



THE TAMPA BAY NITROGEN MANAGEMENT CONSORTIUM *PARTNERSHIP FOR PROGRESS*

TO: Drew Bartlett, FDEP
Mary Walker, US EPA Region 4

FROM: Ed Sherwood, TBEP Executive Director (NMC Facilitator)

DATE: March 7, 2019

SUBJECT: 2018 Tampa Bay Nutrient Management Compliance Assessment Results

CC: Jessica Mostyn, Erin Rasnake, Kevin Petrus, Kevin O'Donnell, Julie Espy, Terry Hansen, Daryll Joyner (FDEP Tallahassee)
Ramandeep Kaur, Vishwas Sathe, Amaury Betancourt, Anthony Annibali, Edgar Guerron-Orejuela (FDEP Tampa)
Anne Heard, Annie Godfrey, Felicia Burks, Mark Nuhfer, Tom McGill (EPA Region 4)
Jeff Greenwell, Santino Provenzano, Tony Janicki, Ray Pribble (TBNMC)
Ed Sherwood, Maya Burke (TBEP)

On behalf of the Tampa Bay Nitrogen Management Consortium, please find attached the 2018 update on water quality and seagrass resources in the Tampa Bay estuary. This update has been developed in accordance with the compliance assessment adopted through FDEP's Tampa Bay Reasonable Assurance determination on December 22nd, 2010 ([Link to FDEP Final Order](#)), FDEP's subsequent approval of the 2017 RA Update ([Link to FDEP Acceptance Letter](#)), and the federally-recognized TMDL for Tampa Bay ([Link to EPA TMDL](#)). The formal annual compliance assessment utilized by the Consortium is detailed in Section VIII.B of the Final 2009 Reasonable Assurance Addendum: Allocation and Assessment Report ([Link to Final Document](#)).

In summary, chlorophyll-a concentrations in all major bay segments were below FDEP-approved numeric nutrient criteria thresholds. Elevated concentrations in Old Tampa Bay and Lower Tampa Bay were primarily due to *Pyrodinium bahamense* and *Karenia brevis* blooms, respectively. Hillsborough Bay also showed elevated concentrations during two months in 2018 - the fall event coincided with blooms of the nonharmful alga, *Tripos hircus*. The approved thresholds were adopted as part of FDEP's 2002 Reasonable Assurance determination for Tampa Bay and, at that time, it was determined that Tampa Bay's seagrass restoration goals could be achieved if annual chlorophyll-a concentrations remained below these thresholds. If a bay segment's chlorophyll-a concentrations remain above thresholds for 2 concurrent years, additional compliance assessment steps are required by the Consortium. This nutrient management strategy has been used consistently by the TBEP and Consortium in their Annual Decision Matrix and Assessment reports for Tampa Bay ([Link to 2018 Update Report](#)).

Tampa Bay's total seagrass coverage continues to remain above the recovery goal, though a slight decrease in acreage was observed from 2016 to 2018. The baywide coverage was estimated to be 40,618 acres as of 2018 (Figure 5). As in 2016, total seagrass coverage remains above both the baywide target (38,000 acres) and the total estimated historic seagrass coverage of the 1950s (40,420 acres). As such, implementation of the Consortium's approved nutrient management strategy continues to be a successful, adaptive management approach for the Tampa Bay estuary.

Thank you again for your continued participation in the Consortium's process. Please contact Ed Sherwood (esherwood@tbep.org) with any questions about the Consortium's Annual Compliance Assessment.

2018 Tampa Bay Estuary Nutrient Management Compliance Assessment

On December 22nd, 2010, FDEP Secretary Drew signed a Final Order ([FDEP 2010](#)) accepting and approving the 2009 Reasonable Assurance (RA; [TBNMC 2010](#)) Addendum for the Tampa Bay estuary. The final order found that the Nitrogen Management Consortium (NMC) provided FDEP reasonable assurance that: 1) completed and proposed management actions in the 2009 RA Addendum will result in the continued attainment of the estuarine nutrient criteria within Tampa Bay, and 2) compliance with the allocations in the 2009 RA Addendum ensures reasonable progress towards continued attainment of the estuarine nutrient criteria and associated Class III designated uses. Furthermore, the FDEP finalized a WQBEL for the Tampa Bay estuary in accordance with the allocations developed under the 2009 RA Addendum in November 2010. The Consortium completed subsequent RA Updates in [2012](#) and [2017](#) maintaining allocations and expanding upon projects originally defined in the [2002 RA Submittal](#), [2007 RA Update](#) and [2009 RA Addendum](#).

As part of the compliance assessment stipulated under the 2009 RA Addendum, the NMC committed to assess the water quality and seagrass conditions within Tampa Bay and report these to FDEP and EPA annually. The Consortium's assessment responsibilities are shown in green in Figure 1. It should be noted that the Consortium's reasonable assurance assessment strategy begins with the observation of water quality conditions in the bay for a particular year. As is recommended in numerous EPA guidance documents for the development of numeric nutrient criteria, the Consortium's assessment strategy attempts to apply a stressor-response rationale for the determination of nitrogen load allocation reasonable assurance in Tampa Bay.

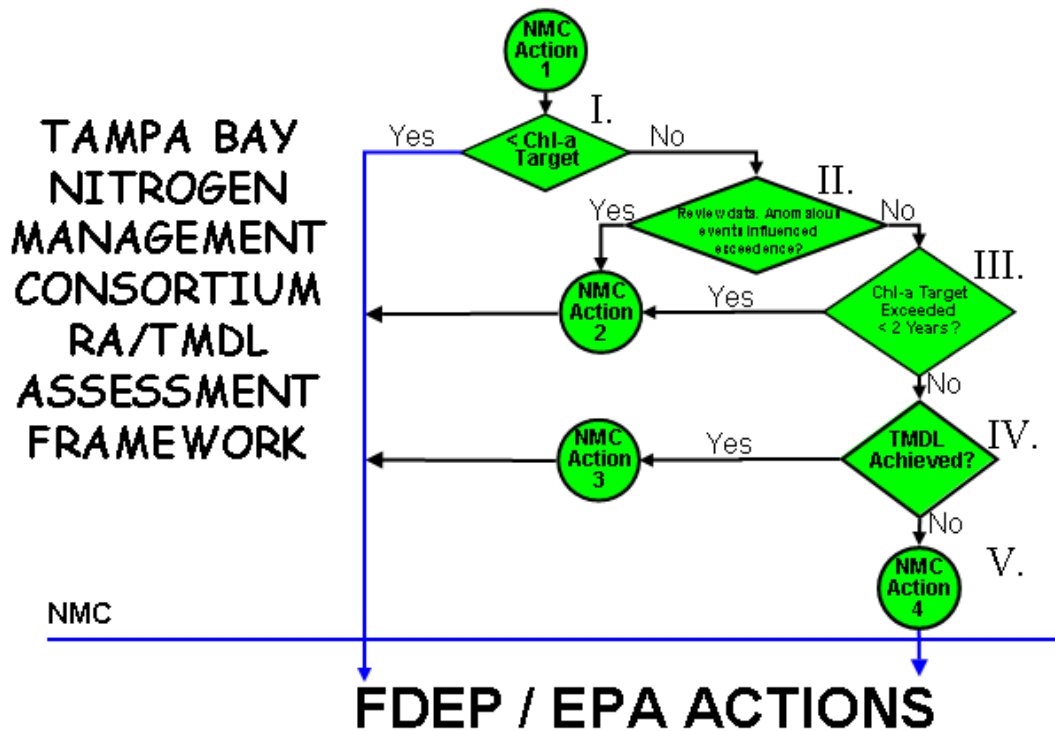


Figure 1: Nitrogen Management Consortium decision framework to assess future reasonable assurance of adopted allocations. Actions and steps to be conducted by the NMC are shown in green. Steps, decision points, and actions are outlined in Table 1 (below) according to the Roman numerals listed in the figure.

The framework is applied on a bay-segment basis, and is predicated on assessing annual attainment of the bay segment chlorophyll-a concentration threshold as the initial step. If the bay segment-specific chlorophyll-a threshold is met, the Consortium annually reports the results to FDEP and EPA and additional assessment steps are not required by the Consortium (by June of the following year). If annual average chlorophyll-a thresholds are not met in one or more bay segments, additional assessment steps are required by the Consortium as noted in the framework and assessment process (Figure 1; Table 1).

Regardless of the assessment results, the Consortium will annually report (by June of the following year) whether the bay segment specific chlorophyll-a thresholds are met using the Environmental Protection Commission of Hillsborough County (EPCHC) dataset, as traditionally assessed using the “Decision Matrix” management strategy developed by the TBEP ([Janicki, Wade and Pribble 2000](#)) and will deliver this to FDEP and EPA (Figure 1; NMC Action 1 in the Framework). If an annual, individual exceedence of a bay segment chlorophyll-a threshold is observed, an addendum report outlining the anomalous event(s) or data which influenced the bay segment chlorophyll-a exceedence will be delivered to FDEP and EPA upon review by NMC participants by September of the following year (Figure 1; NMC Action 2 in the Framework). An evaluation of the bay segment assimilative capacity (i.e. revision to the federally-recognized TMDL) is formally considered (if not already considered by the NMC) when bay segment chlorophyll-a thresholds are not met in 2 concurrent years, and hydrologically normalized loads for those years meet the federally-recognized TMDL (Figure 1; NMC Action 3 in the Framework). Alternatively, when bay segment chlorophyll-a thresholds are not met in 2 concurrent years and hydrologically normalized loads for those years also do not meet the federally-recognized TMDL, the Consortium will deliver a full loading report to FDEP and EPA comparing the observed, combined entity/source annual or multiple year loadings to the sources’ 5-yr annual average allocation by September of the following year. This report will identify any exceedences among combined entity/source load categories after taking into consideration “set allocation” sources and hydrologically-normalized sources, and if necessary, whether exceedences were observed for individual MS4 or unpermitted (LA) sources (Figure 1; NMC Action 4 in the Framework). It is noted that FDEP will independently assess individual entities for compliance with their allocations.

Table 1: Assessment steps linked to the Nitrogen Management Consortium’s decision framework, as depicted in Figure 1.

Assessment Step	Result	Action
I. Determine annual bay segment specific chlorophyll-a FDEP threshold attainment as traditionally assessed using the Decision Matrix management strategy developed by the TBEP (TBEP Technical Publication 04-00).	Yes	NMC Action 1
	No	NMC Action 1
II. Review data and determine if an anomalous event(s) influenced non-attainment of the bay segment specific chlorophyll-a threshold.	Yes	NMC Action 2
	No	Go to III.
III. Determine if the chlorophyll-a thresholds have been exceeded for <2 consecutive years.	Yes	NMC Action 2
	No	Go to IV.
IV. Determine if the bay segment specific federally-recognized TMDL has been achieved using the hydrologically-adjusted compliance assessment outlined in NMC Decision Memo #11 (Appendix 2-11).	Yes	NMC Action 3
	No	Go to V.
V. For a given year or for multiple years, compile and report entity-specific combined source loads in comparison to 5-yr annual average reasonable assurance allocation.	Compile & Report	NMC Action 4

NMC actions outlined in Figure 1 and Table 1 performed during RA Implementation Period (2017-2021) are as follows:

- NMC Action 1 – A report assessing attainment of bay segment specific chlorophyll-a thresholds using the EPCHC dataset, as traditionally assessed using the Decision Matrix management strategy developed by the TBEP ([TBEP Technical Publication 04-00](#)) will be delivered to FDEP and EPA (*this report*).
- NMC Action 2 – A report of the anomalous event(s) or data which influenced the bay segment chlorophyll-a exceedence will be delivered to FDEP and EPA, upon review by NMC participants (*this report*).
- NMC Action 3 – Consider re-evaluation of the bay segment assimilative capacity based on nonattainment of bay segment chlorophyll-a threshold while meeting federally-recognized TMDL.
- NMC Action 4 – If federally-recognized TMDL not achieved, compile results of hydrologic evaluation for FDEP's review and identify potential further actions needed to achieve reasonable assurance for bay segment allocations.

2018 Results Summary

Results from 2018 indicate that all bay segments met chlorophyll-a thresholds accepted by the FDEP to maintain FDEP Reasonable Assurance for Tampa Bay and to comply with the EPA TMDL (Figure 2) and estuarine numeric nutrient criteria for Tampa Bay ([EPA Approval Letter Nov. 30, 2012](#)). In Old Tampa Bay, chlorophyll-a concentrations were elevated in a poorly flushed region that has produced summertime blooms of *Pyrodinium bahamense* (Figure 3; *Note that individual station exceedences are not considered in this RA compliance assessment*). This observation is reflected in the majority of summertime months with chlorophyll-a concentrations higher than long-term median values in Old Tampa Bay (Figure 4). In response, the Consortium funded additional investigations to determine future management actions in Old Tampa Bay that may alleviate the conditions fostering these summertime blooms and is proactively developing loading information over the 2017-2018 period. An integrated ecosystem model was also employed to determine the net environmental benefits that may result from reduced point sources, nonpoint sources and causeway obstructions in Old Tampa Bay ([TBEP Tech. Pub. #10-15](#)). Elevated chlorophyll-a concentrations were also observed in Hillsborough Bay and Lower Tampa Bay as a result of *Triplos hircus* and *Karenia brevis* blooms, respectively. In Middle Tampa Bay monthly chlorophyll-a conditions during 2018 were largely within or below median historic ranges (Figure 4).

Seagrasses are relatively stable given overall improved water quality conditions within Tampa Bay. Aerial photographs taken in December 2017 - January 2018 indicate that seagrass coverage decreased by 1,038 acres baywide over the 2016 estimate, with a total of 40,618 acres (Figure 5). Seagrass acreage showed the greatest decreases in Hillsborough Bay (-639 acres) and Old Tampa Bay (-406 acres). The greatest increases were observed in Boca Ciega Bay (+144 acres) and Lower

Tampa Bay (+155 acres) over the 2016 to 2018 period. The next SWFWMD seagrass coverage estimates will be developed from aerial photographs acquired over the winter 2019-20 period, following the extensive red tide event that plagued the region throughout 2018.

Detailed results for the 2017-2021 RA implementation period are also provided in Tables 2-6 for each bay segment. As of the 2018 reporting period, NMC Actions 2-5 are not necessary based upon observed water quality and seagrass conditions within Tampa Bay. Individual annual reports of the bay's conditions from 2017 – 2018 can be found on the TBEP Tech website, as specified in the following links (TBEP Tech Pub. [01-18](#); [01-19](#)). A summary of historic attainment of the regulatory chlorophyll-a thresholds for each of the bay segments is depicted in Figure 6.

Lastly, annual hydrologic conditions within all four bay segments in 2018 were estimated to exceed 1992-1994 levels. Therefore, hydrologic adjustments for evaluating compliance with load allocations/permitting targets should be applied for the Old Tampa Bay, Hillsborough Bay, Middle Tampa Bay, and Lower Tampa Bay segments ([TBEP Tech. Pub. #05-12](#) & [#03-16](#)). The estimated hydrologic loads for each bay segment relative to observed 1992-1994 levels are indicated in the table below. The associated compliance load adjustment factors (if applicable) are also specified.

Bay Segment	1992-1994 Hydrology (95% Prediction Interval, million m³)	2018 Hydrology Estimate (million m³)	Compliance Load Adjustment Factor
Old Tampa Bay	383 – 548	775	1.73
Hillsborough Bay	753 – 1110	1633	1.80
Middle Tampa Bay	524 – 756	762	1.18
Lower Tampa Bay & the Remainder of LTB	312 – 402	436	1.21

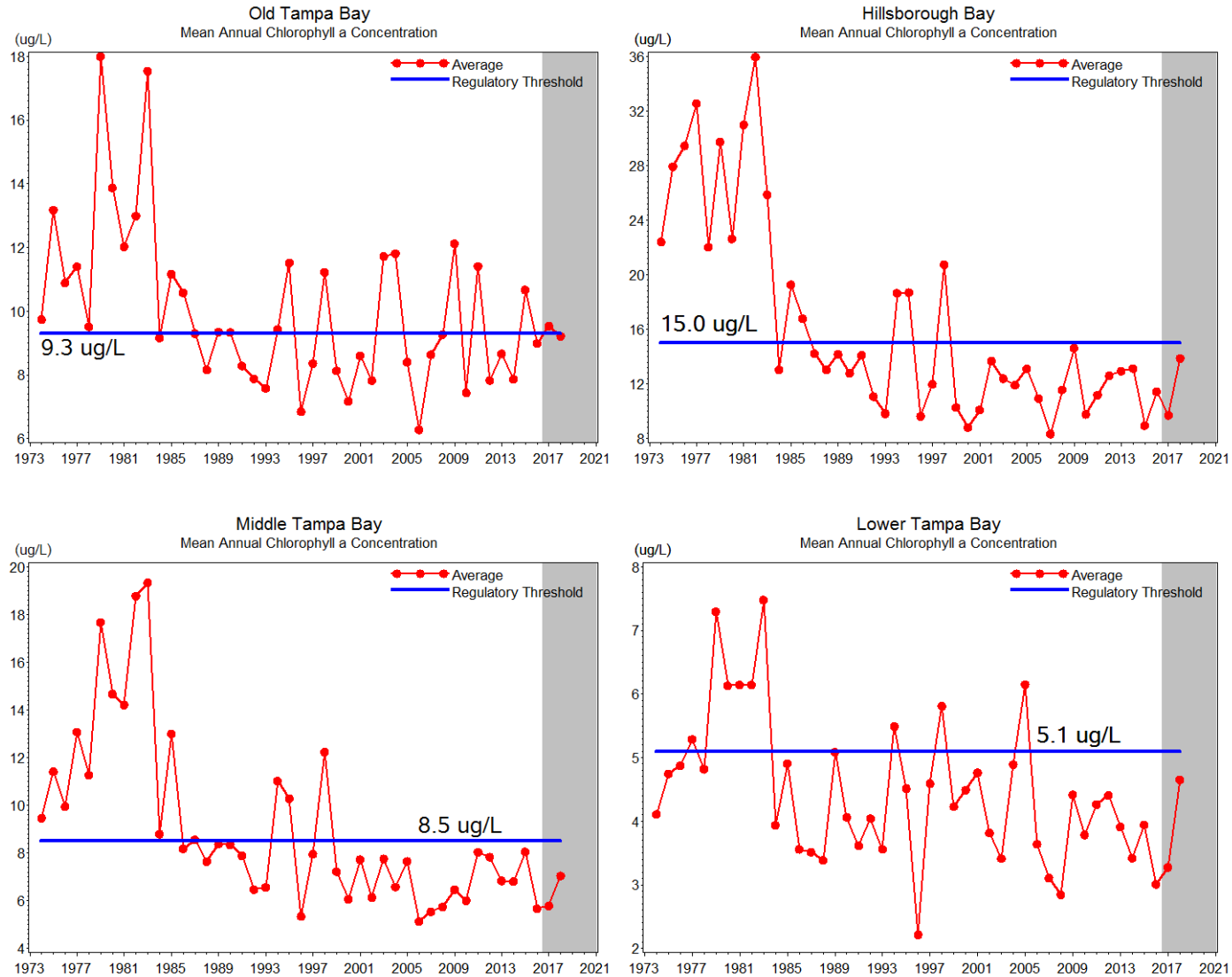


Figure 2: Historic chlorophyll-a annual averages for the four major bay segments of Tampa Bay. Annual averages in 2018 were below the regulatory thresholds developed under the Tampa Nitrogen Management Consortium's nutrient management strategy in all four bay segments. Shaded areas within each graph indicate the 2017-2021 Reasonable Assurance compliance assessment period Data source: EPCHC.

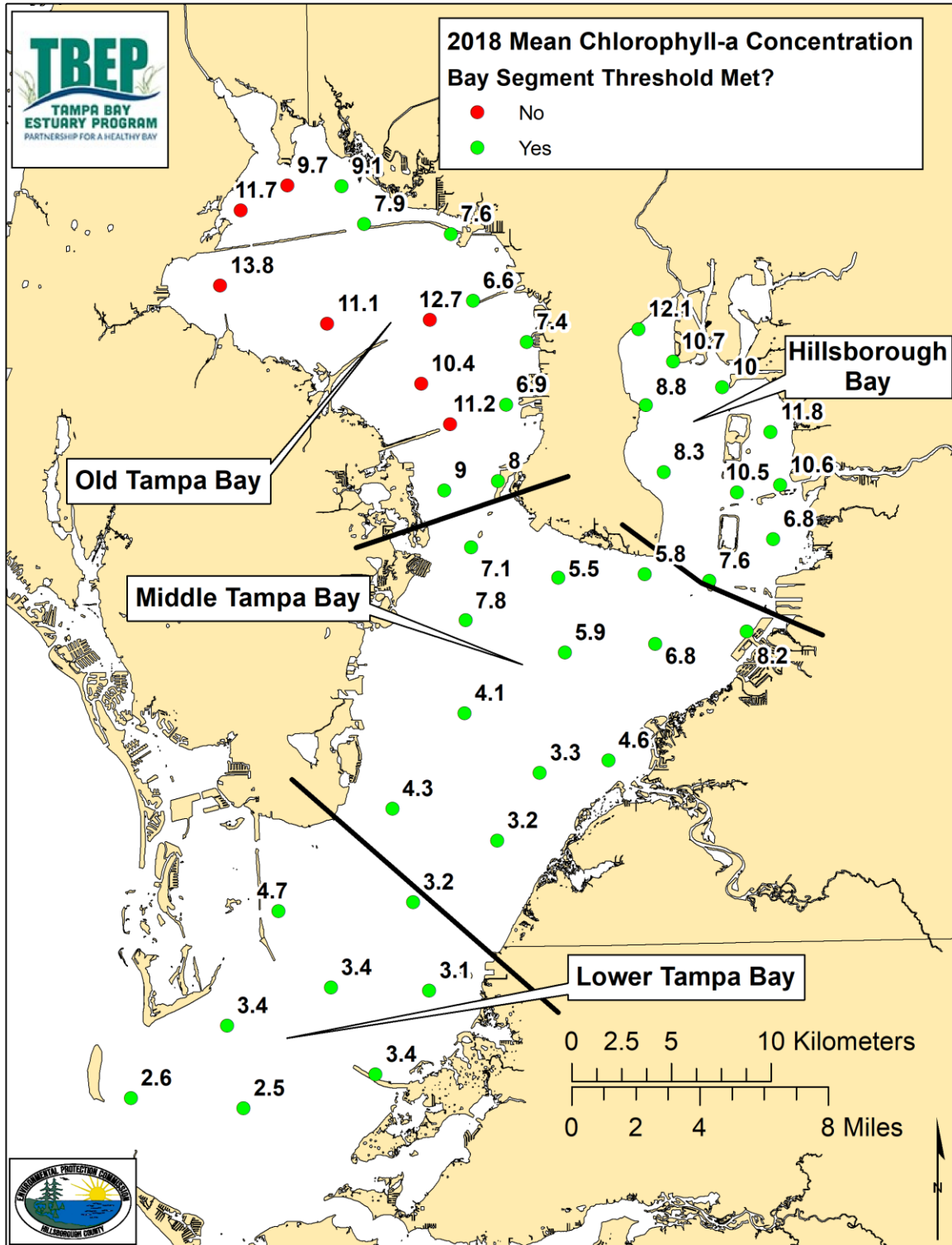


Figure 3: Map depicting individual station chlorophyll-a exceedences in Tampa Bay relative to FDEP regulatory thresholds for chlorophyll-a. Note individual station exceedences do not indicate failed compliance at the bay segment scale.

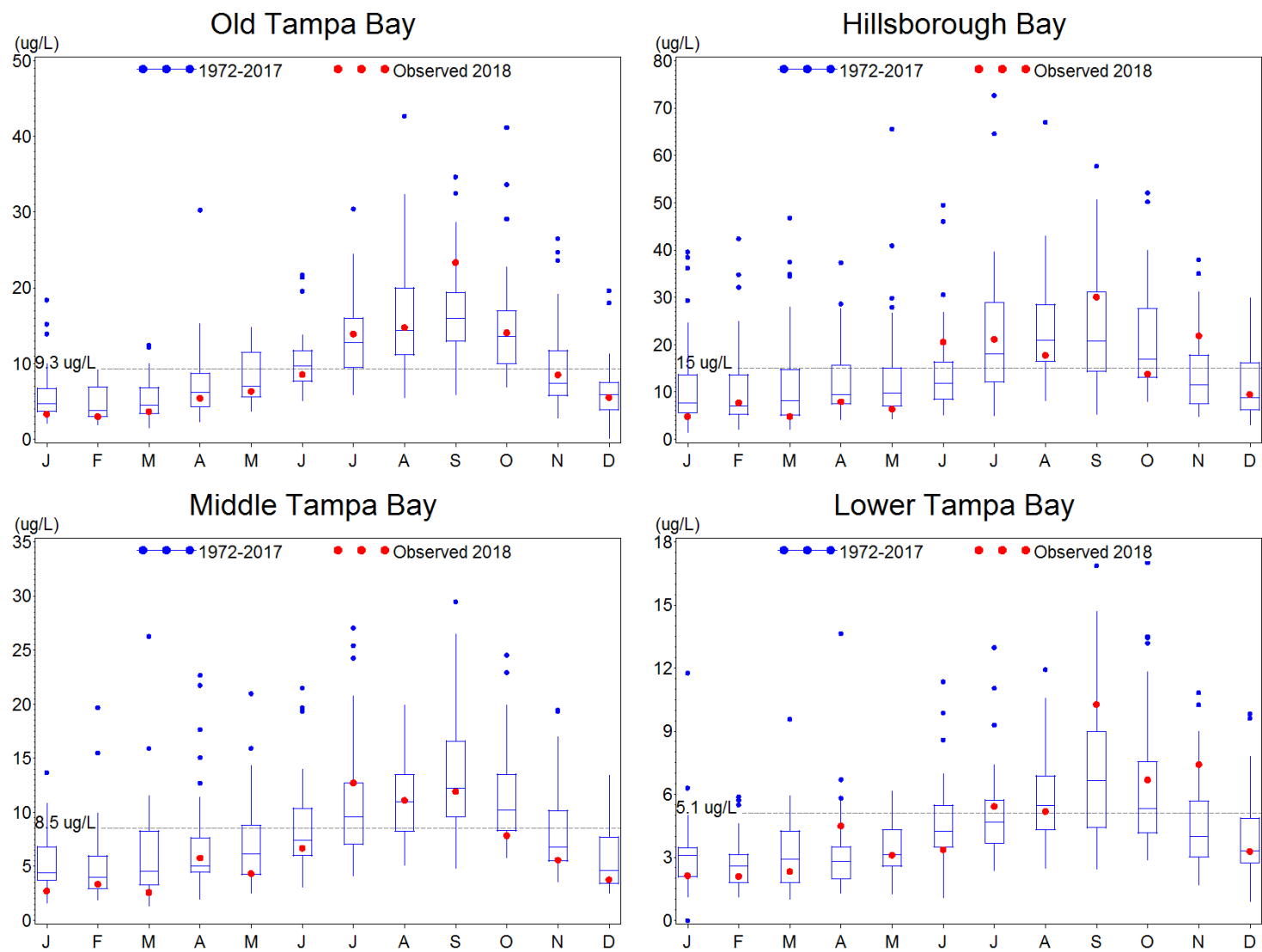


Figure 4: 2018 monthly chlorophyll-a bay segment means (red dots) compared to monthly distributions from 1972-2017 (blue box plots). Boxes encompass the 25th and 75th percentiles, while whiskers bound the interquartile range. Blue dots represent outliers throughout the 1972-2017 sample period.

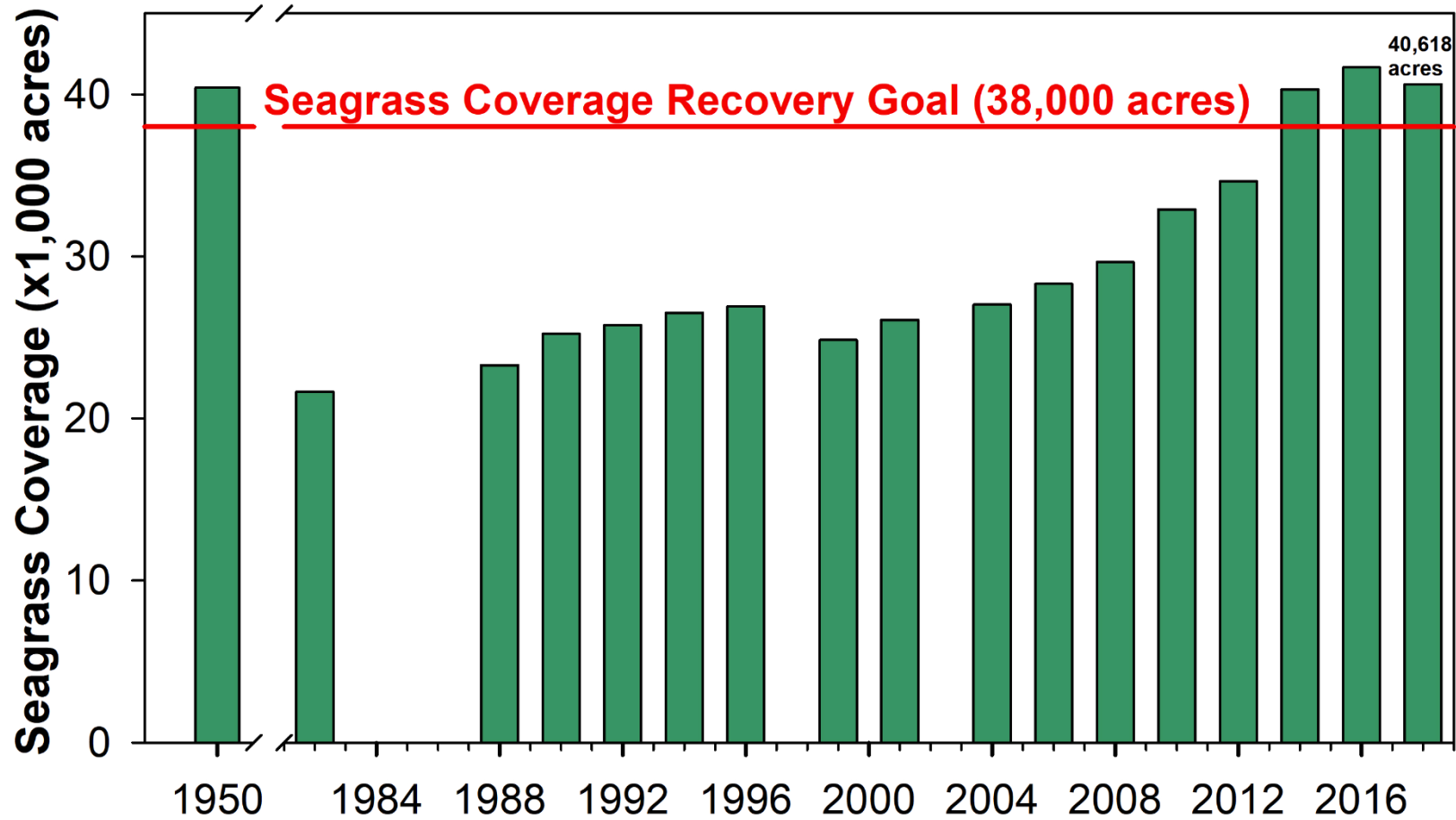


Figure 5: Historic seagrass coverage estimates for Tampa Bay. Data source: TBEP & SWFWMD.

2017-2021 RA
Implementation
Period Begins

Year	Old Tampa Bay	Hillsborough Bay	Middle Tampa Bay	Lower Tampa Bay
1974	No	No	No	Yes
1975	No	No	No	Yes
1976	No	No	No	Yes
1977	No	No	No	No
1978	No	No	No	Yes
1979	No	No	No	No
1980	No	No	No	No
1981	No	No	No	No
1982	No	No	No	No
1983	No	No	No	No
1984	Yes	Yes	No	Yes
1985	No	No	No	Yes
1986	No	No	Yes	Yes
1987	No	Yes	No	Yes
1988	Yes	Yes	Yes	Yes
1989	No	Yes	Yes	Yes
1990	No	Yes	Yes	Yes
1991	Yes	Yes	Yes	Yes
1992	Yes	Yes	Yes	Yes
1993	Yes	Yes	Yes	Yes
1994	No	No	No	No
1995	No	No	No	Yes
1996	Yes	Yes	Yes	Yes
1997	Yes	Yes	Yes	Yes
1998	No	No	No	No
1999	Yes	Yes	Yes	Yes
2000	Yes	Yes	Yes	Yes
2001	Yes	Yes	Yes	Yes
2002	Yes	Yes	Yes	Yes
2003	No	Yes	Yes	Yes
2004	No	Yes	Yes	Yes
2005	Yes	Yes	Yes	No
2006	Yes	Yes	Yes	Yes
2007	Yes	Yes	Yes	Yes
2008	Yes	Yes	Yes	Yes
2009	No	Yes	Yes	Yes
2010	Yes	Yes	Yes	Yes
2011	No	Yes	Yes	Yes
2012	Yes	Yes	Yes	Yes
2013	Yes	Yes	Yes	Yes
2014	Yes	Yes	Yes	Yes
2015	No	Yes	Yes	Yes
2016	Yes	Yes	Yes	Yes
2017	No	Yes	Yes	Yes
2018	Yes	Yes	Yes	Yes

Figure 5: Attainment of adopted chlorophyll-a thresholds (1974 - 2018) in the four major bay segments. Green (yes) indicates that average annual chlorophyll-a thresholds were met; red (no) indicates that threshold levels were not met. Data source: EPCHC.

Table 2: Demonstration of reasonable assurance assessment steps for Old Tampa Bay. Green and yellow squares indicate outcomes of decision points outlined in the Consortium's reasonable assurance assessment framework (Figure 1).

Bay Segment Reasonable Assurance Assessment Steps	DATA USED TO ASSESS ANNUAL REASONABLE ASSURANCE					OUTCOME
	Year 1 (2017)	Year 2 (2018)	Year 3 (2019)	Year 4 (2020)	Year 5 (2021)	
NMC Action 1: Determine if observed chlorophyll-a exceeds FDEP threshold of 9.3 µg/L	9.5 µg/L (Yes)	9.2µg/L (No)				First year (2017) above threshold, not necessary for NMC Actions 2-5.
NMC Action 2: Determine if any observed chlorophyll-a exceedances occurred for 2 consecutive years	No	No				Concurrent years with threshold exceedances did not occur, not necessary for NMC Actions 3-5
NMC Action 3: Determine if observed hydrologically-normalized total load exceeds federally-recognized TMDL of 486 tons/year	N/A	N/A				Not necessary due to observed water quality and seagrass conditions in the bay segment.
NMC Actions 4-5: Determine if any entity/source/facility specific exceedences of 5-yr average allocation occurred during implementation period						Not necessary when chlorophyll-a thresholds met.

Table 3: Demonstration of reasonable assurance assessment steps for Hillsborough Bay. Green squares indicate outcomes of decision points outlined in the Consortium's reasonable assurance assessment framework (Figure 1).

Bay Segment Reasonable Assurance Assessment Steps	DATA USED TO ASSESS ANNUAL REASONABLE ASSURANCE					OUTCOME
	Year 1 (2017)	Year 2 (2018)	Year 3 (2019)	Year 4 (2020)	Year 5 (2021)	
NMC Action 1: Determine if observed chlorophyll-a exceeds FDEP threshold of 15.0 µg/L	9.7 µg/L (No)	13.9 µg/L (No)				All years below threshold, not necessary for NMC Actions 2-5
NMC Action 2: Determine if any observed chlorophyll-a exceedences occurred for 2 consecutive years	No	No				All years met threshold, not necessary for NMC Actions 3-5
NMC Action 3: Determine if observed hydrologically-normalized total load exceeds federally-recognized TMDL of 1451 tons/year	N/A	N/A				Not necessary due to observed water quality and seagrass conditions in the bay segment.
NMC Actions 4-5: Determine if any entity/source/facility specific exceedences of 5-yr average allocation occurred during implementation period						Not necessary when chlorophyll-a thresholds met.

Table 4: Demonstration of reasonable assurance assessment steps for Middle Tampa Bay. Green squares indicate outcomes of decision points outlined in the Consortium's reasonable assurance assessment framework (Figure 1).

Bay Segment Reasonable Assurance Assessment Steps	DATA USED TO ASSESS ANNUAL REASONABLE ASSURANCE					Comment
	Year 1 (2017)	Year 2 (2018)	Year 3 (2019)	Year 4 (2020)	Year 5 (2021)	
NMC Action 1: Determine if observed chlorophyll-a exceeds FDEP threshold of 8.5 µg/L	5.8 µg/L (No)	7.0 µg/L (No)				All years below threshold, not necessary for NMC Actions 2-5
NMC Action 2: Determine if any observed chlorophyll-a exceedences occurred for 2 consecutive years	No	No				All years met threshold, not necessary for NMC Actions 3-5
NMC Action 3: Determine if observed hydrologically-normalized total load exceeds federally-recognized TMDL of 799 tons/year	N/A	N/A				Not necessary due to observed water quality and seagrass conditions in the bay segment.
NMC Actions 4-5: Determine if any entity/source/facility specific exceedences of 5-yr average allocation occurred during implementation period						Not necessary when chlorophyll-a threshold and TMDL target met

Table 5: Demonstration of reasonable assurance assessment steps for Lower Tampa Bay. Green squares indicate outcomes of decision points outlined in the Consortium's reasonable assurance assessment framework (Figure 1).

Bay Segment Reasonable Assurance Assessment Steps	DATA USED TO ASSESS ANNUAL REASONABLE ASSURANCE					OUTCOME
	Year 1 (2017)	Year 2 (2018)	Year 3 (2019)	Year 4 (2020)	Year 5 (2021)	
NMC Action 1: Determine if observed chlorophyll-a exceeds FDEP threshold of 5.1 µg/L	3.3 µg/L (No)	4.7 µg/L (No)				All years below threshold so far, not necessary for NMC Actions 2-5
NMC Action 2: Determine if any observed chlorophyll-a exceedences occurred for 2 consecutive years	No	No				All years met threshold, not necessary for NMC Actions 3-5
NMC Action 3: Determine if observed hydrologically-normalized total load exceeds federally-recognized TMDL of 349 tons/year	N/A	N/A				Not necessary due to observed water quality and seagrass conditions in the bay segment.
NMC Actions 4-5: Determine if any entity/source/facility specific exceedences of 5-yr average allocation occurred during implementation period						Not necessary when chlorophyll-a threshold and TMDL target met

Table 6: Demonstration of reasonable assurance assessment steps for the Remainder of the Lower Tampa Bay watershed. Green squares indicate outcomes of decision points outlined in the Consortium's reasonable assurance assessment framework (Figure 1).

Bay Segment Reasonable Assurance Assessment Steps	DATA USED TO ASSESS ANNUAL REASONABLE ASSURANCE					OUTCOME
	Year 1 (2017)	Year 2 (2018)	Year 3 (2019)	Year 4 (2020)	Year 5 (2021)	
NMC Action 1: Determine if observed chlorophyll-a exceeds FDEP threshold of 5.1 µg/L for Lower Tampa Bay proper	3.3 µg/L (No)	4.7 µg/L (No)				All years below threshold so far, not necessary for NMC Actions 2-5
NMC Action 2: Determine if any observed chlorophyll-a exceedences occurred for 2 consecutive years	No	No				All years met threshold, not necessary for NMC Actions 3-5
NMC Action 3: Determine if observed hydrologically-normalized total load exceeds RA target load of 629 tons/year	N/A	N/A				Not necessary due to observed water quality and seagrass conditions in the bay segment.
NMC Actions 4-5: Determine if any entity/source/facility specific exceedences of 5-yr average allocation occurred during implementation period						Not necessary when chlorophyll-a threshold and TMDL target met