EXHIBIT– 1

Hall & Associates

Suite 701
1620 I Street, NW
Washington, DC 20006-4033
Telephone: (202) 463-1166 Web: http://www.hall-associates.com Fax: (202) 463-4207

Reply to E-mail:
jhall@hall-associates.com

December 15, 2011

VIA U.S. FIRST CLASS MAIL & E-MAIL

Stephen S. Perkins
Director, Office of Ecosystem Protection
U.S. Environmental Protection Agency, Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

RE: Request for Public Comment on Proposed Town of Newmarket, NH, NPDES Permit No. NH0100196

Dear Mr. Perkins:

The Great Bay Municipal Coalition ("the Coalition") is an organization dedicated to the establishment of appropriate and cost-effective restoration measures to protect Great Bay and its resources. The Coalition represents five major communities whose wastewater flows into various parts of the Great Bay system – Dover, Exeter, Newmarket, Portsmouth, and Rochester. These communities are directly impacted by the proposed nutrient reduction water quality objectives and requirements for the Town of Newmarket. Attached please find comments and objections to the proposed draft NPDES Permit No. NH0100196 for the Town of Newmarket, NH. These comments are provided on behalf of the Coalition and on behalf of the Coalition's individual members and supplement the Coalition's public hearing comments. The Coalition has requested that EPA produce, under the Freedom of Information Act, those agency records that support various claims that EPA has made in the permit Fact Sheet and in its public presentations. This information, which is critical to the preparation of comprehensive comments on the proposed permit, has yet to be received by the Coalition. Therefore, the Coalition is unable to provide "all available arguments and supporting information" relevant to the proposed permit. Upon EPA's response to these requests, the Coalition intends to supplement these preliminary comments if necessary. Thank you for your consideration of these comments. We look forward to the Region's response.

Sincerely,

John Hall / AWT

John C. Hall

Enclosures
cc: Coalition Members
Ted Diers, DES

Proposed Newmarket Permit
Comments of the Great Bay Municipal Coalition

The Great Bay Municipal Coalition (the Coalition) is an organization dedicated to the establishment of appropriate and cost-effective restoration measures to protect Great Bay and its resources. The Coalition members include the towns of Dover, Exeter, Newmarket, Portsmouth, and Rochester. These communities are directly impacted by the proposed nutrient reduction requirements for the Town of Newmarket.

The following provides the comments and objections to the draft NPDES Permit No. NH0100196 for the Town of Newmarket, NH. Pursuant to this proposed permit action, EPA is seeking to include a 3 mg/l total nitrogen (TN) monthly average limitation, asserting that such limitation is necessary to ensure compliance with New Hampshire's narrative water quality standards and abate existing impairments in the Lamprey River. In particular, the Region asserts that attainment of a 0.3 mg/l TN instream objective in the Lamprey River is necessary to restore lost eelgrass beds in that waterway. EPA's "Fact Sheet" relies extensively on various draft documents prepared by New Hampshire Department of Environmental Services (DES) in concluding the stringent limitations are both necessary and appropriate. EPA has also stated in various forums that the same criteria and load reduction requirements will be applied to other wastewater discharges throughout the Great Bay watershed, confirming that the draft nutrient criteria developed by DES in 2009 are being applied as area wide water quality criteria, universally applicable in all Great Bay waters and tidal tributaries. For the reasons stated below, and based on information to be developed in accordance with the Coalition's Memorandum of Agreement (MOA) with "DES" (Ex. 1), we object to this permit action as technically and legally flawed and request that the proposed permit be withdrawn or modified.

Preliminary Issues Regarding the Ability to Identify Available Arguments and All Supporting Materials

1. EPA's Failure to Provide Timely Access to Relevant Supporting Documents

The Coalition, through its representatives, has requested that EPA produce, under the Freedom of Information Act ("FOIA"), those agency records that support various claims that EPA has made in the permit Fact Sheet and in its public presentations. (*See* Ex. 2.) This information is critical to the preparation of comprehensive comments on the proposed permit. The completeness and applicability of EPA's response is yet to be determined. Therefore, the Coalition is unable to provide "all available arguments and supporting information" relevant to the proposed permit. Upon review of the requested information, the Coalition intends to supplement these preliminary comments if necessary.

2. Ongoing Water Quality Studies and Peer Review of Eelgrass Draft Numeric Criteria

Pursuant to the MOA, ongoing water quality modeling and peer review activities are underway regarding the draft numeric criteria that EPA relied upon in deciding to establish the proposed effluent limits. These studies relate directly to the scientific defensibility of EPA's assertion that a transparency-based 0.3 mg/l TN criterion must be achieved in the Lamprey River at the point of Newmarket's discharge to allow for recovery of eelgrass in this tidal river. In prior correspondence, EPA has acknowledged that such information will be considered after the close of the public comment period. Therefore, when such information is available, the Coalition will submit it to EPA as supplemental comments and information that must be considered in issuing this permit as proposed. EPA has also been separately collecting dissolved oxygen (DO), transparency and macroalgae data for the bay. Whether and how EPA will use such data to reach technical conclusions impacting this permit is not known. When such information and analyses are publicly available, additional comment on such information may be provided, to the degree it affects Newmarket's permitting decision.

3. Assumptions Regarding Causes of Use Impairment are Premature and Unsupported

The MOA between the Coalition and DES recognizes that use impairments exist in the Bay, but the causes of such impairments are still under investigation. EPA, however, presumed that all of the existing impairment designations were properly determined and conclusively related to excess nitrogen levels, based on DES documents developed *prior to the MOA and subsequent MOA review committee analyses*. It is generally understood that all Section 303(d) impairment designations are based on limited data and relatively little analysis as to cause. That is why during the permitting or TMDL process it is necessary to document and confirm that (1) the impairment designation is fully supported and (2) the cause is independently verified. EPA, however, presumed that such preliminary impairment designations and causes were fully documented by DES, contrary to the MOA which confirms that they are under active review. In fact, the review procedure established under the MOA has indicated that transparency was not the cause of eelgrass decline in either the Bay or tidal rivers at issue (i.e., Squamscott and Lamprey Rivers). The following briefly summarizes the results of the MOA Review Committee and the updated information from various water quality assessments (e.g., Squamscott River sampling program).

Two meetings were held with a group of UNH researchers, DES, Coalition members, and Coalition members' consultants. An EPA representative was only present at the first meeting but was copied on all subsequent correspondence. The UNH participants were selected because of their specific expertise on key ecological issues of concern. Many of these participants are also members of the PREP review committee. The meeting minutes from those discussions are attached. (*See* Exs. 21 and 22.) Based upon those discussions, the following technical conclusions have been drawn:

a. Eelgrass losses in the portions of Great Bay and tidal rivers where nitrogen levels are elevated do not appear to be a result of either insufficient transparency or excessive epiphyte growth; eelgrass receive sufficient light over the tidal cycle (confirmed by Fred Short);

b. Macroalgae growth has significantly increased in the Great Bay over the past two decades, and this condition is adversely impacting habitat and eelgrass populations (confirmed by Art Mathieson) (Note: Such excessive macroalgae growth has not been documented in any of the Bay's tidal rivers or tied to any decline in eelgrasses in those areas.);

c. Macroalgae die back every winter, and their regrowth occurs primarily during warmer weather, peak light months (May to September) (confirmed by Art Mathieson);

d. The excessive macroalgae are most likely caused by increased dissolved inorganic nitrogen (DIN) loads to the Great Bay though certain invasive species may also tolerate low DIN levels (confirmed by Art Mathieson, DES); and

e. The level of DIN control required to control macroalgae is not known with any certainty, but these invasive species should be controllable through reduction of inorganic nitrogen loading levels to mid-1990 conditions when the eelgrass resource experienced a period of abundance (confirmed by group discussion).

Based upon this information, the 2009 proposed draft TN criteria are plainly in error and should be amended, as well as the 2009 amendment to the 2008 Section 303(d) lists in which NHDES posited that decreases in the eelgrass resource was caused by elevated nitrogen levels and reductions in transparency. It is now clear that the draft criteria's assumption that transparency, chlorophyll *a* levels, and TN were the causal factors for eelgrass losses in both tidal rivers and the Bay was incorrect. All of the water quality standards ("WQS") development documents based on that paradigm are equally in error and misdirected. The focus for the Bay restoration should be changed to macroalgae and DIN. Thus, EPA's reliance on Section 303(d) lists should be revised to indicate that the designated cause of eelgrass declines in the Bay is excessive macroalgae growth and increased DIN loadings. Presently, there is no identifiable DIN concentration that can be used as a simple instream nutrient objective, but accomplishing reductions to the mid-1990 levels seems advisable. An accelerated program to identify the level of DIN control needed to limit macroalgae growth and a survey of macroalgae impacts also need to be developed. Because of this new information, the Coalition is proposing an adaptive management plan which will implement DIN controls at key wastewater facilities.

Given this information that demonstrates the prior DES analyses and recommended numeric nutrient criteria are not scientifically defensible, the permit should be withdrawn to reflect the recommendations contained in the draft adaptive management plan (i.e., a season limit of 8 mg/l TN for Newmarket, Exeter, and Durham). Any continued reliance by EPA on the historical DES technical analyses would be arbitrary and capricious given the updated scientific information.

In addition, the impairment designations for the Lamprey River (and other tidal rivers) are plainly in error with respect to the causes of eelgrass losses and DO impairments. In the Lamprey River and several other tidal rivers, it is acknowledged that the habitat/water quality is not suitable for eelgrass. (*See, e.g.,* Ex. 3, Great Bay Restoration Compendium, September 2006, Figure 6.) The 2009 PREP report, as well as EPA's Fact Sheet (*see* Fact Sheet @ 17), confirmed the cause of the loss was "unknown." Therefore, EPA's assertions that excessive nitrogen concentration is the reason for eelgrass loss and the key to their restoration in the Lamprey River or where this river enters the Bay are entirely misplaced.

In addition, various reports, discussed herein, confirmed that periodic low DO conditions in the Squamscott and Lamprey Rivers were <u>not</u> associated with excessive algal growth. This finding is consistent with the PREP 2009 State of the Estuaries report at 14: *"The causes of the sporadic low dissolved oxygen concentrations in the tidal rivers are unknown. Some possible explanations are algal blooms, benthic organism respiration, and oxygen demand from wastewater facility effluent. In some cases low concentrations may be natural phenomena."*

EPA's recent testing of the Squamscott River also confirmed that lower DO was associated with lower, not higher, algal growth in that system. (*See* Ex. 7, Diurnal DO Variation in the Squamscott River.) EPA's Nov. 18, 2011, FOIA response that provided copies of the data collected for the Squamscott River in August and September, 2011, is incorporated by reference, herein. Therefore, regulating TN would not eliminate low DO in these waters as originally thought by DES. EPA's reliance on the impairment listings and preliminary causes previously identified by DES is without legal or technical basis. Under federal and state laws, EPA needs to justify this permit action, if it can, based on a site-specific demonstration that nutrients are causing the claimed impairments in the water body of concern and not based on generalized information or preliminary impairment designations that have subsequently been shown to be misplaced following more detailed assessments. Such site-specific analysis must be presented to the public for review <u>before</u> any further action on this permit may occur.

Procedural Issues and Objections

1. The proposed permit action is premised on the conclusion that the underlying technical basis of DES' proposed draft numeric criteria used to justify the TN limits has been fully peer reviewed and is scientifically defensible. (*See* June 29, 2010, letter from EPA (Perkins) to DES (Stewart).) This is a requirement of 40 C.F.R. § 131.11.[1] These conclusions are in error from several perspectives. First, the Coalition and the impacted communities were excluded from the Regional Office peer review of the draft state numeric nutrient criteria. This violated the Clean Water Act's ("CWA") public participation mandate. (*See, e.g.*, CWA Sections 101(e) and 304(a); *see also* OMB Peer Review Bulletin, 70 Fed. Reg. 2664, 2668 (January 14, 2005) ("[m]ore rigorous peer review is necessary for information that is based on ***novel methods*** or presents complex challenges for interpretation. Furthermore, the need for rigorous peer review is greater when the information contains ***precedent-setting*** methods or models, presents conclusions that are likely to ***change prevailing practices***, or is likely to affect ***policy decisions*** that have a significant impact.") (emphasis added)).[2] The Coalition submitted relevant comments on the technical deficiencies in the DES numeric nutrient objectives to EPA and the deficiencies in the peer review charge questions which were not designed to elicit a probing review on the more obvious technical problems with the draft numeric

[1] 40 C.F.R. § 131.11(a) states that "[s]uch criteria must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use." 40 C.F.R. § 131.11(b) provides that "[i]n establishing criteria, States should: (1) Establish numerical values based on: (i) 304(a) Guidance; or (ii) 304(a) Guidance modified to reflect site-specific conditions; or (iii) Other scientifically defensible methods."

[2] Given the Region's stated intentions of employing these instream criteria throughout New Hampshire and the Great Bay watershed, EPA's permit limitation is akin to criteria development, a process that must include the opportunity for public comment. *See* CWA § 304(a)(3) ("Such criteria and information *and revisions thereof, shall be issued to the states and shall be published in the Federal Register and otherwise made available to the public*.") (emphasis added).

criteria. In particular, these comments noted that the draft numeric criteria lacked documentation of basic cause and effect relationships and, therefore, cannot be "scientifically sound" as required by 40 C.F.R. § 131.11. (*See* Ex. 4, correspondence on the peer review.) However, these comments and the supporting assessments were never provided to the Region's chosen peer reviewers and, consequently, were never addressed by the two peer reviewers. (*See* EPA Peer Review Handbook, 3rd Ed., EPA/100/B-06/002, May 2006 ("If you obtain stakeholder input, include interested parties to the extent feasible based upon statutory, regulatory, budgetary and/or time constraints. Do not limit input to one stakeholder or one side of a controversial issue (e.g., a responsible party or environmental group).").) Therefore, the proposed permit's reliance on that peer review effort is inappropriate, as due process rights were violated and major technical issues were ignored by the peer reviewers. By excluding public participation on this critical review, EPA also violated mandatory duties under the Act. (*See* CWA §§ 101(e) and 304 (a).)

Second, the peer review concluded that there was no certainty that the proposed nitrogen criteria would actually result in restoration of the use impairments as claimed in the draft numeric criteria document. (*See* May 29, 2010, comments of Walter Boynton.) This is also consistent with the findings and conclusions of the MOA. Therefore, the peer review (and MOA) confirms that the proposed nutrient criteria are not sufficient to meet CWA objectives. (*See American Iron & Steel Inst. v. EPA*, 115 F.3d 979, 990 (D.C. Cir. 1997) ("We have already mentioned that permits must incorporate discharge limitations necessary to ensure that the water quality standards are met. This requirement applies to *narrative criteria as well as to criteria specifying maximum amounts of particular pollutants.*") (emphasis added).) Thus, the Region's reliance on the peer review results is arbitrary and capricious and otherwise not in accordance with the Act. (*See* 40 C.F.R. § 122.44(d)(1)(vi)(A) (requiring a narrative standard-based effluent limitation to "fully protect the designated use").) By EPA's own expert's admission, the instream TN standard chosen for the Lamprey River will not protect the designated use.

The issues raised in the correspondence to the peer reviewers must be addressed in this permit action. Moreover, in accordance with applicable water quality criteria public participation provisions, we request that the public be given an opportunity to present information to this peer review panel before such draft criteria are considered acceptable for use in NPDES actions.

2. EPA's proposed actions are inconsistent with the current position of DES regarding the reliability and use of the draft numeric criteria/narrative criteria interpretation, as documented by the MOA. (Ex. 1.) The MOA concurs that the impact of nitrogen on eelgrass losses, via transparency, is uncertain and requires further peer review assessment. (*See* MOA Coalition Provision V and Whereas provisions.) Due to these uncertainties, DES, the document author, has stated that the draft criteria should <u>not</u> be used for NPDES derivation purposes until the subsequent peer review confirms that the criteria are necessary and appropriate. (*See* MOA Provision Mutual Agreement II and III.) EPA's proposed permit is using the draft criteria in a manner inconsistent with the directives and intent of the state. This is prohibited under 40 C.F.R. § 122.44(d) when

translating a state's narrative criteria. (*See Clarifications Regarding Certain Aspects of EPA's Surface Water Toxics Control Regulations*, USEPA, August 14, 1992, Response @ 4 (stating that permit writers are required to use formally-adopted state policies in interpreting narrative standards); *Kentucky Waterways Alliance v. Johnson*, 540 F.3d 493, 469 n.1 (6th Cir. 2008) ("In interpreting a state's water quality standard, ambiguities must be resolved by 'consulting with the state and relying on authorized state interpretations."); *Marathon Oil Co. v. Environmental Protection Agency*, 830 F.2d 1346, 1351-1352 (5th Cir. 1987) (EPA is merely an "interested observer" as to how a state interprets its WQS provisions); *American Paper Inst. v. EPA*, 996 F.2d 346, 351 (D.C. Cir. 1993) ("Of course, that does not mean that the language of a narrative criterion does not cabin the *permit writer's* authority at all; rather, *it is an acknowledgement that the writer will have to engage in some kind of interpretation to determine what chemical-specific numeric criteria--and thus what effluent limitations--are most consistent with the state's intent as evinced in its generic standard.*") (emphasis added).) Moreover, the applicable federal regulations do not allow EPA to take a draft, yet to be published for adoption criterion and apply that draft value as if it were the adopted standard. DES has explicitly acknowledged that it needs to propose the draft criterion for adoption and has not yet done so in light of the admitted technical uncertainties. (*See* Ex. 1, MOA – DES Agreement II; *see also* 40 C.F.R. § 131.20). This applies to both narrative and numeric criteria interpretations. EPA's actions run roughshod over the state's proposed approach and use the draft criteria in a manner expressly inconsistent with state guidance/policy on the use/interpretation of this narrative criteria interpretation. EPA's action plainly violates 40 C.F.R. § 122.44(d)(1)(vi)(A), as well as the public comment and notice provisions included in 40 C.F.R. § 131 (*see* Comment No. 3, below) applicable to the adoption of narrative criteria interpretations of general/regional applicability.

3. EPA is applying an unadopted and unproposed numeric nutrient value to derive the permit limitations and conclude that limits of technology ("LOT") requirements should be applied to all point sources in this basin. There is nothing site-specific or waterbody specific with regard to the methods EPA employed to conclude that a 0.3 mg/l TN numeric criterion must be achieved. EPA has verbally indicated that this same standard will be used as the basis for revising permits for all of the major municipal facilities tributary to Great Bay. Thus, it is apparent that EPA is *de facto* adopting the draft narrative criterion interpretation as the applicable numeric standard for the Great Bay region, without undertaking the formal adoption process required by state and federal law. Specifically, the CWA and implementing statutes mandate that state water quality standards (WQS), including new narrative criteria interpretation approaches, undergo a public review and adoption process BEFORE being used in the regulatory process pursuant to EPA's "Alaska rule."[3] This also applies to new narrative translator procedures. (*See* Ex. 6, United States Environmental Protection Agency Determination on Referral Regarding Florida Administrative Code Chapter 62-303, Identification of Impaired Surface Waters, July 6, 2005, EPA Florida Determination at 9 ("Provisions that affect attainment decisions made by the State and that define, change, or establish the level of protection to be applied in those attainment decisions affect existing standards

[3] Criteria, regardless of whether they are narrative or numeric, must be vetted through a thorough public notice and comment process. 40 C.F.R. § 131.13; 40 C.F.R. § 131.20(a), (b), and (c).

implemented under section 303(c) of the Act. These provisions constitute new or revised water quality standards.").[4] Failure of the state and EPA to undertake this process has violated federal law, state law, and the due process rights of the communities and individuals affected by the proposed numeric nutrient criteria. The communities must be afforded the opportunity to submit comments within the designated standard adoption process and appeal, if appropriate, this rule adoption action.

State authority over water quality standard decision-making, in general, must be respected by EPA pursuant to applicable federal rules. (*See* 33 U.S.C. §1313, *et seq.*[5]) EPA is supposed to implement the state's interpretation of the state's narrative criteria application. (S*ee* Comment No. 2, above.) EPA proposed permit action presumes that the draft numeric standards for Great Bay constitute the state's adopted narrative criteria interpretation of necessary water quality objectives to protect designated uses. However, under the MOA, which was issued after the publication of the draft criterion, the state has indicated that these values should not be used in a permitting context until additional scientific evaluation occurs. (*See* MOA Mutual Provisions II and III.) Moreover, DES has determined that the DO-based nutrient objectives are the concern in the tidal rivers, not the transparency-based objectives. (*See generally* MOA.) Thus, assuming the underlying technical basis for a transparency-based TN criterion was adequate, EPA has failed to properly apply the relevant draft numeric value consistent with the state's intended use of that criterion. Application of the draft DO-based objective, if justified, would produce a significantly different effluent limit requirement. Because EPA's narrative criteria interpretation authority is subject to these state decisions, the permit has been improperly drafted and must be withdrawn. (Note: To the degree that DES is now requesting that EPA apply the draft criterion in the tidal rivers, that request is legally and technically flawed as discussed herein. No site-specific data show that TN levels have anything to do with tidal river eelgrass loss or restoration, and DES has never adopted

---

[4] *See also* EPA's "Alaska Rule" governing adoption and modification of state water quality standards – 40 C.F.R. § 131.21, 65 Fed. Reg. 24641, 24647 (April 27, 2000) ("During the adoption of the detailed procedures, all stakeholders and EPA have an opportunity to make sure that important technical issues or concerns are adequately addressed in the procedures. *** This approach is particularly useful for criteria which are heavily influenced by site-specific factors such as nutrient criteria or sediment guidelines. Such procedures must include a public participation step to provide all stake-holders and the public an opportunity to review the data and calculations supporting the site-specific application of the implementation procedures."); U.S. Environmental Protection Agency, Water Quality Standards Handbook, Second Edition, EPA 823-9-94-005a (August 1994), available at http://water.epa.gov/scitech/swguidance/standards/handbook/index.cf, at 3-22 ("Where a State elects to supplement its narrative criterion with an accompanying implementing procedure, it *must formally* adopt such a procedure as a part of its water quality standards. The procedure *must* be used by the State to calculate derived numeric criteria that will be used as the basis for all standards' purposes, including the following: *developing TMDLs*, WLAs, and limits in NPDES permits . . . .") (emphasis added); *id.* at 3-22 ("To be consistent with the requirements of the Act, the State's procedures to be applied to the narrative criterion *must* be submitted to EPA for review and approval, and will become a part of the State's water quality standards. (*See* 40 C.F.R. § 131.21 for further discussion.)") (emphasis added); *id.* at 3-24 ("Where a State plans to adopt a procedure to be applied to the narrative criterion, it *must* provide full opportunity for public participation in the development and adoption of the procedure as part of the State's water quality standards.") (emphasis added).

[5] EPA's ability to promulgate new or revised standards is extremely limited. *See* 33 U.S.C. §§ 303(a)(2), (b)(1), and (c)(4); 40 C.F.R. §§ 131.21 and 131.22.

either a narrative or numeric TN criterion for the Great Bay watershed or any waterbody therein.

4. EPA's reliance on nutrient objectives adopted for other estuaries in the country as the basis for determining the numeric criteria for Great Bay is not allowable under either 40 C.F.R. §§ 131 or 122.44(d). Nowhere in the Act, or in its implementing regulations, is EPA authorized to conclude that the actions of other states may be used to govern or justify a narrative criteria interpretation in a different state, excepting where the actions of one state adversely affect standards compliance in another state. (*See* 40 C.F.R. § 122.4(d)). The specific physiological characteristics of a state and of the water body types in that state must be fully considered to establish the specific nutrient values necessary to protect those waters from the adverse impacts of cultural eutrophication. (*See* SAB's *Review of Empirical Approaches for Nutrient Criteria Derivation*, April 27, 2010, at 38 ("Numeric nutrient criteria developed and implemented without consideration of system specific conditions (e.g., from a classification based on site types) can lead to management actions that may have negative social and economic and unintended environmental consequences without additional environmental protection.").)[6] EPA's approach for the Lamprey River ignored the pertinent site-specific characteristics, contrary to published EPA guidance on nutrient criteria derivation and the recommendations of EPA's Science Advisory Board. Such actions are "per se" arbitrary and capricious. (*See Texas Oil & Gas Ass'n v. United States EPA*, 161 F.3d 923, 935 (5th Cir. 1998) ("When an agency adopts a regulation based on a study [that is] not designed for the purpose and is limited or criticized by its authors on points essential to the use sought to be made of it the administrative action is arbitrary and capricious and a clear error in judgment.") (*quoting Humana of Aurora, Inc. v. Heckler,* 753 F.2d 1579, 1583 (10th Cir. 1985), *cert. denied*, 474 U.S. 863 (1985)); *see, e.g., Pac. Coast Fed'n of Fishermen's Ass'ns, Inc. v. Nat'l Marine Fisheries Serv.*, 265 F.3d 1028, 1037-38 (9th Cir. 2001) (agency acted arbitrarily and capriciously by ignoring its own expert advice where no contrary recommendations existed in the record).) The failure to consider the relevant physical, chemical, and biological differences between the Lamprey River and the relevant conditions upon which other state criteria were based renders EPA's analysis fatally flawed and nothing more than speculation.

5. EPA's failure to consider site-specific factors before concluding that the Newmarket facility contributes to transparency-based eelgrass restoration criteria violations "at the point of discharge" (Fact Sheet @ 10) is another serious deficiency in the Region's justification for imposition of stringent TN limitations. Nothing in the record shows that TN is controlling transparency levels at the point of discharge (or downstream from that location), or that the relative importance of factors influencing transparency in the Bay are the same in the Lamprey River at the point of Newmarket's discharge. As noted earlier, there are several expert technical reports that show eelgrass restoration is not

---

[6] Available at http://yosemite.epa.gov/sab/sabproduct.nsf/0/E09317EC14CB3F2B85257713004BED5F/$File/EPA-SAB-10-006-unsigned.pdf; *see also Nutrient Criteria Technical Guidance Manual – Rivers and Streams*, USEPA, July 2000, at 13 ("Initial criteria should be verified and calibrated by comparing criteria in the system of study to nutrients, chl *a* and turbidity values in water bodies of known condition to ensure that the system of interest operates as expected.").

possible in the Squamscott and Lamprey Rivers due to habitat and other factors. Moreover, information presented by the Coalition at the public hearing confirmed TN levels were not controlling transparency in the Squamscott River. The same conclusions apply to the Lamprey because the Squamscott River data played a pivotal role in DES' numeric criteria evaluation. The riverine transparency data used to generate the TN/transparency relationship are not controlled by the level of algal growth present. That fact is easily demonstrated by plotting Kd as a function of chlorophyll *a* level. (*See* Ex. 23, Lamprey River transparency analysis; Ex. 20, Squamscott River Kd Versus Chlorophyll *a*.) Thus, use of those data in the regression analysis was a gross scientific error. Thus, EPA's assumption that a 0.3 mg/l TN objective in the Lamprey River is required to meet state narrative criteria objectives is not scientifically defensible.

6. EPA's proposed permit asserting a need for stringent TN limitations at the Newmarket facility is not based on the latest available scientific information. Moreover, as explained below, EPA's Fact Sheet analysis is based on a gross oversimplification and misapplication of the available information. In short, the proposed effluent limitations are not scientifically defensible and have not been demonstrated necessary to achieve applicable standards to protect the designated uses, contrary to Section 301(b)(1)(C) of the Act. Specifically, the fundamental "cause and effect" connections are missing from EPA's analyses (which rely on erroneous DES reports), in particular with respect to addressing eelgrass losses and low DO in the estuary arms.[7] Nowhere in the record, or in EPA's Fact Sheet discussion, is the public presented with a scintilla of evidence that (1) eelgrass were present in the Lamprey River in the vicinity of Newmarket's discharge, (2) changes in transparency or nutrient levels likely caused the eelgrass losses in this tidal river, or (3) that controlling nutrients will significantly improve transparency in this tidal river, allowing eelgrass to repopulate historical areas near the mouth of the Lamprey River. Other DES documents (e.g., Great Bay Nitrogen Loading Analysis @ 10) confirm tidal river eelgrass losses have occurred even where waters are not considered nitrogen impaired (e.g. Winnicut River). EPA's Science Advisory Board has admonished the Agency for presuming, rather than demonstrating, that cause and effect exists when it is developing nutrient criteria. (*See* SAB's *Review of Empirical Approaches for Nutrient Criteria Derivation*, April 27, 2010, at 6 ("Without a mechanistic understanding and a clear causative link between nutrient levels and impairment, there is no assurance that managing for particular nutrient levels will lead to the desired outcome."); *id.* at 38 ("Large uncertainties in the stressor-response relationship and the fact that causation is neither directly addressed nor documented indicate that the stressor-response approach using empirical data cannot be used in isolation to develop technically defensible water quality criteria that will protect against environmental degradation by nutrients.").) As discussed in Comment No. 5 (above) narrative criteria implementation requires site-specific data showing that the pollutant of concern is the cause of the use impairment.

[7] It is a general principle of the Clean Water Act, or any environmental statute for that matter, that pollutants be regulated if and only if they are causing harm or impairment. In generating numeric water quality criteria, EPA must abide by the same principle. (*See* CWA §§ 303(c)(2)(A) and 304(a); 40 C.F.R. § 131.3(b); *Leather Indus. of Am. v. EPA*, 40 F.3d 392, 401 (D.C. Cir. 1994) ("EPA's mandate to establish standards 'adequate to protect public health and the environment from any reasonably anticipated adverse effects of each pollutant,' does not give the EPA blanket one-way ratchet authority to tighten standards.").)

There are no such data for the Lamprey River and, to the degree the issues have been analyzed by local experts, those analyses have confirmed that nitrogen is *not* the cause of the impairments EPA is intending to address. (*See, e.g.*, Jones et al., *Impacts of Wastewater Treatment Facilities on Receiving Water Quality* (April 2007) (New Hampshire Estuary Project Report).) Thus, EPA has failed to properly interpret the state's narrative standard and failed to demonstrate, with credible site-specific information, that nutrients are the cause of alleged eelgrass losses in the Lamprey River.

7. EPA's interpretation of CWA § 301(b)(1)(C) is in error. This provision of the Act does not mandate that a facility receive effluent limitations that ensures it does not "cause or contribute to" a WQS exceedance, it only requires that limitations be imposed as "necessary to [a]chieve water quality standards established under Section 303 of the CWA." (40 C.F.R. § 122.44(d)(1).) Federal rules only prohibit "causing or contributing" where new facilities are being permitted, not existing facilities. (Compare 40 C.F.R. § 122.4(i) with § 122.44(d).[8]) Moreover, nowhere in the Fact Sheet does EPA demonstrate that a 3 mg/l TN monthly maximum limitation, as opposed to a less stringent limitation, is "necessary to achieve water quality standard" compliance in the Lamprey River, as required by the Act and implementing regulations (e.g., 40 C.F.R. § 122.44(d)(1)). EPA seeks to rely on a draft document prepared by DES which analyzed several possible permitting scenarios, depending upon which yet-unadopted, numeric nutrient criteria is used as the basis for analysis. The draft DES report is nothing more than a straw man and does not provide a technical basis for concluding a specific set of limitations must be incorporated into Newmarket's permit. The very language of the report discloses that no decision regarding the proper instream criteria or plant effluent limits was being established: "If the WWTPs receive permits that limit effluent nitrogen concentrations to protect eelgrass in downstream locations, non-point sources would have to be reduced by -- percent." (Great Bay Nitrogen Loading Analysis - Draft Report @ 12, discussing the Lamprey Subestuary.) Moreover, the analysis specifically assessed annual and multi-year average load reductions, not monthly maximum conditions as interpreted by the Region. Thus, to the degree EPA relied on this report as the basis for imposing limitations, EPA misapplied the results.

8. In other forums, EPA has informed courts that extended schedules should be allowed to develop "quality TMDLs" where complex point and non-point interactions affect nutrient impacts. (*See* Ex. 24, EPA order files in Black Swan Case.) In this instance, EPA is relying upon a draft WLA document that has never been adopted as a TMDL nor even explores the nutrient dynamics central to understanding and remedying the alleged impairments. Accepting such a poor quality draft analysis that has not undergone formal public review violates the TMDL development procedures of the Act and treats New

[8] New sources of discharges are prohibited from causing or contributing to a violation of water quality standards. (*See* 40 C.F.R. § 122.4(i) ("No permit may be issued: … (i) to a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards.").) Whereas, the trigger for existing sources is when a permitting authority determines that a specific discharger's effluent is at a level which is causing or contributing to a water quality standard excursion. (*See* 40 C.F.R. § 122.44(d)(1)(i) (A WQBEL analysis occurs when a discharger's effluent "[is] or may be discharged at a level which will cause, or have the reasonable potential to cause, or contribute to an excursion above any State water quality standard.").)

Hampshire communities differently than those in Montana. The Administrative Procedure Act ("APA") does not countenance either action.

9. EPA is reinterpreting its rules to mandate LOT requirements for any facility that contributes a pollutant of concern to impaired waters, which is an illegal modification of applicable federal rules and is inconsistent with the framework of the Act. Nowhere does the Act provide authority for mandating a technology-based limitation simply because waters are found to be impaired and an existing discharge contributes some amount of a pollutant to those waters.[9] The Supreme Court in *Arkansas v. Oklahoma* indicated that the water quality management planning provisions of the Act (i.e., Section 303(d) TDML process) are the vehicle for resolving the establishment of limitations necessary to achieve applicable water quality standards.[10] There are thousands of nutrient-impaired waters throughout the country, and EPA has never issued a rule or statutory interpretation that required imposition of LOT where a water body is impaired, in advance of TMDL development. The Region, via the NPDES process, is not authorized to establish, adopt, or amend rules of general applicability or to set technology-based limits for POTWs. If this were a federal requirement, the entire drainage basin for the Mississippi River would be subject to this mandate due to nutrient impacts on the Gulf of Mexico. Thus, EPA's regulation of Newmarket is in conflict with EPA's historical application of the Act and implementing regulations, as well as prior permitting decisions in this Region (e.g., Attleboro decision). This unfair and inequitable treatment of similarly situated facilities violates due process, equal protection, and is fundamentally unfair.

Scientific Issues and Objections

1. The Agency's permitting analysis relies heavily on prior DES decisions regarding impairments occurring in the system, the causes of such impairments, and as of yet unadopted criteria derived to address the causes of impairment. (*See* Fact Sheet @ 10-19.) The Great Bay communities have met with DES to review the prior technical conclusions related to the impairments and have presented information showing that those decisions were seriously flawed (discussed in greater detail below). As discussed in the Coalition's public hearing comments (incorporated by reference herein), the Bay and tidal rivers are not suffering from insufficient transparency due to excessive plant growth, and the periodic low DO levels in the tidal rivers do not appear to be a function of the algal growth in those areas. There is no analysis anywhere in the record showing (1) transparency has decreased during the period of eelgrass decline, (2) existing transparency in Great Bay is insufficient given the tidal variation in the system, or (3)

[9] The only technology-based limitation applicable to POTWs is the secondary treatment rule, which does not apply to nutrients. (*See generally Maier v. EPA*, 114 F.3d 1032 (10th Cir. 1997); *Natural Resources Defense Council, Inc. v. EPA*, 790 F.2d 289 (3d Cir. 1986); 40 Fed. Reg. 34522, 34522 (Aug. 15, 1975) ("[s]econdary treatment processes were developed to biologically remove degradable organic materials from wastewater. The term 'secondary treatment' eventually became synonymous with the biological treatment of wastewater *for the removal of carbonaceous organic material*.").)

[10] *Arkansas v. Oklahoma*, 503 U.S. 91, 108 (U.S. 1992) ("The [CWA] does, however, contain provisions designed to remedy existing water quality violations and to allocate the burden of reducing undesirable discharges between existing sources and new sources. *See, e.g.*, § 1313(d).").

nitrogen has triggered excessive plant growth lowering ambient transparency levels in either the tidal rivers or the Bay. Absent such information, there can be no legally or scientifically defensible conclusion that transparency is a cause of eelgrass decline, as presumed in EPA's assessment, or that reducing TN levels is the solution to the alleged impairments. Analyses prepared by the Coalition's consultants (*see* Ex. 5) confirm that (1) transparency in the Bay was not materially impacted by increased algal growth during the period of significant eelgrass decline and that (2) controlling nitrogen cannot ensure attainment of the transparency objectives underlying the 0.3 mg/l TN water quality objective used as the basis for this permit limitation. These are fundamental deficiencies in the scientific basis for this proposed permit action. EPA recently attended a meeting with DES and the Coalition where Prof. Fred Short, the primary eelgrass expert relied upon by EPA, confirmed that transparency and epiphyte growth are not major factors limiting eelgrass growth in these waters as originally presumed. These statements are reflected in the MOA group meeting minutes that EPA had an opportunity to review and comment on. (*See* Exs. 21 and 22.) Thus, continued reliance on prior studies by this author to reach an opposite conclusion would be inappropriate and violate EPA's scientific integrity policies.

2. EPA has also asserted that the Newmarket discharge is responsible for low DO conditions found in this system. (*See* Fact Sheet @ 28-29.) That position is plainly misplaced. Analysis of data for the Lamprey River showed that low DO's occurred where low algal growth existed due to the system hydrodynamics and stratification. (*See* Pennock (2005), cited in *Numeric Nutrient Criteria for Great Bay – draft* (NHDES 2009) at 51 (hereafter 2009 DES Report)). None of the river-specific data indicated a significant relationship between minimum DO and algal growth, confirming that (1) preliminary impairment causes of low DO were not well supported, and (2) the system wide analysis used by DES to generate the DO-based TN numeric criteria provided misleading results.

   DES' consideration of this information is what led the parties to conclude that a water quality model was required to properly assess the components affecting the DO regime and the remedial measure appropriate for improving the DO condition (assuming it is not otherwise natural). Therefore, EPA's reliance on the DES assumption that algal growth is the key factor influencing this DO condition is premature at best, if not demonstrably incorrect.

3. The Bay does have a macroalgae problem due to invasive species, as confirmed by several UNH researchers. (*See* Exs. 21 and 22 – MOA Group Meeting Minutes.) However, the degree of nitrogen control necessary to address that issue is not known. The 2009 DES Report hypothesized that possible Great Bay TN objectives to address this area of concern might range from 0.34 - 0.38 mg/l TN. DES estimates that somewhere between a 10-20% TN reduction may be needed to reduce the growth of such species. (*See* 2009 DES Report.) This level of reduction would reflect TN levels in the mid-to-late-1990s when macroalgae growth was minimal. Subsequent MOA group meetings indicated that DIN, not TN, would be the form of nitrogen that could control macroalgae growth. It is reasonable that a mid-range reduction of 15% TIN would be used as a

starting point, given the uncertainties with this endpoint and the lack of understanding regarding the ability to control the invasive species. This level of reduction would not require point sources to achieve TN limits less than 8 mg/l which would ensure municipal loads (and likely system DIN loads) are well below pre-1990 levels when macroalgae growth was minor. Thus, there is no basis for EPA to conclude that a 3 mg/l TN level is necessary to protect the Bay or the tidal rivers from cultural eutrophication.

4. As noted above, EPA is recommending regulation of the wrong form of nitrogen. The invasive species and macroalgae are stimulated by excess inorganic nitrogen; therefore, the form of nitrogen to control would not be TN, which contains a substantial organic N component not available for plant growth. Given the system dynamics and relatively short detention time (18 days – Fact Sheet @ 12), there is no reason to believe that organic nitrogen cycling plays any role in stimulating plant growth in this system. Furthermore, no analysis shows that it is a significant factor influencing plant growth in this system. If nitrogen control is necessary to address excessive plant growth (via macroalgae), then only inorganic nitrogen forms need to be regulated. Likewise, there is no information showing that TN versus TIN would be the appropriate parameter to regulate in the tidal rivers (assuming it is the pollutant controlling algal growth – another undocumented assumption). The detention time in the Lamprey River is even shorter (estimated about 1.5 days) rendering this form of nitrogen completely irrelevant in that part of the system. EPA's July 29, 2011, FOIA response regarding the Squamscott River, herein incorporated by reference, has acknowledged that EPA has no information regarding the degree to which organic nitrogen converts to inorganic nitrogen in this system. (*See* July 29, 2011, EPA Response to FOIA Request No. 01-FOI-00148-11.) Absent such information, regulating this nitrogen form is not scientifically defensible.

5. Coalition analyses show that, by achieving an 8 mg/l TN value, inorganic nitrogen loadings during the period of concern for macroalgae (May/June to September) will produce DIN loadings well below mid-1990 levels. (*See* Exs. 24 and 25 – DIN loading analysis and the reduction in DIN associated with an 8 mg/L TN limit for the Lamprey) This provides reasonable assurance that narrative criteria will be met through a lesser level of TN control over the next 10 years. Consequently, EPA's proposed limits of 3 mg/l TN is clearly more restrictive than needed to achieve applicable water quality objectives. The proposed permit should be withdrawn and republished to reflect an 8 mg/l TN level of treatment should be sufficient to abate the increases in macroalgae that have occurred in the system.

6. EPA's beliefs that transparency is controlling eelgrass growth in Great Bay and that increased nitrogen is the cause of reduced transparency are misplaced (as also recently clarified by Professor Short). For nitrogen to affect transparency, it must cause increased and excessive chlorophyll *a* levels. (*See* EPA Fact Sheet @ 14.) The historical data evaluations presented for Great Bay confirm that average algal growth increases have been slight and therefore could not have been the underlying cause of eelgrass decline occurring throughout the system. The PREP Environmental Indicators Report - 2009 shows that from 1993-2000 chlorophyll *a* levels did not increase and averaged about 2.5 ug/l. (*See* 2009 PREP Report, Figure NUT3-5.) This was also confirmed by time series

analysis of the data. (*See* Ex. 8). Therefore, algal growth induced transparency decreased and could not have played any role in eelgrass declines during this period, as EPA has assumed. This same PREP Report figure shows that algal levels increased by about 1 ug/l from 2001-2008. These are very low levels of primary productivity and minor changes in average system productivity that produced trivial changes in light penetration. Such algal growth in the Bay was demonstrated by Morrison to be a minor component affecting transparency. (*See* 2009 DES Report @ 61; Ex. 9.) EPA's peer review also noted that the Great Bay did not exhibit substantial algal growth and that, therefore, limited transparency benefits could be obtained by attempting to reduce algal growth in the Bay.

The various references to the 2003 and 2006 PREP reports cited by EPA confirm that, even though nitrogen levels have "increased by 59% in the past 25 years, the negative effects of excessive nitrogen, such as algal blooms and low dissolved oxygen levels, are not evident." (Fact Sheet @ 18.) Thus, the ability of nitrogen to affect transparency through algal growth in this system, at this time, is not very significant. It is not apparent how EPA could conclude that a limit of technology approach for nitrogen is necessary to restore eelgrass populations by improving transparency, given these regulatory findings and the relevant sampling data. HydroQual's analysis of transparency impact (Ex. 10), dated January, 2011, confirms that attaining the proposed TN standard will only change ambient transparency by about 5% and cannot possibly ensure that the intended level of transparency (assuming it was needed to protect eelgrass growth) will be achieved in the Bay. Thus, the proposed TN criteria for ensuring that transparency goals will be met is neither necessary nor appropriate.

Regarding DO in the tidal rivers, it should be noted that the more recent assessments indicate that low DO conditions occurred less frequently from 2005-2008 than occurred earlier in the decade. (*See* 2009 PREP Estuaries Report NUT 5-1 to 5-5.) Thus, the DO data demonstrate that there is not a direct connection between low DO and TN levels, as the *higher* TN levels and loadings have produced the *better* DO conditions. Clearly, EPA's misplaced generalizations regarding trend data and the influence of TN on transparency and DO conditions in the estuary do not provide a scientifically defensible basis for imposing stringent TN limitations in the Newmarket permit as the "cure" for the alleged transparency and DO impairments.

7. Conclusions regarding the increase of system wide TN loadings in the past 5 years (2002 versus 2008) are misleading and inappropriate. (*See* Fact Sheet @ 19.) First, the change in TN level is due to an evaluation comparing loads between drought years and extreme wet weather years as noted in the 2009 PREP report. (*See* Ex. 26, Change in Rainfall Patterns.) This change in rainfall fully accounts for the difference in loading and does not indicate a system subject to runaway growth inducing higher TN levels. Data on WWTP flows indicate that municipal loadings have been relatively constant for the past 15 years. (Ex. 11, Trend Analysis of Municipal Flows During Dry Weather Years.) Thus, the change in conditions is not due to significant increases in point source contributions but rather to changes in precipitation and land use practices. This indicates that only a moderate reduction in point source contribution is necessary to ensure reduced inorganic

nitrogen levels to the Bay to reflect mid-to-late-1990s conditions when eelgrass health was excellent. Likewise, EPA's conclusion that point sources account for over 30% of the TN loadings to the Bay is misplaced. (EPA Public Hearing Observation.) DES recalculated the point source load inputs, accounting for system hydrodynamics. The point source contribution of TN is currently about 16%. (*See* Ex. 1, MOA attachment Table II.) Given this small percentage of TN loading, forcing communities to "limits of technology" would not result in any meaningful changes, in comparison to less restrictive limitations (e.g., 8 mg/l TN). As EPA's load reduction analysis was premised on a belief that point source loads were a far greater percentage of TN loads, the analysis must be reconsidered. An 8 mg/l TN limit would produce approximately a 70% reduction in current point source TIN levels and result in water quality reflecting acceptable mid-to-late 1990s conditions for this parameter when the system was considered "healthy."

Load analyses based on TIN yield a completely different picture that confirms the Fact Sheet impacts analysis is completely in error. During the critical macroalgae growth period, point sources in the western end of the Bay (Exeter, Newmarket and Durham) dominate the DIN loading to the estuary. (*See* Ex. 25.) This data and analysis confirms that a lesser level of point source control will produce far greater benefits than estimated by DES or EPA because they both evaluated the wrong form of nitrogen. As noted earlier, setting seasonal limits equal to 8 mg/l will more than achieve the mid-1990 loading threshold. Due to these basic evaluation errors the proposed permit needs to be withdrawn and reconsidered.

8. EPA's assertion that the greatest loss in eelgrass has occurred in the upper portion of the estuary where TN levels are highest is incorrect. (*See* Fact Sheet @ 19.) This statement was intended to confirm that reducing TN levels would lead to improved eelgrass populations. Data from the Piscataqua River developed by Prof. Fred Short (an eelgrass expert for Great Bay), show that eelgrass losses are equally high where lower TN levels occur and water quality is otherwise excellent. (*See* Figure HAB12-1, PREP 2009 Report; Ex. 5, HydroQual, Figure 12). Figure 6 presented in the Fact Sheet also documents that EPA's position is in error, showing 100% eelgrass loss in the upper and lower Piscataqua River where the transparency is excellent and TN concentrations meet the 0.3 mg/l TN objective assumed applicable in this action. The cause of this dramatic eelgrass decline is unknown. The undisputable fact that eelgrass declined in areas with both elevated and low TN concentrations means that it cannot be presumed that lowering TN levels will result in eelgrass restoration in the tidal rivers or the Bay. (*Compare* EPA Fact Sheet Figures 6/7 with Figure 5.) Likewise, as discussed earlier, lower DO occurs in the tidal rivers, but the occurrence of such conditions is not a function of chlorophyll *a* or TN levels, even though the highest TN levels occur in these areas. It should be noted that virtually EVERY water quality pollutant indicator is higher in the tributaries than in the Bay or Piscataqua River where greater dilution exists. This coincidence does not prove that a particular pollutant caused the impairment of concern and is little more than generalized speculation. The Lamprey River, with the lowest chlorophyll *a* levels, has the *poorest* DO compliance due to system hydrodynamics. (*See* Ex. 12; Pennock (2005).) Thus, EPA's broad brush analysis asserting TN and chlorophyll *a* are the causes of all system impairments is simply not scientifically defensible and is demonstrably incorrect.

9. Data on chlorophyll *a* levels and secchi depth, not originally considered by DES when issuing the 2009 draft numeric criteria document, confirm that transparency did not materially change in Great Bay during the period of eelgrass reduction and that chlorophyll *a* increases are not associated with eelgrass decline. (*See* Ex. 8.) These data confirm that transparency was not a causative agent in the eelgrass decline of the 1990s and that, in fact, transparency appears better today than during the mid-1990s. Moreover, the data further support the conclusion that transparency (as measured by secchi depth) is not materially impacted by the chlorophyll *a* level in this system, as Morrison had also determined. Comparing EPA's Figure 5 – Gradient of Light Attenuation with Figure 4 – Gradient of Chlorophyll *a* confirms that median transparency has little to do with algal growth; therefore, controlling TN levels to control algal growth will have no material impact on water column transparency. The data cited by the Region in support of the permit action show that TN control will not achieve its intended purpose. The Upper Piscataqua has a lower transparency level than Great Bay, but also lower chlorophyll *a* levels, verifying that other factors are controlling transparency in this system. In fact, the difference in median chlorophyll *a* in all of these areas is negligible (1-3 ug/l). This difference in chlorophyll *a* could not physically account for the wide range of light attenuation occurring in the various areas (0.5-2.3 Kd m^{-1}). Thus, the Region's assumption that reducing TN will produce significant improvement in water column transparency is not supported by the information presented in the Fact Sheet.

Finally, the DES analyses relied upon by EPA provide no demonstration that eelgrass losses in the Bay are, in fact, correlated to reduced transparency. If they were, eelgrass losses from the deeper Bay waters would be the most prevalent – they are not. (*See* Ex. 13, Figure 5, presentation of Fred Short, Impediments to Eelgrass Restoration.) Recently, Professor Fred Short has acknowledged that the large tidal fluctuation in Great Bay allows the eelgrass to receive sufficient light and that, therefore, transparency is not likely a controlling factor in this area. (*See* Exs. 21 and 22 – MOA Meeting minutes.) In contrast to the transparency theory of eelgrass loss, higher losses appear to have occurred in shallower environments where the most light is available, and eelgrass are healthiest in the deeper waters. (*See* Figure HAB2-2, 2009 PREP Report.) This <u>could</u> evidence that macroalgae or shoreline development are adversely impacting eelgrass populations. Therefore, mandating TN reduction because of an assumed connection between eelgrass loss and transparency was in error.

In conclusion, throughout the late 1990s as eelgrass declined, chlorophyll *a* levels remained constant, even though data confirm that TIN levels increased by 40%. These data confirm that chlorophyll *a* growth in the system is not significantly responding to increase inorganic nitrogen levels (the component of nitrogen that supports plant growth). Likewise, data from the tidal rivers do not show any significant relationship between algal levels and minimum DO occurrence. The assumption that nitrogen levels and excessive phytoplankton growth in the system is causing widespread impairment is simply not justified based on the available data. As noted earlier, the focus needs to be on macroalgae using an adaptive management approach.

10. The underlying technical basis for the nutrient criteria applied in the permit is a "stressor response" analysis completed by DES in 2009. That analysis plotted total nitrogen concentrations from various places in the estuary system versus light extinction and concluded that a specific ambient nitrogen concentration was necessary to attain a Kd of 0.75/m in the Great Bay and its tributaries. (*See* Ex. 14.) The method used to derive the DO-based TN objectives was derived similarly. The proposed criteria derivation method employed by DES and relied upon by EPA to set ambient total nitrogen water quality standards is not scientifically defensible and was not based on accepted scientific methodologies. DES plotted areas with radically different physical and chemical conditions and presumed that the level of TN occurring in the different areas was the only parameter controlling changes in DO, transparency, or algal growth. (*See* Ex. 15.) It is not scientifically defensible to plot data from such different areas on a single graph and conclude that the dependent pollutant caused the system response when other major physical and chemical factors are known to affect the result and have not been considered in the analysis. Given EPA's existing guidance on this issue and the 2009 SAB report on appropriate stressor-response analyses (discussed in greater detail below), it would be a violation of EPA's science integrity policy to continue to rely on this information in issuing the permit.

11. The USEPA Science Advisory Board has indicated that the type of "cause and effect" relationships developed by DES in 2009 cannot be presumed from such simplified analyses and that other factors that co-vary and may otherwise explain the change in the measured response variable must be assessed. (*See* "Review of Empirical Approaches to Nutrient Criteria Derivation," April 28, 2010.) The SAB has also cautioned that only data taken from similar habitats should be used for stressor-response analyses. EPA's Fact Sheet likewise noted that "estuarine nutrient dynamics are complex, and are influenced by flushing time, freshwater inflow and stratification among other factors." (Fact Sheet @ 14.) None of these factors or changing conditions were considered by DES in the evaluation of the system response to nutrient inputs. Dilution alone can explain the majority of the relationship between TN and all of the parameters plotted that were claimed to be caused by changes in TN. (*See* Ex. 16.) Moreover, HydroQual confirmed that, for transparency, turbidity co-varied with nitrogen levels and also explained the change in transparency throughout the Great Bay system. (*See* Ex. 17.) Nitrogen does not relate directly to "turbidity" that is caused by a number of physical processes unrelated to the ambient nutrient concentration. Other parameters such as TSS, salinity, dissolved organic matter, color, SOD, phosphorus, and a host of other parameters also co-vary with TN and DO levels. (*See, e.g.*, Exs. 18 and 19.) Unless these factors are considered and it is confirmed that TN caused excessive plant growth, which in turn controlled the endpoint of concern (low DO or decreased transparency), there is no basis to conclude that TN was the cause of the changes occurring in DO or transparency throughout the system. This is a seriously flawed analysis, as the basic physical and chemical parameters influencing the pollutant levels and resultant water quality were not addressed in the DES assessment. This fundamentally flawed assessment methodology cannot be relied upon to demonstrate that TN reduction is necessary to protect the Bay or that the particular ambient TN level selected by DES will be sufficient to restore use impairments of concern.

12. The TN/transparency relationship developed for the Bay does not apply to the tidal rivers, as EPA has assumed. The factors controlling transparency in the Bay, Piscataqua River, and mouth of the estuary are dramatically different than those controlling transparency in the tidal rivers or near their mouths in the Bay. The Lamprey River and other tidal rivers are heavily influenced by the color of the waters entering the system. (*See* Ex. 19.) These areas have naturally low transparency due to color leaching out of wetland and other areas into the system. Turbulence due to tidal exchange also causes high turbidity in these systems, as demonstrated by the DES turbidity data contained in Ex. 17. Consequently, transparency is naturally low in the Squamscott and Lamprey Rivers and cannot be increased simply by regulating TN to control chlorophyll '*a*' growth. (*See* Exs. 20 and 23.) Because the conditions producing poor water quality are natural, these conditions do not constitute a violation of the state's narrative water quality standards, and a TN-based transparency standard to protect eelgrass growth is not germane to this area. In summary, the typically low transparency of the Lamprey River has virtually nothing to do with nutrient levels or algal growth. This is a natural condition that cannot be changed. Therefore, EPA's presumption that TN control will produce improved transparency levels in the Lamprey River sufficient to allow eelgrass growth is unfounded. This permit action should be withdrawn since the central scientific and legal premises of the action are in error.

13. EPA's reliance on studies from other states or EPA manuals (*see* Fact Sheet @ 26-27) to assert that specific nitrogen-related impairments are present in Great Bay is misplaced. The available data from the underlying studies indicate that the system was not suffering adverse impacts from excessive algal growth or reduced transparency due to excessive algal growth. Moreover, there is no indication that application of such results from Massachusetts or Delaware was intended to apply to the highly dynamic tidal river and bay systems present here. Absent some demonstration that the physical settings and water quality conditions are the same (i.e., critical factors influencing plant growth in any system), there is no technical basis to conclude that these other state standards have any relevance to Great Bay. It should be noted further that 40 C.F.R. § 122.44(d) does not allow the presumptive application of "out of state" standards as a basis for interpreting a narrative criteria. Thus, the applicable federal regulation is being misapplied.

Finally, the focus on eelgrass loss in the tidal rivers is completely arbitrary, given that it is admitted no one knows why the eelgrass loss occurred over 40 years ago and that the State of New Hampshire has determined that the primary ecologic concern in the tidal rivers is DO. (*See* Fact Sheet @ 17.) Neither DES nor PREP has ever attempted to claim that reduced nitrogen levels would restore eelgrass in these areas. The analysis was focused on an alleged relationship between transparency and TN in the Bay, not miles up the tidal rivers. Therefore, EPA's assertion that "[s]ince eelgrass was present in the Lamprey River from the Lower Narrows down to Great Bay, the applicable total nitrogen criteria to ensure its recovery is 0.30 mg/l" is simply unsupported speculation. (*See* Fact Sheet @ 30.) Other DES-funded studies (e.g., 2006 Great Bay Estuary Restoration Compendium) confirm that it is not reasonable to presume that reducing TN levels will result in eelgrass restoration in the Lamprey River, and Ex. 23 indicates that natural transparency is insufficient to support eelgrass growth. Given that major eelgrass losses are also occurring even in high quality waters, EPA's decision to stringently control TN inputs is not supported by the relevant data for the estuary.

Pursuant to 122.44(d), EPA is to follow the state's narrative criteria approach where such information is available. That approach does not support applying the Bay eelgrass protection targets in the tidal rivers, assuming the criteria were not fundamentally flawed, as explained earlier. Consequently, EPA's proposed permitting approach for Newmarket should be withdrawn because there is no credible scientific data showing that decades-old eelgrass losses in the Lamprey River have anything to do with changes in TN levels. To the opposite, EPA's own fact sheet recognized that the cause (and therefore the remedy) of such losses is currently "unknown." Therefore, any regulatory requirement at this point is pure speculation, and, consequently, the proposed related effluent limits are arbitrary and capricious.[11]

14. The proposed permit applies the proposed criteria for eelgrass protection in the tidal rivers at a 7/Q/10 low flow. (*See* Fact Sheet @ 28-29.) The chosen water quality criteria are not based on short-term or near field impact considerations. Consequently, this is a misapplication of the draft DES TN criteria from several perspectives. First, the impact of concern – "transparency" – is a long-term effect. The data used by DES to derive the 0.3 mg/l TN criteria was based on multi-year average ambient conditions. It is therefore inappropriate to assert that compliance with that objective must be maintained under a rare 7/Q/10 flow condition. Second, the impact on transparency, if it did exist, has nothing to do with the dilution available in the current Newmarket mixing zone. There is not sufficient time for the Town's effluent quality to alter algal growth at this point of discharge. Assuming the 0.3 mg/l TN objective was properly derived and necessary to ensure use protection, this objective would be applied under some type of growing season average tidal dilution flow condition, relevant to the time period when algal growth could significantly influence water column transparency.

15. The proposed permit requires that the facility optimize TN reduction during the non-growing season (November – March), despite recognizing that "these months are not the most critical period for phytoplankton and macroalgae growth." (Fact Sheet @ 11.) There is no technical or regulatory justification for this requirement; therefore, it should not be included in the permit. As noted earlier, EPA must demonstrate that a water quality-based effluent limitation is necessary to achieve water quality standard compliance. The permit record provides no such demonstration and concedes that it is not demonstrated to be necessary. Therefore, this provision is not legally or technically supported.

16. The permit should not contain a monthly maximum effluent limit since it has not been demonstrated that this restrictive permit averaging period is necessary to ensure WQS compliance. Assuming it is proper to rely on the state's draft, unadopted criteria in

[11] It should be noted that, out of concern for the health of the Bay, the Coalition has agreed that several facilities should be designed to achieve an 8 mg/l TN limit. This agreement, however, is not premised on a conclusion that TN has been adequately confirmed to be the cause of eelgrass loss.

setting permit limits, those criteria are based on long-term (multi-year) median conditions. Therefore, at a minimum, limitations necessary to comply with such limits should be established as long-term averages, as EPA has done in similar situations. For instance, nutrient limits were applied to derive annual average requirements with EPA's approval in Chesapeake Bay and Long Island Sound. If EPA now insists that monthly averages must be set, EPA must account for the difference between the standard and permit averaging periods when setting the limits. Finally, the use of concentration-based limits, which assume the facility is discharging at design flow, produces unnecessarily restrictive permit limits. Under lower flow conditions and existing effluent discharge rates, the allowable effluent quality may range up to 6 mg/l and still meet loading targets equal to 3 mg/l at the design flow of 0.85 MGD. To ensure that only necessary permit limitations are established, flow tiered concentration limits should be established to properly implement whatever load limits are set to achieve narrative criteria compliance.

The permit should include a long term schedule of compliance as allowed by New Hampshire state law. (*See* RSA 485-A:13 (2011).) Given the uncertainties and high costs associated with the proposed limits, a 20-year schedule of compliance is requested. The first 10 years will be used to construct and monitor the effects of reducing TN levels to 8 mg/l. The next five years will be used to evaluate whether a more restrictive TN reduction is necessary to promote reduced macroalgae growth. If found necessary, the remaining five years will be used to construct facilities necessary to meet a 3 mg/l TN limitation.

NEWMARKET EXHIBIT LIST

EX. 1 Memorandum of Agreement (MOA)

EX. 2 Freedom of Information Act (FOIA) Requests

EX. 3 Figure 6 –Great Bay Restoration Compendium, September 2006

EX. 4 Assessment of Appropriate Peer Review Charge Questions

EX. 5 Evaluation of Proposed Numeric Nutrient Water Quality Criteria – June 30, 2010

EX. 6 EPA Region IV – Statement on WQS Changes Requiring EPA Approval

EX. 7 Diurnal DO Variation in Squamscott

EX. 8 Measured Chl *a* and Secchi Disk at Adams Point (1988-2009)

EX. 9 Contributions to Kd (PAR) Measured at the Great Bay Buoy

EX. 10 HydroQual Report – January 10, 2011

EX. 11 Trend Analysis – WWTP Loads/Flows

EX. 12 In-situ Measurements Refine Thresholds for DO Violations (DES 2011)

EX. 13 Impediments to Eelgrass (Zostera Marina) Restoration – Figure 5

EX. 14 Relationship Between Light Attenuation Coefficient and TN at Trend Stations (DES 2009)

EX. 15 Major Physical Differences in Sample Location

EX. 16 Salinity/Dilution TN Covary in GB System

EX. 17 Covariation between Turbidity and TN at Datasonde Stations

EX. 18 Salinity/Dilution: Transparency Covary in GB System

EX. 19 Color-Salinity/Dilution Covary in GB System – Tidal River Source

EX. 20 Transparency Versus Chlorophyll *a* – Squamscott River

EX. 21 MOA Group Meeting Minutes – July 29, 2011

EX. 22 MOA Group Meeting Minutes – September 26, 2011

EX. 23 Transparency Versus Chlorophyll *a* – Lamprey River

NEWMARKET EXHIBIT LIST

EX. 24 DIN Loading Analysis of Lamprey River

EX. 25 DIN Load Reductions from 8 mg/L TN limit

EX. 26 Change in Rainfall Pattern

EXHIBIT 1

Memorandum of Agreement between
The Great Bay Municipal Coalition
and
New Hampshire Department of Environmental Services
relative to
Reducing Uncertainty in Nutrient Criteria
for the Great Bay / Piscataqua River Estuary

WHEREAS, the Department of Environmental Services (DES) has published a Clean Water Act 305(b)/303(d) report for 2010 (the 2010 list) that lists aquatic life impairments due to nutrient-related parameters in assessment units of the Great Bay Estuary as shown in Table I (attached); DES has compiled the 303(d) list in accordance with the 2010 Consolidated Assessment and Listing Methodology (CALM); the CALM procedures for assessment of nitrogen effects on aquatic life are based on Numeric Nutrient Criteria for the Great Bay Estuary published by DES in June, 2009 (nutrient criteria); DES has published a draft Analysis of Nitrogen Loading Reductions for Wastewater Treatment Facilities and Non-Point Sources in the Great Bay Estuary Watershed dated December 2010 (loading analysis);

WHEREAS, the members of the Great Bay Municipal Coalition (Coalition) comprising the municipalities of Exeter, Dover, Durham, Newmarket, Portsmouth and Rochester, each operate a wastewater treatment facility discharging to an assessment zone listed on the 2010 list as impaired for aquatic life due to nitrogen, and each stand to incur significant costs for construction and operation of upgraded treatment facilities to reduce nitrogen loads from these facilities;

WHEREAS, DES and the Coalition agree that, relative to impairments on the 2010 303(d) list attributed to dissolved oxygen (DO) and nitrogen, there is uncertainty about the extent to which nitrogen is a causative factor relative to other factors in the listed assessment units and further agree that a dynamic, calibrated hydrodynamic and water quality model could reduce the uncertainty;

WHEREAS, DES and the Coalition agree that a weight of evidence approach such as presented in the nutrient criteria is appropriate as it relates to impairments related to eelgrass loss, there is uncertainty in the line of evidence for eutrophication as a causative factor, and additional analyses are required for macroalgae proliferation and epiphyte growth as causative factors;

WHEREAS, DES and the Coalition agree that the results of the loading analysis indicate that existing nitrogen loadings from treatment facilities operated by Coalition and other municipalities are as shown in Table II (attached); and

WHEREAS, DES and the Coalition agree that, given the uncertainties stated above and the potential financial burden of treatment plant upgrades to the Coalition municipalities, an adaptive management approach to water quality improvement is required to reduce impairments to aquatic life use in the Great Bay Estuary.

NOW, THEREFORE, IT IS MUTUALLY AGREED THAT :

I. The best way to resolve the scientific uncertainties with respect to assessment units impaired for DO and nitrogen is a collaborative effort to build a dynamic, calibrated hydrodynamic and water quality model, starting with the Squamscott River, that includes all of the major factors affecting the DO regime. This effort would include additional data collection as needed to calibrate and verify the model and will be substantially completed by January 2012.

II. EPA action to finalize and issue the draft Exeter permit, and any other draft permits that may be released, should be stayed so that municipal resources may be focused on resolving collaboratively with DES the uncertainties concerning the relationship between DO and nitrogen in the Squamscott and Lamprey Rivers.

III. Additional work on the multiple lines of evidence for the relationship between nitrogen and eelgrass loss should be conducted before the nutrient criteria are used to set permit limits for protection of eelgrass in assessment units on the 2010 list as impaired for nitrogen and eelgrass loss.

THE COALITION AGREES TO:

I. Construct, calibrate, and validate a dynamic hydrodynamic and water quality model for the Squamscott River, using a public domain model. Prior to commencing work, prepare a workscope and quality assurance project plan (QAPP) for the model in accordance with EPA guidance and generally accepted practice, to be submitted to DES for comment and approval;

II. Collect data required to calibrate and validate the model. Prior to commencing work, prepare a workscope and QAPP for data collection in accordance with EPA guidance and generally accepted practice, to be submitted to DES for comment and approval;

III. Provide DES with data collected in II, and all applicable metadata, in a format that can be easily entered into the DES Environmental Monitoring Database. Provide DES with source code and a compiled version of the model used in I. All modeling shall be substantially completed by January 2012;

IV. Use the model to propose site-specific nitrogen criteria for the Squamscott River, as well as wasteload allocations / NPDES permit limits for the Exeter wastewater treatment plant for nitrogen, phosphorus, and BOD;

V. Enter into a process jointly with DES, under the auspices of the Southeast Watershed Alliance (SWA) or Piscataqua Region Estuary Partnership (PREP), to address the uncertainties with the transparency, macroalgae, and epiphyte lines of evidence of the nutrient criteria for associated eelgrass loss;

VI. Commit to achieve 8 mg/l Total Nitrogen (seasonal average) effluent limit for wastewater treatment facilities discharging to the Great Bay impairment zone via the Squamscott and Lamprey Rivers and promptly begin the process to design such facilities; and

VII. Commit to optimize the existing facilities discharging to the Piscataqua River and its tributaries to promote cost-effective TN reduction and complete engineering evaluations to determine the degree of modifications needed to achieve an 8 mg/l TN (seasonal average) effluent limit, should such limits be found necessary to achieve DO standards.

DES AGREES TO:

I. Review the modeling and monitoring workscopes and QAPPs developed by the Coalition pursuant to this Memorandum of Agreement in a timely and constructive fashion to ensure that the collaborative approach to the model will serve all parties.

II. Publish site-specific nitrogen criteria for each assessment unit on the 2010 list with impairments attributed to dissolved oxygen (DO) and nitrogen as soon as practicable after results of a calibrated, verified dynamic hydrodynamic and water quality model are available for the assessment unit.

III. With full participation of Coalition municipalities, work with PREP or SWA to conduct a study with robust multiple lines of evidence for nitrogen as a cause of eelgrass loss for assessment units with impairments on the 2010 list attributed to eelgrass loss and documented criteria thresholds for nitrogen to restore Great Bay to attainment of the aquatic life designated use.

IV. Commit to supporting a delay in EPA's issuance issuing final NPDES permits for Coalition wastewater treatment facilities until applicable site-specific nitrogen criteria have been developed.

By signing this agreement, each signatory certifies that it is fully authorized to enter into this agreement:

Thomas S. Burack, Commissioner
NH Department of Environmental Services

Edward J. Wojnowski, ~~Town Administrator~~
for the Town of Newmarket

J. Michael Joyal, Jr., City Manager
for the City of Dover

John P. Bohenko, City Manager
for the City of Portsmouth

Russell J. Dean, Town Manager
for the Town of Exeter

Daniel Fitzpatrick, City Manager
for the City of Rochester

Table I: Aquatic Life Impairments for Nutrient-Related Parameters in the Great Bay Estuary from New Hampshire's 2010 303(d) List

Assessment Zone	Parameter	Impairment Category*
WINNICUT RIVER	Estuarine Bioassessments	5-P
SQUAMSCOTT RIVER	Chlorophyll-a	5-P
	Oxygen, Dissolved	5-P
	Light Attenuation Coefficient	5-P
	Estuarine Bioassessments	5-P
	Nitrogen (Total)	5-P
LAMPREY RIVER	Chlorophyll-a	5-M
	Dissolved oxygen saturation	5-M
	Oxygen, Dissolved	5-P
	Light Attenuation Coefficient	5-P
	Estuarine Bioassessments	5-P
	Nitrogen (Total)	5-P
OYSTER RIVER	Chlorophyll-a	5-P
	Dissolved oxygen saturation	5-M
	Oxygen, Dissolved	5-P
	Light Attenuation Coefficient	5-P
	Estuarine Bioassessments	5-P
	Nitrogen (Total)	5-P
BELLAMY RIVER	Estuarine Bioassessments	5-P
	Nitrogen (Total)	5-M
COCHECO RIVER	Chlorophyll-a	5-M
	Nitrogen (Total)	5-P
SALMON FALLS RIVER	Chlorophyll-a	5-M
	Dissolved oxygen saturation	5-M
	Oxygen, Dissolved	5-P
	Nitrogen (Total)	5-M
UPPER PISCATAQUA RIVER	Light Attenuation Coefficient	5-P
	Estuarine Bioassessments	5-P
	Nitrogen (Total)	5-P
GREAT BAY	Light Attenuation Coefficient	5-P
	Estuarine Bioassessments	5-P
	Nitrogen (Total)	5-M
LITTLE BAY	Light Attenuation Coefficient	5-M
	Estuarine Bioassessments	5-P
	Nitrogen (Total)	5-M
LOWER PISCATAQUA RIVER	Estuarine Bioassessments	5-P
PORTSMOUTH HARBOR	Light Attenuation Coefficient	5-M
	Estuarine Bioassessments	5-T
	Nitrogen (Total)	5-M
SAGAMORE CREEK	Estuarine Bioassessments	5-P
LITTLE HARBOR/BACK CHANNEL	Light Attenuation Coefficient	5-M
	Estuarine Bioassessments	5-P
	Nitrogen (Total)	5-M

* 5-M = Marginal impairment, 5-P = Serious Impairment, 5-T = Threatened

Table II: Existing Nitrogen Loads to Assessment Zones from Point and Non-Point Sources*

(Source: draft Analysis of Nitrogen Loading Reductions for Wastewater Treatment Facilities and Non-Point Sources in the Great Bay Estuary Watershed dated December 2010)

	Winni-cut River	Squam-scott River	Lamprey River	Oyster River	Bellamy River	Cocheco River	Salmon Falls River	Upper Piscataqua River	Great Bay	Little Bay	Lower Piscataqua River	Ports-mouth Harbor	Sagamore Creek	Little Harbor/ Back Channel
Point Sources														
Durham				11.76						11.76	TBD	TBD	TBD	TBD
Exeter		42.69							42.69	42.69	TBD	TBD	TBD	TBD
Newfields		1.58							1.58	1.58	TBD	TBD	TBD	TBD
Newmarket			30.42						30.42	30.42	TBD	TBD	TBD	TBD
Dover								103.69			TBD	TBD	TBD	TBD
South Berwick							5.53	5.53			TBD	TBD	TBD	TBD
Kittery								0.40	0.74	5.29	TBD	TBD	TBD	TBD
Newington								0.07	0.13	0.96	TBD	TBD	TBD	TBD
Portsmouth								0.95	1.76	12.56	TBD	TBD	TBD	TBD
Pease ITP								0.16	0.31	2.19	TBD	TBD	TBD	TBD
Farmington						2.66		2.66			TBD	TBD	TBD	TBD
Rochester						127.47		127.47			TBD	TBD	TBD	TBD
Epping			4.31						4.31	4.31	TBD	TBD	TBD	TBD
Berwick							9.52	9.52			TBD	TBD	TBD	TBD
Milton							1.59	1.59			TBD	TBD	TBD	TBD
Rollinsford							2.84	2.84			TBD	TBD	TBD	TBD
Somersworth							10.56	10.56			TBD	TBD	TBD	TBD
North Berwick							1.94	1.94			TBD	TBD	TBD	TBD
Subtotal	0.00	44.27	34.73	11.76	0.00	130.13	31.98	267.39	81.94	111.76	TBD	TBD	TBD	TBD
Non-Point Sources	30.94	167.25	204.14	48.61	47.92	151.15	303.89	474.69	443.46	553.92	TBD	TBD	TBD	TBD
Total	30.94	211.52	238.87	60.37	47.92	281.29	335.88	742.07	525.40	665.68	TBD	TBD	TBD	TBD

*Units: Delivered nitrogen load to the assessment zone (tons per year). Average values for 2003-2008.

EXHIBIT 2

HALL & ASSOCIATES

Suite 701
1620 I Street, NW
Washington, DC 20006-4033
Telephone: (202) 463-1166 Web: http://www.hall-associates.com Fax: (202) 463-4207

Reply to E-mail:
jhall@hall-associates.com

November 10, 2011

VIA US MAIL AND FACSIMILE

Regional Freedom of Information Officer
U.S. EPA, Region I (OARMO 1-6)
5 Post Office Square, Suite 100
Boston, MA 02109-3912
Facsimile: (617) 918-0102

RE: Freedom of Information Act Request for Records Associated with EPA Region I's Draft NPDES Permit No. NH0100196 for the Town of Newmarket, NH, Wastewater Treatment Plant – Lamprey River Data

To Whom This May Concern:

This is a request for public records pursuant to the Freedom of Information Act ("FOIA"), 5 U.S.C. Section 552, as implemented by the Environmental Protection Agency ("EPA") at 40 C.F.R. Part 2. This request is submitted by Hall & Associates on behalf of the Great Bay Municipal Coalition. For purposes of this request, the definition of "records" includes, but is not limited to, documents, letters, memoranda, notes, reports, e-mail messages, policy statements, data, technical evaluations or analysis, and studies.

Background

EPA Region I issued a Draft NPDES Permit for the Town of Newmarket, NH, Wastewater Treatment Plant (NPDES Permit No. NH0100196) on October 5, 2011. EPA Region I determined that a more restrictive nitrogen limitation was necessary and included a 3 mg/l total nitrogen (TN) limit in this draft permit. This draft discharge permit is currently undergoing public review.

Request

Generally, this request seeks EPA Region I's records associated with its permit decision for the Town of Newmarket, NH, Wastewater Treatment Plant NPDES Permit No. NH0100196 regarding the need to impose "limits of technology" (3 mg/l TN) requirements to ensure attainment of transparency-based numeric criteria in the Lamprey River.

Specifically, we request the following documents related to the background of and basis for EPA

Region I's decision to impose the "limits of technology" (3 mg/l TN) requirement:

1. Data from and analyses of the Lamprey River showing:

   a. changes in transparency caused the eelgrass losses in this system;

   b. whether the 0.75 Kd (the transparency basis for the 0.3 mg/l TN numeric criteria) is attainable in this system;

   c. how other confounding/contributing factors, unrelated to algal growth, impact transparency in this system (i.e., color, turbulent mixing, turbidity);

   d. the relative importance of turbidity and color versus algal level in controlling transparency in the Lamprey River;

   e. whether it is proper to apply the 0.3 mg/l TN median value developed by DES under low flow, limited dilution conditions to derive pe1mit limits;

   f. the frequency of occurrence for the conditions used by EPA to generate the TN permit limits;

   g. that TN, rather than biologically available nitrogen (generally inorganic nitrogen - TIN), is the appropriate form of nitrogen to control in this system;

   h. that there is sufficient detention time in this system to convert organic forms of nitrogen into inorganic nitrogen and significantly impact algal growth in the system;

   i. the degree to which chlorophyll *a* in the Lamprey River affects transparency under average/median conditions; and

   j. that nutrients are the limiting factor controlling algal growth in the Lamprey River and Great Bay.

2. Documentation showing where eelgrass originally was present in the Lamprey system and whether the habitat in those areas has changed in the past 40 years.

3. Documentation showing what the TIN, TN and algal levels were in the system when eelgrass was present in the Lamprey River.

4. Documentation showing what caused the loss of eelgrass in the Lamprey River prior to 1980.

5. Documentation showing that the causes of eelgrass decline in the Bay, are the same factors that caused eelgrass losses in the Lamprey River decades earlier.

6. Documentation showing that DES has adopted and EPA has approved the proposed numeric criteria used to derive the Newmarket permit limits.

7. Documentation of the public review process showing that the 0.3 mg/l TN criteria applied by EPA has undergone formal notice and comment by DES as part of the CW A Section 303(c) adoption process, as required by applicable federal rules (40 CFR 131.21).

8. Documentation showing that the 0.3 mg/l TN criteria was based on an analysis of how conditions in the tidal rivers influence algal growth and transparency.

9. Documentation showing that attainment of the 0.3 mg/l TN criteria will assure attainment of the 22% incident light at 2 meters (0.75 Kd) in the Lamprey River.

10. Documentation that promoting eelgrass growth in the Lamprey River requires the same degree of light penetration as the Bay (22% incident light at 2 meters).

11. Documentation on the degree of transparency improvement and algal growth reduction that will occur in the Lamprey River if the Newmarket discharge is limited to 3 mg/l as recommended in the draft permit.

12. Documentation showing that reduced transparency has occurred in Great Bay from 1990-2008 and that the change in transparency was sufficient to cause the eelgrass reductions occurring in the Great Bay system.

13. Any correspondence/communications between EPA and NHDES indicating whether or not that EPA should impose the transparency-based TN criteria in the tidal rivers such as the Lamprey River.

14. Documentation showing that the TN objectives used by Massachusetts and Delaware referenced in the permit Fact Sheet were intended to be applied in tidal rivers with hydrodynamics similar to the Lamprey River.

Please contact the undersigned if the associated search and duplication costs are anticipated to exceed $250.00. Please duplicate the records that are responsive to this request and send them to the undersigned at the above address. If any requested records are withheld based upon any asserted privilege, please identify the basis for the non-disclosure. If EPA asserts that it is relying on documents developed by the State of New Hampshire for any of these issues, simply identify the state report which is claimed to contain the relevant information. If the Agency lacks records responsive to a particular item, please note that in the response. If you have any questions regarding this request, please do not hesitate to contact this office so as to ensure that agency resources are conserved and only the necessary documents are reproduced.

Sincerely,

John C. Hall

HALL & ASSOCIATES

Suite 701
1620 I Street, NW
Washington, DC 20006-4033
Telephone: (202) 463-1166 Web: http://www.hall-associates.com Fax: (202) 463-4207

Reply to E-mail:
jhall@hall-associates.com

November 10, 2011

VIA US MAIL AND FACSIMILE

Regional Freedom of Information Officer
U.S. EPA, Region I (OARMO 1-6)
5 Post Office Square, Suite 100
Boston, MA 02109-3912
Facsimile: (617) 918-0102

RE: Freedom of Information Act Request for Records Associated with EPA Region I's Draft NPDES Permit No. NH0100196 for the Town of Newmarket, NH, Wastewater Treatment Plant Use of 55:1 Dilution Factor

To Whom This May Concern:

This is a request for public records pursuant to the Freedom of Information Act ("FOIA"), 5 U.S.C. Section 552, as implemented by the Environmental Protection Agency ("EPA") at 40 C.F.R. Part 2. This request is submitted by Hall & Associates on behalf of the Great Bay Municipal Coalition. For purposes of this request, the definition of "records" includes, but is not limited to, documents, letters, memoranda, notes, reports, e-mail messages, policy statements, data, technical evaluations or analysis, and studies.

Background and Request

EPA Region I issued a Draft NPDES Permit for the Town of Newmarket, NH, Wastewater Treatment Plant (NPDES Permit No. NH0100196) on October 5, 2011. EPA Region I determined that a more restrictive, 3 mg/l total nitrogen limitation was necessary based on applying a 0.3 mg/l TN water quality objective to the Lamprey River. This draft discharge permit is currently undergoing public review. Generally, this request seeks EPA Region I's records associated with its permit decision regarding the need to impose "limits of technology" (3 mg/l TN) requirements to ensure attainment of selected numeric nutrient criteria in the Lamprey River. Specifically, we request the following records related to decision to apply the 0.3 mg/l TN objective under the stream conditions that gave rise to the 55:1 dilution factor:

1. Records showing or otherwise evaluating that the exposure frequency, magnitude, and duration used by DES to develop the draft 0.3 mg/l TN numeric nutrient criteria are similar to or consistent with those used to generate the 55:1 dilution factor in the Lamprey River.

2. Records showing the conditions under which the 55:1 dilution factor, referenced on page 28 of the Draft Permit Fact Sheet, was determined.

Please contact the undersigned if the associated search and duplication costs are anticipated to exceed $250.00. Please duplicate the records that are responsive to this request and send them to the undersigned at the above address. If any requested records are withheld based upon any asserted privilege, please identify the basis for the non-disclosure. If EPA asserts that it is relying on documents developed by the State of New Hampshire for any of these issues, simply identify the state report which is claimed to contain the relevant information. If the Agency lacks records responsive to a particular item, please note that in the response. If you have any questions regarding this request, please do not hesitate to contact this office so as to ensure that agency resources are conserved and only the necessary documents are reproduced.

Sincerely,

John C. Hall

HALL & ASSOCIATES

Suite 701
1620 I Street, NW
Washington, DC 20006-4033
Telephone: (202) 463-1166 Web: http://www.hall-associates.com Fax: (202) 463-4207

Reply-to Email:
jhall@hall-associates.com

November 23, 2011

VIA FACSIMILE

Regional Freedom of Information Officer
U.S. EPA, Region I (OARMO 1-6)
5 Post Office Square, Suite 100
Boston, MA 02109-3912
Facsimile: (617) 918-0102

RE: Freedom of Information Act Request for Records Associated with EPA Region I's Draft NPDES Permit No. NH0100196 for the Town of Newmarket, NH, Wastewater Treatment Plant – MOA Technical Review Conclusions

To Whom This May Concern:

This is a request for public records pursuant to the Freedom of Information Act ("FOIA"), 5 U.S.C. Section 552, as implemented by the Environmental Protection Agency ("EPA") at 40 C.F.R. Part 2. This request is submitted by Hall & Associates on behalf of the Great Bay Municipal Coalition. For purposes of this request, the definition of "records" includes, but is not limited to, documents, letters, memoranda, notes, reports, e-mail messages, policy statements, data, technical evaluations or analysis, and studies.

Background and Request

EPA Region I issued a Draft NPDES Permit for the Town of Newmarket, NH, Wastewater Treatment Plant (NPDES Permit No. NH0100196) on October 5, 2011. EPA Region I determined that a more restrictive nitrogen limitation was necessary and included a 3 mg/l total nitrogen (TN) limit in this draft permit. This draft discharge permit is currently undergoing public review. The proposed TN permit limitation was based on attaining a draft nutrient standard (0.3 mg/l TN) that was subject to an ongoing technical review, pursuant to the Great Bay Memorandum of Agreement (MOA) signed by the DES Commissioner and the town managers of five Great Bay communities. Review committee meetings were held in July and September 2011. Region I representatives were present at the first meeting.

Generally, this request seeks any records in EPA Region I's possession that demonstrate that the findings of the MOA Review Committee, specified below, are in error. In responding, to the extent EPA relies on either the June 2009 DES Numeric Nutrient Criteria document or the draft 2010 Nitrogen Loading Analysis, reference to these documents will be adequate and providing copies will not be necessary as these documents are already under MOA review. Specifically, we request any and all records that demonstrate that the following technical conclusions, with respect to Great Bay, are erroneous:

1. Eelgrass losses in Great Bay do not appear to be a result of either insufficient transparency or excessive epiphyte growth because eelgrass receive sufficient light over the tidal cycle and excessive epiphyte growth has not been shown to be present;

2. Macroalgae growth has significantly increased in the Bay over the past two decades and is adversely impacting habitat and eelgrass populations;

3. Macroalgae die back every winter, and their regrowth occurs primarily during warmer weather, peak light months (May to September);

4. Excessive macroalgae occurring in the Bay are most likely caused by increased dissolved inorganic nitrogen (DIN) loads to the Bay;

5. The level of DIN loading which may cause excessive macroalgae growth in the Bay has not been determined with certainty;

6. The level of DIN control required to eliminate excessive macrophyte growth in the Bay has not been determined with certainty; and

7. Since data in Great Bay indicate that macroalgae growth did not have a significant impact on the eelgrass resource prior to the early 2000s, attaining the DIN loading levels present in the mid-1990s when eelgrass was abundant should be protective of the resource.

Please contact the undersigned if the associated search and duplication costs are anticipated to exceed $250.00. Please duplicate the records that are responsive to this request and send them to the undersigned at the above address. If any requested records are withheld based upon any asserted privilege, please identify the basis for the non-disclosure. If EPA asserts that it is relying on documents developed by the State of New Hampshire for any of these issues, simply identify the state report which is claimed to contain the relevant information. If the Agency lacks records responsive to a particular item, please note that in the response. If you have any questions regarding this request, please do not hesitate to contact this office so as to ensure that agency resources are conserved and only the necessary documents are reproduced.

Sincerely,

John Hall /AMT

John C. Hall

HALL & ASSOCIATES

Suite 701
1620 I Street, NW
Washington, DC 20006-4033
Telephone: (202) 463-1166 Web: http://www.hall-associates.com Fax: (202) 463-4207

Reply-to Email:
jhall@hall-associates.com

December 6, 2011

VIA FACSIMILE

Regional Freedom of Information Officer
U.S. EPA, Region I (OARMO 1-6)
5 Post Office Square, Suite 100
Boston, MA 02109-3912
Facsimile: (617) 918-0102

RE: Freedom of Information Act Request for Records Associated with EPA Region I's Draft NPDES Permit No. NH0100196 for the Town of Newmarket, NH, Wastewater Treatment Plant and EPA Region I's Proposed Permit Modification for the Town of Exeter, NH, Wastewater Treatment Plant NPDES Permit No. NH0100871 – Tidal Variation in the Lamprey River, Squamscott River, and Great Bay

To Whom This May Concern:

This is a request for public records pursuant to the Freedom of Information Act ("FOIA"), 5 U.S.C. Section 552, as implemented by the Environmental Protection Agency ("EPA") at 40 C.F.R. Part 2. This request is submitted by Hall & Associates on behalf of the Great Bay Municipal Coalition. For purposes of this request, the definition of "records" includes, but is not limited to, documents, letters, memoranda, notes, reports, e-mail messages, policy statements, data, technical evaluations or analysis, and studies.

Request

Generally, this request seeks EPA Region I's records associated with its proposed permit decisions for the Town of Exeter, NH, Wastewater Treatment Plant NPDES Permit No. NH100871 and the Town of Newmarket, NH, Wastewater Treatment Plant NPDES Permit No. NH0100196 regarding the need to achieve a transparency-based 0.3 mg/l TN instream requirement and to allow recovery of eelgrass in the tidal rivers and Great Bay.

Specifically, we request the following records related to the background of and basis for EPA Region I's decision to impose this transparency-based 0.3 mg/l TN instream requirement and Region I's assertion that this limit is necessary to allow recovery of eelgrass in the Great Bay and the tidal rivers:

1. All data and records showing that the existing transparency levels in the Lamprey River, Squamscott River, and Great Bay are insufficient for eelgrass regrowth even after accounting for the tidal variations in these systems.

2. All data and records evaluating the degree of macroalgae growth in the Lamprey and Squamscott Rivers.

Please contact the undersigned if the associated search and duplication costs are anticipated to exceed $250.00. Please duplicate the records that are responsive to this request and send them to the undersigned at the above address. If any requested records are withheld based upon any asserted privilege, please identify the basis for the non-disclosure. If EPA asserts that it is relying on documents developed by the State of New Hampshire for any of these issues, simply identify the state report which is claimed to contain the relevant information. If the Agency lacks records responsive to a particular item, please note that in the response. If you have any questions regarding this request, please do not hesitate to contact this office so as to ensure that agency resources are conserved and only the necessary documents are reproduced.

Sincerely,

John C. Hall

HALL & ASSOCIATES

Suite 701
1620 I Street, NW
Washington, DC 20006-4033
Telephone: (202) 463-1166 Web: http://www.hall-associates.com Fax: (202) 463-4207

Reply-to Email:
jhall@hall-associates.com

December 8, 2011

VIA FACSIMILE

Regional Freedom of Information Officer
U.S. EPA, Region I (OARMO 1-6)
5 Post Office Square, Suite 100
Boston, MA 02109-3912
Facsimile: (617) 918-0102

RE: **Freedom of Information Act Request for Records Associated with EPA Region I's Draft NPDES Permit No. NH0100196 for the Town of Newmarket, NH, Wastewater Treatment Plant and EPA Region I's Proposed Permit Modification for the Town of Exeter, NH, Wastewater Treatment Plant NPDES Permit No. NH0100871 – Organic Forms of Nitrogen**

To Whom This May Concern:

This is a request for public records pursuant to the Freedom of Information Act ("FOIA"), 5 U.S.C. Section 552, as implemented by the Environmental Protection Agency ("EPA") at 40 C.F.R. Part 2. This request is submitted by Hall & Associates on behalf of the Great Bay Municipal Coalition. For purposes of this request, the definition of "records" includes, but is not limited to, documents, letters, memoranda, notes, reports, e-mail messages, policy statements, data, technical evaluations or analysis, and studies.

Request

Generally, this request seeks EPA Region I's records associated with its proposed permit decisions for the Town of Exeter, NH, Wastewater Treatment Plant NPDES Permit No. NH100871 and the Town of Newmarket, NH, Wastewater Treatment Plant NPDES Permit No. NH0100196 regarding the need to achieve a 3 mg/l TN effluent limitation to allow recovery of eelgrass in the tidal rivers and Great Bay.

Specifically, we request the following records related to the background of and basis for EPA Region I's draft permit decision:

1. All data and analyses showing that organic forms of nitrogen discharged from the Exeter and Newmarket facilities are promoting macroalgae growth and/or inhibiting eelgrass growth in the Lamprey River, Squamscott River, and/or Great Bay.

2. All data and analyses for the Great Bay system relied upon by the Region that demonstrate organic nitrogen discharged to the tidal rivers is converted to inorganic nitrogen <u>within the tidal rivers</u>.

3. All data and analyses for Great Bay showing the degree to which organic nitrogen forms contributed by the Lamprey and Squamscott Rivers convert to inorganic nitrogen forms <u>within Great Bay</u>.

4. All data and analyses demonstrating that organic nitrogen forms discharged by Exeter and Newmarket cause lower dissolved oxygen (DO) to occur in the Lamprey or Squamscott Rivers.

Please contact the undersigned if the associated search and duplication costs are anticipated to exceed $250.00. Please duplicate the records that are responsive to this request and send them to the undersigned at the above address. If any requested records are withheld based upon any asserted privilege, please identify the basis for the non-disclosure. If EPA asserts that it is relying on documents developed by the State of New Hampshire for any of these issues, simply identify the state report which is claimed to contain the relevant information. If the Agency lacks records responsive to a particular item, please note that in the response. If you have any questions regarding this request, please do not hesitate to contact this office so as to ensure that agency resources are conserved and only the necessary documents are reproduced.

Sincerely,

John Hall /AM

John C. Hall

EXHIBIT 3

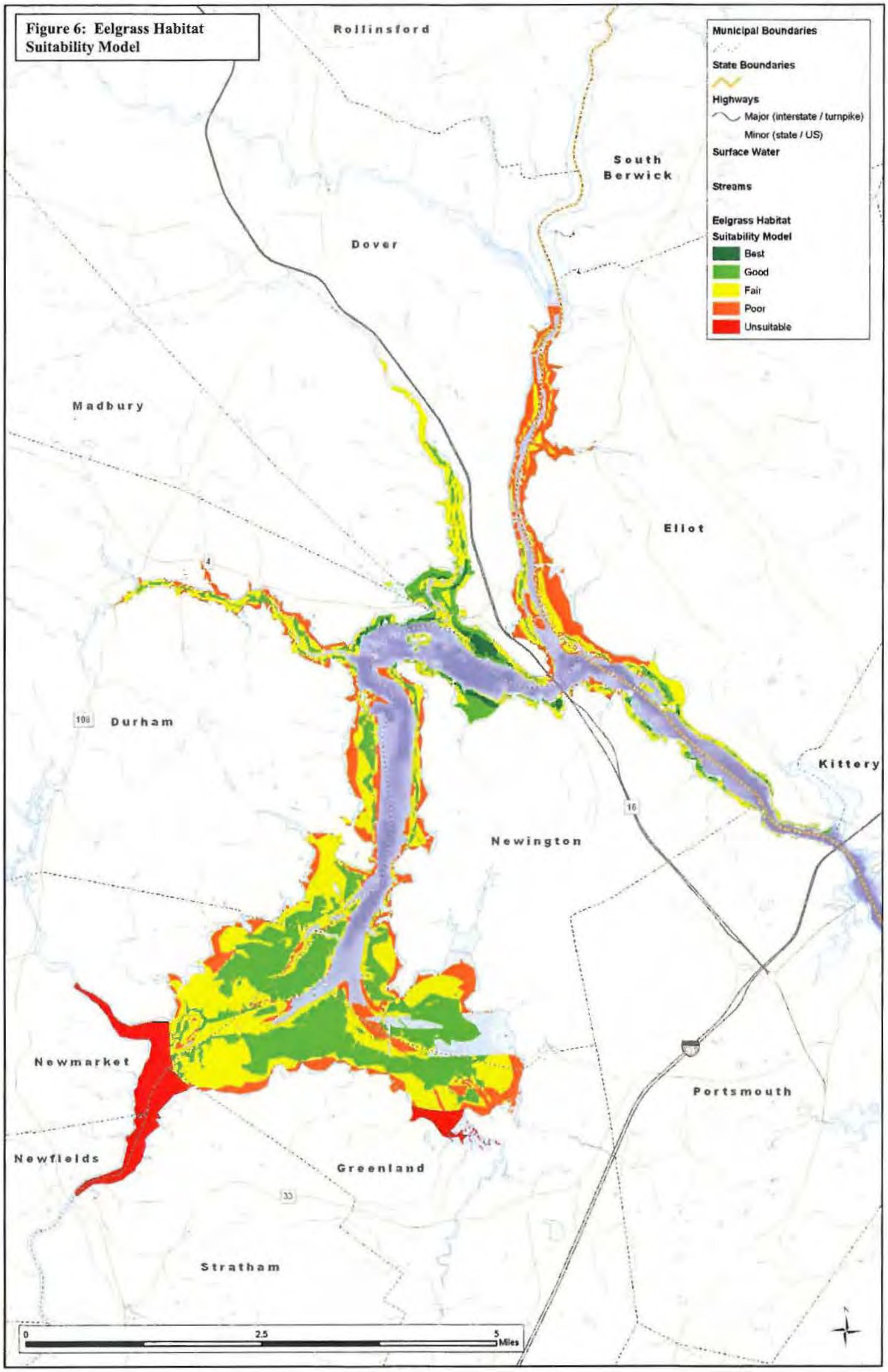

Figure 6: Eelgrass Habitat Suitability Model
Rollinsford
South Berwick
Dover
Madbury
Eliot
Durham
Kittery
Newington
Newmarket
Portsmouth
Newfields
Greenland
Stratham
Municipal Boundaries
State Boundaries
Highways
Major (interstate / turnpike)
Minor (state / US)
Surface Water
Streams
Eelgrass Habitat Suitability Model
Best
Good
Fair
Poor
Unsuitable
0
2.5
5 Miles

EXHIBIT 4

Assessment of Appropriate Peer Review Charge Questions For Evaluation of the Numeric Nutrient Criteria for the Great Bay Estuary, New Hampshire

The New Hampshire Department of Environmental Services (DES) recently proposed draft numeric criteria for total nitrogen to protect eelgrass habitat in the Great Bay Estuary. [1] The Report indicates that multiple lines of evidence were used in a "weight-of-evidence" analysis to derive the proposed numeric nutrient criteria. The Report states that data sources were chosen based on relevance to a conceptual model of eutrophication in estuaries. This would imply that total nitrogen (TN) was the cause of excessive plant growth in the Great Bay Estuary, which in turn caused the reduced light penetration that adversely affected eelgrass growth. The evaluation concluded that low dissolved oxygen and loss of eelgrass habitat were the most important impacts to aquatic life from nutrient enrichment and recommended ambient thresholds for TN concentration to address these impacts. Correlations between TN concentrations and chlorophyll-a, dissolved oxygen, and water clarity were assessed using linear regressions to establish the proposed numeric criteria.

Unrelated to this development, the EPA Science Advisory Board, Ecological Processes and Effects Committee, recently considered draft guidance on Empirical Approaches for Nutrient Criteria Derivation developed by EPA.[2] This guidance document described regression techniques for evaluating data for nutrient criteria derivation, such as the linear regressions used by DES for the Great Bay Estuary. The SAB cited significant deficiencies in this approach. Prior to the issuance of the SAB report, the City of Portsmouth requested that the draft nutrient criteria undergo a similar peer review. The assessment below summarizes the SAB findings relevant to the empirical nutrient criteria development approach used for the Great Bay Estuary, critiques the charge questions suggested by DES and EPA, and presents more relevant charge questions for consideration by the peer review panel, given the SAB findings.

EPA Science Advisory Board Findings on Utility of Empirical Approaches for Nutrient Criteria Development

In general, the SAB found that empirical approaches cannot be used as a stand-alone demonstration that criteria are justified. In reviewing EPA's draft guidance manual, the SAB reached the following findings that are relevant to review of the draft total nitrogen criteria developed for Great Bay Estuary.

- A clear framework for statistical model selection is needed. This framework should include: 1) an assessment of whether analyses indicate that the stressor-response approach is appropriate; 2) selection criteria to evaluate the capability of models to consider cause/effect and direct/indirect relationships between stressors and responses; 3) consideration of model relevance to known mechanisms and existing conditions; 4) establishment of biological relevance; and 5) ability to predict probability of meeting designated use categories. (at xix, first bullet response on Charge Question 6)

---

[1] New Hampshire Department of Environmental Services. June 2009. Numeric Criteria for the Great Bay Estuary.

[2] US EPA Science Advisory Board, Ecological Processes and Effects Committee. April 27, 2010. SAB Review of Empirical Approaches for Nutrient Criteria Derivation.

- Without a mechanistic understanding and a clear causative link between nutrient levels and impairment, there is no assurance that managing for particular nutrient levels will lead to the desired outcome. (at 6, first paragraph)
- [T]he empirical stressor-response approach does not result in cause-effect relationships; it only indicates correlations that need to be explored further. (at 41, bullet #1)
- In order to be scientifically defensible, empirical methods must take into consideration the influence of other variables. (at 24, 2nd bullet from bottom) The statistical methods in the Guidance require careful consideration of confounding variables before being used as predictive tools. ... Without such information, nutrient criteria developed using bivariate methods may be highly inaccurate. (at 24, first complete bullet)

EPA has also provided additional background documentation regarding what should constitute an acceptable "weight of evidence" approach used in criteria development. (*"Using Field Data and Weight of Evidence to Develop Water Quality Criteria", Cormier et al, 2008 SETAC*). That document, prepared by EPA's Office of Research and Development, specifies the following, with respect to criteria derivation:

Development of numeric WQC is based on 3 basic assumptions: First, causal relationships exist between agents and environmental effects. Second, these causal relationships can be quantitatively modeled. Finally, if exposures to the causal agent remain within a range predicted by the quantitative model, unacceptable affects will not occur and designated uses will be safeguarded. Therefore, for criteria to be valid there must be evidence that the criteria are based on reasonably consistent and scientifically defensible causal relationships.

Issues of Concern with Numeric Nutrient Criteria Development

The findings in the SAB report are directly applicable to the evaluations presented in the Report to support the proposed numeric nitrogen criteria, particularly with regard to the assumed relationship between eelgrass habitat and annual median total nitrogen concentration in the Great Bay Estuary. The Report (at 55, et seq.) attempts to establish a linkage between eelgrass habitat and total nitrogen via its effect on water clarity (light attenuation). The Report presents a multivariate linear regression linking light attenuation to phytoplankton (chlorophyll-a), colored dissolved organic matter (CDOM), non-algal turbidity, and water. The Report cites a study by Morrison et al. (2008) that determined the relative contribution of each of these factors to the light attenuation coefficient, indicating the following contributions: water (32%), phytoplankton (12%), CDOM (27%) and non-algal turbidity (29%). These factors are reported to explain 95 percent of the variance in the observed light attenuation measurements. The Report then presents linear regression analyses relating *total nitrogen* to median turbidity and to median light attenuation coefficient as the basis to support the proposed total nitrogen criteria.

The Report presents no mechanistic model linking total nitrogen to non-algal turbidity and the total nitrogen – water clarity regression jumps over underlying factors influencing light attenuation. The SAB report repeatedly warns that such regressions do not demonstrate cause-and-effect, and such a demonstration is needed to provide assurance that compliance with the criteria will protect the designated use. For example, that fact that TN is associated with non-algal particulates (turbidity) does not mean that controlling TN from all sources will control turbidity. Rather, if non-algal particulates are somehow controlled, turbidity would be reduced and the nitrogen associated with these particulates will also be controlled. However, waste load allocations limiting TN from POTWs, which is primarily present in the dissolved form, will have no effect on non-algal particulates and would be inappropriate if the real goal was to reduce turbidity.

The Report must provide a mechanistic model linking the stressor (nitrogen) to the responses (water clarity, eelgrass habitat) before the proposed relationships can be accepted. Of the four factors acknowledged to influence light attenuation, only phytoplankton growth is mechanistically associated with nitrogen, but the Report does not present a regression analysis for phytoplankton and light attenuation. For biologically available nitrogen to affect light attenuation, changes in concentration or loading must result in phytoplankton (chlorophyll-a) changes that are significant with respect to light attenuation. However, the data presented in the Report indicate that algal levels are quite low given the available nutrients. The fact that median phytoplankton levels are low suggests that nutrient concentrations are <u>not</u> the primary factor controlling phytoplankton growth and, therefore, nitrogen control may not significantly affect phytoplankton levels. Moreover, given the assessment indicating that only 12% of the light attenuation coefficient is attributed to phytoplankton, there is no reasonable expectation that light attenuation is significantly related to median total nitrogen due to the effect of nitrogen on phytoplankton growth. *Consequently, it appears that the entire premise of the draft criteria is misplaced.*

To be scientifically defensible, these concerns regarding the relationship between nitrogen, phytoplankton, and light attenuation must be addressed. The Report needs to provide the following evaluations:

- An analysis demonstrating that median total nitrogen controls phytoplankton growth in the Great Bay Estuary;

- A mechanistic analysis demonstrating that a reduction in median phytoplankton concentration will occur, and the impact of this reduction on light penetration, if the proposed criteria are achieved;

- A mechanistic analysis demonstrating that a TN reduction is required to address non-algal turbidity;

- A mechanistic analysis demonstrating the light attenuation goals will be achieved by reducing dissolved forms of nitrogen;

- An assessment of factors influencing light penetration that co-vary with TN and may otherwise explain or control the available light for submerged aquatic vegetation; and

- An analysis showing that (1) eelgrass losses are tied to TN increases and (2) eelgrass will be restored if the proposed criteria are achieved.

Charge Questions

The DES and EPA suggested that the peer review panel evaluate the proposed nutrient criteria with respect to the following charge questions.

- **Transparency**

  Is the process for the development of the criteria well described and documented?

- **Defensibility**

  Were accepted sampling and analysis methods used?

  Was a QA/QC process used and documented?

  Are the designated uses of the Great Bay clearly articulated?

  Is there a clear discussion of the logic of how the criteria protect those designated uses?

- **Reproducibility**

  Does analysis of the available data reproduce the results included in the report?

These proposed charge questions do not address the concerns identified by the SAB on the use of empirical approaches to develop numeric nutrient criteria. The SAB noted that the relationship between nutrients and designated use impairments is often very complex, with many confounding factors. For this reason, the SAB recommended that nutrient criteria be developed using a weight-of-evidence approach that significantly reduces uncertainty and that a clear causative link be established between nutrient levels and use impairment. These concerns are not addressed with the proposed charge questions. The basic problem with the proposed peer review is that it fails to seek confirmation on whether the Great Bay nutrient criteria report has (1) established the existence of a direct causal relationship between light penetration, eelgrass losses and TN concentration, (2) fully evaluated the factors that influence light penetration and (3) demonstrated the impact of the suggested TN reductions on algal growth/light penetration improvement. These key issues, among others, should be the focus of the peer review.

In order to address the concerns raised by the SAB and to ensure that the final numeric criteria are scientifically defensible, we recommend that the following charge questions be posed to the peer review committee.

Proposed Charge Questions

1. To be scientifically defensible, the Numeric Nutrient Criteria for the Great Bay Estuary must be based on the correct underlying causal model that considers all of the significant factors affecting the causal variable (light penetration) and designated uses of concern (eelgrass).

   a. Has the report adequately documented that lower light penetration was the cause of eelgrass losses? Was the level of light penetration used to set nutrient targets demonstrated to be necessary to support healthy eelgrass growth?

   b. Has the Report adequately confirmed that ambient TN concentration increases since 1997 were the cause of eelgrass losses in the Bay and that other factors were not responsible for this condition?

   c. Do the linear regressions presented in the report demonstrate cause-and-effect relationships between total nitrogen and the designated use metric (light penetration)?

   d. Is the linear regression relating TN to turbidity scientifically defensible and will TN control result in significant changes in turbidity with respect to light attenuation in the estuary?

   e. Has the evaluation confirmed that TN is the factor controlling phytoplankton chlorophyll 'a' concentration and that reducing TN will significantly reduce the level of plant growth with respect to light attenuation?

   f. Has the Report documented that dissolved forms of nitrogen discharged by wastewater facilities or present in runoff must be controlled to achieve light penetration goals?

2. Has the uncertainty in the regression analysis been addressed sufficiently to support a target of 0.25 – 0.30 mg N/L (annual median)?

3. The Report establishes a median annual instream concentration of total nitrogen and a 90^{th} percentile chlorophyll-a concentration as the basis for maintaining compliance with the instantaneous dissolved oxygen water quality standard.

   a. Is it scientifically defensible to establish an annual median total nitrogen concentration to protect an instantaneous minimum dissolved oxygen concentration?

   b. Is it scientifically defensible to establish a 90th percentile chlorophyll-a concentration to protect an instantaneous minimum dissolved oxygen concentration?

EXHIBIT 5

EVALUATION OF PROPOSED NUMERIC NUTRIENT WATER QUALITY CRITERIA FOR THE GREAT BAY ESTUARY

PREPARED FOR THE CITIES OF DOVER, DURHAM, EXETER, NEWMARKET, PORTSMOUTH AND ROCHESTER

By:

JOHN C. HALL
HALL & ASSOCIATES
Washington, DC

AND

THOMAS GALLAGHER
HYDROQUAL, INC
Mahwah, NJ

June 30, 2010

DRAFT

INTRODUCTION

The purpose of this White Paper is to review the technical merit and scientific basis of the proposed numeric nutrient criteria under consideration for the protection of the Great Bay Estuary, as set forth in *Numeric Nutrient Criteria for the Great Bay Estuary* – June 2009, New Hampshire Department of Environmental Services. This analysis is intended to (1) outline the legal/regulatory requirements associated with the criteria adoption/impaired waters designations; (2) evaluate the technical merits of the proposed criteria; and (3) present an alternative strategy to resolve the scientific uncertainties with the proposed approach that minimizes unnecessary adverse social and economic impacts while attaining applicable environmental goals.

The New Hampshire Department of Environmental Services ("NHDES") recently proposed draft numeric criteria for total nitrogen ("TN") to protect eelgrass habitat and improve dissolved oxygen ("DO") levels in the Great Bay Estuary.[1] The Great Bay Estuary includes waters of Great Bay, Little Bay, the Upper and Lower Piscataqua River, Portsmouth Harbor and the tidal segments of rivers tributary to these waters. A map of the Great Bay Estuary is shown in Figure 1.

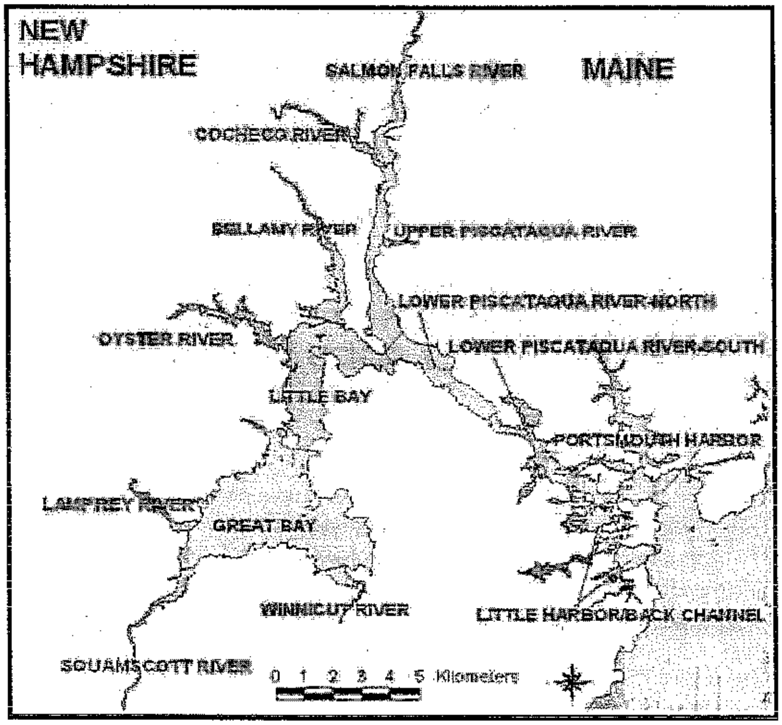

Figure 1. Assessment Zones in The Great Bay Estuary (New Hampshire DES, 2009)

[1] New Hampshire Department of Environmental Services. June 2009. Numeric Criteria for the Great Bay Estuary.

The technical analyses (mostly simple regressions) presented in this report were performed by NHDES with assistance from the Piscataqua Region Estuarine Partnership ("PREP"). Numeric nutrient criteria were derived from an analysis of water quality data collected between January 1, 2000 and December 31, 2008 at the monitoring stations shown in Figure 2.

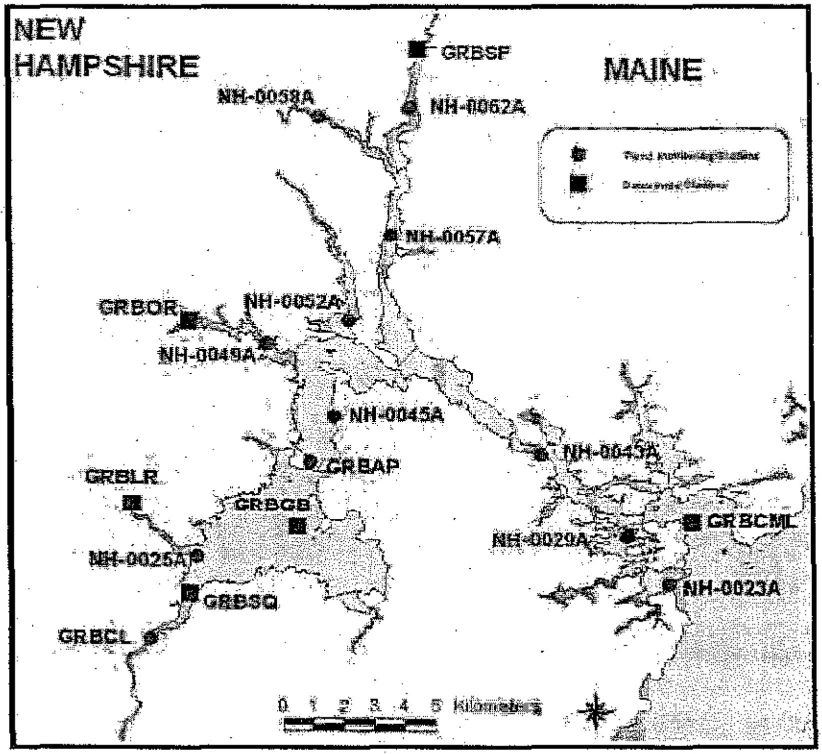

Figure 2. Trend Monitoring Stations for Water Quality in The Great Bay Estuary (New Hampshire DES, 2009)

The final report establishing the proposed TN criteria indicates that multiple lines of evidence were used in a "weight-of-evidence" ("WoE") analysis to derive the proposed numeric nutrient criteria. The report states that data sources were chosen based on relevance to a conceptual model of eutrophication in estuaries. This indicates that the purpose of the proposed TN water quality objectives is the control of excessive plant growth (i.e., phytoplankton growth influencing water column transparency). These data were evaluated using linear regressions between TN concentrations and chlorophyll-'a', DO, and water clarity. The evaluation determined that low DO occurring in the estuary tidal river arms and loss of eelgrass habitat throughout the system were the most important impacts to aquatic life from nutrient enrichment and recommended ambient thresholds for TN concentration to address these impacts.

Unrelated to this development, the EPA Science Advisory Board ("SAB"), Ecological Processes and Effects Committee, recently considered draft guidance entitled *Empirical Approaches for Nutrient Criteria Derivation* developed by EPA. This guidance document described regression techniques for evaluating data for nutrient criteria derivation such as the linear regressions used by NHDES for selecting water quality standards for the Great Bay Estuary. The SAB cited significant deficiencies in this approach and recommended major changes in how such methods are used in criteria derivation. To a certainty, application of these simplified methods to derive nutrient criteria will lead to substantial municipal and private expenditures unrelated to actual environmental need if they are not tailored to site-specific conditions. The purpose of this White Paper is to review the technical sufficiency and environmental ramifications of adopting the TN criteria as suggested by NHDES and to offer suggestions on how to ensure that a scientifically defensible approach, that is likely to achieve its intended objectives, may be developed.

I. REGULATORY BACKGROUND

Pursuant to Clean Water Act (CWA) Section 303(c) and its implementing regulations at 40 C.F.R. Part 131, state water quality criteria are set at the level "necessary to protect the [designated] uses." 40 C.F.R. 131.2. Criteria also must be based on "sound scientific rationale." 40 C.F.R. 131.11(a). Numeric criteria should be based on EPA's Section 304(a) guidance, modified to reflect site-specific conditions, or "other scientifically defensible methods." 40 C.F.R. 131.11(b). In addition, narrative criteria may be established where numeric criteria can not to supplement numeric criteria. *Id.* Thus, it is axiomatic that approvable criteria must be set at the level that is demonstrated to be both necessary and appropriate for protecting a particular aquatic use (*i.e.*, fishery or human health protection). [2]

National Guidelines Principles Governing Numeric Criteria Development

EPA has had long standing published procedures for developing water quality criteria. "*Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*", USEPA 1985 (hereafter "*National Guidelines*"). EPA's *National Guidelines* establish the threshold principles that all aquatic water quality criteria must meet to be considered "scientifically defensible." First, the purpose of criteria is to protect aquatic organisms and their uses from unacceptable effects. *See, National Guidelines*, at vi. "Criteria should attempt to provide a reasonable and adequate amount of protection with only a small possibility of considerable overprotection or underprotection." *National Guidelines*, at 5. Proper criteria derivation requires the

[2] *See, e.g., Thomas v. Jackson*, 581 F.3d 658, 661 (8th Cir. Iowa 2009) (emphasis supplied) ("The water quality standards comprise: (1) designated uses; (2) water quality criteria *defining the amounts of pollutants that the water can contain without impairment of the designated uses*; and (3) anti-degradation requirements, which apply to bodies of water whose quality is better than required."); *Natural Resources Defense Council v. United States EPA*, 915 F.2d 1314, 1317 (9th Cir. 1990) (emphasis supplied) ("Second, the state was to determine the "criteria" for each segment - *the maximum concentrations of pollutants that could occur without jeopardizing the use.* These criteria could be either numerical (e.g. 5 milligrams per liter) or narrative (e.g. no toxics in toxic amounts)"); *American Wildlands v. Browner*, 94 F. Supp. 2d 1150, 1154 (D. Ct. Colo. 2000) ("The second area is "criteria for all toxic pollutants" which articulates the amounts of various pollutants that may be present in the water without interfering with the designated uses. 33 U.S.C. § 1313(c)(2)."); *MCEA v. EPA*, 2005 U.S. Dist. LEXIS 12652, *14 (D.C. Minn. 2005) (emphasis added) ("When establishing a water quality standard or water quality criterion, it is axiomatic that the standard is set at a *level necessary to protect the designated uses.*").

establishment of a "cause and effect" relationship to ensure that regulation of the pollutant is necessary and will produce the desired effect. *National Guidelines,* at 15-16, 21. Thus, "[t]he concentrations, durations, and frequencies specified in criteria are based on biological, ecological, and toxicological data, and are designed to protect aquatic organisms and their uses from unacceptable effects." *Id.* at 16. To develop such criteria, adequate data must be available or the criteria should not be developed. *Id.* at 5-6. Specifically, there must be adequate data on pollutant levels that cause an unacceptable adverse effect on any of the specified biological measurements. *Id.* at 39. For materials that have a threshold effect (like nutrients), the threshold of unacceptable effect must be determined. *Id.* at 8. In addition, "[c]riterion must be used in a manner that is consistent with the way in which they were derived...." *Id.* at 7.

EPA has also provided additional background documentation regarding what should constitute an acceptable WoE approach used in criteria development. ("*Using Field Data and Weight of Evidence to Develop Water Quality Criteria," Cormier et al, 2008 SETAC*). That document, prepared by EPA's Office of Research and Development, specifies the following with respect to criteria derivation:

> *Development of numeric WQC is based on 3 basic assumptions: First, causal relationships exist between agents and environmental effects. Second, these causal relationships can be quantitatively modeled. Finally, if exposures to the causal agent remain within a range predicted by the quantitative model, unacceptable affects will not occur and designated uses will be safeguarded. Therefore, for criteria to be valid there must be evidence that the criteria are based on reasonably consistent and scientifically defensible causal relationships.*

Consistent with the *National Guidelines'* requirement that a criteria development document provide a clear demonstration of causation, the various EPA nutrient criteria documents for estuary, lake and stream environments all clearly specify that dose/response demonstrations and identifiable impairment thresholds are required to set scientifically defensible nutrient standards. For instance, the *Nutrient Criteria Technical Guidance Manual – Rivers and Streams*, USEPA July 2000 (hereafter "*Rivers and Streams Document*") is clear that a nutrient criterion must be based on a demonstration that nutrients are causing excessive plant growth (eutrophication), measured by cholorophyll 'a'. ("Nutrient criteria development should relate nutrient concentrations in streams, algal biomass and changes in ecological condition (*e.g.*, nuisance algae accrual rate and deoxygenation.... Initial criteria should be verified and calibrated by comparing criteria in the system of study to nutrients, chlorophyll 'a', and turbidity values in water bodies of known condition to ensure that the system of interest operates as expected.") *Rivers and Streams Document* @ 13. Additionally, the *Rivers and Streams Document* stressed that the targeted instream objective must be related back to an impairment threshold. ("Predictive relationships between nutrients and periphyton (or phytoplankton) biomass are *required* to identify the critical or threshold concentrations that produce nuisance algal biomass.") *Id* @ 76. (emphasis supplied).

Nutrient Criteria Development Issues

Nitrogen and phosphorus are essential nutrients for life on earth. However, too much nitrogen or phosphorus can cause excessive plant growth that reduces the DO and impairs water clarity adversely affecting the ecology of a water body. Nutrients are not toxics that have a threshold above which adverse impacts are certain to occur. Physical factors, such as sunlight, water velocity, tidal exchange, turbidity, substrate, presence of zooplankton (grazers), presence of filter feeders (oysters, mussels) and other biological factors may prevent excessive plant growth even when high nutrient concentrations occur. This is what makes setting appropriate nutrients standards a very difficult process. Due to the many factors affecting whether or not nutrient levels will trigger excessive plant growth, the Association of State and Interstate Water Pollution Control Administrators ("ASIWPCA"), in June 2007, informed EPA that attempting to establish statewide nutrient objectives was not technically defensible:

> *During their considerable development processes, many States are failing to find a strong linkage between the EPA recommended cause variables (N and P) and response variables of chlorophyll-a and transparency, but are finding wide variations in parameters that seem unrelated to professional assessments of ''trophic health'' status. In many cases, a relationship cannot be demonstrated between causal variables N and P, and factors such as turbidity, light limitation, canopy cover, substrate, aquatic community structure, bioavailability, reservoir sequestration, micronutrient limitations and other ''response'' variables. These problems can only lead to mis-cues in impairment identification and mis-direction of scarce management and implementation resources.*
>
> Letter from ASIWPCA to Ben Grumbles (EPA Assistant Administrator Office of Water) (July 18, 2007); *http://www.asiwpca.org/home/docs/Ltr2EPANutrients.pd*

The complexity of this issue was anticipated by EPA many years earlier:

> *Algal growth typically is greatly reduced or negligible during the winter low light and temperatures; it then usually increases during the spring under increasing sunlight... Nutrients might not always be the limiting factor controlling nuisance plant growth. Several other constraints, such as light availability, flow, availability of trace elements, substrate conditions, management (CuSO4+, grazing, and temperature) potentially could be limiting. See Protocol for Developing Nutrient TMDLs,* First Edition, Page 3 –5, 6 (EPA 841-B-99-007).

Presently, NHDES has no TN or total phosphorus ("TP") standards that serve as a benchmark for protecting aquatic life, recreation, or drinking water uses. It is the Department's proposed initial standards that are the subject of this paper's detailed technical and regulatory review. As noted earlier, water quality standards are required to be set at the level "necessary to protect uses." 40 CFR 131.2. In general, this requires that a clear "cause and effect" relationship to use impairment be documented for different classes of waters and various uses. For example, the Rivers and Streams Technical

Guidance Manual makes it clear that establishing a "cause and effect" relationship between nutrients and an adverse response is critical:

> *When evaluating the relationships among nutrients and algal response within stream systems, it is important to first understand which nutrient is limiting. Once the liming nutrient is defined, critical nutrient concentrations can be specified and nutrient and algal biomass relationships can be examined to identify potential criteria to avoid nuisance algal levels.*

Nutrient Criteria Technical Guidance Manual Rivers and Streams, at 13.
(USEPA 2000)

As noted by ASIWPCA, state programs have encountered severe problems in making this demonstration for nutrients, and, at EPA's suggestion, have begun to use more simplified statistical methods to identify numeric standards. These simplified methods (regression analyses) *presume, but do not demonstrate*, that elevated levels of nutrients are the cause of impairments in any water where they may occur. This assumption is directly at odds with decades of nutrient research and EPA-published technical guidance which has repeatedly affirmed that nutrients do not cause impairments in many situations, since other factors may also control plant growth.

On April 27, 2010, EPA's SAB issued a report highly critical of the "statistical" methods being used to generate nutrient criteria and found these procedures inadequate for developing scientifically defensible criteria because they lack a "cause and effect" demonstration.[3] These are the same types of procedures that NHDES has used to identify its preliminary estuary standards. In general, the SAB found that empirical approaches cannot be used as the primary demonstration that criteria are justified and a detailed consideration of habitat and other relevant factors must be conducted. In reviewing EPA's draft guidance manual on use of regression methods, the SAB reached the following findings that are directly relevant to review of the draft TN criteria developed for the Great Bay Estuary.

- A clear framework for statistical model selection is needed. This framework should include: 1) an assessment of whether analyses indicate that the stressor-response approach is appropriate; 2) selection criteria to evaluate the capability of models to consider cause/effect and direct/indirect relationships between stressors and responses; 3) consideration of model relevance to known mechanisms and existing conditions; 4) establishment of biological relevance; and 5) ability to predict probability of meeting designated use categories. (at xix, first bullet response on Charge Question 6)

[3] *See*, SAB Ecological Processes and Effects Committee Review of Empirical Approaches for Nutrient Criteria Derivation. (April 27, 2010).

- Without a mechanistic understanding and a clear causative link between nutrient levels and impairment, there is no assurance that managing for particular nutrient levels will lead to the desired outcome. (at 6, first paragraph)
- For criteria that meet EPA's stated goal of "protecting against environmental degradation by nutrients," the underlying causal models must be correct. Habitat condition is a crucial consideration in this regard (*e.g.*, light [for example, canopy cover], hydrology, grazer abundance, velocity, sediment type) that is not adequately addressed in the Guidance. Thus, a major uncertainty inherent in the Guidance is accounting for factors that influence biological responses to nutrient inputs. Addressing this uncertainty requires adequately accounting for these factors in different types of water bodies. (at 38, first bullet)
- [T]he empirical stressor-response approach does not result in cause-effect relationships; it only indicates correlations that need to be explored further. (at 41, bullet #1)
- In order to be scientifically defensible, empirical methods must take into consideration the influence of other variables. (at 24, 2nd bullet from bottom). The statistical methods in the Guidance require careful consideration of confounding variables before being used as predictive tools. ... Without such information, nutrient criteria developed using bivariate methods may be highly inaccurate. (at 24, first complete bullet)
- The Guidance should contain a quantitatively based "weight-of-evidence" (WoE) framework using multiple methods and then combining them into figures and tables for visualization. Multiple statistical methods on one dataset do not equate to a reasonable WoE that significantly reduces uncertainty. Rather, the WoE should involve different assessment methods (*e.g.*, different datasets, different biological endpoints, measures of habitat, etc.). This premise has been embraced by other EPA programs and the scientific community. (at 16,17). The Guidance can be used to develop nutrient criteria in a tiered weight of evidence assessment using appropriately modified EPA approved procedures together with other approaches that address causation. (at 37)

These various scientific recommendations apply directly to the methods used to develop the draft Great Bay Estuary criteria. As discussed below, major issues that EPA's SAB considered critical to ensure scientifically-defensible nutrient objectives were not addressed in developing the proposed standards. The SAB report strongly concluded that the simplified statistical methods should not be used as the primary basis for criteria derivation since the methods may lead to erroneous regulatory determinations that fail to protect the environment and waste resources. Based on these concerns, a more careful assessment of the underlying science and certainty of the relationships predicted by the NHDES would seem prudent. The need to establish a clear "cause and effect" relationship prior to adopting stringent nutrient criteria, especially for nitrogen, is discussed further below. Absent information addressing these issues, there is no way to ensure that achieving the proposed criteria will provide any benefit, whatsoever, to the ecology of Great Bay.

Overview of the Proposed Water Quality Objectives for the Great Bay Estuary

A summary of the proposed numeric nutrient criteria for the New Hampshire estuarine waters in the Great Bay Estuary is presented in Table 1.

Table 1. Proposed Numeric Nitrogen and Chl-a Criteria for Great Bay Estuary

Use	Parameter	Threshold	Statistics
Primary Contact	chl-a	20 ug/L	90th percentile
Aquatic Life - DO	TN	0.45 mg/L	median
	chl-a	10 ug/L	90th percentile
Aquatic Life - Eelgrass	TN	0.30 mg/L (1)	median
		0.27 mg/L (2)	median
		0.25 mg/L (3)	median
	Kd	0.75 /m (1)	median
		0.60 /m (2)	median
		0.50 /m (3)	median

Notes:
(1) Eelgrass restoration depth = 2.0 m
(2) Eelgrass restoration depth = 2.5 m
(3) Eelgrass restoration depth = 3.0 m

For primary contact recreation a 90th percentile chlorophyll-'a' threshold concentration of 20 µg/L is proposed. This criterion has been used by NHDES for 305(b) assessments since 2004. Currently this criterion is not violated in the waters of the Great Bay Estuary, but if this criterion is violated, NHDES will list the waterbody as impaired for nitrogen based on regression analyses of 90th percentile chlorophyll 'a' versus nitrogen. To achieve the current DO criteria for aquatic life support, NHDES has proposed median TN and 90th percentile chlorophyll-'a' criteria of 0.45 mg/L and 10 µg/L, respectively. These criteria apply in sections of the Great Bay Estuary where eelgrass has not historically existed, which are typically the upper reaches of the tidal rivers. To protect eelgrass, NHDES has proposed light attenuation coefficients for different eelgrass restoration depths that provide 22% of surface light on the estuary bottom. Through regression analyses, NHDES has equated various light attenuation coefficients with median TN concentrations. Initially a restoration depth of 2.0 meters is proposed for areas of the Great Bay Estuary where eelgrass has historically existed except for the Lower Piscataqua River – South, Portsmouth Harbor, and Little Harbor/Back Channel areas where a restoration depth of 2.5 to 3.0 meters will be determined after further research. Median TN criteria for eelgrass restoration depths of 2.0 m, 2.5 m, and 3.0 m are 0.30 mg/L, 0.27 mg/L, and 0.25 mg/L, respectively. NHDES considers nitrogen to be the limiting nutrient in the Great Bay Estuary and has therefore not established phosphorus criterion for the Great Bay Estuary waters.

II. EVALUATION OF SCIENTIFIC APPROACH

Major Deficiencies with Proposed Criteria

A. <u>SAB Review of Similar Nutrient Criteria Approaches</u>

Since early 2008, EPA, via its N-STEPS program, has presented state agencies and Regional Technical Advisory Groups with information indicating that simplified regression approaches may be used to develop nutrient standards. The NHDES proposal appears to have embraced that advice from EPA Headquarters. In September 2009, EPA published a draft guidance document entitled *"Empirical Approaches for Nutrient Criteria Derivation"* and submitted the document to the SAB Ecological Processes and Effects Committee for review. The SAB review was requested by a group of municipalities that had been adversely impacted by application of these methods to derive nutrient objectives in several Pennsylvania watersheds as part of TMDL development. That SAB Committee roundly criticized the simplified regression methods as not demonstrating "cause and effect" and likely to result in misplaced regulatory determinations. Key findings of the SAB directly applicable to this regulatory effort for Great Bay are discussed below.

(1) "Cause and Effect" Demonstration Necessary

The single, most important aspect of criteria derivation is a clear "cause and effect" demonstration. As noted by the SAB, simplified stressor–response regressions do not provide scientific proof that "cause and effect" is demonstrated:

> *[T]he final document should clearly state that statistical associations may not be biologically relevant and do not prove cause and effect. (at 2, italicized text in last paragraph) Without a mechanistic understanding and a clear causative link between nutrient levels and impairment, there is no assurance that managing for particular nutrient levels will lead to the desired outcome. (at 6, first paragraph); The Guidance needs to clearly indicate that the empirical stressor-response approach does not result in cause-effect relationships; it only indicates correlations that need to be explored further. (at 41, bullet #1)*

The single greatest deficiency with the draft criteria is that "cause and effect" is nowhere demonstrated. This deficiency occurs both with respect to the eelgrass-based objective and the DO-based objective. Figure 3 below presents the various scientific connections that must be demonstrated to show that TN increases actually caused eelgrass losses.

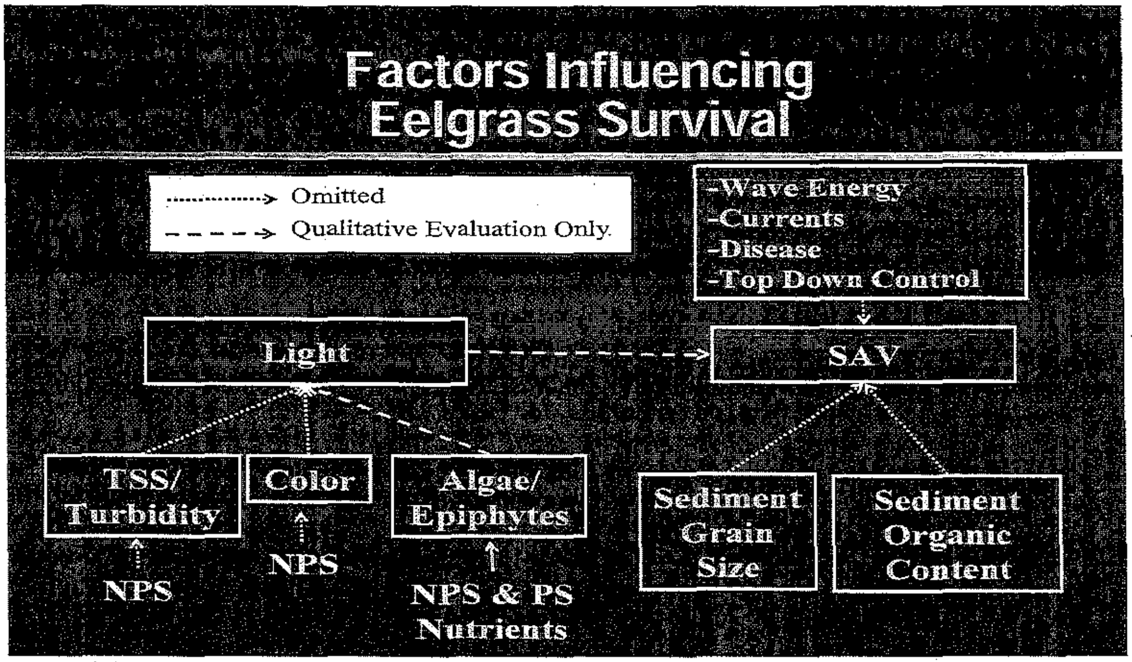

Figure 3. Factors Influencing Eelgrass Survival

The NHDES Report (at 55, *et seq.*) attempts to establish a direct linkage between eelgrass habitat and TN via its effect on water clarity (light attenuation). The Report presents a multivariate linear regression linking light attenuation to phytoplankton (chlorophyll 'a'), colored dissolved organic matter ("CDOM"), non-algal turbidity, and water. The Report cites a study by Morrison *et al.* (2008) that determined the relative contribution of each of these factors to the light attenuation coefficient, indicating the following contributions: water (32%), phytoplankton (12%), CDOM (27%) and non-algal turbidity (29%). These factors are reported to explain 95 percent of the variance in the observed light attenuation measurements. The Report then presents linear regression analyses relating solely *TN* to median turbidity and to median light attenuation coefficient as the basis to support the proposed TN criteria. The Report presents no mechanistic model linking TN to non-algal turbidity and the TN-water clarity regression jumps over underlying factors influencing light attenuation. Moreover, the Report does not even demonstrate that regulating TN will, in fact, reduce algal turbidity. As indicated in the above figure by the dotted lines, the majority of cause and effect relationships necessary to link TN levels to eelgrass losses were never evaluated in the draft criteria document.

Regarding the proposed DO-related TN criteria, *none* of the basic connections needed to demonstrate that TN or plant growth was the cause of the low DO monitored in the upper tidal river arms were evaluated. *See*, Figure 4. It is not even apparent that the chlorophyll 'a' levels in the tidal arms are controlled by TN levels. It is possible, if not probable, that the algal levels existing in the upper tidal river arms grew in the fresh water sections of the rivers. In which case, controlling this plant growth would require upstream TP controls to be instituted, not TN control.

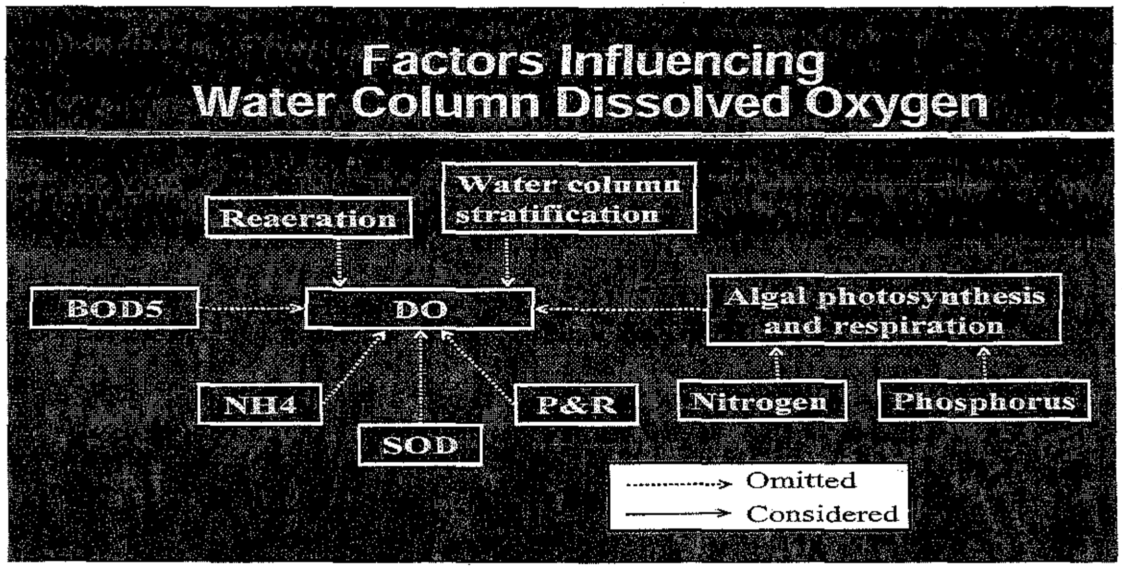

Figure 4. Factors Influencing Water Column Dissolved Oxygen

The SAB report repeatedly warns that such regressions do not demonstrate "cause and effect", and such a demonstration is needed to provide assurance that compliance with the criteria will protect the designated use. For example, the fact that TN is associated with non-algal particulates (turbidity) does not mean that controlling TN from all sources will control turbidity. Rather, if non-algal particulates are somehow controlled, turbidity would be reduced and the nitrogen associated with these particulates will also be controlled. However, waste load allocations limiting TN from POTWs, which is primarily present in the *dissolved* form, will have no effect on non-algal particulates and would be inappropriate if the real goal was to reduce turbidity.

(2) Consideration of Factors Influencing Nutrient Dynamics/Impairment Metric

To complete a reliable analysis of "cause and effect", it is critical that the habitat factors that may control various phenomena are considered and accounted for in the assessment.

> *In order to be scientifically defensible, empirical methods must take into consideration the influence of other variables. (at 24, 2nd bullet from bottom)...The statistical methods in the Guidance require careful consideration of confounding variables before being used as predictive tools. ... Without such information, nutrient criteria developed using bivariate methods may be highly inaccurate. (at 24, first complete bullet)*
>
> *For criteria that meet EPA's stated goal of "protecting against environmental degradation by nutrients," the underlying causal models must be correct. Habitat condition is a crucial consideration in this regard (e.g., light [for example, canopy cover], hydrology, grazer abundance, velocity, sediment type) that is not adequately addressed in the Guidance. Thus, a major uncertainty inherent in the Guidance is accounting for factors that influence biological responses to nutrient*

inputs. Addressing this uncertainty requires adequately accounting for these factors in different types of water bodies. (at 38, first bullet). Numeric nutrient criteria developed and implemented without consideration of system specific conditions (e.g., from a classification based on site types) can lead to management actions that may have negative social and economic and unintended environmental consequences without additional environmental protection. (at 38, third bullet)

Again, nowhere in the report were the various physical factors or other biological influences considered in rendering the TN criteria recommendations. The Report must provide a mechanistic model linking the stressor (nitrogen) to the responses (water clarity, eelgrass habitat) before the proposed relationships can be accepted. Of the four factors acknowledged to influence light attenuation (Figure 3), only phytoplankton growth is mechanistically associated with nitrogen, but the Report does not present a regression analysis for phytoplankton and light attenuation. For biologically available nitrogen to affect light attenuation, changes in concentration or loading must result in phytoplankton (chlorophyll 'a') changes that are significant with respect to light attenuation. However, the data presented in the Report indicate that algal levels are quite low given the available nutrients. The fact that median phytoplankton levels are low suggests that nutrient concentrations are <u>not</u> the primary factor controlling phytoplankton growth and, therefore, nitrogen control may not significantly affect phytoplankton levels. Moreover, as discussed in greater detail subsequently, available data indicate that only 12% of the light attenuation coefficient is attributed to phytoplankton (plus detritus). Consequently, there is no reasonable expectation that light attenuation is significantly related to median TN due to the effect of nitrogen on phytoplankton growth. *Consequently, it appears that the entire premise of the draft criteria may be misplaced.*

With regard to DO concerns, it is not even apparent that TN or chlorophyll 'a' level has any influence on the periodic low DO documented to occur in each of the estuary arms. If it is caused by plant growth, then that plant growth may be occurring in the freshwater section and is transported in the upper arms of the tidal rivers. In that case, it is likely that plant growth would be phosphorus, not nitrogen controlled. If the minimum is caused primarily by SOD occurring in the depositional areas at the beginning of the arms, then TN reduction will do little to solve this issue. There needs to be some form of quantitative assessment to rule out these obvious possibilities.[4]

---

[4] The NHDES and EPA suggested that the peer review panel evaluate the proposed nutrient criteria with respect to the following charge questions.

- **Transparency:** Is the process for the development of the criteria well described and documented?
- **Defensibility:** Were accepted sampling and analysis methods used?; Was a QA/QC process used and documented?; Are the designated uses of the Great Bay clearly articulated?; Is there a clear discussion of the logic of how the criteria protect those designated uses?
- **Reproducibility:** Does analysis of the available data reproduce the results included in the report?

These proposed charge questions do not address the concerns identified by the SAB on the use of empirical approaches to develop numeric nutrient criteria. The SAB noted that the relationship between nutrients and designated use impairments is often very complex, with many confounding factors. For this reason, the SAB recommended that nutrient criteria be developed using a WoE approach that significantly reduces uncertainty and that a clear causative

(3) Basic Analyses Missing From the Support Documents

The following basic demonstrations necessary to show "cause and effect" between TN levels and eelgrass losses/low DO levels are missing from the state's report:

- An analysis demonstrating that median TN concentrations control phytoplankton growth in the Great Bay Estuary and the degree of phytoplankton reduction expected for various TN levels;

- An analysis showing that areas of increased turbidity are correlated to reduced eelgrass populations, in particular that eelgrass losses are greatest in deeper waters with less light penetration;

- A mechanistic analysis demonstrating that a reduction in median phytoplankton concentration will occur, and the impact of this reduction on light penetration, if the proposed criteria are achieved;

- A mechanistic analysis demonstrating that a TN reduction is required to address non-algal turbidity;

- A mechanistic analysis demonstrating the light attenuation goals will be achieved by reducing dissolved forms of nitrogen;

- An assessment of factors influencing light penetration that co-vary with TN and may otherwise explain or control the available light for submerged aquatic vegetation;

- An analysis showing that (1) historic eelgrass losses are tied to TN increases/turbidity increases and (2) eelgrass will be restored if the proposed criteria are achieved;

- An analysis showing that the chlorophyll 'a' levels in the estuary arms is sufficient to cause the degree of low DO occurring in those specific sites;

- An analysis confirming that sediment oxygen demand ("SOD") was not the cause of DO depletion occurring in the estuary arms; and

- An analysis showing that increased chlorophyll 'a' levels occurring in estuary arms resulted from phytoplankton growth in the saline and not fresh water sections of the watershed.

Normally, if one were to assert that transparency is the cause of eelgrass losses and a specific transparency level is needed to restore these plants, some form of analysis would be presented showing that in areas with decreased transparency or in deeper waters where

---

link be established between nutrient levels and use impairment. These concerns are not addressed with the proposed charge questions. The basic problem with the proposed peer review is that it fails to seek confirmation on whether the Great Bay nutrient criteria report has (1) established the existence of a direct causal relationship between light penetration, eelgrass losses and TN concentration; (2) fully evaluated the factors that influence light penetration; and (3) demonstrated the impact of the suggested TN reductions on algal growth/light penetration improvement.

less light penetration occurs, eelgrass losses are prevalent. That is, at greater depths more eelgrass losses occurred and such losses did not occur in shallow waters where ample light is present. Such analyses are not presented anywhere in the supporting materials. A simple claim is made, "transparency caused the eelgrass decline" with not a shred of evidence presented to confirm that position. Rather an even more tenuous (and even more unsupported claim) is made: "TN increases caused the eelgrass losses." These claims require a sound technical justification as they are in conflict with much of the information presented in the reports. For example, phytoplankton levels are generally quite low throughout the system and dissolved nitrogen levels do not appear to be exhausted. This implied that hydrodynamics, not nutrient levels, control plant growth. Thus, reducing the TN levels to the projected targets may produce little if any measurable algal reduction and certainly not at a level that could dramatically increase existing water clarity. Moreover, it is not well established that transparency is actually the cause of eelgrass losses. Figure 5a shows the extent of eelgrass losses and macro algae increase in Great Bay. The most prevalent eelgrass losses and macro algae increases appear to have occurred in the shallower waters near the shorelines. These waters should have greater light availability than the deeper waters. Moreover, it appears that losses occurred in relation to more extensive land use development. See, Figure 5b. This information needs to be explained before a defensible conclusion regarding turbidity may be reached.

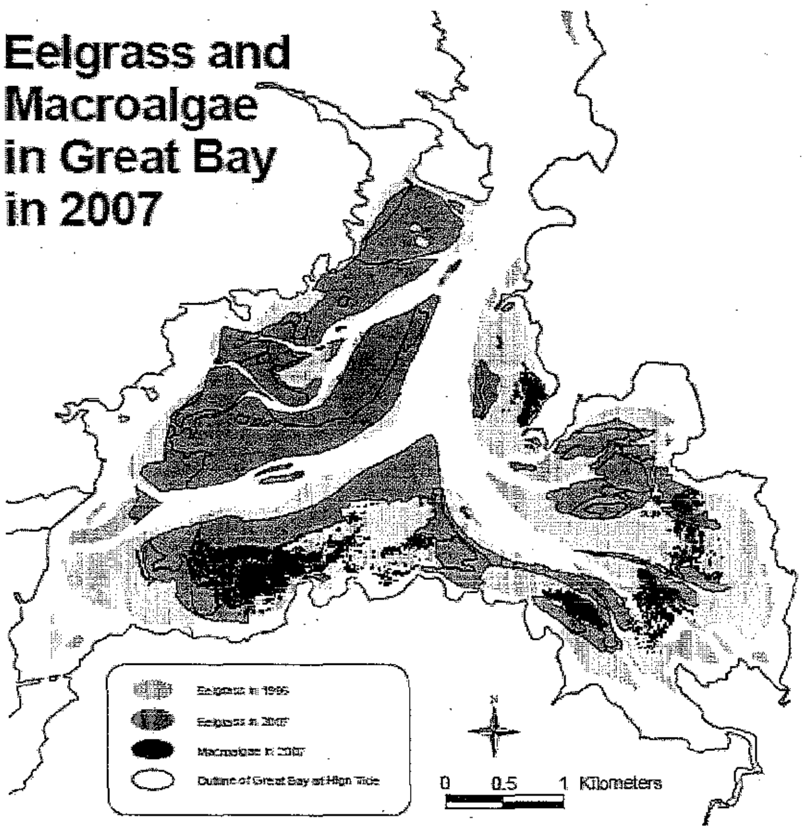

Figure 5a. Eelgrass and Macroalgae in Great Bay in 2007 and 1996 (DES 2009)

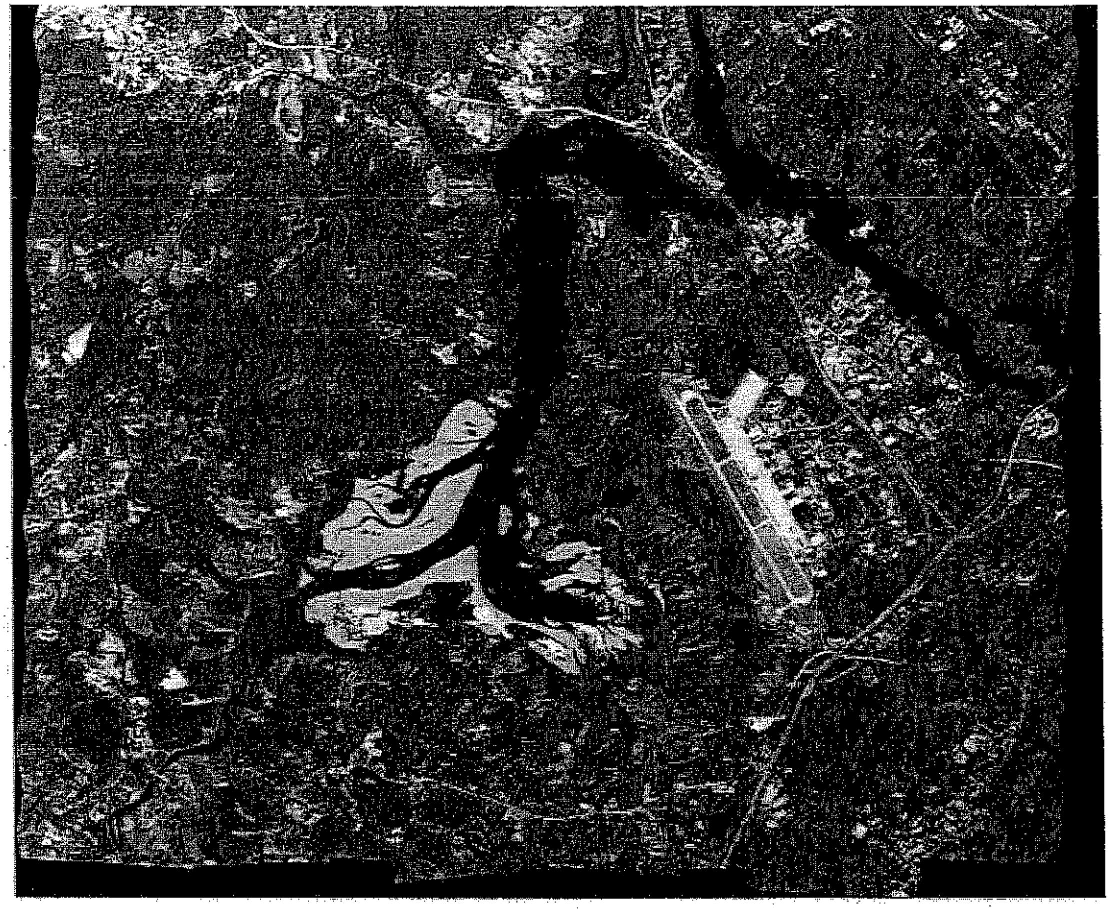

Figure 5b. Eelgrass and Macroalgae in Great Bay in 2007 with Land Uses (Pe'eri 2008)

The report asserts conclusions have been made based on WoE but no objective WoE analysis appears anywhere in the supporting materials. The SAB underscored that a structured presentation of the information, for and against, must occur to allow for an objective WoE evaluation to occur. It is particularly disturbing that the data which indicated TN is not the cause of eelgrass losses or low DO conditions in the arms of the estuary are generally ignored in the assessment. For example, it is widely acknowledged that a wasting disease and harmful bacteria has historically caused adverse impacts on eelgrass and oysters throughout the system. Oyster losses could be expected to exacerbate turbidity or increase parasite issues since less filtering of the waters would be occurring in the system. Nonetheless, a more tangential parameter – TN – was chosen as the culprit for eelgrass demise, even where data confirmed such losses occur in waters with very low nitrogen levels. For example, Short 2008 reported that over a 99% loss in eelgrass population occurred in the Piscataqua River. These impacts occurred in areas with high water clarity, as discussed below. No explanation is offered within the various reports on how such a dramatic decline could be attributed to nutrient levels. These are not the type of balanced, thorough analyses that are necessary to generate a scientifically-based nutrient objective.

B. Specific Technical Concerns

The following is a brief review and critique of the TN and chlorophyll 'a' criteria established to achieve existing DO criteria and provide sufficient light for eelgrass.

(1) Nitrogen and Chlorophyll 'a' Criteria for Meeting DO Criteria

As a first attempt to determine TN and 90th percentile chlorophyll 'a' criteria to meet the minimum DO criterion of 5 mg/L, NHDES plotted minimum DO versus 90th percentile chlorophyll 'a' and median TN (Figures 27 and 29 of NHDES Nutrient Criteria Report). NHDES rejected these regressions due to unacceptable uncertainty. Although this approach was abandoned, it is appropriate to critique this approach because the same concepts apply to the approach NHDES finally used. The minimum DO at the monitoring stations used in these regressions is measured at various locations throughout the Great Bay Estuary including the tidal rivers, Great Bay, and Portsmouth Harbor. The minimum DO at each of these stations is affected by site-specific factors including BOD oxidation, ammonia oxidation, SOD, atmospheric reaeration, and algal photosynthesis and respiration. It is highly unlikely that all these factors are identical at each of these diverse locations and the only discriminating variable between sites is algal photosynthesis and respiration represented by 90th percentile chlorophyll 'a' and median TN. This is a highly dynamic system due to the large tidal exchange occurring each day. The only reliable method to determine the effect of algae on minimum DO levels is to develop a hydrodynamic DO model that properly represents each component of the DO balance including algal photosynthesis and respiration. If algal photosynthesis is an important component of the total DO balance, a nutrient-algal model should be developed to quantitatively relate nitrogen concentrations to algal photosynthesis and respiration.

NHDES developed 90th percentile chlorophyll 'a' and median TN criteria to meet the minimum DO standard of 5 mg/L from an analysis of continuous DO data recorded at stations in the Great Bay Estuary coupled with chlorophyll 'a' and TN data. Figures 6 and 7 present the datasonde minimum DO measurements recorded at six stations in the Great Bay Estuary in addition to 90th percentile chlorophyll 'a' and median TN data.

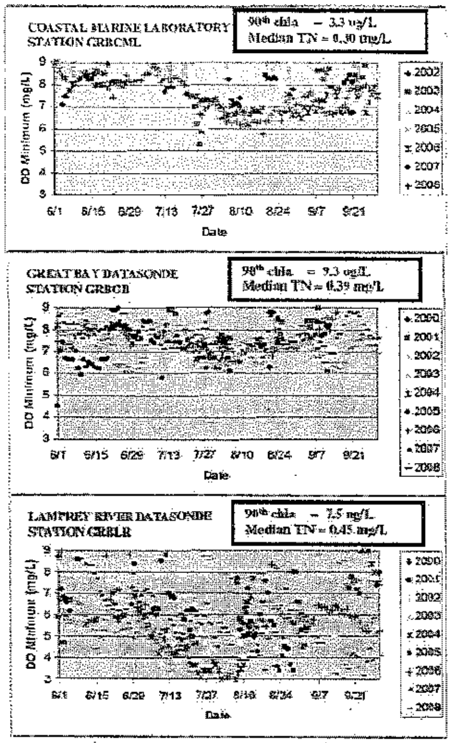

Figure 6. Daily Minimum DO (mg/L), June-September, 2000-2008. Stations GRBCML, GRBGB, GRBLR (New Hampshire DES, 2009)

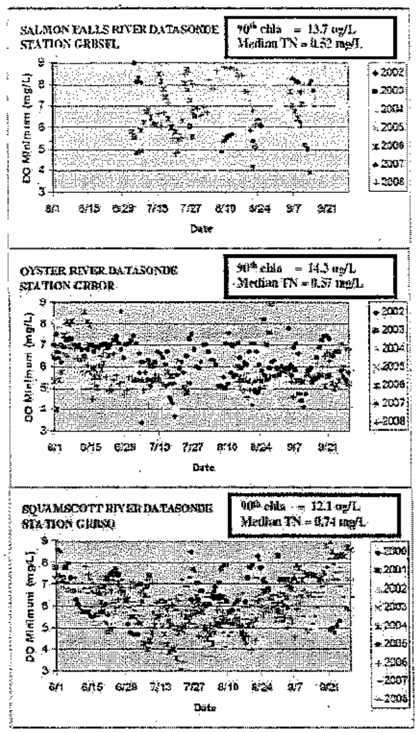

Figure 7. Daily Minimum DO (mg/L) June-September 2000-2008 Stations GRBSFL, GRBOR GRBSQ (New Hampshire DES, 2009)

The minimum DO criterion is achieved in Great Bay and the Coastal Marine Laboratory stations and violated in the upper tidal reaches of the Lamprey River, Salmon Falls River, Oyster River, and the Squamscott River with the most severe DO violations occurring in the Lamprey River. In their report, NHDES first notes that at the two stations (GRBGB and GRBCML) where the minimum DO was acceptable the 90th percentile chlorophyll 'a' and median TN are 3.3 µg/L and 0.30 mg/L respectively for GRBCML an 9.3 µg/L and 0.39 mg/L for GRBGB respectively. From this information NHDES concludes that the maximum measured 90th percentile chlorophyll 'a' and median TN at stations not impaired for DO are 9.3 µg/L and 0.39 mg/L respectively. NHDES then states that the Lamprey River low DO recorded with the datasonde is influenced by stratifications that occur at neap tide and possibly SOD and may not be representative of typical conditions and therefore excludes this data from further consideration. NHDES then observes that the minimum 90th percentile chlorophyll 'a' at the remaining three DO impaired river stations is 12.1 µg/L at the Squamscott River and the minimum median TN is 0.52 mg/L at the Salmon Falls River station. The final criteria for 90th percentile chlorophyll 'a' and median TN is established as the midpoint between the Great Bay chlorophyll 'a' (9.3 µg/L) and TN (0.39 mg/L) values and the minimum chlorophyll 'a' (12 µg/l) and TN (0.52 mg/L) measured in the DO impaired tidal tributaries yielding a median 90th percentile chlorophyll 'a' criterion of 10 µg/L (rounded down from 10.7 µg/L) and a median TN criterion of 0.45 mg/L.

This analysis suffers from the same problem indicated in the discussion of the attempted regressions of minimum DO versus 90th percentile chlorophyll 'a' and median TN, *i.e.*, the minimum DO at each of these monitoring stations is the result of site-specific factors including degree of stratification, SOD, and atmospheric reaeration and therefore should not be grouped together to develop chlorophyll 'a' and TN criteria. These conditions are likely to be significantly different between the tidal river stations and the Great Bay station. Secondly, the minimum DO data from the Lamprey River was excluded on the basis of neap tide stratification and the likely presence of SOD. No data is presented to indicate that the minimum DO at the other three upper tidal river stations do not experience periodic stratification and have no significant SOD. In summary there is clearly no sound science in this method of establishing chlorophyll 'a' and TN criteria for the tidal river waters in the Great Bay Estuary. The only scientifically-based approach to developing chlorophyll 'a' and TN criteria for each of these tidal rivers is to develop site-specific water quality models that relate nutrients to algae and minimum DO. The application of these models may also show that algal concentrations and minimum DO levels in these upper tidal rivers may be more effectively controlled by limiting phosphorus levels instead of nitrogen concentrations.

(2) TN Criteria to Provide Sufficient Light for Eelgrass Survival

There has been a substantial decline in eelgrass in various waters of the Great Bay Estuary since 1996 and an increase in macroalgae. NHDES has considered the potential effects of nitrogen on macroalgae growth and reduction in water column light through nitrogen stimulation of primary productivity. Based on a regression analysis of the water column light attenuation coefficient versus median TN, NHDES has concluded that water column light attenuation considerations yield a more stringent TN criterion than macroalgae effects. This part of the numeric nutrient criteria review evaluates the scientific soundness of the relationship between water column light extinction and TN.

NHDES has adopted the Chesapeake Bay Program Office target bottom light of 22% of surface light for the survival of eelgrass. Light at any depth can be computed from the equation

$$I_z = I_o e^{-k_d z} \quad (1)$$

where

I_z = light intensity at depth z
I_o = surface light intensity
K_d = light attenuation coefficient (1/m)

Equation 1 can be rearranged to compute a K_d that would provide a defined percentage of surface light at a specified depth.

$$K_d = \frac{\ln(I_z / I_o)}{z} \quad (2)$$

For $I_z/I_o = 0.22$

$$K_d = \frac{1.51}{z} \quad (3)$$

For eelgrass restoration depths of 2.0 m, 2.5 m, and 3.0 m, the equivalent values of K_d are 0.75/m, 0.60/m and 0.50/m. These are the K_d values contained in the proposed numeric nutrient criteria summarized in Table 1.

NHDES developed a regression of median light attenuation versus median TN for eight Great Bay Estuary monitoring stations that is reproduced in this memorandum as Figure 8. As previously indicated for a target eelgrass restoration depth of 2.0 meters the equivalent light attenuation coefficient is 0.75/m. As shown in Figure 8, the regression line indicates that a 0.75/m attenuation coefficient will occur at a median TN of 0.30 mg/L which is the proposed nitrogen criterion contained in Table 1 for a restoration depth of 2.0 m.

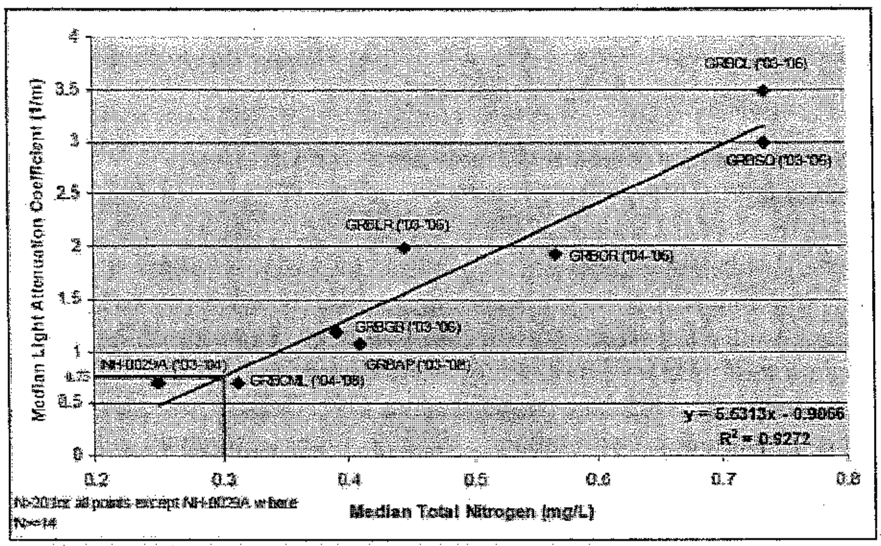

Figure 8. Relationship between Light Attenuation Coefficient and TN at Trend Stations (New Hampshire DES, 2009)

The light attenuation coefficient K_d is due to the absorption and scattering of light by water, CDOM, turbidity, and suspended algal cells as indicated by chlorophyll 'a'. NHDES acknowledges that water column light extinction due to water and CDOM is not controllable. CDOM is largely based on delivery of dissolved organic carbon from the decomposition of plants and organic soils in the watershed. NHDES believes that point and nonpoint source nitrogen control will reduce phytoplankton levels and detrital particulate organic matter derived from primary productivity in the water and terrestrial productivity. The regression shown in Figure 8 (Figure 35 of NHDES Nutrient Criteria Report) leads NHDES to conclude that a significant component of turbidity in the Great Bay Estuary waters is associated with particulate organic matter which is controllable by point and nonpoint source nitrogen reduction.

The regression of turbidity versus particulate organic carbon ("POC") shown in Figure 9 can easily be analyzed to estimate the contribution of particulate organic matter to turbidity.

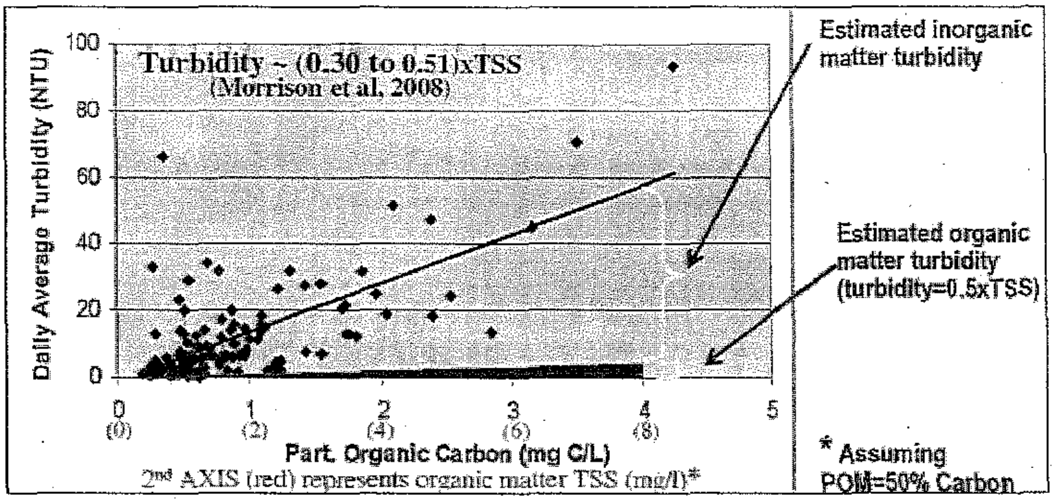

Figure 9. Measured Daily Average Turbidity vs. Particulate Organic Carbon (2000-2007)

POC concentration can be converted to organic matter concentration with the approximation that organic matter is 50% carbon. The equivalent organic matter concentration or TSS associated with the POC is indicated by the red values on the x axis of Figure 9. For example, a POC concentration of 4 mg/l is approximately equivalent to a TSS concentration of 8 mg/l for organic matter that is 50% carbon. Although there is no single relationship between turbidity and TSS because of variations in particle sizes and composition, a conversion factor relating turbidity to TSS generally falls within a reasonably narrow range. In a report entitled, "Using Moored Arrays and Hyperspectral Aerial Imagery to Develop Nutrient Criteria for New Hampshire's Estuaries – September, 2008" by Morrison *et al.* conversion factors of 0.30 and 0.51 NTU $g^{-1}m^3$ are given in Table 7.3 (note: the units for TSS were mistakenly reported as g/L rather than g/m^3 or mg/L). Conversion factors between turbidity and TSS similar to these values are reported in numerous studies. Converting the TSS (mg/L) values shown in red to turbidity ("NTU") with a factor of 0.50 NTU $g^{-1}m^3$ results in the green line shown in Figure 9. For example, a TSS concentration of 8 mg/L (or 8 g/m^3) is approximately equivalent to a turbidity of 4 NTU. As indicated in Figure 9, the organic matter component of turbidity derived from this analysis is less than 10% of the total turbidity. Even allowing for variability in the factors used to relate POC to turbidity, it is clear that a significant component of the Great Bay Estuary turbidity is associated with inorganic matter and that control of nitrogen alone will not reduce water column turbidity.

Figure 10 is a reproduction of Figure 8.5 from the Morrison *et al.* report and indicates the relative contribution of water, turbidity, CDOM, and chlorophyll 'a' to the light attenuation coefficient at the Great Bay Buoy for the period April 4, 2007 through December 1, 2007.

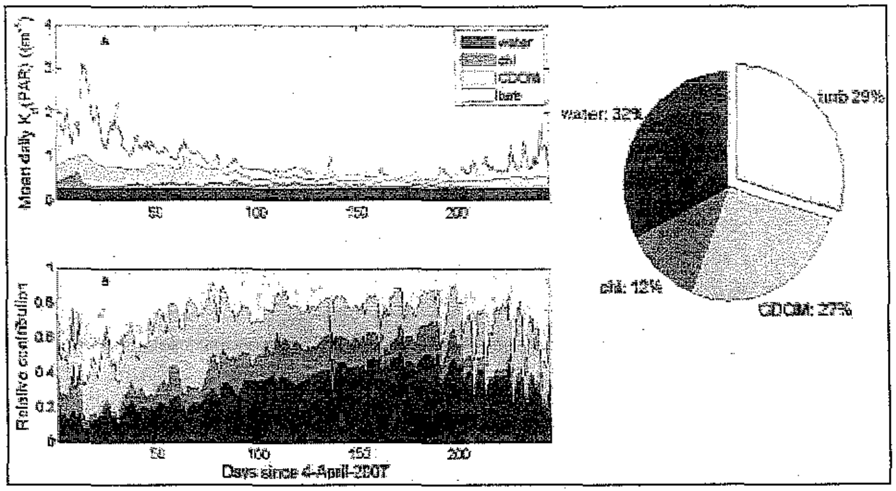

Figure 10. Contributions to Kd (PAR) Measured at The Great Bay Buoy (From Morrison et al, 2008)

The fraction of the water column light attenuation coefficient associated with water, turbidity, CDOM, and chlorophyll 'a' was derived from a multiple linear regression of the water column light attenuation coefficient and these variables. Point and nonpoint source nitrogen control will not reduce the water and CDOM components of K_d. Nitrogen control may slightly reduce Great Bay chlorophyll 'a' levels below their median level of 3.4 μg/L and slightly reduce the small organic matter component of turbidity. It is likely there will not be an appreciable reduction in the long-term Great Bay median light attenuation coefficient of 1.11/m (Table 8 NHDES report) to the target value of 0.75/m with just nitrogen control. Further improvement in the Great Bay Estuary water clarity may come with turbidity reduction through implementation of best management practices ("BMP's") or, possibly restoration of the bivalve population in the Great Bay Estuary waters.

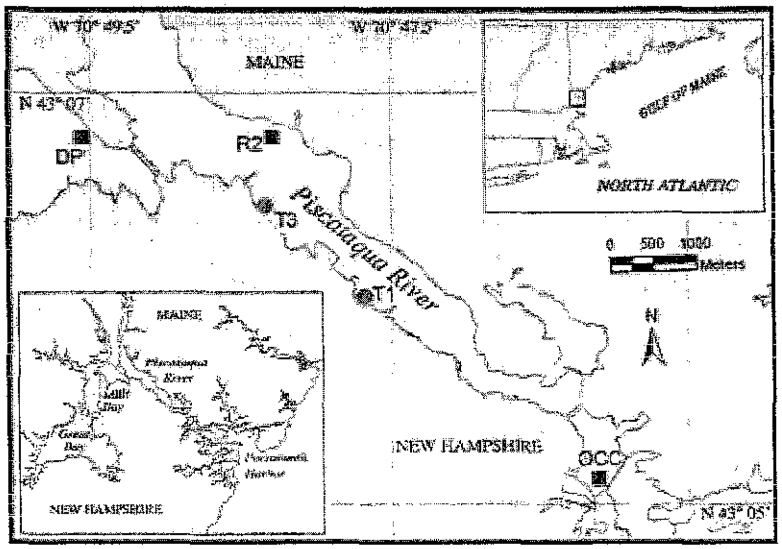

Figure 11. NHPA Eelgrass Monitoring Sites Within the Piscataqua River and Little Bay (Nora T. Beem & Frederick T. Short (2009)

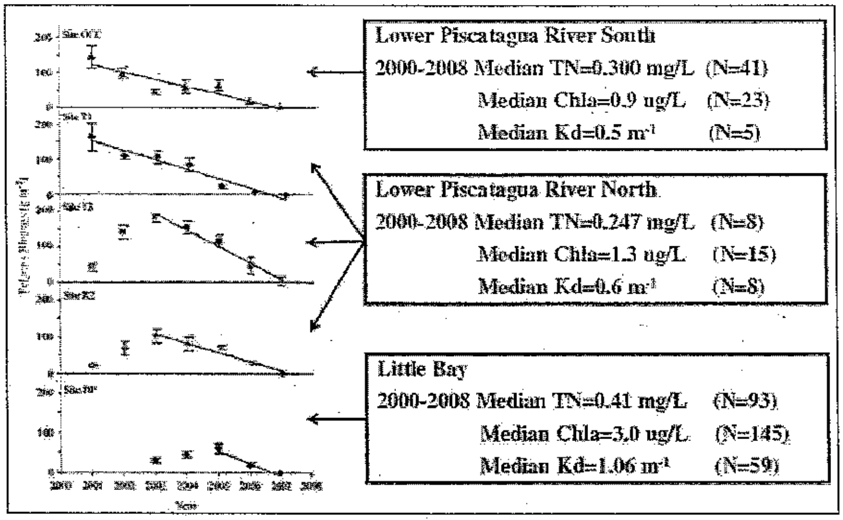

Figure 12. NHPA Eelgrass Monitoring Sites Within the Piscataqua River and Little Bay (N. Beem & F. Short, 2009) With Relevant Water Quality Data

In 2009 a note in Estuaries and Coasts 32: 202-305 entitled, "Subtidal Eelgrass Declines in the Great Bay Estuary, New Hampshire and Maine, USA" was written by Nora Beem and Frederick Short. Long-term monitoring of eelgrass beds in the central subtidal portion of the Great Bay Estuary showed declines in both transplanted sites and reference beds. A map of these eelgrass sites is shown in Figure 11 with the T1 and T3 sites representing the transplanted sites and the DP, R2 and OCC the reference sites. A plot of the eelgrass biomass at each of these stations between 2001 and 2007 is shown in Figure 12. Also shown in Figure 12 is the median TN, chlorophyll 'a', and K_d in these assessment areas with the number of measurements (N). The Lower Piscataqua River South area experienced a complete loss of eelgrass between 2001 and 2007 with what appears to be TN, chlorophyll 'a' and K_d values representative of good water quality. Although the K_d data are limited, it appears that factors other than nitrogen and turbidity may be affecting eelgrass survival in Lower Piscataqua River South. A similar observation is true for Lower Piscataqua North although the data are more limited. Station DP in Little Bay has TN, chlorophyll 'a', and K_d values similar to Great Bay and lost all eelgrass between 2005 and 2007 while Great Bay did not experience a precipitous decline in eelgrass during this same period. Although the authors indicate an increase in impervious area in the Great Bay Estuary watershed with a concurrent increase in turbidity and nitrogen, there is no quantitative link between turbidity, TN and the survival of eelgrass in each of the assessment zones of the Great Bay Estuary. Until this link is established, it is scientifically unacceptable to establish TN targets for the waters of the Great Bay Estuary on the basis of the regression analysis presented in the NHDES numeric nutrient criteria report.

III. CONCLUSIONS

The TN and chlorophyll 'a' criteria developed for the Great Bay Estuary to achieve the DO criteria are scientifically unsound in that NHDES develops TN and chlorophyll 'a' criteria by interpolating between the lowest values in the upper tidal tributaries (excluding the Lamprey River) and Great Bay which has minimum DO above the criterion of 5.0 mg/L. The TN and chlorophyll 'a' criteria of 0.45 mg/L and 10 µg/L respectively are based on an approach that ignores the difference in factors that affect the minimum DO in the upper tidal rivers and Great Bay including SOD, atmospheric reaeration, and stratification. In addition, it is assumed that the upper tidal Lamprey River is different than the other tributaries in terms of stratification and sediment oxygen without any data to support this assumption.

The TN criterion of 0.30 mg/L to achieve 22% of surface light on the bottom for eelgrass survival is based on an incorrect assumption that organic matter comprises a significant component of turbidity and that nitrogen control will radically reduce organic matter and consequently significantly reduce turbidity. An analysis of the fraction of turbidity produced by organic matter indicates that inert solids are the major component of turbidity in Great Bay and that point and nonpoint source control of nitrogen to achieve a median TN of 0.30 mg/L in Great Bay will not achieve the target of 22% of surface light at the bottom

Recommended Approach to the Great Bay Estuary Restoration

Although the NHDES analysis and proposed criteria derivation method is seriously flawed, it is apparent that the Great Bay Estuary is under duress – the causes of which are only partially known. A more structured and thorough approach to analyzing the various biological and water quality stressors will be needed if this resource is to be protected and restored. While little can be done to stop the wasting disease or bacteria killing oyster populations, efforts can be made to restore the lost eelgrass beds, replenish oyster populations and develop the tools needed to complete more reliable assessments of water quality changes. A program that cost-effectively reduces pollutant inputs while scientific and restoration efforts are ongoing provides the most comprehensive basis for protecting the resources of the Great Bay Estuary. The following actions are recommended to achieve that goal:

1. **Data Collection to Address Critical Analysis Deficiencies**

   Collect a comprehensive water quality data set to relate turbidity levels (and their causes) to eelgrass losses and needs. Determine if parasites or other factors are adversely impacting eelgrass growth. These data will be used in a comprehensive hydrodynamic model.

2. **Hydrodynamic Model with Fate/Transport Capabilities**

   Develop a detailed hydrodynamic model that can be used to forecast and hindcast water quality conditions and to evaluate the efficacy of various control measures on tidal river arms and the bay. This model may be used to predict the benefits of various point and nonpoint control strategies.

3. **Low Cost WWTP TN Reduction**

Although TN reduction is not likely to result in significant phytoplankton growth reduction, significant reductions (in excess of 50%) may be attainable with minor plant improvements and operational changes. The effect of these reductions will be monitored to provide a "before and after" picture of how inorganic nitrogen levels impact phytoplankton growth in the estuary.

4. **Stormwater Improvements**

It is apparent that transparency has somewhat decreased in the estuary, over the years. Increased runoff is the likely cause, in particular increase delivery of "fines" to the system that are easily resuspended due to wind and tidal action. BMP's directed at reducing suspended solids contributions to the estuary should be implemented.

5. **Eelgrass Restoration**

A program for eelgrass restoration and detailed follow-up monitoring is necessary. This program will provide the information needed to calibrate the water quality modeling needed to project the expected benefits from various management options. It will also provide a direct means for assessing the impacts of existing nitrogen levels and changes in light penetration.

6. **Oyster Restoration**

Oysters are a critical part of the Great Bay ecology. Increased oyster populations will reduce phytoplankton levels and increase water clarity in general. Repopulating the estuary is a critical need. The effect of new oyster beds on nearby water clarity will be monitored so this important ecological component may be included in the water quality modeling effort.

7. **Ongoing Monitoring Program**

Increased monitoring is needed in the tributaries to the system. This will help to identify important trends in water quality and delivered loads. This should be undertaken in a comprehensive and coordinated manner by the Southeast Watershed Alliance.

This proposed alternative program should provide greater benefits more quickly and at far less cost than the current proposed approach. The program would focus on the verified issues of concern and institute controls that ensure water quality is improved pending the acquisition of critical missing data and analyses. Data collection could begin as soon as a comprehensive sampling plan is developed and approved by NHDES. Monitoring should continue for at least two years. It is expected that low cost/operation changes to promote TN reduction could be accomplished within one to two years. The hydrodynamic modeling effort will likely take 3-4 years to complete. Oyster and eelgrass restoration efforts (and follow up monitoring) will occur over an extended period, likely on the order of 3-5 years.

EXHIBIT 6

United States Environmental Protection Agency
Determination on Referral Regarding
Florida Administrative Code Chapter 62-303
Identification of Impaired Surface Waters

I. Executive Summary

Pursuant to a referral by the District Court in Florida Public Interest Research Group, et. al. v. EPA, No. 4:02cv408WS-WCS (N.D. Fla.), the U.S. Environmental Protection Agency (EPA) Region 4 reviewed the State of Florida's Identification of Impaired Surface Waters Rule (Impaired Waters Rule or IWR) for the purpose of determining whether the IWR, as applied by the State of Florida, revised or modified the State's water quality standards. For the reasons discussed below, EPA has concluded that, as applied by Florida, several portions of the IWR are new or revised water quality standards. EPA has also concluded, for the reasons discussed below, that many portions of the IWR are not new or revised water quality standards. EPA's determination that any provision of the IWR constitutes a new or revised water quality standard does not speak to whether the provision is consistent with the Clean Water Act (CWA or Act) nor is EPA making any approval or disapproval decision with respect to those provisions as part of this document.

II. Statutory and Regulatory Background

Under section 303(a)-(c) of the CWA, states are required to establish water quality standards. 33 U.S.C. § 1313(a)-(c). These standards describe the desired condition of a waterbody and consist of three principal elements: (1) the "designated uses" of the state's waters, such as public water supply, recreation, propagation of fish, or navigation; (2) "criteria" specifying the amounts of various pollutants, in either numeric or narrative form, that may be present in those waters without impairing the designated uses; and (3) antidegradation requirements, providing for protection of existing water uses and limitations on degradation of high quality waters. See 33 U.S.C. § 1313(c); PUD No. 1 of Jefferson County v. Washington Department of Ecology, 511 U.S. 700, 704-05 (1994); Sierra Club v. Meiburg, 296 F.3d 1021, 1025 (11th Cir. 2002) ("To determine the water quality standard, a state designates the use for which a given body of water is to be protected (fishing, for example), and then determines the level of water quality needed to safely allow that use. That level becomes the water quality standard for that body of water."). EPA's regulations at 40 C.F.R. Part 131 describe the minimum requirements for these three elements of water quality standards. EPA has also issued guidance for states and tribes in EPA's Water Quality Standards Handbook and the Technical Support Document for Water Quality-based Toxics Control.[1]

The CWA sets forth a cooperative system under which states have the primary authority for setting water quality standards and EPA reviews a state's new or revised standards as they are adopted. See 33 U.S.C. § 1251(b), 1313(c). Under section 303(c) of the Act, 33 U.S.C. 1313(c), EPA is responsible for reviewing standards adopted by the states to ensure their consistency with the requirements of the Act. Any new or revised water quality standards adopted by states must be approved by EPA in order for those standards to be effective. 40 C.F.R. § 131.21(c)(2).[2]

---

[1] Water Quality Standards Handbook, USEPA-823-B-94-005, August 1994, http://www.epa.gov/waterscience/standards/handbook/; Technical Support Document for Water Quality-based Toxics Control, USEPA/505/2-90-001; PB91-127415; March 1991. http://www.epa.gov/npdes/pubs/owm0264.pdf.

[2] 40 C.F.R. 131.21(c)(2) provides in pertinent part:

> If a State or authorized Tribe adopts a water quality standard that goes into effect under State or Tribal law on or after May 30, 2000, then once EPA approves that water quality standard, it becomes the applicable water quality standard for purposes of the Act unless EPA has promulgated a more stringent water quality standard for the State or Tribe that is in effect, in which case the EPA-promulgated water quality

Section 303(c) of the Act provides two distinct mechanisms by which EPA oversees state development of water quality standards. First, pursuant to section 303(c)(2)(A), states submit all new or revised standards to EPA for approval or disapproval.[3] 33 U.S.C. § 1313(c)(2)(A). EPA must then approve or disapprove these standards within 60 or 90 days, respectively, of their submittal.[4] Second, section 303(c)(4)(B) allows EPA, even in the absence of any submission of new or revised standards by a state, to publish revised water quality standards for a state "in any case where the Administrator determines that a new or revised standard is necessary to meet the requirements of the Act." 33 U.S.C. § 1313(c)(4)(B). This latter provision allows EPA to assess the continued sufficiency of previously approved standards in light of changed circumstances or

---

> standard is the applicable water quality standard for purposes of the Act until EPA withdraws the Federal water quality standard.

[3] Section 303(c)(2)(A) of the CWA provides, in pertinent part:

> Whenever the State revises or adopts a new standard, such revised or new standard shall be submitted to the Administrator. Such revised or new water quality standard shall consist of the designated uses of the navigable waters involved and the water quality criteria for such uses. Such standards shall be such as to protect the public health or welfare, enhance the quality of water and serve the purposes of this chapter...

[4] Section 303(c)(3) of the CWA provides, in pertinent part:

> If the Administrator, within sixty days after the date of submission of the revised or new standard, determines that such standard meets the requirements of this chapter, such standard shall thereafter be the water quality standard for the applicable waters of that State. If the Administrator determines that any such revised or new standard is not consistent with the applicable requirements of this chapter, he shall not later than the ninetieth day after the date of submission of such standard notify the State and specify the changes to meet such requirements...

new data, and ensures that states will continue to meet the goals of the CWA even if they fail to submit new or revised water quality standards to EPA.

On May 26, 1999, the Florida legislature enacted the Florida Watershed Restoration Act (WRA), which was then signed into law by the Governor and became effective on June 10, 2002. Fla. Stat. § 403.067. Among other things, the WRA directed the Florida Department of Environmental Protection (FDEP) to develop and adopt by rule a methodology to identify waters that are not attaining the State's approved water quality standards and, thus, are required to be included on any future impaired waters list developed by the State pursuant to section 303(d) of the Act. Id. at Subsection 3. In early 2000, FDEP formed a Technical Advisory Committee to help develop a clear, consensus-based method to define impaired lakes, streams, and estuaries.

On April 26, 2001, FDEP adopted Florida Administrative Code (FAC) Chapter 62-303, entitled Identification of Impaired Surface Waters (Impaired Waters Rule or IWR). The IWR establishes a methodology for the FDEP to identify waterbodies for inclusion on the list of water quality limited segments requiring total maximum daily loads (TMDLs) pursuant to section 303(d) of the Act and 40 C.F.R. Part 130.

III. The Court Proceedings

On December 2, 2002, a citizen suit was filed against EPA in the United States District Court for the Northern District of Florida, Florida Public Interest Research Group, et. al. v. EPA, No. 4:02cv408WS-WCS (N.D. Fla.). The complaint contains six claims. Claims 1-5 allege that particular provisions of the IWR modify Florida's water quality standards and that EPA failed to perform a mandatory duty under the CWA where EPA had not reviewed the IWR for consistency with the requirements of the CWA. Claim 6 is in the alternative to Claims 1-5. Claim 6 alleges that EPA has unlawfully withheld or unreasonably delayed its review of the IWR as a policy affecting the application and implementation of Florida's water quality standards under 40 C.F.R. § 131.13.

After FDEP intervened in the litigation as a party-defendant, all parties filed motions for summary judgment. EPA argued in its motion that: (i) Florida's decision to identify or not identify waters as impaired does not modify the terms of the State's underlying water quality standards; (ii) the IWR is not a de jure revision to the State's water quality standards because the State had not engaged in the administrative process for such a revision; and (iii) the IWR could not operate as a de facto revision to the State's water quality standards because EPA must apply Florida's water quality standards as codified and approved by EPA in reviewing the State's section 303(d) list or "impaired waters" list (i.e., EPA must apply Florida's water quality standards for this purpose without regard to the IWR).[5]

The District Court ruled in favor of EPA. The District Court first concluded that Florida had not undertaken formal rulemaking necessary to make the IWR part of its water quality standards, and that EPA had not approved any modifications to Florida's water quality standards. See Florida Public Interest Research Group (FPIRG) v. EPA, No. 4:02cv408WC-WCS (N.D. Fla.), Doc. #64 (May 29, 2003) at 12. Accordingly, the Court found that the IWR was not part of the State's water quality standards and could not be relied on by EPA in its review of Florida's 303(d) list:

[5] On May 31, 2005, Judge Mickle of the U.S. District Court for the Northern District of Florida granted summary judgment in favor of EPA in a case in which several environmental organizations sought review under the Administrative Procedure Act of EPA's partial approval/partial disapproval and addition of waters to the State's section 303(d) list update for 2002. (The State's 2002 list update was the first to be generated based on the State's application of the IWR methodology.) Judge Mickle found that EPA had properly applied the State's existing water quality standards in its review of the State's section 303(d) list update for 2002. See Sierra Club, et al. v. EPA, No. 4:04cv120SPM/AK, Doc. #91.

> The CWA, as well as the EPA's implementing regulations, require EPA to consider a state's existing, EPA-approved water quality standards when reviewing a state's section 303(d) list. If Florida's listing methodology has resulted in a section 303(d) list that is inconsistent with the state's existing, EPA-approved water quality standards * * *, the EPA would be required to disapprove the list in whole or in part, and make its own listing decisions as appropriate. The listing methodology set forth in the IWR, in other words, cannot possibly have the effect of revising Florida's water quality standards or policies affecting those standards, provided that EPA complies – as it must – with the requirements of the CWA.

Id. (citations omitted). Thus, the Court concluded that the IWR neither "formally, nor in effect, established new or modified existing water quality standards or policies generally affecting those water quality standards." Id. at 13. Accordingly, the Court held that EPA had no mandatory duty to review the IWR. Id.

Plaintiffs appealed the District Court's decision to the Eleventh Circuit Court of Appeals. The Court of Appeals reversed the District Court, based on a finding that the IWR could potentially be a change to the State of Florida's water quality standards. FPIRG, et. al. v. EPA, 386 F.3d 1070 (11th Cir. 2004). The Court of Appeals remanded the case back to the District Court for additional factfinding to determine whether or not application of the IWR by FDEP effected a change to the State's water quality standards. Id.

EPA subsequently requested and the District Court ordered the matter to be referred to the Agency for one hundred and twenty (120) days to allow the Agency to conduct an examination of whether the IWR, as applied by the State of Florida, revised or modified Florida's water quality standards. Pursuant to the Court's Order, EPA is to report its findings to the

District Court and all parties. This document and the administrative record for this determination constitute EPA's report.[6]

IV. Issue on Remand/Referral

The issue on remand and referral is whether, as a factual matter, Florida's application of the IWR effected a change or revision to Florida's existing water quality standards. Pursuant to the Order Granting EPA's Motion for Stay and Referral to the Agency, EPA has agreed to review the IWR as though it had been submitted for review under section 303(c) of the Act, 33 U.S.C. § 1313(c).

V. EPA's Analysis

As discussed above, water quality standards have three components: designated uses, criteria and antidegradation.[7] PUD No. 1 of Jefferson County, 511 U.S. at 704-05; Sierra Club v. Meiburg, 296 F.3d at 1025.; see also 40 C.F.R. § 131.3(i) (definition of water quality standards as designated uses and water quality criteria); 40 C.F.R. § 131.12 (antidegradation requirements). The component of water quality standards most relevant to EPA's review of the IWR is the "criteria" component. Water quality criteria are "elements of State water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use." 40 C.F.R. § 131.3(b). Water quality criteria describe the desired ambient condition of a waterbody to support a particular designated use.[8]

---

[6] EPA is also filing today, pursuant to this Court's Order, a certified index to the administrative record for this determination.

[7] Antidegradation policies are the third element of water quality standards. The requirements for state antidegradation policies are set out at 40 C.F.R. § 131.12. No provision of the IWR relates to antidegradation.

[8] Designated uses are those uses specified in water quality standards for each water body or segment whether or not they are attained. 40 C.F.R. § 131.3(3)(f).

Water quality criteria for protection of aquatic life also usually have three components. The first component is "magnitude," level, or mass value (e.g., 10 mg/l) of a pollutant or pollutant indicator that can occur in the ambient water without adversely affecting the designated use the criteria is intended to support. The second component is "duration," or the period of time over which the instream concentration is averaged for comparison with criteria concentrations. Duration is often referred to as an averaging period. The third component is "frequency," or how often the magnitude/duration condition can be exceeded within a specified duration period and still protect the designated use. EPA's Technical Support Document for Water Quality-based Toxics Control describes the importance of the magnitude-duration-frequency format:

> [B]ecause of variation in the flows of the effluent and the upstream receiving water as well as variation in the concentrations of pollutants in the upstream effluent and in the receiving water, a simple format, such as specifying concentration that must not be exceeded at any time or place, is not realistic. Furthermore, such a simple format does not take into account the fact that aquatic organisms can tolerate higher concentrations of pollutants for short periods of time than they can tolerate throughout a complete life cycle. . . . Use of this concentration-duration-frequency format allows water quality criteria for aquatic life to be adequately protective without being as overprotective as would be necessary if criteria were expressed using a simpler format.

See Attachment 1 at D-1.[9]

Accordingly, in considering the IWR upon referral to the Agency, EPA interprets the CWA and its implementing regulations to include as "water quality standards" (or the relevant component of "water quality standards," which is "water quality criteria" as that term is defined in 40 C.F.R. § 131.3(b)), those provisions of the IWR that define, change, or establish the magnitude (concentration), duration, or frequency that the State would use to determine when a

[9]Only the relevent Appendix of EPA's Technical Support Document for Water Quality-based Toxics Control has been provided for convenience. The entire document may be found at www.epa.gov.npdes.pubs/owm0264.pdf.

waterbody is attaining any applicable water quality standards. Defined magnitude, duration, and frequency is also referred to herein as the established "ambient condition" or "level of protection."

EPA understands that provisions in the IWR apply only to water quality attainment decisions used to identify water quality limited segments for addition to the section 303(d) list and they do not apply to permitting. See Fla. Admin. Code 62-303.100(3). However, those provisions of the IWR relating to magnitude, duration and frequency of concentration exceedances do define the "ambient condition" or "level of protection" that the State affords waters for purposes of making attainment decisions. An attainment decision is one where a State decides what it means to attain or to not attain any "water quality standard applicable to such waters" for purposes of establishing total maximum daily loads (TMDLs) under section 303(d)(1)(A) of the Act, 33 U.S.C. § 1313(d)(1)(A). TMDLs, in turn, serve as the basis for permit decisions. For these reasons, in order to determine whether any provision of the IWR constitutes a new or revised water quality standard, EPA reviewed each provision of the IWR based on a two-part analysis: (1) Does the provision relate to an attainment decision? (2) If so, does the provision define, change, or establish the magnitude, duration, or frequency related to water quality criteria necessary to support a designated use? Provisions that affect attainment decisions made by the State and that define, change, or establish the level of protection to be applied in those attainment decisions, affect existing standards implemented under section 303(c) of the Act. These provisions constitute new or revised water quality standards.

On the other hand, provisions that merely describe the sufficiency or reliability of information necessary for the State to make an attainment decision, and do not change a level of protection, are methodologies under section 303(d) of the Act. See 40 C.F.R. § 130.7(b)(6).

These provisions set out the circumstances that must exist for the State to make an attainment decision in the first instance and contain policy choices about the reliability of data; however they do not describe the condition of the water body assessed. EPA interprets CWA section 303(c)(2)(A), and its implementing regulations at 40 C.F.R. Part 131, not to include such a provision as a "water quality standard" as that term is used in section 303(c)(2)(A) of the CWA and its implementing regulations at 40 C.F.R. §§ 131.3(b), 131.3(i), 131.5(a)(2), 131.6(c), 131.11, and 131.20. This is because pursuant to the regulations, "water quality standards" consist of "designated uses" and "criteria" that are defined as descriptions of the ambient conditions of a water body. See CWA section 303(c)(2)(A) [33 U.S.C. § 1313(c)(2)(A)] and 40 C.F.R. §§ 131.3(i) (definition of water quality standard); 131.3(b) (definition of water quality "criteria"); 131.3(f) (definition of "designated uses"); and 131.3(i) (definition of water quality limited segment), also defined at 40 C.F.R. § 130. 2(j). A listing policy provision that describes sufficiency or reliability of information is not a water quality standard because it is not a "criterion." It is not a "criterion" because it does not establish an ambient condition or level of protection by specifying a magnitude, duration, or frequency of water quality criteria exceedence that the State uses to identify water quality limited segments. It also does not establish a designated use. Therefore, this type of provision is not a water quality standard as that term is used in section 303(c) of the CWA or the regulations at 40 C.F.R. Part 131.

For example, some provisions of the IWR relate to the requirement pursuant to section 303(d) of the Act and 40 C.F.R. § 130.7(b) of "identification and priority setting for water quality limited segments still requiring TMDLs." In particular, 40 C.F.R. § 130.7(b)(5) requires states to "assemble and evaluate all existing and readily available water quality-related data and information to develop the [section 303(d)] list." Other provisions of the IWR relate to the requirement pursuant to section 303(d) of the CWA and 40 C.F.R. § 130.7(b)(6)(iii) that states provide a rationale for decisions not to rely on certain data and information in developing the section 303(d) list. Primary examples of provisions of the IWR that are only section 303(d) methodologies include minimum sample size requirements, age of data requirements, and the requirement that FDEP know the pollutant causing a water quality impairment before that water may be included on the section 303(d) list. These provisions do not relate to the ambient condition in the waterbody, i.e., what level of pollutant (or pollutant indicator) may be in the waterbody before determining that the waterbody is not meeting all applicable water quality standards. Instead, these provisions may relate to the information necessary to conduct an attainment decision pursuant to section 303(d) of the Act and 40 C.F.R. § 130.7(b)(5) - (6) (as compared to section 303(c) of the Act) and, as such, do not constitute water quality standards. Finally, the IWR contains many administrative and formatting provisions for constructing and adopting a 303(d) list, which also do not constitute water quality standards. Because EPA only has a duty to review new or revised water quality standards pursuant to CWA section 303(c), NWF v. Browner, 127 F.3d 1126, 1131 (D.C. Cir. 1997), EPA is not under a duty to review provisions of the IWR that implement other sections of the Act as new or revised water quality standards.

Table 1 below summarizes EPA's conclusions as to which provisions of the IWR constitute new or revised water quality standards pursuant to section 303(c) of the Act and identifies those provisions that implement other sections of the Act or are otherwise unrelated to water quality standards. EPA has determined that specified provisions of the IWR set out in the chart below are water quality standards because they define or revise an ambient condition or "level of protection" afforded the State's waters. In other words, these provisions describe a new or different (1) level or concentration of pollutant or pollutant indicator allowed in the water, (2) duration or averaging period over which such concentrations or levels may occur, or (3) frequency of exceedence of those levels that the State regulation uses to assess whether a water is attaining applicable water quality standards. A more detailed analysis of all provisions, as well as EPA's rationale underlying each decision, is located in the administrative record for this determination.

EPA has determined that other provisions of the IWR do not constitute new or revised water quality standards for a number of reasons as also shown in Table 2, below. First, there are introductory statements with no regulatory effect. EPA does not review such provisions as substantive water quality standards. Second, there are provisions that simply restate the existing, EPA-approved water quality standards found at Fla. Admin. Code Chapter 62-302. Finally, as noted above, EPA has determined that a number of remaining provisions of the IWR are not water quality standards because they implement other provisions of the Act and do not affect an attainment decision related to a level of protection afforded by Florida to its ambient waters, as described more fully above.[10]

---

[10] The fact that a provision of the IWR is not reviewed by EPA as a new or revised water quality standard does not remove that provision from EPA's oversight responsibilities. To the extent that such provisions do not comply with the requirements for developing impaired water lists pursuant to section 303(d) of the Act and its implementing regulations at 40 C.F.R. § 130.7(b), EPA has taken and will continue to take action as necessary when reviewing Florida's section 303(d) list submittals. After reviewing Florida's Group 1 Update, EPA decided that the IWR provision prohibiting the listing of any water based on less than 20 samples was not reasonable in all situations. EPA disapproved the State's failure to list certain waters based on this provision and added those waters to the State 303(d) list. EPA also decided that the IWR provision prohibiting the listing of any water where the pollutant causing an impairment is unknown was not reasonable. EPA disapproved the State's failure to list certain waters based on this provision and added those waters to the State list. See EPA's June 11, 2003, Decision Document regarding the FDEP's section 303(d) List. Judge Mickle granted summary judgment in favor of EPA, finding that EPA's partial approval/partial disapproval and addition of waters to

Although it may appear that EPA has identified numerous subsections of the IWR as new or revised water quality standards, the identified provisions all relate to five basic topics: (1) practices related to quantitative interpretation and analysis of water quality criteria (for example, the frequency of exceedence component of the statistical approach for attainment decisions related to numeric criteria); (2) use of biological thresholds for assessing aquatic life use support; (3) use of numeric thresholds for interpreting Florida's narrative standard for nutrients; (4) use of Florida Department of Health fish and shellfish classifications and advisories for attainment decisions, (5) and use of whole effluent toxicity test methods in ambient waters for use attainment decisions. The number of subsections in the IWR that EPA has identified as new or revised standards is more than the five topics listed above because each of these five topics may be discussed more than once in the IWR. The provisions of the IWR identified as a new or revised water quality standard are set forth in Table 1, below. The provisions of the IWR that EPA determines are not a new or revised water quality standard are set forth in Table 2, below.

Table 1

New or Revised Water Quality Standards[11]		
Topic	**Sections Covered**	**Subsections Identified**
Practices Related to Quantitative Interpretation and Analysis of	62-303.320 & .420	320(1), 320(4), 320(5), 420(1), 420(2), 420(3), 420(6)

Florida's section 303(d) update for 2002 was not arbitrary and capricious. See Sierra Club, et al. v. EPA, 4:04cv120SPM/AK, Doc. #91.

[11] Please note that these tables provide a brief summary of EPA's determination regarding the IWR. For a complete explanation of EPA's decision, please see the following documents contained in EPA's administrative record: Doc. 1.2, Table: Whole IWR Sections that are not New or Revised Water Quality Standards, and Doc. 1.3, Table: Whole or Partial IWR Sections that are New or Revised Water Quality Standards.

Water Quality Criteria, Excluding Topics Listed Hereafter	62-303.360 & .460	360(1), 460(1), 460(2)
	62-303.380 & .480	480(1)
	62-303.400	400(1) (also applies to Biological Assessment and Fish and Shellfish Assessment)
Biological Assessment: Use of biological thresholds for aquatic life use support.	62-303.330 & .430	330(2), 330(3), 430(2), 430(3)
	62-303.200	200(1), 200(7), 200(18)
Nutrient Assessment: Use of numerical nutrient thresholds for attainment decisions.	62-303.351, .352, .353, & .450	351(1), 351(2), 352(1), 352(2), 352(3), 353(entire section), 450(1)
Fish & Shellfish Assessment: Use of Health Department Classifications and Advisories. (Also Uses Procedures in .320)	62-303.370 & .470	370(1), 370(2), 370(3), 470(3)
Toxicity Testing using ambient WET tests.	62-303.340 & .440	340(2), 340(3), 440(1)
Impairment Delisting Procedures	62-303.720	380(1)[by reference], 720(2)(a)-(g) and (i)

Table 2

NOT New or Revised Water Quality Standards		
Topic (Listing & Delisting)	**Sections Covered**	**Number of Subsections Identified**
Scope and Intent	62-303.100	Entire section (5 subsections)
Planning and Verified Lists	62-303.150, .300, .400, .700, .710	150(1), 150(2), 300(1), 300(2), 400(2), 700(1), 700(2), 710(1), 710(2).
Definitions	62-303.200	200(2), 200(3), 200(4), 200(5), 200(6), 200(8), 200(9), 200(10), 200(11), 200(12), 200(13), 200(14), 200(15), 200(16), 200(17), 200(19), 200(20), 200(21), 200(22), 200(23), 200(24),

NOT New or Revised Water Quality Standards		
Topic (Listing & Delisting)	**Sections Covered**	**Number of Subsections Identified**
		200(25),
Aquatic Life Use Support	62-303.310 & .410	310(1), 310(2), 310(3), 310(4), 410
Exceedances of Aquatic Life-Based Water Quality Criteria	62-303.320 & .420	320(2), 320(3), 320(6), 320(7), 320(8), 320(9), 320(10), 420(4), 420(5)
Biological Assessment	62-303.330 & .430	330(1), 330(4), 430(1), 430(4)
Toxicity	62-303.340 & .440	340(1), 440(2), 440(3)
Narrative Nutrient Criteria	62-303.350 & .450	350(1), 350(2), 350(3), 450(2)
Primary Contact and Recreation Use	62-303.360	360(2), 360(3)
Drinking Water Use	62-303.380 & .480	380(2), 480(2)
Fish and Shellfish Consumption Use	62-303.470	470(1), 470(2)
Prioritization	62-303.500	Entire section (4 subsections)
Pollution Control Mechanisms	62-303.600	Entire section (2 subsections)
Impairment Delisting Procedures	62-303.720	720(1), 720(2)(h) and (j), 720(3).
Impairment of Interstate & Tribal Waters	62-303.810	Entire section (1 subsection)

VI. "Effects" Test

In its decision, the Eleventh Circuit suggested that in order to determine whether the IWR constituted a new or revised water quality standard, it would be necessary to "examine whether there were waterbodies that were equally polluted both before and after the Impaired Waters Rule took effect, but that were classified differently depending on whether or not the Rule was used." FPIRG, et al. v. EPA, 386 F.3d 1070, 1090 (11th Cir. 2004). The Court stated "[t]hus, if waterbodies that under pre-existing testing methodologies would have been included on the list were left off the list because of the Impaired Waters Rule, then *in effect* the Rule would have created new or revised water quality standards, even if the language of the regulation said otherwise." Id. (emphasis in original).

For a number of reasons, it is not appropriate simply to look at whether a water was no longer listed or added to Florida's section 303(d) list after application of the IWR in order to determine whether the IWR provision constitutes a new or revised water quality standard.

First, such an "effects test" presumes that the first or original section 303(d) list correctly identified all impaired waterbodies. Without a methodology, however, it is often impossible to determine the basis for or validity of the initial listing decisions. Thus, more recent changes to the list may actually correct a mistake from a previous list, or may reflect a lack of certainty as to the basis for listing a water in the first instance.[12] Second, using a test of whether a provision of state law had an "effect" on a state's section 303(d) list could result in a situation where any state provision which causes a different result than that of a previous list would be classified as a water quality standard subject to EPA's mandatory duty to review pursuant to section 303(c) of

[12] In granting summary judgment in favor of EPA in the challenge to EPA's partial approval/partial disapproval and addition of waters following the State's submission of the 2002 section 303(d) list update, Judge Mickle found that EPA did not err in approving Florida's delisting of waterbodies for certain pollutants where the original basis for the listing was determined to have been inaccurate. See Sierra Club, et al. v. EPA, No. 4:04cv120SPM/AK, Doc. #91 at 19-22.

the Act, even if the provision clearly does not meet the definition of water quality standard under the CWA and its implementing regulations.

As EPA has set out more fully above, provisions of the IWR may have affected Florida's section 303(d) list in two different ways. For example, as described above, there are provisions of the IWR that describe the data requirements necessary for the State to find that it has reliable and/or sufficient data and information to make an attainment decision. These types of provisions do not change or further define the ambient condition of a water that represents attainment of the applicable water quality standards and thus the "level of protection" provided by Florida's water quality standards. EPA has determined that these provisions are not new or revised water quality standards but, rather, are policies for implementing section 303(d) of the Act. By contrast, there are provisions of the IWR that further define or change the magnitude, duration or frequency of a water quality standard (water quality criterion). EPA has determined that those provisions related to the ambient condition of a waterbody that represents attainment or nonattainment of the applicable water quality standard provide a level of protection for the water, and therefore are new or revised water quality standards subject to review pursuant to section 303(c) of the Act.

A strict application of the "effects" test suggested by the Eleventh Circuit would inappropriately expand the scope of water quality standards beyond use, criteria and antidegradation in a manner not contemplated by the CWA and its implementing regulations. Such a test would contravene the principle that mandatory duties be narrowly construed. See, e.g., Mountain States Legal Found. v. Costle, 630 F.2d 754, 766 (10th Cir. 1980); Monongahela Power Co. v. Reilly, 980 F.2d 272, 275-76 n. 3 (4th Cir. 1992)("The term 'nondiscretionary' has been construed narrowly."); NRDC v. Train, 510 F.2d 692, 700 (D.C. Cir. 1975)(in authorizing citizen suits under section 505 of the Act, "Congress did not fling the courts' door wide open," but rather confined such suits to "clear-cut" failures to perform mandatory duties); Sierra Club v. Thomas, 828 F.2d 783 (D.C. Cir. 1987); Oljato Chapter of Navajo Tribe v. Train, 515 F.2d 654, 663 (D.C. Cir. 1975)(Congress drafted citizen suit provisions so as "to limit suits against the Administrator to a chosen few" to enforce a specific duty clearly mandated by statute.); Kennecott Copper Corp. v. Costle, 572 F.2d 1349, 1353 (9th Cir. 1978)("[T]he nondiscretionary duty requirement imposed . . . must be read in light of Congressional intent to use this phrase to limit the number of citizen suits which could be brought against the Administrator and to lessen the disruption of the Act's complex administrative process.").

EPA believes that applying the level of protection test pursuant to section 303(c) of the Act and its implementing regulations at 40 C.F.R. Part 131, rather than an effects test, is the appropriate interpretation of the term "water quality standard" as that term is used in the CWA and its implementing regulations.

V. Conclusion

For the reasons discussed above, EPA has concluded that, as applied by Florida, certain portions of the IWR are new or revised water quality standards. EPA has also concluded, for the reasons discussed above, that certain portions of Florida's IWR are not new or revised water quality standards. EPA's conclusions as to which provisions of the IWR constitute new or revised water quality standards are summarized in Table 1 above. A more detailed analysis of EPA's analysis of all provisions of the IWR, as well as EPA's rationale underlying each decision, is located in the administrative record for this determination.

7/6/05
Date

/s/
James D. Giattina, Director
Water Management Division

EXHIBIT 7

DO at the Squamscott River Datasonde July-October 2009

(New Hampshire DES, 2011)

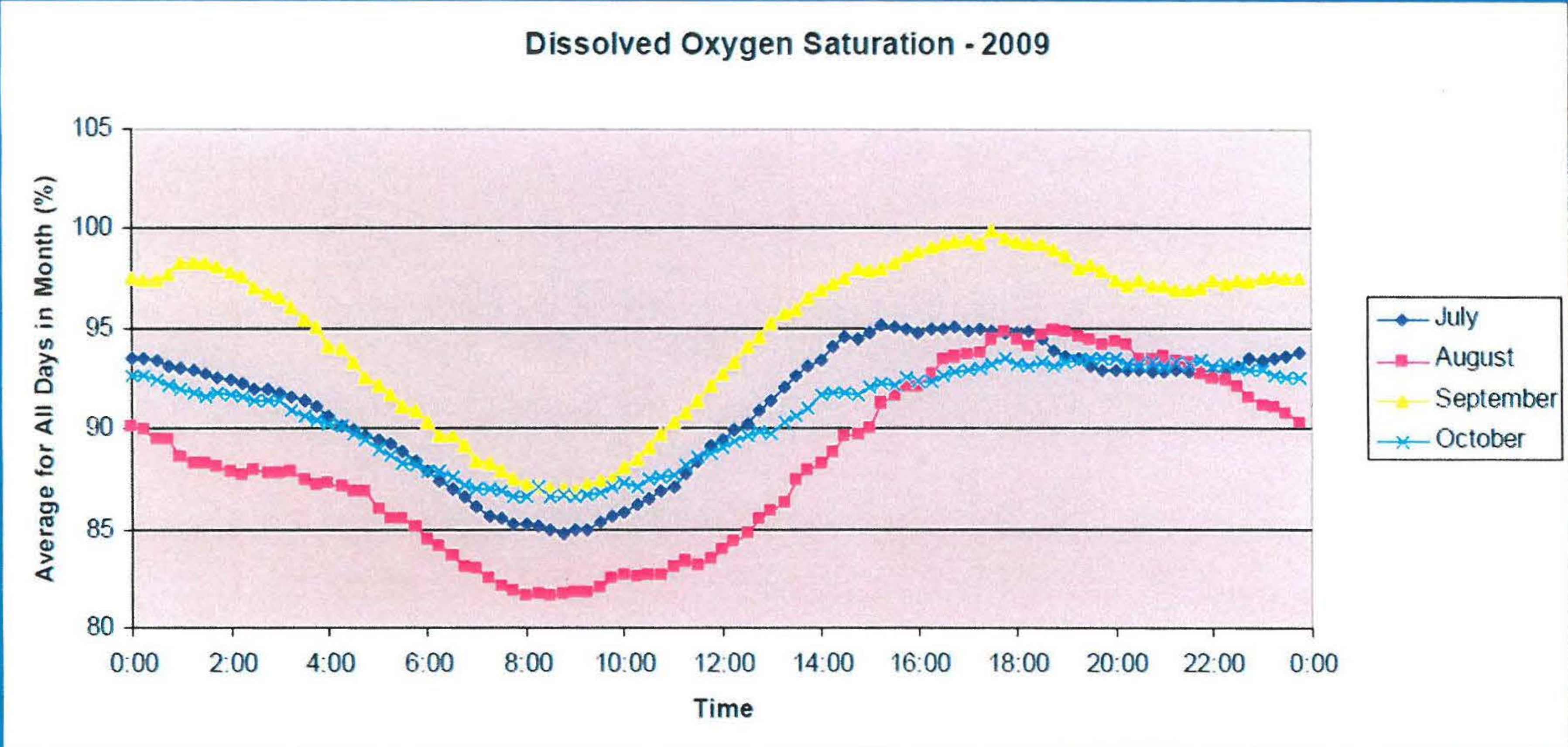

EXHIBIT 8

Measured Chl-a and Secchi Disk at Adams Point (1988-2009)

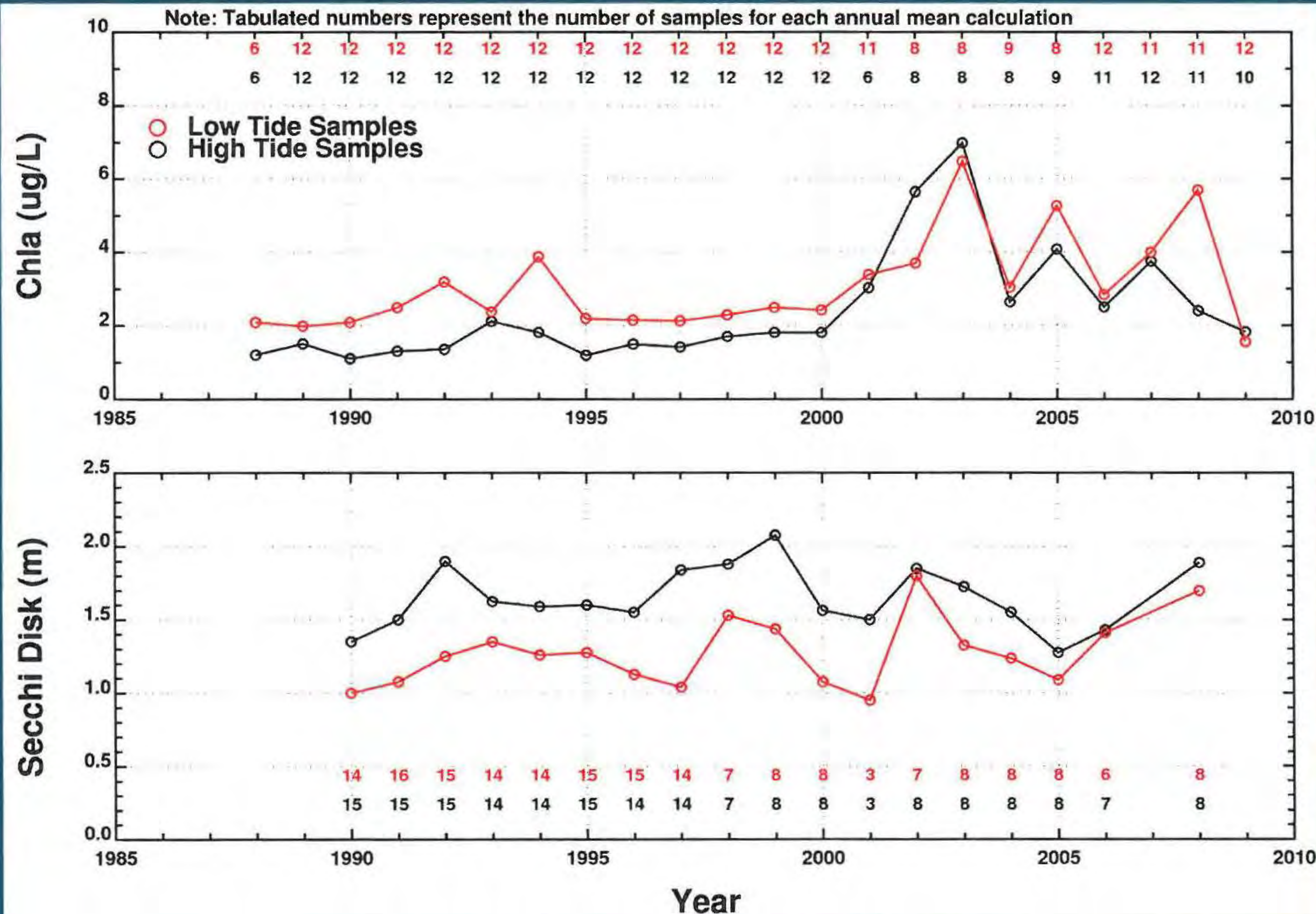

EXHIBIT 9

Contributions to Kd (PAR) Measured at the Great Bay Buoy

(From Morriston et al, 2008)

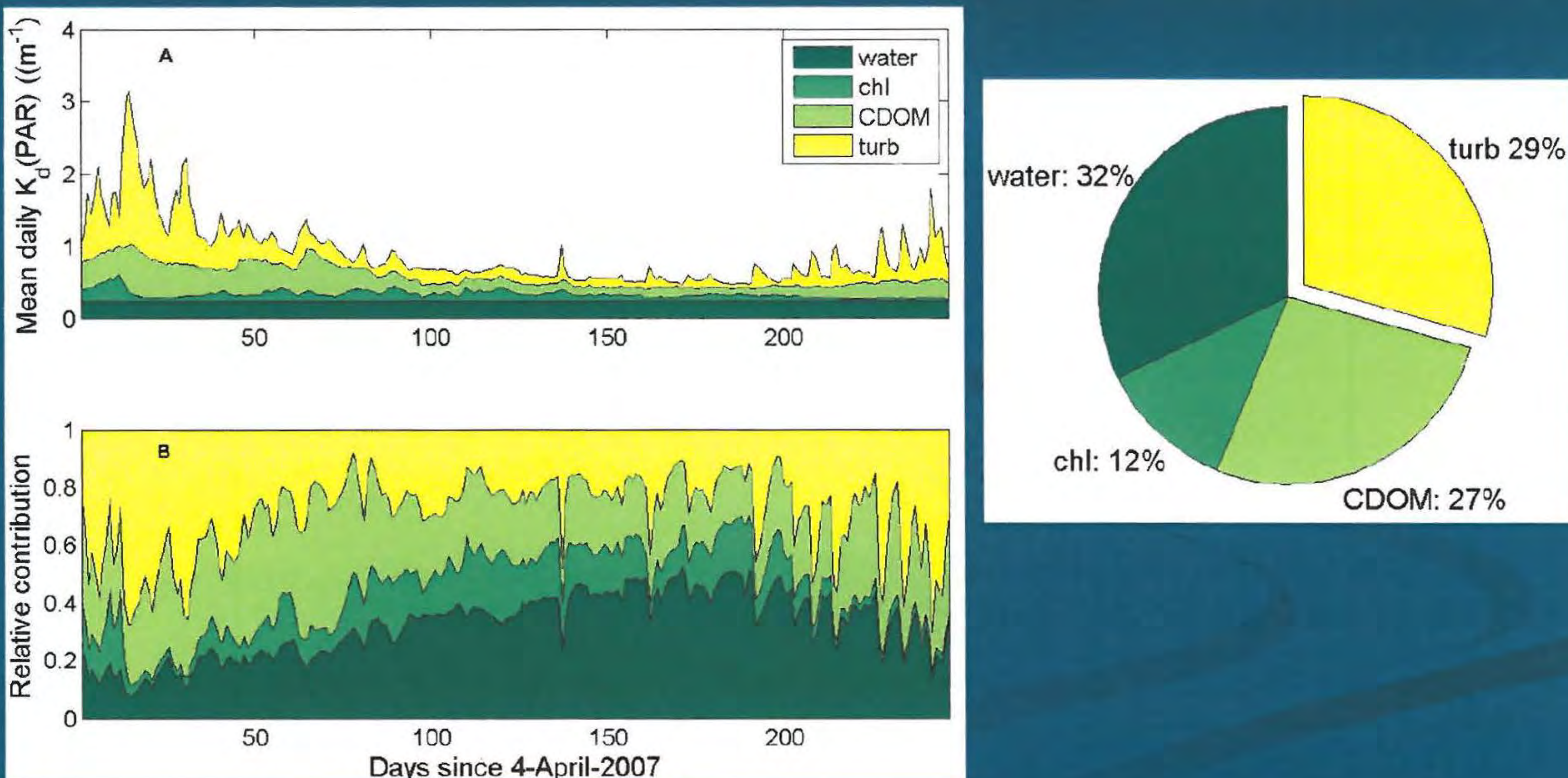

EXHIBIT 10

TECHNICAL MEMORANDUM

TO:	JOHN HALL	DATE:	JANUARY 10, 2011
		RE:	REVIEW OF NEW HAMPSHIRE DES TOTAL NITROGEN CRITERIA DEVELOPMENT FOR THE GREAT BAY ESTUARY
FROM:	THOMAS W. GALLAGHER CRISTHIAN MANCILLA	FILE:	HAAS.006.000

1. INTRODUCTION

The purpose of this memorandum is three-fold:

a) To review an analysis of eelgrass and nitrogen temporal trends performed by new the Hampshire Department of Environmental Services (NHDES) as presented in Figure 1;
b) To review the NHDES conclusions drawn from Figure 8 with respect to dissolved oxygen (DO) diurnal swings and primary productivity; and
c) To analyze a set of water quality data collected during the summer of 2010 to test the validity of a previous HydroQual analysis that concluded that a significant component of Great Bay Estuary turbidity is associated with inorganic matter and that control of nitrogen alone will not reduce water column turbidity.

2. SUMMARY OF NHDES TN CRITERIA DEVELOPMENT TO PROVIDE SUFFICIENT LIGHT FOR EELGRASS SURVIVAL

There has been a substantial decline in eelgrass in various waters of the Great Bay Estuary since 1996 and an increase in macroalgae. NHDES has considered the potential effects of nitrogen on macroalgae growth and reduction in water column light through nitrogen stimulation of primary productivity. Based on a regression analysis of the water column light attenuation coefficient versus median total nitrogen, NHDES has concluded that water column light attenuation considerations yields a more stringent total nitrogen criterion than macroalgae effects.

NHDES has adopted the Chesapeake Bay Program Office target bottom light of 22% of surface light for the survival of eelgrass. For eelgrass restoration depths of 2.0 m, 2.5 m, and 3.0 m, the equivalent values of K_d are 0.75/m, 0.60/m and 0.50/m. These are the K_d values contained in the proposed NHDES numeric nutrient criteria. NHDES developed a regression of median light attenuation versus median TN for eight Great Bay Estuary monitoring stations. As previously indicated for a target eelgrass restoration depth of 2.0 meters the equivalent light attenuation coefficient is 0.75/m. The regression analysis performed by NHDES indicated that a 0.75/m attenuation coefficient will occur at a median total nitrogen of 0.30 mg/L which is the proposed nitrogen criterion for a restoration depth of 2.0 m.

3. SUMMARY OF NHDES NITROGEN TEMPORAL TRENDS ANALYSIS AND WITHIN DAY DO VARIABILITY ANALYSIS

As shown in Figure 1, NHDES has compared temporal plots of nitrogen (nitrate and dissolved inorganic nitrogen) with changes in eelgrass coverage in acres from 1974 to 2009. Based on these temporal plots, some of the conclusions proposed by NHDES are: a) the apparent increase in inorganic nitrogen is an indicator of an increase in total nitrogen loading to the system; b) since 1995 nitrate levels have exceeded 50 ug/L which they state is the threshold to produce direct effects (toxicity) on eelgrass.

Figure 8 presents DO measurements (%DO saturation) recorded by an in-situ datasonde in the tidal portion of the Squamscott River. Based on this figure, NHDES concluded that primary productivity, via photosynthesis and respiration, is the reason for the DO diurnal swings from supersaturation to 60%-70% saturation.

4. ADDITIONAL DATA ANALYSES AND REVIEW OF NHDES NITROGEN TEMPORAL TRENDS ANALYSIS

HydroQual performed an analysis of temporal trends for several constituents besides the nitrogen forms studied by NHDES. Figures 2 to 4 present temporal plots of annual values of several nitrogen forms, salinity, dissolved oxygen (DO), water temperature, chlorophyll-a, total suspended sediments (TSS), and phosphate (PO4). To be consistent with the NHDES analysis methodology all annual values depicted on these plots represent annual median values. The tabulated values for each year represent the number of samples employed for each annual median computation. For these figures, in contrast to the NHDES analysis that included low tide measurements only, low as well as high tide measurements were considered for the 1988-2009 dataset. Therefore, 24 (2 per month, 1 low and 1 high) is the maximum number of possible samples for each year. The 1973-1981 dataset contained a maximum of 12 samples per year (1 per month) with no indication of the tide stage. The entire database (1973-1981, 1988-2009) provided to HydroQual by NHDES did not contain the required nitrogen forms to compute total nitrogen concentrations. Because the inorganic nitrogen forms included at these plots show an apparent increase for data post 1988, several other constituents were simultaneously analyzed. Salinity was employed to examine for any possible sampling bias with respect to freshwater and ocean water content of the samples. The salinity annual values concurrent with the annual measured nitrogen values, for both time periods, show similar magnitudes and therefore imply a similar freshwater content. Also, DO, PO4 and water temperature show comparable levels for both time periods. Pre 1981 chlorophyll-a shows higher values than then 1988-2000 time period values, but post 2000 chlorophyll-a values represent an increase with respect to previous years. TSS for the period 1993-1998 shows rather constant levels although NHDES considers 1996 as the beginning of the eelgrass decline and asserts that TSS fluctuations are fully explained by changes in eelgrass.

Eelgrass biomass was considered to be a better indicator of eelgrass abundance and therefore used instead of eelgrass coverage. Eelgrass biomass values for several years (1990-2004) were digitized from a report prepared by Morrison et al. (2008). Figure 5 indicates that for several years nitrate levels were greater than or equal to 50 ug/L with no identifiable decrease in eelgrass biomass. For example, in Figure 5 (1973-1981 data), no available eelgrass is available but it is assumed that eelgrass was abundant despite the stated nitrate threshold of 50 ug/L being exceeded during several years. In several occasions, in Figure 5 (1988-2009 data), eelgrass biomass seems stable or even increasing when nitrate levels are greater than the stated nitrate threshold.

The use of inorganic nitrogen (Figure 2) as an indicator of total nitrogen trends can be inaccurate because with declining eelgrass levels less inorganic nitrogen is taken up from the water column (uptake) by eelgrass primary productivity. Figures 6-1 and 6-2 provide a seasonal analysis (monthly) of several constituents at Adams Point. From these figures, temperature seasonal trends could explain the seasonal variations of water column inorganic nitrogen as the eelgrass nitrogen uptake rate is directly related to temperature.

If a more comprehensive analysis of Great Bay total nitrogen concentrations indicates that there are no increasing trends when eelgrass declines, total nitrogen may not be the cause of declining eelgrass. A comprehensive analysis should identify temporal trends on non-point source and point source total nitrogen loads into the system. Figure 7 is similar to Figure 2 but includes some total nitrogen data at Adams Point queried from Great Bay water quality databasets and used by NHDES for the development of the total nitrogen threshold for eelgrass protection. On this figure, the total nitrogen temporal trends don't follow the inorganic nitrogen trends and depict a more steady pattern. These dissimilar trends could be explained by a re-distribution of nitrogen species for the similar total nitrogen levels due to eelgrass uptake, macroalgae uptake or an unidentified mechanism.

5. REVIEW OF NHDES CONCLUSIONS ON PRIMARY PRODUCTIVITY AND DO DIURNAL VARIATION

Figure 8 presents dissolved oxygen measurements (% saturation) recorded by an in-situ datasonde in the tidal portion of the Squamscott River. NHDES asserts that primary productivity is the reason for the diurnal swings. Although there is evidence of primary productivity as indicated by the supersaturated DO, much of the diel variability is due to tidal translation rather than primary productivity. The evidence for the effect of tidal translation is indicated by peak DO values at night and the one hour per day shift in the diel DO pattern consistent with the shift in the tidal phase by approximately one hour each day. In addition the steep decline in DO within the day can be associated with ebb tide drainage of adjacent marshes with low DO concentrations.

To provide some insight into the tidal translation effects in the DO diurnal variation, high frequency data (15 minutes) was obtained from the National Estuarine Research Reserve System website for the Squamscott River Monitoring Station. The dissolved oxygen saturation data presented in Figure 8 (NHDES) presents data recorded in July 2008, days 16^{th} to 20^{th}. Figure 9-1 presents temporal plots of dissolved oxygen saturation, water depth and turbidity for the same time period depicted in Figure 8. From Figure 9-1, it is evident that the diurnal DO variability is due to tidal translation as the DO saturation values within a day are consistent with the measured tidal phase. Furthermore, other factors may also be responsible for the DO diurnal variation, e.g., increasing turbidity trends seem to correspond to decreasing DO saturation trends. Alternatively, the same graphical analysis was performed with data recorded in July 2005 and similar conclusions can be drawn. Figure 9-2 presents the July 2005 DO analysis. The DO at this river location is the result of site specific factors including degree of stratification, SOD, and atmospheric reaeration and therefore additional data collection and the development of a water quality model are required for the estimation of each component of the DO balance.

6. ANALYSIS OF 2010 WATER QUALITY DATA

As previously indicated, NHDES used a regression of light attenuation coefficient versus total nitrogen to establish a total nitrogen criterion of 0.3 mg/L for eelgrass survival. This relationship implies that nitrogen contributes significantly to a reduction in the water column light attenuation coefficient. The mechanism by which nitrogen may contribute to a reduction in water column clarity is stimulation of the growth of phytoplankton. In addition, organic nitrogen is a surrogate for organic matter (which can lower the water column transparency) associated with non point source loads.

In June 2010, HydroQual performed a review of the NHDES nitrogen criteria development and a preliminary data analysis that suggests that a high percentage of the light reduction associated with turbidity is due to non-volatile suspended solids (NVS) and therefore unrelated to nitrogen. These inert particles are unrelated to effects of nitrogen and are actually silts and clays that are probably resuspended from the bay bottom or brought in with river flows.

In June 2010, HydroQual proposed a short term field program to test the hypothesis that particular organic matter is a small component of the water column turbidity. The sampling program was conducted during the summer of 2010 with the collection of water quality constitutes to compute the non-volatile suspended solids fraction in Great Bay. Five stations were sampled in Great Bay, August 5th to September 2nd 2010. Measurements included: wind speed, tide stage, temperature, salinity, TSS, NVS, POC, PON, CDOM, chlorophyll-a and secchi disk. Measurements of temperature, salinity, TSS, and VSS were taken at surface, mid and bottom depths. The remaining parameters were taken at mid depths only. Figure 10 depicts the station locations. Temporal plots of several constituents are shown in Figures 11 and 12. From these figures it can be seen that chlorophyll-a levels are relatively low. The volatile suspended solids (VSS) concentrations were computed as the difference between TSS and NVS. Temporal plots presented in Figures 11 and 12 include all 5 sampled locations, therefore chlorophyll-a variability for the same sampling day is due to variability across stations while the variability for temperature, salinity, TSS, and NVS is due to variability across stations and also sample depth. Appendix A presents temporal plots for the same water quality parameters included in Figures 11 and 12 but for individual stations.

A regression analysis of NVS versus TSS is shown in Figure 13. The results indicate that NVS is approximately 85% of the TSS concentrations thus supporting HydroQual's assumption that nitrogen is not a significant factor in contributing to a reduction in water column clarity. The remaining 15% of TSS is VSS associated with algae (chlorophyll-a) and detritus. Because chlorophyll-a is quite low (~ 3 ug/L), algae are a minor contributor to a reduction in water column transparency. These results are in agreement with the analysis presented by Morrison et al. (2008) as shown in Figure 14.

7. CONCLUSIONS

a) The nitrogen temporal trends analysis performed by NHDES is not sufficient to affirm that there has been an increasing temporal trend in total nitrogen loading to the system. The use of inorganic nitrogen as an indicator of total nitrogen trends can be inaccurate because with declining eelgrass levels less inorganic nitrogen is taken up from the water column by eelgrass primary productivity. A comprehensive nitrogen temporal trend analysis should identify temporal trends on non-point source and point source total nitrogen loads into the system.

b) The NHDES proposed nitrate threshold of 50 ug/L has been exceeded several years in the past when abundance of eelgrass beds was assumed. Furthermore, the proposed nitrate threshold has also been exceed for several years for which eelgrass coverage and biomass measurements are available and these show steady abundance patterns over such years.

c) The measured diurnal DO variability in the tidal portion of the Squamscott River is due to tidal translation rather than primary productivity. Additional data collection and the development of a mechanistic water quality model are requited for the estimation of the DO balance components.

d) The analysis of the 2010 water quality dataset shows that nitrogen effects are not a significant factor in reducing water column transparency and therefore the establishment of a total nitrogen criteria of 0.3 mg/L from a regression of water column light attenuation coefficient versus nitrogen is inappropriate. About 15% of TSS is VSS associated with algae (chlorophyll-a) and detritus, because chlorophyll-a is quite low, algae are a minor contributor to a reduction in water column transparency. As a consequence of this analysis, total nitrogen load reductions to Great Bay will not substantially improve the water column transparency.

TWG/amm
WordProcessing\Jobs\HAAS\006.000\Hall10Jan11TMEM

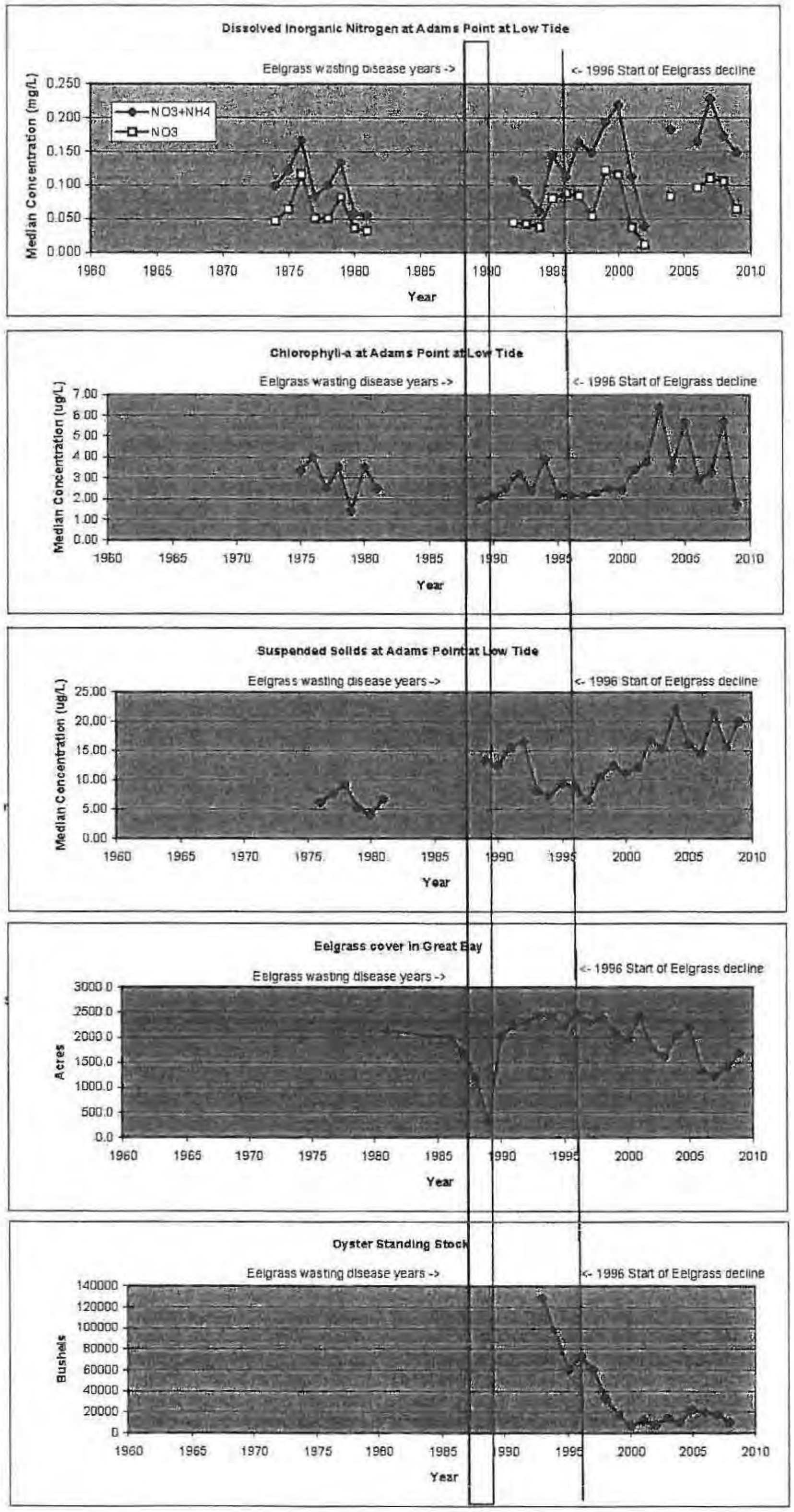

Figure 1. NHDES Temporal Trends Analysis

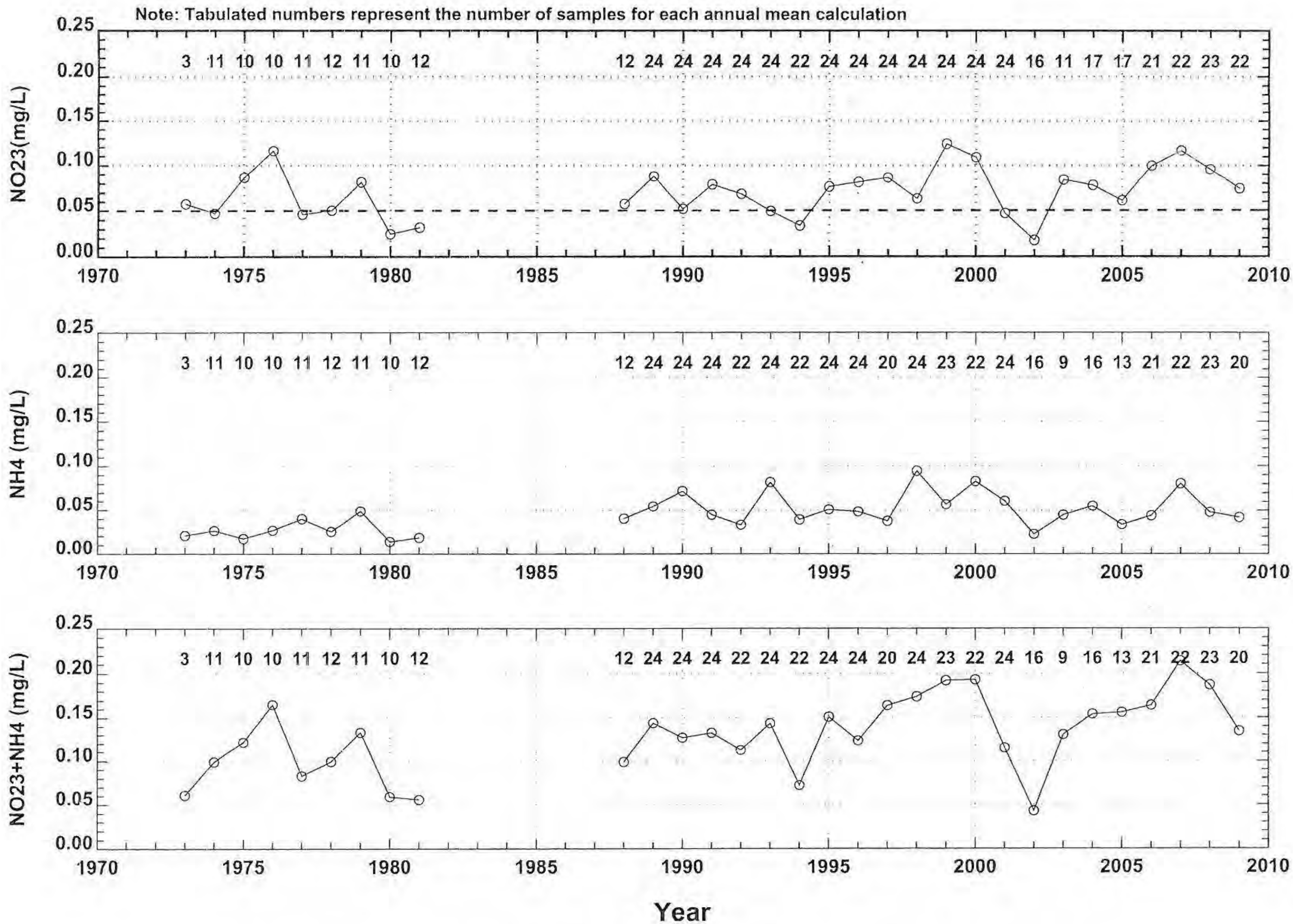

Figure 2. DES Monitoring Data (1973-2009), Adams Point

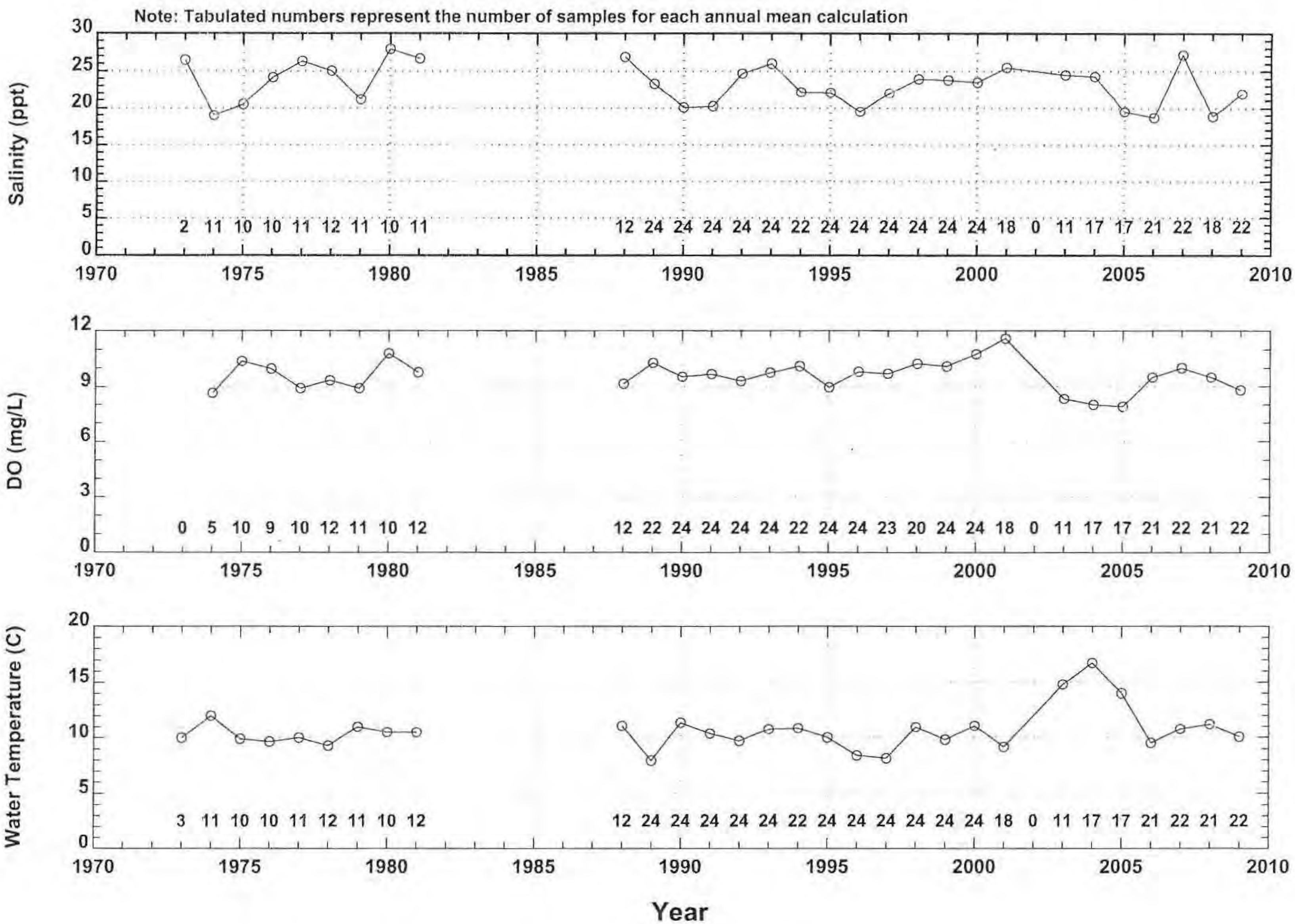

Figure 3. DES Monitoring Data (1973-2009), Adams Point

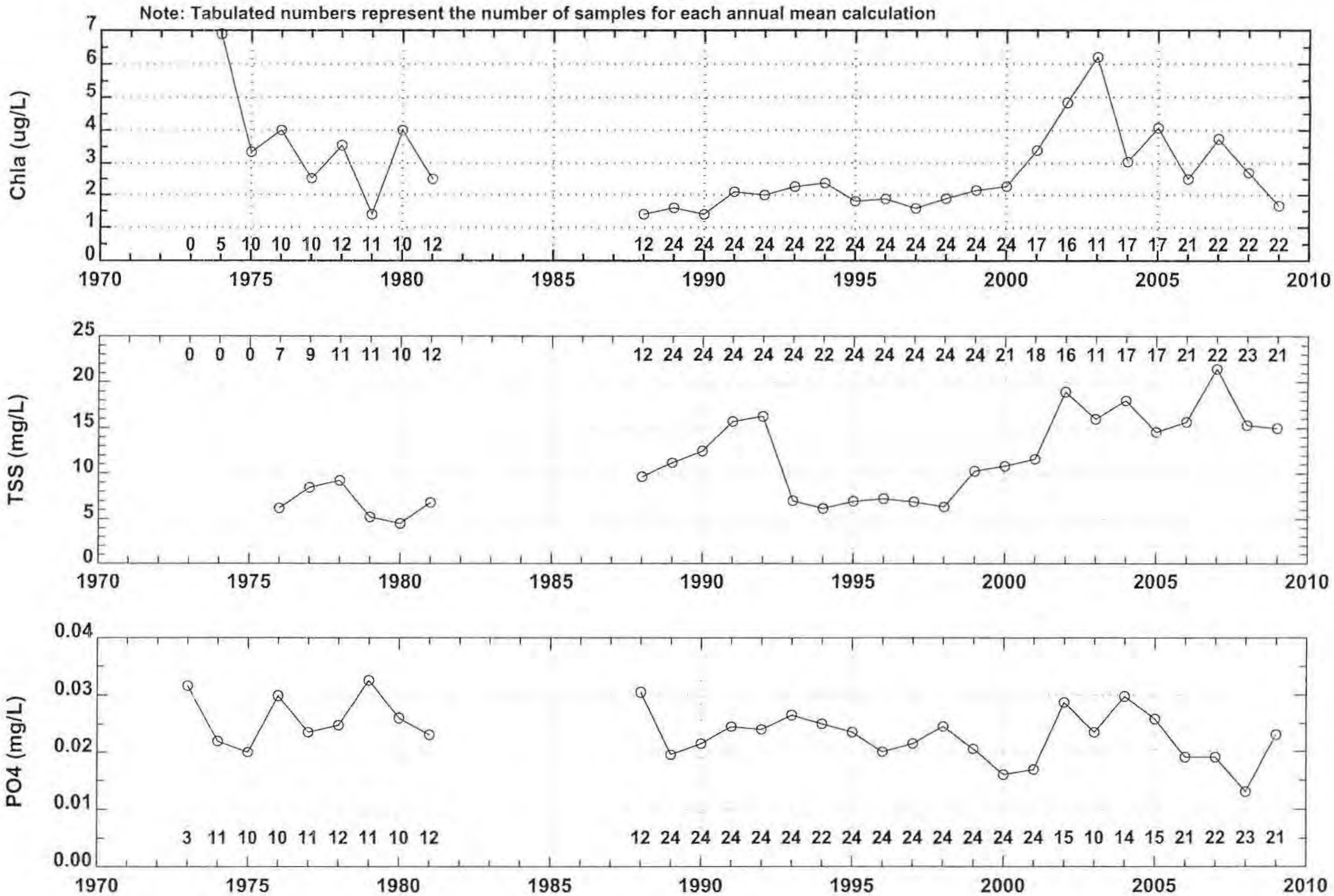

Figure 4. DES Monitoring Data (1988-2009), Adams Point

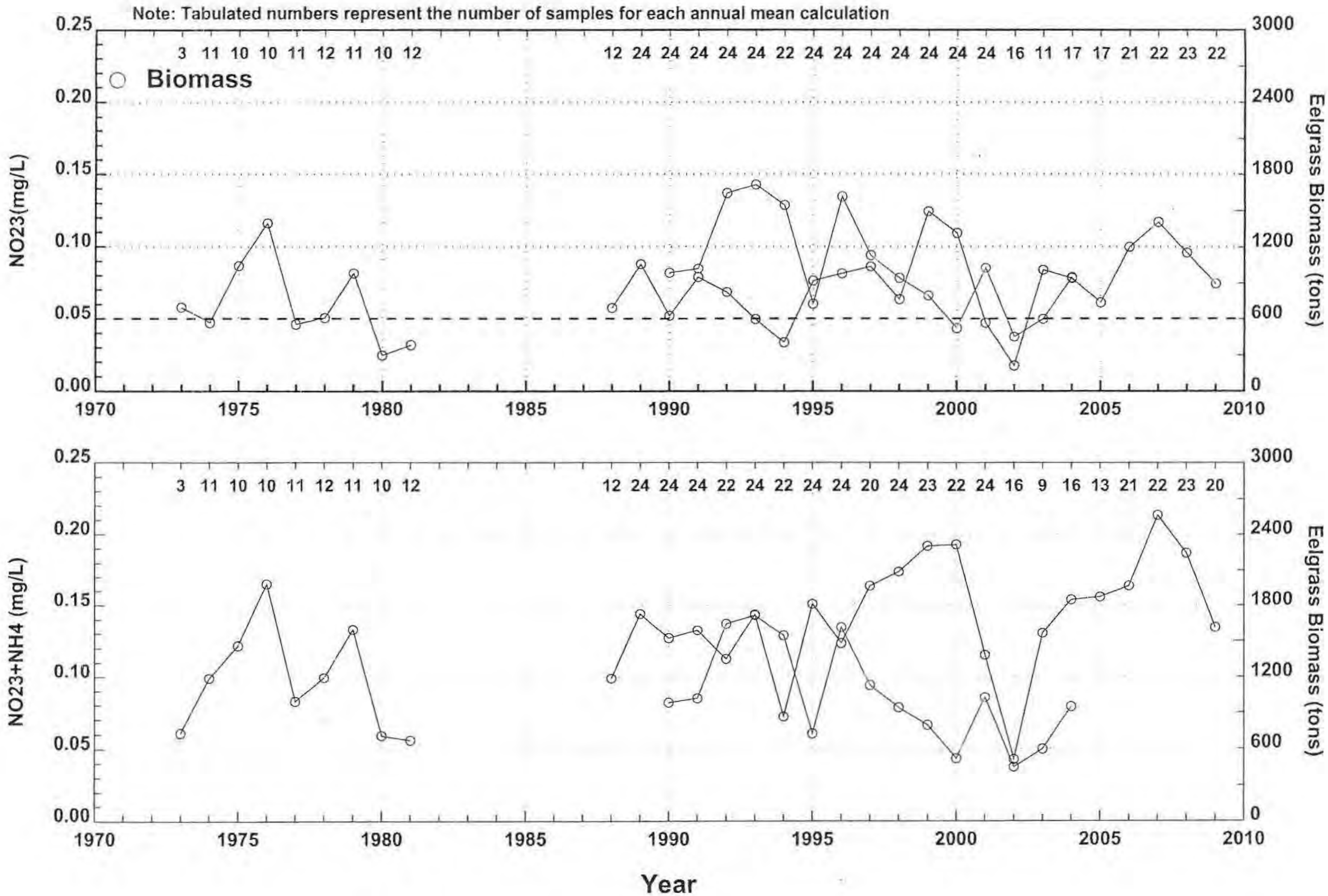

Figure 5. DES Monitoring Data (1973-2009), Adams Point

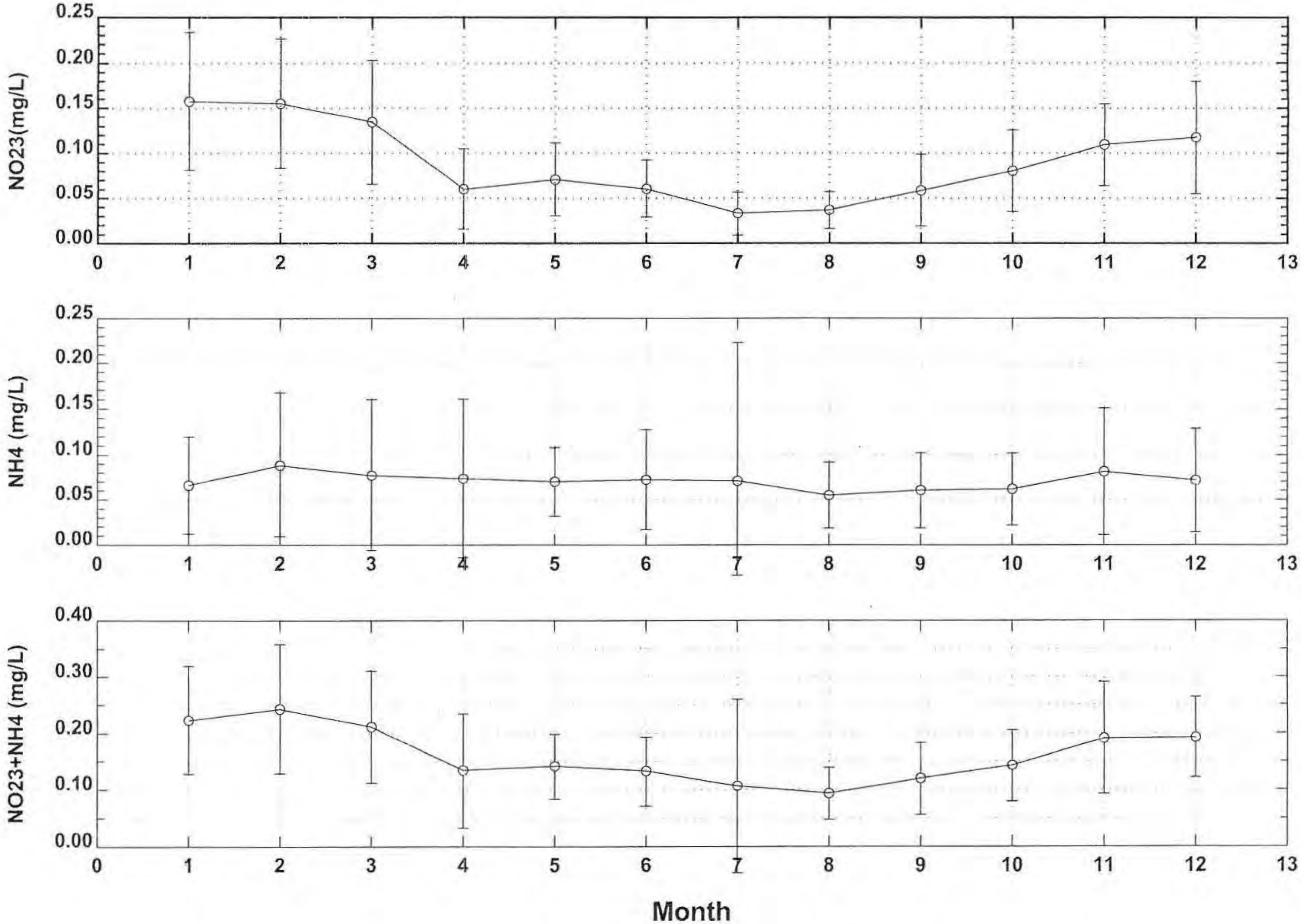

Figure 6-1. DES Monitoring Data (1988-2009), Adams Point

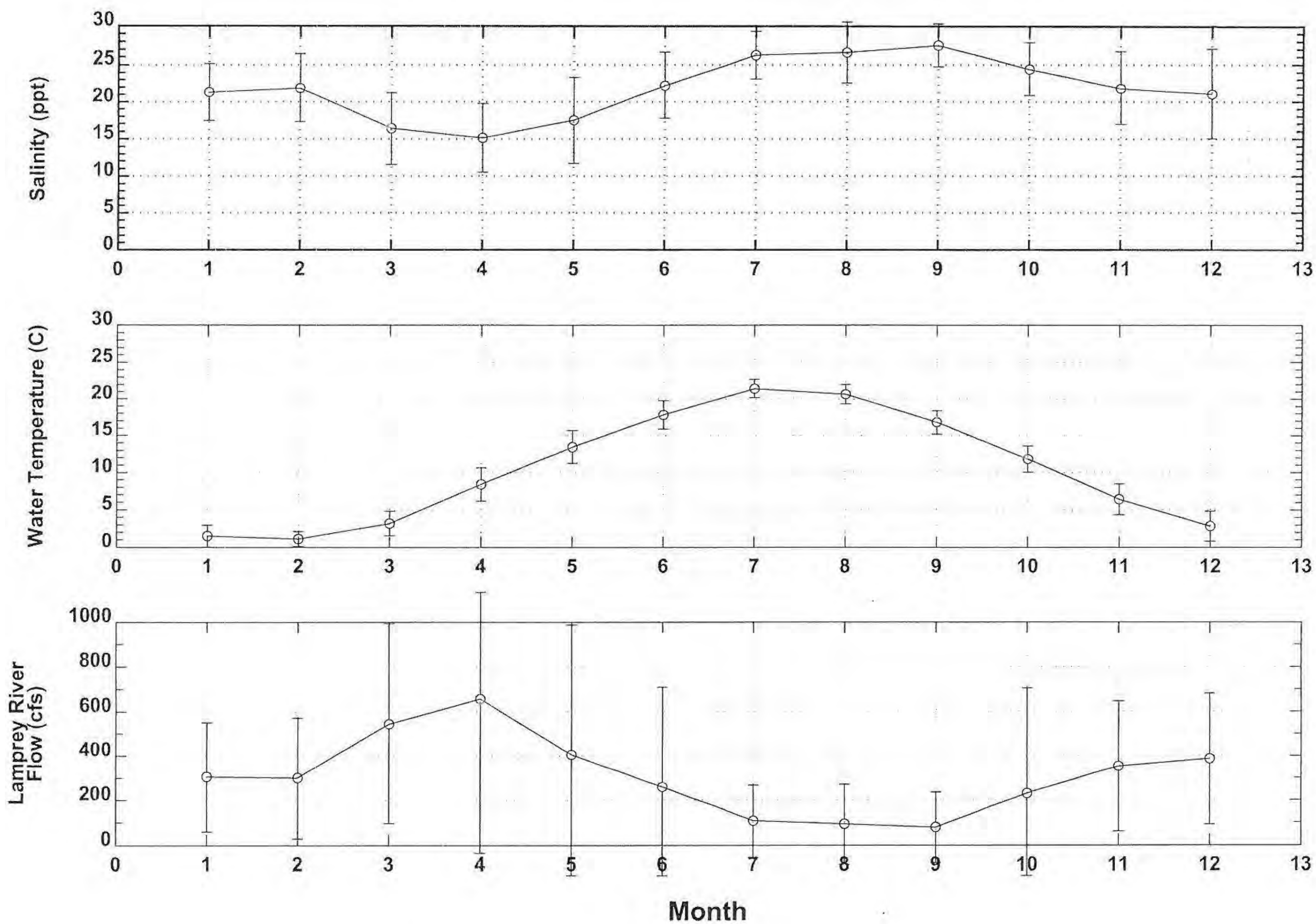

Figure 6-2. DES Monitoring Data (1988-2009), Adams Point

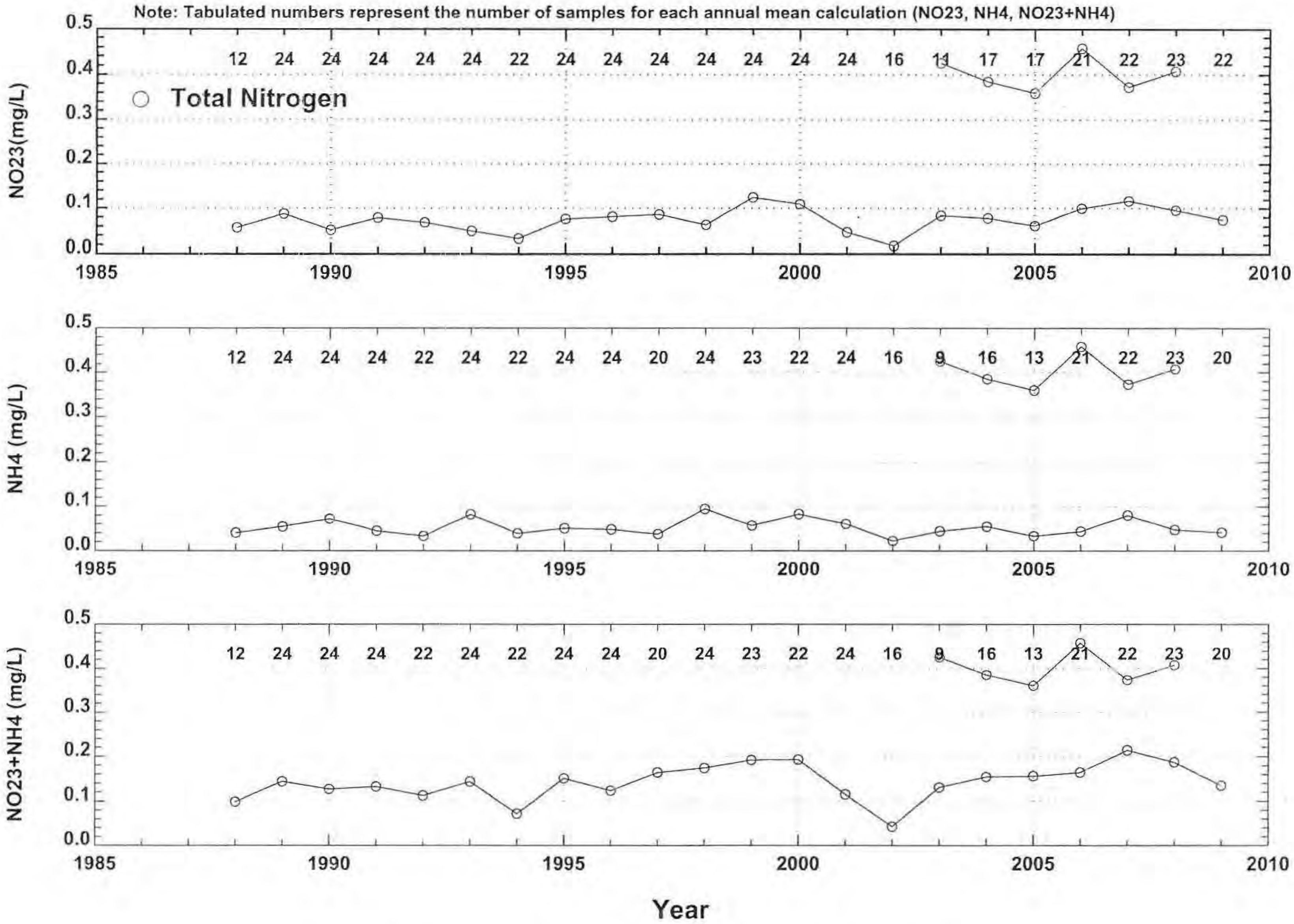

Figure 7. DES Monitoring Data (1988-2009), Adams Point

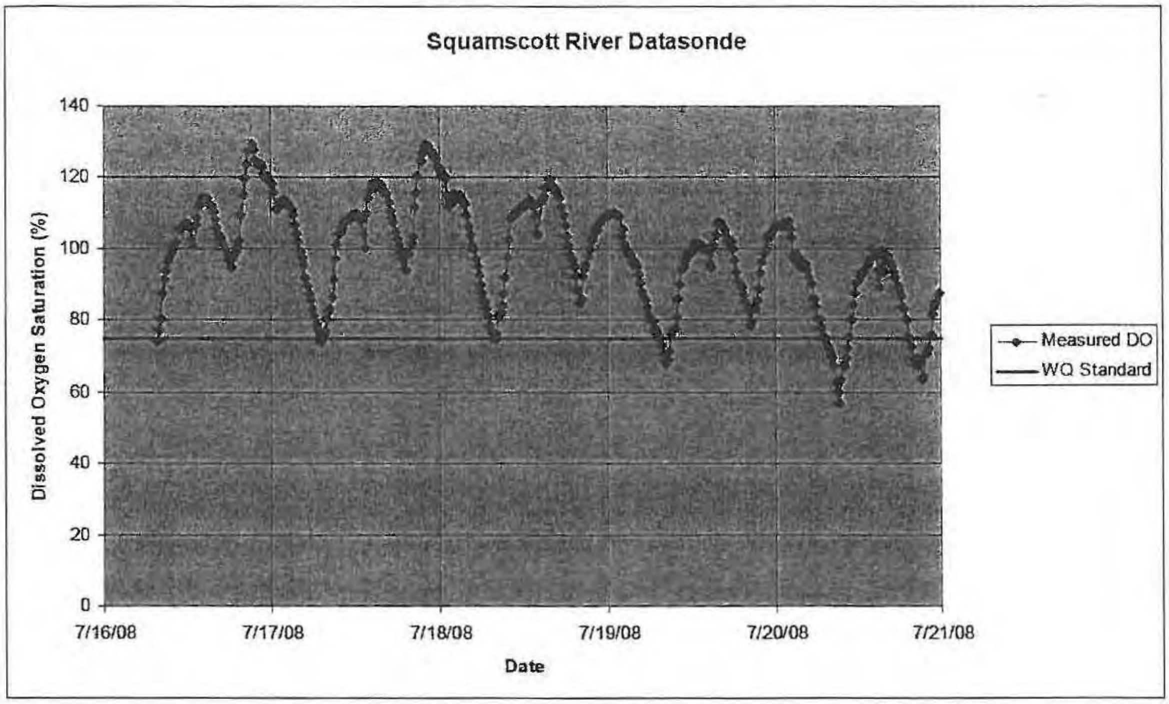

Figure 8. Dissolved Oxygen at the Squamscott River Datasonde Location

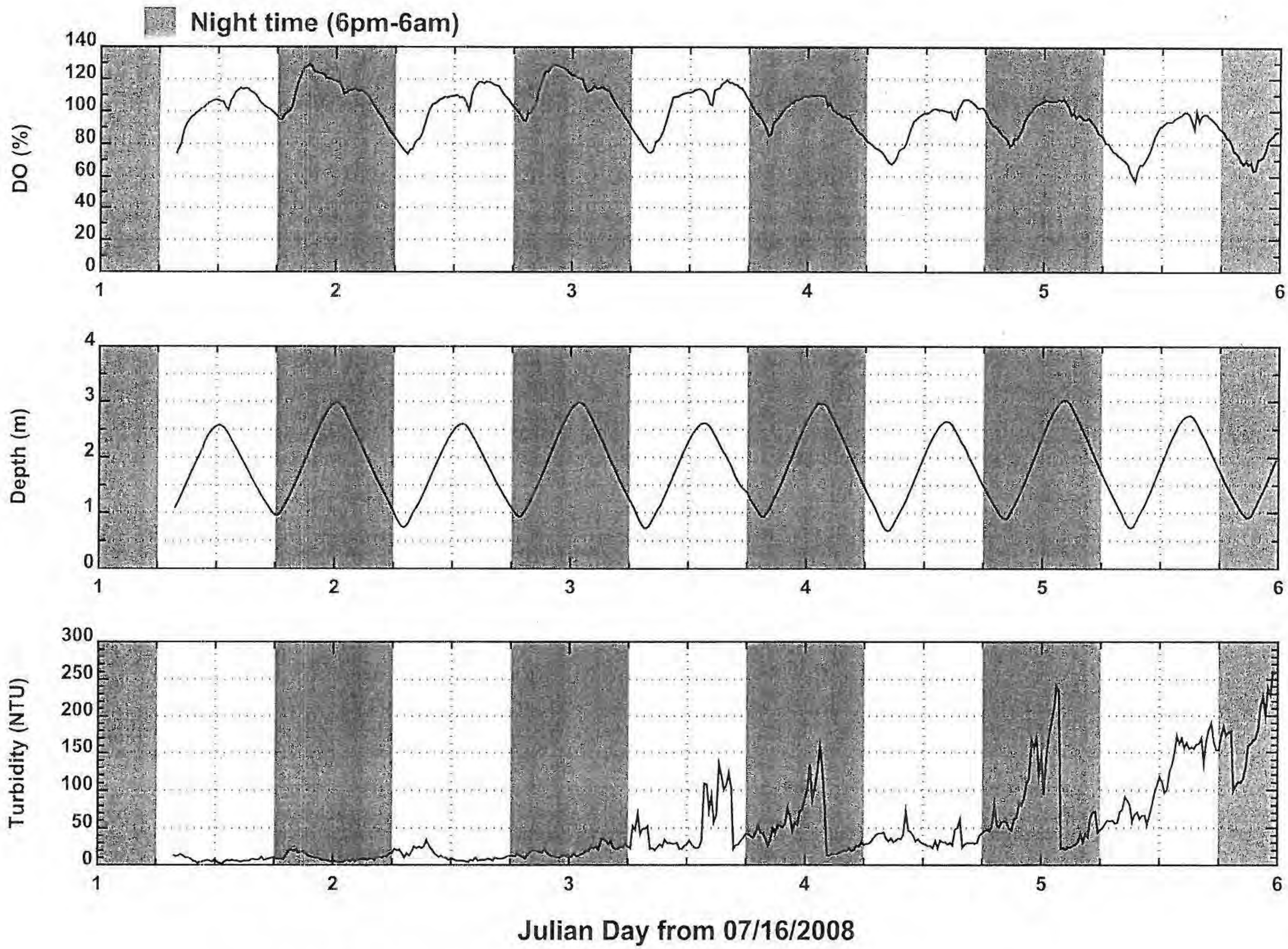

Figure 9-1. Squamscott River Monitoring Data (07/16/2008-07/20/2008)

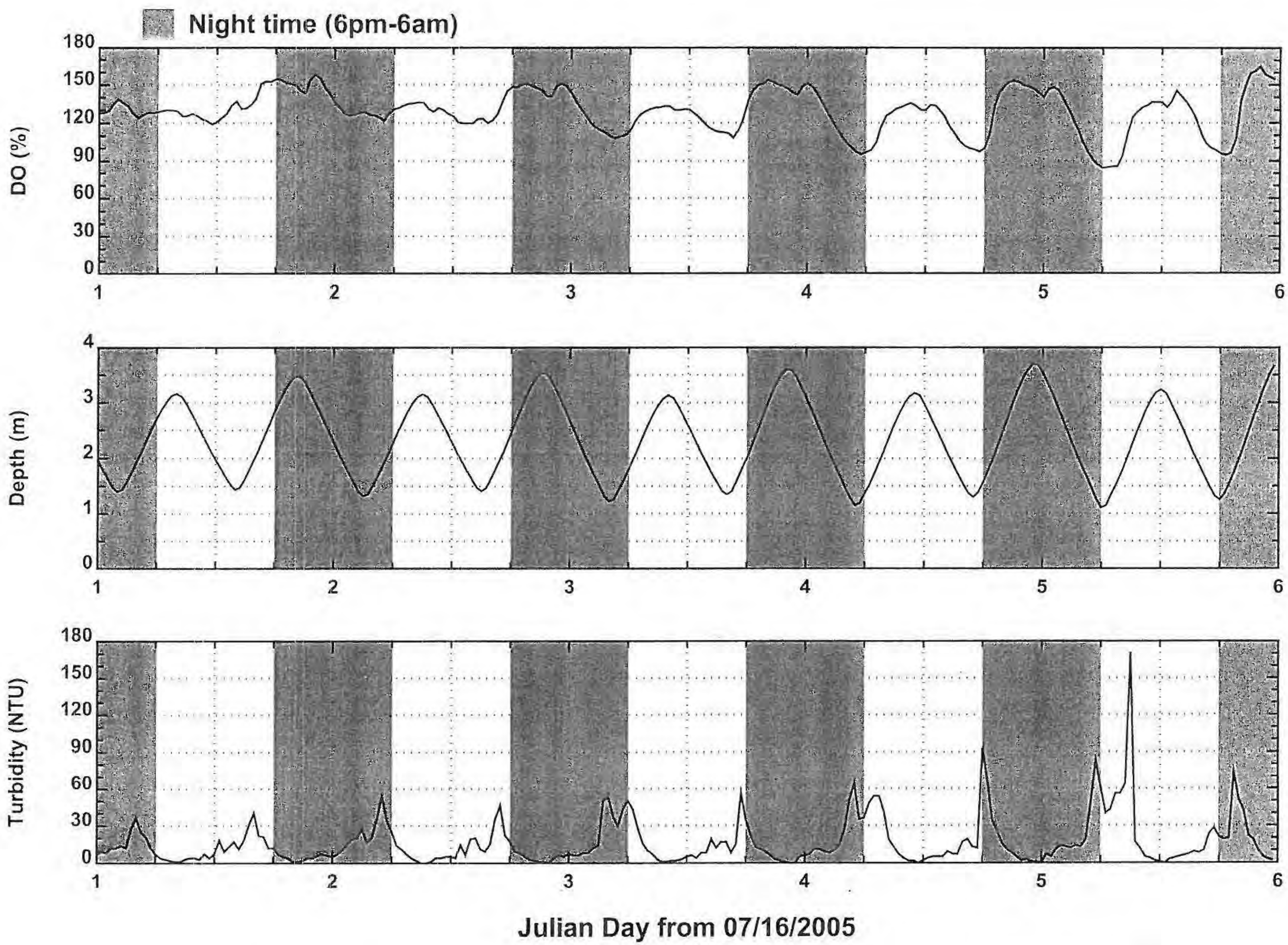

Figure 9-2. Squamscott River Monitoring Data (07/16/2005-07/20/2005)