Freedom Water Quality Report

GREEN MOUNTAIN
CONSERVATION GROUP

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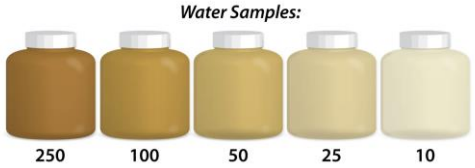
RIVERS Field Sampling Parameters

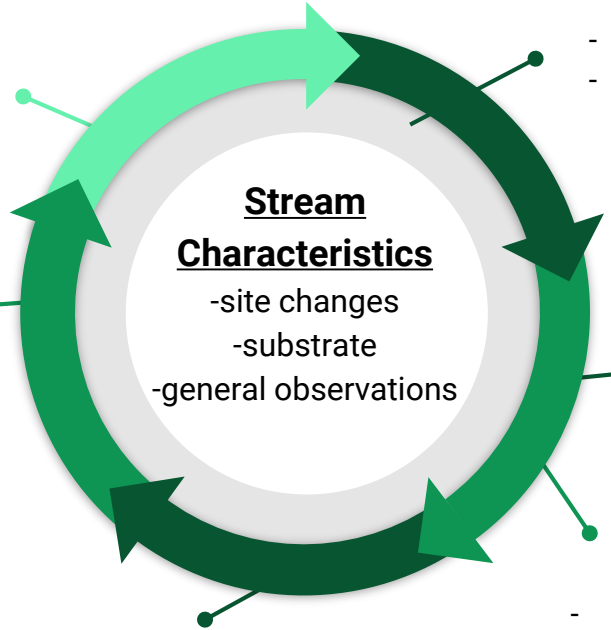


Total Phosphorus (TP)

- Valuable nutrient, alongside Nitrogen, for plant development
- High levels indicate elevated decomposition (ie. sewage inputs)

Turbidity

- Clarity of the fluid
- Determined by the amount of suspended particulates

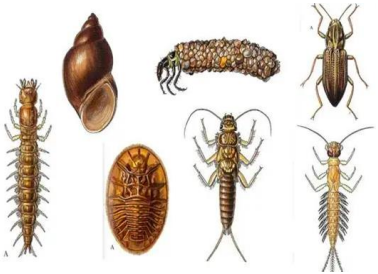


Conductivity

- Ability of water to pass an electrical charge
- Based on the amount of positively (Mg+, Ca+) or negatively (Cl-, NO_3-) charged elements

Temperature

- Influences…
  - biological activity
  - plant growth
  - rate of chemical reactions
  - DO levels



Dissolved Oxygen (DO)

- Measure of how much oxygen is available for aquatic organisms
- Different species require different DO levels

pH

- Pure water is 7 (neutral)
- Most water in NH is slightly acidic (~6.5)
- Optimal levels to support aquatic organisms: 6.5 - 8.2

Water Quality Standards & Allowable Limits

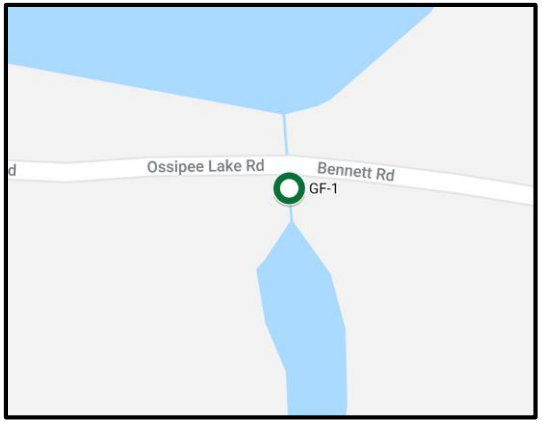
- Turbidity
  - < 10 NTU
- Temperature
  - No standard, but monitored for changes
- pH
  - 6 - 8
  - Preferably closer to 6.5
- Dissolved Oxygen (DO)
  - 6 - 11 mg/L
  - 75% - 120%
- Conductivity
  - < 100 µS/cm
- Total Phosphorus (TP)
  - < 30 µg/L
  - Anything above is considered “nuisance levels”

Based on NHDES and EPA Criteria

Each site monitored will vary slightly due to differences in geology, plant life, site characteristics, etc.

GF-1 Danforth Brook: 2018 - Oct. 2023

- Monitored since 2002
- Parameters collected: pH, turbidity, TP, temperature, conductivity, DO

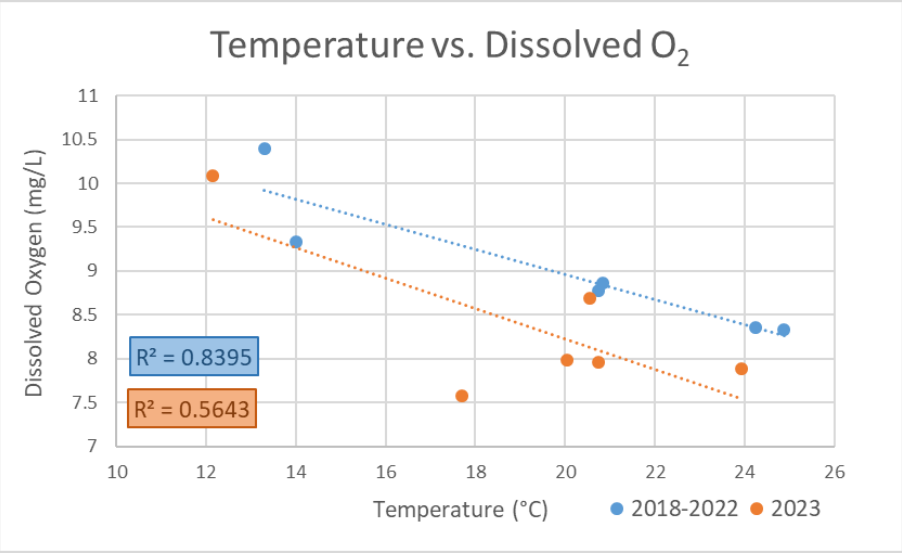


Parameter	Status*
Turbidity	Stable
pH	Stable
Total Phosphorus	Stable

**Data from 2018 - Oct. 2023*

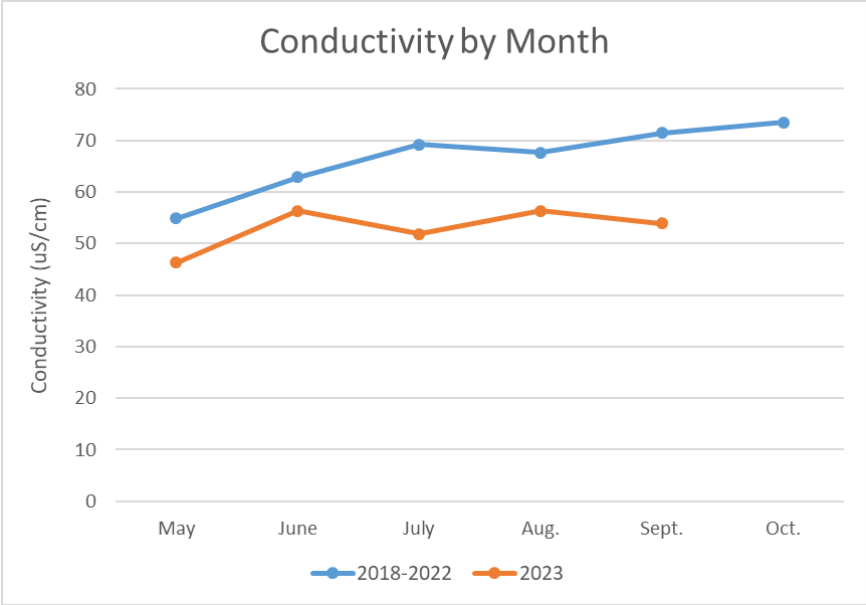
GF-1 Danforth Brook: 2018 - 2023

Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases, DO decreases.

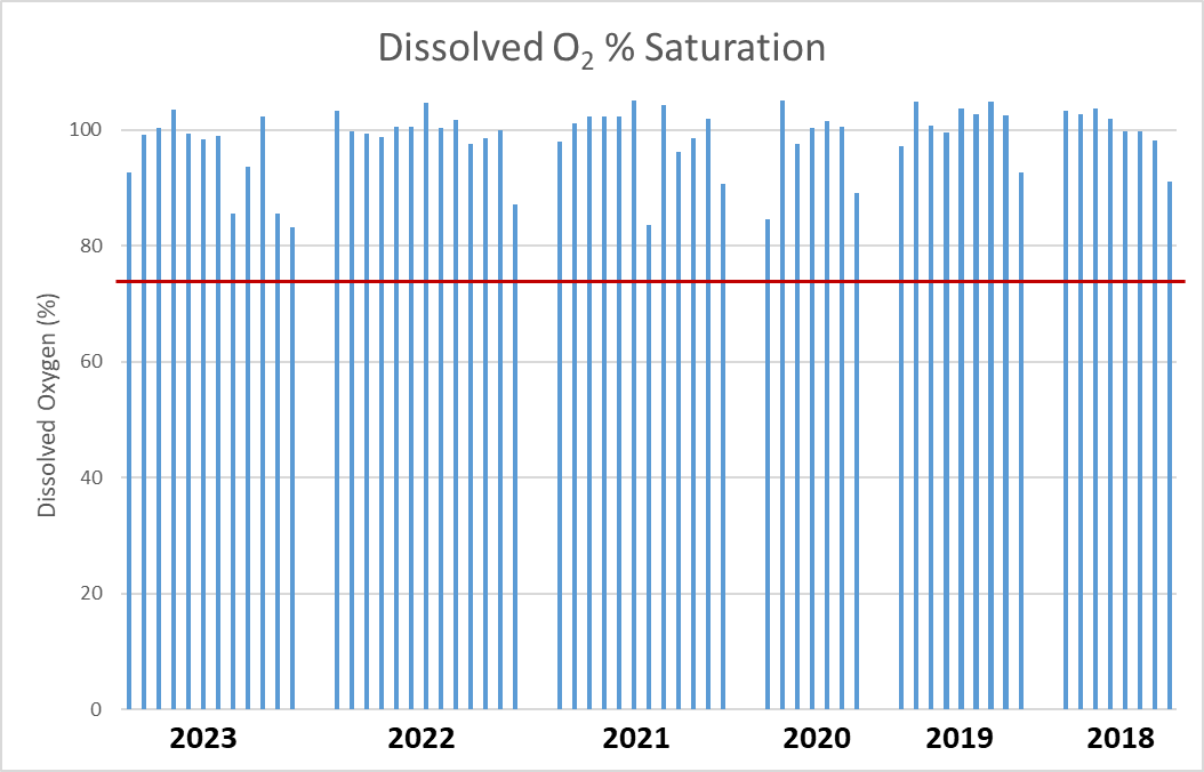


The R^2 value from 2023 (orange) is low and may indicate a weaker relationship between the parameters at this site, compared to the 2018-2022 value (blue). All values exceed the 6.0 mg/L minimum.

Conductivity shows a series of lower values at GF-1 in 2023 compared to 2018-2022. Values are below 100 uS/cm, indicating good (normal) water quality in respect to salt concentrations.



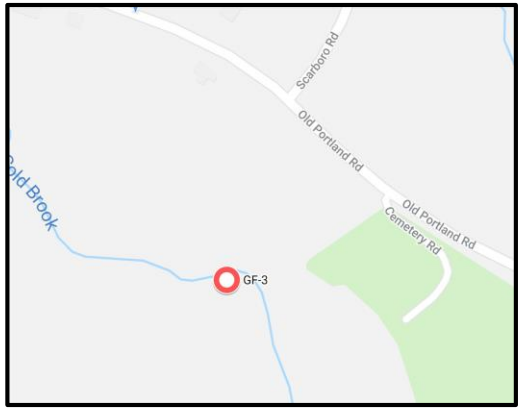
GF-1 Danforth Brook: 2018 - 2023



New Hampshire State DO standard for Class A waters is above 75% during the months GMCG tests.

GF-3 Cold Brook: 2018 - Dec. 2023

- Monitored since 2003
- Parameters collected: pH, turbidity, TP, temperature, conductivity, DO

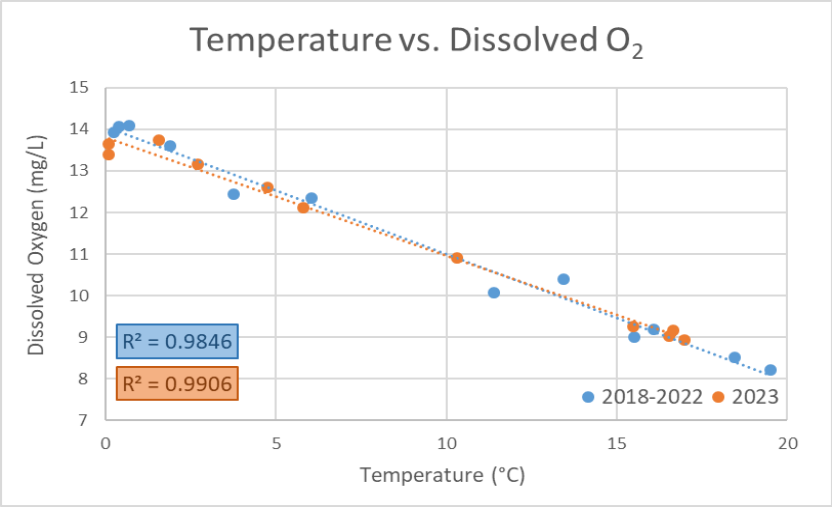


Parameter	Status*
Turbidity	Stable
pH	Stable
Total Phosphorus	Stable

**Data from 2018 – Oct. 2023*

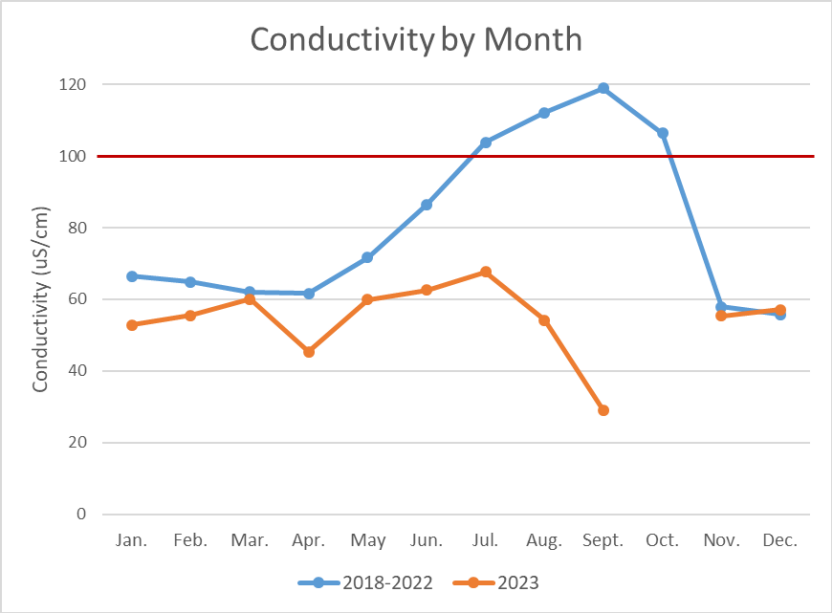
GF-3 Cold Brook: 2018 - 2023

Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases, DO decreases.

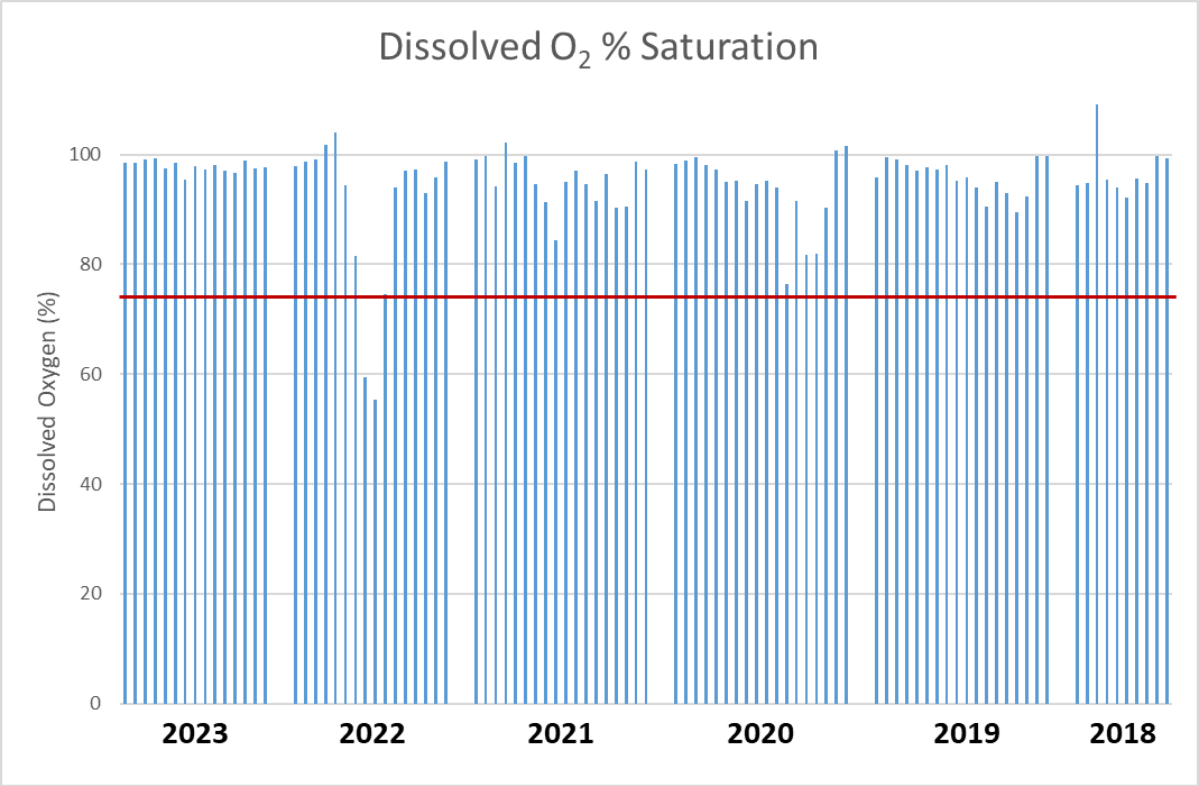


The R^2 value from 2023 (orange) is similar to the compiled 2018-2022 value (blue). This indicates little change in DO. All values exceed the 6.0 mg/L minimum.

Conductivity shows a series of lower values at GF-3 in 2023 compared to 2018-2022. All values are above 100 uS/cm, indicating good (normal) water quality in respect to greater salt concentrations.



GF-3 Cold Brook: 2018 - 2023



New Hampshire State DO standard for Class A waters is above 75% during the months GMCG tests.

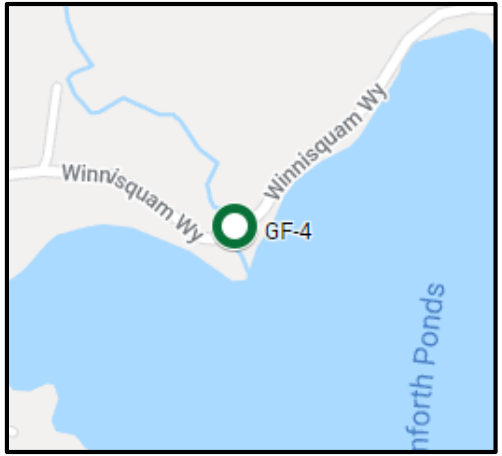
GF-3 Cold Brook: 2018 – Oct. 2023

Parameter	Status
Ammonium	Stable
Orthophosphate	Slightly above pristine limits of 10ug/L
Dissolved Organic Carbon	Stable
Total Dissolved Nitrogen	Stable
Chloride	Slightly above pristine limit of 10mg/L
Nitrate	Slightly above pristine limits of 50ug/L
Sulfate	Stable
Sodium	Stable
Potassium	Stable
Magnesium	Stable
Calcium	Stable
Dissolved Organic Nitrogen	Stable

Parameter	Typical Pristine Surface Water Concentrations
Ammonium	<0.2mg/L
Orthophosphate	<10ug/L
Dissolved Organic Carbon	N/A; between 1-10mg/L
Total Dissolved Nitrogen	<0.5mg/L
Chloride	<10mg/L
Nitrate	<50ug/L
Sulfate	<80mg/L
Sodium	<50mg/L
Potassium	<10mg/L
Magnesium	1-100mg/L
Calcium	<15mg/L
Dissolved Organic Nitrogen	N/A

GF-4 Shawtown Brook: 2022 - Oct. 2023

- Monitored since 2022
- Parameters collected: pH, turbidity, TP, temperature, conductivity, DO

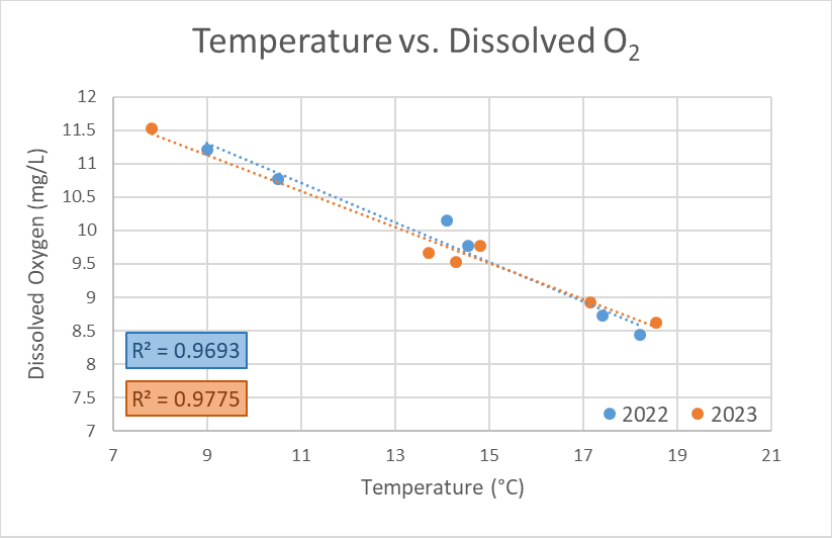


Parameter	Status*
Turbidity	Stable
pH	Stable
Total Phosphorus	Stable

**Data from 2022 - Oct. 2023*

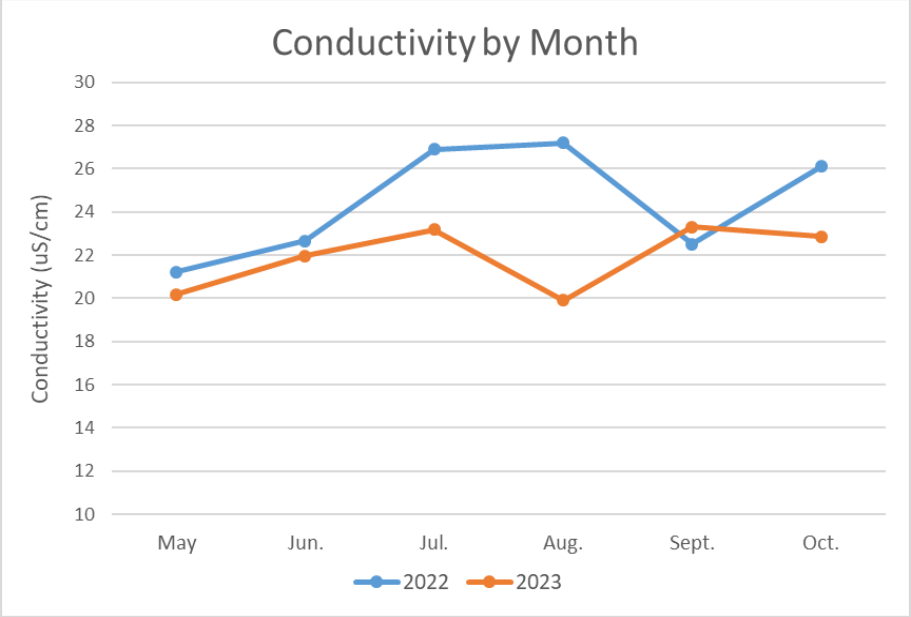
GF-4 Shawtown Brook: 2022-2023

Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases, DO decreases.

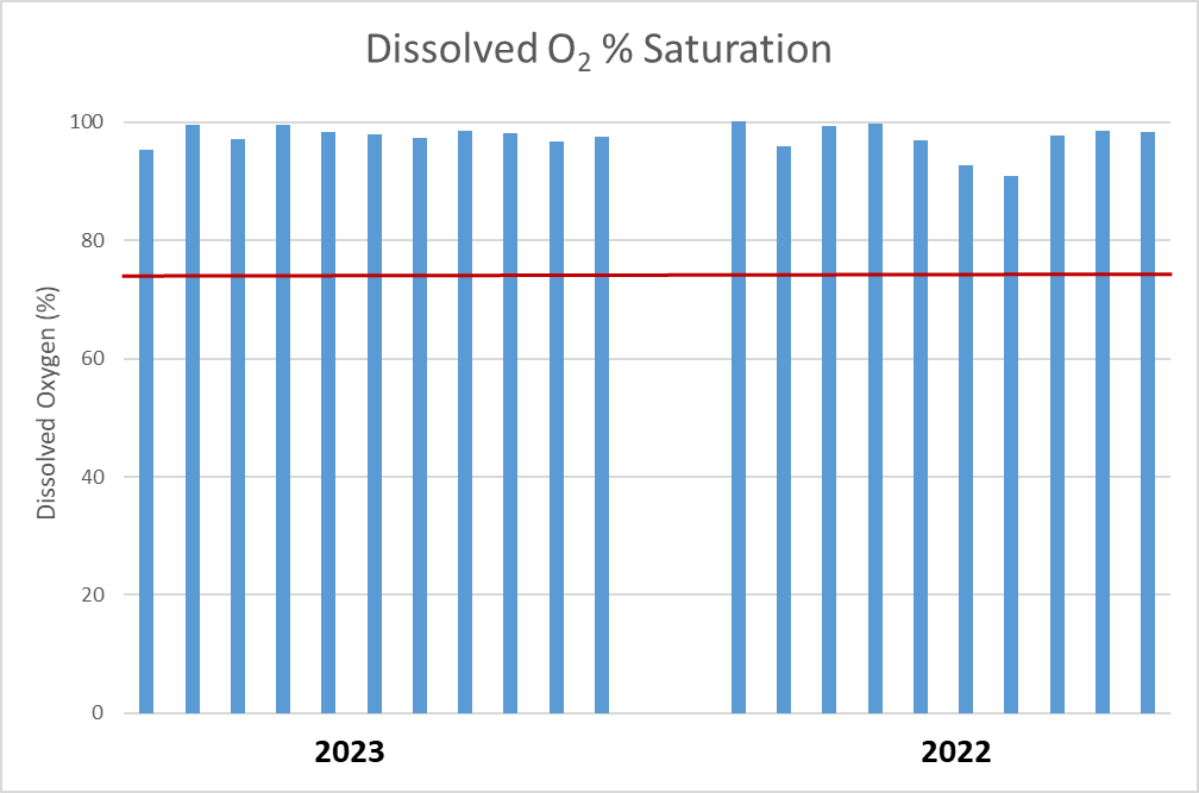


The R^2 value from 2023 (orange) is similar to the 2022 value (blue). This indicates little change in DO. All values exceed the 6.0 mg/L minimum.

Conductivity shows a series of lower values at GF-4 in 2023 compared to 2022. All values are above 100 uS/cm, indicating good (normal) water quality in respect to greater salt concentrations.



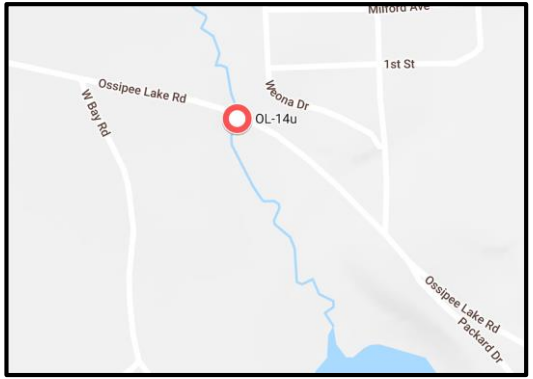
GF-4 Shawtown Brook: 2022 – 2023



New Hampshire State DO standard for Class A waters is above 75% during the months GMCG tests.

OL-14u Square Brook: 2018 - Dec. 2022

- Monitored since 2005
- Parameters collected: pH, turbidity, TP, temperature, conductivity, DO

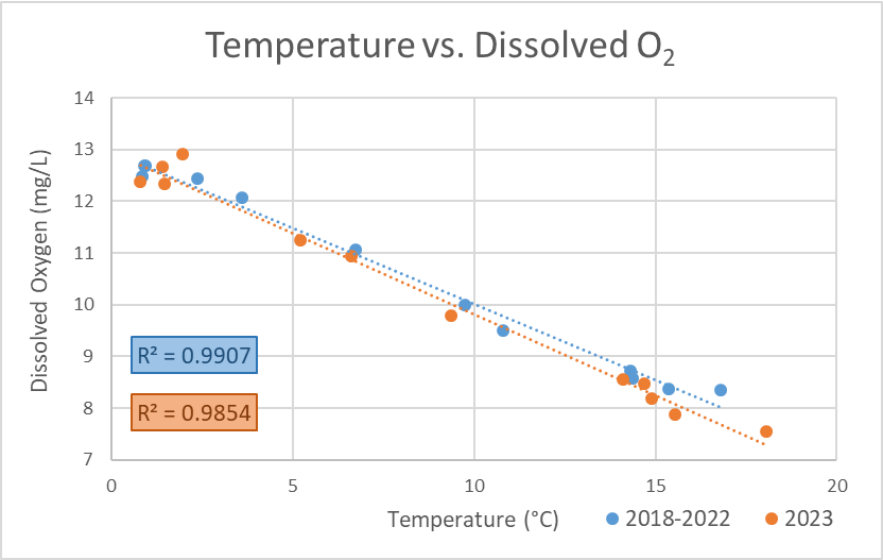


Parameter	Status*
Turbidity	Stable
pH	Stable
Total Phosphorus	Stable

**Data from 2018 - Oct. 2023*

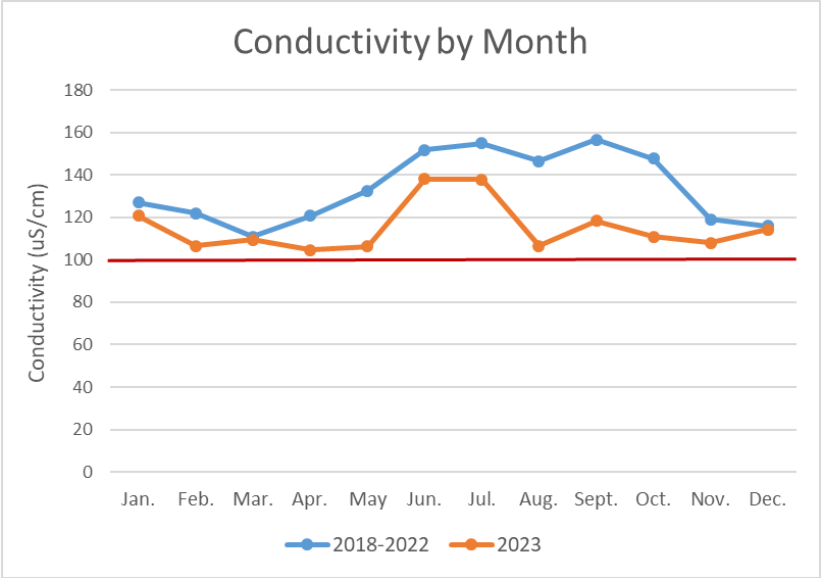
OL-14u Square Brook: 2018 - 2023

Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases, DO decreases.

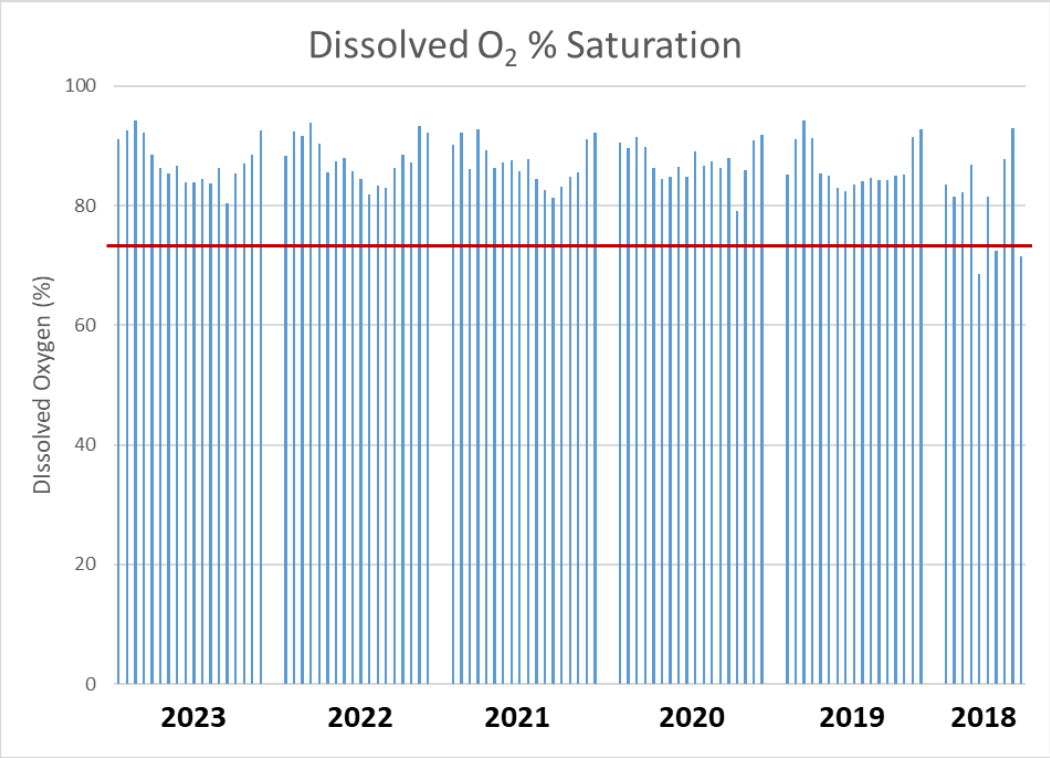


The R^2 value from 2023 (orange) is similar compared to the compiled 2018-2022 value (blue). This indicates little change in DO levels. All values exceed the 6.0 mg/L minimum.

Conductivity shows a series of slightly lower values at OL-14u in 2023 compared to 2018-2022. All values for 2023 are above 100 uS/cm, indicating water quality in respect to greater salt concentrations is a low impact concern.



OL-14u Square Brook: 2018 - 2023



New Hampshire State DO standard for Class A waters is above 75% during the months GMCG tests.

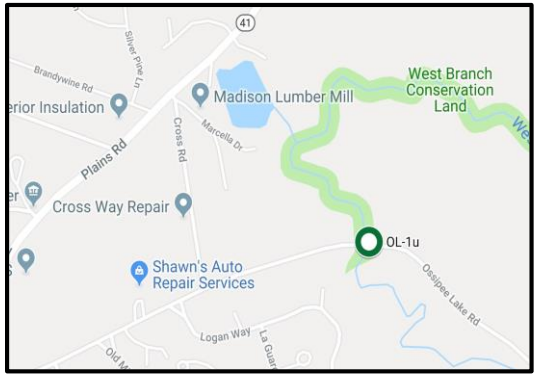
OL-14u Square Brook: 2018 – Oct. 2023

Parameter	Status
Ammonium	Stable
Orthophosphate	Slightly above pristine limits of 10ug/L
Dissolved Organic Carbon	Stable
Total Dissolved Nitrogen	Stable
Chloride	Above pristine limits of 10mg/L
Nitrate	Slightly above pristine limits of 50ug/L
Sulfate	Stable
Sodium	Stable
Potassium	Stable
Magnesium	Stable
Calcium	Stable
Dissolved Organic Nitrogen	Stable

Parameter	Typical Pristine Surface Water Concentrations
Ammonium	<0.2mg/L
Orthophosphate	<10ug/L
Dissolved Organic Carbon	N/A; between 1-10mg/L
Total Dissolved Nitrogen	<0.5mg/L
Chloride	<10mg/L
Nitrate	<50ug/L
Sulfate	<80mg/L
Sodium	<50mg/L
Potassium	<10mg/L
Magnesium	1-100mg/L
Calcium	<15mg/L
Dissolved Organic Nitrogen	N/A

OL-1u West Branch River: 2018 - Oct. 2023

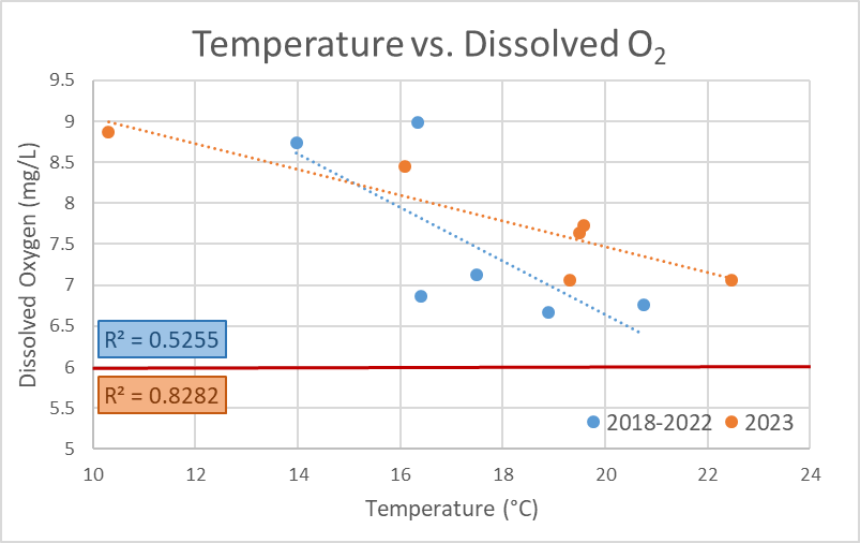
- Monitored since 2005
- Parameters collected: pH, turbidity, TP, temperature, conductivity, DO



Parameter	Status*
Turbidity	Stable
pH	Usually near or below 6, well above 6 in 2023
Total Phosphorus	Stable

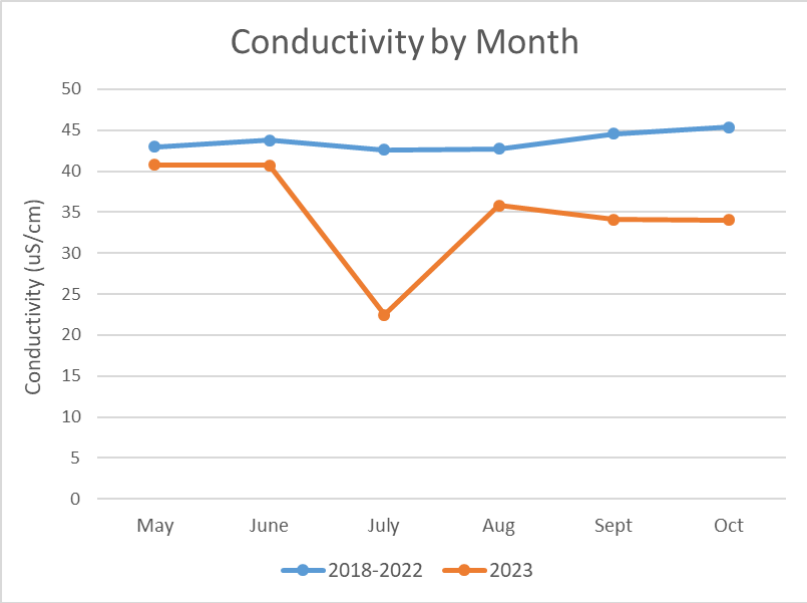
OL-1u West Branch River: 2018 - 2023

Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases, DO decreases.

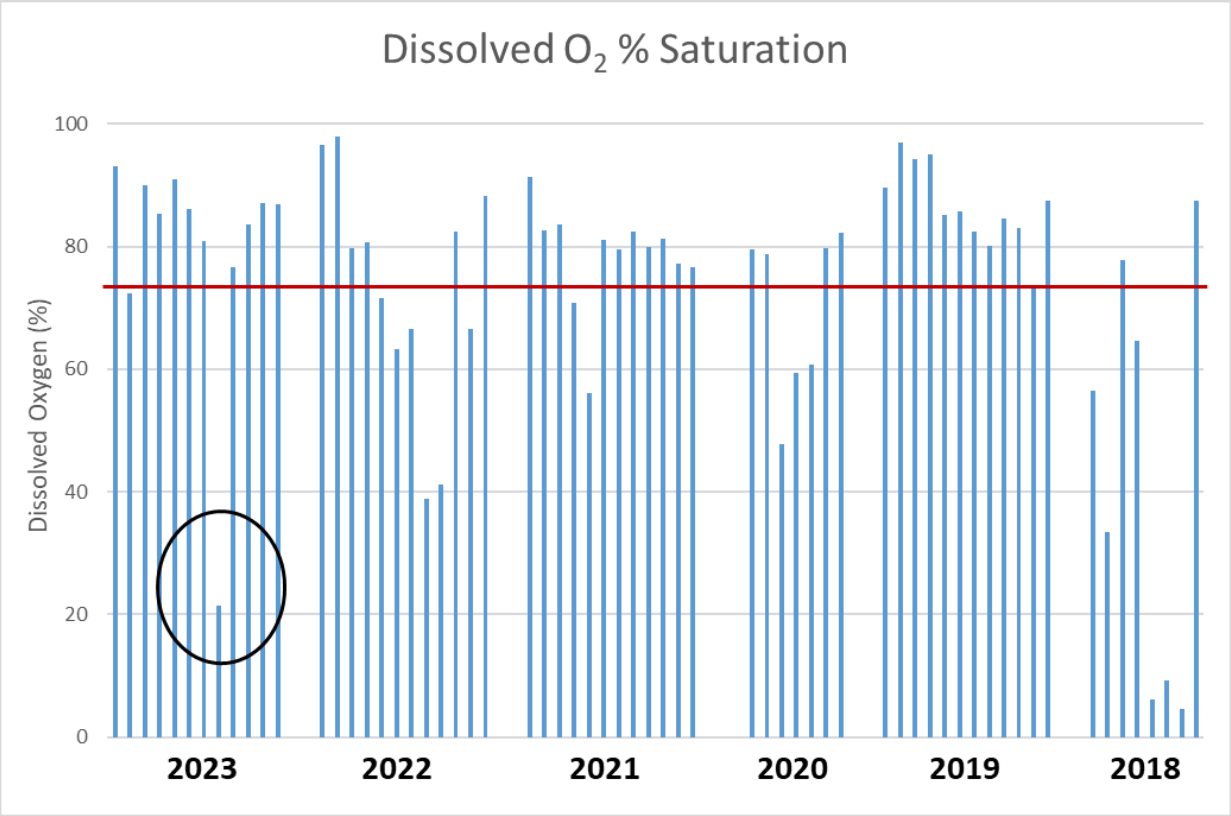


The R^2 value from 2023 (orange) is much higher compared to the compiled 2018-2022 value (blue). All values exceed the 6.0 mg/L minimum, indicating that DO levels are improving and increasing.

Conductivity shows a series of lower values at OL-1u in 2023 compared to 2018-2022. All values for 2023 are below 100 uS/cm, indicating good (normal) water quality in respect to salt concentrations.



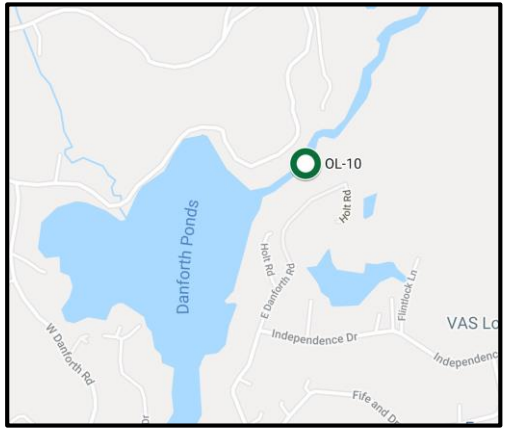
OL-1u West Branch River: 2018 - 2023



New Hampshire State DO standard for Class A waters is above 75% during the months GMCG tests.

OL-10 Huckins Pond Outflow: 2018 - Oct. 2023

- Monitored 2003 - 2007, and since 2013
- Parameters collected: pH, turbidity, TP, temperature, conductivity, DO

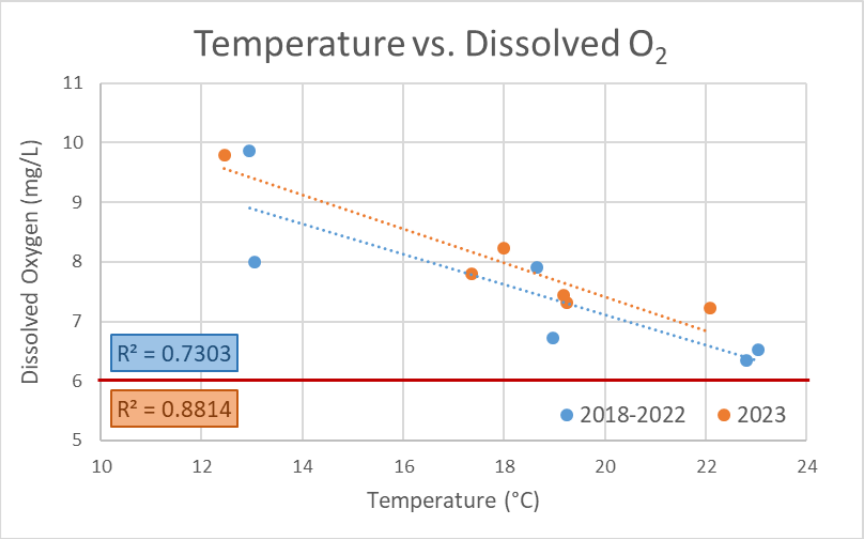


Parameter	Status*
Turbidity	Stable
pH	Stable
Total Phosphorus	Stable

**Data from 2018 - Oct. 2023*

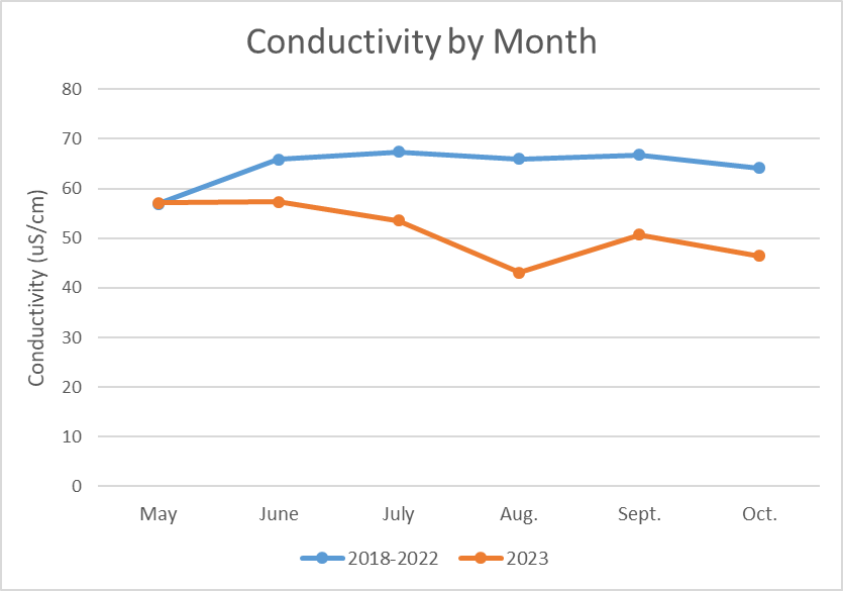
OL-10 Huckins Pond Outflow: 2018 - 2023

Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases, DO decreases.

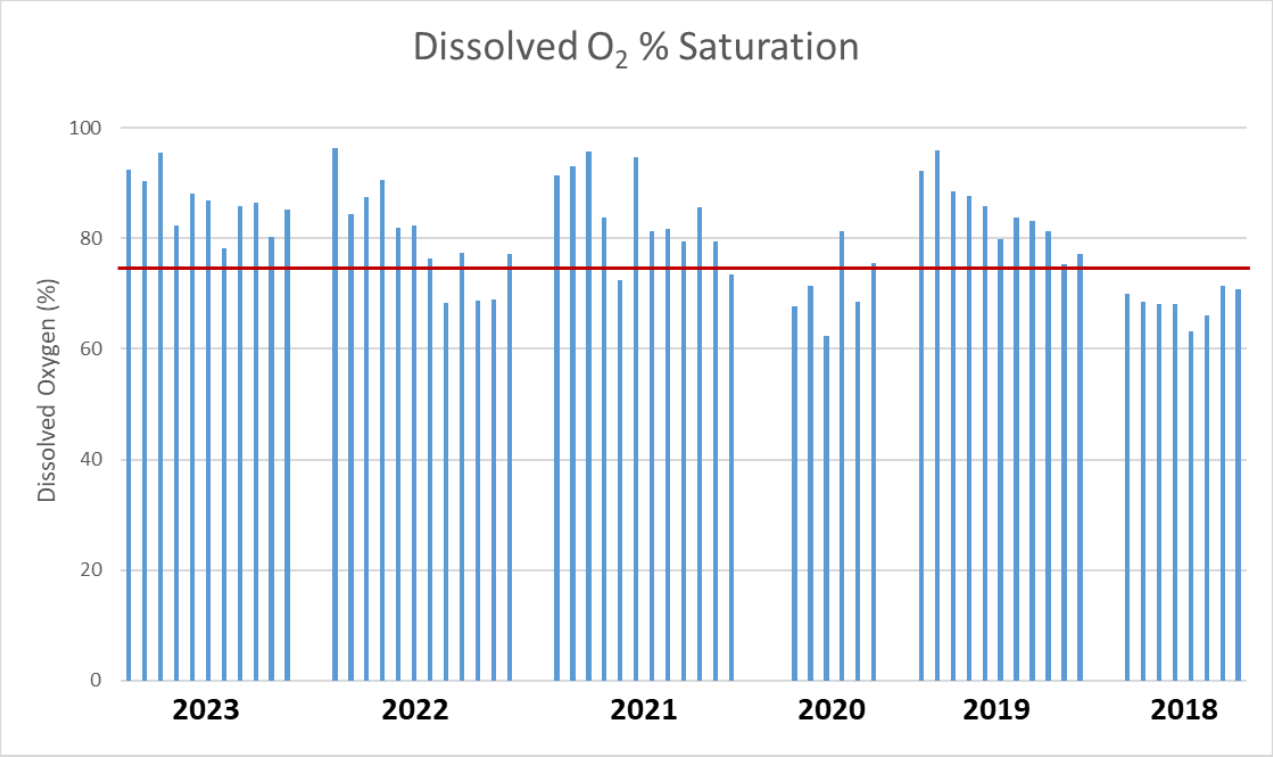


The R^2 value from 2023 (orange) is higher than the compiled 2018-2022 value (blue). This indicates an improvement in water quality in respect to DO. All values exceed the 6.0 mg/L minimum.

Conductivity shows a series of lower values at OL-10 in 2023 compared to 2018-2022. All values for 2023 are below 100 uS/cm, indicating good (normal) water quality in respect to salt concentrations.



OL-10 Huckins Pond Outflow: 2018 - 2023



New Hampshire State DO standard for Class A waters is above 75% during the months GMCG tests.

OL- 9u Cold Brook: 2018 - Oct. 2023

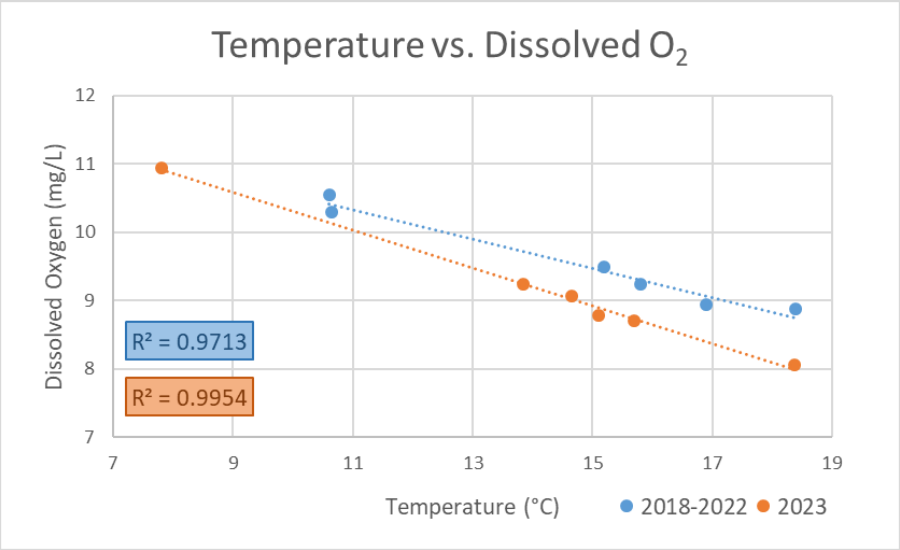
- Monitored 2003 - 2007, and since 2005
- Parameters collected: pH, turbidity, TP, temperature, conductivity, DO

Parameter	Status*
Turbidity	Stable
pH	Stable
Total Phosphorus	Stable

**Data from 2018 - Oct. 2023*

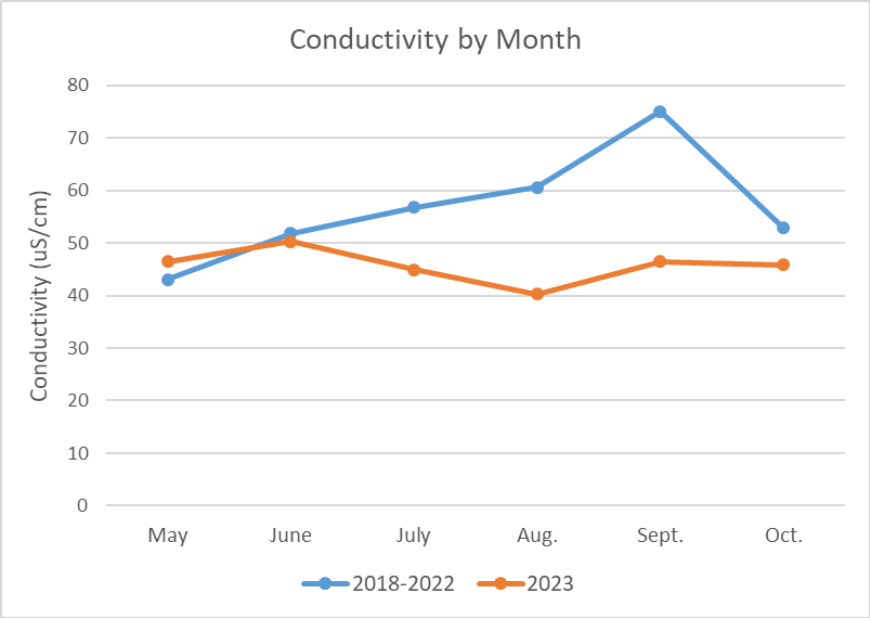
OL-9u Cold Brook: 2018 - 2023

Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases, DO decreases.

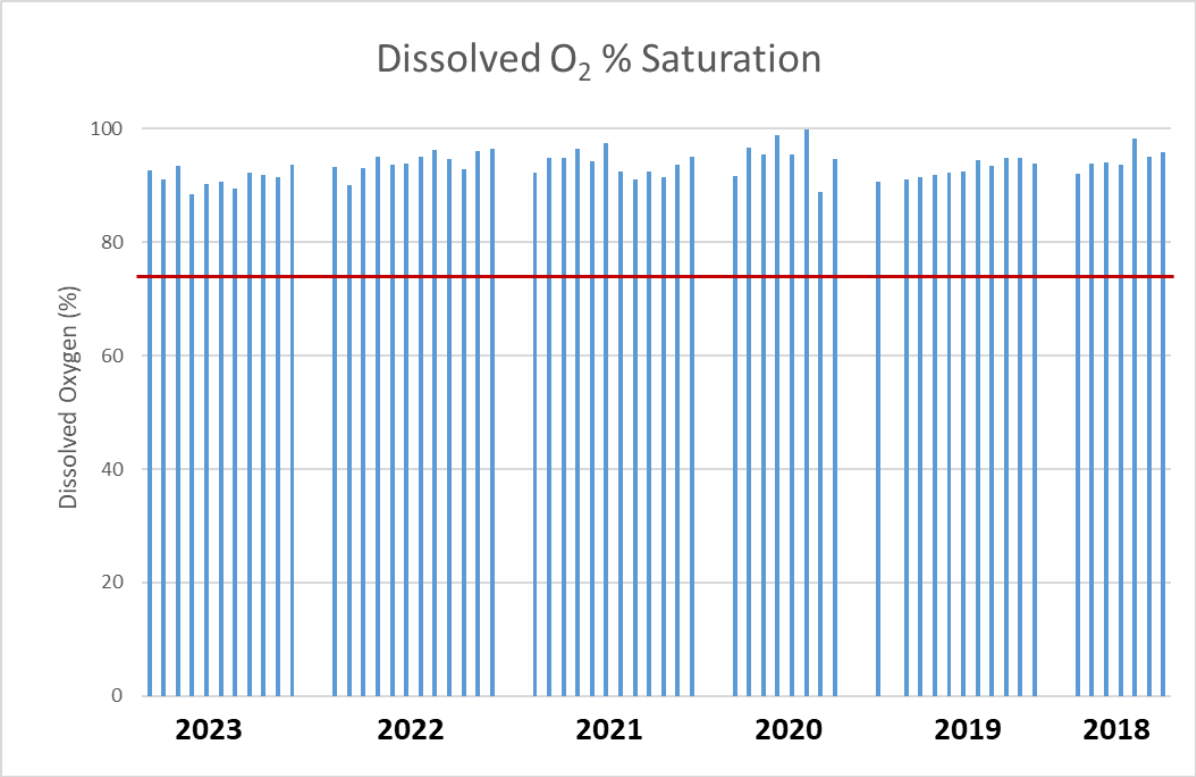


The R^2 value from 2023 (orange) is similar compared to the compiled 2018-2022 value (blue). This indicates little change in DO levels. All values exceed the 6.0 mg/L minimum.

Conductivity shows a series of lower values at OL-9u in 2023 compared to 2018-2022. All values for 2023 are below 100 uS/cm, indicating good (normal) water quality in respect to salt concentrations.



OL-9u Cold Brook: 2018 - 2023



New Hampshire State DO standard for Class A waters is above 75% during the months GMCG tests.

Freedom Water Quality Summary

- The majority of parameters tested fell within the acceptable limits for surface waters set by the New Hampshire Department of Environmental Services (NHDES) and/or the Environmental Protection Agency, however…
  - GF-1
    - DO: Irregular and inconsistent values, though all exceed the 6.0 mg/L minimum
  - GF-3
    - Nitrate: Above pristine limit, though has been consistently hovering around 50ug/L the past 5 years
    - Chloride: Currently above pristine limit, but decreasing and reaching reaching pristine range of values
    - Orthophosphate: Slightly above pristine limit of 10ug/L
  - OL-14u
    - Conductivity: All values exceed 100 uS/cm = low impact concern
    - Orthophosphate and Nitrate: Slightly above pristine conditions, showing some human impact
    - Chloride: Above the pristine limits of 10mg/L, and has remained steady at the 25-30mg/L range the past 5 years.
  - OL-1u
    - pH: Within limits, but highest it has been in the past 5 years
    - DO: Two values below 75% saturation minimum

What can Freedom do to protect its waters?

1. Encourage residents to get their septic system checked
2. Minimize salt application on roadways, especially around bodies of water and other sensitive habitats
    a. Brine is a equally effective and more environmentally friendly alternative
3. Maintain riparian habitats (aka Streamside Management Zones) around bodies of water
4. Use Best Management Practices (BMPs)
    a. Proper disposal of chemicals and other anthropogenic waste
5. Monitor the effectiveness of culverts in your town, and replace those posing as safety and environmental hazards

Thank You For Your Time

Report respectfully submitted by:
J. Emerson, *Water Quality Coordinator*
G. Piselli, *AmeriCorps Water Quality Resources Assistant*