Eelgrass:

Coalition Perspective:

- Prolonged reduction in eelgrass cover began in 2006.
- The Coalition cites the effects of the Mother's Day storm in 2006 (when up to 15 inches of rain fell over the course of a few days) for eelgrass loss within Great Bay proper during this year.
- Great Bay has not been able to recover from the extreme storm event in 2006 but was able to recover from a wasting disease outbreak in 1989 when the eelgrass acreage in Great Bay dropped to about 300 acres.
- Eelgrass losses are caused by factors other than nitrogen such as turbidity, colored dissolved organic matter (CDOM), and sediment loads.
- The Coalition focuses on eelgrass coverage in Great Bay proper

EPA Perspective:

- Eelgrass coverage has been on a steady downward trend since 1996.
- Because the eelgrass was already declining prior to 2006 it was already a stressed system.
- It is much more difficult for a system that is already suffering the effects of chronic stress causing a ~~chronic~~ negative trend, to rebound from short term acute events such as the Mother's Day storm.
- The lack of recovery from the 2006 storm is not because the bottom no longer supports eelgrass but rather because recruitment was not significant. There can be multiple reasons for this including reduced seed production, reduced germination and survival, and invertebrates which are known to feed on eelgrass seeds. Also, seeds could be germinating but seedling survival is low. Seedlings need significantly more light than adult shoots to survive. In the less than clear waters of Great Bay seedling survival can be very difficult.
- There are 13 assessment zones within the Great Bay estuary which have historically had eelgrass. Of these, 7 assessment zones no longer have any eelgrass coverage and the remaining six have eelgrass coverages that continue on a negative trend.

Coalition Perspective:

- The Coalition cites to a PREP, 2016 report titled "Eelgrass/Macroalgae Discussion Primer for TAC Activities 2016-2017" stating, "These surveys have documented mats of macroalgae even below dense eelgrass beds. In this case is appears that eelgrass and macroalgae apparently co-exist in such a way that it is possible for complete coverage by both plant types."

EPA Perspective:

- The full quote from the PREP, 2016 report relates to how one might interpret eelgrass mapping and states, "One might think that one could use DES' "Eelgrass Viewer" and click on the various polygons on the map to find out what percent cover eelgrass was mapped at for certain areas, and then conclude that what isn't covered by eelgrass is covered by either bare ground or algae. However, that isn't the case, because the eelgrass and algae co-exist in such a way that it's possible for there to be complete coverage of both plant types in the same quadrat."

Commented [JH1]: Not relevant to issues noted – a regression line will always drop from the max level – The system was not impaired prior to 2005. The maximum growth level in 1996 is not the basis for assessing the health of eelgrass in this system (See 2018 CALM)

Commented [JH2]: Based on what factor is has this occurred. 1996 photos are not available, do there is no data in the record to confirm this is a correct statement.

Commented [JH3]: One is not required to go below a WQS under state or federal law– and this did not happen previously with wasting disease

Commented [JH4]: No basis for this assertion is presented or exists for this system.

Commented [JH5]: EPA provides no basis for this claim – light in system determined sufficient on multiple occasions.

Commented [JH6]: True but not relevant as to the cause. High CDOM naturally precludes river areas from eelgrass and that does not violated state or federal law.

Commented [LJ7]: It, or if wrong in original [sic]

Commented [LJ8]: Where is the partial quote – preceding or following the quote taken out of context by the coalition

Commented [JH9]: This is not responsive to the point being made

- The eelgrass beds in Great Bay are not dense. In 2016-2017, EPA measured shoot densities at 11 sites including Great Bay. Great Bay was on the lower end with about 200 shoots/m^2. Most location were around 500 shoots/m^2 with the highest just under 1000 shoots/m^2.
- A single snap shot of eelgrass and macroalgae together at one point in time does not mean they are peacefully co-existing.
- In NHDES's Numeric Nutrient Criteria for the Great Bay Estuary (2009), page 37 discusses 137 acres of macroalgae and 1,246 acres of eelgrass identified in Great Bay in 2007. In contrast, the maximum extent of eelgrass in Great Bay in 1996 was 2,421 acres. The macroalgae was predominantly located in areas where eelgrass formerly existed. Therefore, macroalgae mats have now replaced nearly 5.7% of the area formerly occupied by eelgrass in Great Bay.
- EPA does not dispute that eelgrass and macroalgae can exist in the same area however, when macroalgae proliferates as it has in the Great Bay Estuary, it can have detrimental effects to eelgrass habitats. Hauxwell et al. (2001) cite a critical threshold of 9-12 cm^2 of macroalgae as the point where eelgrass declines. This is likely due to light inhibition and sulfide build up in the sediments.

Commented [JH10]: Density has never been the basis of eelgrass health in this system. None of the other EPA studies cited were based on density. Historical density is not known – documents are not available to confirm accuracy of photos. Prior density predictions from Dr. Short were determined to be unreliable.

Commented [LJ11]: Weird word in this context, how about non-competitively?

Commented [JH12]: This is the best available data and EPA is required to use the best available data.

Commented [JH13]: The record confirms this was a temporary condition and eelgrasses prepopulated this area – see Trowbridge Deposition.

Commented [LJ14]: I don't understand this area value. Is it the depth of the macroalgal layer? If so, it should be cm, not cm2

Commented [JH15]: This is not a relevant statement for this system. The eelgrasses are reported to be very healthy in areas where macroalgae are growing beneath the canopy.

<u>Coalition Assessment of TN and Chlorophyll-a Response in the Upper Piscataqua River Following Voluntary TN Reductions at the Dover and Rochester POTWs</u>

Coalition Perspective:

- In 2015 the Coalition performed sampling in the Upper Piscataqua River and also deployed data sondes at several locations. This sampling was performed following upgrades to both the Rochester and Dover POTWs.
- On page 10 of their report the Coalition states that while total nitrogen decreased significantly, no corresponding reduction in chlorophyll-a was detected in 2015.
- They also state that DO concentrations in these waters were also demonstrated to be insensitive to the change in ambient TN and DIN levels.

EPA Perspective:

- The Rochester upgrades went online in the summer of 2013, the Dover upgrades went online early in the summer of 2015. The Coalition conducted their evaluation of the effect of total nitrogen reductions in August and September of 2015, just after the Dover upgrades went online.
- Depending on the system, the effects of reduced total nitrogen loading can take years to be realized.
- The Coalitions focused on chlorophyll-a which has not been an issue in this part of the Great Bay system.
- They did not assess macroalgae which is a significant issue in the system.
- The Coalition did not present sonde data collected from three locations during their study. Sonde deployments at each of these stations show significant periods of dissolved oxygen supersaturation (lasting for over a week) in excess of 160% which is a clear sign of primary growth stimulated by nitrogen.
- After total nitrogen reductions at Dover and Rochester, patches of eelgrass have been observed in the lower Cocheco River where it has never been documented.

Commented [JH16]: Not a relevant observation or response. Algal growth response does not take years and this system showed an immediate major decrease in TN/DIN with no effect on algal growth. Macroalgal growth occurs from zero each year – with no apparent relationship to the TN level present.

Commented [JH17]: This comment applies to the entire system. There is no chl a response to varying TN levels and never has been in this system, as noted by PREP reports.

Commented [JH18]: Macroalgae growth is not assessed anywhere in this system where prime sub-tidal eelgrass habitat exists. There is minimal macroalgal growth in the Piscataqua River, confirming it cannot be the reason eelgrass repopulation has failed to occur in the past 20 years.

Commented [JH19]: This is not relevant to whether TN is affecting eelgrass propagation.

Commented [JH20]: That occurred in an extreme low flow year which reduced the naturally high CDOM level and improved water clarify. It was also transient occurrence.

Mischaracterization of materials from the Piscataqua Region Estuaries Partnership (PREP), New Hampshire Department of Environmental Services (NHDES), and external advisors:

Coalition Assertion and Citation:

- Decreases in dissolved inorganic nitrogen to levels from the 1970s and early 1990s show improvements to the system.
- PREP's 2018 State of Our Estuaries (SOOE). "Since then, DIN levels have decreased such that the concentrations in 2014-2015 are equivalent to those concentrations seen in the 1970s (PREP 2018 SOOE at 18-19)."

Full/Omitted Citations EPA Perspective:

- The Coalitions does not provide the part of the SOOE report on DIN which states, "This report discuss two forms of nitrogen: total nitrogen (TN) and dissolved inorganic nitrogen (DIN). It is important to note that both forms – but especially DIN, are taken up quickly by plants and algae, so the concentration of DIN does not necessarily reflect the potential effects of nitrogen on the estuarine system."
- The Coalition also leaves out the statement from the SOOE report stating, "Additionally, loading has been reduced due to consecutive years of low annual rainfall amounts and low occurrence of extreme rainfall events, which equates to less non-point source loadings from run-off."

Coalition Assertion and Citation:

- The Coalition cites to NHDES's 2016 final Section 303(d) list and the Great Bay Estuary 303(d) List Technical Support Document (TSD) to support their view that nitrogen is not an issue for Great Bay.
- The Coalition provides the following quote from the TSD, "It is less clear, at this time, whether the response datasets demonstrate sufficient power to determine that the eutrophication effects on designated used can be attributed to total nitrogen alone. Given that uncertainty, impairment is not warranted under New Hampshire's narrative standard. As such, this assessment zone has been assessed at Insufficient Information – Potentially Not Supporting (3-PNS)."

Full/Omitted Citations EPA Perspective:

- The Coalition leaves out importance sentences prior to their citation. These sentences state, "Chlorophyll-a experiences peak concentrations annually from 10-69 ug/L in the south western area. The eelgrass beds are degraded and the available light attenuation (median=1.5 m^{-1} (n=128)) is poor. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), as appears to be occurring in the Great Bay assessment zone. There is evidence that macroalgae is impacting eelgrass and changing the species composition and diversity in Great Bay to some extent. Using data from Great Bay (Pe'eri, Morrison, Short, Mathieson, Brook, & Trowbridge, 2008), NHDES determined that macroalgae mats had replaced nearly 5.7% of the area formerly occupied by eelgrass in Great Bay in 2007 (NHDES, 2009) and that replaced area has not been recolonized by eelgrass. Some of the loss of eelgrass in the intertidal zone is consistent with smothering by macroalgae. The foremost authority on macroalgae for this estuary, Dr. Arthur C. Mathieson, commented on the draft 2012 303(d) that he remains concerned about the macroalgae

Commented [LJ21]: FYI "Forms" may not have been the best way to describe the differences between TN and DIN. TN is made up of NO3, NO2, NH3, Organic nitrogen compounds in a total particulate + dissolved sample; while DIN is made up of NO3, NO2, NH3 (only is a filtered sample). In the future perhaps two "compilations" of nitrogen would be better. Nevertheless, the point is well taken, the forms of nitrogen contained in DIN in water are much more labile and represent the "left-overs" after the plants use them.

Commented [JH22]: The point is not relevant as DIN reduction would occur in all prior years due to plant uptake also. DIN has plainly been reduced dramatically since the later 1990s, as PREP noted.

Commented [JH23]: The system data show that DIN is much lower regardless of what type of "flow year" it is. DIN is the form of N that may stimulate macroalgal growth – it is now at a 40 year low.

Commented [LJ24]: Obviously, it is "use" not "used." If in original put [sic]

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Commented [JH25]: This comment is only applicable for impacts occurring at the mouth of the Squamscott River and is not relevant to 95% of the estuary. It provides no basis to regulate Dover's discharge which has no impact on this condition.

Commented [JH26]: There is no such evidence and if there was EPA should present it.

Commented [JH27]: Statement confirms that the author does not know the current status of the system. This was a temporary occurrence after the Mother's Day storm. No areas on eelgrass have been "replaced" by macroalgae under current conditions.

Commented [JH28]: There is no documented "smothering" of eelgrass by macroalgae – the author of this statement (Gobler) was just engaging in unsupported speculation.

and epiphyte conditions in Great Bay (NHDES, 2013). Burdick et al. (2016) note that, "Monitoring results from 2014 show high levels of cover of nuisance green and red algae (Ulva and Gracilaria, respectively) at all sites except near the mouth of the Estuary." The Burdick et al. (Burdick, Mathieson, Peter, & Sydney, 2016) study included several sites within Great Bay. Some of the classic indicators of nutrient eutrophication are present in this assessment zone and total nitrogen remains elevated in portions of the assessment zone. As the discussion above illustrates, there is a clear nutrient "signature" in the data."

- The 2016 303(d) has not yet been approved nor have all sections for Great Bay for the 2014 303(d) list.
- The threshold NHDES seems to be using is whether or not nitrogen alone is responsible for eutrophication related issues in Great Bay. The regulatory threshold for whether or not a pollutant needs to be limited is whether or not it has the reasonable potential to cause or contribute to numeric or narrative water quality standards, not whether or not is the sole cause. Nitrogen clearly plays a role in eutrophication effects in Great Bay.

Coalition Assertion and Citation:

- The Coalition cites to NHDES's 2016 final Section 303(d) list and the Great Bay Estuary 303(d) List Technical Support Document (TSD) to support their view that nitrogen is not an issue for Upper Piscataqua River.
- The Coalition provides the following quote from the TSD, "However, there are insufficient response datasets to determine the eutrophication by total nitrogen alone is not known to be strong enough to warrant impairment under New Hampshire's narrative standard. Additionally, the nutrient load to this assessment zone is rapidly decreasing due to the ongoing work by the municipalities (Rochester reductions in 2015 and Dover began reductions in 2015). As such, this assessment zone has been assessed as Insufficient Information – Potentially Not Supporting (3-PNS) for total nitrogen."

Full/Omitted Citations EPA Perspective:

- Again, the Coalition leaves out important sentences prior to their citation. These sentences state, "The grab sample-based light attenuation (median=1.025 m_{Δ}^{-1} (n=81)) is quite poor suggesting strong resuspension in the system. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), as appears to be occurring in the Great Bay Estuary. The foremost authority on macroalgae for this estuary, Dr. Arthur C. Mathieson, commented on the draft 2012 303(d) that he remains concerned about the macroalgae and epiphyte conditions in Great Bay (NHDES, 2013). At this time there are some of the classic indicators of nutrient eutrophication present in this assessment zone and total nitrogen remains high".
- The 2016 303(d) has not yet been approved nor have all section for Great Bay for the 2014 303(d) list.
- The threshold NHDES seems to be using is whether or not nitrogen alone is responsible for eutrophication related issues in Great Bay. The regulatory threshold for whether or not a pollutant needs to be limited is whether or not it has the reasonable potential to cause or contribute to numeric or narrative water quality standards, not whether or not is the sole cause. Nitrogen clear plays a role in eutrophication effects in Great Bay.

Commented [JH29]: This only occurs in areas that are not sub tidal – and does not adversely affect the prime eelgrass habitat as noted by Dr. Burdick in his most recent report.

Commented [JH30]: The is no "clear signature in the data". In fact, EPA points to no data that show eelgrasses are currently adversely affected by anything occurring in this system.

Commented [JH31]: EPA has violated its CWA responsibilities in refusing to address three submitted delisting from DES.

Commented [JH32]: There is no objective assessment or data analysis showing TN is even partially responsible or significantly affecting eelgrass propagation in this system.

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Commented [JH33]: Whether someone "remains concerned" based on a statement 8 years ago is not relevant to declaring waters impaired or dictating a major nutrient reduction program. Speculation of "concern" is not a basis for imposing regulatory requirements under state or federal law.

Commented [JH34]: There is no data showing "classic indicators" of eutrophication in this system. Invasive species have increased shallow water macroalgal growth, completely unrelated to the nutrient concentration present. Phytoplankton growth (the "classic" indicator) has remained low and essentially unchanged in 40 years. DO remains high. Eelgrasses have continued to propagate in all areas of GB. There is no documentation of macroalgal "smothering".

Commented [JH35]: There is no evidence that DES is applying a "solely responsible" impairment framework

Commented [JH36]: "Reasonable potential" is a permitting term, not the term employed in the state narrative criteria, which controls in this instance.

Coalition Assertion and Citation:

- The Coalition believes that the Great Bay Estuary may have traits that make it tolerant of high nutrient levels.
- The Coalition cites the SOOE report stating,"[T]he Great bay estuary may have traits that make it more tolerant of high nutrient levels (such as high flushing rates) […] (SOOE at 8)."

Full/Omitted Citations EPA Perspective:

- The full sentence states, "While the Great Bay Estuary may have traits that make it more tolerant of high nutrient levels (such as high flushing rates) our system has three times the threshold from that study which is a concern."
- EPA does not believe that the estuary has traits which make it more tolerant of high nutrient levels. Eelgrass acreage has been steadily declining throughout the estuary since 1996 and is now completely absent where it had previously existed in tidal rivers.

Coalition Assertion and Citation:

- The Coalition cites to external advisors for the SOOE report who reviewed stressors in Great Bay to support their assertion that the contribution of total nitrogen to conditions in Great Bay is not known.

Full/Omitted Citations EPA Perspective:

- The Coalition did not include the external advisors statement on page 9 of the report which states, "Despite encouraging reductions from wastewater treatment facilities, nitrogen loading levels are high enough that they should be considered an important stressor."
- The regulatory threshold for whether or not a pollutant needs to be limited is whether or not it has the reasonable potential to cause or contribute to numeric or narrative water quality standards, not whether or not is the sole cause. Nitrogen clearly plays a role in eutrophication effects in Great Bay.

Commented [JH37]: The response is not relevant – GB certainly has confirmed less susceptibility to nutrient impacts due to the high flushing rate and tidal exchange.

Commented [JH38]: Eelgrass decline in this system has been documented to be caused by a number of non-nutrient events (wasting disease, high flows delivering greater CMOM from the watershed). Whether eelgrass have increased or decreased has nothing to do with whether a is physically less susceptible to nutrient effects.

Commented [JH39]: The PREP report plainly concluded that the effect of TN needed to be confirmed, not that it was confirmed TN was presently a significant stressor in this system.

Commented [JH40]: EPA's claim is not supported by any actual data analysis for this system.