R-WD-12-5

New Hampshire's 2012 Section 305(b)/303(d) List

Technical Support Document

Assessments of Aquatic Life Use Support in the Great Bay Estuary for Chlorophyll-a, Dissolved Oxygen, Water Clarity, Eelgrass Habitat, and Nitrogen

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

THOMAS S. BURACK
COMMISSIONER

HARRY T. STEWART, P.E.
DIRECTOR
WATER DIVISION

PREPARED BY
PHILIP TROWBRIDGE, P.E.
WATERSHED MANAGEMENT BUREAU

April 20, 2012

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 (EPA) 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 is typically called the "303(d) List " which is so named because it is a requirement of Section 303(d) of the CWA. The 303(d) List 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 and
3. require 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 (DES) assesses all available data for lakes, rivers, and estuaries 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 fishing (i.e., Aquatic Life). The full list of designated uses considered by DES are:

- Aquatic Life: Waters that provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms.
- Fish Consumption: Waters that support fish free from contamination at levels that 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
- Drinking Water Supply After Adequate Treatment: Waters that with adequate treatment will be suitable for human intake and meet state/federal drinking water regulations.
- 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: Waters that support recreational uses that involve minor contact with the water.
- Wildlife: Waters that provide suitable physical and chemical conditions in the water and the riparian corridor to support wildlife as well as aquatic life.

Eutrophication from excess nutrients is a critical issue affecting the Aquatic Life designated use in the Great Bay Estuary. The Great Bay Estuary is a national treasure and a valuable resource

to New Hampshire. It is one of 28 "estuaries of national significance" designated by EPA under Section 320 of the CWA. The 2009 State of the Estuaries Report for the estuary (PREP, 2009) showed that the Great Bay Estuary has all the classic signs of eutrophication: increasing nitrogen concentrations, low dissolved oxygen, and disappearing eelgrass habitat. These symptoms of eutrophication impair the Aquatic Life designated use which is 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.

In response to these trends, DES developed numeric nutrient thresholds for the Great Bay Estuary as numeric translators of the narrative standard to determine compliance with Env-Wq 1703.14 (DES, 2009). Translators are a common tool employed by state environmental agencies as a method to interpret existing narrative water quality standards so that they can be applied to specific waters. Numeric translators were developed for chlorophyll-a, light attenuation (a general measure of water clarity), total nitrogen, and eelgrass cover. Chlorophyll-a was chosen because it is an accepted indicator of algae blooms and primary productivity. Light attenuation was selected because it is a good indicator of the presence or absence of eelgrass especially in the deeper areas of the estuary. Even in shallow areas, light attenuation is still an important contributing factor for eelgrass viability because sufficient light is a requirement for plant survival in all areas. Total nitrogen was used because it is a stable indicator of excess nutrients, as opposed to the more reactive form of dissolved inorganic nitrogen, which is rapidly removed from the water by algae and plants. Finally, the area of estuary that is covered by eelgrass habitat was used because it is a direct measurement of the health of this keystone species. Translators were not needed for dissolved oxygen and dissolved oxygen saturation because the State already has water quality criteria for these parameters (Env-Wq 1703.07).

In 2009, after applying the numeric translators, DES concluded that most of the Great Bay Estuary did not meet surface water quality standards and specifically did not comply with the Env-Wq 1703.14 narrative standard for nutrients. These impairments were added to the 2008 303(d) list on August 14, 2009, approved by EPA on September 30, 2009, and were subsequently retained on the 2010 303(d) list. Reducing nitrogen loads to the estuary to remove these impairments and restore the estuary are priorities for DES and EPA.

The purpose of this report is to update New Hampshire's 305(b)/303(d) assessments of eutrophication impacts on the Aquatic Life designated use in the Great Bay Estuary. The report documents the most recent data and methodologies used for the 2012 assessments. The water

quality parameters included in these assessments are: dissolved oxygen, dissolved oxygen saturation, chlorophyll-a, water clarity, eelgrass habitat, and total nitrogen.

Methods

The assessment methodology has four steps which are described in the following sections.

1. Establish homogeneous assessment zones for different parts of the Great Bay Estuary.
2. Compile and process available data for each assessment zone.
3. Calculate eutrophication indicators and determine impairments.
4. Compare 2012 assessments to 2010 assessments.

1. ASSESSMENT UNITS AND ASSESSMENT ZONES

For 305(b)/303(d) assessments, DES uses 43 assessment units to cover the Great Bay Estuary that are coincident with the shellfish growing areas established by the DES Shellfish Program. Great Bay itself consists of seven different assessment units. In terms of nitrogen and eutrophication parameters it makes sense to evaluate 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, DES aggregated the assessment units in the Great Bay Estuary into 20 assessment zones. The boundaries of each of the aggregated assessment zones are shown in Figure 1. For 305(b)/303(d) reporting, the categories assigned to these larger assessment zones will be assigned to each of the assessment units within the zone (Table 1). 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 DES only apply to the New Hampshire side of the river. The Maine Department of Environmental Protection makes its own impairment determinations for the Maine side of the Salmon Falls/Piscataqua River.

The only major changes to the assessment zone boundaries between the 2010 and 2012 assessment cycles occurred in the Lamprey River and Squamscott River assessment zones. In these tidal rivers, eelgrass has historically only existed in the downstream areas near the mouth where the river discharges to Great Bay. DES split these assessment zones into two pieces each to clarify that the restoration goal for eelgrass only applies in the areas where eelgrass has historically existed near the Bay (DES, 2011). The restoration goal for the new upstream zones will be to prevent low dissolved oxygen. In the new assessment zones near the Bay, the restoration goal will be to prevent low dissolved oxygen and to restore eelgrass habitat.

2. DATA PROCESSING METHODS

For each assessment zone, data for dissolved oxygen, total nitrogen, chlorophyll-a, and water clarity were combined to calculate summary statistics or violation frequencies. The base dataset for the 2012 assessments included all the measurements collected on or after 1/1/2006 that were incorporated in the DES Environmental Monitoring Database by 12/18/2011. The data were pulled from the database with an automated query. Some of the conditions on the query were:

a. Results marked as invalid were excluded.
b. Results marked as below detection were assigned a value of one-half the method detection limit. [Note: For the 2010 305(b)/303(d) eutrophication assessments of the Great Bay Estuary, DES assigned these non-detect samples a value equal to the method detection limit. Treatment of these non-detect samples was changed for 2012 to have consistency between eutrophication assessment methods and other DES assessments methods. The effect of this change is expected to be negligible.]
c. Quality assurance samples, including field duplicate samples, were excluded. [Note: For the 2010 305(b)/303(d) eutrophication assessments of the Great Bay Estuary, DES averaged field duplicate quality assurance results with the corresponding routine sample. Treatment of these field duplicate samples was changed for 2012 to have consistency between eutrophication assessment methods and other DES assessments methods. The effect of this change is expected to be negligible.]

The remaining data in the bulk query were checked for consistency, duplication, and anomalous values. Lookup queries were used to assign each measurement to an assessment zone. The following additions and subtractions to the datasets used for assessments were made for the reasons provided below:

a. From September 12 to September 26, 2011, EPA deployed two datasondes to measure dissolved oxygen in the Squamscott River South assessment unit. In January 2012, These data were quality assured by the EPA New England Regional Laboratory and the dissolved oxygen measurements from this deployment were determined to be of sufficient quality for water quality assessment purposes (EPA, 2012). DES incorporated these data into the assessment of the Squamscott River South assessment zone.
b. Chlorophyll-a data collected using an autosampler in the Lamprey River North assessment zone were excluded from assessments. The autosampler was deployed by the University of New Hampshire. The autosampler can entrain small bits of moss, macroalgae, and other organic matter into the sample because the autosampler intake is near the bottom. The entrained material can cause chlorophyll-a concentrations in the autosampler to not be representative of phytoplankton populations in the water column. Therefore, these data were invalidated and excluded from the analysis.

Dissolved oxygen data were processed and analyzed according to the methods listed in the Consolidated Assessment and Listing Methodology ("the CALM", DES, 2012). For assessment zones in which a datasonde had been deployed, the dissolved oxygen assessments were preferentially based on datasonde measurements. Datasondes, which record dissolved oxygen near-continuously, are a better source for representative data than grab samples.

For total nitrogen, chlorophyll-a, and water clarity, if there were multiple samples taken at the station on the same date (e.g., from different depths or at different times), a single independent result was calculated from the maximum value for each unique combination of station and date. Summary statistics for chlorophyll-a, water clarity, and total nitrogen in each assessment unit

were calculated using this list of independent samples. If total nitrogen concentrations were not measured directly, total nitrogen was calculated from the sum of total dissolved nitrogen and particulate nitrogen or the sum of total Kjeldahl nitrogen and nitrate+nitrite.

3. INDICATORS FOR EUTROPHICATION ASSESSMENTS

Six quantitative indicators were used to determine compliance with the water quality standards for nutrients (Env-Wq 1703.14) and biological and aquatic community integrity (Env-Wq 1703.19) using a stressor-response decision matrix:

- Dissolved oxygen (daily minimum in mg/L)
- Dissolved oxygen saturation (daily average in %sat)
- Chlorophyll-a (90th percentile in ug/L)
- Eelgrass estuarine bioassessments (area of mapped eelgrass habitat in acres)
- Water clarity (median light attenuation coefficient in m^{-1})
- Total nitrogen (median in mg/L)

Detailed methods for calculating and making assessment using these indicators are provided in Appendix A and the CALM (DES, 2012).

The indicators and the methods used in the 2012 assessments did not change from the 2010 assessments except for:

- DES employed additional quality-assurance checks on the GIS datalayers for eelgrass. The quality assurance checks discovered that eelgrass cover in the Great Bay in 2010 was 185 acres lower than had been originally reported by UNH. The polygons outlining two eelgrass beds had been duplicated and were being counted twice. This error was corrected before the data were used for assessments. DES ran the same quality assurance checks on the eelgrass datalayers for all other years (1981-2009) and small corrections were made to some datalayers. For the 2012 305(b)/303(d) assessments, calculations of the eelgrass estuarine bioassessment indicator were made using the corrected eelgrass cover totals. The quality assurance methods and corrections are explained in detail in Appendix B.
- Information about eelgrass biomass was considered as supplemental information for assessments of areas with significant eelgrass cover. The indicator of eelgrass cover does not measure the thinning of beds, which is also a loss of habitat and ecosystem services. Biomass is calculated by multiplying the eelgrass area by the eelgrass density following the methods established by the Piscataqua Region Estuaries Partnership (PREP, 2008). Eelgrass biomass was not treated as a stand-alone indicator because the error in the biomass estimates is larger than for the eelgrass cover indicator and the magnitude of this error has not yet been quantified (DES, 2008). In addition, DES considered published reports about eelgrass impacts due to the proliferation of macroalgae as supplemental information for eelgrass assessments.

The values of the various indicators were combined using a stressor-response matrix for a unified assessment of compliance with the water quality standard for nutrients (Env-Wq 1703.14). For the unified assessment, dissolved oxygen, dissolved oxygen saturation, chlorophyll-a, eelgrass assessments, and water clarity were considered response indicators. The nutrient stressor indicator was the median total nitrogen concentration because nitrogen is the limiting nutrient in

the Great Bay Estuary (DES, 2009). The decision matrix in Table 2 illustrates how information from the stressor and response indicators were integrated in all cases. Following the decision matrix, a nitrogen impairment would be assigned to the 2012 303(d) list only if both the response and stressor indicators exceeded thresholds. However, if there were radically conflicting results between indicators, a weight-of-evidence approach, considering the quality of the underlying data for each indicator, was used to make impairment determination and a narrative justification was provided.

4. ASSESSMENT CYCLE RECONCILIATION

Impairments cannot be removed from the 303(d) list unless there are sufficient data to show that the water quality standards have been attained. A justification for an impairment delisting must be based on the minimum number of samples needed for an indicator collected under critical conditions and/or conditions under which the impairment was observed. The new data must show no violations of the water quality standard because a delisting cannot be justified while there are documented violations of the standard. Justifications also typically include a discussion on what management actions have been taken to cause the change in conditions in the water body.

Data from the past five years are reviewed for 305(b)/303(d) assessments. Monitoring in the Great Bay Estuary has been less intense in the last five years than during 2000-2006 when federal funding from the National Coastal Assessment was available., Therefore, in many assessment zones, there were less data for the 2012 assessments than were available for the 2010 assessments. Many assessment zones did not have enough data to calculate the indicators for the 2012 assessments. For these assessment zones, impairments for eutrophication indicators from the 2010 assessments were retained on the 2012 303(d) list. DES performed a cross check of the 2010 and 2012 assessment categories to ensure identification of all retained impairments and any new impairments so that they could be carefully reviewed for quality assurance.

The cross checks between the 2010 and 2012 303(d) lists were complicated in the Lamprey and Squamscott Rivers where the assessment units were split for the 2012 assessments. These assessment units were split to clarify that the restoration goal for eelgrass only applied in the areas where eelgrass has historically existed near Great Bay. Therefore, impairments for eelgrass bioassessments from the parent assessment units were only carried forward to the child assessment units where eelgrass has existed. The rest of the impairments from the parent assessment units were carried forward to both of the child assessment units unless there were sufficient data for a new assessment in the child assessment unit.

Results

1. SUMMARY TABLES

The results of the 2012 eutrophication assessments for the Great Bay Estuary have been summarized in several large tables. Over 200 parameter-level assessments were made, too many to discuss individually. Therefore, detailed tables were created with data summaries and justifications. Key findings from the assessments are discussed in the next section.

- Table 3 shows the area of eelgrass habitat in each assessment zone between 1948 and 2010. The assessment category for each area based on the most recent data is also shown on this table.
- Table 4 is made up of 20 sub-tables (Tables 4A through 4T) which summarize the data and 2012 assessment determinations for all eutrophication indicators in each assessment zone.
- Table 5 shows the comparison between the 2010 and 2012 assessments for each eutrophication indicator.
- Figure 2 shows the assessment zones that were determined to be impaired for nitrogen for the 2012 303(d) list.

2. KEY FINDINGS

1. There were no changes to the areas of the Great Bay Estuary that were impaired for total nitrogen between the 2010 and 2012 303(d) lists. The assessment zones that were impaired for nitrogen on the 2010 303(d) list are also impaired on the 2012 303(d) list. No nitrogen impairments were added or removed. Figure 2 shows the extent of nitrogen impairments in the Great Bay Estuary, which includes Portsmouth Harbor, Little Harbor/Back Channel, and all areas upstream from Dover Point except for the Winnicut River. These nitrogen impairments are generally based on response indicator impairments for dissolved oxygen and chlorophyll-a in the tidal rivers and eelgrass habitat loss and poor water clarity in the deeper bays and harbors.

2. Eelgrass habitat has continued to decline in the Great Bay Estuary. In the Great Bay itself, both eelgrass cover and eelgrass biomass are in decline (Figure 3). The current (2010) extent of eelgrass cover in Great Bay is 1,722.2 acres and the median extent in 2008-2010 was 1,700.6 acres, which is a -20.2% change from its historical extent of 2,130.7 acres. There has been a steeper trend (-54%) in eelgrass biomass loss because of thinning of the eelgrass beds. Significant eelgrass loss was evident in all areas where eelgrass has been mapped (Table 3). The median total nitrogen in the assessment zones with significant eelgrass loss ranged from 0.31 to 0.71 mg/L.

3. Many impairments for eutrophication parameters on the 2012 303(d) list were retained from the 2010 list because there were insufficient data to make a new assessment. For example, the nitrogen impairments for the Squamscott River South, Lamprey River South, Bellamy River, Cocheco River, and Little Harbor/Back Channel were retained from the 2010

303(d) list. Insufficient new data were available to re-evaluate these impairments. Impairments from a previous 303(d) list cannot be removed unless there are sufficient data for a new assessment.

4. As a result of assessment methodology changes and review of new data, DES is removing the following impairments from the 2010 303(d) list.

- Eelgrass Estuarine Bioassessments and Light Attenuation Coefficient in the Squamscott River South and Lamprey River North Assessment Zones: In the tidal portions of the Squamscott and Lamprey Rivers, eelgrass has historically existed only in the downstream areas near the mouth where the river discharges to Great Bay. For the 2012 assessments, DES split these assessment zones into two pieces each to clarify that the restoration goal for eelgrass only applied in the areas where eelgrass has historically existed near the Bay (DES, 2011). The restoration goal for the new upstream areas (Squamscott River South and Lamprey River North) is to prevent low dissolved oxygen. Since the eelgrass estuarine bioassessment and light attenuation coefficient indicators are no longer applicable to these assessment zones, the categories for these parameters were changed from 5-P to No Standard as shown in the table below. These changes are not a formal delisting because they are due to a re-segmentation of the assessment units and the 2010 303(d) list impairments from the parent assessment units were retained on one of the child assessment units.

Assessment Zone	Assessment Unit ID	Impairment Name	2010 Category	2012 Category
SQUAMSCOTT RIVER SOUTH	NHEST600030806-01-01	Estuarine Bioassessments	5-P	No Stnd
		Light Attenuation Coefficient	5-P	No Stnd
LAMPREY RIVER NORTH	NHEST600030709-01-01	Estuarine Bioassessments	5-P	No Stnd
		Light Attenuation Coefficient	5-P	No Stnd

- Dissolved Oxygen and Dissolved Oxygen Saturation in the Lamprey River South Assessment Zone: The Lamprey River South assessment unit was created for the 2012 cycle by splitting the parent Lamprey River assessment unit (NHEST600030709-01). The parent assessment unit was listed as impaired for dissolved oxygen and dissolved oxygen saturation on the 2010 303(d) list. The impairments in the parent assessment unit were based on datasonde measurements in the other child assessment unit (Lamprey River North, NHEST600030709-01-01). Once these datasonde measurements were assigned to the other child assessment unit, there were 29 and 21 independent measurements of dissolved oxygen and dissolved oxygen saturation, respectively, in the Lamprey River South assessment unit. The data were sufficient for a new assessment and no violations of the water quality standards were detected. Therefore, the categories for dissolved oxygen and dissolved oxygen saturation in the Lamprey River South assessment unit

should be changed as shown in the following table. These changes are not a formal delisting because they are due to a re-segmentation of the assessment units and the 2010 303(d) list impairments from the parent assessment unit were retained on the other child assessment unit (Lamprey River North, NHEST600030709-01-01).

Assessment Zone	Assessment Unit ID	Impairment Name	2010 Category	2012 Category
LAMPREY RIVER SOUTH	NHEST600030709-01-02	Dissolved oxygen saturation	5-M	2-G
		Oxygen, Dissolved	5-P	2-G

5. Based on new information provided by the Great Bay Municipal Coalition, DES is retaining the dissolved oxygen impairment for the Squamscott River South assessment unit. The Squamscott River South assessment unit was created for the 2012 cycle by splitting the parent Squamscott River assessment unit (NHEST600030806-01). The parent assessment unit was listed as impaired for dissolved oxygen on the 2010 303(d) list. The impairments in the parent assessment unit were based on datasonde measurements in the other child assessment unit (Squamscott River North, NHEST600030806-01-02). Once these datasonde measurements were assigned to the other child assessment unit, there were 42 independent measurements of dissolved oxygen in the Squamscott River South assessment unit. The data were sufficient for a new assessment and no violations of the water quality standards were detected. However, a March 2012 report by HydroQual, consultants for the Great Bay Municipal Coalition, appears to document numerous violations of the dissolved oxygen standard in this assessment unit (HydroQual, 2012). The report documents water quality sampling, including datasonde deployments, conducted by HydroQual in the Squamscott River in August and September 2011. Most of the sampling stations were in the Squamscott River South assessment unit. Text and figures in the report show several instances of dissolved oxygen concentrations falling below the criterion of 5 mg/L. On page 13 of the report, HydroQual states: "The results of these field studies indicate that dissolved oxygen levels in the Squamscott River periodically fall below the instantaneous DO criterion of 5.0 mg/L." Based on this report, DES is retaining the impairment for dissolved oxygen for this assessment unit. Removing impairments cannot be justified while there are still documented violations of the water quality criteria. The actual data from the report could not be analyzed for assessments because the report was missing information on quality assurance and other metadata.

6. The nitrogen impairment determinations for the Cocheco River and the Lamprey River North were complicated by conflicting indicators and/or inadequate data. The data for these assessment zones are summarized in Tables 4C and 4E, respectively. Based on the weight of evidence, DES retained the nitrogen impairments from the 2010 303(d) list for these assessment zones as explained below.

- <u>Nitrogen and Dissolved Oxygen in the Cocheco River Assessment Zone</u>: For this assessment unit, the total nitrogen and chlorophyll-a thresholds for the prevention of low dissolved oxygen (0.45 mg/L median total nitrogen and 10 ug/L 90th percentile chlorophyll-a) are the applicable thresholds for the stressor-response matrix assessment. This assessment unit was listed as impaired for nitrogen on the 2010 303(d) list because of high nitrogen concentrations (TN median = 0.763 mg/L, n=21) and exceedences of the

chlorophyll-a threshold (90th percentile = 11.9 ug/L, n=32). For the 2012 assessment cycle, there were insufficient nitrogen data for a new assessment but the available data continued to show high nitrogen (TN median = 0.99 mg/L, n=3) and high chlorophyll-a concentrations (90th percentile = 62 ug/L, n=5). The nitrogen impairment from the 2010 303(d) list will be retained because: (1) Assessment units that were impaired in the previous cycle cannot be removed from the 303(d) list if there are insufficient data to make a new assessment; and (2) The limited data available continue to indicate high nitrogen and high chlorophyll-a concentrations in this assessment unit. It should be noted that the Cocheco River has also been classified as impaired for nitrogen under the Primary Contact Recreation designated use due to high chlorophyll-a concentrations. Similar to the 2010 assessment, grab sample data for dissolved oxygen reviewed for the 2012 cycle did not fall below standards, but these results were not considered representative of dissolved oxygen in the assessment unit. Half of the grab samples were collected at station (GBCW-17), which is just downstream of the rapids in downtown Dover where the water is almost fresh, fast-moving, and well aerated. Only one sample was collected in an area of slower water movement near the mouth of the river and this sample had dissolved oxygen levels less than 6 mg/L and <70% saturation. No high-frequency datasonde measurements were available. Therefore, the dissolved oxygen measurements in this assessment unit are not likely to be representative of conditions in slower-moving areas where dissolved oxygen exceedences would occur. High frequency datasonde measurements of dissolved oxygen, which provide more accurate and representative data, are needed to characterize conditions in slower-moving sections of the Cocheco River. In the meantime, dissolved oxygen and dissolved oxygen saturation will be categorized as "insufficient information".

- Nitrogen in the Lamprey River North Assessment Zone: For this assessment unit, the total nitrogen threshold for the prevention of low dissolved oxygen (0.45 mg/L total nitrogen) is the applicable nutrient stressor threshold for stressor-response matrix assessments. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01) into two pieces. On the 2010 303(d) list, total nitrogen was listed as impaired for the parent assessment unit. The median total nitrogen concentration in this assessment unit changed slightly from 0.451 to 0.444 mg/L between the 2010 and 2012 assessment cycles, respectively. This change is insignificant because it is within the analytical accuracy of the nitrogen measurements. And, more importantly, the most recent data show that there are still dissolved oxygen and chlorophyll-a impairments in this assessment unit and there have been no changes in nutrient loads. Therefore, delisting the nitrogen impairment from the 2010 303(d) list cannot be justified and the impairment should be retained on the 2012 303(d) list.

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Table 1: Assessment units in each assessment zone of the Great Bay Estuary

Assessment Zone	Water Body Name	Assessment Unit ID
BELLAMY RIVER	BELLAMY RIVER NORTH	NHEST600030903-01-01
BELLAMY RIVER	BELLAMY RIVER SOUTH CLEMENT POINT	NHEST600030903-01-03
BELLAMY RIVER	BELLAMY RIVER SOUTH	NHEST600030903-01-04
BERRYS BROOK	WITCH CREEK	NHEST600031002-01-01
BERRYS BROOK	BERRYS BROOK	NHEST600031002-01-02
COCHECO RIVER	COCHECO RIVER	NHEST600030608-01
GREAT BAY	GREAT BAY PROHIB SZ1	NHEST600030904-02
GREAT BAY	GREAT BAY PROHIB SZ2	NHEST600030904-03
GREAT BAY	CROMMET CREEK	NHEST600030904-04-02
GREAT BAY	PICKERING BROOK	NHEST600030904-04-03
GREAT BAY	FABYAN POINT	NHEST600030904-04-04
GREAT BAY	GREAT BAY - COND APPR	NHEST600030904-04-05
GREAT BAY	ADAMS POINT SOUTH - COND APP	NHEST600030904-04-06
LAMPREY RIVER NORTH	LAMPREY RIVER NORTH	NHEST600030709-01-01
LAMPREY RIVER SOUTH	LAMPREY RIVER SOUTH	NHEST600030709-01-02
LITTLE BAY	ADAMS POINT MOORING FIELD SZ	NHEST600030904-06-10
LITTLE BAY	ADAMS POINT TRIB	NHEST600030904-06-11
LITTLE BAY	U LITTLE BAY (SOUTH)	NHEST600030904-06-12
LITTLE BAY	LOWER LITTLE BAY MARINA SZ	NHEST600030904-06-14
LITTLE BAY	LOWER LITTLE BAY GENERAL SULLIVAN BRIDGE	NHEST600030904-06-15
LITTLE BAY	LOWER LITTLE BAY	NHEST600030904-06-18
LITTLE BAY	UPPER LITTLE BAY	NHEST600030904-06-19
LITTLE HARBOR/BACK CHANNEL	BACK CHANNEL	NHEST600031001-05
LITTLE HARBOR/BACK CHANNEL	WENTWORTH-BY-THE-SEA	NHEST600031001-08
LITTLE HARBOR/BACK CHANNEL	LITTLE HARBOR	NHEST600031002-02
LOWER PISCATAQUA RIVER - NORTH	LOWER PISCATAQUA RIVER - NORTH	NHEST600031001-02-01
LOWER PISCATAQUA RIVER - SOUTH	LOWER PISCATAQUA RIVER - SOUTH	NHEST600031001-02-02
NORTH MILL POND	NORTH MILL POND	NHEST600031001-10
OYSTER RIVER	OYSTER RIVER (JOHNSON CR)	NHEST600030902-01-01
OYSTER RIVER	OYSTER RIVER (BUNKER CR)	NHEST600030902-01-02
OYSTER RIVER	OYSTER RIVER	NHEST600030902-01-03
OYSTER RIVER	OYSTER RIVER MOUTH	NHEST600030904-06-17
PORTSMOUTH HARBOR	UPPER PORTSMOUTH HARBOR-NH	NHEST600031001-11
SAGAMORE CREEK	UPPER SAGAMORE CREEK	NHEST600031001-03
SAGAMORE CREEK	LOWER SAGAMORE CREEK	NHEST600031001-04
SALMON FALLS RIVER	SALMON FALLS RIVER	NHEST600030406-01
SOUTH MILL POND	SOUTH MILL POND	NHEST600031001-09
SQUAMSCOTT RIVER NORTH	SQUAMSCOTT RIVER NORTH	NHEST600030806-01-02
SQUAMSCOTT RIVER SOUTH	SQUAMSCOTT RIVER SOUTH	NHEST600030806-01-01
UPPER PISCATAQUA RIVER	UPPER PISCATAQUA RIVER-NH-NORTH	NHEST600031001-01-01
UPPER PISCATAQUA RIVER	DOVER WWTF SZ-NH	NHEST600031001-01-02
UPPER PISCATAQUA RIVER	UPPER PISCATAQUA RIVER-NH-SOUTH	NHEST600031001-01-03
WINNICUT RIVER	WINNICUT RIVER	NHEST600030904-01

Table 2: Decision matrix to assign a category for nitrogen for estuarine assessment units using the results from both response and nitrogen indicators

		Nutrient Indicator		
		Category 5 (Not Supporting)	Category 2 (Fully Supporting)	Category 3 (Insufficient Information)
Response Indicator	Category 5 (Not Supporting)	Category 5	Category 3-PNS	Category 3-PNS
	Category 2 (Fully Supporting)	Category 3-PNS	Category 2	Category 3 (See Note 2)
	Category 3 (Insufficient Information)	If Response Indicator is 3-PNS, then Category 5. If Response Indicator is 3-PAS or 3-ND, then Category 3-PNS. See Note 4	If Response Indicator is 3-PAS, then Category 2. If Response Indicator is 3-PNS or 3-ND, then Category 3-PAS. See Note 4	

	3-ND	3-PAS	3-PNS
3-ND	3-ND	3-PAS	3-PNS
3-PAS	3-ND	3-PAS	Note 4
3-PNS	3-ND	Note 4	3-PNS

Note 1: If the conditions warrant, DES reserves the right to deviate from this matrix.
Note 2: The category for the nutrient will be 3-PAS, 3-PNS, or 3-ND based on the assessment of the nutrient indicator.
Note 3: Full descriptions of the insufficient information categories are provided in Section 3.1.5 of DES (2012). 3-PAS = "Insufficient Information- Potentially Attaining Standards", 3-PNS = "Insufficient Information- Potentially Not Attaining Standards", or 3-ND = "No Data".
Note 4: If there are incomplete data for the response indicator which are consistent with the category for the nutrient indicator, then the category for the nutrient indicator will be used. If the incomplete data for the response indicator are inconsistent with the nutrient indicator or if there are no data for the response indicator, the category for the nutrient will be 3-PNS or 3-PAS as shown in the matrix.
Note 5: In the case where there are incomplete or missing data for both the nutrient and the response indicators, the sub-table in the lower right corner will be used. The category for the nutrient indicator will be used for the nutrient category except for the two cases marked by Note 4. For these cases, where the available data for the response indicator and nutrient indicator conflict, the category for the higher quality dataset will be used. If data quality is the same for the two indicators, then the category for the nutrient indicator will be used.
Note 6 : For the cases where the available data for the response indicator and nutrient indicator conflict, the category for the higher quality dataset will be used. If data quality is the same for the two indicators, then the category for the nutrient indicator will be used.

Table 3: Eelgrass cover in different zones of the Great Bay Estuary (acres)

Year	Winnicut River	Squamscott River (N)	Lamprey River (S)	Oyster River	Bellamy River	Great Bay	Little Bay	Upper Piscataqua River*	Lower Piscataqua River (N)*	Lower Piscataqua River (S)*	Portsmouth Harbor*	Little Harbor	Sagamore Creek
1948	0.0	42.1	53.4	182.5	66.9	263.9	76.5	62.0	a	a	a	a	a
1962	a	a	a	a	a	a	a	17.7	20.0	21.8	a	a	a
1980-1981	a	a	a	a	36.0	1217.4	408.7	42.2	75.9	10.7	a	a	a
1981	0.0	0.0	0.0	a	3.4	2130.7	252.0	0.5	60.1	5.1	227.7	68.8	4.1
1986	2.2	0.0	0.0	a	a	2015.2	a	a	a	a	a	a	a
1987	2.2	0.0	0.0	a	a	1685.7	a	a	a	a	a	a	a
1988	0.0	0.0	0.0	a	a	1187.5	a	a	a	a	a	a	a
1989	0.0	0.0	0.0	a	a	312.6	a	a	a	a	a	a	a
1990	15.9	0.0	0.0	a	a	2024.2	a	a	a	a	a	a	a
1991	23.4	0.0	0.0	a	a	2255.8	a	a	a	a	a	a	a
1992	7.3	0.0	0.0	a	a	2334.4	a	a	a	a	a	a	a
1993	6.9	0.0	0.0	a	a	2444.9	a	a	a	a	a	a	a
1994	13.8	0.0	0.0	a	a	2434.3	a	a	a	a	a	a	a
1995	7.8	0.0	0.0	a	a	2224.9	a	a	a	a	a	a	a
1996	7.6	0.0	0.0	14.0	0.0	2495.4	32.7	1.6	20.9	10.2	245.6	70.1	1.8
1997	7.5	0.0	0.0	a	a	2297.8	a	a	a	a	a	a	a
1998	10.0	0.0	0.0	a	a	2387.8	a	a	a	a	a	a	a
1999	10.2	0.0	0.0	0.0	0.0	2119.5	26.2	0.5	7.4	4.0	244.0	50.1	3.0
2000	0.0	0.0	0.0	0.0	0.0	1944.5	7.5	1.6	3.8	7.6	260.5	60.9	0.9
2001	4.1	0.0	0.0	0.0	0.0	2388.2	10.9	2.0	9.7	10.7	274.2	45.3	2.2
2002	3.5	0.0	0.0	0.0	0.0	1791.8	4.3	0.5	8.0	9.3	268.9	63.1	2.3
2003	3.5	0.0	2.2	0.0	0.0	1620.9	14.2	2.9	22.9	9.2	270.1	54.7	2.2
2004	4.2	0.0	0.0	0.0	0.8	2037.6	12.8	0.7	13.5	6.5	225.2	65.8	2.5
2005	9.1	0.0	0.0	0.0	0.0	2165.7	25.8	0.4	14.5	9.6	232.5	47.9	6.1
2006	0.8	0.0	0.0	0.0	0.0	1319.8	12.2	0.8	10.8	11.6	217.6	52.1	0.9
2007	0.0	0.0	0.0	0.0	0.0	1245.3	0.1	0.0	0.4	5.6	201.3	42.7	0.6
2008	0.0	0.0	0.0	0.0	0.0	1394.9	0.0	0.0	0.0	3.9	183.8	41.4	2.3
2009	0.1	0.0	0.0	0.0	0.0	1700.6	0.0	0.0	0.0	6.4	155.0	30.2	0.5
2010	0.0	0.0	0.0	0.0	0.0	1722.2	0.3	0.0	0.0	3.5	128.0	42.5	0.2
2008-2010 median	0.0	0.0	0.0	0.0	0.0	1700.6	0.0	0.0	0.0	3.9	155.0	41.4	0.5
Percent Change: Historic to '08-'10	NA	-100.0%	-100.0%	-100.0%	-100.0%	-20.2%	-100.0%	-100.0%	-100.0%	-87.9%	-31.9%	-39.8%	-88.3%
Significant Decrease Since 1990	-70.9%	NA	NA	NA	NA	-15.2%	-48.8%	-41.9%	-29.5%	No trend	-16.2%	-19.2%	No trend
Listing	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired

a = not mapped NA = not analyzed * The 1948 and 1980-1981 surveys only covered the NH side of the river. The 1962 survey only covered the ME side.

* The acreages for 1996-2008 include beds from both the NH and ME sides of the river but not the tidal creeks along the Maine shore.

Eelgrass has not been mapped in North Mill Pond, South Mill Pond, Berrys Brook, Salmon Falls River, and Cocheco River. These assessment zones were left off this table.

Table 4: Summary of data and assessment categories for eutrophication parameters in each assessment zone of the Great Bay Estuary

Assessment Categories

The basic categories for the 305b/303d assessment include Category 2 (Fully Supporting), Category 5 (Not Supporting), and Category 3 (Insufficient Information). The 303d List is comprised of all the waters in Category 5. DES has added sub-categories to provide more information on how good or bad the water quality is in Category 2 and Category 5 water bodies, respectively. Category 3 has also been divided to distinguish between water bodies without any information and water bodies with incomplete information. The DES categories will be used for the rest of this report. A crosswalk between the DES categories and the basic 305b/303d assessment categories is provided below.

305b/303d Category	DES Category	Description
Category 2 (Fully Supporting)	2-G	Full Support, good water quality
	2-M	Full Support, marginally above criteria
Category 3 (Insufficient Information)	3-PAS	Insufficient information, potentially attaining standards
	3-PNS	Insufficient information, potentially not supporting
	3-ND	Insufficient information, no data
Category 5 (Not Supporting, 303d)	5-M	Impaired, marginally below criteria (303d)
	5-P	Impaired, poor water quality (303d)

Table 4-A

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
BELLAMY RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=8 ug/L (n=17). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L.	2-M
BELLAMY RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 23 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 2 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-G
BELLAMY RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	No data.	3-ND
BELLAMY RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 66.9 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 0 acres, which is a -100% change. 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 loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.	5-P

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
BELLAMY RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Median=0.93 m^-1 (n=5). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1.	3-PNS
BELLAMY RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=0.455 mg/L (n=13). For this assessment unit, the total nitrogen threshold for the protection of eelgrass (median TN=0.3 mg/L) is the applicable nutrient stressor threshold for stressor-response matrix assessments. This assessment unit was listed as impaired (5-M) for total nitrogen to protect eelgrass on the 2010 303d list. There were insufficient data to make a new assessment for the 2012 cycle. The available data indicate nitrogen concentrations are above the threshold. Assessment units 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 impairment (5-M) listing from the 2010 303d list should be retained.	5-M

Table 4-B

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
BERRYS BROOK	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	No data.	3-ND
BERRYS BROOK	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	No data.	3-ND
BERRYS BROOK	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	No data.	3-ND
BERRYS BROOK	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	No data.	3-ND
BERRYS BROOK	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	No data.	3-ND
BERRYS BROOK	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	No data. For this assessment unit, the total nitrogen threshold for the protection of eelgrass is the applicable nutrient stressor threshold for stressor-response matrix assessments.	3-ND

Table 4-C

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
COCHECO RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=62.46 ug/L (n=5). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L. This assessment unit was listed as impaired (5-M) for chlorophyll-a on the 2010 303d list. There were insufficient data to make a new assessment for the 2012 cycle but the available data indicate chlorophyll-a concentrations are still above the threshold. Assessment units 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 303d list should be retained.	5-M
COCHECO RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 55 measurements, there was/were 0 exceedence(s) of the standard and 0 exceedence(s) of the MAGEX criterion (for this sample size 6 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples. Similar to the 2010 assessment, grab sample data for dissolved oxygen reviewed for the 2012 cycle did not fall below standards, but these results were not considered representative of dissolved oxygen in the assessment unit. Half of the grab samples were collected at station (GBCW-17), which is just downstream of the rapids in downtown Dover where the water is almost fresh, fast-moving, and well aerated. Only one sample was collected in an area of slower water movement near the mouth of the river and this sample had dissolved oxygen levels less than 6 mg/L and <70% saturation. No high-frequency datasonde measurements were available. Therefore, the dissolved oxygen measurements in this assessment unit are not likely to be representative of conditions in slower-moving areas where dissolved oxygen exceedences would occur. High frequency datasonde measurements of dissolved oxygen, which provide more accurate and representative data, are needed to characterize conditions in slower-moving sections of the Cocheco River. In the meantime, dissolved oxygen and dissolved oxygen saturation will be categorized as “insufficient information” (category 3-PAS).	3-PAS

COCHECO RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 44 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 4 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples. Similar to the 2010 assessment, grab sample data for dissolved oxygen reviewed for the 2012 cycle did not fall below standards, but these results were not considered representative of dissolved oxygen in the assessment unit. Half of the grab samples were collected at station (GBCW-17), which is just downstream of the rapids in downtown Dover where the water is almost fresh, fast-moving, and well aerated. Only one sample was collected in an area of slower water movement near the mouth of the river and this sample had dissolved oxygen levels less than 6 mg/L and <70% saturation. No high-frequency datasonde measurements were available. Therefore, the dissolved oxygen measurements in this assessment unit are not likely to be representative of conditions in slower-moving areas where dissolved oxygen exceedences would occur. High frequency datasonde measurements of dissolved oxygen, which provide more accurate and representative data, are needed to characterize conditions in slower-moving sections of the Cocheco River. In the meantime, dissolved oxygen and dissolved oxygen saturation will be categorized as "insufficient information".	3-PAS
COCHECO RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Total Nitrogen	Median=0.99 mg/L (n=3). The threshold for TN to prevent low dissolved oxygen is 0.45 mg/L. For this assessment unit, the total nitrogen threshold for the prevention of low dissolved oxygen is the applicable nutrient stressor threshold for stressor-response matrix assessments. This assessment unit was listed as impaired (5-P) for nitrogen to prevent low dissolved oxygen on the 2010 303d list because of high nitrogen concentrations observed (TN median = 0.763 mg/L, n=21), even though dissolved oxygen measurements by grab samples did not show an impairment. The nitrogen impairment from the 2010 303(d) list will be retained because: (1) Assessment units that were impaired in the previous cycle cannot be removed from the 303(d) list if there are insufficient data to make a new assessment; and (2) The limited data available continue to indicate high nitrogen and high chlorophyll-a concentrations in this assessment unit.	5-P
COCHECO RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	Not applicable. Eelgrass habitat has not historically existed in this assessment zone.	NA
COCHECO RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Not applicable.	NA

Table 4-D

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
GREAT BAY	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=6.31 ug/L (n=130). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L.	2-G
GREAT BAY	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 1179 measurements, there was/were 0 exceedence(s) of the standard and 0 exceedence(s) of the MAGEX criterion (for this sample size 118 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit.	2-G
GREAT BAY	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 1031 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 103 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit.	2-G
GREAT BAY	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 2130.7 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 1700.6 acres, which is a -20.2% change. Since 1990, the trend in eelgrass cover in this assessment zone was -15.2%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss. Another indicator of eelgrass habitat loss is the decline in eelgrass biomass in Great Bay. The historical extent of eelgrass biomass in this assessment zone was 1169 metric tons in 1981. The current extent of eelgrass biomass in 2008-2010 is 539 metric tons, which is a -54% change. Since 1990, the trend in eelgrass biomass in this assessment zone was -39%. There is strong evidence that macroalgae proliferation is impacting eelgrass and changing the species composition and diversity in the Great Bay. A recent report by Nettleton et al. (2011) documented large increases in macroalgae populations in Great Bay in 2008-2010 relative to baseline studies in 1979-1980. The report concluded that: “Great increases in both mean and peak Ulva and Gracilaria biomass and percent cover have occurred in the Great Bay Estuarine System. These changes coincide with increases in water nitrogen levels observed over the past two decades. The increases in nuisance algal blooms are likely the result of increased nutrient loading in the bay, and, in the case of Gracilaria vermiculophylla, may also be a symptom of a harmful invasion. Current nitrogen levels in the system are substantial enough to support even larger Ulva and Gracilaria blooms than were observed in this study, based on minimum growth requirements.” (p. 82) In addition, using data from Pe’eri et al. (2008), DES determined that macroalgae mats had replaced nearly 5.7% of the area formerly occupied by eelgrass in Great Bay in 2007 (DES, 2009).	5-P

GREAT BAY	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Median=0.917 m^-1 (n=92). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1.	5-M
GREAT BAY	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=0.419 mg/L (n=57). For an eelgrass restoration depth of 2 m, the nitrogen threshold is 0.3 mg/L. For this assessment unit, the total nitrogen threshold for the protection of eelgrass is the applicable nutrient stressor threshold for stressor-response matrix assessments.	5-M

Table 4-E

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
LAMPREY RIVER NORTH	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=12.324 ug/L (n=43). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01).	5-M
LAMPREY RIVER NORTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 1103 measurements, there was/were 181 exceedence(s) of the standard and 140 exceedence(s) of the MAGEX criterion (for this sample size 110 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01).	5-P
LAMPREY RIVER NORTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 1045 measurements, there was/were 128 exceedence(s) of the standard (for this sample size 105 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01).	5-M
LAMPREY RIVER NORTH	Dissolved Oxygen (Env-Wq 1703.07)	Total Nitrogen	Median=0.444 mg/L (n=26). The threshold for TN to prevent low dissolved oxygen is 0.45 mg/L. For this assessment unit, the total nitrogen threshold for the prevention of low dissolved oxygen is the applicable nutrient stressor threshold for stressor-response matrix assessments. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01) into two pieces. On the 2010 303d list, total nitrogen was listed as impaired (5-M) relative to preventing low dissolved oxygen in the parent assessment unit. The median total nitrogen concentration in this assessment unit changed slightly from 0.451 to 0.444 mg/L between the 2010 and 2012 assessment cycles, respectively. This change is insignificant because it is within the accuracy of the measurements. And, more importantly, recent data show that there are still dissolved oxygen and chlorophyll-a impairments in this assessment unit and there have been no changes in nutrient loads. Therefore, de-listing the nitrogen impairment cannot be justified and the impaired (5-M) category from the 2010 303d list should be retained.	5-M

LAMPREY RIVER NORTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	Not applicable. Eelgrass habitat has not historically existed in this assessment zone. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01) into two pieces. The parent assessment unit was listed as impaired (5-P) for eelgrass loss on the 2010 303d list. For the 2012 list, the impairment will be associated with the other child assessment unit because eelgrass has not historically existed in this assessment unit.	No Stnd
LAMPREY RIVER NORTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Not applicable. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01) into two pieces. The parent assessment unit was listed as impaired (5-P) for water clarity to protect eelgrass habitat on the 2010 303d list. The impairment will not be retained on this assessment unit because eelgrass has not historically existed in this assessment unit.	No Stnd

Table 4-F

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
LAMPREY RIVER SOUTH	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=21.67 ug/L (n=1). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01). The parent assessment unit was listed as impaired (5-M) for chlorophyll-a on the 2010 303d list. There were insufficient data for a new assessment for the 2012 cycle but the available data indicate chlorophyll-a concentrations greater than the applicable threshold. Therefore, the 2010 impairment was retained.	5-M
LAMPREY RIVER SOUTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 29 measurements, there was/were 0 exceedence(s) of the standard and 0 exceedence(s) of the MAGEX criterion (for this sample size 3 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01). The parent assessment unit was listed as impaired (5-P) for dissolved oxygen on the 2010 303d list. This impairment was retained on the other child assessment unit (Lamprey River North, NHEST600030709-01-01).	2-G
LAMPREY RIVER SOUTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 21 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 2 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01). The parent assessment unit was listed as impaired (5-M) for dissolved oxygen saturation on the 2010 303d list. This impairment was retained on the other child assessment unit (Lamprey River North, NHEST600030709-01-01).	2-G
LAMPREY RIVER SOUTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 53.4 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 0 acres, which is a -100% change. 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 loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.	5-P

LAMPREY RIVER SOUTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	No data. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01) into two pieces. The parent assessment unit was listed as impaired (5-P) for water clarity to protect eelgrass habitat on the 2010 303d list. Assessment units 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-P) listing from the 2010 303d list should be retained.	5-P
LAMPREY RIVER SOUTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=1.055 mg/L (n=1). For this assessment unit, the total nitrogen threshold for the protection of eelgrass (median TN=0.3 mg/L) is the applicable nutrient stressor threshold for stressor-response matrix assessments. This assessment unit was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01) into two pieces. The parent assessment unit was listed as impaired (5-P) for total nitrogen to prevent eelgrass loss on the 2010 303d list. The impairment will be carried forward to this assessment unit because assessment units that were impaired in the previous cycle cannot be removed from the 303d list if there are insufficient data to make a new assessment. The impairment will not be retained on the other child assessment unit (NHEST600030709-01-01) because eelgrass has not historically existed in that assessment unit. Therefore, the impaired (5-P) listing from the 2010 303d list should be retained.	5-P

Table 4-G

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
LITTLE BAY	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=7.418 ug/L (n=93). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L.	2-G
LITTLE BAY	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 170 measurements, there was/were 1 exceedence(s) of the standard and 1 exceedence(s) of the MAGEX criterion (for this sample size 17 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-M
LITTLE BAY	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 121 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 12 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-G
LITTLE BAY	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 252 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 0 acres, which is a -100% change. Since 1990, the trend in eelgrass cover in this assessment zone was -48.8%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.	5-P
LITTLE BAY	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Median=0.985 m^-1 (n=59). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1.	5-M
LITTLE BAY	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=0.41 mg/L (n=75). For an eelgrass restoration depth of 2 m, the nitrogen threshold is 0.3 mg/L. For this assessment unit, the total nitrogen threshold for the protection of eelgrass is the applicable nutrient stressor threshold for stressor-response matrix assessments.	5-M

Table 4-H

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
LITTLE HARBOR/BACK CHANNEL	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=3.078 ug/L (n=5). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L.	3-PAS
LITTLE HARBOR/BACK CHANNEL	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 41 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 4 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-G
LITTLE HARBOR/BACK CHANNEL	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	No data.	3-ND
LITTLE HARBOR/BACK CHANNEL	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 68.8 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 41.4 acres, which is a -39.8% change. Since 1990, the trend in eelgrass cover in this assessment zone was -19.2%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss. Another indicator of eelgrass habitat loss is the decline in eelgrass biomass. The historical extent of eelgrass biomass in this assessment zone was 14.9 metric tons in 1981. The current extent of eelgrass biomass in 2008-2010 is 6.3 metric tons, which is a -57.8% change. Since 1990, the trend in eelgrass biomass in this assessment zone was -58.2%.	5-P
LITTLE HARBOR/BACK CHANNEL	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Median=1.046 m^-1 (n=2). For an eelgrass restoration depth of 3 m, the light attenuation coefficient threshold is 0.5 m^-1. This assessment unit was listed as impaired (5-M) for water clarity to protect eelgrass habitat on the 2010 303d list. Assessment units 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 303d list should be retained.	5-M

LITTLE HARBOR/BACK CHANNEL	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=0.373 mg/L (n=5). For an eelgrass restoration depth of 3 m, the nitrogen threshold is 0.25 mg/L. For this assessment unit, the total nitrogen threshold for the protection of eelgrass is the applicable nutrient stressor threshold for stressor-response matrix assessments. This assessment unit was listed as impaired (5-M) for total nitrogen to protect eelgrass on the 2010 303d list. Assessment units 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 303d list should be retained.	5-M

Table 4-I

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
LOWER PISCATAQUA RIVER – NORTH	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=1.986 ug/L (n=7). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L.	3-PAS
LOWER PISCATAQUA RIVER - NORTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 35 measurements, there was/were 0 exceedence(s) of the standard and 0 exceedence(s) of the MAGEX criterion (for this sample size 4 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-G
LOWER PISCATAQUA RIVER - NORTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 20 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 2 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-G
LOWER PISCATAQUA RIVER - NORTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 60.1 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 0 acres, which is a -100% change. Since 1990, the trend in eelgrass cover in this assessment zone was -29.5%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.	5-P
LOWER PISCATAQUA RIVER - NORTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Median=0.919 m^-1 (n=3). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1.	3-PNS
LOWER PISCATAQUA RIVER - NORTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=0.39 mg/L (n=7). For an eelgrass restoration depth of 2 m, the nitrogen threshold is 0.3 mg/L. For this assessment unit, the total nitrogen threshold for the protection of eelgrass is the applicable nutrient stressor threshold for stressor-response matrix assessments.	3-PNS

Table 4-J

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
LOWER PISCATAQUA RIVER – SOUTH	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=1.721 ug/L (n=8). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L.	3-PAS
LOWER PISCATAQUA RIVER – SOUTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 10 measurements, there was/were 1 exceedence(s) of the standard (for this sample size 2 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-M
LOWER PISCATAQUA RIVER – SOUTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	No data.	3-ND
LOWER PISCATAQUA RIVER – SOUTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 32.5 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 3.9 acres, which is a -87.9% change. Since 1990, the trend in eelgrass cover in this assessment zone was not significant. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.	5-P
LOWER PISCATAQUA RIVER – SOUTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Median=0.465 m^-1 (n=4). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1.	3-PAS
LOWER PISCATAQUA RIVER – SOUTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=0.38 mg/L (n=8). For an eelgrass restoration depth of 2 m, the nitrogen threshold is 0.3 mg/L. For this assessment unit, the total nitrogen threshold for the protection of eelgrass is the applicable nutrient stressor threshold for stressor-response matrix assessments.	3-PNS

Table 4-K

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
NORTH MILL POND	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	No data.	3-ND
NORTH MILL POND	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 28 measurements, there was/were 0 exceedence(s) of the standard and 0 exceedence(s) of the MAGEX criterion (for this sample size 3 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-G
NORTH MILL POND	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 19 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 2 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-G
NORTH MILL POND	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	No data.	3-ND
NORTH MILL POND	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	No data.	3-ND
NORTH MILL POND	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	No data. For this assessment unit, the total nitrogen threshold for the protection of eelgrass is the applicable nutrient stressor threshold for stressor-response matrix assessments.	3-ND

Table 4-L

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
OYSTER RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=11.4 ug/L (n=46). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L.	5-M
OYSTER RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 977 measurements, there was/were 34 exceedence(s) of the standard and 10 exceedence(s) of the MAGEX criterion (for this sample size 98 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit.	5-P
OYSTER RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 923 measurements, there was/were 30 exceedence(s) of the standard (for this sample size 92 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit. This assessment unit was listed as impaired (5-M) for dissolved oxygen saturation on the 2010 303d list. The most recent data do not meet the criteria for a new impairment but there are still multiple measurements that violate standards. The impairment listing cannot be removed while there are still documented violations of the standard. Therefore, the impaired (5-M) listing from the 2010 303d list should be retained.	5-M
OYSTER RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 182.5 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 0 acres, which is a -100% change. 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 loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.	5-P
OYSTER RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Median=1.745 m^-1 (n=36). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1.	5-P
OYSTER RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=0.544 mg/L (n=25). For this assessment unit, the total nitrogen threshold for the protection of eelgrass (median TN=0.3 mg/L) is the applicable nutrient stressor threshold for stressor-response matrix assessments.	5-P

Table 4-M

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
PORTSMOUTH HARBOR	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=2.69 ug/L (n=52). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L.	2-G
PORTSMOUTH HARBOR	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 1252 measurements, there was/were 1 exceedence(s) of the standard and 1 exceedence(s) of the MAGEX criterion (for this sample size 125 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit.	2-M
PORTSMOUTH HARBOR	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 1184 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 118 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit.	2-G
PORTSMOUTH HARBOR	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 227.7 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 155 acres, which is a -31.9% change. Since 1990, the trend in eelgrass cover in this assessment zone was -16.2%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss. Another indicator of eelgrass habitat loss is the decline in eelgrass biomass. The historical extent of eelgrass biomass in this assessment zone was 171.7 metric tons in 1981. The current extent of eelgrass biomass in 2008-2010 is 42.5 metric tons, which is a -75.3% change. Since 1990, the trend in eelgrass biomass in this assessment zone was not significant.	5-P
PORTSMOUTH HARBOR	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Median=0.645 m^-1 (n=40). For an eelgrass restoration depth of 3 m, the light attenuation coefficient threshold is 0.5 m^-1.	5-M
PORTSMOUTH HARBOR	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=0.312 mg/L (n=52). For an eelgrass restoration depth of 3 m, the nitrogen threshold is 0.25 mg/L. For this assessment unit, the total nitrogen threshold for the protection of eelgrass is the applicable nutrient stressor threshold for stressor-response matrix assessments.	5-M

Table 4-N

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
SAGAMORE CREEK	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=1.44 ug/L (n=3). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L.	3-PAS
SAGAMORE CREEK	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 4 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 2 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	3-PAS
SAGAMORE CREEK	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	No data.	3-ND
SAGAMORE CREEK	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 4.1 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 0.5 acres, which is a -88.3% change. Since 1990, the trend in eelgrass cover in this assessment zone was not significant. The threshold for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.	5-P
SAGAMORE CREEK	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	No data.	3-ND
SAGAMORE CREEK	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=0.174 mg/L (n=3). For an eelgrass restoration depth of 2 m, the nitrogen threshold is 0.3 mg/L. For this assessment unit, the total nitrogen threshold for the protection of eelgrass is the applicable nutrient stressor threshold for stressor-response matrix assessments.	3-PAS

Table 4-O

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
SALMON FALLS RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=30 ug/L (n=43). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L.	5-P
SALMON FALLS RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 235 measurements, there was/were 29 exceedence(s) of the standard and 14 exceedence(s) of the MAGEX criterion (for this sample size 24 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit.	5-P
SALMON FALLS RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 161 measurements, there was/were 9 exceedence(s) of the standard (for this sample size 16 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit. This assessment unit was listed as impaired (5-M) for dissolved oxygen saturation on the 2010 303d list. The most recent data do not meet the criteria for a new impairment but there are still multiple measurements that violate standards. The impairment listing cannot be removed while there are still documented violations of the standard. Therefore, the impaired (5-M) listing from the 2010 303d list should be retained.	5-M
SALMON FALLS RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Total Nitrogen	Median=0.54 mg/L (n=41). The threshold for TN to prevent low dissolved oxygen is 0.45 mg/L. For this assessment unit, the total nitrogen threshold for the prevention of low dissolved oxygen is the applicable nutrient stressor threshold for stressor-response matrix assessments.	5-M
SALMON FALLS RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	Not applicable. Eelgrass habitat has not historically existed in this assessment zone.	NA
SALMON FALLS RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Not applicable.	NA

Table 4-P

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
SOUTH MILL POND	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	No data.	3-ND
SOUTH MILL POND	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 42 measurements, there was/were 1 exceedence(s) of the standard and 1 exceedence(s) of the MAGEX criterion (for this sample size 4 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-M
SOUTH MILL POND	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 32 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 3 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-G
SOUTH MILL POND	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	No data.	3-ND
SOUTH MILL POND	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	No data.	3-ND
SOUTH MILL POND	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	No data. For this assessment unit, the total nitrogen threshold for the protection of eelgrass is the applicable nutrient stressor threshold for stressor-response matrix assessments.	3-ND

Table 4-Q

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
SQUAMSCOTT RIVER NORTH	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=16.66 ug/L (n=85). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment unit (NHEST600030806-01).	5-P
SQUAMSCOTT RIVER NORTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 1208 measurements, there was/were 89 exceedence(s) of the standard and 52 exceedence(s) of the MAGEX criterion (for this sample size 121 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment unit (NHEST600030806-01).	5-P
SQUAMSCOTT RIVER NORTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 1060 measurements, there was/were 9 exceedence(s) of the standard (for this sample size 106 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were available for this assessment unit. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment unit (NHEST600030806-01).	2-M
SQUAMSCOTT RIVER NORTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 42.1 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 0 acres, which is a -100% change. 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 loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.	5-P
SQUAMSCOTT RIVER NORTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Median=2.905 m^-1 (n=52). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment unit (NHEST600030806-01) into two pieces. The parent assessment unit was listed as impaired (5-P) for water clarity to protect eelgrass habitat on the 2010 303d list.	5-P

SQUAMSCOTT RIVER NORTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=0.706 mg/L (n=51). For this assessment unit, the total nitrogen threshold for the protection of eelgrass (median TN=0.3 mg/L) is the applicable nutrient stressor threshold for stressor-response matrix assessments. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment unit (NHEST600030806-01) into two pieces. The parent assessment unit was listed as impaired (5-P) for total nitrogen on the 2010 303d list. For the 2012 list, the impairment will be associated with this child assessment unit. The impairment will not be retained on other child assessment unit (NHEST600030806-01-01) because eelgrass has not historically existed in that assessment unit.	5-P

Table 4-R

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
SQUAMSCOTT RIVER SOUTH	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=60.9 ug/L (n=1). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment unit (NHEST600030806-01). The parent assessment unit was listed as impaired (5-P) for chlorophyll-a on the 2010 303d list. There were insufficient data for a new assessment for the 2012 cycle but the available data indicate chlorophyll-a concentrations greater than the applicable threshold. Therefore, the 2010 impairment was retained.	5-P
SQUAMSCOTT RIVER SOUTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment unit (NHEST600030806-01). The parent assessment unit was listed as impaired (5-P) for dissolved oxygen on the 2010 303d list. Out of 42 measurements, there was/were 0 exceedence(s) of the standard and 0 exceedence(s) of the MAGEX criterion (for this sample size 4 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were only available for 15 days at the end of the critical period (9/12/11 to 9/26/11). The data were sufficient for a new assessment and no violations of the water quality standards were detected. However, a March 2012 report by HydroQual, consultants for the Great Bay Municipal Coalition, appears to document numerous violations of the dissolved oxygen standard in this assessment unit (HydroQual, 2012). The report documents water quality sampling, including datasonde deployments, conducted by HydroQual in the Squamscott River in August and September 2011. Most of the sampling stations were in the Squamscott River South assessment unit. Text and figures in the report show several instances of dissolved oxygen concentrations falling below the criterion of 5 mg/L. On page 13 of the report, the consultants state: “The results of these field studies indicate that dissolved oxygen levels in the Squamscott River periodically fall below the instantaneous DO criterion of 5.0 mg/L.” Based on this report, the impairment for dissolved oxygen should be retained for this assessment unit. Removing impairments cannot be justified while there are still documented violations of the water quality criteria. The actual data from the report could not be analyzed for assessments because the report was missing information on quality assurance and other metadata.	5-P

SQUAMSCOTT RIVER SOUTH	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 37 measurements, there was/were 3 exceedence(s) of the standard (for this sample size 4 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were only available for 15 days at the end of the critical period (9/12/11 to 9/26/11). During this period, exceedences of the standard were detected on 3 of the 13 days with complete data. This dataset indicates an impairment that should be listed per the CALM as 5-M. This conflicts with the results from grab samples which did not show any exceedences. High frequency datasonde measurements provide more accurate and representative data than grab samples. Therefore, the listing derived from the datasonde measurements will be applied to this assessment unit. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment unit (NHEST600030806-01).	5-M
SQUAMSCOTT RIVER SOUTH	Dissolved Oxygen (Env-Wq 1703.07)	Total Nitrogen	Median=0.919 mg/L (n=1). The threshold for TN to prevent low dissolved oxygen is 0.45 mg/L. For this assessment unit, the total nitrogen threshold for the prevention of low dissolved oxygen is the applicable nutrient stressor threshold for stressor-response matrix assessments. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment unit (NHEST600030806-01) into two pieces. On the 2010 303d list, total nitrogen was listed as impaired (5-P) for the parent assessment unit. Assessment units that were impaired in the previous cycle cannot be removed from the 303d list if there are insufficient data to make a new assessment. The limited data for this assessment unit continue to indicate a nitrogen impairment in this assessment unit: Nitrogen concentrations are double the threshold and dissolved oxygen violations have been measured. Therefore, the listing of impaired (5-P) from the 2010 303d list should be retained.	5-P
SQUAMSCOTT RIVER SOUTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	Not applicable. Eelgrass habitat has not historically existed in this assessment zone. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment unit (NHEST600030806-01) into two pieces. The parent assessment unit was listed as impaired (5-P) for eelgrass loss on the 2010 303d list. For the 2012 list, the impairment will be associated with the other child assessment unit because eelgrass has not historically existed in this assessment unit.	No Stnd
SQUAMSCOTT RIVER SOUTH	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Not applicable. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment unit (NHEST600030806-01) into two pieces. The parent assessment unit was listed as impaired (5-P) for water clarity to protect eelgrass habitat on the 2010 303d list. The impairment will not be retained on this assessment unit because eelgrass has not historically existed in this assessment unit.	No Stnd

Table 4-S

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
UPPER PISCATAQUA RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	90th %ile=8.828 ug/L (n=54). The chlorophyll-a threshold to prevent low dissolved oxygen is 10 ug/L.	2-M
UPPER PISCATAQUA RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 87 measurements, there was/were 1 exceedence(s) of the standard and 0 exceedence(s) of the MAGEX criterion (for this sample size 9 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-M
UPPER PISCATAQUA RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 47 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 5 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-G
UPPER PISCATAQUA RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was 79.7 acres from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 0 acres, which is a -100% change. Since 1990, the trend in eelgrass cover in this assessment zone was -41.9%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.	5-P
UPPER PISCATAQUA RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	Median=1.43 m^-1 (n=32). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1.	5-P
UPPER PISCATAQUA RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	Median=0.478 mg/L (n=32). For an eelgrass restoration depth of 2 m, the nitrogen threshold is 0.3 mg/L. For this assessment unit, the total nitrogen threshold for the protection of eelgrass is the applicable nutrient stressor threshold for stressor-response matrix assessments.	5-P

Table 4-T

Assessment Zone	Relevant Water Quality Standard	Indicator	Comments	Category
WINNICUT RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Chlorophyll-a	No data.	3-ND
WINNICUT RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen	Out of 27 measurements, there was/were 1 exceedence(s) of the standard and 1 exceedence(s) of the MAGEX criterion (for this sample size 3 exceedences of the standard or 2 exceedences of the MAGEX criterion are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-M
WINNICUT RIVER	Dissolved Oxygen (Env-Wq 1703.07)	Dissolved oxygen saturation	Out of 23 measurements, there was/were 0 exceedence(s) of the standard (for this sample size 2 exceedences are needed to indicate impairment). High frequency datasonde measurements of DO were not available. There may have been exceedences of the standard that were not detected by grab samples.	2-G
WINNICUT RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Estuarine Bioassessments (eelgrass)	The historical extent of eelgrass in this assessment zone was not available from the 1948, 1962, 1980, and 1981 datasets. The current extent of eelgrass in 2008-2010 is 0 acres. Since 1990, the trend in eelgrass cover in this assessment zone was -70.9%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.	5-P
WINNICUT RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Water Clarity (Light Attenuation Coefficient)	No data.	3-ND
WINNICUT RIVER	Biological and Aquatic Community Integrity (Env-Wq 1703.19)	Total Nitrogen	No data. For this assessment unit, the total nitrogen threshold for the protection of eelgrass (median TN=0.3 mg/L) is the applicable nutrient stressor threshold for stressor-response matrix assessments.	3-ND

Table 5: Comparison of final assessment categories from the 2010 and 2012 assessments for eutrophication parameters in the Great Bay Estuary

Table 5-A: Chlorophyll-a

Assessment Zone	Assessment Unit ID	2010 Category	2012 Category	Comment
BELLAMY RIVER	NHEST600030903-01-01	2-G	2-M	No change
	NHEST600030903-01-03	2-G	2-M	No change
	NHEST600030903-01-04	2-G	2-M	No change
BERRYS BROOK	NHEST600031002-01-01		3-ND	No change
	NHEST600031002-01-02		3-ND	No change
COCHECO RIVER	NHEST600030608-01	5-M	5-M	No change. Insufficient data for new assessment. 2010 impairment retained.
GREAT BAY	NHEST600030904-02	2-M	2-G	No change
	NHEST600030904-03	2-M	2-G	No change
	NHEST600030904-04-02	2-M	2-G	No change
	NHEST600030904-04-03	2-M	2-G	No change
	NHEST600030904-04-04	2-M	2-G	No change
	NHEST600030904-04-05	2-M	2-G	No change
	NHEST600030904-04-06	2-M	2-G	No change
LAMPREY RIVER NORTH	NHEST600030709-01-01	5-M	5-M	No change
LAMPREY RIVER SOUTH	NHEST600030709-01-02	5-M	5-M	No change. Insufficient data for new assessment. 2010 impairment retained.
LITTLE BAY	NHEST600030904-06-10	2-M	2-G	No change
	NHEST600030904-06-11	2-M	2-G	No change
	NHEST600030904-06-12	2-M	2-G	No change
	NHEST600030904-06-14	2-M	2-G	No change
	NHEST600030904-06-15	2-M	2-G	No change
	NHEST600030904-06-18	2-M	2-G	No change
	NHEST600030904-06-19	2-M	2-G	No change
LITTLE HARBOR/BACK CHANNEL	NHEST600031001-05	2-G	3-PAS	Full Support to Insufficient Information
	NHEST600031001-08	2-G	3-PAS	Full Support to Insufficient Information
	NHEST600031002-02	2-G	3-PAS	Full Support to Insufficient Information
LOWER PISCATAQUA RIVER - NORTH	NHEST600031001-02-01	3-PAS	3-PAS	No change

LOWER PISCATAQUA RIVER - SOUTH	NHEST600031001-02-02	2-G	3-PAS	Full Support to Insufficient Information
NORTH MILL POND	NHEST600031001-10	3-PAS	3-ND	No change
OYSTER RIVER	NHEST600030902-01-01	5-P	5-M	No change
	NHEST600030902-01-02	5-P	5-M	No change
	NHEST600030902-01-03	5-P	5-M	No change
	NHEST600030904-06-17	5-P	5-M	No change
PORTSMOUTH HARBOR	NHEST600031001-11	2-G	2-G	No change
SAGAMORE CREEK	NHEST600031001-03	3-PAS	3-PAS	No change
	NHEST600031001-04	3-PAS	3-PAS	No change
SALMON FALLS RIVER	NHEST600030406-01	5-M	5-P	No change
SOUTH MILL POND	NHEST600031001-09		3-ND	No change
SQUAMSCOTT RIVER NORTH	NHEST600030806-01-02	5-P	5-P	No change
SQUAMSCOTT RIVER SOUTH	NHEST600030806-01-01	5-P	5-P	No change. Insufficient data for new assessment. 2010 impairment retained.
UPPER PISCATAQUA RIVER	NHEST600031001-01-01	2-G	2-M	No change
	NHEST600031001-01-02	2-G	2-M	No change
	NHEST600031001-01-03	2-G	2-M	No change
WINNICUT RIVER	NHEST600030904-01		3-ND	No change

Table 5-B: Dissolved oxygen saturation

Assessment Zone	Assessment Unit ID	2010 Category	2012 Category	Comment
BELLAMY RIVER	NHEST600030903-01-01	3-ND	3-ND	No change
	NHEST600030903-01-03	3-ND	3-ND	No change
	NHEST600030903-01-04	3-ND	3-ND	No change
BERRYS BROOK	NHEST600031002-01-01	3-ND	3-ND	No change
	NHEST600031002-01-02	3-ND	3-ND	No change
COCHECO RIVER	NHEST600030608-01	2-G	3-PAS	Full Support to Insufficient Information
GREAT BAY	NHEST600030904-02	2-M	2-G	No change
	NHEST600030904-03	2-M	2-G	No change
	NHEST600030904-04-02	2-M	2-G	No change
	NHEST600030904-04-03	2-M	2-G	No change
	NHEST600030904-04-04	2-M	2-G	No change
	NHEST600030904-04-05	2-M	2-G	No change
	NHEST600030904-04-06	2-M	2-G	No change
LAMPREY RIVER NORTH	NHEST600030709-01-01	5-M	5-M	No change
LAMPREY RIVER SOUTH	NHEST600030709-01-02	5-M	2-G	Impairment retained on NHEST600030709-01-01
LITTLE BAY	NHEST600030904-06-10	2-M	2-G	No change
	NHEST600030904-06-11	2-M	2-G	No change
	NHEST600030904-06-12	2-M	2-G	No change
	NHEST600030904-06-14	2-M	2-G	No change
	NHEST600030904-06-15	2-M	2-G	No change
	NHEST600030904-06-18	2-M	2-G	No change
	NHEST600030904-06-19	2-M	2-G	No change
LITTLE HARBOR/BACK CHANNEL	NHEST600031001-05	3-ND	3-ND	No change
	NHEST600031001-08	3-ND	3-ND	No change
	NHEST600031002-02	3-ND	3-ND	No change
LOWER PISCATAQUA RIVER - NORTH	NHEST600031001-02-01	2-G	2-G	No change
LOWER PISCATAQUA RIVER - SOUTH	NHEST600031001-02-02	3-ND	3-ND	No change
NORTH MILL POND	NHEST600031001-10	2-G	2-G	No change
OYSTER RIVER	NHEST600030902-01-01	5-M	5-M	No change
	NHEST600030902-01-02	5-M	5-M	No change
	NHEST600030902-01-03	5-M	5-M	No change
	NHEST600030904-06-17	5-M	5-M	No change

PORTSMOUTH HARBOR	NHEST600031001-11	2-G	2-G	No change
SAGAMORE CREEK	NHEST600031001-03	3-ND	3-ND	No change
	NHEST600031001-04	3-ND	3-ND	No change
SALMON FALLS RIVER	NHEST600030406-01	5-M	5-M	No change
SOUTH MILL POND	NHEST600031001-09	2-G	2-G	No change
SQUAMSCOTT RIVER NORTH	NHEST600030806-01-02	2-M	2-M	No change
SQUAMSCOTT RIVER SOUTH	NHEST600030806-01-01	2-M	5-M	Full Support to Impaired
UPPER PISCATAQUA RIVER	NHEST600031001-01-01	2-G	2-G	No change
	NHEST600031001-01-02	2-G	2-G	No change
	NHEST600031001-01-03	2-G	2-G	No change
WINNICUT RIVER	NHEST600030904-01	2-G	2-G	No change

Table 5-C: Dissolved oxygen

Assessment Zone	Assessment Unit ID	2010 Category	2012 Category	Comment
BELLAMY RIVER	NHEST600030903-01-01	3-PAS	2-G	Insufficient Information to Full Support
	NHEST600030903-01-03	2-G	2-G	No change
	NHEST600030903-01-04	2-G	2-G	No change
BERRYS BROOK	NHEST600031002-01-01	3-ND	3-ND	No change
	NHEST600031002-01-02	3-ND	3-ND	No change
COCHECO RIVER	NHEST600030608-01	2-G	3-PAS	Full Support to Insufficient Information
GREAT BAY	NHEST600030904-02	2-M	2-G	No change
	NHEST600030904-03	2-M	2-G	No change
	NHEST600030904-04-02	2-M	2-G	No change
	NHEST600030904-04-03	2-M	2-G	No change
	NHEST600030904-04-04	2-M	2-G	No change
	NHEST600030904-04-05	2-M	2-G	No change
	NHEST600030904-04-06	2-M	2-G	No change
LAMPREY RIVER NORTH	NHEST600030709-01-01	5-P	5-P	No change
LAMPREY RIVER SOUTH	NHEST600030709-01-02	5-P	2-G	Impairment retained on NHEST600030709-01-01
LITTLE BAY	NHEST600030904-06-10	2-M	2-M	No change
	NHEST600030904-06-11	2-M	2-M	No change
	NHEST600030904-06-12	2-M	2-M	No change
	NHEST600030904-06-14	2-G	2-M	No change
	NHEST600030904-06-15	2-M	2-M	No change
	NHEST600030904-06-18	2-M	2-M	No change
	NHEST600030904-06-19	2-M	2-M	No change
LITTLE HARBOR/BACK CHANNEL	NHEST600031001-05	2-G	2-G	No change
	NHEST600031001-08	2-G	2-G	No change
	NHEST600031002-02	2-G	2-G	No change
LOWER PISCATAQUA RIVER - NORTH	NHEST600031001-02-01	2-G	2-G	No change
LOWER PISCATAQUA RIVER - SOUTH	NHEST600031001-02-02	2-G	2-M	No change
NORTH MILL POND	NHEST600031001-10	2-G	2-G	No change
OYSTER RIVER	NHEST600030902-01-01	5-P	5-P	No change
	NHEST600030902-01-02	5-P	5-P	No change
	NHEST600030902-01-03	5-P	5-P	No change
	NHEST600030904-06-17	5-P	5-P	No change

PORTSMOUTH HARBOR	NHEST600031001-11	2-G	2-M	No change
SAGAMORE CREEK	NHEST600031001-03	3-PAS	3-PAS	No change
	NHEST600031001-04	3-PAS	3-PAS	No change
SALMON FALLS RIVER	NHEST600030406-01	5-P	5-P	No change
SOUTH MILL POND	NHEST600031001-09	2-M	2-M	No change
SQUAMSCOTT RIVER NORTH	NHEST600030806-01-02	5-P	5-P	No change
SQUAMSCOTT RIVER SOUTH	NHEST600030806-01-01	5-P	5-P	No change
UPPER PISCATAQUA RIVER	NHEST600031001-01-01	3-PAS	2-M	Insufficient Information to Full Support
	NHEST600031001-01-02	2-G	2-M	No change
	NHEST600031001-01-03	3-PAS	2-M	Insufficient Information to Full Support
WINNICUT RIVER	NHEST600030904-01	2-G	2-M	No change

Table 5-D: Eelgrass estuarine bioassessments

Assessment Zone	Assessment Unit ID	2010 Category	2012 Category	Comment
BELLAMY RIVER	NHEST600030903-01-01	5-P	5-P	No change
	NHEST600030903-01-03	5-P	5-P	No change
	NHEST600030903-01-04	5-P	5-P	No change
BERRYS BROOK	NHEST600031002-01-01		3-ND	No change
	NHEST600031002-01-02		3-ND	No change
GREAT BAY	NHEST600030904-02	5-P	5-P	No change
	NHEST600030904-03	5-P	5-P	No change
	NHEST600030904-04-02	5-P	5-P	No change
	NHEST600030904-04-03	5-P	5-P	No change
	NHEST600030904-04-04	5-P	5-P	No change
	NHEST600030904-04-05	5-P	5-P	No change
	NHEST600030904-04-06	5-P	5-P	No change
LAMPREY RIVER NORTH	NHEST600030709-01-01	5-P	No Stnd	Criteria does not apply for 2012 assessments.
LAMPREY RIVER SOUTH	NHEST600030709-01-02	5-P	5-P	No change
LITTLE BAY	NHEST600030904-06-10	5-P	5-P	No change
	NHEST600030904-06-11	5-P	5-P	No change
	NHEST600030904-06-12	5-P	5-P	No change
	NHEST600030904-06-14	5-P	5-P	No change
	NHEST600030904-06-15	5-P	5-P	No change
	NHEST600030904-06-18	5-P	5-P	No change
	NHEST600030904-06-19	5-P	5-P	No change
LITTLE HARBOR/BACK CHANNEL	NHEST600031001-05	5-P	5-P	No change
	NHEST600031001-08	5-P	5-P	No change
	NHEST600031002-02	5-P	5-P	No change
LOWER PISCATAQUA RIVER - NORTH	NHEST600031001-02-01	5-P	5-P	No change
LOWER PISCATAQUA RIVER - SOUTH	NHEST600031001-02-02	5-P	5-P	No change
NORTH MILL POND	NHEST600031001-10		3-ND	No change
OYSTER RIVER	NHEST600030902-01-01	5-P	5-P	No change
	NHEST600030902-01-02	5-P	5-P	No change
	NHEST600030902-01-03	5-P	5-P	No change
	NHEST600030904-06-17	5-P	5-P	No change
PORTSMOUTH HARBOR	NHEST600031001-11	5-T	5-P	No change

SAGAMORE CREEK	NHEST600031001-03	5-P	5-P	No change
	NHEST600031001-04	5-P	5-P	No change
SOUTH MILL POND	NHEST600031001-09		3-ND	No change
SQUAMSCOTT RIVER NORTH	NHEST600030806-01-02	5-P	5-P	No change
SQUAMSCOTT RIVER SOUTH	NHEST600030806-01-01	5-P	No Stnd	Criteria does not apply for 2012 assessments.
UPPER PISCATAQUA RIVER	NHEST600031001-01-01	5-P	5-P	No change
	NHEST600031001-01-02	5-P	5-P	No change
	NHEST600031001-01-03	5-P	5-P	No change
WINNICUT RIVER	NHEST600030904-01	5-P	5-P	No change

Table 5-E: Water clarity (light attenuation coefficient)

Assessment Zone	Assessment Unit ID	2010 Category	2012 Category	Comment
BELLAMY RIVER	NHEST600030903-01-01	3-ND	3-PNS	No change
	NHEST600030903-01-03	3-ND	3-PNS	No change
	NHEST600030903-01-04	3-ND	3-PNS	No change
BERRYS BROOK	NHEST600031002-01-01		3-ND	No change
	NHEST600031002-01-02		3-ND	No change
GREAT BAY	NHEST600030904-02	5-P	5-M	No change
	NHEST600030904-03	5-P	5-M	No change
	NHEST600030904-04-02	5-P	5-M	No change
	NHEST600030904-04-03	5-P	5-M	No change
	NHEST600030904-04-04	5-P	5-M	No change
	NHEST600030904-04-05	5-P	5-M	No change
	NHEST600030904-04-06	5-P	5-M	No change
LAMPREY RIVER NORTH	NHEST600030709-01-01	5-P	No Stnd	Criteria does not apply for 2012 assessments.
LAMPREY RIVER SOUTH	NHEST600030709-01-02	5-P	5-P	No change. Insufficient data for new assessment. 2010 impairment retained.
LITTLE BAY	NHEST600030904-06-10	5-M	5-M	No change
	NHEST600030904-06-11	5-M	5-M	No change
	NHEST600030904-06-12	5-M	5-M	No change
	NHEST600030904-06-14	5-M	5-M	No change
	NHEST600030904-06-15	5-M	5-M	No change
	NHEST600030904-06-18	5-M	5-M	No change
	NHEST600030904-06-19	5-M	5-M	No change
LITTLE HARBOR/BACK CHANNEL	NHEST600031001-05	5-M	5-M	No change. Insufficient data for new assessment. 2010 impairment retained.
	NHEST600031001-08	5-M	5-M	No change. Insufficient data for new assessment. 2010 impairment retained.
	NHEST600031002-02	5-M	5-M	No change. Insufficient data for new assessment. 2010 impairment retained.
LOWER PISCATAQUA RIVER - NORTH	NHEST600031001-02-01	3-PNS	3-PNS	No change
LOWER PISCATAQUA RIVER - SOUTH	NHEST600031001-02-02	3-PAS	3-PAS	No change
NORTH MILL POND	NHEST600031001-10	3-PAS	3-ND	No change
OYSTER RIVER	NHEST600030902-01-01	5-P	5-P	No change
	NHEST600030902-01-02	5-P	5-P	No change

	NHEST600030902-01-03	5-P	5-P	No change
	NHEST600030904-06-17	5-P	5-P	No change
PORTSMOUTH HARBOR	NHEST600031001-11	5-M	5-M	No change
SAGAMORE CREEK	NHEST600031001-03	3-PNS	3-ND	No change
	NHEST600031001-04	3-PNS	3-ND	No change
SOUTH MILL POND	NHEST600031001-09		3-ND	No change
SQUAMSCOTT RIVER NORTH	NHEST600030806-01-02	5-P	5-P	No change
SQUAMSCOTT RIVER SOUTH	NHEST600030806-01-01	5-P	No Stnd	Criteria does not apply for 2012 assessments.
UPPER PISCATAQUA RIVER	NHEST600031001-01-01	5-P	5-P	No change
	NHEST600031001-01-02	5-P	5-P	No change
	NHEST600031001-01-03	5-P	5-P	No change
WINNICUT RIVER	NHEST600030904-01	3-ND	3-ND	No change

Table 5-F: Nitrogen (total)

Assessment Zone	Assessment Unit ID	2010 Category	2012 Category	Comment
BELLAMY RIVER	NHEST600030903-01-01	5-M	5-M	No change. Insufficient data for new assessment. 2010 impairment retained.
	NHEST600030903-01-03	5-M	5-M	No change. Insufficient data for new assessment. 2010 impairment retained.
	NHEST600030903-01-04	5-M	5-M	No change. Insufficient data for new assessment. 2010 impairment retained.
BERRYS BROOK	NHEST600031002-01-01		3-ND	No change
	NHEST600031002-01-02		3-ND	No change
COCHECO RIVER	NHEST600030608-01	5-P	5-P	No change. Insufficient data for new assessment. 2010 impairment retained.
GREAT BAY	NHEST600030904-02	5-M	5-M	No change
	NHEST600030904-03	5-M	5-M	No change
	NHEST600030904-04-02	5-M	5-M	No change
	NHEST600030904-04-03	5-M	5-M	No change
	NHEST600030904-04-04	5-M	5-M	No change
	NHEST600030904-04-05	5-M	5-M	No change
	NHEST600030904-04-06	5-M	5-M	No change
LAMPREY RIVER NORTH	NHEST600030709-01-01	5-P	5-M	No change
LAMPREY RIVER SOUTH	NHEST600030709-01-02	5-P	5-P	No change. Insufficient data for new assessment. 2010 impairment retained.
LITTLE BAY	NHEST600030904-06-10	5-M	5-M	No change
	NHEST600030904-06-11	5-M	5-M	No change
	NHEST600030904-06-12	5-M	5-M	No change
	NHEST600030904-06-14	5-M	5-M	No change
	NHEST600030904-06-15	5-M	5-M	No change
	NHEST600030904-06-18	5-M	5-M	No change
	NHEST600030904-06-19	5-M	5-M	No change
LITTLE HARBOR/BACK CHANNEL	NHEST600031001-05	5-M	5-M	No change. Insufficient data for new assessment. 2010 impairment retained.
	NHEST600031001-08	5-M	5-M	No change. Insufficient data for new assessment. 2010 impairment retained.
	NHEST600031002-02	5-M	5-M	No change. Insufficient data for new assessment. 2010 impairment retained.
LOWER PISCATAQUA RIVER - NORTH	NHEST600031001-02-01	3-PNS	3-PNS	No change

LOWER PISCATAQUA RIVER - SOUTH	NHEST600031001-02-02	3-PNS	3-PNS	No change
NORTH MILL POND	NHEST600031001-10	3-PNS	3-ND	No change
OYSTER RIVER	NHEST600030902-01-01	5-P	5-P	No change
	NHEST600030902-01-02	5-P	5-P	No change
	NHEST600030902-01-03	5-P	5-P	No change
	NHEST600030904-06-17	5-P	5-P	No change
PORTSMOUTH HARBOR	NHEST600031001-11	5-M	5-M	No change
SAGAMORE CREEK	NHEST600031001-03	3-PNS	3-PAS	No change
	NHEST600031001-04	3-PNS	3-PAS	No change
SALMON FALLS RIVER	NHEST600030406-01	5-M	5-M	No change
SOUTH MILL POND	NHEST600031001-09	3-ND	3-ND	No change
SQUAMSCOTT RIVER NORTH	NHEST600030806-01-02	5-P	5-P	No change
SQUAMSCOTT RIVER SOUTH	NHEST600030806-01-01	5-P	5-P	No change. Insufficient data for new assessment. 2010 impairment retained.
UPPER PISCATAQUA RIVER	NHEST600031001-01-01	5-P	5-P	No change
	NHEST600031001-01-02	5-P	5-P	No change
	NHEST600031001-01-03	5-P	5-P	No change
WINNICUT RIVER	NHEST600030904-01	3-PNS	3-ND	No change

Figure 1: Assessment zones in the Great Bay Estuary

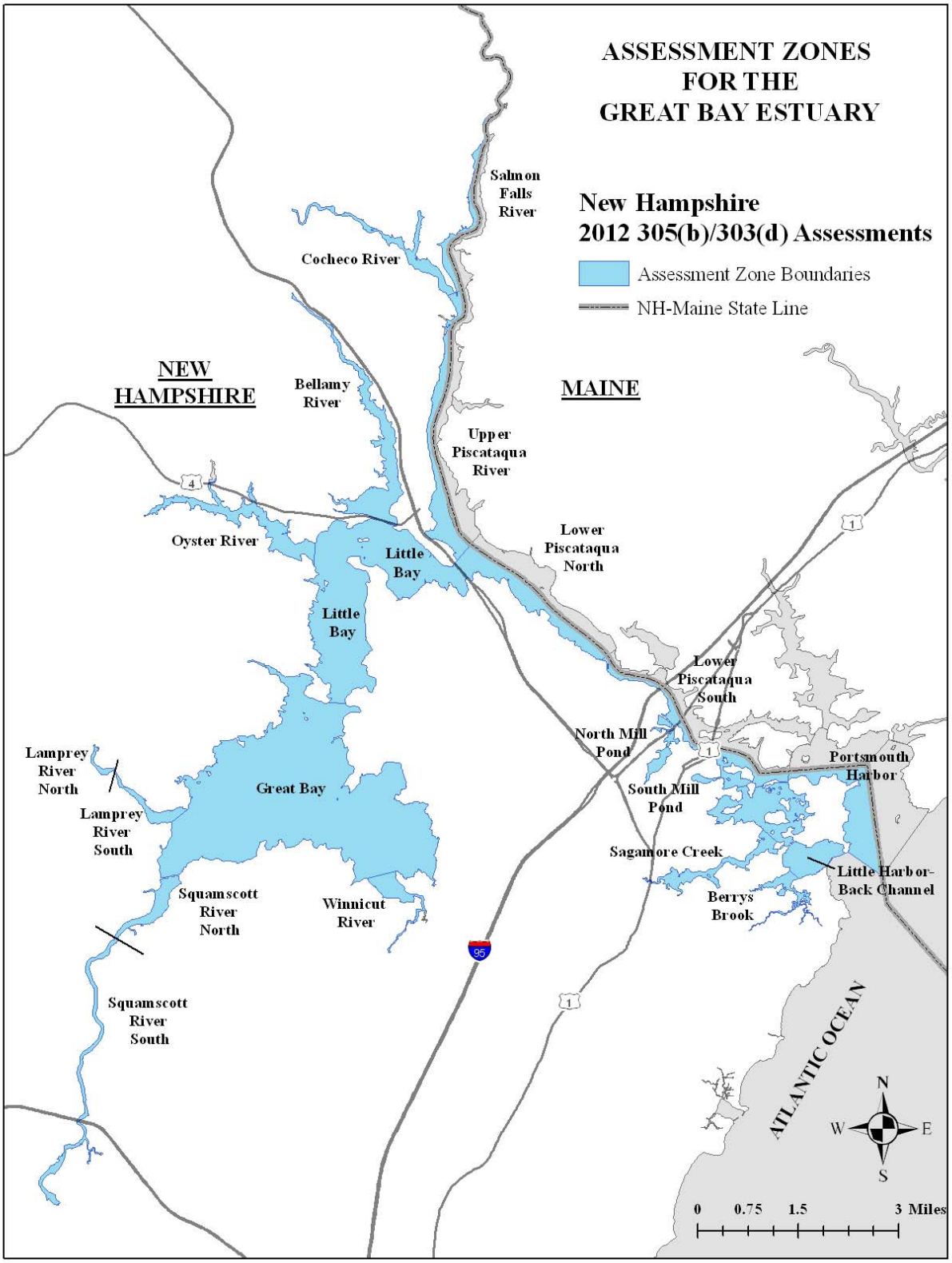


Figure 2: Nitrogen impairments for the 2012 303(d) list for assessment zones in the Great Bay Estuary

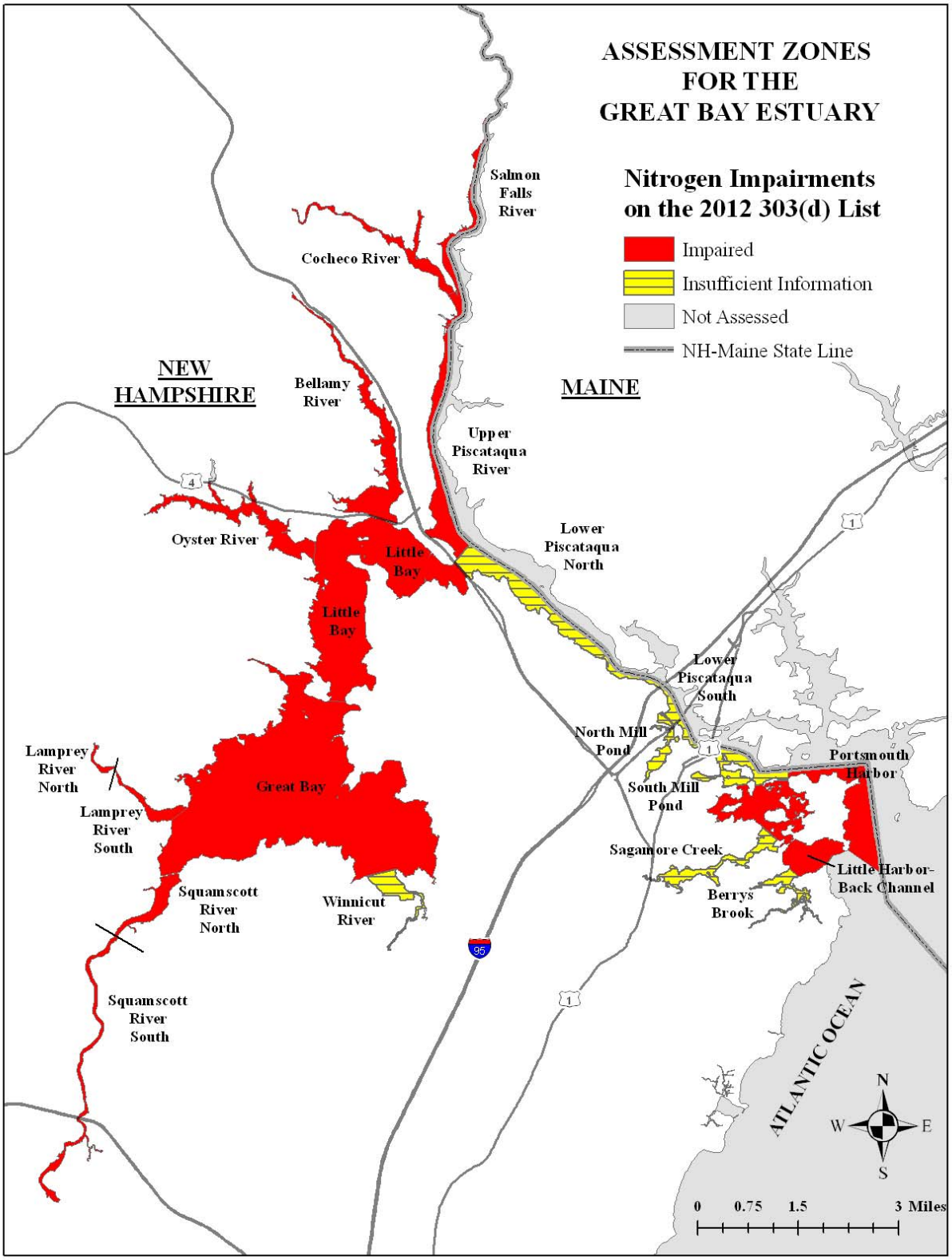
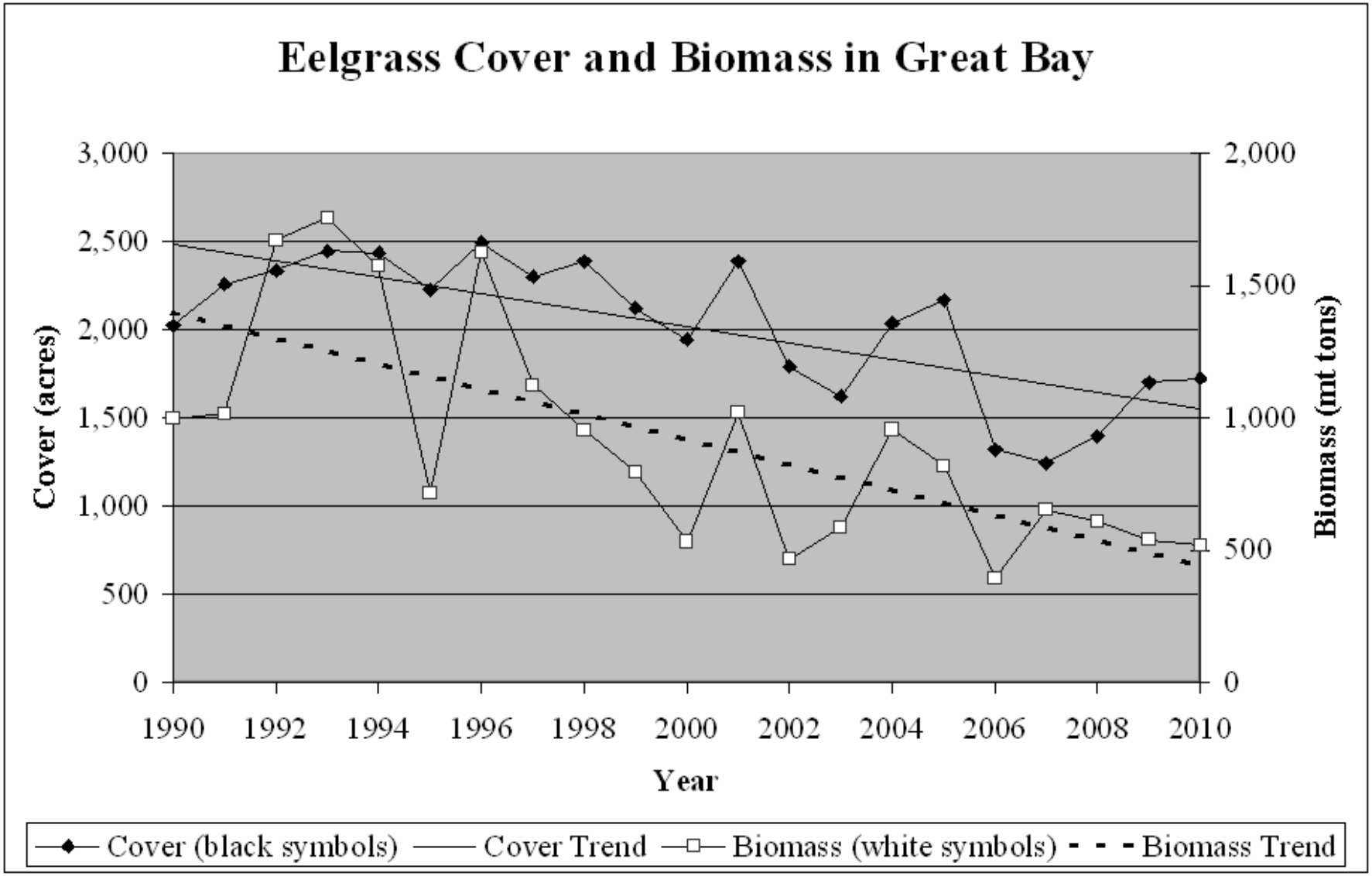


Figure 3: Eelgrass cover and biomass in Great Bay



APPENDIX A

INDICATORS FOR EUTROPHICATION ASSESSMENTS

Assessment Categories

The basic categories for the 305b/303d assessment include Category 2 (Fully Supporting), Category 5 (Not Supporting), and Category 3 (Insufficient Information). The 303d List is comprised of all the waters in Category 5. DES has added sub-categories to provide more information on how good or bad the water quality is in Category 2 and Category 5 water bodies, respectively. Category 3 has also been divided to distinguish between water bodies without any information and water bodies with incomplete information. The DES categories will be used for the rest of this report. A crosswalk between the DES categories and the basic 305b/303d assessment categories is provided below.

305b/303d Category	DES Category	Description
Category 2 (Fully Supporting)	2-G	Full Support, good water quality
	2-M	Full Support, marginally above criteria
Category 3 (Insufficient Information)	3-PAS	Insufficient information, potentially attaining standards
	3-PNS	Insufficient information, potentially not supporting
	3-ND	Insufficient information, no data
Category 5 (Not Supporting, 303d)	5-M	Impaired, marginally below criteria (303d)
	5-P	Impaired, poor water quality (303d)

Indicator: Dissolved Oxygen (DO) and Dissolved Oxygen Saturation (Sections relevant to estuaries only)

Use Support Matrix for Dissolved Oxygen

Total Sample Size	Total # WQC Exceedances	Total # of MAGEXC Exceedances	Use Support
≥ 10	< 10% of samples rounded to the nearest integer or 2 whichever is larger	≤ 1	FS
< 10	< 2	≤1	INSUFFICIENT INFORMATION or NOT ASSESSED
< 10	≥ 2	≥ 0	NS
≥ 10	≥ 10% of samples rounded to the nearest integer or 2 whichever is larger	≥ 0	
≥ 2	≥ 2	≥ 2	

Notes:

1. Assessments shall be based on the most recent full calendar year of data (or years if there was insufficient data in the most recent year to make an assessment). If, however, older data indicated NS, the more recent data used to make a FS decision must meet the requirements in Table 3-20 and must include at least 2 samples collected at the same or more water quality limited sites and under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.

2. To be assessed as FS for dissolved oxygen:

   a. There must be sufficient data to indicate that all appropriate DO criteria are met (i.e., instantaneous minimum, daily average and in some cases, the 7 day mean as well).

   b. Samples must be taken during critical times of day (see Note 5c below) and seasons depending on the water type and use:

      - If the surface water is not a cold water natural reproducing fishery), at least 50% of the number of independent samples (i.e., n>5) needed for FS, shall be taken between June 1 and September 30 (i.e., the critical season) and during the critical time of day. This is when DO is most apt to be lowest due to high temperatures and low flows. The remaindered of the minimum number of independent samples needed for FS shall also be collected during the critical time of day but do not need to be collected during the critical season noted above. In cases where there are numerous non-critical season and non-critical time of day samples, the overall sample count will not be used to artificially increase the needed exceedences to exceed the binomial count.

      - In surface waters that are cold water natural reproducing fisheries, 100 % of the minimum number of independent samples (i.e., n=10) needed for FS determination shall be taken between October 1 and May 14.

3. Exceedances of the Water Quality Criteria for DO are defined as:

   Base D.O. Assessment Criteria

Applicable waters	Daily Average Measurement	Instantaneous Measurement
Class B: Applies to any depth in tidal waters	< 75% saturation	< 5 mg/L

4. Exceedances of the Magnitude of Exceedance Criteria (MAGEXC) for DO are defined as:

   Class A: DO < 5.5 mg/L or <65% saturation
   Class B: DO < 4.5 mg/L or <65% saturation
   Cold Water Fish Spawning Area (Class A or B): DO <7.5 mg/L

5. Data requirements for determining compliance:

   a Where DO is used as a Core Indicator, there must be sufficient data to indicate that all appropriate DO criteria are met (i.e., instantaneous minimum, daily average and in some cases, the 7 day mean as well) before DO can be assessed attaining water quality standards

   b Preferred data/conditions for assessing DO:

      1) Compliance with instantaneous minimum DO concentration (mg/L) criteria shall be based on the minimum of a series of dissolved oxygen measurements taken at the same location and a maximum of one hour apart for 24 continuous hours except as noted in 5c below. High frequency datasonde measurements generally provide the most accurate and representative data.

      2) Compliance with average daily DO percent saturation criteria shall be based on the time weighted average of DO measurements taken at the same location and a maximum of one hour apart for 24 continuous hours except as noted in Note 5c below.

   c Other allowable data/conditions for assessing DO:

      1) For tidal waters:

         a. If preferred data is not available (see Note 5b), tidal waters may be assessed for compliance with the instantaneous minimum, MAGEXC and 75% average daily saturation DO criteria using a series of DO measurements at the same location and a maximum of one hour apart for at least 18 hours within the day.
         b. If preferred data is not available (see Note 5b), tidal waters may be assessed for compliance with the instantaneous minimum and MAGEXC DO saturation criteria based on pairs of grab samples taken at high and low tide.
         c. If preferred data is not available (see Note 5b), tidal waters may be assessed for compliance with the 75% average daily saturation DO criteria based on the average of 2 grab samples as shown below, provided that the samples are taken at concurrent high and low tides.
         d. Source: NHDES, 2004a.

         Alternative % Saturation DO Compliance Criteria for Tidal Waters

Use Support	DO (% saturation)
FS	> 80%
Insufficient Information	≥ 65% but ≤ 80%
NS	< 65%

6. Each daily average calculation is an independent sample for comparison to daily average criteria. Each 7 day mean calculation is considered an independent sample for comparison to 7 day mean criteria. For comparison to the instantaneous minimum or MAGEX criteria, independent samples shall be those taken on different calendar days. If more than one sample is taken on a given calendar day, the worse case sample will be the independent sample for that day. If there are multiple vertical profile measurements at a station, the worse case sample shall be the independent sample for that day.

Indicator: Dissolved Oxygen Impairments Predicted from Total Nitrogen Concentrations (TN)

Fully Supporting: Median TN concentrations are <= 0.45 mg N/L
Not Supporting: Median TN concentrations are > 0.45 mg N/L

Notes:

1. Four quantitative indicators are related to violations of the water quality standards for dissolved oxygen. DES already uses direct measurements of dissolved oxygen and dissolved oxygen saturation and compares those to the numeric water quality criteria in Env-Wq 1703.07. The indicators for total nitrogen and chlorophyll-a concentrations can also be used as indicators of violations of the dissolved oxygen criteria in the CALM. The methodology for directly assessing dissolved oxygen and dissolved oxygen saturation measurements are provided in the CALM. The methodologies for assessing the nitrogen and chlorophyll-a indicators are described below as derived from "Numeric Nutrient Criteria for the Great Bay Estuary" (http://des.nh.gov/organization/divisions/water/wmb/wqs/index.htm).
2. Data Requirements
    a Assessments shall be based on TN data that is 5 years or less in age and the median TN concentration shall be used to make the criteria comparison.
    b The median TN concentration shall be calculated from representative data that cover all four seasons of the year.
    c The minimum sample size of independent results for TN shall be 15 for a given waterbody.
    d If older data indicated Non Support, the more recent data used to make a Full Support decision must have been collected under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.
3. The values of the various indicators were combined using a stressor-response matrix for a unified assessment of compliance with the water quality standard for nutrients (Env-Wq 1703.14). For the unified assessment, dissolved oxygen, dissolved oxygen saturation, chlorophyll-a, eelgrass assessments, and water clarity were considered response indicators. The nutrient stressor indicator was the median total nitrogen concentration because nitrogen is the limiting nutrient in the Great Bay Estuary (DES, 2009). The decision matrix in Table 2 illustrates how information from the stressor and response indicators were integrated in all cases. Following the decision matrix, a nitrogen impairment would be assigned if both the response and stressor indicators exceeded thresholds. However, if there were radically conflicting results between indicators, a weight-of-evidence approach, considering the quality of the underlying data for each indicator, was used to make impairment determination and a narrative justification was provided.
4. DES subcategories shall be assigned according to the following:
    a For Category 2, the DES category shall be 2-G if the TN indicator is less than 75% of the criterion. Otherwise, the DES category shall be 2-M.
    b For Category 3, the DES category shall be 3-PAS if there are fewer samples than required for the sample size but the available data have a median value less than the criterion. The DES category shall be 3-PNS if there are fewer samples than required for the sample size but the available data have a median value greater than the criterion; however, DES may assign Category 5 if the median value of the available TN data is several times greater than the criterion. The DES category shall be 3-ND if there are no data for this indicator.
    c For Category 5, the DES category shall be 5-P if the TN indicator is more than 50% greater than the criterion. Otherwise, the DES category shall be 5-M.

Indicator: Dissolved Oxygen Impairments Predicted from Chlorophyll-a Concentrations (Chl-a)

Fully Supporting: 90th Percentile Chl-a concentrations are <= 10 ug/L
Not Supporting: 90th Percentile Chl-a concentrations are > 10 ug/L

Notes**:**

1. Data Requirements
    - a Assessments shall be based on Chl-a data that is 5 years or less in age and the 90th percentile Chl-a concentration shall be used to make the criteria comparison.
    - b The 90th percentile Chl-a concentration shall be calculated from representative data that cover all four seasons of the year.
    - c The minimum sample size of independent results for Chl-a shall be 15 for a given waterbody.
    - d If older data indicated Non Support, the more recent data used to make a Full Support decision must have been collected under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.
2. The values of the various indicators were combined using a stressor-response matrix for a unified assessment of compliance with the water quality standard for nutrients (Env-Wq 1703.14). For the unified assessment, dissolved oxygen, dissolved oxygen saturation, chlorophyll-a, eelgrass assessments, and water clarity were considered response indicators. The nutrient stressor indicator was the median total nitrogen concentration because nitrogen is the limiting nutrient in the Great Bay Estuary (DES, 2009). The decision matrix in Table 2 illustrates how information from the stressor and response indicators were integrated in all cases. Following the decision matrix, a nitrogen impairment would be assigned if both the response and stressor indicators exceeded thresholds. However, if there were radically conflicting results between indicators, a weight-of-evidence approach, considering the quality of the underlying data for each indicator, was used to make impairment determination and a narrative justification was provided.
3. DES subcategories shall be assigned according to the following:
    - a. For Category 2, the DES category shall be 2-G if the Chl-a indicator is less than 75% of the criterion. Otherwise, the DES category shall be 2-M.
    - b. For Category 3, the DES category shall be 3-PAS if there are fewer samples than required for the sample size but the available data have a 90th percentile value less than the criterion. The DES category shall be 3-PNS if there are fewer samples than required for the sample size but the available data have a 90th percentile value greater than the criterion. The DES category shall be 3-ND if there are no data for this indicator.
    - c. For Category 5, the DES category shall be 5-P if the Chl-a indicator is more than 50% greater than the criterion. Otherwise, the DES category shall be 5-M.

Indicator: Biological and Aquatic Community Integrity Impairments Predicted from Water Clarity (light attenuation coefficient, Kd)

Fully Supporting: Median Kd values are <= criteria in table below note 2
Not Supporting: Median Kd values are > criteria in table below note 2

Notes:

1. Three quantitative indicators are related to violations of the water quality criteria for Biological and Aquatic Community Integrity (Env-Wq 1703.19), one manifestation of which is significant eelgrass loss. DES already uses trends in eelgrass cover as an indicator (Indicator 8). The indicator for water clarity and total nitrogen concentrations can also be used as indicators of violations of the Biological and Aquatic Community Integrity criteria. The methodologies for assessing the nitrogen and water clarity indicators are described below.
2. Data Requirements
    - a Assessments shall be based on Kd data that is 5 years or less in age and the median Kd value shall be used to make the criteria comparison.
    - b The median Kd value shall be calculated from representative data that cover all four seasons of the year.
    - c The minimum sample size of independent results for Kd shall be 15 for a given waterbody.
    - d If older data indicated Non Support, the more recent data used to make a Full Support decision must have been collected under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.
    - e The waterbody being assessed must have been assigned an eelgrass restoration depth. The default restoration depth is 2 m below mean water level (MWL). Restoration depths of 2.5 and 3.0 m below MWL should be considered for deeper waterbodies.
3. The Kd thresholds vary by eelgrass restoration depth. The thresholds for different depths are depicted in the table below.

Restoration Depth (m below MWL)	Median Kd (m^{-1})
2.0	0.75
2.5	0.60
3.0	0.50

4. The values of the various indicators were combined using a stressor-response matrix for a unified assessment of compliance with the water quality standard for nutrients (Env-Wq 1703.14). For the unified assessment, dissolved oxygen, dissolved oxygen saturation, chlorophyll-a, eelgrass assessments, and water clarity were considered response indicators. The nutrient stressor indicator was the median total nitrogen concentration because nitrogen is the limiting nutrient in the Great Bay Estuary (DES, 2009). The decision matrix in Table 2 illustrates how information from the stressor and response indicators were integrated in all cases. Following the decision matrix, a nitrogen impairment would be assigned if both the response and stressor indicators exceeded thresholds. However, if there were radically conflicting results between indicators, a weight-of-evidence approach, considering the quality of the underlying data for each indicator, was used to make impairment determination and a narrative justification was provided.
5. DES subcategories shall be assigned according to the following:
    - a For Category 2, the DES category shall be 2-G if the Kd indicator is less than 75% of the criterion. Otherwise, the DES category shall be 2-M.
    - b For Category 3, the DES category shall be 3-PAS if there are fewer samples than required for the sample size but the available data have a median value less than the criterion. The DES category shall be 3-PNS if there are fewer samples than required for the sample size but the available data have a median value greater than

the criterion. The DES category shall be 3-ND if there are no data for this indicator.

c For Category 5, the DES category shall be 5-P if the Kd indicator is more than 50% greater than the criterion. Otherwise, the DES category shall be 5-M.

Indicator: Biological and Aquatic Community Integrity Impairments Predicted from Total Nitrogen Concentrations (TN)

Fully Supporting: Median TN concentrations are <= criteria in table below note 2
Not Supporting: Median TN concentrations are > criteria in table below note 2

Notes:

1. Data Requirements
   - a Assessments shall be based on TN data that is 5 years or less in age and the median TN concentration shall be used to make the criteria comparison.
   - b The median TN concentration shall be calculated from representative data that cover all four seasons of the year.
   - c The minimum sample size of independent results for TN shall be 15 for a given waterbody.
   - d If older data indicated Non Support, the more recent data used to make a Full Support decision must have been collected under similar conditions (i.e., wet weather, dry weather, season, etc) as when the older exceedances occurred.
   - e The waterbody being assessed must have been assigned an eelgrass restoration depth. The default restoration depth is 2 m below mean water level (MWL). Restoration depths of 2.5 and 3.0 m below MWL should be considered for deeper waterbodies.
2. The TN thresholds vary by eelgrass restoration depth. The thresholds for different depths are depicted in the table below.

Restoration Depth (m below MWL)	Median TN (mg N/L)
2.0	0.30
2.5	0.27
3.0	0.25

3. The values of the various indicators were combined using a stressor-response matrix for a unified assessment of compliance with the water quality standard for nutrients (Env-Wq 1703.14). For the unified assessment, dissolved oxygen, dissolved oxygen saturation, chlorophyll-a, eelgrass assessments, and water clarity were considered response indicators. The nutrient stressor indicator was the median total nitrogen concentration because nitrogen is the limiting nutrient in the Great Bay Estuary (DES, 2009). The decision matrix in Table 2 illustrates how information from the stressor and response indicators were integrated in all cases. Following the decision matrix, a nitrogen impairment would be assigned if both the response and stressor indicators exceeded thresholds. However, if there were radically conflicting results between indicators, a weight-of-evidence approach, considering the quality of the underlying data for each indicator, was used to make impairment determination and a narrative justification was provided.
4. DES subcategories shall be assigned according to the following:
   - a For Category 2, the DES category shall be 2-G if the TN indicator is less than 75% of the criterion. Otherwise, the DES category shall be 2-M.
   - b For Category 3, the DES category shall be 3-PAS if there are fewer samples than required for the sample size but the available data have a median value less than the criterion. The DES category shall be 3-PNS if there are fewer samples than required for the sample size but the available data have a median value greater than the criterion; however, DES may assign Category 5 if the median value of the available TN data is several times greater than the criterion. The DES category shall be 3-ND if there are no data for this indicator.
   - c For Category 5, the DES category shall be 5-P if the TN indicator is more than 50% greater than the criterion. Otherwise, the DES category shall be 5-M.

Indicator: Eelgrass (*Zostera marina*) cover in the Great Bay Estuary Impairments

FS: No historical loss > 20% and No decreasing trend that shows a loss of 20% of the resource

NS: Historical loss > 20% or Decreasing trend that shows a loss of 20% of the resource

Notes:

1. The New Hampshire Department of Environmental Services (DES) developed an assessment methodology for determining compliance with water quality standards for biological integrity (Env-Wq 1703.19) using eelgrass (*Zostera marina*) cover in the Great Bay Estuary as an indicator. DES reviewed eelgrass cover data from 1948 to present.
2. Two methods for assessing eelgrass cover data are evaluated,
    a. If there are reliable historic and current maps of eelgrass cover for an area, DES will use the percent decline from the historic level to determine impairments. A region will be considered to have significant eelgrass loss if the change from historic levels is >20%. This threshold value was determined from natural variability observed in recent eelgrass cover in Great Bay.
    b. If sufficient data from annual surveys are available, DES will evaluate recent trends in the eelgrass cover indicator. Trends will be evaluated using linear regression of eelgrass cover in a zone versus year. The assessment zone will be considered to have significant eelgrass loss if there is a statistically significant ($p<0.05$), decreasing trend that shows a loss of 20% of the resource with 95% confidence (i.e., the 95th percentile upper confidence limit of the regression for the most recent date is less than 20% of the maximum value of the cover over the time series).
3. DES will consider a zone to be impaired if either of the two methods indicates significant eelgrass loss. In the EPA Assessment Database, impairments due to significant eelgrass loss will be coded as "Estuarine Bioassessments". For assessment zones with significant eelgrass loss, DES will review available records for dredging and mooring fields to identify potential impacts to eelgrass from these activities.
4. DES may also consider trends in eelgrass biomass as supplemental information when making some assessments. Eelgrass cover does not account for thinning of beds, which is also a loss of habitat and ecosystem services. Biomass is calculated by multiplying the eelgrass area by the eelgrass density (PREP, 2008). In addition, DES may consider published reports about eelgrass impacts due to the proliferation of macroalgae as supplemental information for eelgrass assessments.

APPENDIX B

SUMMARY OF DES EELGRASS GIS FILE TOPOLOGY REVIEW AND UPDATES FOR THE 2012 305(B)/303(D) SURFACE WATER QUALITY ASSESSMENTS

Summary of DES Eelgrass GIS File Topology Review and Updates for the 2012 305(b)/303(d) Surface Water Quality Assessments

The UNH Seagrass Ecology Group maps eelgrass habitat in the Great Bay Estuary every year with funding from the Piscataqua Region Estuaries Partnership. The data collection and mapping protocols are documented in an approved Quality Assurance Project Plan.

UNH produced a report on the 2010 eelgrass habitat on June 15, 2011 and transmitted the final GIS files for 2010 to DES at the same time. While working with the GIS files, DES noticed that a few eelgrass bed polygons had been duplicated in the 2010 layer, which caused the area of eelgrass in Great Bay to be inflated due to double counting. To correct the problem, DES established a GIS topology rule that would check for overlapping polygons for all of the eelgrass layers from 1981 to 2010. The only significant overlaps were the duplicated polygons in the 2010 layer and some larger overlaps for Great Bay and Little Harbor beds in the 2005. In addition, the topology rule found several small slivers where abutting polygons overlapped in the 1981 and 2004-2010 layers. The areas of these slivers were typically too small to affect the eelgrass totals significantly (see last paragraph).

DES eliminated all of the overlapping areas to prevent double counting and to improve the overall quality of the eelgrass layers. The following protocols were used to fix the layers:

- For duplicate polygons with identical attributes: Delete one of the polygons.
- For a polygon of the same eelgrass density inside a larger polygon: Merge the smaller polygon into the larger polygon.
- For an eelgrass polygon inside a polygon marked as "Not Mapped" (1981 layer only): Merge the eelgrass polygon with the Not Mapped polygon.
- For small or sliver overlaps between two polygons: Merge the sliver with the polygon with the lower Object ID (the polygon with the lower ObjectID was selected by default by the software).
- For slivers that consist of two identical polygons but with different densities[1] (2010 layer only): Delete the sliver with the lower ObjectID (the polygon with the lower ObjectID was selected by default by the software) and then merge the remaining sliver with the adjacent polygon of the same density[2].
- For larger overlaps in 2005 and 2010: Consult with the data authors at UNH (see approved changes below after the "→").
    - 2005: Object ID 103 (p) overlap with Object ID 72 (sb) → new ObjectID 188 (p)
    - 2005: Object ID 121 (h) overlap with Object ID 171 (d) → new ObjectID 189 (d)
    - 2005: Object ID 121 (h) overlap with Object ID 143 (sb) → new ObjectID 190 (sb)
    - 2005: Object ID 121 (h) overlap with Object ID 143 (sb) → new ObjectID 191 (sb)
    - 2010: Object ID 155 duplicate polygon with two densities (p or sb) → assigned to (p)

Because overlaps cause double counting, correcting the overlaps caused eelgrass cover totals to decrease in some areas, particularly in 2005 and 2010. In Great Bay, the totals decreased by <1 acre in 1981, 5.6 acres in 2004, 35.4 acres in 2005, <1 acre in 2006-2009, and 185.7 acres in 2010. In Little Harbor, the eelgrass total in 2005 decreased by 2.9 acres. In all other areas and years, correcting the overlaps resulted in <0.15 acres change from the previous totals. The updated eelgrass cover totals for all years that were changed were used for the 2012 305(b)/303(d) assessments.

1. UNH gives each eelgrass polygon a density code: d (dense), sb (some bottom), h (half), and p (patchy).
2. There was one exception to this protocol. For multiple overlaps involving Object ID 167, 168, 153, 154, 72, and 73, the following actions were taken: Deleted 168 (dupe with 167), deleted 153 (dupe with 154), merged 167 sliver with 72 (both d), and merged 154 sliver with 73 (both p). This approach differs from the protocol because Object ID 167 should have been deleted but the configuration of the polygons did not support this and the area involved was minimal (<0.02 acres).

APPENDIX C

DES. 2011. Letter to the Environmental Protection Agency Dated August 8, 2011 Regarding Squamscott River and Lamprey River Assessment Units for 2012 305(b)/303(d) Cycle. New Hampshire Department of Environmental Services, Water Division, Watershed Management Bureau, Concord, NH.

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner

August 8, 2011

Stephen Perkins
Environmental Protection Agency
Region 1
Mail Code OEP06-5
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: Squamscott River and Lamprey River Assessment Units for 2012 305(b)/303(d) Cycle

Dear Mr. Perkins:

Assessment units are the basic unit of record for conducting and reporting surface water quality assessments under Sections 305(b) and 303(d) of the Clean Water Act. Assessment units must not contain areas where multiple conflicting water quality standards apply. Additionally, assessment units need to be small enough to have reasonable homogenous water quality but at the same time they need to be large enough to create a spatial converge of New Hampshire's waters that is useful for watershed management activities.

The Squamscott River assessment unit stretches six miles from the head-of-tide dam in downtown Exeter to the railroad causeway across the Squamscott at the common boundary of Newmarket, Newfields, and Stratham (see Figure 1A). Similarly, the assessment unit for the tidal Lamprey River extends for two miles from the head-of-tide dam in Newmarket to the confluence with the Great Bay (Figure 2A). For the 2008 assessment cycle, DES determined that these two assessment units were impaired for nitrogen due to both low dissolved oxygen and eelgrass habitat loss for the aquatic life designated use. Low dissolved oxygen has been measured throughout these assessment units but potential eelgrass habitat only exists in the lower (downstream) portions of these assessment units.

DES has proposed two different water quality criteria for total nitrogen for the prevention of low dissolved oxygen and the protection eelgrass habitat. The total nitrogen criterion for the prevention of low dissolved oxygen is 0.45 mg/L and is relevant to all sections of the Great Bay Estuary. The total nitrogen criterion for the protection of eelgrass habitat is 0.3 mg/L and is only relevant to sections of the Great Bay Estuary where eelgrass has historically existed. Both of these criteria are applicable to the Squamscott River and Lamprey River assessment units. The eelgrass criterion applies near the mouth where eelgrass historically existed. The dissolved oxygen criterion applies to the entire assessment unit and is the only applicable criterion upstream of the area of historic eelgrass habitat to the head-of-tide dam. While these two criteria do not directly conflict, having two different numeric criteria for nitrogen for these assessment units has been confusing to the regulated community, especially since only one of the two applies in a good portion of the assessment units.

DES Web site: **www.des.nh.gov**
P.O. Box 95, 29 Hazen Drive, Concord, New Hampshire 03302-0095
Telephone: (603) 271-2457 • Fax: (603) 271-7894 • TDD Access: Relay NH 1-800-735-2964

To resolve this confusion, DES is planning to split the Squamscott River and Lamprey River assessment units each into two pieces for the 2012 assessment cycle. The Squamscott River assessment unit will be split at the Route 108 bridge near Chapman's Landing. The nitrogen criterion to prevent low dissolved oxygen will apply to the southern portion because there has never been documented eelgrass in that area and all indications are that there is no suitable habitat. Both the nitrogen criterion to protect eelgrass use and the nitrogen criterion to prevent low dissolved oxygen will apply to the northern portion as there has been documented eelgrass in that area and the model from Short et al. (2002)[1] indicates suitable habitat if water quality were not degraded (Figures 1B and 1C). The Lamprey River assessment unit will be split at the Lower Narrows. The nitrogen criterion to prevent low dissolved oxygen will apply to the northern portion and both the nitrogen criterion to protect eelgrass use and the nitrogen criterion to prevent low dissolved oxygen will apply to the southern portion based on the data presented in Figures 2B and 2C. Having two different assessment units in each of these tidal rivers with more explicit definitions of the applicable nutrient criteria should resolve confusion within the regulated community.

In 2010, DES developed a mixing model to predict the watershed nitrogen loading reductions that would be needed to meet the total nitrogen criteria. The modeled scenarios for the Squamscott River and the Lamprey River are consistent with the proposed changes to the assessment unit boundaries. Therefore, the changes to the assessment unit boundaries are not likely to significantly change the nitrogen load reductions predicted by DES for the Exeter/Squamscott River or the Lamprey River watersheds.

DES is sharing our plans for splitting the Squamscott River and Lamprey River assessment units now to get EPA's comments before we start our 2012 assessment cycle and to inform your decision making regarding permits for municipal wastewater treatment facilities.

If you have any questions, please contact me at (603) 271-7940 or Ted.Diers@des.nh.gov.

Sincerely,

Gregg Comstock for

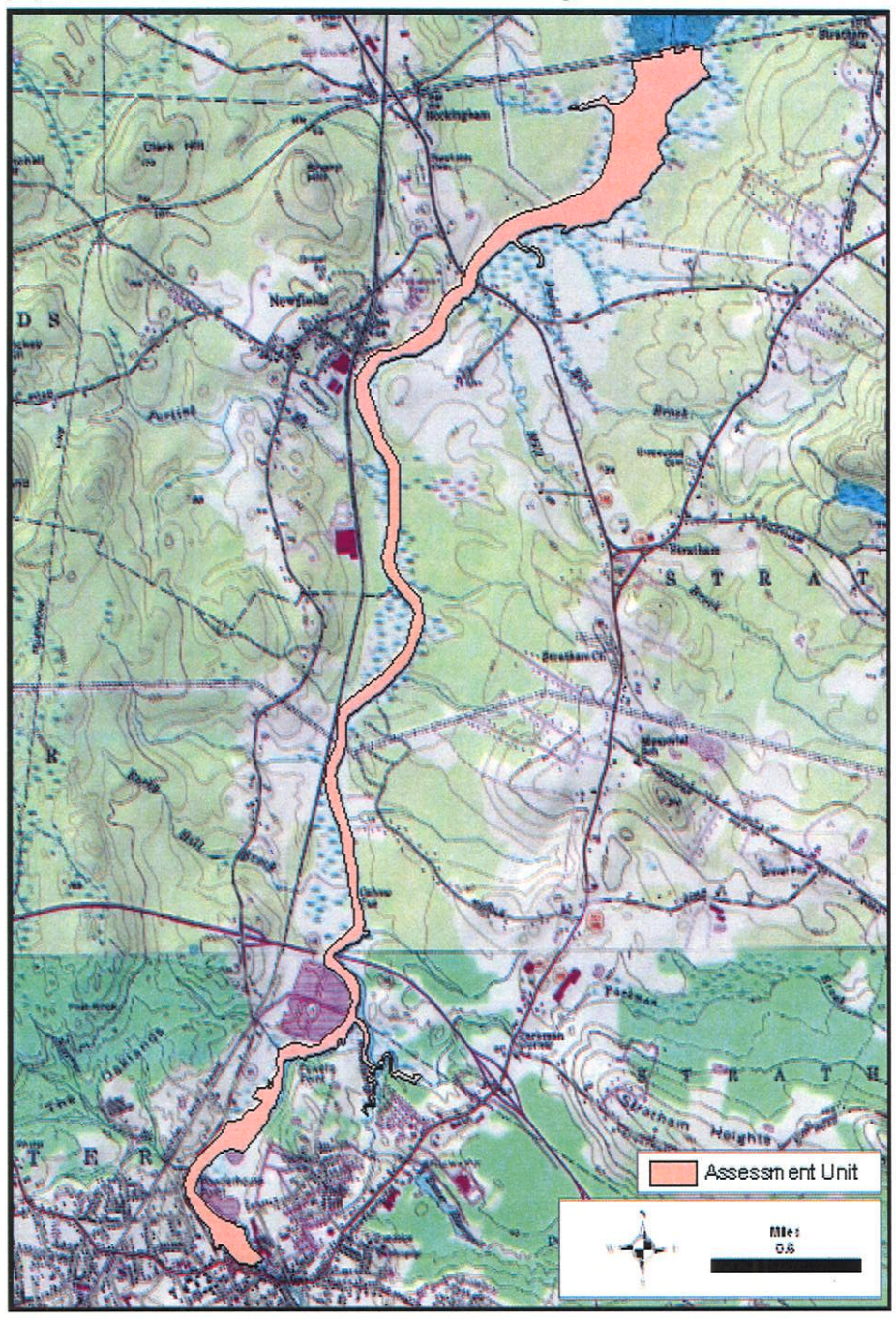
Ted Diers, Administrator
Watershed Management Bureau

Cc: Harry Stewart, DES
Dan Arsenault, EPA
Stephen Silva, EPA

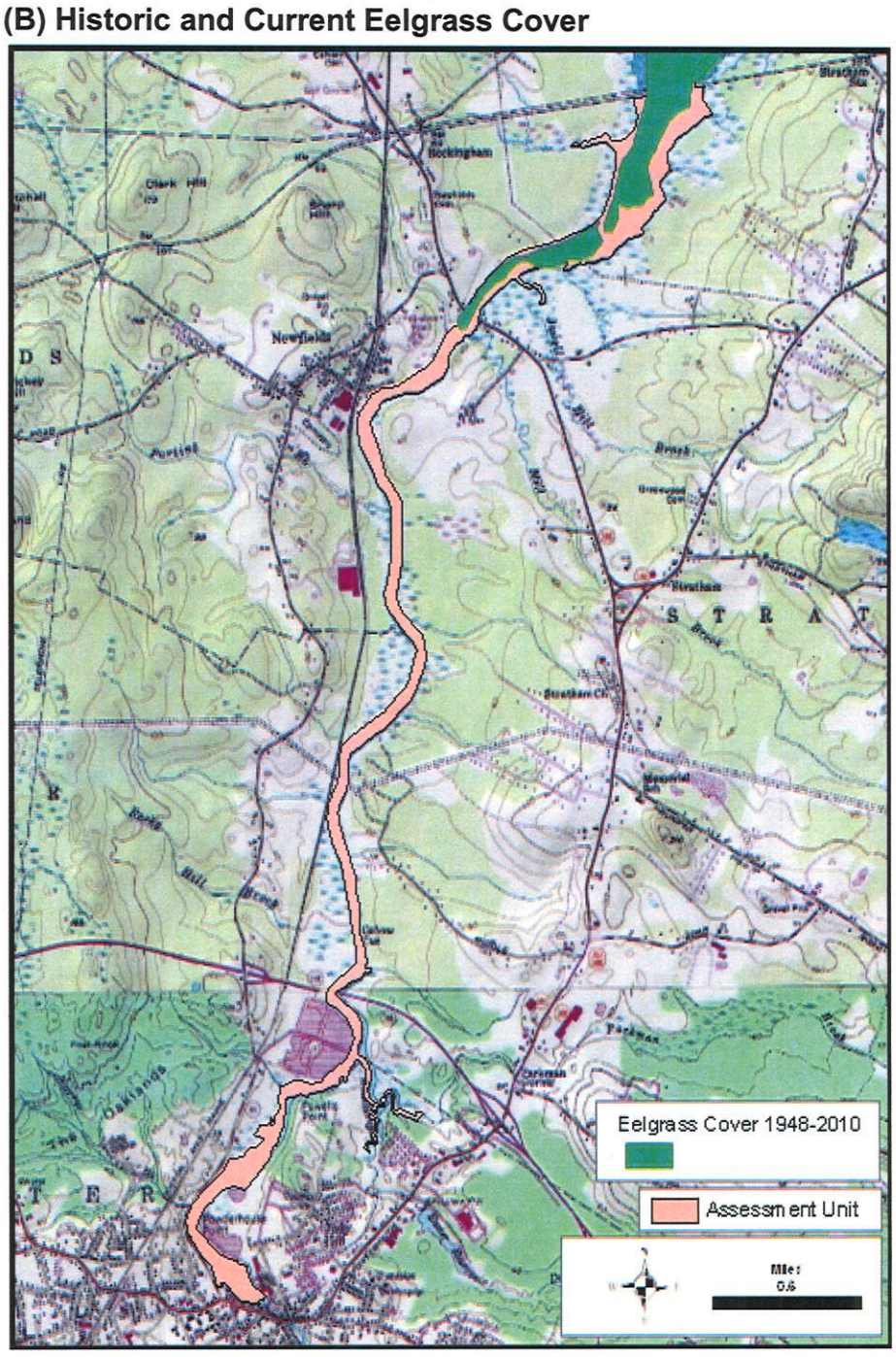
[1] Short, F.T. et al. 2002. Site selection model for optimal restoration of eelgrass, *Zostera marina* L. *Marine Ecology Progress Series* 227: 253-267. This model considers factors such as sediment type, wave exposure, water depth, and the presence of current or historic eelgrass.

Figure 1: Squamscott River

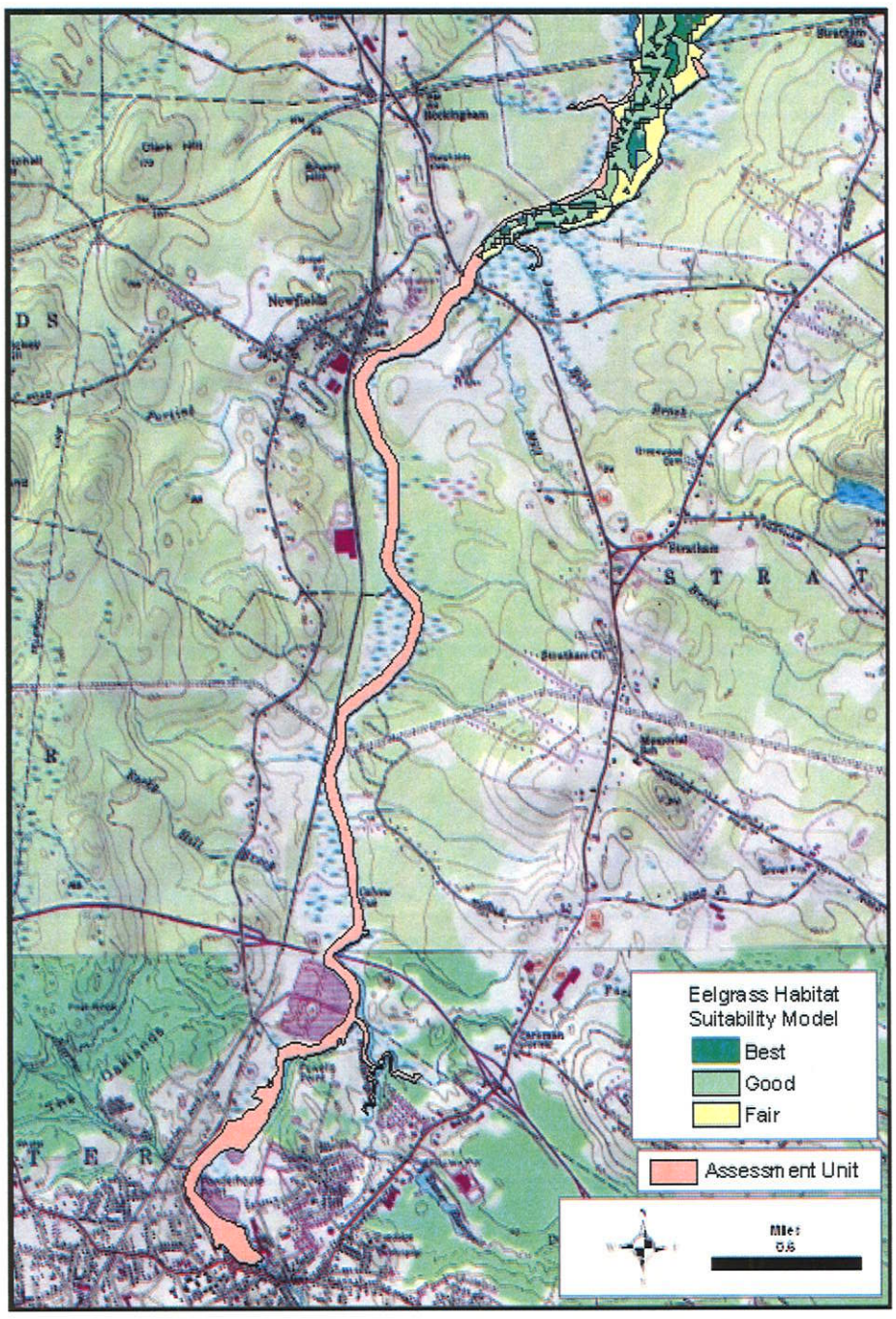
(A) Current Assessment Unit Boundary



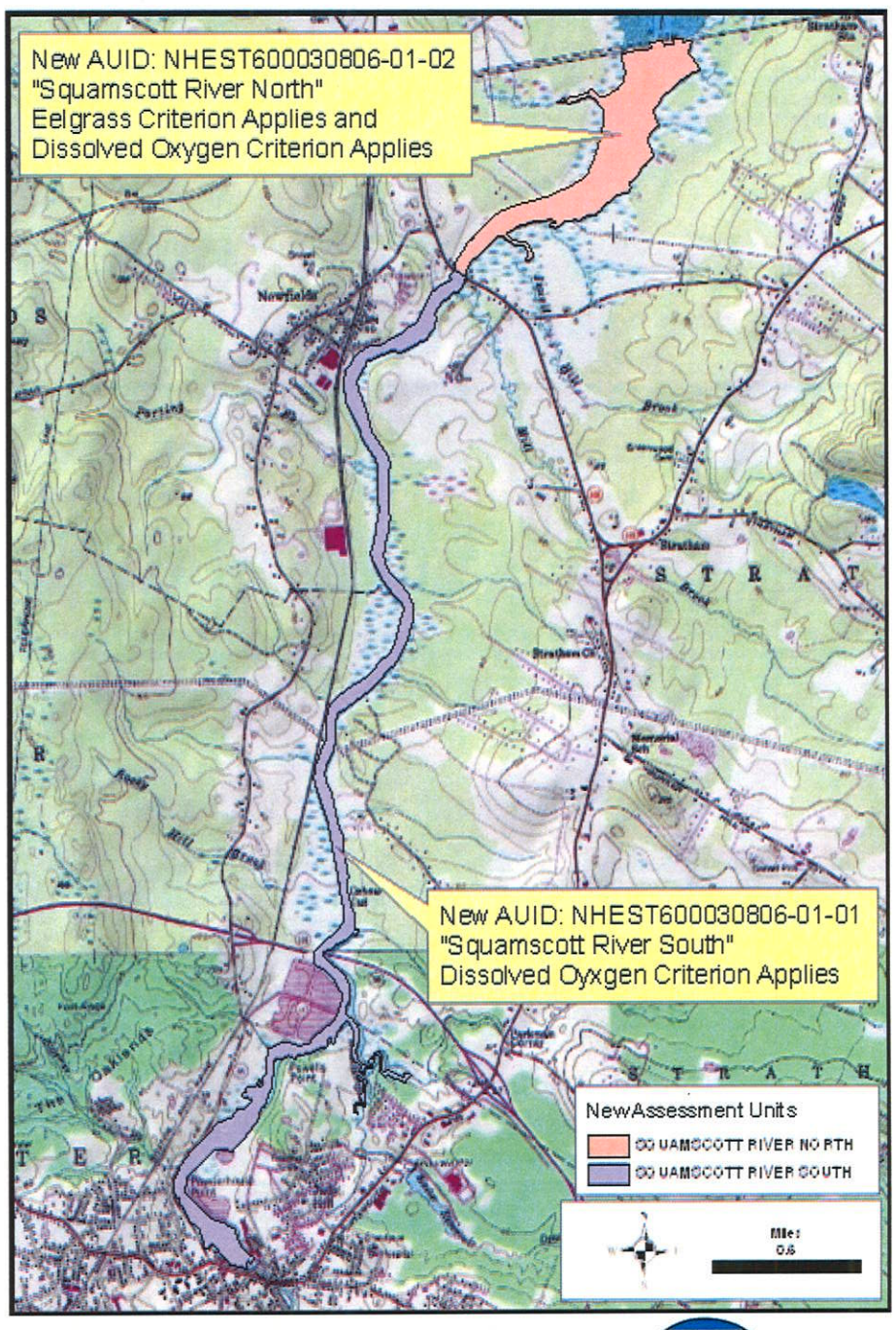
(B) Historic and Current Eelgrass Cover



(C) Eelgrass Habitat Suitability Predictions



(D) New Assessment Unit Boundary



Map created 7/27/2011

The coverages presented are under constant revision as new sites or facilities are added, and may not contain all potential or existing sites or facilities. NHDES is not responsible for the use or interpretation of this information by third parties.

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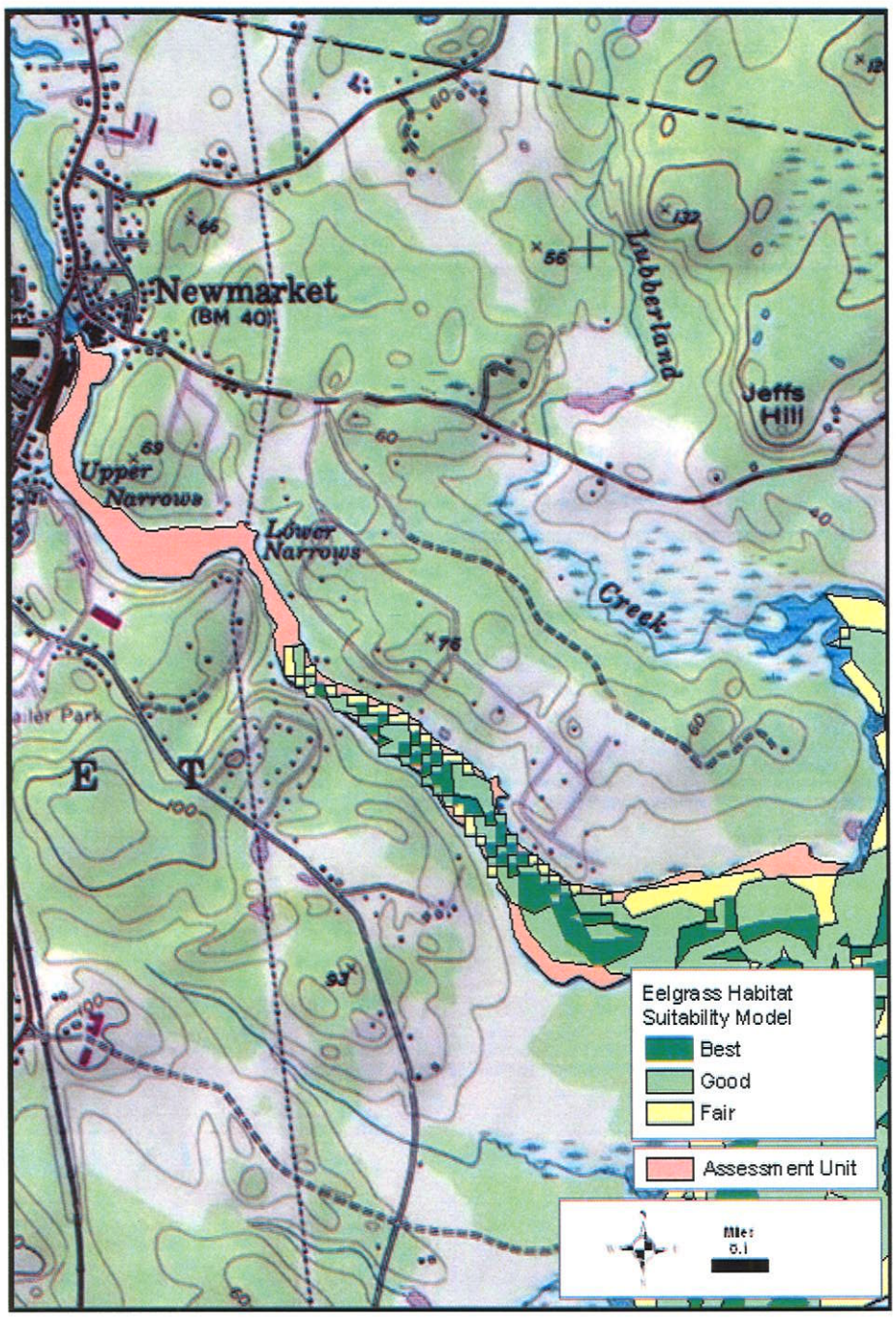
Figure 2: Lamprey River

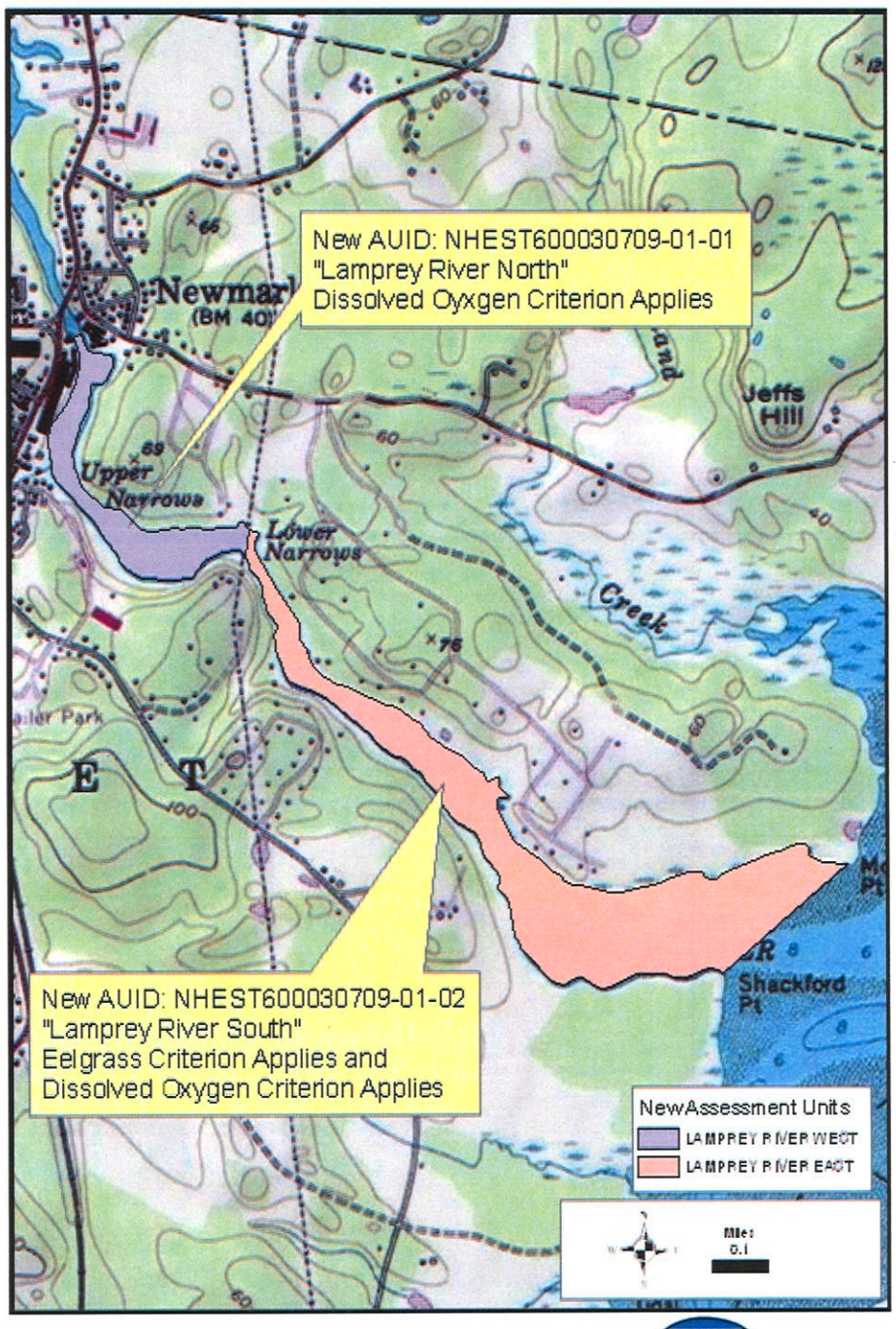
(A) Current Assessment Unit Boundary

(B) Historic and Current Eelgrass Cover

(C) Eelgrass Habitat Suitability Predictions



(D) New Assessment Unit Boundary



Map created 7/27/2011

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