Review of Potential Influence of Method Detection Limits on Arthur R. Marshall Loxahatchee National Wildlife Refuge Trend Analysis (February 1999–March 2016)

Prepared in response to a question asked during the July 19, 2016 meeting.

Provided for the October 18, 2016 meeting.

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REVIEW OF POTENTIAL INFLUENCE OF METHOD DETECTION LIMITS ON ARTHUR R. MARSHALL LOXAHATCHEE NATIONAL WILDLIFE REFUGE TREND ANALYSIS (FEBRUARY 1999–MARCH 2016)

At the July 19, 2016, Quarterly Everglades Technical Oversight Committee (TOC) Meeting, Stuart Van Horn of the South Florida Water Management District presented an update to long-term trends in total phosphorus (TP) data for the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge). One chart displayed the monthly geometric means for phosphorus used for compliance in the Refuge since its Settlement Agreement Interim Level became effective on February 1999 as well as several common trending methods indicating a reduction in phosphorus concentrations over time. It was questioned whether this analysis was potentially biased because of changes in lab reporting of low phosphorus values over time. The question and response are documented below.

Question:

Could laboratory limitations for measurement of phosphorus known as method detection limits (MDLs) potentially influence the trend analysis on Refuge geometric means presented at the July 2016 Quarterly Everglades TOC meeting?

Response:

A concentration measurement can fall anywhere between zero and higher values regardless of the MDL. However, if a measurement is below the MDL, the District's database (DBHYDRO) reports it only as 'less-than-MDL' (or censors it) and does not report the actual measurement value.

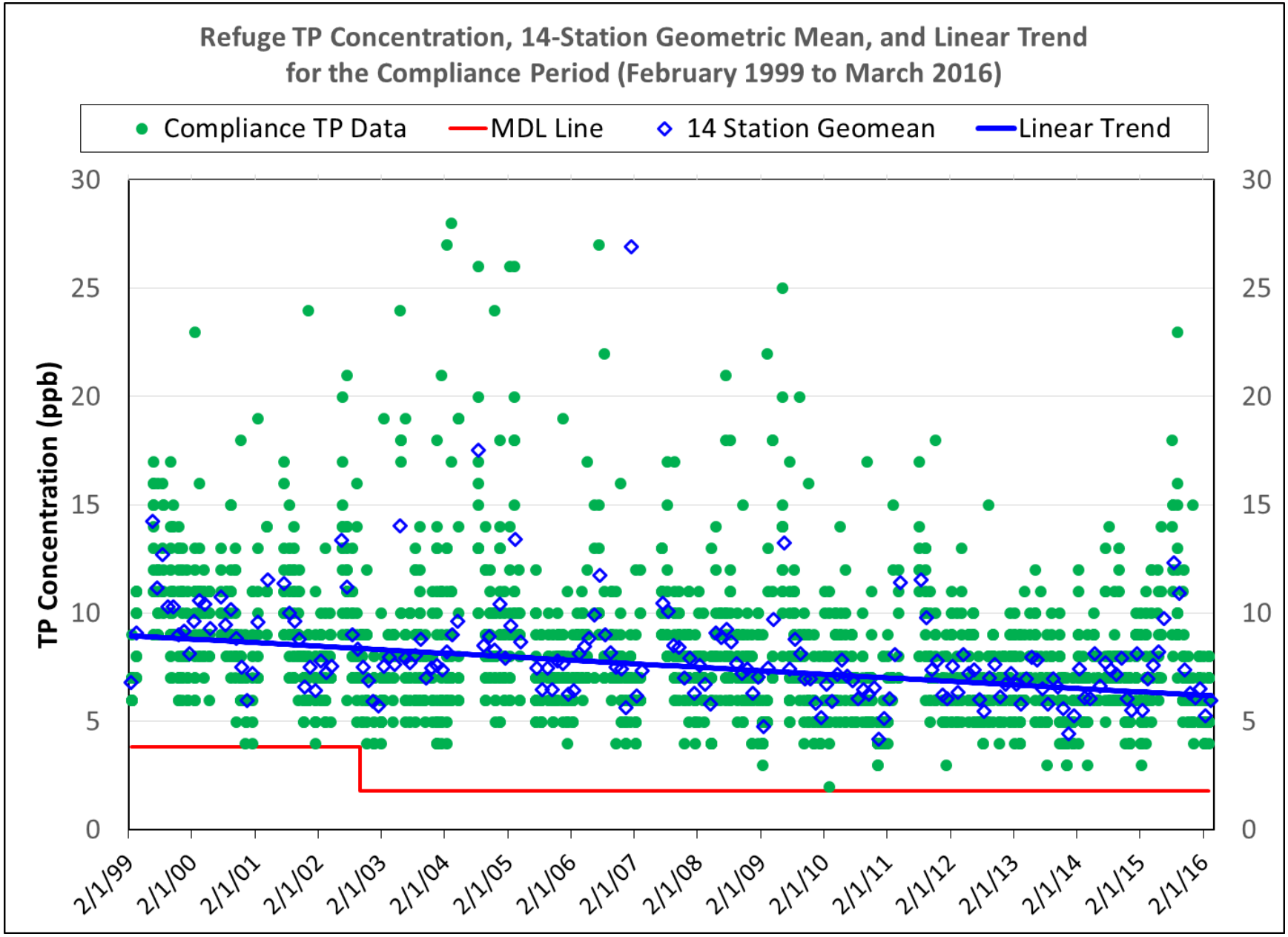
The trend analysis for the monthly geometric means of the 14-station compliance network samples in question was for the February 1999 to March 2016 period. There were no compliance samples analyzed below the MDL in the calculation of geometric mean concentrations during that period. Therefore, all the values used in the trend analysis would have been reported exactly the same as values reported in the current database no matter the MDL. As a result, no additional analysis related to "what if" or uncertainty is warranted to confirm the previously presented trends of monthly Refuge compliance reporting geometric means.

Overall, 2,291 sample results were used for Refuge compliance calculation under the Settlement Agreement quarterly period of February 1999 through March 2016. These were the values used in this trend analysis. The MDL was 4 micrograms per liter (µg/L) from February 1999 through September 2002, and a total of 437 sample results were used with no samples falling below the MDL (see the table and figure below). Three compliance values were measured at 4 µg/L during that period. From October 2002 through March 2016, the MDL was 2 µg/L, and there were ten samples measured at 2 and 3 µg/L. One may notice that one split sample data point from 2001 in DBHYDRO (analyzed by the United States Geological Survey lab) was below their MDL of 2 µg/L, but split sample results were not part of the compliance data set and, therefore, were not part of the trend results.

Phosphorus Data Summary for the Refuge's 14 Settlement Agreement Sites

Period	MDL (µg/L)	Count of Compliance Data for Geometric Mean	Count of Compliance Data < 4 ppb [a]	Count of Compliance Data < 2 ppb
February 1999–September 2002	4	437	0	0
October 2002–March 2016	2	1,854	10	0

a. ppb – parts per billion


Refuge TP Concentration, 14-Station Geometric Mean, and Linear Trend
for the Compliance Period (February 1999 to March 2016)
Compliance TP Data
MDL Line
14 Station Geomean
Linear Trend
TP Concentration (ppb)
30
25
20
15
10
5
0
2/1/99
2/1/00
2/1/01
2/1/02
2/1/03
2/1/04
2/1/05
2/1/06
2/1/07
2/1/08
2/1/09
2/1/10
2/1/11
2/1/12
2/1/13
2/1/14
2/1/15
2/1/16