(NHRIV801030506-10)
pH
"Current" Line for 2020
pH-GRAB
pH-Max-Magex
pH Max
pH Min
pH-Min-Magex
Gage CFSM on Sample Days
USGS 01075000
PEMIGEWASSET RIVER AT WOODSTOCK, NH
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)

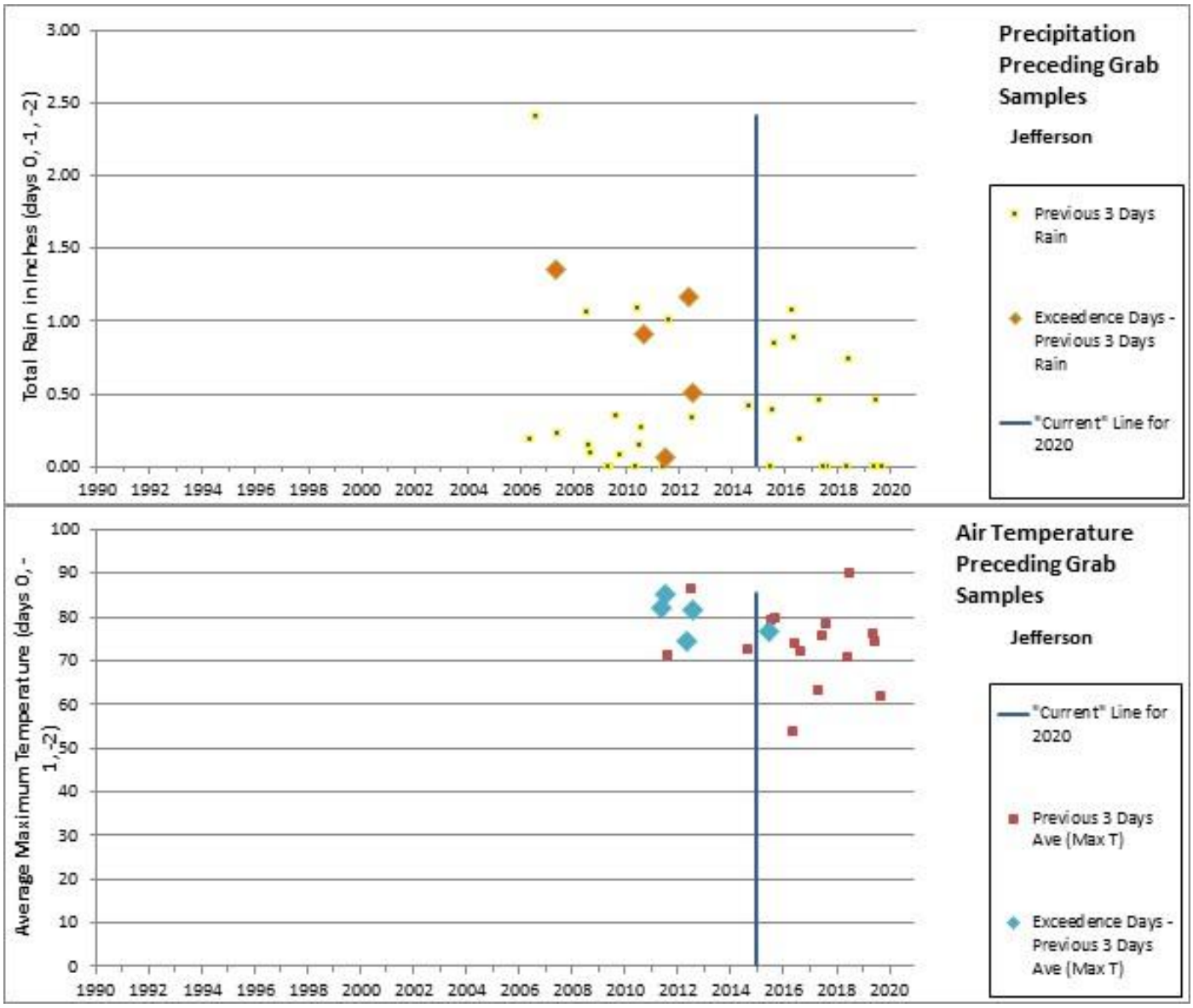


AMMONOOSUC RIVER DAM POND (NHIMP801030506-02)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
AMMONOOSUC RIVER DAM POND	NHIMP801030506-02	pH	BATH	5-M	2-M

The Ammonoosuc River Dam Pond (NHIMP801030506-02) was originally impaired during the 2010 assessment cycle using data collected at station 04-AMM. Since 1990, 9 of 37 (24.3%) grab samples collected were below the lower pH threshold of 6.5. Of the 9 samples, 6 samples ranged from 6.43-6.48, which is very close to the 6.5 threshold. The three remaining low pH samples were collected at flows ranging from 0.32-5.80 cfsm on the Pemigewasset River gage (01075000) and varying weather conditions (three-day rainfall total of 0.00-1.36). In the current assessment period (2010-2020), only 1 of 14 (7%) grab samples were below the lower pH criterial, although very close at 6.48. The pH samples collected during this assessment period were collected at flows ranging from 0.41-4.26 cfsm on the Pemigewasset River gage (01075000) and varying weather conditions (three-day rainfall total of 0.00 – 1.07 inches). The current data was collected at the same station and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of the Ammonoosuc River Dam Pond in the 2020/2022 assessment cycle. The Ammonoosuc River Dam Pond (NHIMP801030506-02) has been moved from 5-M to 2-M for pH for the aquatic life integrity designated use based on data collected in the current assessment period.

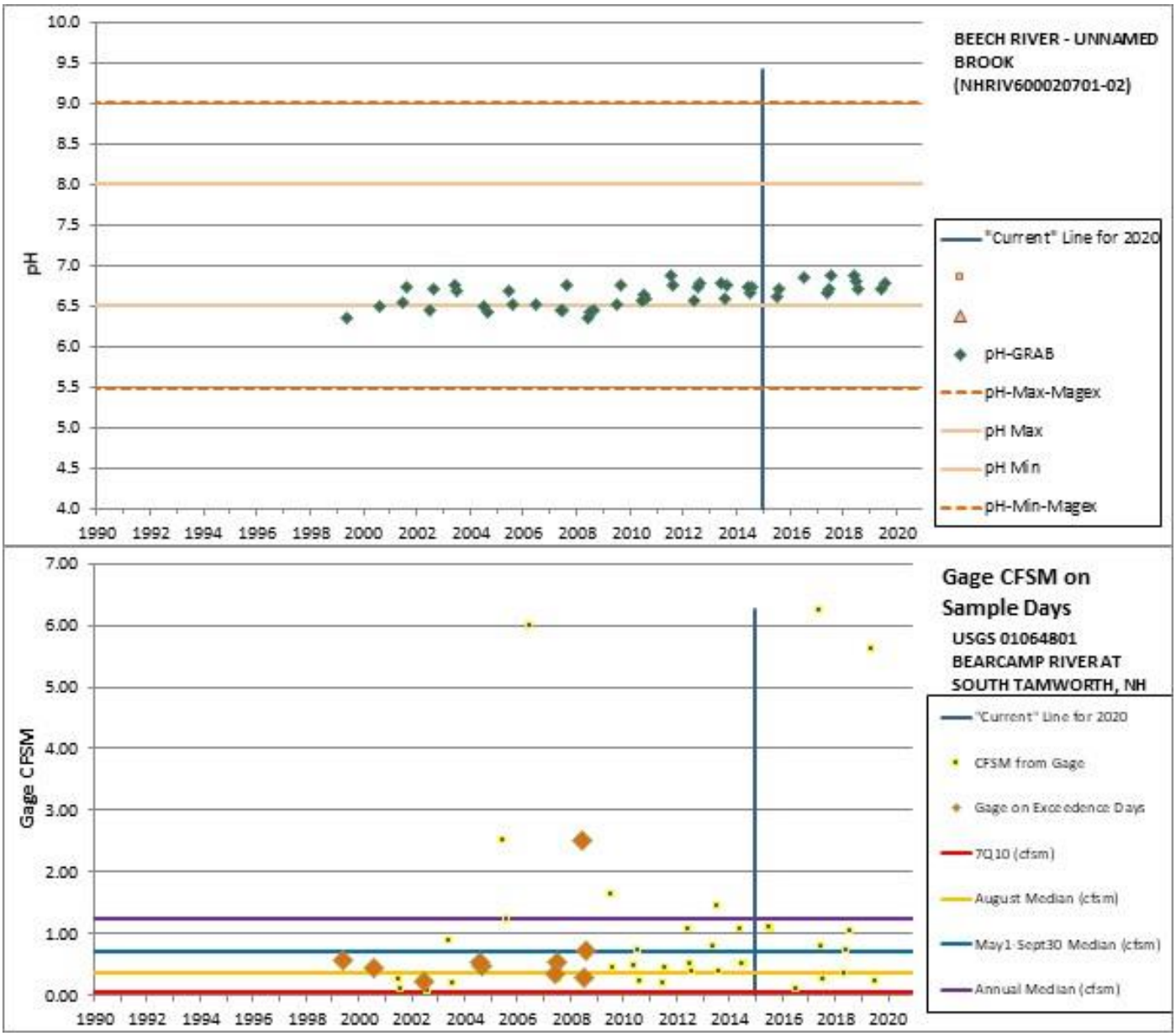

AMMONOOSUC RIVER
DAM POND
(NHIMPB01030506-02)
pH
"Current" Line for 2020
pH-GRAB
pH-Max-Magex
pH Max
pH Min
pH-Min-Magex
Gage CFSM on Sample Days
USGS 01075000
PEMIGEWASSET RIVER AT
WOODSTOCK, NH
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)

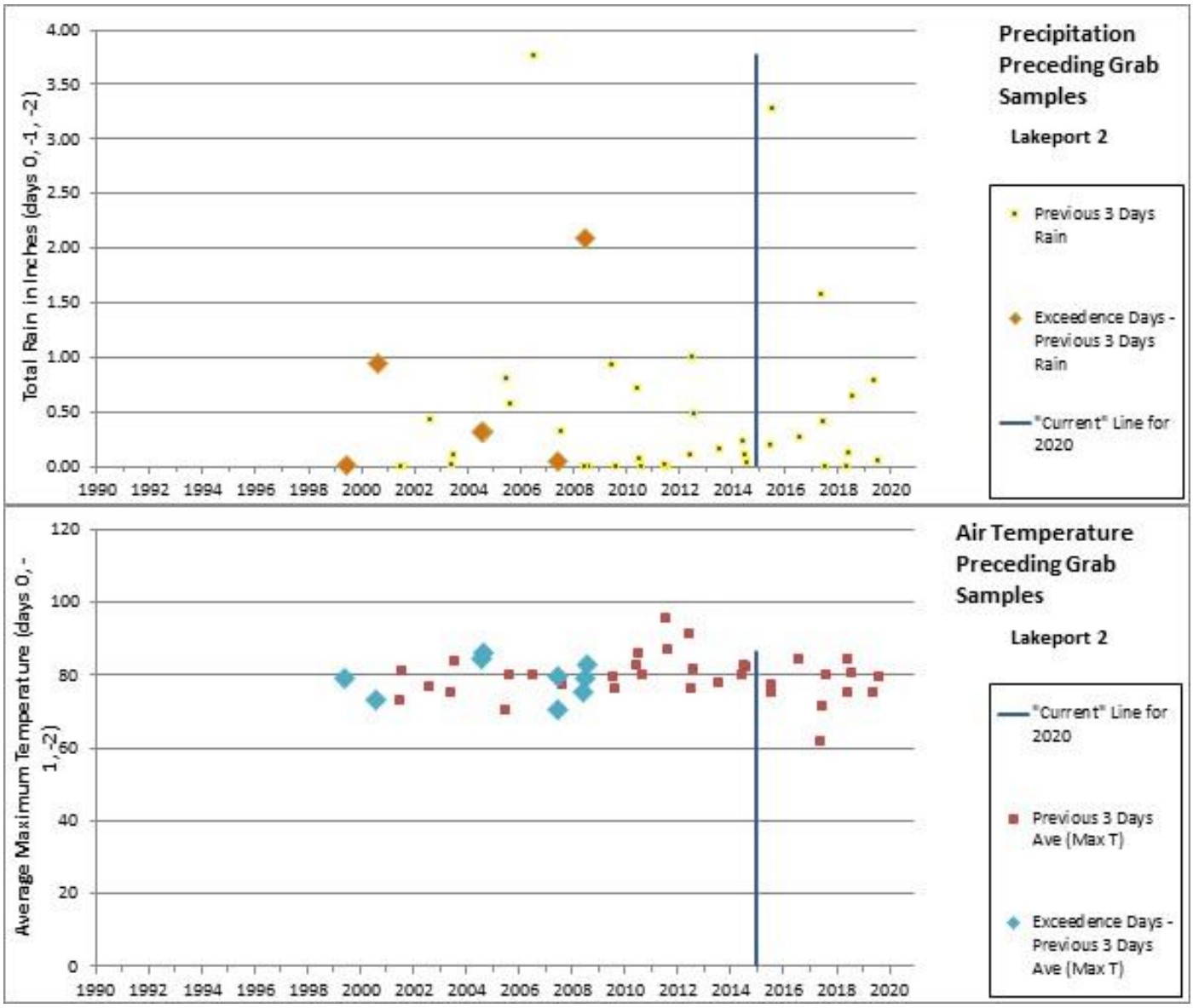


BEECH RIVER - UNNAMED BROOK (NHRIV600020701-02)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
BEECH RIVER - UNNAMED BROOK	NHRIV600020701-02	pH	TUFTONBORO	5-M	2-G

The Beech River-Unnamed Brook (NHRIV600020701-02) was originally impaired during the 2006 assessment cycle using data collected at station BEELTUFO. Since 1990, 10 of 46 (21.7%) grab samples collected were below the lower pH threshold of 6.5. The low pH samples were collected at flows ranging from 0.23-2.51 cfsm on the Bearcamp River gage (01064801) and varying weather conditions (three-day rainfall total of 0.00-2.09 inches). Of the 10 samples, 8 samples ranged from 6.42-6.49, which is very close to the 6.5 threshold. In the current assessment period (2015-2020), all of the grab samples (n=11) collected at station BEELTUFO were between the lower and upper pH criteria (6.5 and 8.0, respectively). These pH samples were collected between June and August at flows ranging from 0.10 to 6.24 cfsm on the Bearcamp River gage (01064801) and varying weather conditions (three-day rainfall total of 0.00 – 3.28 inches). The current data was collected at the same station and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of the Beech River-Unnamed Brook in the 2020/2022 cycle. The Beech River-Unnamed Brook (NHRIV600020701-02) has been moved from 5-M to 2-G for pH for the aquatic life integrity designated use based on data collected in the current assessment period.

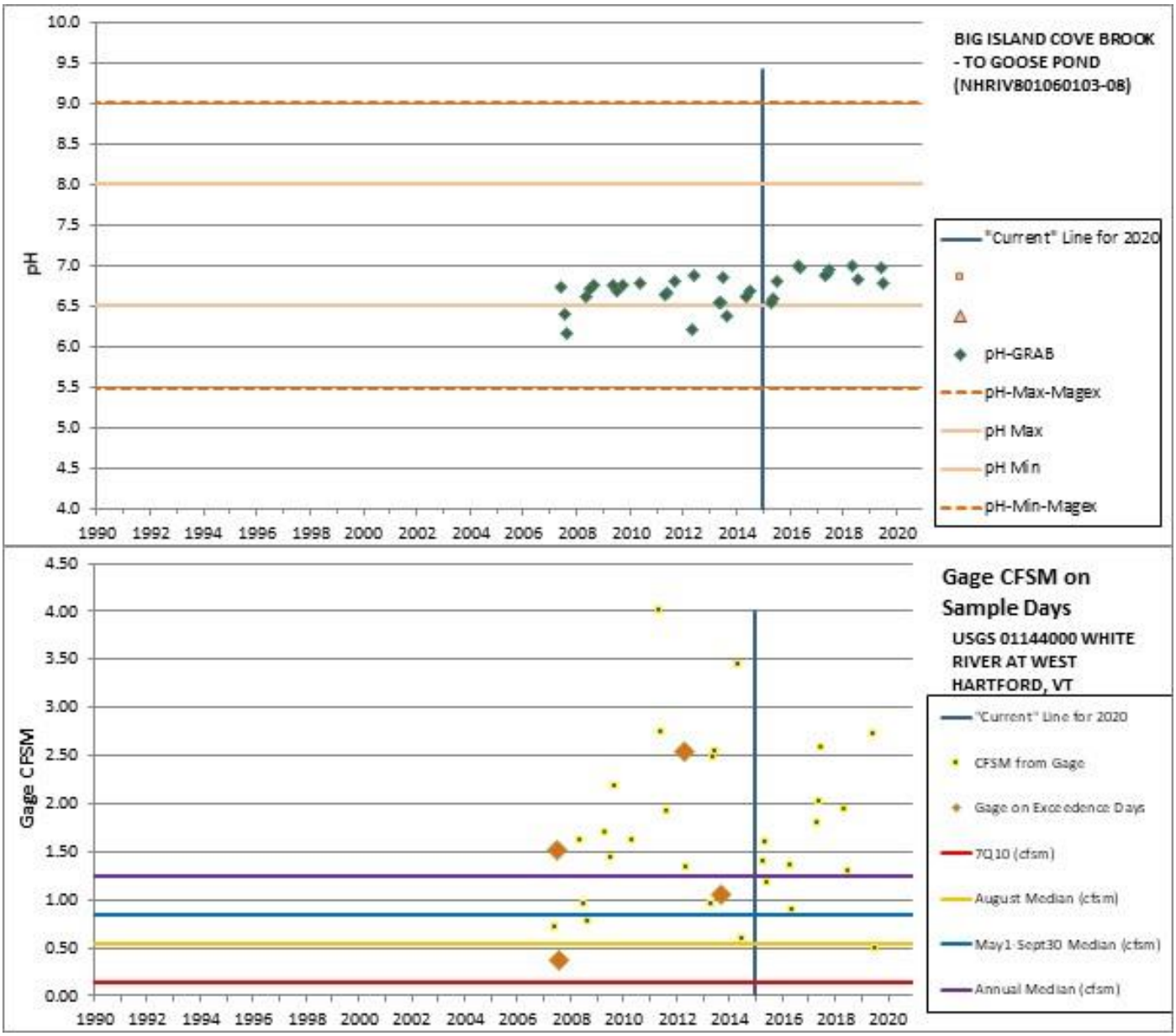

BEECH RIVER - UNNAMED BROOK (NHRIV600020701-02)
pH
"Current" Line for 2020
pH-GRAB
pH-Max-Magex
pH Max
pH Min
pH-Min-Magex
Gage CFSM on Sample Days
USGS 01064801 BEARCAMP RIVER AT SOUTH TAMWORTH, NH
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)

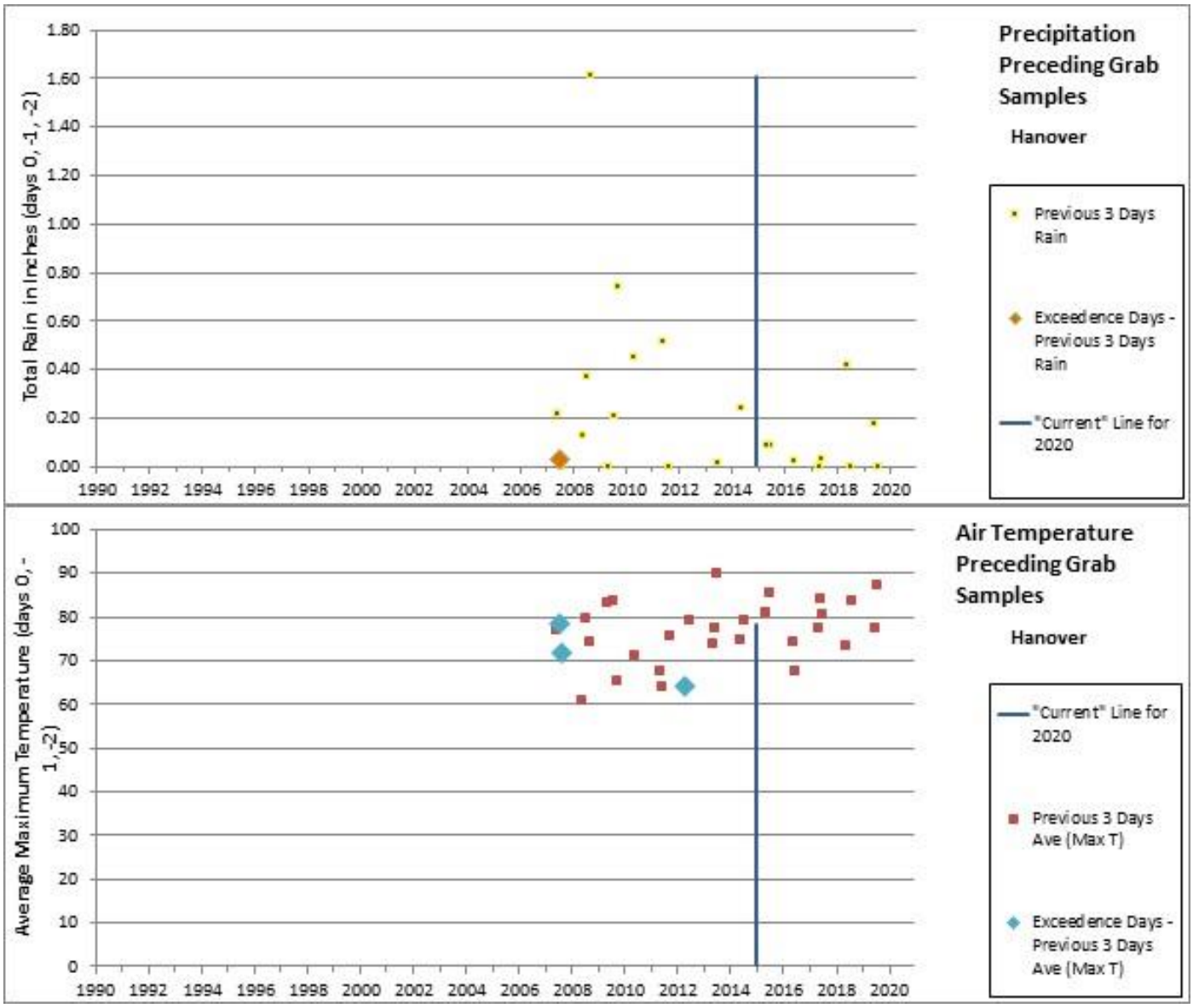


BIG ISLAND COVE BROOK – TO GOOSE POND (NHRIV801060103-08)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
Big Island Cove Brook – to Goose Pond	NHRIV801060103-08	pH	Canaan, Hanover	5-M	2-M

Big Island Cove Brook – to Goose Pond (NHRIV801060103-08) was originally impaired during the 2010 assessment cycle using data collected at station GOOCANBI. During the current assessment period (2015-2020) none of the twelve (0%) grab samples collected at station GOOCANBI were below the lower pH threshold of 6.5 or above the upper pH threshold of 8.0. Samples were collected during flows ranging from 0.5 to 2.72 cfsm at the White River gauge (01144000) and under variable weather conditions (0.0 to 1.60 inch 3-day rainfall total). The current data was collected at the same station and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of the Big Island Cove Brook – to Goose Pond in the 2020/2022 assessment cycle. The Big Island Cove Brook – to Goose Pond (NHRIV801060103-08) has been moved from 5-M to 2-M for pH for the aquatic life integrity designated use based on data collected in the current assessment period.

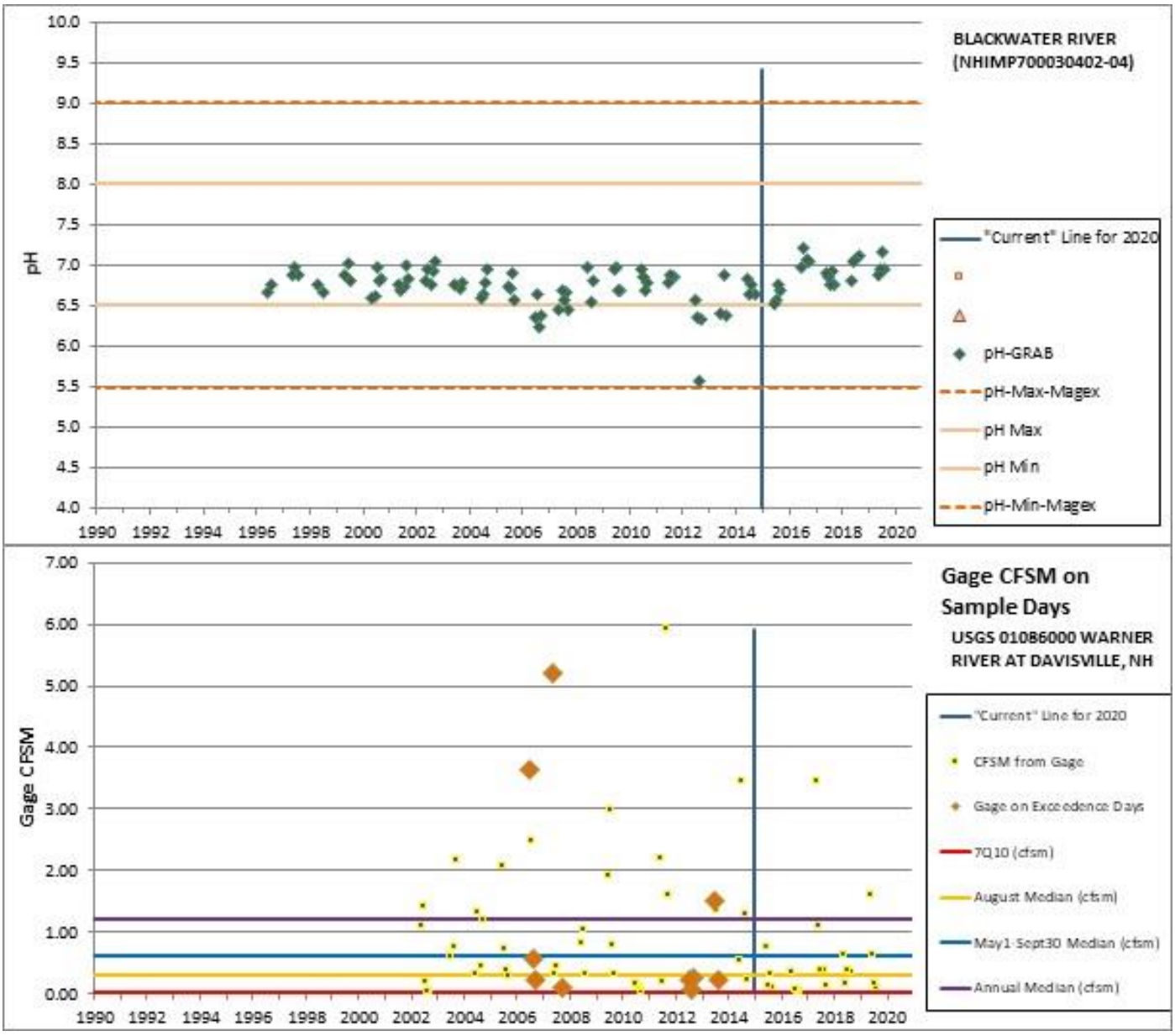

BIG ISLAND COVE BROOK - TO GOOSE POND (NHRIV801060103-08)
pH
"Current" Line for 2020
pH-GRAB
pH-Max-Magex
pH Max
pH Min
pH-Min-Magex
Gage CFSM on Sample Days
USGS 01144000 WHITE RIVER AT WEST HARTFORD, VT
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)

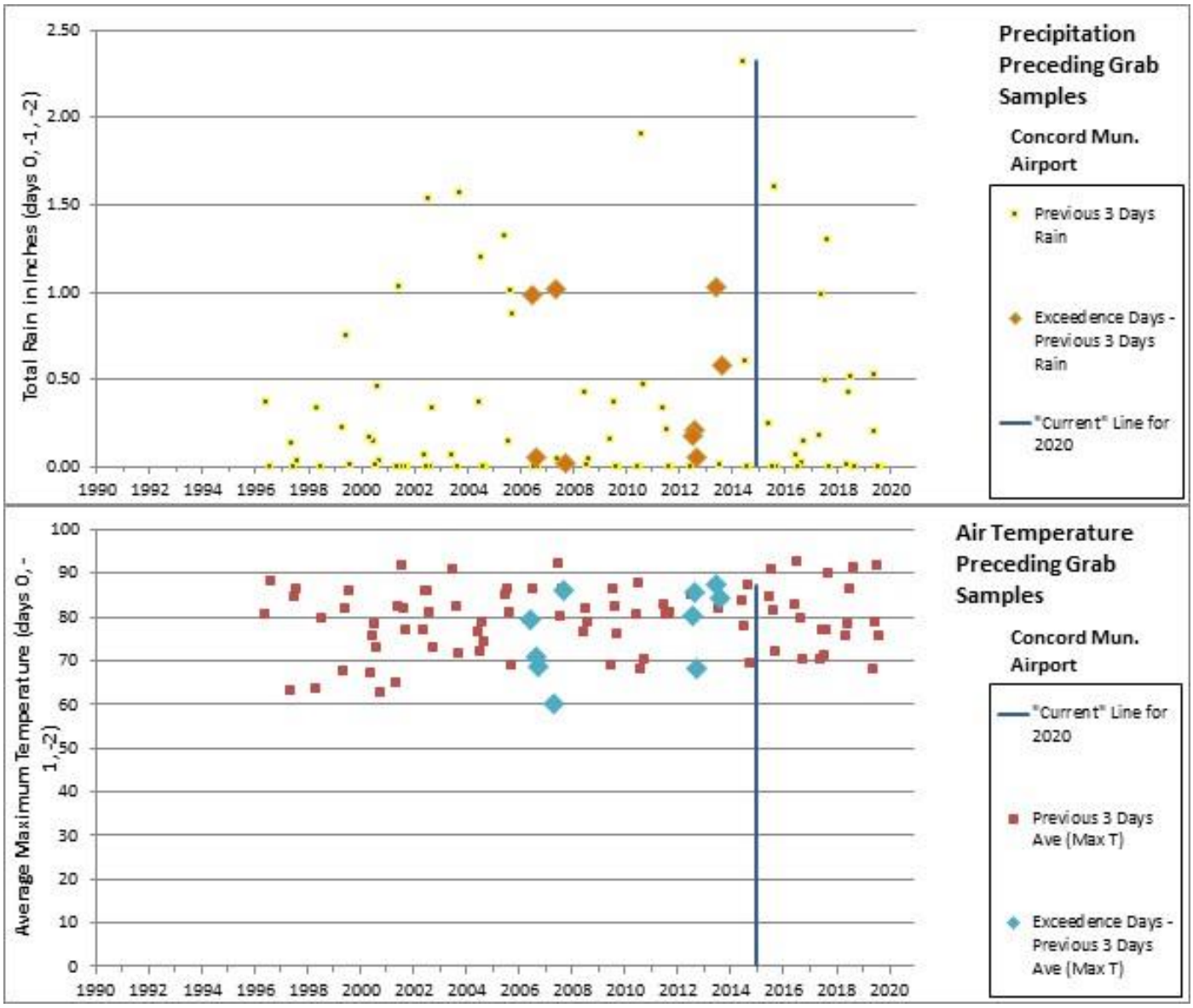


BLACKWATER RIVER (NHIMP700030402-04)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
BLACKWATER RIVER	NHIMP700030402-04	pH	NEW LONDON	5-M	2-G

The Blackwater River (NHIMP700030402-04) was originally impaired during the 2008 assessment cycle using data collected at station PLENWLPL1. Since 1990, 10 of 92 (10.9%) grab samples collected were below the lower pH threshold of 6.5. The low pH samples were collected at flows ranging from 0.09-5.22 cfsm on the Warner River gage (01086000) and varying weather conditions (three-day rainfall total of 0.00-1.03 inches). Of the 10 samples, 7 samples ranged from 6.35-6.46, which is very close to the 6.5 threshold. In the current assessment period (2015-2020), all of the grab samples (n=21) collected at station PLENWLPL1 were between the lower and upper pH criteria (6.5 and 8.0, respectively). The pH samples were collected between May and October at flows ranging from 0.04 to 3.48 cfsm on the Warner River gage (01086000) and varying weather conditions (three-day rainfall total of 0.00 – 1.60 inches). The current data was collected at the same station and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of Blackwater River in the 2020/2022 cycle. The Blackwater River (NHIMP700030402-04) has been moved from 5-M to 2-G for pH for the aquatic life integrity designated use based on data collected in the current assessment period.

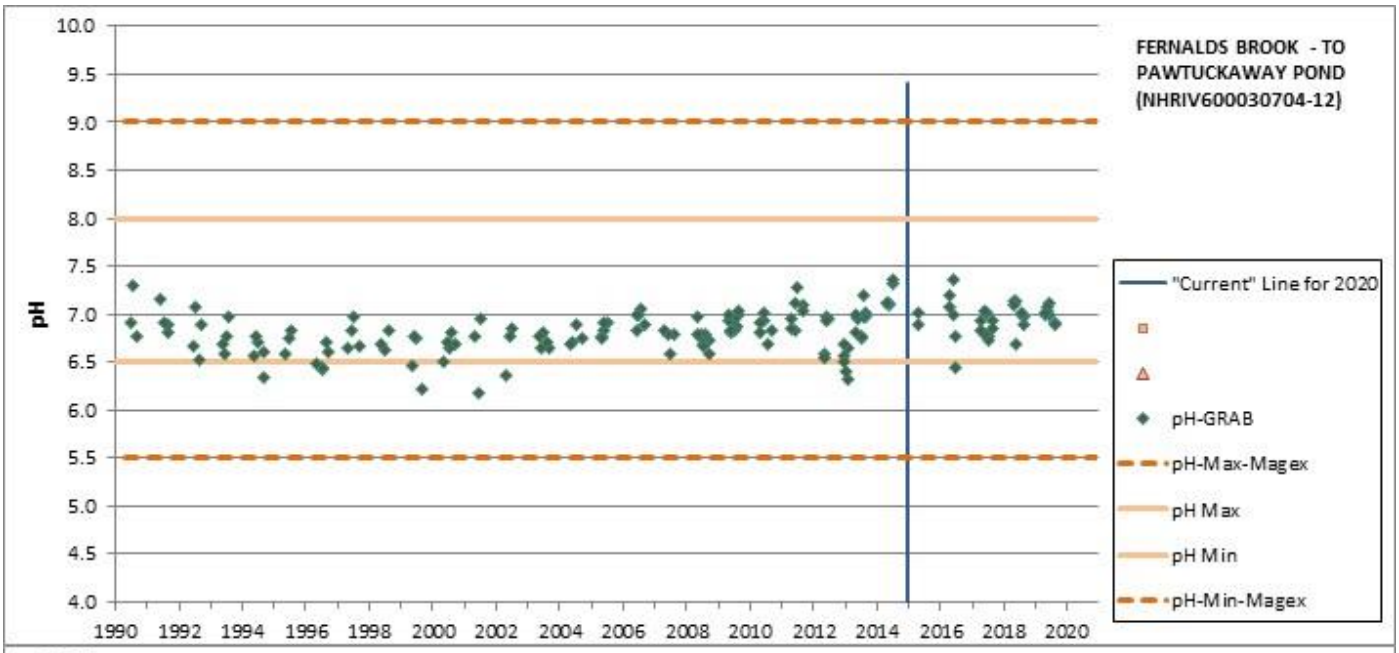

BLACKWATER RIVER
(NHIMP700030402-04)
pH
"Current" Line for 2020
pH-GRAB
pH-Max-Magex
pH Max
pH Min
pH-Min-Magex
Gage CFSM on Sample Days
USGS 01086000 WARNER RIVER AT DAVISVILLE, NH
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)

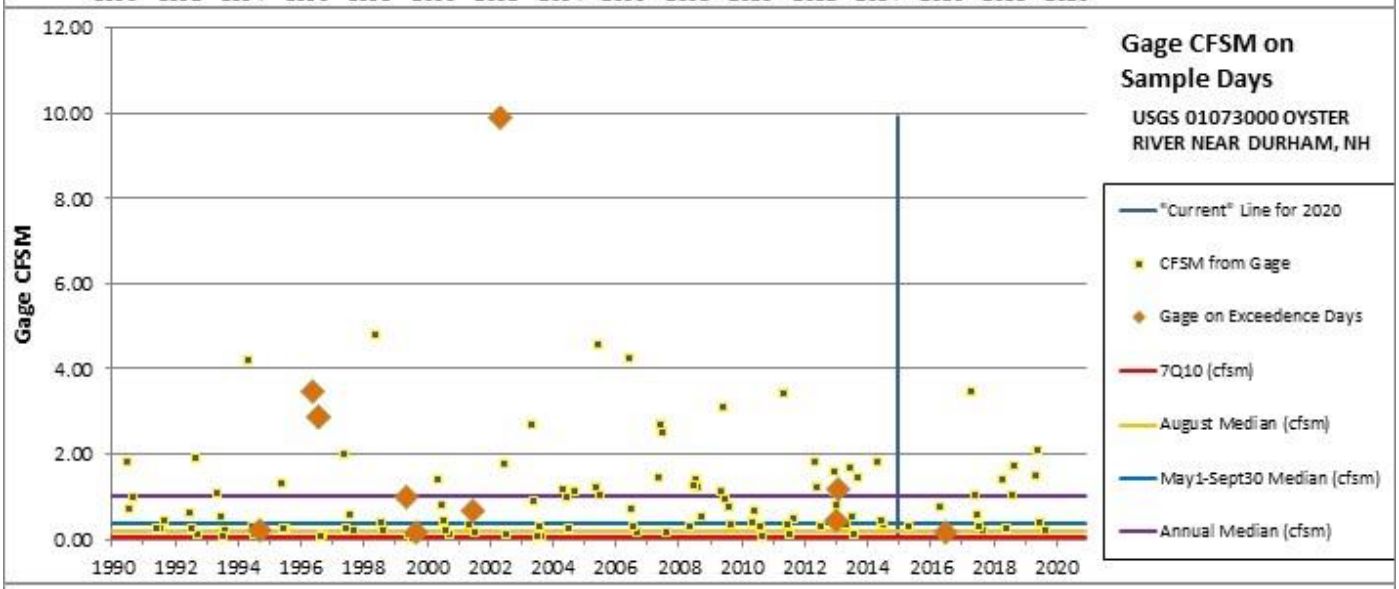


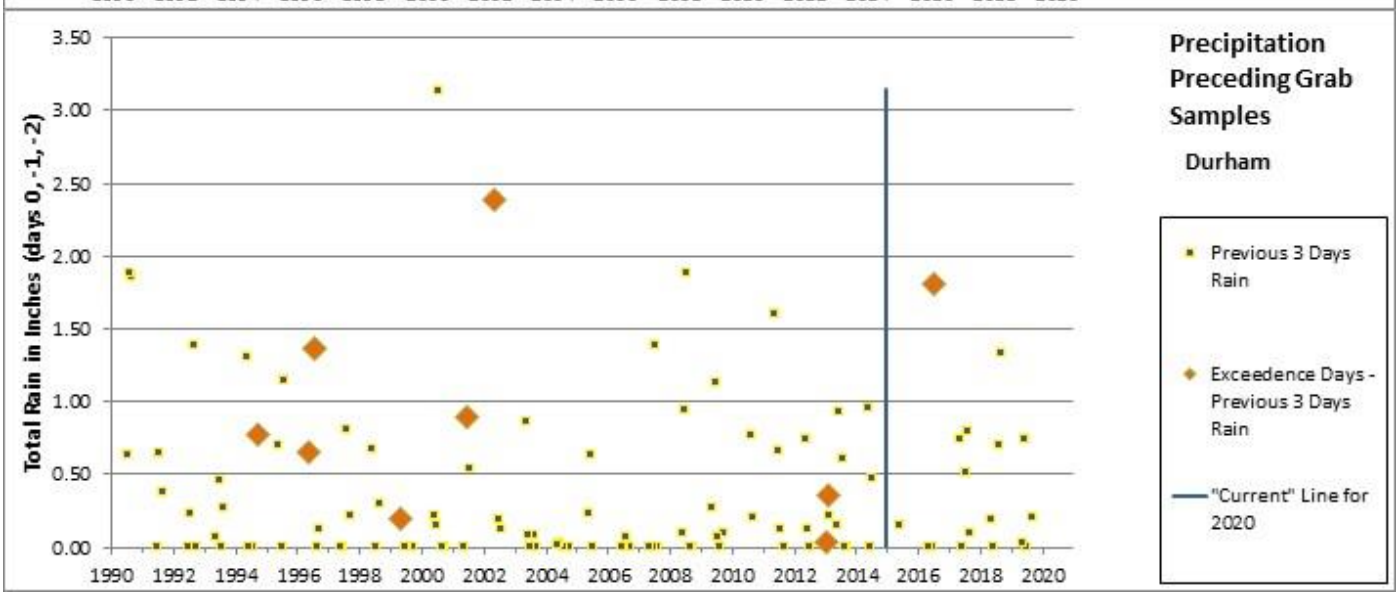
FERNALDS BROOK - TO PAWTUCKAWAY POND (NHRIV600030704-12)

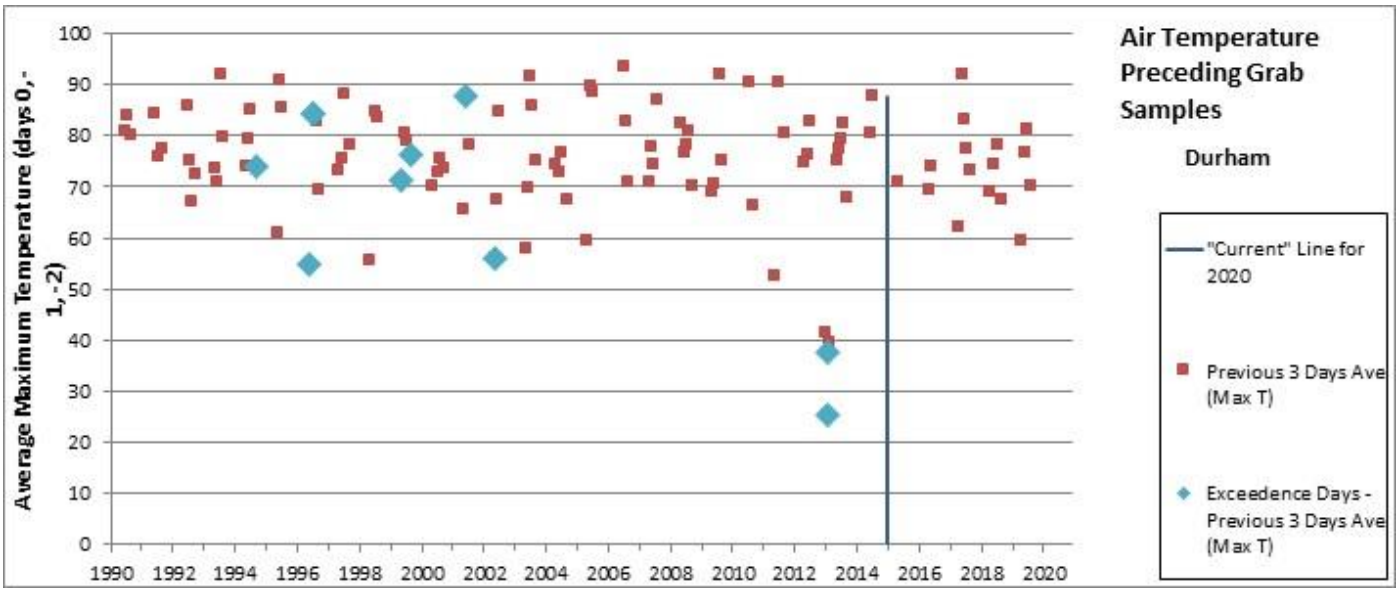
Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
FERNALDS BROOK - TO PAWTUCKAWAY POND	NHRIV600030704-12	pH	NOTTINGHAM	5-M	2-M

Fernalds Brook-To Pawtuckaway Pond (NHRIV600030704-12) was originally impaired during the 2004 assessment cycle using data collected at station PAWNOTF1 and PAWNOTF3. Since 1990, 11 of 166 (6.6%) grab samples collected were below the lower pH threshold of 6.5. The low pH samples were collected at flows ranging from 0.16-9.92 cfsm on the Oyster River gage (01073000) and varying weather conditions (three-day rainfall total of 0.00-2.39 inches). Of the 11 samples, 6 samples ranged from 6.41-6.48, which is very close to the 6.5 threshold. In the current assessment period (2015-2020), only 1 of 33 (3%) samples collected at station PAWNOTF1 was below the pH threshold of 6.5, although very close at 6.44. The 33 pH samples were collected at flows ranging from 0.21-3.45 cfsm on the Oyster River gage (01073000) and varying weather conditions (three-day rainfall total of 0.00 – 1.81 inches). The current data was collected at the same stations and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of Fernalds Brook-To Pawtuckaway Pond in the 2020/2022 cycle. The Fernalds Brook-To Pawtuckaway Pond (NHRIV600030704-12) has been moved from 5-M to 2-M for pH for the aquatic life integrity designated use based on data collected in the current assessment period.


FERNALDS BROOK - TO PAWTUCKAWAY POND (NHRIV600030704-12)
pH
"Current" Line for 2020
pH-GRAB
pH-Max-Magex
pH Max
pH Min
pH-Min-Magex


Gage CFSM on Sample Days
USGS 01073000 OYSTER RIVER NEAR DURHAM, NH
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)

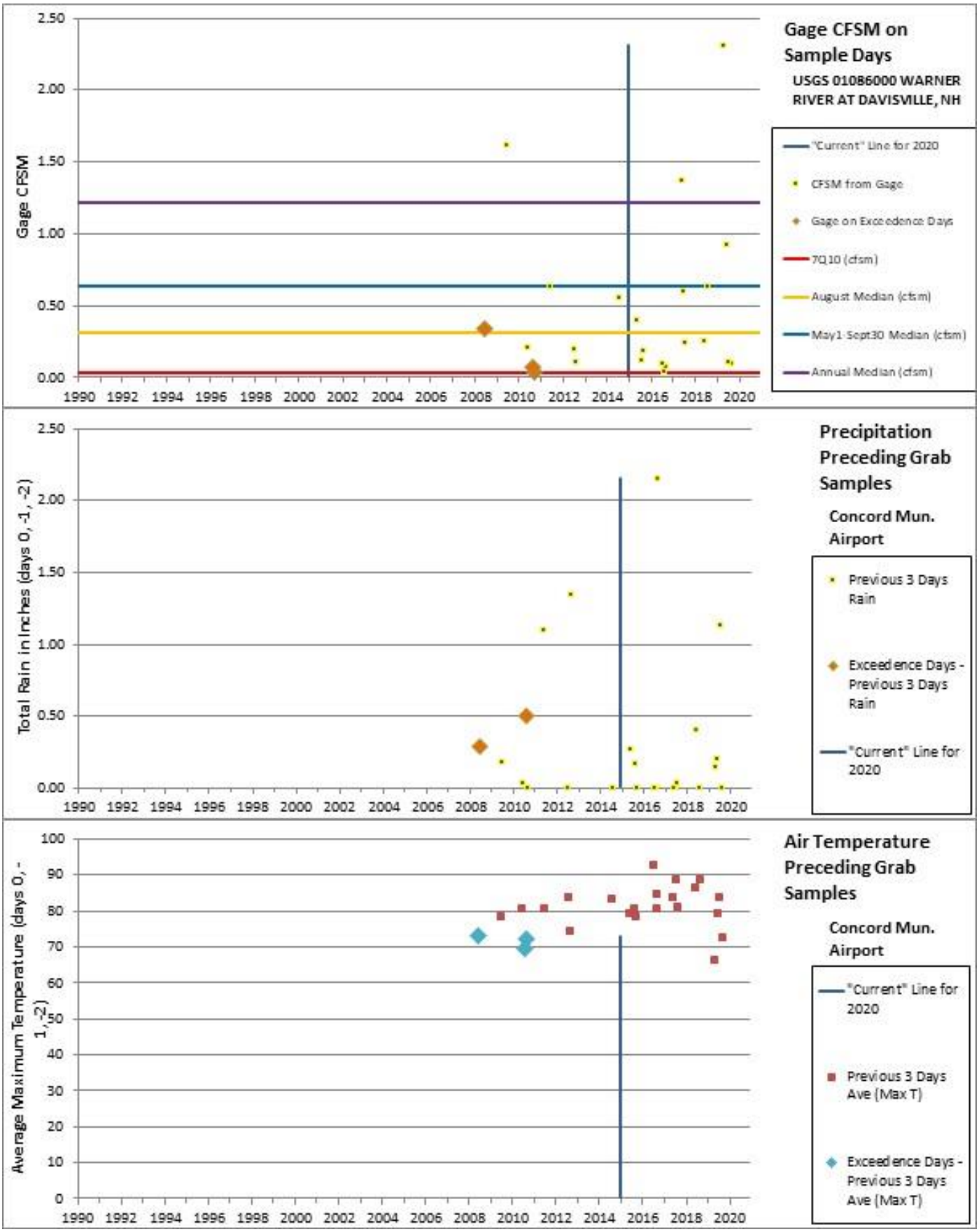

Precipitation Preceding Grab Samples
Durham
Total Rain in Inches (days 0, -1, -2)
Previous 3 Days Rain
Exceedence Days - Previous 3 Days Rain
"Current" Line for 2020



MESSER POND-NORTH INLET (NHRIV700030303-01)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
MESSER POND-NORTH INLET	NHRIV700030303-01	pH	NEW LONDON	5-M	2-G

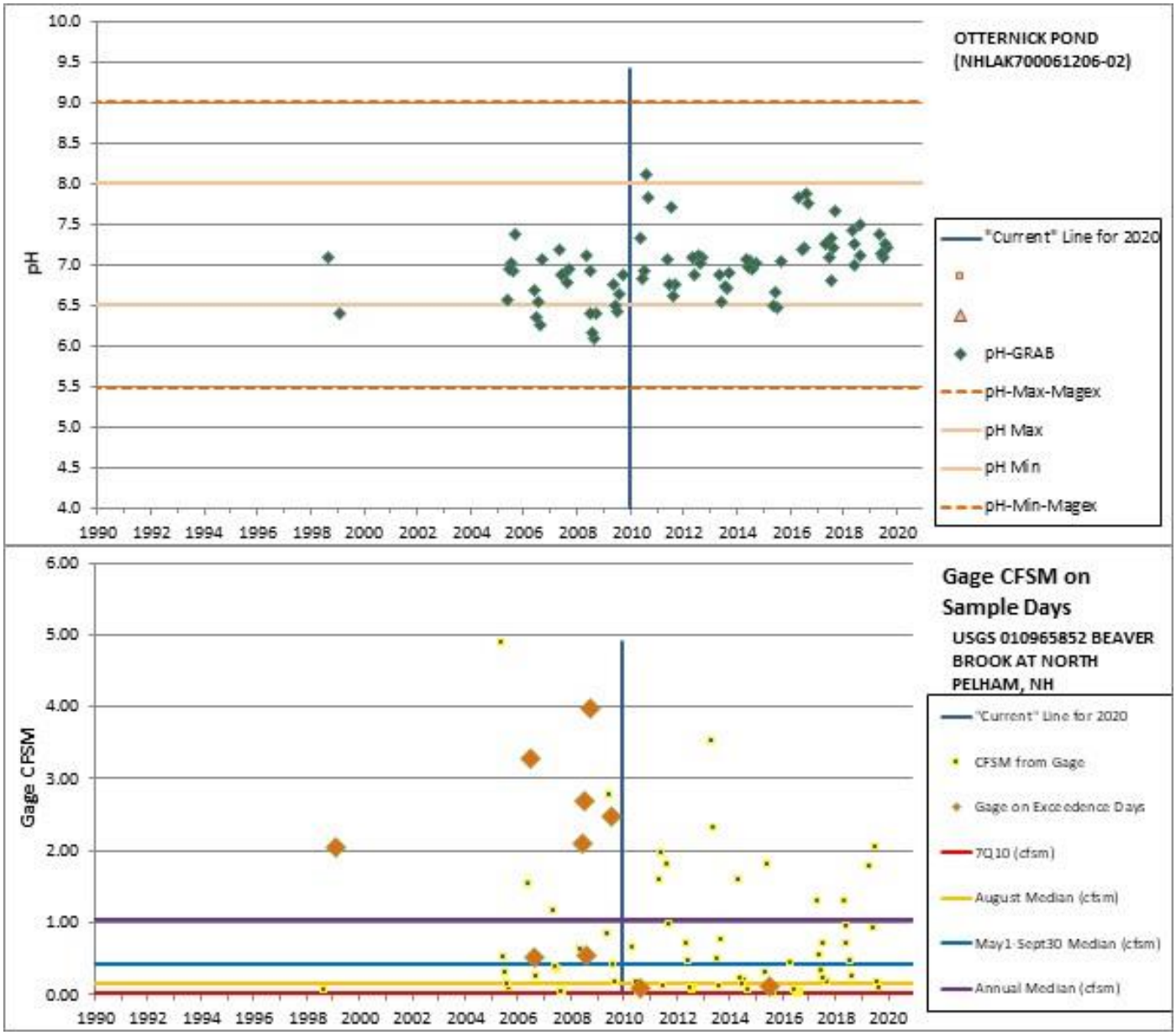
Messer Pond-North Inlet (NHRIV700030303-01) was originally impaired during the 2012 assessment cycle using data collected at station MESNWL2. Since 2008, 3 of 24 (12.5%) grab samples collected at MESNWL2 were below the lower pH threshold of 6.5. The low pH samples were collected at flows ranging from 0.04-0.34 cfsm on the Warner River gage (01086000) and varying weather conditions (three-day rainfall total of 0.00-0.50 inches). These 3 samples (6.36,6.43,6.43) were all close to the 6.5 threshold. In the current assessment period (2015-2020), all of the grab samples collected at station MESNWL2 (n=15) were within the lower and upper pH thresholds (6.5 and 8.0, respectively). The 15 pH samples were collected at flows ranging from 0.07-2.31 cfsm on the Warner River gage (01086000) and varying weather conditions (three-day rainfall total of 0.00 – 2.15 inches). The current data was collected at the same station and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of the Messer Pond-North Inlet in the 2020/2022 cycle. Messer Pond-North Inlet (NHRIV700030303-01) has been moved from 5-M to 2-G for pH for the aquatic life integrity designated use based on data collected in the current assessment period.

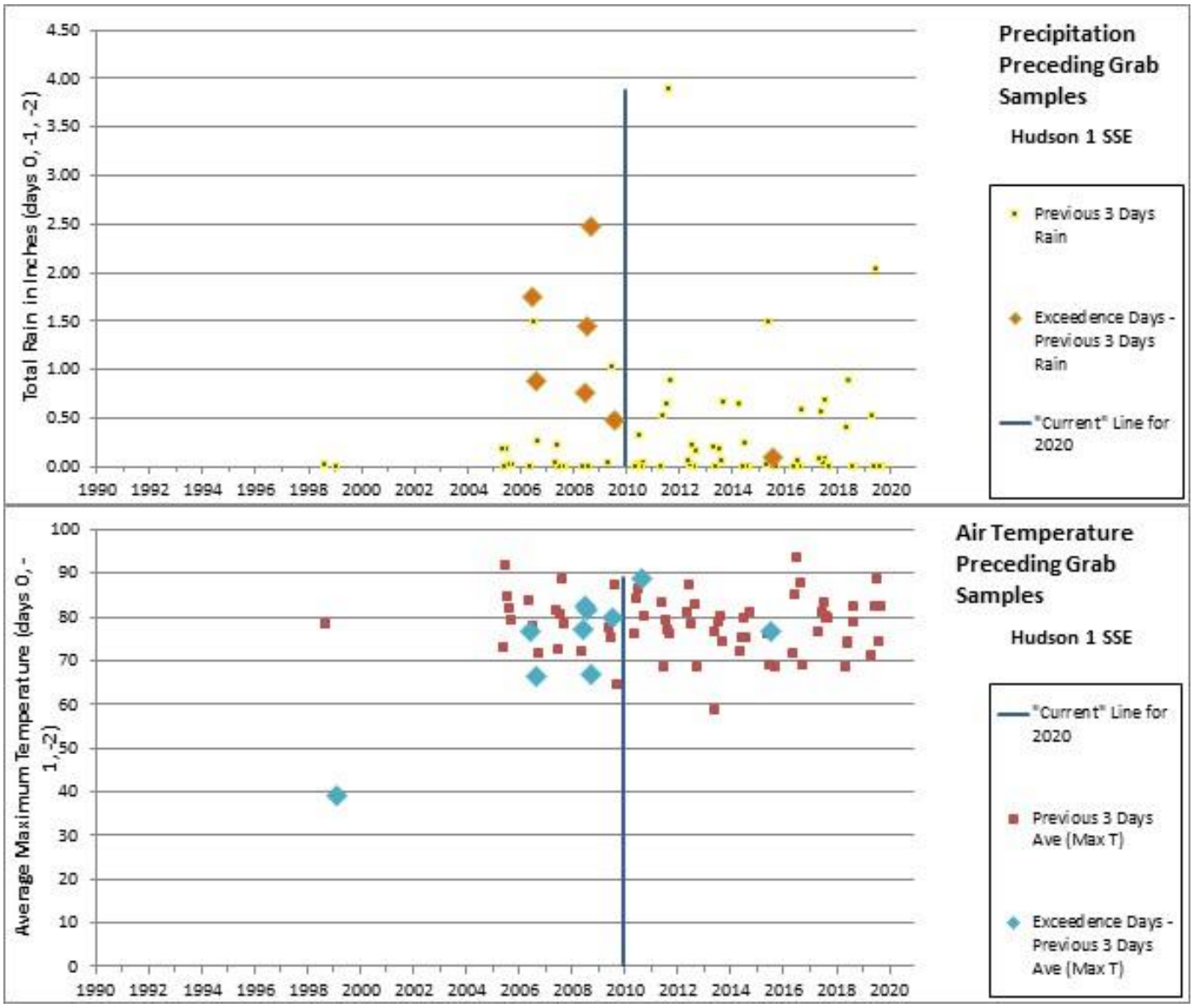

Gage CFSM on Sample Days
USGS 01086000 WARNER RIVER AT DAVISVILLE, NH
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)
Precipitation Preceding Grab Samples
Concord Mun. Airport
Total Rain in Inches (days 0, -1, -2)
Previous 3 Days Rain
Exceedence Days - Previous 3 Days Rain
"Current" Line for 2020
Air Temperature Preceding Grab Samples
Concord Mun. Airport
Average Maximum Temperature (days 0, -1, -2)
"Current" Line for 2020
Previous 3 Days Ave (Max T)
Exceedence Days - Previous 3 Days Ave (Max T)

OTTERNICK POND (NHLAK700061206-02)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
OTTERNICK POND	NHLAK700061206-02	pH	HUDSON	5-M	2-M

Otternick Pond (NHLAK700061206-02) was originally implemented during the 2010 assessment cycle using data collected at station OTTHUDD. Since 1990, 10 of 78 (12.8%) grab samples collected were not within the lower and upper pH thresholds (6.5 and 8.0, respectively). Of the 10 samples, 5 samples ranged from 6.40-6.47, which is very close to the 6.5 threshold. The remaining low pH samples were collected at flows ranging from 0.09-3.97 cfsm on the Beaver Brook gage (010965852) and varying weather conditions (three-day rainfall total of 0.00-2.47). In the current assessment period (2010-2020), only 1 of 50 grab samples was below the lower pH criterial, although very close at 6.47. The pH samples collected during this assessment period were collected at flows ranging from 0.01-3.54 cfsm on the Beaver Brook gage (010965852) and varying weather conditions (three-day rainfall total of 0.00 – 3.88 inches). The current data was collected at the same station and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of Otternick Pond. Otternick Pond (NHLAK700061206-02) has been moved from 5-M to 2-M for pH for the aquatic life integrity designated use based on data collected in the current assessment period. It should be noted that this is a delisting that is tied to an assessment unit that falls within EPA's 2017 MS4 General Permit Area.

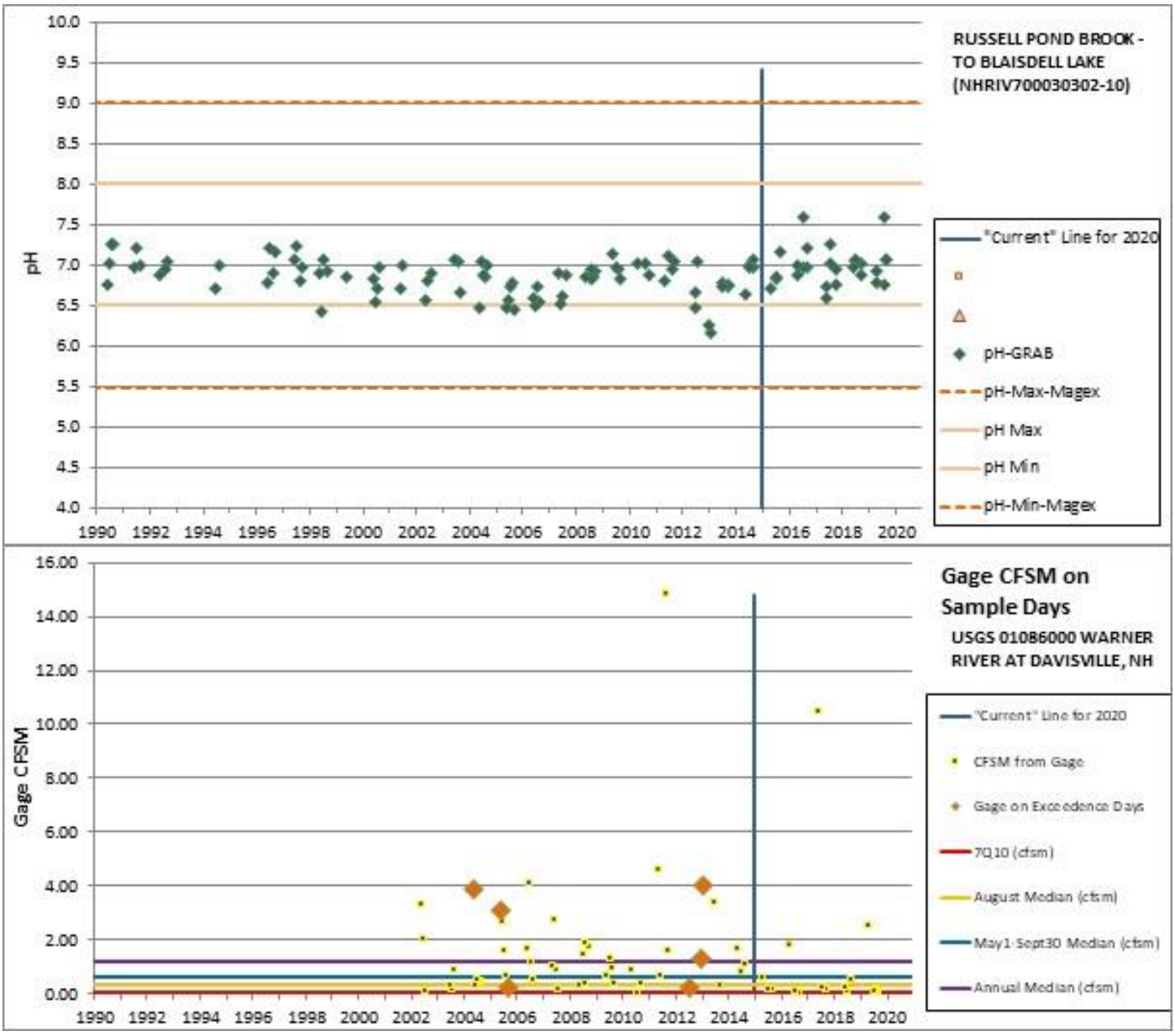


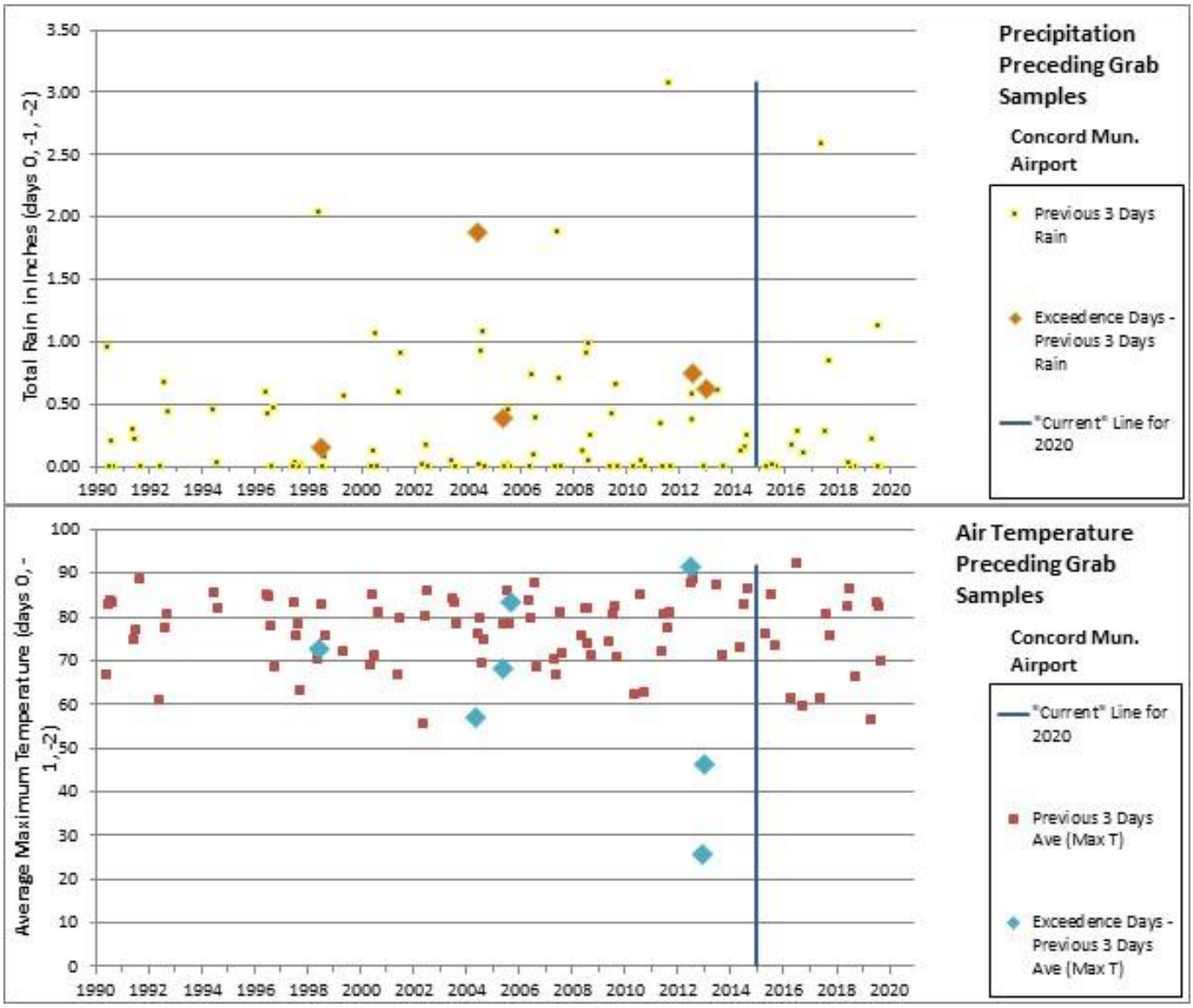


RUSSELL POND BROOK - TO BLAISDELL LAKE (NHRIV700030302-10)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
RUSSELL POND BROOK - TO BLAISDELL LAKE	NHRIV700030302-10	pH	SUTTON	5-M	2-G

The Russell Pond Brook-To Blaisdell Lake (NHRIV700030302-10) was originally impaired during the 2006 assessment cycle using data collected at station BLASUTR. Since 1990, 7 of 112 (6.3%) grab samples collected at BLASUTR and BLASUTRP were below the lower pH threshold of 6.5. The low pH samples were collected at flows ranging from 0.22-4.01 cfsm on the Warner River gage (01086000) and varying weather conditions (three-day rainfall total of 0.00-1.88 inches). Of the 7 samples, 5 samples ranged from 6.42-6.48, which is very close to the 6.5 threshold. In the current assessment period (2015-2020), all of the grab samples collected at station BLASUTR (n=15) and BLASUTRP (n=12) were within the lower and upper pH threshold (6.5 and 8.0, respectively). The pH samples at BLASUTR were collected at flows ranging from 0.05-10.48 cfsm on the Warner River gage (01086000) and varying weather conditions (three-day rainfall total of 0.00 – 2.59 inches). The current data was collected at the same station (with additional data at a nearby station) and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of the Russel Pond Brook- To Blaisell Lake in the 2020/2022 cycle. Russell Pond Brook-To Blaisdell Lake (NHRIV700030302-10) has been moved from 5-M to 2-G for pH for the aquatic life integrity designated use based on data collected in the current assessment period.


RUSSELL POND BROOK - TO BLAISDELL LAKE (NHRIV700030302-10)
pH
"Current" Line for 2020
pH-GRAB
pH-Max-Magex
pH Max
pH Min
pH-Min-Magex
Gage CFSM on Sample Days
USGS 01086000 WARNER RIVER AT DAVISVILLE, NH
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)

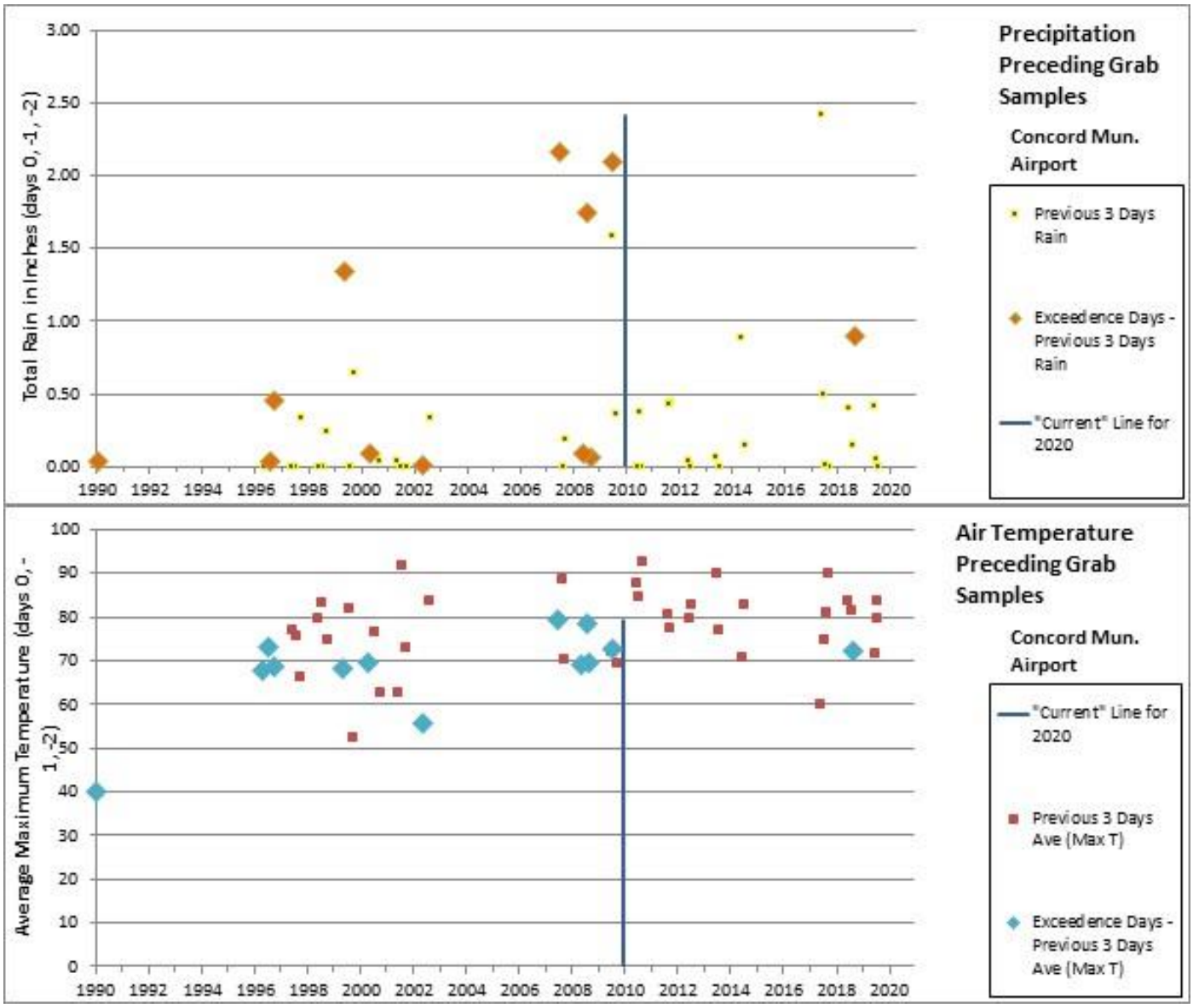


TURREE POND (NHLAK700060301-01)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
TURREE POND	NHLAK700060301-01	pH	BOW	5-M	2-M

Turree Pond (NHLAK700060301-01) was originally impaired during the 2010 assessment cycle using data collected at station TURBOWD. Since 1990, 13 of 51 (25.5%) grab samples collected were below the lower pH threshold of 6.5. The low pH samples were collected at flows ranging from 0.18-4.68 cfsm on the Soucook River gage (01089100) and varying weather conditions (three-day rainfall total of 0.00-2.16 inches). Of the 13 samples, 7 samples ranged from 6.41-6.49, which is very close to the 6.5 threshold. In the current assessment period (2010-2020), only 1 of 21 (4.8%) grab samples were below the lower pH criteria, although only slightly below at 6.49. The pH samples collected during this assessment period were collected at the same station and under similar hydrological and meteorological conditions to those that drove the initial impairment, with flows ranging from 0.11 to 3.10 cfsm on the Soucook River gage (01089100) and three-day rainfall total of 0.00 – 2.41 inches. This new additional data collected during similar conditions supports the delisting of Turree Pond for the 2020/2022 cycle. Turree Pond (NHLAK700060301-01) has been moved from 5-M to 2-M for pH for the aquatic life integrity designated use based on data collected in the current assessment period.

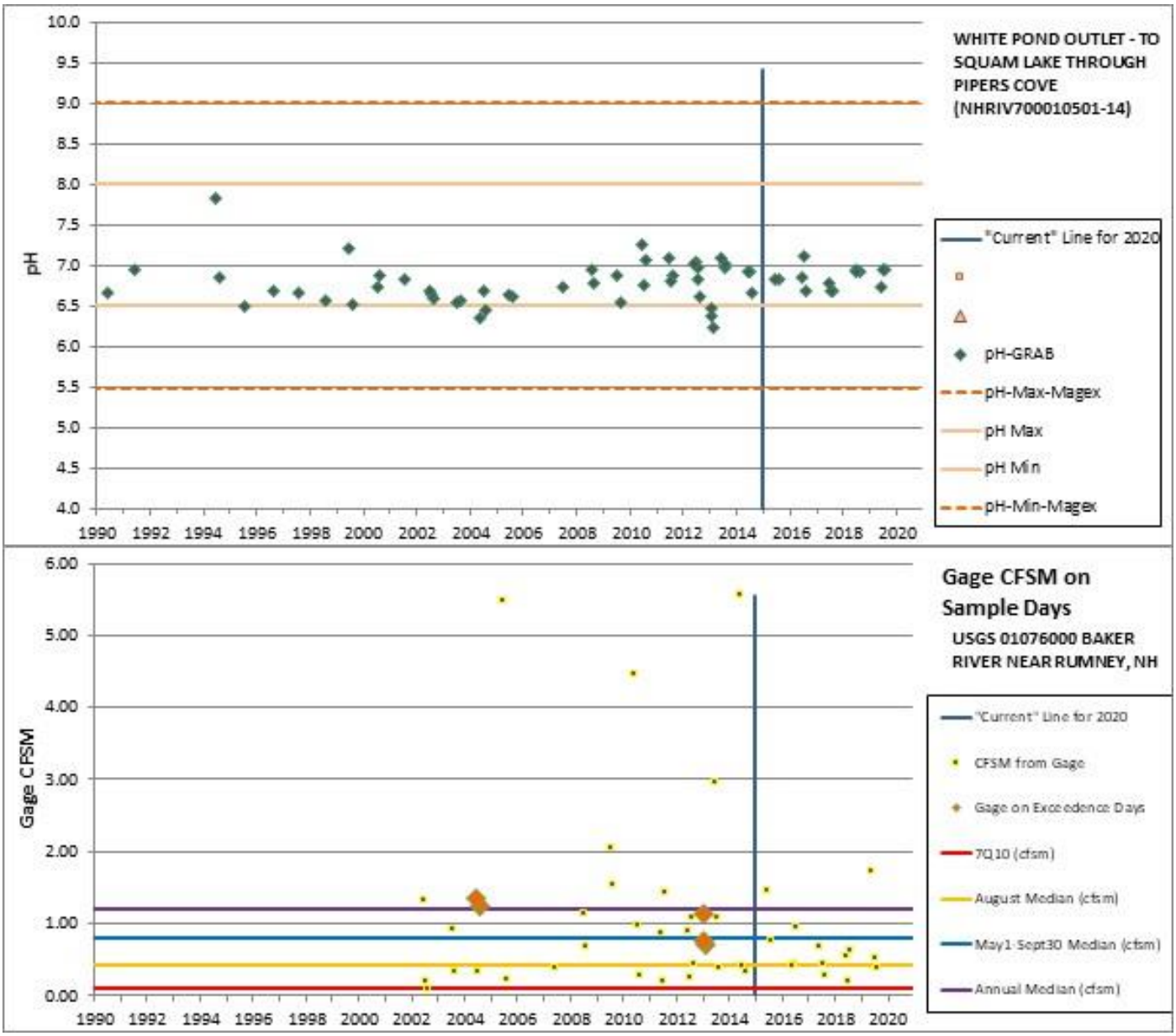

TUREE POND
(NHLAK700060301-01)
pH
"Current" Line for 2020
pH-GRAB
pH-Max-Magex
pH Max
pH Min
pH-Min-Magex
Gage CFSM on Sample Days
USGS 01089100 SOUCOOK RIVER, AT PEMBROKE ROAD, NEAR CONCORD, NH
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)

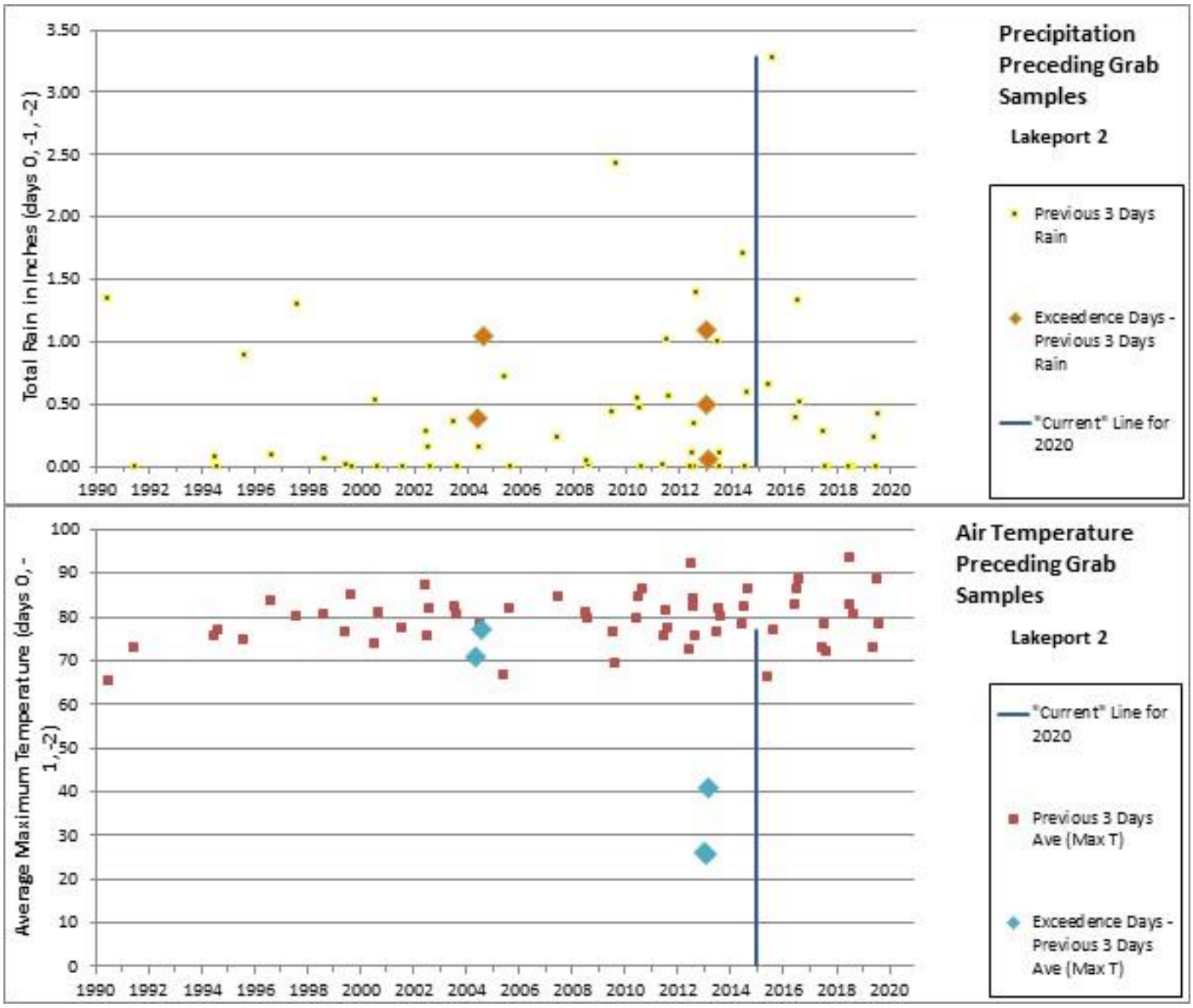


WHITE POND OUTLET - TO SQUAM LAKE THROUGH PIPERS COVE (NHRIV700010501-14)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
WHITE POND OUTLET - TO SQUAM LAKE THROUGH PIPERS COVE	NHRIV700010501-14	pH	HOLDERNESS	5-M	2-G

White Pond Outlet - To Squam Lake Through Pipers Cove (NHRIV700010501-14) was originally impaired during the 2012 assessment cycle using data collected at station WHIHOL4. Since 1990, 5 of 62 (8.1%) grab samples collected at WHIHOL4 were below the lower pH threshold of 6.5. The low pH samples were collected at flows ranging from 0.70-1.35 cfsm on the Baker River gage (01076000) and varying weather conditions (three-day rainfall total of 0.06-1.10 inches). Of the 5 samples, 3 samples range from 6.39-6.48, which is very close to the 6.5 threshold. In the current assessment period (2015-2020), all of the grab samples collected at stations WHIHOL4 (n=14) were within the lower and upper pH thresholds (6.5 and 8.0, respectively). These pH samples were collected at flows ranging from 0.20-1.73 on the Baker River gage (01076000) and varying weather conditions (three-day rainfall total of 0.00 – 3.28 inches). The current data was collected at the same station and under similar hydrological and meteorological conditions as those that drove the initial impairment, which supports the delisting of White Pond Outlet in the 2020/2022 cycle. White Pond Outlet - To Squam Lake Through Pipers Cove (NHRIV700010501-14) has been moved from 5-M to 2-G for pH for the aquatic life integrity designated use based on data collected in the current assessment period.


WHITE POND OUTLET - TO SQUAM LAKE THROUGH PIPERS COVE (NHRIV700010501-14)
pH
"Current" Line for 2020
pH-GRAB
pH-Max-Magex
pH Max
pH Min
pH-Min-Magex
Gage CFSM on Sample Days
USGS 01076000 BAKER RIVER NEAR RUMNEY, NH
Gage CFSM
"Current" Line for 2020
CFSM from Gage
Gage on Exceedence Days
7Q10 (cfsm)
August Median (cfsm)
May1-Sept30 Median (cfsm)
Annual Median (cfsm)



WEBSTER STREAM - LOCKE LAKE (NHIMP700060402-02)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Town(s) - Primary Town Listed First	2018	2020/2022
WEBSTER STREAM - LOCKE LAKE	NHIMP700060402-02	pH	BARNSTEAD	5-M	4A-M

On September 29, 2020 EPA approved the Total Maximum Daily Load for Phosphorus for Locke Lake, Barnstead, NH. The purpose of the TMDL is to address impairments of the aquatic life integrity designated use due to total phosphorus, chlorophyll-a, pH and for the primary contact recreation designated use due to cyanobacteria hepatotoxic microcystins. These impairments were due to atmospheric deposition, internal loading, septic systems (within 125 feet of the pond), waterfowl and watershed loads. The TMDL will result in attainment of surface water quality criteria and thresholds for total phosphorus, chlorophyll-a, dissolved oxygen, as well as cyanobacteria. A copy of the EPA TMDL approval letter and additional detail documents may be found in NHDES' TMDL Webpage. Since the TMDL has been approved by EPA, Webster Stream - Locke Lake (NHIMP700060402-02) has been moved from 5-M to 4A-M for Cyanobacteria hepatotoxic microcystins for the aquatic life integrity designated use.

Macroinvertebrates for Aquatic Life Integrity

AMEY BROOK (NHRIV700030502-10)

Assessment Unit Name	Assessment Unit ID	Parameter Name	Primary Town	2018	2020/2022
AMEY BROOK	NHRIV700030502-10	Benthic-Macroinvertebrate Bioassessments (Streams)	HENNIKER	5-P	2-G

Two invertebrate samples collected (1998 and 2018). B-IBI ratio less than 1.0 in 1998 and greater than 1.0 in 2018. B-IBI ratios (NH B-IBI/ 90% threshold) greater than 1.0 indicate the invertebrate community meets or exceeds the narrative aquatic life use water quality criteria. The B-IBI ratio in 2018 was 1.23, meeting the 2-G category. Poor B-IBI score in 1998 a result of water quality violations from an adjacent crushed stone/concrete operation that was directly discharging turbid water and silt/sediment to Amey Brook. Site inspection details/photos can be found with the site information from 1999. The owner at that time hired an engineering firm to come into compliance. During site visits in 2018, no indication of recent water quality violations were present. Documentation in the NHDES Alteration of Terrain file (permit WPS-5833-A, dated Dec. 6, 2001) outlined corrective measures eliminating water quality violations from the crushed stone/ concrete operation occurred in 1999 and 2000. Amey Brook (NHRIV700030502-10) has been delisted from 5-P to 2-G for Benthic-Macroinvertebrate Bioassessments (Streams) for the aquatic life integrity designated use based on data collected in the current assessment period.

Waterbody	Station ID	Activity ID	Collection Date	B-IBI Score	B-IBI Threshold (90%)	B-IBI Ratio (B-IBI score /90%Threshold)
Amey Brook	03-AMY	BEN-03-AMY-01	14-Sep-18	68.67	55.53	1.24
Amey Brook	03-AMY	BEN99M-51	28-Sep-99	51.07	55.53	0.92

STATE OF NEW HAMPSHIRE

Technical Support Document for the Great Bay Estuary Aquatic Life Integrity Designated Use Assessments, 2020/2022 305(b) Report/303(d) List

February 18, 2022

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Technical Support Document for the Great Bay Estuary Aquatic Life Integrity Designated Use Assessments, 2020/2022 305(b) Report/303(d) List

STATE OF NEW HAMPSHIRE
DEPARTMENT OF ENVIRONMENTAL SERVICES
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CONCORD, N.H. 03301

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February 18, 2022

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Introduction

The Federal Water Pollution Control Act [PL92-500, commonly called the Clean Water Act (CWA)], as last reauthorized by the Water Quality Act of 1987, requires each state to submit two surface water quality documents to the U.S. Environmental Protection Agency (USEPA) every two years. Section 305(b) of the CWA requires submittal of a report (commonly called the "305(b) Report") that describes the quality of its surface waters and an analysis of the extent to which all such waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water. The second document, typically called the "303(d) List," which is required by Section 303(d) of the CWA, includes surface waters that are:

1. Impaired or threatened by a pollutant or pollutant(s).
2. Not expected to meet water quality standards within a reasonable time even after application of best available technology standards for point sources or best management practices for nonpoint sources.
3. Require the development and implementation of a comprehensive water quality study (i.e., called a Total Maximum Daily Load or TMDL study) that is designed to meet water quality standards.

In accordance with these requirements, the New Hampshire Department of Environmental Services (NHDES) assesses all available data for freshwaters and marine waters every two years to determine compliance with the Surface Water Quality Regulations, Env-Wq 1700 *et sq*. The assessments determine whether or not water quality supports specific designated uses. Designated uses are the desirable uses that surface waters should support such as swimming (i.e., Primary Contact Recreation) and Aquatic Life use. The full list of designated uses considered by NHDES is:

- Aquatic Life Integrity: Waters that support aquatic life, including a balanced, integrated, and adaptive community of organisms having a species composition, diversity and functional organization comparable to that of similar natural habitats of the region.
- Fish Consumption: Waters that support a population of fish free from toxicants and pathogens that could pose a human health risk to consumers.
- Shellfish Consumption: Waters that support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers.
- Potential Drinking Water Supply: Waters that could be suitable for human intake and meet State and federal drinking water requirements after adequate treatment.
- Swimming and Other Recreation In and On the Water: Waters that are suitable for swimming, wading, boating of all types, fishing, surfing, and similar activities.
    - Primary Contact Recreation (i.e. swimming): Waters suitable for recreational uses that require or are likely to result in full body contact and/or incidental ingestion of water.
    - Secondary Contact Recreation (i.e. boating): Waters that support recreational uses that involve minor contact with the water.
- Wildlife: Waters that provide habitat capable of supporting any life stage or activity of undomesticated fauna on a regular or periodic basis.

The Great Bay estuary constitutes approximately 86% (by area) of all New Hampshire estuaries. The Great Bay estuary is a valuable resource to the State and nation, and, as such, has been designated by USEPA as an "estuary of national significance" under Section 320 of the CWA. The 2013 State of the Estuaries Report (SOOE) for the estuary (PREP, State of Our Estuaries, 2013) showed that the Great Bay

estuary has all the classic signs of eutrophication: increasing nitrogen concentrations, low dissolved oxygen and disappearing eelgrass habitat. The 2018 report (PREP, 2018) that followed found that the estuaries are declining due to stress from human activities as well as natural processes influenced by human activities. These symptoms of eutrophication have the potential to impair the Aquatic Life Integrity designated use, which would be a violation of the State water quality standards for nutrients (Env-Wq 1703.14) and biological and aquatic community integrity (Env-Wq 1703.19):

> Env-Wq 1703.14
> (b) Class B waters shall contain no phosphorus or nitrogen in such concentrations that would impair any existing or designated uses, unless naturally occurring.
>
> Env-Wq 1703.19
> (a) The surface waters shall support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.
> (b) Differences from naturally occurring conditions shall be limited to non-detrimental differences in community structure and function.

Given the complexity of the Great Bay estuary and the inherent challenges in assessing it, this technical support document (TSD) is meant to provide additional information about how the water quality status of each of the 19 assessment zone was determined. Specifically, this document addresses the water quality data used to determine if the estuary meets the Aquatic Life designated use.

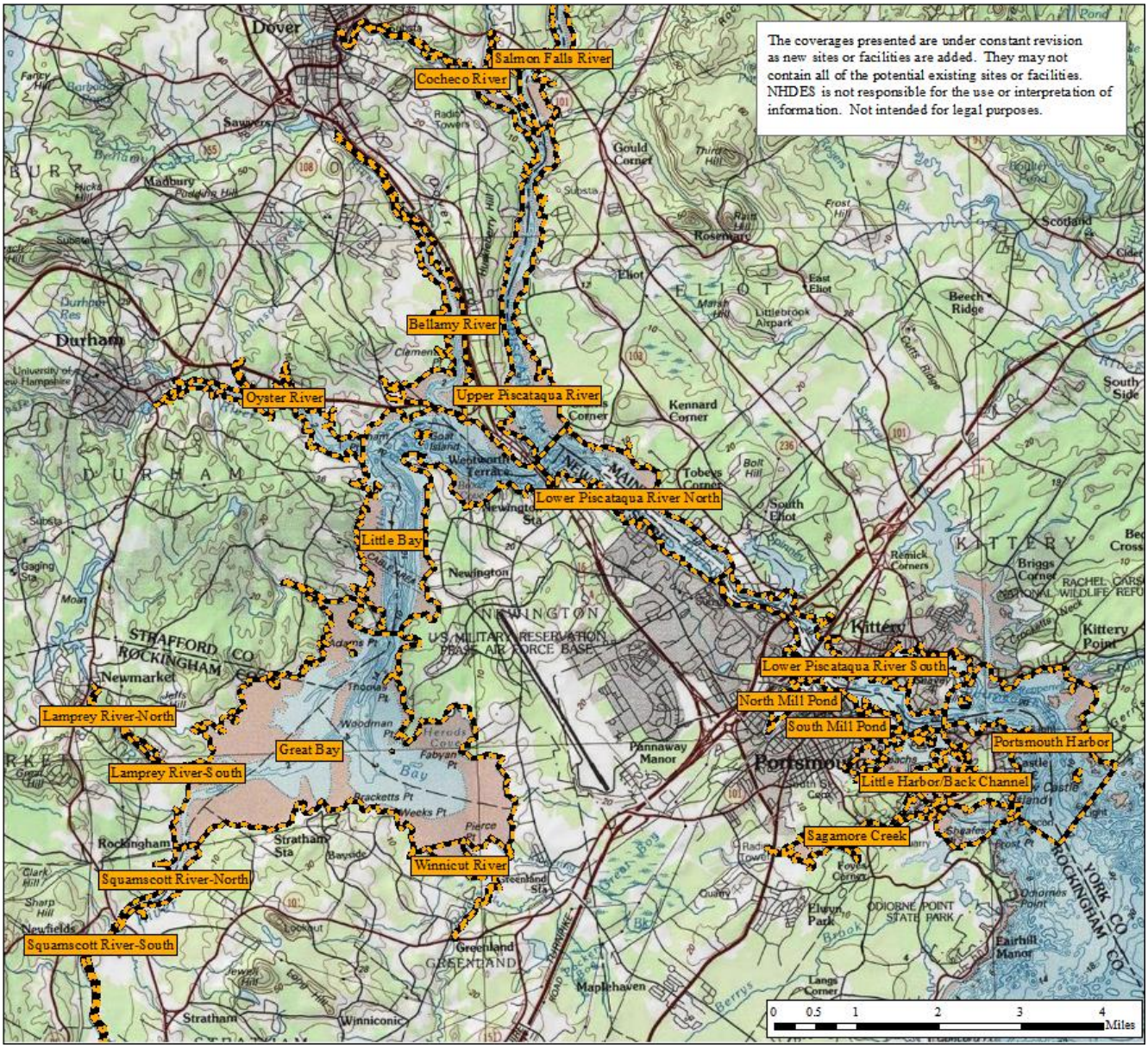
On January 17, 2020 NHDES withdrew from further consideration the following assessment zones, and their respective parameters, from the 2018 303(d) list: Little Bay, Bellamy River, Upper Piscataqua River, Portsmouth Harbor, Little Harbor/Back Channel and Great Bay assessment zones (NHDES, January 17, 2020). As such, for those assessment zones, the 2020/2022 assessment represents and update to the 2016 surface water quality assessments.

Estuary Assessment Zones

For 305(b)/303(d) assessments, NHDES uses 43 assessment units to cover the Great Bay estuary that are coincident with the shellfish growing areas established by the NHDES Shellfish Program. Great Bay itself consists of seven different assessment units. Nitrogen and eutrophication parameters are logically evaluated utilizing data from larger aggregates of assessment units covering contiguous areas. Eutrophication effects are less localized than the bacteria pollution sources that affect shellfish harvesting. Therefore, NHDES aggregated the 43 assessment units in the Great Bay estuary into 19 assessment zones. The boundaries of each of the aggregated assessment zones are shown in Figure 1. For the purposes of 305(b)/303(d) reporting, the categories assigned to these larger assessment zones will be assigned to each of the assessment units comprising the assessment zone. For the Salmon Falls/Piscataqua River, the assessment zones cover both the New Hampshire and Maine sides of the main stem of the river in order to select data from both sides of the river. The river is well-mixed and data from both sides of the State-line are needed to provide a comprehensive dataset for assessments.

However, the impairment determinations made by NHDES only apply to the New Hampshire side of the river. The Maine Department of Environmental Protection makes its own assessment determinations for the Maine side of the Salmon Falls/Piscataqua River. No changes have been made to the composition or locations of assessment zones between the 2016-2018 and 2020/2022 reporting cycles.

Figure 1. Great Bay estuary assessment zones for the 2020/2022 305(b)/303(d) aquatic life integrity designated use assessments.



Eelgrass Mapping

In 2013, eelgrass was mapped in the Great Bay estuary using two different sets of aerial imagery. As has been done since 1996, UNH (Dr. Fred Short) mapped eelgrass using low-altitude, oblique aerial

photographs, while in 2013, 2016, 2017, and 2019, Seth Barker used high resolution vertical aerial imagery collected by Cornerstone Energy Services (formerly Kappa Mapping Inc.). Eelgrass extent was independently mapped using both sets of imagery in 2013. These concurrent datasets were obtained as a way to evaluate each of the methodologies. For assessment purposes, NHDES took an average of the eelgrass mapped by UNH and Cornerstone/Barker in the years where both mappers produced datasets. Eelgrass was not mapped in 2018. As such, 2016, 2017 and 2019 were used to calculate recent the 3-year median for historic acreage comparisons.

Water Quality Data

The NHDES Environmental Monitoring Database (EMD) is a publically accessible database containing field observations, measurements and laboratory samples for various public, private and volunteer programs. It was developed in March 2003 and became available on the web in June 2004. Data sets are continuously being added and updated. Datasets from the EMD are the foundation of the water quality assessments. The procedures below describe the processes that were undertaken to compile and synthesize the comprehensive dataset from the EMD for the Aquatic Life designated use assessment of the Great Bay estuary described in this document.

1. The base dataset that is considered "current" data for the 2020/2022 assessments are the measurements collected on or after January 1, 2014, that were incorporated in the NHDES Environmental Monitoring Database (EMD) by January 10, 2020. For nutrients and most estuarine samples this generally meant data collected through the end of 2018. To enhance the ability to look across cycles and into more historic data the Supplemental Assessment Database (SADB) minimum date age was set to January 1, 1990.
2. The data were pulled from the EMD into the SADB by an automated query. Some of the conditions on the query were:
   a. Results marked as invalid were carried forward but marked as not to be used in the final summaries.
   b. Results marked as Below Detection Limits (BDL) were assigned a value of one-half the Method Detection Limit (MDL). There are two limited cases of high detection limits where this was not followed as to not introduce bias; 1) where ammonia samples were BDL and the MDL was greater than or equal to 200 µg/L, and 2) where total Kjeldahl nitrogen samples were BDL and the MDL was greater than or equal to 500 µg/L. [Also note: Regarding BDLs, in the nutrient criteria report, NHDES used the MDL for BDLs. In the bulk query, the adjusted value is reported as 1/2 the MDL. PREP has used 1/2 MDL for BDLs for trends in "modern" datasets. Therefore, for the 2020/2022 assessments, NHDES will apply the 1/2 MDL approach for consistency across datasets.]
   c. Quality assurance samples were excluded. This condition removed field duplicate samples. [Note: QA samples: In the nutrient criteria report, NHDES averaged field duplicate results. In the bulk data pull for the 305(b)/303(d) assessment, field duplicates were excluded to have consistency between eutrophication assessment methods and other DES assessments methods. PREP had included replicates in the past but as of 2014 the TAC decided to not include QA samples to be

consistent across datasets. Therefore, since the 2012 assessments, NHDES has excluded QA replicate samples for consistency.]

Assessment Zone Data Summaries

Plot Legend and Summary Table Abbreviations

In the assessment zone summaries that follow, all available data from January 1, 2000, to January 10, 2020, are displayed in the data plots for context (except eelgrass cover which is plotted back to 1990 along with all available light attenuation data). Summary statistics in the data tables cover the period from January 1, 2014, to January 10, 2020. For nutrients and most estuarine samples this generally meant data collected through 2018. The legend for a given attribute only contains text for those parameters that have data available since the year 2000. The full comparison codes for the samples are predominantly those from the SADB and were used within the legend of the graphs and tables for brevity. The descriptions for those codes are provided below. For total nitrogen, total suspended solids and light attenuation coefficient, in cases where multiple samples were collected on a single day from a given station, those samples were averaged for the day for use in the plots and data tables. For chlorophyll-a the highest concentration for a day is used.

- Chlorophyll-a
    - CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN - The majority of the chlorophyll-a in the marine environment has been processed with the correction for pheophytin.
    - CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN – In a few cases samples the chlorophyll-a in the marine environment has been processed without the correction for pheophytin.
    - CHLOROPHYLL A, combined – In those cases where both corrected and uncorrected chlorophyll-a have been collected, the statistics for the combined measurements are provided.
    - Annual 90th Percentile (n>=5) – Plots only.
    - Daily 10th/90th Percentile - Devalidated Logger data – Plots only.
- Dissolved Oxygen Concentration
    - DO-PPM-24HR-MIN-CP = 24-hour minimum dissolved oxygen concentration from a datalogger deployed during the summer critical period.
    - DO-PPM-24HR-MIN-NCP = 24-hour minimum dissolved oxygen concentration from a datalogger not deployed during the summer critical period.
    - DO-PPM-GRAB-CP = Grab samples of dissolved oxygen concentration during the summer critical period.
    - DO-PPM-GRAB-NCP = Grab samples of dissolved oxygen concentration during the summer critical period.
- Dissolved Oxygen Percent Saturation
    - DO-PERC-24H-MEAN-CP = 24-hour average dissolved oxygen percent saturation from a datalogger deployed during the summer critical period.

  - DO-PERC-24H-MEAN-NCP = 24-hour average dissolved oxygen percent saturation from a datalogger not deployed during the summer critical period.
  - DO-PERC-2TIDE-GRAB-CP = The average to two grab samples for dissolved oxygen percent saturation, one at high tide and one at low tide of a single day, during the summer critical period.
  - DO-PERC-2TIDE-GRAB-NCP = The average to two grab samples for dissolved oxygen percent saturation, one at high tide and one at low tide of a single day, not during the summer critical period.
  - DO-PERC-GRAB (% sat) = Dissolved oxygen percent saturation grab samples not used in a high tide-low tide average.
- Total Suspended Solids (TSS)
  - TSS – Total Suspended Solids
  - Annual Median (n>=5) – Plots only
- Light Attenuation Coefficient (Water Clarity)
  - Light Attenuation Coefficient – A measurement of the light attenuation coefficient, Kd.
  - Annual Median (n>=5) – Plots only
- Eelgrass and Light Attenuation Coefficient (Water Clarity)
  - Eelgrass cover acres – Plots only
  - Light Attenuation Coefficient – A measurement of the light attenuation coefficient, Kd.
  - Annual Median Light Attenuation Coefficient (n>=5) – Plots only
- Nitrogen – Graphics within this document plot the primary measure of total productivity within the system, total nitrogen (TN), while the tables provide the statistics for TN and individual fractions of nitrogen. In most cases, there was one sample collected at a given station per day. Where multiple samples were collected at a particular station on a single day, those samples for multiple times and/or depths were averaged and then processed as described in the sections above.
  - Day Ave of TN – Total Nitrogen

    If multiple values of TN are available for the same date / time / station, the hierarchy is 1 over 2 over 3.

    1. If total dissolved nitrogen and particulate nitrogen were measured, sum these two values.
    2. If TN was measured directly, use that value.
    3. If total Kjeldahl nitrogen and nitrate+nitrite were measured, sum these two values.
  - Annual Median (n>=5) – Plots only
  - Annual Median (n<5) – Plots only
  - Day Ave of TDN – Total Dissolved Nitrogen
  - Day Ave of DIN (NH3 + NO2/3) – Dissolved Inorganic Nitrogen
  - Day Ave of NH3 - Ammonia
  - Day Ave of PON – Particulate Organic Nitrogen
  - Day Ave of NO2/3 – Nitrite/Nitrate

- Turbidity (data tables only) – While both grab samples and datalogger records exist for turbidity, daily statistics make up 98% of the record. As such, the table provides summary statistics on the two data types (grab samples and daily medians) as a single group.
- Colored Dissolved Organic Matter (CDOM) (data tables only) – Summary statistics are provided based on the currently available CDOM data.
- Salinity (data tables only)
    - Grab Samples
    - Datalogger Daily Median
- Plot Reference Lines
    - "Current" Line for 2020/2022 - Per the methodology outlined in the CALM, all data to the right of this referenced data are considered "current." Available older data are provided for context and are needed for that historic context if newer data indicates improved conditions. See the 2020/2022 CALM for addition details.
    - Chl-a Ind. (90^{th} percentile) – This is the reference line for the chlorophyll-a indicator. The 90^{th} percentile (10 µg/L) of the assessment zone dataset is compared to this chlorophyll-a threshold indicator described in the CALM.
    - DO mg/L Std. – This is the 5 mg/L reference line for the dissolved oxygen criteria.
    - DO mg/L Ind MAGEX – This is the 4.5 mg/L reference line for the dissolved oxygen magnitude of exceedance indicator described in the CALM.
    - DO % Sat Std. – This is the 24-hour average 75 percent reference line for the dissolved oxygen percent saturation criteria.
    - DO % Sat Ind. MAGEX – This is the 24-hour average 65% reference line for the dissolved oxygen percent saturation magnitude of exceedance indicator described in the CALM.
    - Survival Min. Ind. (median) – This is the light attenuation coefficient threshold that corresponds to the minimum light needed for eelgrass to survive at the restoration depth set for a given assessment zone. The median of the assessment zone dataset is compared to this light attenuation coefficient threshold indicator as described in the CALM.

Aquatic Life Integrity Designated Use Assessment Summary Table

Comparison of the Final 2016 and Final 2018 (based on assessment zone) to the 2020/2022 assessment of eutrophication parameters for the Aquatic Life designated use in the Great Bay Estuary assessment zones. Assessment category definitions are provided in sections 3.1.3 and 3.1.5 of the 2020/2022 CALM.

De-impairment | New Impairment

Assessment Zone	Cycle	Chlorophyll-a	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat)	Estuarine Bioassessments (eelgrass)	Water Clarity (Light Attenuation Coefficient, Kd)	Total Nitrogen
Squamscott River South	2018	5-P	5-P	5-M	No Std	No Std	5-P
	2020/2022	5-P	5-P	5-P	No Std	No Std	5-P
Squamscott River North	2018	5-P	5-P	5-M	5-P	5-P	5-P
	2020/2022	5-P	5-P	5-M	5-P	5-P	5-P
Lamprey River North	2018	5-M	5-P	5-P	No Std	No Std	5-M
	2020/2022	5-M	5-P	5-P	No Std	No Std	5-M
Lamprey River South	2018	5-M	2-G	3-ND	5-P	5-P	5-M
	2020/2022	5-M	3-PNS	3-PNS	5-P	5-P	5-M
Winnicut River	2018	3-ND	3-ND	3-ND	5-P	3-ND	3-ND
	2020/2022	3-ND	3-ND	3-ND	5-P	3-ND	3-ND
Great Bay	*2016*	3-PNS	3-PNS	2-M	5-P	5-M	3-PNS
	2020/2022	5-M	3-PNS	2-M	5-P	5-M	5-M
Oyster River	2018	2-M	5-P	5-P	5-P	5-P	5-P
	2020/2022	5-M	5-P	5-P	5-P	5-P	5-M
Bellamy River	*2016*	3-ND	3-ND	3-ND	5-P	3-ND	3-ND
	2020/2022	5-M	5-P	2-M	5-P	5-P	5-P
Little Bay	*2016*	3-PNS	2-G	2-G	5-P	5-M	3-PNS
	2020/2022	3-PNS	2-G	2-G	5-P	5-M	3-PNS
Cocheco River	2018	5-P	5-M	2-M	No Std	No Std	5-M
	2020/2022	5-P	5-M	3-PAS	No Std	No Std	5-M
Salmon Falls River	2018	5-P	5-P	5-M	No Std	No Std	5-M
	2020/2022	5-P	5-P	5-M	No Std	No Std	5-M
Upper Piscataqua River	*2016*	2-M	3-PNS	2-G	5-P	5-P	3-PNS
	2020/2022	2-M	2-M	2-M	5-P	5-M	3-PNS
Lower Piscataqua River - North	2018	2-G	2-G	3-PAS	5-P	3-PNS	3-PAS
	2020/2022	3-PAS	2-G	2-G	5-P	3-ND	3-PAS
Lower Piscataqua River - South	2018	2-G	2-G	3-PAS	5-P	3-PAS	3-PAS
	2020/2022	3-PAS	2-G	2-G	5-P	3-ND	3-PAS
North Mill Pond	2018	3-ND	3-ND	3-ND	3-ND	3-ND	3-ND
	2020/2022	3-ND	3-ND	3-ND	3-ND	3-ND	3-ND
South Mill Pond	2018	3-ND	3-ND	3-ND	3-PAS	3-ND	3-ND
	2020/2022	3-ND	3-ND	3-ND	3-PAS	3-ND	3-ND
Portsmouth Harbor	*2016*	2-G	2-G	3-PAS	5-P	5-M	2-M
	2020/2022	2-G	2-G	2-G	5-P	5-M	2-M
Sagamore Creek	2018	3-ND	5-M	3-PNS	5-P	3-ND	3-ND
	2020/2022	5-P	5-P	2-M	5-P	3-ND	5-M

Assessment Zone	Cycle	Chlorophyll-a	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat)	Estuarine Bioassessments (eelgrass)	Water Clarity (Light Attenuation Coefficient, Kd)	Total Nitrogen
Little Harbor/Back Channel	2016	3-ND	2-M	3-ND	5-P	5-M	3-ND
	2020/2022	3-PAS	3-PAS	3-ND	5-M	5-M	3-ND

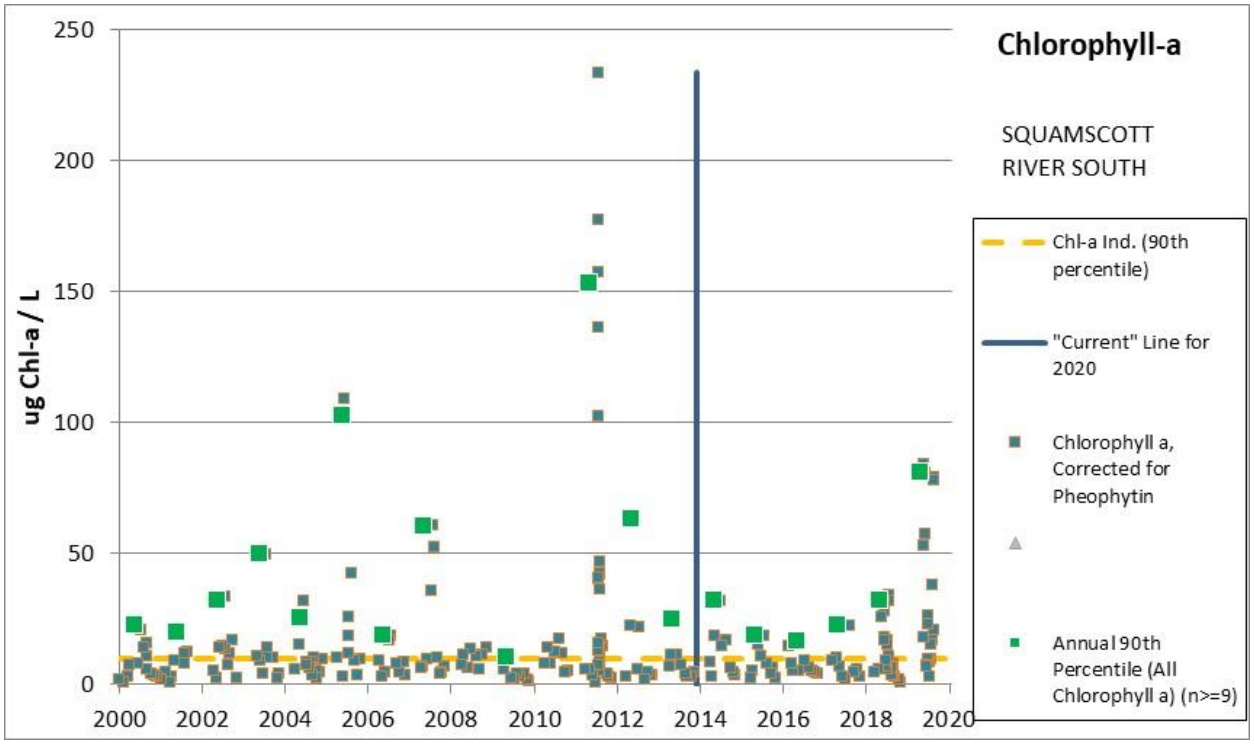
Assessment Zone = SQUAMSCOTT RIVER SOUTH

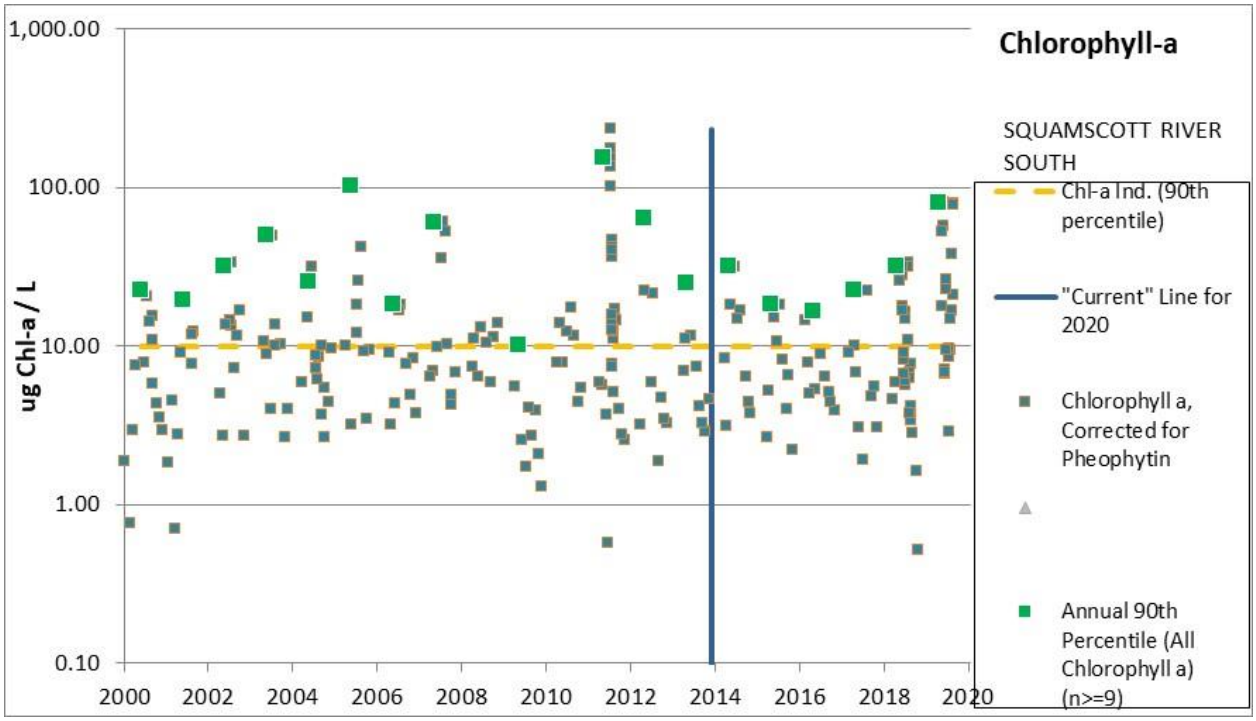
(NHEST600030806-01-01)

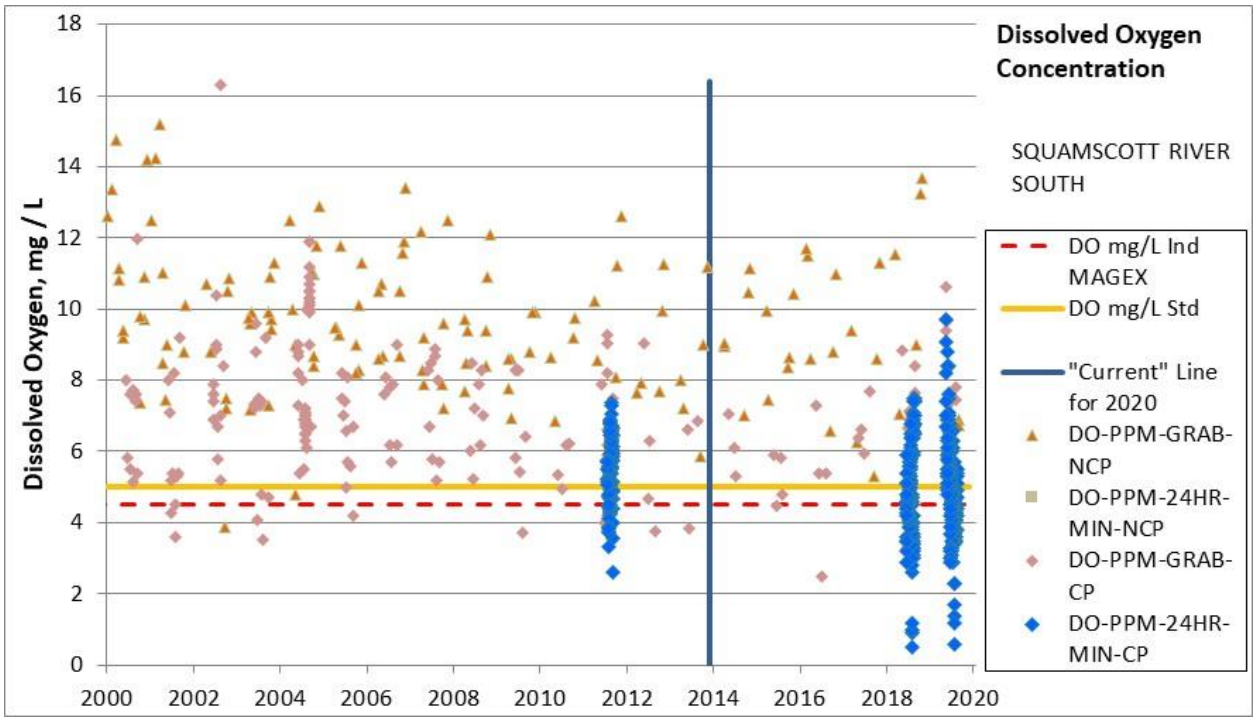
As of the date of data retrieval (January 10, 2020) water quality data for this assessment zone through 2019 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are three additional years (2017, 2018, 2019) of data compared to the 2018 assessment.

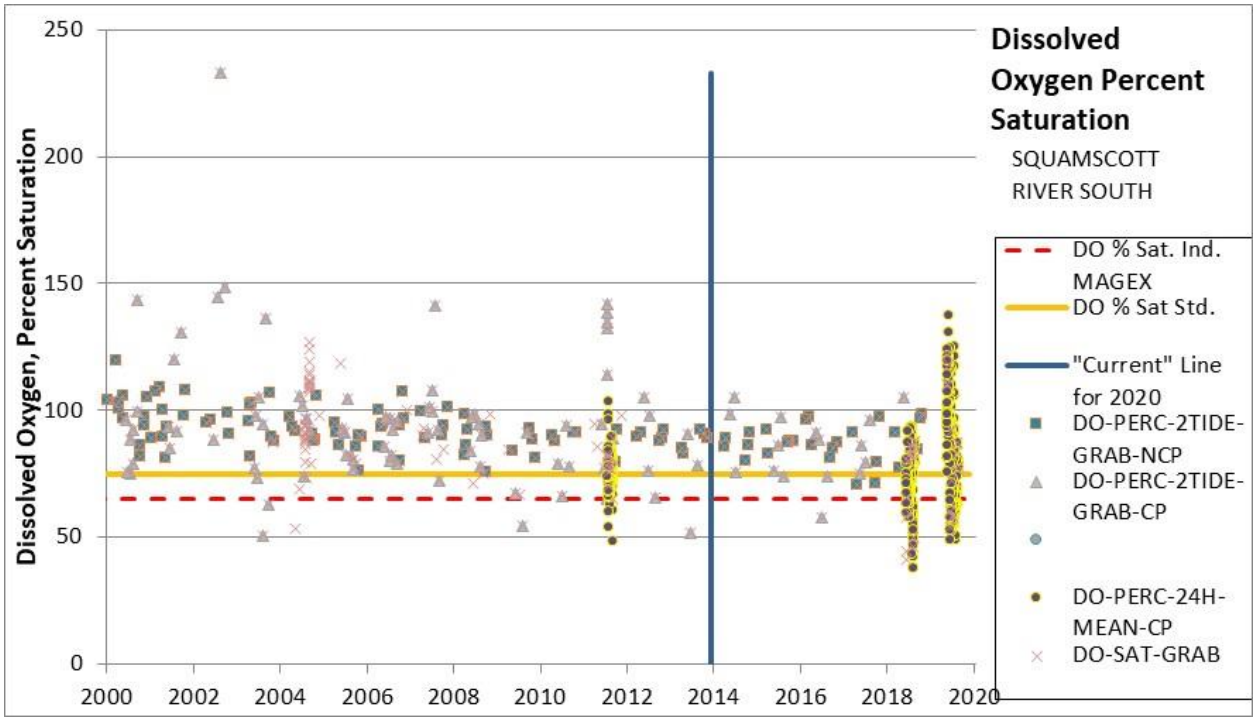
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	5-P / 5-P	All of the chlorophyll-a data reported for the Squamscott River South from 2012 through 2017 has been collected at Chapmans Landing (GRBCL), the downstream boundary of the assessment zones. In 2018 and 2019, the GRBCL data was supplemented with two years of data collected at three sites further upstream in proximity to the WWTF discharges. Consequentially, the 90th percentile for chlorophyll-a for the 2020/2022 assessment is now up to 38 µg/L (n=88). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 µg/L. As noted in the March 20, 2012 HydroQual report, "…such elevated algal levels probably contribute to increased SOD which will contribute to lower DO when algal levels are low…" (HydroQual, March 20, 2012). The chlorophyll-a impairment has been retained.
Dissolved Oxygen (mg/L)	5-P / 5-P	All of the dissolved oxygen (DO) concentration data reported for the Squamscott River South from 2012 through 2017 has been collected at Chapmans Landing (GRBCL), the downstream boundary of the assessment zones. In 2018 and 2019, the GRBCL grab sample data was supplemented with two years of datalogger deployments collected at three sites further upstream in proximity to the WWTF discharges. Excursions below 5 mg/L in the 2018/2019 datasets were frequent, of extended durations and far below 5 mg/L. The new deployments, as well as the 2011 datalogger deployment, demonstrated that grab samples underrepresent the frequency of low dissolved oxygen conditions.
Dissolved Oxygen (% Saturation)	5-M / 5-P	All of the dissolved oxygen (DO) percent saturation data reported for the Squamscott River South from 2012 through 2017 has been collected at Chapmans Landing (GRBCL), the downstream boundary of the assessment zones. In 2018 and 2019, the GRBCL grab sample data was supplemented with two years of datalogger deployments collected at three sites further upstream in proximity to the WWTF discharges. Excursions below 75 percent daily average saturation in the 2018/2019 datasets were frequent and on multiple occasions falling below a daily average of 50%. The new deployments, as well as the 2011 datalogger deployment, demonstrated that paired high-tide/low-tide grab sample percent saturation averages underrepresent the frequency of low dissolved oxygen saturation conditions.
Estuarine Bioassessments (eelgrass)	No Std / No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone. This assessment zone was created for the 2012 cycle by splitting the Squamscott River assessment zone (assessment unit ID = NHEST600030806-01) into two pieces. The parent assessment zone was listed as impaired (5-P) for eelgrass loss on the 2010 303d list. For the 2012 list, the impairment was associated with the other child assessment zone (Squamscott River North; NHEST600030806-01-02) because eelgrass has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std / No Std	Not applicable. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment zone (assessment unit ID = NHEST600030806-01) into two pieces. The parent assessment zone was listed as impaired (5-P) for water clarity to protect eelgrass habitat on the 2010 303d list. The impairment was contingent upon the Estuarine Bioassessments (eelgrass) impairment and therefore not retained on this assessment zone in 2012 because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	5-P / 5-P	The median total nitrogen from 2014 through 2019 was 752 µg/L (n=88), just 1 ug/L lower than the 2018 assessment cycle median. All of the total nitrogen (TN) data used in the 2018 assessment was collected at Chapmans Landing, the downstream boundary of the assessment

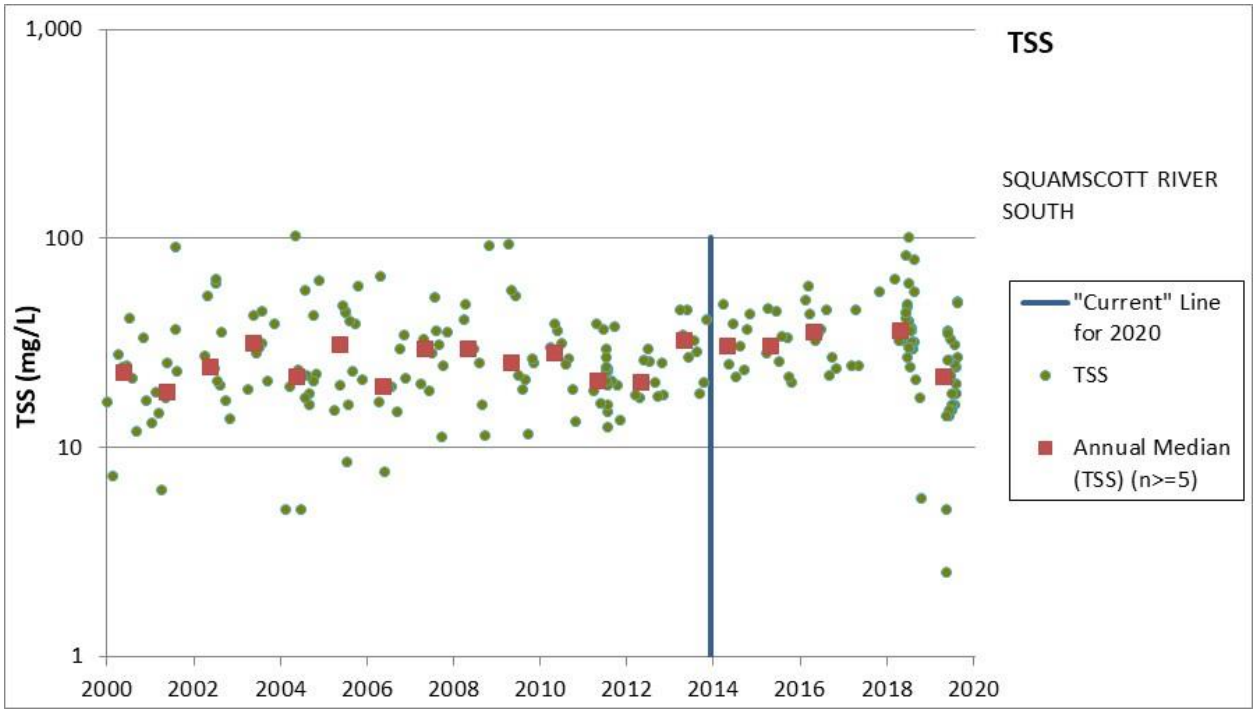
		zone. The 2020/2022 assessment includes data collected in 2018 and 2019 at three sites further upstream in proximity to the WWTF discharges. This extension of sampling is reflected in the apparently higher TN in 2018 and in part makes the 2019 TN not look substantially lower even though Exeter's new nitrogen removal process went on-line on June 10, 2019 and after a few weeks of initial operation was switched to the designed Bardenpho configuration (Town of Exeter, January 31, 2020). This assessment zone experiences frequent dissolved oxygen concentrations far below 5 mg/L and far below daily average percent saturation of 75%. It is of note that some periods pre-2012 demonstrated super saturation including multiple days in the 2011 as well as 2018/2019 experiencing dissolved oxygen saturation well over 125 percent. The 90th percentile for chlorophyll-a concentration was 38 (n=88) from 2014 through 2019 including one sample measured at 84 µg/L. Total nitrogen reductions began in the summer of 2019 within this assessment zone. The status of the indicators of nutrients and nutrient-related impacts has not changed, and continue to present a preponderance of evidence that eutrophication effects are lingering. As such, the impairment has been retained.

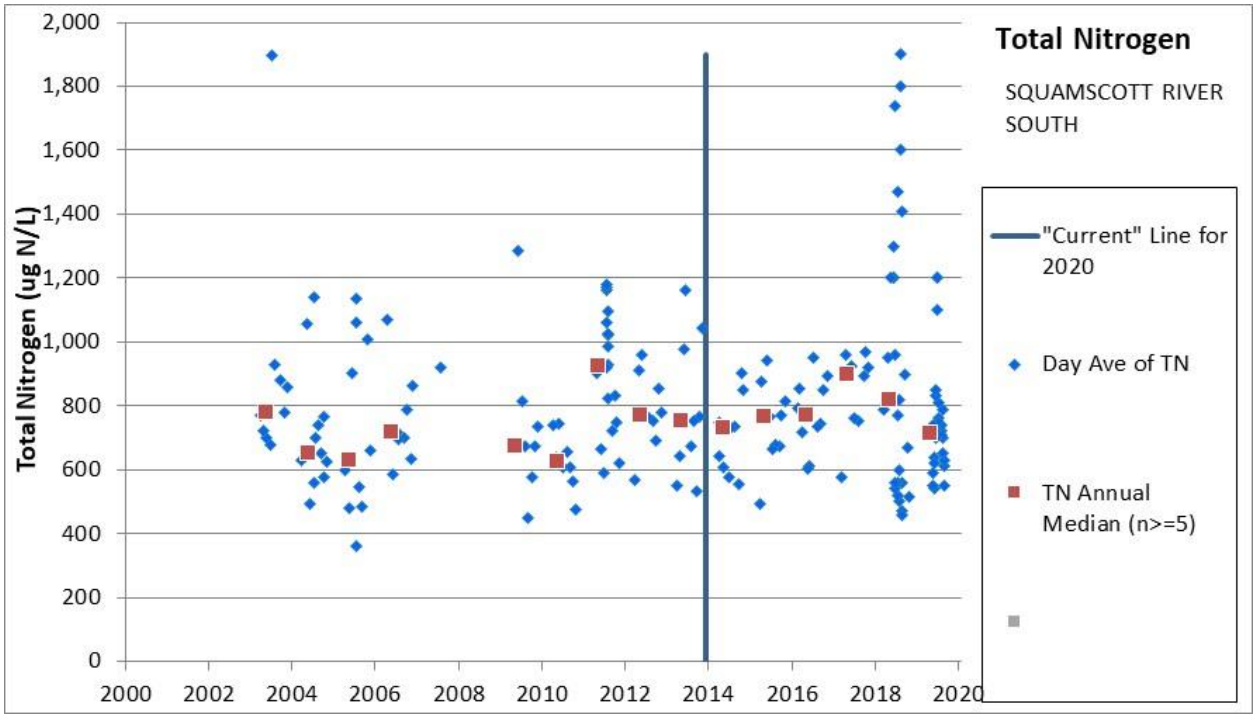



Chlorophyll-a
SQUAMSCOTT RIVER SOUTH
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)
ug Chl-a / L
1,000.00
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020


Dissolved Oxygen Concentration
SQUAMSCOTT RIVER SOUTH
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP
Dissolved Oxygen, mg / L
18
16
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020


Dissolved Oxygen Percent Saturation
SQUAMSCOTT RIVER SOUTH
Dissolved Oxygen, Percent Saturation
250
200
150
100
50
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
SQUAMSCOTT RIVER SOUTH
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Total Nitrogen
SQUAMSCOTT RIVER SOUTH
Total Nitrogen (ug N/L)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Squamscott River - South Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	88	0.5	8.5	38.0	84.0
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, Combined (ug/L)	88	0.0	8.5	38.0	84.0
LIGHT ATTENUATION COEFFICIENT (1/m)	43	1.30	3.03	4.85	8.73
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	0	-	-	-	-
TSS (mg/L)	83	2.5	31.0	53.3	100.7
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	46	2.8	5.2	9.4	12.3
DO-PPM-24HR-MIN-CP (mg/L)	338	0.5	4.5	6.6	9.7
DO-PPM-24HR-MIN-NCP (mg/L)	1	5.4	5.4	-	5.4
DO-PPM-GRAB-CP (mg/L)	42	2.5	6.0	9.2	10.6
DO-PPM-GRAB-NCP (mg/L)	28	5.3	9.0	11.9	13.7
DO-PERC-24H-MEAN-CP (% sat)	310	37.7	74.0	107.4	137.4
DO-PERC-24H-MEAN-NCP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP (% sat)	18	58.0	83.0	104.9	105.3
DO-PERC-2TIDE-GRAB-NCP (% sat)	26	70.8	87.2	97.2	98.4
DO-PERC-GRAB (% sat)	26	41.2	79.8	112.6	121.9
Day Ave of TN (ug N/L)	88	460	752	1,200	1,900
Day Ave of TDN (ug N/L)	46	333	586	800	1,309
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	78	77	330	575	880
Day Ave of NH3 (ug N/L)	78	3	163	330	500
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	88	35	160	273	561
SALINITY-Grabs (pss)	86	0.1	6.6	19.7	26.5
SALINITY-Datalogger Daily Median (pss)	324	0.1	5.8	15.5	23.8
pH-grab	7	6.9	7.1	-	7.7
pH-24HR (min)	339	6.5	7.0	6.8*	7.5
pH-24HR (max)	339	6.7	7.7	8.5	9.1
Temperature	86	1.7	21.6	25.5	28.3
Temperature-Daily Median	339	15.2	24.1	26.5	29.3

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

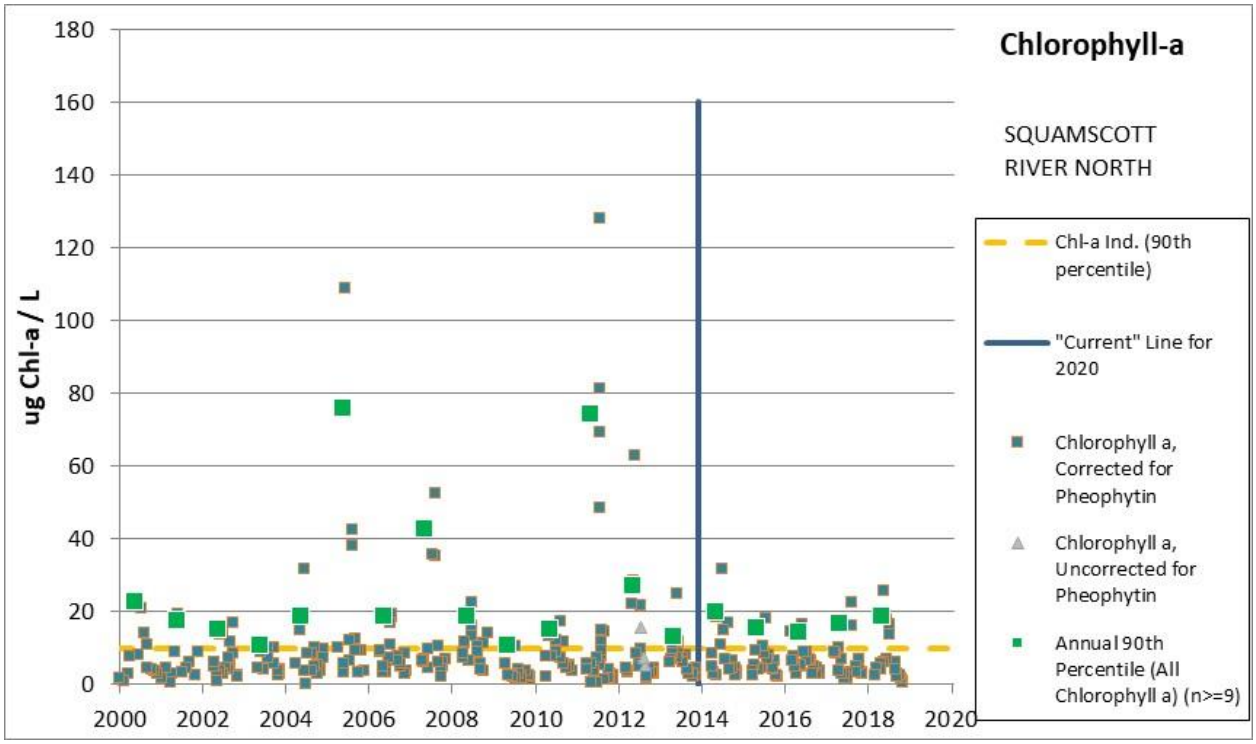
Assessment Zone = SQUAMSCOTT RIVER NORTH

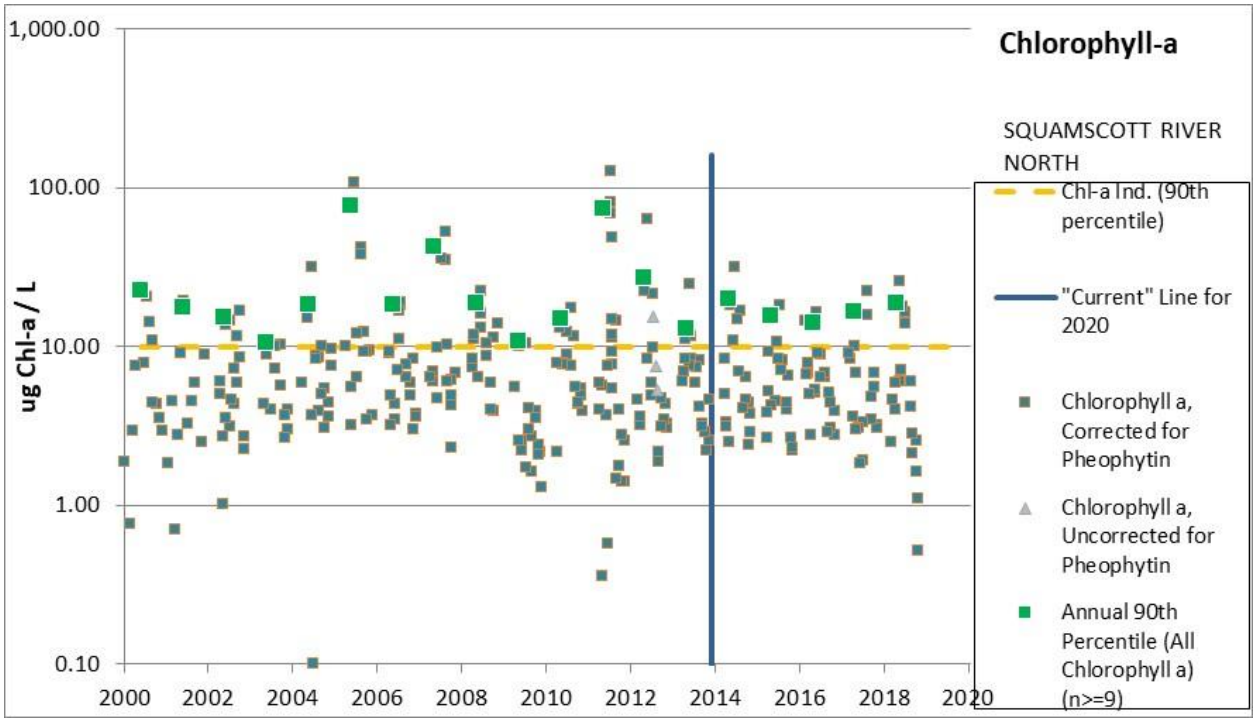
(NHEST600030806-01-02)

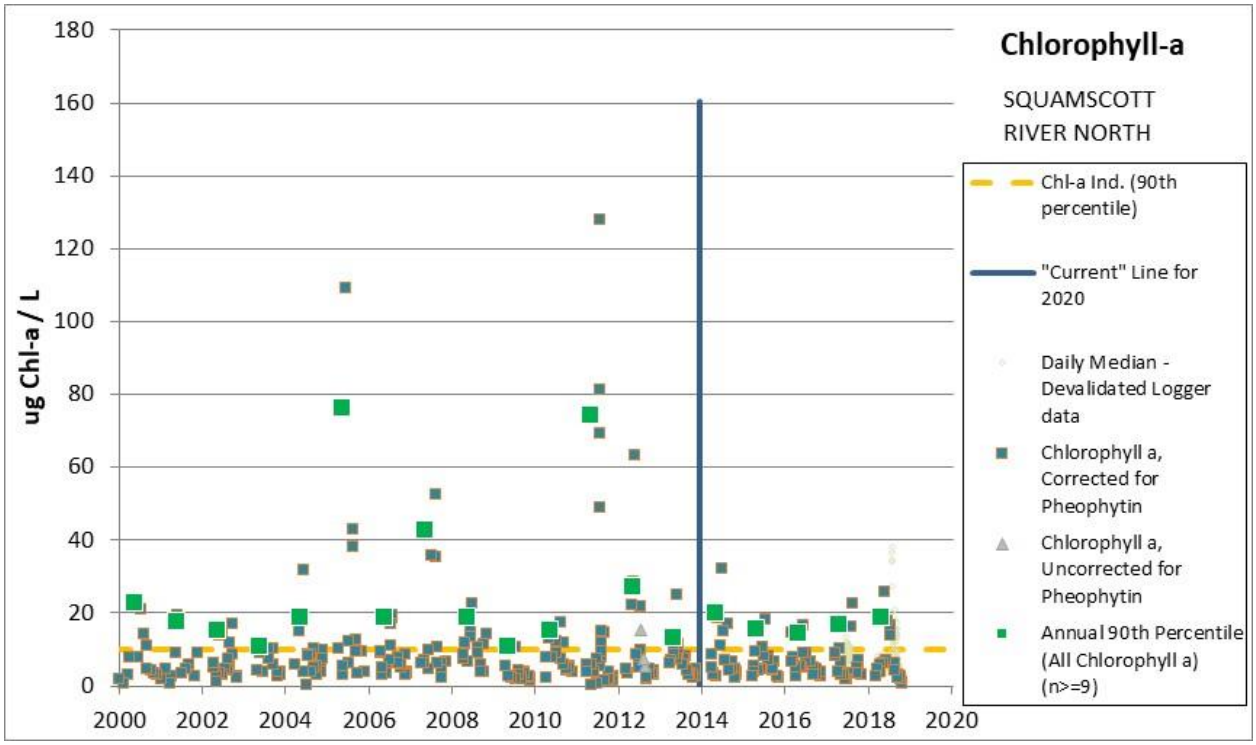
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are two additional years of data (2017, 2018) compared to the 2018 assessment but the 2019 data is not included.

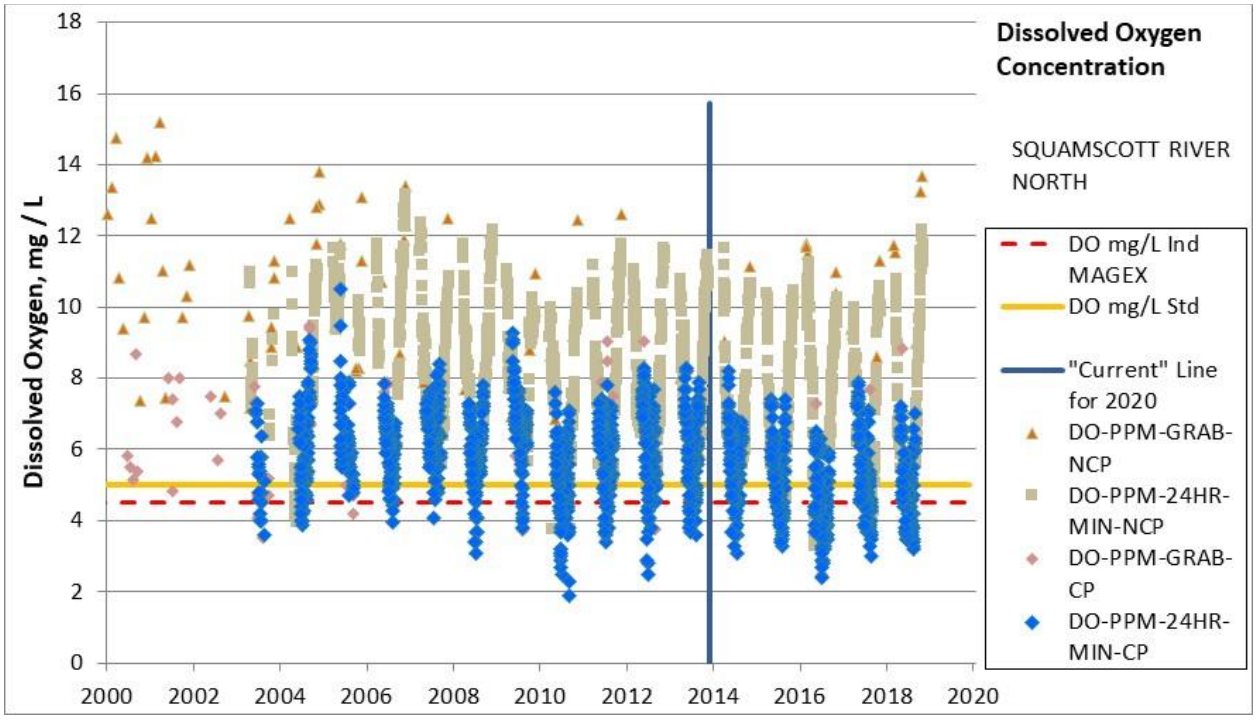
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	5-P / 5-P	The 90th percentile for chlorophyll-a, is 16.4 µg/L (n=92). The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L. As noted in the March 20, 2012 HydroQual report, "…such elevated algal levels probably contribute to increased SOD which will contribute to lower DO when algal levels are low…" (HydroQual, March 20, 2012). Although the probe based chlorophyll-a data (not used in the median above) collected in the assessment zone at in both 2017 and 2018 was qualified as "estimated," due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and the data distribution is similar to that of the grab samples of chlorophyll-a. The chlorophyll-a impairment has been retained.
Dissolved Oxygen (mg/L)	5-P / 5-P	Dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year. Because a portion of those measurements fall below 4 mg/L each year, and in some years below 3 mg/L, this impairment is considered severe.
Dissolved Oxygen (% Saturation)	5-M / 5-M	Following the 10% method listed in the 2020/2022 CALM this parameter would be categorized as 2-M. Part of the concept behind the 10% rule was to address random errors within the meter measurement accuracy, thereby limiting accidental impairments. The magnitude of exceedance indicator threshold was layered into the assessment process to address major exceedances and exceedances beyond all normal measurement errors. In the case of this assessment zone there are 595 station/days of DO readings during the critical summer period. Four of the last five years of data show criteria exceedances sometimes on multiple days, which demonstrates that this phenomenon is not limited to a single summer. Looking back through the dataset, we see that this is a regularly occurring condition, further demonstrating that this phenomenon is not limited to a single summer. It is clear that it is common in this assessment zone to have 24-hour average dissolved oxygen below 75 percent. While no 24-hour average dissolved oxygen readings fell below the magnitude of exceedance indicator threshold of 65 percent, there were several close values (e.g. 68 percent average in 2018).
Estuarine Bioassessments (eelgrass)	5-P / 5-P	In the 2012 assessment cycle, this assessment zone was listed as impaired for "Estuarine Bioassessments" (i.e. a lack of eelgrass) based on the 1948 survey that indicated that roughly 42 acres of eelgrass were present and despite intensive mapping efforts since 1981, eelgrass has never again been documented in this zone. While the 1948 map is rough enough that we cannot say that precisely 42 acres of eelgrass were present, its presence was clearly documented. Combined with the application of the Eelgrass Site Selection Model (Short, Davis, Kopp, Short, & Burdick, 2002) and a rudimentary suitability evaluation of temperature and salinity leads one to conclude that eelgrass should be present. Taken in totality, there is insufficient evidence to remove the 2018 "Estuarine Bioassessment" impairment. As such, the impairment for "Estuarine Bioassessments" and "Water Clarity (Light Attenuation Coefficient)" has been retained on the 2020/2022 final 303(d).
Water Clarity (Light Attenuation Coefficient)	5-P / 5-P	Median water clarity is 3.00 m^-1 (n=84). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. Therefore, the impaired (5-P) listing from the 2016 303d list has been retained.
Total Nitrogen	5-P / 5-P	The median total nitrogen from 2014 through 2018 was 769 µg/L (n=92). This assessment zone continues to experience frequently dissolved oxygen concentrations well below 5 mg/L and periodically below a 24-hour average dissolved oxygen saturation of 75%. The chlorophyll-a

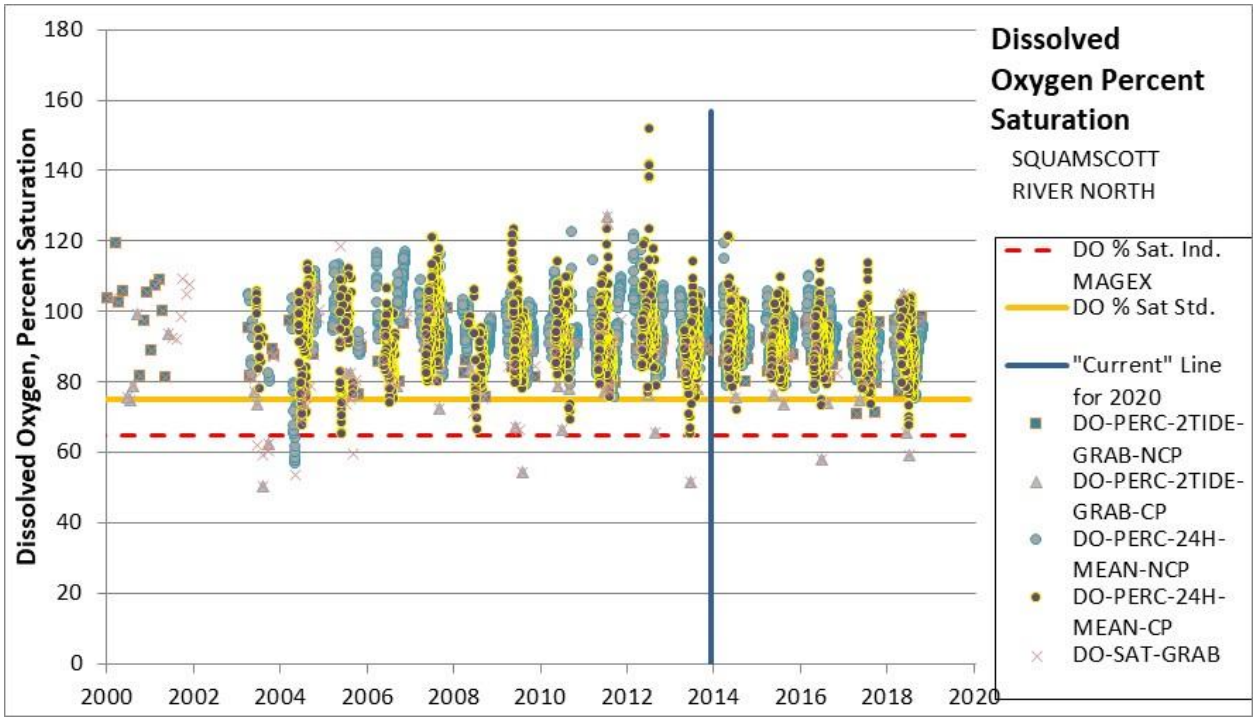
		concentration 90th percentile was 16.4 (n=92) from 2014 through 2018. This data used in this assessment does not include the period after Exeter WWTF's new nitrogen removal process went on-line on June 10, 2019 and then after a few weeks of initial operation was switched to the designed Bardenpho configuration (Town of Exeter, January 31, 2020). The status of the indicators of nutrients and nutrient-related impacts has not changed, and continue to present a preponderance of evidence that eutrophication effects are ongoing. As such, the impairment for nitrogen has been retained

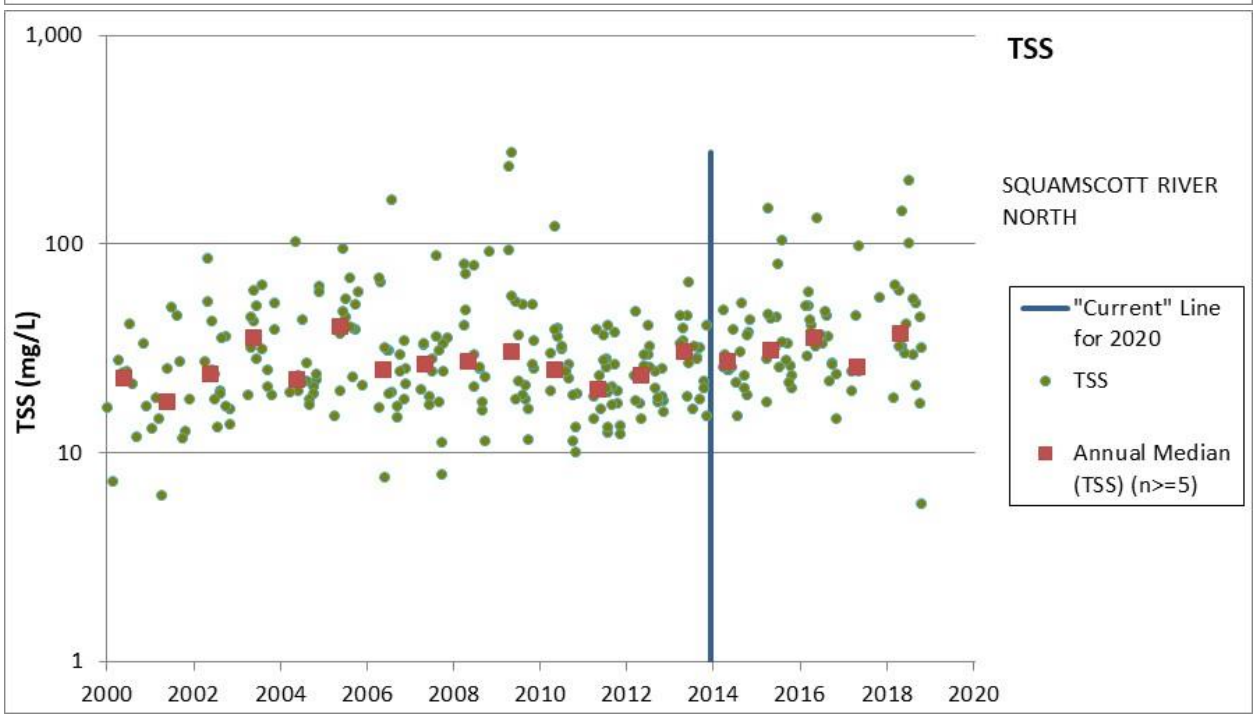


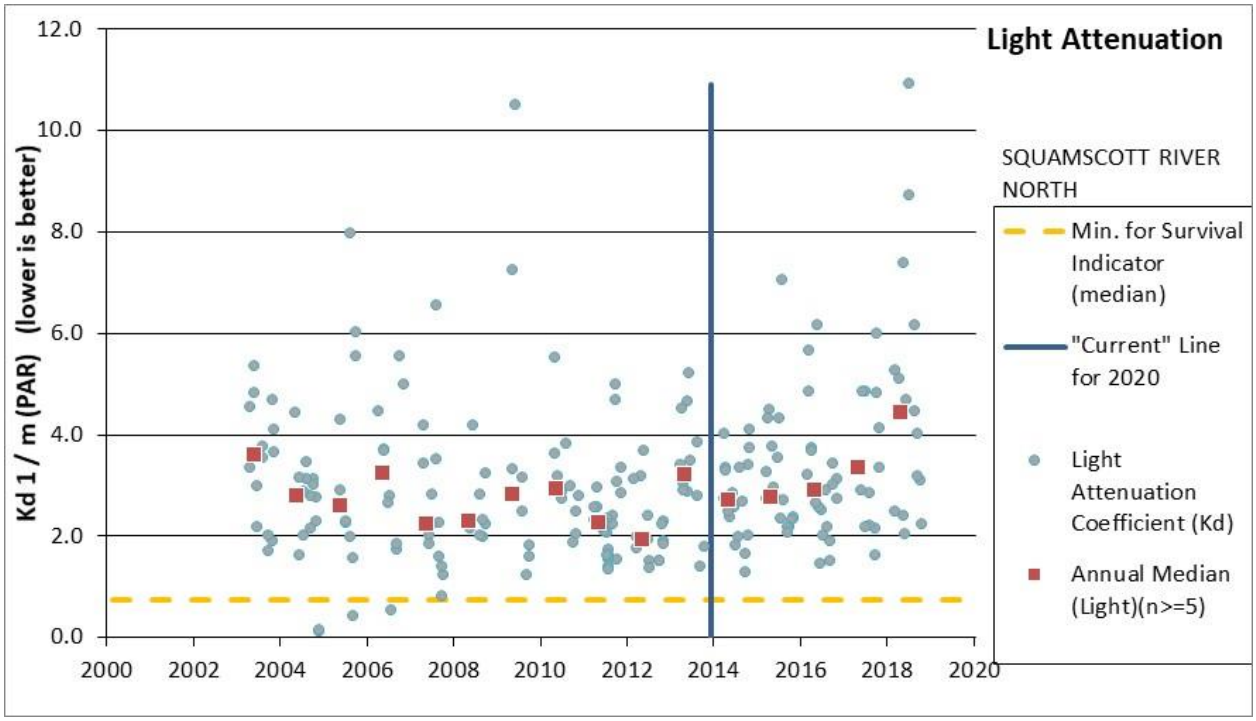


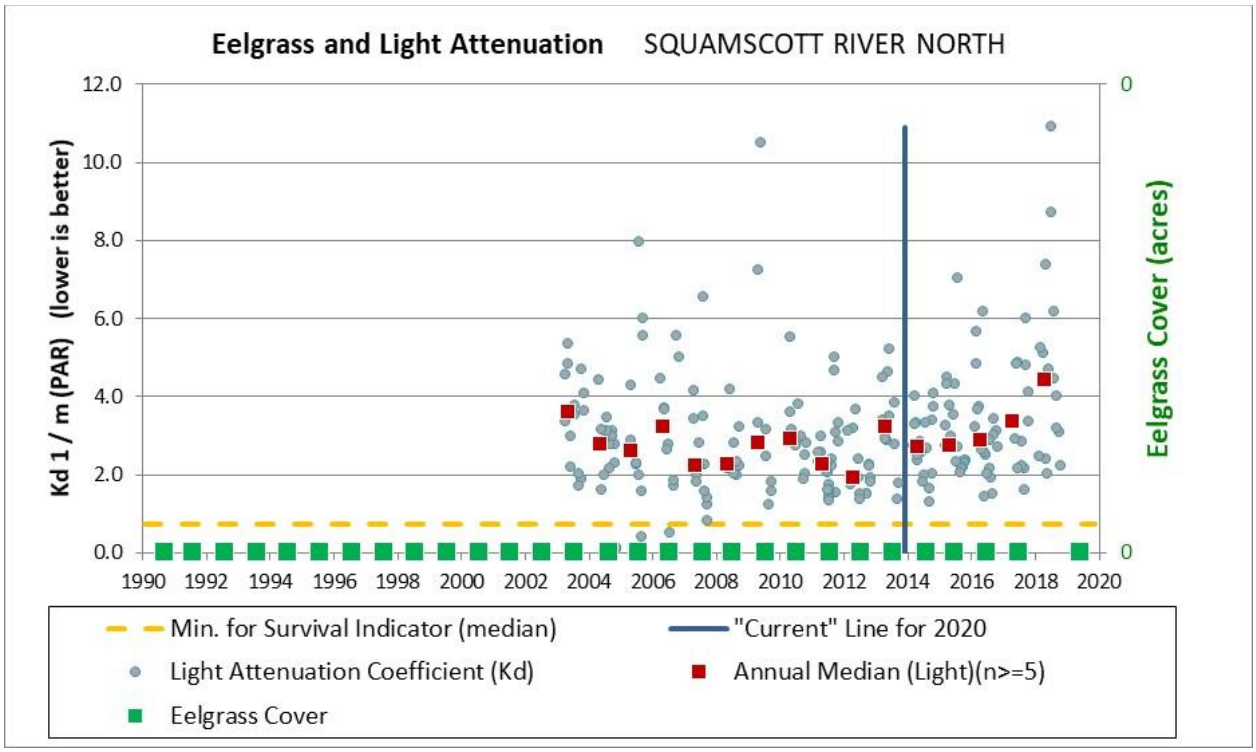

Chlorophyll-a
SQUAMSCOTT RIVER NORTH
ug Chl-a / L
180
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Daily Median - Devalidated Logger data
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

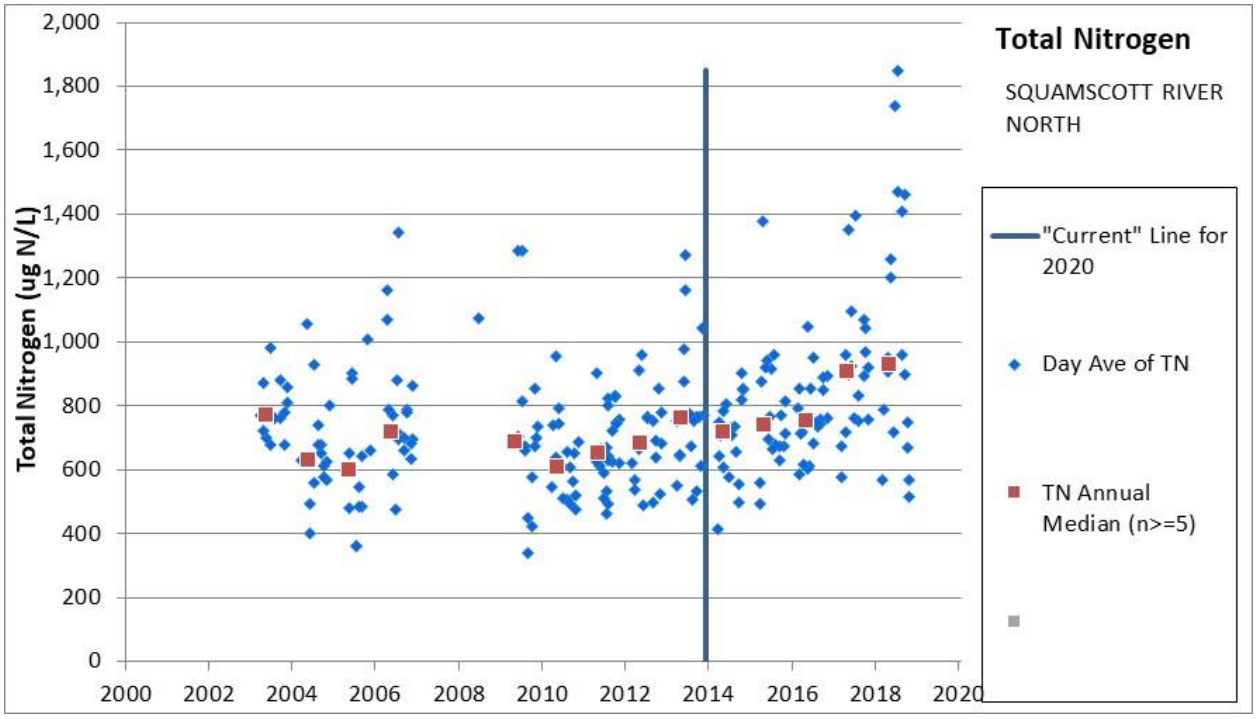

Dissolved Oxygen Concentration
SQUAMSCOTT RIVER NORTH
Dissolved Oxygen, mg / L
18
16
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
SQUAMSCOTT RIVER NORTH
Dissolved Oxygen, Percent Saturation
180
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
SQUAMSCOTT RIVER NORTH
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Light Attenuation
SQUAMSCOTT RIVER NORTH
Kd 1 / m (PAR) (lower is better)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)


Eelgrass and Light Attenuation
SQUAMSCOTT RIVER NORTH
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)
Eelgrass Cover


Total Nitrogen
SQUAMSCOTT RIVER NORTH
Total Nitrogen (ug N/L)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Squamscott River - North Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	92	0.5	5.1	16.4	32.0
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, Combined (ug/L)	92	0.0	5.1	16.4	32.0
LIGHT ATTENUATION COEFFICIENT (1/m)	84	1.30	3.00	5.47	10.92
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	1,136	3.0	13.0	24.0	229.0
TSS (mg/L)	81	5.7	32.2	76.7	201.8
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	92	1.4	5.3	9.6	12.3
DO-PPM-24HR-MIN-CP (mg/L)	594	2.4	5.1	6.6	8.2
DO-PPM-24HR-MIN-NCP (mg/L)	544	3.3	8.4	10.5	12.2
DO-PPM-GRAB-CP (mg/L)	18	2.5	5.9	7.8	8.9
DO-PPM-GRAB-NCP (mg/L)	31	5.3	9.4	11.8	13.7
DO-PERC-24H-MEAN-CP (% sat)	595	67.9	90.9	100.9	121.5
DO-PERC-24H-MEAN-NCP (% sat)	531	75.5	91.5	99.2	119.4
DO-PERC-2TIDE-GRAB-CP (% sat)	18	58.0	83.0	104.9	105.3
DO-PERC-2TIDE-GRAB-NCP (% sat)	27	70.8	87.4	97.3	98.4
DO-PERC-GRAB (% sat)	4	82.5	88.5	-	98.0
Day Ave of TN (ug N/L)	92	416	769	1,240	1,851
Day Ave of TDN (ug N/L)	92	228	591	781	1,309
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	92	77	374	571	918
Day Ave of NH3 (ug N/L)	92	3	188	327	549
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	92	35	165	283	561
SALINITY-Grabs (pss)	89	0.1	11.5	23.6	26.9
SALINITY-Datalogger Daily Median (pss)	1,137	0.7	22.9	29.3	31.5
pH-grab	0	-	-	-	-
pH-24HR (min)	1,125	6.4	7.2	7*	7.9
pH-24HR (max)	1,125	7.4	8.0	8.1	8.4
Temperature	90	1.7	16.0	24.7	26.9
Temperature-Daily Median	1,143	0.1	18.0	24.3	26.8

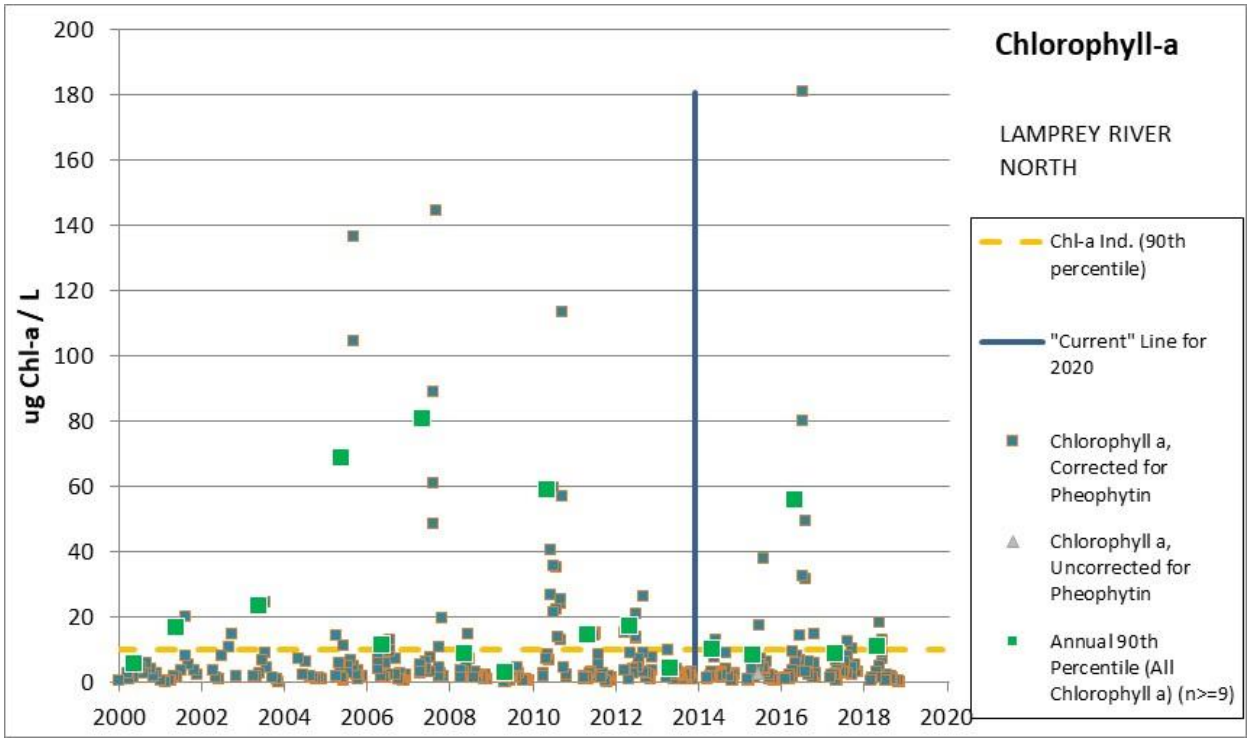
*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

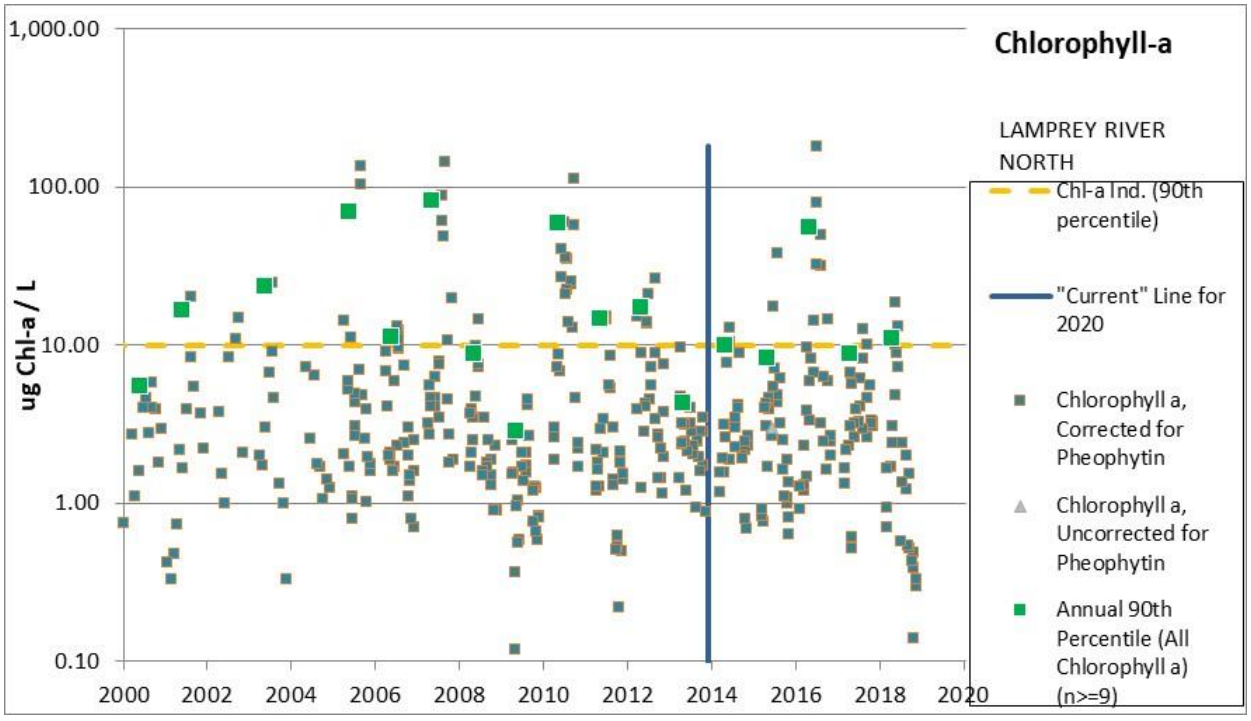
Assessment Zone = LAMPREY RIVER NORTH

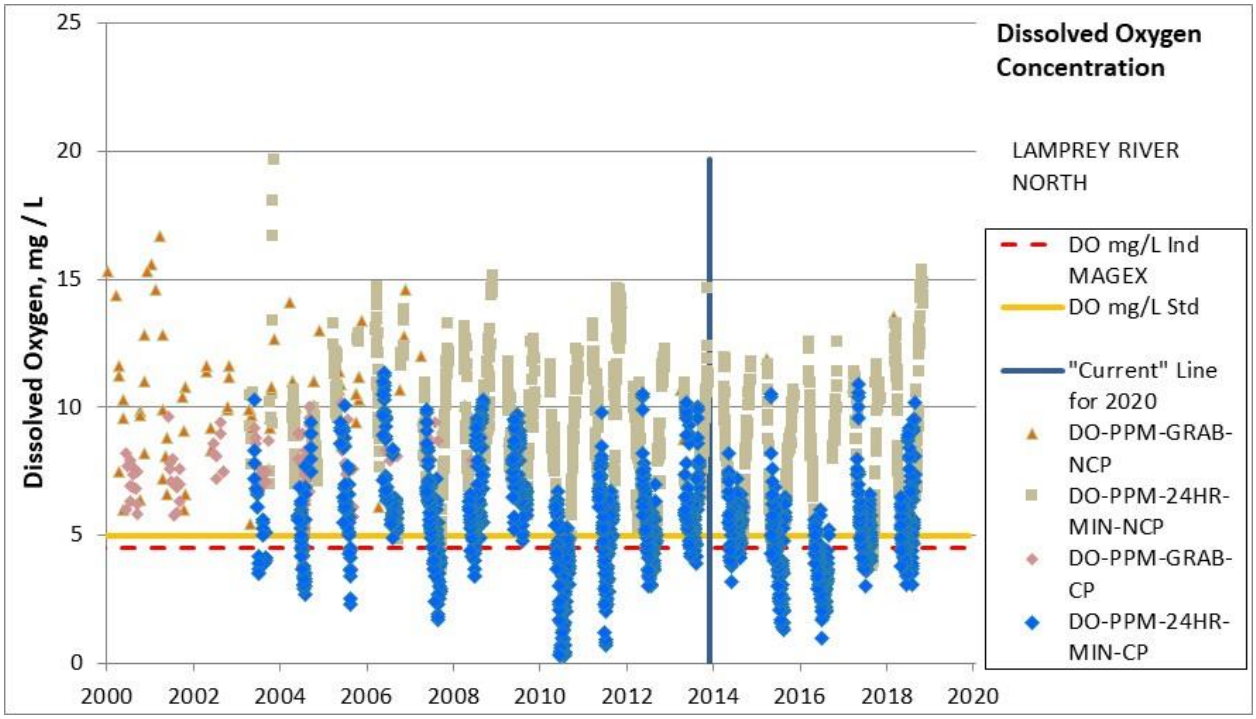
(NHEST600030709-01-01)

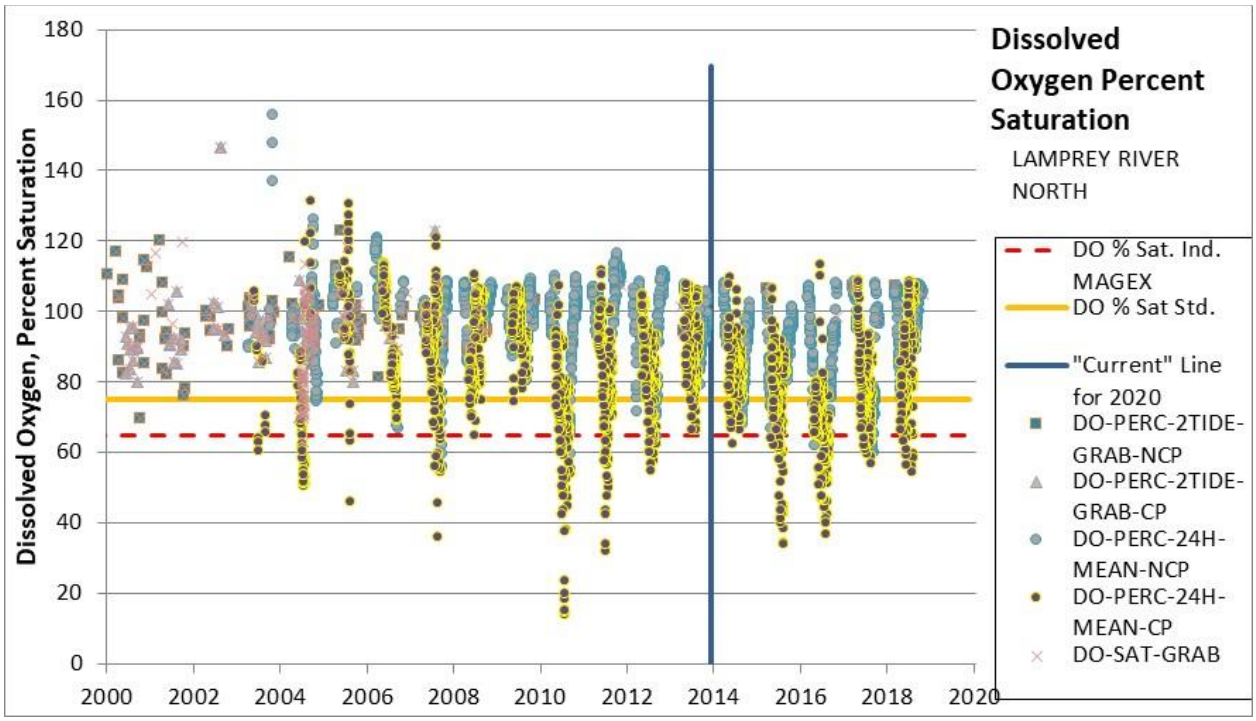
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are two additional years of data (2017, 2018) compared to the 2018 assessment but the 2019 data is not included.

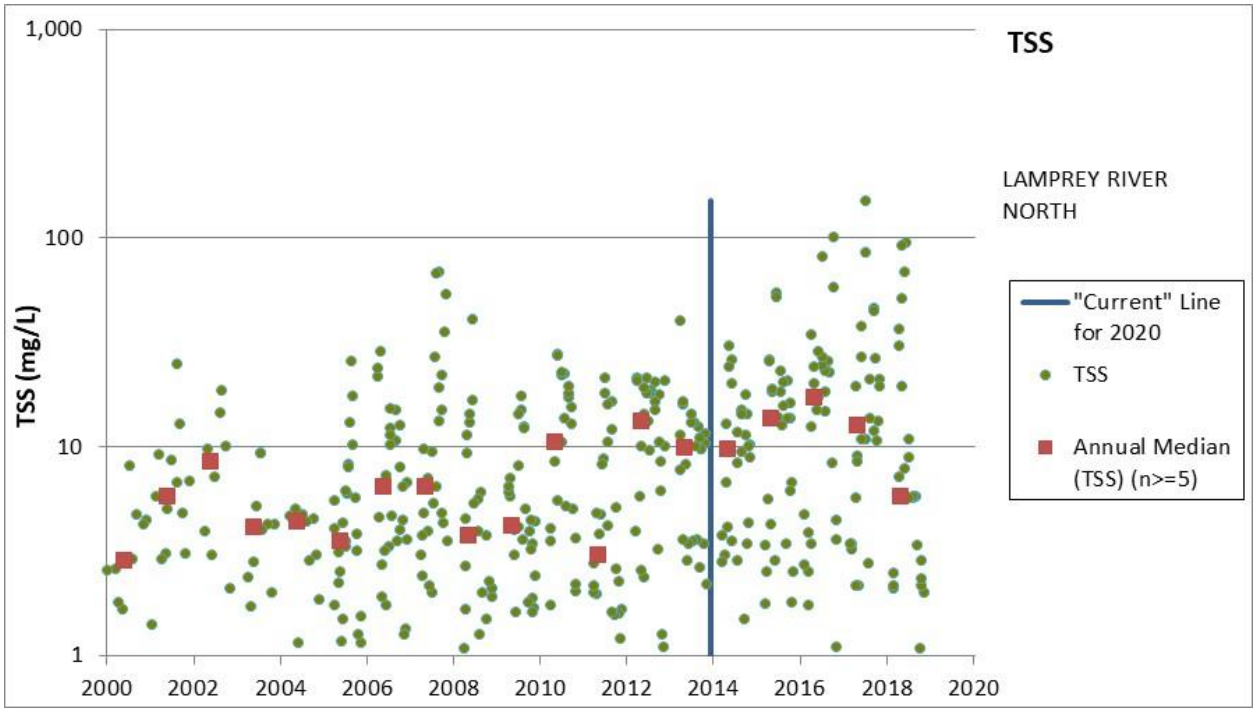
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	5-M / 5-M	The calculated 90th percentile chlorophyll-a in this assessment zone is 11.7 µg/L (n = 133) and there have been no readings over 50 µg/L since 2016. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 µg/L. Large nutrient load reductions began when the new waste water treatment facility came online in 2017, which may be reflected on the lack of very high readings in 2017 and 2018. The chlorophyll-a impairment has been retained.
Dissolved Oxygen (mg/L)	5-P / 5-P	Dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year. Because a portion of those measurements fall below 4 mg/L each year, and in some years within the "current period" down to 1 mg/L, this impairment is considered severe.
Dissolved Oxygen (% Saturation)	5-P / 5-P	Dissolved oxygen 24-hour average percent saturation measurements in this assessment zone fall below the 75% every year. Because a portion of those measurements fall below 65% each year, and in some years below 40% within the "current period", this criteria indicator suggests that the aquatic life use is impaired, as such, dissolved oxygen 24-hour average percent saturation has been assessed as not supporting.
Estuarine Bioassessments (eelgrass)	No Std / No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std / No Std	Not applicable. The water clarity has not been assessed because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	5-M / 5-M	The median total nitrogen from 2014 through 2018 was 438 µg/L (n=45). It is important to note that some of the 2017 and all of the 2018 data represents the period after the large nutrient load reductions from the new waste water treatment facility came online in 2017. Indeed, the 2017 and 2018 datasets do not show the spikes over 700 ug/L that have been present for years. In the available dataset, this assessment zone still experiences frequent dissolved oxygen concentrations well below the 5 mg/L criteria and daily average saturation below 75 percent. The chlorophyll-a concentration 90th percentile was 11.7 µg/L (n=133) from 2014 through 2018 and several measurements were over 50 µg/L. The status of the indicators of nutrients and nutrient-related impacts has not changed, and continue to present a preponderance of evidence that eutrophication effects are ongoing. As such, the impairment for nitrogen has been retained.

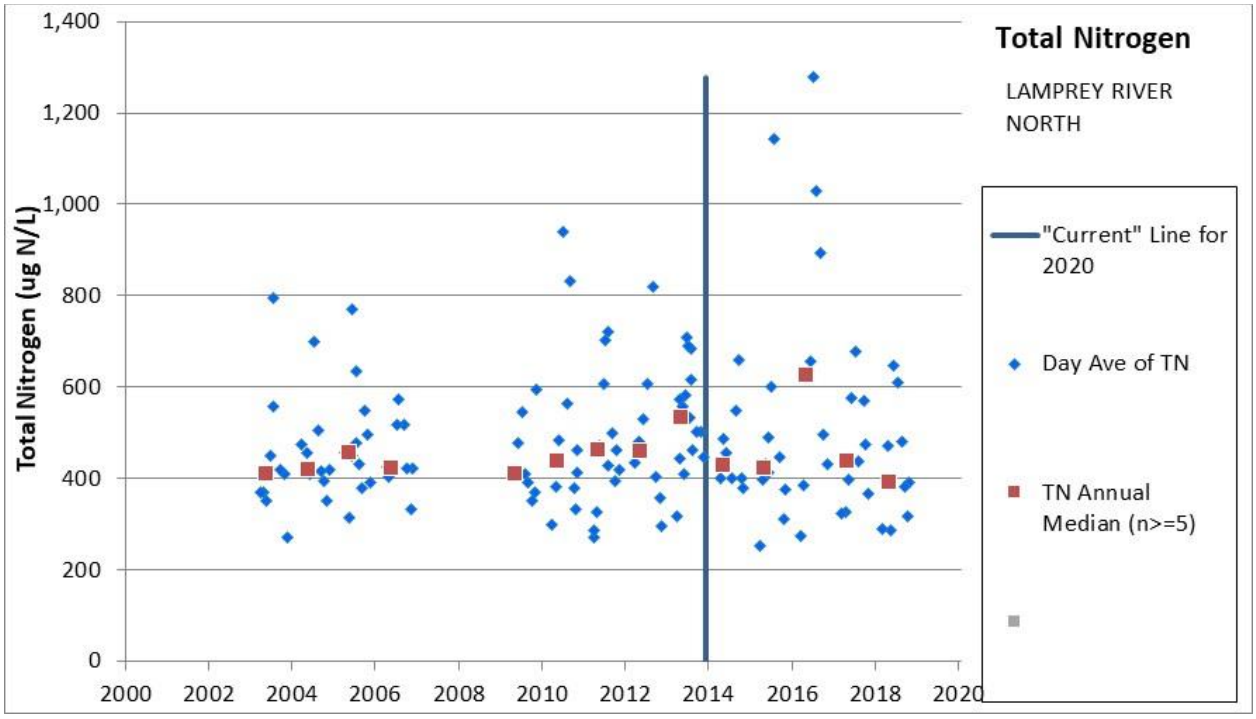

Chlorophyll-a
LAMPREY RIVER NORTH
ug Chl-a / L
200
180
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)


Chlorophyll-a
LAMPREY RIVER NORTH
ug Chl-a / L
1,000.00
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)


Dissolved Oxygen Concentration
LAMPREY RIVER NORTH
Dissolved Oxygen, mg / L
25
20
15
10
5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
LAMPREY RIVER NORTH
Dissolved Oxygen, Percent Saturation
180
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
LAMPREY RIVER NORTH
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Total Nitrogen
LAMPREY RIVER NORTH
Total Nitrogen (ug N/L)
1,400
1,200
1,000
800
600
400
200
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Lamprey River - North Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	132	0.1	2.7	11.9	181.0
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	1	3.0	3.0	-	3.0
CHLOROPHYLL A, Combined (ug/L)	133	0.1	2.7	11.7	181.0
LIGHT ATTENUATION COEFFICIENT (1/m)	41	0.95	1.56	2.45	2.75
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	1,142	0.0	5.0	10.0	19.0
TSS (mg/L)	132	0.5	10.9	42.6	151.1
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	132	2.5	4.6	7.8	11.3
DO-PPM-24HR-MIN-CP (mg/L)	590	1.0	4.9	6.6	10.9
DO-PPM-24HR-MIN-NCP (mg/L)	509	3.8	8.9	12.3	15.4
DO-PPM-GRAB-CP (mg/L)	1	6.5	6.5	-	6.5
DO-PPM-GRAB-NCP (mg/L)	4	10.8	12.7	-	14.1
DO-PERC-24H-MEAN-CP (% sat)	601	34.0	77.3	96.1	113.4
DO-PERC-24H-MEAN-NCP (% sat)	543	59.5	95.6	105.9	108.6
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	3	106.4	107.4	-	107.5
DO-PERC-GRAB (% sat)	3	98.1	98.4	-	104.9
Day Ave of TN (ug N/L)	45	254	438	763	1,279
Day Ave of TDN (ug N/L)	132	211	434	646	1,027
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	133	57	238	481	828
Day Ave of NH3 (ug N/L)	133	3	60	302	633
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	133	42	142	221	453
SALINITY-Grabs (pss)	44	0.0	1.5	20.9	24.9
SALINITY-Datalogger Daily Median (pss)	1,124	0.0	17.6	26.2	30.1
pH-grab	1	6.8	6.8	-	6.8
pH-24HR (min)	1,160	6.0	7.2	6.8*	7.8
pH-24HR (max)	1,160	6.2	7.6	7.9	8.2
Temperature	44	1.9	16.7	24.7	26.7
Temperature-Daily Median	1,158	0.1	18.4	24.7	27.3

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

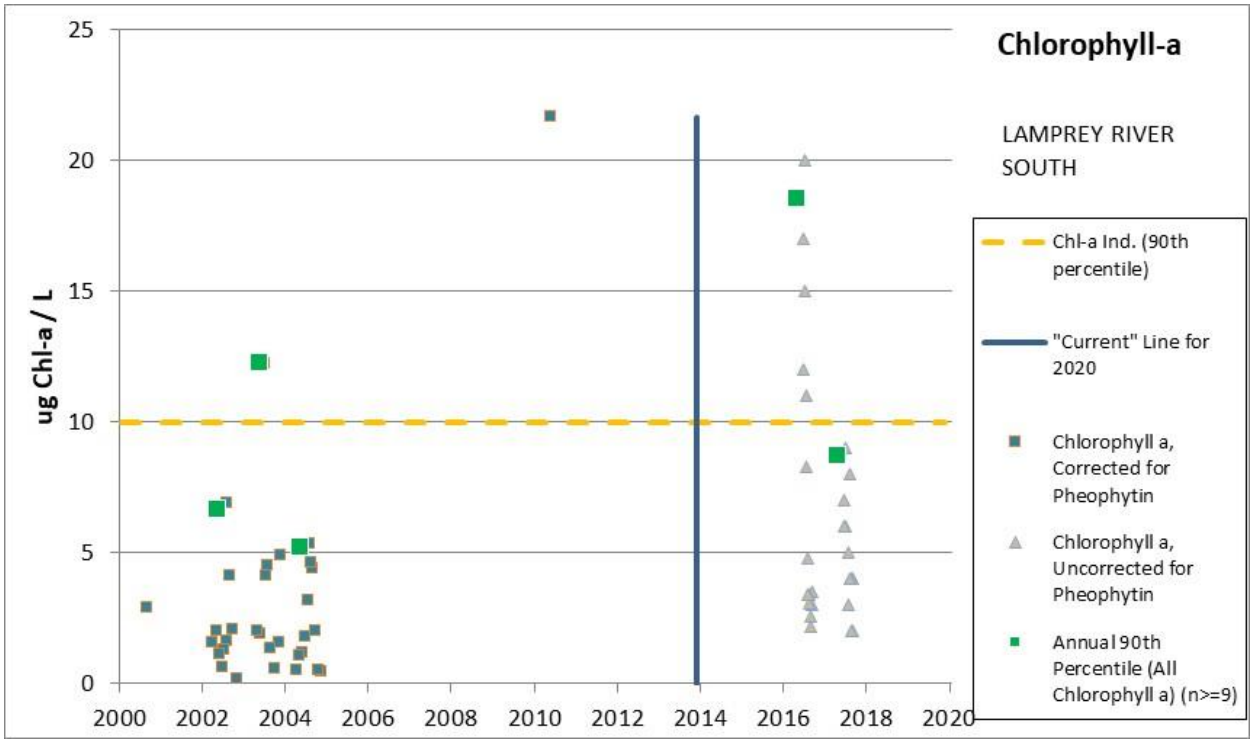
Assessment Zone = LAMPREY RIVER SOUTH

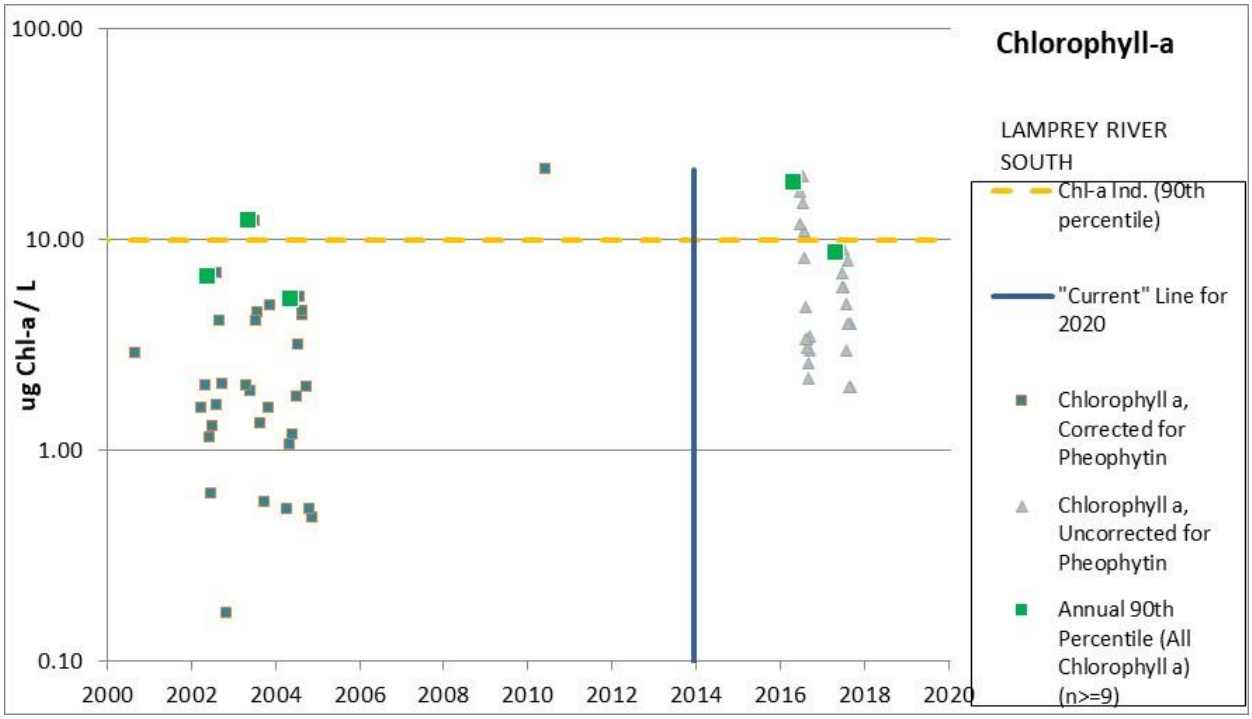
(NHEST600030709-01-02)

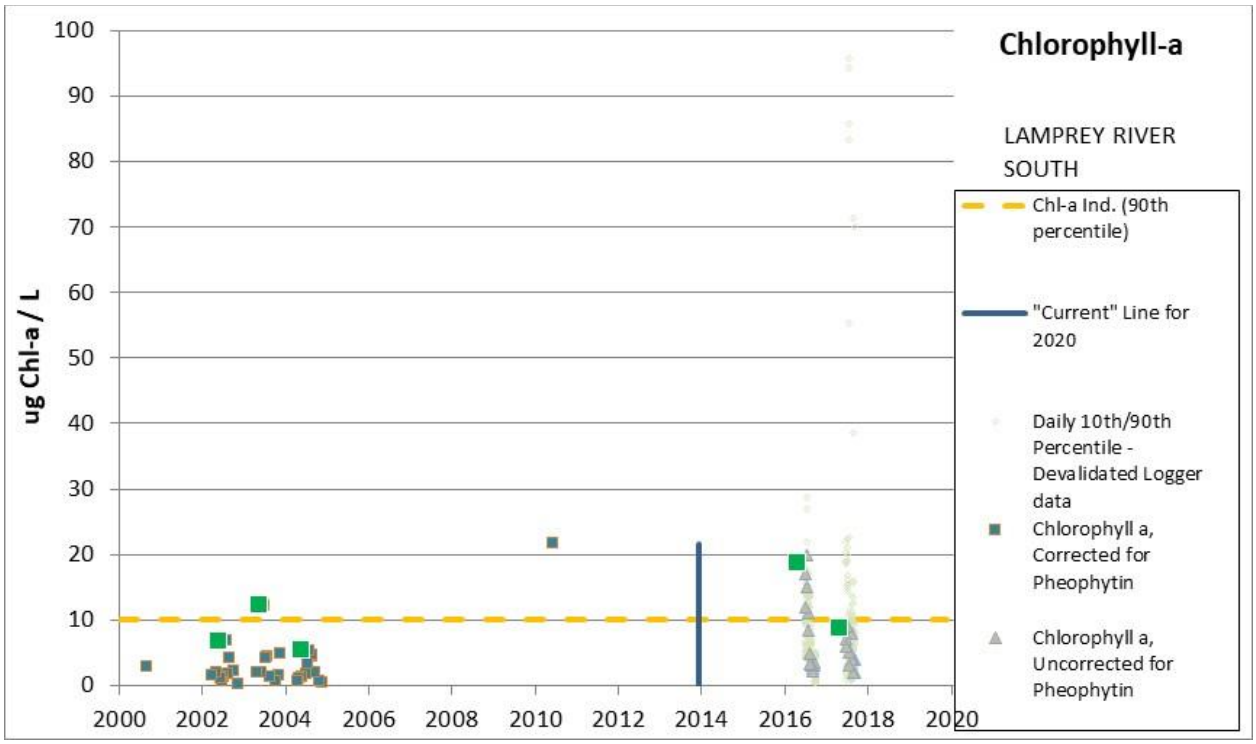
As of the date of data retrieval (January 10, 2020) water quality data through 2017 had been uploaded to the Environmental Monitoring Database for this assessment zone. While no grab samples or dataloggers were deployed in 2018, UNH collected data for Newmarket in 2019 and will in 2020 and 2021 which will be made public at some point. For this assessment zone, that means there are no additional years of data compared to the 2018 assessment.

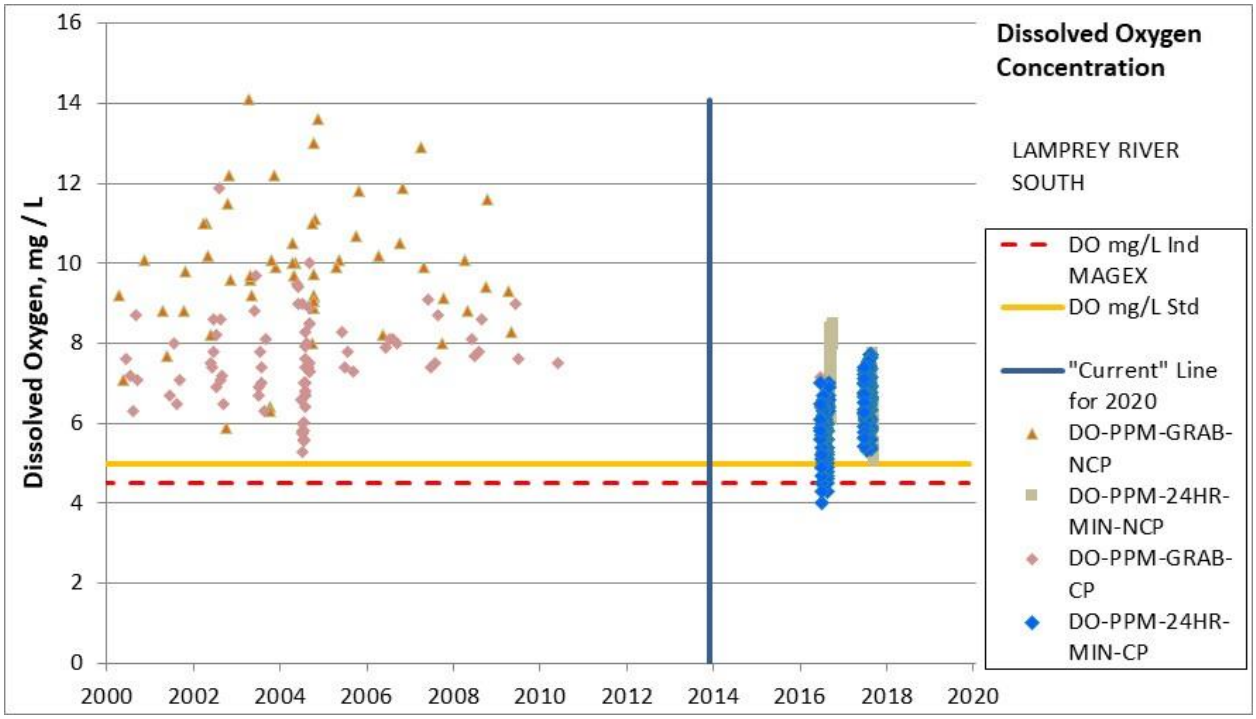
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	5-M / 5-M	The calculated 90th percentile chlorophyll-a (uncorrected for pheophytin) in this assessment zone is 15.6 µg/L (n = 26). The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L. Although the probe based chlorophyll-a data (not used in the median above) collected in the assessment zone at two sites in both 2016 and 2017 was qualified as "estimated," due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and shows large spikes in chlorophyll-a. Large nutrient load reductions began when the new waste water treatment facility came online in 2017 and the differences in the 2016 verses 2017 datasets suggest that those reductions are having the desired impact. The chlorophyll-a impairment has been retained until additional data demonstrates continued chlorophyll-a reductions.
Dissolved Oxygen (mg/L)	3-PNS / 3-PNS	This assessment zone received its first datalogger deployments in 2016 and 2017, straddling the period when the new waste water treatment facility came online. Dissolved oxygen concentration measurements in 2016 in this assessment zone routinely fell below the 5 mg/L and at times below 4 mg/L. Given the change in loading and differences in concentration between 2016 and 2017 there is not yet enough DO data to justify changing the assessment status, therefore, dissolved oxygen concentration has been retained as being assessed as potentially not supporting.
Dissolved Oxygen (% Saturation)	3-PNS / 3-PNS	This assessment zone received its first datalogger deployments in 2016 and 2017, straddling the period when the new waste water treatment facility came online. Dissolved oxygen 24-hour average percent saturation measurements in this assessment zone periodically fell below the 75 percent in both 2016 and 2017. Because a portion of those measurements fall below 75 percent, the data suggests that the aquatic life use is impaired, as such, dissolved oxygen 24-hour average percent saturation has been retained as being assessed as potentially not supporting.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 53.4 acres from the 1948 dataset. Patches of eelgrass were found in 2003 (2.2 acres) and 2011 (0.5 acres). The median current extent of eelgrass in 2016-2019 is 0 acres, which is a 100% decrease. Since 1990, the trend in eelgrass cover in this assessment zone could not be determined because the eelgrass cover has been zero for most years since 1981. The thresholds for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-P / 5-P	The median light attenuation could not be calculated for the for the current period (n=0) within this assessment zone. For an eelgrass restoration depth of 2 m, the light attenuation coefficient indicator threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. This assessment unit (zone) was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01) into two pieces. The parent assessment zone was listed as impaired (5-P) for water clarity based on data from station GRBLR to protect eelgrass habitat on the 2010 303d list. The GRBLR station is roughly 0.5 miles upstream (north) of the Lamprey River North/South split and has a median light attenuation coefficient of 1.56 m^-1 (n=41) for the 2014 through 2017 period. The downstream boundary to the Lamprey River South assessment zone is Great Bay, which had a median=1.63 m^-1 (n=131) for the 2014 through 2018 period. Assessment zones that were impaired in the previous cycle cannot be removed from the 303d list if there are insufficient data to make a new assessment.

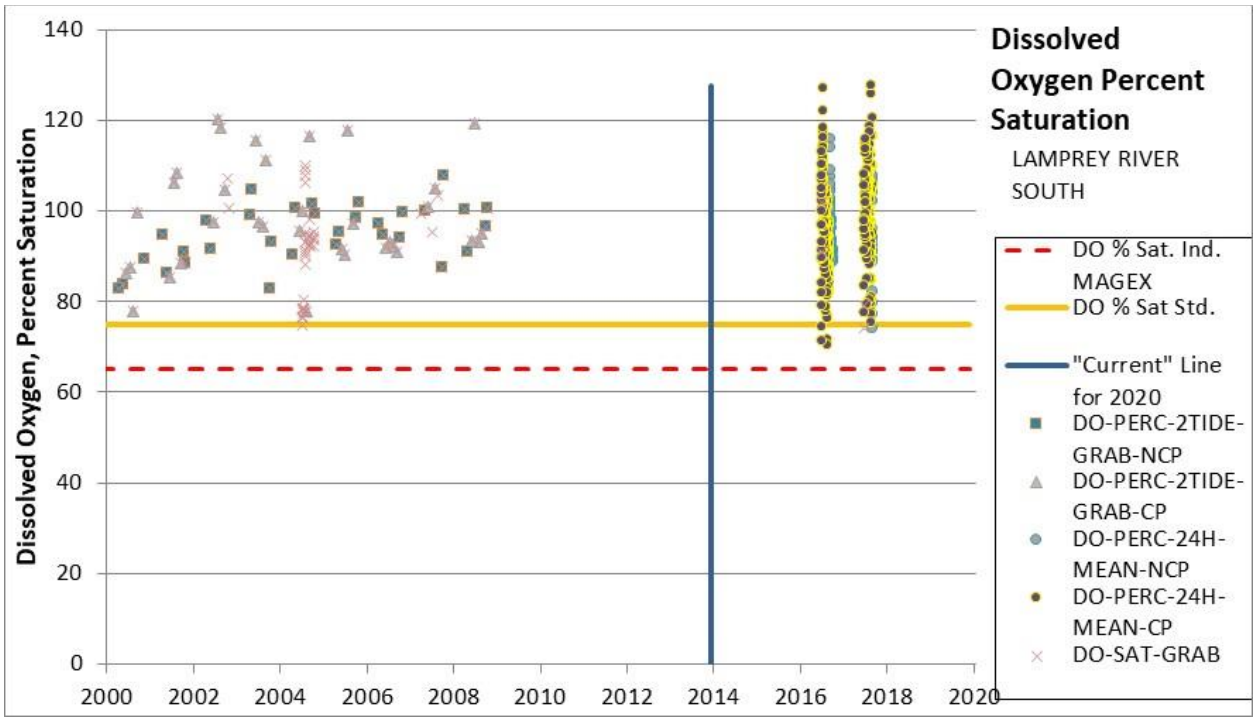
		Given the lack of new site specific data and the measurements upstream and downstream of this assessment zone the impaired (5-P) listing from the 2016 303d list has been retained.
Total Nitrogen	5-M / 5-M	The median total nitrogen from 2014 through 2017 was 395 µg/L (n=26). It is important to note that the available data straddles the period when the new waste water treatment facility came online and the reduction in total nitrogen is apparent in the dataset. The calculated 90th percentile chlorophyll-a in this assessment zone is 15.6 µg/L (n = 26). The eelgrass beds have been eliminated. The median light attenuation coefficient was not calculated due to no samples collected in the 2014 through 2017 period in this assessment zone, however, both the upstream assessment light attenuation coefficient is poor (median = 1.56 m^-1, n=41) and the downstream assessment zone is impaired due to the poor light attenuation coefficient (median = 1.63 m^-1, n=131). This assessment zone experienced dissolved oxygen concentrations well below the 5 mg/L criteria in 2016 but none in 2017 and daily average saturation fell below 75% in both 2016 and 2017. This assessment zone is generally characterized by limited and sometimes mixed eutrophication indicator data. While local data is currently limited and sometimes mixed its neighboring assessment zones have more detailed datasets. The upstream Lamprey River North assessment zone has extensive datasets demonstration impairments due to elevated chlorophyll-a and severely depleted dissolved oxygen. The downstream Great Bay assessment zone has elevated chlorophyll-a and marginal dissolved oxygen due to the severely poor condition coming out of the Squamscott River assessment zone as well as degraded eelgrass, poor light transmittance, and evidence of macroalgae. The status of the indicators of nutrients and nutrient-related impacts has not changed, and continue to present a preponderance of evidence that eutrophication effects are lingering. As such, the impairment for nitrogen has been retained and we look forward to the exploring complete post WWTF upgrade data.

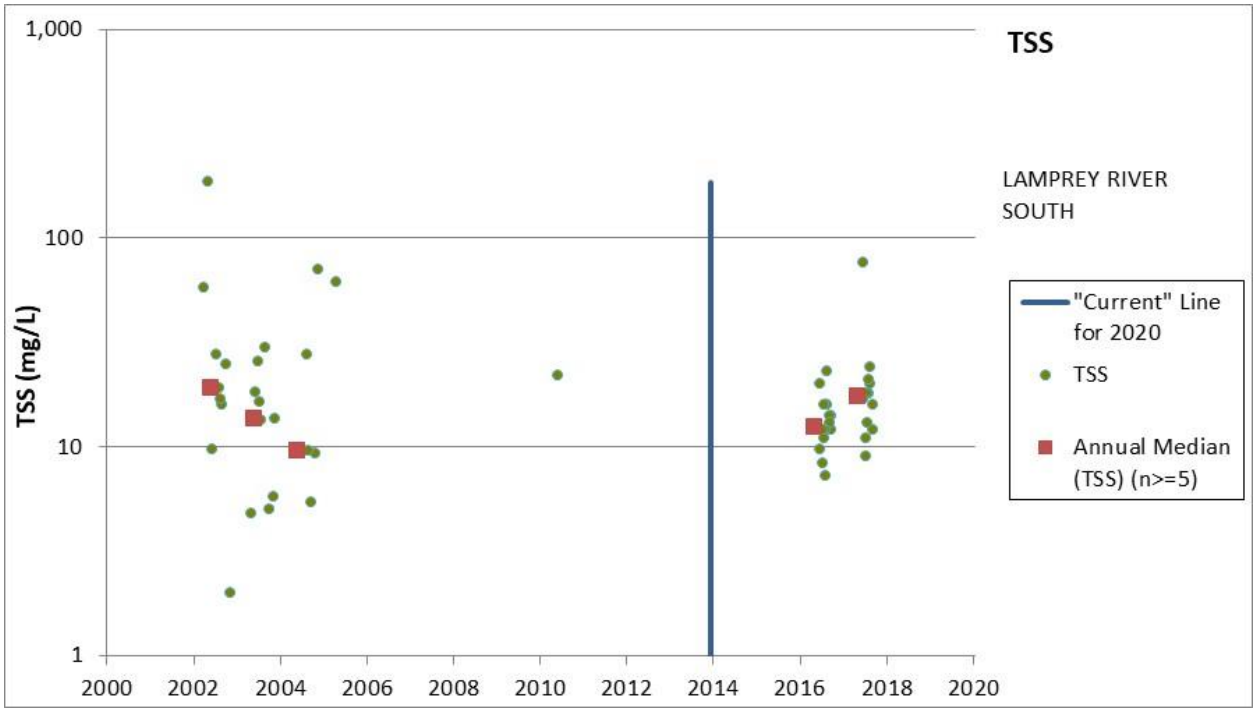


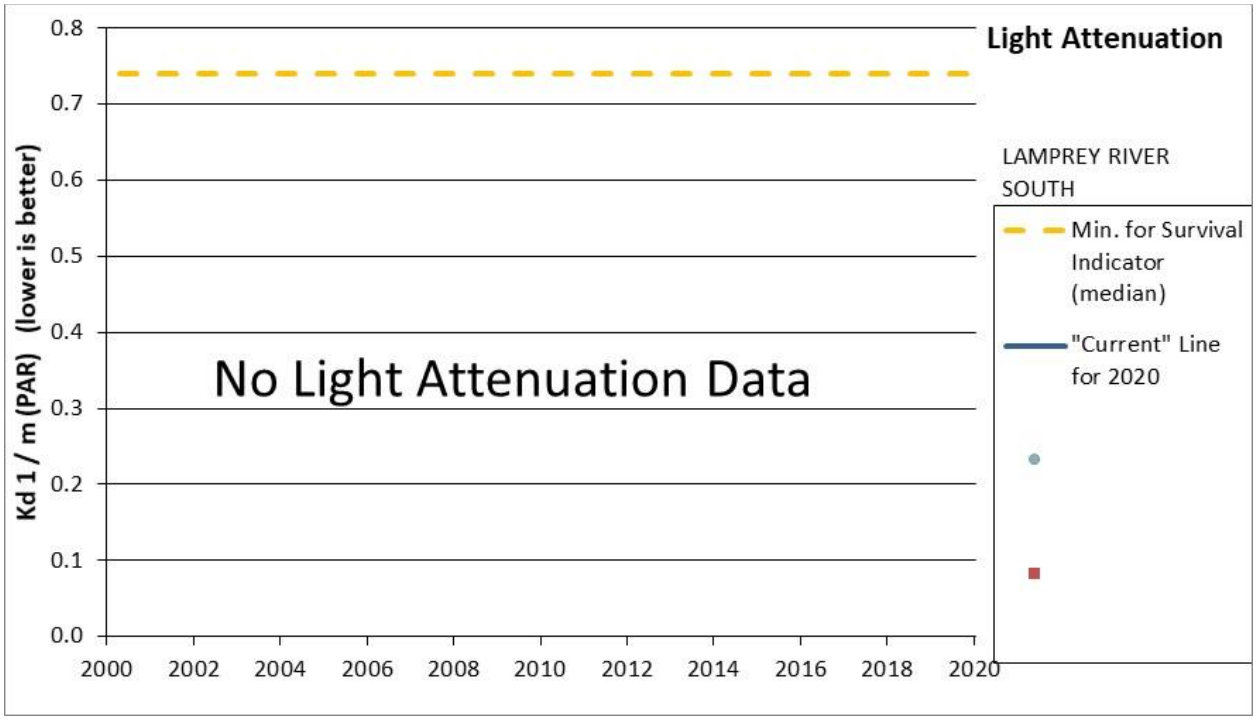

Chlorophyll-a
LAMPREY RIVER SOUTH
ug Chl-a / L
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

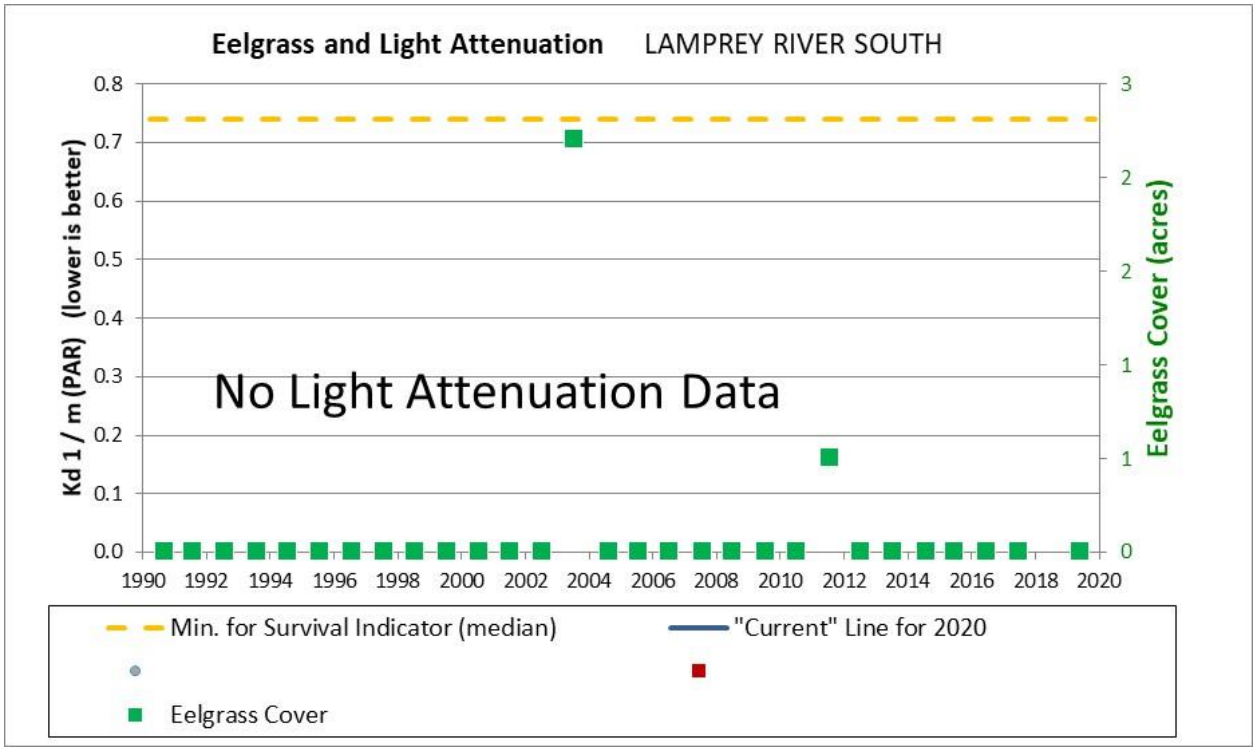

Chlorophyll-a
LAMPREY RIVER SOUTH
ug Chl-a / L
100
90
80
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Daily 10th/90th Percentile - Devalidated Logger data
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin

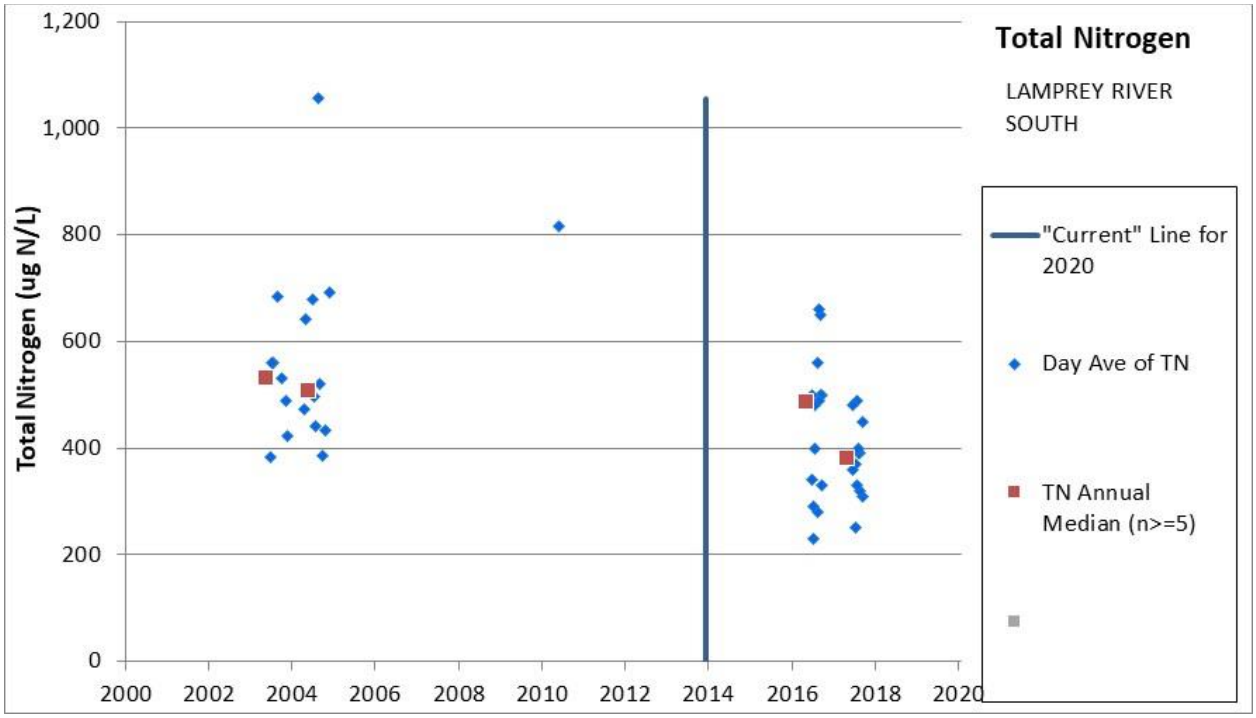

Dissolved Oxygen Concentration
LAMPREY RIVER SOUTH
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
LAMPREY RIVER SOUTH
Dissolved Oxygen, Percent Saturation
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
LAMPREY RIVER SOUTH
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020


Light Attenuation
LAMPREY RIVER SOUTH
Min. for Survival Indicator (median)
"Current" Line for 2020
No Light Attenuation Data
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020


Eelgrass and Light Attenuation
LAMPREY RIVER SOUTH
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
No Light Attenuation Data
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
3
2
2
1
1
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Eelgrass Cover


Total Nitrogen
LAMPREY RIVER SOUTH
Total Nitrogen (ug N/L)
1,200
1,000
800
600
400
200
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Lamprey River - South Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	26	2.0	4.4	15.6	20.0
CHLOROPHYLL A, Combined (ug/L)	26	0.0	4.4	15.6	20.0
LIGHT ATTENUATION COEFFICIENT (1/m)	0	-	-	-	-
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	0	-	-	-	-
TSS (mg/L)	26	7.3	14.0	23.3	76.0
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	0	-	-	-	-
DO-PPM-24HR-MIN-CP (mg/L)	242	4.0	6.2	7.2	7.7
DO-PPM-24HR-MIN-NCP (mg/L)	70	5.1	7.2	8.3	8.5
DO-PPM-GRAB-CP (mg/L)	4	6.0	6.3	-	7.2
DO-PPM-GRAB-NCP (mg/L)	0	-	-	-	-
DO-PERC-24H-MEAN-CP (% sat)	268	70.5	98.0	112.1	127.7
DO-PERC-24H-MEAN-NCP (% sat)	66	74.2	93.8	106.2	115.8
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	0	-	-	-	-
DO-PERC-GRAB (% sat)	4	74.2	85.0	-	102.0
Day Ave of TN (ug N/L)	26	230	395	587	660
Day Ave of TDN (ug N/L)	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	26	37	158	461	508
Day Ave of NH3 (ug N/L)	27	11	124	348	368
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	26	10	48	113	140
SALINITY-Grabs (pss)	26	15.0	25.9	29.2	30.9
SALINITY-Datalogger Daily Median (pss)	325	12.0	27.3	30.6	31.3
pH-grab	0	-	-	-	-
pH-24HR (min)	356	7.2	7.7	7.5*	8.1
pH-24HR (max)	356	7.6	8.0	8.2	8.6
Temperature	26	14.4	21.0	25.6	26.0
Temperature-Daily Median	341	8.9	21.1	25.3	27.2

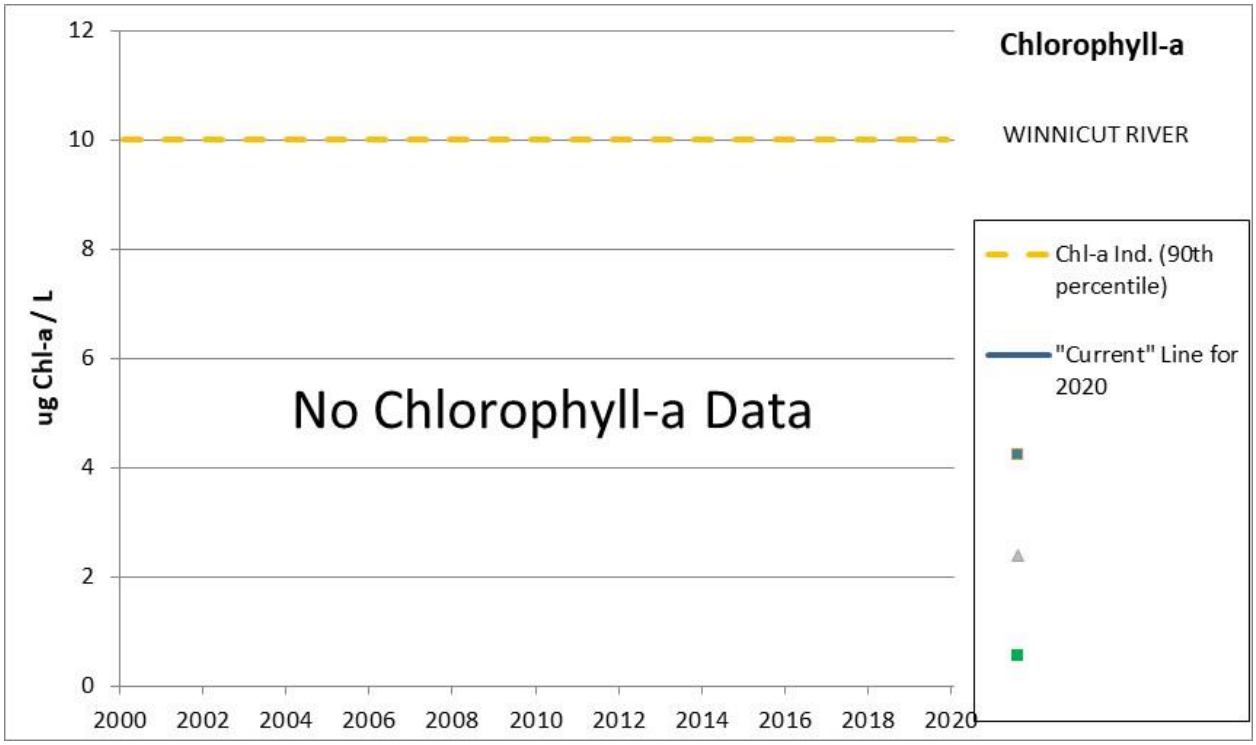
*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

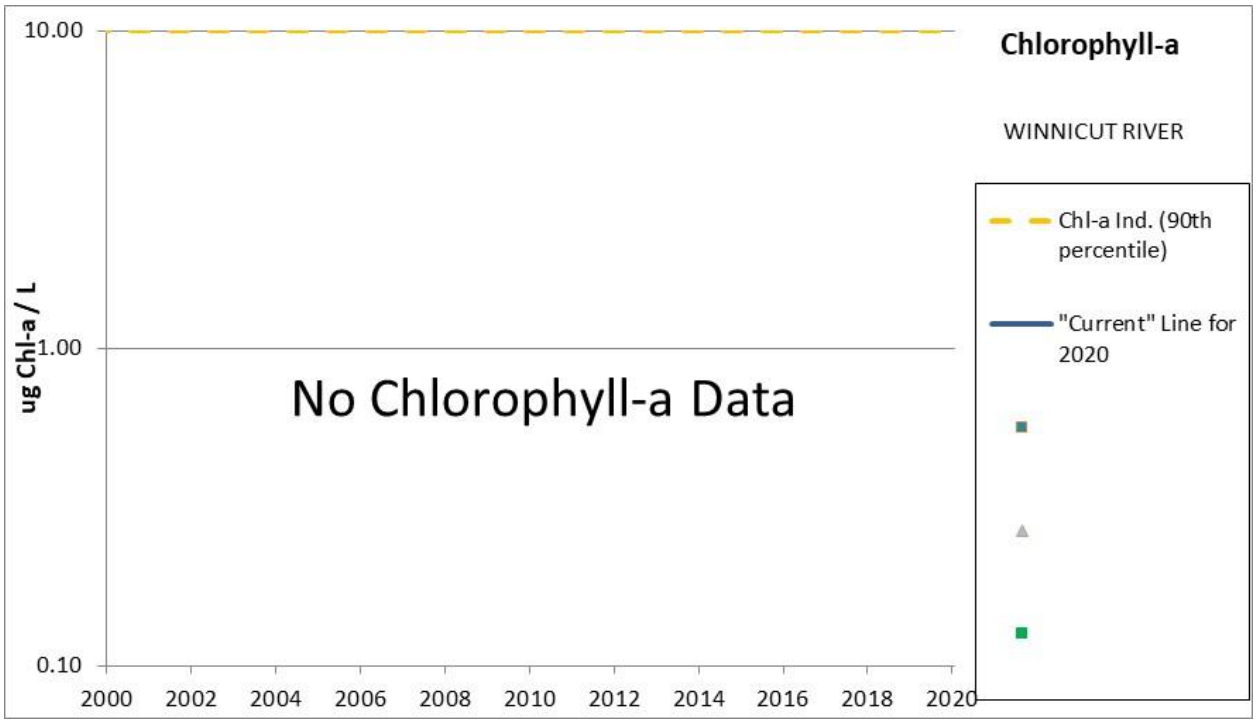
Assessment Zone = WINNICUT RIVER

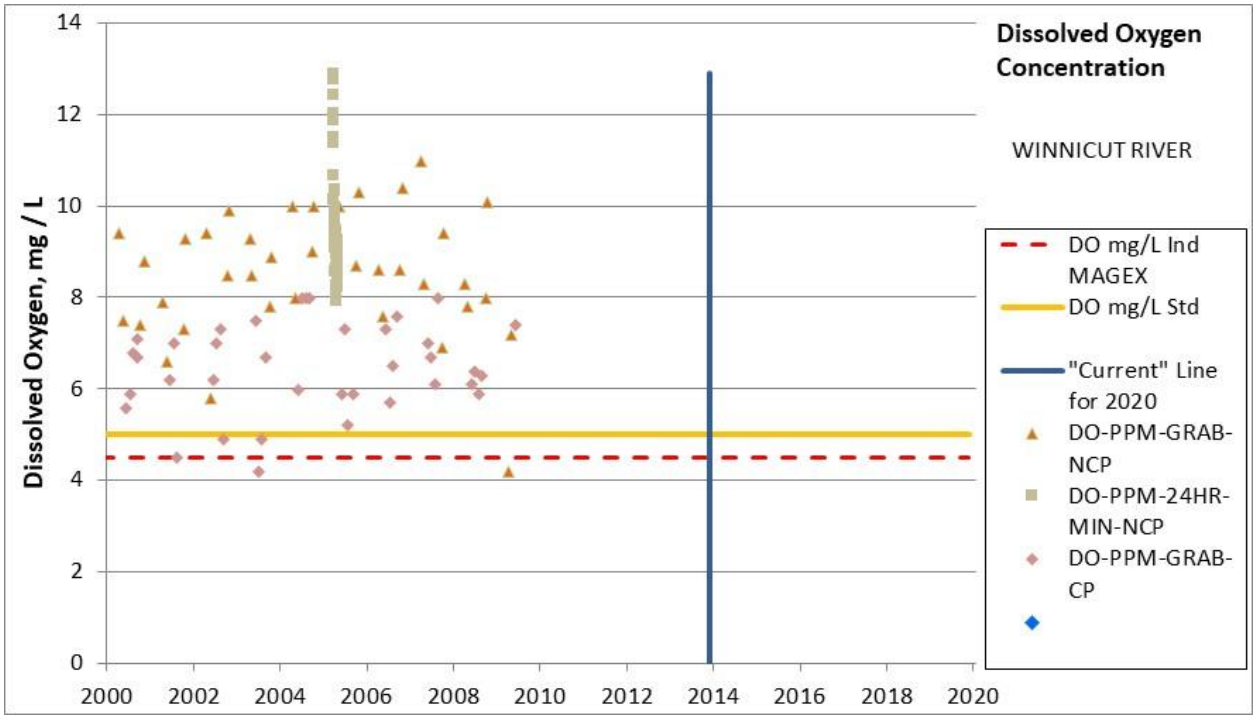
(NHEST600030904-01)

As of the date of data retrieval (January 10, 2020) water quality data through 2016 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are no additional years of data compared to the 2018 assessment.

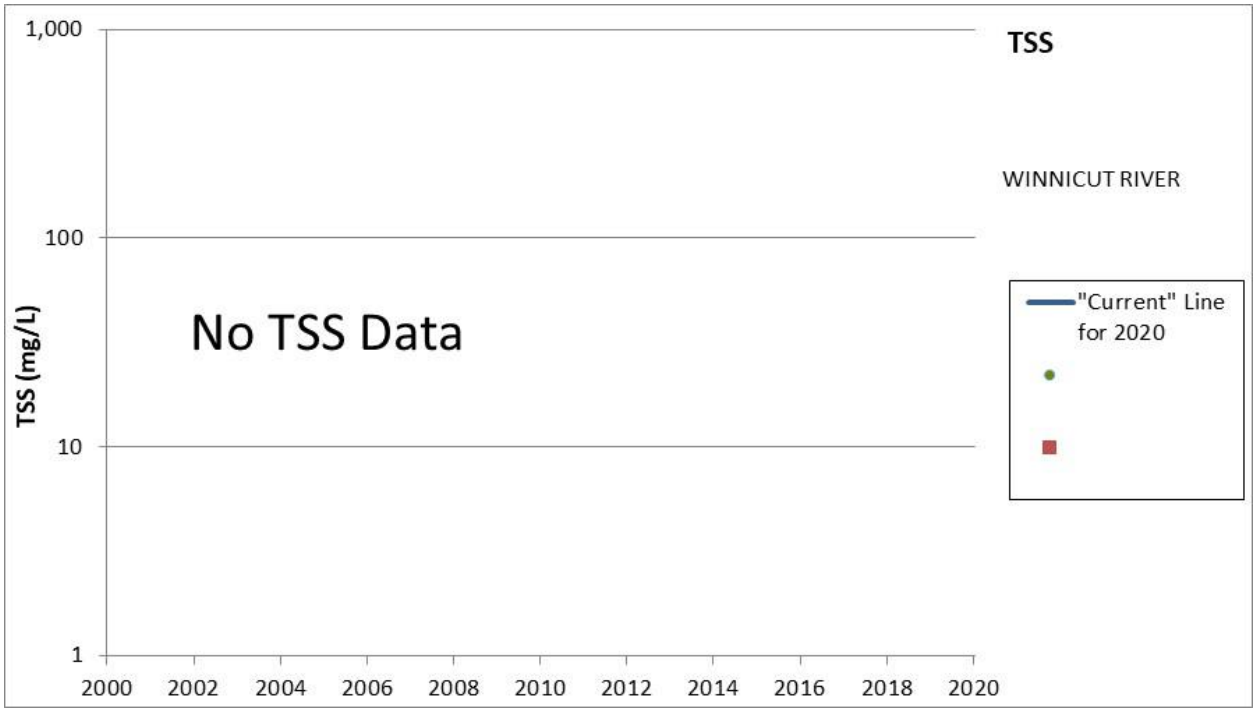
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	3-ND / 3-ND	The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L. However, no chlorophyll-a data was collected in the current period for this assessment zone.
Dissolved Oxygen (mg/L)	3-ND / 3-ND	This assessment zone has no measurements for dissolved oxygen concentration since 2009. As such, this assessment zone has been assessed as 3-ND (No Data) dissolved oxygen concentration.
Dissolved Oxygen (% Saturation)	3-ND / 3-ND	This assessment zone has no measurements for dissolved oxygen percent saturation since 2008. As such, this assessment zone has been assessed as 3-ND (No Data) for dissolved oxygen percent saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was not available from the 1948, 1962, 1980, and 1981 datasets. Eelgrass was present from 1990 through 2006. The median current extent of eelgrass in 2016-2019 is 0.6 acres. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 80.6%. The thresholds for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	No light attenuation coefficient data has been collected in the current period for this assessment zone.
Total Nitrogen	3-ND / 3-ND	There are no “current” total nitrogen data from which to calculate a median total nitrogen from 2012 through 2018. As such, this assessment zone cannot be assessed for total nitrogen.

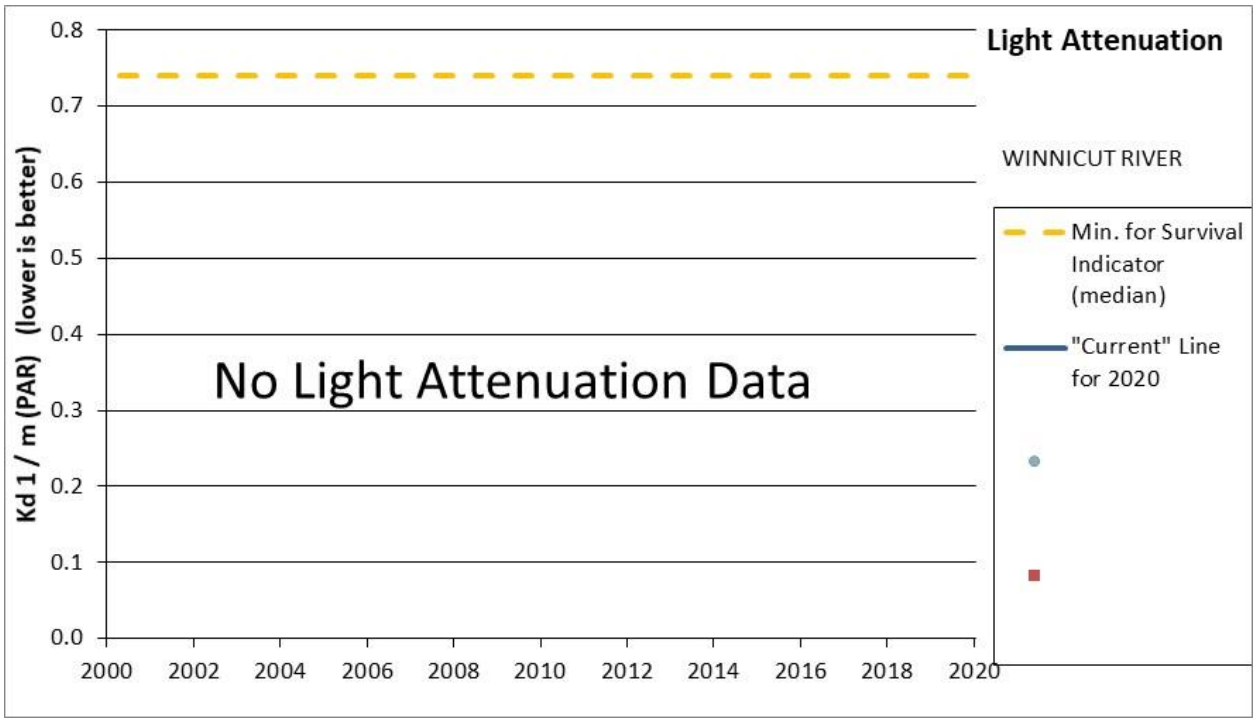

Chlorophyll-a
WINNICUT RIVER
ug Chl-a / L
No Chlorophyll-a Data
Chl-a Ind. (90th percentile)
"Current" Line for 2020
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020

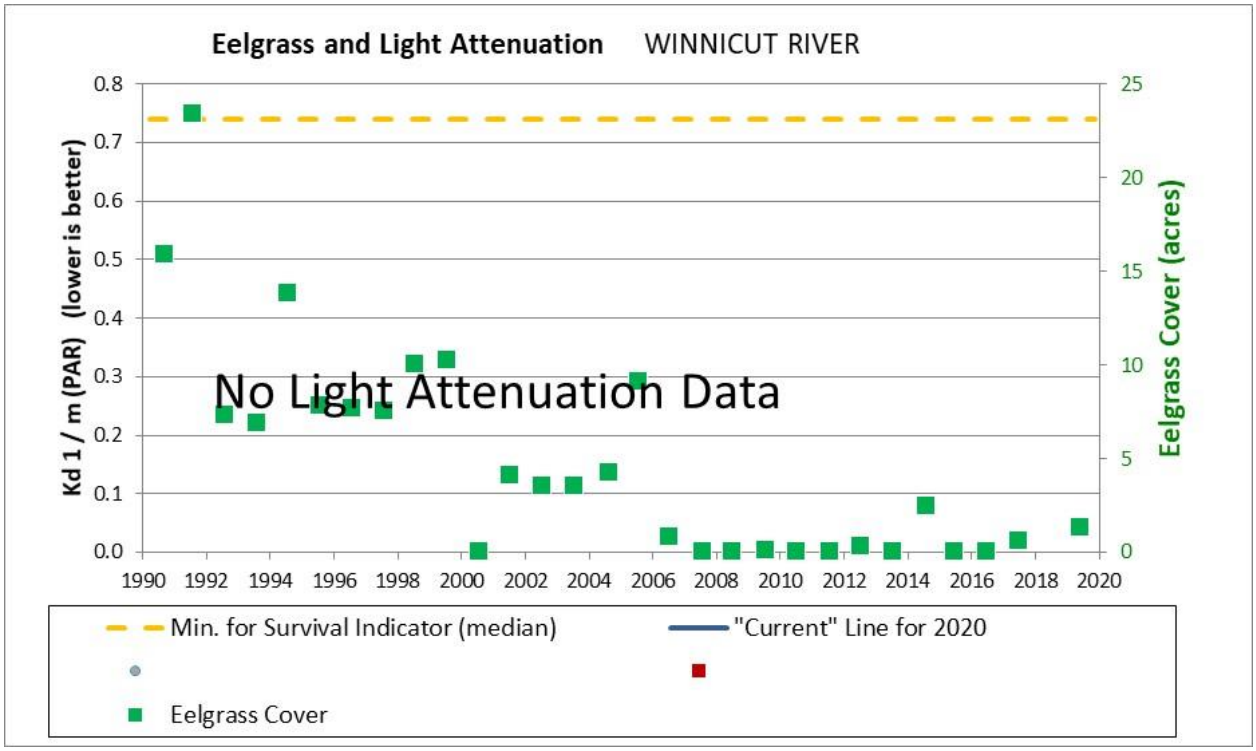

Chlorophyll-a
WINNICUT RIVER
ug Chl-a / L
No Chlorophyll-a Data
Chl-a Ind. (90th percentile)
"Current" Line for 2020
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020

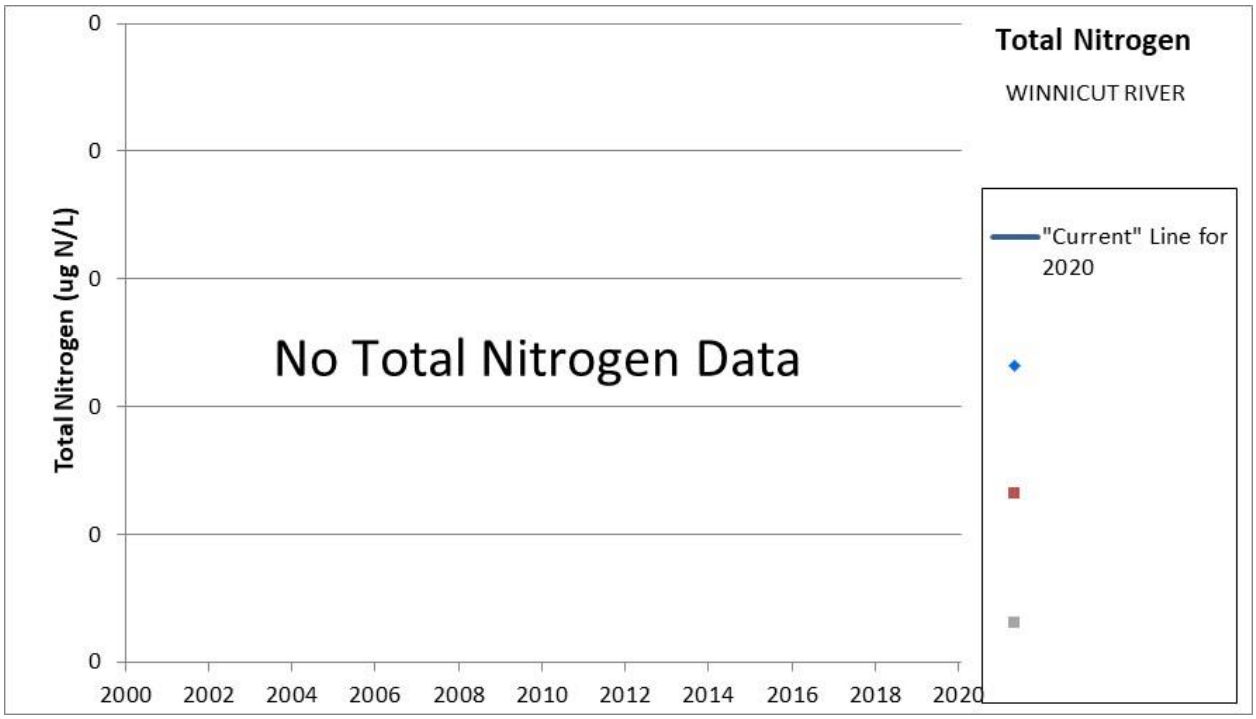

Dissolved Oxygen Concentration
WINNICUT RIVER
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP


Dissolved Oxygen Percent Saturation
WINNICUT RIVER
Dissolved Oxygen, Percent Saturation
0
20
40
60
80
100
120
140
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-SAT-GRAB


TSS
WINNICUT RIVER
No TSS Data
"Current" Line for 2020
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020


Light Attenuation
WINNICUT RIVER
No Light Attenuation Data
Min. for Survival Indicator (median)
"Current" Line for 2020
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020


Eelgrass and Light Attenuation
WINNICUT RIVER
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
No Light Attenuation Data
Min. for Survival Indicator (median)
"Current" Line for 2020
Eelgrass Cover


Total Nitrogen
WINNICUT RIVER
Total Nitrogen (ug N/L)
No Total Nitrogen Data
"Current" Line for 2020

Winnicut River Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, Combined (ug/L)	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT (1/m)	0	-	-	-	-
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	0	-	-	-	-
TSS (mg/L)	0	-	-	-	-
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	0	-	-	-	-
DO-PPM-24HR-MIN-CP (mg/L)	0	-	-	-	-
DO-PPM-24HR-MIN-NCP (mg/L)	0	-	-	-	-
DO-PPM-GRAB-CP (mg/L)	0	-	-	-	-
DO-PPM-GRAB-NCP (mg/L)	0	-	-	-	-
DO-PERC-24H-MEAN-CP (% sat)	0	-	-	-	-
DO-PERC-24H-MEAN-NCP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	0	-	-	-	-
DO-PERC-GRAB (% sat)	0	-	-	-	-
Day Ave of TN (ug N/L)	0	-	-	-	-
Day Ave of TDN (ug N/L)	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	0	-	-	-	-
Day Ave of NH3 (ug N/L)	0	-	-	-	-
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	0	-	-	-	-
SALINITY-Grabs (pss)	10	7.0	24.2	29.3	29.7
SALINITY-Datalogger Daily Median (pss)	0	-	-	-	-
pH-grab	0	-	-	-	-
pH-24HR (min)	0	-	-	-	-
pH-24HR (max)	0	-	-	-	-
Temperature	10	4.5	16.0	23.3	23.3
Temperature-Daily Median	0	-	-	-	-

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

Assessment Zone = GREAT BAY

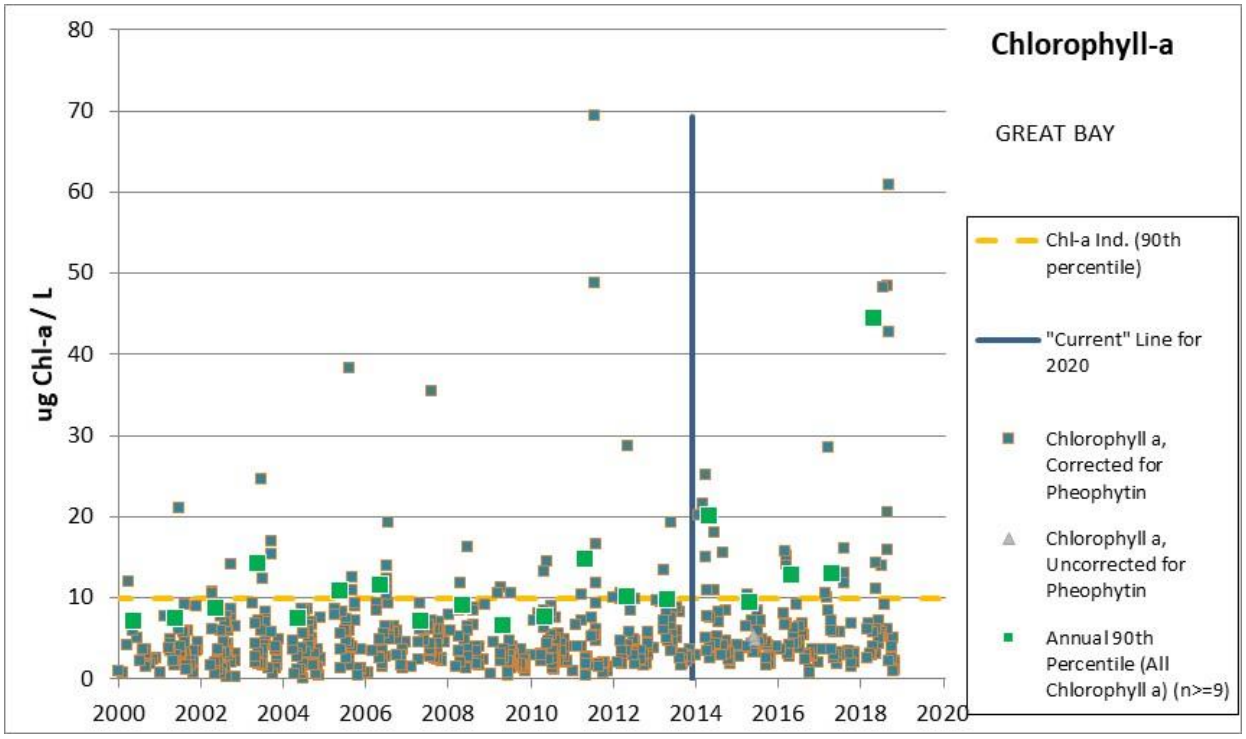
(NHEST600030904-02, NHEST600030904-03, NHEST600030904-04-02, NHEST600030904-04-03, NHEST600030904-04-04, NHEST600030904-04-05, NHEST600030904-04-06)

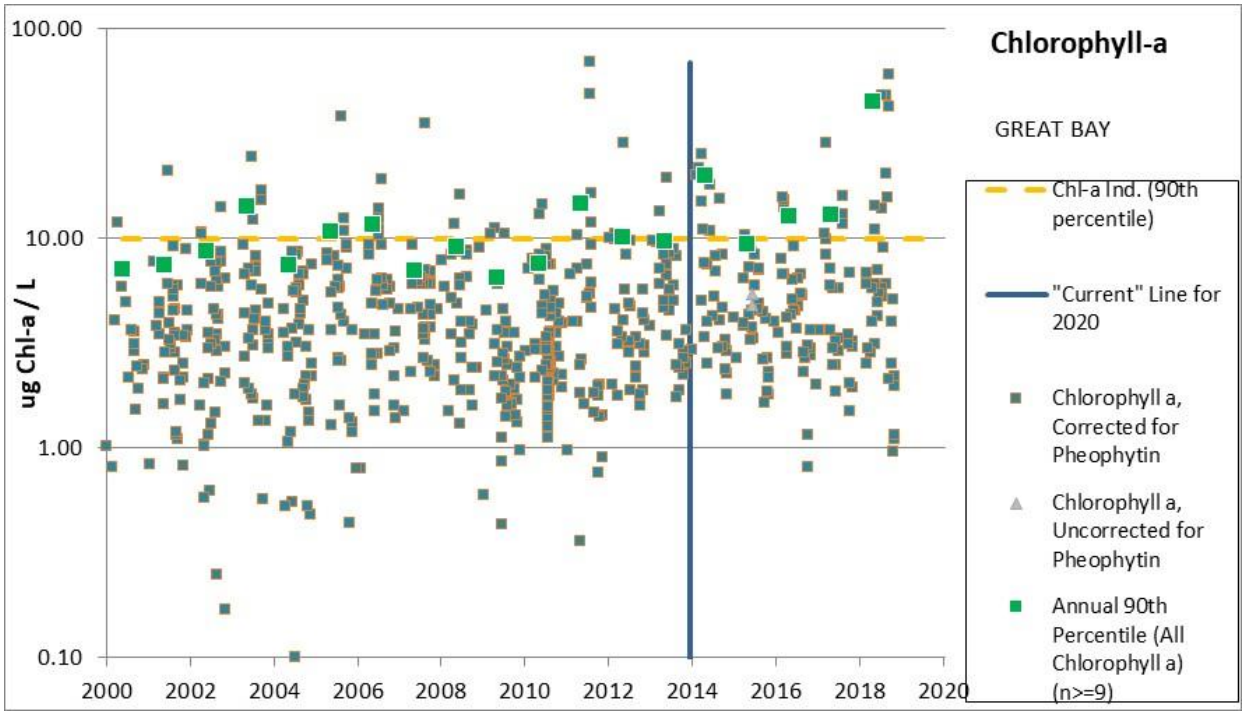
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are three additional years of data (2016, 2017, 2018) compared to the 2016 assessment but the 2019 data is not included. There were two new stations to the Great Bay assessment zone. In 2017 (Jun-Dec) Great Bay West had a datalogger deployed and in 2018 (Apr-Nov) Great Bay East had a datalogger deployed and grab samples for chemistry and chlorophyll-a.

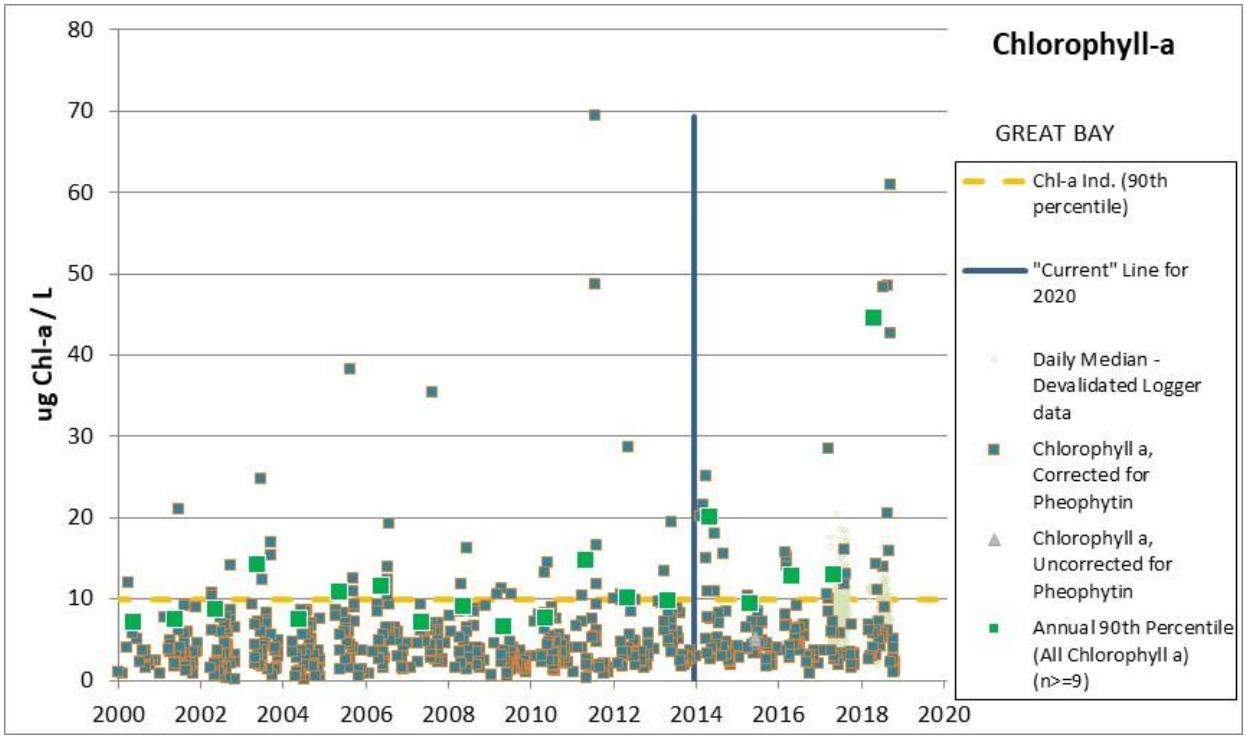
Indicator	Aquatic Life Use Category 2016 / 2020/2022	2020/2022 Comment
Chlorophyll-a	3-PNS / 5-M	The calculated 90th percentile for chlorophyll-a in this assessment zone is 14.9 µg/L (n = 160) [21.3 µg/L (n=58) without GRBAP and GRBSQ]. The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L. Elevated chlorophyll-a levels were particularly common in 2017 and 2018 in the non-boundary stations, GRBGB and the new GRBGBE exceeding 40 ug/L on 4 of the 36 different grab sample dates, the highest reading being 60.9 ug/L at GRBGB. Although the probe based chlorophyll-a data (not used in the median above) collected in the assessment zone at GRBGB (2017 and 2018) and GRBGBW (2018) was qualified as "estimated," due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and shows a similar distribution to the grab samples. It is worth noting that while grab samples are surface collected (0.5m), the dataloggers are at depth, affixed off the bottom, confounding any paired grab/probe analysis. As chlorophyll-a is very high at the Squamscott River boundary and generally high and at times very high at two additional stations within Great Bay, one of the response variables is marginal (dissolved oxygen), and the other is very poor (light), chlorophyll-a has been assessed as Not Supporting.
Dissolved Oxygen (mg/L)	3-PNS / 3-PNS	This assessment zone has 24 hour datalogger and grab measurements for dissolved oxygen concentration. One of the assigned stations (GRBSQ - Squamscott River datalogger at RR bridge) is at the mouth of the Squamscott River, precisely at the divide between the Squamscott River and Great Bay assessment zones. The very low readings from GRBSQ are a cause for concern. While GRBSQ more accurately represents the conditions in the Squamscott River than the entirety of Great Bay proper, it indicates that low DO issues are likely to extend into portions of Great Bay. As it has for years, the GRBGB station had no readings below 5 mg/L (2014-2018). In 2017 a new rotational site was established on the west side of Great Bay (GRBGBW) and had a minimum DO of 5.7 mg/L. Were the low DO issues from GRBSQ to extend into Great Bay, GRBGBW is the datalogger where we would expect to see those low DO concentrations. Then, in 2018 an additional new rotational site was established on the east side of Great Bay (GRBGBE) which recorded a minimum DO below 5 mg/L on 4-dates (9/5 to 9/8). Even by themselves, the 4 summer critical period (n=122) values are insufficient to trigger impairment based on the 10% rule. Considering all the data across the assessment zone, conditions warrant retention of the dissolved oxygen concentration assessment as Insufficient Information – Potentially Not Supporting.
Dissolved Oxygen (% Saturation)	3-PAS / 2-M	This assessment zone has 24 hour datalogger and grab measurements for dissolved oxygen percent saturation. One of the assigned stations (GRBSQ - Squamscott River datalogger at RR bridge) is at the mouth of the Squamscott River, precisely at the divide between the Squamscott River and Great Bay assessment zones. While GRBSQ more accurately represents the conditions in the Squamscott River than the entirety of Great Bay proper, it does indicate low DO issues are likely to extend into portions of Great Bay. The primary sampled station (GRBGB) as well as the

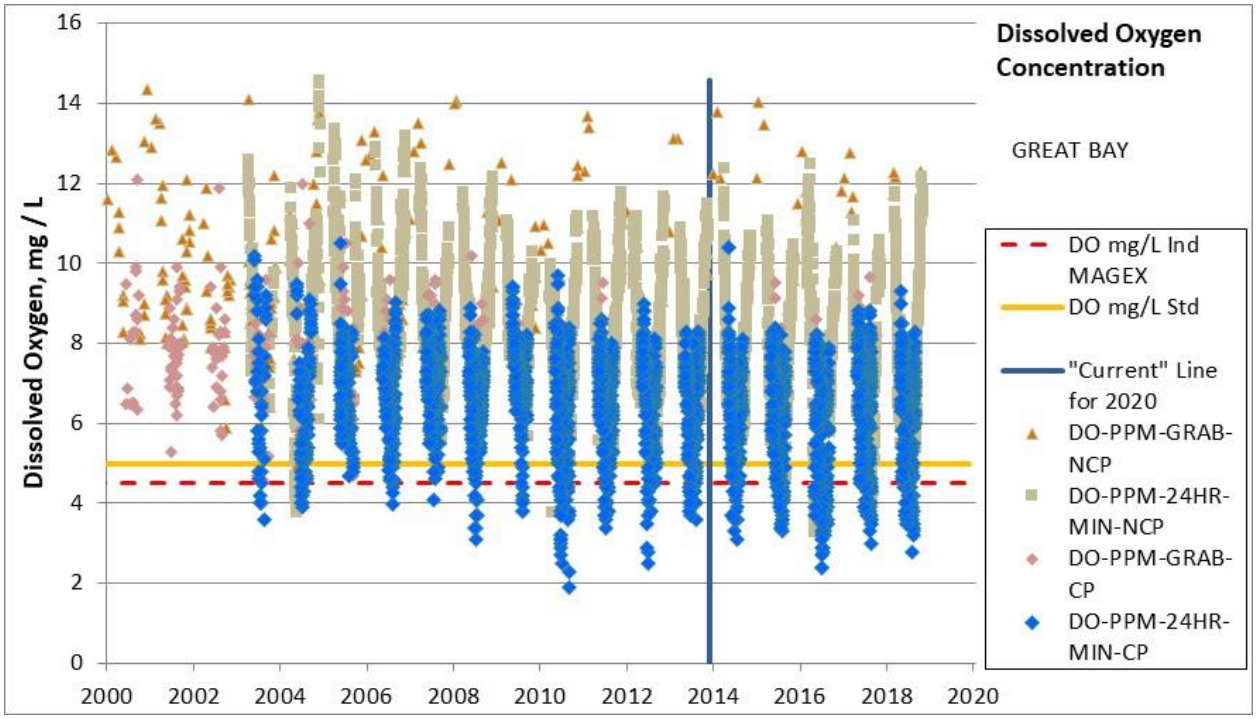
		new GRBBGW and GRBGBE stations inside of the Great Bay assessment zone all have recorded acceptable dissolved oxygen saturation 0.5 meters off the bottom.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 2,130.7 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2016-2019 is 1,450 acres, which is a 31.9% decrease. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 30.4%. The thresholds for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	Median=1.63 m^-1 (n=131) [1.42 µg/L (n=46) without GRBAP and GRBSQ]. For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. Therefore, the impaired (5-M) listing from the 2018 303d list has been retained.
Total Nitrogen	3-PNS / 5-M	The median total nitrogen from 2014 through 2019 was 378 µg/L (n=58) when considering only the stations in the middle of Great Bay; and 401 µg/L (n=161) when including the boundary stations GRBSQ and GRBAP. The long-term Great Bay site (GRBGB) recorded 6-measurments over 500 ug/L in 2018 (6/19=518 ug/L, 8/14=542 ug/L, 9/25=501 ug/L, 10/15=864 ug/L, 11/12=569 ug/L, & 12/3=643 ug/L). The new GRBGBE site documented 3-measurments over 500 ug/L in 2018 (8/17=908 ug/L, 9/24= 502 ug/L, 10/16=1,610 ug/L, 11/19=501 ug/L). Dr. Howes indicated (Howes, 2019) a growing season (May-Sept) average of 320-350 ug/L "…should be protective of that resource [eelgrass in the Great Bay system] based on [his] experience with nearby Massachusetts estuarine waters." As indicated here, the median total nitrogen from 2014 through 2019 was 378 µg/L (n=58) when considering only the stations in the middle of Great Bay. The average of the same 58 samples is 429 ug/L over the full calendar year and 409 ug/L (n=33) in the growing season. The calculated 90th percentile for chlorophyll-a in this assessment zone is 14.9 µg/L (n = 160) [21.3 µg/L (n=58) without GRBAP and GRBSQ]. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), which in part appears to be the case in the Great Bay assessment zone. Both intertidal green and red seaweeds (macroalgae) decreased (weakly significant) since 2013 at the Depot Road site which, of the macroalgae monitoring sites, is closest to the mouths of the Lamprey and Squamscott Rivers and intertidal green macroalgae decreased (significantly) since 2014 at Adams Point (Burdick, et al., 2020). However, the appreciable cover at Lubberland Creek and Sunset Hill Farm did not show statistical decreases although those two sites have only been sampled 3-times from 2013-2019 making trend detection more difficult (Burdick, et al., 2020). Beginning in 2018, subtidal sampling was first added to the macroalgae monitoring at the four sites around Great Bay. The 2019 annual macroalgae report notes that, "Sites with the highest percent cover and biomass of red and green seaweed had the lowest abundance of eelgrass." (Burdick, et al., 2020), a finding that is consistent of competitive displacement. There is evidence that macroalgae is impacting eelgrass and changing the species composition and diversity in Great Bay to some extent. Using data from Great Bay (Pe'eri, Morrison, Short, Mathieson, Brook, & Trowbridge, 2008), NHDES determined that macroalgae mats had replaced nearly 5.7% of the area formerly occupied by eelgrass in Great Bay in 2007 (NHDES, 2009). The 2017 and 2019 eelgrass mapping suggests that the large area that was dominated by macroalgae along the south side of the bay is slowly being recolonized by eelgrass from the edges of that macroalgae zone although some of that area is now interspersed with widgeon grass and most has no mapped eelgrass. Overall, the eelgrass beds remain degraded and the available light attenuation ([median=1.63 m^-1 (n=131)] [1.42 µg/L (n=46) without GRBAP and GRBSQ]) is poor. This assessment zone has no demonstrated dissolved oxygen concentration exceedances at station GRBGB in the middle of Great Bay, nor at GRBGBW (2017) on the west side, but a few days of low DO at GRBGBE (2018) on the east side. However, when considering all sampling stations of Great Bay there are areas in the southwest that may exhibit poor dissolved oxygen concentration. Daily average dissolved oxygen percent saturation values remain above 75% at the main stations GRBGB, GRBGBW (2017) and GRBGBE (2018). However, when considering all

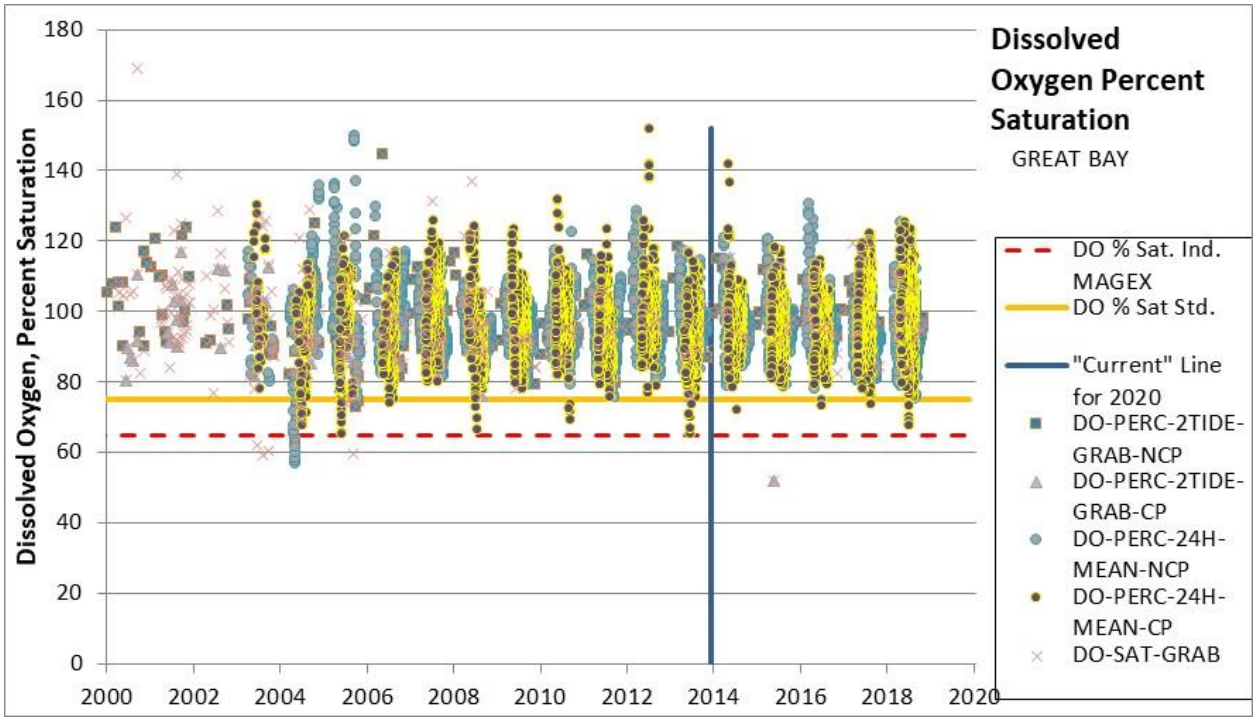
		sampling stations of Great Bay there are areas in the southwest that may exhibit poor daily average dissolved oxygen percent saturation. Per the CALM, in order to assess compliance with the narrative nutrient criteria for the Great Bay estuary, the indicators of nutrients and nutrient-related impacts are collectively evaluated . The methodology describes that the assessment decision is based on a preponderance of evidence and the status of those indicators. In this assessment zone, not only has eelgrass been lost and light attenuation is unsuitable for its growth, but the chlorophyll-a indicator is elevated above the 90th percentile for the protection of eelgrass and is elevated as compared to previous assessment periods. The levels of TN in the assessment zone are higher than what would be considered protective levels (Howes, 2019) and are quite high (over 500 ug/L) on many occasions (13 of 58 samples or 22% of the time). Given the number of eutrophication indicators that are above the levels identified in CALM as needed to support aquatic life use, and the preponderance of evidence indicating the impacts of eutrophication, this assessment zone has been moved to non-supporting for total nitrogen.

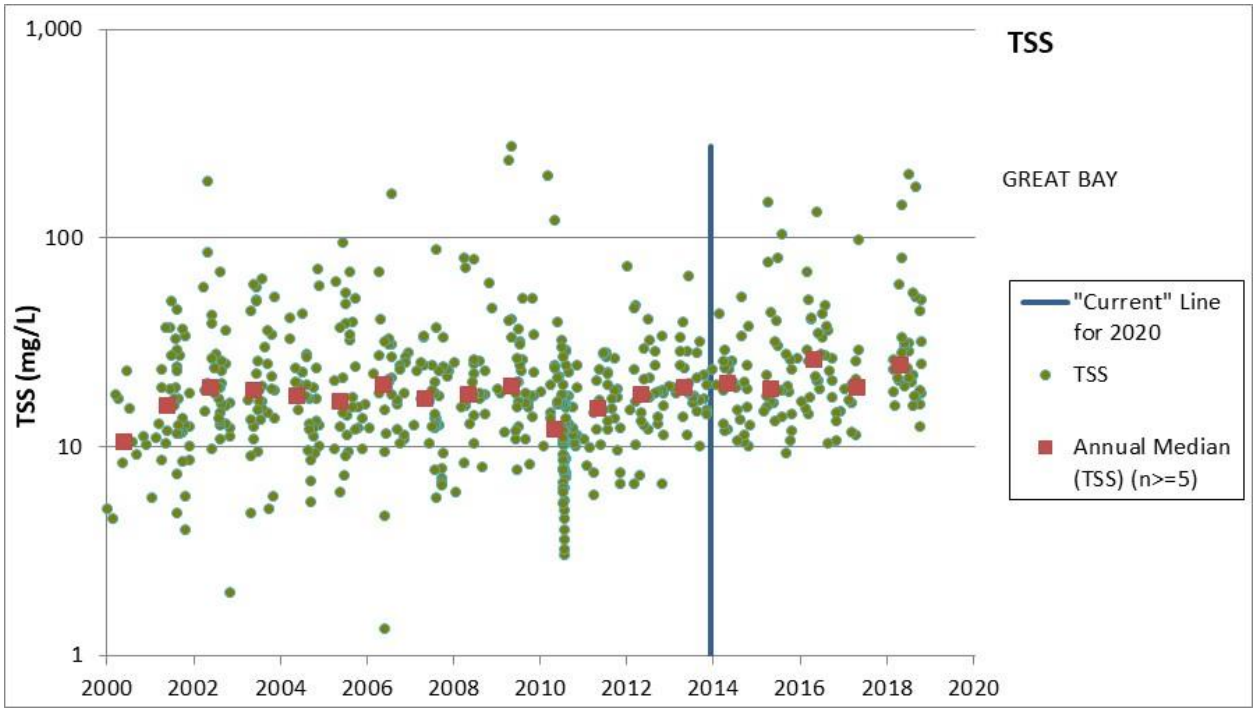


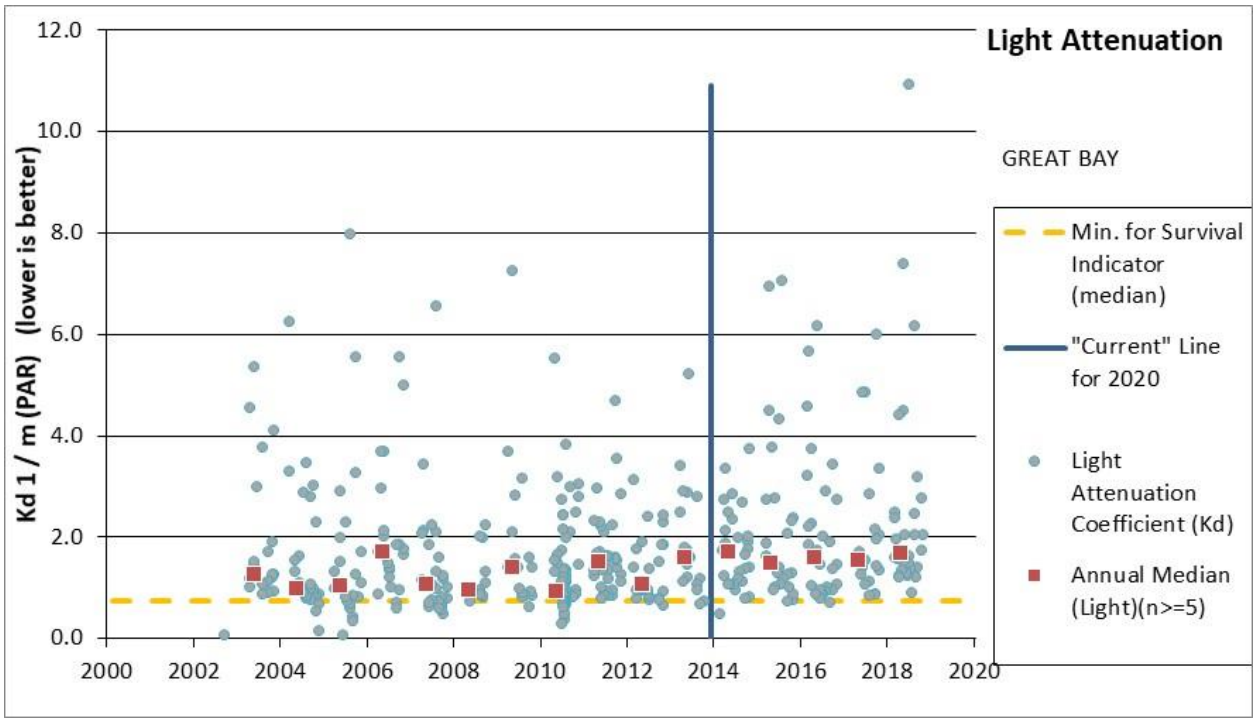

Chlorophyll-a
GREAT BAY
ug Chl-a / L
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

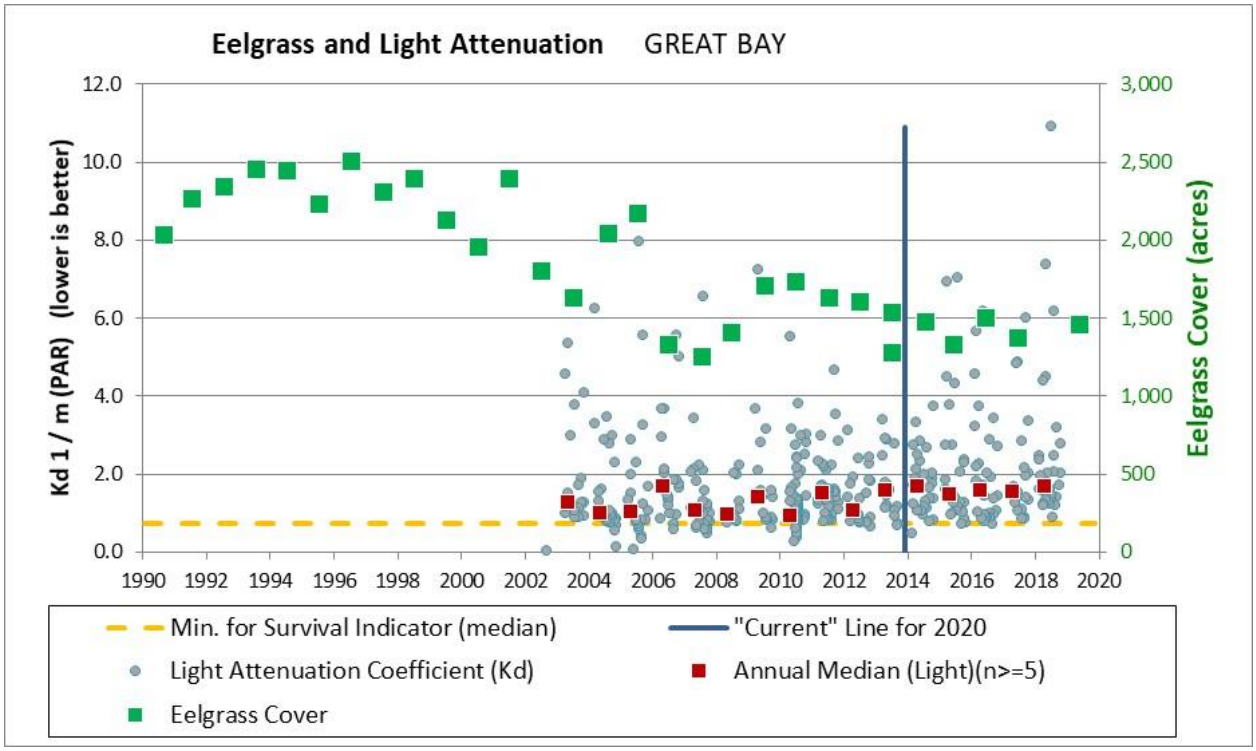

Chlorophyll-a
GREAT BAY
ug Chl-a / L
80
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Daily Median - Devalidated Logger data
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

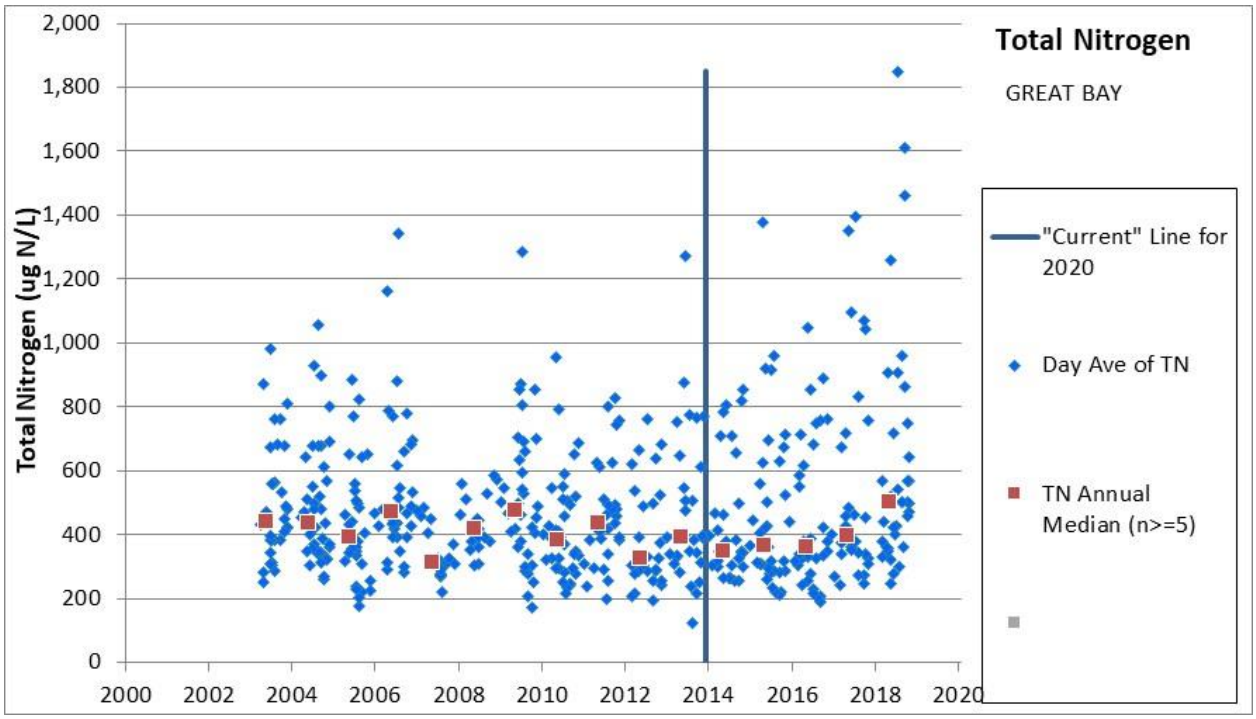

Dissolved Oxygen Concentration
GREAT BAY
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP

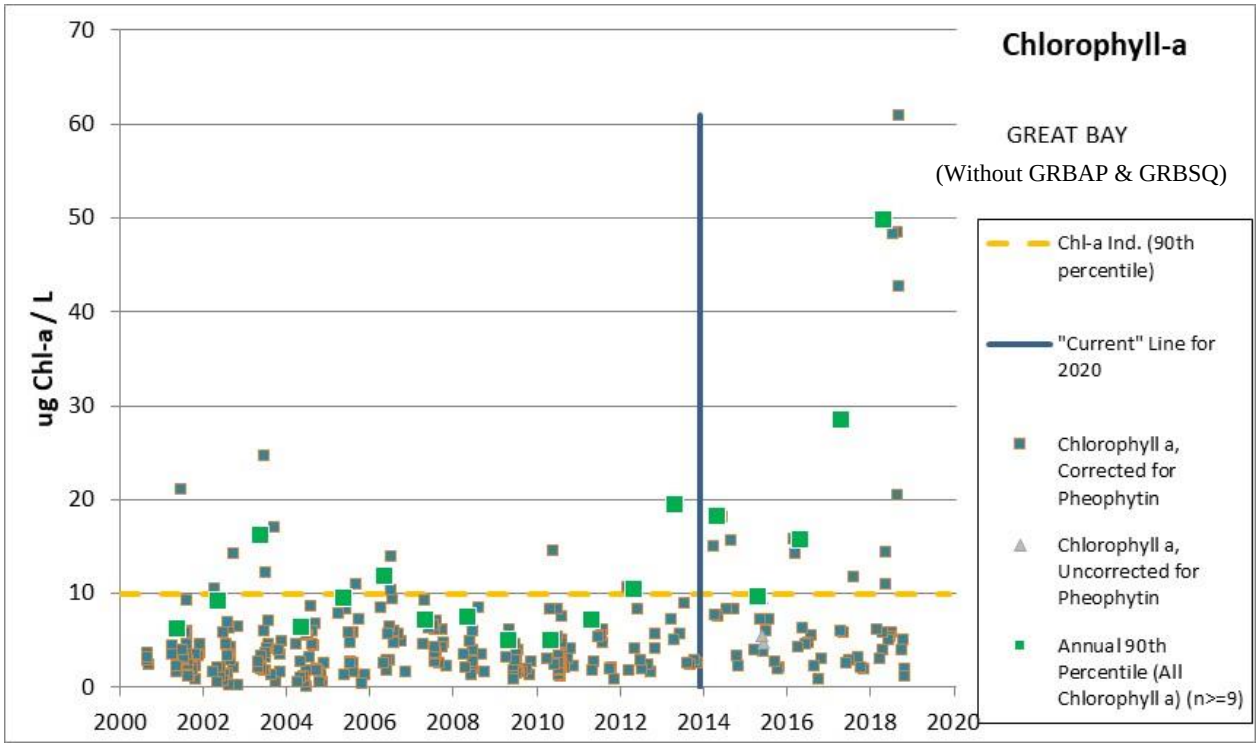

Dissolved Oxygen Percent Saturation
GREAT BAY
Dissolved Oxygen, Percent Saturation
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB

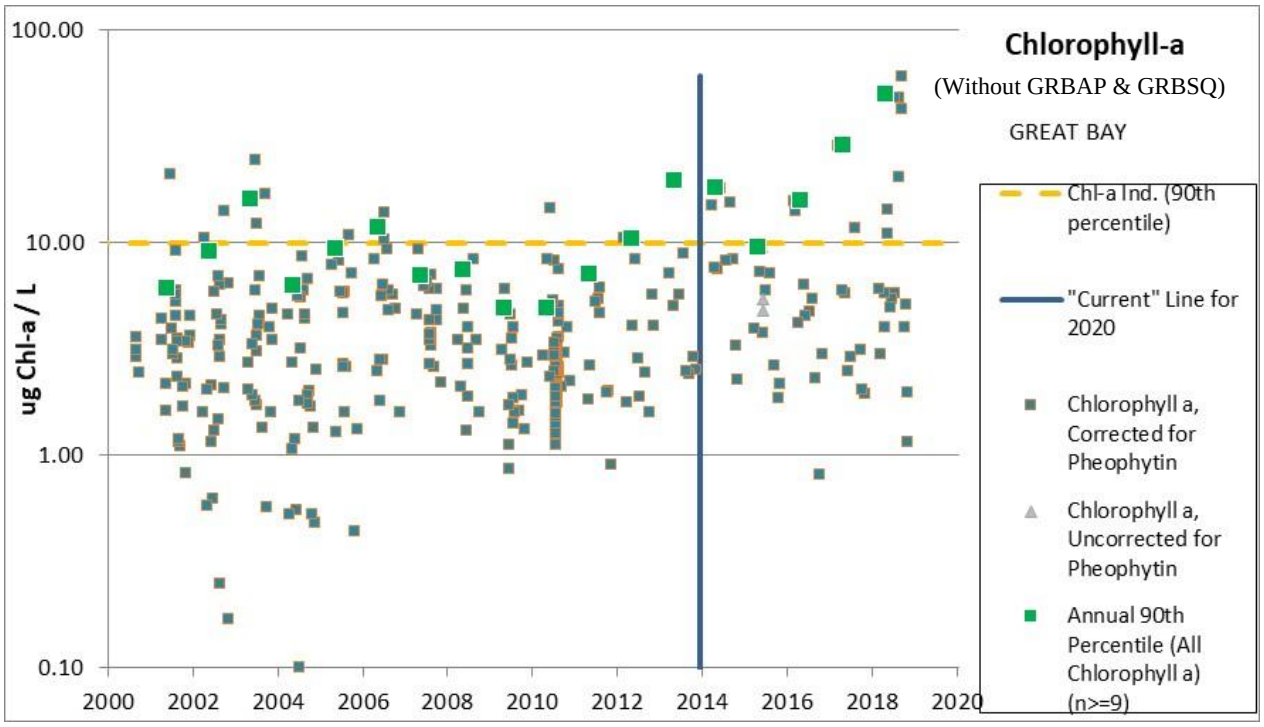

TSS
GREAT BAY
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)

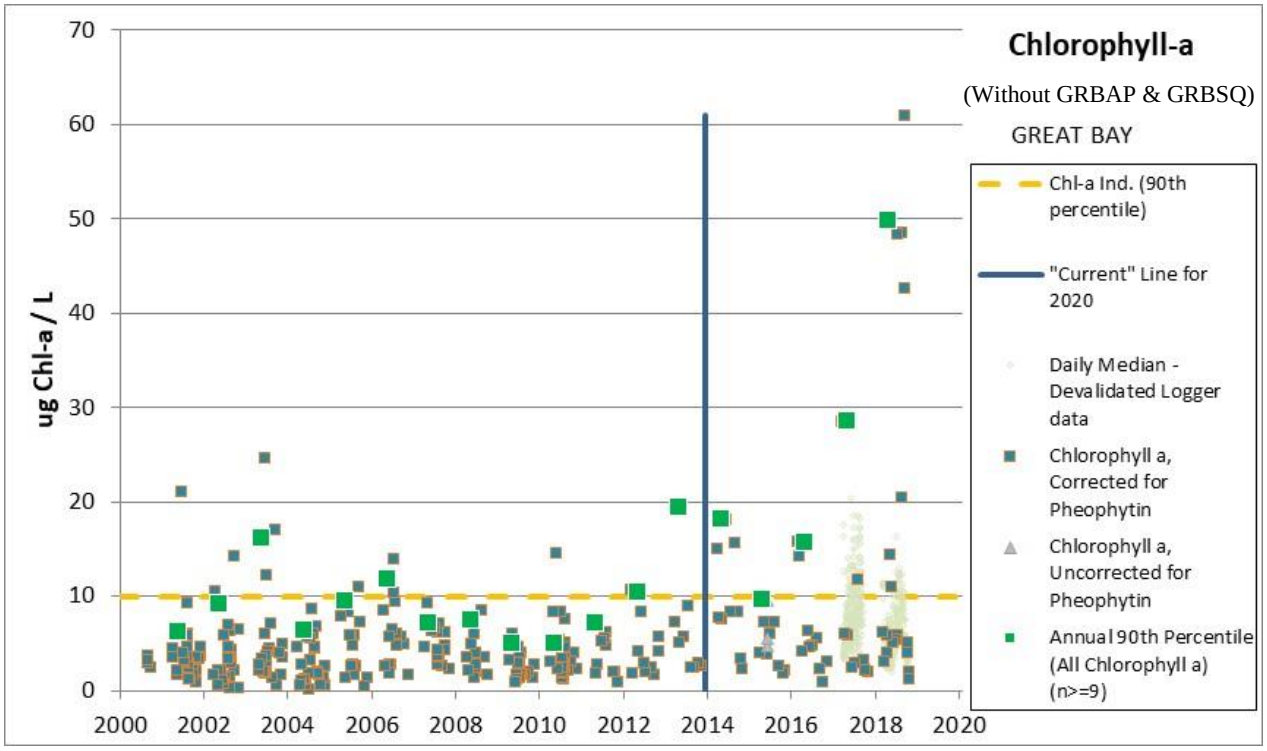

Light Attenuation
GREAT BAY
Kd 1 / m (PAR) (lower is better)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)

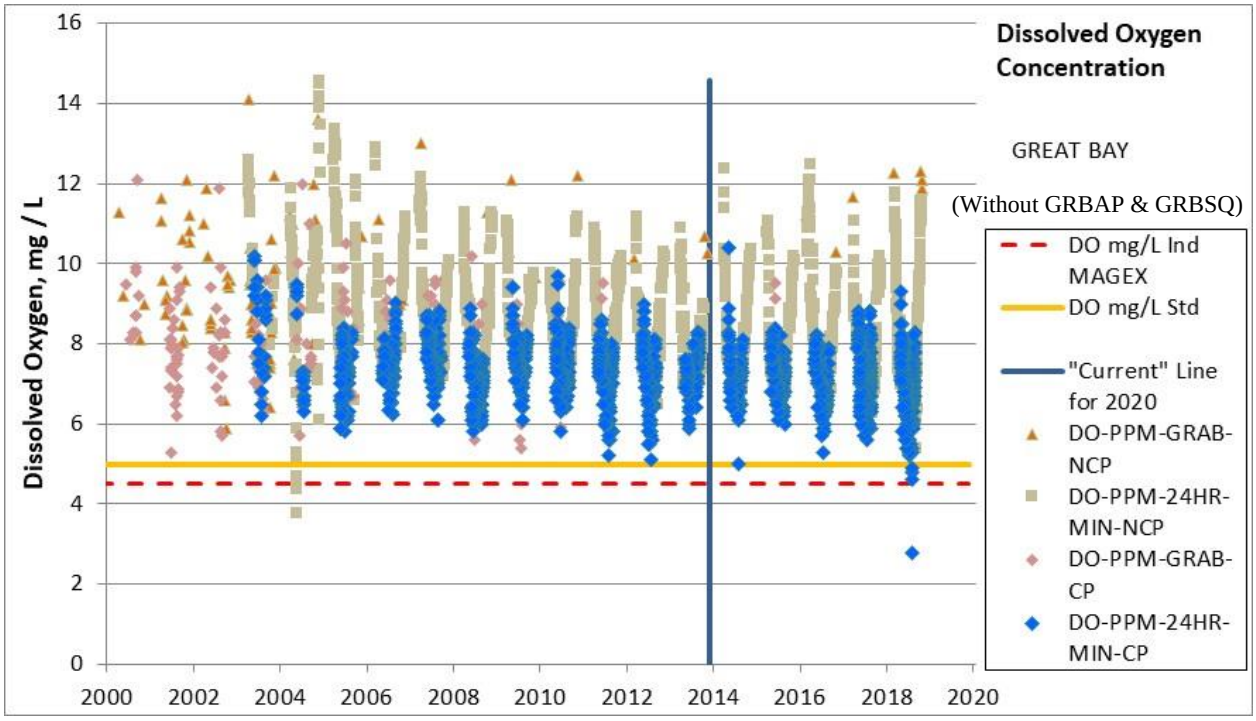

Eelgrass and Light Attenuation GREAT BAY
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
3,000
2,500
2,000
1,500
1,000
500
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)
Eelgrass Cover

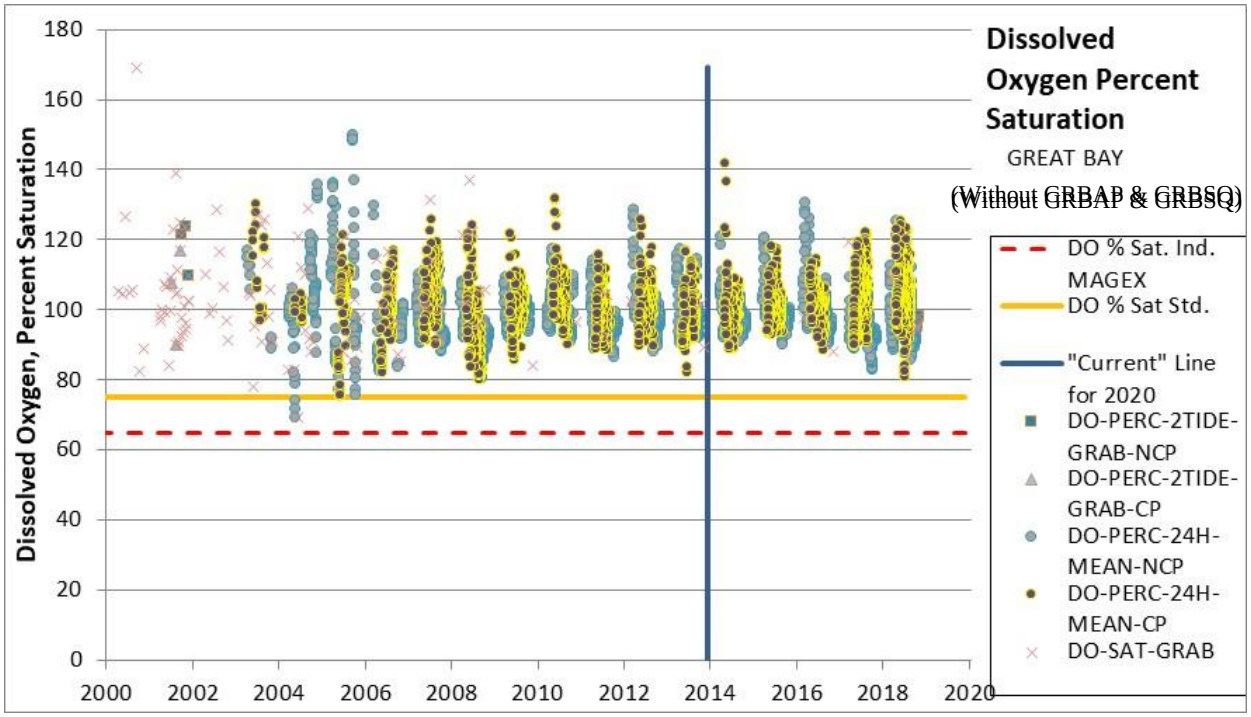

Total Nitrogen
GREAT BAY
Total Nitrogen (ug N/L)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

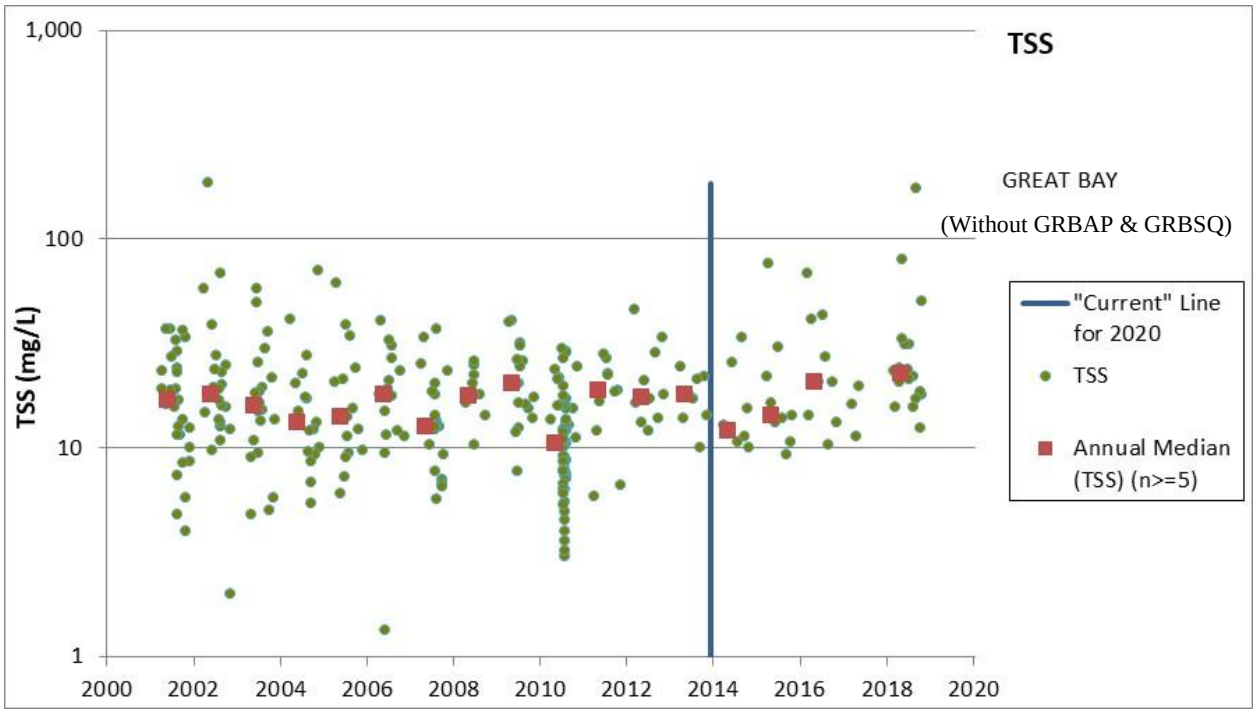

Chlorophyll-a
GREAT BAY
(Without GRBAP & GRBSQ)
ug Chl-a / L
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

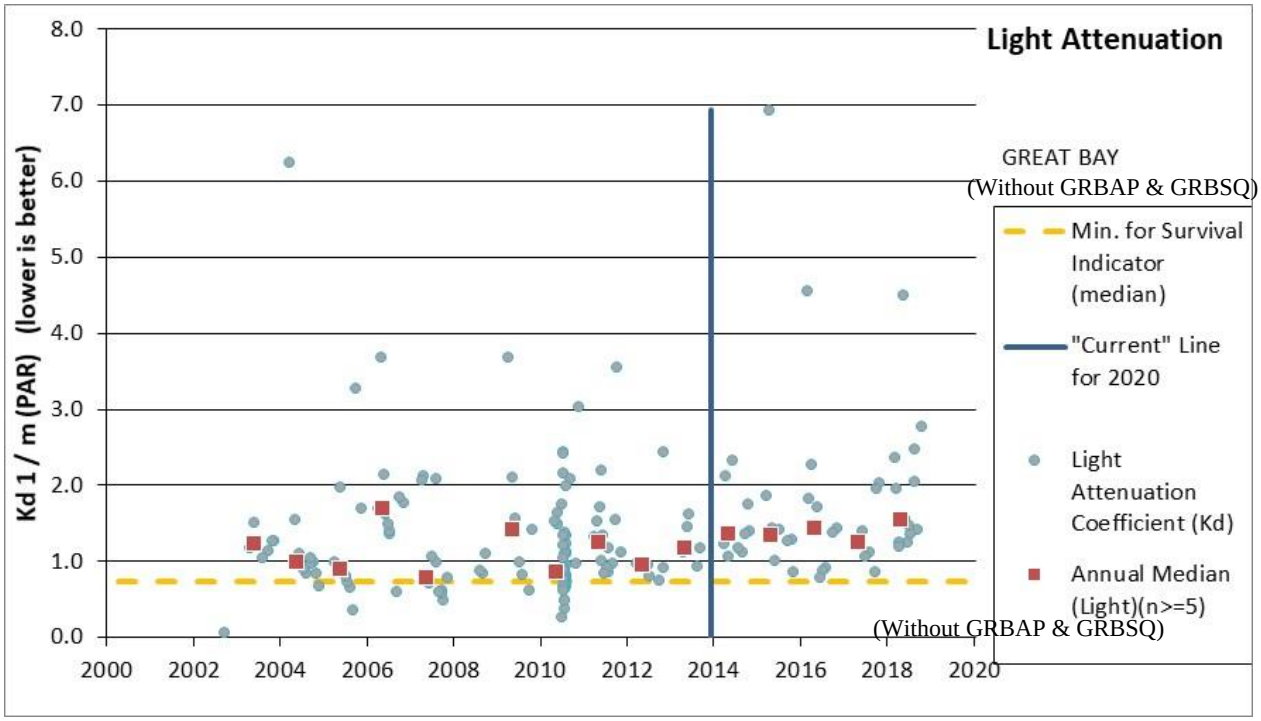

Chlorophyll-a
(Without GRBAP & GRBSQ)
GREAT BAY
ug Chl-a / L
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

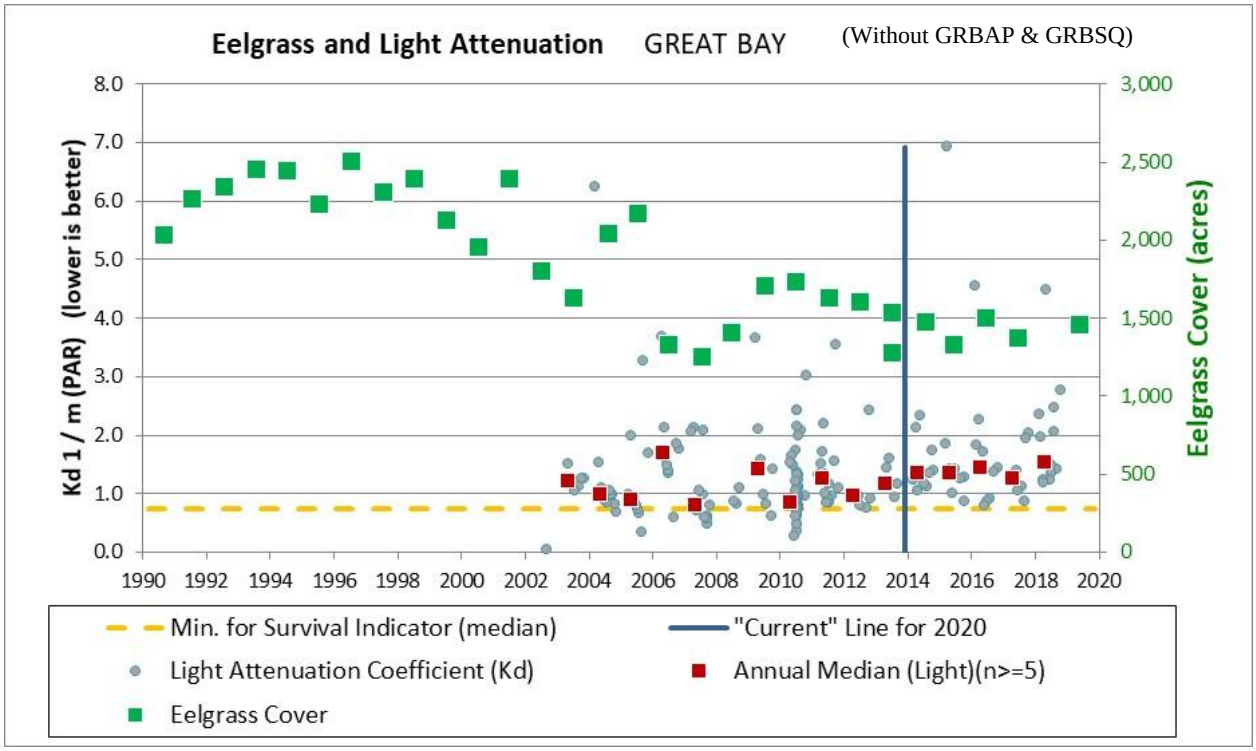

Chlorophyll-a
(Without GRBAP & GRBSQ)
GREAT BAY
ug Chl-a / L
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Daily Median - Devalidated Logger data
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

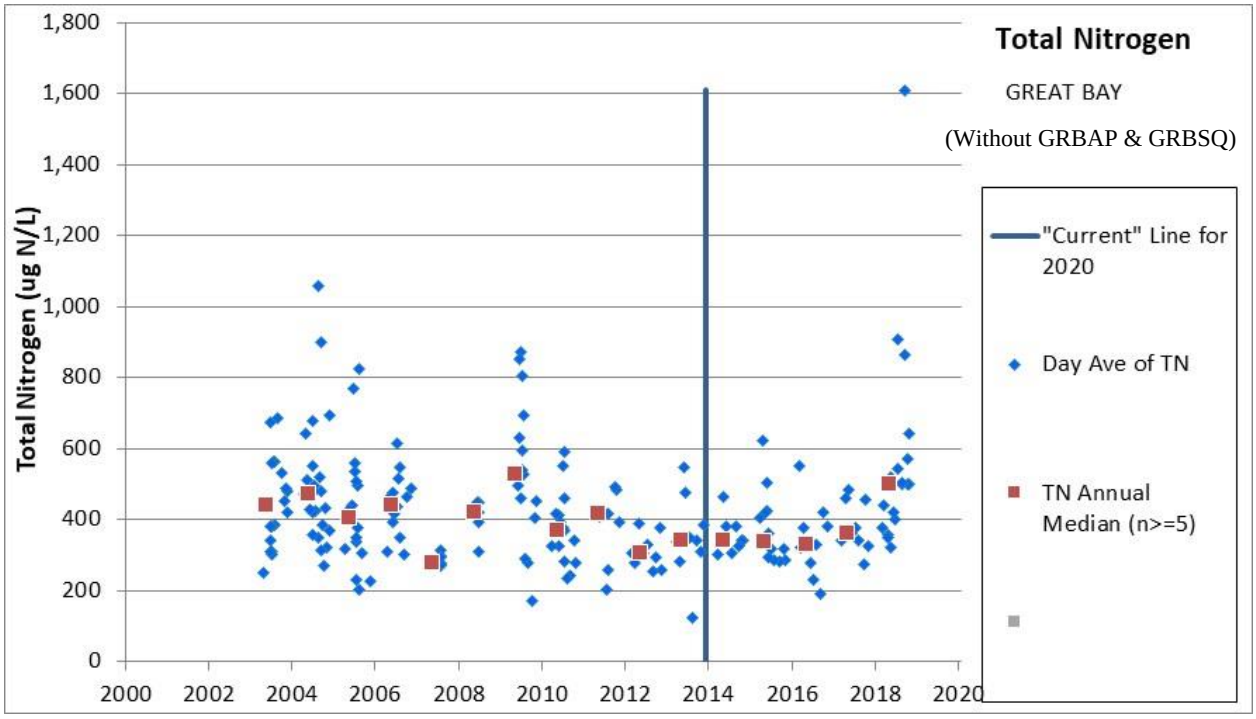

Dissolved Oxygen Concentration
GREAT BAY
(Without GRBAP & GRBSQ)
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
GREAT BAY
(Without GRBAP & GRBSQ)
Dissolved Oxygen, Percent Saturation
180
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
GREAT BAY
(Without GRBAP & GRBSQ)
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Light Attenuation
GREAT BAY
(Without GRBAP & GRBSQ)
Kd 1 / m (PAR) (lower is better)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)
(Without GRBAP & GRBSQ)


Eelgrass and Light Attenuation
GREAT BAY
(Without GRBAP & GRBSQ)
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3,000
2,500
2,000
1,500
1,000
500
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)
Eelgrass Cover


Total Nitrogen
GREAT BAY
(Without GRBAP & GRBSQ)
Total Nitrogen (ug N/L)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Great Bay Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	157	0.8	4.4	15.0	60.9
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	3	4.8	5.5	-	9.6
CHLOROPHYLL A, Combined (ug/L)	160	0.8	4.5	14.9	60.9
LIGHT ATTENUATION COEFFICIENT (1/m)	131	0.48	1.63	4.48	10.92
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	2,627	1.0	7.0	20.0	366.0
TSS (mg/L)	138	9.3	21.6	52.4	201.8
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	158	1.4	3.3	6.3	12.2
DO-PPM-24HR-MIN-CP (mg/L)	1,415	2.4	6.5	7.8	10.4
DO-PPM-24HR-MIN-NCP (mg/L)	1,241	3.3	8.7	10.5	12.5
DO-PPM-GRAB-CP (mg/L)	22	6.0	7.6	9.4	9.7
DO-PPM-GRAB-NCP (mg/L)	49	7.5	11.2	12.8	14.0
DO-PERC-24H-MEAN-CP (% sat)	1,400	67.9	98.5	110.8	141.7
DO-PERC-24H-MEAN-NCP (% sat)	1,207	75.5	93.7	103.8	130.7
DO-PERC-2TIDE-GRAB-CP (% sat)	19	52.2	102.3	115.9	118.8
DO-PERC-2TIDE-GRAB-NCP (% sat)	40	83.8	97.1	111.8	114.9
DO-PERC-GRAB (% sat)	9	82.5	94.4	119.3	119.3
Day Ave of TN (ug N/L)	161	190	401	908	1,851
Day Ave of TDN (ug N/L)	158	128	276	658	1,017
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	161	5	148	404	918
Day Ave of NH3 (ug N/L)	161	3	35	223	549
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	161	2	94	204	506
SALINITY-Grabs (pss)	287	0.1	22.4	27.0	30.4
SALINITY-Datalogger Daily Median (pss)	2,637	0.7	24.9	30.0	32.2
pH-grab	3	7.8	8.1	-	8.2
pH-24HR (min)	2,499	6.4	7.6	7.1*	8.3
pH-24HR (max)	2,499	7.4	8.0	8.2	8.6
Temperature	288	-1.5	13.3	23.0	25.9
Temperature-Daily Median	2,664	0.1	17.6	23.5	26.8

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

Great Bay Assessment Zone (Without GRBAP & GRBSQ) (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	55	0.8	5.8	23.7	60.9
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	3	4.8	5.5	-	9.6
CHLOROPHYLL A, Combined (ug/L)	58	0.8	5.6	21.3	60.9
LIGHT ATTENUATION COEFFICIENT (1/m)	46	0.80	1.42	2.57	6.94
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	1,491	1.0	5.0	10.0	366.0
TSS (mg/L)	49	9.3	19.6	50.4	175.4
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	55	1.6	3.1	5.8	8.3
DO-PPM-24HR-MIN-CP (mg/L)	821	2.8	7.1	8.0	10.4
DO-PPM-24HR-MIN-NCP (mg/L)	697	5.4	8.8	10.5	12.5
DO-PPM-GRAB-CP (mg/L)	3	7.0	9.2	-	9.5
DO-PPM-GRAB-NCP (mg/L)	7	10.3	11.9	-	12.3
DO-PERC-24H-MEAN-CP (% sat)	805	80.8	102.9	113.3	141.7
DO-PERC-24H-MEAN-NCP (% sat)	676	82.9	95.7	106.8	130.7
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	3	95.5	98.0	-	109.2
DO-PERC-GRAB (% sat)	4	88.2	96.0	-	119.3
Day Ave of TN (ug N/L)	58	190	378	575	1,610
Day Ave of TDN (ug N/L)	55	129	234	377	432
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	58	5	74	192	275
Day Ave of NH3 (ug N/L)	58	3	19	68	106
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	58	2	58	156	245
SALINITY-Grabs (pss)	177	0.3	23.4	27.2	30.4
SALINITY-Datalogger Daily Median (pss)	1,500	7.6	26.5	30.3	32.2
pH-grab	3	7.8	8.1	-	8.2
pH-24HR (min)	1,374	7.2	7.8	7.6*	8.3
pH-24HR (max)	1,374	7.4	8.0	8.2	8.6
Temperature	177	-0.1	13.3	22.8	25.7
Temperature-Daily Median	1,521	3.1	17.5	22.8	25.9

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

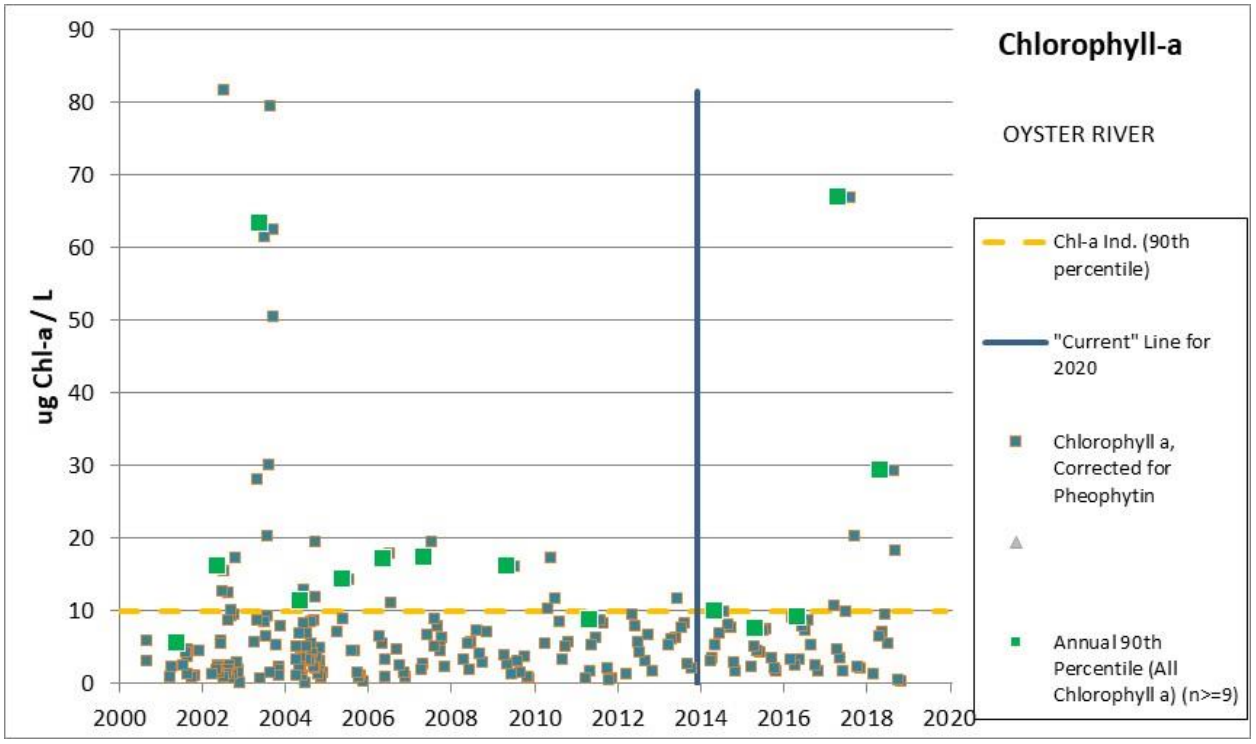
Assessment Zone = OYSTER RIVER

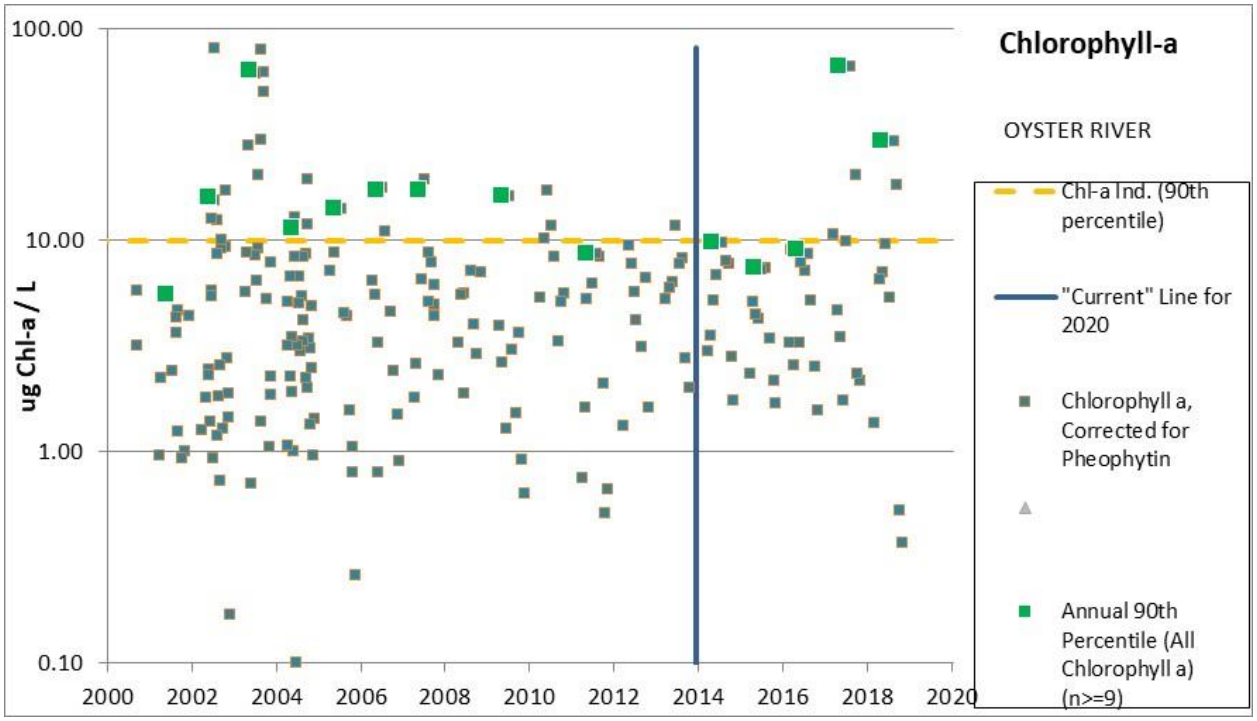
(NHEST600030902-01-03, NHEST600030902-01-04, NHEST600030904-06-17)

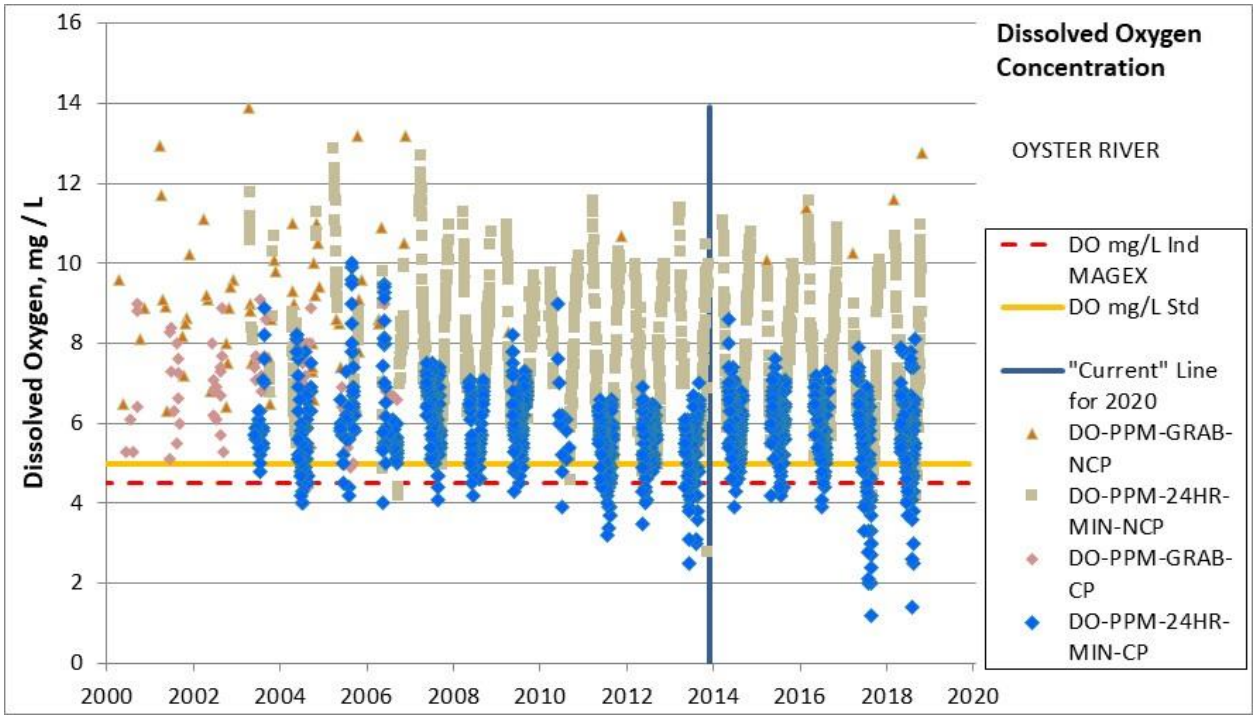
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are two additional years of data (2017, 2018) compared to the 2018 assessment but the 2019 data is not included.

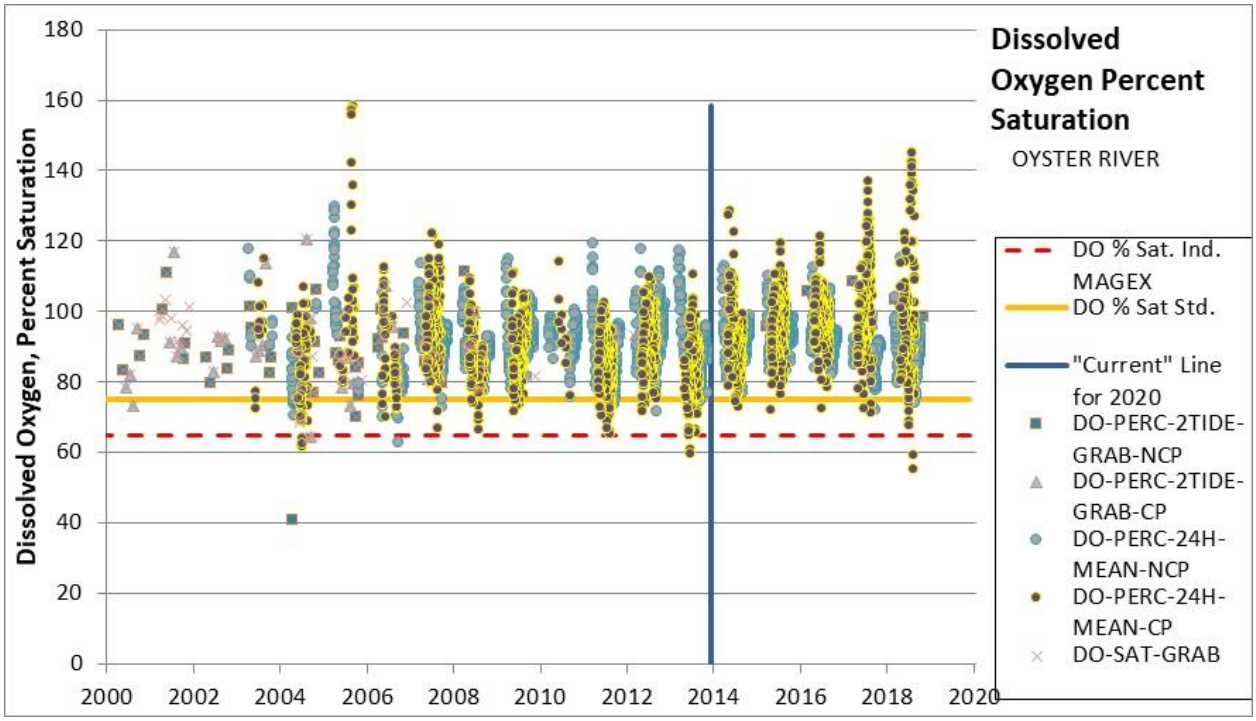
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	2-M / 5-M	The calculated 90th percentile chlorophyll-a in this assessment zone is 13.0 µg/L (n = 46) and a maximum reading of 66.9 µg/L in 2017. The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L. Although there was probe based chlorophyll-a data (not used in the median above) collected in the assessment zone in 2017, that data did not cover enough of a summer season (4/27-6/17) to be considered here. The assessment for chlorophyll a remains not supporting.
Dissolved Oxygen (mg/L)	5-P / 5-P	Up until 2016 the minimum dissolved oxygen concentration appeared to be improving, however, 2017 and 2018 saw the worst recorded dissolved oxygen in the 16-years of datalogger deployment. Dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year and in 2017 and 2018 below 3 mg/L and on rare occasions even below 2 mg/L, therefore this impairment is considered severe.
Dissolved Oxygen (% Saturation)	5-P / 5-P	Up until 2016 the minimum dissolved oxygen percent saturation appeared to be improving, however, 2017 and 2018 saw some of the most extreme recorded dissolved oxygen saturation in the 16-years of datalogger deployment with many days below a 24-hour average of 75%. Further, in 2017 and 2018 there were 24-hour averages frequently in excess of 120% and occasionally over 140% in 2018. In 2013 and again in 2018 a portion of those 24-hour averages fell below 65%, therefore this assessment zone has been assessed as potentially not supporting aquatic life based on the dissolved oxygen saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 182.5 acres from the 1948 dataset. Some of eelgrass was found in 1996 (14 acres) and 2015 (2.4 acres). The median current extent of eelgrass in 2016-2019 is 0 acres, which is a decrease of 100%. Since 1990, the trend in eelgrass cover in this assessment zone could not be determined because the eelgrass cover has been zero for most years since 1981. The thresholds for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-P / 5-P	Median=1.41 m^-1 (n=32). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. The recent mapping (2015 showed 2.4 acres, the first observed eelgrass since the 1996 mapping effort) showed eelgrass principally in the shallow areas. Older datasets had eelgrass growing in both the shallow and deeper habitat. The potential for the deeper habitat and the improved restoration potential provided by improved water clarity make the 2m restoration depth a valid target. Therefore, the impaired (5-P) listing from the 2018 303d list has been retained.
Total Nitrogen	5-P / 5-P	The median total nitrogen from 2014 through 2018 was 505 µg/L (n=46). This assessment zone experiences frequent dissolved oxygen concentrations well below 5 mg/L and, at times, below 2 mg/L. The daily average dissolved oxygen percent saturation falls below 75% nearly every year and in one recent year below 65%. During multiple years this assessment zone has also demonstrated super saturation over 125% including 24-hour averages unto 145% (2018). The chlorophyll-a concentration 90th percentile was 13.0 (n=46) from 2014 through 2018. The eelgrass beds are severely degraded and the available light attenuation (median=1.41 m^-1 (n=32)) is poor. In the 2019 macroalgae annual report, the appreciable cover at Wagon Hill Farm did not show statistical decreases although that site has only been sampled 3-times (2013, 2015, 2018) making trend detection more difficult (Burdick, et al., 2020). The status of the indicators of

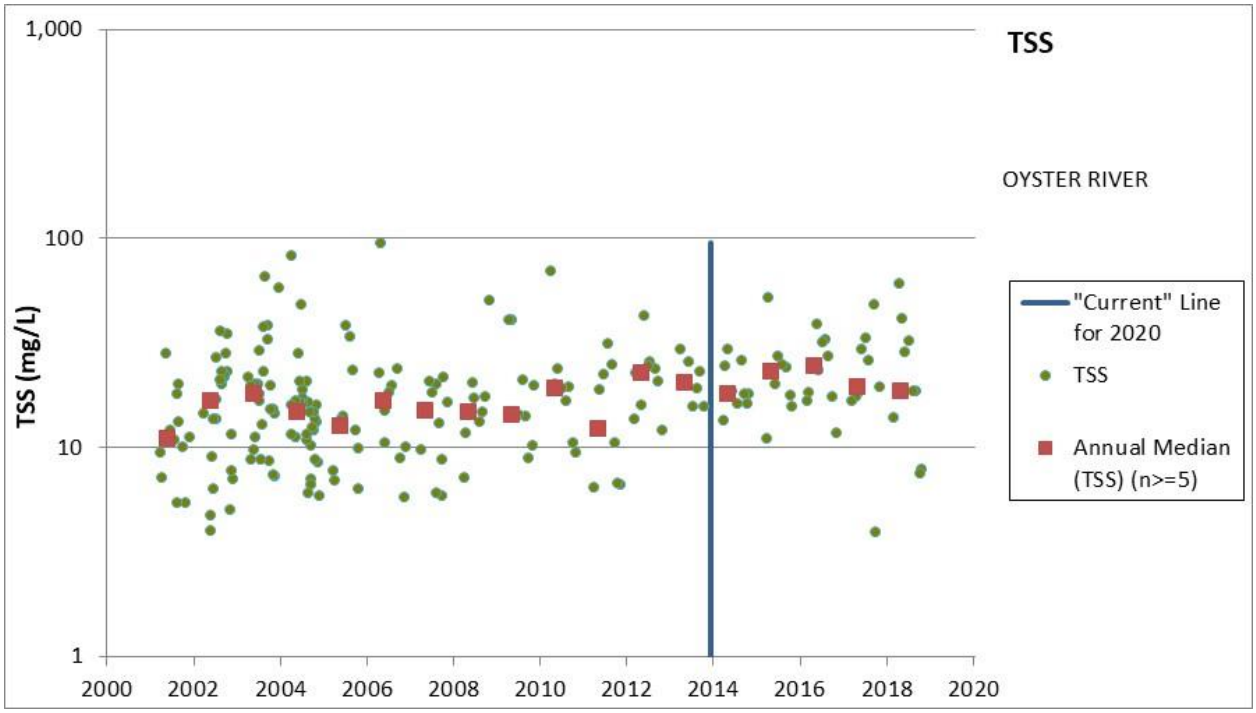
		nutrients and nutrient-related impacts has not changed, and continue to present a preponderance of evidence that eutrophication effects are ongoing. As such, the impairment for nitrogen has been retained.

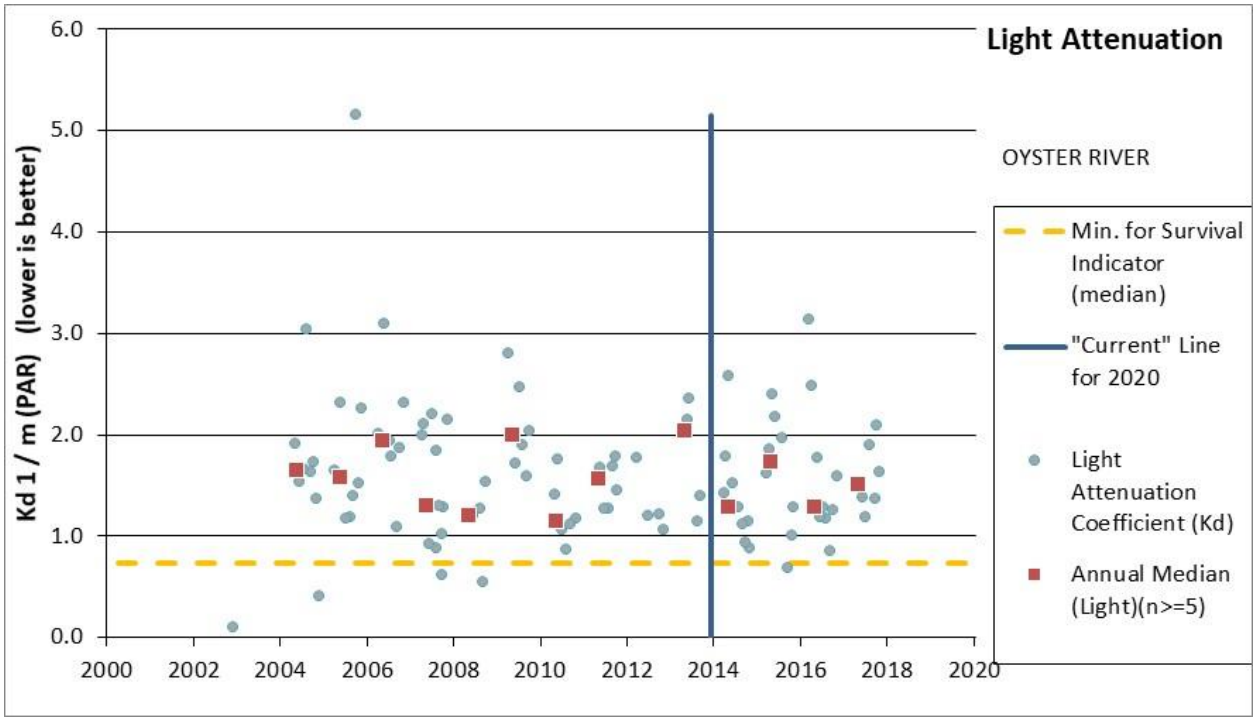


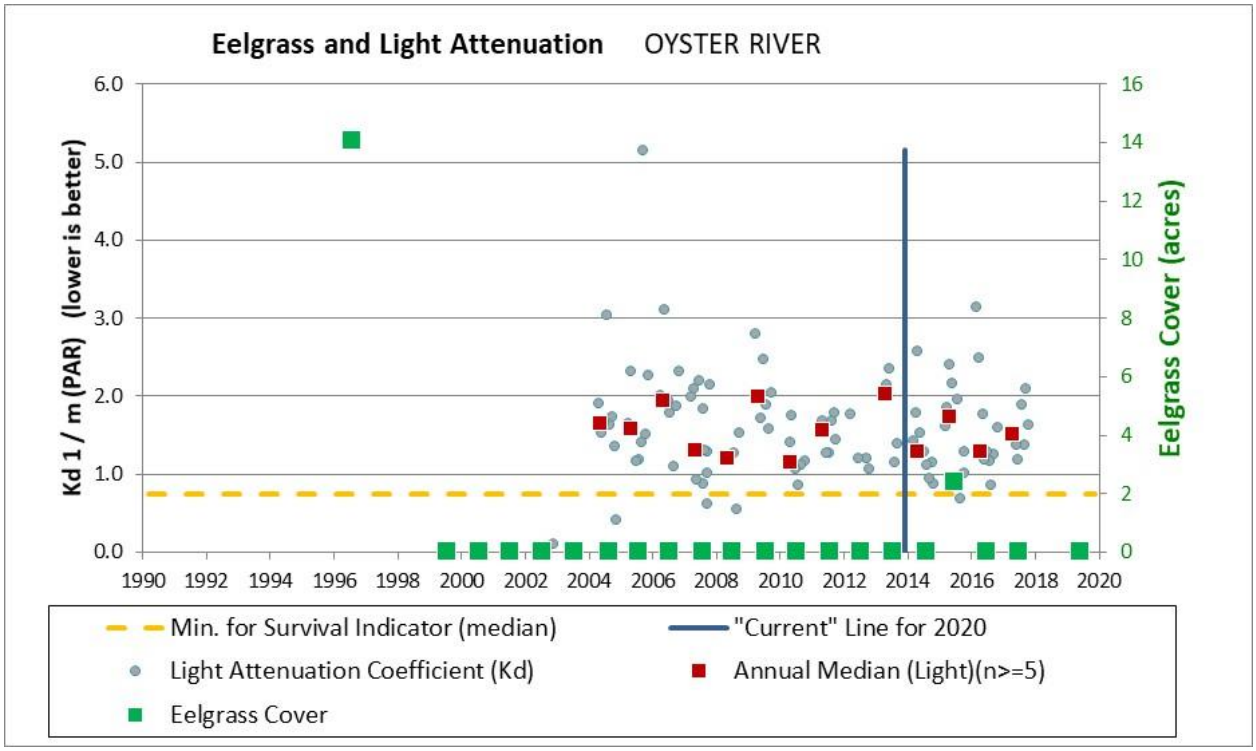


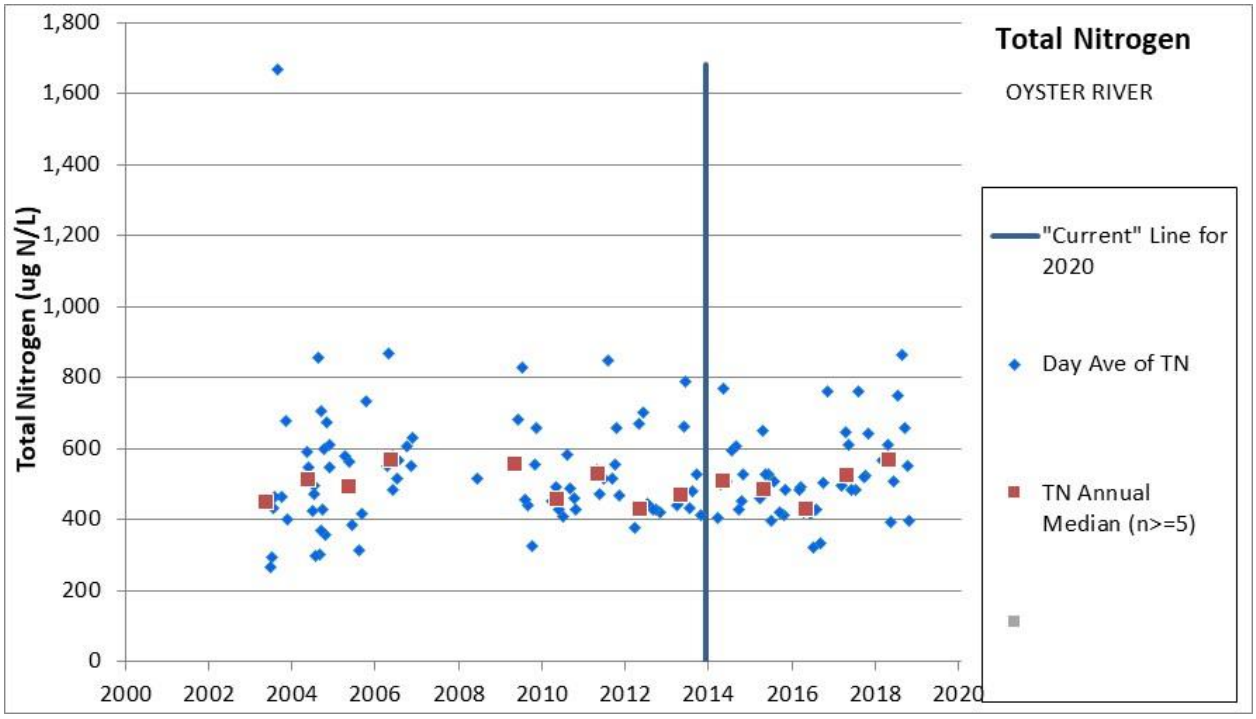

Dissolved Oxygen Concentration
OYSTER RIVER
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
OYSTER RIVER
Dissolved Oxygen, Percent Saturation
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
OYSTER RIVER
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Light Attenuation
OYSTER RIVER
Kd 1 / m (PAR) (lower is better)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)


Eelgrass and Light Attenuation
OYSTER RIVER
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
16
14
12
10
8
6
4
2
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)
Eelgrass Cover


Total Nitrogen
OYSTER RIVER
Total Nitrogen (ug N/L)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Oyster River Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	46	0.4	4.9	13.0	66.9
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, Combined (ug/L)	46	0.0	4.9	13.0	66.9
LIGHT ATTENUATION COEFFICIENT (1/m)	32	0.69	1.41	2	3.15
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	1,133	2.0	8.0	15.0	197.0
TSS (mg/L)	46	3.9	19.6	39.7	61.1
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	46	2.0	3.8	6.0	8.6
DO-PPM-24HR-MIN-CP (mg/L)	571	1.2	5.9	6.9	8.6
DO-PPM-24HR-MIN-NCP (mg/L)	528	4.2	7.9	10.1	11.6
DO-PPM-GRAB-CP (mg/L)	0	-	-	-	-
DO-PPM-GRAB-NCP (mg/L)	5	10.1	11.4	-	12.8
DO-PERC-24H-MEAN-CP (% sat)	597	55.1	95.7	112.8	145.1
DO-PERC-24H-MEAN-NCP (% sat)	505	72.1	90.8	98.2	115.3
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	5	95.7	103.2	-	108.4
DO-PERC-GRAB (% sat)	0	-	-	-	-
Day Ave of TN (ug N/L)	46	321	505	751	864
Day Ave of TDN (ug N/L)	46	179	365	518	677
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	46	39	202	330	574
Day Ave of NH3 (ug N/L)	46	3	64	167	208
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	46	20	104	220	530
SALINITY-Grabs (pss)	104	0.0	19.0	26.8	30.6
SALINITY-Datalogger Daily Median (pss)	1,108	0.7	24.6	29.3	31.1
pH-grab	0	-	-	-	-
pH-24HR (min)	1,123	6.3	7.6	7.3*	8.0
pH-24HR (max)	1,123	7.4	7.9	8.1	8.8
Temperature	104	0.9	12.9	22.6	28.1
Temperature-Daily Median	1,840	1.8	17.9	23.5	27.6

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

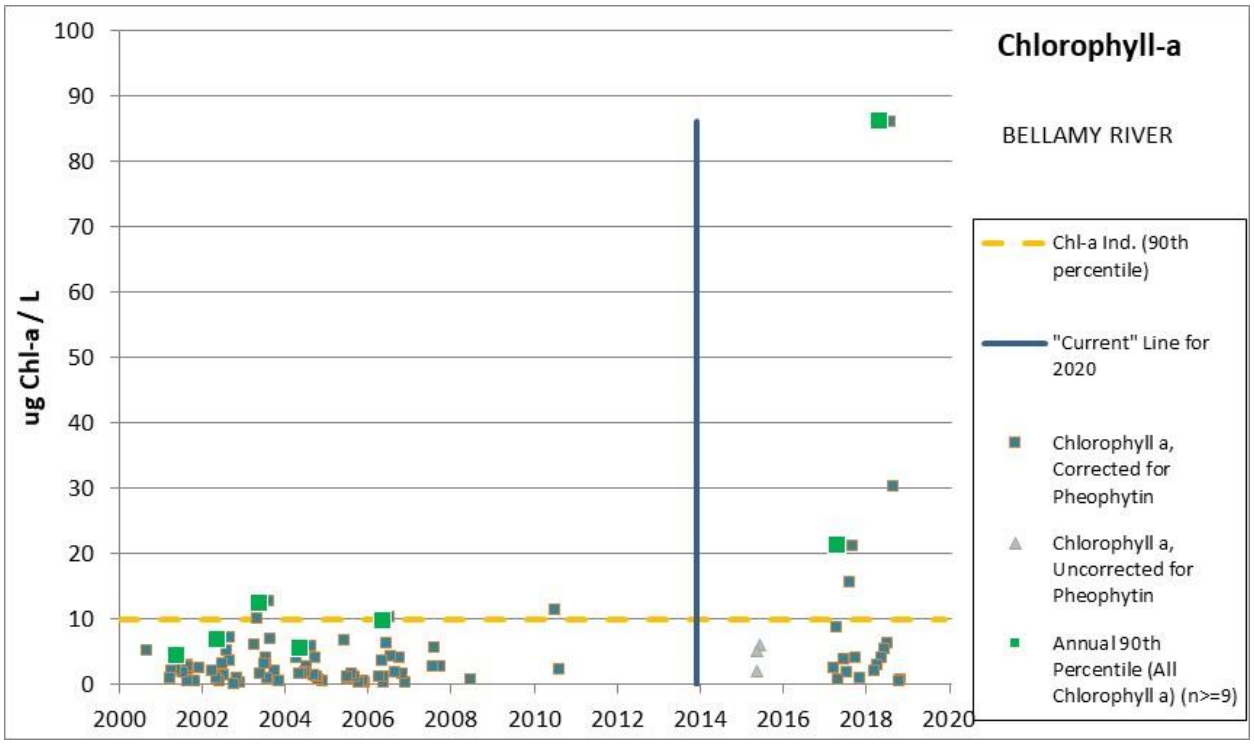
Assessment Zone = BELLAMY RIVER

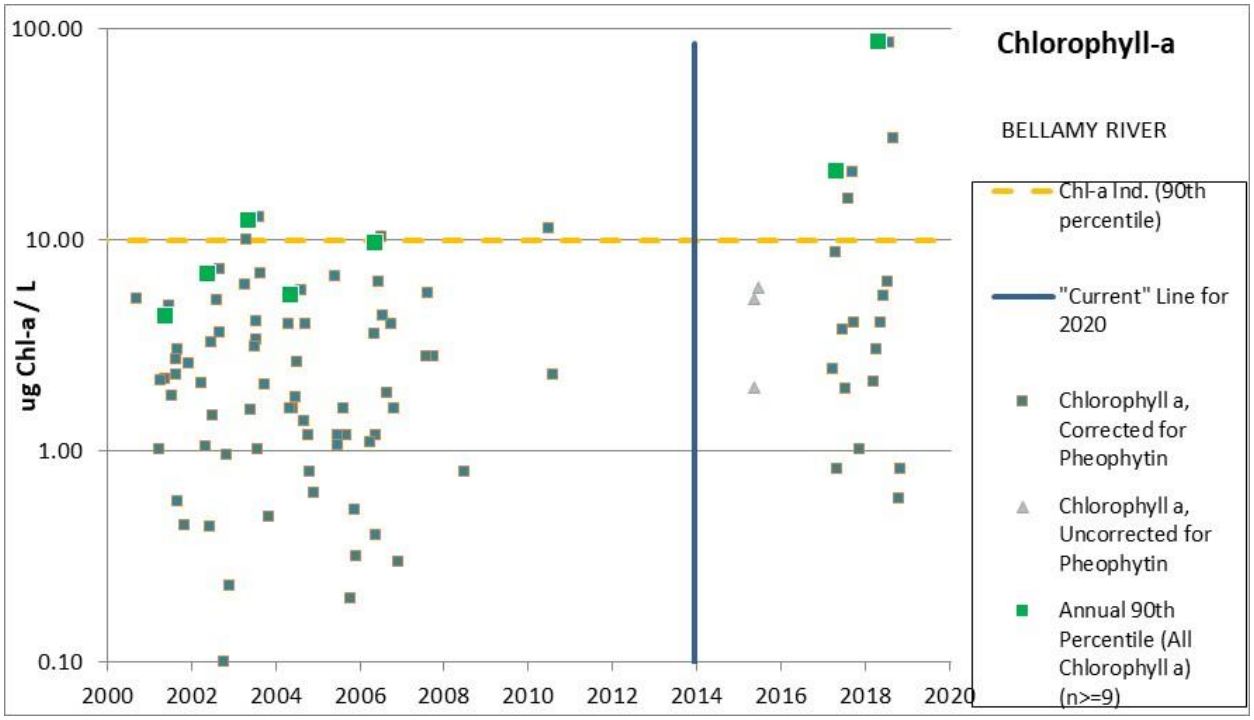
(NHEST600030903-01-01, NHEST600030903-01-03, NHEST600030903-01-04)

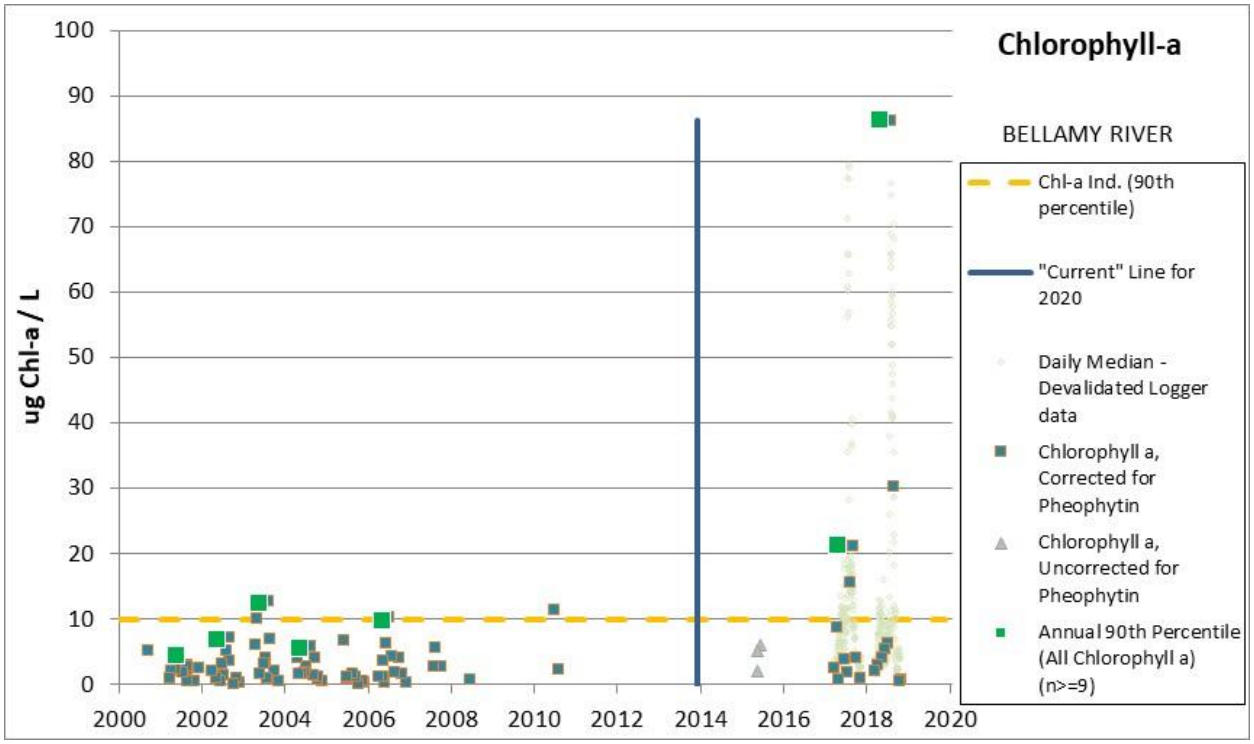
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there is two additional year of data (2017, 2018) compared to the 2016 assessment but the 2019 data is not included.

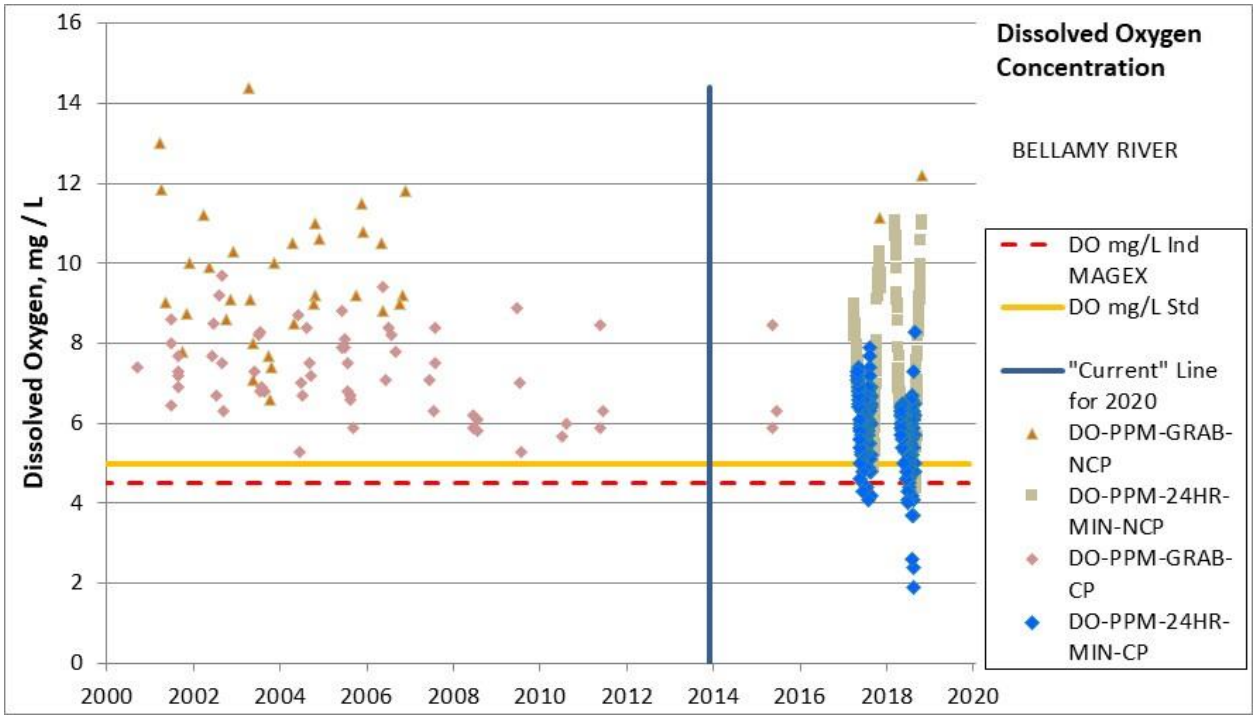
Indicator	Aquatic Life Use Category 2016 / 2020/2022	2020/2022 Comment
Chlorophyll-a	3-PNS / 5-P	The calculated 90th percentile chlorophyll-a in this assessment zone is 28.4 µg/L (n = 21) and a maximum reading of 86.2 µg/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L. Although the probe based chlorophyll-a data (not used in the median above) collected in the assessment zone in 2017 and 2018 was qualified as "estimated," due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and shows large spikes in chlorophyll-a with the regular tidal cycles. Therefore, this assessment zone has been assessed as not supporting aquatic life based on chlorophyll-a.
Dissolved Oxygen (mg/L)	3-PNS / 5-P	This assessment zone had its first datalogger deployments in 2017 and 2018. 36 of 241 days (15%) of summer datalogger records experienced DO below 5 mg/L and 78 distinct events in the full record where DO fell below 5 mg/L. Additionally, 5 of the events saw DO fall below 3 mg/L. Many of the low DO events occurred in the night to early morning hours that coincided with low tide and these events lasted up to 5-hours around low-tide. In both 2017 and 2018 the DO below 5 mg/L started in mid-July. The added warmth of August and September of 2018 may have contributed in The available dissolved oxygen data discussed below was collected in 2017 and 2018 indicates there is a consistent moderate level of stress in the system and multiple occasions of severe stress when the DO goes below 3 mg/L. The frequency, duration, and magnitude of the low DO warrants an impairment. This assessment zone has been assessed as not supporting aquatic life due to low dissolved oxygen concentration.
Dissolved Oxygen (% Saturation)	3-PAS / 2-M	Based on the datalogger data-set, in 2017 there was one day that DO percent saturation 24-hour average fell to 74% and in 2018 there were 9 days including one day when the average fell to 62% (insufficient to trigger the magnitude of exceedance indicator). In 2018 there was a 4-consecutive day period wherein the 24-hour averages were below 75%. The earliest percent saturation below 75% was in mid-July. Counting just the summer critical period, there were 8 days (3%) in 2017 and 2018 (n=242 days of datalogger record) during which the 24-hour averages were below 75%. Similarly, counting all days of datalogger record, there were 10 days (2%) in 2017 and 2018 (n=436 days of datalogger record) during which the 24-hour averages were below 75%. Regardless of the time period, this indictor does not reach the 10% exceedance limit to suggest impairment. This assessment zone has been assessed as supporting aquatic life based on dissolved oxygen percent saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 66.9 acres from the 1948, 1962, 1980, and 1981 datasets. Some eelgrass was found in 2004 (0.8 acres). The median current extent of eelgrass in 2016-2019 is 0 acres, which is a decrease of 100%. Since 1990, the trend in eelgrass cover in this assessment zone could not be determined because the eelgrass cover has been zero for most years since 1981. The thresholds for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-PNS / 5-P	Median water clarity is 1.88 m^-1 (n=15). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. Given the eelgrass condition and the available light data, this assessment zone has been assessed as not supporting aquatic life integrity due to light attenuation.

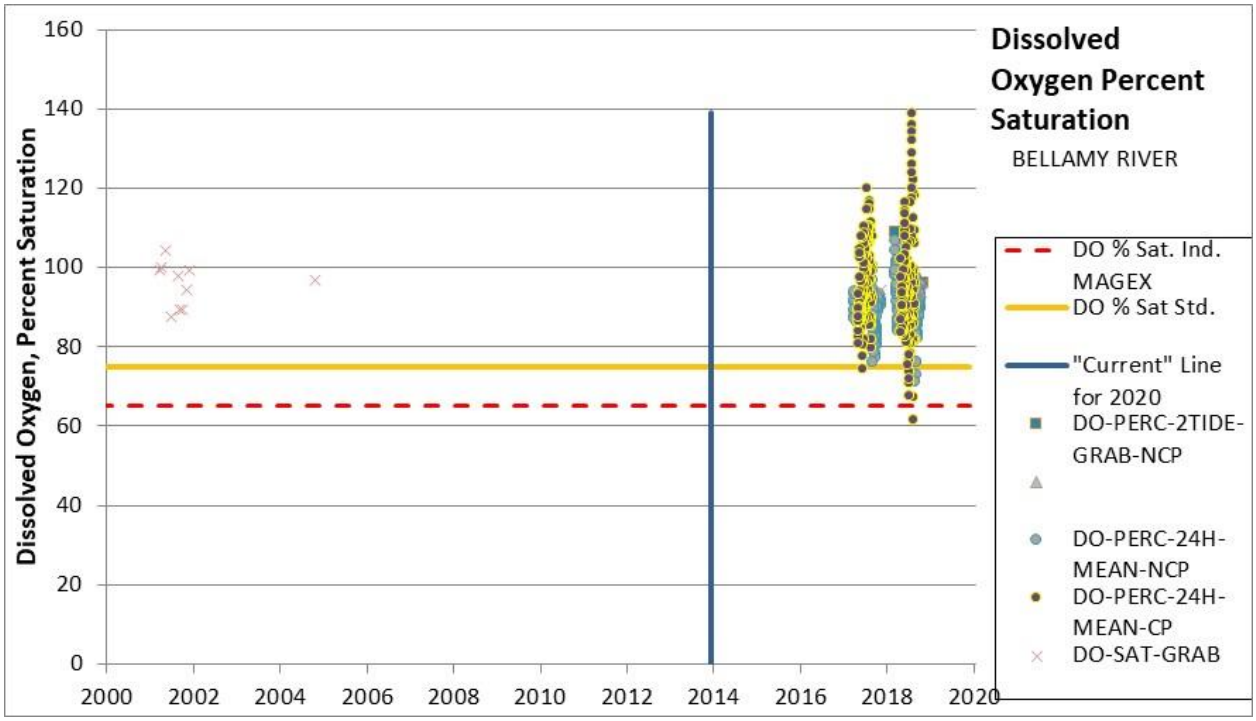
Total Nitrogen	3-PNS / 5-P	The median total nitrogen from 2014 through 2019 (really just 2017/2018 data) was 471 µg/L (n=20). This assessment zone experiences dissolved oxygen concentrations below 5 mg/L (at times below 3 mg/L and occasional daily average saturation below 75%. During multiple years this assessment zone also demonstrated super saturation well over 125% as a daily average and over 165% in the 15-minute dataset. The chlorophyll-a concentration 90th percentile was 28.4 µg/L (n = 21) and a maximum reading of 86.2 µg/L. The status of the indicators of nutrients and nutrient-related impacts have been revealed by the sampling data to present a preponderance of evidence of eutrophication impacts. As such, this assessment zone has been assessed as not supporting aquatic life integrity due to total nitrogen.

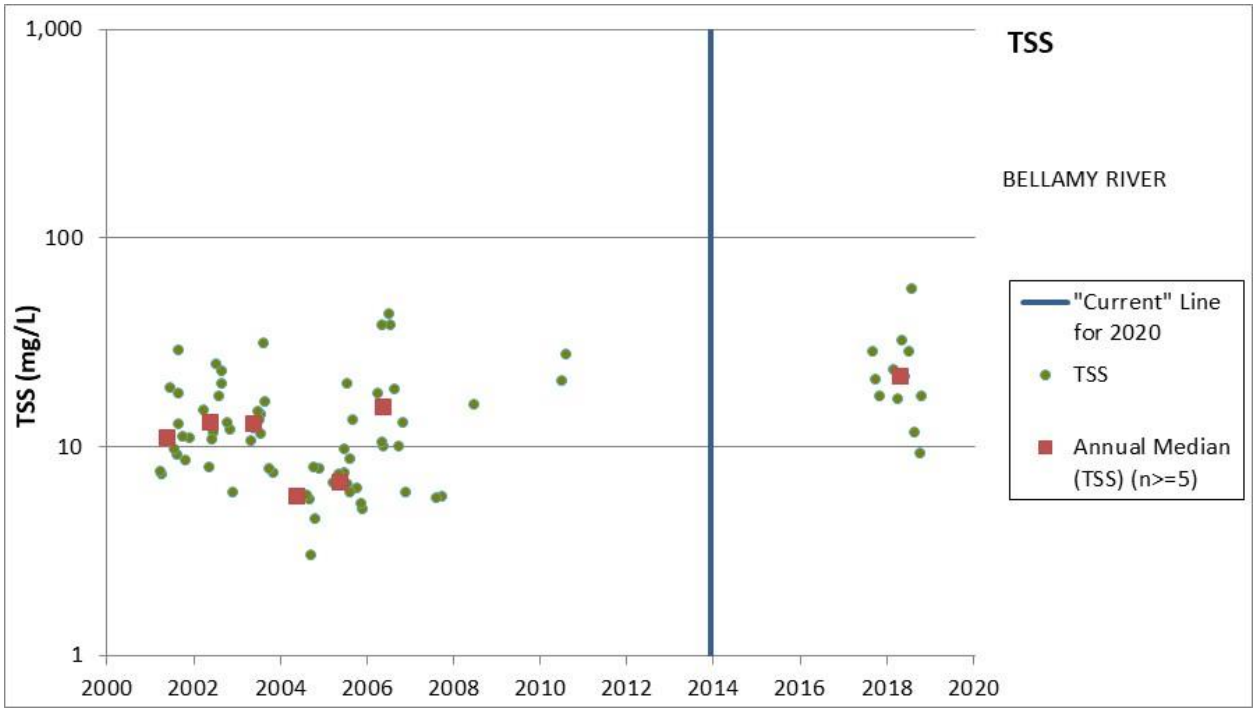


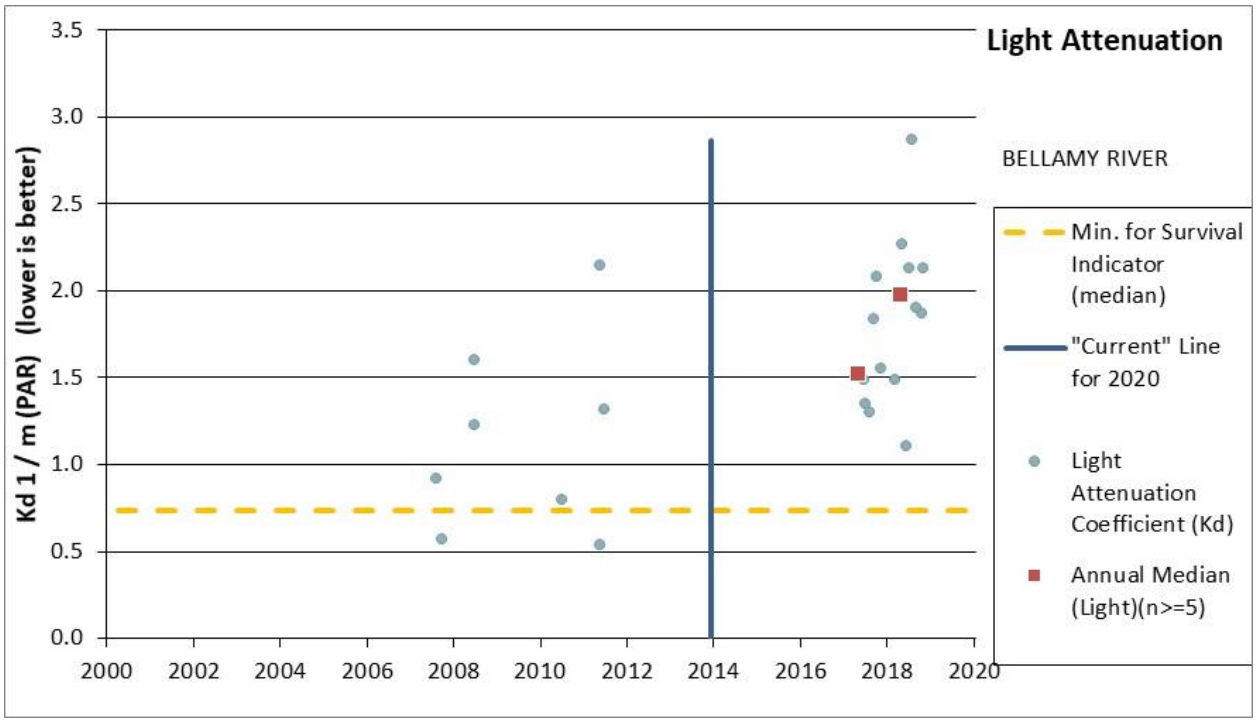

Chlorophyll-a
BELLAMY RIVER
ug Chl-a / L
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

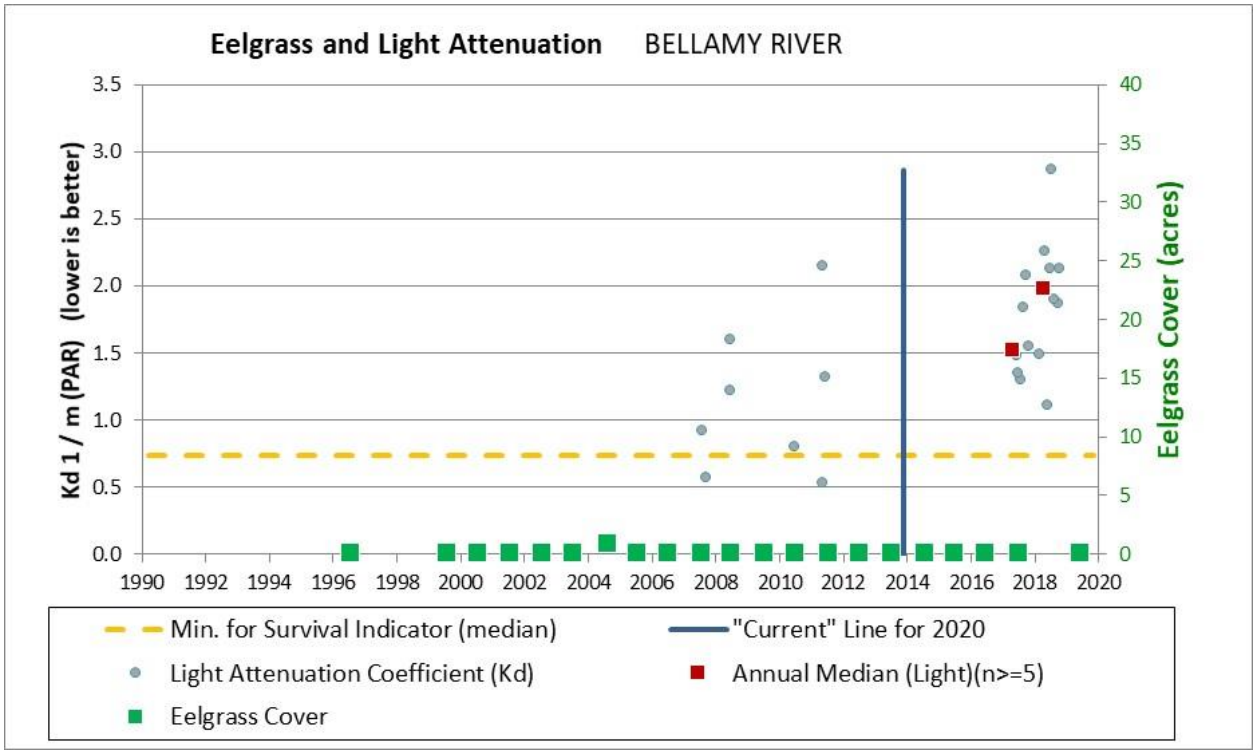

Chlorophyll-a
BELLAMY RIVER
ug Chl-a / L
100
90
80
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Daily Median - Devalidated Logger data
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

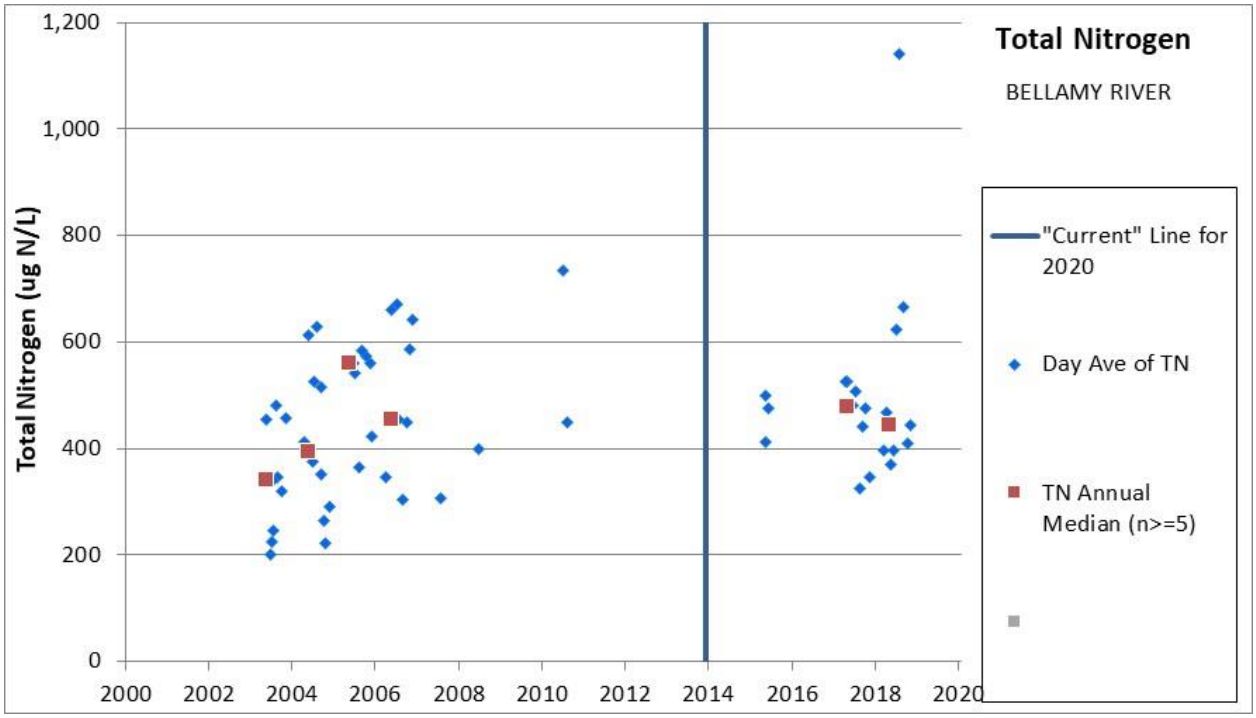

Dissolved Oxygen Concentration
BELLAMY RIVER
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
BELLAMY RIVER
Dissolved Oxygen, Percent Saturation
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
BELLAMY RIVER
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Light Attenuation
BELLAMY RIVER
Kd 1 / m (PAR) (lower is better)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)


Eelgrass and Light Attenuation
BELLAMY RIVER
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
40
35
30
25
20
15
10
5
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)
Eelgrass Cover


Total Nitrogen
BELLAMY RIVER
Total Nitrogen (ug N/L)
1,200
1,000
800
600
400
200
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Bellamy River Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	18	0.6	3.9	35.8	86.2
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	3	2.0	5.3	-	6.0
CHLOROPHYLL A, Combined (ug/L)	21	0.6	4.1	28.4	86.2
LIGHT ATTENUATION COEFFICIENT (1/m)	15	1.12	1.88	2.51	2.87
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	433	3.0	7.0	11.0	47.0
TSS (mg/L)	12	9.3	21.3	49.9	57.4
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	18	2.8	4.8	7.3	8.4
DO-PPM-24HR-MIN-CP (mg/L)	241	1.9	5.9	6.7	8.3
DO-PPM-24HR-MIN-NCP (mg/L)	202	4.4	8.1	9.9	11.1
DO-PPM-GRAB-CP (mg/L)	3	5.9	6.3	-	8.5
DO-PPM-GRAB-NCP (mg/L)	2	11.2	11.7	-	12.2
DO-PERC-24H-MEAN-CP (% sat)	242	61.7	94.5	110.9	139.0
DO-PERC-24H-MEAN-NCP (% sat)	194	71.1	89.5	96.4	106.6
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	2	96.2	102.6	-	109.0
DO-PERC-GRAB (% sat)	2	93.7	94.1	-	94.4
Day Ave of TN (ug N/L)	20	326	471	661	1,140
Day Ave of TDN (ug N/L)	18	216	313	416	501
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	21	38	129	208	243
Day Ave of NH3 (ug N/L)	21	3	35	94	154
Day Ave of PON (ug N/L)	2	240	315	-	390
Day Ave of NO2/3 (ug N/L)	21	23	89	155	176
SALINITY-Grabs (pss)	94	0.1	22.5	27.8	30.7
SALINITY-Datalogger Daily Median (pss)	452	1.6	21.9	27.8	28.9
pH-grab	3	7.2	7.7	-	7.9
pH-24HR (min)	417	6.8	7.5	7.2*	7.9
pH-24HR (max)	417	7.5	8.0	8.1	8.5
Temperature	94	1.0	13.9	21.5	25.6
Temperature-Daily Median	452	3.7	18.6	24.5	27.8

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

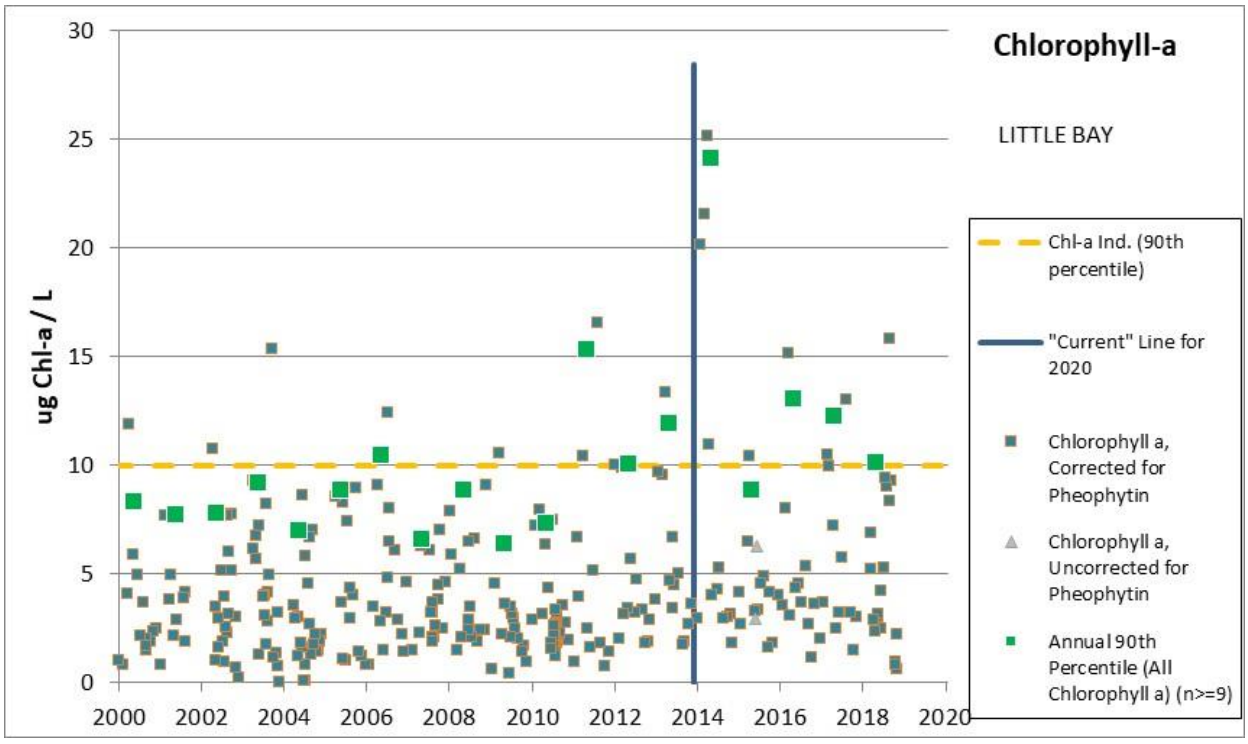
Assessment Zone = LITTLE BAY

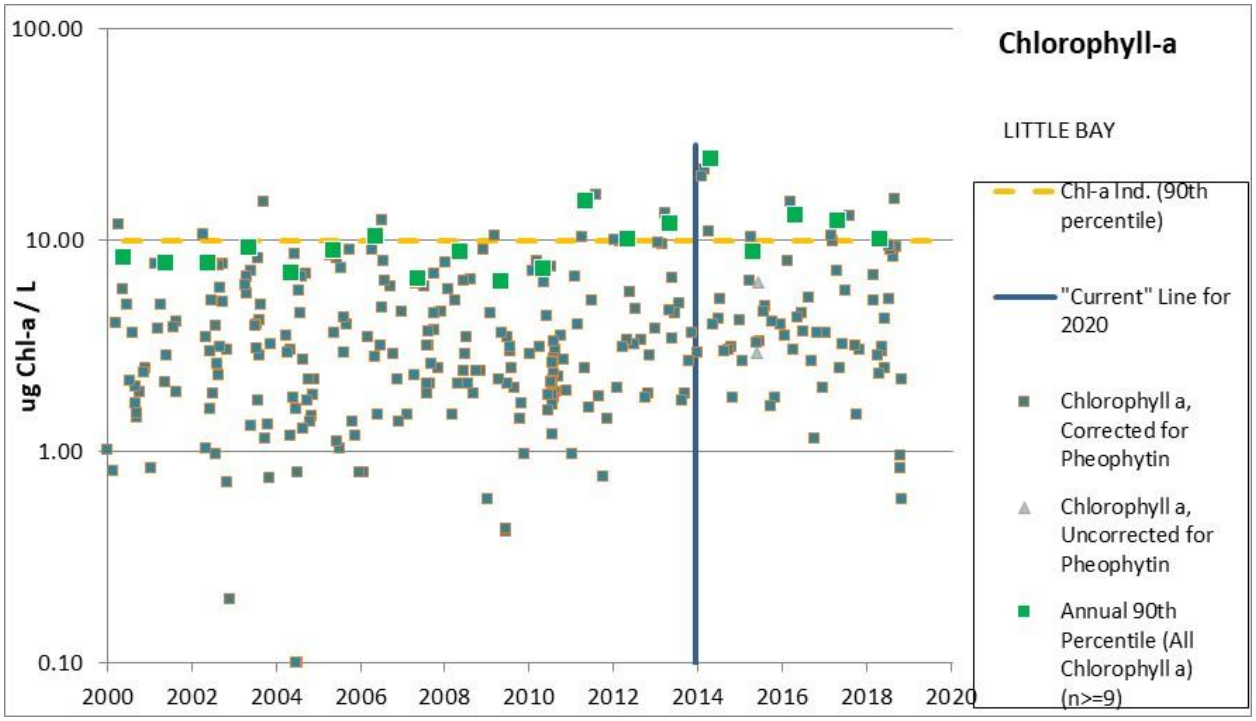
(NHEST600030904-06-10, NHEST600030904-06-11, NHEST600030904-06-14, NHEST600030904-06-15, NHEST600030904-06-18, NHEST600030904-06-19, NHEST600030904-06-20)

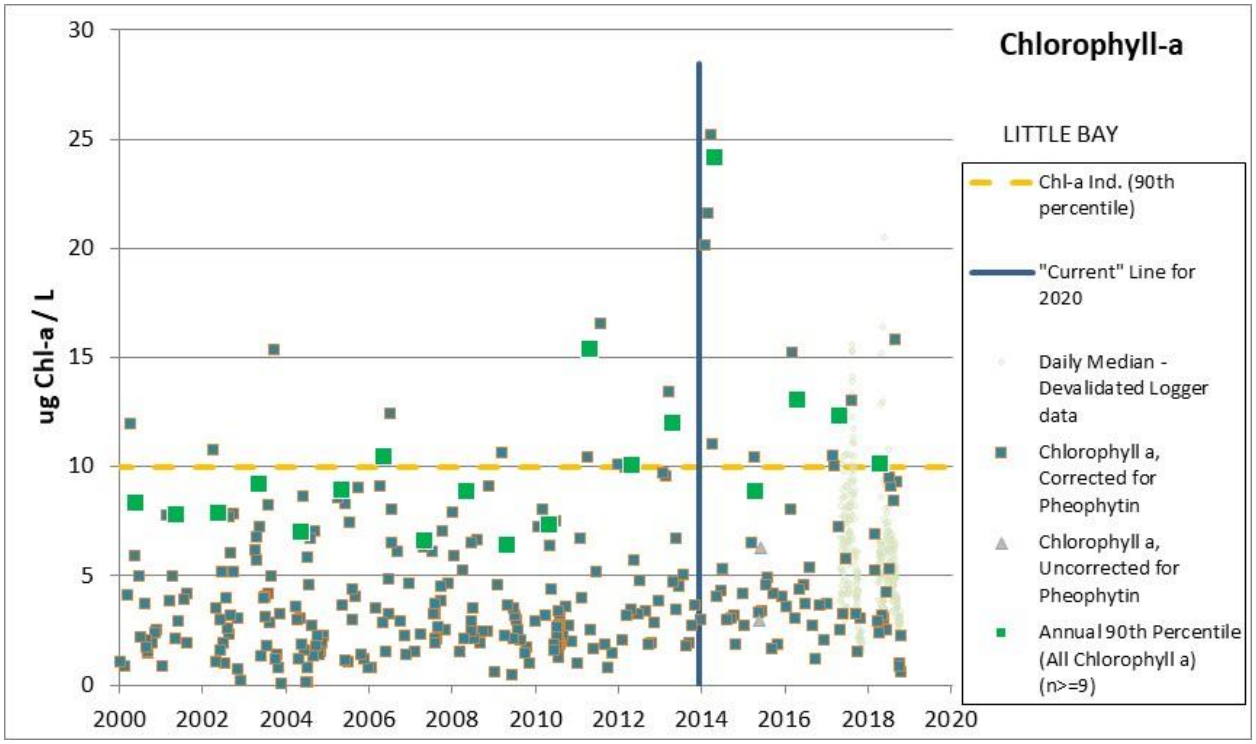
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are three additional years of data (2016, 2017, 2018) compared to the 2016 assessment but the 2019 data is not included. There were two new stations to the Little Bay assessment zone. In 2017 (Jun-Dec) a datalogger was deployed in at GRBLB and in 2018 (May-Nov) grab samples for chemistry and chlorophyll-a were collected and a datalogger deployed at GRBULB.

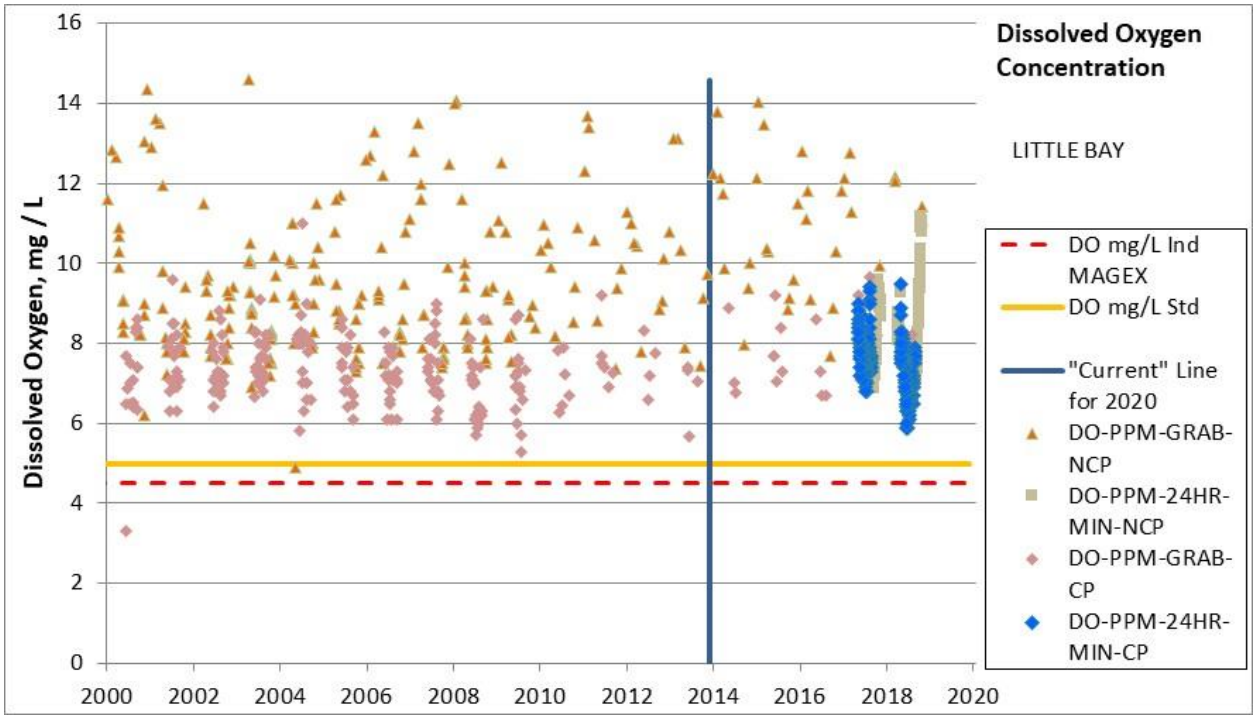
Indicator	Aquatic Life Use Category 2016 / 2020/2022	2020/2022 Comment
Chlorophyll-a	3-PNS / 3-PNS	The calculated 90th percentile chlorophyll-a in this assessment zone is 11.4 µg/L (n = 67) and a maximum reading of 25.2 µg/L. The dataset includes the new GRBULB (2018) sampling site. The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L. Although the multiple probe based chlorophyll-a data (2017 and 2018) (not used in the median above) collected in the assessment zone was qualified as "estimated," due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and did not show large spikes in chlorophyll-a. As chlorophyll-a is marginally above the assessment threshold, one of the response variables is fine, and the other is marginal bad, chlorophyll-a has been assessed as Insufficient Information – Potentially Not Supporting.
Dissolved Oxygen (mg/L)	2-G / 2-G	This assessment zone did not have a datalogger until 2017, only surface (0.5m below surface) grab sample measurements (GRBAP) for dissolved oxygen concentration. A datalogger was deployed in 2017 at GRBLB from June-December and in 2018 at GRBULB from May-November. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-G / 2-G	This assessment zone did not have a datalogger until 2017, only surface (0.5m below surface) grab sample measurements (GRBAP) to evaluate against the dissolved oxygen 24-hour average percent saturation. A datalogger was deployed in 2017 at GRBLB from June-December and in 2018 at GRBULB from May-November. The available data indicates that this assessment zone's dissolved oxygen percent saturation is good.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 252 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2016-2019 is 3.6 acres. While 2019 had the most eelgrass since 2012 there is an overall a decrease of 98.6%. There is no significant trend in eelgrass cover in this assessment zone since 1990. The thresholds for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	The dataset includes the new GRBULB (2018) sampling site in addition the annual data at GRBAP. Median=1.19 m^-1 (n=53). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. Therefore, the impaired (5-M) listing from the 2018 303d list has been retained.
Total Nitrogen	3-PNS / 3-PNS	The dataset includes the new GRBULB (2018) sampling site in addition the annual data at GRBAP. The median total nitrogen from 2014 through 2018 was 314 µg/L (n=68). Dr. Howes indicated (Howes, 2019) a growing season (May-Sept) average of 320-350 ug/L "…should be protective of that resource [Great Bay system] based on [his] experience with nearby Massachusetts estuarine waters." As indicated here, the median total nitrogen from 2014 through 2019 was 314 µg/L

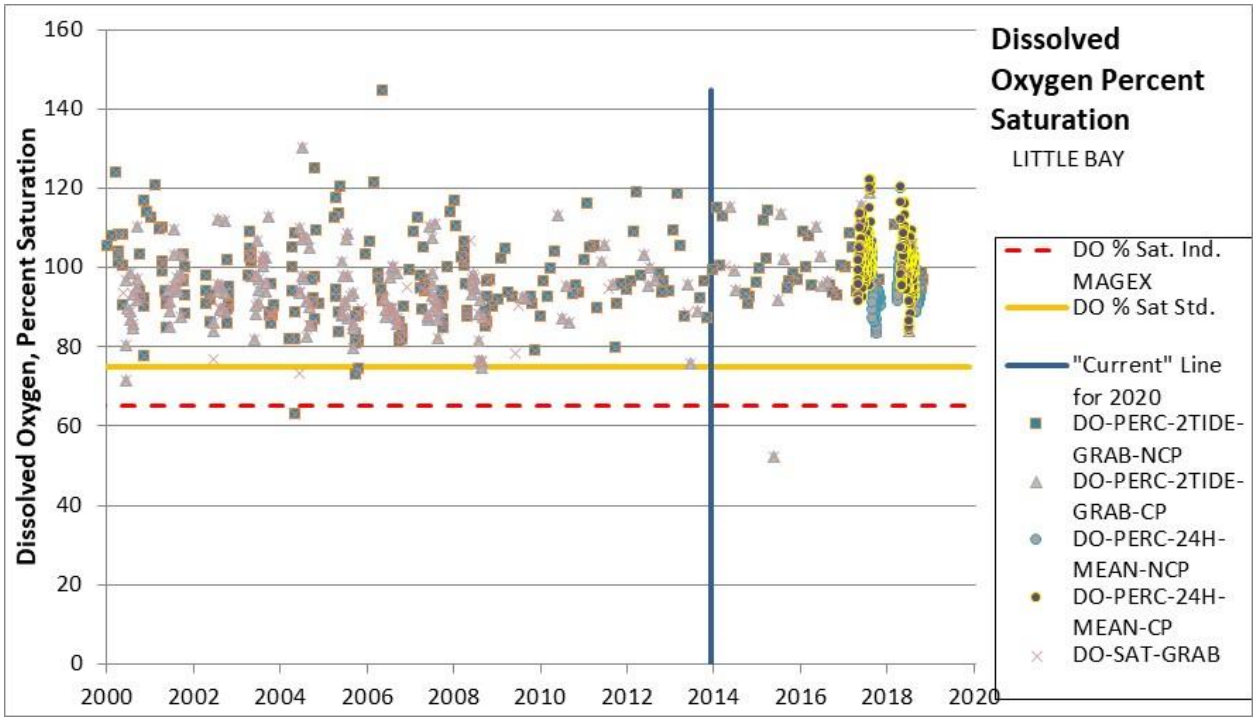
		(n=68). The average of the same 68 samples is 328 ug/L over the full calendar year and 308 ug/L (n=32) in the growing season. Based on grab samples from 2014-2016 and a mix of grab samples and dataloggers from 2017-2018, the measurements in this assessment zone do not demonstrate dissolved oxygen concentration exceedances and there were only occasional grab samples at or below 75% saturation. The calculated 90th percentile chlorophyll-a in this assessment zone is 11.4 µg/L (n = 67) and a maximum reading of 25.2 µg/L. Chlorophyll-a is just above the threshold described in the CALM but dissolved oxygen problems are not evident in the Little Bay grab or datalogger data. The eelgrass beds are severely degraded (98.6% reduction from historic) and the available light attenuation (median=1.19 m^-1 (n=53)) is poor. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), as appears to be occurring in the Great Bay Estuary. Burdick et al. (Burdick, Mathieson, Peter, & Sydney, 2016) note that, "Monitoring results from 2014 show high levels of cover of nuisance green and red algae (*Ulva* and *Gracilaria*, respectively) at all sites except near the mouth of the Estuary." That study included several sites within Little Bay. In the 2019 macroalgae annual report, the appreciable cover at Cedar Point (near the mouth of the Bellamy) appears to have a visually downwards trend in green macroalgae but did not show statistical decreases although that site has only been sampled 3-times (2013, 2015, 2018) making trend detection more difficult (Burdick, et al., 2020). The status of the indicators of nutrients and nutrient-related impacts do not present a preponderance of evidence that eutrophication effects are occurring in this zone. While eelgrass has been lost and light attenuation is often not sufficient, DO levels are better than the levels of concern, chlorophyll-a is close to the assessment indicator threshold and TN levels are within protective levels (Howes, 2019) with few high measurements above 500 ug/L (only 2 of 68 samples). This assessment zone has been assessed as insufficient information – potentially not supporting (3-PNS) for total nitrogen.

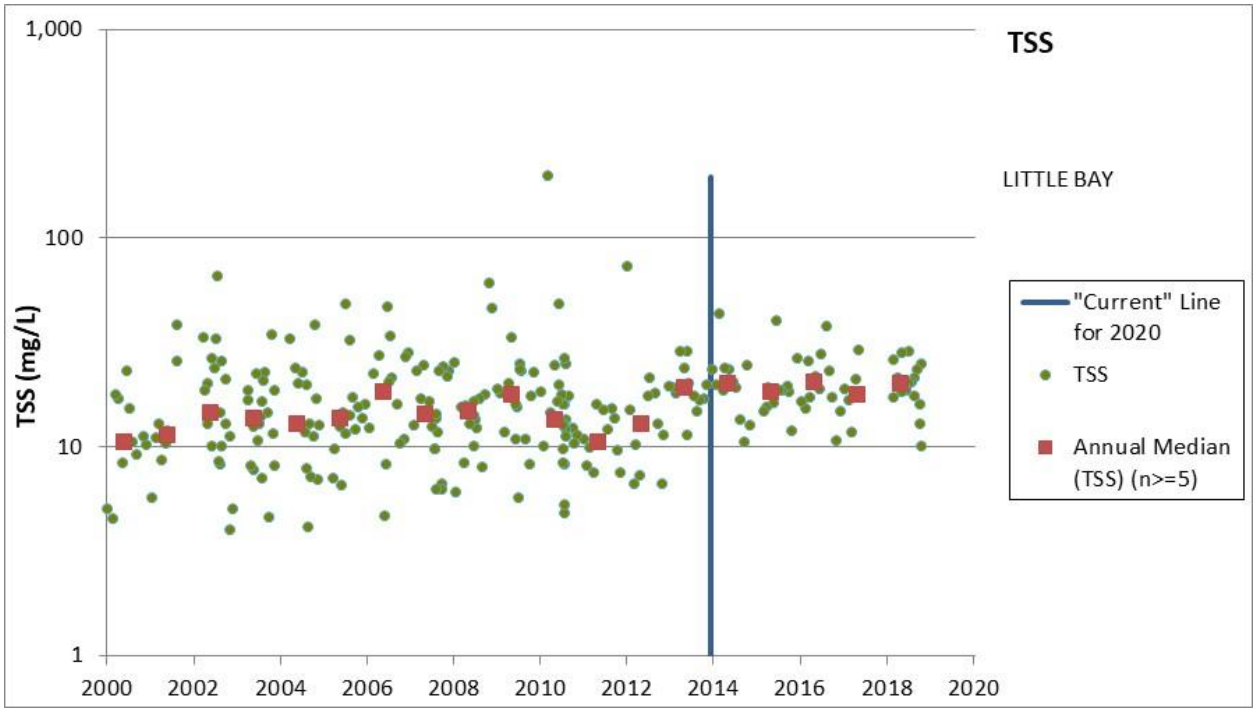


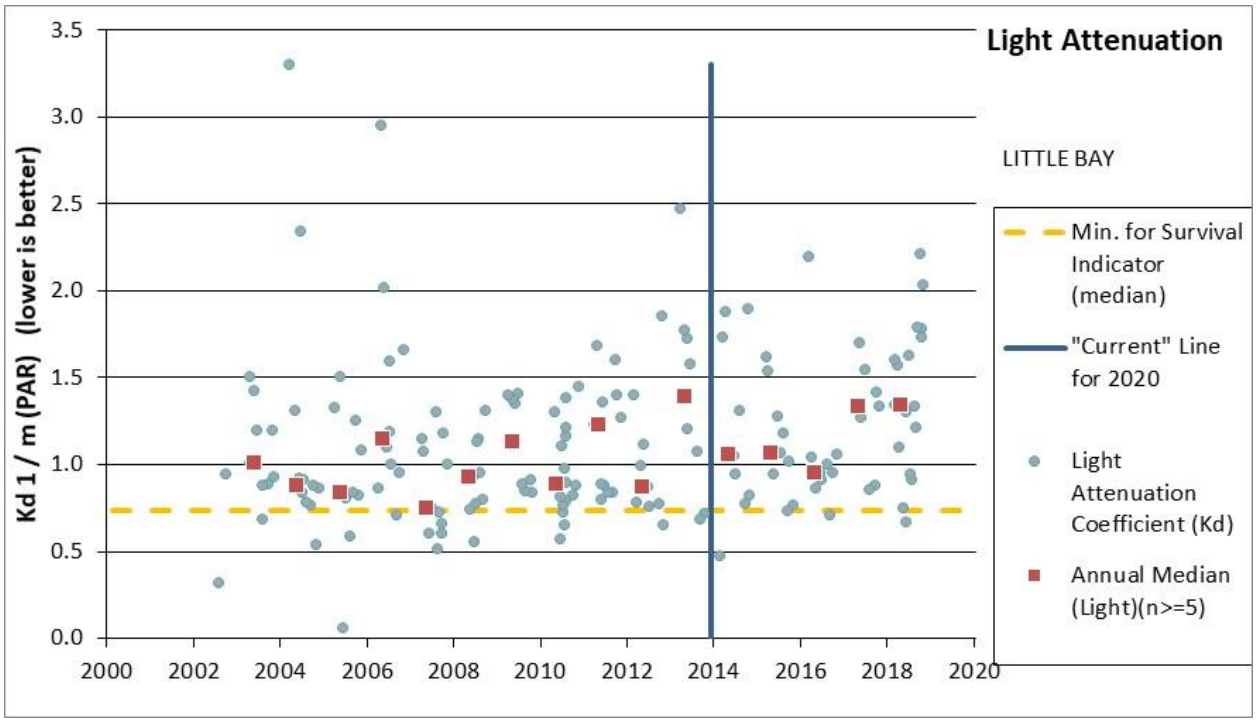

Chlorophyll-a
LITTLE BAY
ug Chl-a / L
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

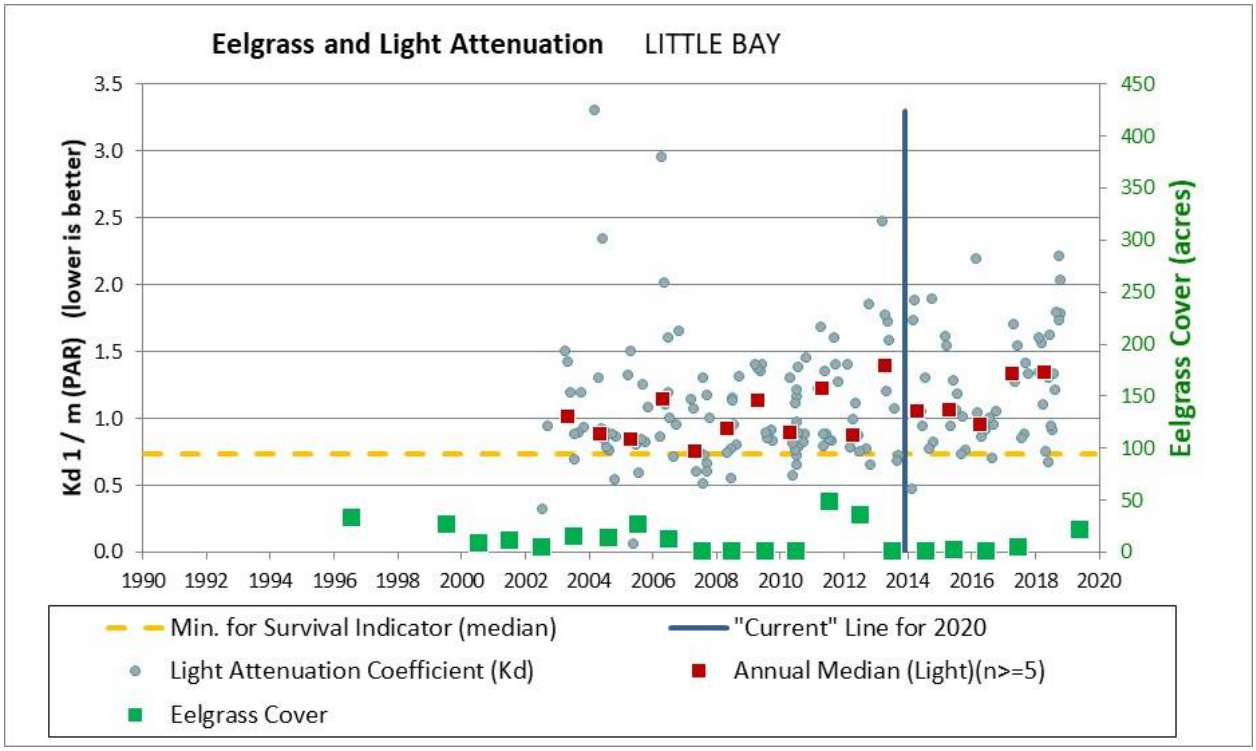

Chlorophyll-a
LITTLE BAY
ug Chl-a / L
30
25
20
15
10
5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Daily Median - Devalidated Logger data
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

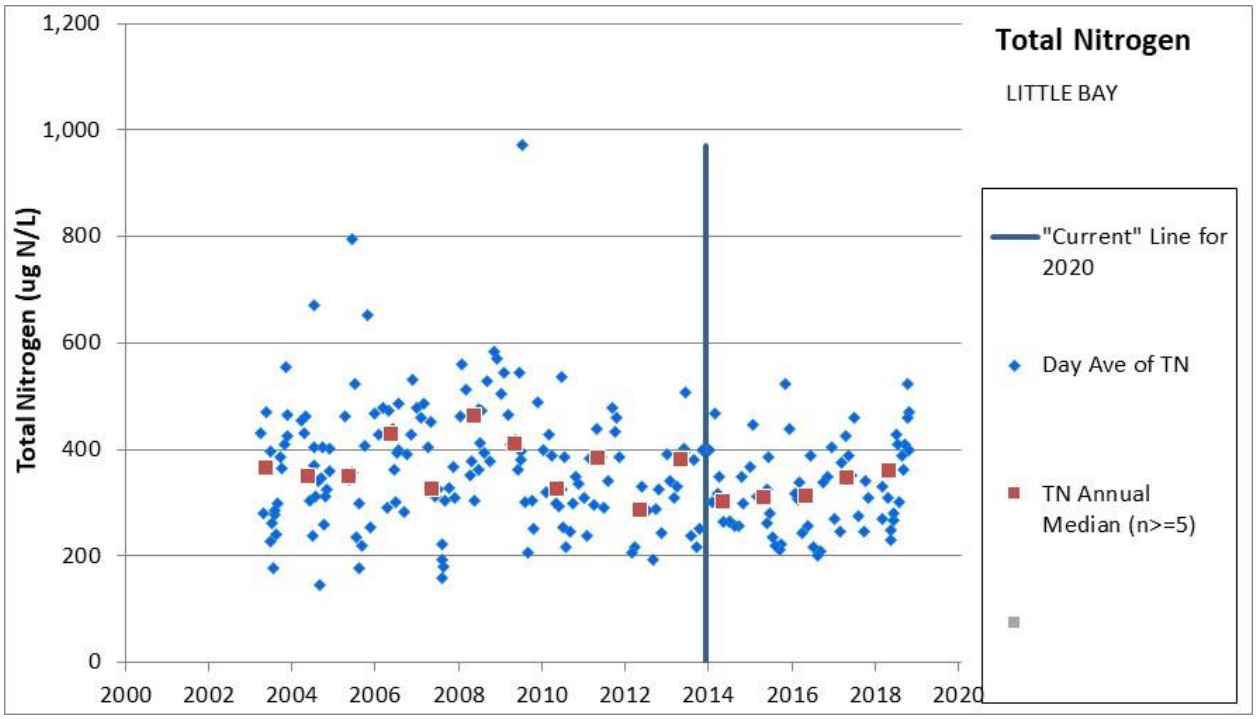

Dissolved Oxygen Concentration
LITTLE BAY
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
LITTLE BAY
Dissolved Oxygen, Percent Saturation
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
LITTLE BAY
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Light Attenuation
LITTLE BAY
Kd 1 / m (PAR) (lower is better)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)


Eelgrass and Light Attenuation
LITTLE BAY
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
450
400
350
300
250
200
150
100
50
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)
Eelgrass Cover


Total Nitrogen
LITTLE BAY
Total Nitrogen (ug N/L)
1,200
1,000
800
600
400
200
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Little Bay Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	65	0.6	4.0	11.8	25.2
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	2	2.9	4.6	-	6.3
CHLOROPHYLL A, Combined (ug/L)	67	0.6	4.0	11.4	25.2
LIGHT ATTENUATION COEFFICIENT (1/m)	53	0.48	1.19	1.85	2.22
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	391	2.0	4.0	6.0	12.0
TSS (mg/L)	58	10.0	19.1	28.1	43.2
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	66	1.5	2.7	4.0	7.0
DO-PPM-24HR-MIN-CP (mg/L)	240	5.9	7.5	8.3	9.5
DO-PPM-24HR-MIN-NCP (mg/L)	151	6.9	8.3	9.5	11.2
DO-PPM-GRAB-CP (mg/L)	21	6.0	7.7	9.2	9.7
DO-PPM-GRAB-NCP (mg/L)	39	7.5	11.1	12.8	14.0
DO-PERC-24H-MEAN-CP (% sat)	235	84.1	101.6	109.5	122.1
DO-PERC-24H-MEAN-NCP (% sat)	147	83.2	92.5	99.6	119.9
DO-PERC-2TIDE-GRAB-CP (% sat)	19	52.2	102.3	115.9	118.8
DO-PERC-2TIDE-GRAB-NCP (% sat)	38	83.8	97.6	112.0	114.9
DO-PERC-GRAB (% sat)	1	100.3	100.3	-	100.3
Day Ave of TN (ug N/L)	68	202	314	447	524
Day Ave of TDN (ug N/L)	66	128	207	339	479
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	68	8	92	221	265
Day Ave of NH3 (ug N/L)	68	3	27	60	129
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	68	3	61	169	226
SALINITY-Grabs (pss)	242	0.1	25.4	28.9	31.0
SALINITY-Datalogger Daily Median (pss)	872	0.0	25.0	29.3	30.6
pH-grab	2	7.9	8.0	-	8.1
pH-24HR (min)	391	7.4	7.9	7.7*	8.1
pH-24HR (max)	391	7.6	8.0	8.1	8.4
Temperature	243	-1.5	14.6	21.8	28.6
Temperature-Daily Median	5,581	2.2	17.6	21.1	24.6

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

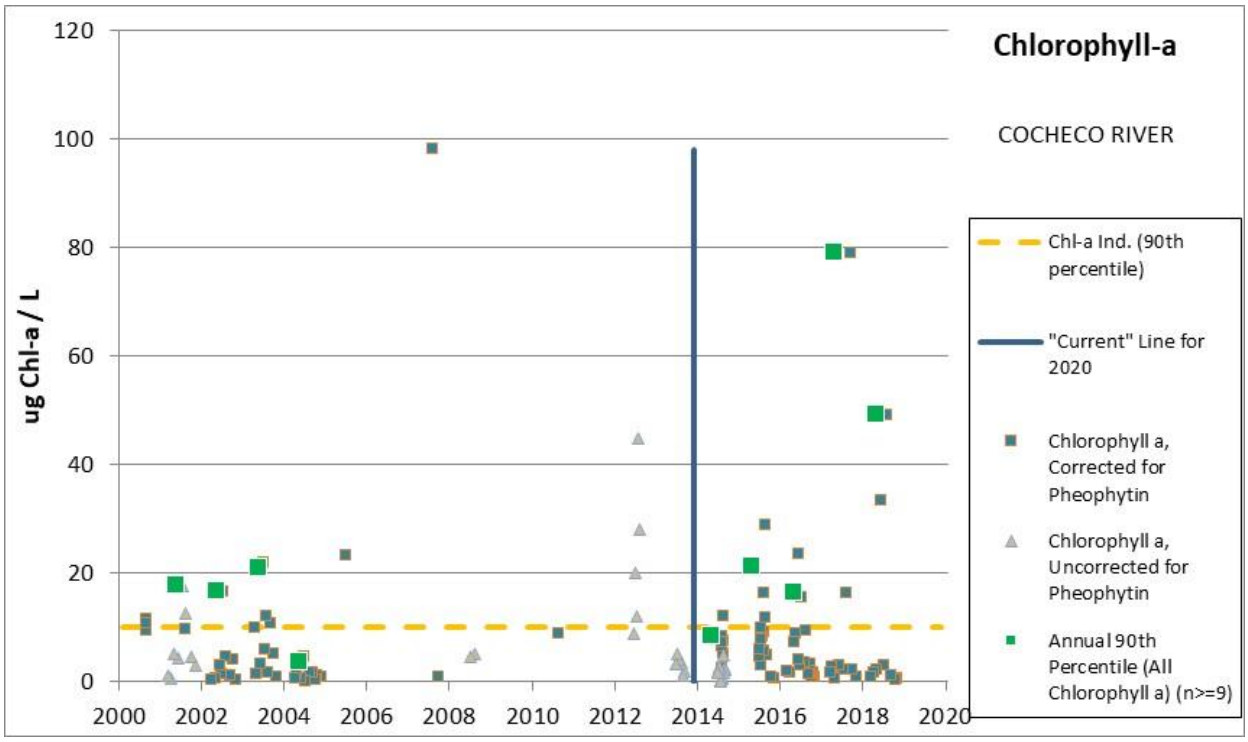
Assessment Zone = COCHECO RIVER

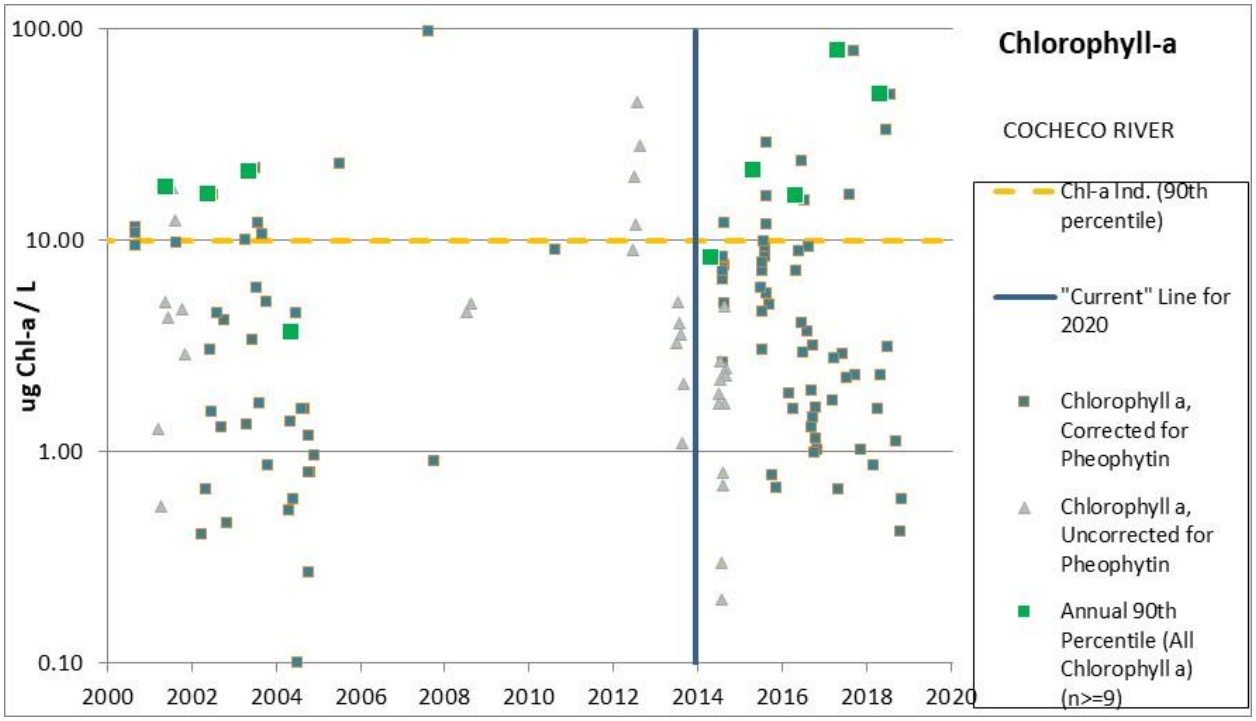
(NHEST600030608-01)

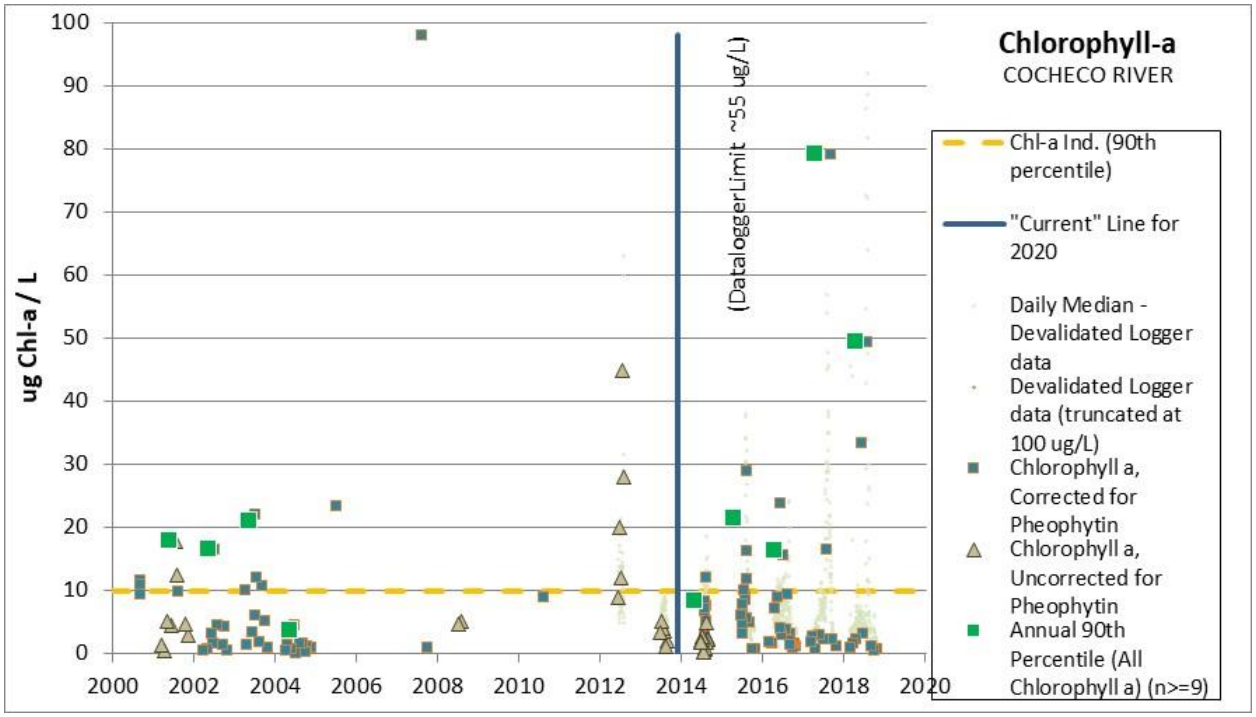
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there is one additional year of data (2018) compared to the 2018 assessment but the 2019 data is not included.

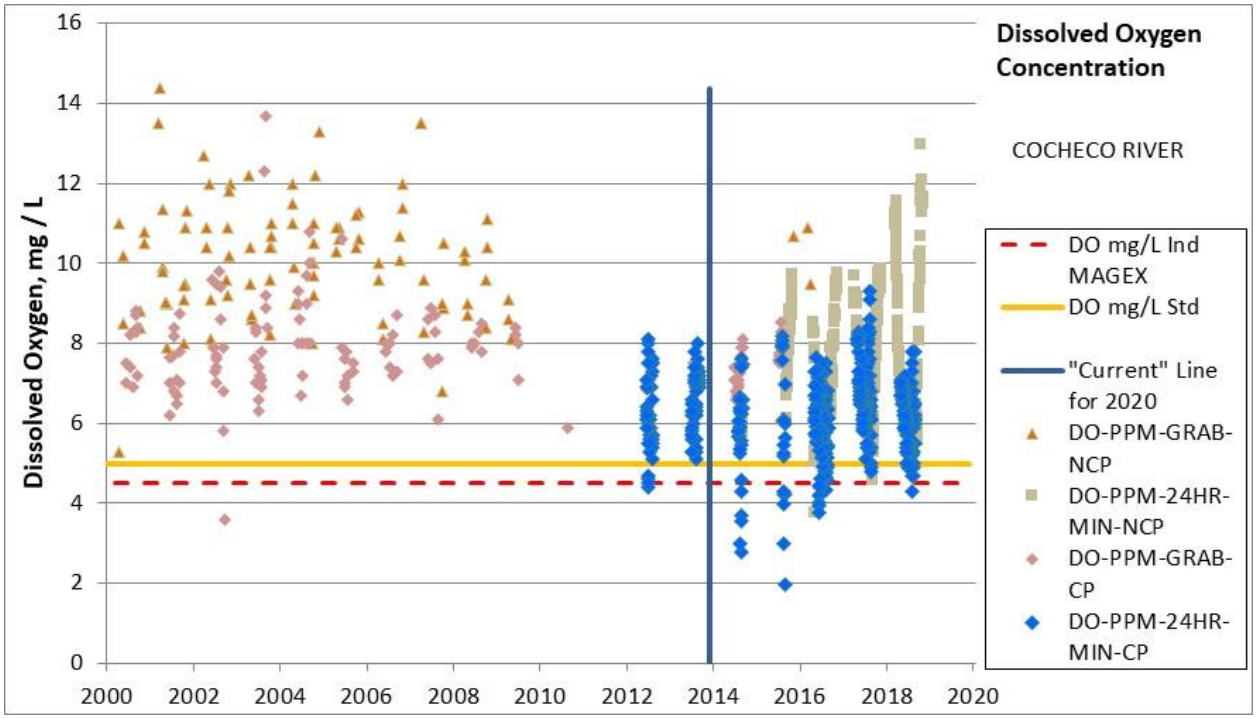
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	5-P / 5-P	The calculated 90th percentile chlorophyll-a in this assessment zone is 16.1 µg/L (n = 71) and a maximum reading of 79 µg/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 µg/L. Although the multiple probe based chlorophyll-a data (not used in the median above) collected in the assessment zone was qualified as "estimated," due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and shows large spikes in chlorophyll-a. Those spikes were most pronounced when low tide (maximum freshwater signal and maximum water temperature) occurred at midday to late afternoon (maximum photosynthesis duration period) and when freshwater inflow was at a minimum (0.23 – 0.10 cfsm) (minimum dilution of upstream loading). Under those conditions, the high nutrient water in the Cocheco River had the optimum conditions to sustain a large phytoplankton biomass.
Dissolved Oxygen (mg/L)	5-M / 5-M	Following the 10% method described in the 2020/2022 CALM, this parameter would be categorized as impaired (42 of 406 days of summer dataloggers few below 5 mg/L, or 10.3% of the days). Part of the concept behind the 10% rule was to address random errors within the meter measurement accuracy thereby limiting accidental impairments. The magnitude of exceedance indicator threshold (< 4.5 mg/L) was layered into the assessment process to address major exceedances and exceedances beyond all normal measurement errors. Of the overall "current" dataset, there were 42 days on which DO fell below 5 mg/L; there were 9 days on which DO fell below 4 mg/L; there were 3 days on which DO fell below 3 mg/; and there was 1 day on which DO fell below 2 mg/L. While the most severe DO depletion occurred in 2014 and 2015, the DO depletion is ongoing as of the 2018 dataset. Given the concerted effort by the municipalities to reduce nutrient loading through infrastructure investments, nonpoint source controls and stormwater ordinances, NHDES anticipates that the condition will continue to improve in the coming years.
Dissolved Oxygen (% Saturation)	2-M / 2-M	Dissolved oxygen percent saturation has been assessed using dataloggers from 2012 through 2018. On only 7-occasions did the critical summer period 24-hour average percent saturation fall below 75% (1.5% of measure days) with a 24-hour minimum of 70% saturation.
Estuarine Bioassessments (eelgrass)	No Std/ No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std/ No Std	Not applicable. The water clarity has not been assessed because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	5-M / 5-M	The median total nitrogen from 2014 through 2019 was 493 µg/L (n=59). It must be noted that recent total nitrogen reductions have occurred due to infrastructure investments by the municipalities (Rochester WWTP reductions in 2014 and Dover WWTP began reductions in 2015). This assessment zone experienced periodic dissolved oxygen concentrations below 5 mg/L in 2014 through 2018 and as low as 2 mg/L and periodic daily average dissolved saturation below 75%. The chlorophyll-a concentration 90th percentile was 16.1 µg/L (n = 71) and a maximum

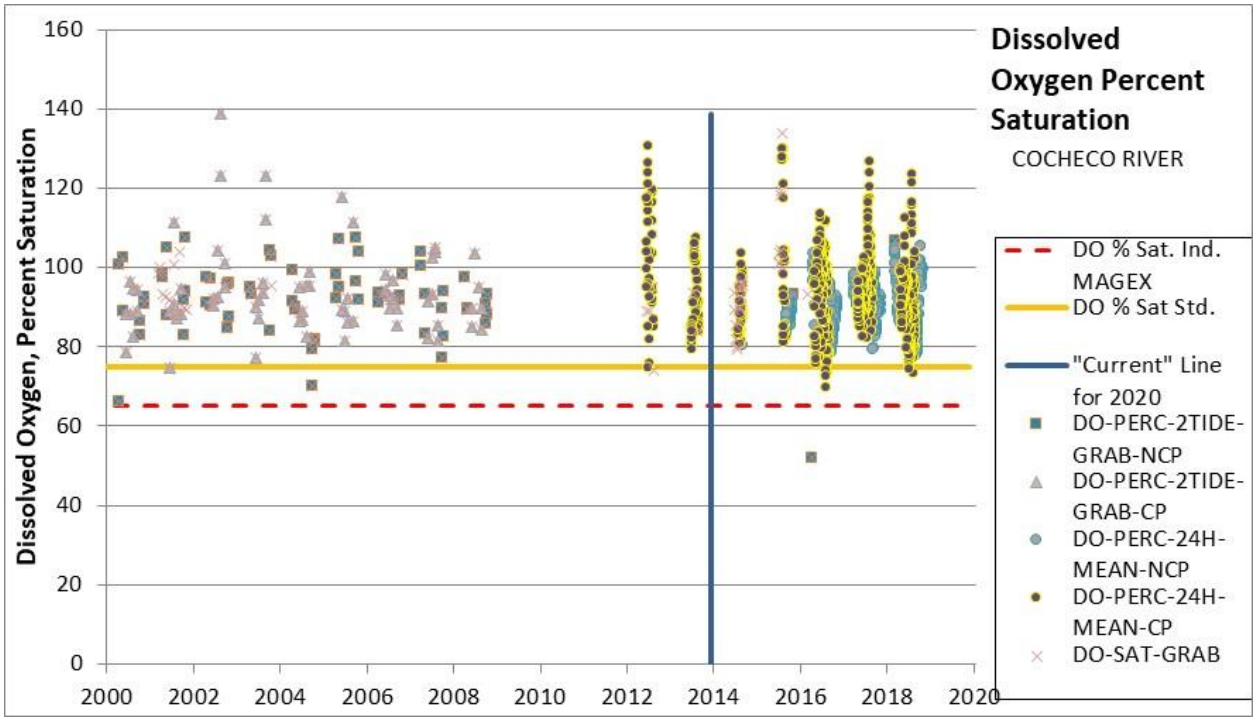
		reading of 79 µg/L. Although the probe based chlorophyll-a data (not used in the median above) was qualified as "estimated" due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and demonstrates that chlorophyll-a biomass can be quite high depending upon the timing on the tide cycle. The Cocheco River appears to be a system in flux. The 2016 TSD (NHDES, May 8, 2017) provided graphics and accompanying narrative to demonstrate that the growth of algae is causing dissolved oxygen to fall below State standards. The concentration of total nitrogen is high enough, especially at low tide and lower river flow conditions, to result in these algal blooms (see the Detailed Cocheco River 2015 Datalogger Evaluation section in the 2016 TSD (NHDES, May 8, 2017).) It is not clear at this time whether the measured high chlorophyll and low dissolved oxygen is solely the result of current loads of nitrogen or if the historically higher loads are still flushing through the ecosystem. The status of the indicators of nutrients and nutrient-related impacts has not changed, and continue to present a preponderance of evidence that eutrophication effects are ongoing. While there has been a rapid decrease in nutrient loading and improved conditions expected in the coming years, the response datasets still warrant nitrogen impairment under New Hampshire's narrative standard.

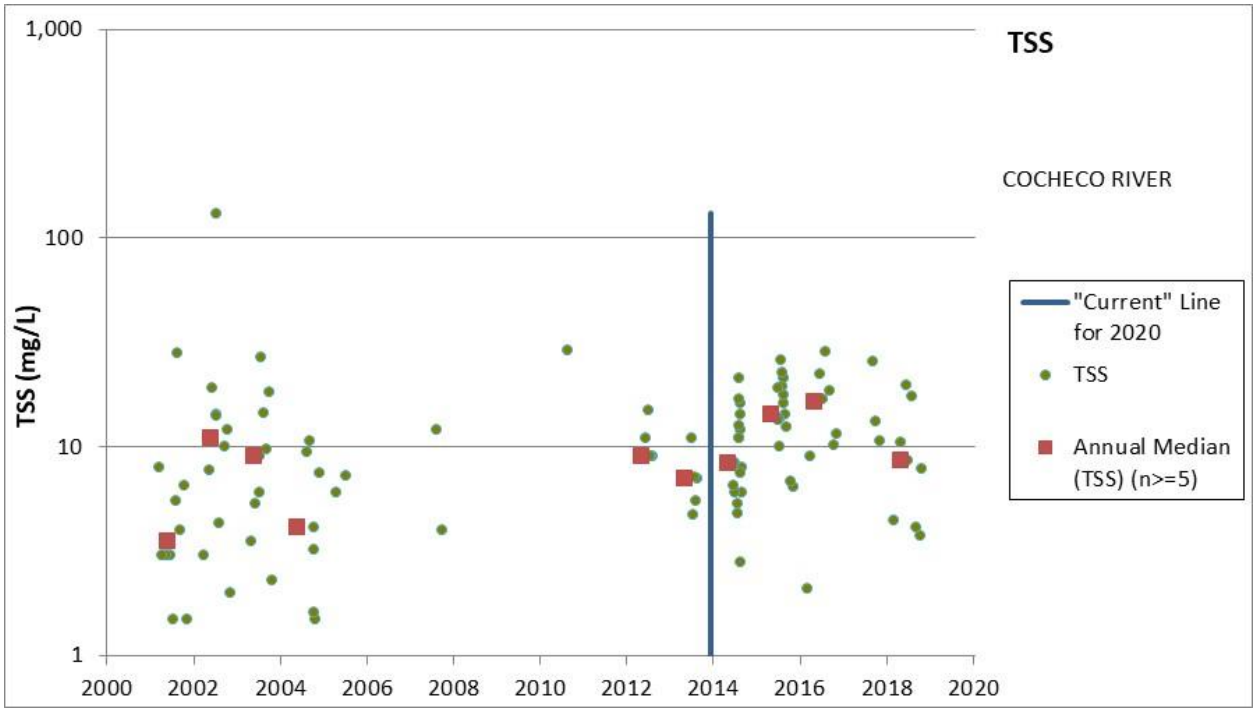


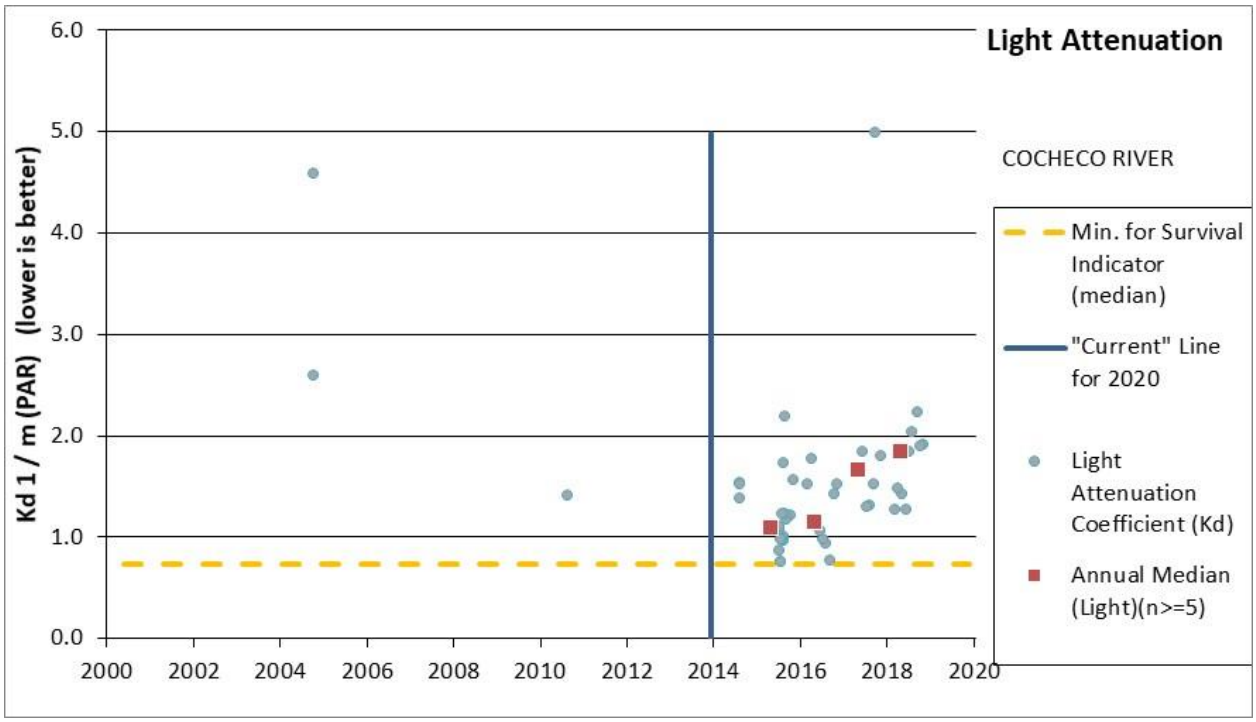

Chlorophyll-a
COCHECO RIVER
ug Chl-a / L
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

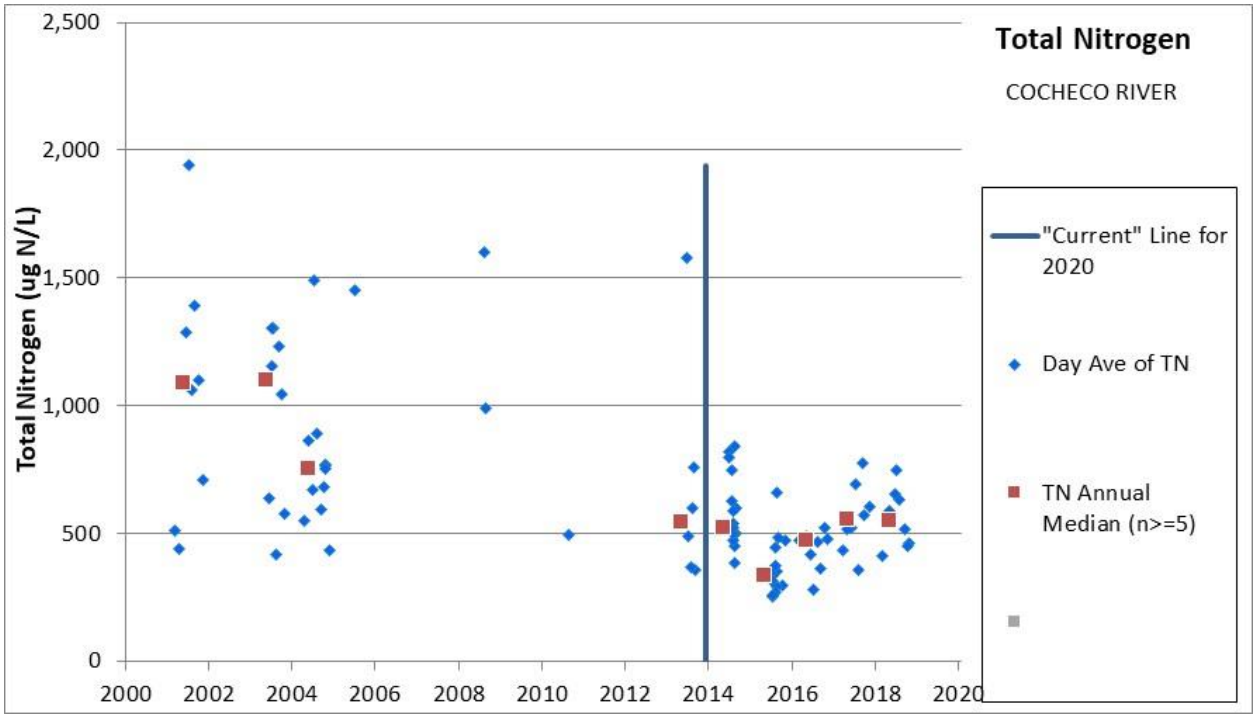

Chlorophyll-a
COCHECO RIVER
ug Chl-a / L
(DataloggerLimit ~55 ug/L)
100
90
80
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Daily Median - Devalidated Logger data
Devalidated Logger data (truncated at 100 ug/L)
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)


Dissolved Oxygen Concentration
COCHECO RIVER
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
COCHECO RIVER
Dissolved Oxygen, Percent Saturation
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
COCHECO RIVER
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Light Attenuation
COCHECO RIVER
Kd 1 / m (PAR) (lower is better)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)


Total Nitrogen
COCHECO RIVER
Total Nitrogen (ug N/L)
2,500
2,000
1,500
1,000
500
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Cocheco River Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	59	0.4	3.7	16.4	79.0
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	12	0.2	1.8	4.2	4.9
CHLOROPHYLL A, Combined (ug/L)	71	0.2	2.9	16.1	79.0
LIGHT ATTENUATION COEFFICIENT (1/m)	43	0.76	1.32	2.00	4.99
TURBIDITY (NTU)	19	1.3	3.9	5.1	8.5
TURBIDITY (datalogger daily median) (NTU)	754	0.2	6.0	11.0	1,222.0
TSS (mg/L)	54	2.1	11.7	21.8	28.4
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	42	2.0	3.8	6.7	13.4
DO-PPM-24HR-MIN-CP (mg/L)	406	2.0	6.2	7.5	9.3
DO-PPM-24HR-MIN-NCP (mg/L)	340	3.8	8.4	10.3	13.0
DO-PPM-GRAB-CP (mg/L)	23	6.1	7.3	8.2	8.6
DO-PPM-GRAB-NCP (mg/L)	3	9.5	10.7	-	10.9
DO-PERC-24H-MEAN-CP (% sat)	403	69.6	93.1	107.1	129.9
DO-PERC-24H-MEAN-NCP (% sat)	340	78.1	90.1	99.2	105.5
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	3	52.0	93.5	-	106.9
DO-PERC-GRAB (% sat)	25	79.3	95.2	118.5	133.7
Day Ave of TN (ug N/L)	59	253	493	746	840
Day Ave of TDN (ug N/L)	42	167	360	459	536
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	60	6	170	289	408
Day Ave of NH3 (ug N/L)	60	3	29	61	109
Day Ave of PON (ug N/L)	19	5	115	350	488
Day Ave of NO2/3 (ug N/L)	60	2	131	254	357
SALINITY-Grabs (pss)	54	0.2	18.0	26.0	26.8
SALINITY-Datalogger Daily Median (pss)	769	0.1	21.1	25.6	28.8
pH-grab	23	7.2	7.7	8.0	10.8
pH-24HR (min)	751	6.2	7.5	7.11*	8.1
pH-24HR (max)	751	7.1	7.9	8.1	8.5
Temperature	55	2.3	20.8	24.9	25.9
Temperature-Daily Median	788	1.4	18.0	23.7	25.9

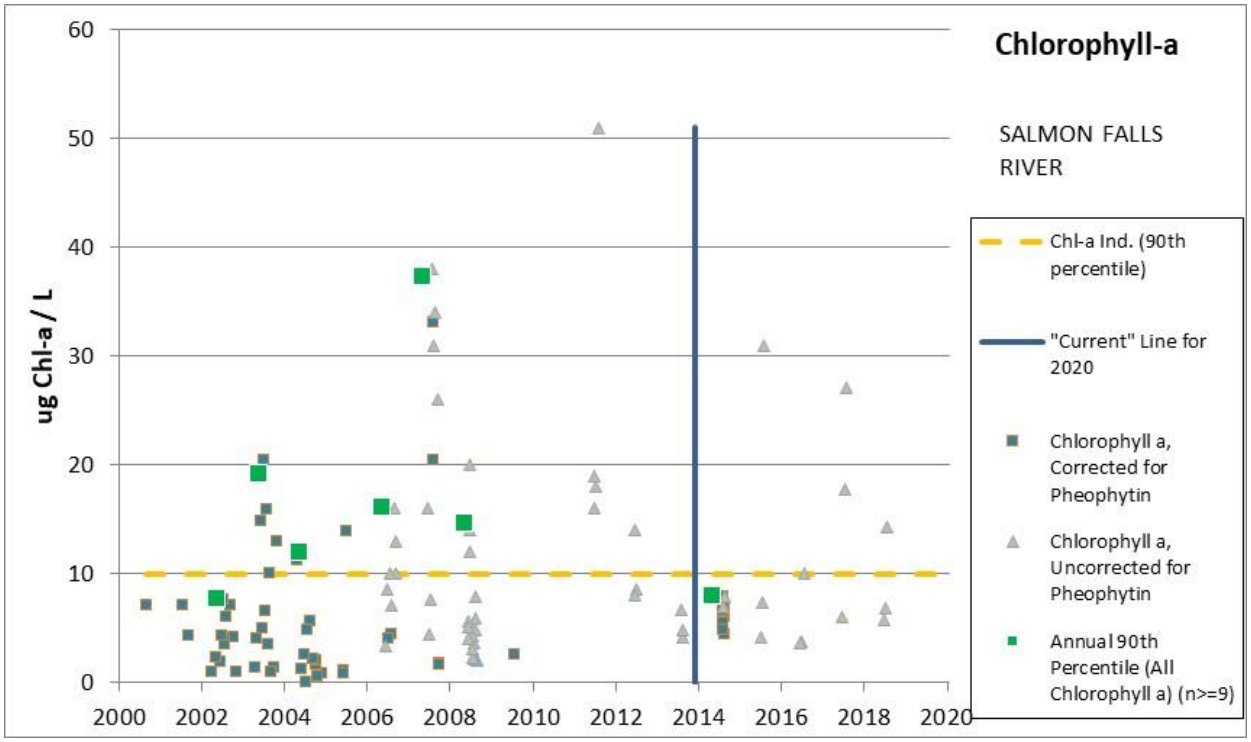
*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

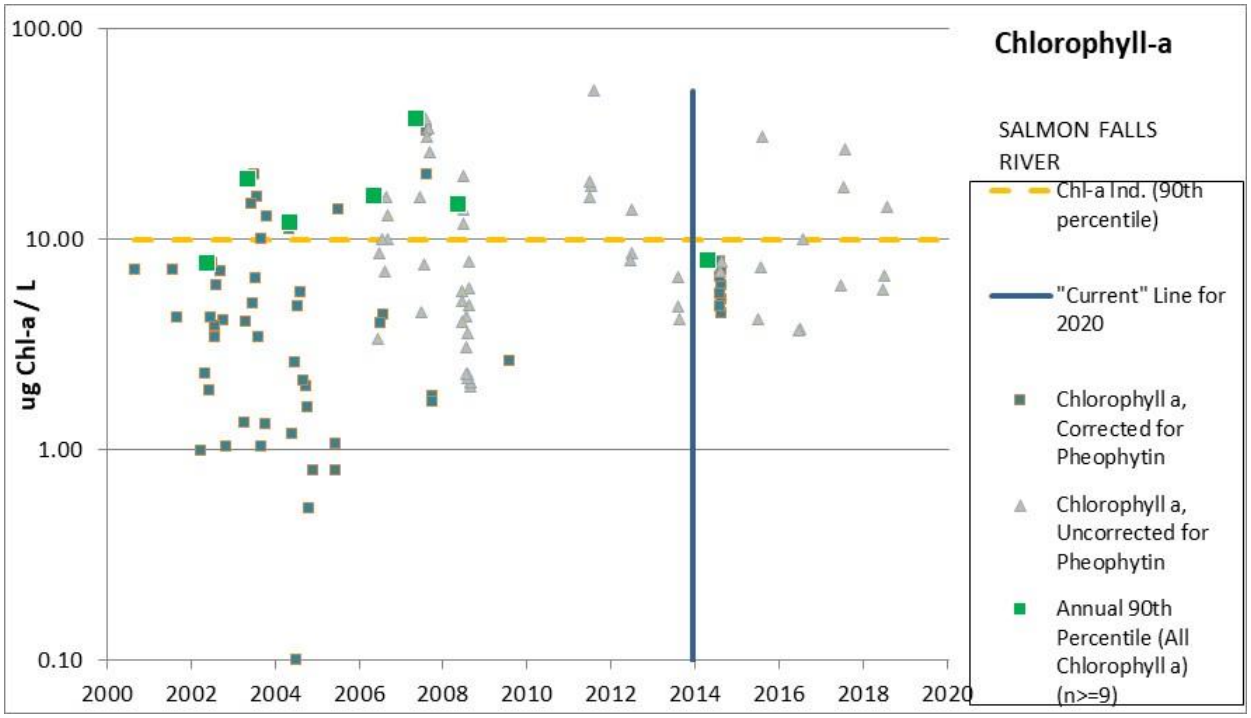
Assessment Zone = SALMON FALLS RIVER

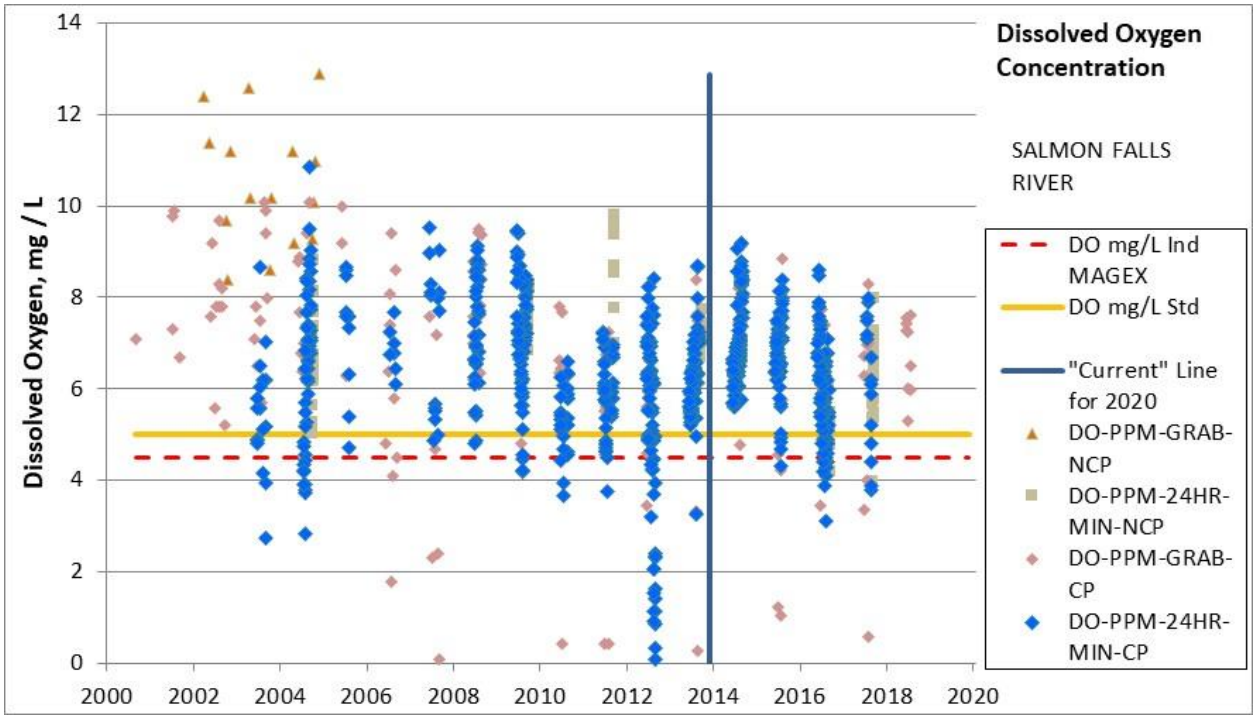
(NHEST600030406-01)

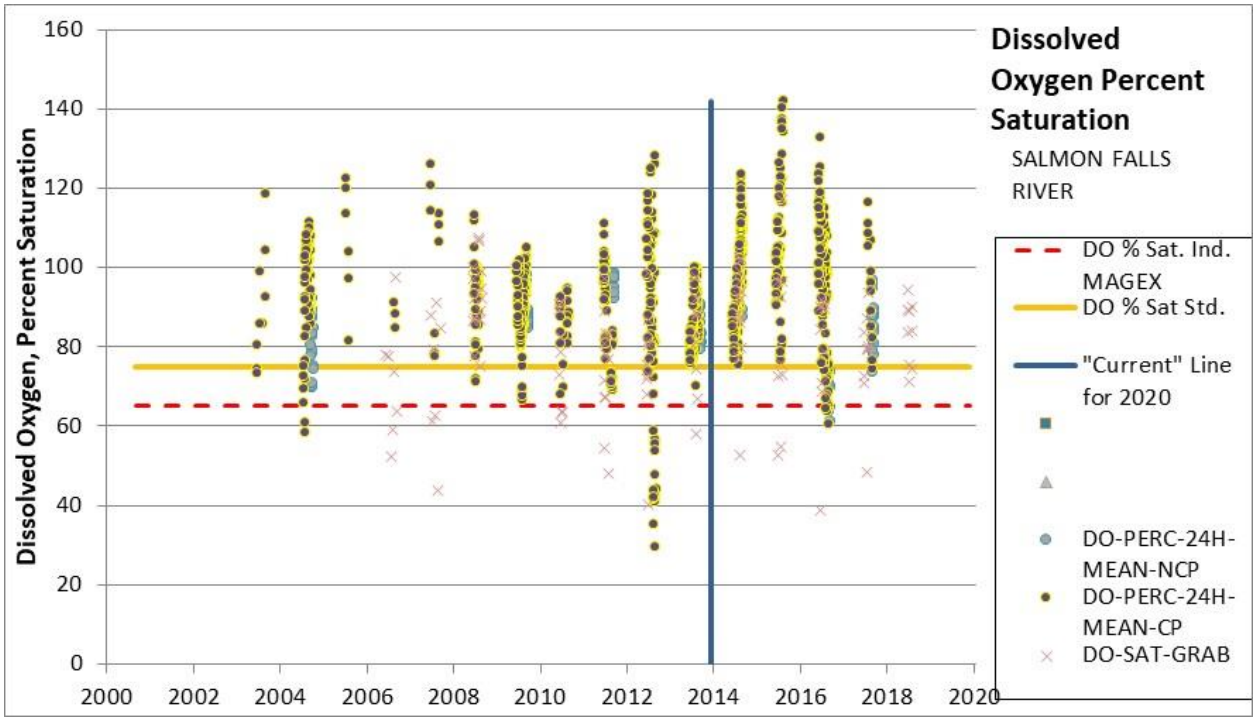
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there is one year of additional datalogger data (2017) and one year of additional grab sample data (2018) compared to the 2018 assessment but the 2019 data is not included.

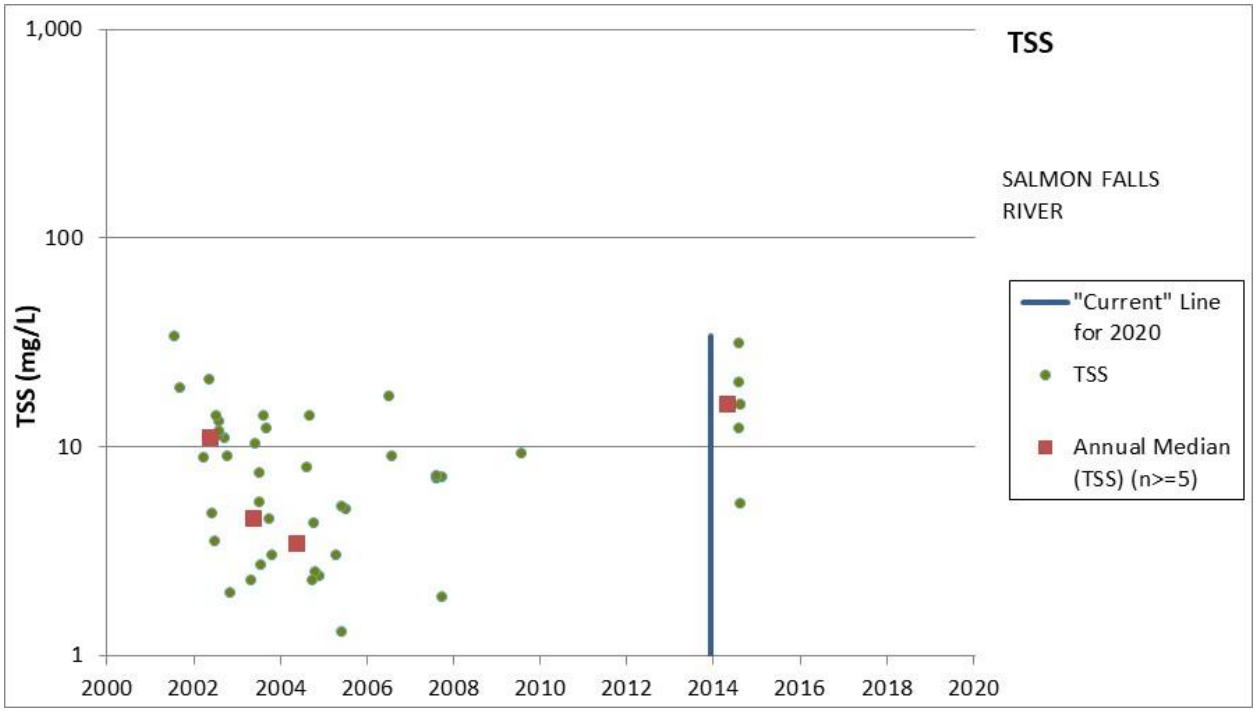
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	5-P / 5-P	The calculated 90th percentile chlorophyll-a in this assessment zone is 24.3 µg/L (n = 22) and a maximum reading of 31 µg/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 µg/L. The chlorophyll-a impairment has been retained.
Dissolved Oxygen (mg/L)	5-P / 5-P	Dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year. In most years a portion of those measurements fall below 4 mg/L, down to 3.1 mg/L in 2017 and in 2012 there were many measurements below 1 mg/L, as such, this impairment is considered severe.
Dissolved Oxygen (% Saturation)	5-M / 5-M	Dissolved oxygen 24-hour average percent saturation measurements in this assessment zone fall below the 75% indicator criteria every year. In 2012 many of the datalogger based 24-hour averages were below 50%. The data suggests that the aquatic life use is impaired, as such, dissolved oxygen 24-hour average percent saturation has been assessed as not supporting.
Estuarine Bioassessments (eelgrass)	No Std / No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std / No Std	Not applicable. The water clarity has not been assessed because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	5-M / 5-P	The median total nitrogen from 2014 through 2019 was 672 µg/L (n=51). This assessment zone experiences frequent dissolved oxygen concentrations well below 5 mg/L and daily average saturation below 75%. During multiple years this assessment zone also demonstrated super saturation well over 125% The chlorophyll-a concentration 90th percentile was 24.3 µg/L (n = 22) and a maximum reading of 31 µg/L. The status of the indicators of nutrients and nutrient-related impacts has not changed, and continue to present a preponderance of evidence that eutrophication effects are ongoing. As such, the impairment for nitrogen has been retained.

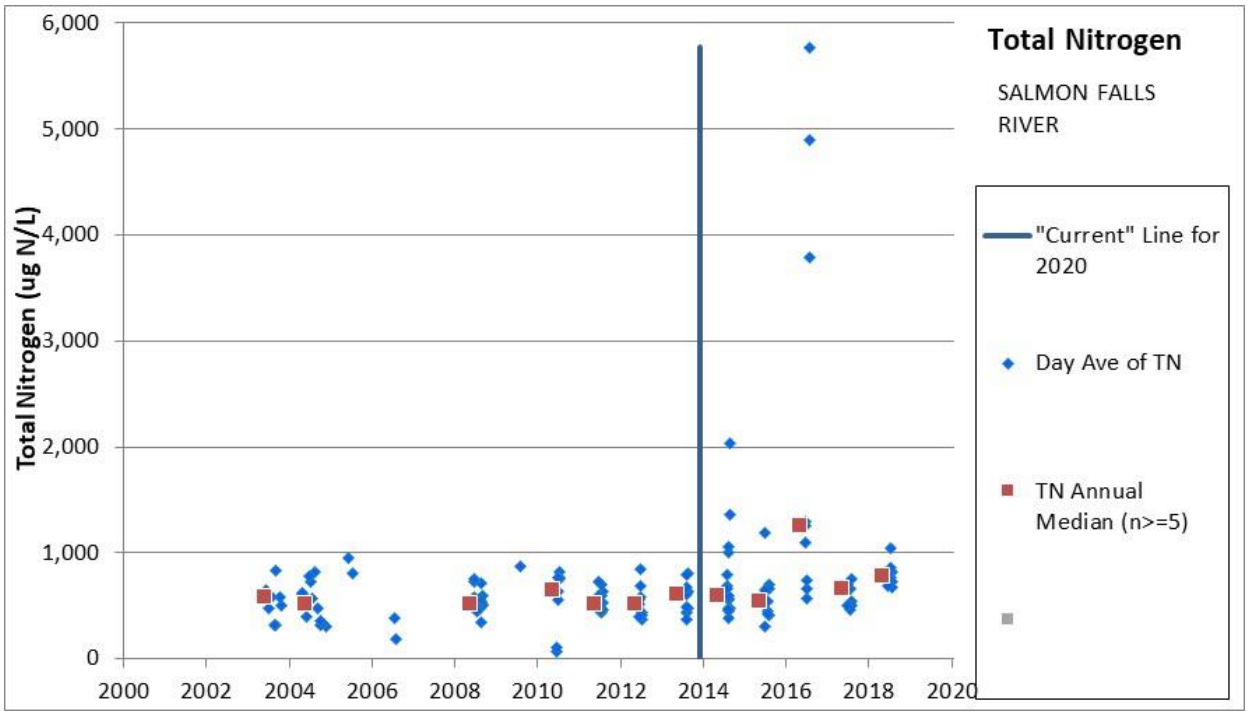

Chlorophyll-a
SALMON FALLS RIVER
ug Chl-a / L
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)


Chlorophyll-a
SALMON FALLS RIVER
ug Chl-a / L
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)


Dissolved Oxygen Concentration
SALMON FALLS RIVER
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
SALMON FALLS RIVER
Dissolved Oxygen, Percent Saturation
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
SALMON FALLS RIVER
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Total Nitrogen
SALMON FALLS RIVER
Total Nitrogen (ug N/L)
6,000
5,000
4,000
3,000
2,000
1,000
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Salmon Falls River Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	8	4.5	5.8	-	7.9
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	14	3.7	7.2	29.1	31.0
CHLOROPHYLL A, Combined (ug/L)	22	3.7	6.7	24.3	31.0
LIGHT ATTENUATION COEFFICIENT (1/m)	6	1.11	1.28	-	1.58
TURBIDITY (NTU)	6	2.2	2.7	-	3.3
TURBIDITY (datalogger daily median) (NTU)	310	0.0	3.0	9.8	332.2
TSS (mg/L)	6	5.4	15.9	-	31.5
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	0	-	-	-	-
DO-PPM-24HR-MIN-CP (mg/L)	287	3.1	6.7	8.1	9.2
DO-PPM-24HR-MIN-NCP (mg/L)	32	4.0	6.2	7.2	8.0
DO-PPM-GRAB-CP (mg/L)	49	0.6	7.0	8.2	9.1
DO-PPM-GRAB-NCP (mg/L)	0	-	-	-	-
DO-PERC-24H-MEAN-CP (% sat)	280	60.5	98.3	117.7	141.9
DO-PERC-24H-MEAN-NCP (% sat)	28	61.4	82.8	94.7	96.8
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	0	-	-	-	-
DO-PERC-GRAB (% sat)	49	38.7	84.3	96.6	117.2
Day Ave of TN (ug N/L)	51	300	672	1,346	5,775
Day Ave of TDN (ug N/L)	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	51	28	219	405	689
Day Ave of NH3 (ug N/L)	51	12	77	187	251
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	51	17	131	274	491
SALINITY-Grabs (pss)	48	0.0	7.3	19.1	23.2
SALINITY-Datalogger Daily Median (pss)	273	0.1	18.6	23.4	26.5
pH-grab	49	6.4	7.1	7.7	8.0
pH-24HR (min)	260	6.2	7.5	7.1*	8.2
pH-24HR (max)	260	6.4	7.9	8.1	8.5
Temperature	51	18.0	23.0	25.4	26.0
Temperature-Daily Median	321	14.7	23.1	25.7	33.6

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

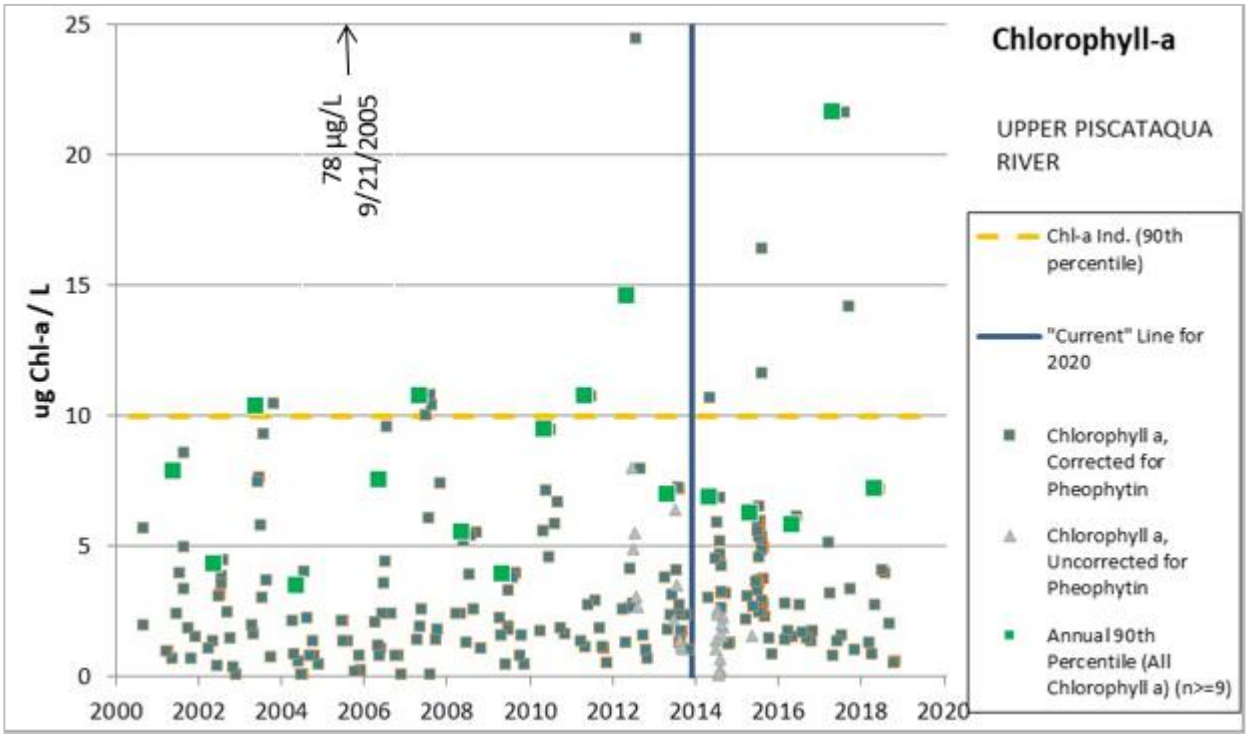
Assessment Zone = UPPER PISCATAQUA RIVER

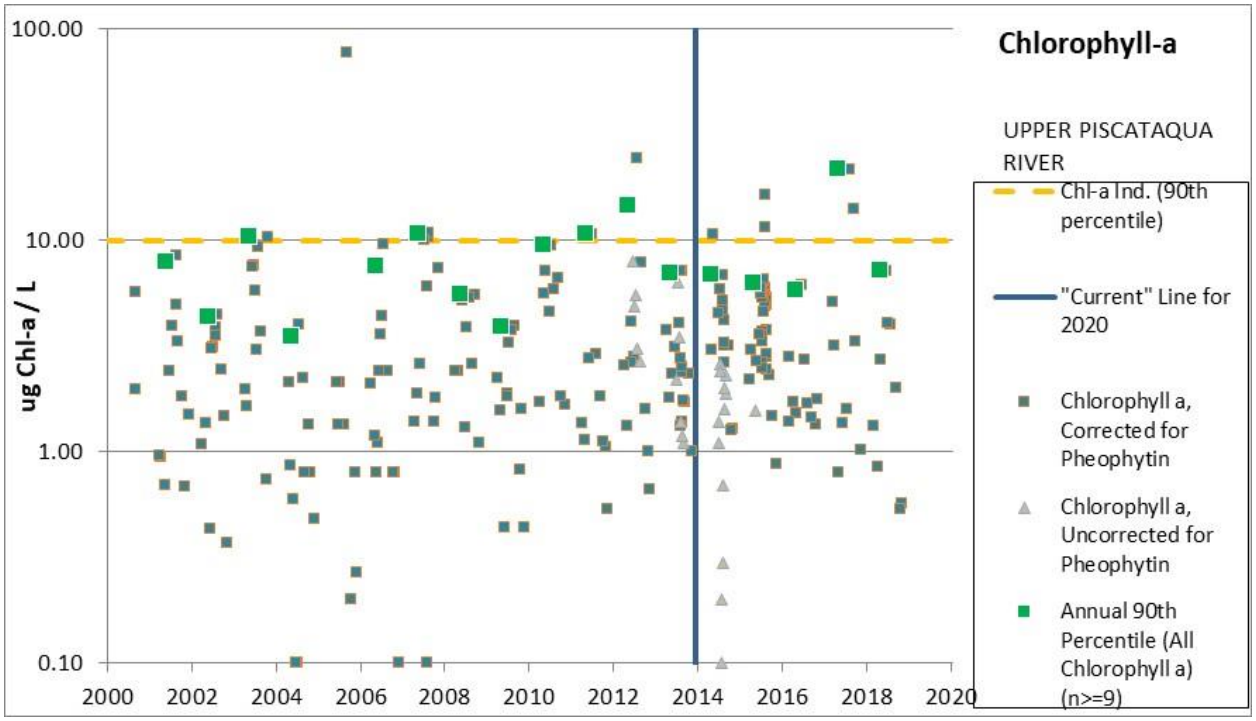
(NHEST600031001-01-01, NHEST600031001-01-02, NHEST600031001-01-03)

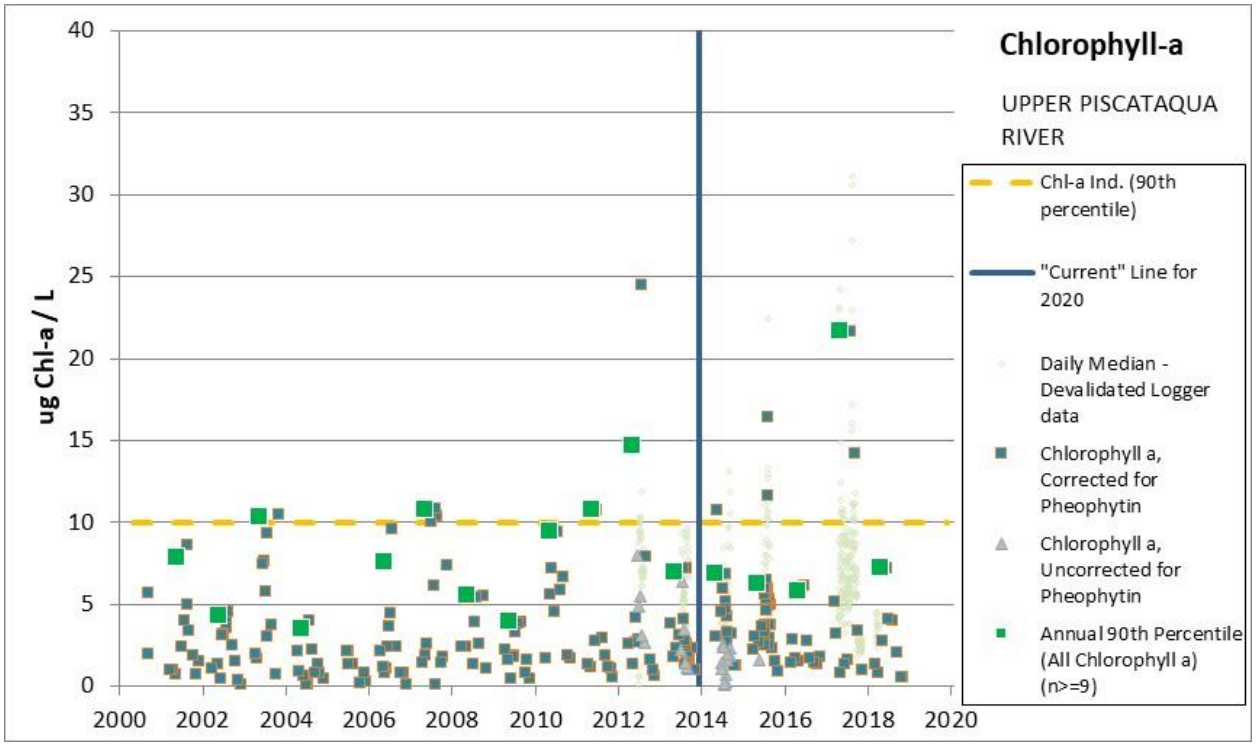
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are three additional years of data (2016, 2017, 2018) compared to the 2016 assessment but the 2019 data is not included.

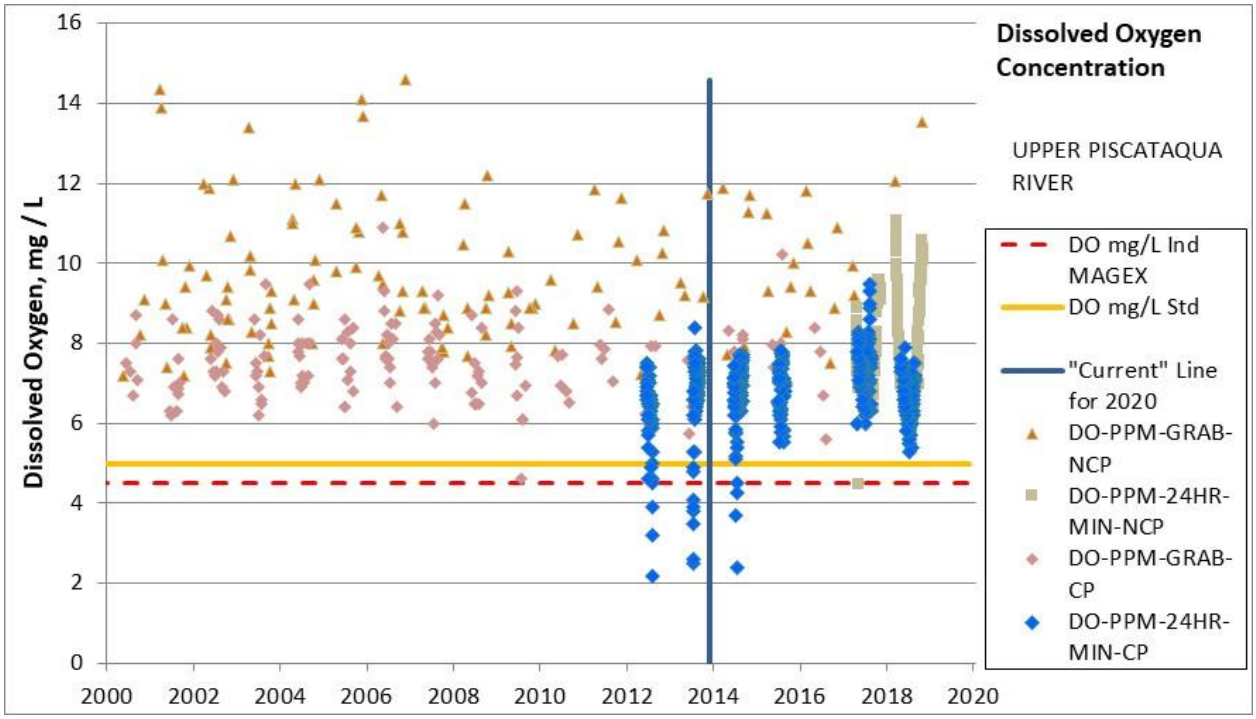
Indicator	Aquatic Life Use Category 2016 / 2020/2022	2020/2022 Comment
Chlorophyll-a	2-M / 2-M	The calculated 90th percentile chlorophyll-a in this assessment zone is 6.5 µg/L (n = 89) and a maximum reading of 21.6 µg/L. Although the probe based chlorophyll-a data (not used in the median above) collected from the UPR stations was qualified as "estimated" due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and shows large spikes in chlorophyll-a. The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L.
Dissolved Oxygen (mg/L)	3-PNS / 2-M	Before 2012, only grab samples of dissolved oxygen had been collected in the Upper Piscataqua River assessment zone. The datalogger deployments from 2012-2014 indicated that there were infrequent but at time severe reductions in DO. The nutrient load to this assessment zone is rapidly decreasing due to ongoing work by the municipalities (Rochester reductions in 2014 and Dover began reductions in 2015). The data logger deployments fin 2015, 2017 and 2018 demonstrate no DO in the summer months below 5.6 mg/L. Acknowledging the existing data and changes in nutrient loading, this assessment zone is being assessed as supporting the dissolved oxygen criteria indicator.
Dissolved Oxygen (% Saturation)	3-PAS / 2-M	This assessment zone has only grab sample measurements for dissolved oxygen 24-hour average percent saturation up until 2011. In 2012-2015, 2017, and 2018 dataloggers were deployed and no 24-hour averages fell below 75%. The available data indicates that this assessment zone has good dissolved oxygen saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 79.7 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2016-2019 is 0 acres, which is a decrease of 100%. In 2019 2.2 acres of eelgrass were mapped, the first eelgrass measured since the last bits of eelgrass that had been hanging on were lost after 2006. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 100%. The thresholds for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	Median=1.03 m^-1 (n=72). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and some in deeper habitat making the 2m restoration depth a valid target. Given how close the light attenuation coefficient is to the indicator threshold and to be consistent with other parts of the estuary, the impaired status has been retained as marginal (5-M).
Total Nitrogen	3-PNS / 3-PNS	The median total nitrogen from 2014 through 2019 was 355 µg/L (n=89). The TN was lowest in 2015 (drought year) and has risen since but not as high as it was pre-2015. While the dissolved oxygen data showed that this assessment zone experienced short duration concentrations below the 5 mg/L criteria before 2015, the assessment zone has had no DO issues since that time. The 24-hour average dissolved oxygen percent saturation did not fall below 75% in any of the 4-years of datalogger records in the current period. The calculated 90th percentile chlorophyll-a in this assessment zone is 6.5 µg/L (n = 89) and a maximum reading of 21.6 µg/L. Although the probe based chlorophyll-a data (not used in the median above) collected from the UPR stations was qualified as "estimated" due to poor correlation between probe and extracted chlorophyll-a grab

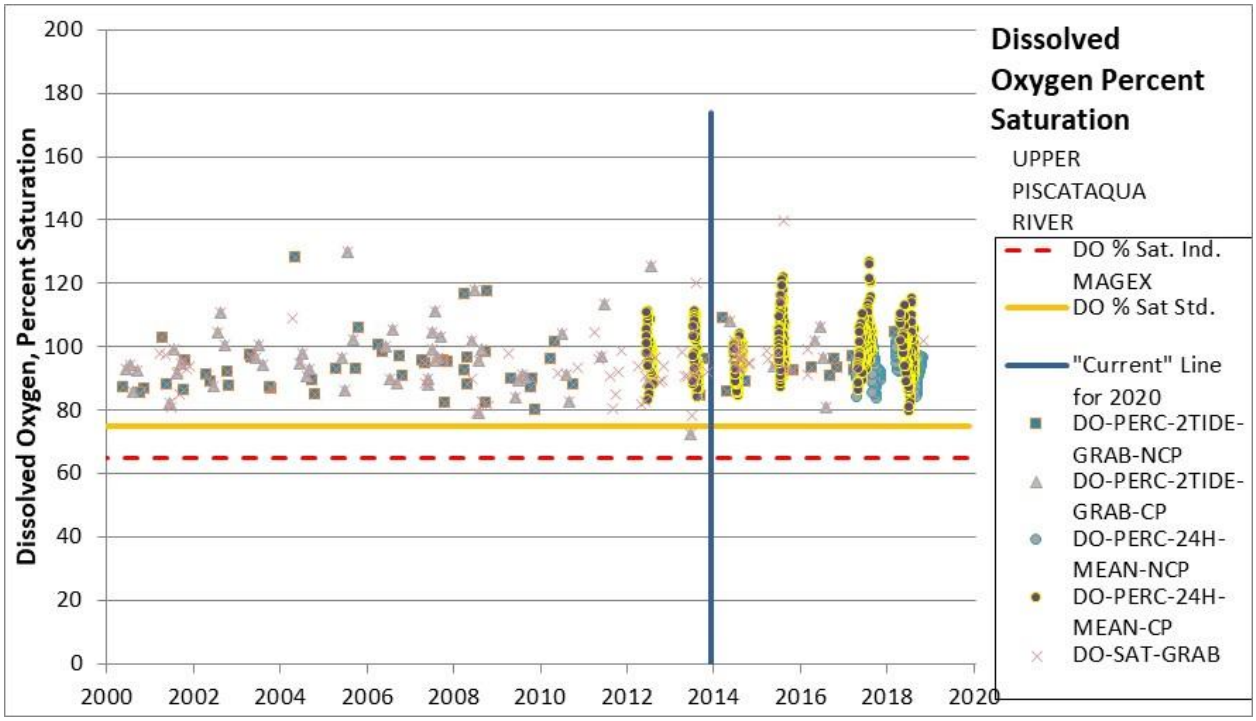
		sample data, the relative biomass is valid and shows moderate spikes in chlorophyll-a. The grab sample-based light attenuation (median=1.03 m^-1, n=72) is poor suggesting strong resuspension in the system. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), as appears to be occurring in the Great Bay Estuary. The foremost authority on macroalgae for this estuary, Dr. Arthur C. Mathieson, commented on the draft 2012 303(d) that he remained concerned about the macroalgae and epiphyte conditions in Great Bay estuary (NHDES, 2013). In the 2019 macroalgae annual report, the appreciable cover at Hilton Point appears to have a visually downwards trend in green macroalgae but did not show statistical decreases in any macroalgae, although that site has only been sampled 3-times (2013, 2015, 2018) making trend detection more difficult (Burdick, et al., 2020). The status of the indicators of nutrients and nutrient-related impacts do not present a preponderance of evidence that eutrophication effects are occurring in this zone. While eelgrass has been lost and light attenuation is typically not sufficient, DO and chlorophyll a levels in this zone are good and the TN levels are elevated but typically within the restoration range. Additionally, the point-source nutrient load to this assessment zone is rapidly decreasing due to ongoing work at WWTFs by the nearby municipalities (Rochester reductions in 2014 and Dover began reductions in 2015, Portsmouth to be online in 2020). As such, this assessment zone has been assessed as insufficient information – potentially not supporting (3-PNS) for total nitrogen.

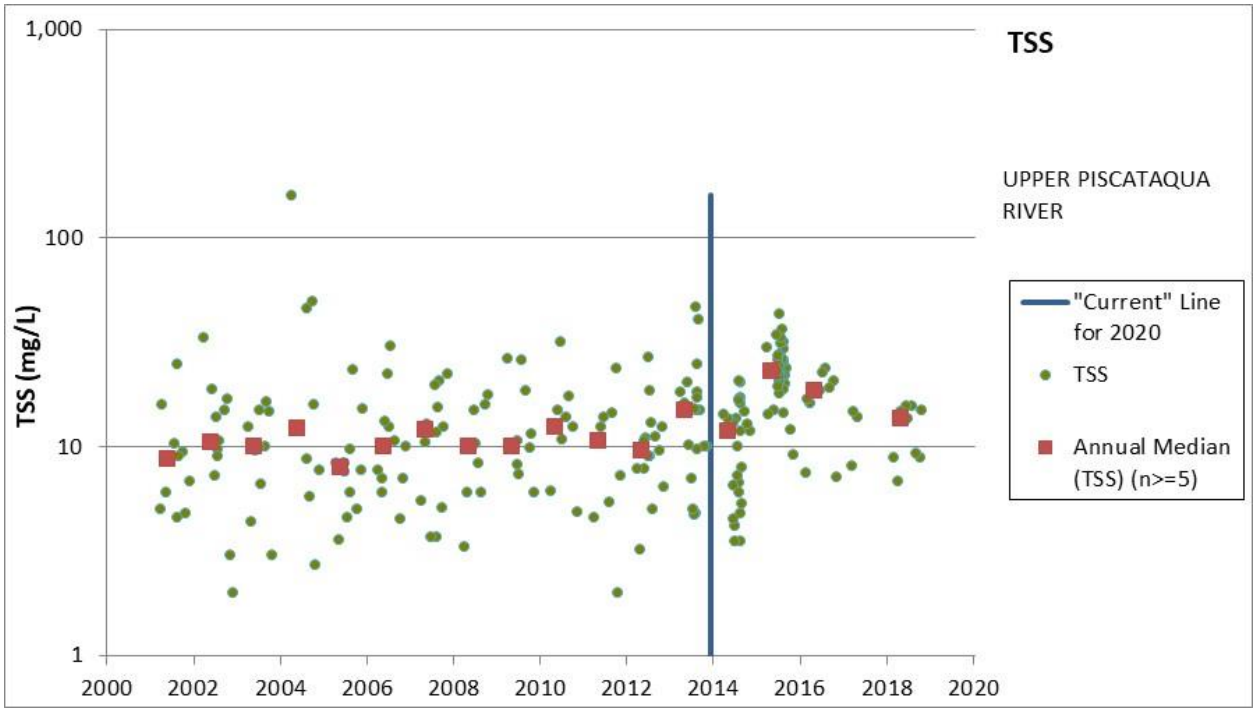


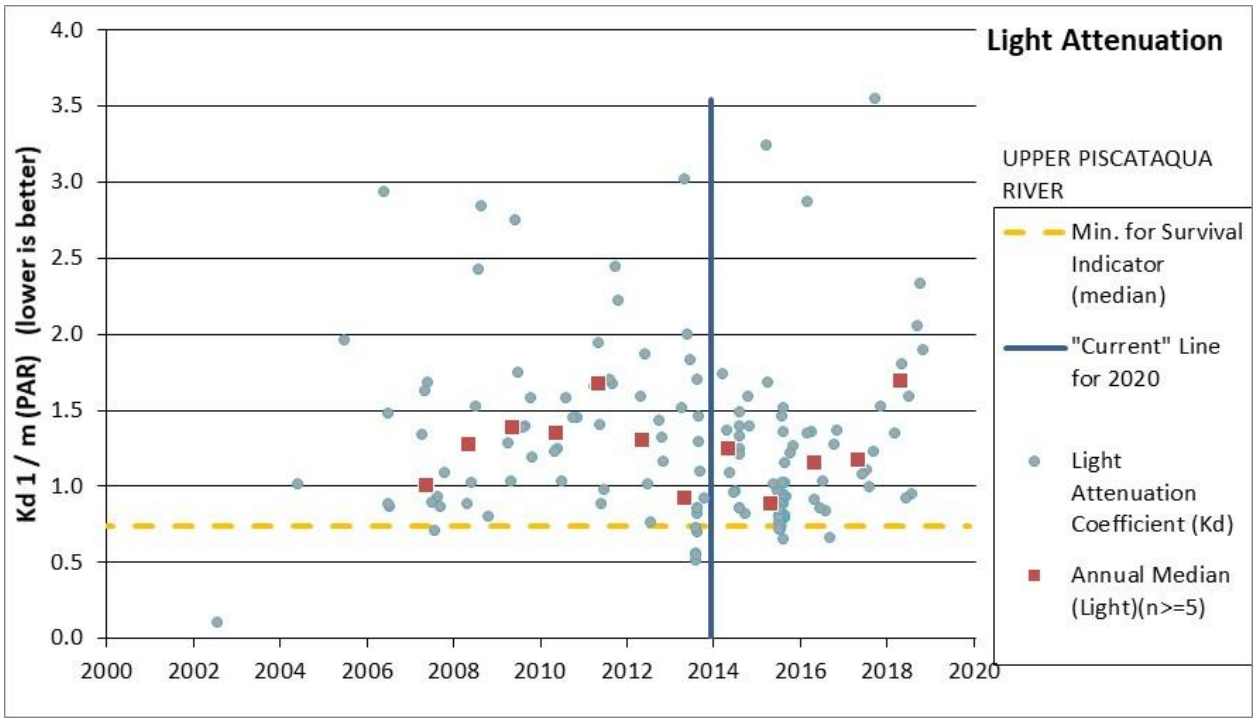

Chlorophyll-a
UPPER PISCATAQUA RIVER
ug Chl-a / L
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

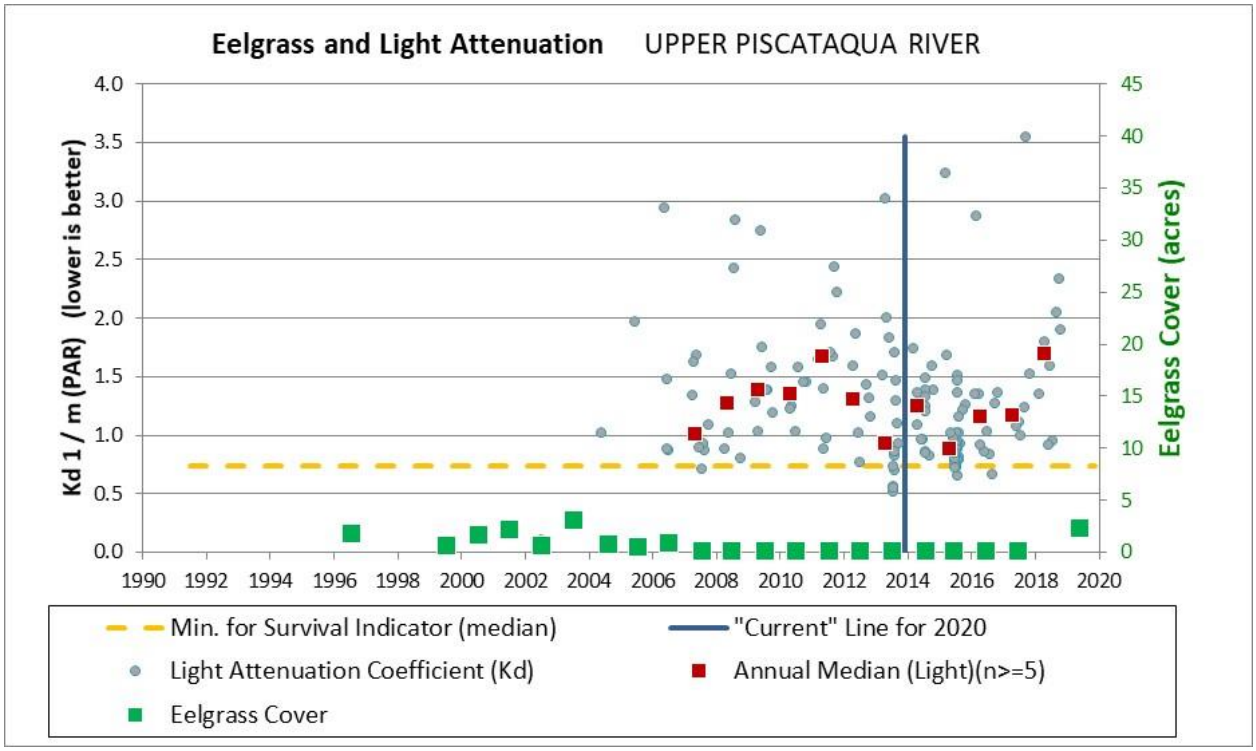

Chlorophyll-a
UPPER PISCATAQUA RIVER
ug Chl-a / L
40
35
30
25
20
15
10
5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Daily Median - Devalidated Logger data
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

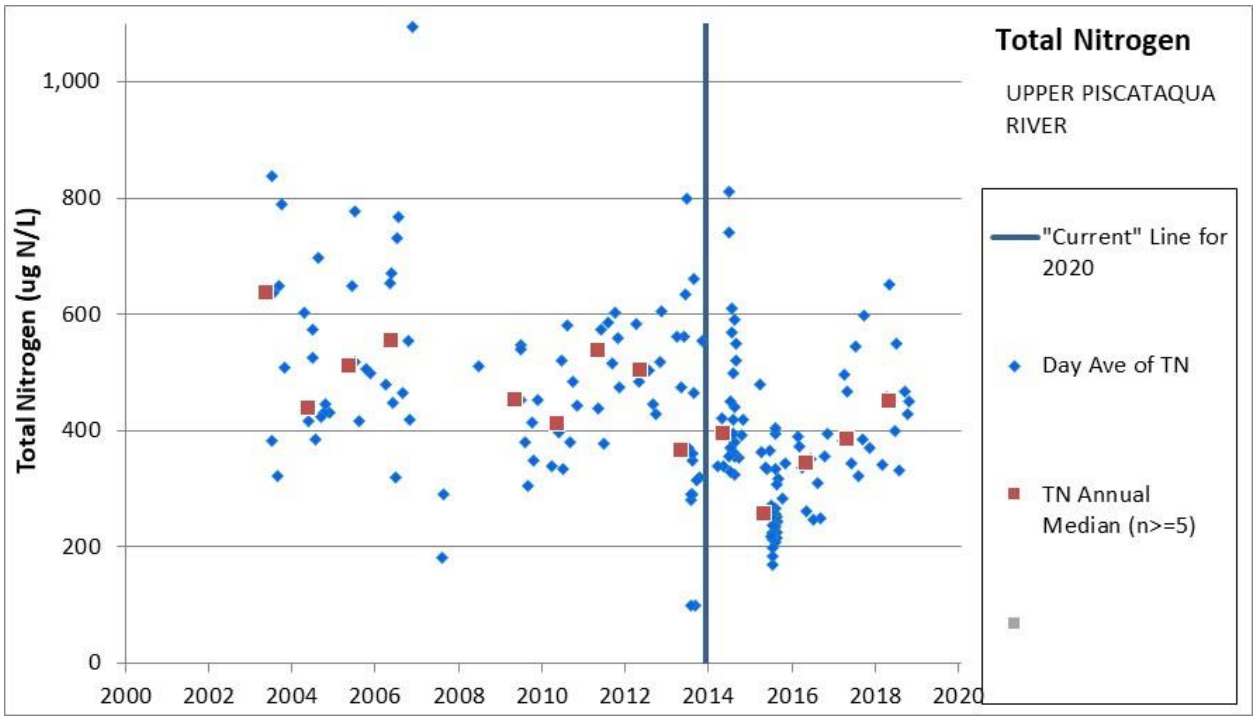

Dissolved Oxygen Concentration
UPPER PISCATAQUA RIVER
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
UPPER PISCATAQUA RIVER
Dissolved Oxygen, Percent Saturation
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
UPPER PISCATAQUA RIVER
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Light Attenuation
UPPER PISCATAQUA RIVER
Kd 1 / m (PAR) (lower is better)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)


Eelgrass and Light Attenuation
UPPER PISCATAQUA RIVER
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
45
40
35
30
25
20
15
10
5
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)
Eelgrass Cover


Total Nitrogen
UPPER PISCATAQUA RIVER
Total Nitrogen (ug N/L)
1,000
800
600
400
200
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Upper Piscataqua River Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	76	0.5	3.3	6.9	21.6
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	13	0.1	1.6	2.5	2.6
CHLOROPHYLL A, Combined (ug/L)	89	0.1	2.9	6.5	21.6
LIGHT ATTENUATION COEFFICIENT (1/m)	72	0.66	1.03	1.79	3.56
TURBIDITY (NTU)	32	1.4	2.6	3.5	4.1
TURBIDITY (datalogger daily median) (NTU)	517	1.1	5.0	12.0	432.0
TSS (mg/L)	82	3.5	16.2	29.1	43.4
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	70	1.6	2.9	5.2	11.3
DO-PPM-24HR-MIN-CP (mg/L)	437	2.4	7.0	7.6	9.5
DO-PPM-24HR-MIN-NCP (mg/L)	186	4.5	8.2	10.0	11.1
DO-PPM-GRAB-CP (mg/L)	22	5.6	7.6	8.4	10.2
DO-PPM-GRAB-NCP (mg/L)	20	7.5	10.0	12.1	13.6
DO-PERC-24H-MEAN-CP (% sat)	451	79.9	97.8	108.8	126.6
DO-PERC-24H-MEAN-NCP (% sat)	180	83.7	92.8	97.6	107.8
DO-PERC-2TIDE-GRAB-CP (% sat)	9	81.2	97.0	115.1	115.1
DO-PERC-2TIDE-GRAB-NCP (% sat)	13	86.1	92.8	107.4	109.2
DO-PERC-GRAB (% sat)	19	91.4	97.1	102.0	139.7
Day Ave of TN (ug N/L)	89	169	355	550	810
Day Ave of TDN (ug N/L)	70	121	240	375	570
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	89	6	106	200	259
Day Ave of NH3 (ug N/L)	89	3	28	60	79
Day Ave of PON (ug N/L)	24	37	75	223	284
Day Ave of NO2/3 (ug N/L)	89	3	75	151	232
SALINITY-Grabs (pss)	101	0.7	24.1	29.9	30.9
SALINITY-Datalogger Daily Median (pss)	666	5.8	26.3	29.1	31.2
pH-grab	7	7.2	7.7	-	7.9
pH-24HR (min)	666	6.6	7.7	7.3*	8.1
pH-24HR (max)	666	7.7	8.0	8.2	8.5
Temperature	102	1.1	19.3	23.7	26.2
Temperature-Daily Median	666	3.1	18.9	22.3	24.5

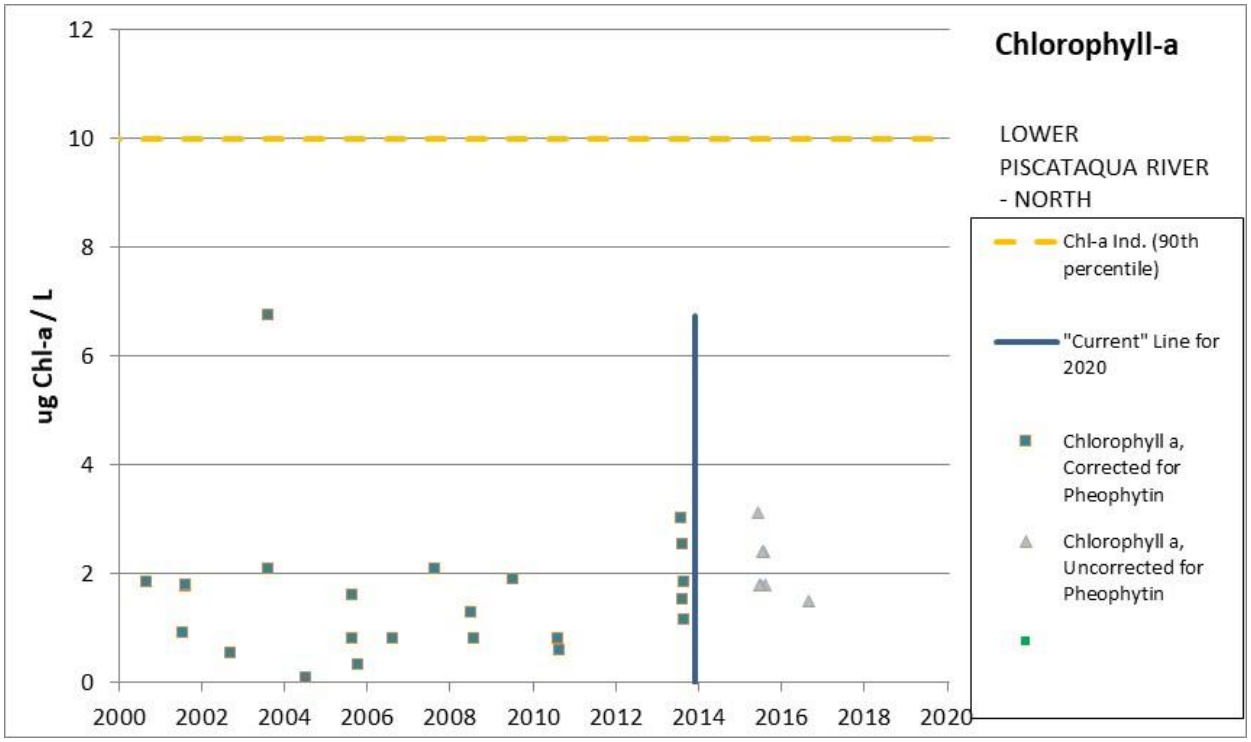
*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

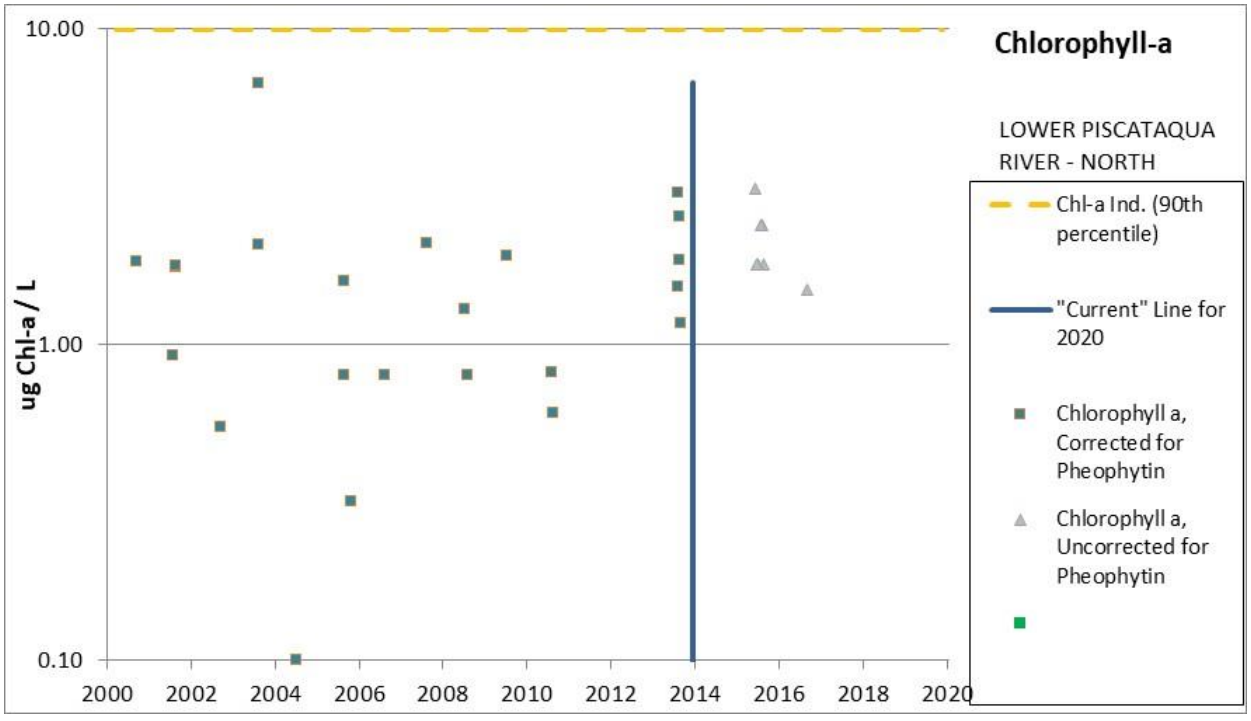
Assessment Zone = LOWER PISCATAQUA RIVER - NORTH

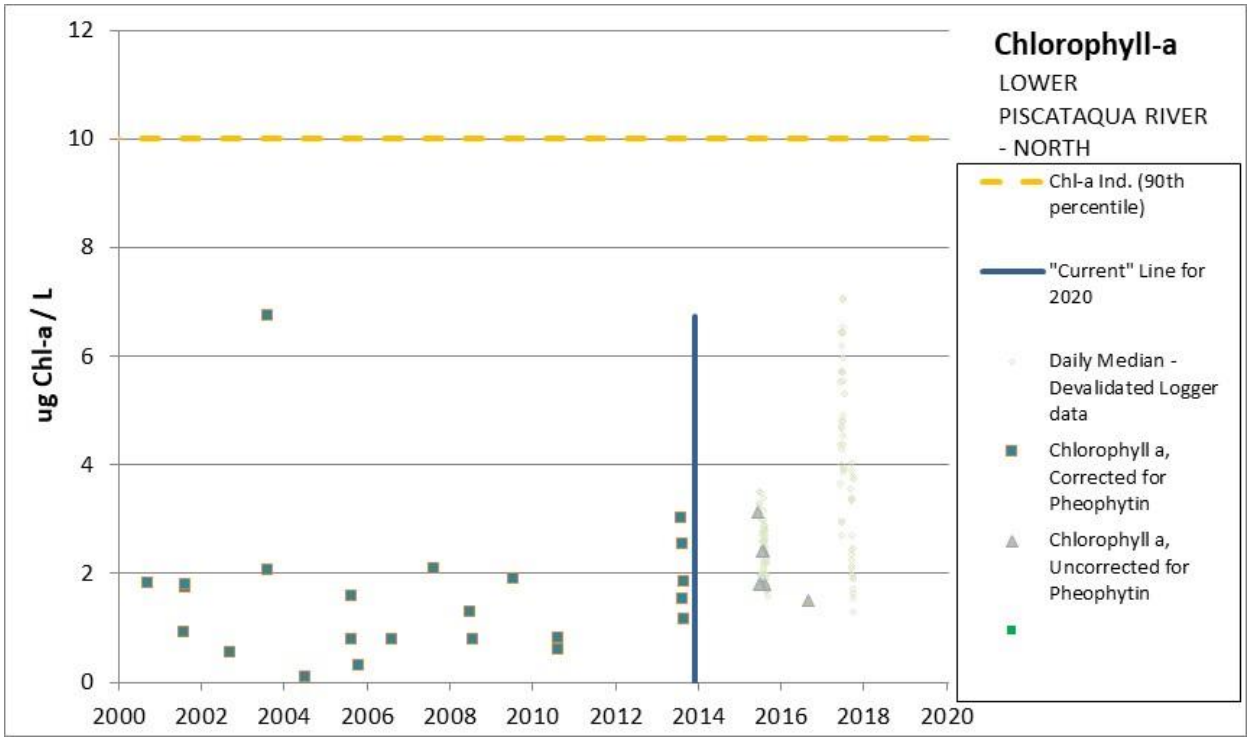
(NHEST600031001-02-01)

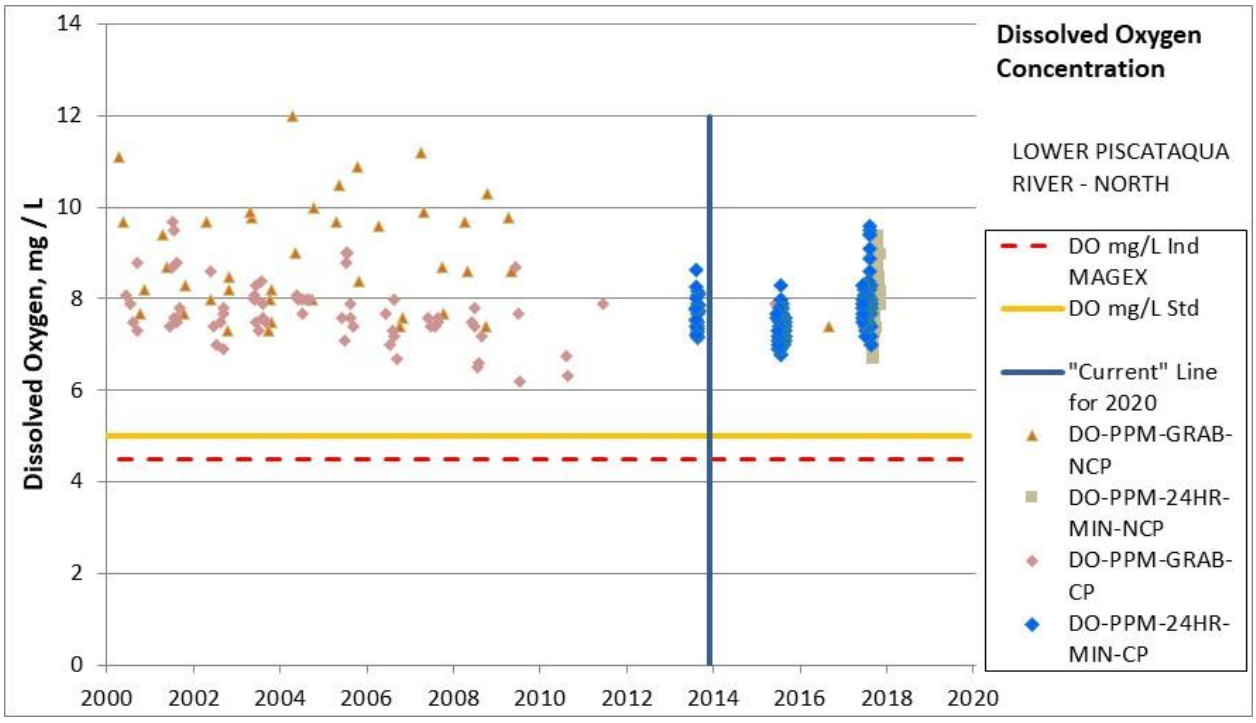
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there is one additional year of datalogger data (2017) compared to the 2018 assessment but the 2019 data is not included.

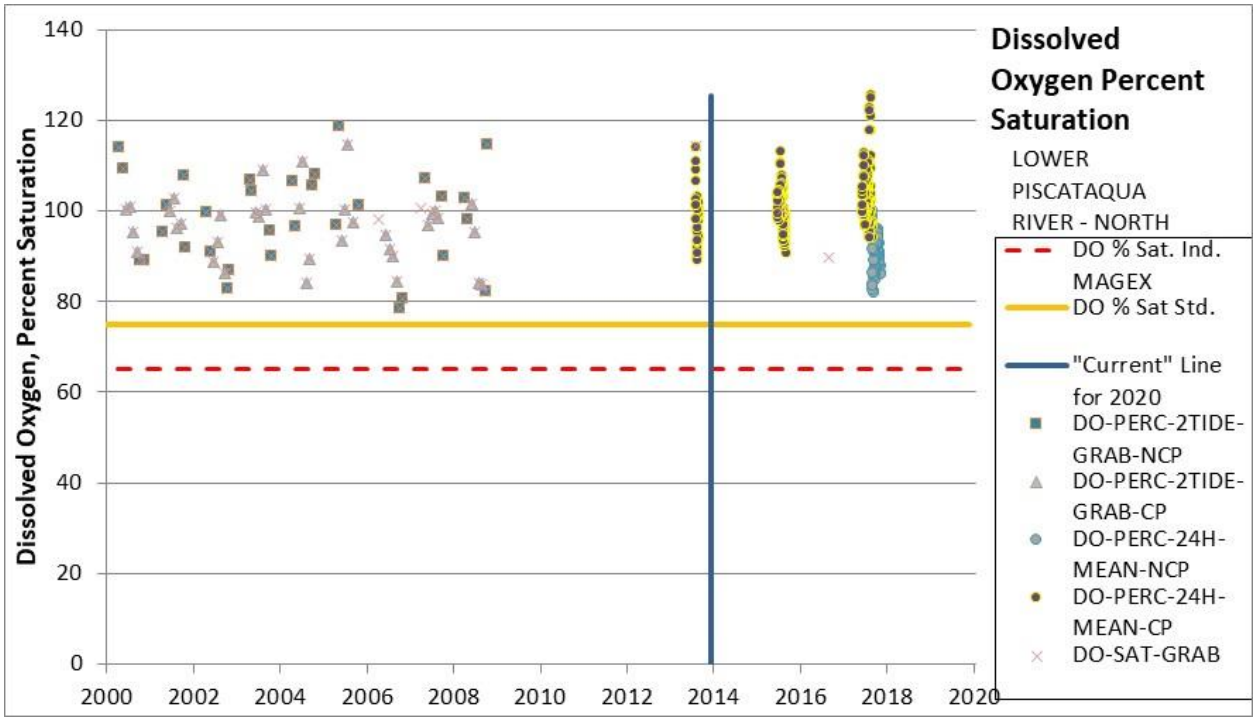
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	3-PAS / 3-PAS	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only 7 measured values in the current period. Of that dataset the minimum and maximum are 1.8 and 3.1 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L.
Dissolved Oxygen (mg/L)	2-G / 2-G	This assessment zone had a datalogger deployment in 2013, 2015 and 2017. During those periods no dissolved oxygen concentration measurements fell below 6.7 mg/L. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-G / 2-G	This assessment zone had datalogger deployments in 2013, 2015 and 2017. During those periods no 24 hour averages fell below 82%. The available data indicates that this assessment zone has good dissolved oxygen saturation .
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 60.1 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2016-2019 is 3 acres, which is a decrease of 95.1%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 49.7%. The thresholds for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-PNS/ 3-ND	There have been no light measurements collected since 2013. Measurements from 2002 to 2013 ranged from 0.05 to 1.3 m^-1. For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. As there is no measured light attenuation, this zone remains assessed as “no data.”
Total Nitrogen	3-PAS / 3-PAS	The median total nitrogen from 2014 through 2019 was 300 µg/L (n=3). Dissolved oxygen concentration remains above 5 mg/L and saturation remains above 75% daily average in the available data. The limited chlorophyll-a data suggests that this assessment zone would meet the chlorophyll-a indicator threshold. The eelgrass beds are severely degraded. There is no longer any current light attenuation data. The limited response dataset does not provide enough evidence to make a full assessment, however the limited indicators of nutrients and nutrient-related impacts do not present a preponderance of evidence that eutrophication effects are occurring in this zone. As such, the assessment zone has been assessed as insufficient information-potential attaining standards for total nitrogen.

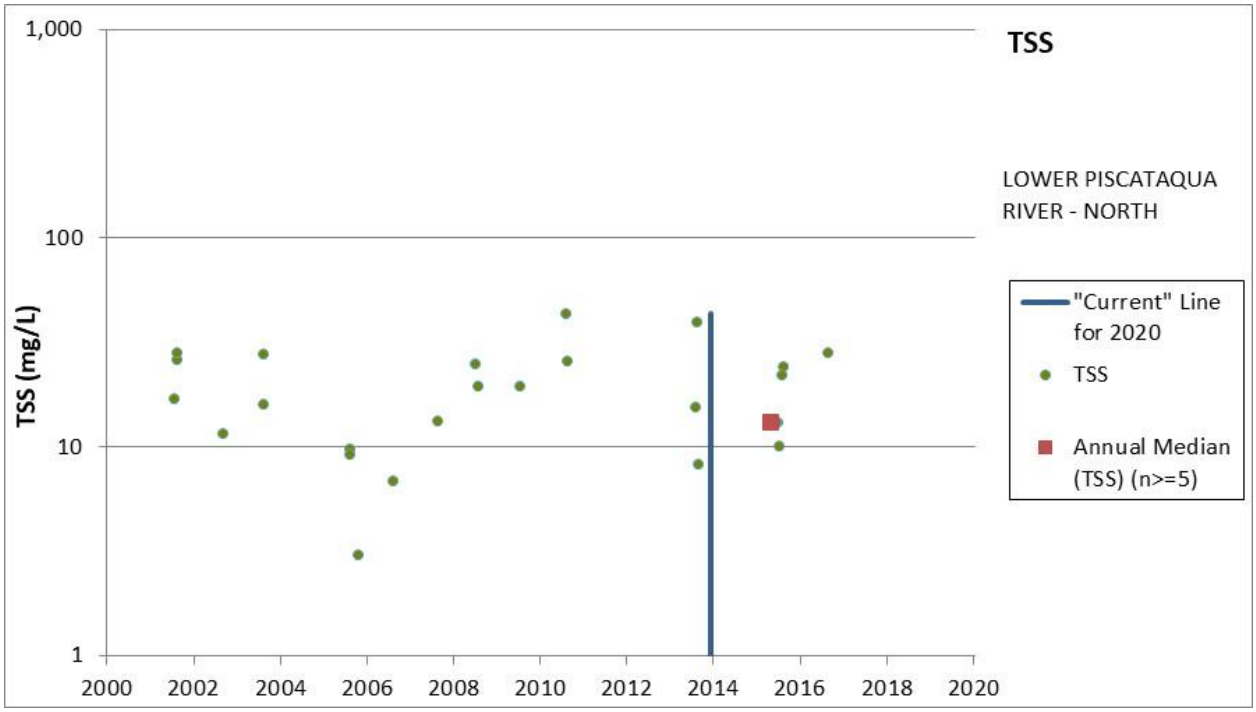

Chlorophyll-a
LOWER PISCATAQUA RIVER - NORTH
ug Chl-a / L
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin

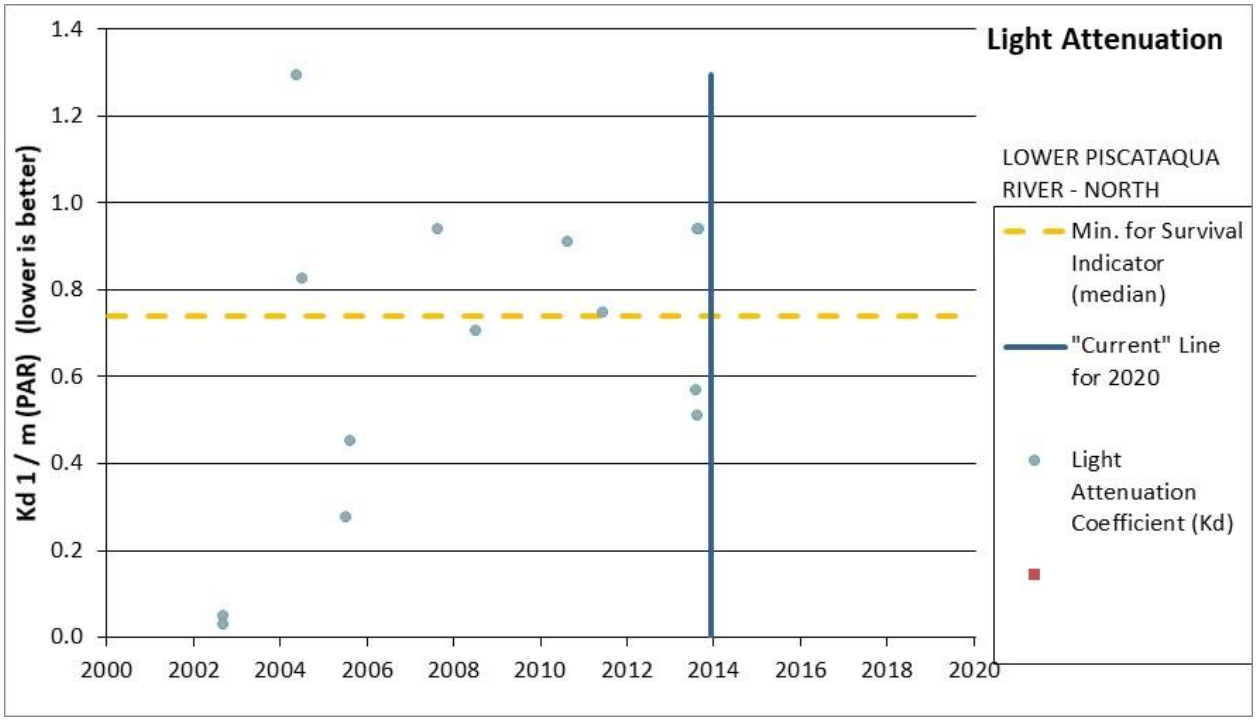

Chlorophyll-a
LOWER PISCATAQUA RIVER - NORTH
ug Chl-a / L
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin

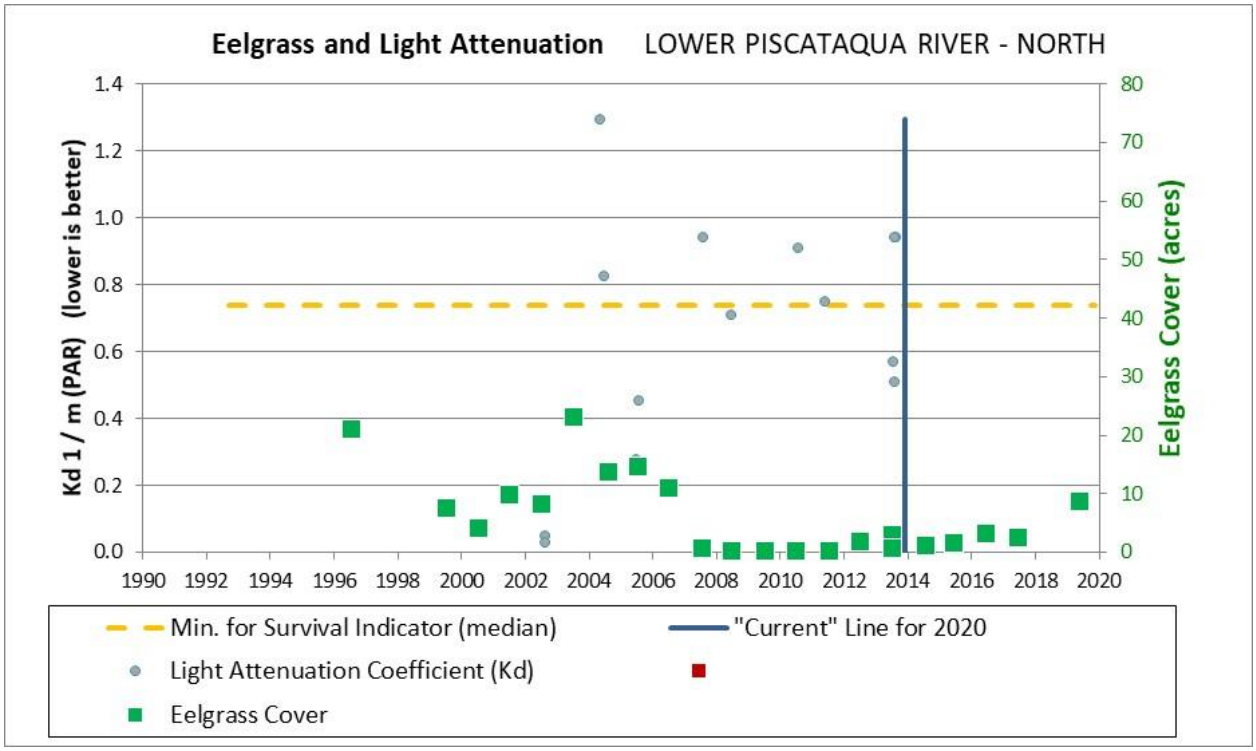

Chlorophyll-a
LOWER PISCATAQUA RIVER - NORTH
ug Chl-a / L
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Daily Median - Devalidated Logger data
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin

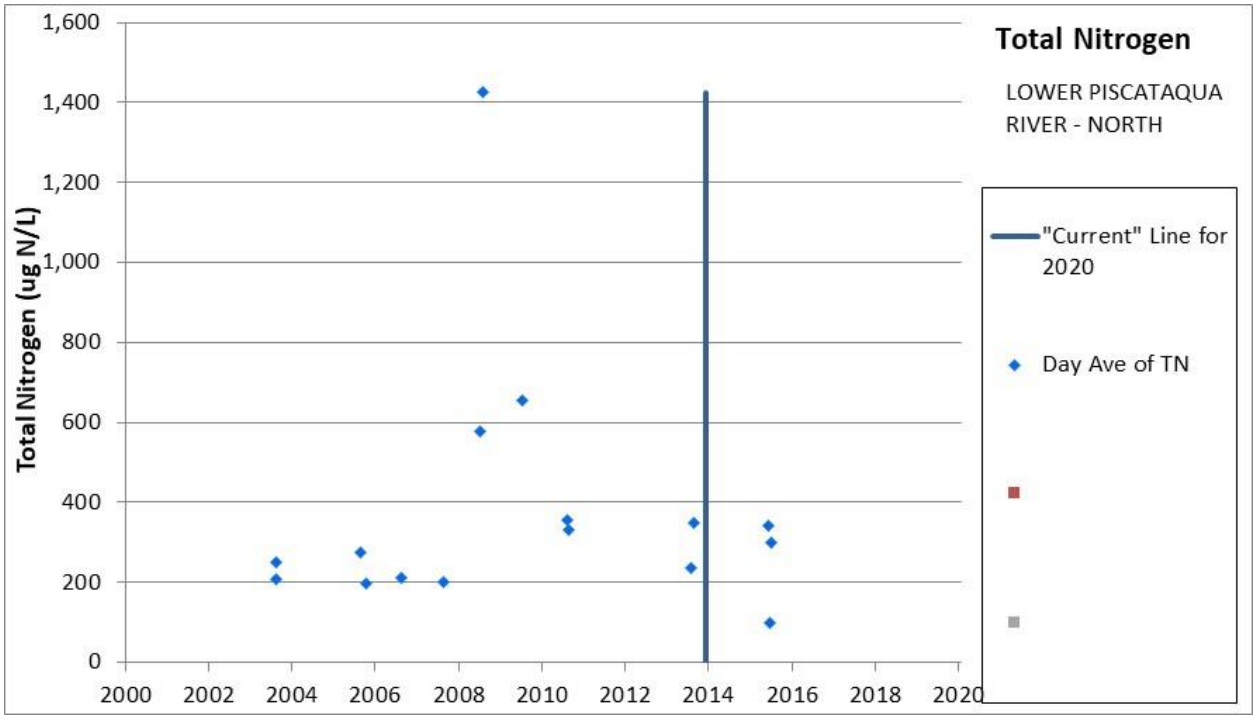

Dissolved Oxygen Concentration
LOWER PISCATAQUA RIVER - NORTH
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
LOWER PISCATAQUA RIVER - NORTH
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
LOWER PISCATAQUA RIVER - NORTH
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Light Attenuation
LOWER PISCATAQUA RIVER - NORTH
Kd 1 / m (PAR) (lower is better)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)


Eelgrass and Light Attenuation
LOWER PISCATAQUA RIVER - NORTH
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Eelgrass Cover


Total Nitrogen
LOWER PISCATAQUA RIVER - NORTH
Total Nitrogen (ug N/L)
1,600
1,400
1,200
1,000
800
600
400
200
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
Day Ave of TN

Lower Piscataqua River - North Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	7	1.5	1.8	-	3.1
CHLOROPHYLL A, Combined (ug/L)	7	0.0	1.8	-	3.1
LIGHT ATTENUATION COEFFICIENT (1/m)	0	-	-	-	-
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	150	1.0	2.0	3.0	7.0
TSS (mg/L)	6	10.0	17.5	-	28.0
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	0	-	-	-	-
DO-PPM-24HR-MIN-CP (mg/L)	148	6.8	7.6	8.3	9.6
DO-PPM-24HR-MIN-NCP (mg/L)	69	6.7	7.9	9.0	9.4
DO-PPM-GRAB-CP (mg/L)	2	7.8	7.9	-	7.9
DO-PPM-GRAB-NCP (mg/L)	1	7.4	7.4	-	7.4
DO-PERC-24H-MEAN-CP (% sat)	143	90.6	101.7	110.9	125.5
DO-PERC-24H-MEAN-NCP (% sat)	65	81.8	89.5	95.2	100.1
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	0	-	-	-	-
DO-PERC-GRAB (% sat)	2	89.6	95.0	-	100.4
Day Ave of TN (ug N/L)	3	100	300	-	343
Day Ave of TDN (ug N/L)	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	3	52	53	-	73
Day Ave of NH3 (ug N/L)	7	10	38	-	57
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	3	10	10	-	35
SALINITY-Grabs (pss)	19	19.8	29.5	30.8	31.1
SALINITY-Datalogger Daily Median (pss)	217	24.9	30.5	31.2	31.6
pH-grab	2	7.7	7.9	-	8.0
pH-24HR (min)	141	7.7	7.9	7.8*	8.1
pH-24HR (max)	141	7.8	8.0	8.2	8.3
Temperature	19	1.6	16.6	19.1	19.4
Temperature-Daily Median	217	6.2	16.5	19.4	20.9

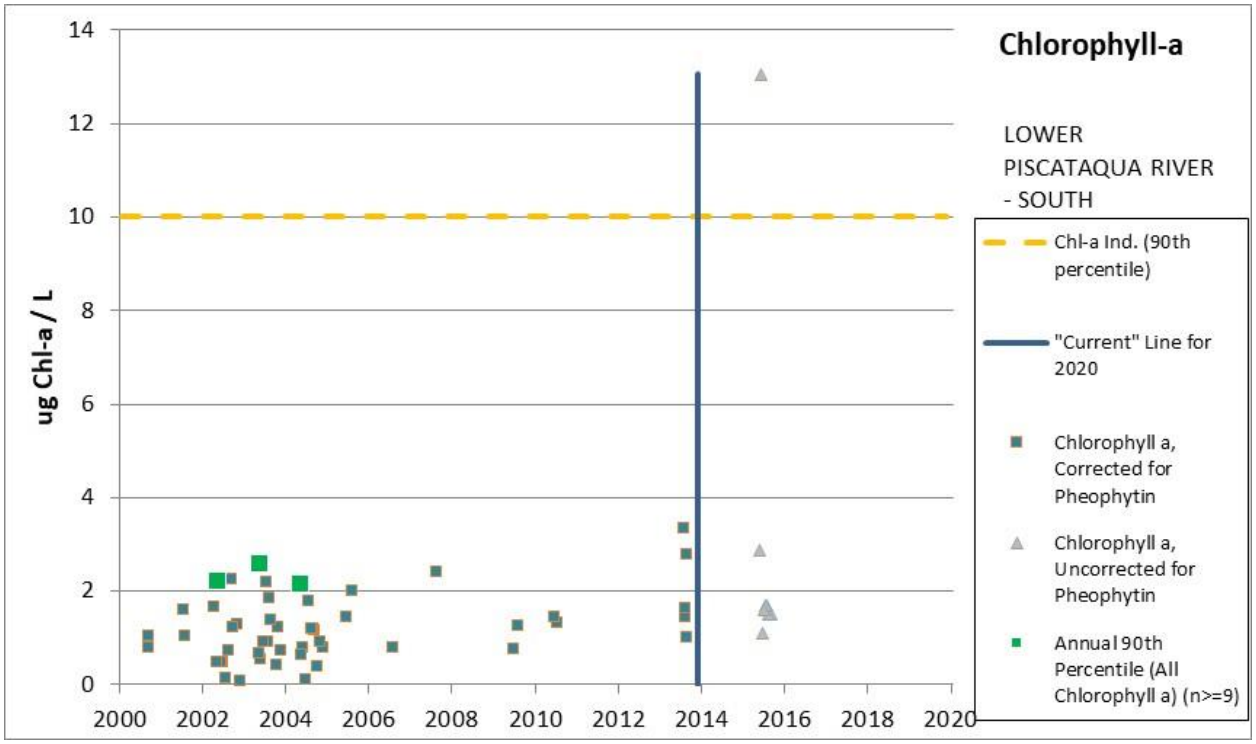
*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

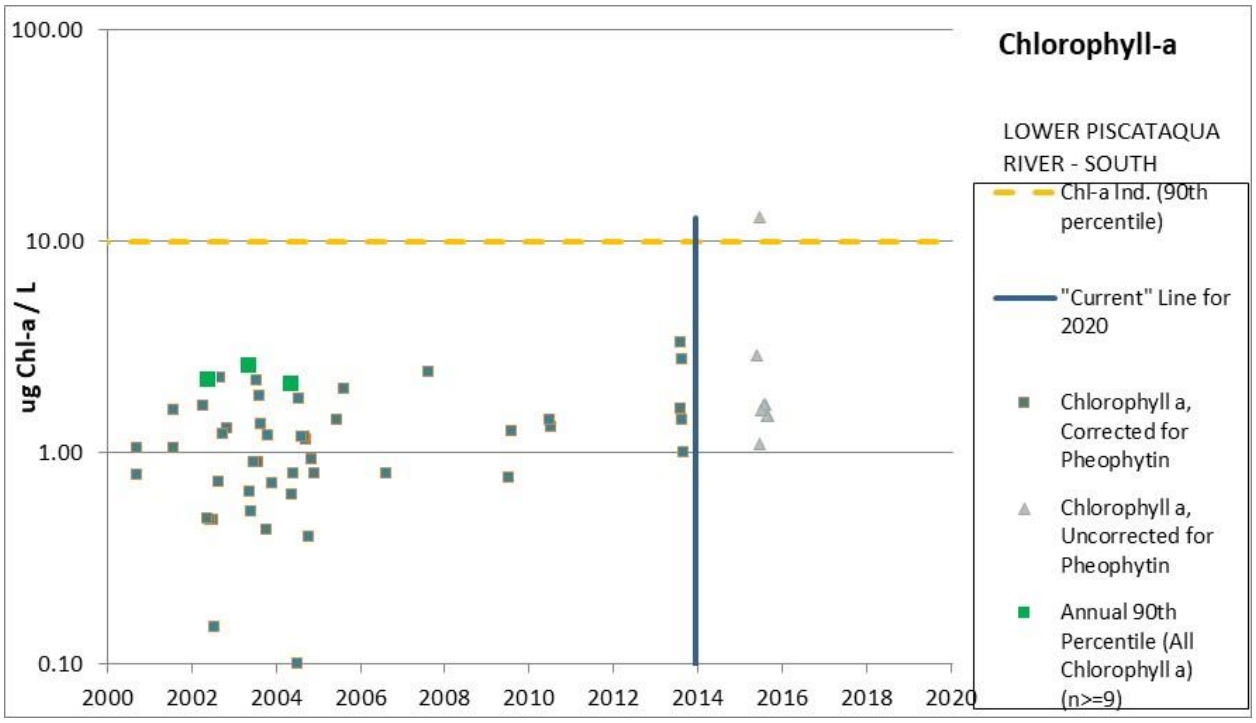
Assessment Zone = LOWER PISCATAQUA RIVER - SOUTH

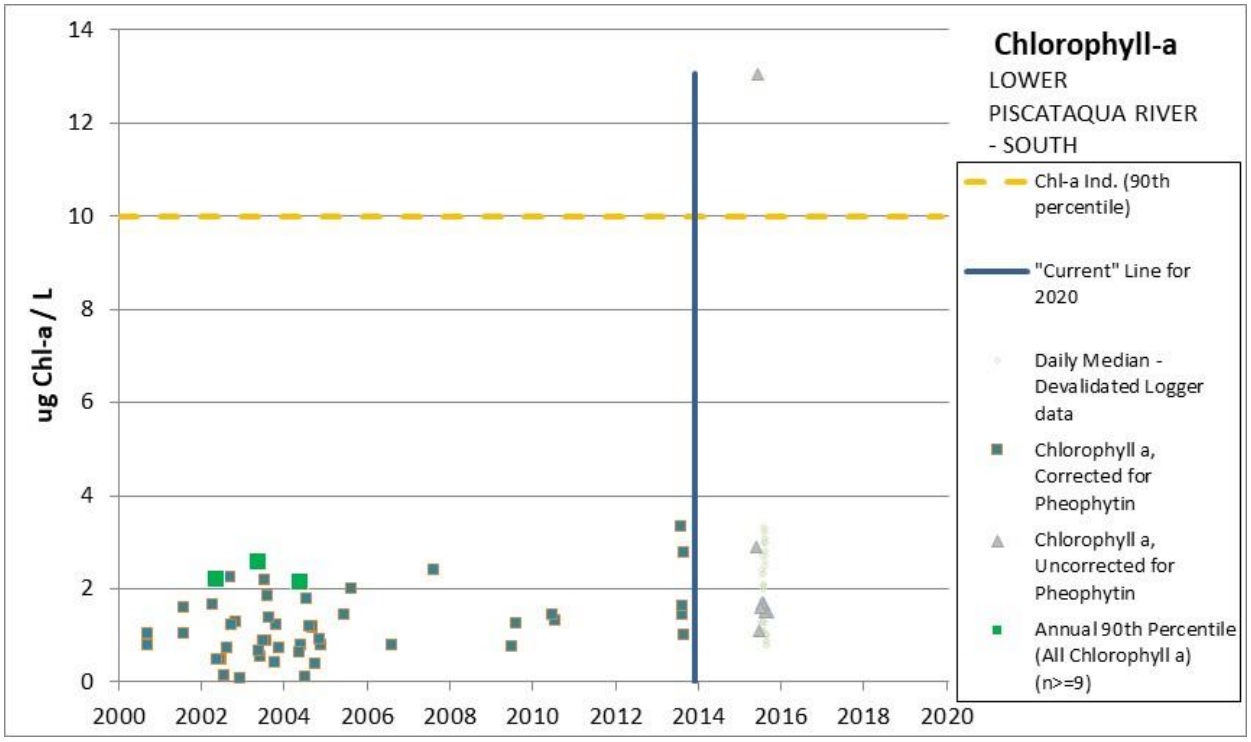
(NHEST600031001-02-02)

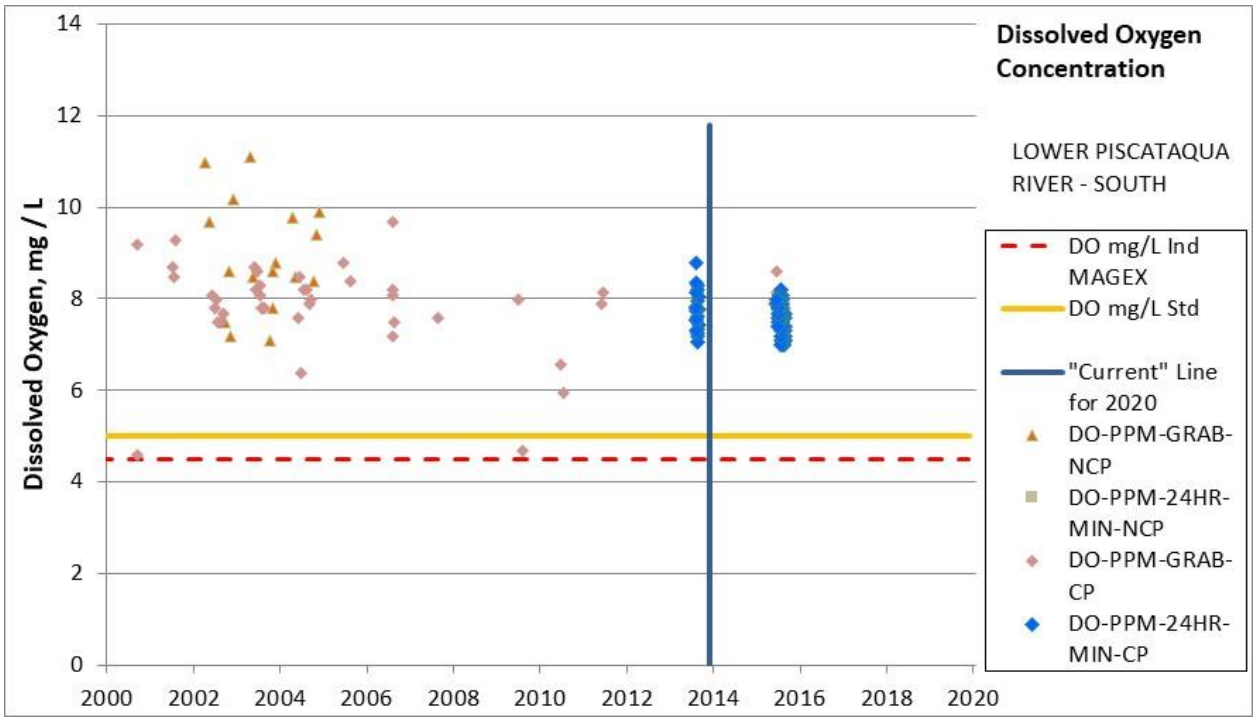
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are no additional years of data compared to the 2018 assessment.

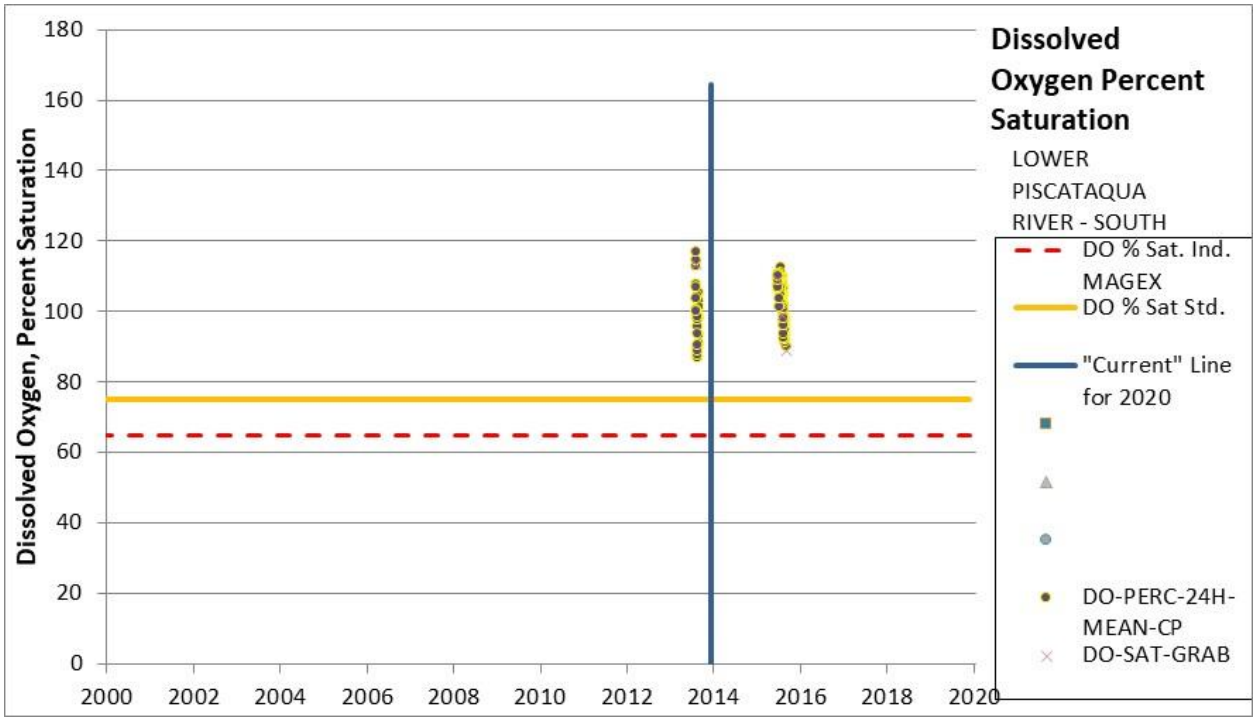
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	3-PAS / 3-PAS	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only 8 measured values in the current period. Of that dataset the minimum and maximum are 1.7 and 13.1 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L.
Dissolved Oxygen (mg/L)	2-G / 2-G	This assessment zone had a datalogger deployment in 2015 and 2017. During those periods no dissolved oxygen concentration measurements fell below 7.1 mg/L. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-G / 2-G	This assessment zone had datalogger deployments in 2015 and 2017. During those periods no 24 hour averages fell below 90%. The available data indicates that this assessment zone has good dissolved oxygen saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 32.5 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2016-2019 is 3.6 acres, which is a decrease of 89.1%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 38.7%. The thresholds for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-PAS / 3-ND	There have been no light measurements collected since 2013. Measurements from 2002 to 2013 ranged from 0.3 to 0.7 m^-1. For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. As there is no measured light attenuation, this zone remains assessed as “no data.”
Total Nitrogen	3-PAS / 3-PAS	The median total nitrogen from 2014 through 2019 was 272 µg/L (n=4). Dissolved oxygen concentration remains above 5 mg/L and saturation remains above 75% daily average in the available data. The limited chlorophyll-a data suggests that this assessment zone would meet chlorophyll-a indicator threshold. The eelgrass beds are severely degraded and there are no current light measurements to compare to the 2 m restoration depth. The limited response dataset does not provide enough evidence to make a full assessment, however the limited indicators of nutrients and nutrient-related impacts do not present a preponderance of evidence that eutrophication effects are occurring in this zone. As such, the assessment zone has been assessed as insufficient information-potential attaining standards for total nitrogen.

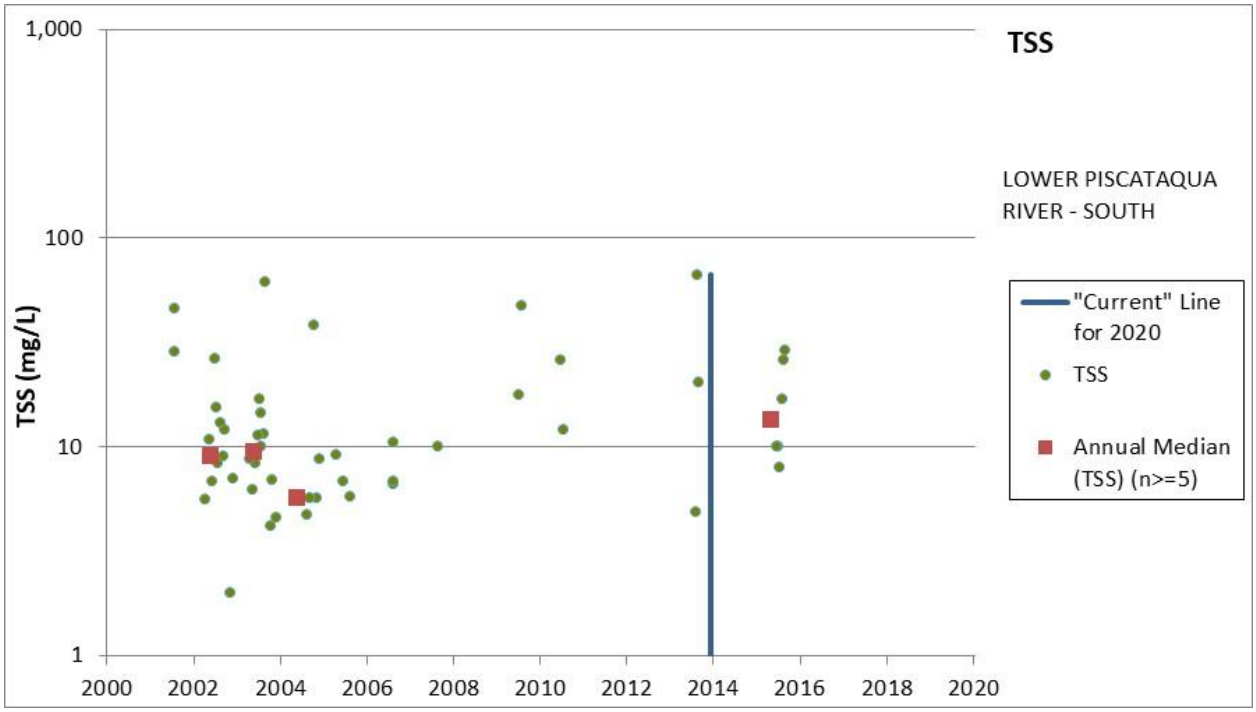

Chlorophyll-a
LOWER PISCATAQUA RIVER - SOUTH
ug Chl-a / L
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

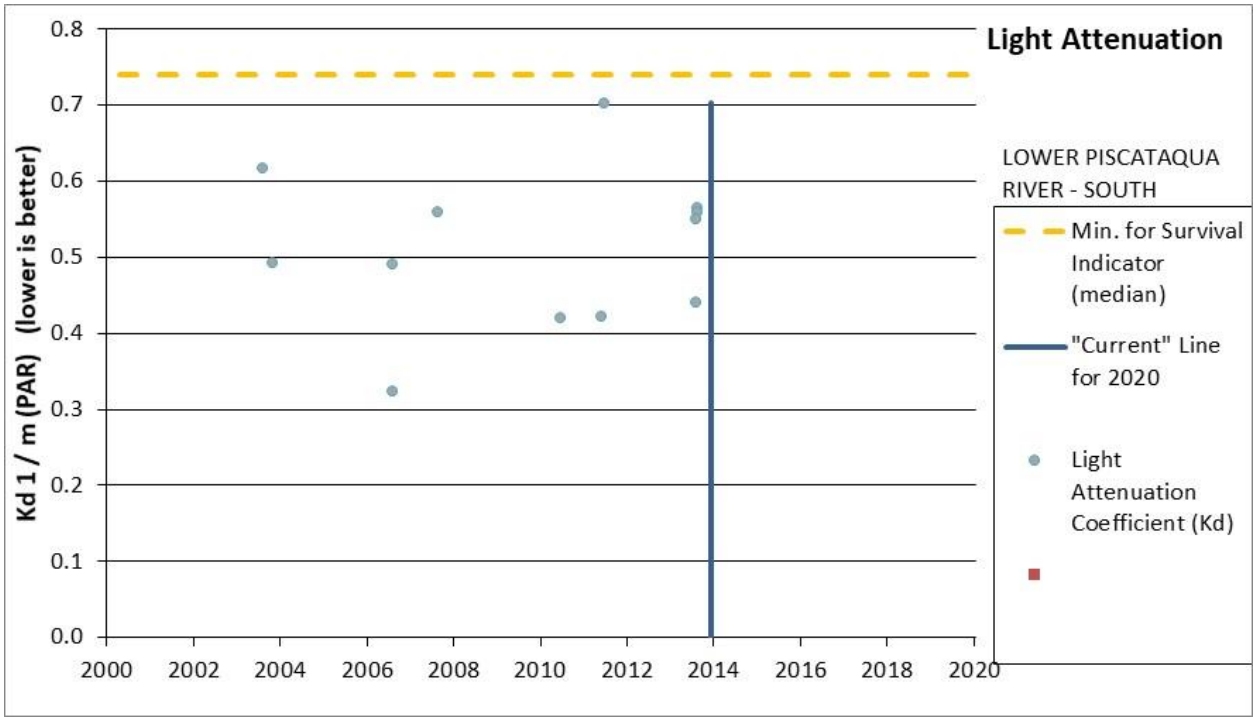

Chlorophyll-a
LOWER PISCATAQUA RIVER - SOUTH
ug Chl-a / L
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

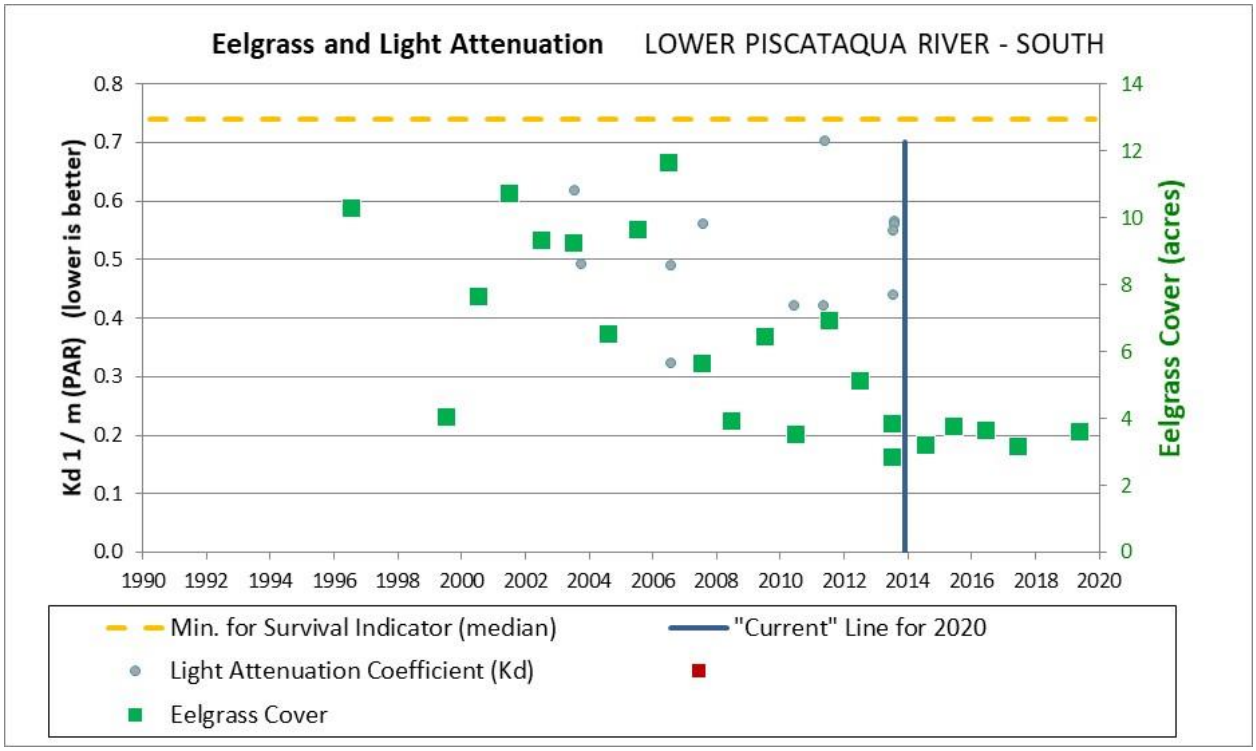

Chlorophyll-a
LOWER PISCATAQUA RIVER - SOUTH
ug Chl-a / L
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Daily Median - Devalidated Logger data
Chlorophyll a, Corrected for Pheophytin
Chlorophyll a, Uncorrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

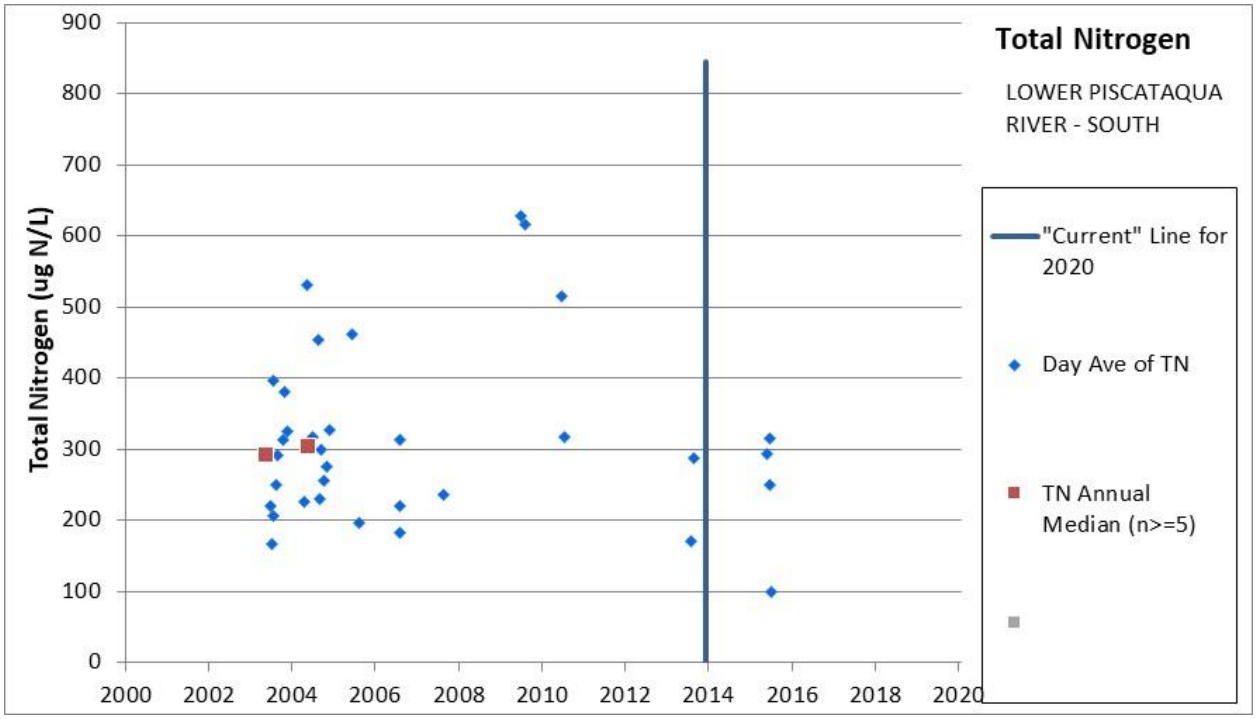

Dissolved Oxygen Concentration
LOWER PISCATAQUA RIVER - SOUTH
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
Dissolved Oxygen, Percent Saturation
180
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
LOWER PISCATAQUA RIVER - SOUTH
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
LOWER PISCATAQUA RIVER - SOUTH
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Light Attenuation
LOWER PISCATAQUA RIVER - SOUTH
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)


Eelgrass and Light Attenuation
LOWER PISCATAQUA RIVER - SOUTH
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
14
12
10
8
6
4
2
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Eelgrass Cover


Total Nitrogen
LOWER PISCATAQUA RIVER - SOUTH
Total Nitrogen (ug N/L)
900
800
700
600
500
400
300
200
100
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Lower Piscataqua River - South Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	8	1.1	1.7	-	13.1
CHLOROPHYLL A, Combined (ug/L)	8	0.0	1.7	-	13.1
LIGHT ATTENUATION COEFFICIENT (1/m)	0	-	-	-	-
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	0	-	-	-	-
TSS (mg/L)	6	8.0	13.5	-	29.0
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	0	-	-	-	-
DO-PPM-24HR-MIN-CP (mg/L)	72	7.0	7.6	8.1	8.2
DO-PPM-24HR-MIN-NCP (mg/L)	1	7.1	7.1	-	7.1
DO-PPM-GRAB-CP (mg/L)	4	7.6	8.0	-	8.6
DO-PPM-GRAB-NCP (mg/L)	1	7.9	7.9	-	7.9
DO-PERC-24H-MEAN-CP (% sat)	69	90.2	105.2	110.2	112.7
DO-PERC-24H-MEAN-NCP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	0	-	-	-	-
DO-PERC-GRAB (% sat)	3	89.1	98.8	-	108.9
Day Ave of TN (ug N/L)	4	100	272	-	315
Day Ave of TDN (ug N/L)	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	4	38	50	-	75
Day Ave of NH3 (ug N/L)	8	22	31	-	36
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	4	10	14	-	41
SALINITY-Grabs (pss)	8	28.3	30.3	-	32.3
SALINITY-Datalogger Daily Median (pss)	73	30.5	31.3	31.6	31.7
pH-grab	2	8.0	8.0	-	8.1
pH-24HR (min)	73	7.9	8.0	7.9*	8.0
pH-24HR (max)	73	7.9	8.1	8.1	8.1
Temperature	8	14.4	17.9	-	19.3
Temperature-Daily Median	73	13.7	17.4	19.1	19.7

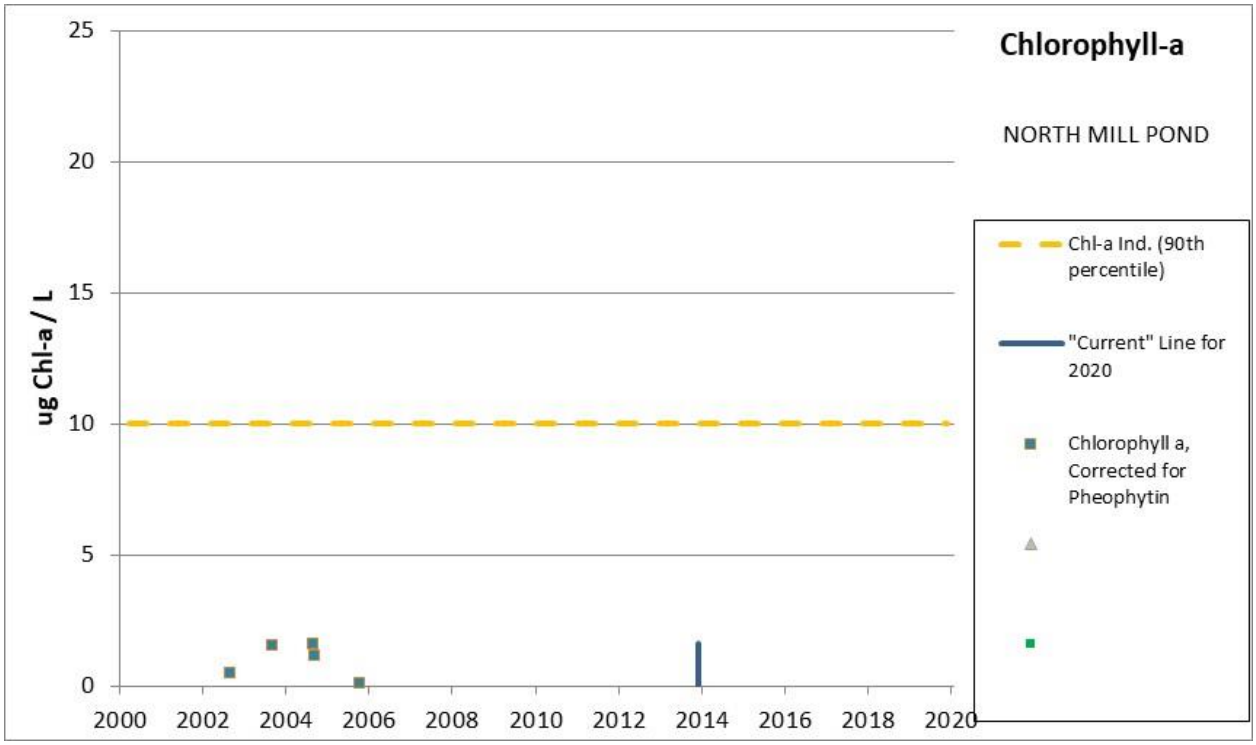
*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

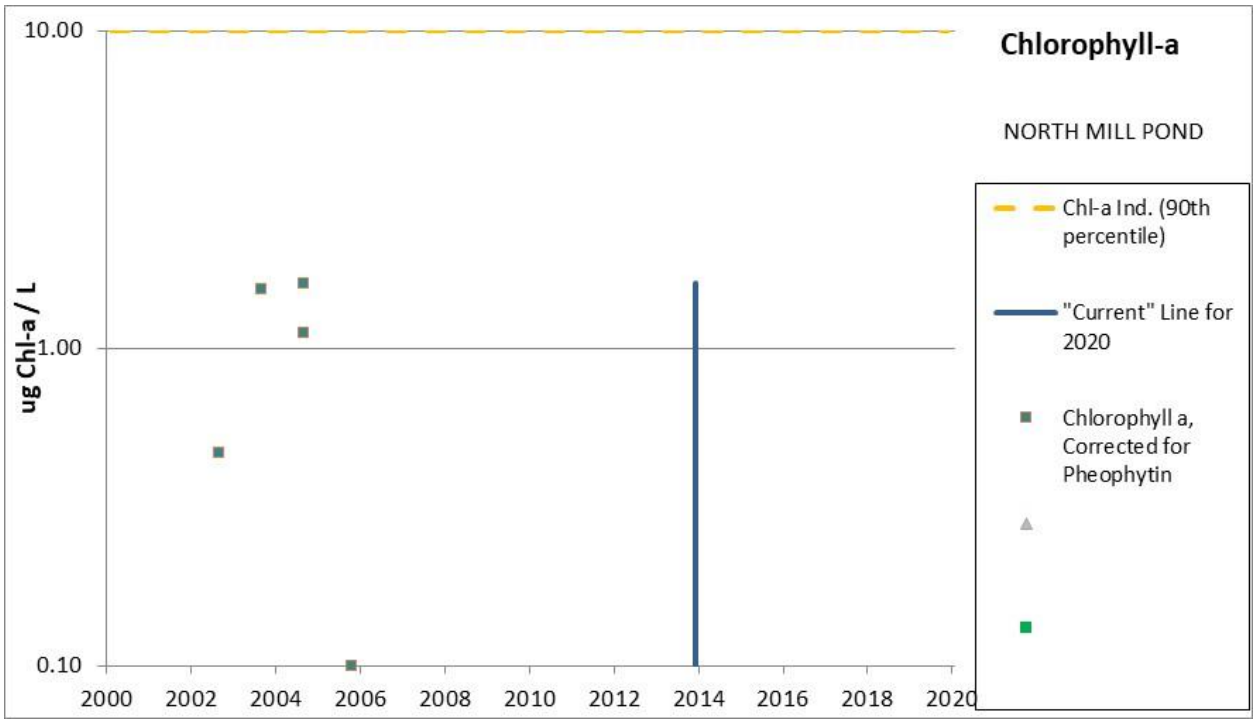
Assessment Zone = NORTH MILL POND

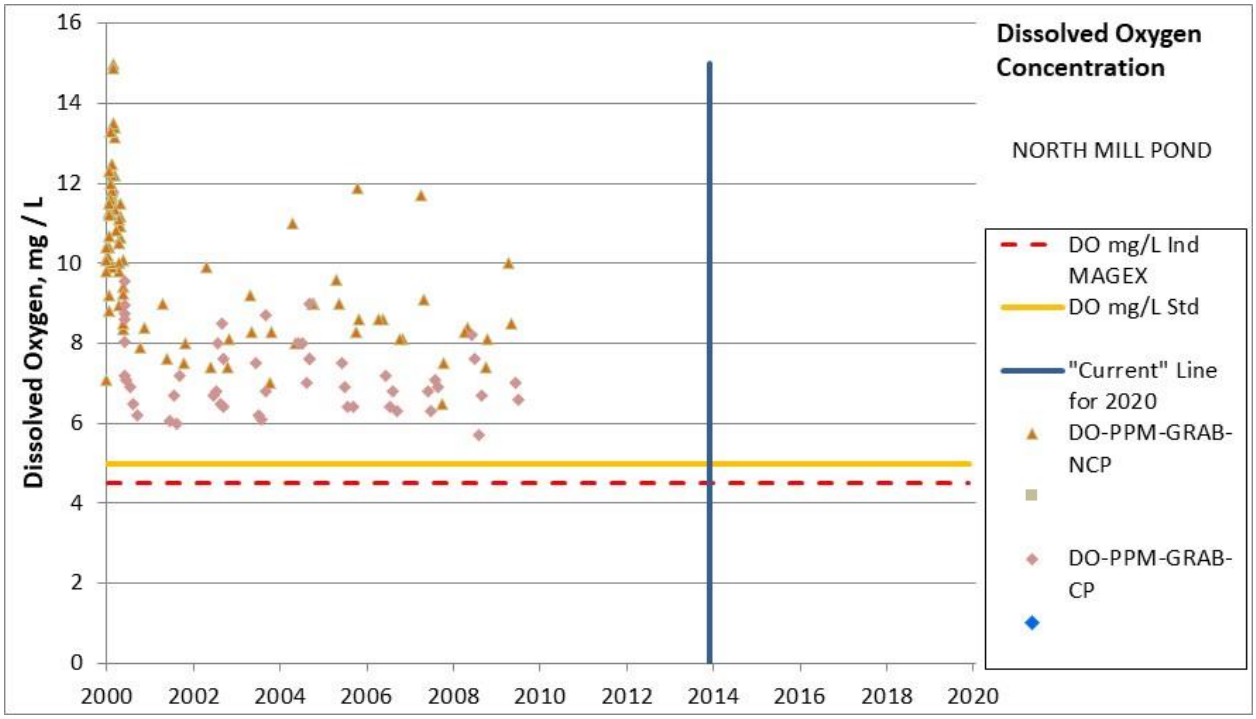
(NHEST600031001-10)

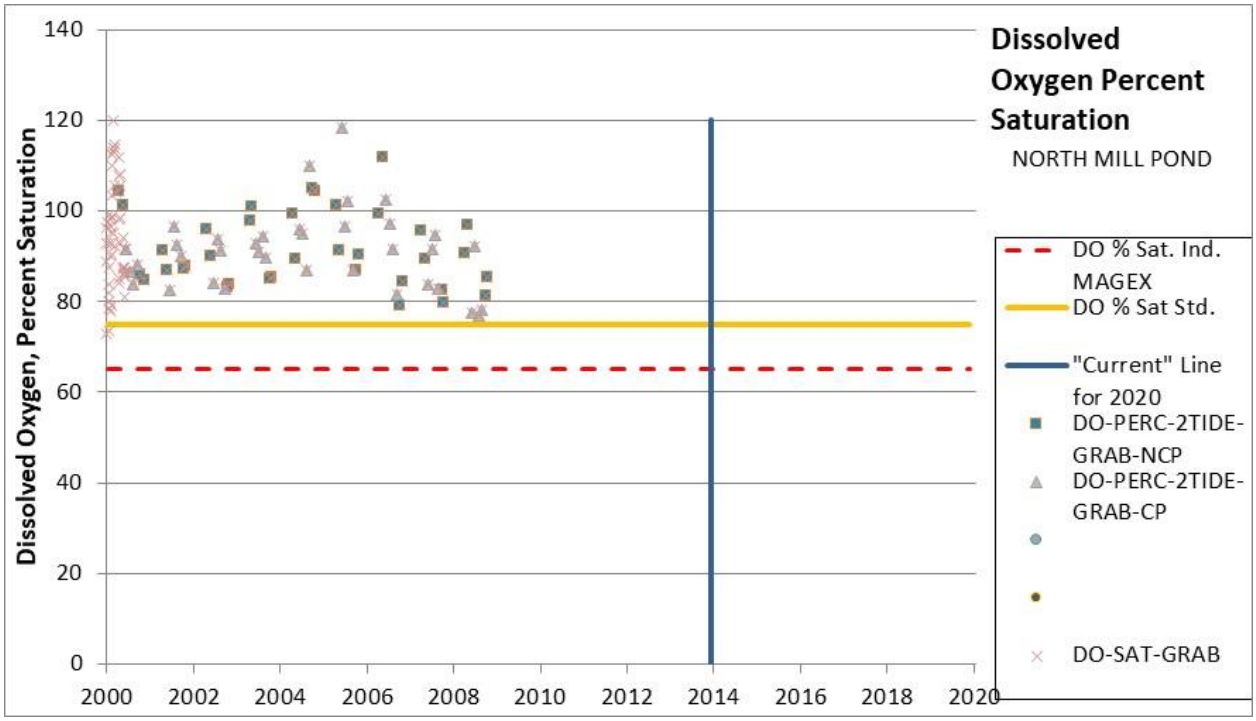
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are no additional years of data compared to the 2018 assessment.

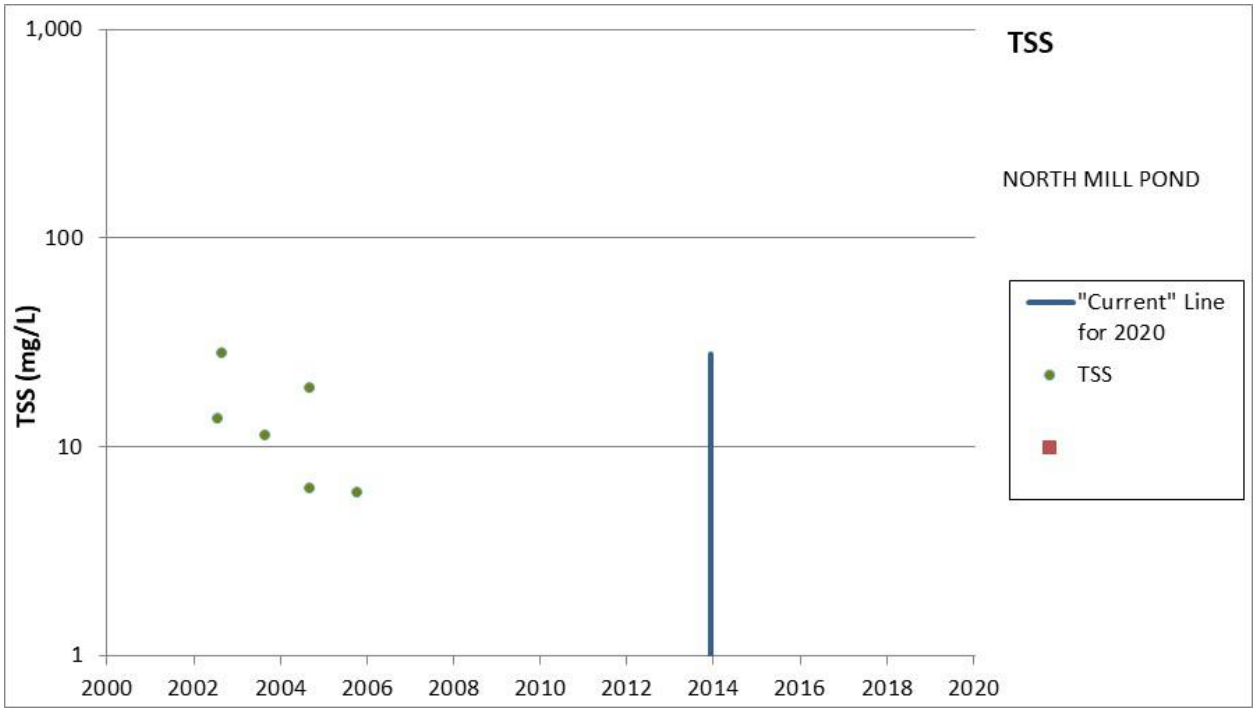
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	3-ND / 3-ND	The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 µg/L. This assessment zone has no measurements for chlorophyll-a since 2005.
Dissolved Oxygen (mg/L)	3-ND / 3-ND	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements were only collected up through 2009. As such, this assessment zone has been assessed as 3-ND (No Data) for the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	3-ND / 3-ND	This assessment zone has only grab sample measurements for dissolved oxygen 24-hour average percent saturation and those measurements were only collected up through 2008. As such, this assessment zone has been assessed as 3-ND (No Data) for dissolved oxygen percent saturation .
Estuarine Bioassessments (eelgrass)	3-ND / 3-ND	No data has been collected in the current period.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	No data has been collected in the current period.
Total Nitrogen	3-ND / 3-ND	There are no “current” total nitrogen data from which to calculate a median total nitrogen from 2012 through 2018. As such, this assessment zone cannot be assessed for total nitrogen.

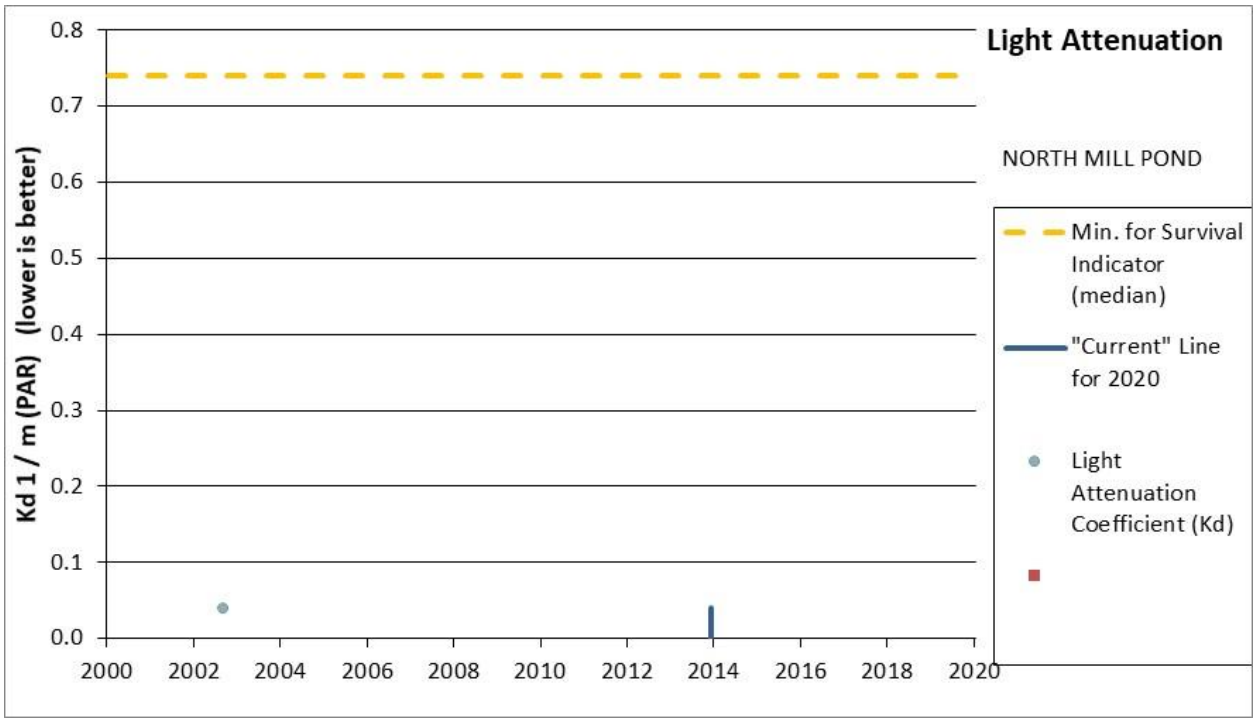

Chlorophyll-a
NORTH MILL POND
ug Chl-a / L
25
20
15
10
5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin

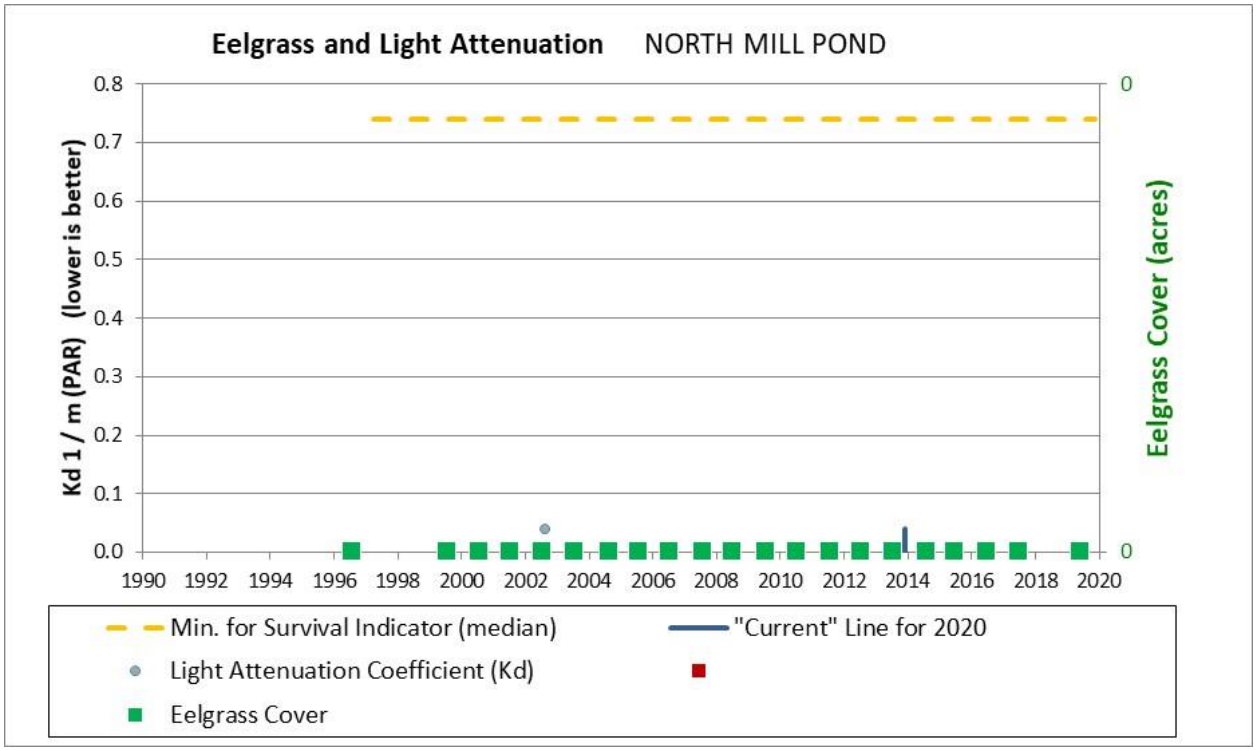

Chlorophyll-a
NORTH MILL POND
ug Chl-a / L
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin

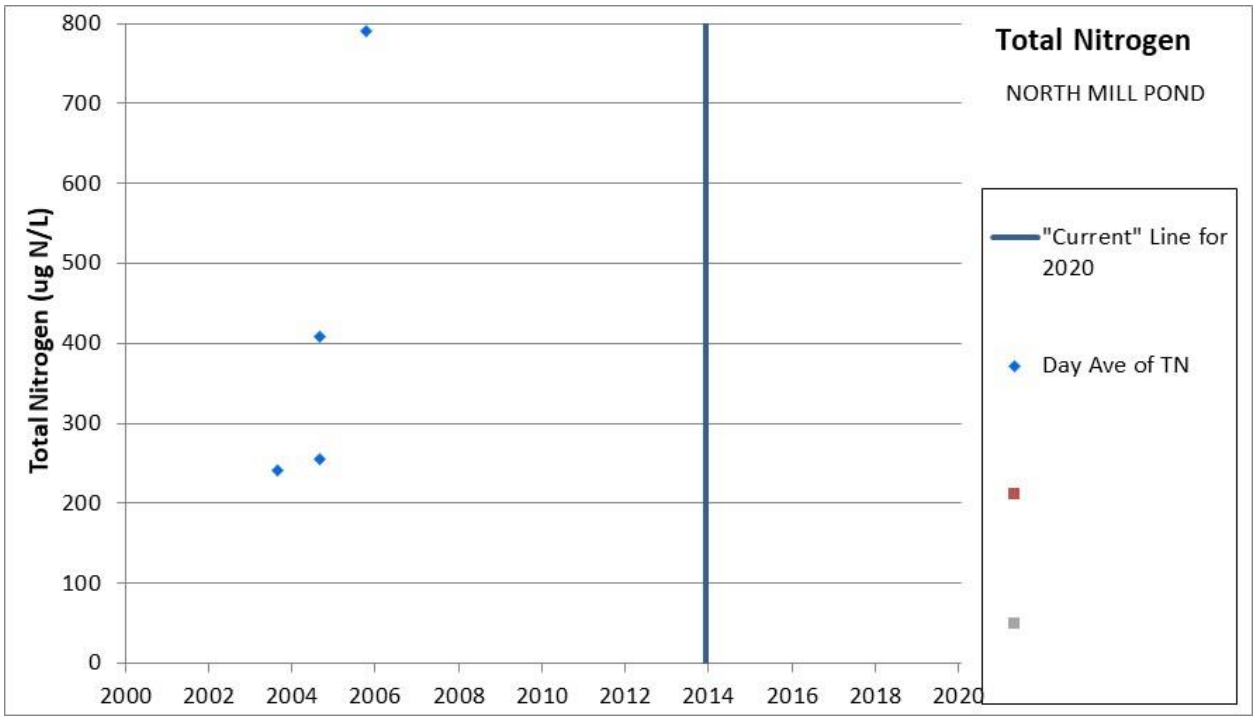

Dissolved Oxygen Concentration
NORTH MILL POND
Dissolved Oxygen, mg / L
16
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP


Dissolved Oxygen Percent Saturation
NORTH MILL POND
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-SAT-GRAB


TSS
NORTH MILL POND
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS


Light Attenuation
NORTH MILL POND
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)


Eelgrass and Light Attenuation
NORTH MILL POND
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Eelgrass Cover


Total Nitrogen
NORTH MILL POND
Total Nitrogen (ug N/L)
800
700
600
500
400
300
200
100
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
Day Ave of TN

North Mill Pond Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, Combined (ug/L)	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT (1/m)	0	-	-	-	-
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	0	-	-	-	-
TSS (mg/L)	0	-	-	-	-
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	0	-	-	-	-
DO-PPM-24HR-MIN-CP (mg/L)	0	-	-	-	-
DO-PPM-24HR-MIN-NCP (mg/L)	0	-	-	-	-
DO-PPM-GRAB-CP (mg/L)	0	-	-	-	-
DO-PPM-GRAB-NCP (mg/L)	0	-	-	-	-
DO-PERC-24H-MEAN-CP (% sat)	0	-	-	-	-
DO-PERC-24H-MEAN-NCP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	0	-	-	-	-
DO-PERC-GRAB (% sat)	0	-	-	-	-
Day Ave of TN (ug N/L)	0	-	-	-	-
Day Ave of TDN (ug N/L)	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	0	-	-	-	-
Day Ave of NH3 (ug N/L)	0	-	-	-	-
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	0	-	-	-	-
SALINITY-Grabs (pss)	0	-	-	-	-
SALINITY-Datalogger Daily Median (pss)	0	-	-	-	-
pH-grab	0	-	-	-	-
pH-24HR (min)	0	-	-	-	-
pH-24HR (max)	0	-	-	-	-
Temperature	0	-	-	-	-
Temperature-Daily Median	0	-	-	-	-

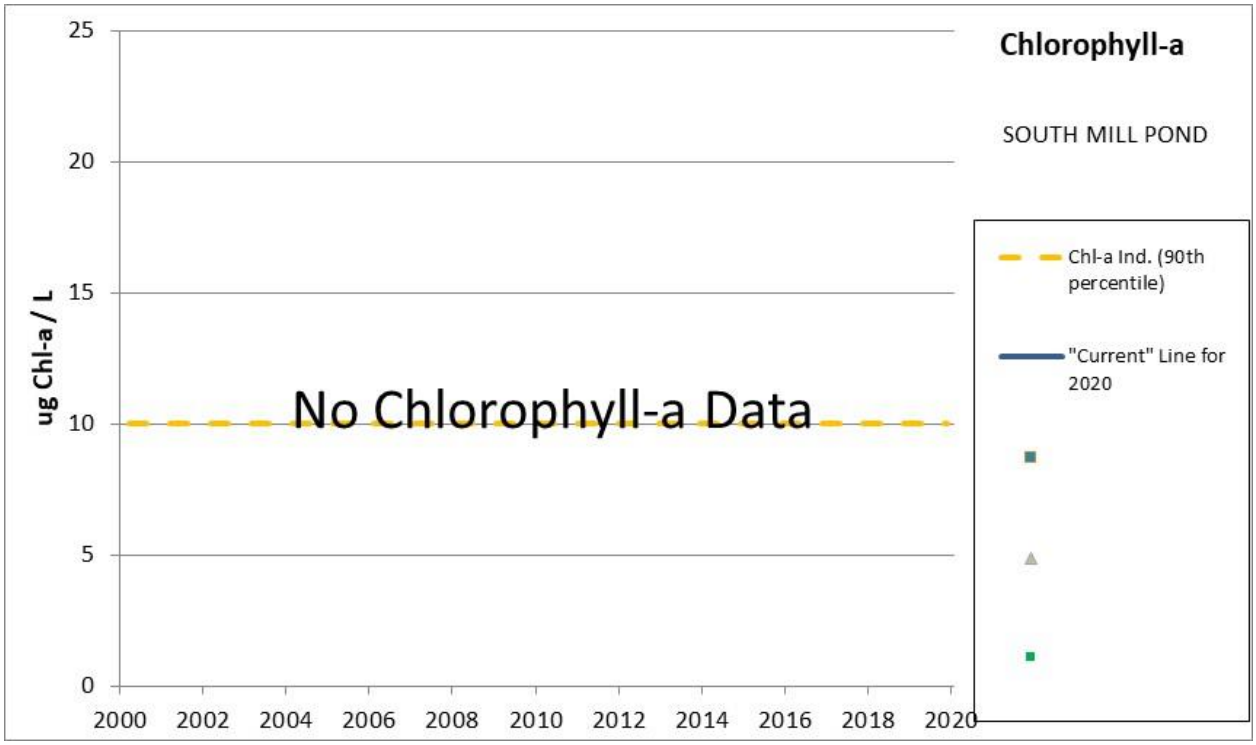
*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

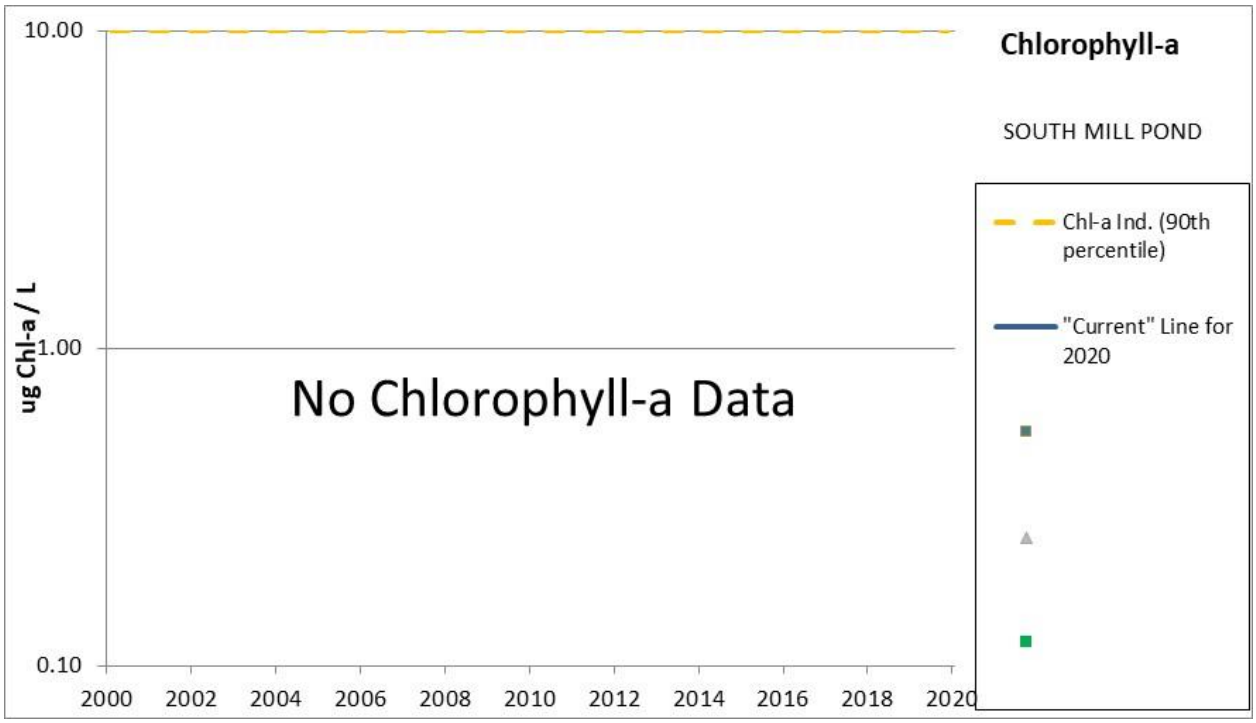
Assessment Zone = SOUTH MILL POND

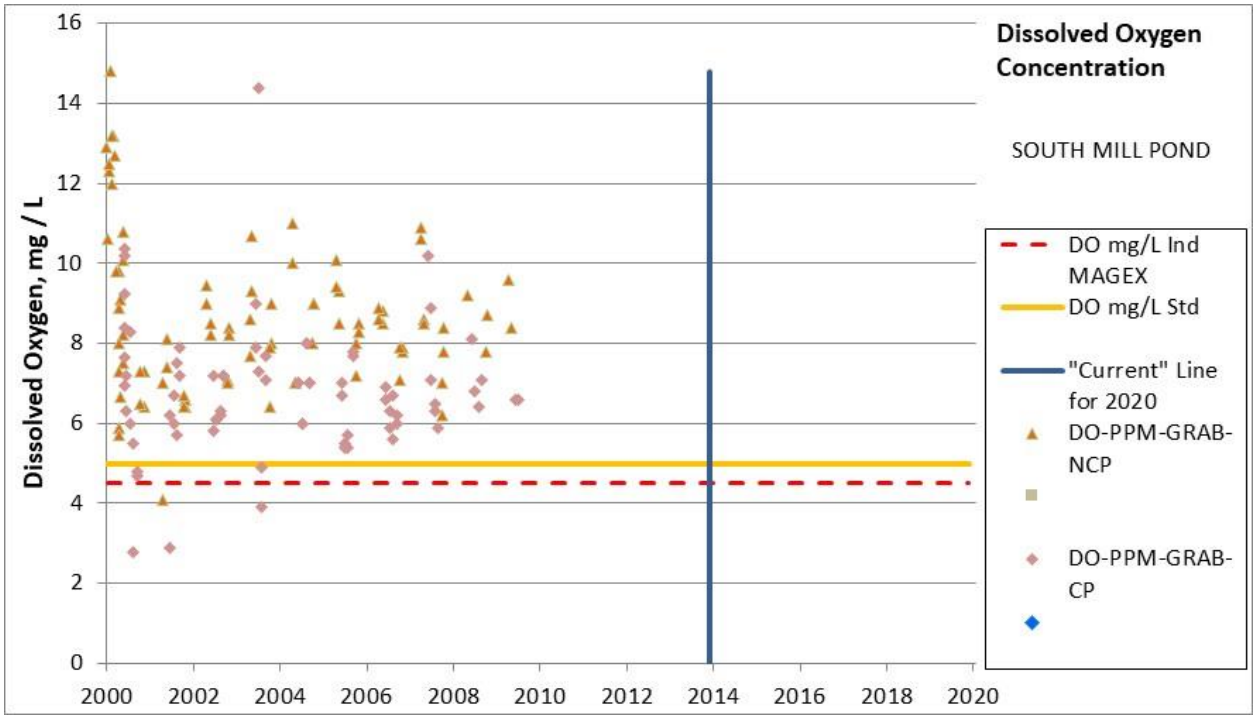
(NHEST600031001-09)

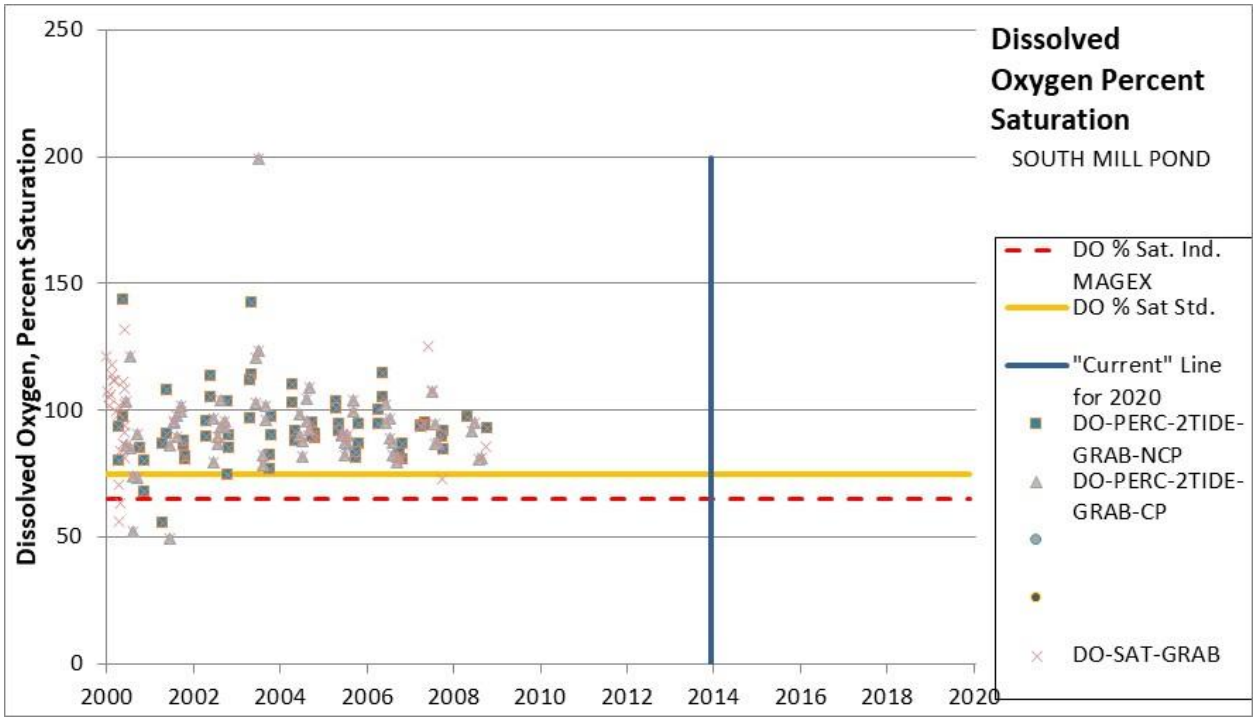
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are no additional years of data compared to the 2018 assessment.

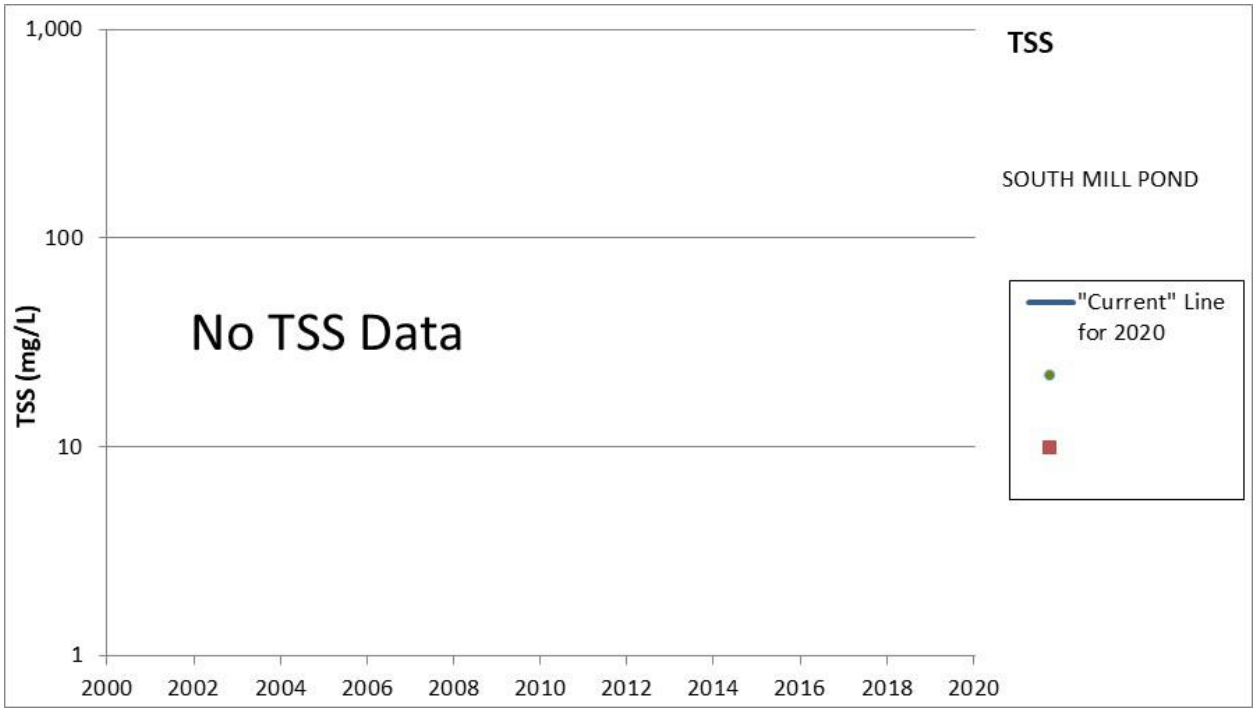
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	3-ND / 3-ND	The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 µg/L. However, there is no chlorophyll-a data for this assessment zone.
Dissolved Oxygen (mg/L)	3-ND / 3-ND	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements were only collected up through 2009. As such, this assessment zone has been assessed as 3-ND (No Data) for the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	3-ND / 3-ND	This assessment zone has only grab sample measurements for dissolved oxygen 24-hour average percent saturation and those measurements were only collected up through 2008. As such, this assessment zone has been assessed as 3-ND (No Data) for dissolved oxygen percent saturation .
Estuarine Bioassessments (eelgrass)	3-PAS / 3-PAS	In 2016, a 0.012 acres (520 sq feet) patch of eelgrass was seen in South Mill Pond for the first time. While the patch was below the minimum mapping unit and not field verified, the mapper was confident that based on morphology and growth pattern the plant seen was indeed *Zostera marina*. As there is no known baseline for comparison and the mapping effort only represents a single year of presence, and not seen again in 2017, estuarine bioassessments (eelgrass) has been assessed as Insufficient Information – Potentially Attaining Standards.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	No data has been collected in the current period.
Total Nitrogen	3-ND / 3-ND	There are no “current” total nitrogen data from which to calculate a median total nitrogen from 2012 through 2018. As such, this assessment zone cannot be assessed for total nitrogen.

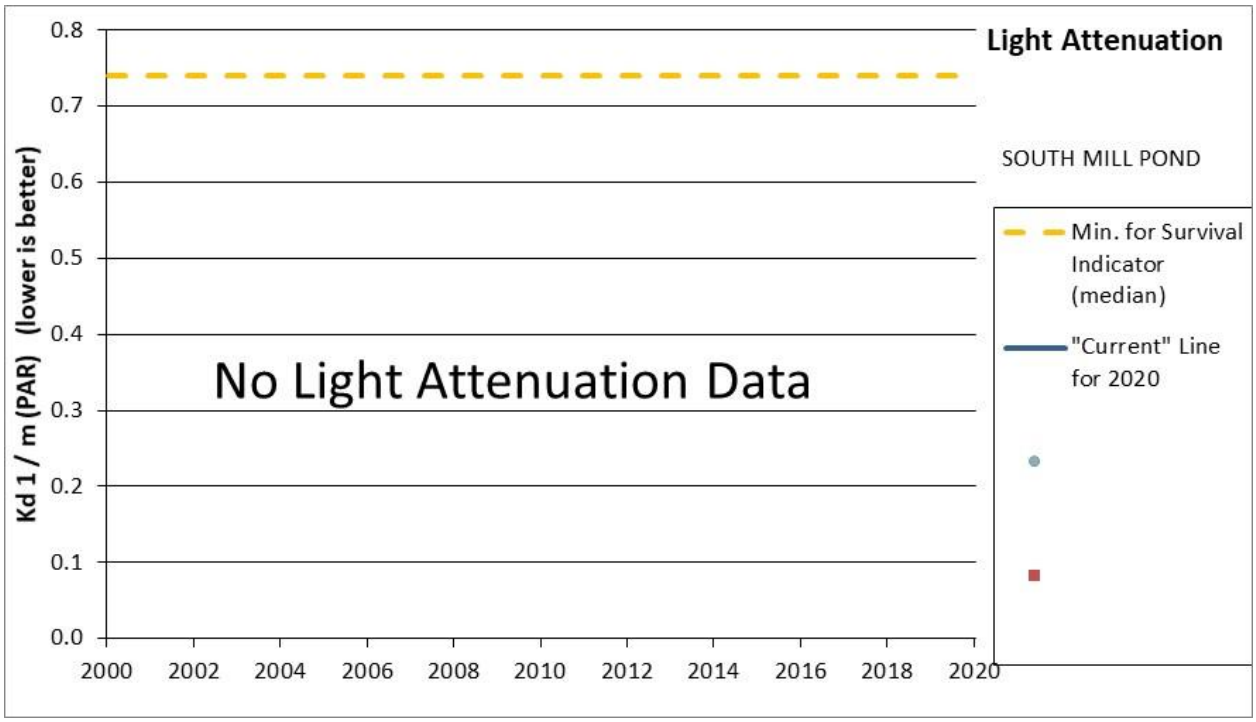

Chlorophyll-a
SOUTH MILL POND
ug Chl-a / L
25
20
15
10
5
0
No Chlorophyll-a Data
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020

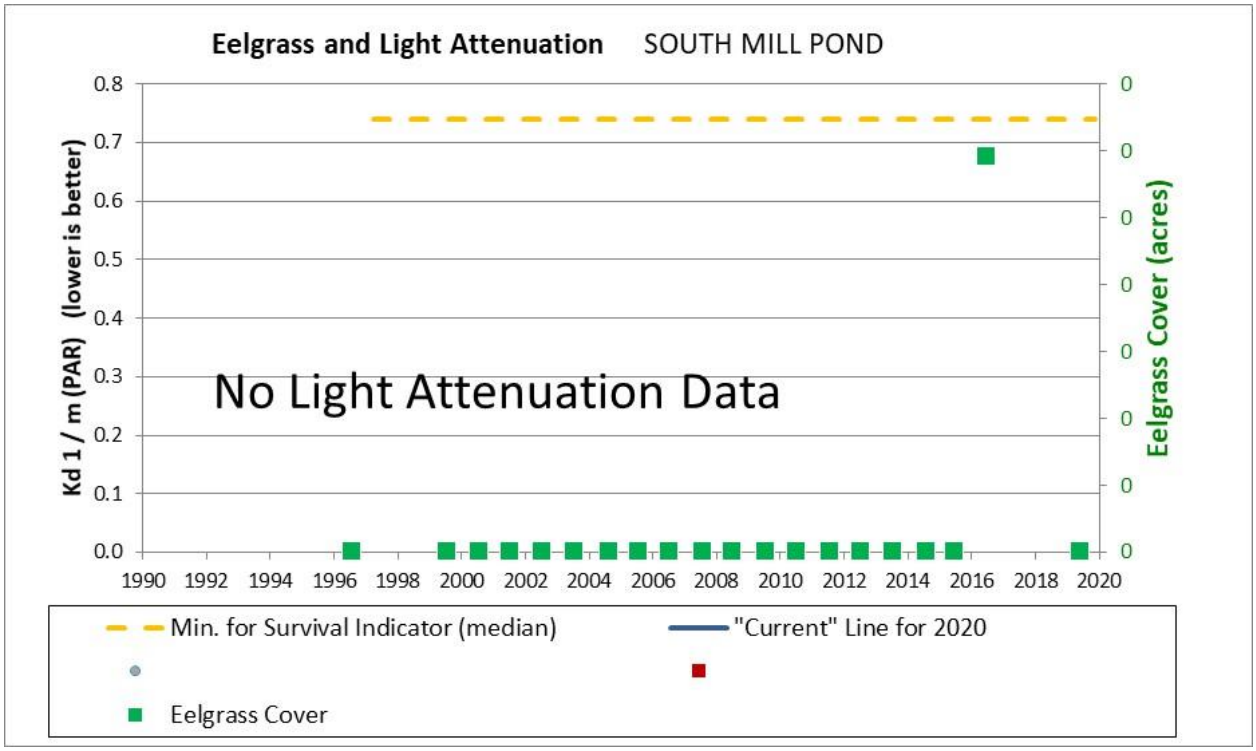

Chlorophyll-a
SOUTH MILL POND
ug Chl-a / L
10.00
1.00
0.10
No Chlorophyll-a Data
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020

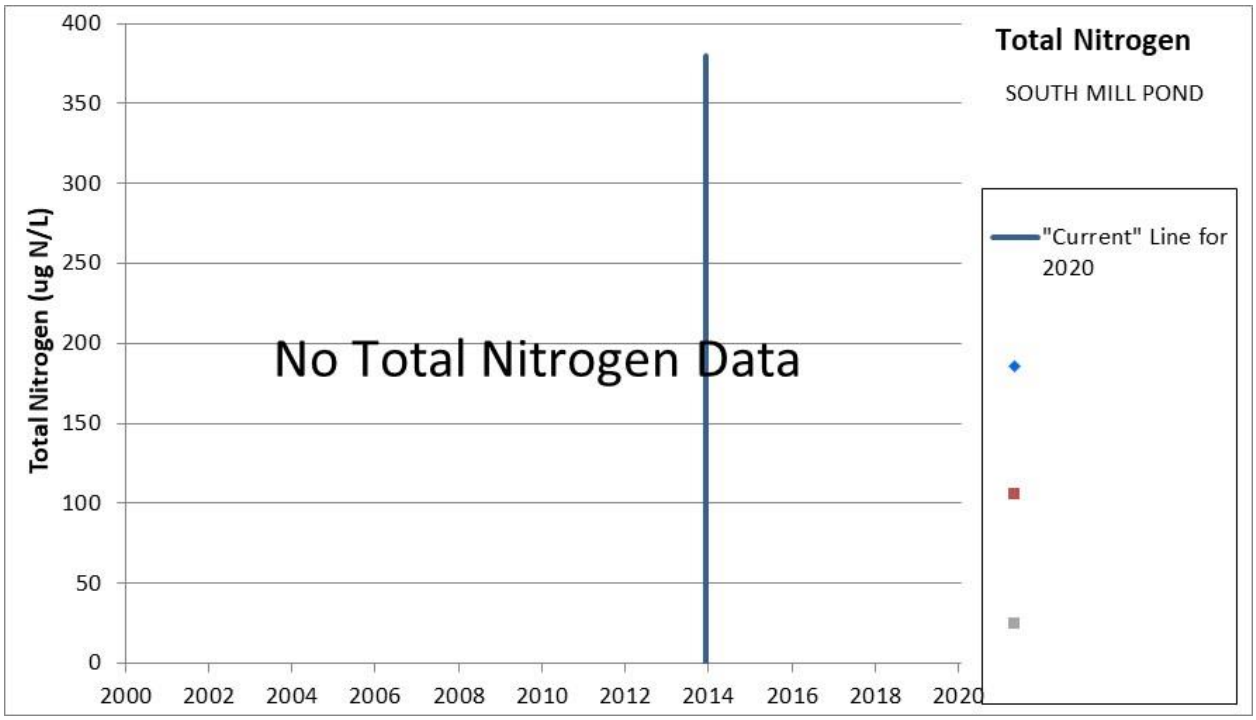

Dissolved Oxygen Concentration
SOUTH MILL POND
Dissolved Oxygen, mg / L
16
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP


Dissolved Oxygen Percent Saturation
SOUTH MILL POND
Dissolved Oxygen, Percent Saturation
250
200
150
100
50
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-SAT-GRAB


TSS
SOUTH MILL POND
No TSS Data
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020


Light Attenuation
SOUTH MILL POND
No Light Attenuation Data
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020


Eelgrass and Light Attenuation
SOUTH MILL POND
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
No Light Attenuation Data
Min. for Survival Indicator (median)
"Current" Line for 2020
Eelgrass Cover


Total Nitrogen
SOUTH MILL POND
Total Nitrogen (ug N/L)
No Total Nitrogen Data
"Current" Line for 2020

South Mill Pond Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, Combined (ug/L)	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT (1/m)	0	-	-	-	-
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	0	-	-	-	-
TSS (mg/L)	0	-	-	-	-
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	0	-	-	-	-
DO-PPM-24HR-MIN-CP (mg/L)	0	-	-	-	-
DO-PPM-24HR-MIN-NCP (mg/L)	0	-	-	-	-
DO-PPM-GRAB-CP (mg/L)	0	-	-	-	-
DO-PPM-GRAB-NCP (mg/L)	0	-	-	-	-
DO-PERC-24H-MEAN-CP (% sat)	0	-	-	-	-
DO-PERC-24H-MEAN-NCP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	0	-	-	-	-
DO-PERC-GRAB (% sat)	0	-	-	-	-
Day Ave of TN (ug N/L)	0	-	-	-	-
Day Ave of TDN (ug N/L)	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	0	-	-	-	-
Day Ave of NH3 (ug N/L)	0	-	-	-	-
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	0	-	-	-	-
SALINITY-Grabs (pss)	0	-	-	-	-
SALINITY-Datalogger Daily Median (pss)	0	-	-	-	-
pH-grab	0	-	-	-	-
pH-24HR (min)	0	-	-	-	-
pH-24HR (max)	0	-	-	-	-
Temperature	0	-	-	-	-
Temperature-Daily Median	0	-	-	-	-

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

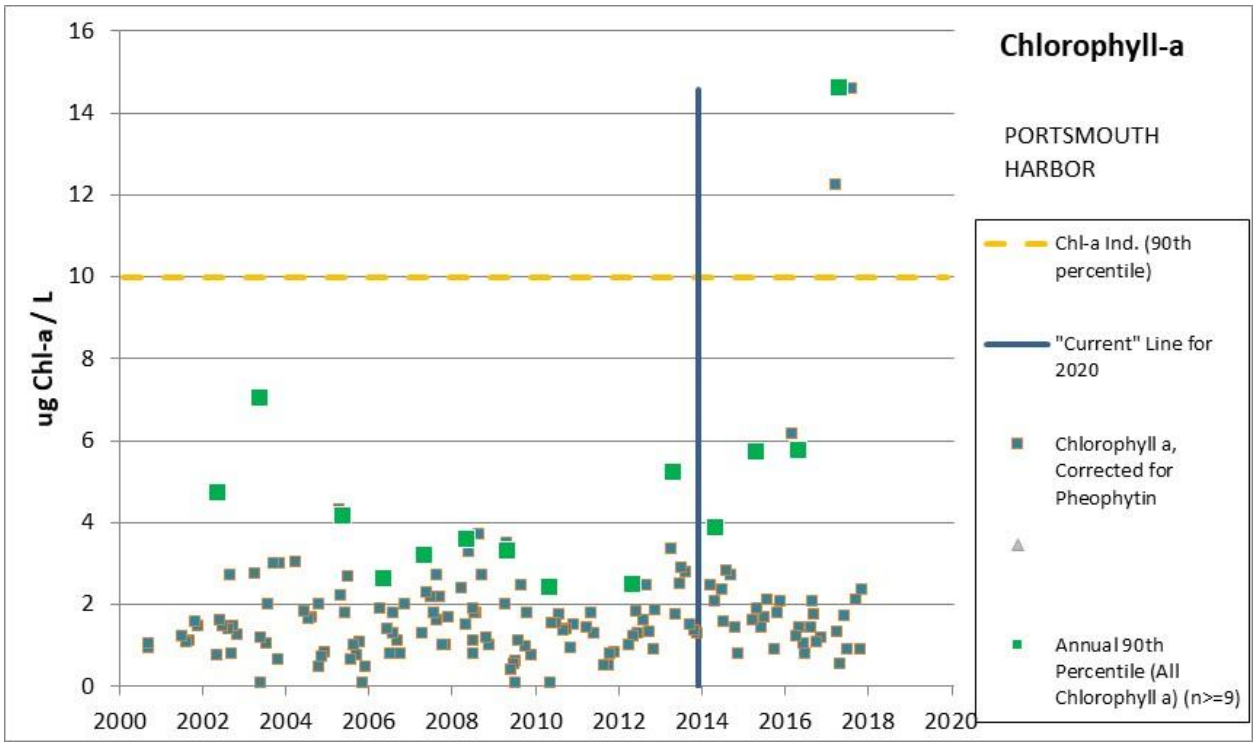
Assessment Zone = PORTSMOUTH HARBOR

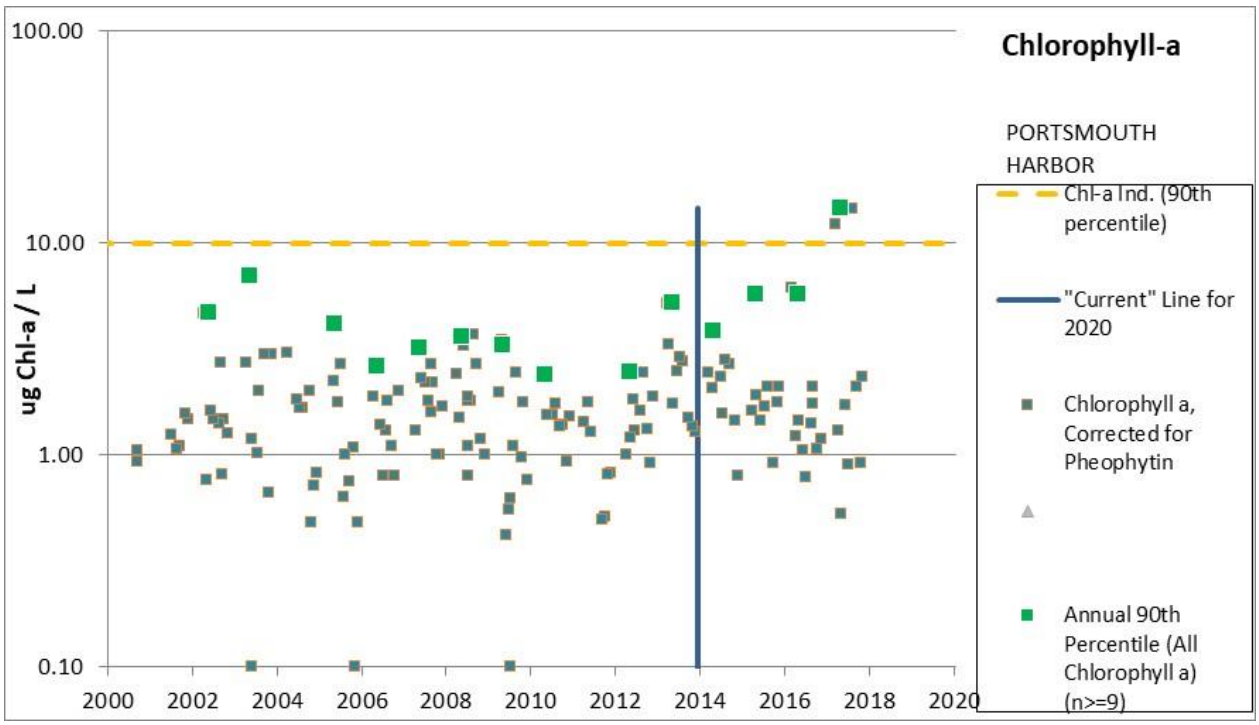
(NHEST600031001-11)

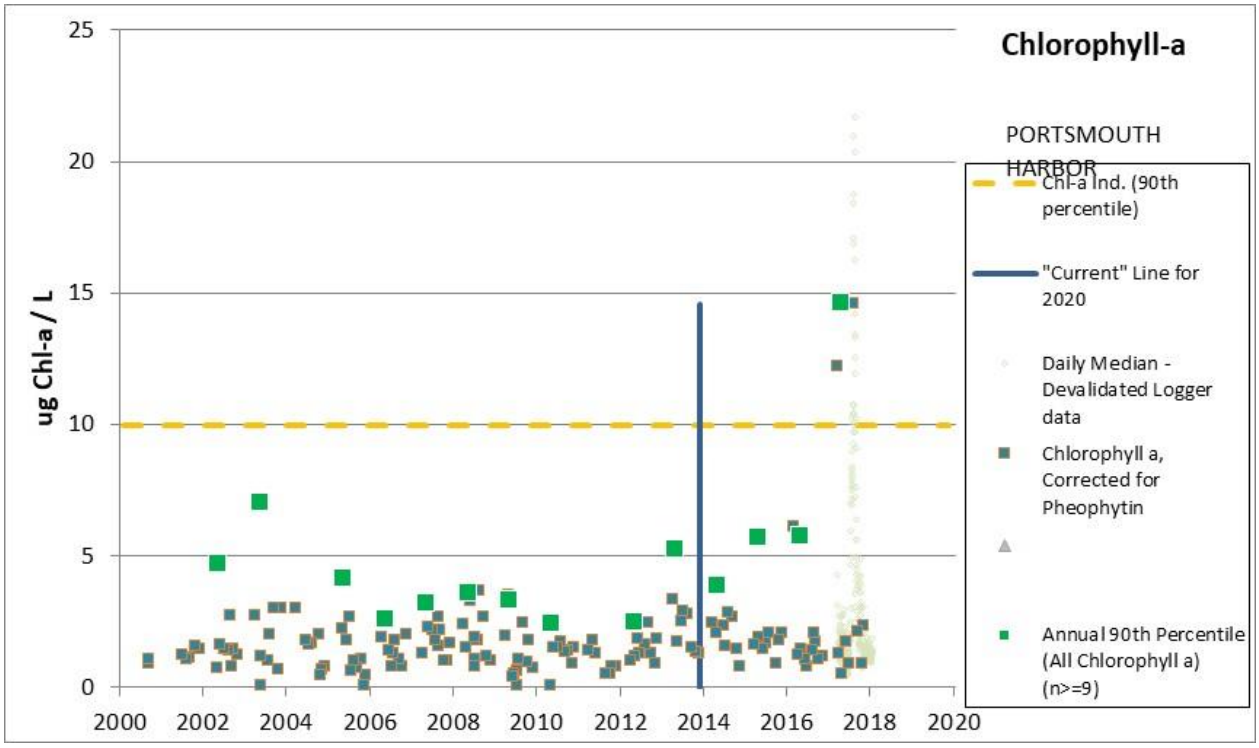
As of the date of data retrieval (January 10, 2020), data datalogger data through February 2018 and grab sample data through 2017 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are three more years (2016, 2017, 2018) of datalogger data and two more years (2016, 2017) of grab samples compared to the 2016 assessment and the 2019 data is not included.

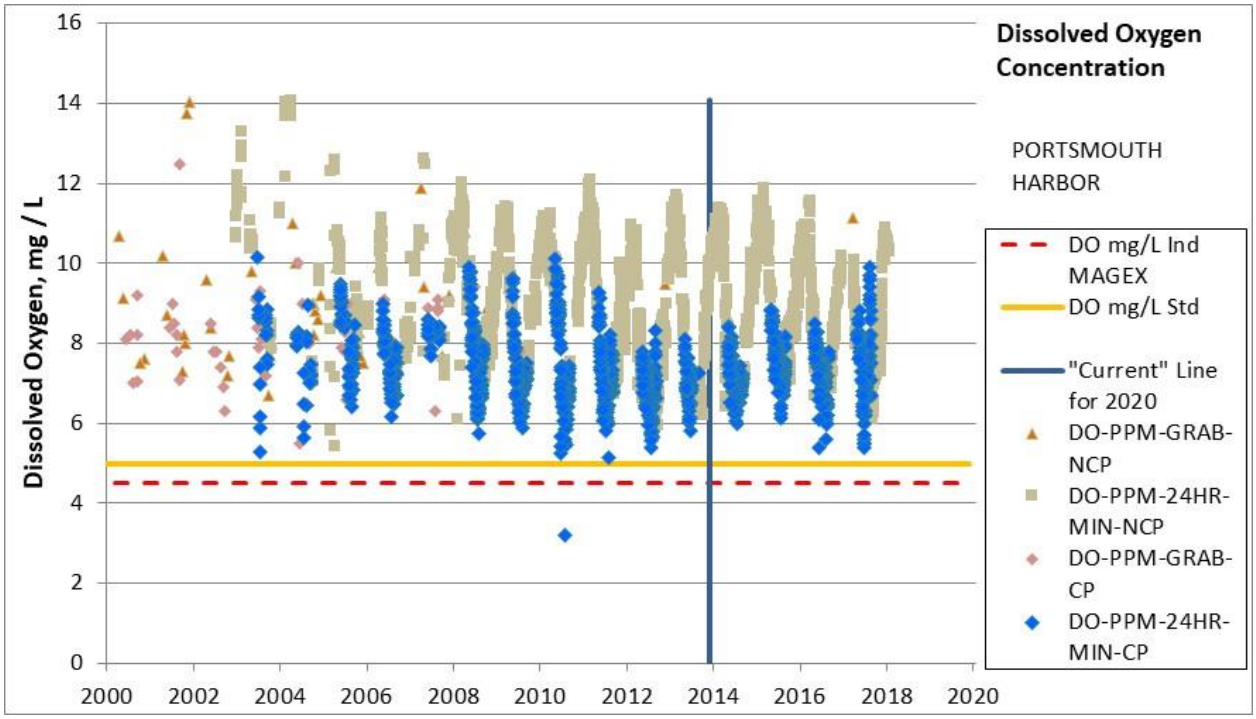
Indicator	Aquatic Life Use Category 2016 / 2020/2022	2020/2022 Comment
Chlorophyll-a	2-G / 2-G	The calculated 90th percentile chlorophyll-a in this assessment zone is 5.8 µg/L (n = 37) and a maximum reading of 14.6 µg/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L. The available data indicates that this assessment zone meets the chlorophyll-a indicator threshold.
Dissolved Oxygen (mg/L)	2-G / 2-G	This assessment zone has datalogger and grab measurements for dissolved oxygen concentration covering 2012 through 2018. No samples fell below 5 mg/L. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-G / 2-G	This assessment zone has 24-hour average datalogger and grab measurements for dissolved oxygen percent saturation covering 2012 through 2018. All 24-hour averages are above 75% saturation in the current period. The available data indicates that this assessment zone has good dissolved oxygen percent saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 227.7 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2016-2019 is 87.1 acres, which is a decrease of 46.9%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 38.9%. The thresholds for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	Median=0.59 m^-1 (n=32). For an eelgrass restoration depth of 3 m, the light attenuation coefficient threshold is 0.5 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 3 m restoration depth a valid target. Further, a review of the location of the deep edge of the eelgrass suggests that the maximum depth of eelgrass survival is not as deep as it was in the past. Due to the proximity of the Portsmouth WWTF, the data through 2018 reflects the pre-upgrade period when there was still a large TSS load out of the discharge. The impaired (5-M) listing from the 2018 303d list has been retained.
Total Nitrogen	2-M / 2-M	The median total nitrogen from 2014 through 2019 was 228 µg/L (n=37). In the continuous data (2014-2018) the dissolved oxygen concentration always remains above 5 mg/L and saturation always remains above 75% daily average. The chlorophyll-a data indicates that this assessment zone meets the chlorophyll-a indicator threshold. The eelgrass beds are severely degraded. The available light attenuation data (median=0.59 m^-1, n=32) appears inadequate for the 3 m restoration depth but may be reflective the Total Suspended Solids (TSS) load from the pre-upgrade Portsmouth WWTF (upgrade nearing completion). For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997). No direct sampling efforts have taken place to evaluate the extent of epiphytes and macrophytes however regarding macroalgae, Burdick et al. (Burdick, Mathieson, Peter, & Sydney, 2016) stated, “Monitoring results from 2014 show high levels of cover of nuisance green and red algae (*Ulva* and *Gracilaria*, respectively) at all sites except near the mouth of the Estuary.” The “mouth of the estuary site” is Four Tree Island, approximately 1 mile upstream from the Portsmouth Harbor assessment zone. In the 2019 macroalgae annual report, the appreciable cover at Four Tree Island is dominated by fucoids (brown) and intermittent nuisance seaweeds (reds and greens) but did not show a statistical trend, although that site has only been sampled 3-times (2014, 2016, 2019) making trend detection more difficult

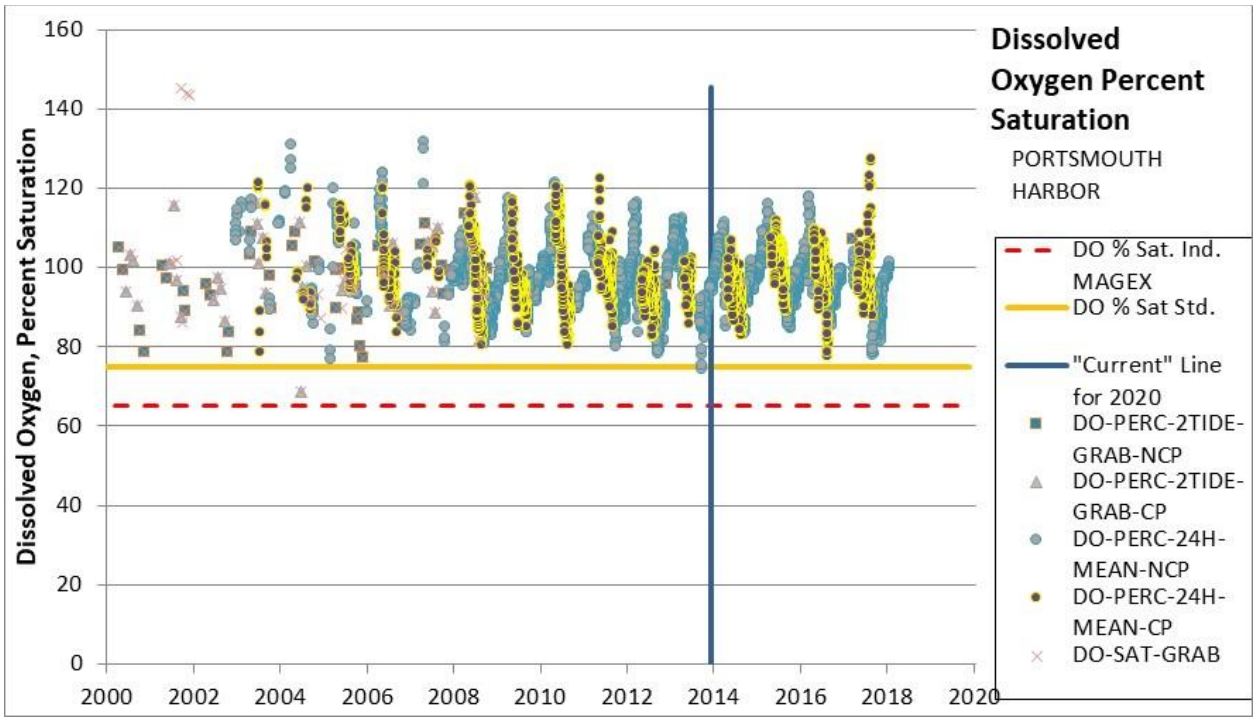
		(Burdick, et al., 2020). While the five-year median total nitrogen is remains slightly above the estimated offshore total nitrogen concentration of 200 µg/L, the data suggest that Portsmouth Harbor total nitrogen has been decreasing over time with essentially offshore-like conditions in 2015 and 2016. The status of the indicators of nutrients and nutrient-related impacts do not present a preponderance of evidence that eutrophication effects are occurring in this zone. While eelgrass has been lost and light attenuation is often not sufficient, DO and chlorophyll a levels in this zone are sufficient and the TN levels are only slightly elevated from the off-shore concentration but well within the restoration range. As such, this assessment zone has been assessed as marginally fully supporting (2-M) for total nitrogen.

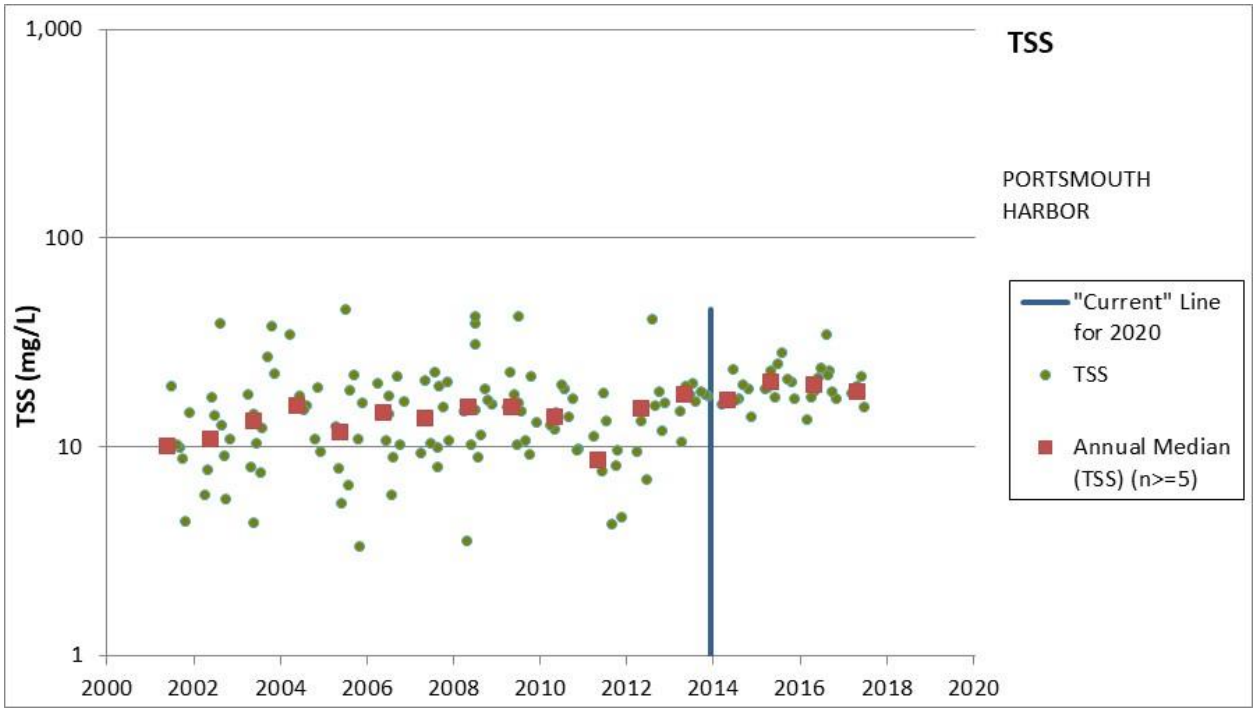


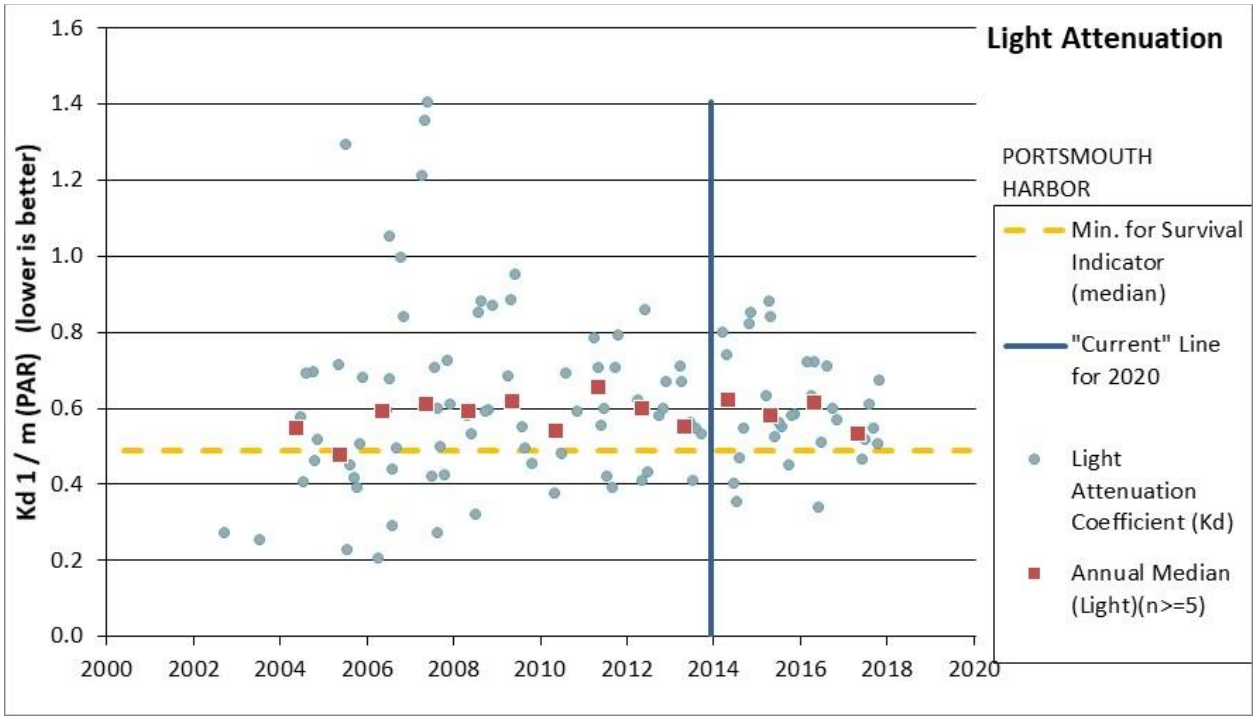

Chlorophyll-a
PORTSMOUTH HARBOR
ug Chl-a / L
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

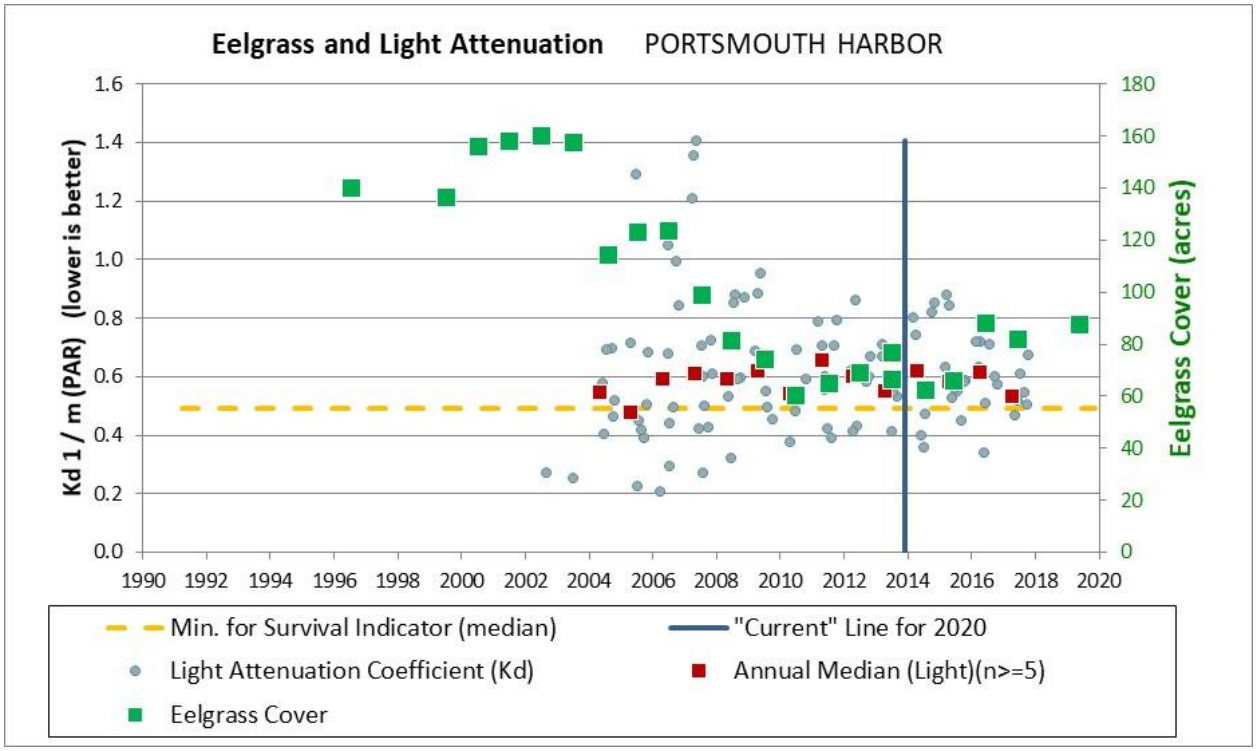

Chlorophyll-a
PORTSMOUTH HARBOR
ug Chl-a / L
25
20
15
10
5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Daily Median - Devalidated Logger data
Chlorophyll a, Corrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

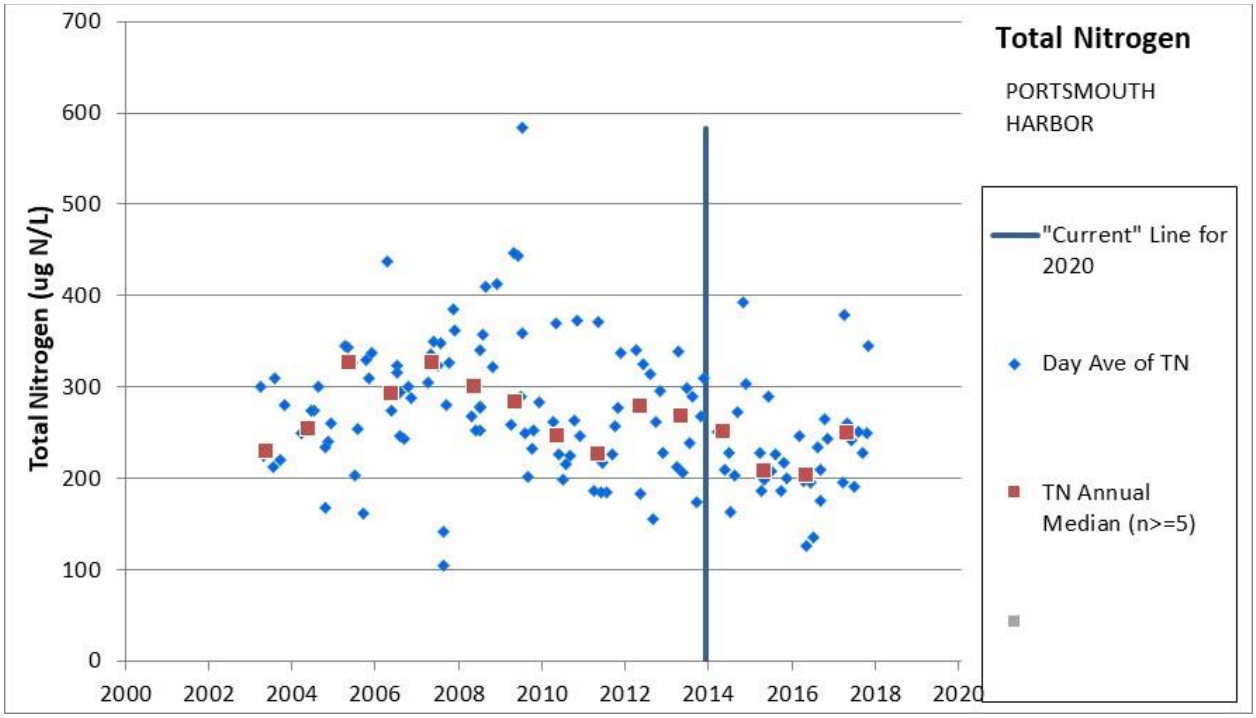

Dissolved Oxygen Concentration
PORTSMOUTH HARBOR
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
PORTSMOUTH HARBOR
Dissolved Oxygen, Percent Saturation
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP
DO-SAT-GRAB


TSS
PORTSMOUTH HARBOR
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)


Light Attenuation
PORTSMOUTH HARBOR
Kd 1 / m (PAR) (lower is better)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)


Eelgrass and Light Attenuation
PORTSMOUTH HARBOR
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
180
160
140
120
100
80
60
40
20
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)
Eelgrass Cover


Total Nitrogen
PORTSMOUTH HARBOR
Total Nitrogen (ug N/L)
700
600
500
400
300
200
100
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Portsmouth Harbor Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	37	0.5	1.7	5.8	14.6
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, Combined (ug/L)	37	0.0	1.7	5.8	14.6
LIGHT ATTENUATION COEFFICIENT (1/m)	32	0.35	0.59	0.84	0.89
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	1,383	0.0	1.0	2.7	96.7
TSS (mg/L)	33	13.4	18.8	24.5	34.4
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	37	1.1	1.5	2.2	2.6
DO-PPM-24HR-MIN-CP (mg/L)	453	5.4	7.3	8.2	9.9
DO-PPM-24HR-MIN-NCP (mg/L)	905	6.1	9.6	11.1	11.9
DO-PPM-GRAB-CP (mg/L)	0	-	-	-	-
DO-PPM-GRAB-NCP (mg/L)	1	11.2	11.2	-	11.2
DO-PERC-24H-MEAN-CP (% sat)	462	77.7	98.7	106.7	127.3
DO-PERC-24H-MEAN-NCP (% sat)	908	78.0	97.7	105.9	117.9
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	1	107.4	107.4	-	107.4
DO-PERC-GRAB (% sat)	0	-	-	-	-
Day Ave of TN (ug N/L)	37	127	228	312	393
Day Ave of TDN (ug N/L)	37	81	165	249	344
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	37	18	86	174	288
Day Ave of NH3 (ug N/L)	37	3	25	54	100
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	37	11	52	148	285
SALINITY-Grabs (pss)	51	22.8	28.6	30.8	32.1
SALINITY-Datalogger Daily Median (pss)	1,317	20.0	30.8	31.9	32.9
pH-grab	0	-	-	-	-
pH-24HR (min)	1,127	7.2	7.9	7.6*	8.1
pH-24HR (max)	1,127	7.3	7.9	8.1	8.8
Temperature	51	1.0	11.6	16.9	18.9
Temperature-Daily Median	1,389	-1.1	9.4	16.3	19.8

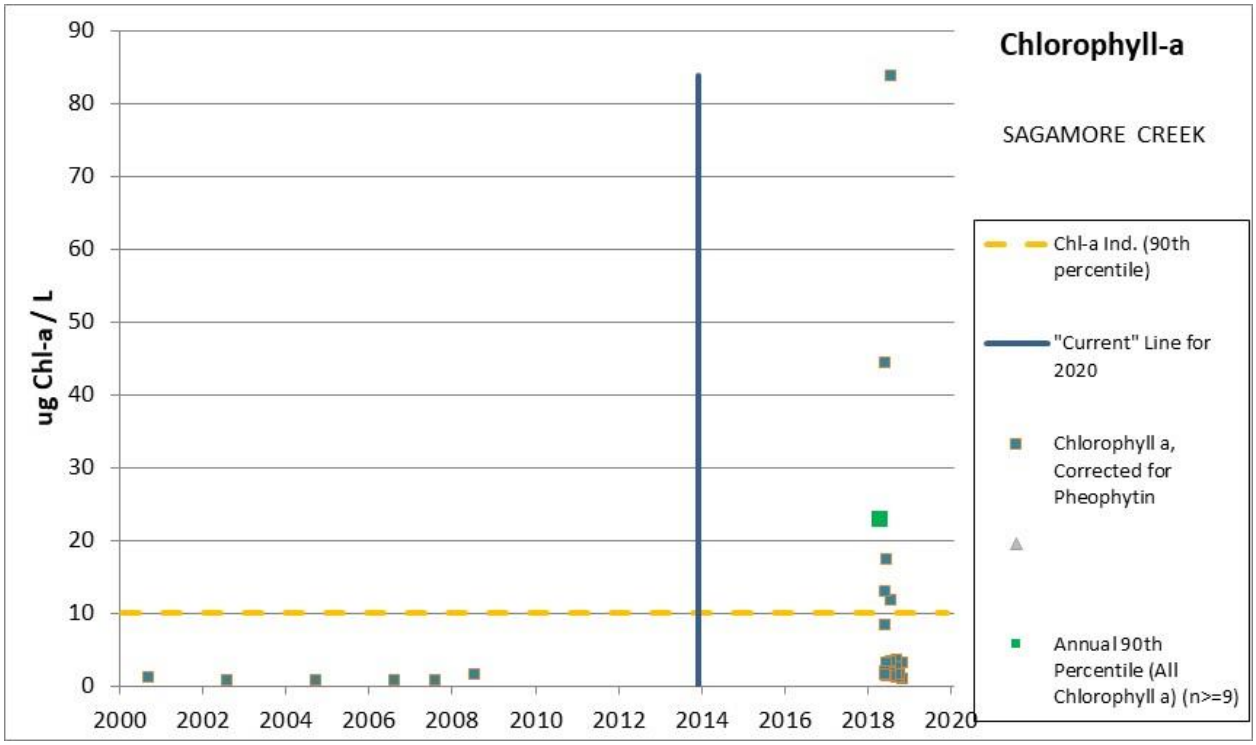
*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

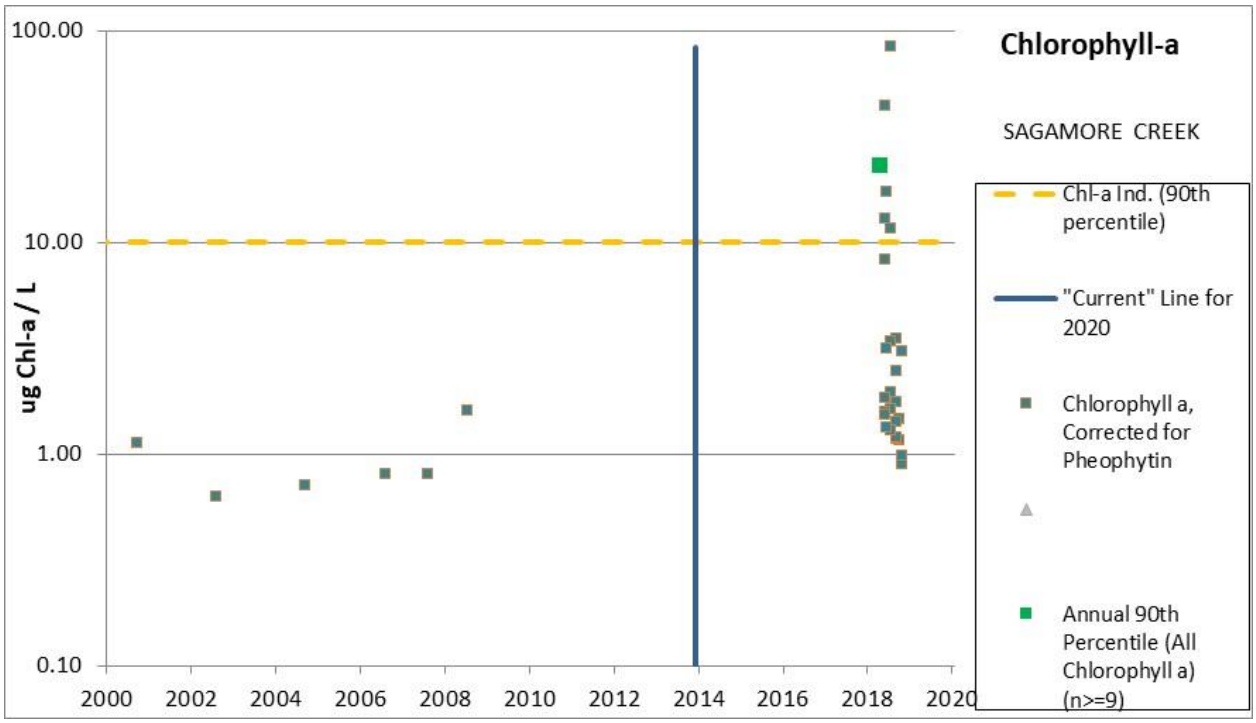
Assessment Zone = SAGAMORE CREEK

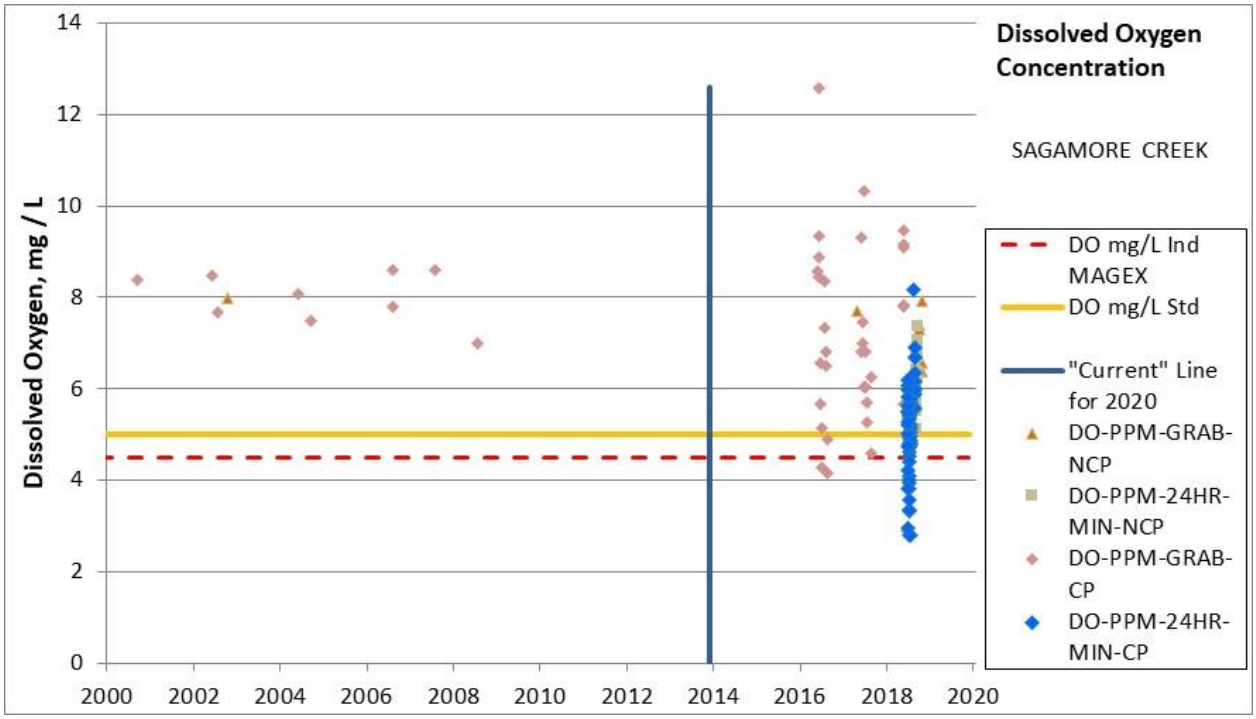
(NHEST600031001-03, NHEST600031001-04)

As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there is one additional year (2018) of datalogger and grab samples for limited parameters compared to the 2018 assessment but no 2019 data is not included.

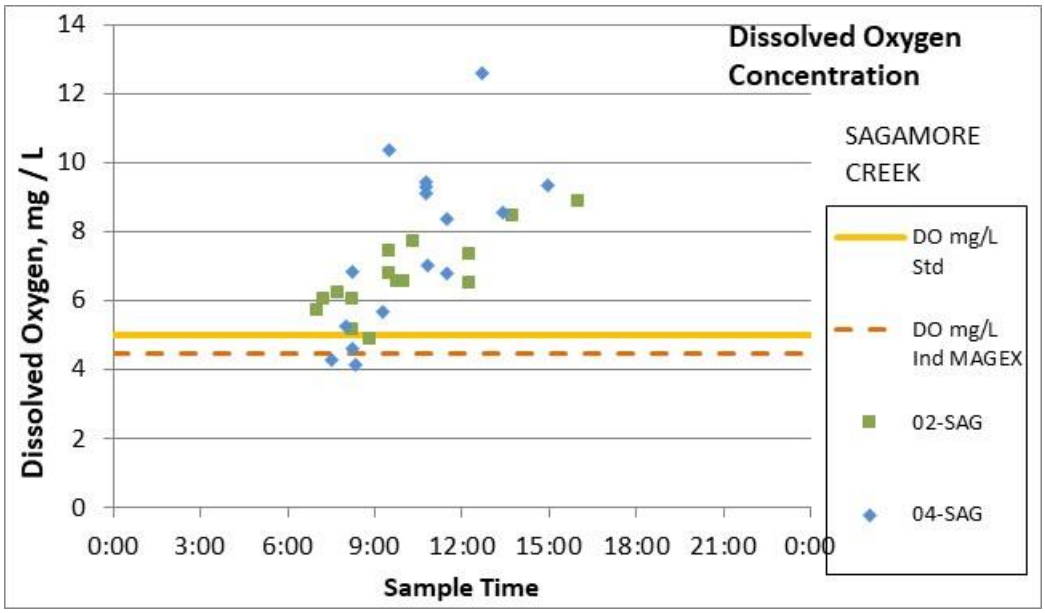
Indicator	Aquatic Life Use Category 2018 / 2020/2022	2020/2022 Comment
Chlorophyll-a	3-ND / 5-P	The calculated 90th percentile chlorophyll-a (corrected for pheophytin) in this assessment zone is 22.7 µg/L (n = 27). The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L.
Dissolved Oxygen (mg/L)	5-M / 5-P	In 2016-2018 this zone had grab samples for DO collected at three sites 02-SAG, 04-SAG and LHB19. Seven of the 38 (18%) grab samples collected were below 5 mg/L and 4 of those measurements were below 4.5 mg/L. Low values were consistently early in the day. Typically, we find that grab samples under-estimate the frequency and magnitude of degraded water quality. Since the 2018 assessment, 2018 datalogger data has been uploaded for sites 02-SAG and 04-SAG. In the summer critical period, 44% of daily records (n=59) were below 5 mg/L, on 9-dates DO fell below 4 mg/L and on 3 dates below 3 mg/L. The available data indicates that this assessment zone does not meet the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	3-PNS / 2-M	In 2016-2018 this zone had grab samples for DO collected at three sites 02-SAG, 04-SAG and LHB19. Grab samples were recorded on 47 dates. Typically, we find that grab samples under-estimate the frequency and magnitude of degraded water quality. Since the 2018 assessment, 2018 datalogger data has been uploaded for sites 02-SAG and 04-SAG. In the summer critical period, 8% of daily records (n=53) were below 75% saturation and the lowest 24-hour average was 69%. The available data indicates that this assessment zone has marginally good dissolved oxygen saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 4.1 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2016-2019 is 1.7 acres, which is a decrease of 58.3%. Since 1990, the trend in eelgrass cover in this assessment zone was not significant. The threshold for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	There have been no light measurements collected since 2005.This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 3m restoration depth a valid target. Further, a review of the location of the deep edge of the eelgrass suggests that the maximum depth of eelgrass survival is not as deep as it was in the past. As there is no measured light attenuation, this zone remains assessed as “no data.”
Total Nitrogen	3-ND / 5-M	The median total nitrogen from 2014 through 2019 was 567 µg/L (n=10) having a range of 309-1,230 ug/L. While short of the desired 15 samples for the median, if an optimistic 5-samples were added into the dataset based on the Portsmouth Harbor median (228 ug/L), the median would still be 397 ug/L. The available dissolved oxygen data shows that water quality concentration frequently falls well below 5 mg/L however the daily average dissolved oxygen percent saturation remains marginally over 75%. There is no light attenuation data in the current period. Chlorophyll-a is high at 22.7 µg/L (n = 27). The eelgrass beds are severely degraded. The status of the indicators of nutrients and nutrient-related impacts have not changed, and continue to present a preponderance of evidence that eutrophication effects are ongoing. While, the high median total nitrogen would suggest a severe-not supporting assessment, the assessment zone has been placed at marginally-not supporting due to having only 10-total nitrogen samples.

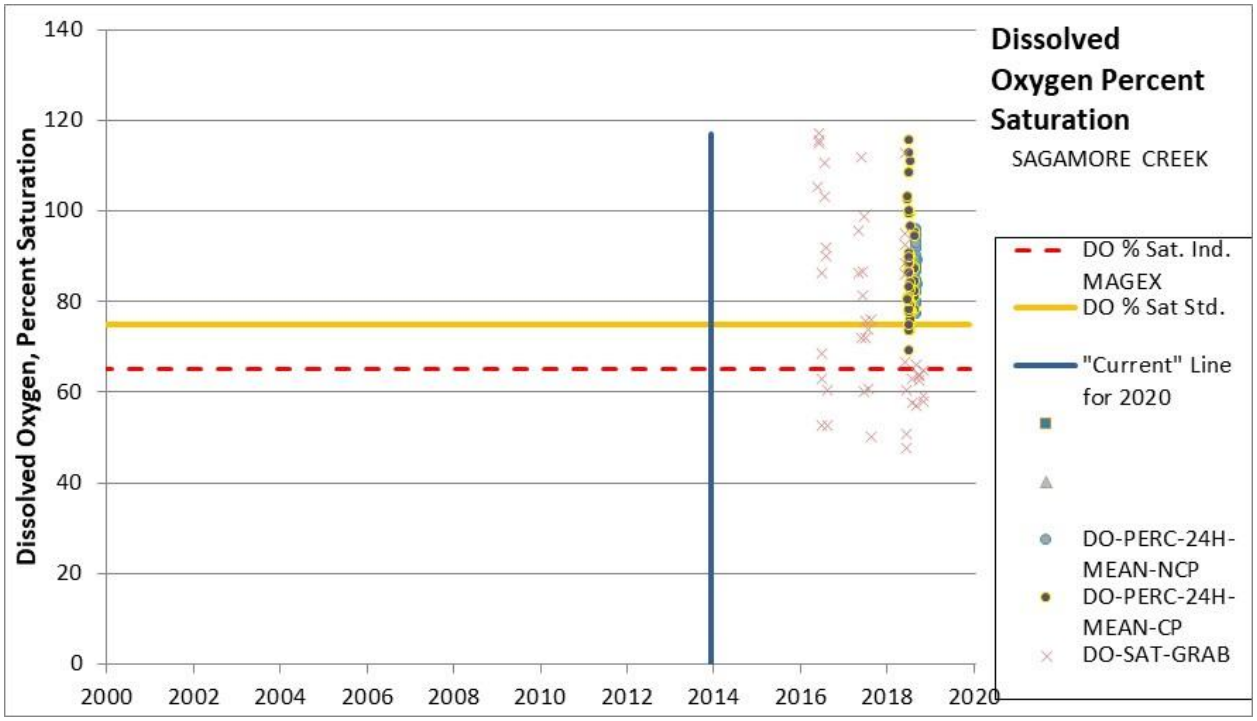

Chlorophyll-a
SAGAMORE CREEK
ug Chl-a / L
90
80
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)


Chlorophyll-a
SAGAMORE CREEK
ug Chl-a / L
100.00
10.00
1.00
0.10
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Chl-a Ind. (90th percentile)
"Current" Line for 2020
Chlorophyll a, Corrected for Pheophytin
Annual 90th Percentile (All Chlorophyll a) (n>=9)

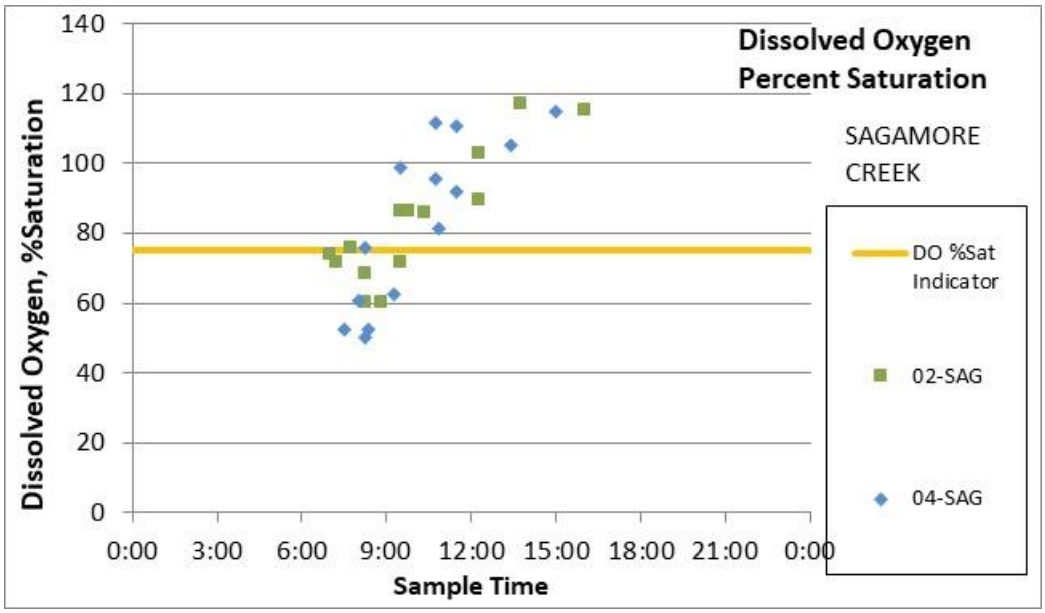


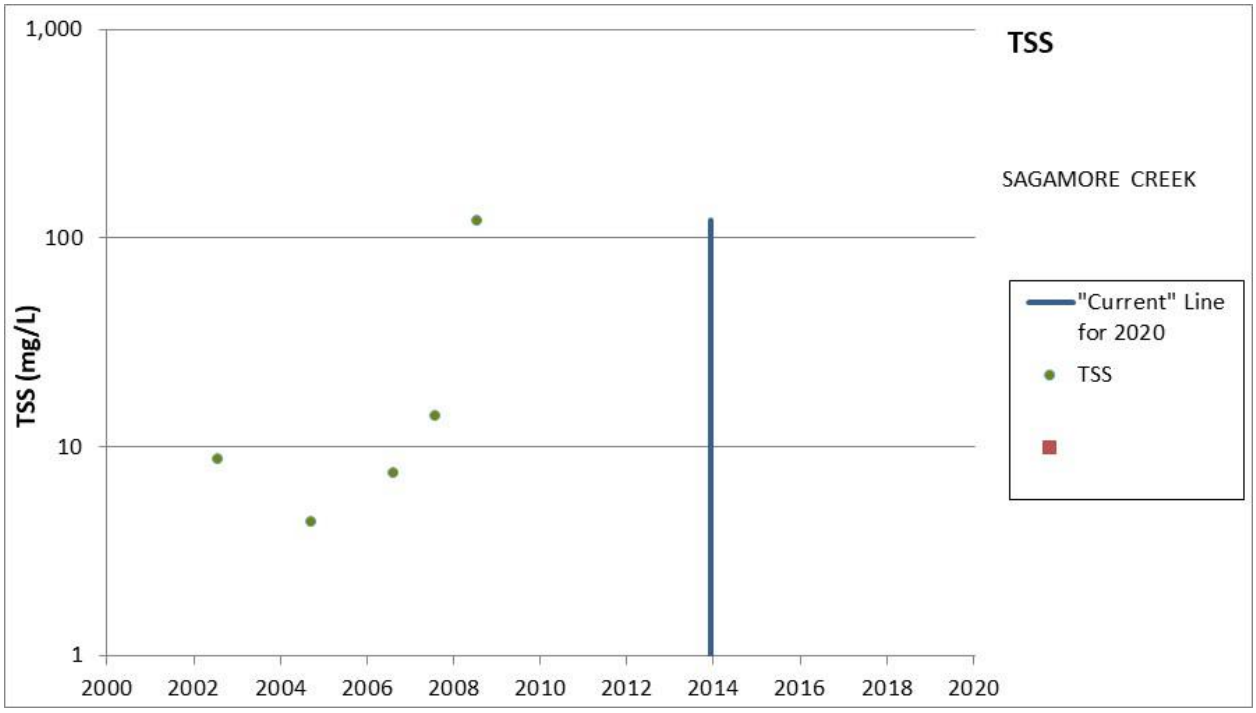
Grab samples by time of day

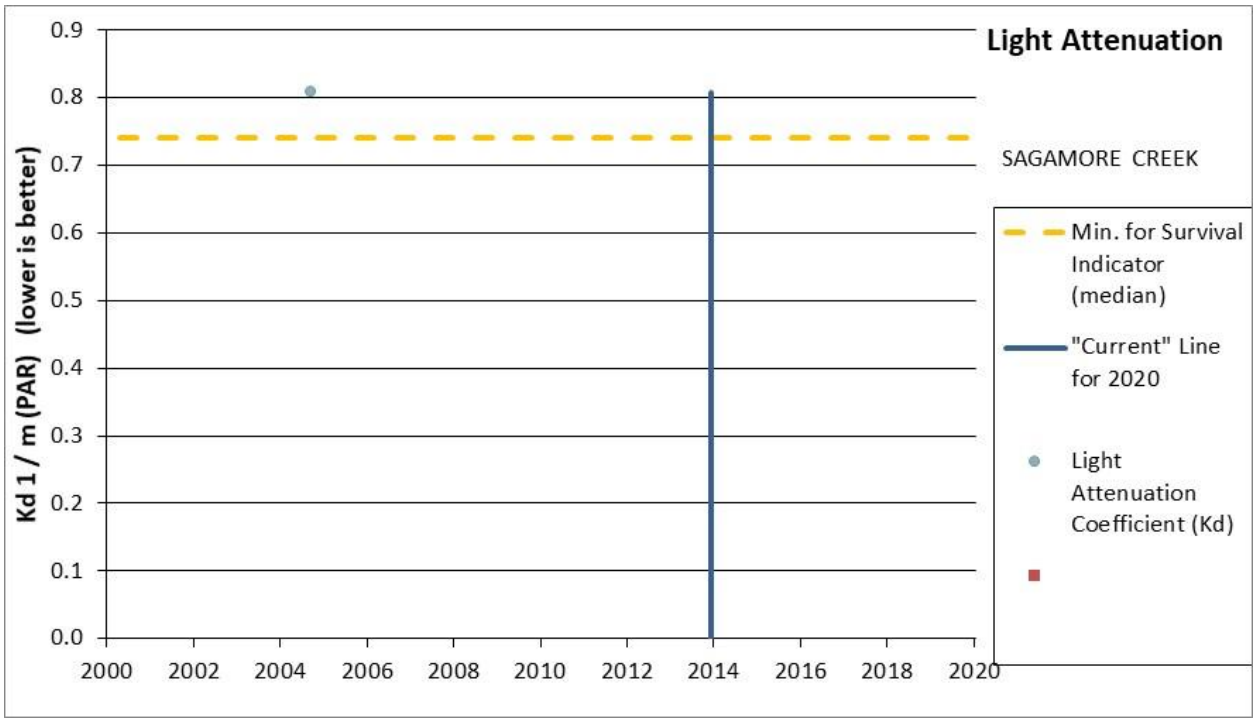


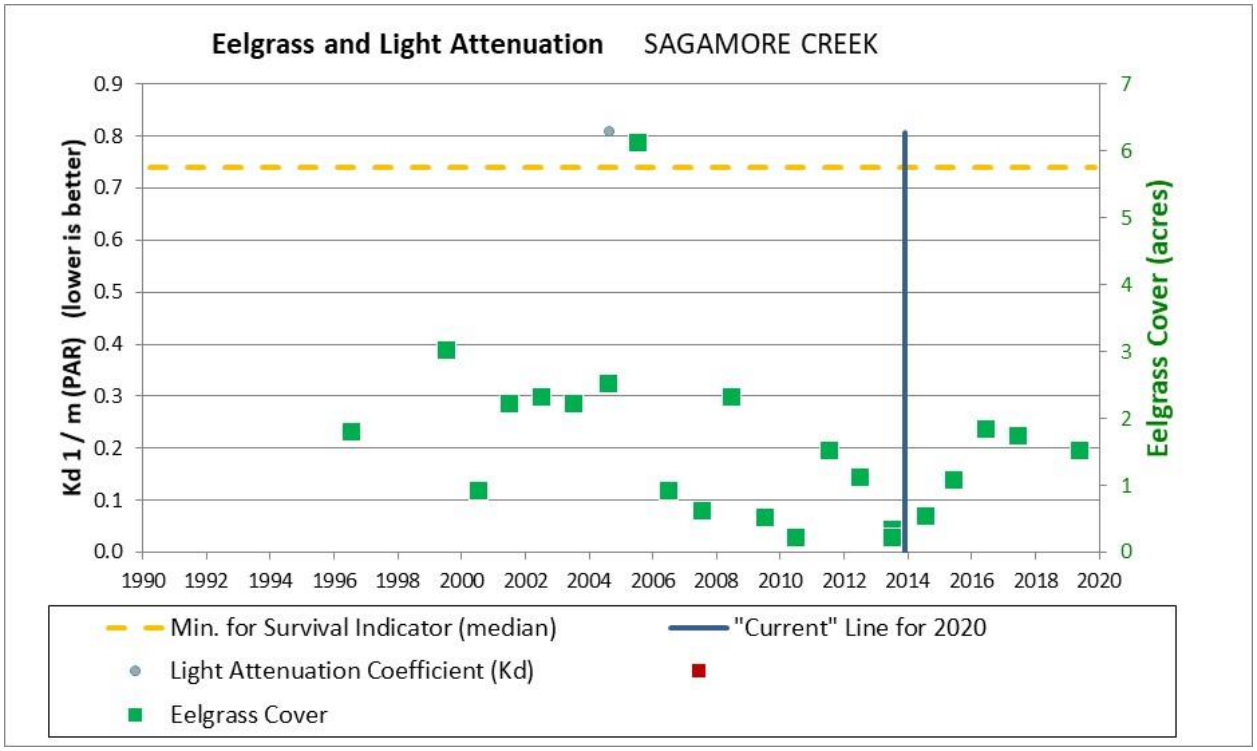


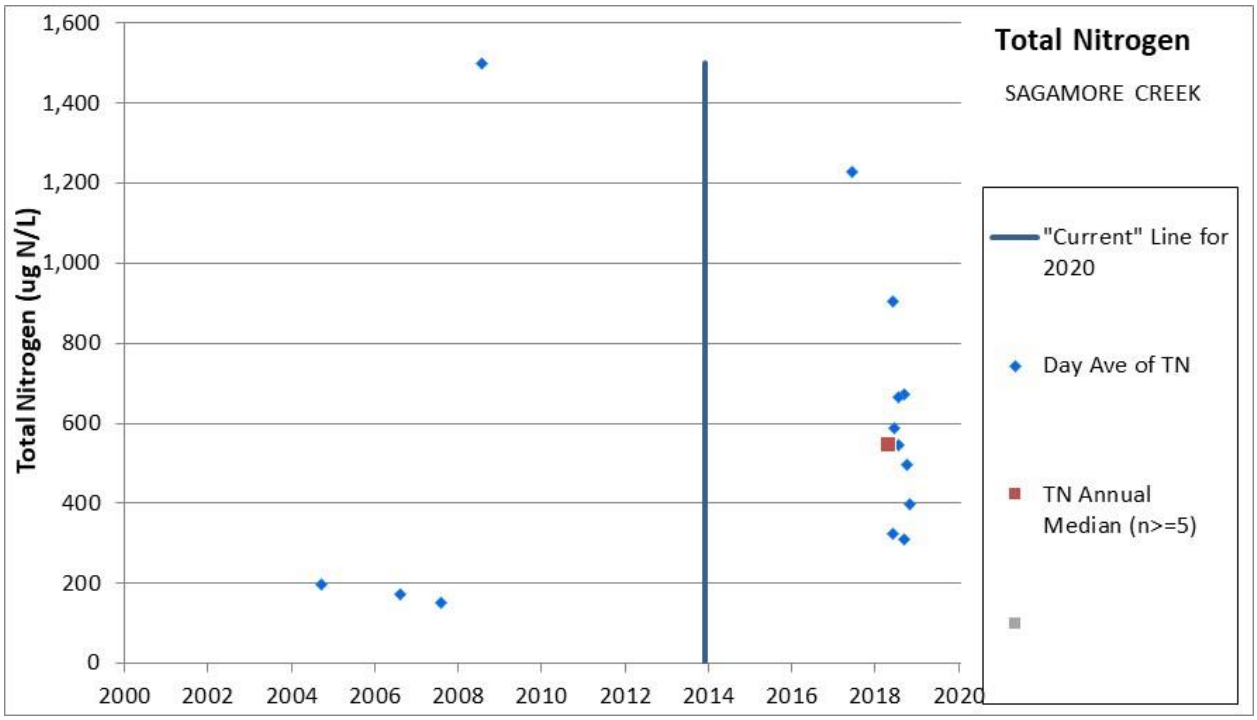
Grab samples by time of day




TSS
SAGAMORE CREEK
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
"Current" Line for 2020
TSS


Light Attenuation
SAGAMORE CREEK
Kd 1 / m (PAR) (lower is better)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)


Eelgrass and Light Attenuation
SAGAMORE CREEK
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
7
6
5
4
3
2
1
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Eelgrass Cover


Total Nitrogen
SAGAMORE CREEK
Total Nitrogen (ug N/L)
1,600
1,400
1,200
1,000
800
600
400
200
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Sagamore Creek Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	27	0.9	1.8	22.7	83.8
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, Combined (ug/L)	27	0.0	1.8	22.7	83.8
LIGHT ATTENUATION COEFFICIENT (1/m)	0	-	-	-	-
TURBIDITY (NTU)	26	1.7	4.7	10.3	14.0
TURBIDITY (datalogger daily median) (NTU)	96	0.0	5.5	18.9	38.7
TSS (mg/L)	0	-	-	-	-
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	27	0.7	2.4	5.1	5.8
DO-PPM-24HR-MIN-CP (mg/L)	59	2.8	5.1	6.2	8.2
DO-PPM-24HR-MIN-NCP (mg/L)	32	5.1	6.1	6.8	7.4
DO-PPM-GRAB-CP (mg/L)	38	2.9	6.7	9.4	12.6
DO-PPM-GRAB-NCP (mg/L)	9	5.6	6.6	7.9	7.9
DO-PERC-24H-MEAN-CP (% sat)	53	69.1	84.4	106.2	115.6
DO-PERC-24H-MEAN-NCP (% sat)	28	77.1	87.7	94.6	95.8
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	0	-	-	-	-
DO-PERC-GRAB (% sat)	47	47.7	72.0	112.0	117.0
Day Ave of TN (ug N/L)	10	309	567	1,197	1,230
Day Ave of TDN (ug N/L)	27	112	211	499	591
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	0	-	-	-	-
Day Ave of NH3 (ug N/L)	0	-	-	-	-
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	33	11	51	215	300
SALINITY-Grabs (pss)	52	11.2	29.6	31.8	32.5
SALINITY-Datalogger Daily Median (pss)	0	-	-	-	-
pH-grab	48	6.7	7.7	9.0	9.2
pH-24HR (min)	115	6.8	7.5	7*	8.0
pH-24HR (max)	115	7.7	8.1	8.2	8.2
Temperature	68	1.9	17.8	23.3	27.3
Temperature-Daily Median	115	12.3	19.1	22.9	24.8

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

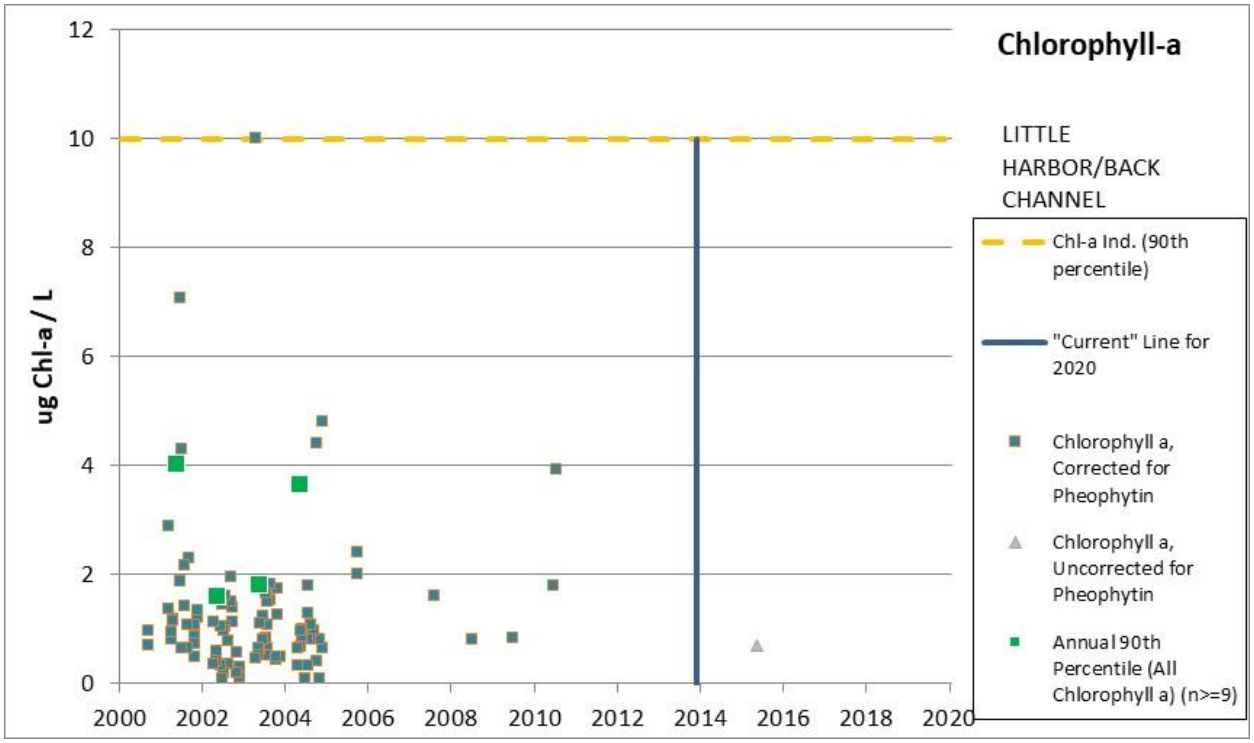
Assessment Zone = LITTLE HARBOR/BACK CHANNEL

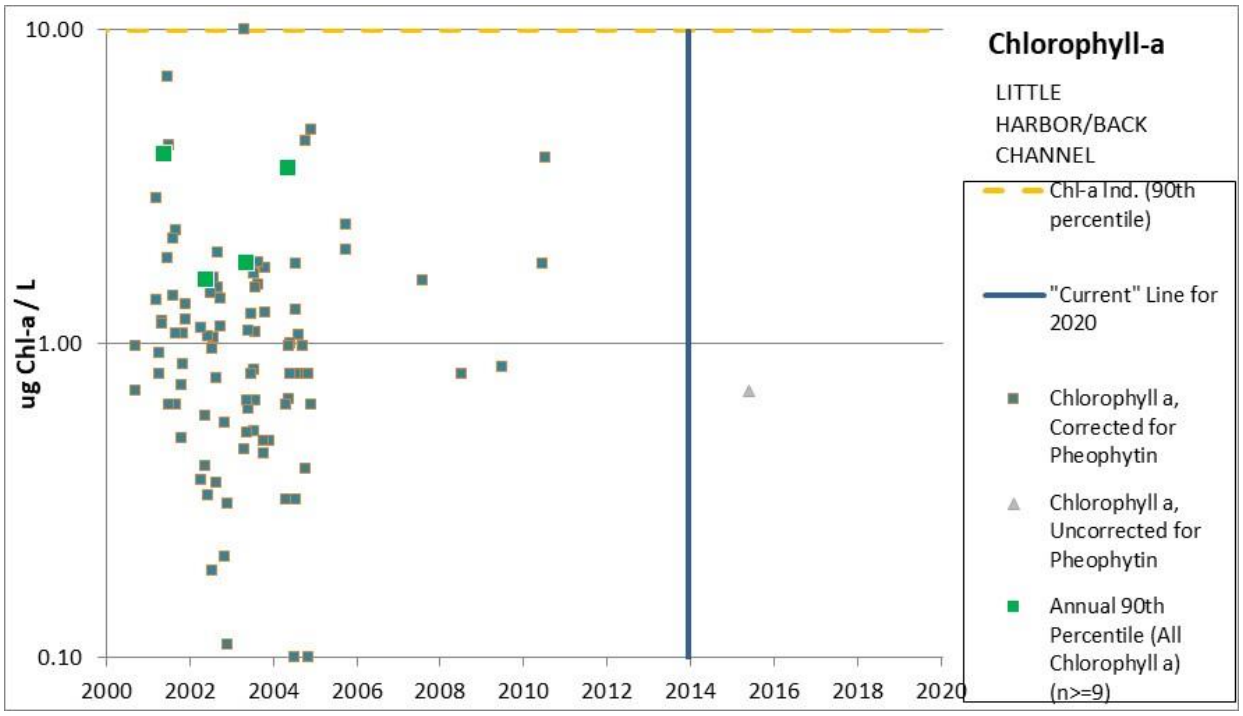
(NHEST600031001-05, NHEST600031001-08, NHEST600031002-02)

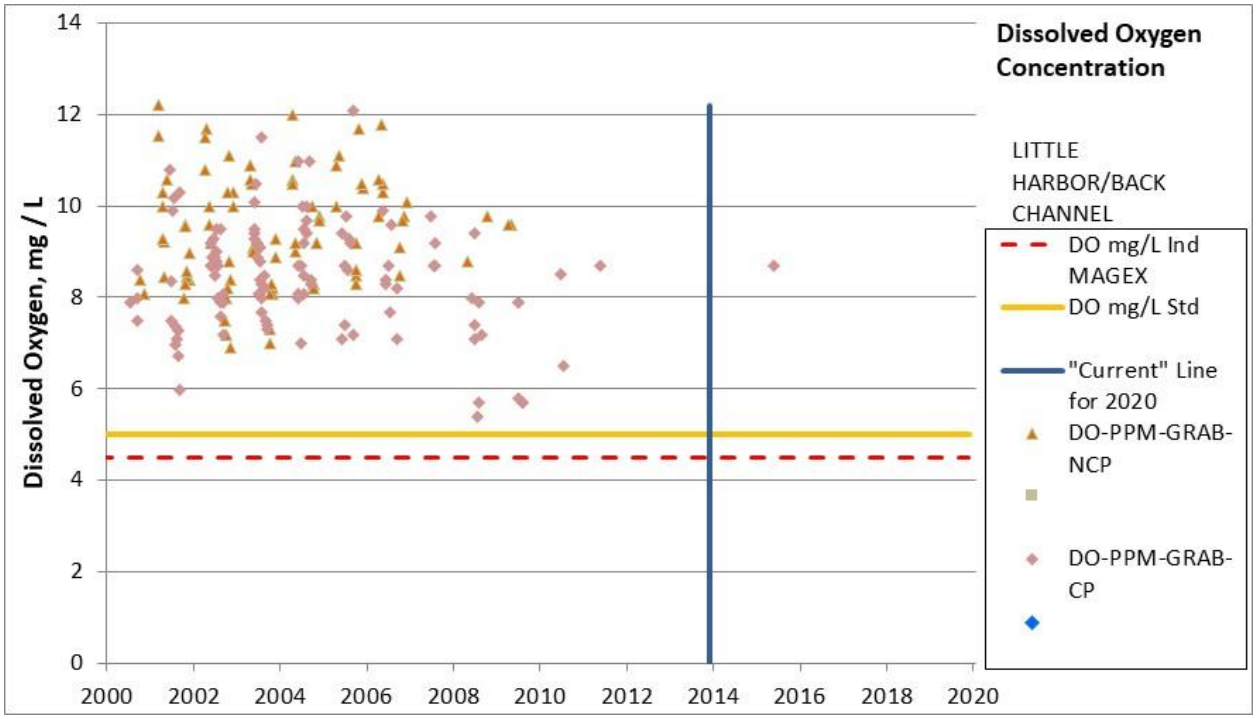
As of the date of data retrieval (January 10, 2020) water quality data through 2018 had been uploaded to the Environmental Monitoring Database for this assessment zone. For this assessment zone, that means there are no additional years of data compared to the 2016 assessment.

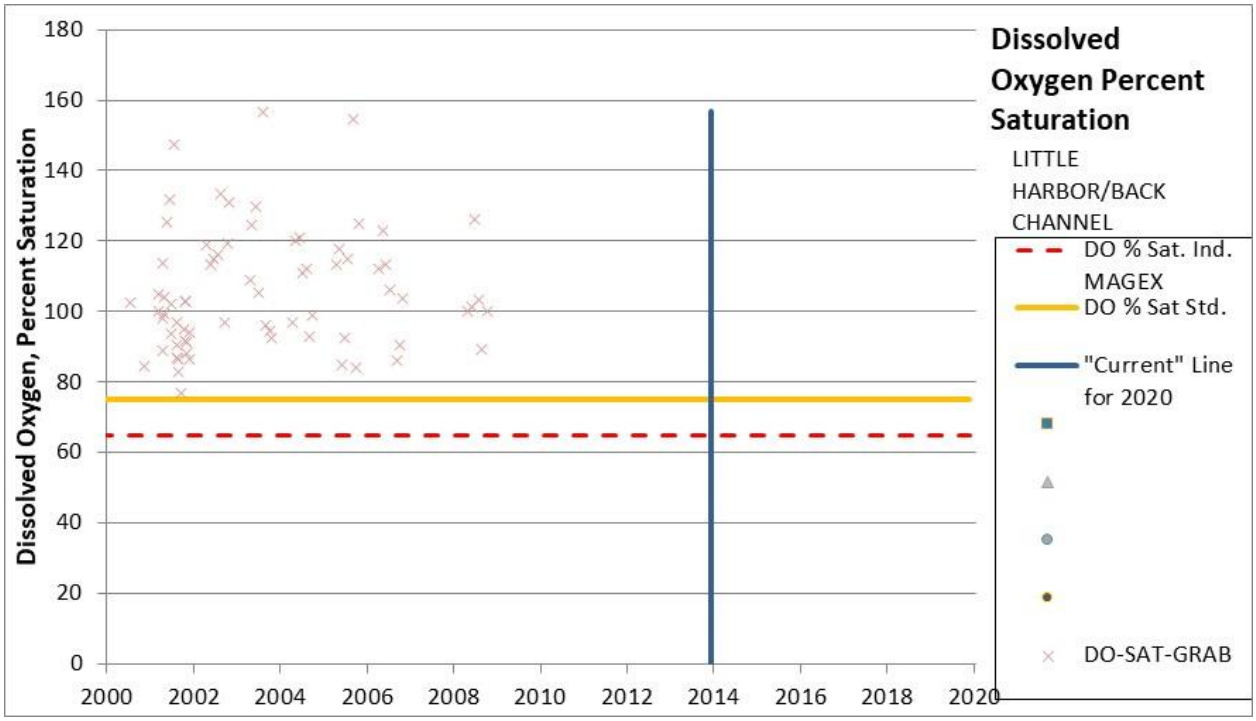
Indicator	Aquatic Life Use Category 2016 / 2020/2022	2020/2022 Comment
Chlorophyll-a	3-ND / 3-PAS	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only a single measurement in the current period. That single measurement was 0.7 ug/L in 2015. The chlorophyll-a indicator threshold to prevent low dissolved oxygen and preserve light for eelgrass is a 90th percentile below 10 µg/L. As such, this assessment zone has been assessed as insufficient information – potentially attaining standards (3-PAS) based on the chlorophyll-a indicator threshold.
Dissolved Oxygen (mg/L)	3-ND / 3-PAS	This assessment zone has a single grab sample measurement collected in 2015 (8.7 mg/L). Routine measurements for dissolved oxygen concentration ended in 2010. As such, this assessment zone has been assessed as insufficient information – potentially attaining standards (3-PAS) for dissolved oxygen concentration.
Dissolved Oxygen (% Saturation)	3-ND / 3-ND	No data has been collected in the current period.
Estuarine Bioassessments (eelgrass)	5-P / 5-M	The historical extent of eelgrass in this assessment zone was 68.8 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2016-2019 is 39.2 acres, which is a decrease of 43.1%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 38.9%. The thresholds for impairment are either a loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	There have been no light measurements collected since 2010. For an eelgrass restoration depth of 3 m, the light attenuation coefficient threshold is 0.5 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 3 m restoration depth a valid target. This assessment zone was listed as impaired (5-M) for water clarity to protect eelgrass habitat on the 2010 303d list. At that time the Light Attenuation Coefficient median was 0.58 m^-1 (n=25). Assessment zones that were impaired in the previous cycle cannot be removed from the 303d list if there are insufficient data to make a new assessment. Therefore, the impaired (5-M) listing from the 2010 through 2016 303d lists has been retained.
Total Nitrogen	3-ND/ 3-PAS	There was one total nitrogen sample collected in 2015 of 225 ug/L and therefore there is insufficient data from which to calculate a median total nitrogen from 2014 through 2019. There is a single grab sample to evaluate dissolved oxygen concentration and chlorophyll-a, and no samples to evaluate percent saturation. The eelgrass beds are just over half their historic extent. There have been no light measurements collected since 2010 to compare to the 3 m restoration depth. No direct sampling efforts have taken place to evaluate the extent of epiphytes and macrophytes however regarding macroalgae, Burdick et al. (Burdick, Mathieson, Peter, & Sydney, 2016) stated, “Monitoring results from 2014 show high levels of cover of nuisance green and red algae (*Ulva* and *Gracilaria*, respectively) at all sites except near the mouth of the Estuary.” The “mouth of the estuary site” is Four Tree Island, approximately 0.5 mile upstream from the Portsmouth Harbor assessment zone. Four Tree Island, approximately 1 mile upstream from the Portsmouth Harbor assessment zone. In the 2019 macroalgae annual report, the appreciable cover at Four Tree Island is dominated by fucoids (brown) and intermittent nuisance seaweeds (reds and greens) but did not show statistical decreases although that site has only been sampled

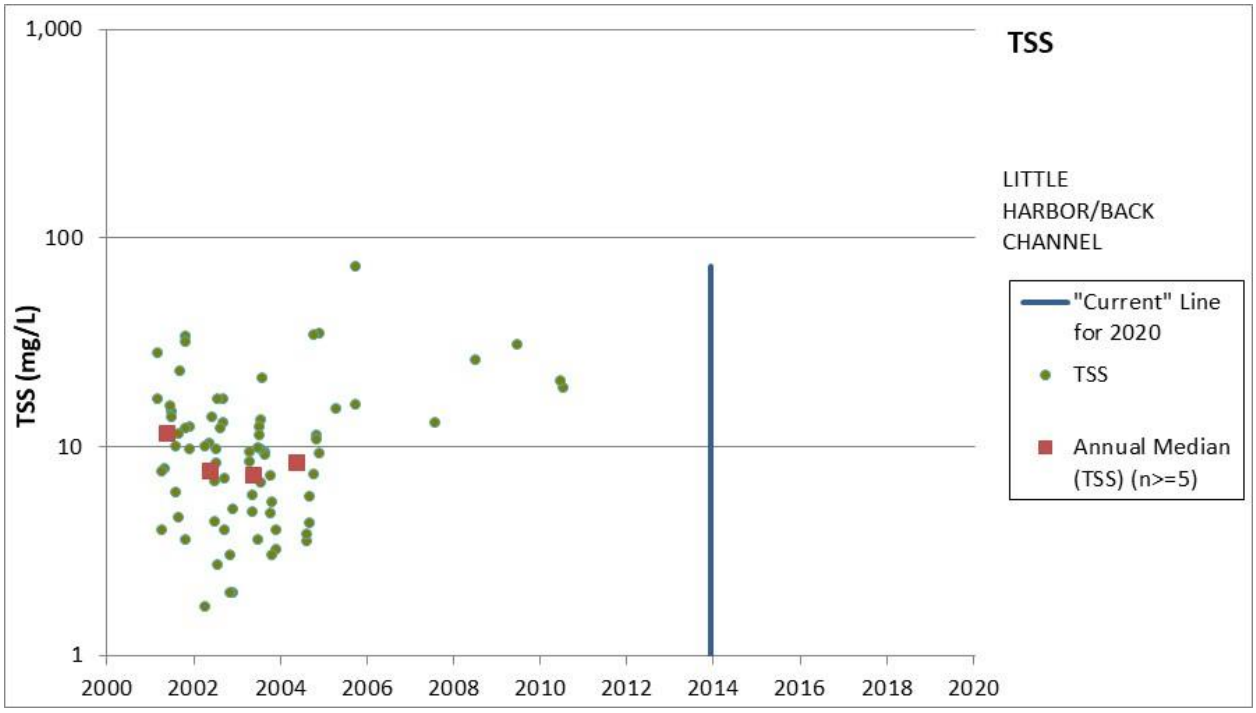
		3-times (2014, 2016, 2019) making trend detection more difficult (Burdick, et al., 2020). This assessment zone is generally characterized by its lack eutrophication indicator data. The limited response dataset does not provide enough evidence to make a full assessment, however the limited indicators of nutrients and nutrient-related impacts do not present evidence suggesting eutrophication in this assessment zone. As such, the assessment zone has been assessed as insufficient information-potential attaining standards for total nitrogen

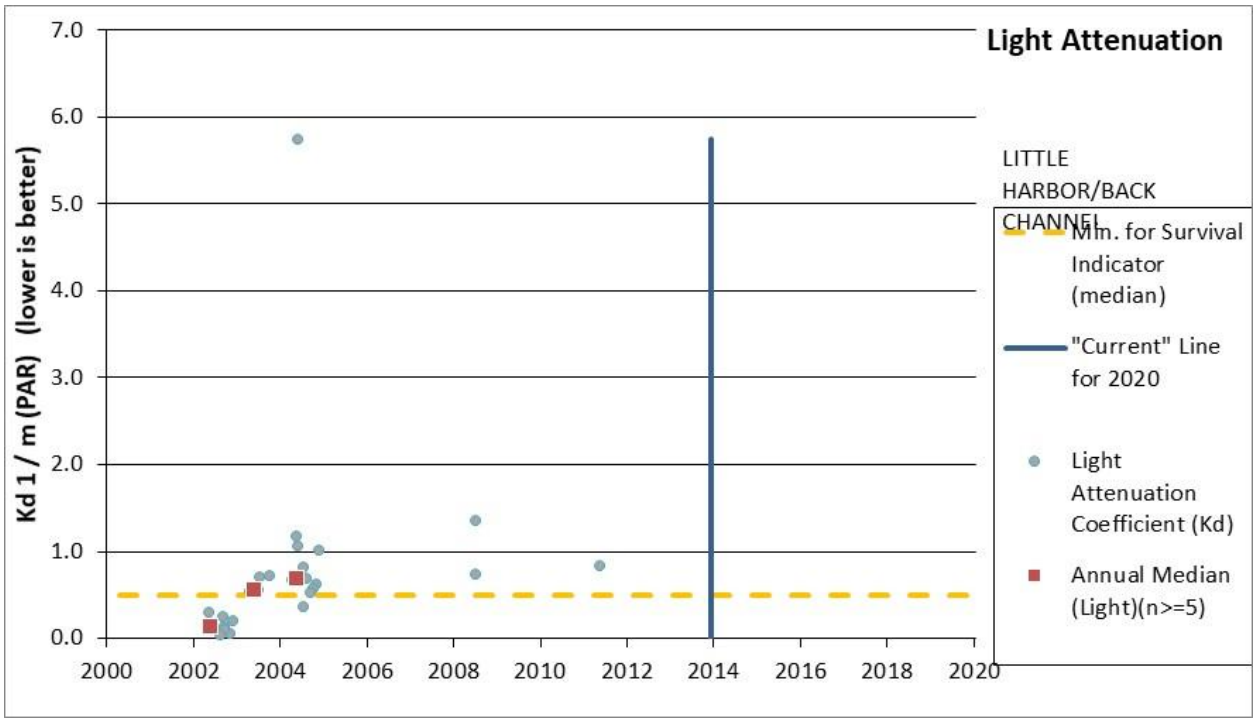


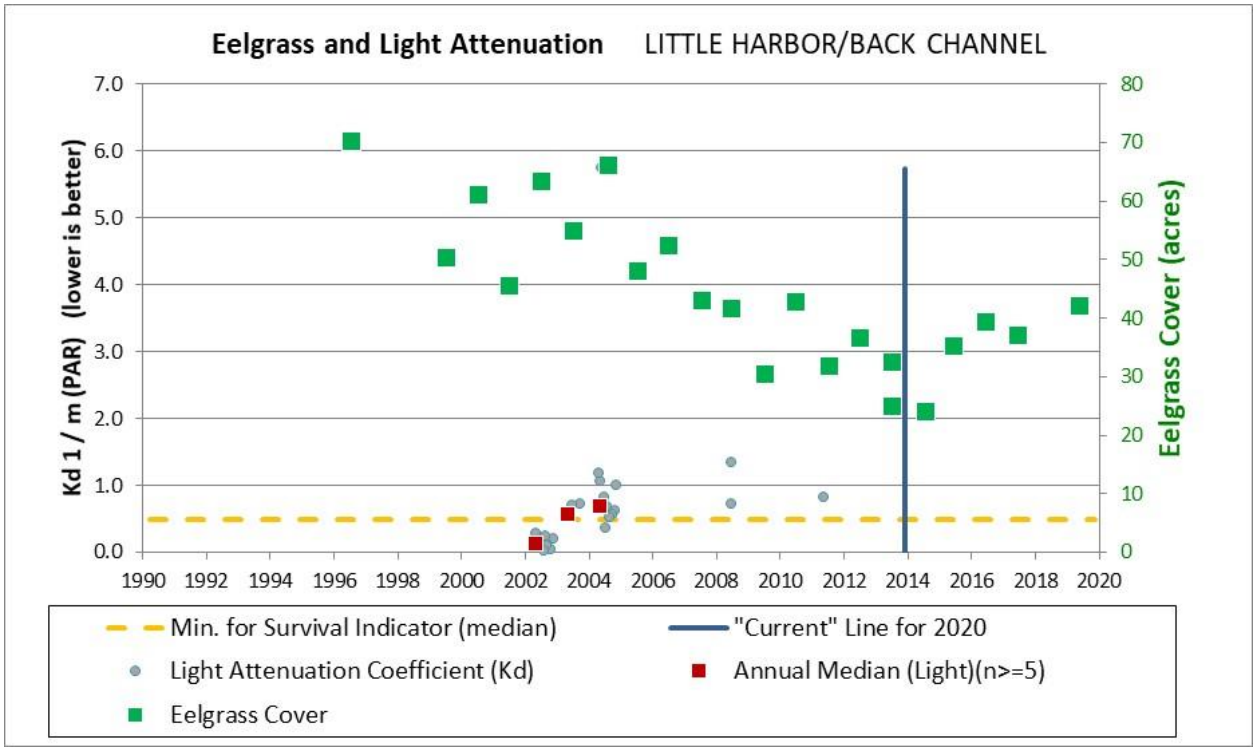


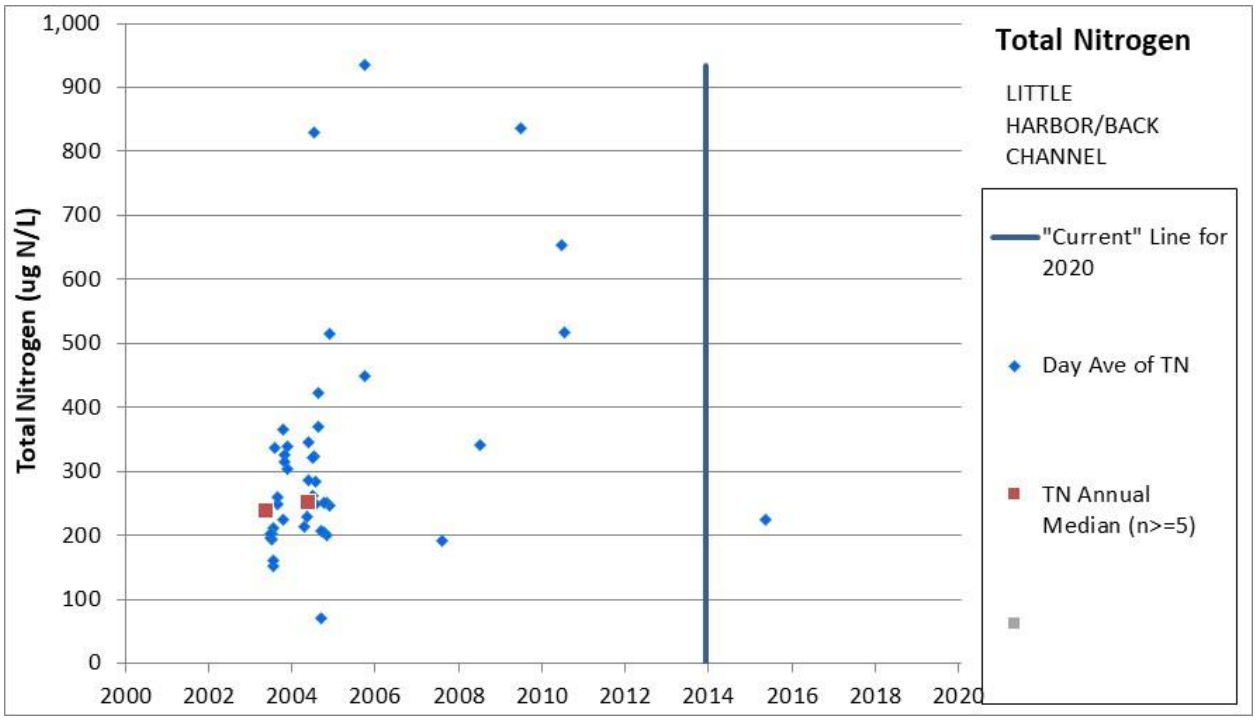

Dissolved Oxygen Concentration
Dissolved Oxygen, mg / L
LITTLE HARBOR/BACK CHANNEL
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2020
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP
0
2
4
6
8
10
12
14
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020


Dissolved Oxygen Percent Saturation
Dissolved Oxygen, Percent Saturation
LITTLE HARBOR/BACK CHANNEL
DO % Sat. Ind. MAGEX
DO % Sat Std.
"Current" Line for 2020
DO-SAT-GRAB
0
20
40
60
80
100
120
140
160
180
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020


TSS
LITTLE HARBOR/BACK CHANNEL
"Current" Line for 2020
TSS
Annual Median (TSS) (n>=5)
TSS (mg/L)
1,000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020


Light Attenuation
LITTLE HARBOR/BACK CHANNEL
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)
Kd 1 / m (PAR) (lower is better)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020


Eelgrass and Light Attenuation
LITTLE HARBOR/BACK CHANNEL
Kd 1 / m (PAR) (lower is better)
Eelgrass Cover (acres)
Min. for Survival Indicator (median)
"Current" Line for 2020
Light Attenuation Coefficient (Kd)
Annual Median (Light)(n>=5)
Eelgrass Cover


Total Nitrogen
LITTLE HARBOR/BACK CHANNEL
Total Nitrogen (ug N/L)
"Current" Line for 2020
Day Ave of TN
TN Annual Median (n>=5)

Little Harbor / Back Channel Assessment Zone (1/1/2014-1/10/2020)	**Date Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN (ug/L)	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN (ug/L)	1	0.7	0.7	-	0.7
CHLOROPHYLL A, Combined (ug/L)	1	0.0	0.7	-	0.7
LIGHT ATTENUATION COEFFICIENT (1/m)	0	-	-	-	-
TURBIDITY (NTU)	0	-	-	-	-
TURBIDITY (datalogger daily median) (NTU)	0	-	-	-	-
TSS (mg/L)	0	-	-	-	-
COLORED DISSOLVED ORGANIC MATTER (CDOM) (1/m)	0	-	-	-	-
DISSOLVED ORGANIC CARBON	0	-	-	-	-
DO-PPM-24HR-MIN-CP (mg/L)	0	-	-	-	-
DO-PPM-24HR-MIN-NCP (mg/L)	0	-	-	-	-
DO-PPM-GRAB-CP (mg/L)	1	8.7	8.7	-	8.7
DO-PPM-GRAB-NCP (mg/L)	0	-	-	-	-
DO-PERC-24H-MEAN-CP (% sat)	0	-	-	-	-
DO-PERC-24H-MEAN-NCP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP (% sat)	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP (% sat)	0	-	-	-	-
DO-PERC-GRAB (% sat)	0	-	-	-	-
Day Ave of TN (ug N/L)	1	225	225	-	225
Day Ave of TDN (ug N/L)	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3) (ug N/L)	1	60	60	-	60
Day Ave of NH3 (ug N/L)	1	38	38	-	38
Day Ave of PON (ug N/L)	0	-	-	-	-
Day Ave of NO2/3 (ug N/L)	1	22	22	-	22
SALINITY-Grabs (pss)	77	15.8	29.8	31.6	32.1
SALINITY-Datalogger Daily Median (pss)	0	-	-	-	-
pH-grab	1	8.0	8.0	-	8.0
pH-24HR (min)	0	-	-	-	-
pH-24HR (max)	0	-	-	-	-
Temperature	77	1.5	9.4	16.7	18.9
Temperature-Daily Median	0	-	-	-	-

*As a statistic on the pH minimum, this is the 10th rather that an 90th percentile.

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