Yahara River Watershed
USGS Water-Quality Monitoring Update
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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
- 4 baseflow monitoring stations (on rotation)
Streamflow
Water Quality Sampling

Selected samples sent to lab(s) for analysis
Combining Streamflow with Water-Quality Data

Graphical Constituent Loading Analysis System (GCLAS) 1.06b
Water Year 2021: Year In Review

• Precipitation and runoff characteristics
• Phosphorus loading and timing
• Winter runoff observations
• Historical perspectives
• Growing season P concentrations
Precipitation Characteristics – Water Year 2021

~25”, about 35% lower than normal (34.5”), Snowfall close to normal
Long-Term Annual Precipitation
Precipitation Characteristics – Water Year 2021

Cumulative Precipitation: MADISON Water Year* 2021
*(1 Oct 2020 - 30 Sep 2021)

Data as of 1-Oct-21

- Cumulative Precip. Water Year-to-Date

Wisconsin State Climatology Office

October

June
Streamflow WY2021

Lake Mendota Tributary Discharge
Dorn, Sixmile, P. Branch, Yahara @ Windsor

Daily Discharge, CFS-Days


0  250  500  750  1,000

WY21
Wy2019 vs. Wy2020 vs. Wy2021 Streamflow

Record High Annual Streamflow

~45” precip.

About 10% less flow than Wy19

About 50% less flow than Wy19

~42” precip.

~25” precip.
Decreasing baseflow WY2019 - WY2021

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

- WY2021 was a very dry, low streamflow year
- Runoff in WY2021 was about 40% less than WY2020
- Not only much smaller runoff events, but greatly decreased baseflow
- Largest runoff event in WY2021 was early in the water year (late October)
- Little snowmelt runoff, despite average snowfall amount
  - Snowmelt is a big wildcard. Affected by soil conditions, sun, air temperatures, characteristics of snowpack, rain on snow, etc.
2021 P Loads to Lake Mendota

WY2021 PRELIMINARY

Lake Mendota Tributary Discharge and TP Load
Dorn, Sixmile, P. Branch, Yahara @ Windsor

WY21 had ~40% less total runoff than WY20, and about 60% less P load
2020 P Loads to Lake Mendota

Lake Mendota Tributary Discharge and TP Load
Dorn, Sixmile, P. Branch, Yahara @ Windsor
WY2020 PRELIMINARY

WY20 had ~10% less total runoff than WY19, but about ½ of the P load
2019 – 2021 P Loads to Lake Mendota
Estimated Tributary TP Loading to Lake Mendota 1990-2021

Long-term average ~65,000 pounds


TP Load, pounds
Timing of Phosphorus Delivery

Tributary P Load to Lake Mendota Seasonal Distribution, WY13-21

- Jan-Mar: 47%
- Apr-Jun: 15%
- Jul-Sep: 18%
- Oct-Dec: 20%

Tributary TP Load to Lake Mendota Seasonal Distribution, WY 2021

- Jan-Mar: 25%
- Apr-Jun: 17%
- Jul-Sep: 11%
- Oct-Dec: 47%
Observations of TP in Winter Runoff (Snowmelt)

Relation between Discharge and P Load

- Y-axis: Annual Phosphorus load
- X-axis: Annual Discharge

Points labeled WY2015, WY2016, WY2017, WY2018, WY2019, WY2020
Historical P Loading (WINS era)

Annual Tributary P Loads to Lake Mendota

Cumulative TP Load, pounds

- WY2013
- WY2014
- WY2015
- WY2016
- WY2017
- WY2018
- WY2019
- WY2020
- WY2021

- WY2019
- WY2018
- WY2013
- WY2014
Observations of TP in Winter Runoff (Snowmelt)

This demonstrates that there is a higher TP concentration per unit runoff during wintertime.
Observations of TP in Winter Runoff (Snowmelt)

There is the potential to significantly lower annual P loading if snowmelt P concentrations are reduced.
Estimated Percentages of P Sources

TP Contributions to Lake Mendota
Estimated ~80,000 lb./yr., 1990-2020

- Direct lake deposition: 4%
- Madison Urban: 8%
- Sixmile: 30%
- Yahara Hwy113: 31%
- P. Branch: 12%
- Dorn: 10%
- Other: 5%
Lake Effects

Lake Mendota Phosphorus

TP, mg/L vs. Year


0.00 0.02 0.04 0.06 0.08 0.10 0.12 0.14

Eutrophic

Mesotrophic

Line of Eutrophication (0.024 mg/L)

Lathrop, written communication
15\textsuperscript{th} of the Month Growing Season TP Concentrations

Median TP Concentrations
May-Oct on or near 15th of each month

- Dorn Creek at Hwy Q
- Dorn Creek at Hwy M
- Sixmile Creek at Hwy 19
- Sixmile Creek at Hwy M
- Yarara River at Fulton
- TP Goal, 0.075 mg/l
Phosphorus Take-Homes

- Water Year 2021 tributary P load to Lake Mendota was about 28,000 pounds, which is among 30-year historical lows.
- Largest P loading event in WY2021 was early in the water year (late October), 7,000 P delivered
- Nearly ½ of the annual TP load was delivered in Oct-Dec (mostly in October)
- Growing season concentrations slightly higher than 2020, remaining above standards
- Years with significant snowmelt runoff demonstrate the higher P concentration per unit runoff during this time and potential importance to overall annual load