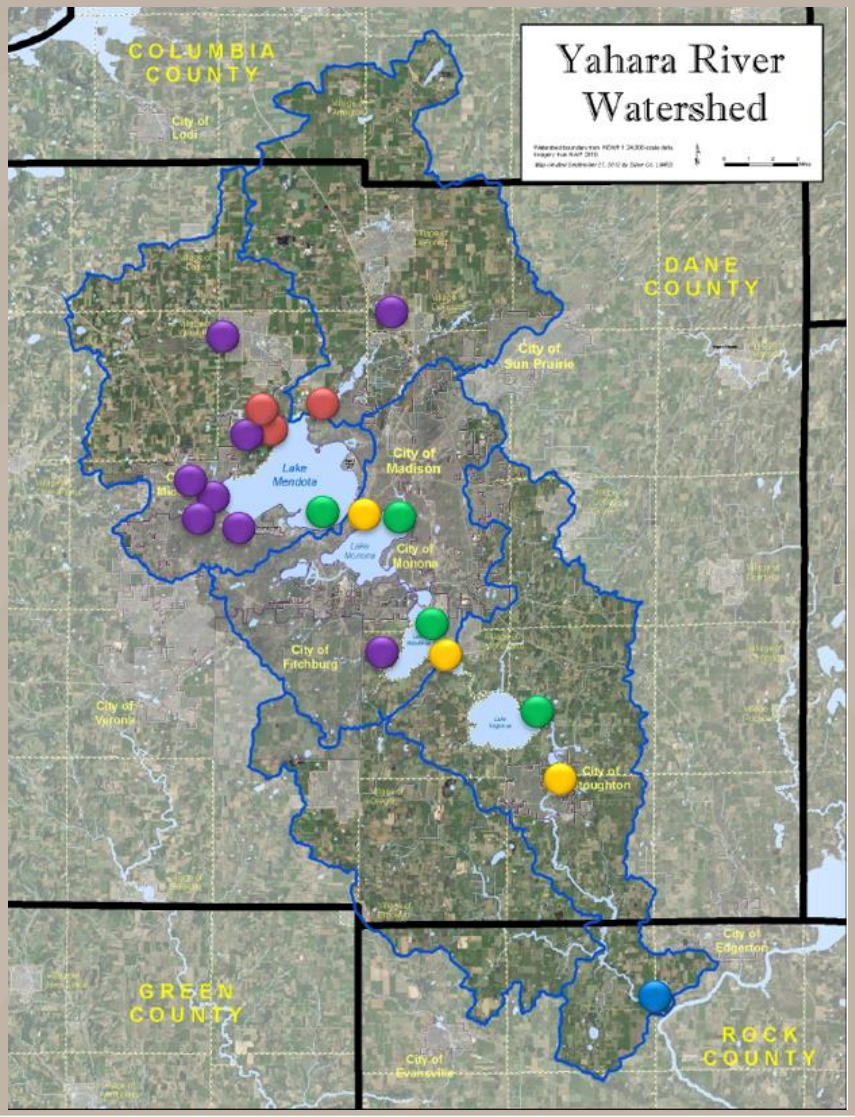
Yahara River Watershed
USGS Water-Quality Monitoring Update
Dec 13, 2022

Todd Stuntebeck

US Geological Survey

USGS “Dane County Monitoring” Project

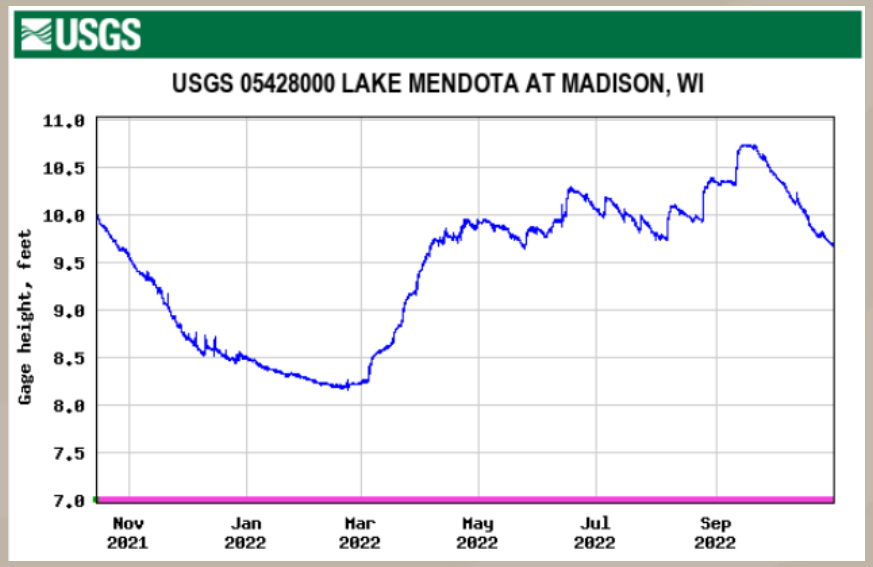


2022 Status

- 8 streamflow (standard) and high-intensity water quality
- 3 streamflow (hydroacoustic) and high-intensity water quality
- 1 streamflow (standard) and fixed-interval water quality
- 4 lake-level
- 3 streamflow (hydroacoustic) only
- 19 long-term baseflow monitoring locations (on rotation)

What is being measured?

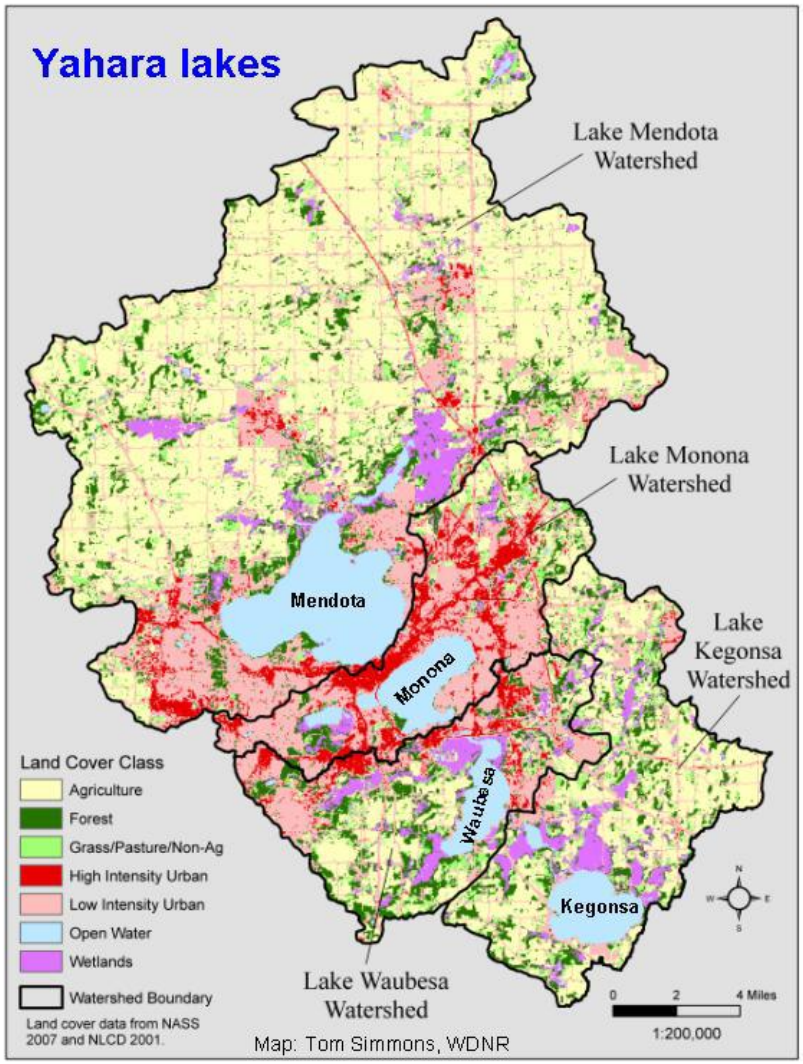
- Water level and/or streamflow
- Periodic water sample concentrations
  - Total Phosphorus
  - Dissolved Phosphorus
  - Suspended Sediment or Suspended Solids
  - Nitrogen (Ammonia, Nitrate, TKN)
  - Chloride



USGS collaborators over the years

- CARPC
- Dane County
- DNR
- Madison, Middleton, Westport, Fitchburg
- MMSD, Yahara WINS
- Nature Conservancy
- NRCS
- Sand County Foundation
- Yahara Pride Farms
- Friends of Waubesa Wetlands
- Lake Waubesa Conservation Association

Monitoring – why is it largely focused in Mendota?

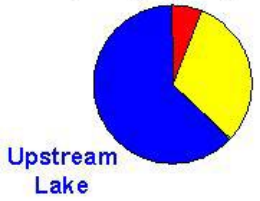


P Loading Sources:

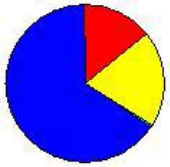
SWAT 2000 modeling estimates for land uses;
1980-2007 monitoring data for lake outlets

Mendota
36,800 kg P (0.92 g/m²/yr)

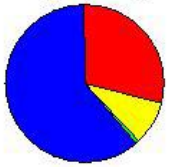
Monona
16,700 kg P (1.26 g/m²/yr)



Waubesa
15,800 kg P (1.88 g/m²/yr)



Kegonsa
20,200 kg P (1.56 g/m²/yr)



Source: R. Lathrop & K. Kirsch, WDNR

What is the driving force behind

madison.com

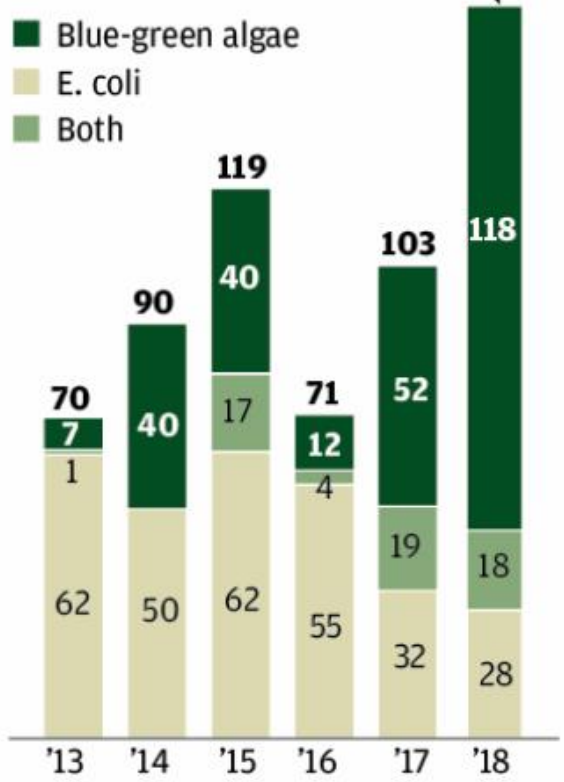
Update: At least 5 Madison-area beaches closed due to blue-green algae | Local News | madison.com

Most beach closings in years

Nutrient runoff helps fuel bacterial growths that forced a record number of Dane County beach closings this year.

Minimum number of beach days lost, by cause

164 days
So far in 2018



SOURCE: Public Health Madison & Dane County

State Journal

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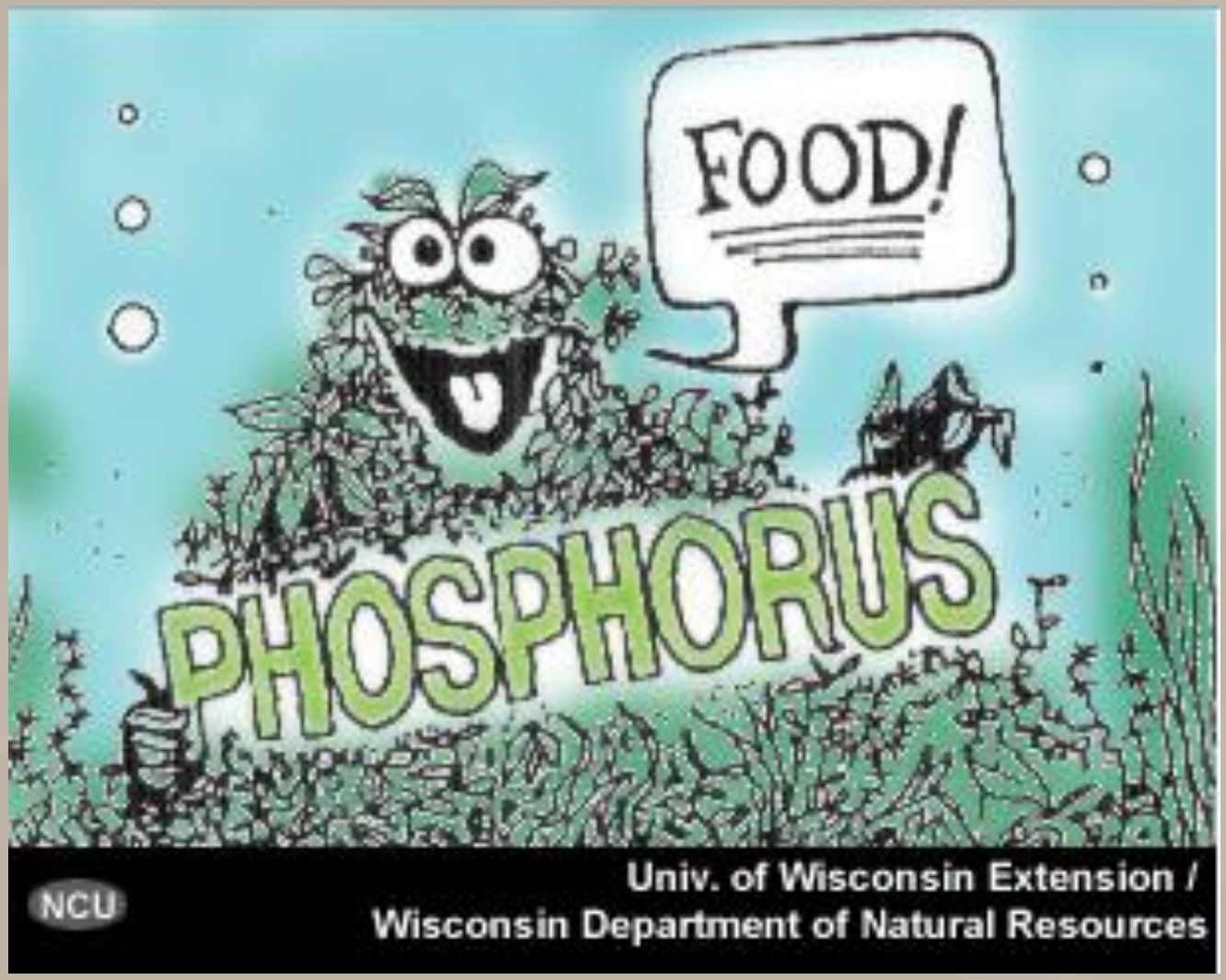
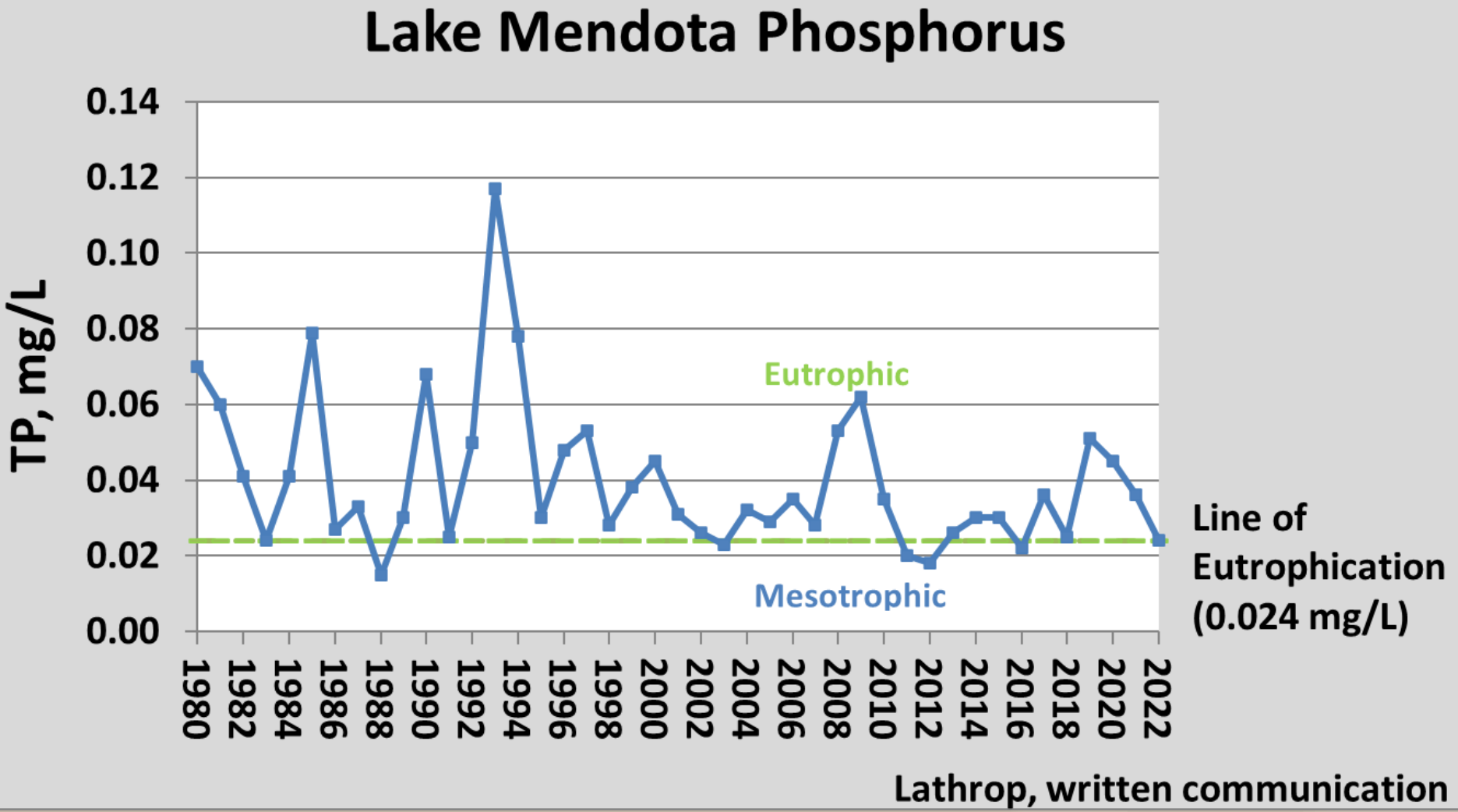
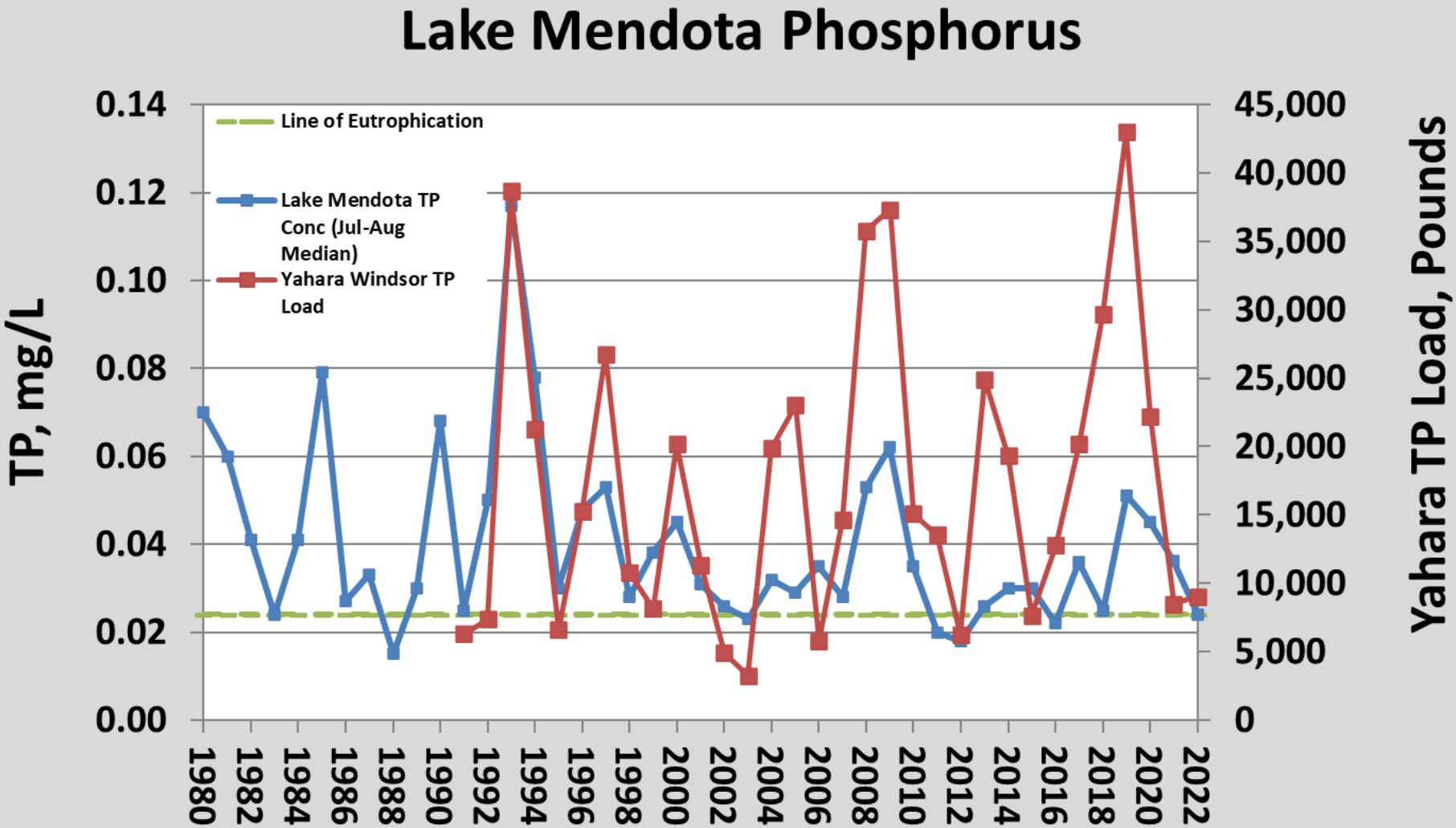
What is the driving force behind algal growth?



Phosphorus and lake effects



Linkage between P inputs and lake water quality



Where is the phosphorus coming from?

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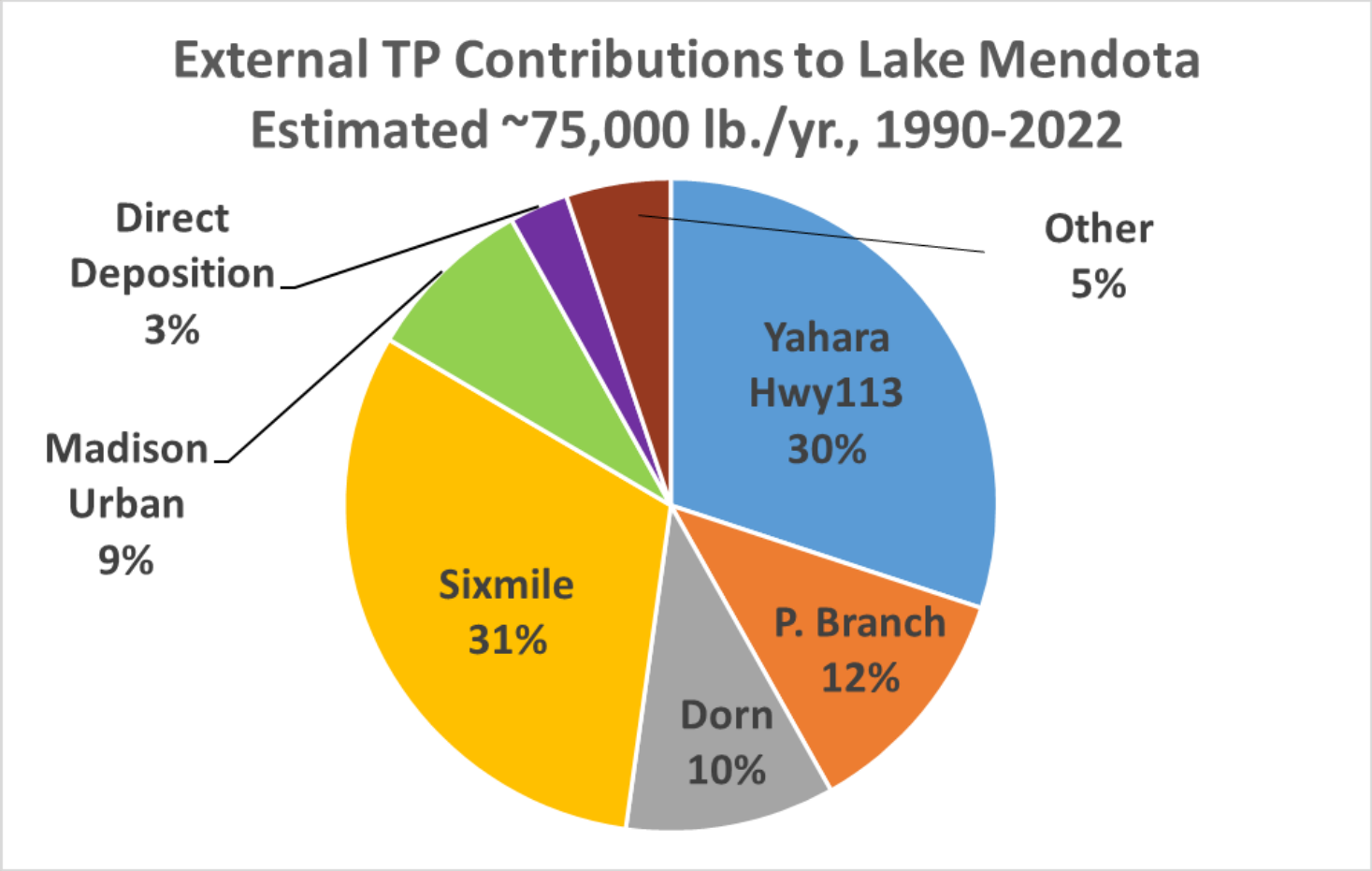
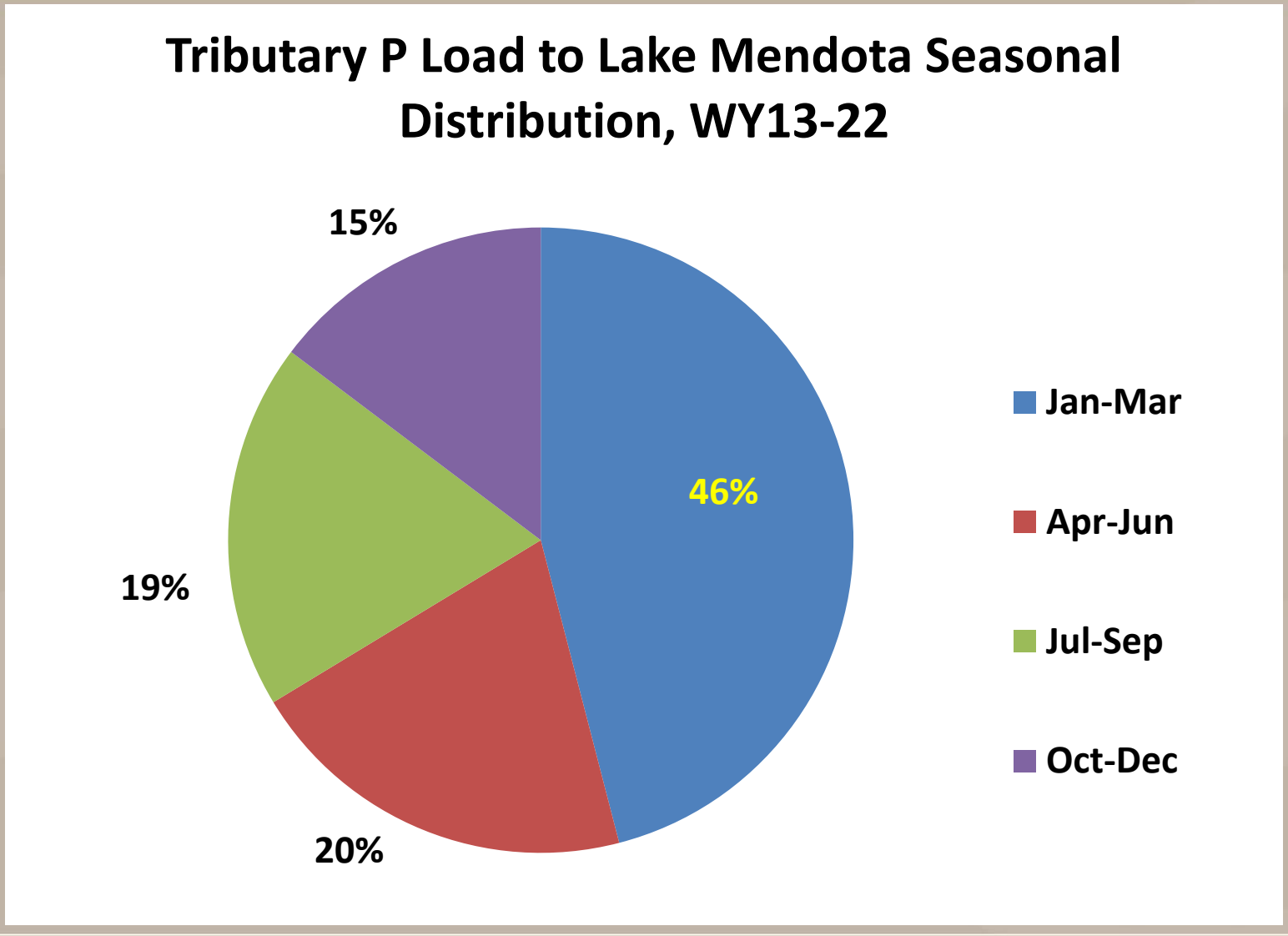
HELPING MANAGERS MAKE INFORMED, SCIENCE-BASED DECISIONS.

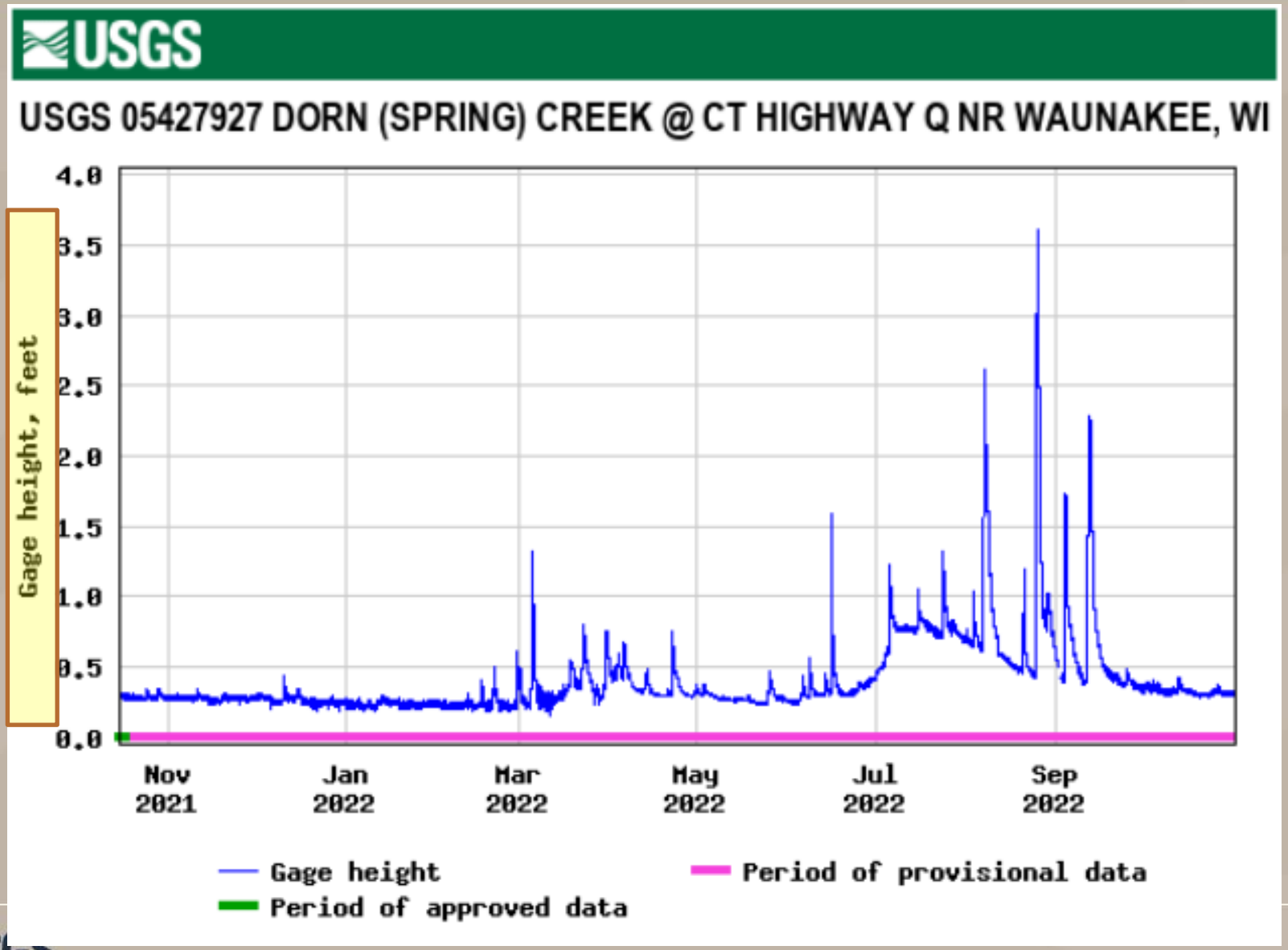
Estimated Percentages of P Sources



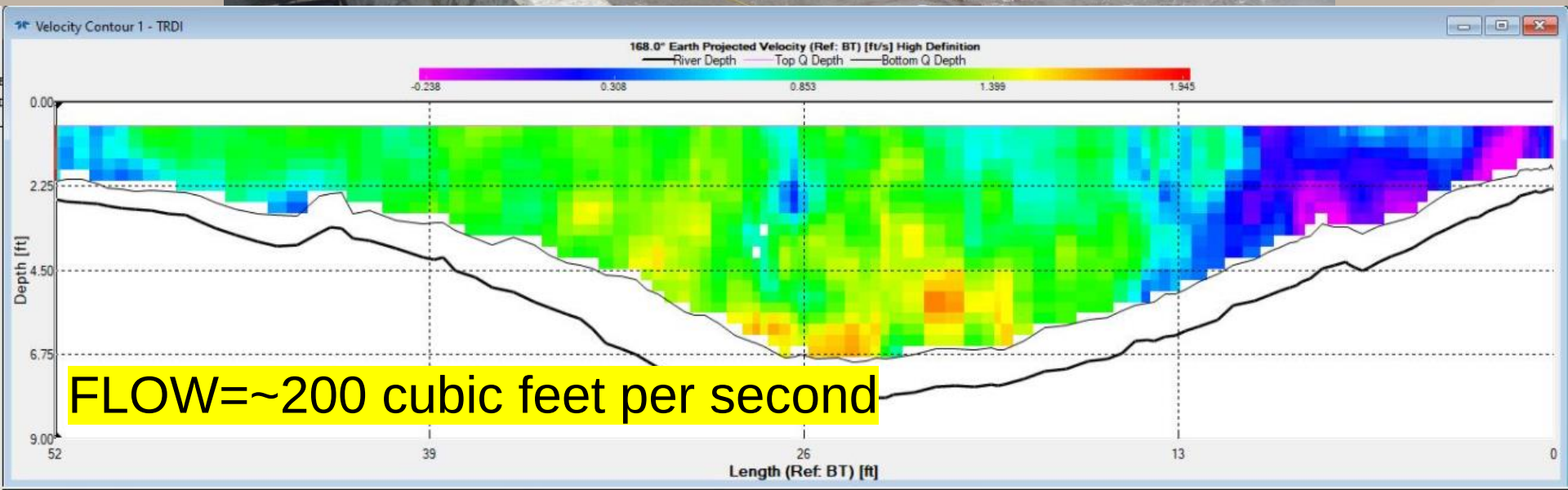
Timing of Phosphorus Delivery



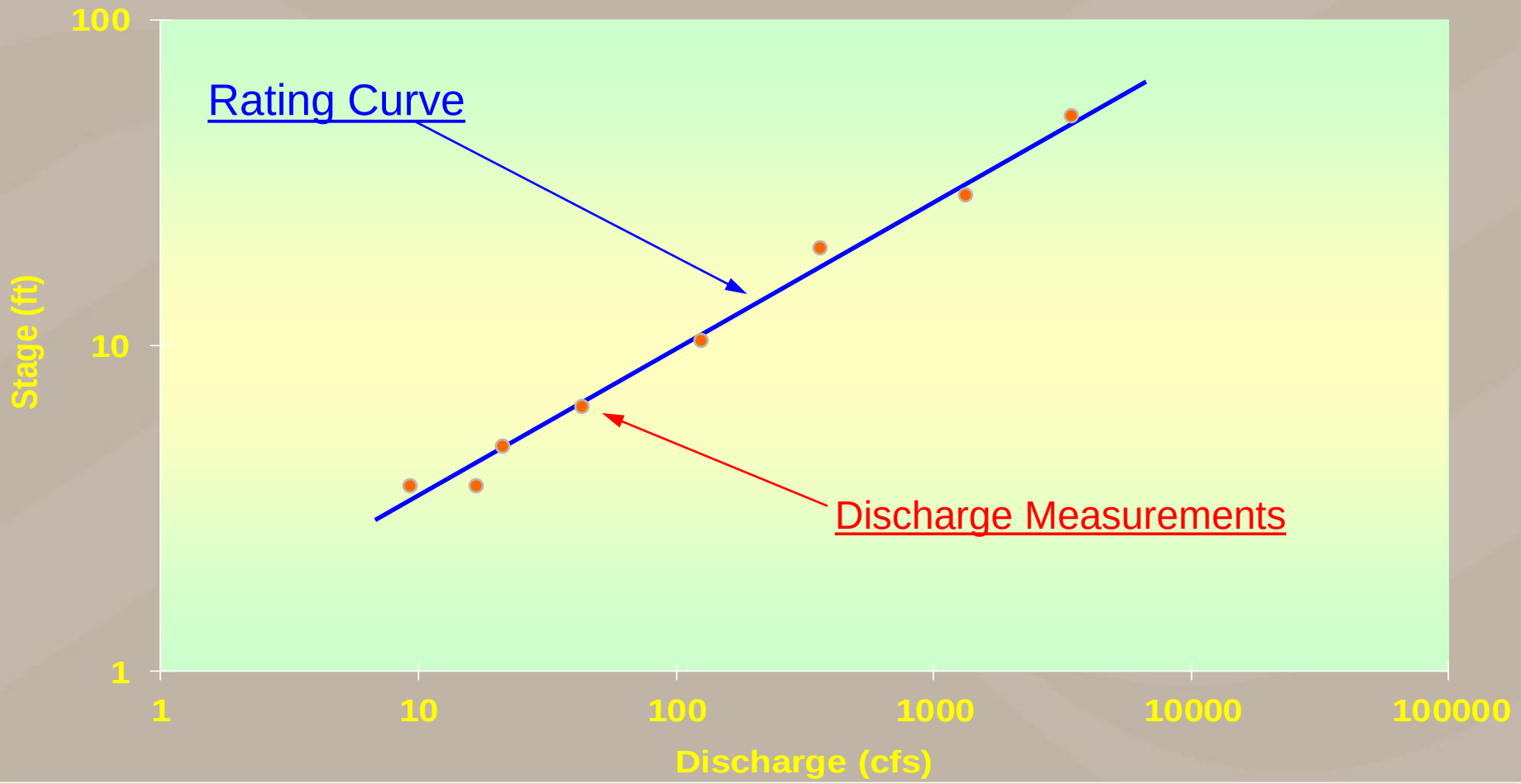
Streamflow


USGS
USGS 05427927 DORN (SPRING) CREEK @ CT HIGHWAY Q NR WAUNAKEE, WI
Gage height, feet
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Nov 2021
Jan 2022
Mar 2022
May 2022
Jul 2022
Sep 2022
Gage height
Period of approved data
Period of provisional data

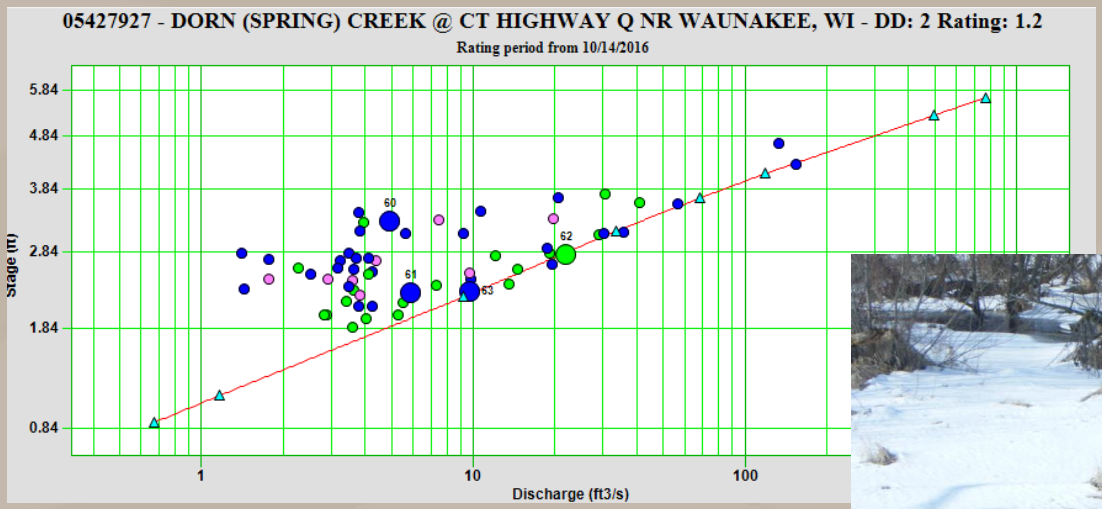
Streamflow


Velocity Contour 1 - TRDI
168.0° Earth Projected Velocity (Ref: BT) [ft/s] High Definition
River Depth
Top Q Depth
Bottom Q Depth
-0.238
0.308
0.853
1.399
1.945
0.00
2.25
4.50
6.75
9.00
Depth [ft]
52
39
26
13
0
Length (Ref: BT) [ft]
FLOW=~200 cubic feet per second

Streamflow


100
10
1
Stage (ft)
Rating Curve
Discharge Measurements
1
10
100
1000
10000
100000
Discharge (cfs)

Streamflow



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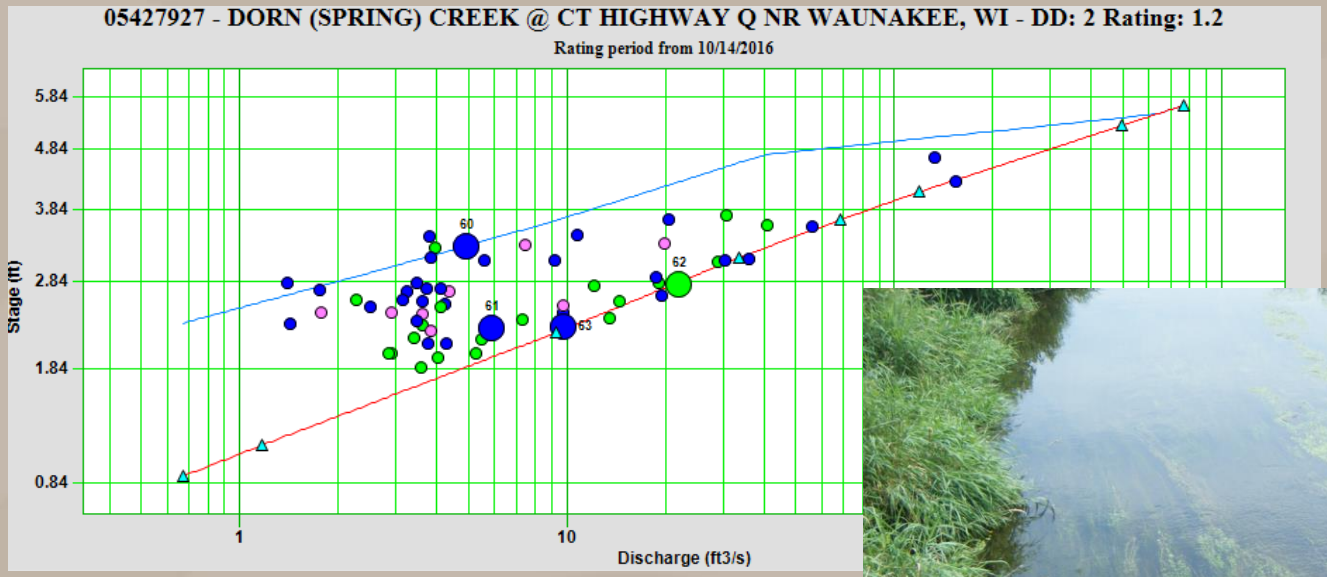
Streamflow



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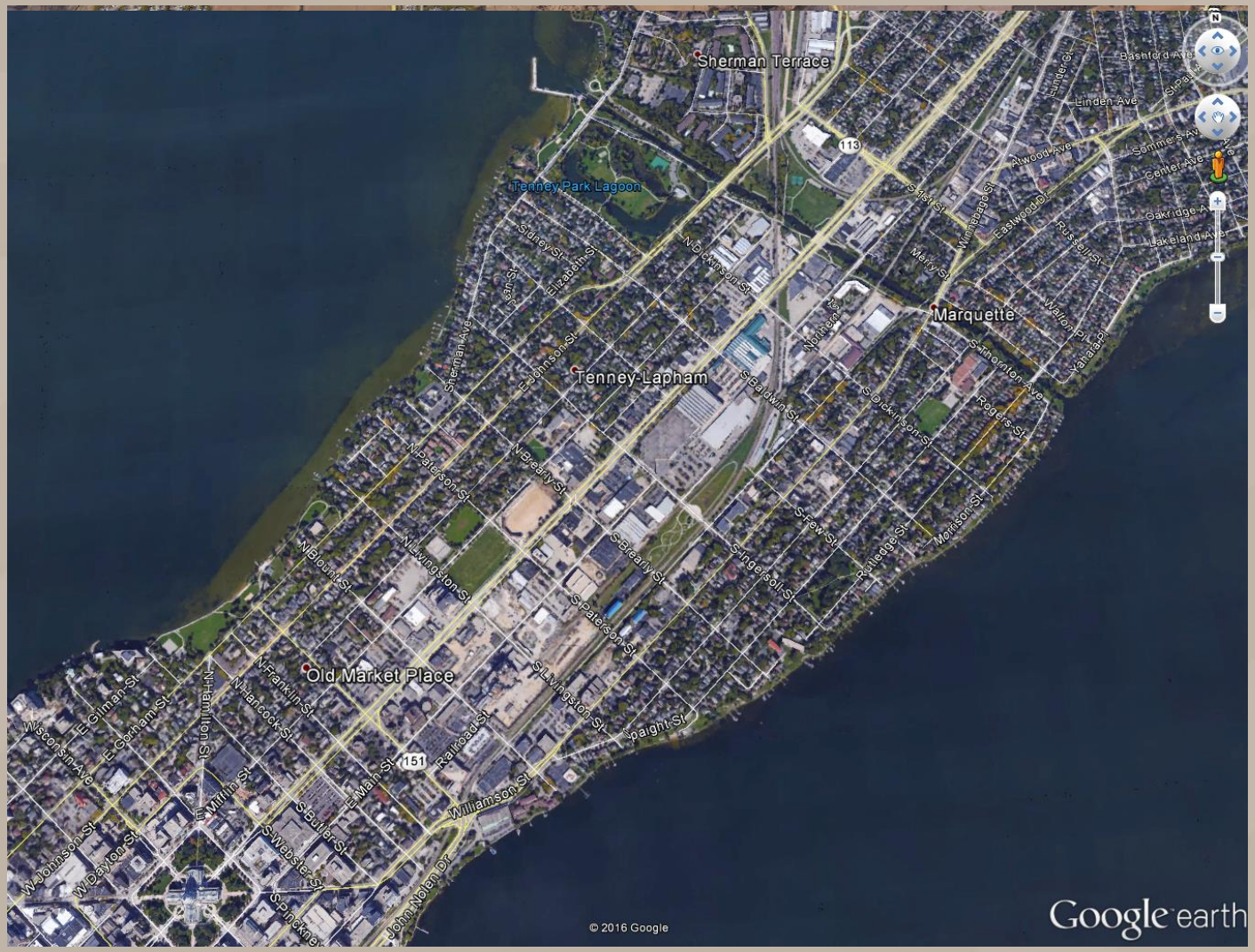
Streamflow Primer – “hydroacoustic”



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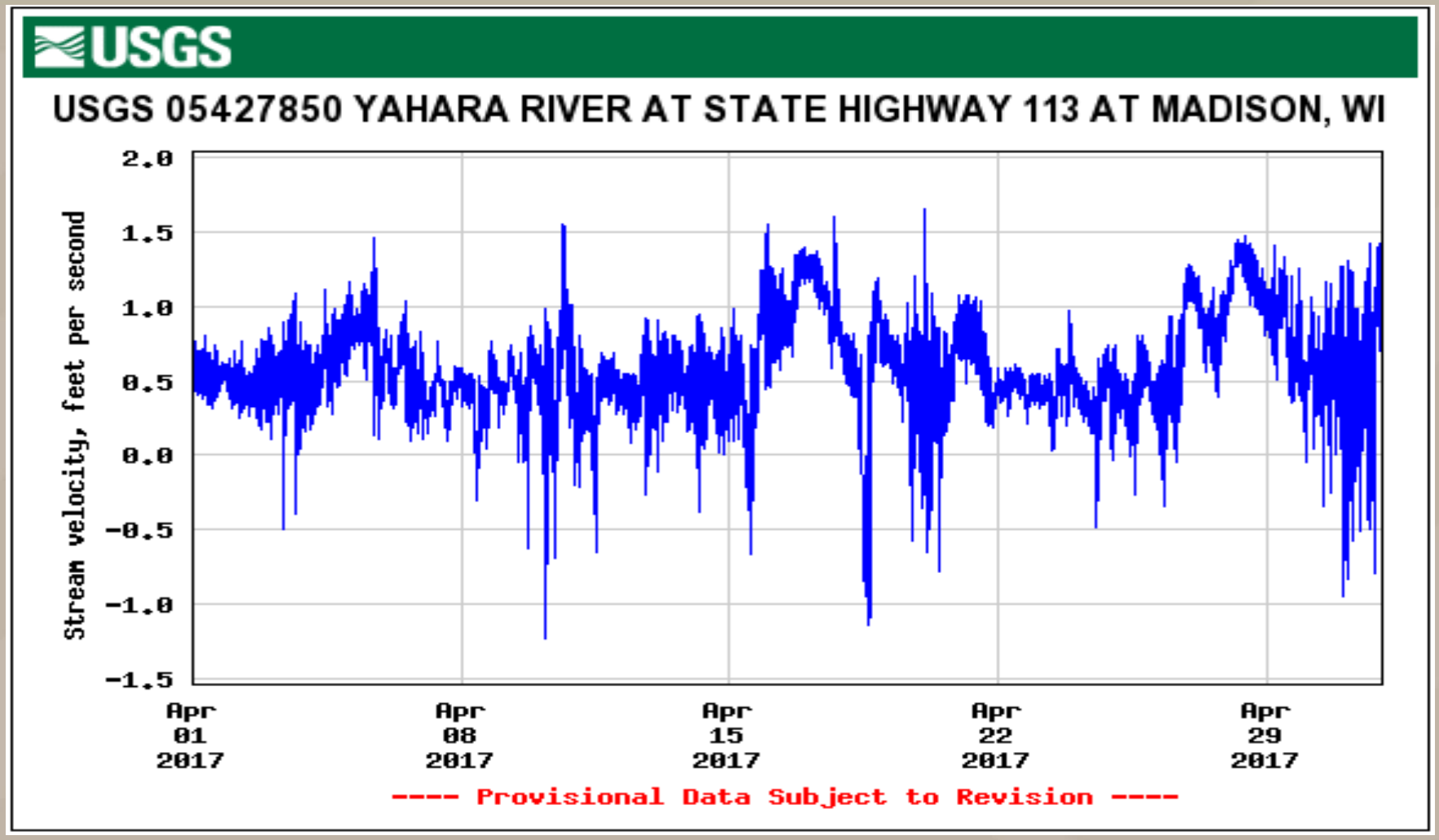
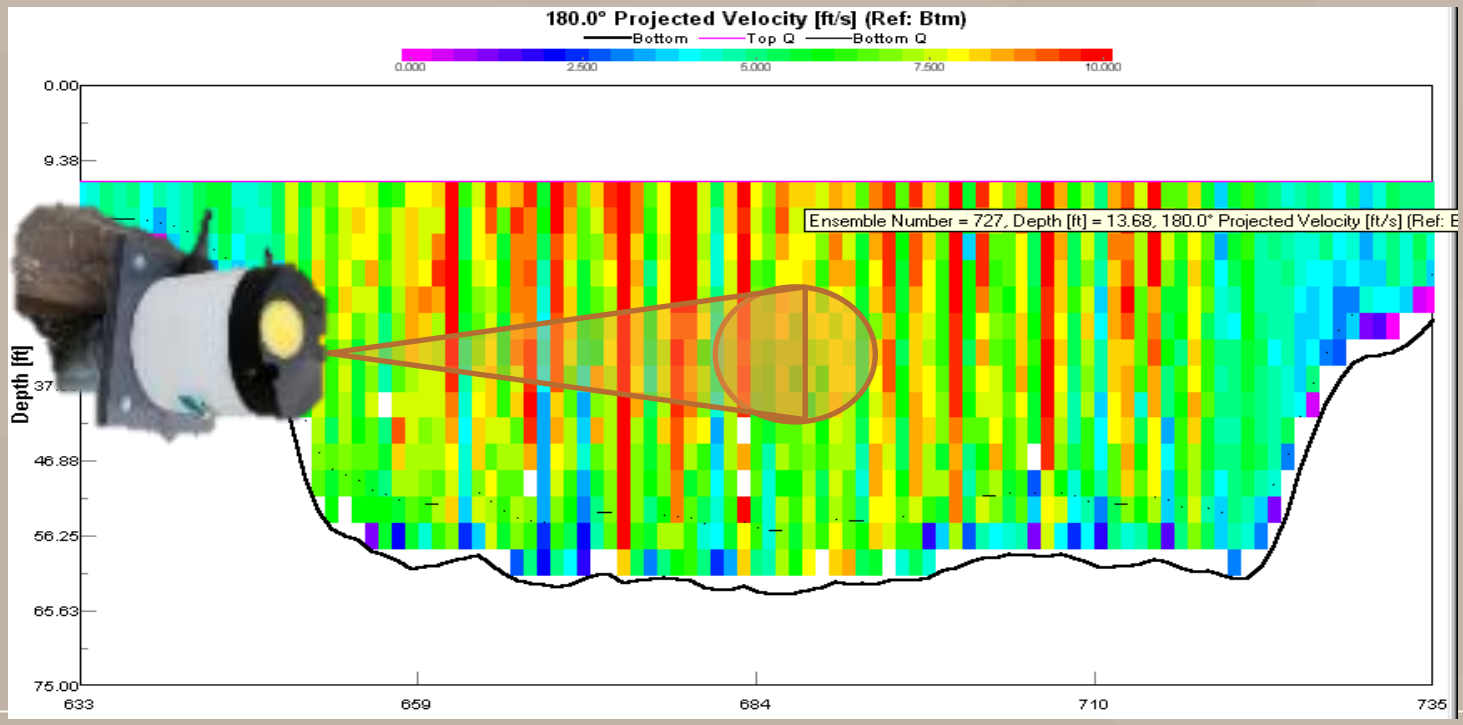


Streamflow Primer – “hydroacoustic”

Acoustic
Doppler
Velocity
Meter (ADVM)



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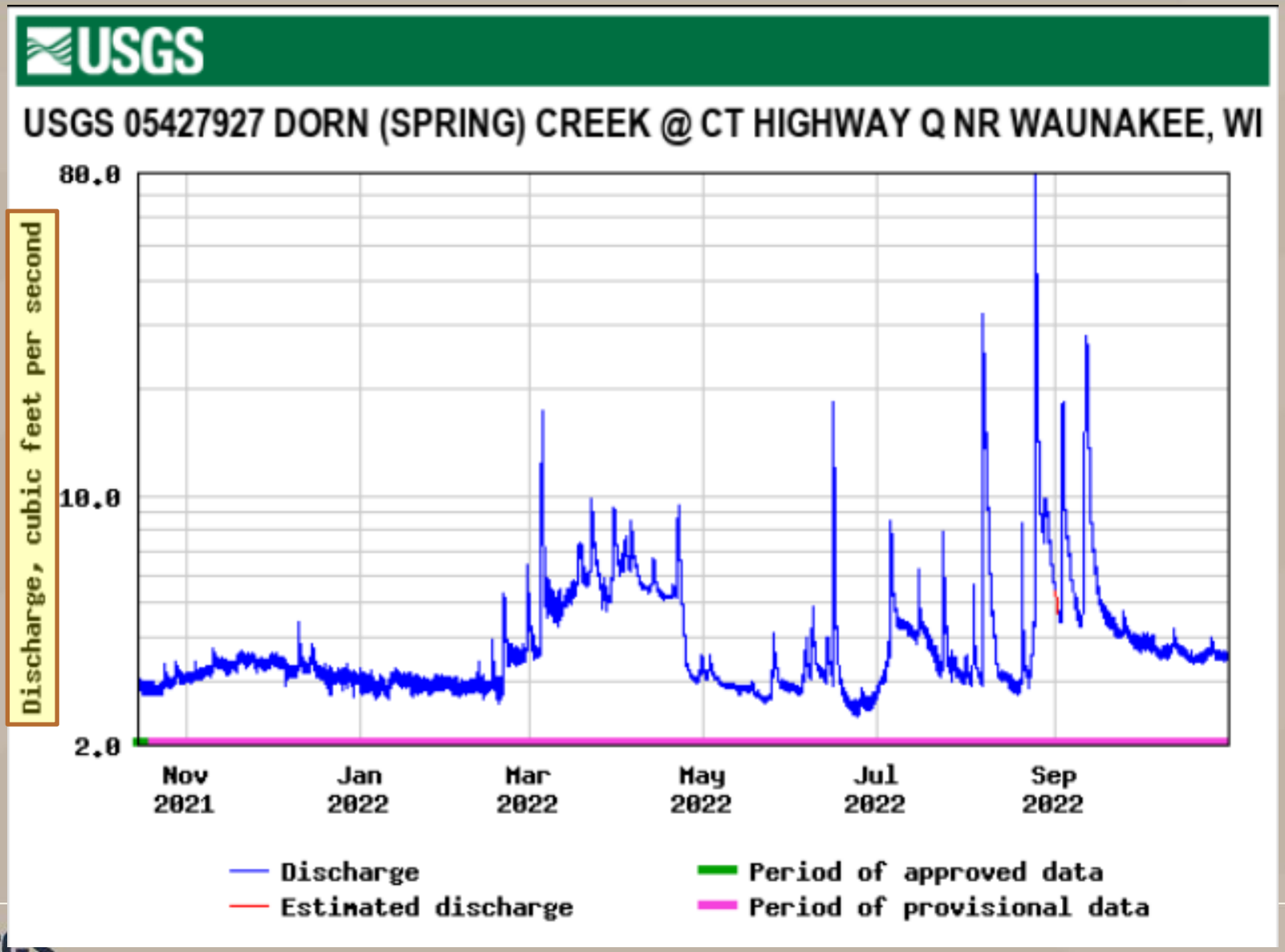
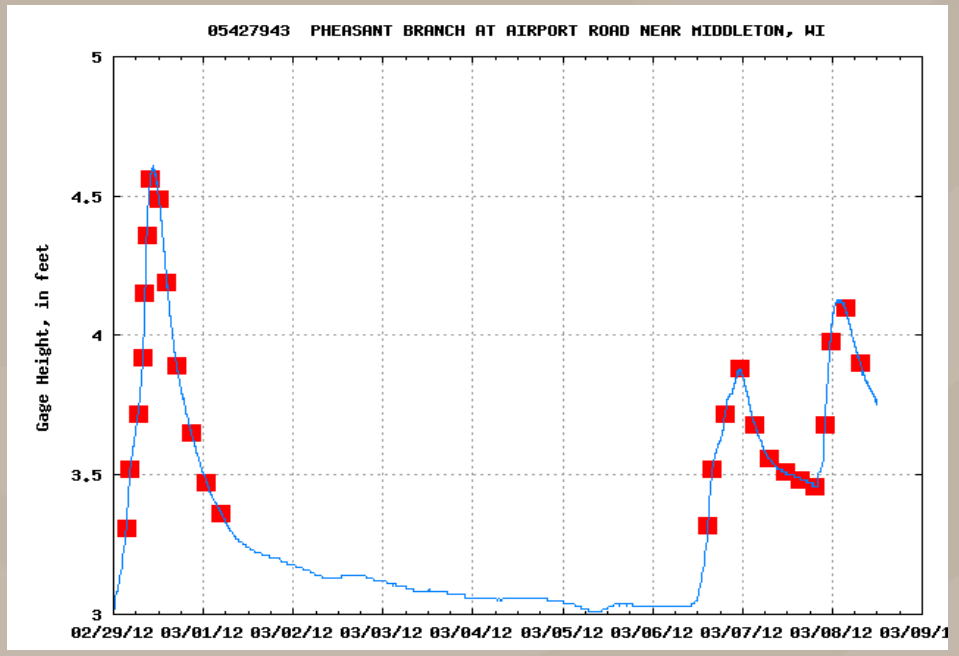
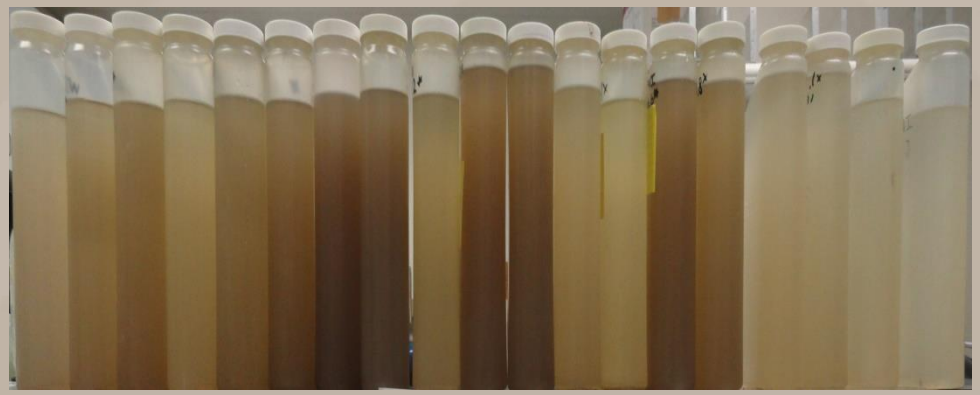
Streamflow


USGS
USGS 05427927 DORN (SPRING) CREEK @ CT HIGHWAY Q NR WAUNAKEE, WI
Discharge, cubic feet per second
80.0
10.0
2.0
Nov 2021
Jan 2022
Mar 2022
May 2022
Jul 2022
Sep 2022
Discharge
Estimated discharge
Period of approved data
Period of provisional data

Water Quality Sampling





Selected samples sent to lab(s) for analysis

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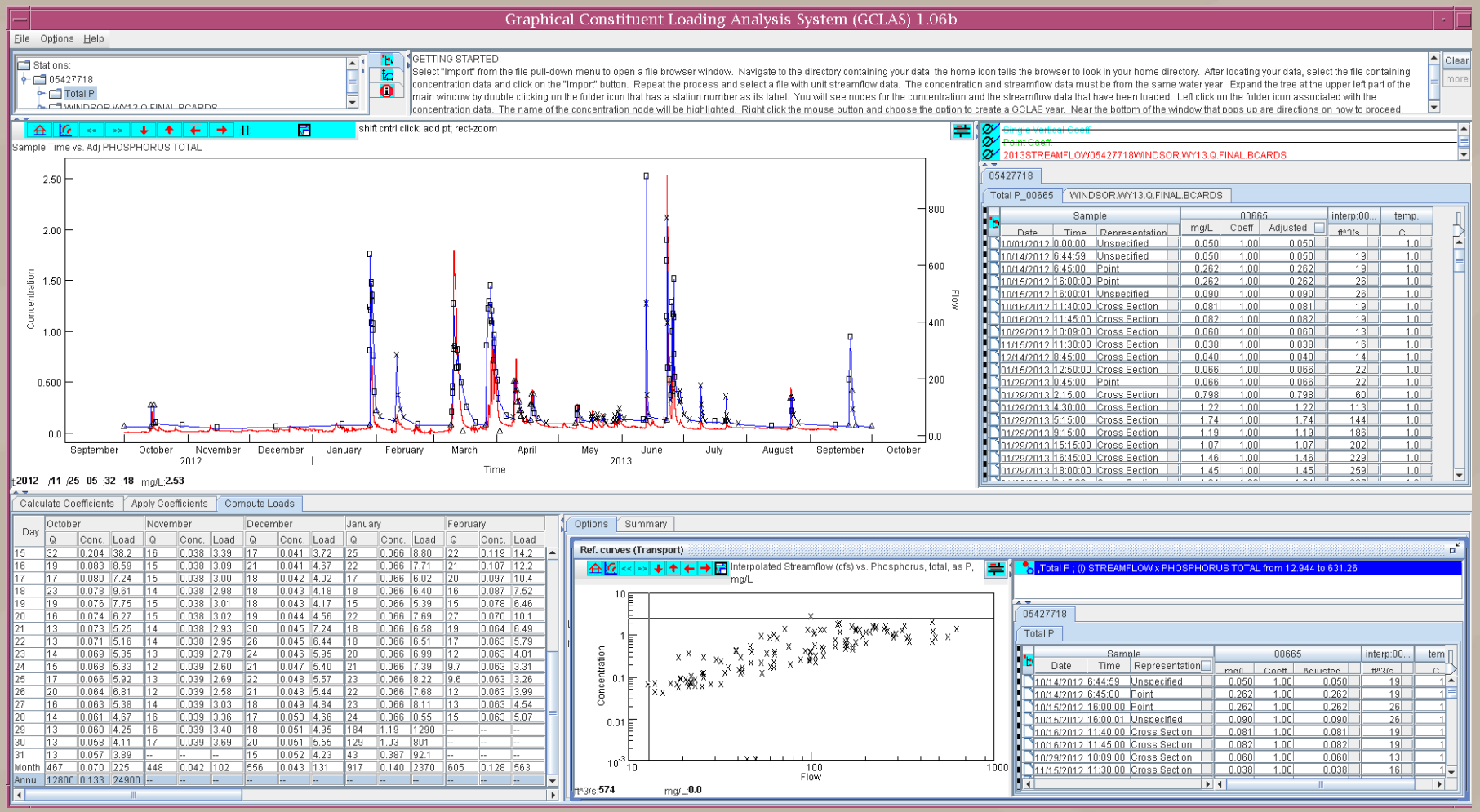
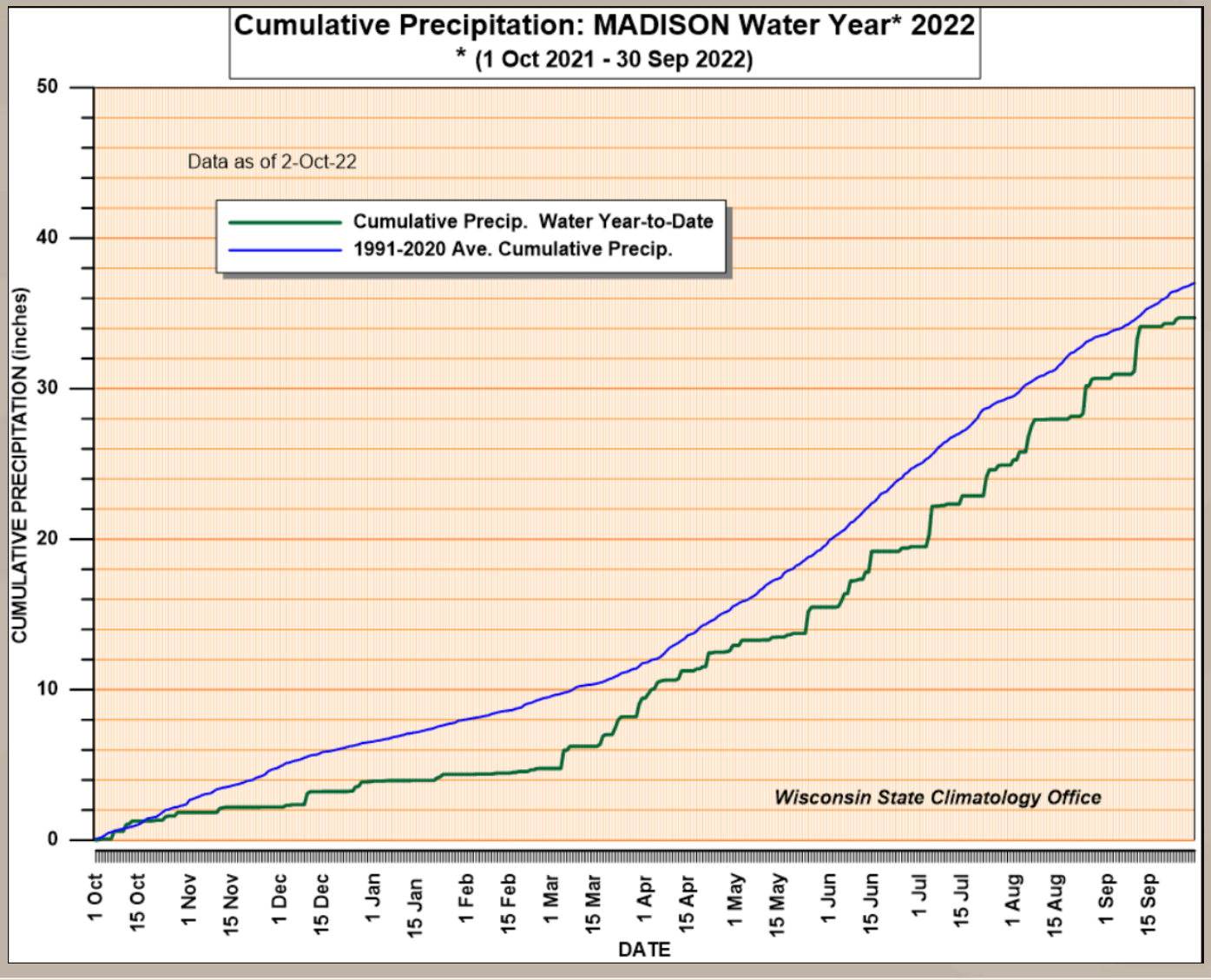
Combining Streamflow with Water-Quality Data



Water Year 2022: Year In Review

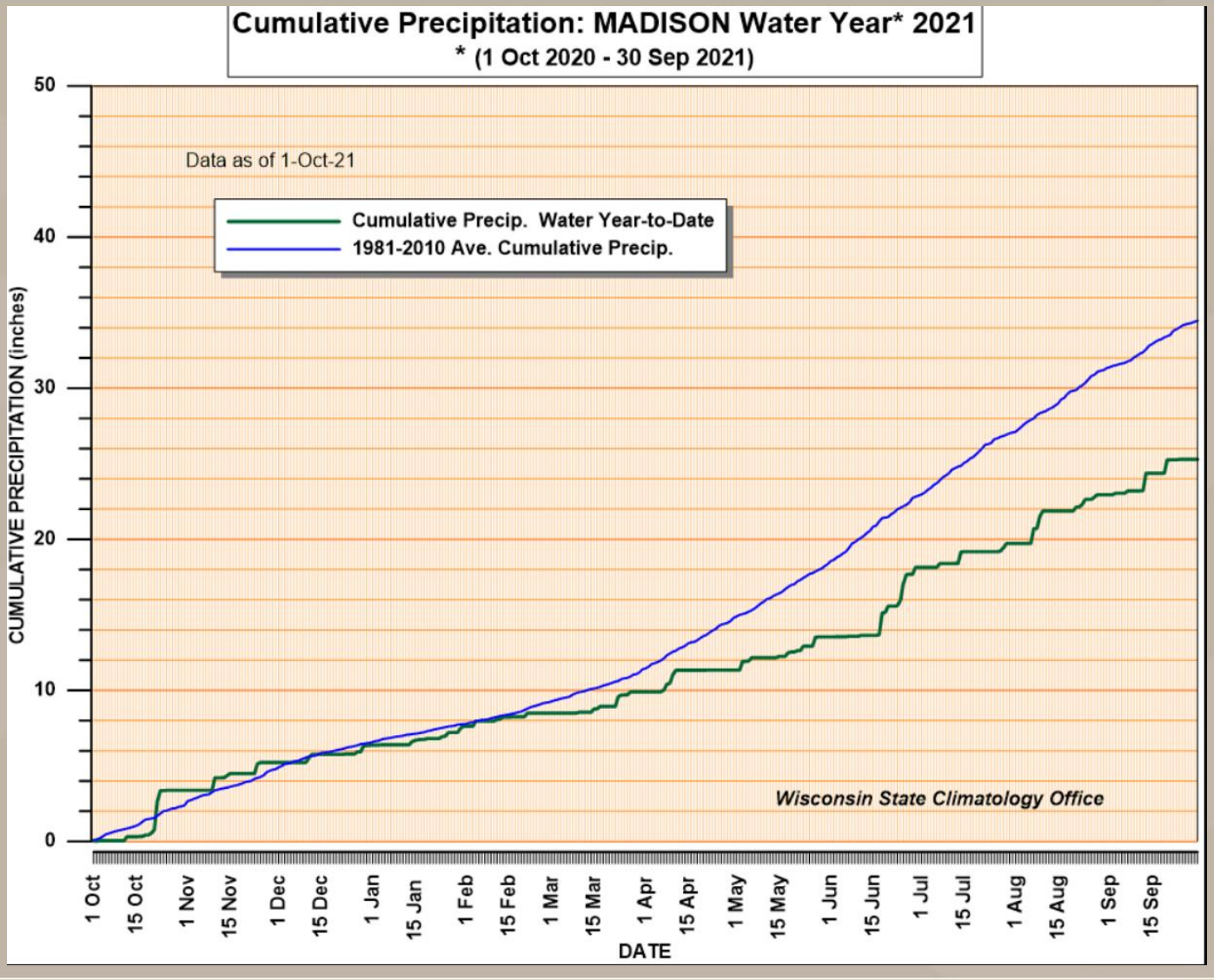
- Precipitation and runoff characteristics
- Phosphorus loading and timing
- Historical perspectives
- Phosphorus loading trends
- Growing season phosphorus concentrations

Precipitation Characteristics – Water Year 2022



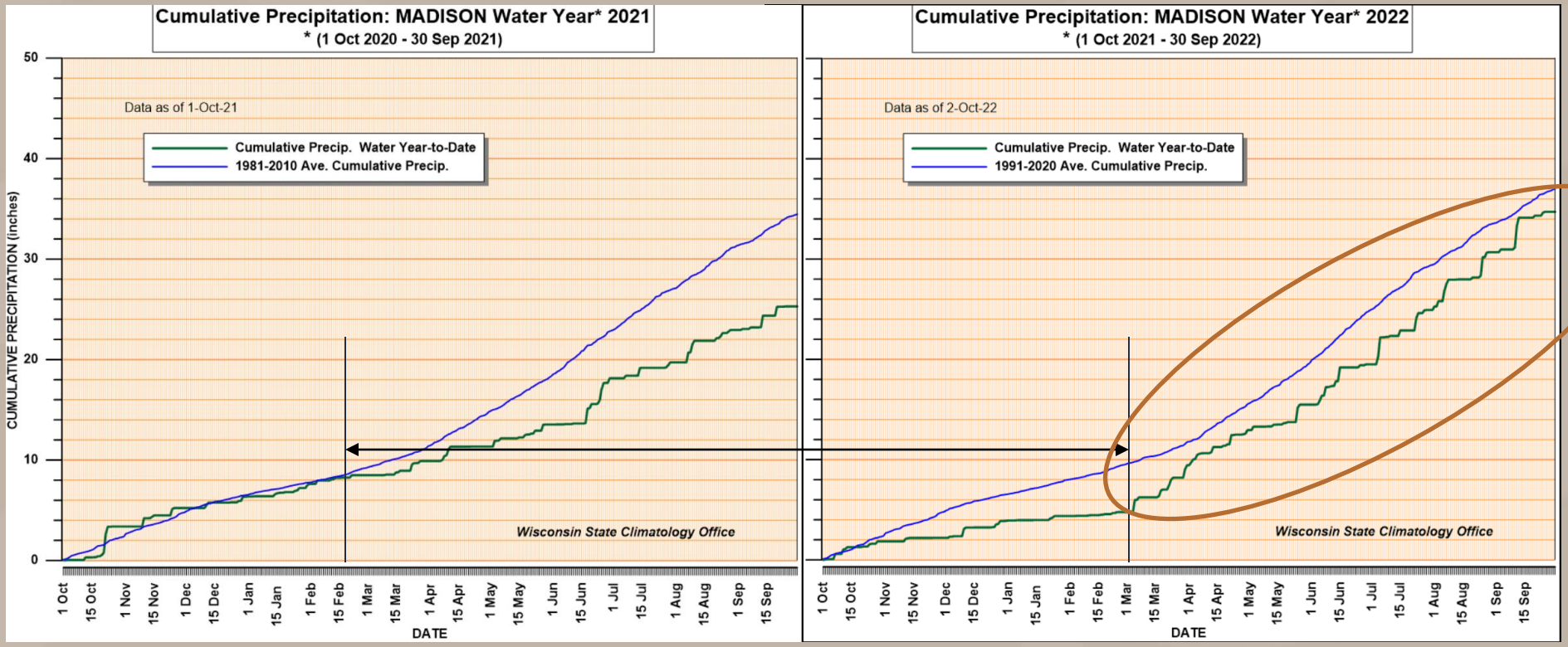
~34”, about 8% lower than normal (37”), Snowfall much below normal

Precipitation Characteristics – Water Year 2021



~25”, about 35% lower than normal (34.5”), Snowfall close to normal

2021-2022 Precipitation



Below-average precipitation from mid-Feb. 2021 to Mar. 2022

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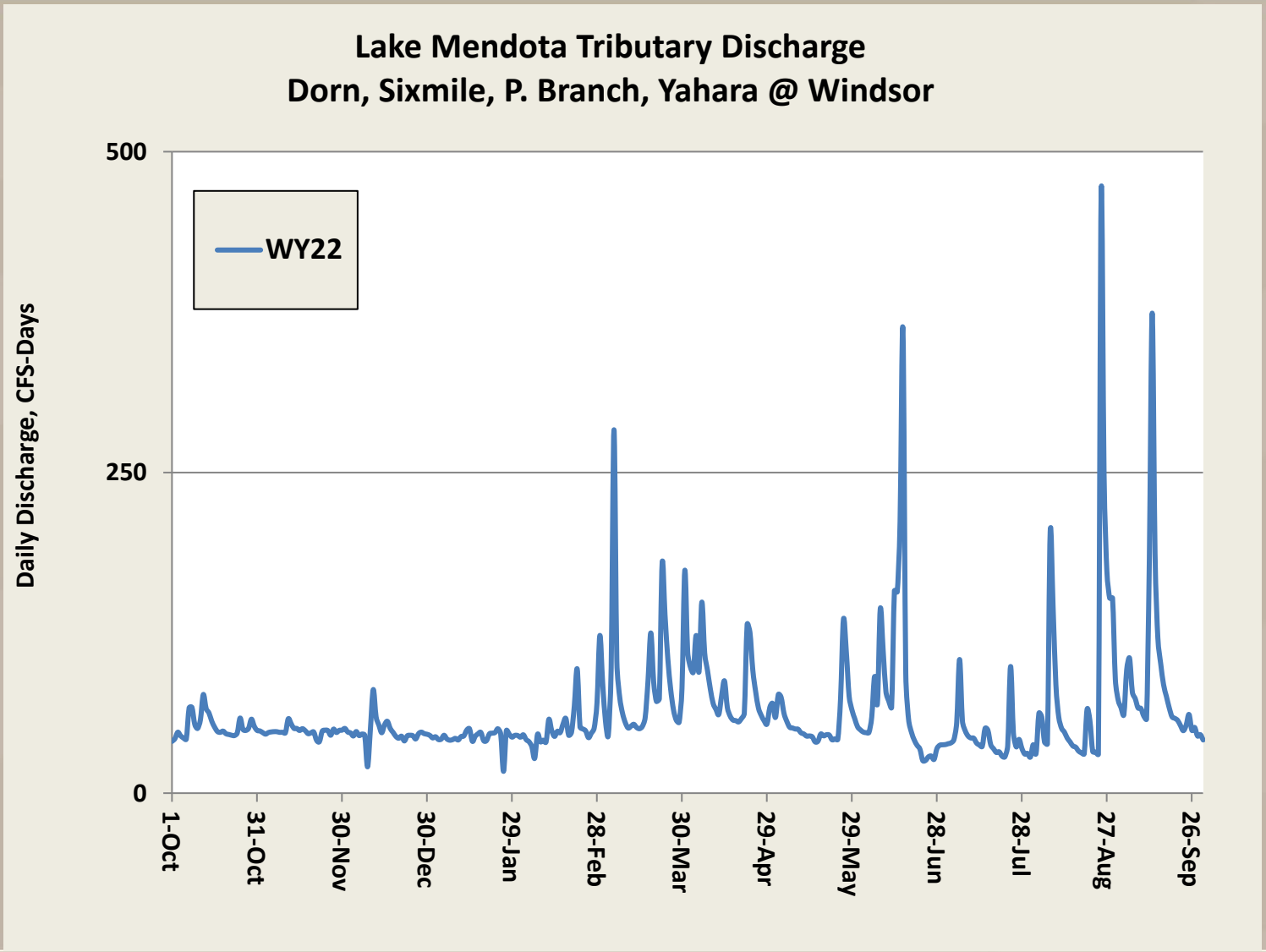
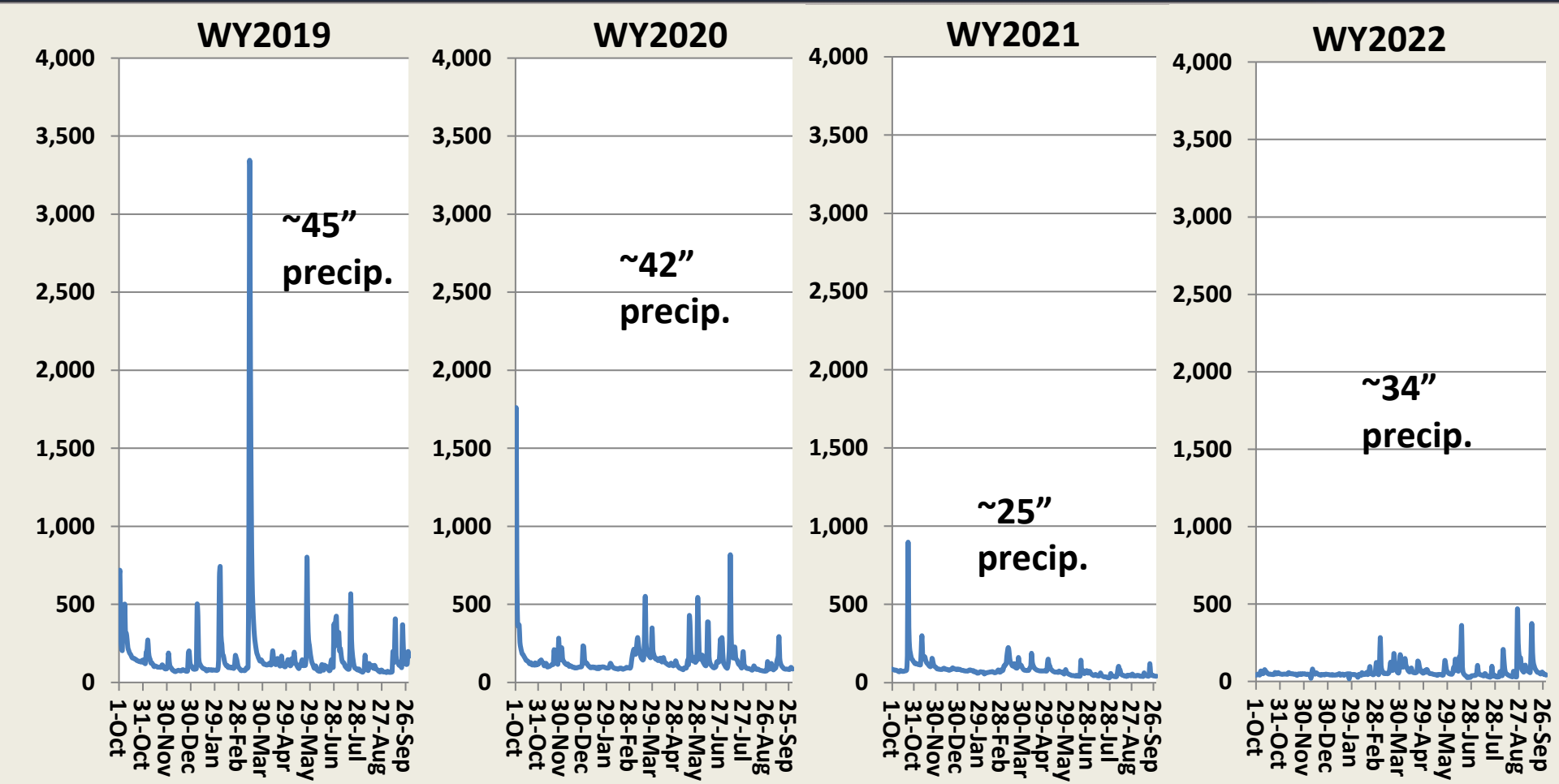
Streamflow WY2022



WY2019 to WY2022 Streamflow Comparison



Record High Annual Streamflow	About 10% less flow than WY19	About 40% less flow than WY20	About 20% less flow than WY21

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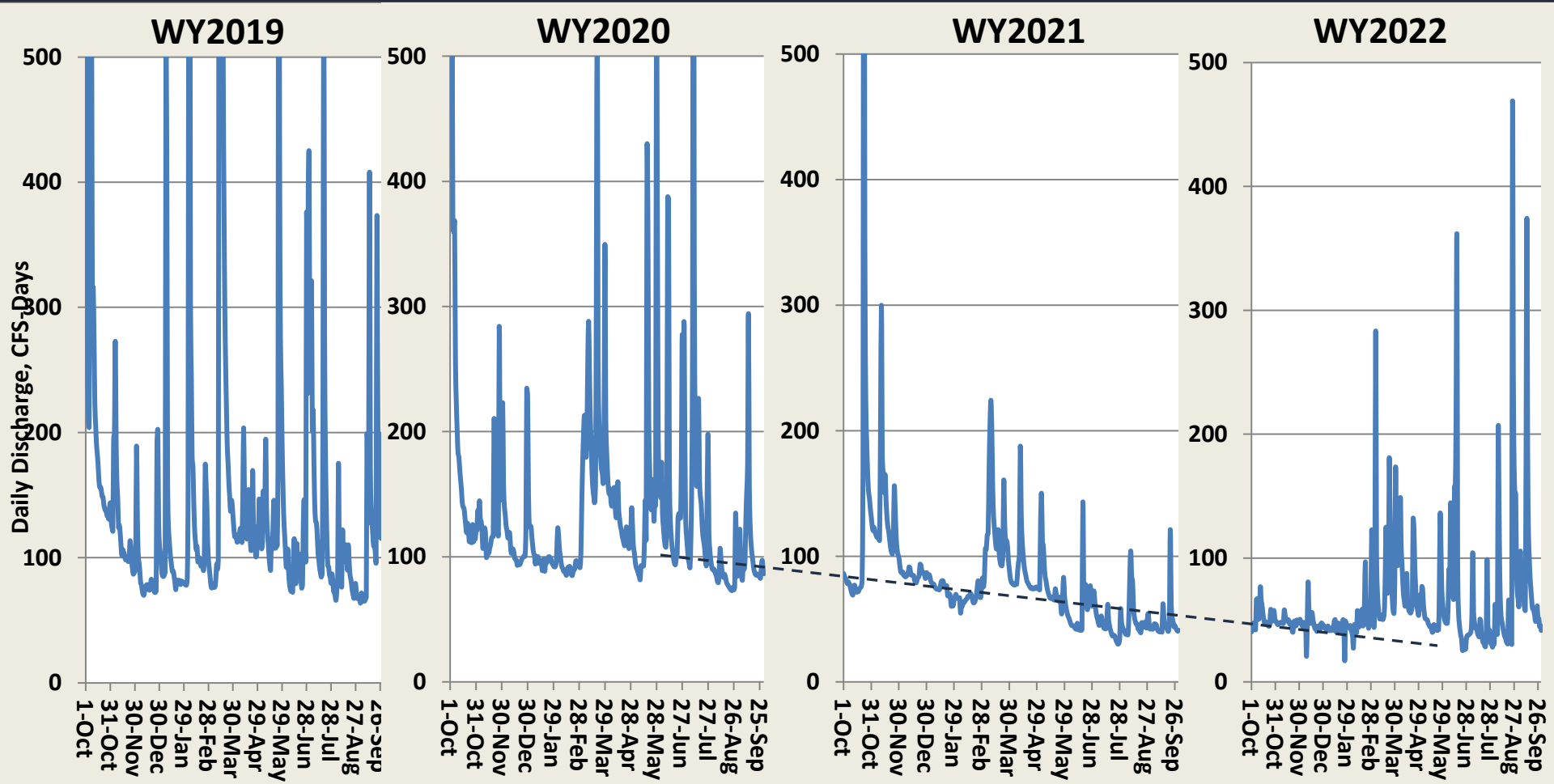
2022 had lowest annual flow since 2015

12/13/13

Decreasing baseflow WY2019 - WY2022



Smaller and fewer runoff events in 2021-2022, and extended period of below average precipitation led to decreased baseflow (groundwater discharge)

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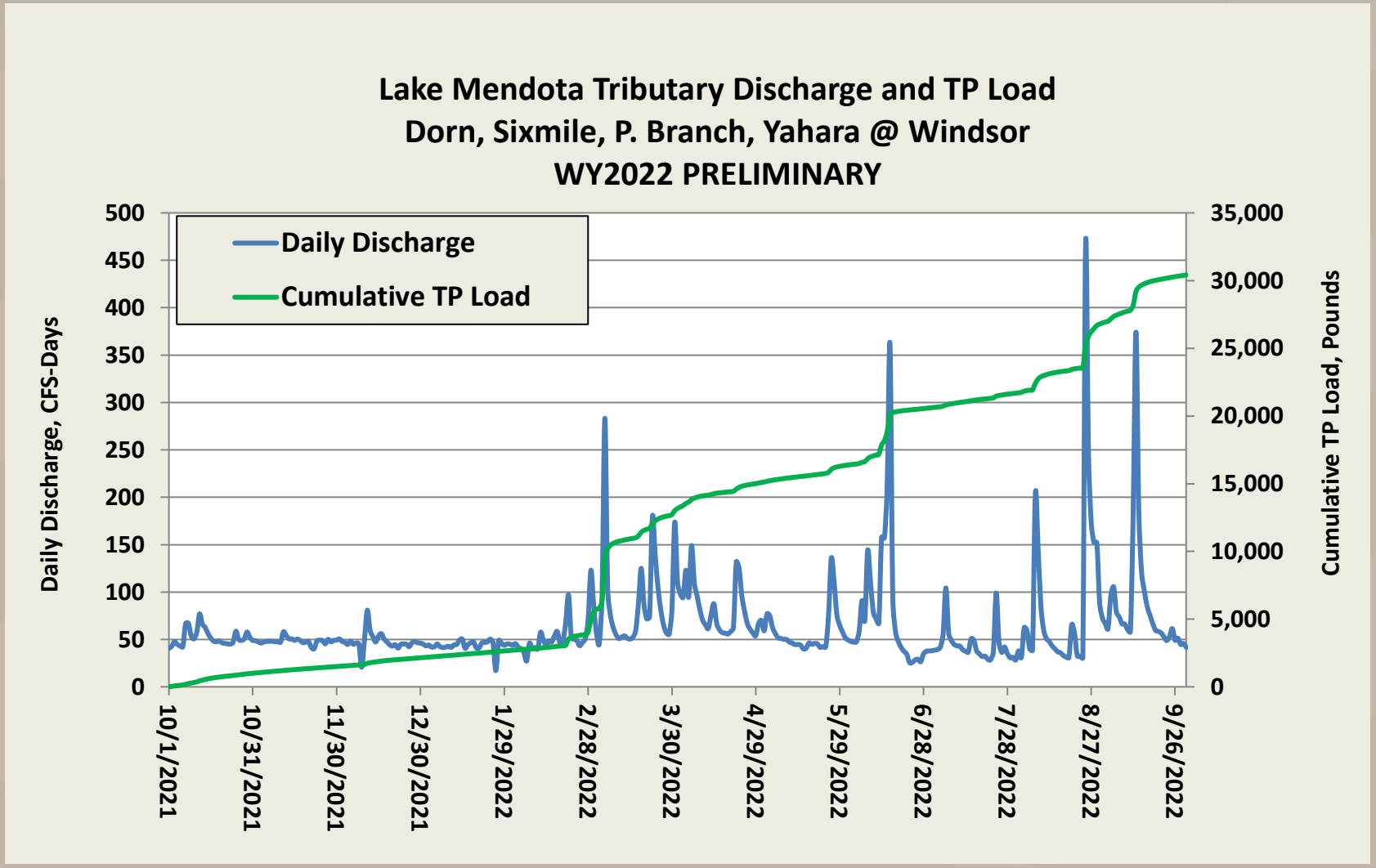
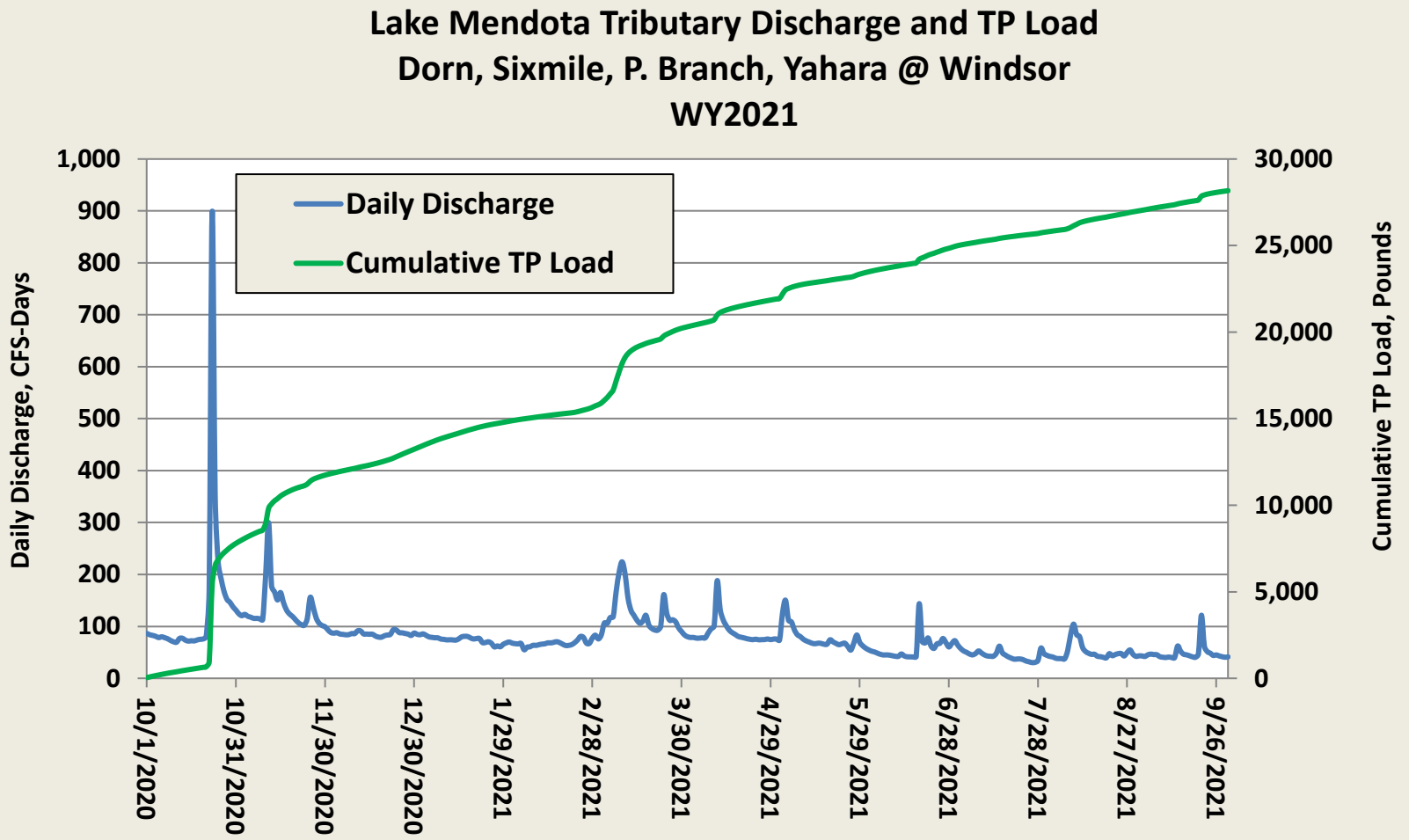
2022 P Loads to Lake Mendota

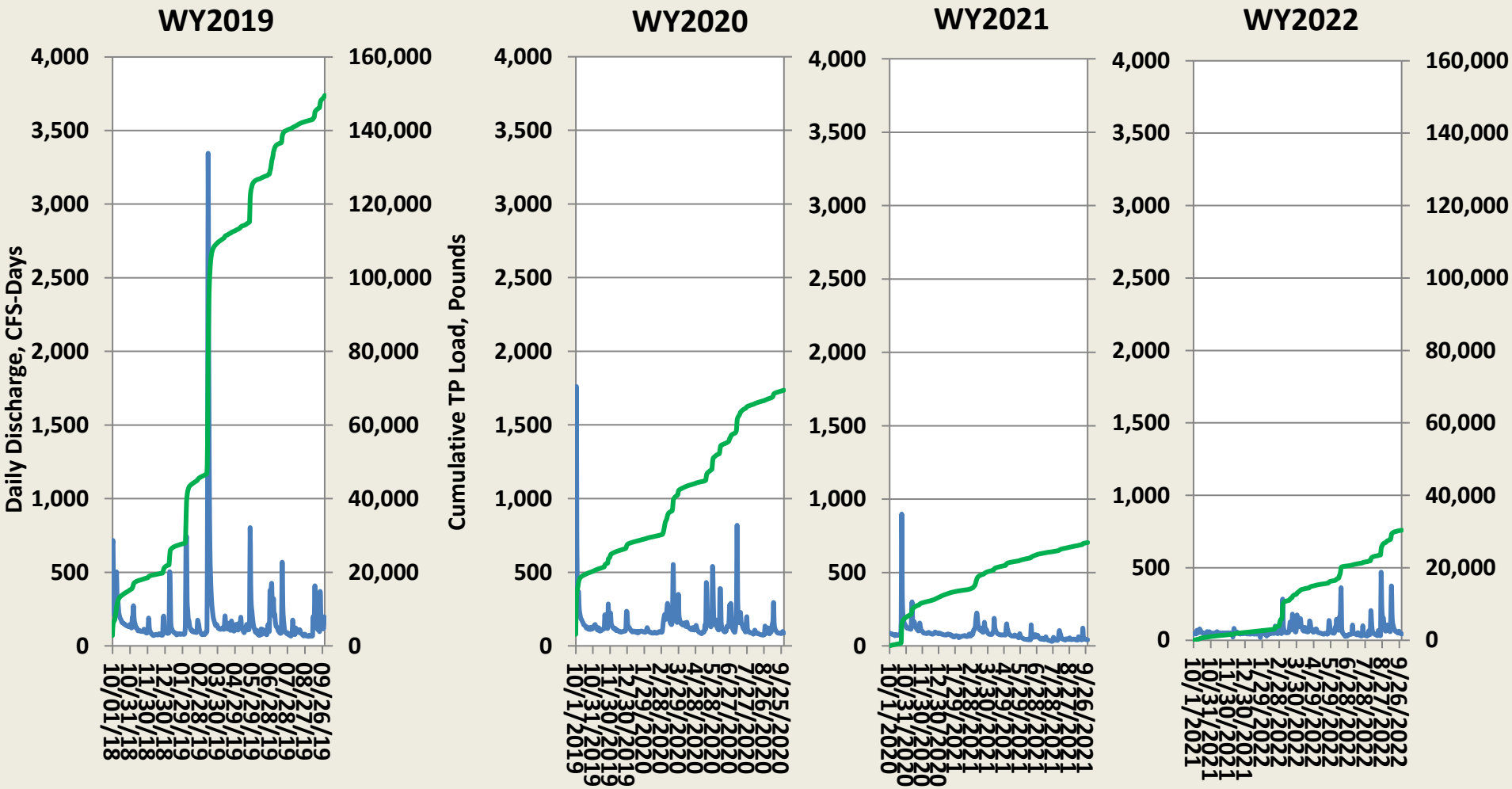


WY22 had ~20% less total runoff than WY21, but about 10% more P load

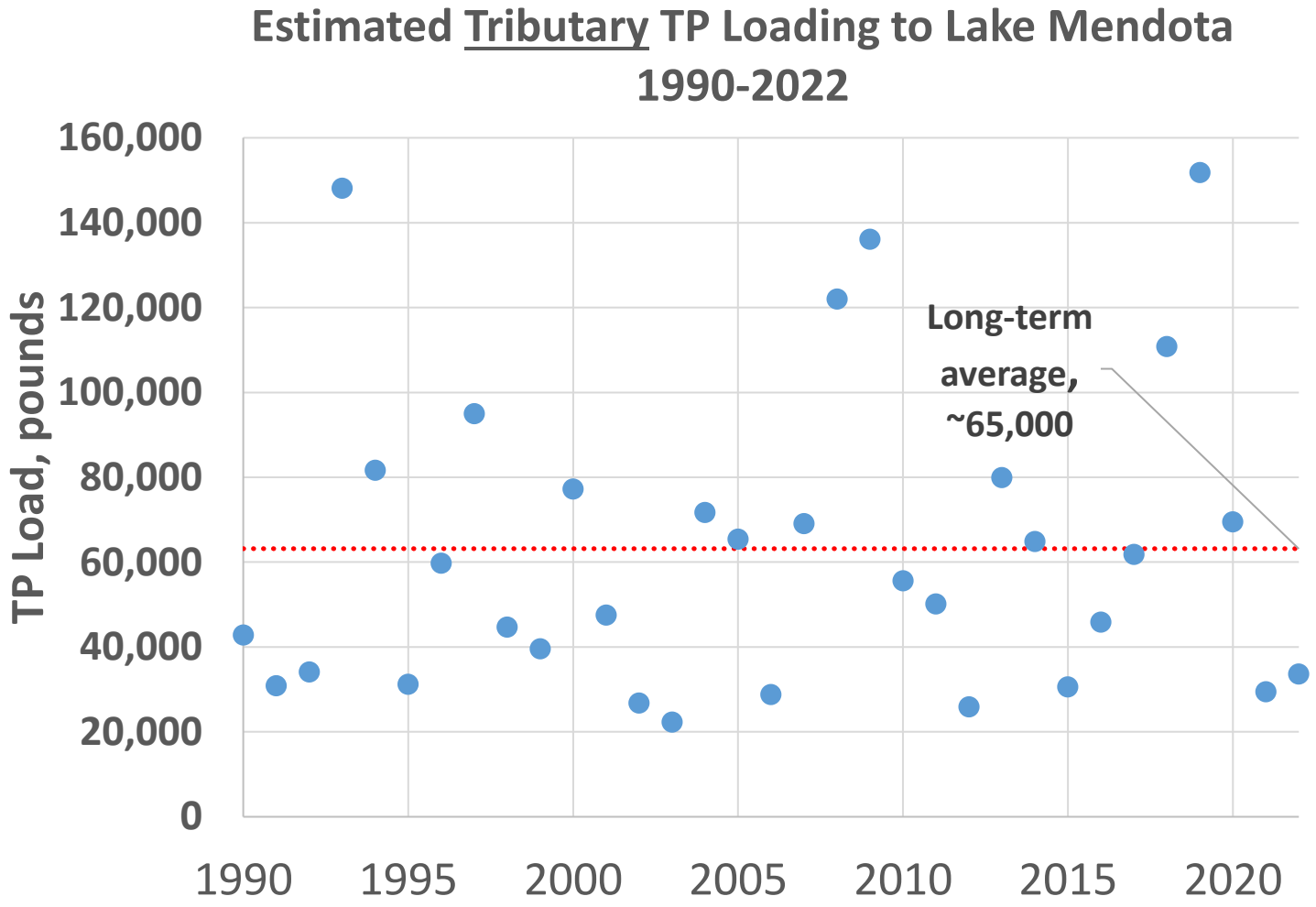
2021 P Loads to Lake Mendota



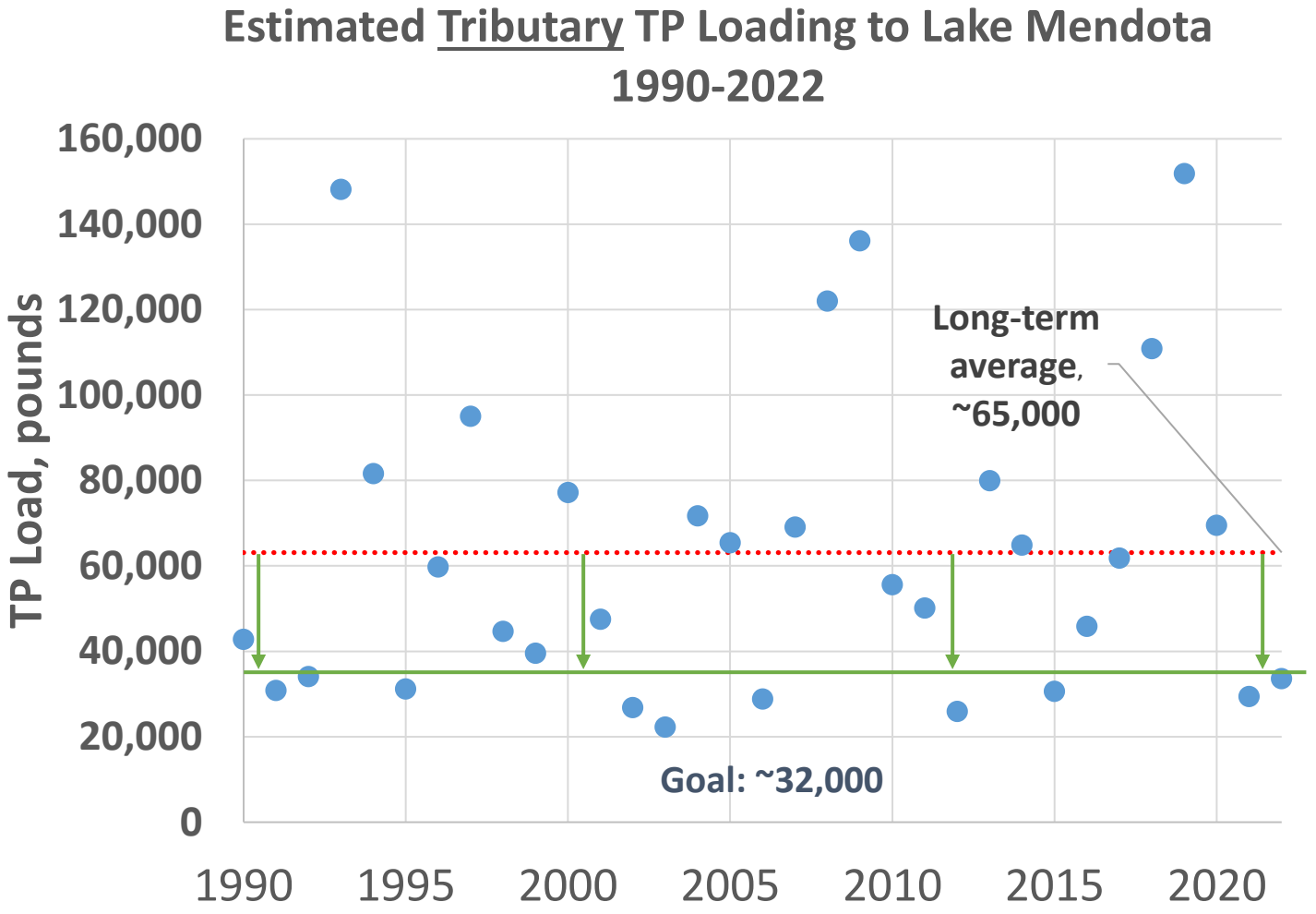
2019 – 2022 P Loads to Lake Mendota



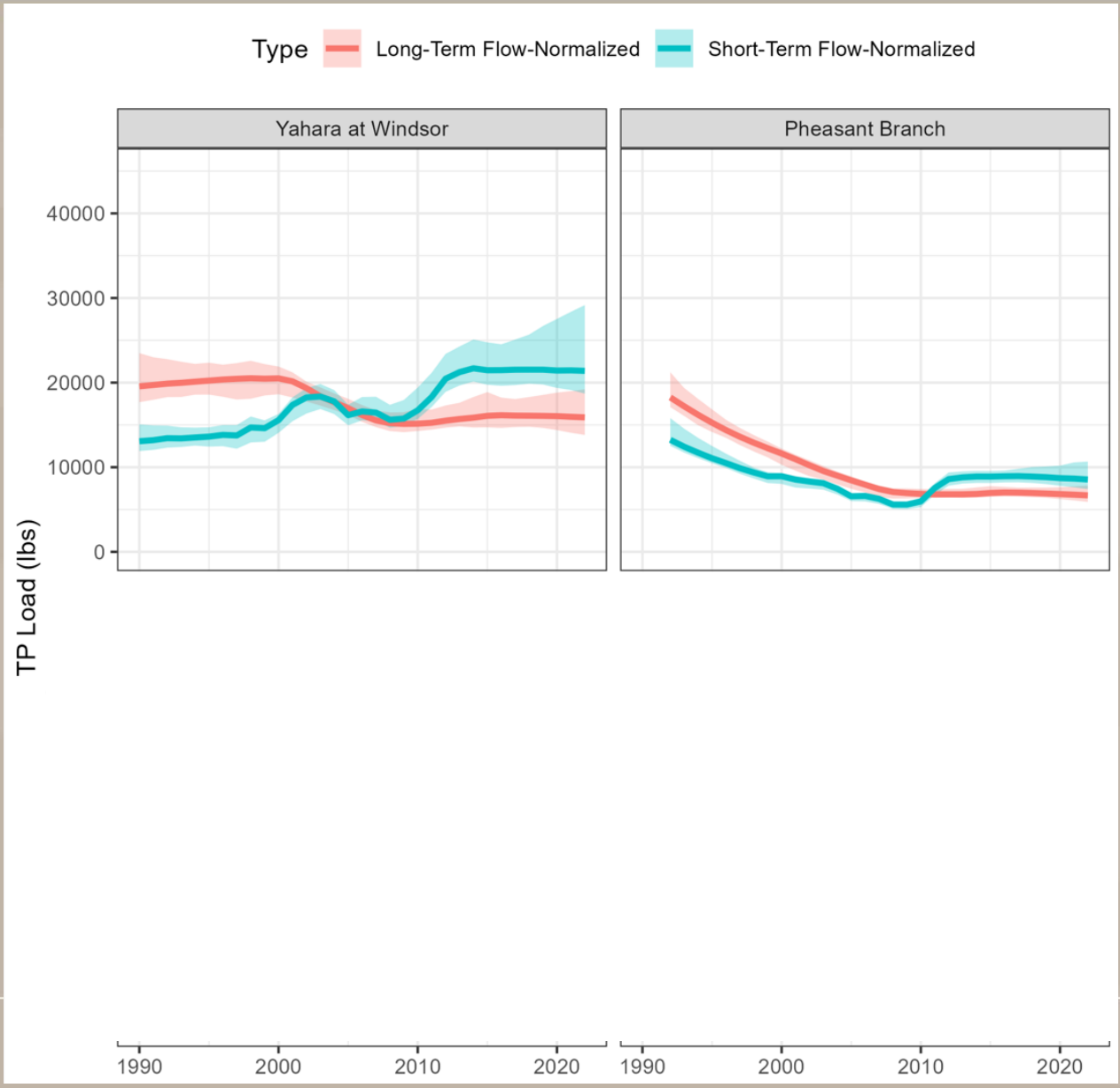
Longer historical perspective



What amount of TP loading is acceptable?

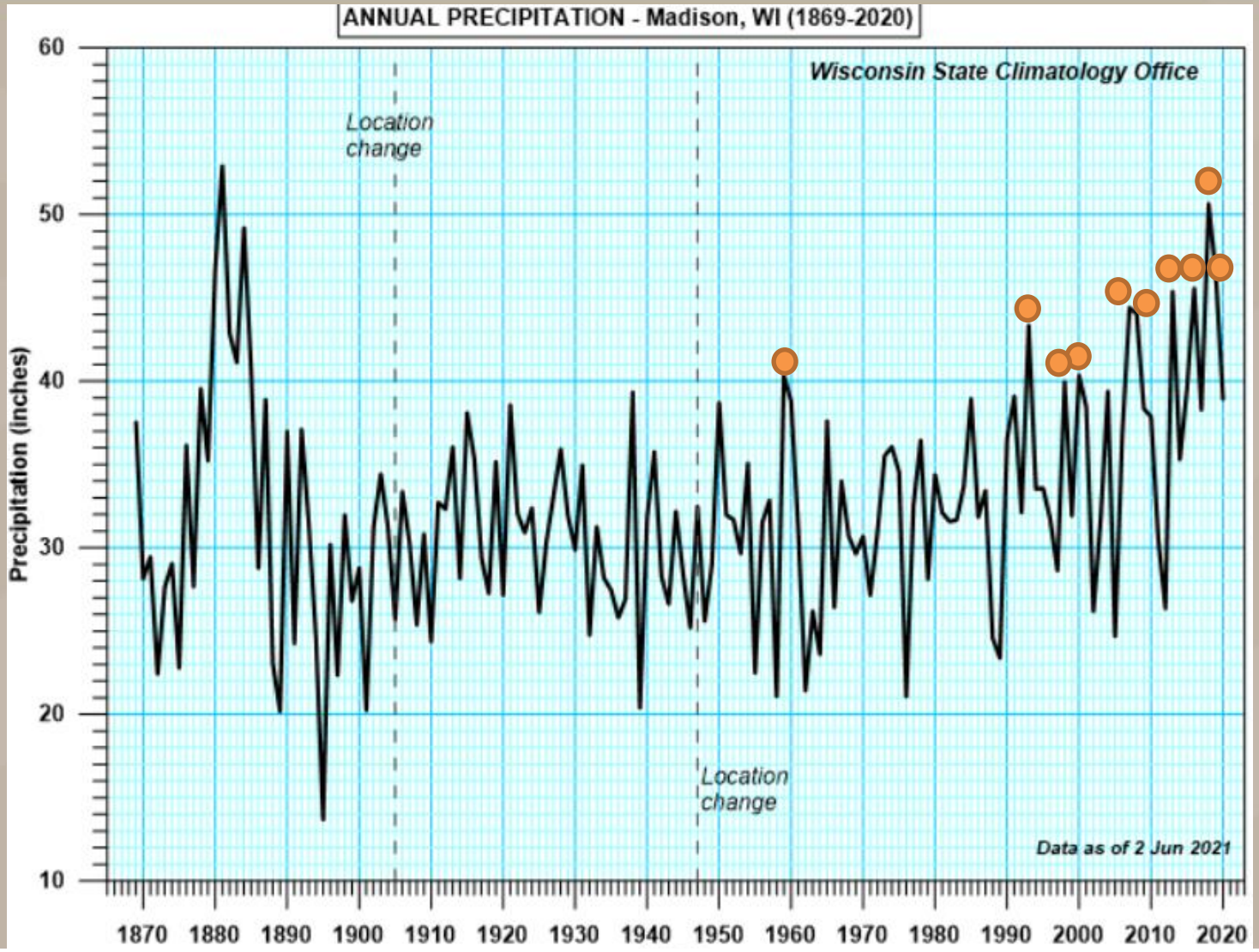


Which way are we trending?



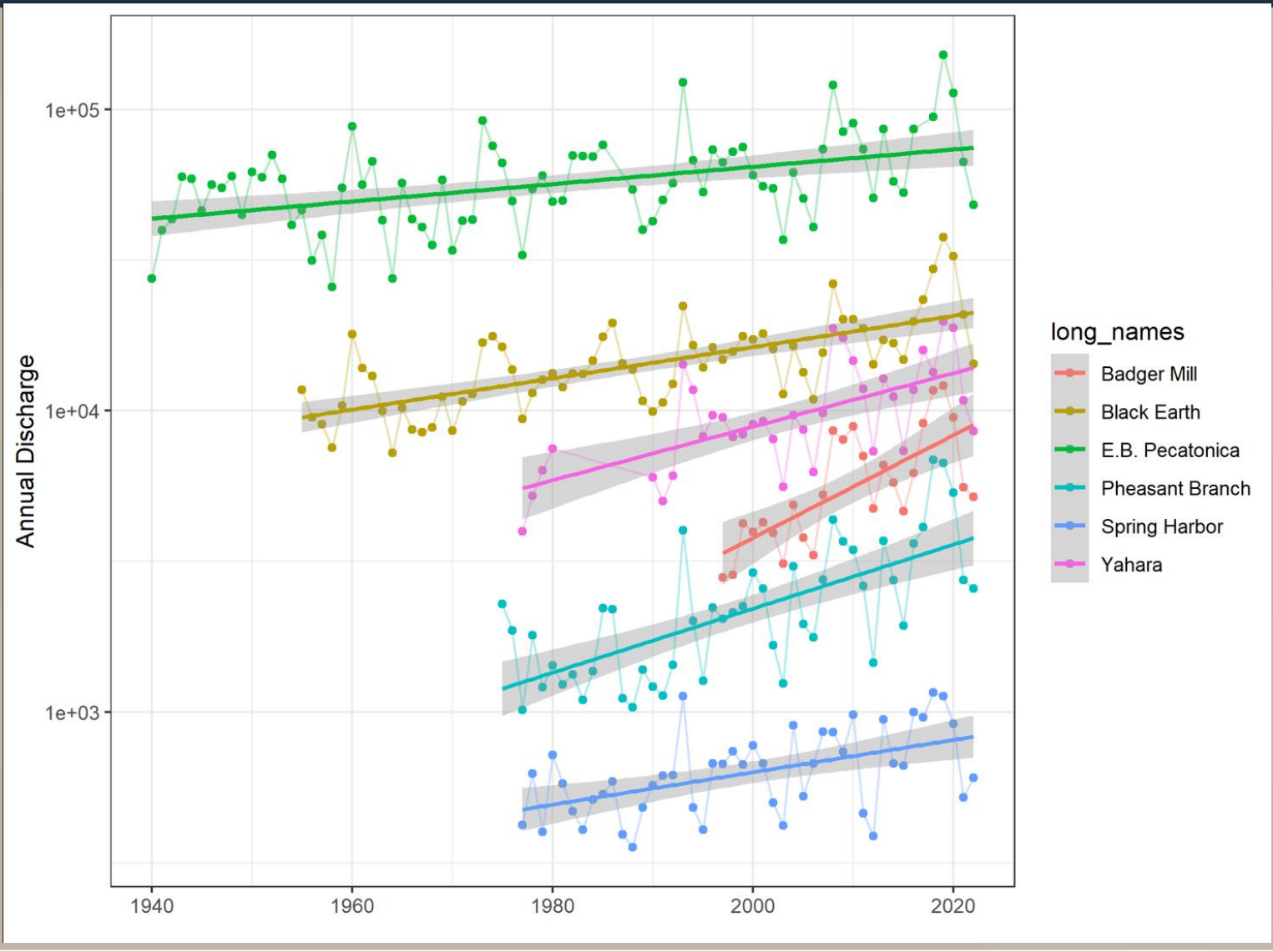
Source: Clean Lakes Alliance "Renew the Blue", May 18, 2022

Local trend in rainfall



Over the past ~150 years (excluding the early-mid1880's) 9 out of the 10 highest annual precipitation totals have occurred in the last ~20 years

Trends in streamflow



“Staying on the treadmill, holding serve, treading water”

- Although we’ve made a lot of progress on the landscape, it has not been enough to be fully realized in the lakes
- “Shifting Drivers” (*Gillon, Booth, and Rissman, 2015*)
  - Precipitation/Runoff
  - Urbanization
  - Ag intensification

Photo: UW-Madison Center for Limnology

What is being done? What is the fate of the Yahara River streams/lakes?

- County and NRCS
- County and Cities
- Yahara Pride Farmers
- Yahara WINS
- Yahara CLEAN 3.0

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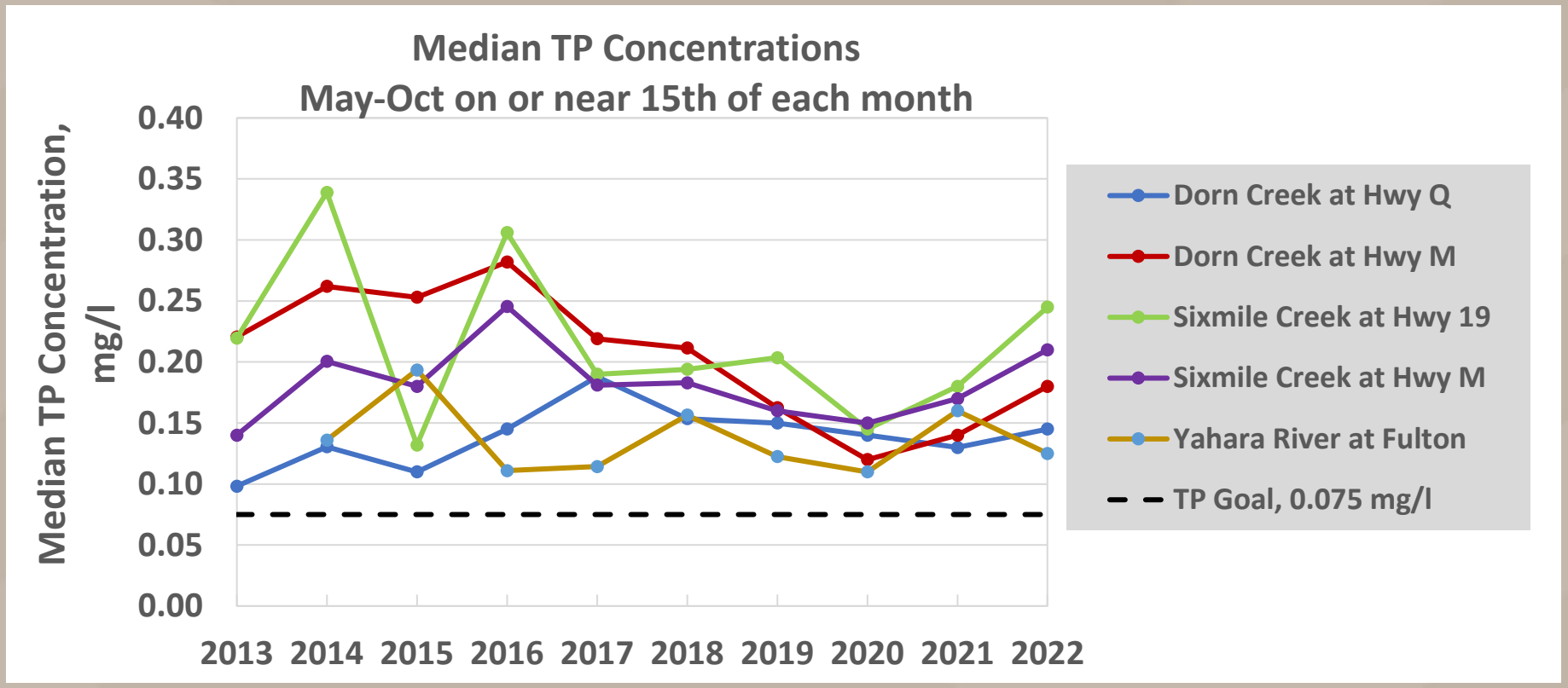
15th of the Month Growing Season TP Concentrations - PRELIMINARY



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Questions?