



Draft Hot Spot Analysis

DEAR
Florida Department of Environmental Protection

January 24, 2024



HOT SPOT ANALYSIS

Purpose for this analysis:

- To find more specific areas to focus on for restoration activities.
- To highlight areas where projects might have stronger results.
- To highlight project areas where funding could/should be prioritized.
- However, this is not the sole determining factor for areas in need of focus.

What this analysis is NOT for:

- Determination of BMAP compliance.
- Determination of ERP compliance.



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Data Preparation Example

Data Requirements:

- At least two years of data.
- No more than five years of data.
- At least four samples per year.
 - Best if samples are spread out, but still useable if not.

Station	Start Year	End Year
WHISGR10	2018	2023
17948	2018	2023
17971	2020	2023
G3SD0224	2022	2023
G3SD0087	2018	2021
CLEW06	2021	2023
CLEW01	2021	2023
CLEW02	2021	2023
CLEW04	2021	2023
CLEW05	2021	2023
G3SD0102	2018	2020
32267	2020	2023
G3SD0162	2020	2022
CLEW03	2021	2023
CLEW07	2021	2023
CLEW08	2021	2023
17545	2018	2023
5157	2018	2023
5158	2018	2023

*Example of useable POR for
a few Caloosahatchee
stations
(this is not the full list)*



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Data Preparation- Species Hierarchy

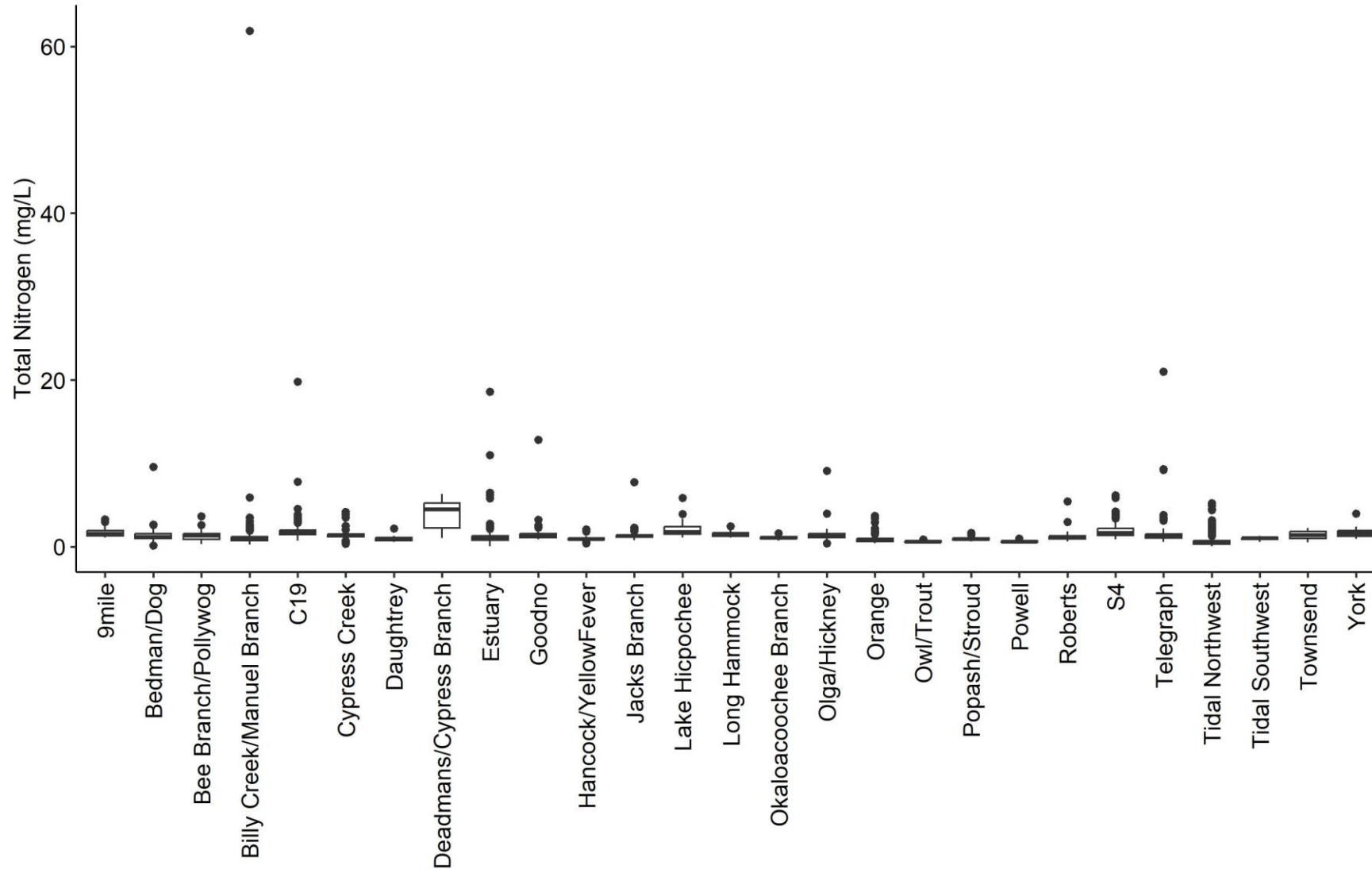
Total Nitrogen (TN) Calculation:

- $TN_{(total)}$, or
- $TKN_{(total)} + NO_2O_{3(total)}$, or
- $TKN_{(total)} + NO_2 + NO_3$, or
- $TKN_{(total)} + NO_2O_{3(dissolved)}$.



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Data Preparation Example



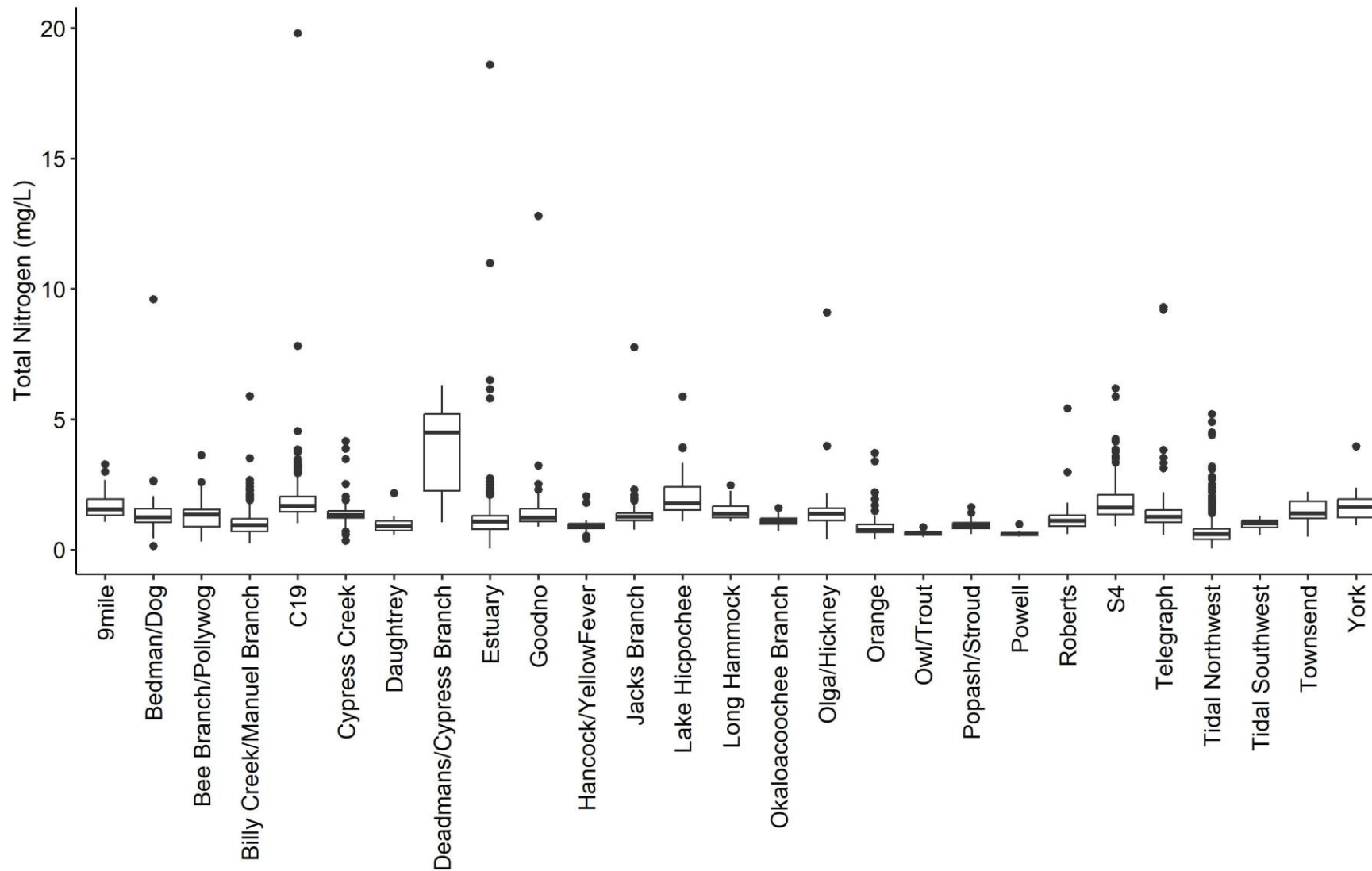
Data Clean-up

- Remove data with fatal qualifiers.
- Look for outlier data
 - Start with 3x interquartile range
- Can affect index ranking later.



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Data Preparation Example



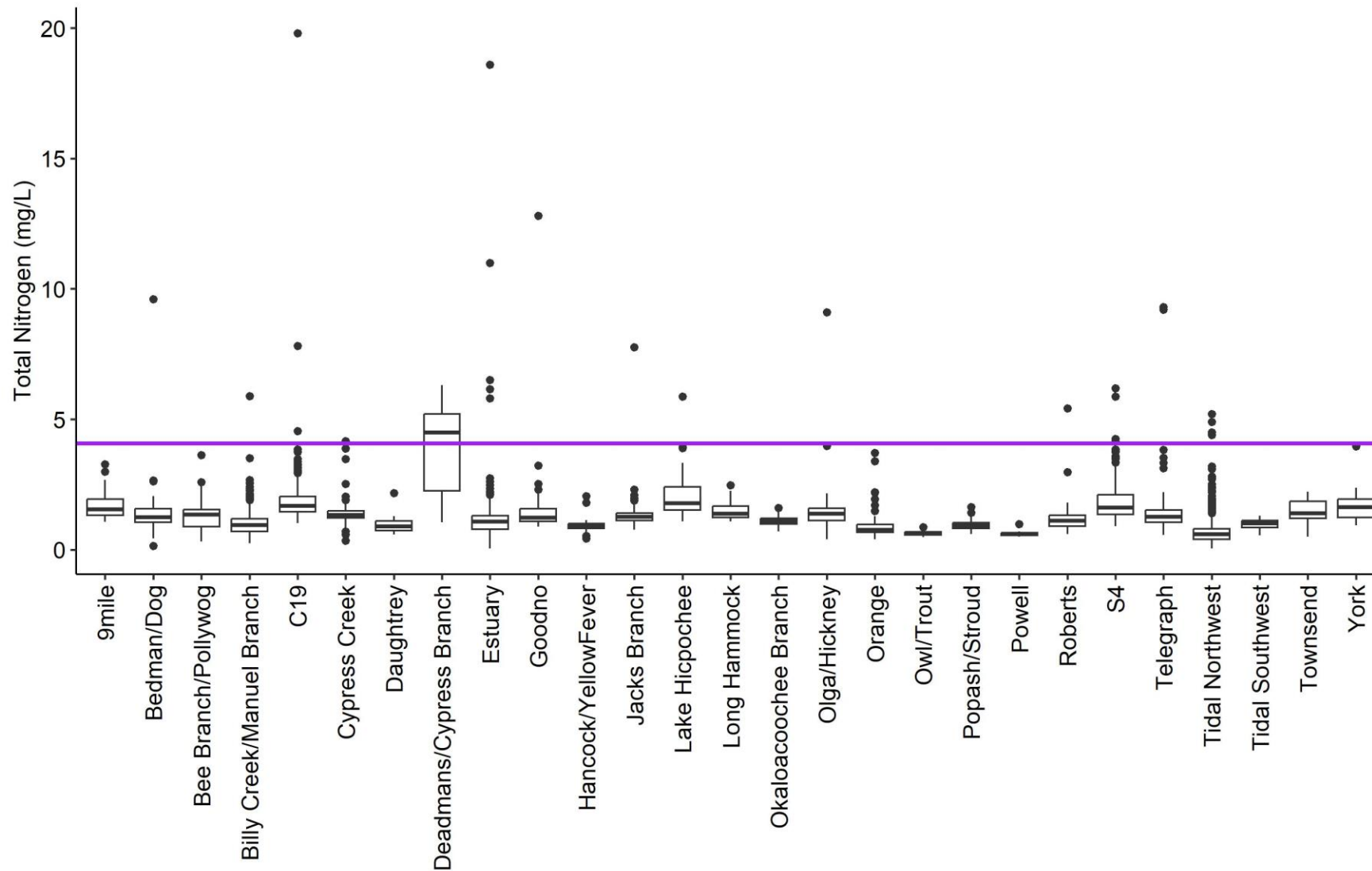
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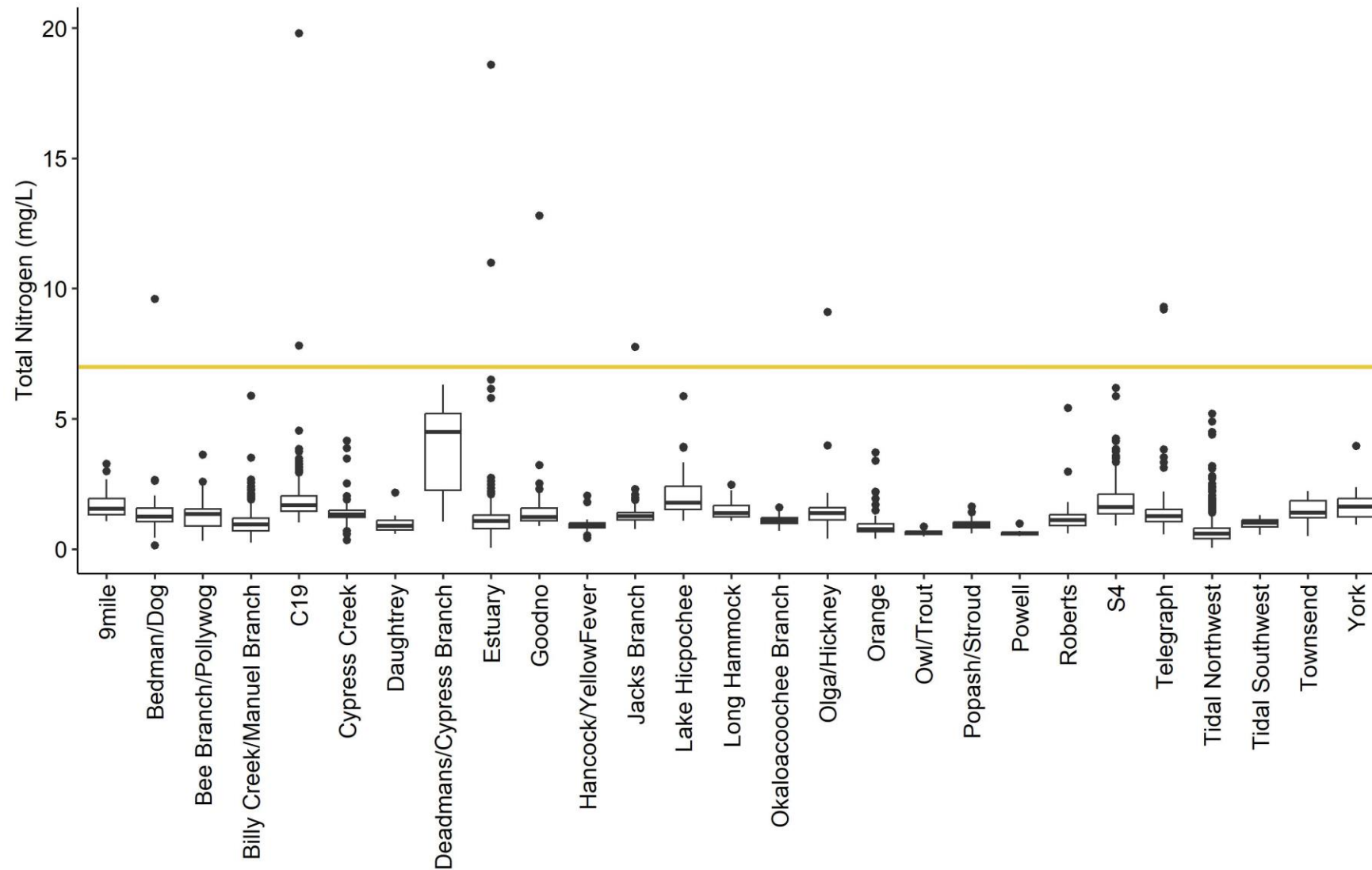
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Data Preparation Example



Data Clean-up

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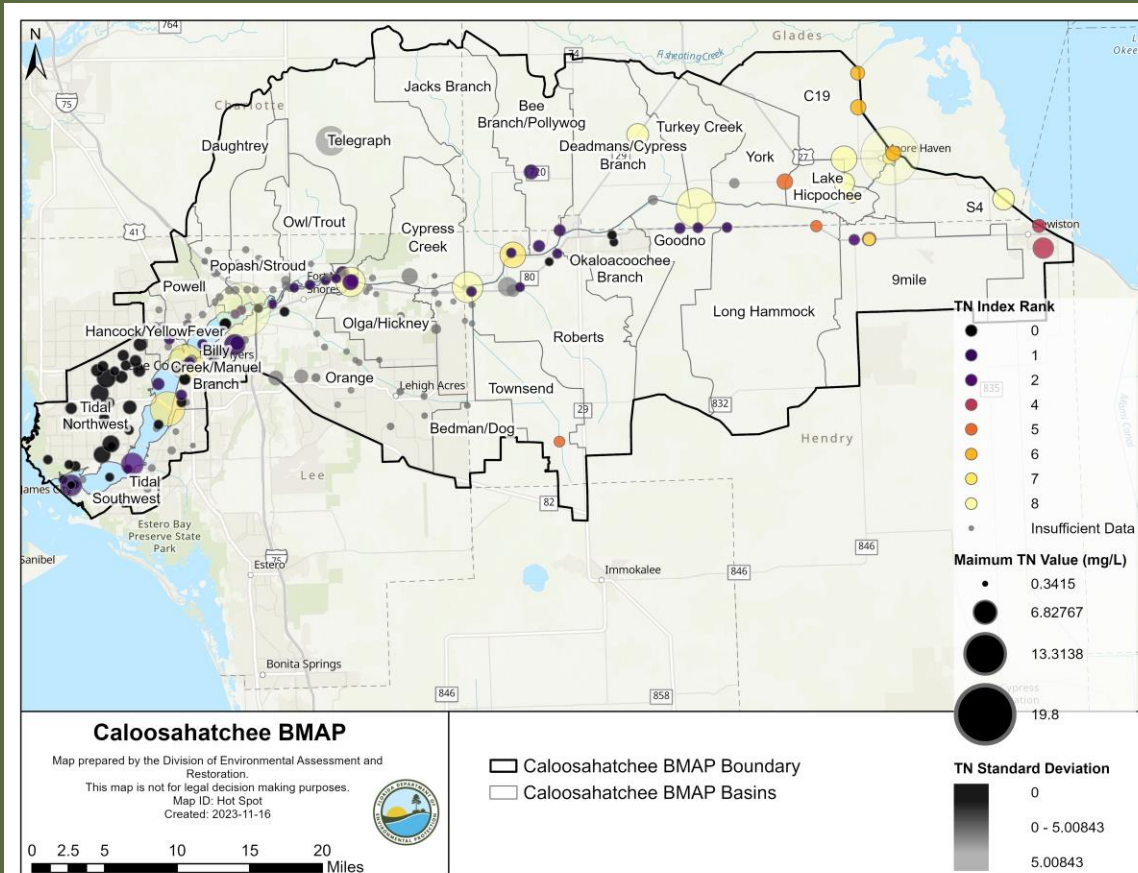
Lose 13 data points,
rather than 35.



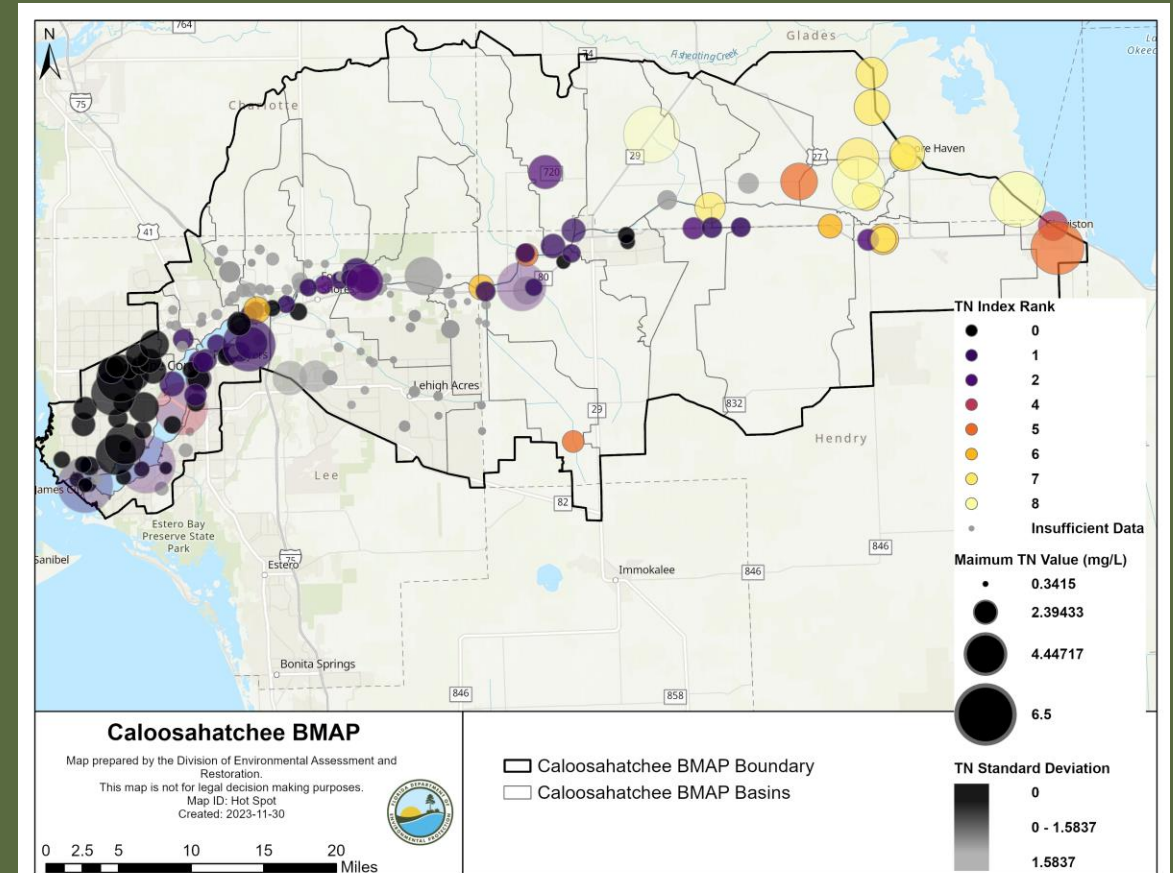
HOT SPOT ANALYSIS

Importance of Outliers Example

With Outliers



Without Outliers





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Data Preparation

Determine thresholds for values of no-concern:

- Caloosahatchee:
 - Peninsular NNC for TN (1.54 mg/L) and TP (0.12 mg/L).
- Lake Okeechobee:
 - Peninsular NNC for TN (1.54 mg/L) and TP TMDL (0.04 mg/L).
- St. Lucie
 - TN TMDL (0.72 mg/L) and TP TMDL (0.081 mg/L).



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Components of the Hot Spot Index

These four statistics calculated for the BMAP overall and used to compare against each station average.

- TN or TP concentration average
- TN or TP 90th percentile
- TN or TP Standard Deviation
- TN or TP Percent Frequency of Samples over Value of No Concern



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Creating the Ranks

Average Rank:

1. Rank 0: station average below BMAP threshold.
2. Rank 1: station average above threshold but below BMAP average.
3. Rank 2: station average 2x above BMAP average.

Percentiles Rank:

1. Rank 0: station average below BMAP threshold.
2. Rank 1: station average above threshold but below 90th percentile.
3. Rank 2: station average above 90th percentile.

Standard Deviation Rank:

1. Rank 0: station average below BMAP average + 0.5 SD.
2. Rank 1: station average at or above average + 0.5 SD but less than BMAP average + 1 SD.
3. Rank 2: station average at or above BMAP average + 1SD.

Frequency Rank:

1. Rank 0: station percent exceedance below 5%.
2. Rank 1: station exceedances between 5% and 49% of samples.
3. Rank 2: station exceedances over 50% of samples



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Final Overall Rank

Average Rank
+
Percentile Rank
+
SD Rank
+
Frequency Rank

=

Total Index Rank

Rank 0 = No Concern
Rank 8 = High Concern



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Creating the Ranks

```
STLU_tsTN = BMAPWQ_wide[,c("Monitoring.Location.ID", "Activity.ID", "Date", "Year", "Basin", "TN_mgL")]
STLU_tsTN = STLU_tsTN %>%
  filter(!is.na(TN_mgL), TN_mgL < 10, Year > 2017 )

QN=quantile(STLU_tsTN$TN_mgL, probs =.90)
# 90% - 1.48
MN=mean(STLU_tsTN$TN_mgL)
# 1.01
SN=sd(STLU_tsTN$TN_mgL)
# 0.399

STLU_exceedTN = STLU_tsTN %>%
  group_by(Monitoring.Location.ID) %>%
  summarise(TNstart_year = min(Year), TNend_year = max(Year),
            TNmax = max(TN_mgL), TNavg = mean(TN_mgL), TNsd = sd(TN_mgL),
            TNfreq = sum(TN_mgL > 0.72), TNnumSamples = length(Monitoring.Location.ID),
            TNnumSites = n_distinct(Monitoring.Location.ID)) %>%
  mutate(TNFreqPerc = TNfreq/TNnumSamples*100,
         TN_Years = TNend_year-TNstart_year+1,
         TN_SampPerYear = TNnumSamples/(TNend_year-TNstart_year+1),
         TN_avg_rank = ifelse(TNavg <= 0.72, 0, ifelse(TNavg>=MN*2, 2, 1)),
         TN_perc_rank = ifelse(TNavg <= 0.72, 0, ifelse(TNavg>QN, 2, 1)),
         TN_sd_rank = ifelse(TNavg <= (SN/2)+MN, 0, ifelse(TNavg>=MN+SN, 2, 1)),
         TN_exceed_rank = ifelse(TNFreqPerc< 5, 0, ifelse(TNFreqPerc>50, 2, 1)))

STLU_exceedTN$TN_total_rank = rowSums(STLU_exceedTN[,c("TN_avg_rank", "TN_perc_rank", "TN_sd_rank", "TN_exceed_rank")])
```



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How is this different from a Trend Analysis?

- Data requirements are **much** less stringent.
 - More monitoring locations can be used.
- Not looking at changes over time.
- Periods of record may differ.



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Results for SJRWMD Surface Water BMAPs

- Upper Ocklawaha.
- Orange Creek.
- Lake Jesup.
- Lakes Harney, Monroe, MSJR, and Smith Canal.
- Lower St. Johns Main Stem (LSJM).



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Data Preparation for Upper Ocklawaha and Orange Creek

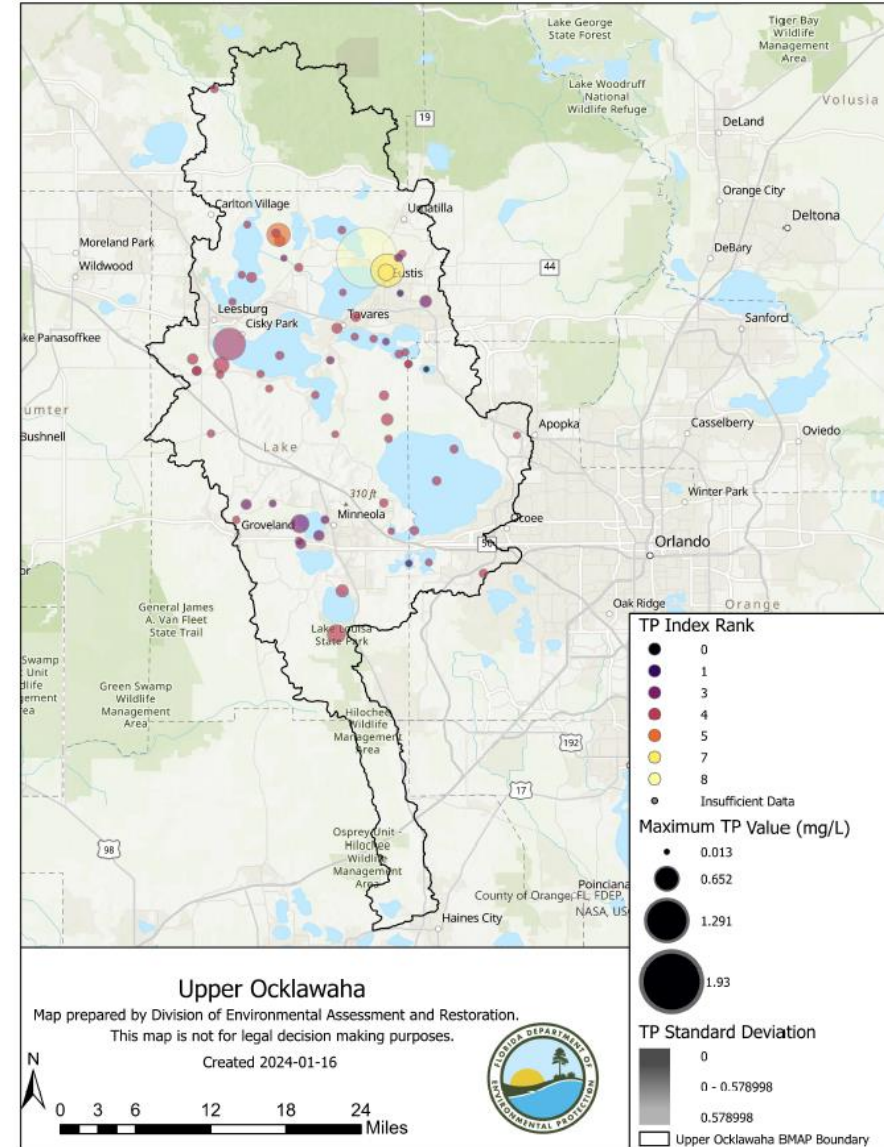
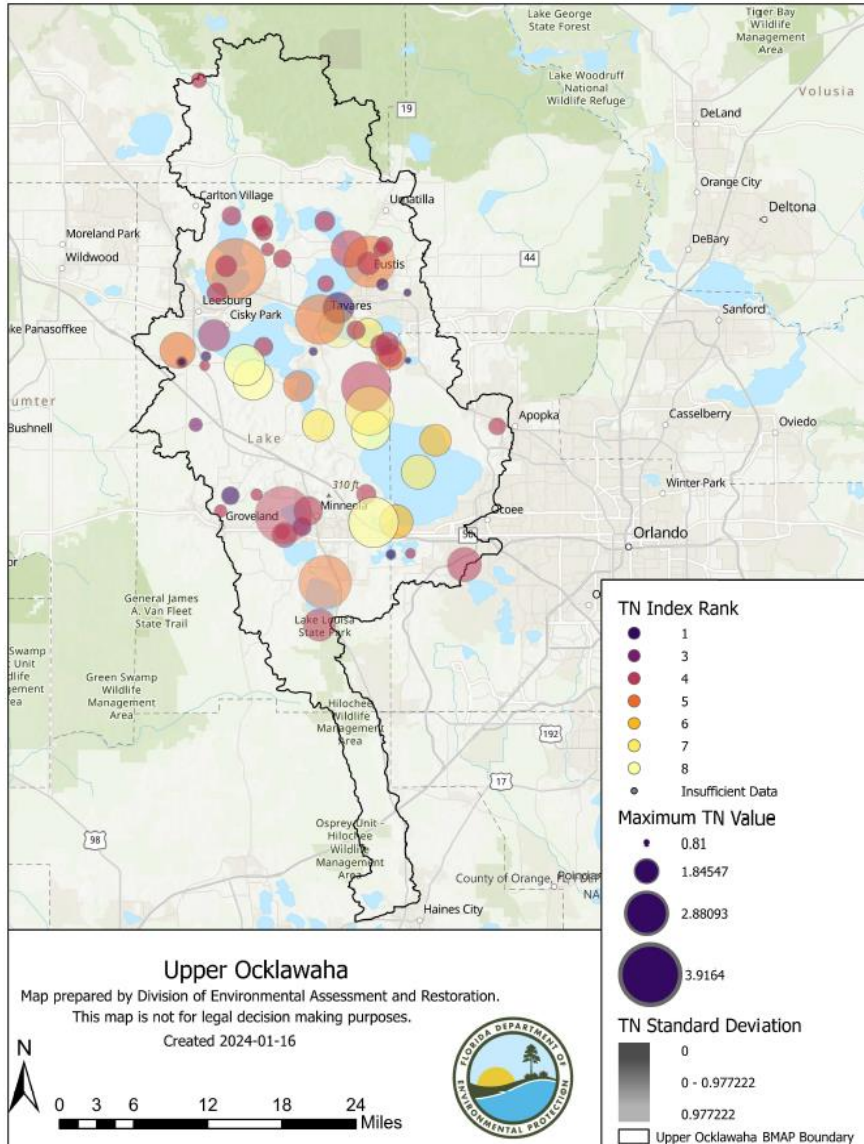
- Upper Ocklawaha:
 - TN TMDL (0.78 mg/L) and TP TMDL (0.02 mg/L).
 - Minimum 3 years data.
 - Minimum of 3 samples per year.
 - Removed outliers.
- Orange Creek:
 - TN TMDL (0.97 mg/L) and TP TMDL (0.031 mg/L).
 - 5 years data.
 - Minimum of 3 samples per year.
 - Removed outliers.

*Used the most protective target concentrations within the BMAP.



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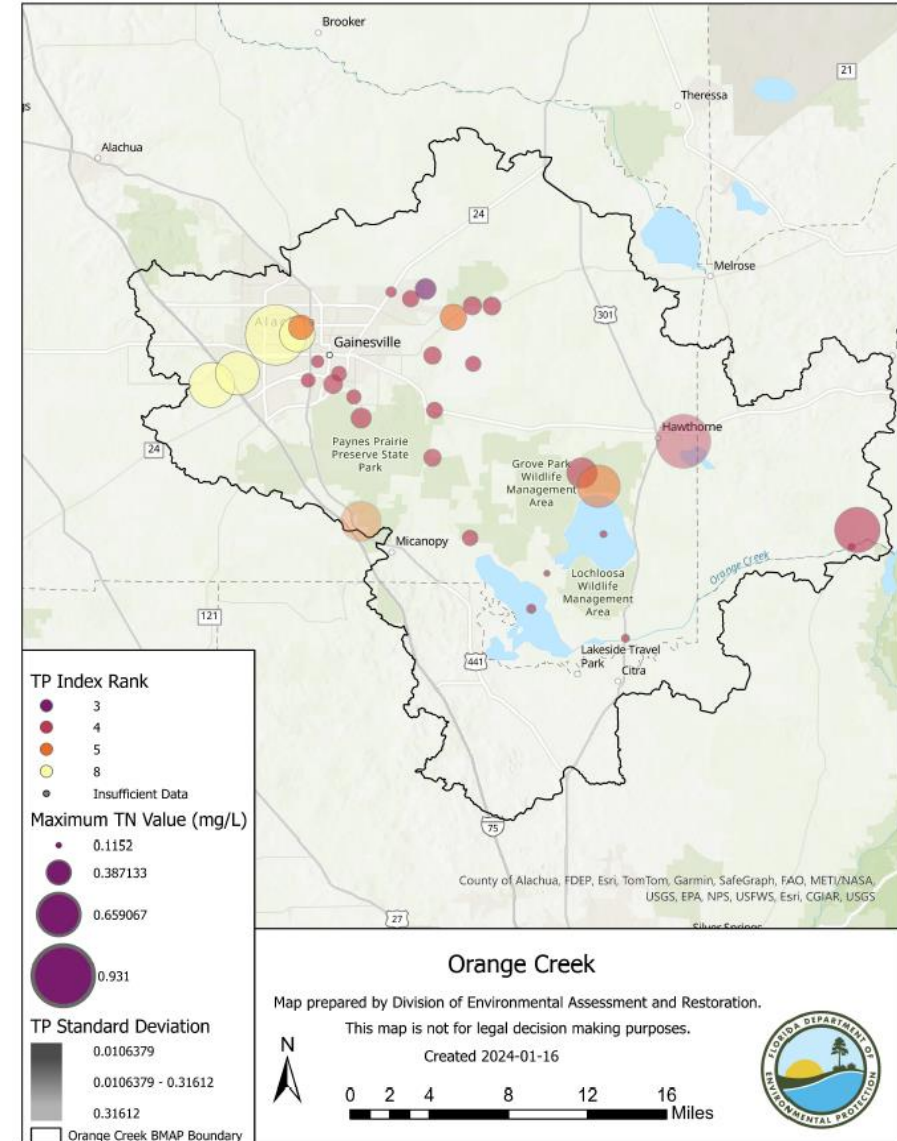
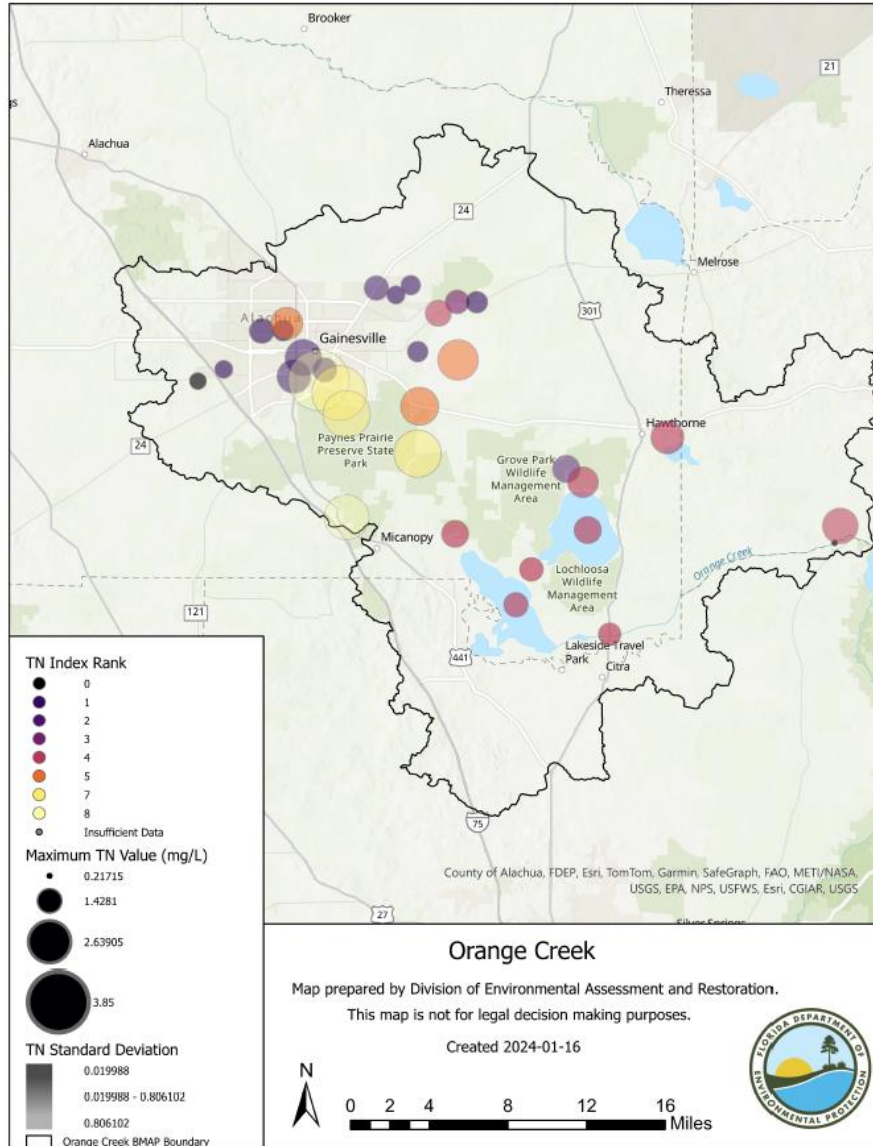
Upper Ocklawaha Results





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Orange Creek Results





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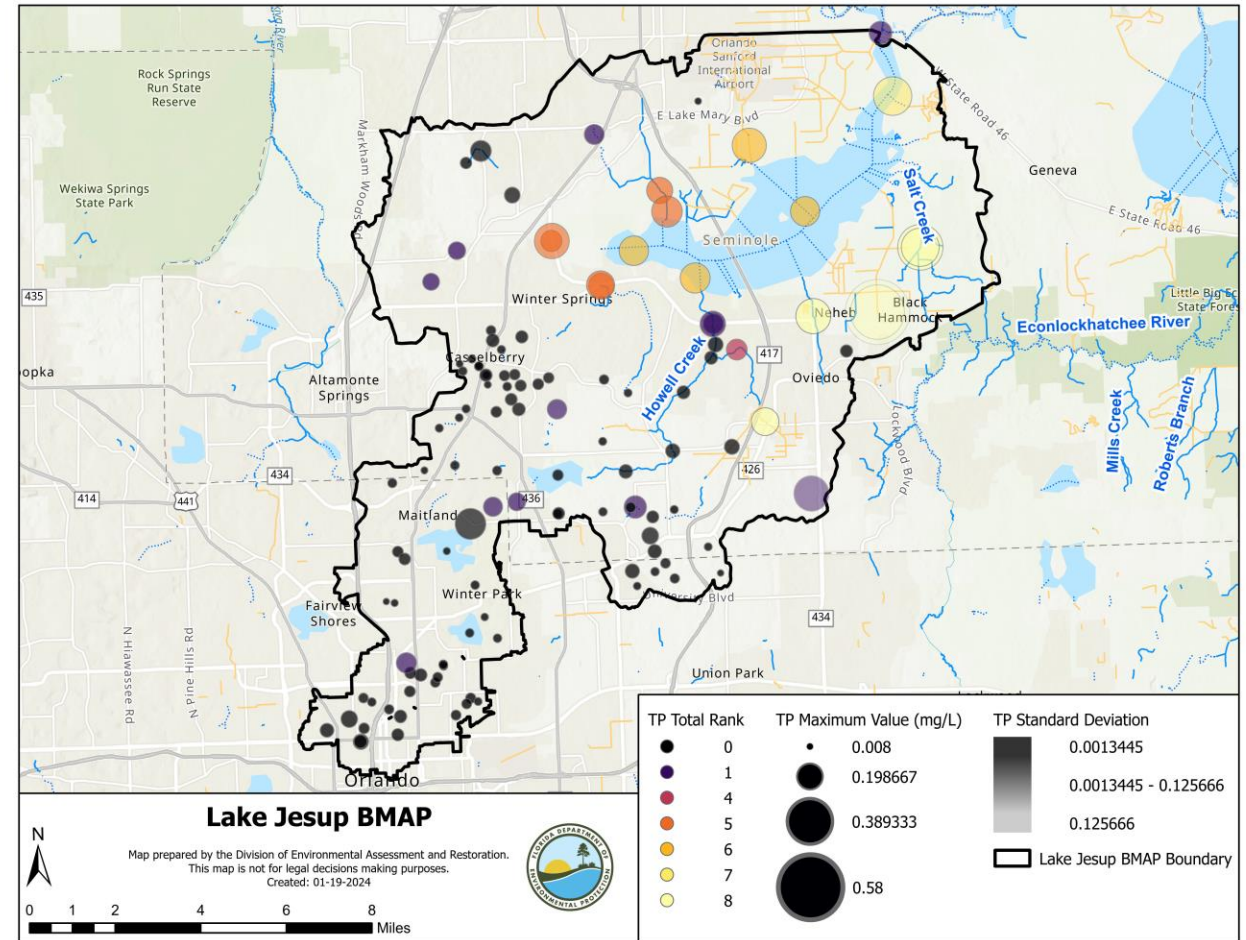
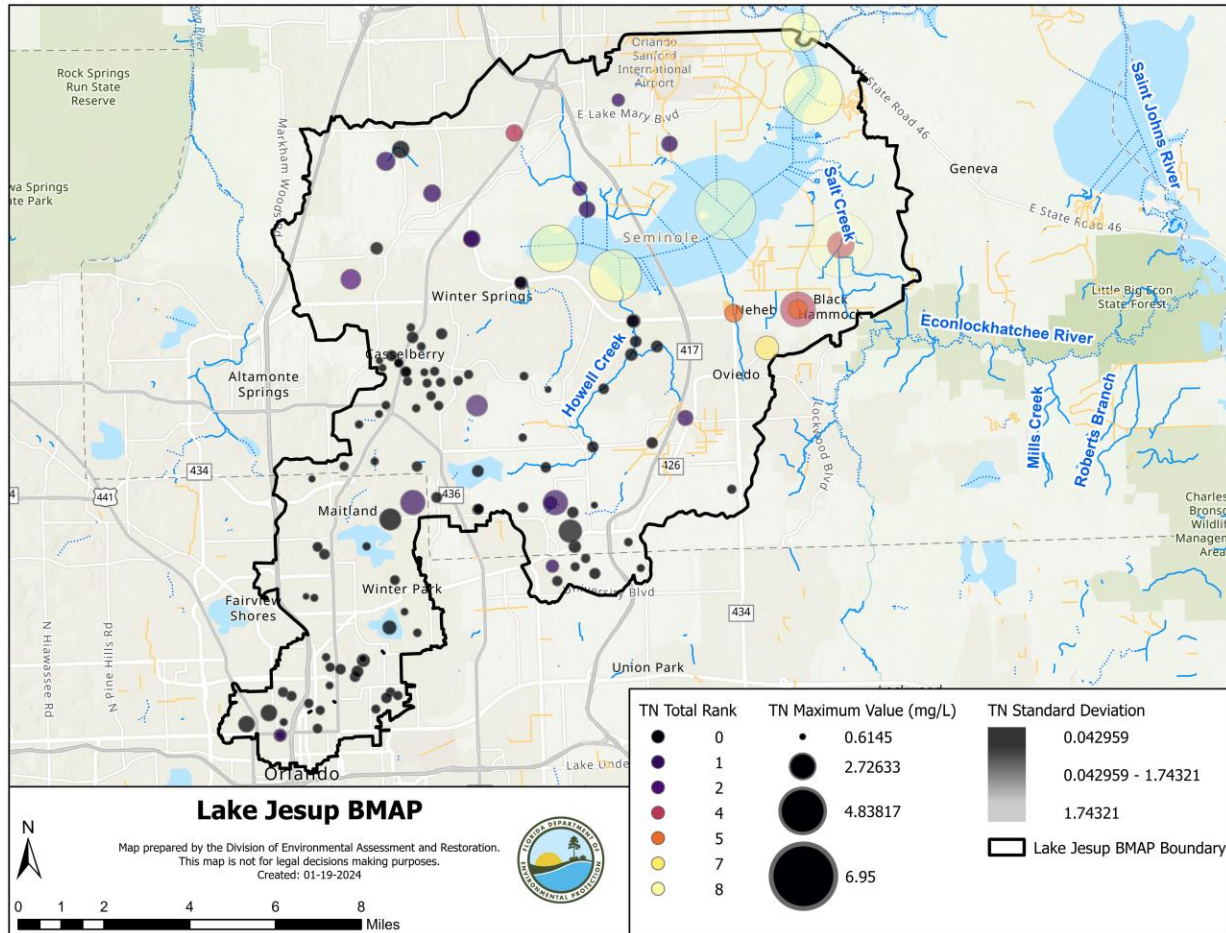
Data Preparation for Lake Jesup and Harney-Monroe BMAPs

- Lake Jesup:
 - TN TMDL (1.27 mg/L) and TP TMDL (0.096 mg/L).
 - Minimum 2 years data.
 - Minimum 3 samples per year.
 - No outliers removed.
- Lakes Harney-Monroe:
 - TN TMDL (1.18 mg/L) and TP TMDL (0.07 mg/L).
 - Minimum 2 years data.
 - Minimum 3 samples per year.
 - No outliers removed.



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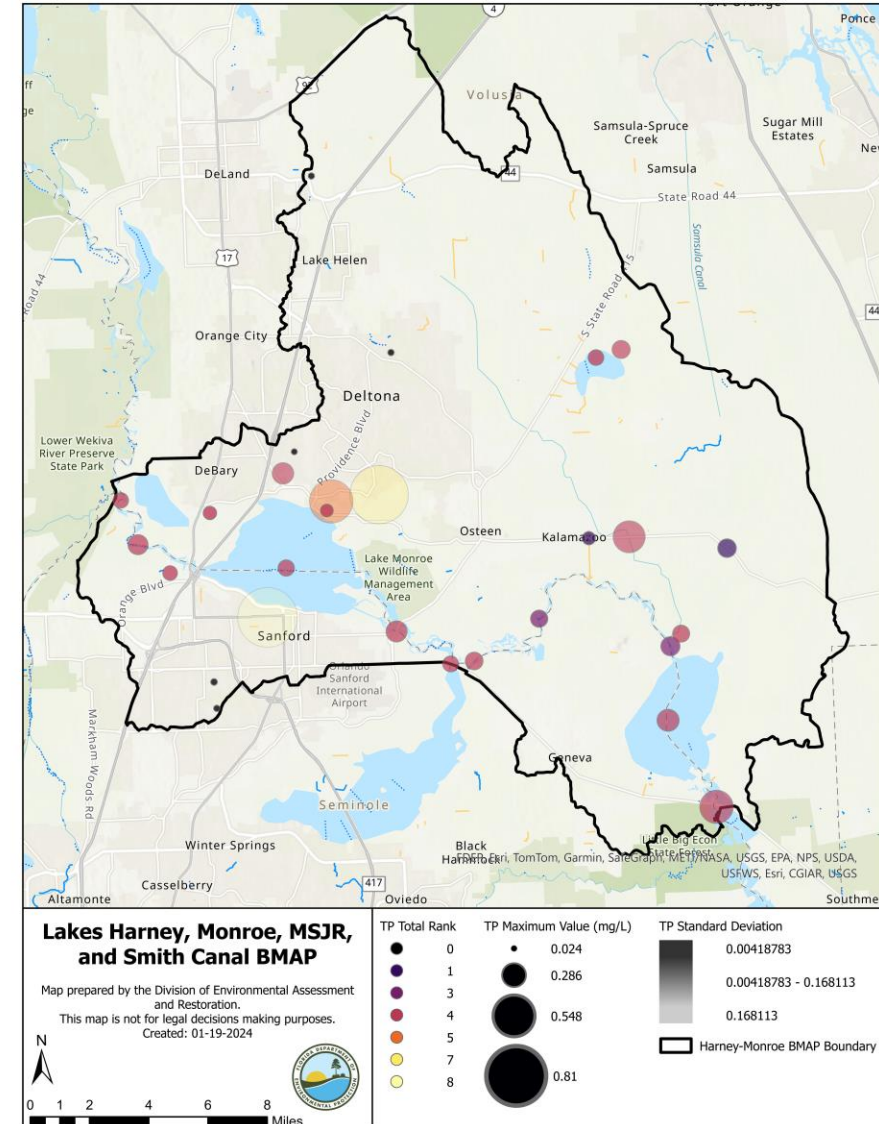
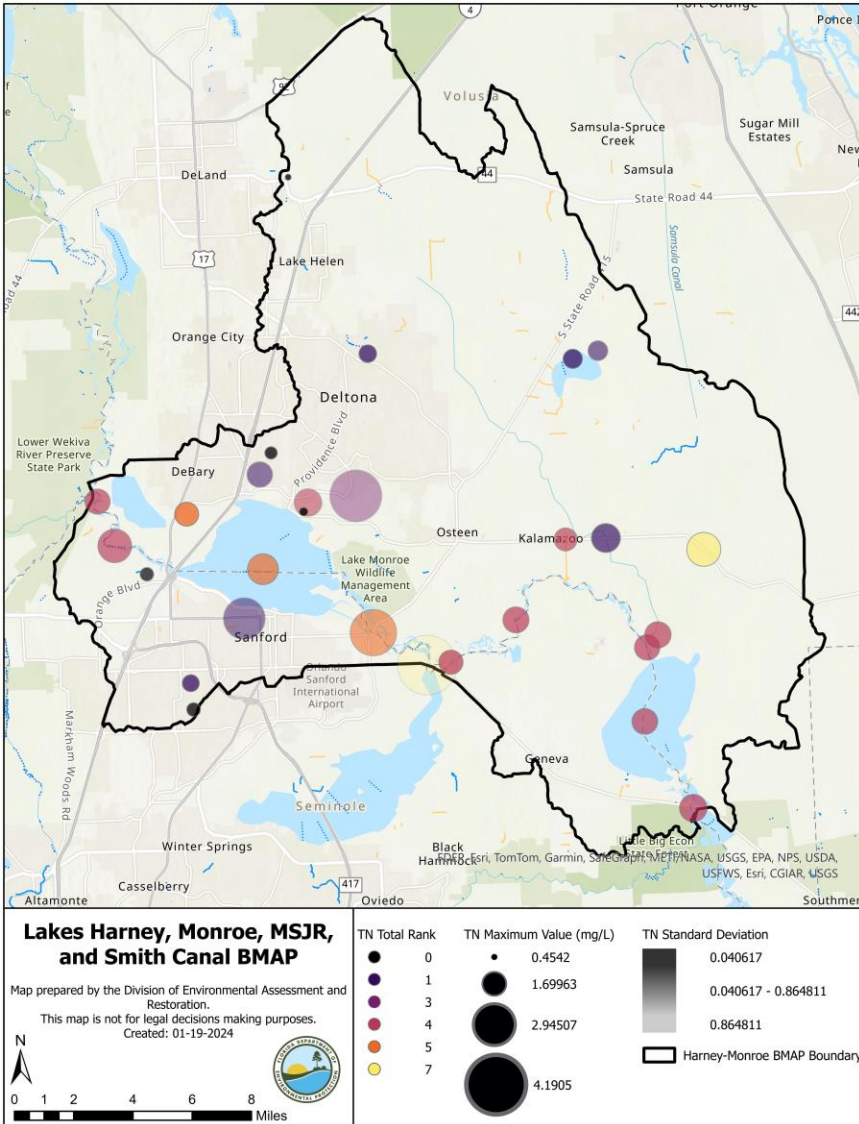
Lake Jesup Results





HOT SPOT ANALYSIS

Lakes Harney-Monroe Results





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Data Preparation for Lower St. Johns Main Stem (LSJM) BMAP

- The LSJM hot spot analysis used the Crescent Lake TMDL concentrations as the threshold for all three subbasins (Crescent Lake, freshwater section, and marine section).
 - TN 1.16 mg/L.
 - TP 0.05mg/L.
- Removed outliers.



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Lower St. Johns Main Stem (LSJM) Results

