The State of New Hampshire
Department of Environmental Services
Thomas S. Burack, Commissioner

Celebrating 25 Years of Protecting New Hampshire's Environment

October 19, 2012

Thomas J. Jean, Mayor
City of Rochester
31 Wakefield Street
Rochester, NH 03867

Dean Trefethen, Mayor
City of Dover
288 Central Avenue
Dover, NH 03820

Eric Spear, Mayor
City of Portsmouth
1 Junkins Avenue
Portsmouth, NH 03801

Re: Request for Meeting to Discuss New Information Regarding Nutrient Effects on the Great Bay Estuary and Independent Peer Review

Dear Mayors Jean, Trefethen, and Spear:

On August 14, 2012, the Department of Environmental Services received letters from your offices, on behalf of the Great Bay Municipal Coalition, asserting certain "new" facts regarding nitrogen pollution in the Great Bay Estuary. In addition, you requested that the Department conduct an additional peer review of the relevant scientific information. We also received a follow-up letter from you on October 4, 2012 that reiterated these claims and this request. The Department has carefully reviewed your letters, developed a detailed response, and arranged for a face-to-face meeting with you to discuss your concerns.

The Department appreciates and shares your interest in basing restoration decisions on a sound scientific footing. We also recognize the potential high costs to your respective communities for wastewater treatment to remove nitrogen. As described in more detail in the attached document, DES refutes the various claims and allegations in your August 14, 2012 letter. In summary, DES maintains that the Great Bay Estuary exhibits all the classic signs of eutrophication and that excessive nitrogen is causing or contributing to the water quality problems in the estuary. Many of the claims in your letter over-simplify the situation, exclude key information, or extrapolate site-specific results to the whole estuary. Some key points from our response include:

1) The Coalition claims that eelgrass is recovering. This claim is based on an incomplete and inaccurate subset of the data. In fact, eelgrass is not "rebounding". The total eelgrass cover in the estuary in 2009, 2010, and 2011 was essentially unchanged and was still 35% below earlier levels. Looking at the whole dataset, it is unfortunate but indisputable that the 15-year trend for eelgrass remains downward.

2) The Coalition claims that algal levels have not increased since 1980. This claim focuses on one type of algae (phytoplankton) and only in certain areas of the estuary, and ignores the information provided by respected UNH scientists about increasing macroalgae. In fact, the Coalition has already stated in writing that, "Great Bay waters (excluding the tidal rivers)

should be identified as impaired due to excessive macroalgae growth." (See November 14, 2011 letter from Dean Peschel to Harry Stewart.)

3) The Coalition claims that nitrogen levels have returned to 1970-1980 levels. DES agrees that average annual *dissolved inorganic nitrogen* (DIN) concentrations in some parts of the estuary have fallen in recent years. However, dissolved inorganic nitrogen is highly variable because it is rapidly taken up by plants. Total Nitrogen (TN) concentrations show a more complete picture of nitrogen levels in the Estuary. Total Nitrogen concentrations show either no or increasing trends in locations across the estuary.

Full responses, including detailed citations and supporting information, to the claims in your letters are provided in the attached document. There is strong evidence that the state's narrative water quality standard for nutrients is violated in most parts of the Great Bay Estuary. It is the hope of the Department of Environmental Services that all interested parties can all put any disagreements aside and begin to work together to develop effective solutions to this problem.

Your letters also request that the Department conduct an additional review of the scientific information. Please be reminded that the nitrogen thresholds developed by the Department in 2009 were peer reviewed by two independent experts from Cornell University and the University of Maryland. Both reviewers found the thresholds to be reasonable and well-supported by the data presented. The reviewers were privy to all the comments and criticisms provided by the municipalities at the time. For the reasons stated in the attached document, DES does not believe that any of the "new" information or additional information developed by the Coalition since that time would lead to a change in findings from those of the initial peer reviewers. Nonetheless, the Department is not opposed to another peer review, on the conditions that all parties, including EPA, agree to the need, the guidelines in the EPA Peer Review Handbook are followed, the charge questions are reasonable, the reviewers are objective, and the requesting communities are able to find a source of funding for the peer review. In our opinion, however, the considerable funds required for an additional peer review would be better spent on enhanced monitoring and site-specific nutrient threshold development.

Thank you for your letter and for your efforts to restore the Great Bay Estuary. If you have any questions, please feel free to contact Harry Stewart, Water Division Director, at 271-3308 or Harry.Stewart@des.nh.gov; Vicky Quiram, Assistant Commissioner, at 271-8806 or Vicki.Quiram@des.nh.gov; or me at 271-2958 or Thomas.Burack@des.nh.gov.

Sincerely,

Thomas S. Burack
Commissioner

Enc.

EXHIBIT 32 (AR H.43)

Responses of the New Hampshire Department of Environmental Services (DES)
To Claims of New Information Regarding Nutrient Effects on the Great Bay Estuary
Included in Letters to Commissioner Burack dated July 20, 2012
From the Mayors of Rochester, Portsmouth, and Dover

October 19, 2012

Note: The three letters from the mayors of Rochester, Portsmouth, and Dover contained the same six claims of new information regarding nutrient effects on the Great Bay Estuary. The claims from these letters appear below in bold, followed by DES's responses. Many of the claims contain multiple aspects, and these have been parsed to facilitate the DES response. The referenced figures appear at the end of this document.

Claim #1

1.A "Algal levels in the system did not change materially from 1980 to present, …"[1]

DES Response:

> "Algal levels" is a broad term. The depositions cited refer specifically to phytoplankton, which is one of many types of algae. Similarly, "the system" is not defined but assumed to mean Great Bay proper because that is the only place for which phytoplankton records extend back to 1980. With those definitions, it is correct that there have been no clear trends in chlorophyll-a (a specific measurement of phytoplankton) measured in Great Bay over the full period of record from 1974 to 2011 in Great Bay (PREP, 2012 at 90).
>
> However, the statement ignores the fact that phytoplankton are not the only form of algae that is important in a shallow estuary like the Great Bay. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery et al., 2007; Valiela et al., 1997), which is what is actually happening in Great Bay. At the mouth of Lubberland Creek in Great Bay, macroalgae increased from 0.8 to 39.3 percent cover between 1980 and 2010 (PREP, 2012 at 86). Dr. Art Mathieson provided comments to DES and PREP stating that macroalgae populations in the estuary have increased:
>
> > "*Prior to the 1980s no major algal blooms were apparent and the nutrient levels were much lower than today (cf. Mathieson and Hehre, 1981). During the past 2-3 decades the following macroalgal patterns have occurred along with increased nutrients:*
> >
> > - *"Extensive ulvoid green algae (Ulva spp.) or "green tides" (Fletcher, 1996) have begun to dominate many of these estuarine areas during the past 15-20 years, particularly within Great Bay proper (Nettleton et al.*

[1] Citation listed as "Trowbridge deposition - June 21, 2012" (no page numbers provided). After reviewing the transcript, the relevant section is likely pp. 132-137 which discusses trends in phytoplankton levels. During the second Trowbridge deposition on July 11, 2012, the same topic was discussed and is covered in pp. 343-345. In both cases, it is clear that the discussion is about phytoplankton levels only.

2011). Such massive blooms of foliose green algae can entangle, smother and cause the death of eelgrass (Zostera marina) within the low intertidal/shallow subtidal zones (pers. obs. A C Mathieson). They primarily represent annual populations that can also regenerate from residual fragments buried in muddy habitats.

- *"Extensive epiphytic growths of seaweeds on eelgrass (Zostera marina) have also occurred during the past 15-20 years, particularly within Great Bay proper (pers. obs. A C Mathieson). These epiphytes, which are mostly filamentous red algae and colonial diatoms, may completely cover the fronds of eelgrass, limiting the host's growth and photosynthesis and compromising its viability.*" (Mathieson, 2012 at 1)

The Great Bay Municipal Coalition (GBMC) has previously acknowledged that macroalgae has increased in the estuary. In a letter from Dean Peschel to Harry Stewart on November 14, 2011, the GBMC stated that "Great Bay waters (excluding the tidal rivers) should be identified as impaired due to excessive macroalgae growth, and the parameter of concern causing the impairment should be identified as DIN." (Peschel, 2011b at 3)

Accordingly, the statement that "algal levels in the system did not change" is only theoretically accurate if it is read as pertaining solely to phytoplankton and not to all types of algae, including some that may be more significant.

1.B "…despite an estimated 59% increase in TN levels between 1980 and 2004."[2]

DES Response:

This statement is incorrect. Total Nitrogen (TN) was first measured in the Great Bay Estuary starting in 2003. There are no known measurements of TN in the Great Bay Estuary from the 1970s, 1980s, or the 1990s. For the TN data that exist, for the period starting in 2003 and running through 2011, there has been no trend in TN at Adams Point in Great Bay (PREP, 2012 at 69). TN has been measured routinely since 2003 at eight trend stations, as well as occasionally at other stations across the estuary.

This incorrect statement seems to refer back to the 2006 State of the Estuaries report (NHEP, 2006 at 12), which was superseded by a 2009 report and is now six years out-of-date. The 2006 report showed that Dissolved Inorganic Nitrogen (DIN) had increased by 59 percent between the year periods of 1974-1981 and 1997-2004. Apparently, the GBMC is assuming that DIN concentrations are the equivalent of TN concentrations. HydroQual, consultants for the GBMC, have specifically advised against making this assumption, stating: "The use of inorganic nitrogen as an indicator of total nitrogen trends can be inaccurate" (HydroQual, 2011 at 4).

[2] The source of this fact is cited as the 2006 State of the Estuaries report from the New Hampshire Estuaries Project (NHEP, 2006 at 12).

DES uses TN for surface water quality assessments of the estuary. DIN is an inferior indicator of nitrogen pollution compared to TN. DIN does not include nitrogen that is incorporated into plants and organic matter and is a more reactive and unpredictable form of nitrogen. For example, DIN concentrations in the water can be very low during periods of high plant growth because the DIN is pulled out of the water and incorporated into phytoplankton, macroalgae, and other plants. As shown in Figure 1, the percent of TN that consists of DIN varies widely during the year.

DES concurs that TN concentrations have likely increased over time as the population in the watershed has increased. However, the statement quoted in the claim is incorrect and, at best, out-dated.

1.C "Therefore, TN inputs could not have caused changed transparency in the system and reducing TN inputs will not improve system transparency as is assumed by DES."[3]

DES Response:

The assumption underlying this statement is that the only way for nitrogen to affect eelgrass is by causing phytoplankton blooms that shade eelgrass so that there is not enough light for eelgrass to survive. This assumption is incorrect. In fact, there are multiple ways in which excess nitrogen can affect eelgrass. In response to comments from the GBMC on the 2012 Consolidated Assessment and Listing Methodology, DES provided the following explanation.

> *"There are multiple ways that excess nitrogen impacts eelgrass in the Great Bay Estuary. First, like all plants, eelgrass needs light to survive. Increasing nitrogen concentrations cause algae blooms (Figure 3) and elevated primary productivity in general. The plant matter floating in the water shades the eelgrass plants so they do not get enough light to survive. Figure 4 shows that light attenuation in the Great Bay Estuary is more strongly correlated with plant/organic matter in the water than any other factor. Second, excess nitrogen creates an environment in which epiphytes can grow on the leaves of eelgrass and macroalgae can out-compete and smother eelgrass. Field studies in Nettleton et al. (2011) and Pe'eri et al. (2008) have demonstrated that macroalgae has increased, dramatically in some places, as nitrogen has increased in the estuary. Finally, excess nitrogen disrupts cellular processes for eelgrass (Burkholder et al., 2007).*
>
> *"The dominant mechanism by which nitrogen affects eelgrass is different in different parts of the Great Bay Estuary and can vary over time. Light attenuation, a general measure of water clarity, is a good indicator of the presence or absence of eelgrass especially in the deeper areas of the estuary. Subtidal eelgrass beds in these areas need clear water to transmit light to the growing depths. In shallower areas, overgrowth and smothering by macroalgae*

[3] This statement has been assumed to be a conclusion drawn by the letter's author. The only section of the deposition transcripts related to this topic is on July 11, 2012 pp. 345-348. This deposition date was not cited with the claim.

> *and/or cellular disruption may be the immediate cause of eelgrass loss. However, even in shallow areas, light attenuation is still an important contributing factor for eelgrass viability because sufficient light is a requirement for plant survival in all areas."*
> (DES, 2012b at 8)

Because the assumption underlying the above GBMC statement on transparency is incorrect and invalid, the statement is also not correct. The opposite is, however, a well accepted scientific conclusion: reduced TN levels can only help to improve the light available to eelgrass, reduce the growth of macroalgae, and reduce direct nitrogen toxicity to submerged aquatic plants (Burkholder et al., 2007).

Claim #2

2.A "Transparency in the major tidal rivers (Squamscott, Lamprey, Upper Piscataqua) is poor, but the available data (not previously analyzed by DES) show that (a) the effect of algal growth on transparency is negligible,"[4]

DES Response:

The portion of the July 11, 2012 deposition relevant to this statement is based on a series of graphs created by the GBMC that relate phytoplankton as chlorophyll-a to water clarity in the Squamscott, Lamprey, and Upper Piscataqua Rivers. The graphs used in the deposition show data from each river separately. Different types of graphs were used for the different rivers and, in the case of the Upper Piscataqua River graph, unproven assumptions about Secchi disk measurements were used. The point of the graphs was to attempt to show that chlorophyll-a was not well correlated with water clarity and, therefore, that other factors such as turbidity and colored dissolved organic matter (CDOM) must be controlling light attenuation. During the deposition, DES staff agreed that the graphs supported those conclusions.

2.B "(b) naturally occurring CDOM and turbidity are the key factors controlling transparency in the system, and"[5]

DES Response:

DES does not dispute that colored dissolved organic matter (CDOM) and turbidity are important factors related to water clarity in the tidal rivers. However, eelgrass was mapped in significant quantities in the tidal rivers in 1948 (DES, 2012 at 14). If "naturally occurring CDOM and turbidity" were the only factors controlling transparency (and presumably eelgrass survival) in the rivers, it would not have been possible for eelgrass to have existed in these areas at all.

2.C "(c) regulating TN in the tidal rivers will not result in any demonstrable improvement in transparency or allow for eelgrass re-establishment."[6]

DES Response:

The assumption that regulating TN will not have any "demonstrable improvement in transparency or allow for eelgrass re-establishment" is a conclusion that is predicated on the assumption that the only way that nitrogen affects eelgrass is through phytoplankton blooms that cause shading. In fact, there are several other ways that excess nitrogen can affect eelgrass (see explanation in response to Claim #1).

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[4] Citation listed as "Trowbridge deposition – July 11, 2012" (no page numbers provided). The relevant section of the deposition transcript is pp. 421-434. The following graphs were discussed in this section: Short Exhibit 18, Short Exhibit 21, and Short Exhibit 22.
[5] Same citation as previous.
[6] Same citation as previous.

In response to similar comments from the GBMC on the 2012 Consolidated Assessment and Listing Methodology, DES showed that TN accounts for 27% of the variability in light attenuation (see Figure 2) in the tidal rivers and provided the following explanation:

> *"The impairments for light attenuation ("transparency/TN-based listings") cannot be deleted from the 303(d) list because light attenuation is a good indicator of eelgrass survival and there is a statistically significant relationship between light attenuation and total nitrogen in the estuary. The Great Bay Municipal Coalition has argued that light attenuation is naturally occurring and unrelated to nitrogen, especially in the tidal rivers. In the N.H. Surface Water Quality Regulations, "naturally occurring" means conditions which exist in the absence of human influences (Env-Wq 1702.29). Figure 2a shows that light attenuation and total nitrogen have statistically significant relationships in the estuary, including in the tidal rivers (Figure 2b). Total nitrogen concentrations are a strong indicator of human influence. Therefore, given the relationship between light attenuation and total nitrogen in the estuary, including in the tidal rivers, it cannot be justified that light attenuation is "naturally occurring" nor can it be justified that light attenuation is unrelated to nitrogen concentrations."* (DES, 2012b at 8)

It must also be recognized that eelgrass has been present in New Hampshire's tidal rivers in recent times. The fact that eelgrass has been detected in the tidal portions of the Winnicut, Lamprey, Oyster, Bellamy, and Upper Piscataqua Rivers in recent years (i.e., since 1981 when the first modern comprehensive mapping was conducted) demonstrates that it should be possible to restore eelgrass in these areas (DES, 2012 at 14).

Claim #3

"Great Bay itself is generally not a transparency limited system because eelgrass populations receive sufficient light during the tidal cycle."[7]

DES Response:

DES assumes that the term "transparency limited" in the claim was intended to mean that the clarity of the water is not the limiting factor for eelgrass survival. DES agrees that one of the reasons why eelgrass still exists in Great Bay proper is the exposure of eelgrass plants to direct sunlight during low tide. However, water clarity is not the only way in which nitrogen affects eelgrass (see response to Claim #1). Therefore, the claim that Great Bay proper is not transparency limited does not mean that nitrogen does not affect eelgrass in the Great Bay proper.

In response to similar comments from the GBMC on the 2012 Consolidated Assessment and Listing Methodology, DES provided the following explanation of why water clarity is still important even in shallow areas:

> *"The dominant mechanism by which nitrogen affects eelgrass is different in different parts of the Great Bay Estuary and can vary over time. Light attenuation, a general measure of water clarity, is a good indicator of the presence or absence of eelgrass especially in the deeper areas of the estuary. Subtidal eelgrass beds in these areas need clear water to transmit light to the growing depths. In shallower areas, overgrowth and smothering by macroalgae and/or cellular disruption may be the immediate cause of eelgrass loss. However, even in shallow areas, light attenuation is still an important contributing factor for eelgrass viability because sufficient light is a requirement for plant survival in all areas."* (DES, 2012b at 8)

[7] Citation listed as "Trowbridge deposition – June 21, 2012 and Short deposition – May 14, 2012, as discussed in numerous emails between DES, EPA, and Dr. Short" (no page numbers listed). The relevant section of the transcript appears to be pp. 177-178. Transcript pp. 360-364 from the July 11, 2012 deposition also appear to be relevant.

Claim #4

4.A "A large increase in rainfall and major floods occurring from 2006-2008 (a natural condition) could be the primary cause of significant eelgrass declines that occurred in Great Bay during that period due to salinity changes, increased turbidity and increased colored dissolved organic matter (CDOM)."[8]

DES Response:

The actual data for eelgrass in the Great Bay do not support this claim (see Figure 3). The data show a steady decline over time with the 2006-2008 years falling slightly below the regression line and the last three years unchanged and slightly above the line. The odds of this trend occurring by chance are less than 1 in 15,000, which, for such a complicated ecosystem, demonstrates a very robust trend. Eelgrass cover in the entire estuary is still 35% below its extent in 1996 (PREP, 2012 at 126). It is not "rebounding". Even if the 2006-2008 years were disregarded, there would still be a statistically significant declining trend in eelgrass since 1990. Finally, it is not possible that heavy rainfalls in 2006-2008 could have caused the eelgrass declines that were evident in 2005 when DES initiated the study of nitrogen in the Great Bay.

DES agrees that changes in CDOM (colored dissolved organic matter), turbidity, and salinity during floods can affect eelgrass. However, another explanation for the worse conditions during heavy rainfall years is that more nitrogen is delivered from the watershed during those years as shown by Figure 4. CDOM itself is organic matter typically exported from wetlands in the watershed. Organic matter necessarily contains a certain fraction of nitrogen. Therefore, CDOM is not an independent parameter from nitrogen. Moreover, delivery of nitrogen from human sources in the watershed is not a "natural process".

4.B "DES failed to assess the importance of these events in triggering the eelgrass decline in the system despite the obvious temporal correlation."[9]

DES Response:

DES protocols for assessing eelgrass populations for the 303d report use eelgrass data from all years and look at trends over the full period of record and averages from the most recent three years (DES, 2012 at 67). Multiple years are used to make assessments to account for year-to-year variability in weather and other factors. It is not clear what is meant by the statement: "DES failed to assess the importance of these events". As stated above, even if the presumed wet years of 2006-2008 were disregarded, there would still be a statistically significant declining trend in eelgrass since 1990.

[8] The citation for this claim is "Trowbridge deposition – July 11, 2012" (no page numbers provided) and "charts: CDOM changes from 2004-2010 and eelgrass changes with freshwater inputs". The relevant sections of the deposition transcript are likely pp. 381-384.
[9] Same citation as previous.

The attachments to the July 20, 2012 letter supporting these claims contain invalid data and are, therefore, incorrect. The GBMC figure showing eelgrass cover versus precipitation shows nearly 2,000 acres of eelgrass in Great Bay in 2010 and no data for 2011 (see Figure 5). The correct values are 1,722 and 1,623 acres for 2010 and 2011, respectively. Despite repeated reports provided by DES and PREP to the GBMC transmitting the correct eelgrass data for 2010, the GBMC continues to use the wrong numbers for eelgrass in the Great Bay. In addition to using the incorrect eelgrass data, the figure presented by the GBMC showing CDOM measurements at the Great Bay Buoy is based on unverified, raw data that have not been quality assured by the UNH researchers.

Claim #5

"The various DES/PREP analyses that confirmed (a) TN increases did not cause changes in transparency, algal levels or DO and (b) a "cause and effect" relationship between TN and transparency/DO did not exist, were excluded from the technical information presented in the 2009 numeric nutrient criteria document and, therefore, were never presented to EPA's internal peer review panel."[10]

DES Response:

Estuaries are very complicated environments. Consequently, the DES study of the impacts of nutrients in the estuary considered multiple approaches and evolved over four years. Some of the initial analyses done by DES at the beginning of the five years of research between 2005 and 2009 failed to show simple relationships between nitrogen and transparency, phytoplankton, or dissolved oxygen. However, these analyses did not prove that relationships between these parameters did not exist. The initial methods and datasets used were simply inadequate for the task. Therefore, the analyses that the GBMC uses to demonstrate the absence of cause-and-effect relationships, do not prove anything.

For the final report in 2009 (DES, 2009), DES ultimately adopted an approach that used long-term averages to take into account delays in the biological response and nonlinear feedback in the complicated estuarine system. Published papers by Burkholder et al. (2007) and Li et al. (2008) demonstrate that eelgrass loss and algae blooms are not expected to directly follow nitrogen concentrations and that plots of monthly data will not illustrate relationships in estuaries. The approach used by DES in the final report was able to illustrate the underlying relationships between nutrients and their effects. The initial analyses that had not been effective were not included in the final report, as was appropriate.

After the 2009 report was completed, DES continued to refine the methods for analyzing data. In response to comments by the GBMC, DES demonstrated that the relationships between TN and chlorophyll-a and transparency were independent of salinity effects (see Figure 6). This result confirmed that the approach taken by DES in the 2009 report to aggregate data from different parts of the estuary, with different salinities, was appropriate.

Finally, the GBMC claims that the 2009 DES report was reviewed by "EPA's internal peer review panel". This is not correct. The peer review of the 2009 report was performed by two independent university professors, not a panel of EPA employees. The two professors who conducted the peer review are widely recognized as being among the top estuarine researchers in the world.

[10] The citation is listed as "Trowbridge deposition – July 11, 2012" (no page numbers provided). The relevant section of the transcript appears to be pp. 436-440. This topic was also discussed on June 21, 2012 as recorded on pp. 232-241.

Claim #6

6.A "Dissolved nutrient concentrations have now returned to 1970-1980 levels. This dramatic change in ambient DIN levels appears to be the result of reduced rainfall and increased eelgrass growth."[11]

DES Response:

DES agrees that average annual DIN concentrations at Adams Point have decreased in the last few years and are similar to concentrations measured in the 1970s. However, as discussed previously, DIN is an inferior indicator of nitrogen pollution compared to TN because DIN is a subset of TN that is the most reactive in the environment. DIN does not include nitrogen that is incorporated into plants and organic matter. DIN concentrations in the water can be very low during periods of high plant growth because the DIN is pulled out of the water and incorporated into phytoplankton, macroalgae, and other plants. TN concentrations in the Great Bay have been measured since 2003. There are no known measurements of TN taken in the 1970s, 1980s, or the 1990s. For the TN data that exist, starting in 2003 and continuing through 2011, there has been no trend in TN at Adams Point (Figure 7). The average TN concentration in 2009-2011 is only 14% lower than in 2006-2008, which is most logically explained by reduced nitrogen loads as a result of more normal rainfall amounts during this period (PREP, 2012 at 30).

While Adams Point is a good location for monitoring, trends at this site do not necessarily reflect changes throughout the estuary. Complex interactions at this location add variability to the dataset. At Chapmans Landing, which is close to nitrogen sources in the Squamscott River, there are increasing trends for nitrate+nitrite, total dissolved nitrogen, and total nitrogen (PREP, 2012 at 35).

6.B "These results indicate that natural processes were primarily controlling eelgrass populations and variations in nitrogen levels in the system."[12]

DES Response:

Since the first part of this claim is not correct, as noted above, this conclusion is not supported. Moreover, the DIN data cited by the GBMC show a long-term increasing trend. The long-term trend for eelgrass is downward, even if the heavy rainfall years were disregarded. Macroalgae abundance is increasing in the estuary, as GBMC consultants have already acknowledged (Peschel 2012 at 1). These facts do not support the conclusion that "natural processes" are the sole factors affecting nitrogen levels and eelgrass populations in the estuary.

[11] The citation listed for the first sentence are charts from the PREP 2013 State of the Estuaries report (draft).
[12] No citation provided.

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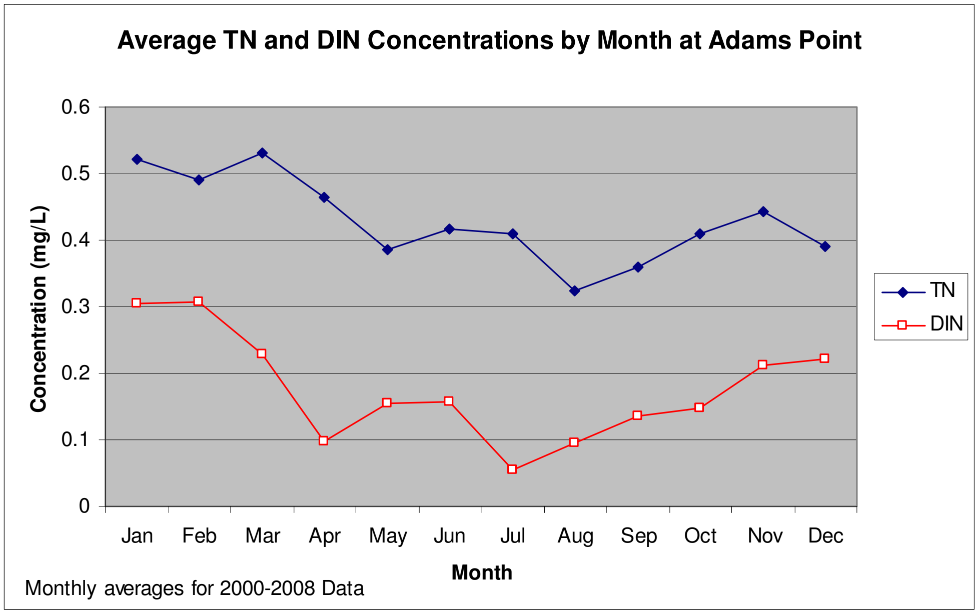
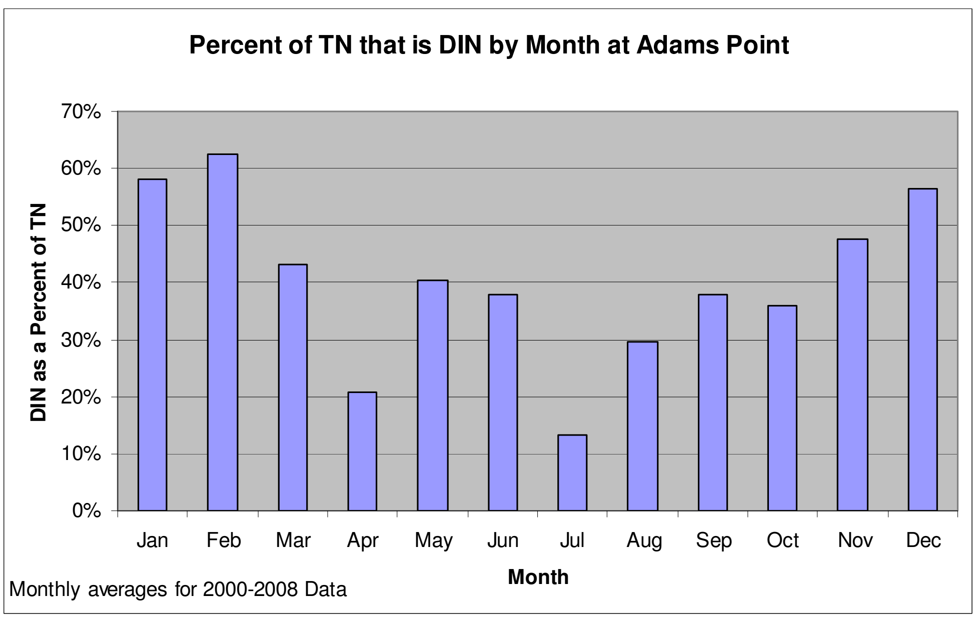
Exhibits

Figure 1: Monthly Average TN and DIN Concentrations at Adams Point in Great Bay

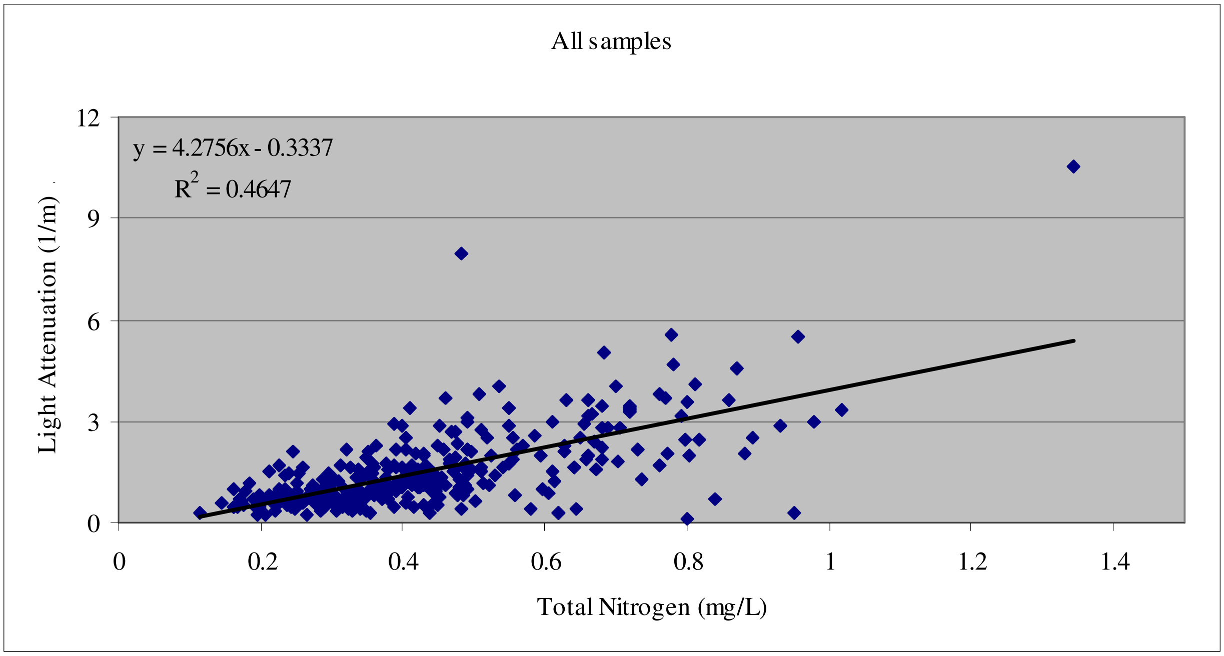




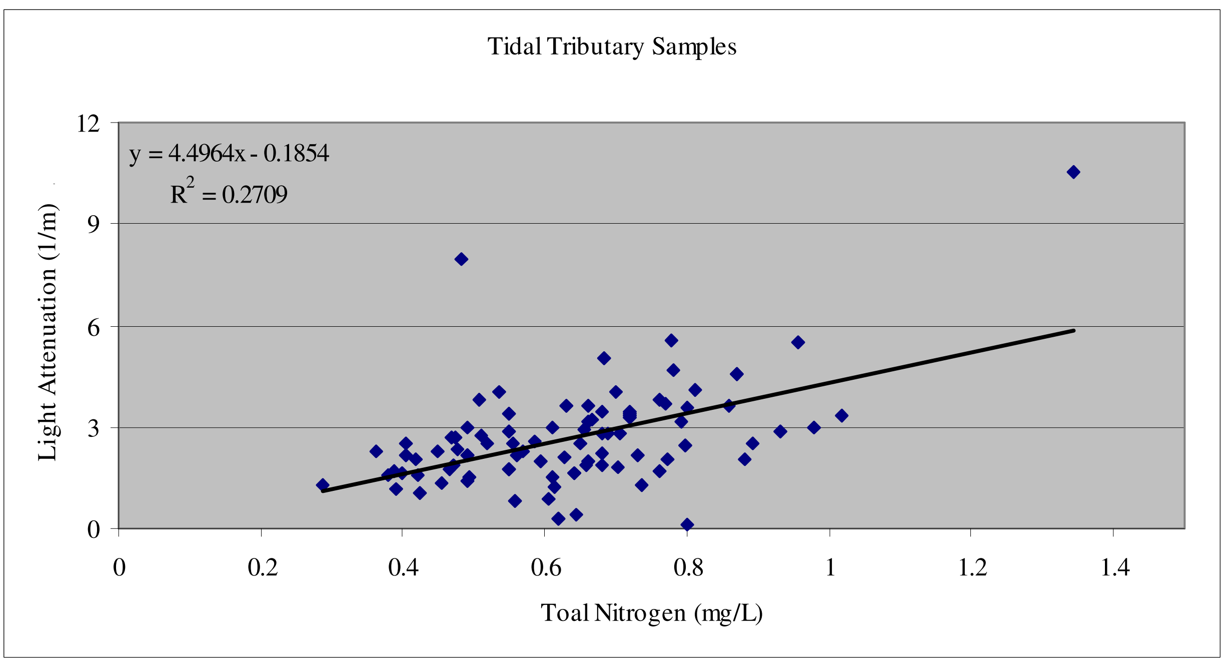
Source: DES (2009) at 22-23 (reformatted)

Figure 2: Statistically-significant relationships between light attenuation and total nitrogen concentrations in the Great Bay Estuary

(a) All samples in all parts of the estuary (2003-2010)



(b) Samples from tidal rivers (2003-2010)



Source: DES (2012b) at 10.

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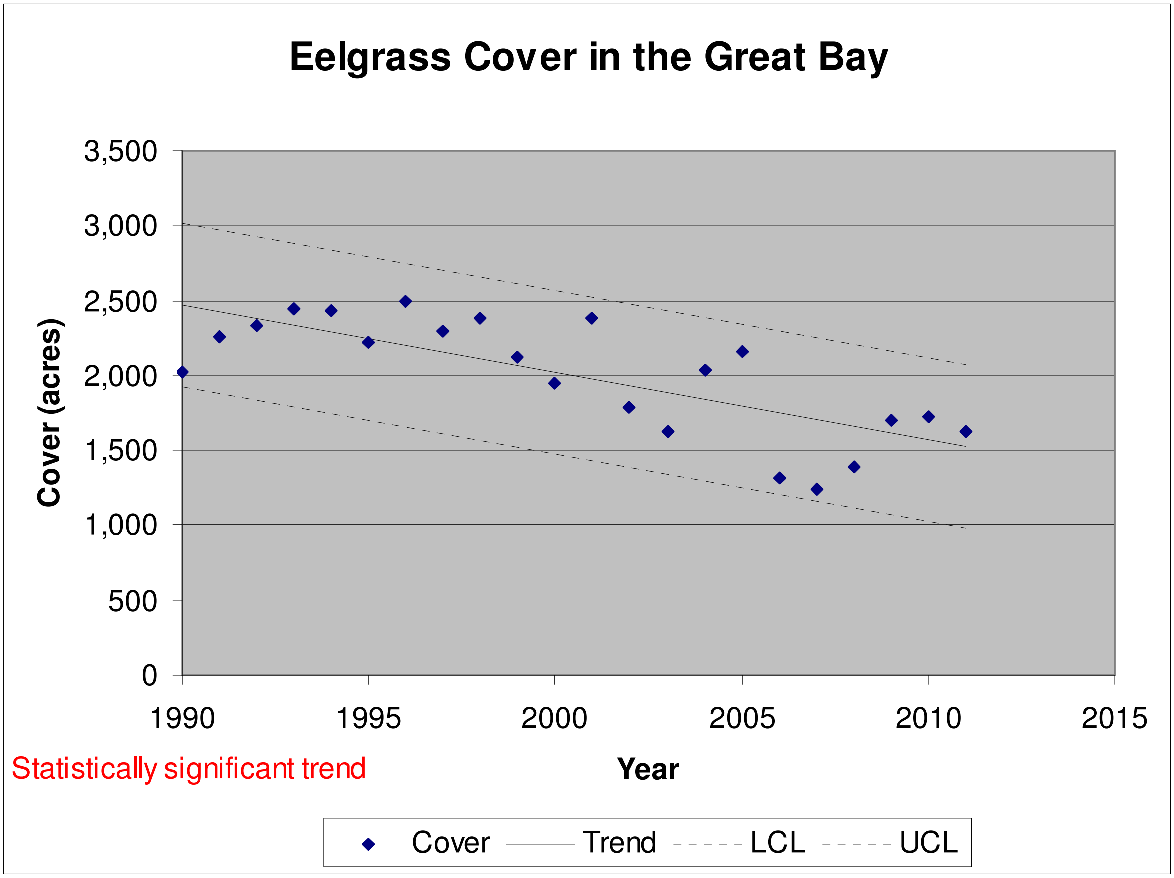
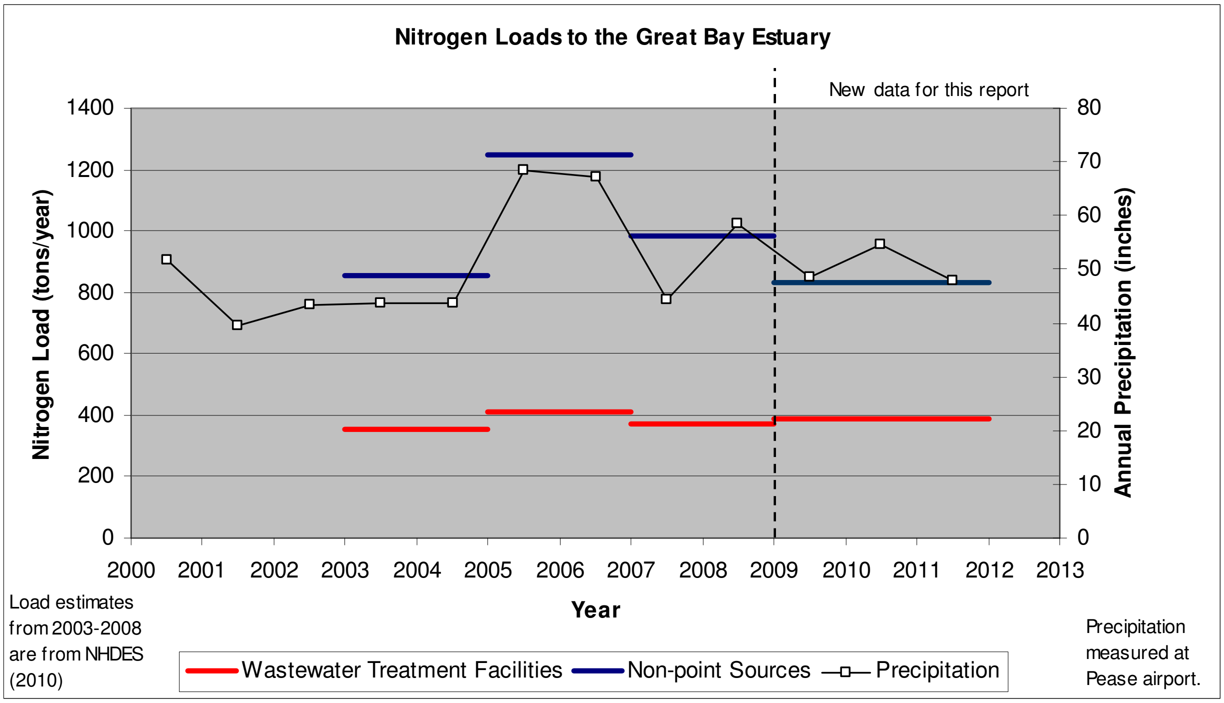
Figure 3: Eelgrass cover in the Great Bay proper



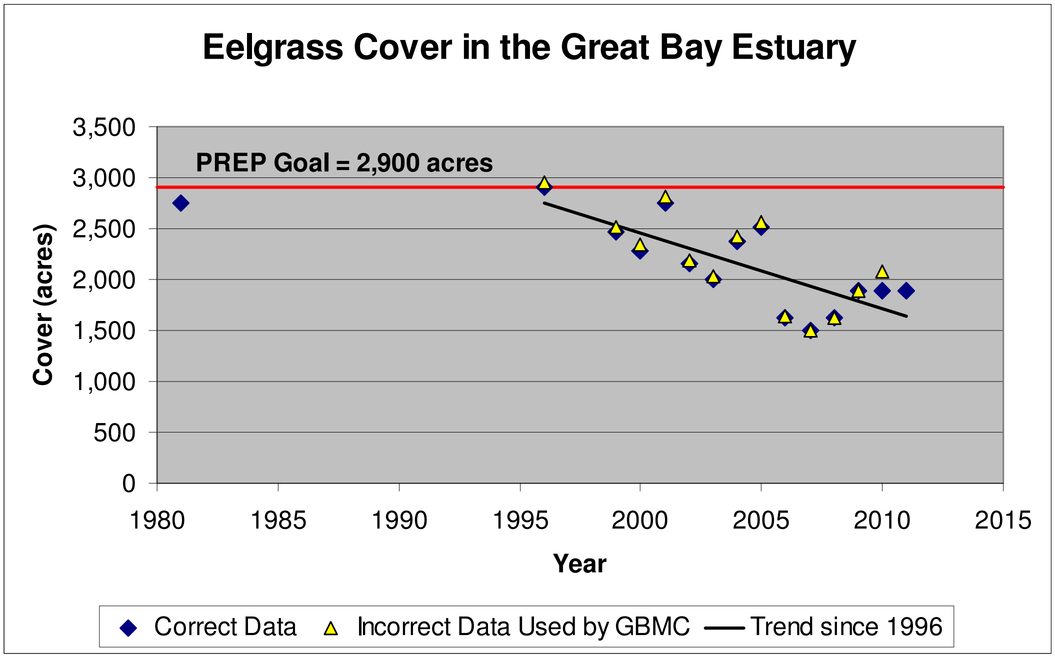
Source: PREP (2012) at 128

Figure 4: Nitrogen loads to the Great Bay Estuary

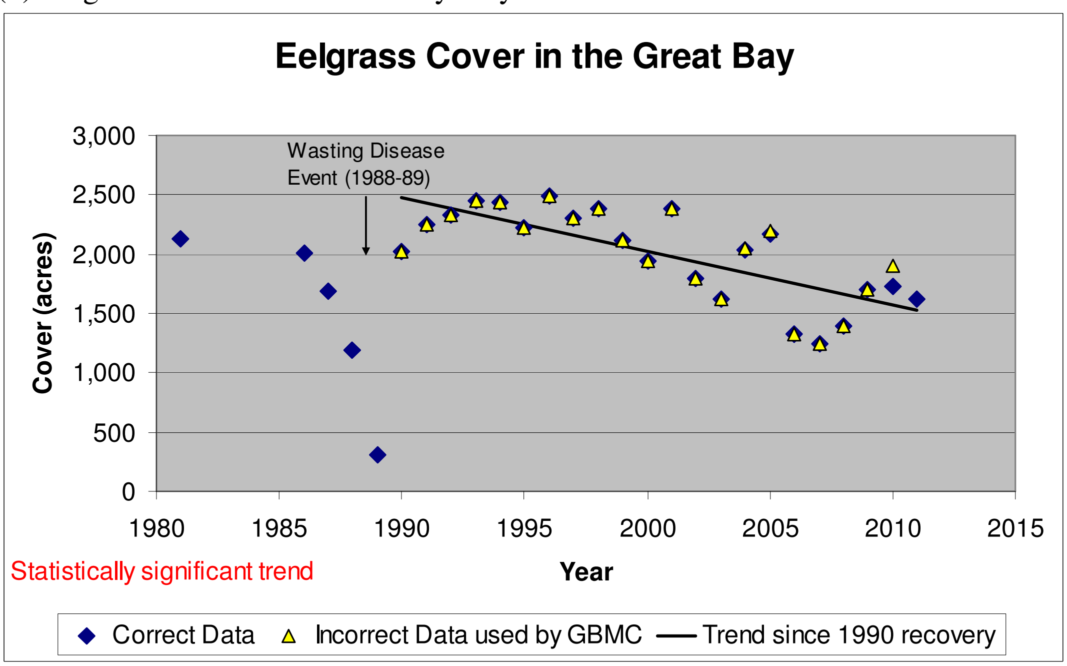


Source: PREP (2012) at 30

Figure 5
(a) Eelgrass Cover in the whole Great Bay Estuary, including Great Bay, Little Bay, Piscataqua River, Little Harbor, and Portsmouth Harbor



(b) Eelgrass Cover in the Great Bay only.



Source: Eelgrass data from Dr. Fred Short, UNH.

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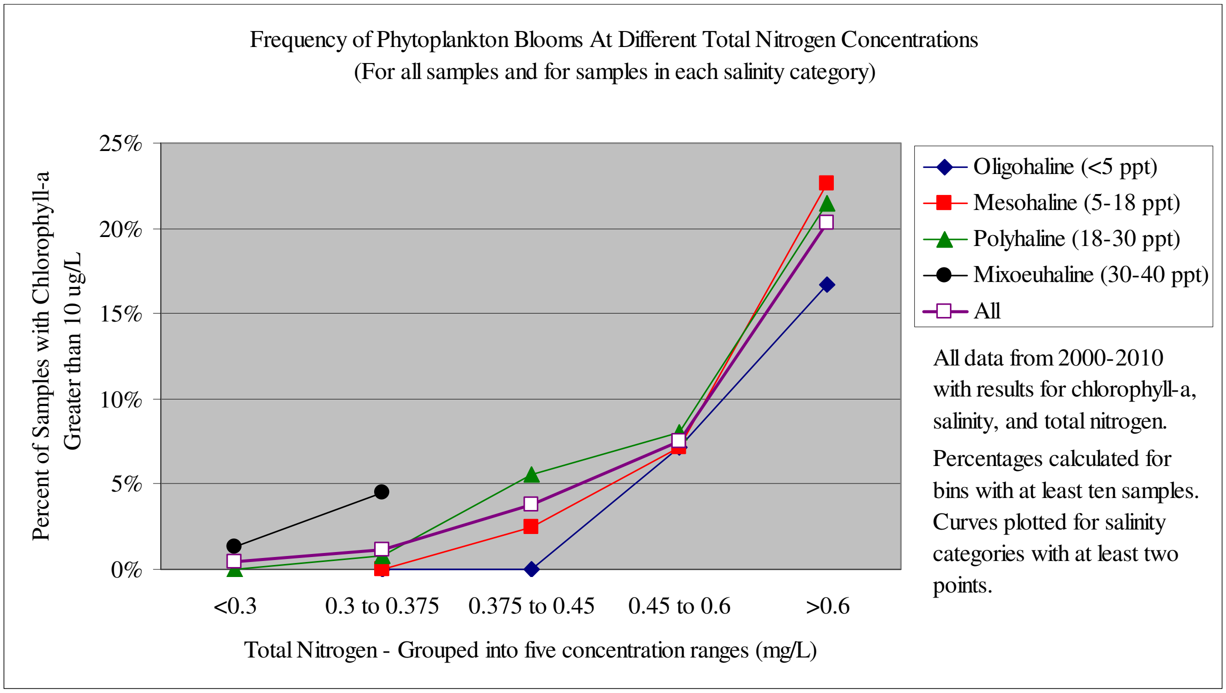
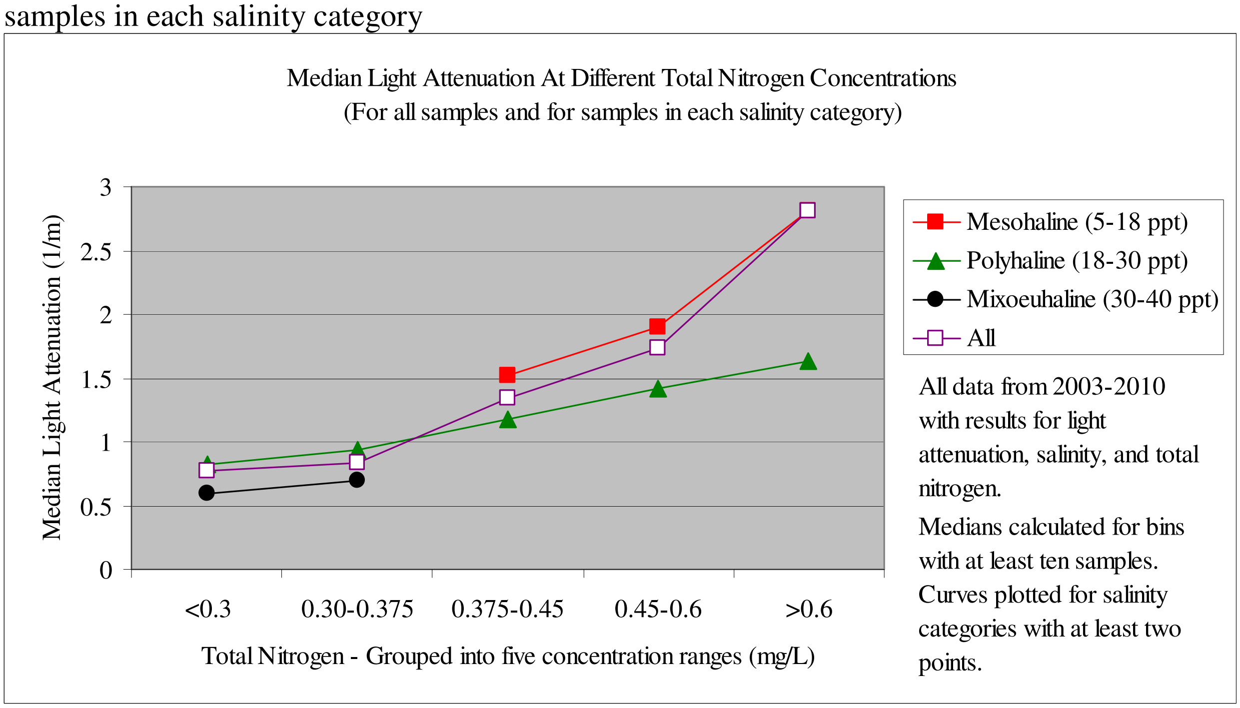
Figure 6
(a) Frequency of Phytoplankton Blooms at Different Total nitrogen Concentrations (for all samples and for samples in each salinity category)

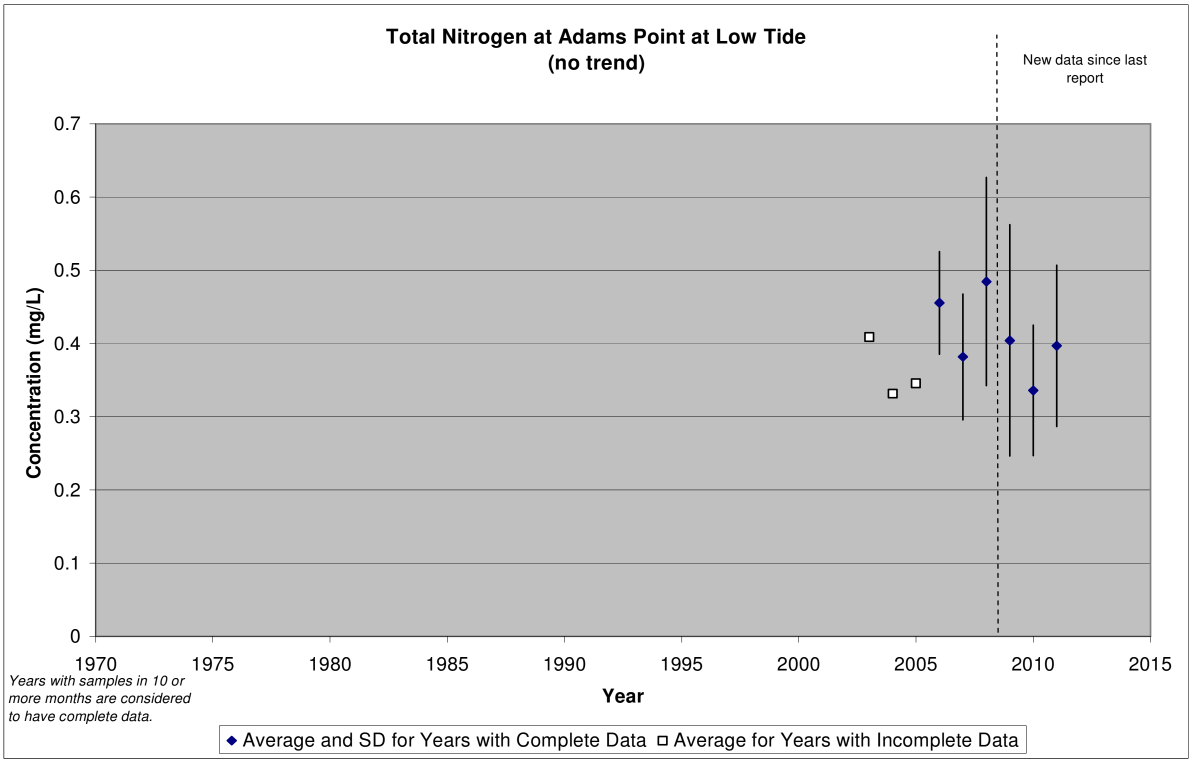


(b) Median Light Attenuation at Different Total nitrogen Concentrations (for all samples and for samples in each salinity category

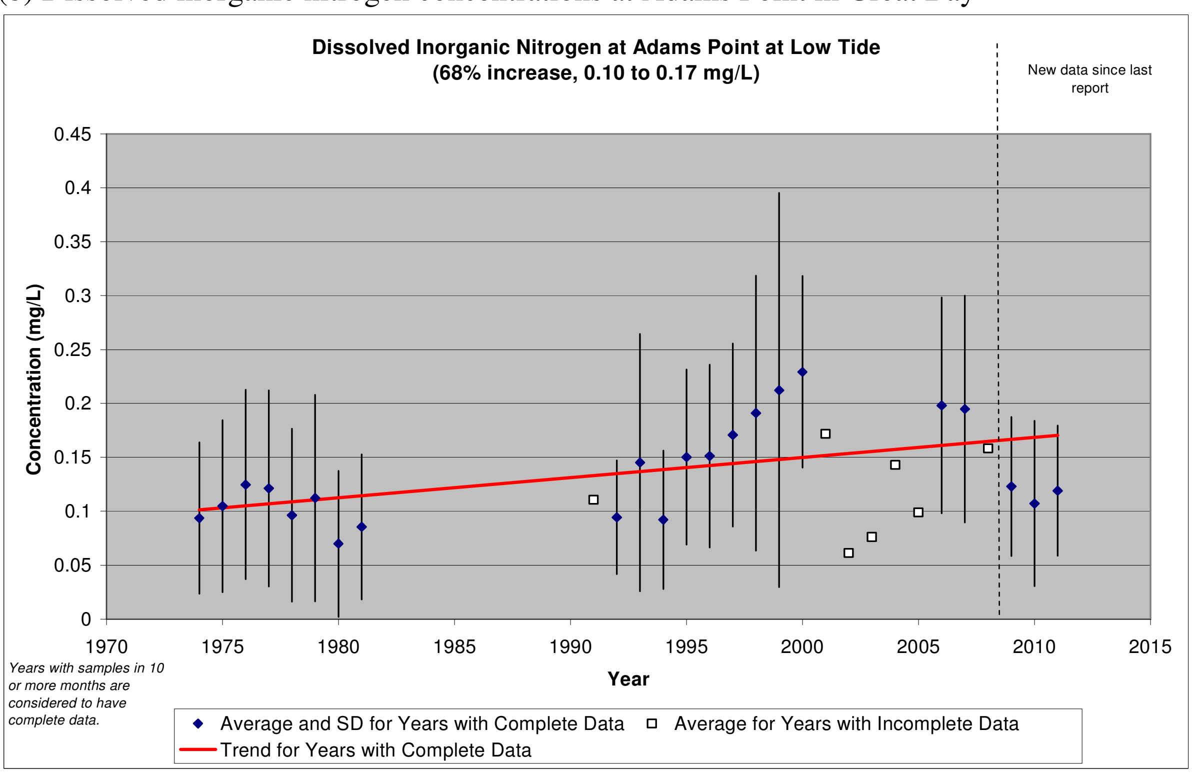


Source: DES (2012b) at 11, 13

Figure 7:
(a) Total nitrogen concentrations at Adams Point in Great Bay



(b) Dissolved inorganic nitrogen concentrations at Adams Point in Great Bay



Source: PREP (2012) at 53, 69