First Year of Monitoring: What have we Learned?

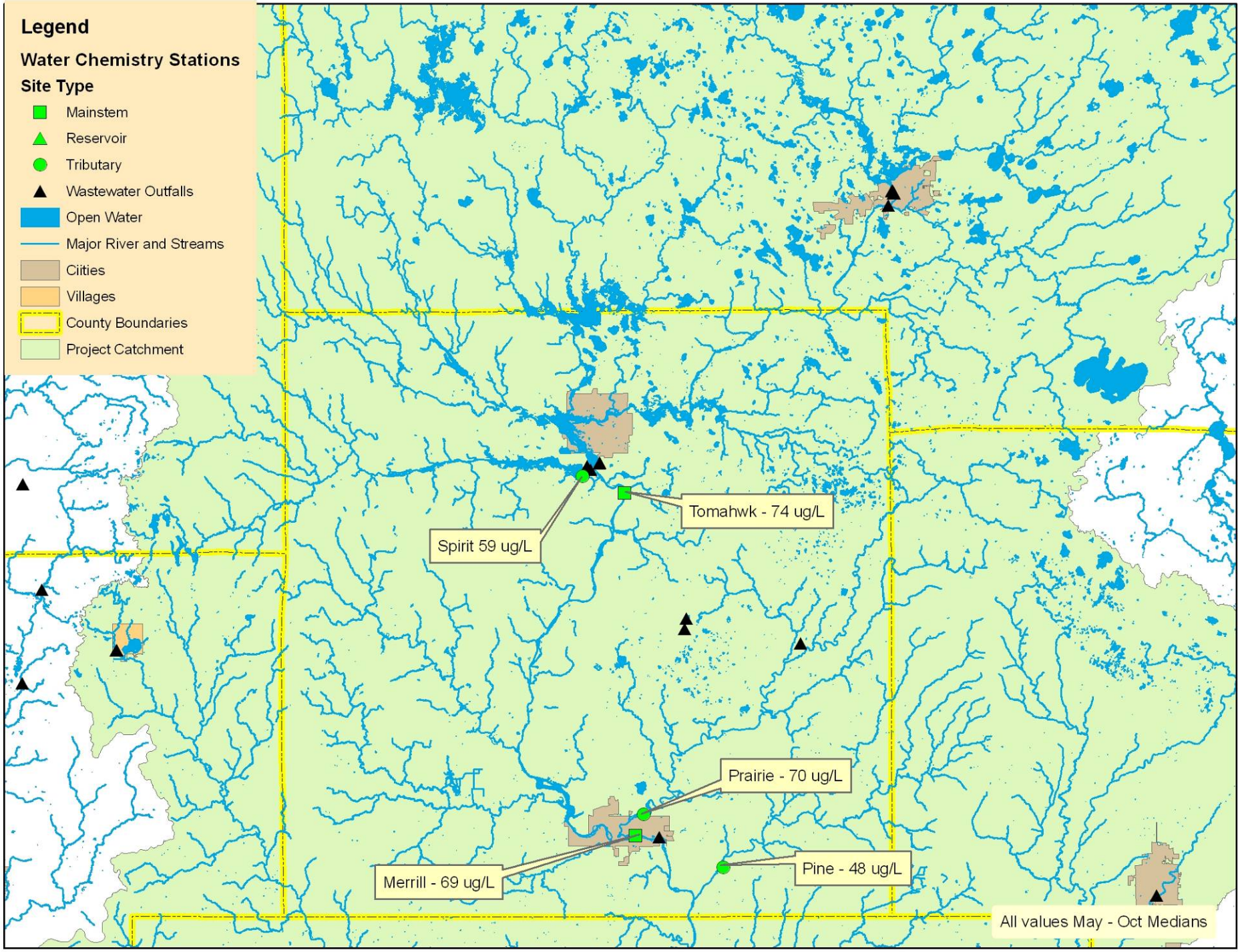
Pat Oldenburg
Water Resources Engineer
Wisconsin Dept. Natural Resources

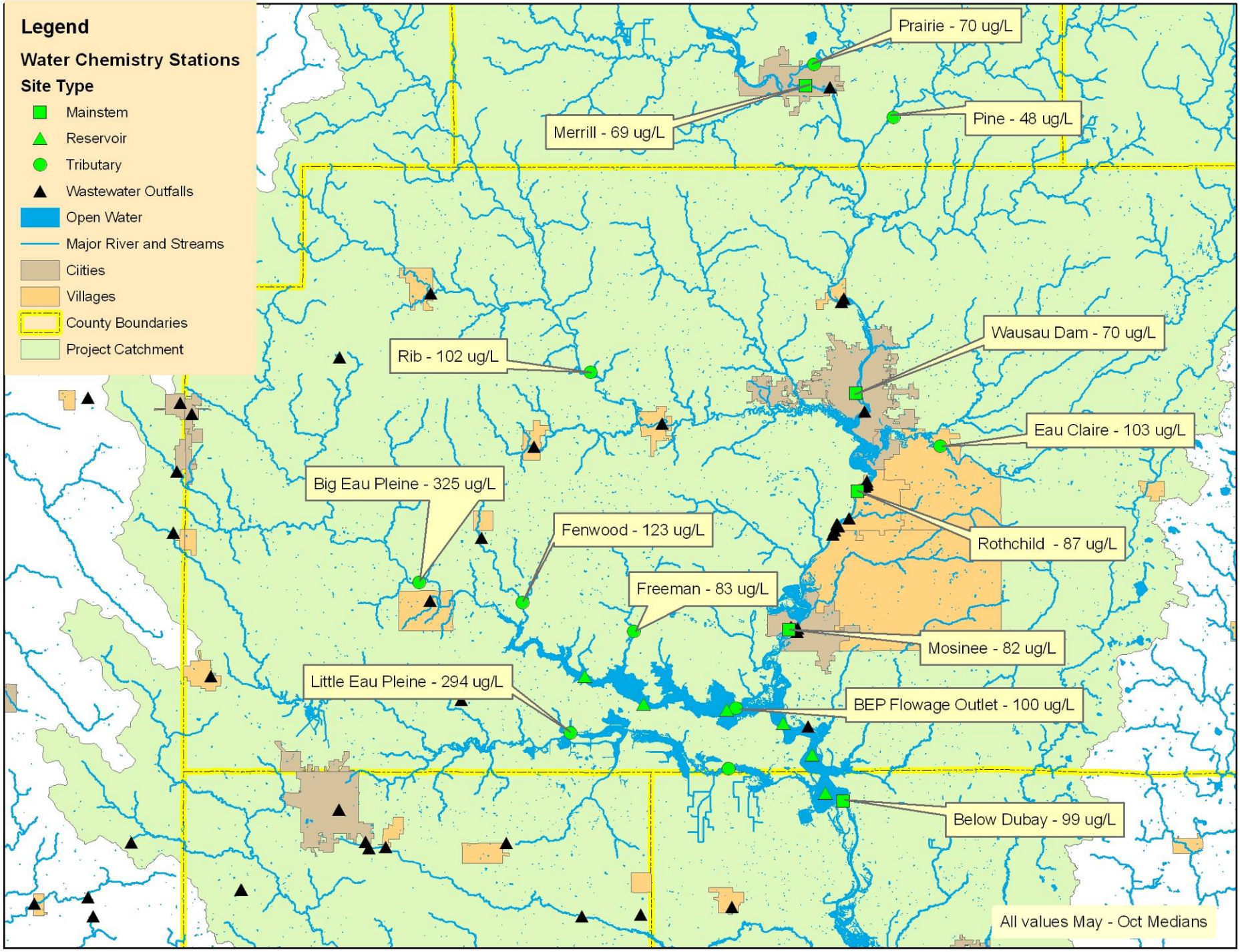
Overview

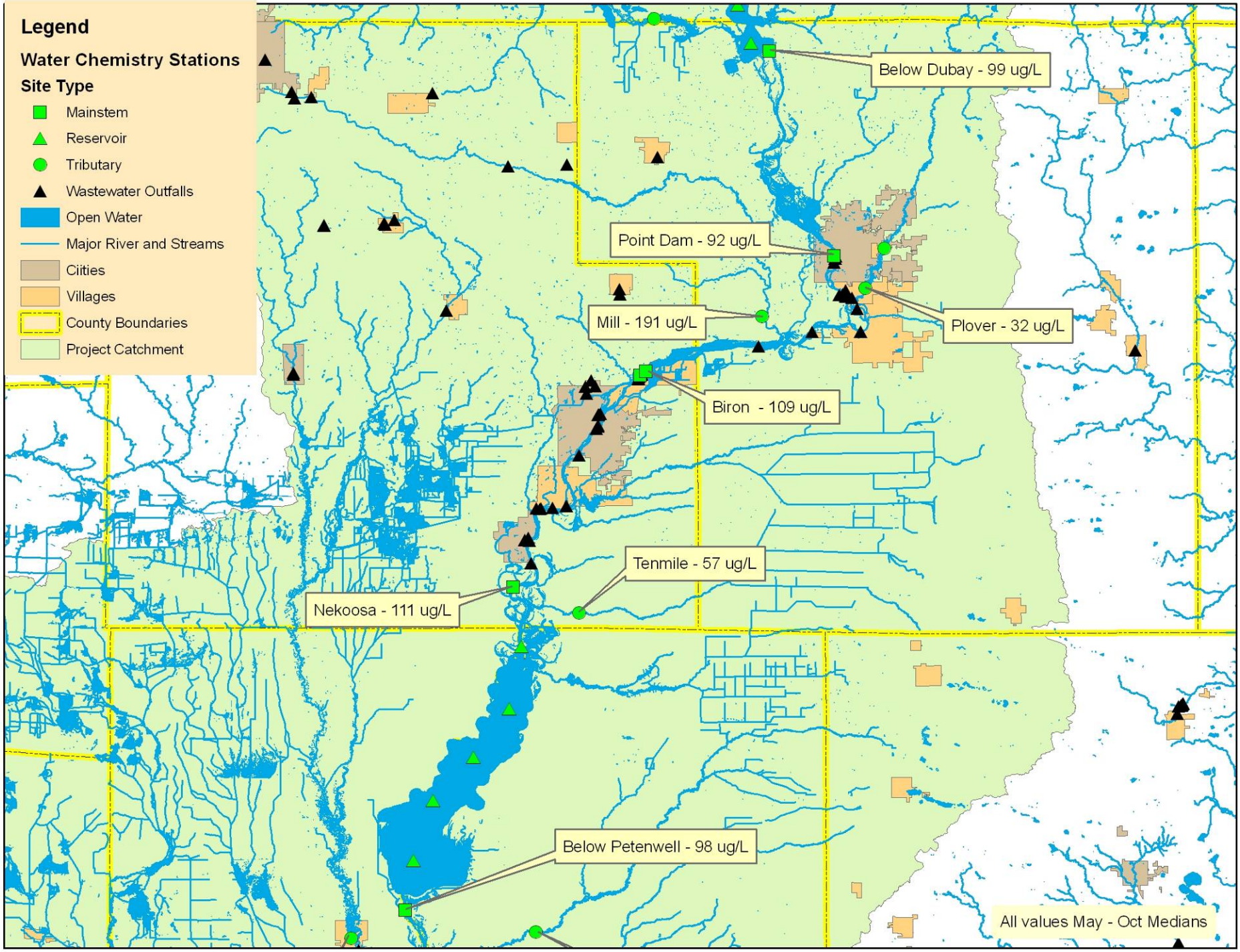
- Quick Discussion of Phosphorus Criteria
- Spatial Trends Phosphorus
- Phosphorus Effects in Reservoirs
- Putting this Summer’s Data in Context

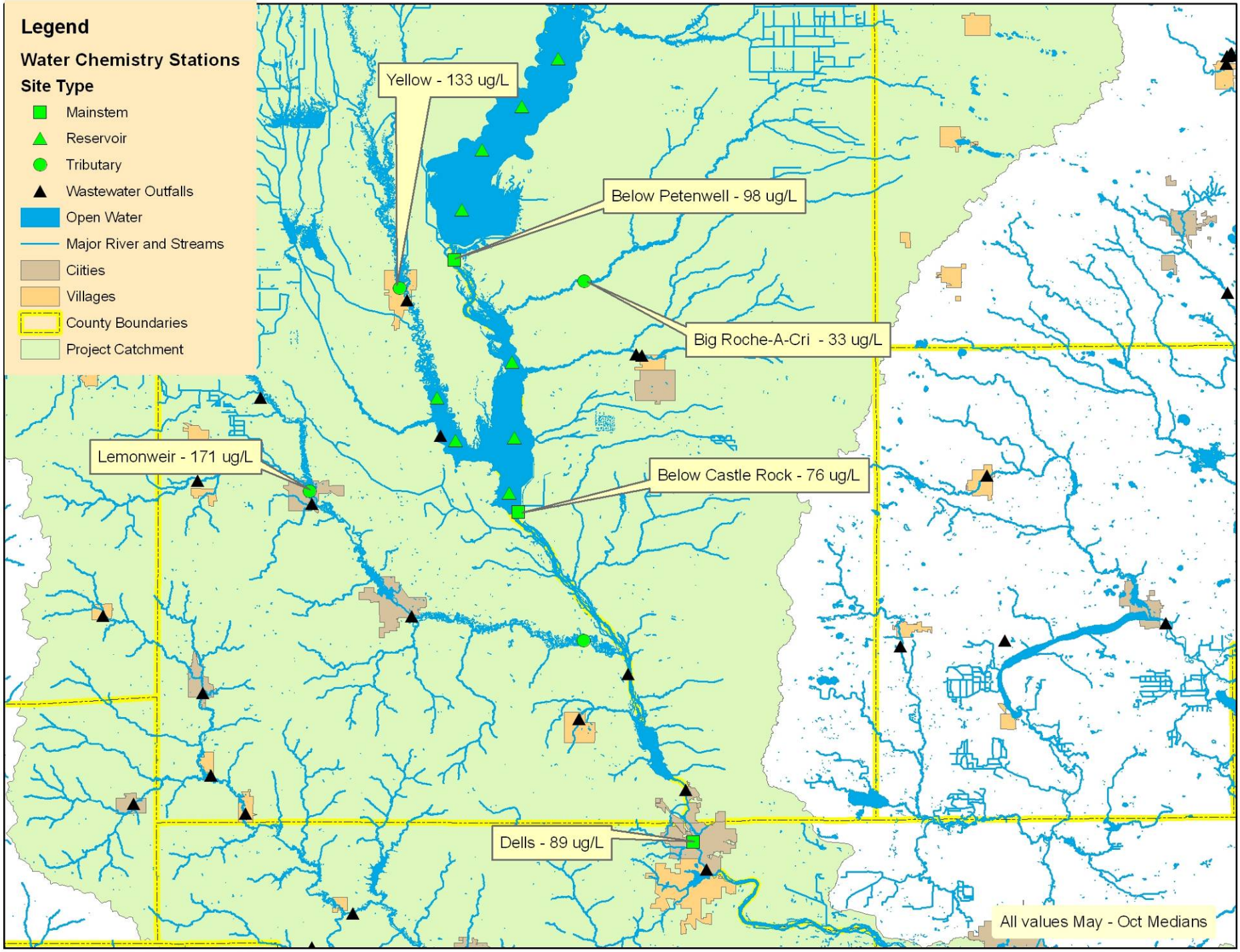
Phosphorus Criteria

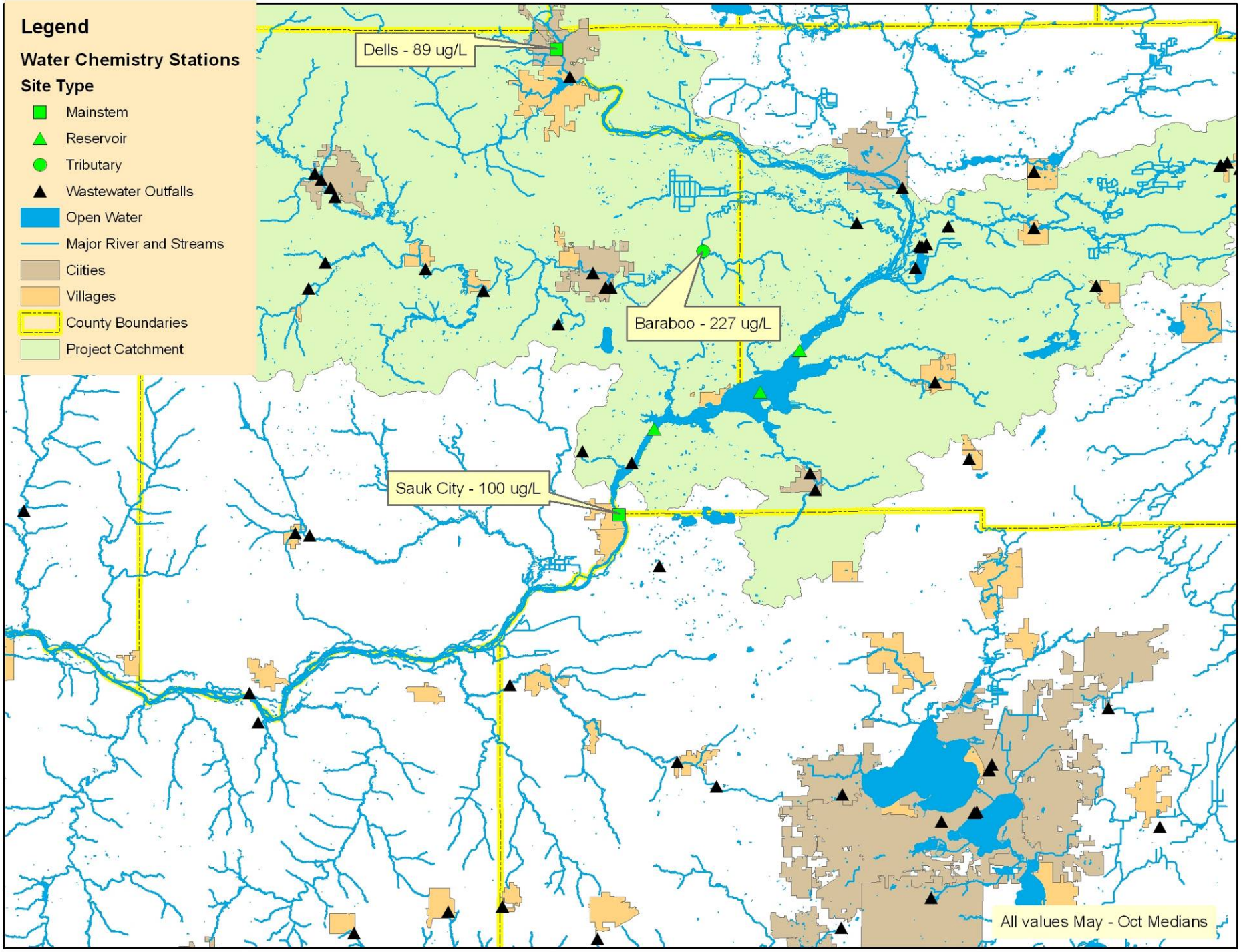
- Contained in s. NR 102.06 WI Admin. Code
- Rivers and Streams
  - Named rivers – 100 μg/L
    - Wisconsin River downstream of Rhinelander
    - Lemonweir River downstream of New Lisbon
    - Baraboo River downstream of La Valle
  - Other rivers in this study - 75 μg/L
- Lakes and Reservoirs
  - Natural lakes – 15 to 40 μg/L (none in this study)
  - Reservoirs
    - Stratified Reservoirs - 30 μg/L
      - Big Eau Pleine(?)
    - Unstratified Reservoirs - 40 μg/L
      - Lake Dubay, Petenwell, and Castle Rock


Legend
Water Chemistry Stations
Site Type
Mainstem
Reservoir
Tributary
Wastewater Outfalls
Open Water
Major River and Streams
Cities
Villages
County Boundaries
Project Catchment
Tomahwk - 74 ug/L
Spirit 59 ug/L
Prairie - 70 ug/L
Merrill - 69 ug/L
Pine - 48 ug/L
All values May - Oct Medians

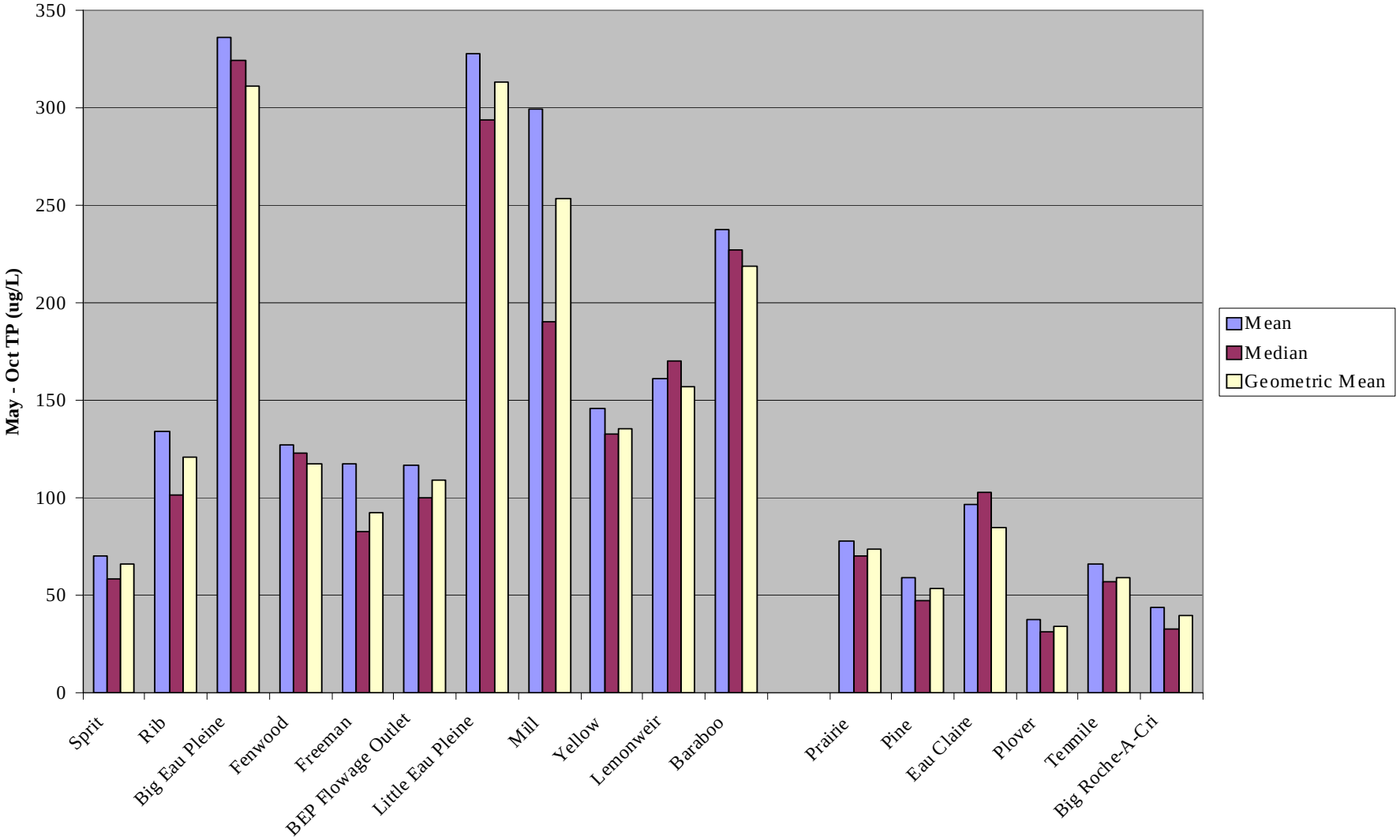

Legend
Water Chemistry Stations
Site Type
Mainstem
Reservoir
Tributary
Wastewater Outfalls
Open Water
Major River and Streams
Cities
Villages
County Boundaries
Project Catchment
Prairie - 70 ug/L
Merrill - 69 ug/L
Pine - 48 ug/L
Wausau Dam - 70 ug/L
Rib - 102 ug/L
Eau Claire - 103 ug/L
Big Eau Pleine - 325 ug/L
Fenwood - 123 ug/L
Rothchild - 87 ug/L
Freeman - 83 ug/L
Mosinee - 82 ug/L
Little Eau Pleine - 294 ug/L
BEP Flowage Outlet - 100 ug/L
Below Dubay - 99 ug/L
All values May - Oct Medians


Legend
Water Chemistry Stations
Site Type
Mainstem
Reservoir
Tributary
Wastewater Outfalls
Open Water
Major River and Streams
Cities
Villages
County Boundaries
Project Catchment
Below Dubay - 99 ug/L
Point Dam - 92 ug/L
Plover - 32 ug/L
Mill - 191 ug/L
Biron - 109 ug/L
Tenmile - 57 ug/L
Nekoosa - 111 ug/L
Below Petenwell - 98 ug/L
All values May - Oct Medians

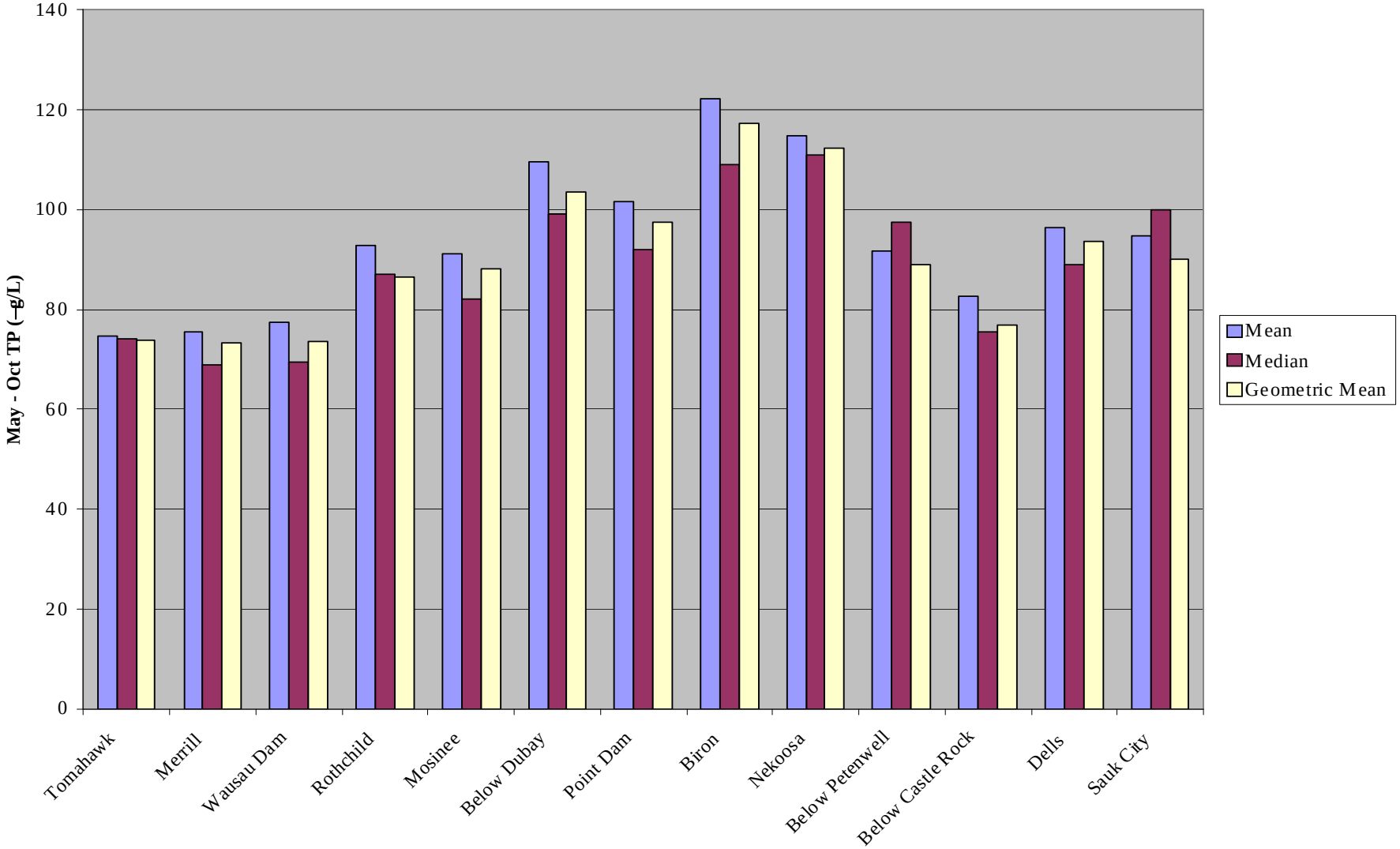

Legend
Water Chemistry Stations
Site Type
Mainstem
Reservoir
Tributary
Wastewater Outfalls
Open Water
Major River and Streams
Cities
Villages
County Boundaries
Project Catchment
Yellow - 133 ug/L
Below Petenwell - 98 ug/L
Big Roche-A-Cri - 33 ug/L
Lemonweir - 171 ug/L
Below Castle Rock - 76 ug/L
Dells - 89 ug/L
All values May - Oct Medians

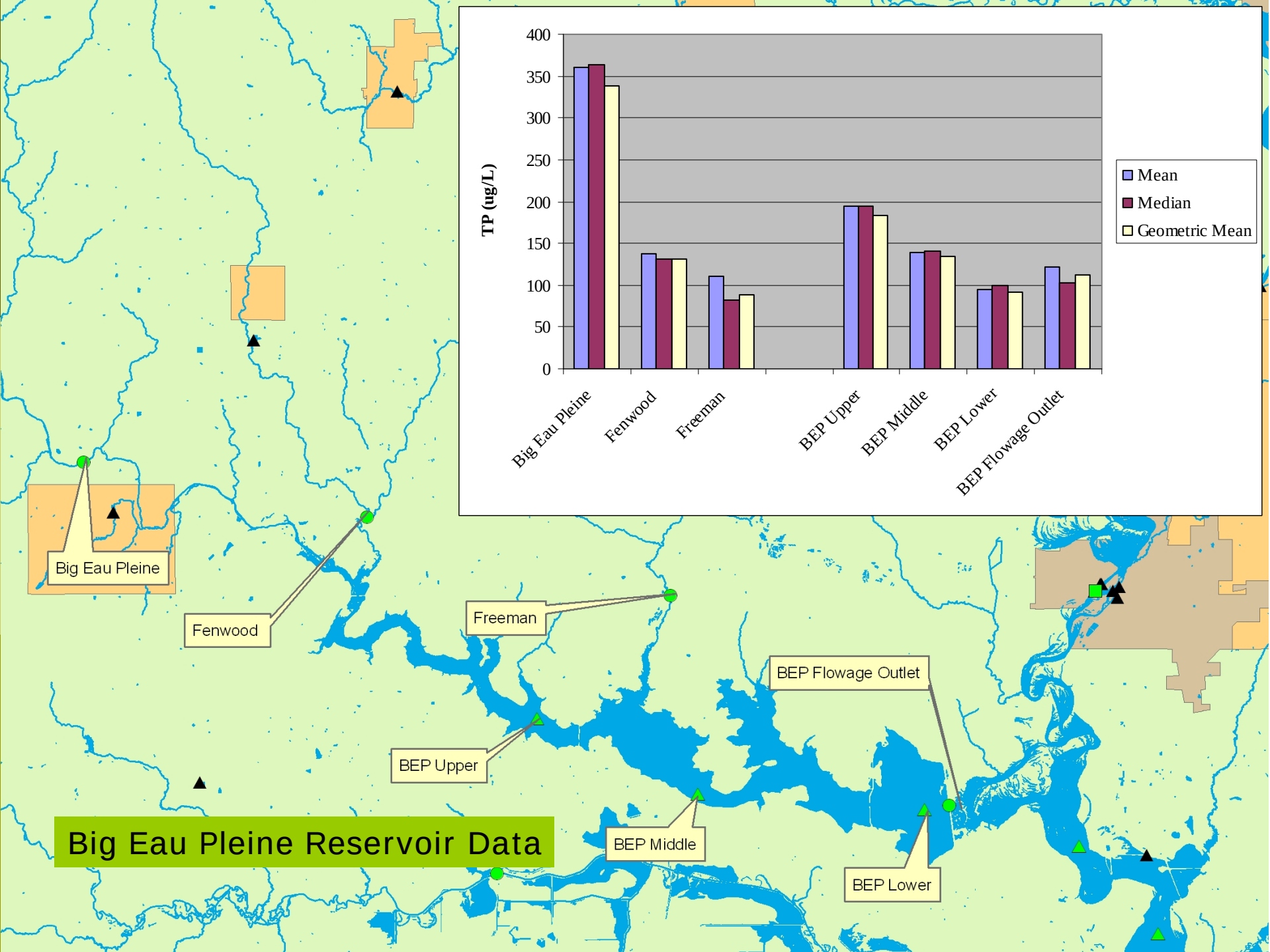

Legend
Water Chemistry Stations
Site Type
Mainstem
Reservoir
Tributary
Wastewater Outfalls
Open Water
Major River and Streams
Cities
Villages
County Boundaries
Project Catchment
Dells - 89 ug/L
Baraboo - 227 ug/L
Sauk City - 100 ug/L
All values May - Oct Medians

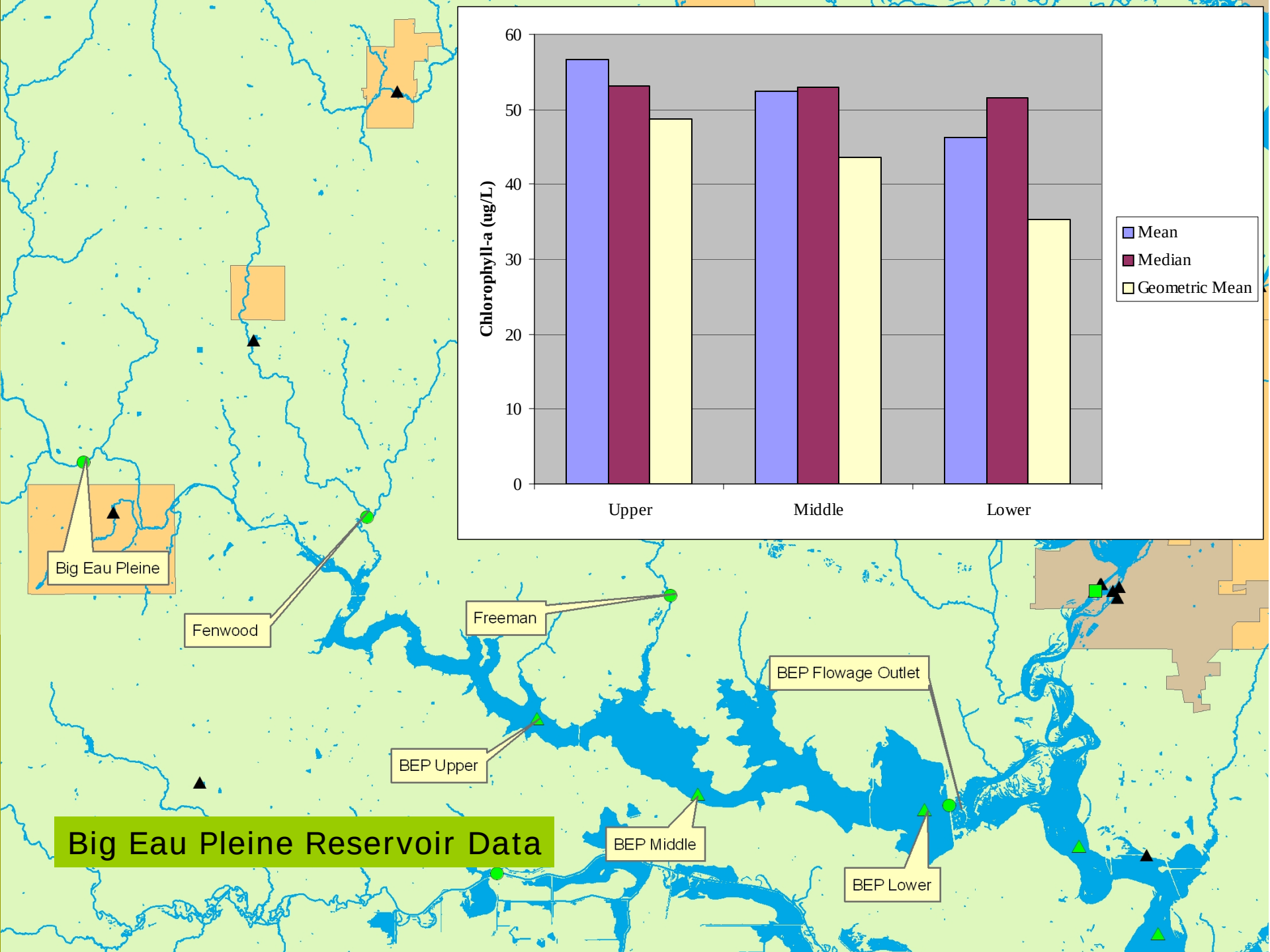
Summary Results - 2010 Wisconsin River Tributaries

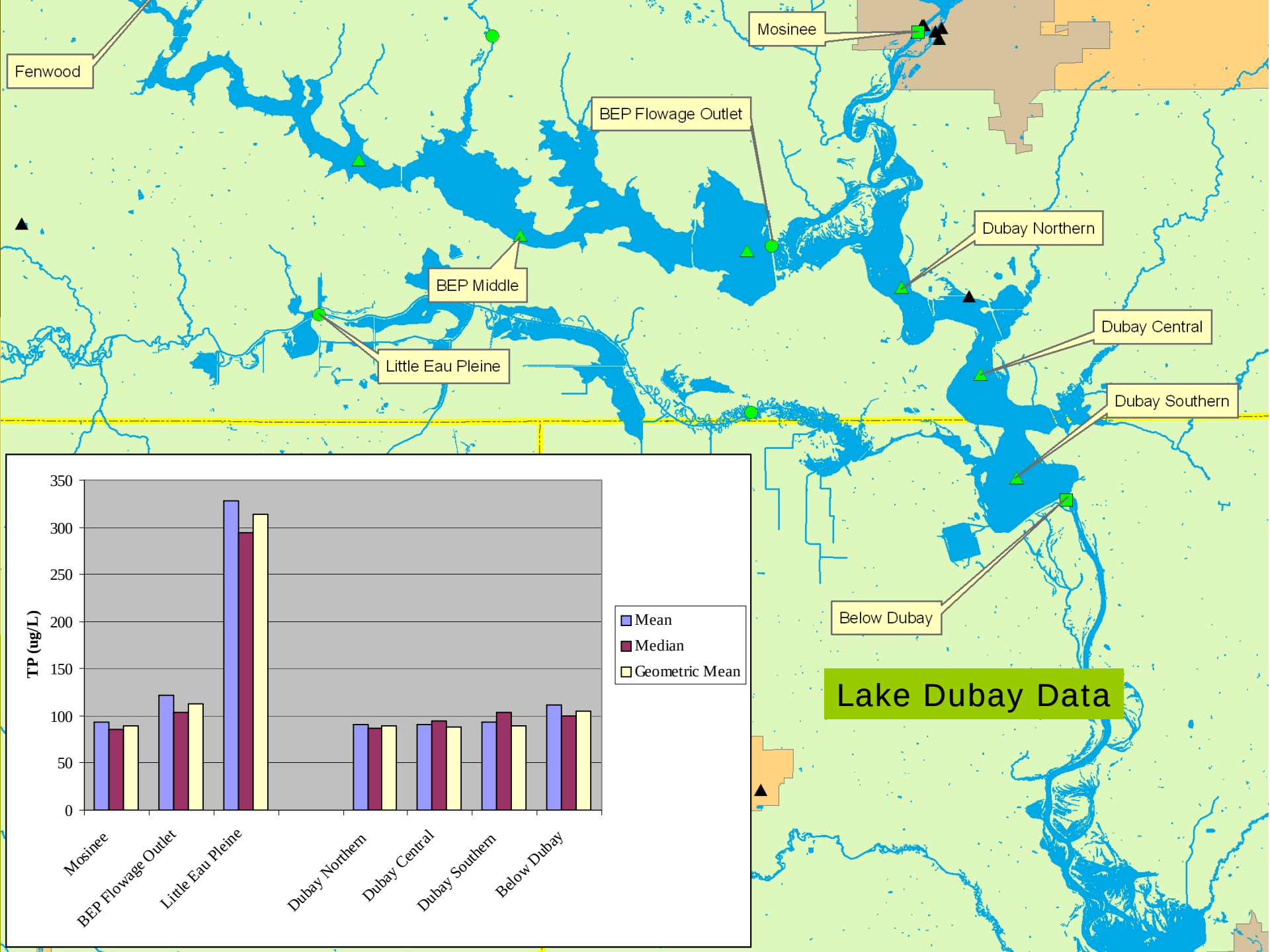


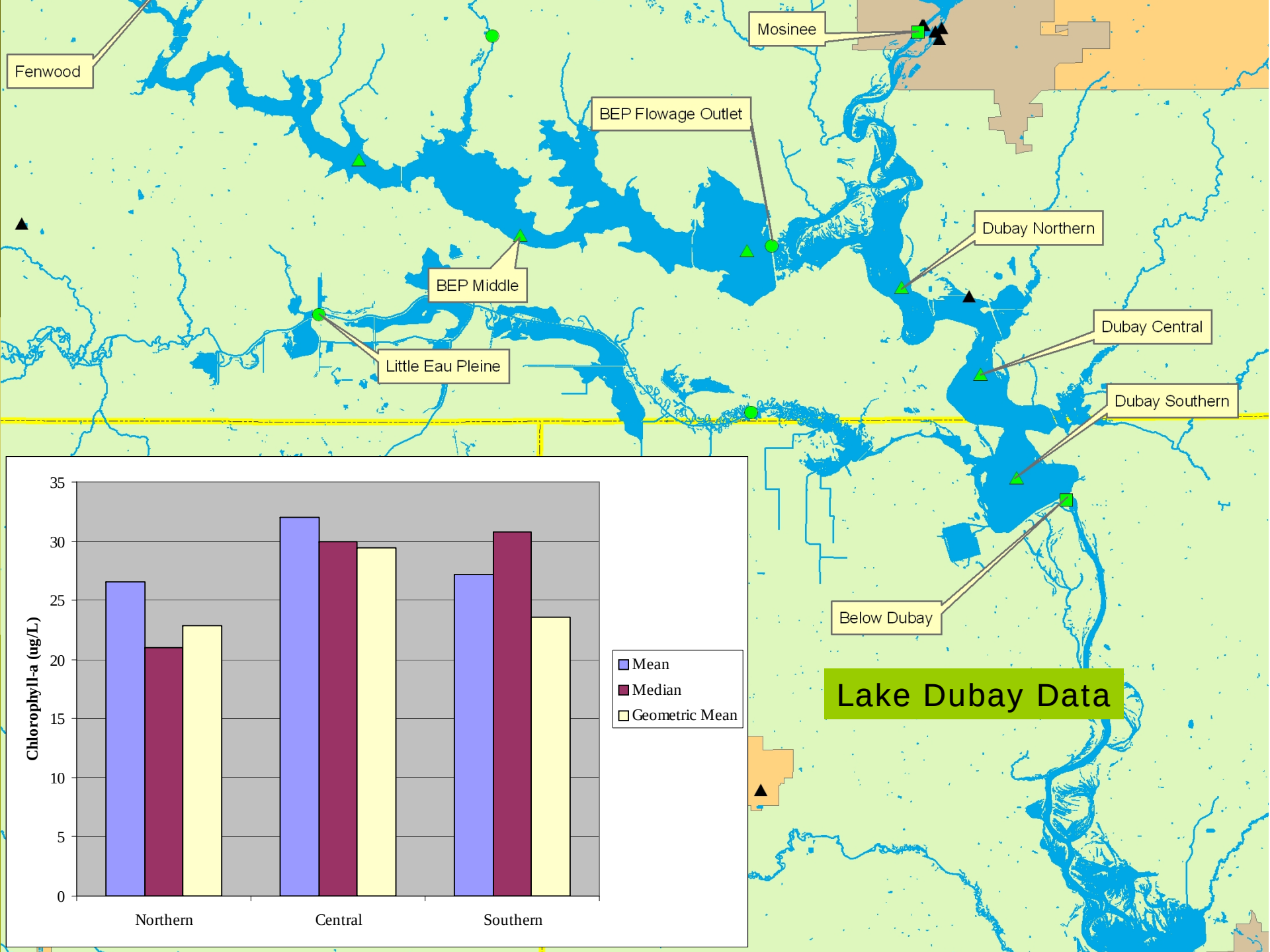
Summary Results - 2010 Wisconsin River Mainstem



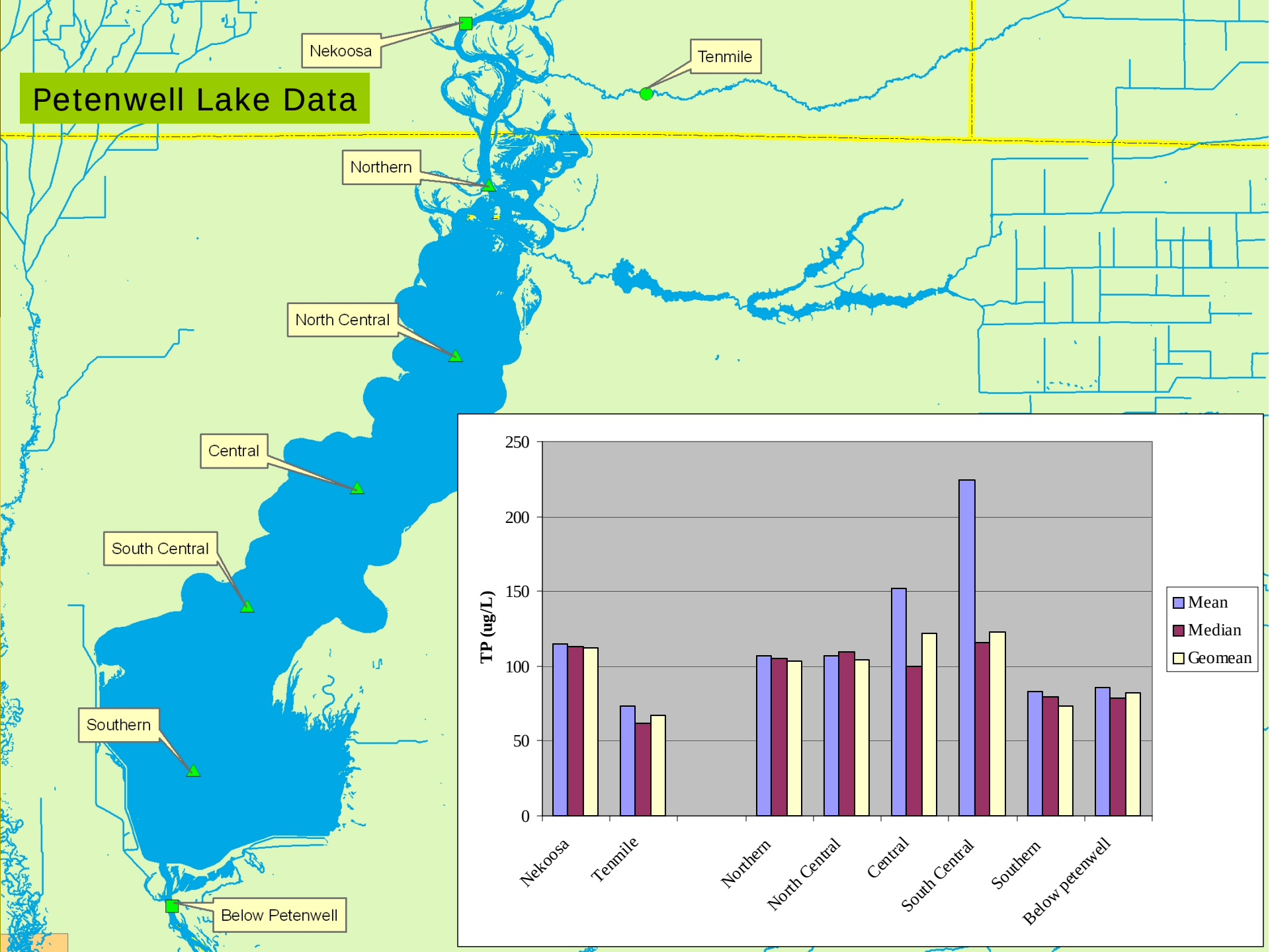

Big Eau Pleine Reservoir Data
TP (ug/L)
400
350
300
250
200
150
100
50
0
Big Eau Pleine
Fenwood
Freeman
BEP Upper
BEP Middle
BEP Lower
BEP Flowage Outlet
Mean
Median
Geometric Mean
Big Eau Pleine
Fenwood
Freeman
BEP Flowage Outlet
BEP Upper
BEP Middle
BEP Lower


Big Eau Pleine Reservoir Data
Big Eau Pleine
Fenwood
Freeman
BEP Upper
BEP Middle
BEP Flowage Outlet
BEP Lower
Chlorophyll-a (ug/L)
0
10
20
30
40
50
60
Upper
Middle
Lower
Mean
Median
Geometric Mean

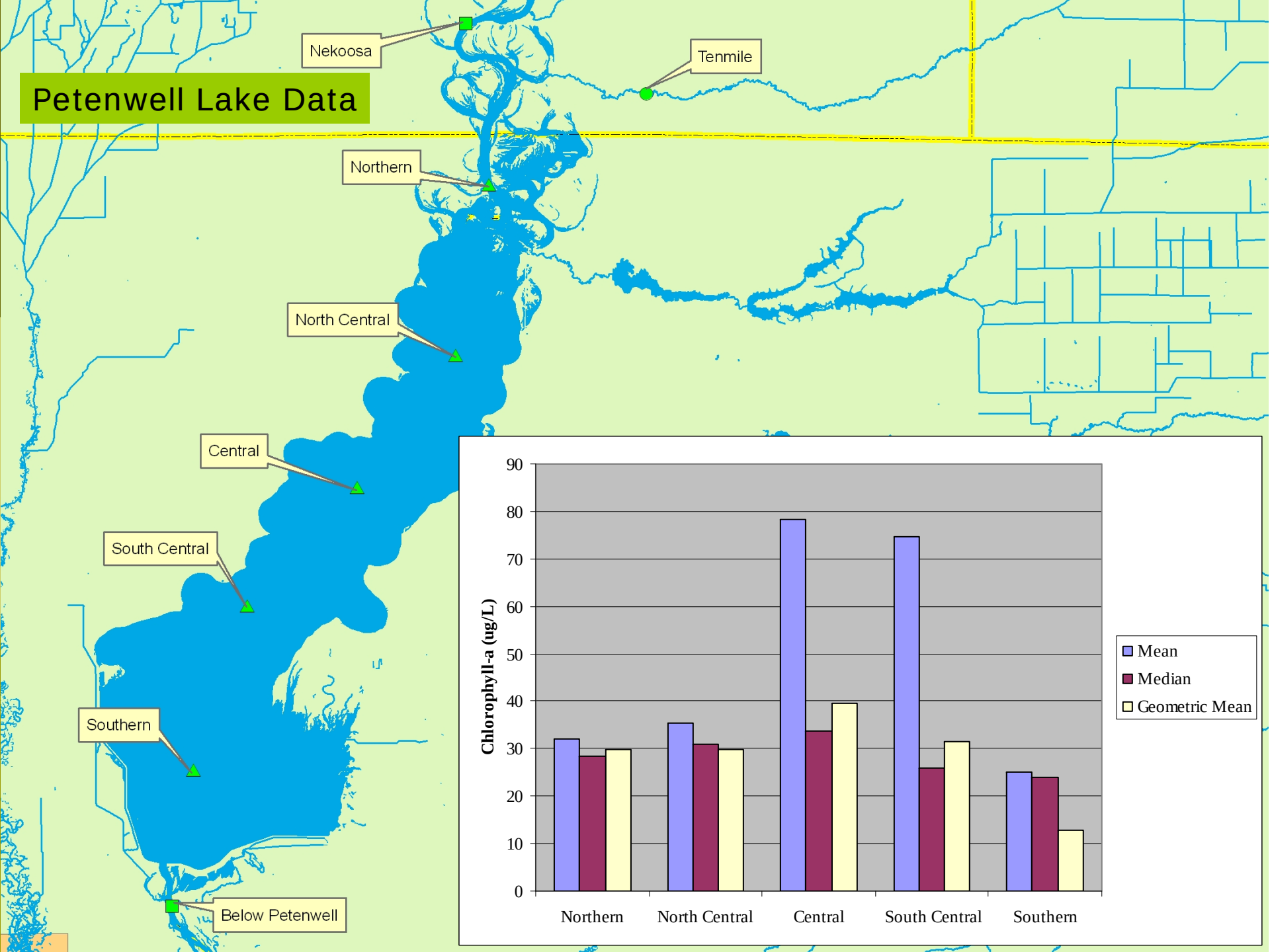

Fenwood
Mosinee
BEP Flowage Outlet
Dubay Northern
BEP Middle
Dubay Central
Little Eau Pleine
Dubay Southern
Below Dubay
Lake Dubay Data
TP (ug/L)
350
300
250
200
150
100
50
0
Mean
Median
Geometric Mean
Mosinee
BEP Flowage Outlet
Little Eau Pleine
Dubay Northern
Dubay Central
Dubay Southern
Below Dubay


Fenwood
Mosinee
BEP Flowage Outlet
Dubay Northern
BEP Middle
Dubay Central
Little Eau Pleine
Dubay Southern
Below Dubay
Lake Dubay Data
Chlorophyll-a (ug/L)
35
30
25
20
15
10
5
0
Northern
Central
Southern
Mean
Median
Geometric Mean

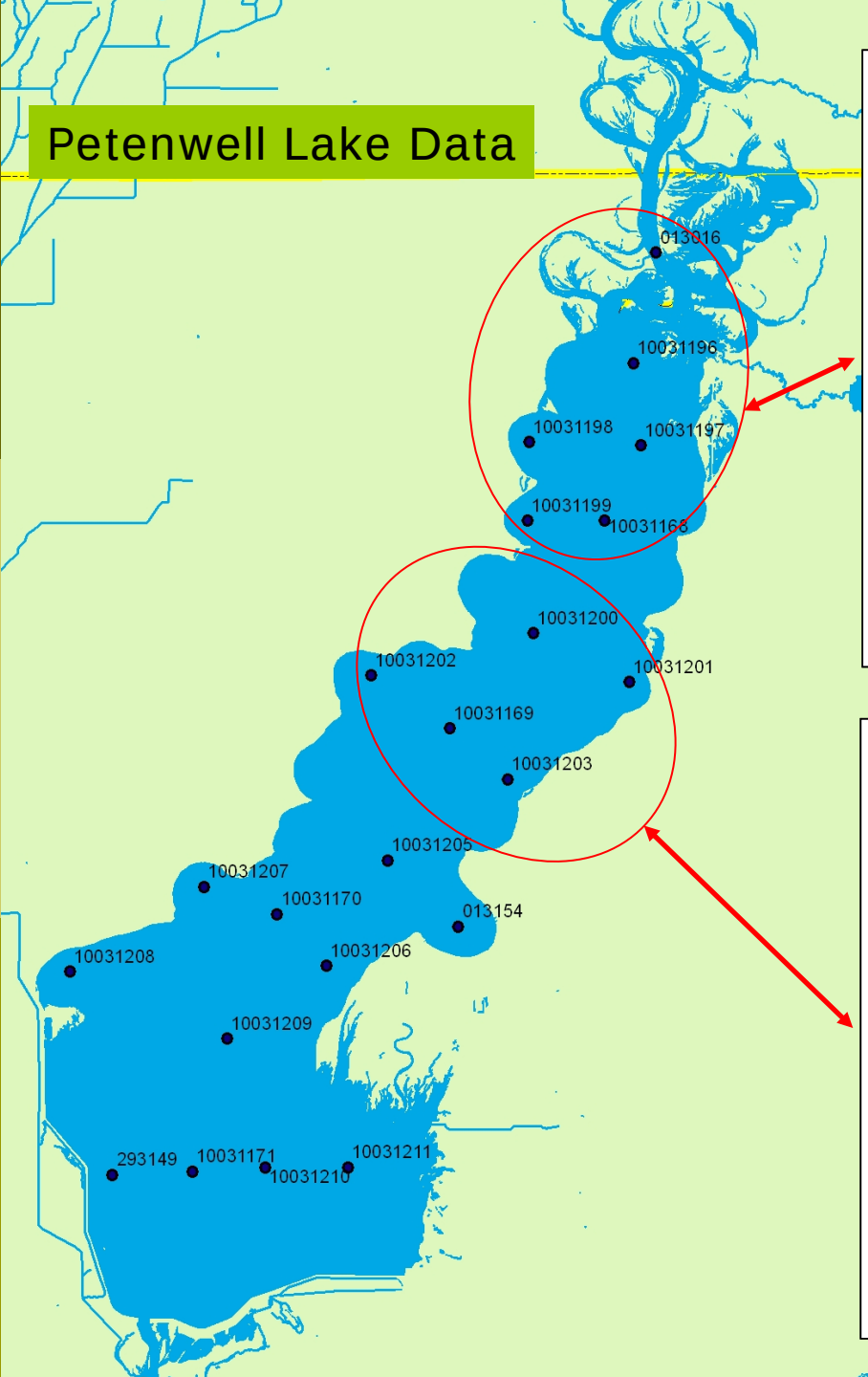
Petenwell Lake Data

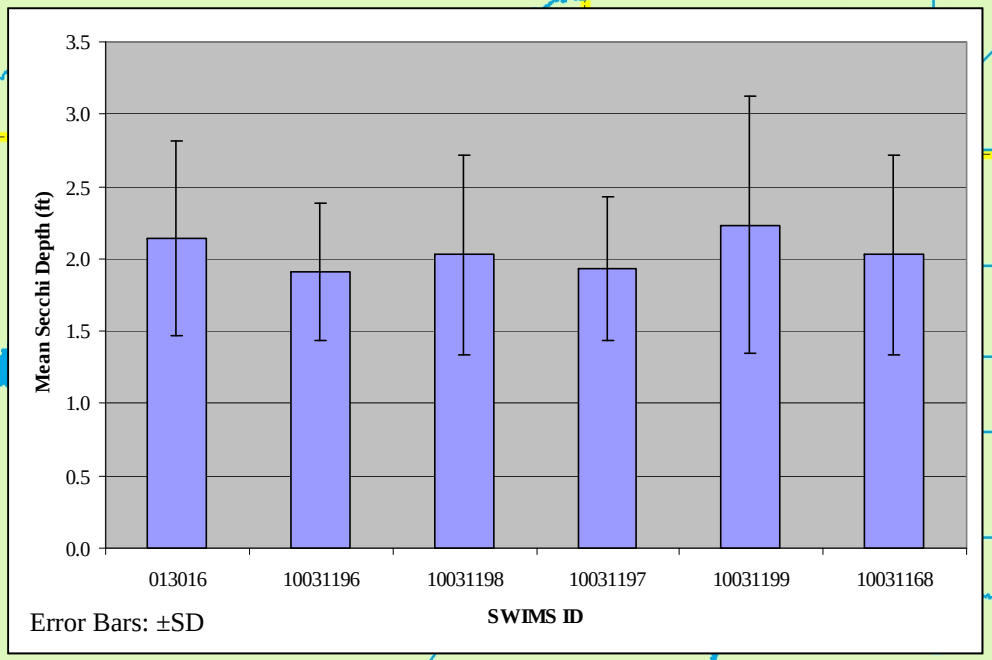


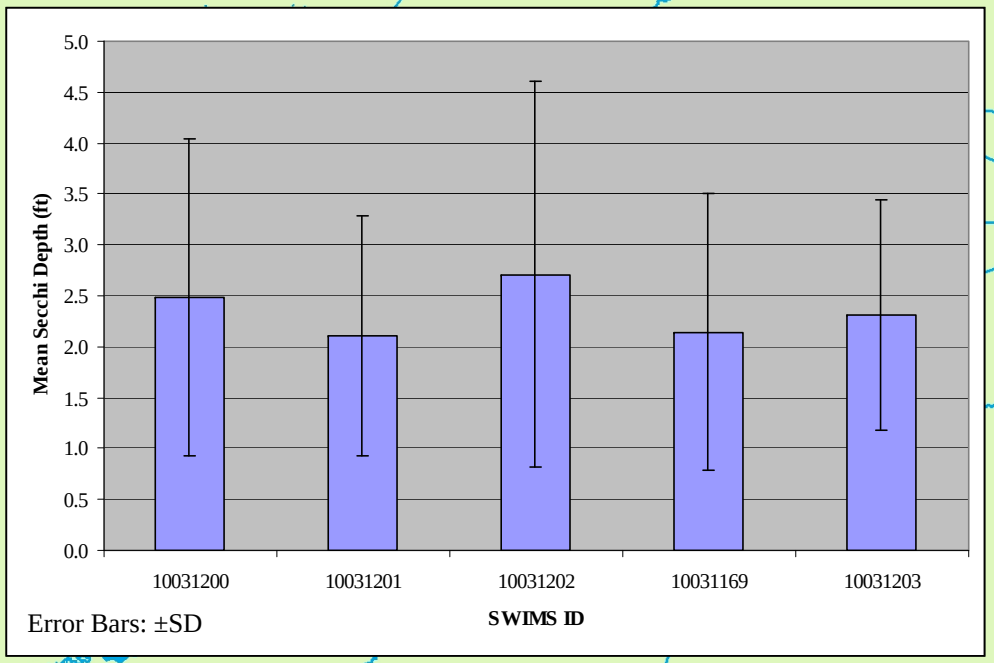
Petenwell Lake Data



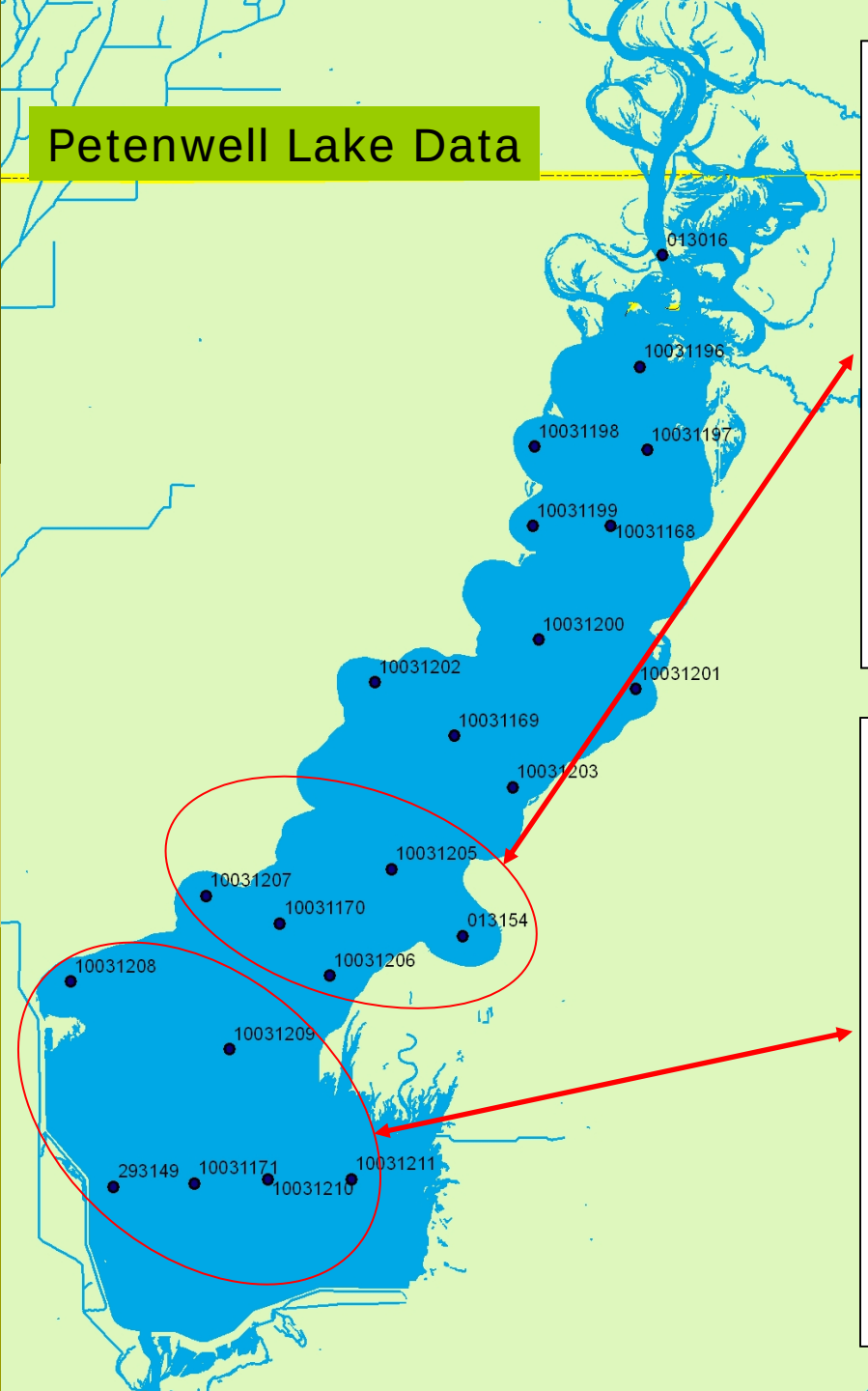
Petenwell Lake Data

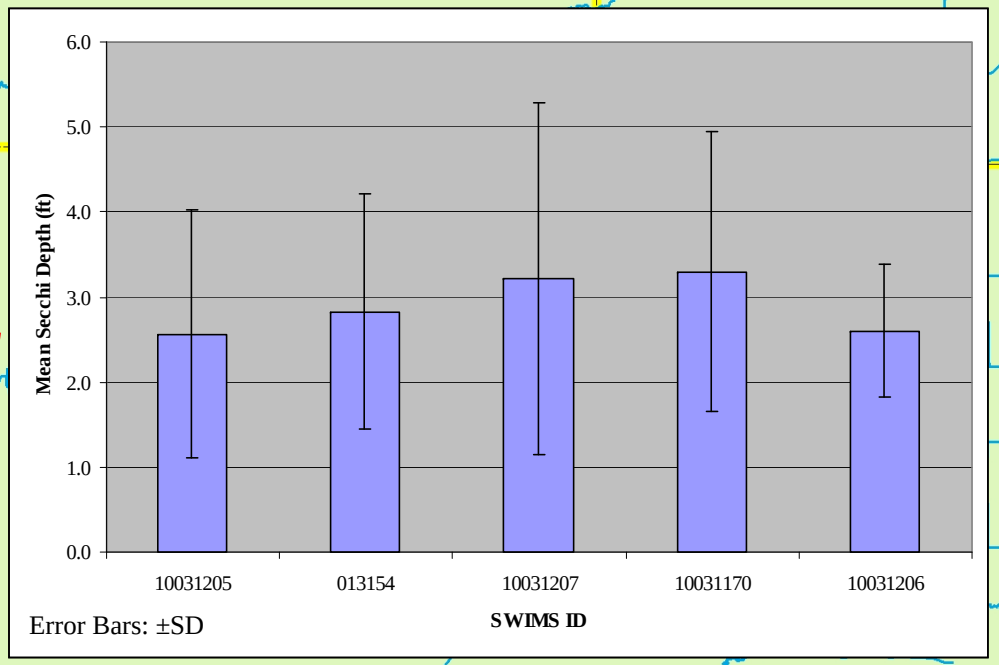


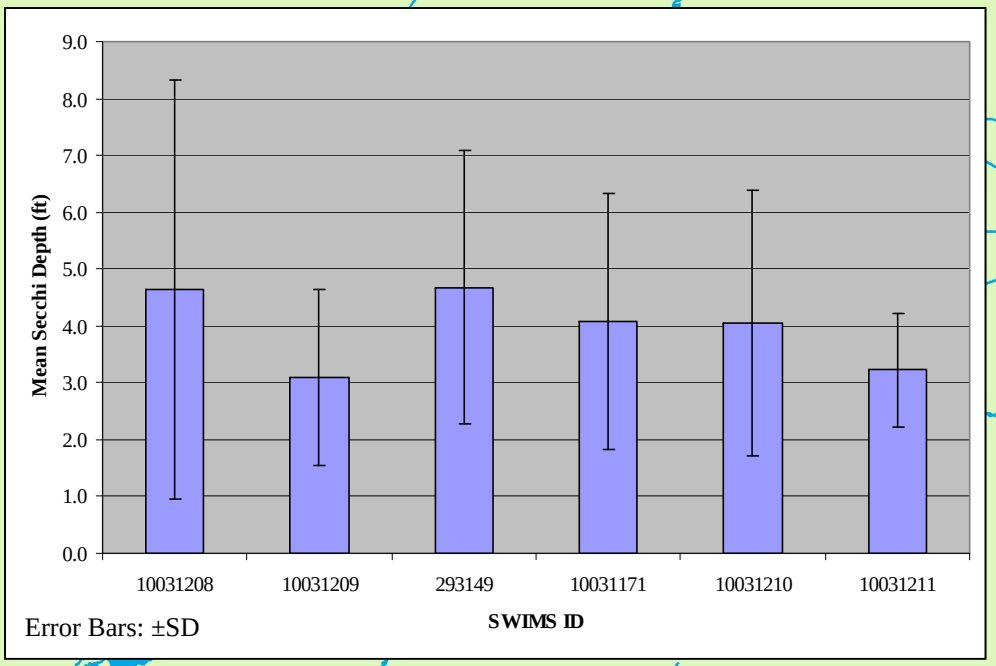




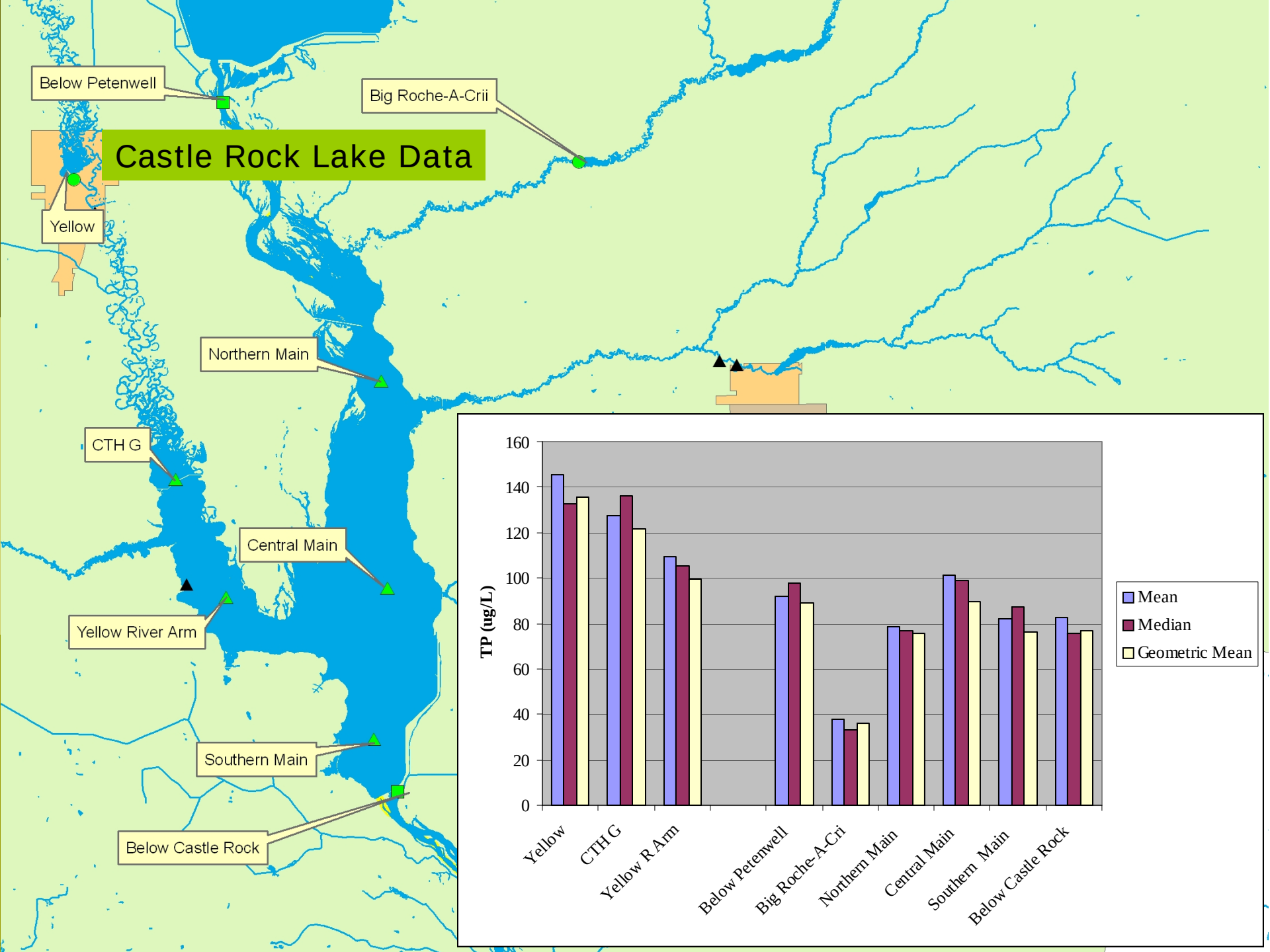
Petenwell Lake Data



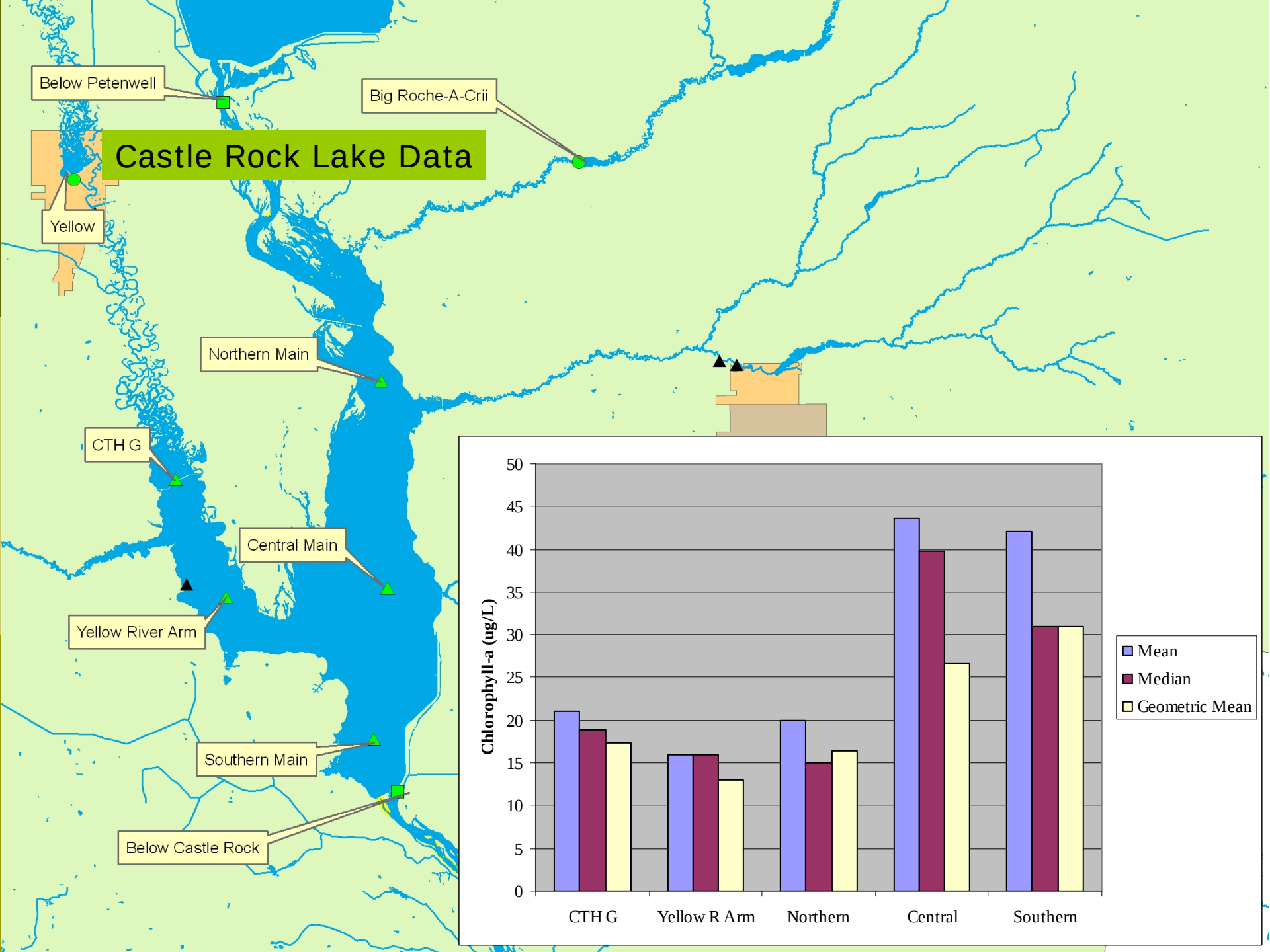




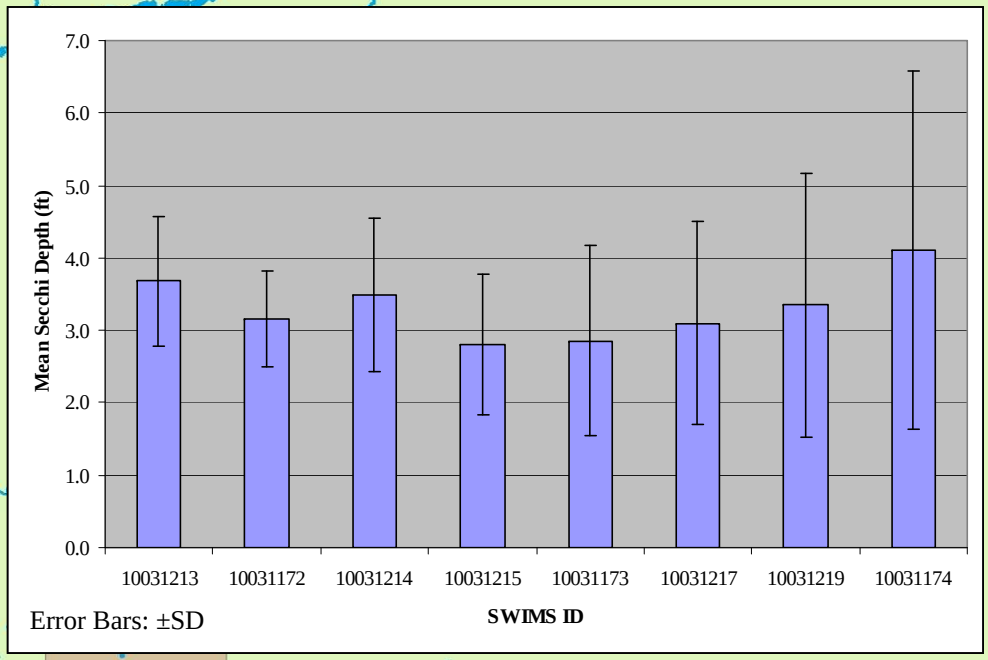
Castle Rock Lake Data

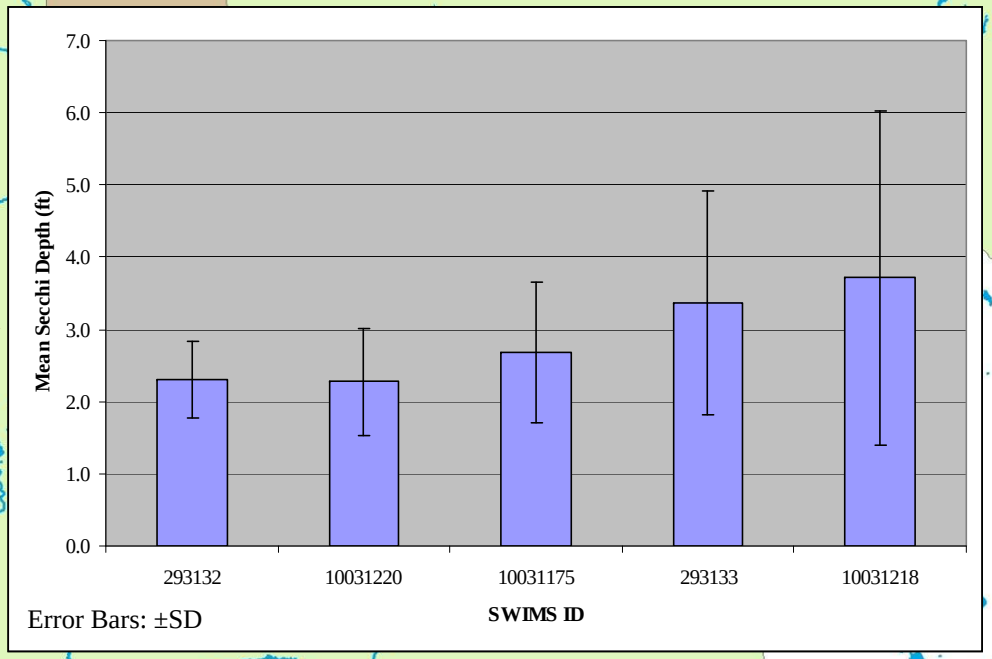


Castle Rock Lake Data

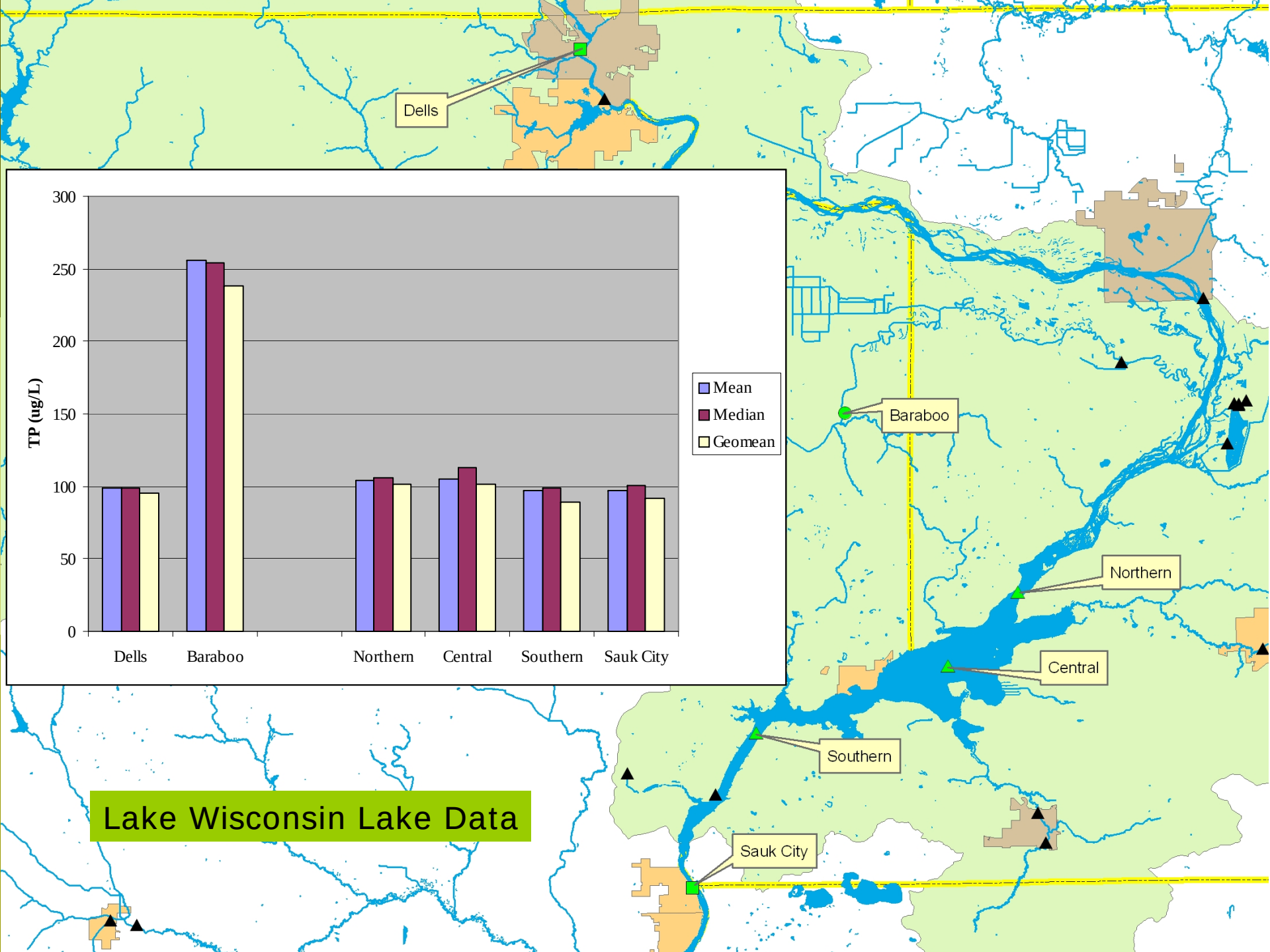


Castle Rock Lake Data

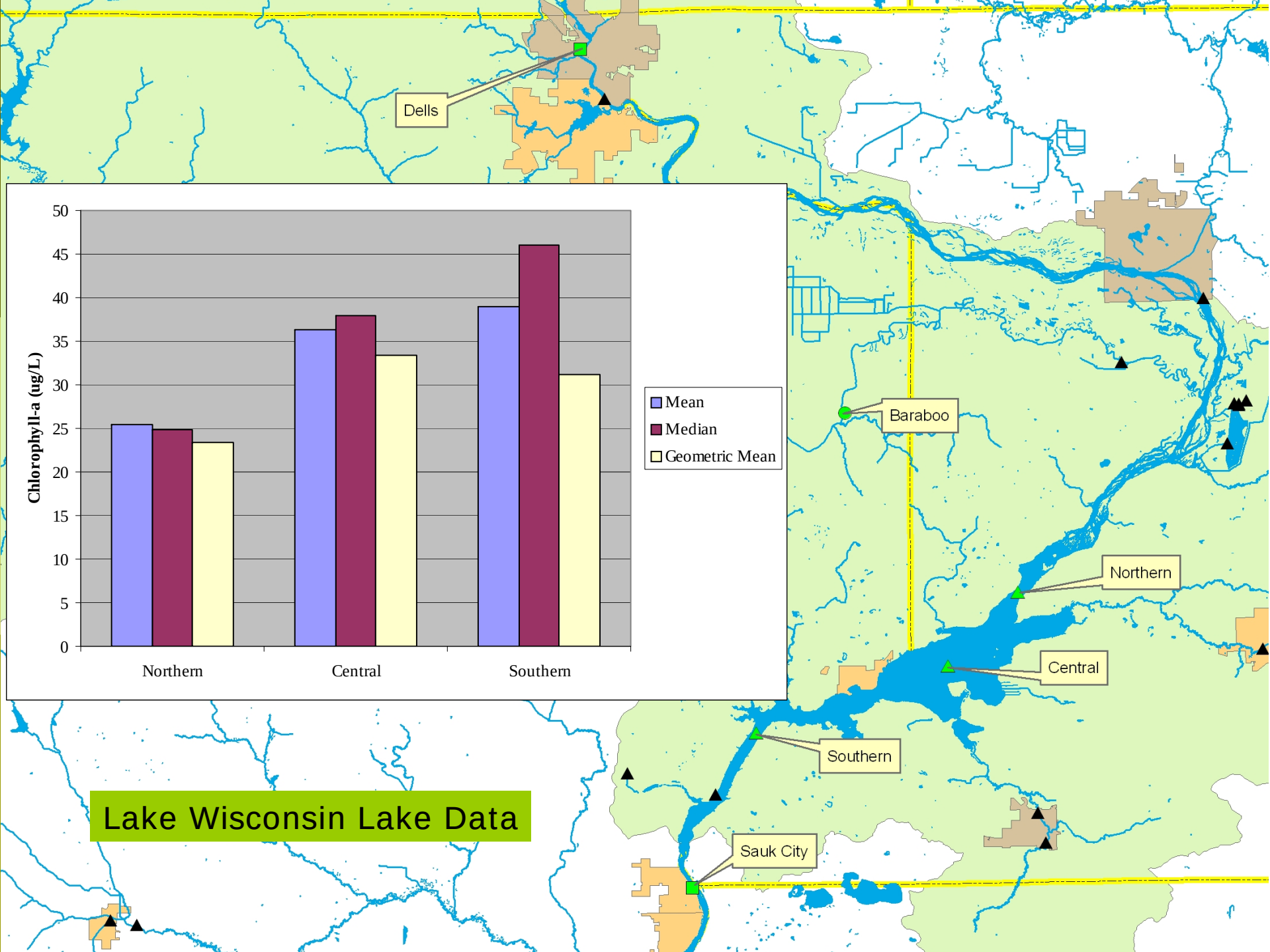




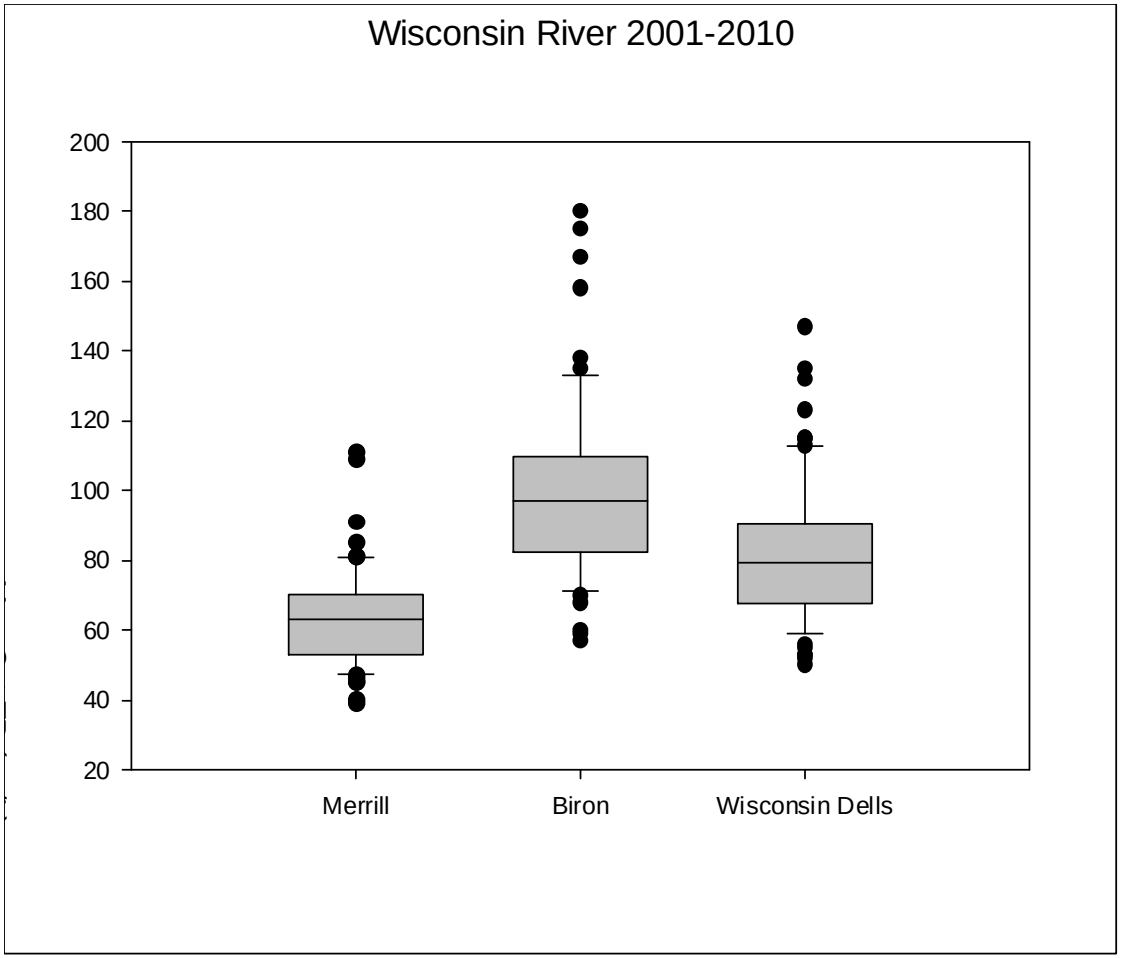
Lake Wisconsin Lake Data



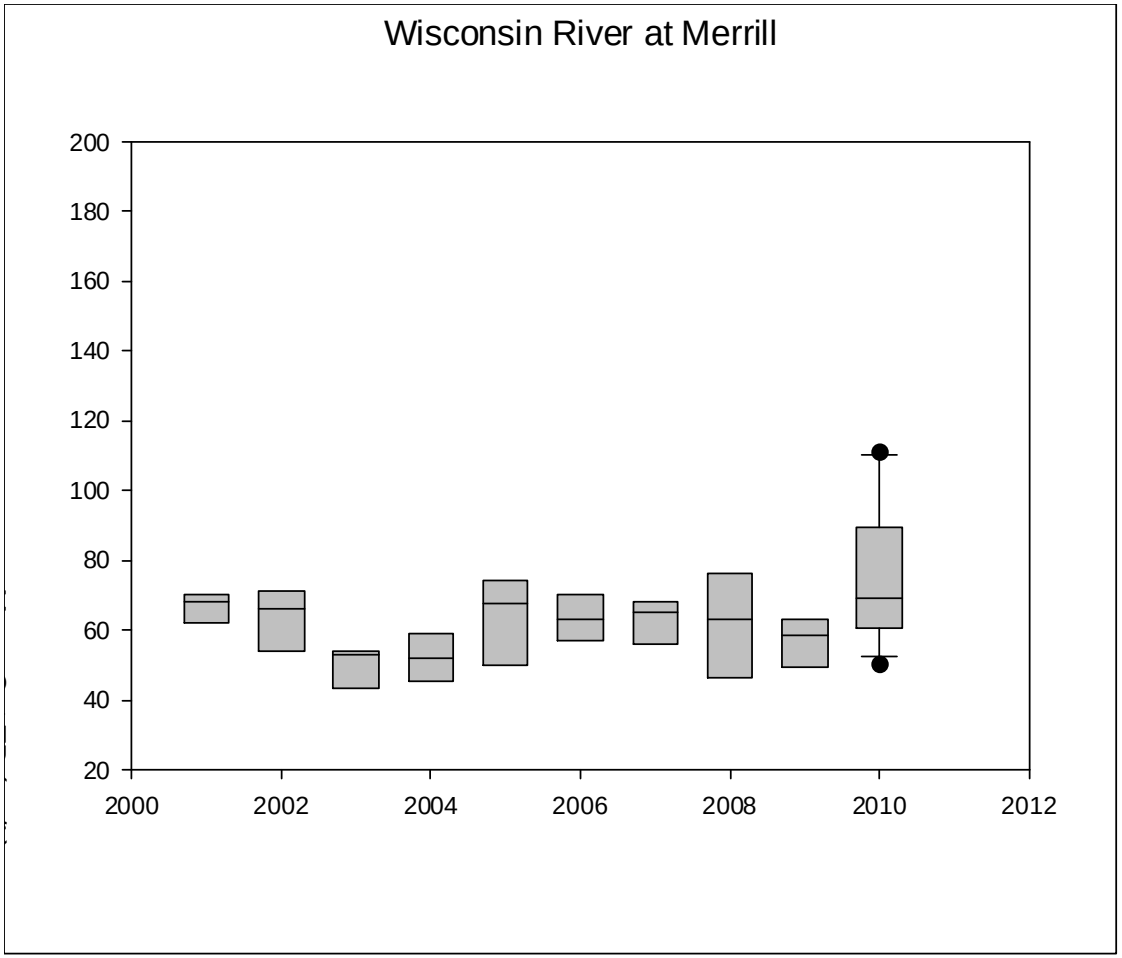
Lake Wisconsin Lake Data



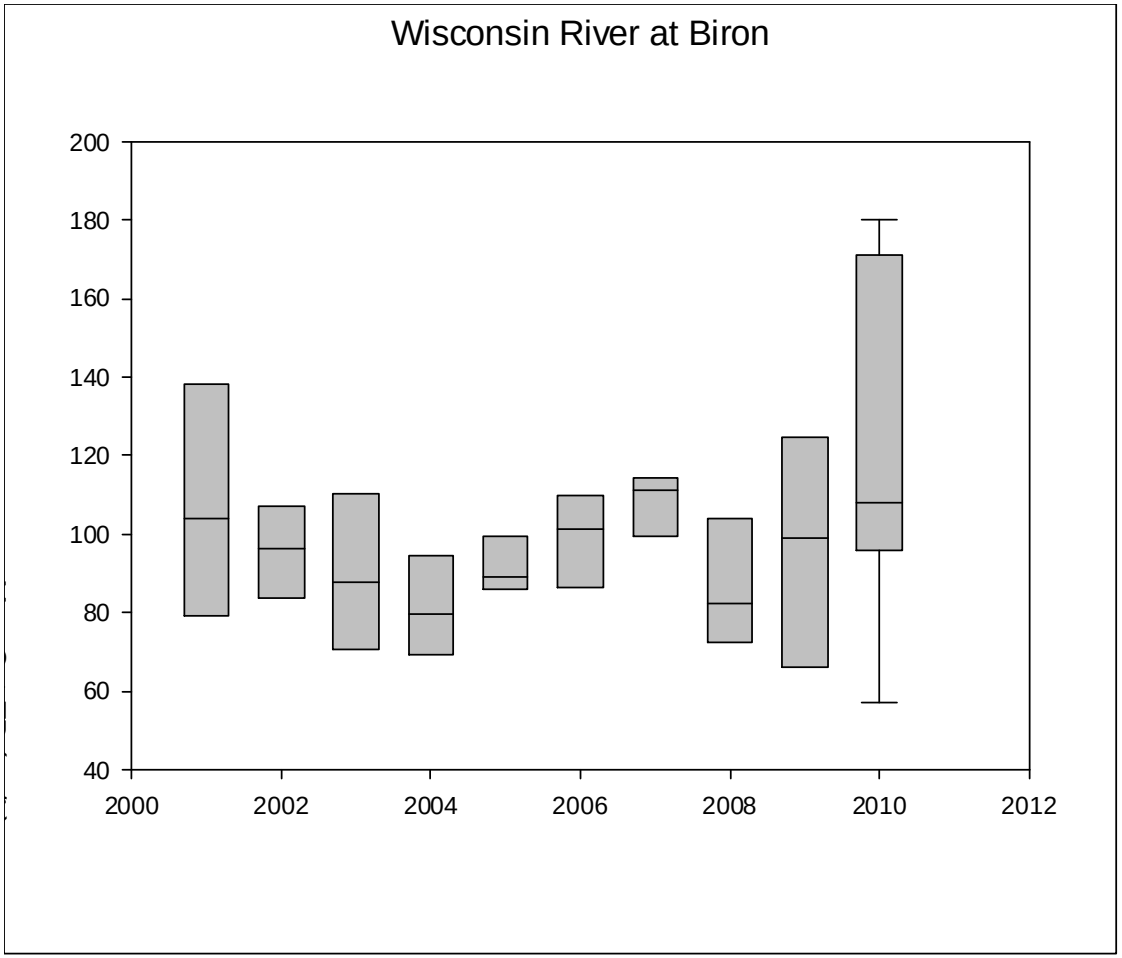
Longer Term Comparisons



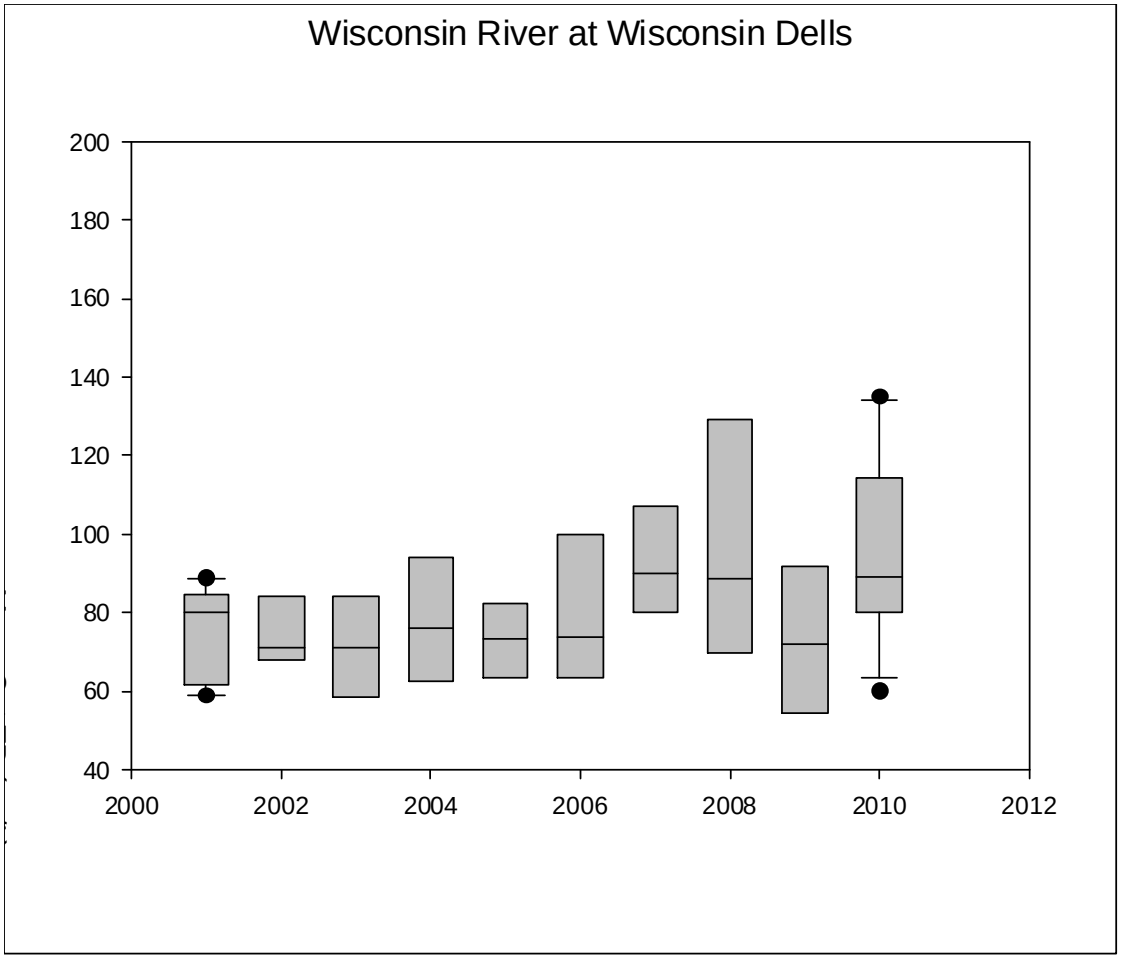
Longer Term Comparisons



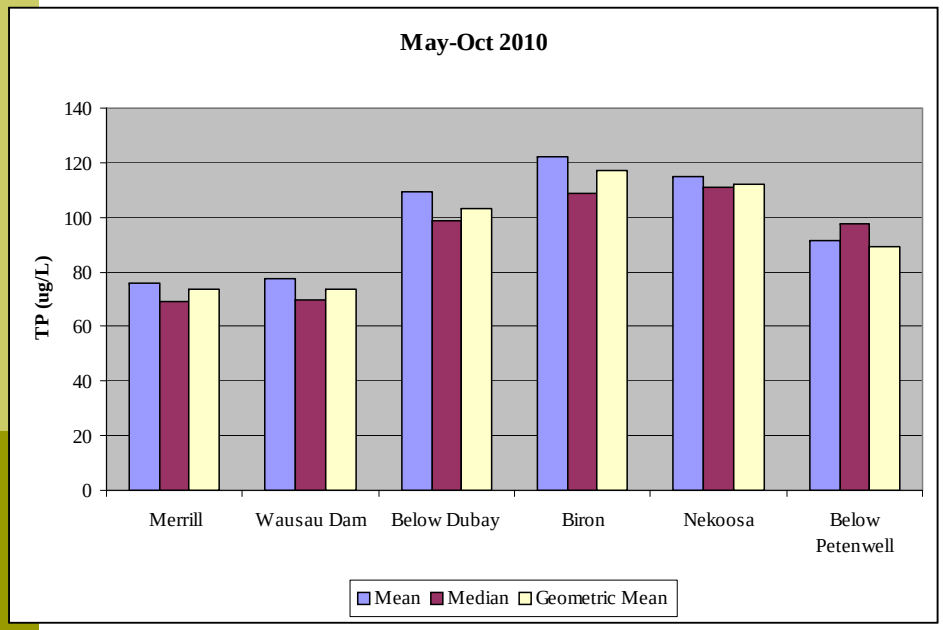
Longer Term Comparisons

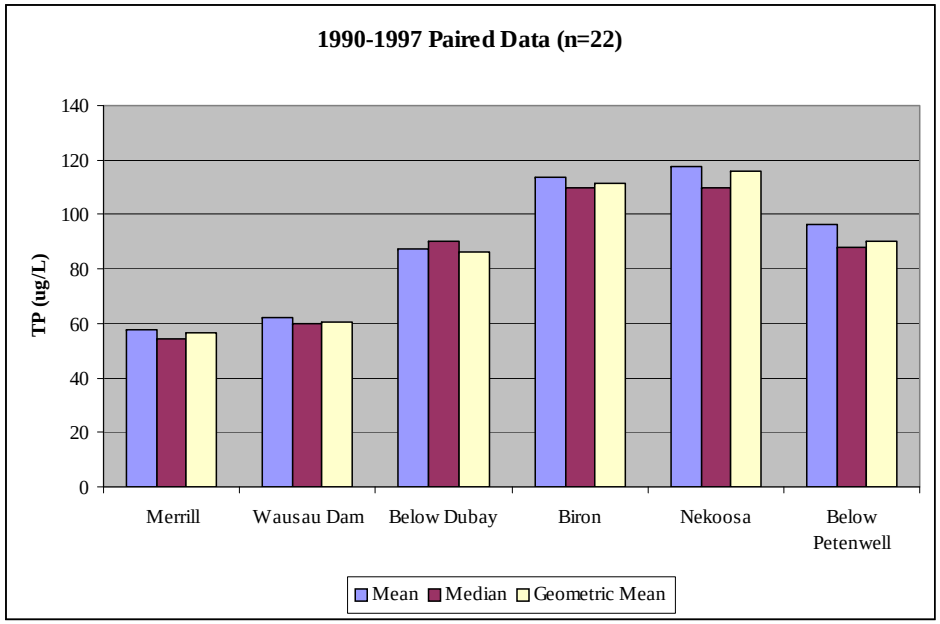


Longer Term Comparisons



Further Comparison





Conclusions

- More like inferences at this point
- Wisconsin River phosphorus concentrations generally increase north to south
  - Big Eau Pleine, Petenwell and Castle Rock appear to act as net sinks for phosphorus
  - Lake Dubay and Lake Wisconsin less clear
- Western tributaries exhibit much higher phosphorus concentrations than eastern tributaries
- Flowages generally exhibit poor water quality (Chlorophyll > 25 µg/L)
- Algae blooms are variable and heterogeneous
- Maybe not a “normal” summer, but not necessarily atypical