



Madison Water Quality Overview

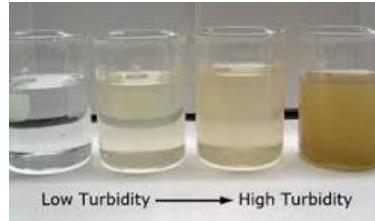
Jill Emerson and Trent Millum

Water Quality Coordinator and Americorps Water Quality Assistant

Green Mountain Conservation Group

- **Turbidity**

- Clarity of the fluid
- Higher level of suspended particles = higher temperature



- **Temperature**

- Metabolism increases with higher temperatures, which can result in lower DO readings
- Different organisms prefer different temperatures

- **pH**

- Pure water is 7.0
- Most natural water in NH is slightly acidic
- Aquatic life prefers pH between 6.5 and 8.2



- **Dissolved Oxygen**

- Measures ability to support life
- VBAP school program looks for various macroinvertebrates which are intolerant to low DO readings

- **Conductivity**

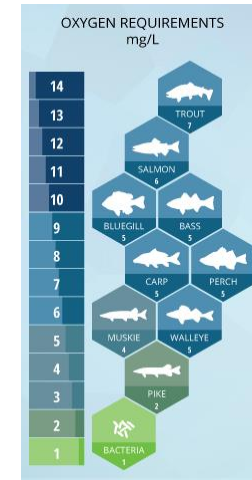
- Ability of water to pass an electrical charge
- Based on other elements in the water that have positive (Mg^+ , Ca^+) or negative (Cl^- , NO_3^-) charges
- Proxy for road salt ($NaCl$ or $CaCl_2$)

- **Total Phosphorus (TP)**

- With nitrogen, the two most important nutrients for plant and microbe life
- Environmental increases indicate decomposition (i.e. sewage)

- **General changes to their site**

- Road work
- New construction/demolition



Water Quality Standards – Acceptable limits

Either from NHDES or EPA*

- Dissolved O₂: between 6-11mg/L and between 75% and 120%
- Conductivity: below 500uS/cm
- pH: between 6-8, preferably close to 6.5, unless naturally occurring as less, then no more than 1 pH shift
- Turbidity: less than 10 NTU, unless baseline data indicates naturally occurring turbidity, then standard is less than 10 NTU above background levels (in our cases, there are no sites with naturally occurring turbidity above 10 NTU)
- Temperature: No standard, but monitored for changes
- Total P: under 30ug/L, over this is considered “nuisance levels”

Each site we monitor will have naturally occurring differences due to geology, plant life, etc.

*The EPA and NHDES have slight differences between their acceptable limits

GM-1 Banfield Brook

2015-2020 snapshot

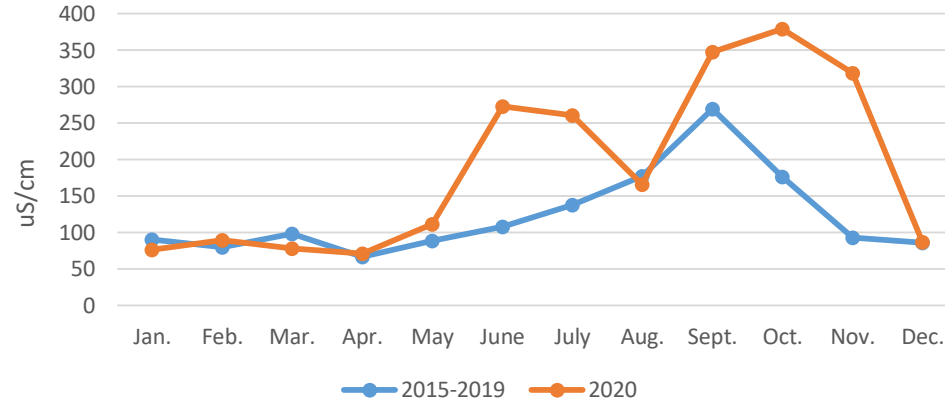
Monitored since 2002

Collecting for: pH, turbidity, TP, temperature, conductivity, dissolved O₂, TN, cations, anions, silica, DOC

Parameter	Rating	Explanation
pH	Stable	Low variability; no significant trends
Turbidity	Worsening	Highest values seen in the last 5 years at close to 4 NTU
Total P*	Stable	Low variability; no significant trends

*TP Data available only through 2019

Conductivity by Month

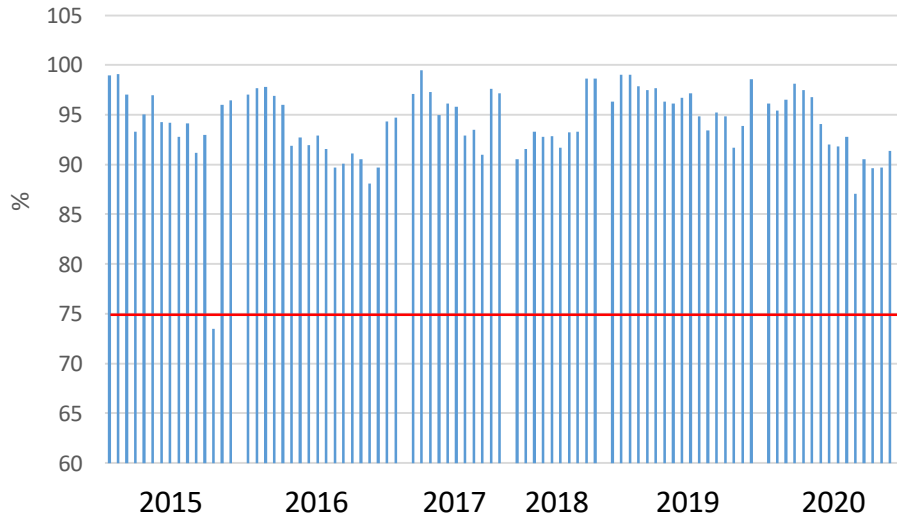


Site location



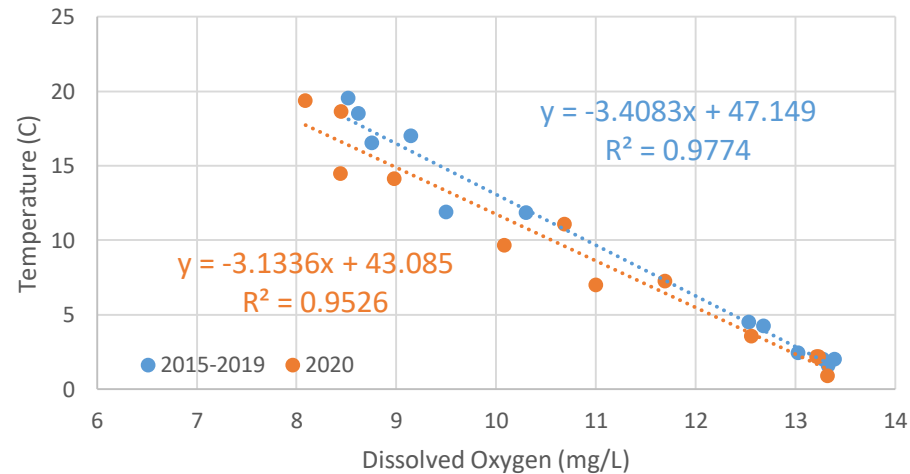
Conductivity at GM-1 has shown high variability and numbers that are concerning high. Increased values in 2020 compared to combined 2015-2019 numbers reach almost 400 uS/cm, indicating a negative water quality impact when it comes to conductivity levels.

Dissolved O₂ % Saturation



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

Dissolved O₂ vs. Temperature



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R² values from 2020 (orange) show a similar value compared to combined 2015-2019 values (blue) which indicates a strong correlation. DO levels at GM-1 are high and point to good water quality.

GM-1 Banfield Brook

2015-2019 snapshot

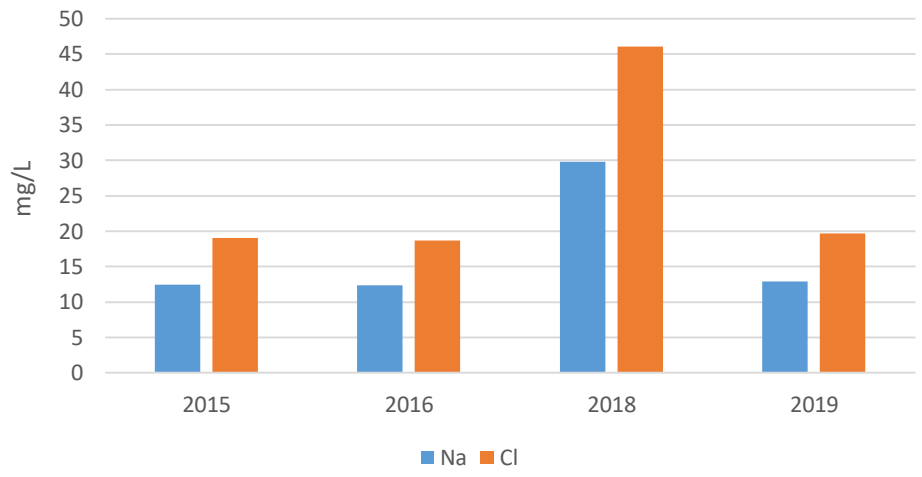
Monitored since 2002

Parameter	2015-2019 Evaluation
Ammonium	Stable
Nitrate	Stable
Total dissolved nitrogen	Stable
Dissolved organic nitrogen	Stable
Chloride	Improving after increased levels in 2018
Sodium	Improving after increased levels in 2018
DOC	Stable
Sulfate	Stable
Magnesium	Stable
Orthophosphate	Improving; still above nuisance levels at times

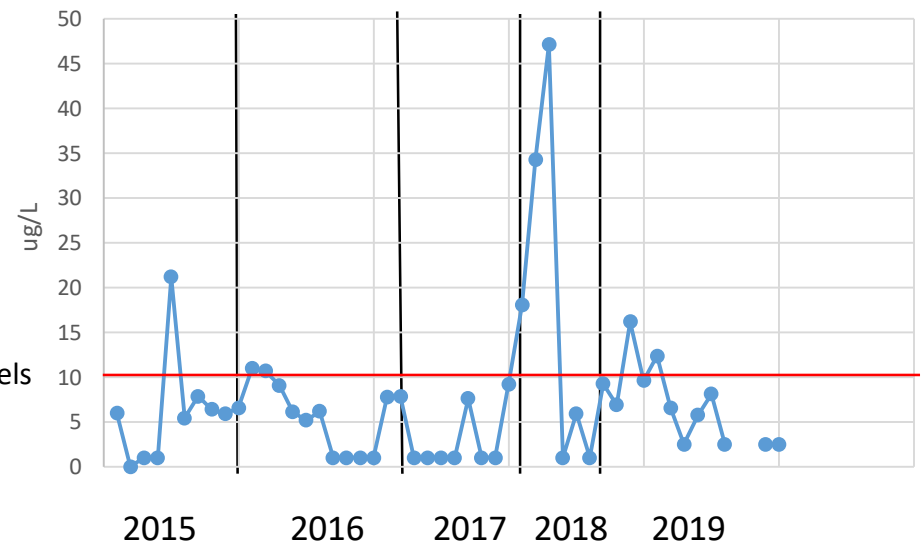
*Data currently available only through 2019

Cation and anion analysis at GM-1 from 2015-2019 demonstrates a stable water quality. Phosphate is still slightly above nuisance levels and sodium and chloride were really high in 2018.

Sodium and Chloride Levels



PO₄³⁻ levels from 2015-2019



Above nuisance levels

GM-3 Forrest Brook

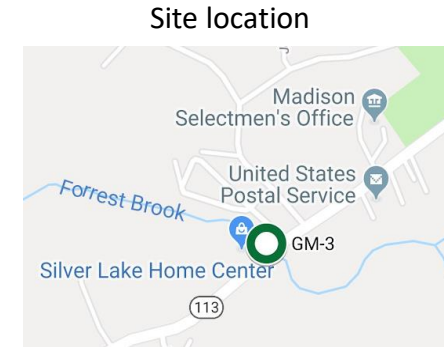
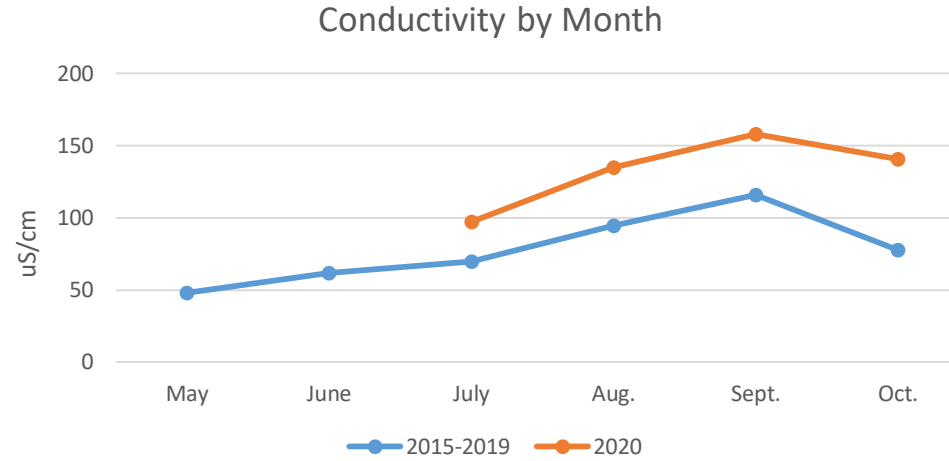
2015-2020 snapshot
Monitored since 2004

Collecting for: pH, turbidity, TP, temperature, conductivity, and dissolved O₂

Parameter	Rating	Explanation
pH	Stable	Low variability; no significant trends
Turbidity	Stable	Low variability; no significant trends
Total P*	Worsening	Highest value seen in the last 5 years and increasing trend over that time span.

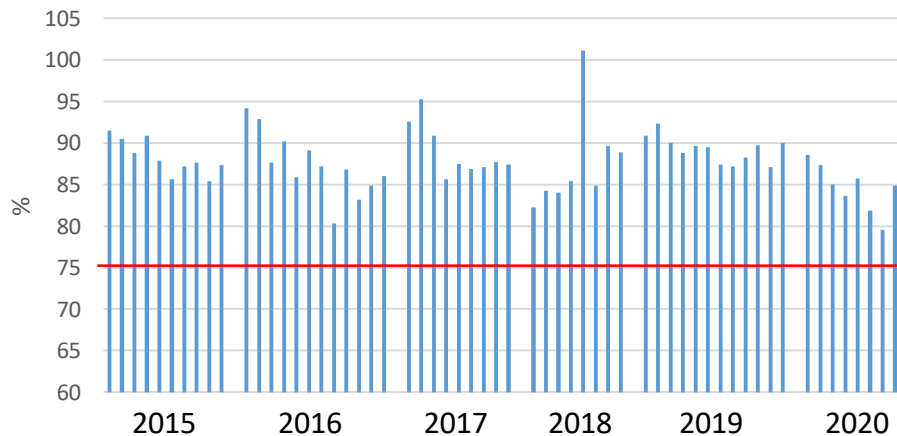
*Data available only through 2018

*Summer field sampling began in July 2020 due to complications with COVID-19



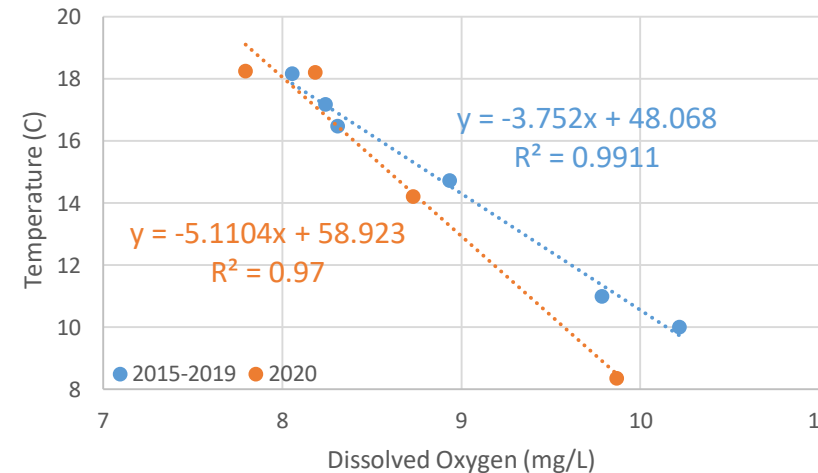
Conductivity at GM-3 increases in 2020 compared to combined 2015-2019 numbers. Values in 2020 reach above 150 uS/cm, indicating a negative water quality impact when it comes to conductivity levels. Values above 100 uS/cm are considered above the NH minimal disturbance levels.

Dissolved O₂ % Saturation



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

Dissolved O₂ vs. Temperature



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R² values from 2020 (orange) show a similar value compared to combined 2015-2019 values (blue) which indicates a strong correlation. DO levels at GM-3 are moderate to high and indicate good water quality.

GM-4 Ferrin Brook

2014-2019 snapshot

Monitored since 2013

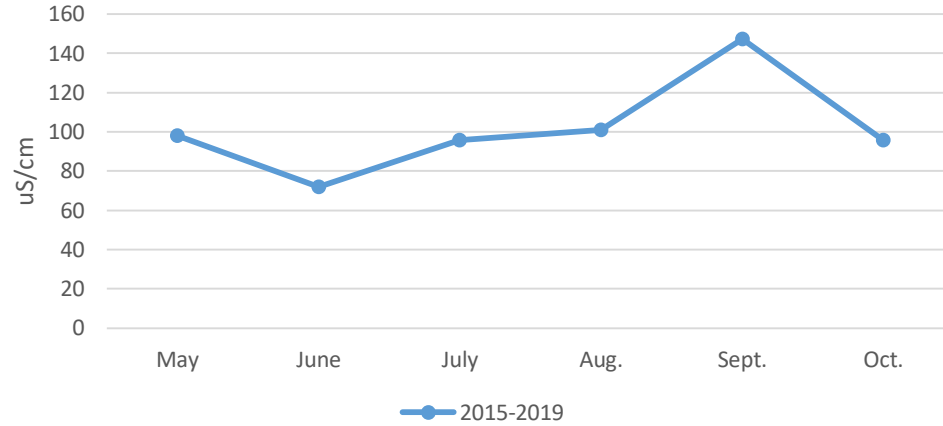
Collecting for: pH, turbidity, TP, temperature, conductivity, and dissolved O2

Parameter	Rating	Explanation
pH	Stable	Low variability; no significant trends
Turbidity	Stable	Low variability; no significant trends
Total P*	Worsening	Highest value seen in 5 years but below DES standards

*TP Data available only through 2019

*Due to drought conditions GM-4 did not maintain flowing water in the summer of 2020

Conductivity by Month

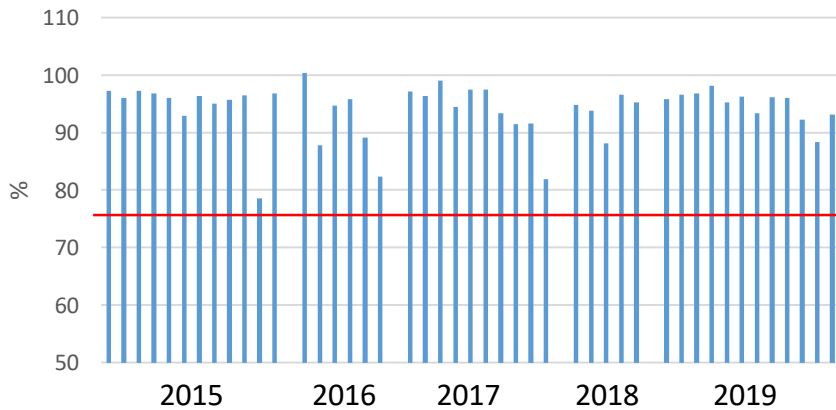


Between 2015-2019, conductivity increased above 100 uS/cm in the late summertime. Values above 100 uS/cm are considered disturbance levels for the state of New Hampshire.

Site location

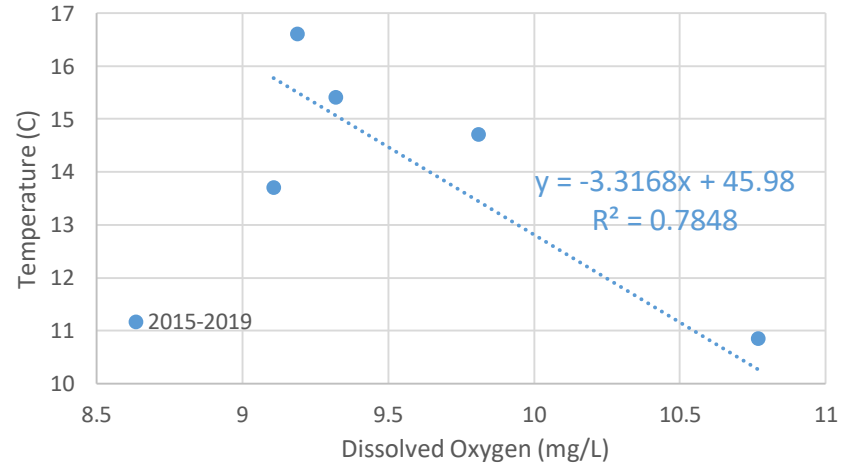


Dissolved O₂ % Saturation



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

Dissolved O₂ vs. Temperature



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R² value from 2015 to 2019 (blue) is fairly high indicating a correlation between the two. DO concentrations at GM-4 have remained high through 2019 indicating good water quality.

GM-5 Mill Brook

2015-2020 snapshot

Monitored since 2013

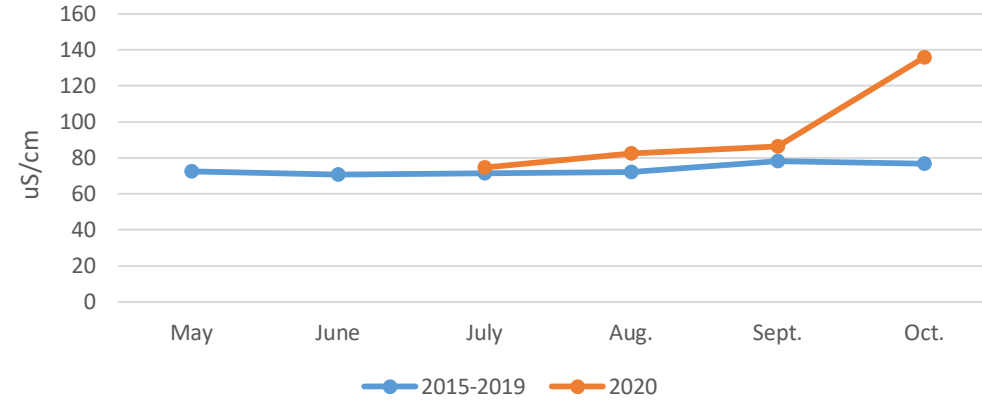
Collecting for: pH, turbidity, TP, temperature, conductivity, and dissolved O₂

Parameter	Rating	Explanation
pH	Stable	Low variability; no significant trends
Turbidity	Stable	Low variability; no significant trends
Total P*	Worsening	Highest value seen in 5 years spiking above 50 ug/L which is above nuisance levels

*TP Data available only through 2019

*Summer field sampling began in July 2020 due to complications with COVID-19

Conductivity by Month

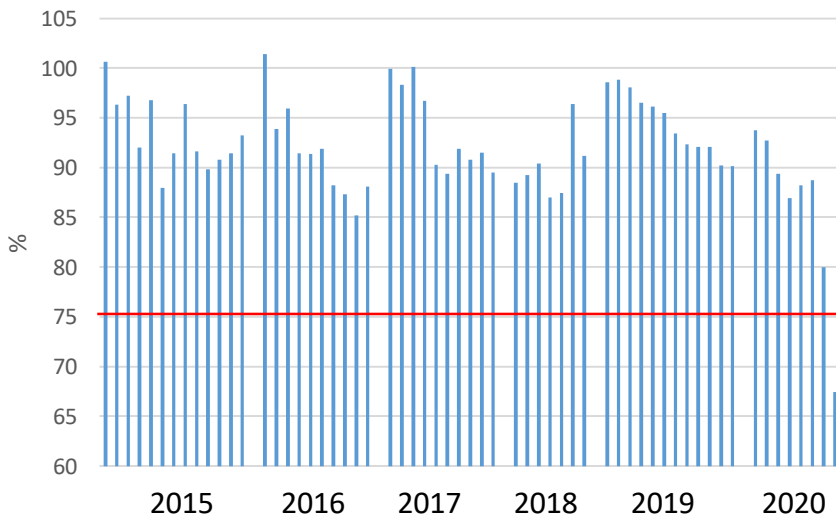


Site location



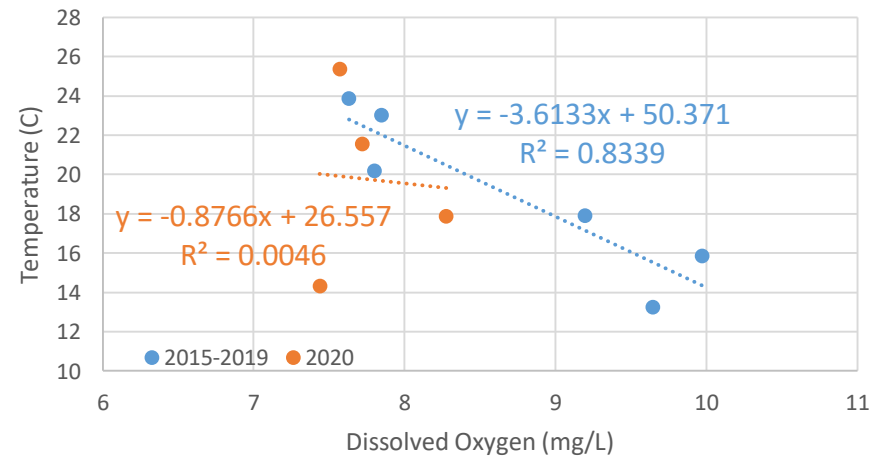
Conductivity at GM-5 increases in 2020 compared to combined 2015-2019 numbers. Values in 2020 increase above 100 uS/cm for the first time in 5 years, indicating a spike when it comes to conductivity levels. This only occurred in October and is not an alarming trend yet.

Dissolved O₂ % Saturation



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

Dissolved O₂ vs. Temperature



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R² value from 2015-2019 (blue) shows a strong correlation compared to 2020 (orange) which shows almost no correlation. T increases in 2020 while DO remains stable compared to 2015-2019. Changes in T in 2020 do not cause DO to change.

In Summation

- Overall, data from these Madison sites show fairly good water quality
- GM-2 (Pequawket Brook) is not included in this report because sampling did not take place in the summer of 2020 due to complications with COVID-19. GM-4 only displays data up through 2019 due to drought conditions in 2020.
- TP is worsening at all sites except GM-1 with a few data points above nuisance levels
 - TP from GM-5 had a spike above 50 ug/L with otherwise lower values.
 - Values at GM-3 were increasing and highest in 2019 compared to the previous 4 years.
- Conductivity increases at all sites, with very high values at GM-1, indicating an increase in road salt runoff into streams. Values are as high as 400 uS/cm at GM-1 and above 100 uS/cm at every other site in 2020. This trend is concerning for water quality.
- Ways to reduce road salt impact?
 - Best Management Practices (BMP's) such as brining
 - Reduction of road salt usage on major roads