

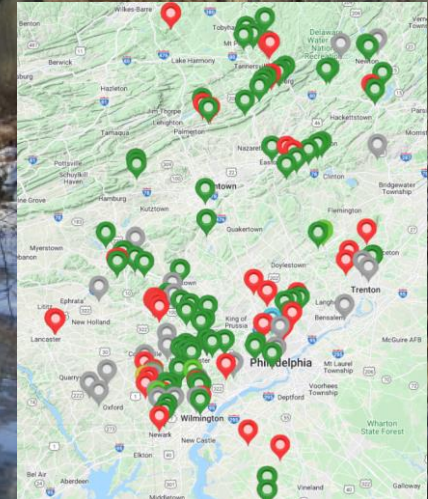
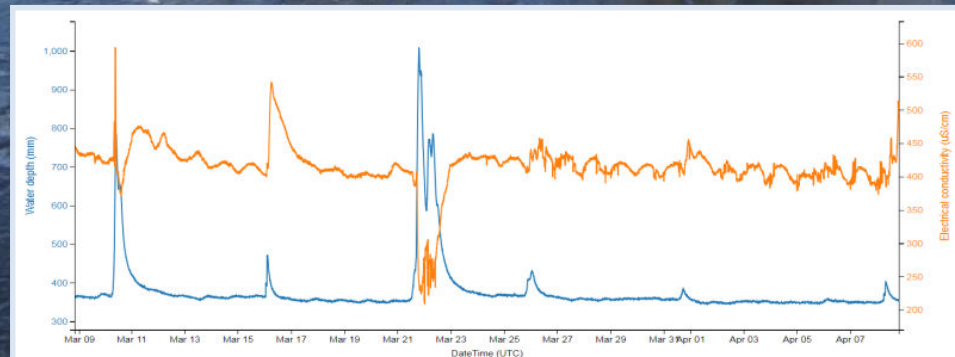
# WELCOME!

## Monthly EnviroDIY in the DRB User Group Meeting

*Online, Thursday, December 15, 2022, 2:30-3:30p*



 **Monitor My Watershed®**



**STROUD**  
WATER RESEARCH CENTER

# Today's Agenda

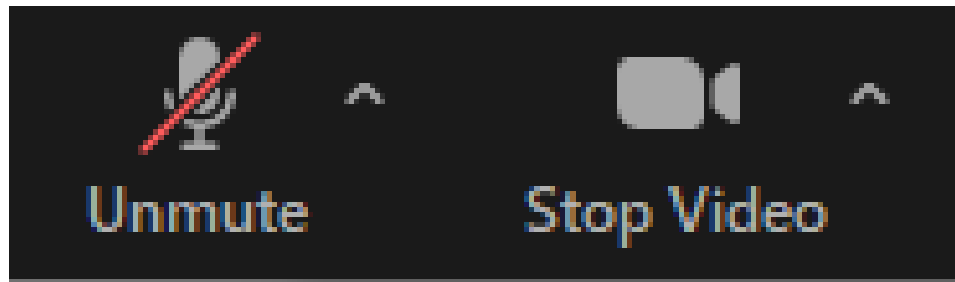
1. Introduction
2. Stroud Updates
3. Presentation: EnviroDIY in the DRB  
2022 year in review
4. Discussion
5. Conclusion



# Zoom Orientation



**\*Meeting is being recorded**



**\*Please mute when not speaking to the group**



# These Monthly Meetings

Recordings available at: <https://wikiwatershed.org/drwi/>

YouTube

Search

**WELCOME!**  
**Monthly EnviroDIY-DRWI User Group Meeting**  
*Online, Thursday February 17, 2021, 2:30-3:30p*

EnviroDIY

Monitor My Watershed®

STROUD

February 2022 EnviroDIY-DRWI Monthly Meeting

24 views • Feb 17, 2022

1 DISLIKE SHARE SAVE ...

Stroud Water Research Center Videos  
571 subscribers

SUBSCRIBE

# These Monthly Meetings

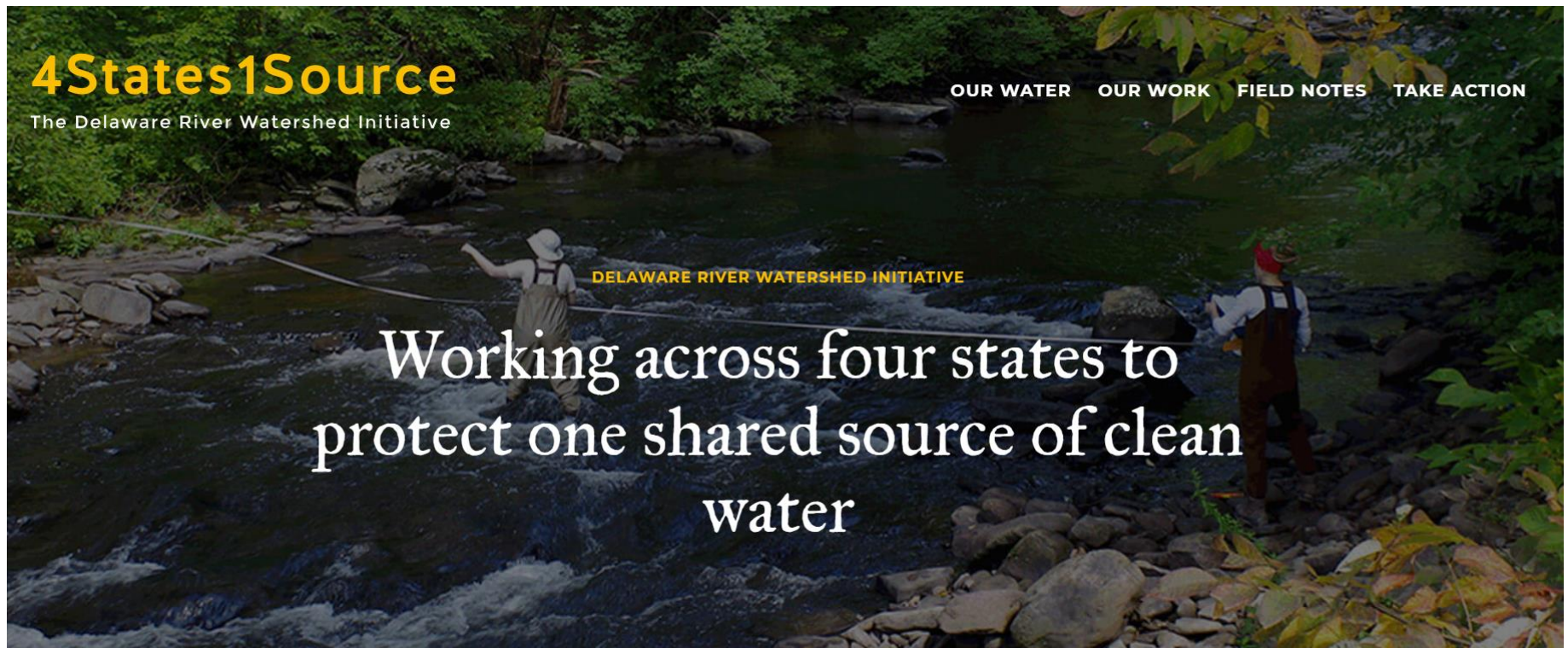
- Every third Thursday of the month
- 2:30-3:30p
- Zoom link will remain the same:  
<https://us02web.zoom.us/j/81881801310?pwd=eUFmbXZLbmRibVcxa1dtNVhzRmNvZz09>
- Reminder email one week prior to each month's meeting
  - All are welcome, please share
  - **And let us know if others should be added**

# REMINDER

- Attendees include:
  - Groups working in Delaware River Watershed Initiative (DRWI)
  - Groups working in Delaware River Basin (DRB) but not DRWI
  - Folks from outside the DRB
- Stroud Center support via DRWI and C-SAW

# Delaware River Watershed Initiative (DRWI)

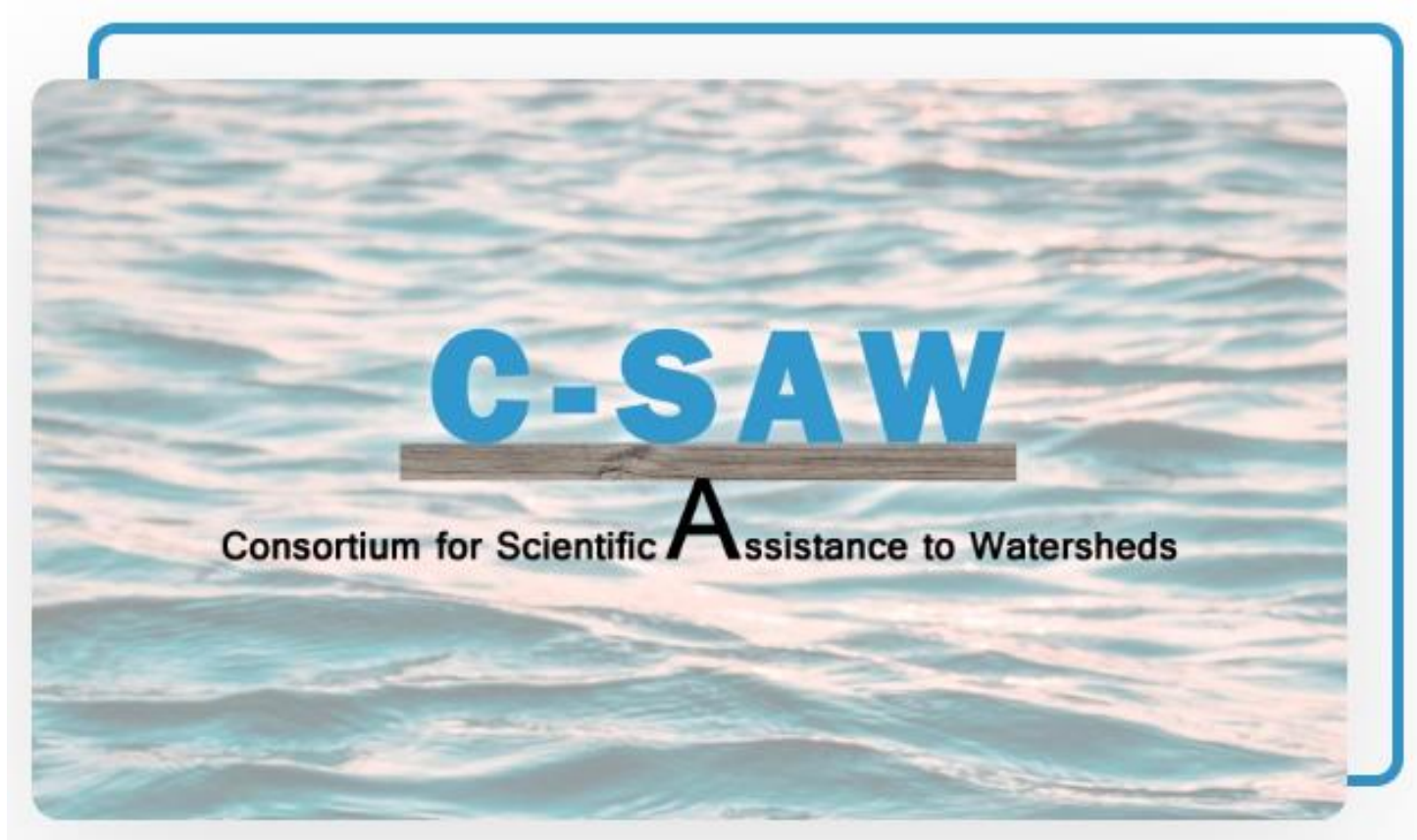
<https://4states1source.org/>





# C-SAW

<https://www.c-saw.info/>





# Goals for these monthly meetings

- **Time to check-in, ask questions, report issues, network, etc.**
- **Updates** from the Stroud Center
- **Presentations**
  - **Station Owner/Manager Presentations** – communicate about individual situations, local watershed work
  - **Focus Topic Presentations** – guest presenters talk about technical/ecological/other focus topics

***\*All of this to support gathering good data and using it purposefully***

# Stroud Center project personnel

## Stroud Center Facilitators:

David Bressler



Project facilitator

Rachel Johnson



Research Engineer  
Technician

Christa Reeves



Northern DRB  
technician and  
organization  
collaborator

Shannon Hicks



Research Engineer,  
Mayfly and EnviroDIY  
Inventor/Designer



Elena Hadley  
Part-Time Environmental Educator  
Research Technician

# Stroud Center project personnel

## Master Watershed Steward Facilitators:

Carol Armstrong



George Seeds



Master Watershed  
Steward Program



PennState Extension

# Stroud Center project personnel

## Stroud Center DRWI Leads:

Dr. John Jackson



Senior Research Scientist

Matt Ehrhart



Director of Watershed Restoration

Dr. David Arscott

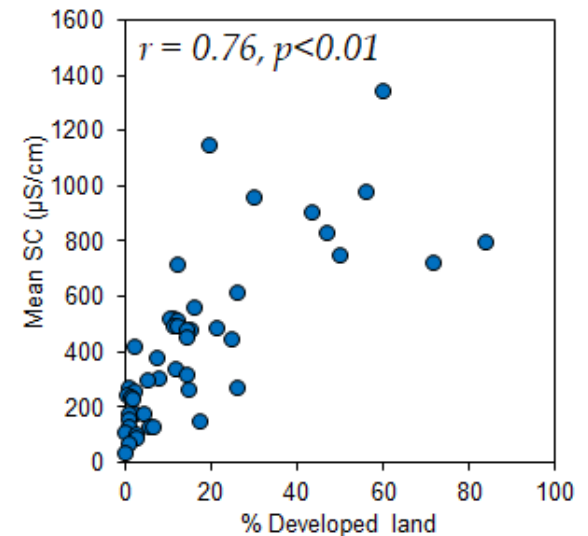


Executive Director, President  
Research Scientist



# Stroud Center Perspective – EnviroDIY in the DRB

- Primary Goal
  - Support Station owners, managers, and volunteers
  - Use stations for local purposes
- Secondary Goal
  - Analyze basin-wide data set
  - Develop tools to characterize and contextualize watersheds



# EnviroDIY manual

- EnviroDIY manual - <https://www.envirodiy.org/knowledge-base/>

The screenshot shows the EnviroDIY website. The top navigation bar includes links for About, Participate, Mayfly, Blog, Forums, Videos, Shop, Help, Register, and Log In. A dropdown menu is open under 'Mayfly', showing options: Getting Started, Hardware, Software, and Monitoring Station Manual and Appendices (which is highlighted with a red box). Below the navigation bar, there is a search bar and a list of help topics. The 'EnviroDIY Monitoring Station Manual' section lists 9 articles, and the 'EnviroDIY Monitoring Station Manual Appendices' section lists 8 articles. A 'View all' link is at the bottom of the appendices list.

EnviroDIY  
An Initiative of Stroud Water Research Center

Getting Started  
Hardware  
Software  
Monitoring Station Manual and Appendices

Welcome to EnviroDIY, a community for do-it-yourself environmental science and practitioners, municipal decision-makers, researchers, educators, and students advocate for fresh water. [Watershed](#), a web toolkit designed to help citizens, conservation fresh water. **New to EnviroDIY?** [Start here](#)

Search the

Help Topics

**EnviroDIY Monitoring Station Manual** (9 Articles)  
The EnviroDIY team created this manual to help you build, program, and install an EnviroDIY Monitoring Station. Please leave feedback on the individual articles so that we can continue to improve the documentation.

1. Key Terms and Links
2. EnviroDIY Overview
3. EnviroDIY Monitoring Station
4. Preparing the Mayfly Data Logger
5. Programming and Activating an EnviroDIY Monitoring Station
6. Building an EnviroDIY Monitoring Station
7. Installing an EnviroDIY Monitoring Station
8. Monitoring Station Management
9. References and Acknowledgments

**EnviroDIY Monitoring Station Manual Appendices** (8 Articles)  
The EnviroDIY Monitoring Station appendices contain supplemental information to help you manage your EnviroDIY Monitoring Station. Please leave feedback on the individual articles so that we can continue to improve the documentation.

1. Battery and Solar Options
2. Example Data
3. Data Patterns
4. Troubleshooting
5. Commercial Meters
6. Field Supplies Checklist
7. Maintenance Checklist
8. Supplemental Sampling, Rating Curves, Loads

View all

# EnviroDIY and monitoring resources

- Guidance materials - <https://wikiwatershed.org/drwi/>

## Shortcuts to General Resources

- [EnviroDIY Field Visit Data](#)
- [EnviroDIY Monitoring Station Help Resources](#)
- [Salt Monitoring Resources](#)
- [Data and Data Visualization Resources](#)
- [Volunteer Management Guidance Materials](#)
- [WikiWatershed Toolkit](#)
- [Project Updates](#)

## Shortcuts to Meetings, Workshops, Conferences

- [Monthly EnviroDIY-DRWI User Group Meetings](#)
- [User Support Workshops and Trainings](#)
- [Conference Presentations](#)
- [Watershed Ecology Workshops](#)

# Stroud Center Updates

- A number of groups doing Salt Snapshots
  - Be in touch with the Stroud Center if you'd like assistance in doing this





# Stroud Center Updates

## Watershed Salt Snapshot – Instructions

### Overview

The following is a method for documenting salt levels in streams and rivers across a watershed by measuring the concentration of chloride (Cl<sup>-</sup>)(milligrams/liter, mg/l) during baseflow conditions. Measuring electrical conductivity is also recommended as it can provide explanatory information and is directly related to chloride concentration.

The intent of this method is to 1) determine salt levels that aquatic life is exposed to the majority of the time (i.e., during baseflow conditions) in streams of a watershed(s) and 2) identify specific areas of the watershed(s) that may be contributing to or preventing salt contamination of nearby streams.

### The basic method:

Over a short period of time (less than a week, to ensure consistency in data) a group of people fans out across a watershed (or other area of interest) during baseflow conditions and collects water samples from pre-determined stream sites. Sites are strategically chosen to help identify specific areas of the landscape that may be contributing to or protecting nearby streams from salt contamination. The samples are returned to a central meeting location where they are measured for chloride (mg/l) and specific conductivity ( $\mu\text{S}/\text{cm}$ ). Because sampling is recommended to occur over a relatively short time period, it is important to consider the number of people available to conduct the work and the number of sites that can be visited in the allotted time. Judgment will be required to balance desired number of sites with personnel and time availability.

*Baseflow: the resting state of a stream between precipitation events; a stream or river's normal flow state when not influenced by recent precipitation runoff, often composed primarily of groundwater; the flow that would exist in a stream without the contribution of direct overland runoff from rainfall or melting snow/ice.*

### Equipment/Supplies

- [Chloride QuanTab® Test Strips, 30-600 mg/L](#) or other chloride measurement method
- Conductivity meter (e.g., [Hanna DiST®3 Waterproof EC Tester](#))
- Conductivity meter calibration solution (e.g., [1413  \$\mu\text{S}/\text{cm}\$  Conductivity Standard](#))
- 500-1000mL clean plastic or glass bottles with lids (one bottle per site).
- Waterproof bottle labels (if possible). Bottles can be directly labeled if necessary or labels can be prepared with normal paper and covered with packaging tape after labeling is completed
- Small plastic cups/containers (one per site) – for chloride strip measurements, should be small enough so chloride strip can stand upright on its own
- Pencils
- Watershed Salt Snapshot Data Sheet
- Portable/collapsible table (big enough to hold all sample bottles)
- Optional: white board to record sample results for group discussion
- Optional: large map to record sample results and locations for group discussion

# Stroud Center Updates

- Follow-up Questions/Discussion from these meetings and in general
  - Post to [ManageMyWatershed.org](https://www.ManageMyWatershed.org) – Stroud Center current recommendation





Any questions before we move on?





# Presentation

- Presentation: EnviroDIY and associated monitoring in the DRB, 2022 year in review





# Monthly meeting presentation topics

- **Winter**

- **January**

- Monitor My Watershed updates and EnviroDIY technology upgrades/updates (Stroud)

- **February**

- Monitoring Pickering Creek (Master Watershed Stewards/Carol Armstrong)
    - Surveys on Monitor My Watershed usage, salt in tap water, and terminology in science and monitoring efforts (Stroud)

- **March**

- Survey results on Monitor My Watershed usage, salt in tap water, and terminology in science and monitoring efforts (Stroud)



# Monthly meeting presentation topics

- **Spring**

- April

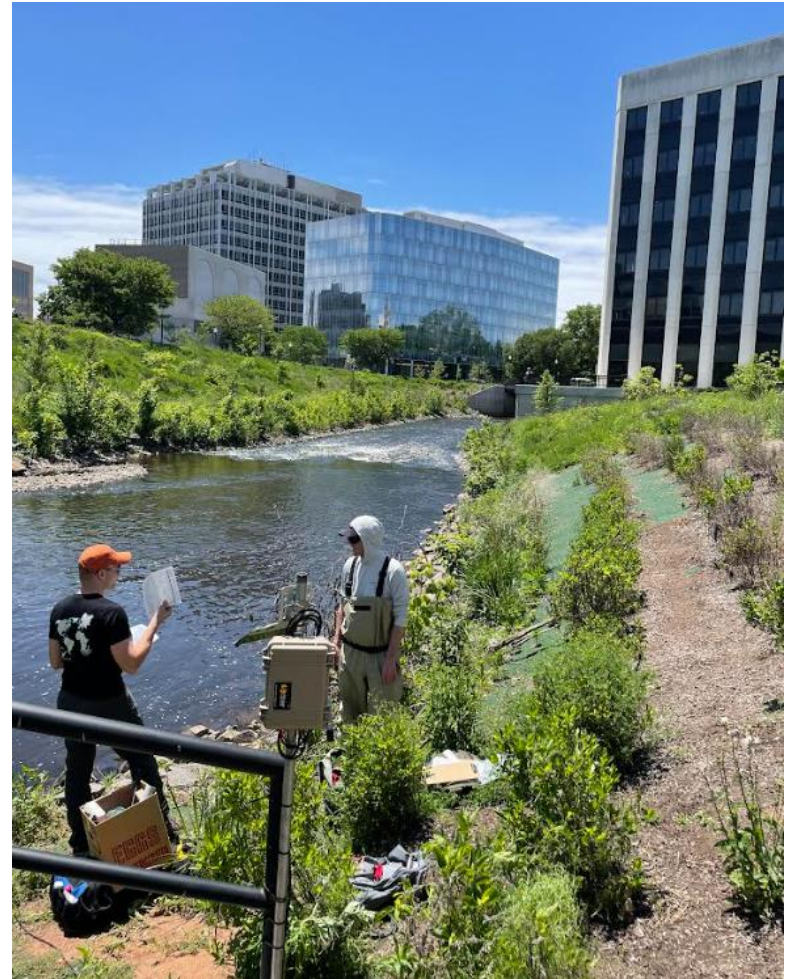
- Analysis of continuous data from the DRB (Stroud)
    - Chloride/Conductivity rating curves for different DRB watersheds

- May

- Temperature monitoring in the Musconetcong watershed (Musconetcong Watershed Association)

- June

- Developing data communication products (Tookany-Tacony/Frankford Watershed Partnership, Pennypack Ecological Restoration Trust, Wissahickon Trails)



# Monthly meeting presentation topics

- **Summer**

- July

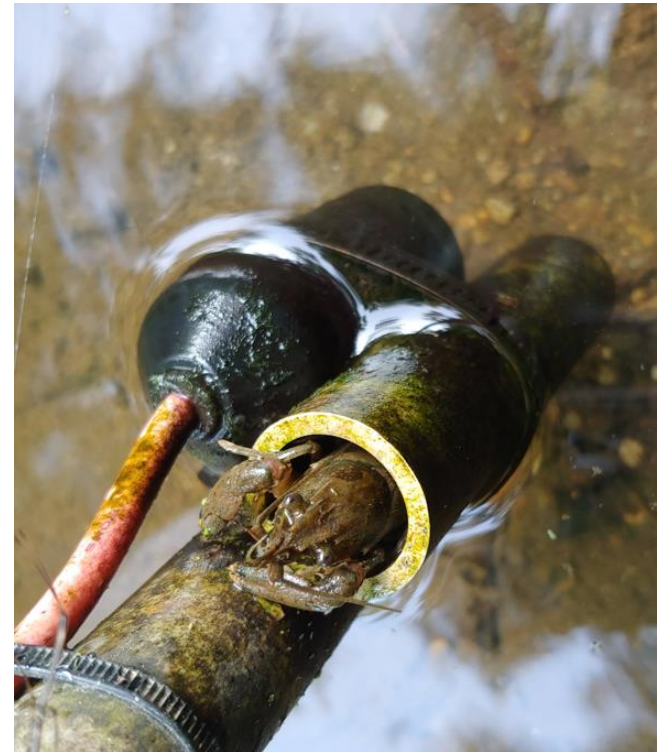
- Review of warehouse development on Tunkhannock Ck and monitoring using EnviroDIY stations (Tobyhanna/Tunkhannock Creek Watershed Association and Brodhead Watershed Association)

- August

- Stats and data summaries of EnviroDIY station data across DRB (Stroud)
    - Revisit pilot Salt in Tap Water Survey results
    - Review of MonitorMW features for station tracking
    - Review of data on station visits and Quality Control

- September

- Salt snapshots – methods and purpose (Stroud)





# Monthly meeting presentation topics

- **Fall**

- **October (Stroud)**

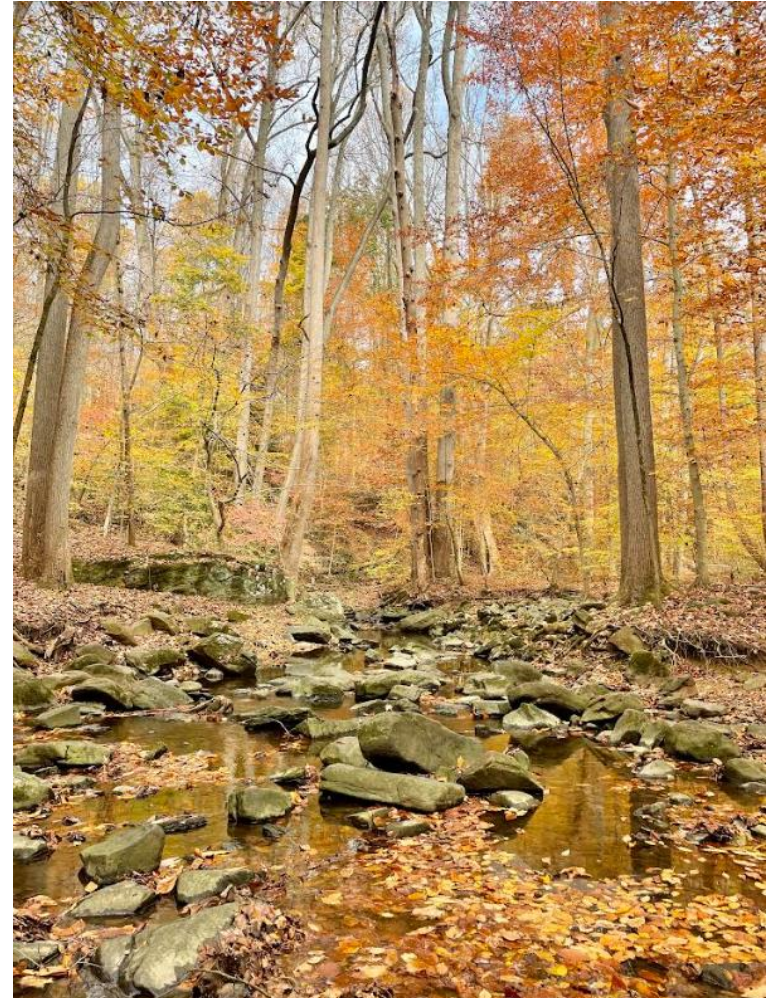
- Winter salt data (conductivity, chloride, and cations Na, K, Mg, and Na) and importance in understanding salt pollution
- Feedback on monthly meeting format/content

- **November**

- Darby Creek Headwaters Monitoring Project and recent salt snapshot (Willistown Conservation Trust/Darby Creek Valley Association)

- **December**

- 2022 Year in Review (Stroud)





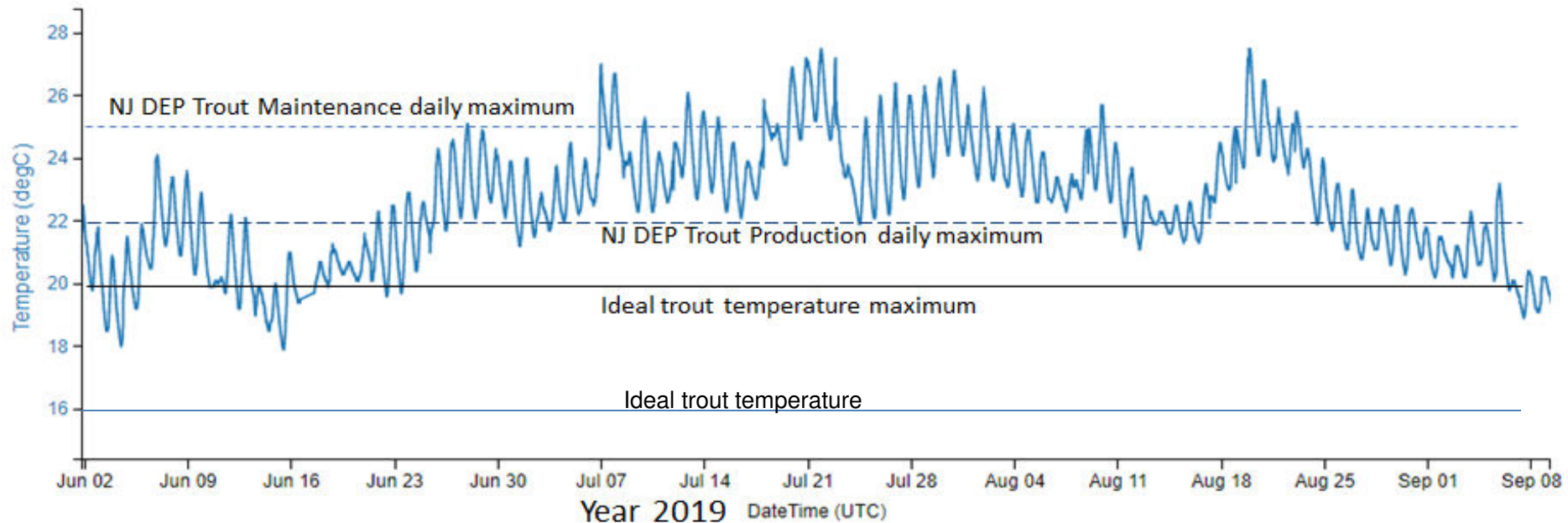
# Technology

- Tech upgrades
  - Mayfly upgrades from ver0.5b to ver1.0 or higher – 43 stations
    - Ver1.1 is current
  - Upgrade to EnviroDIY LTE bee cell board – 43 stations
- View the details of changes between board versions here :
  - <https://www.envirodiy.org/mayfly/hardware/details-and-specs/>



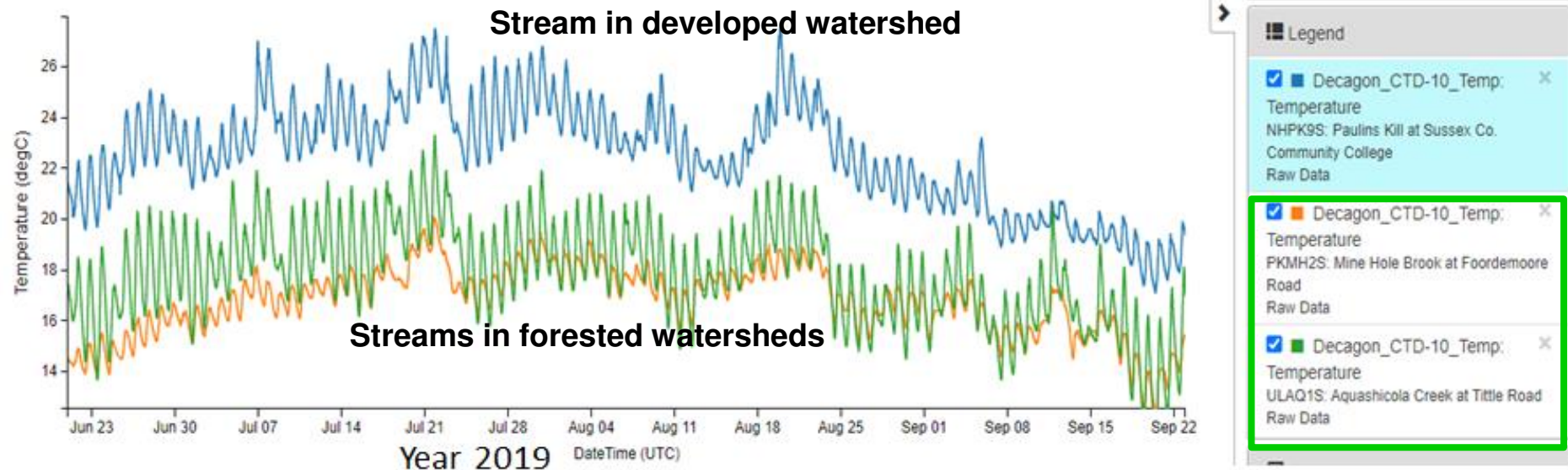
# Understanding water quality using continuous data

## Comparing water temperature to trout criteria/thresholds



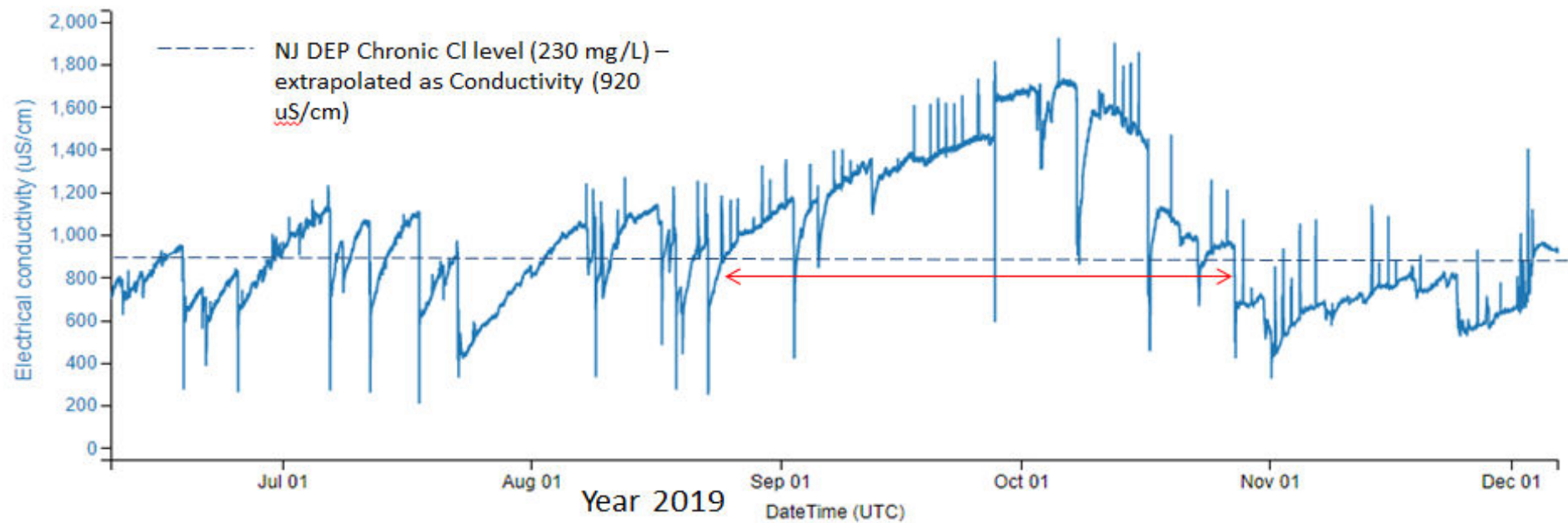
# Understanding water quality using continuous data

Comparing water temperature in streams from different landscapes



# Understanding water quality using continuous data

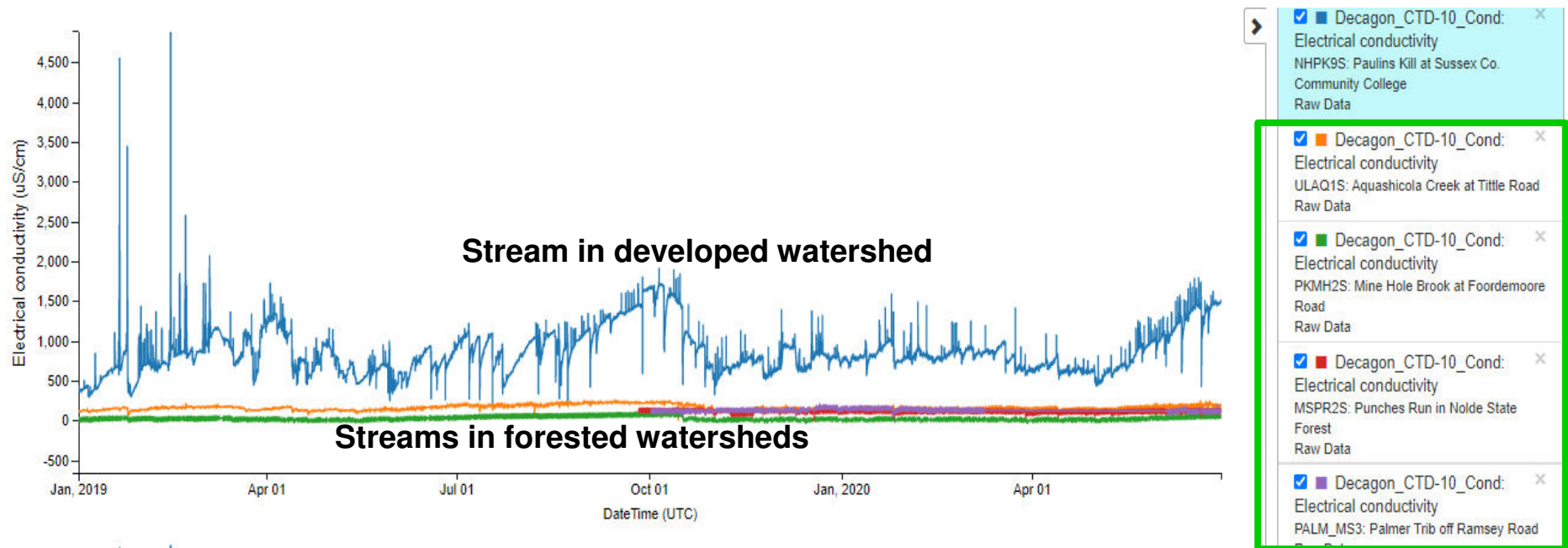
## Comparing conductivity (and chloride) in to criteria/thresholds





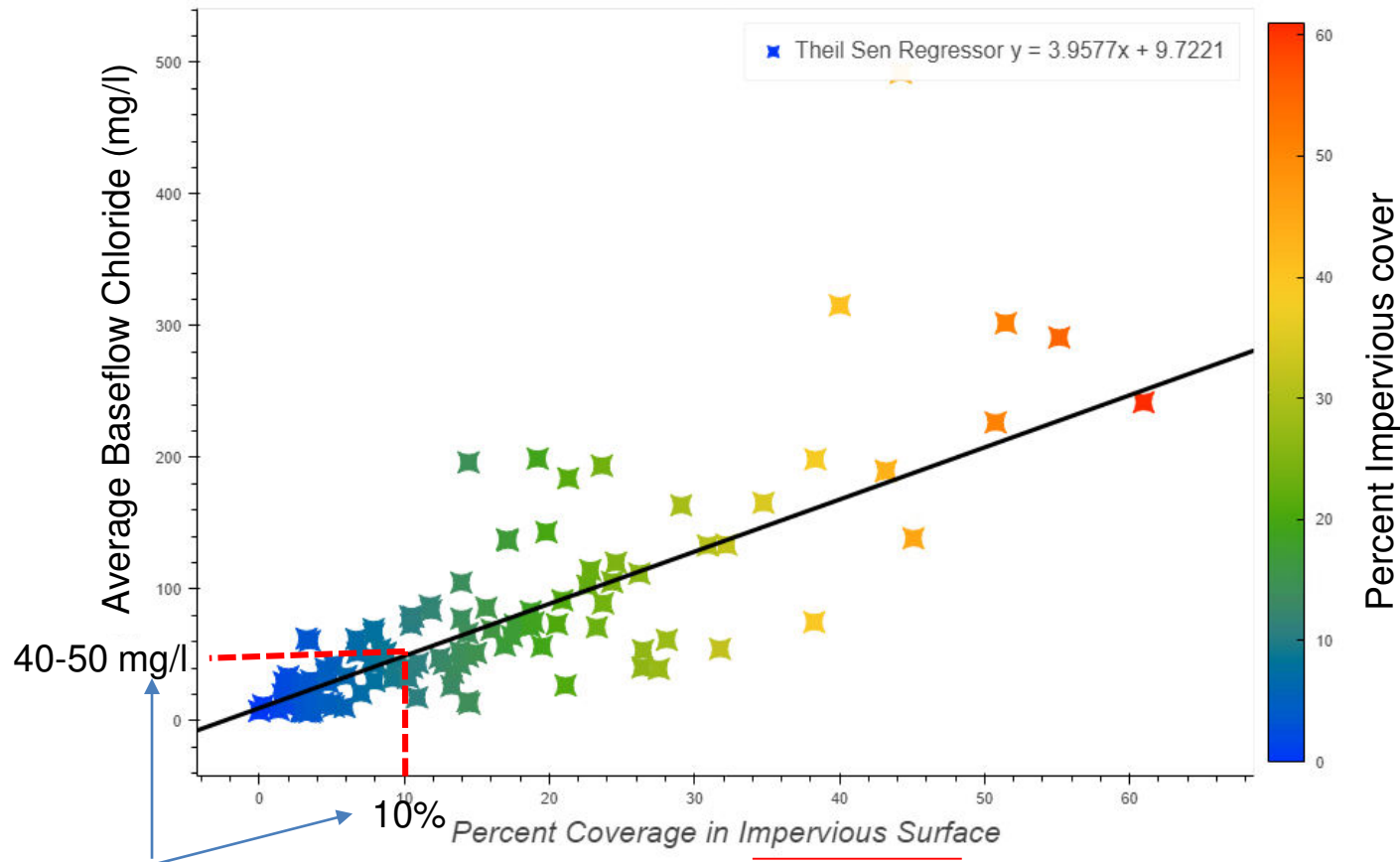
# Understanding water quality using continuous data

## Comparing conductivity (and chloride) in streams from different landscapes



# Broad data trends

- Salt levels increase with imperviousness – more roads and parking lots means more salt



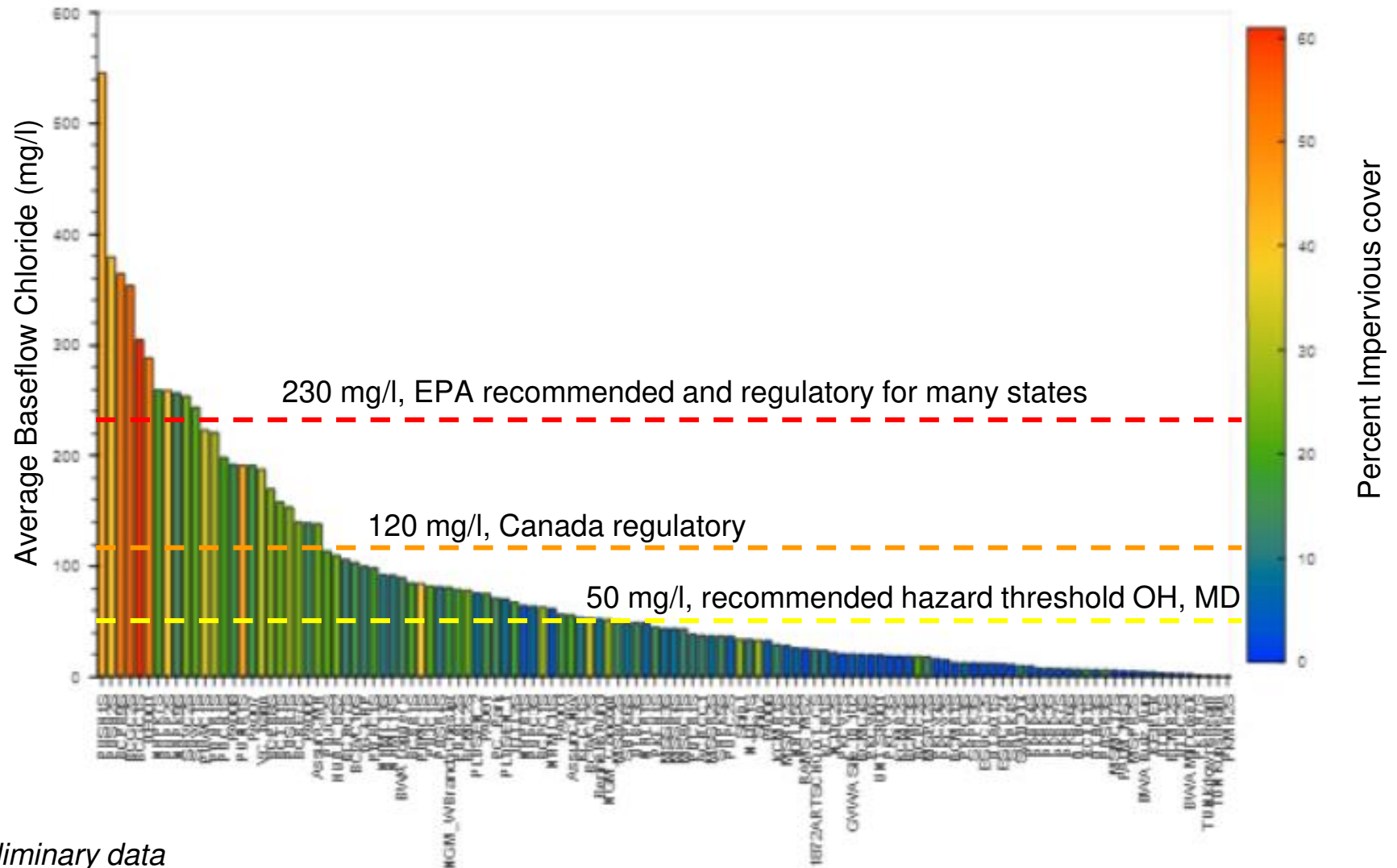
Research has shown:

- 40-50 mg/l Chloride = impact on aquatic life
- ~10% (and less) impervious surface = impact on aquatic life

*\*Preliminary data*

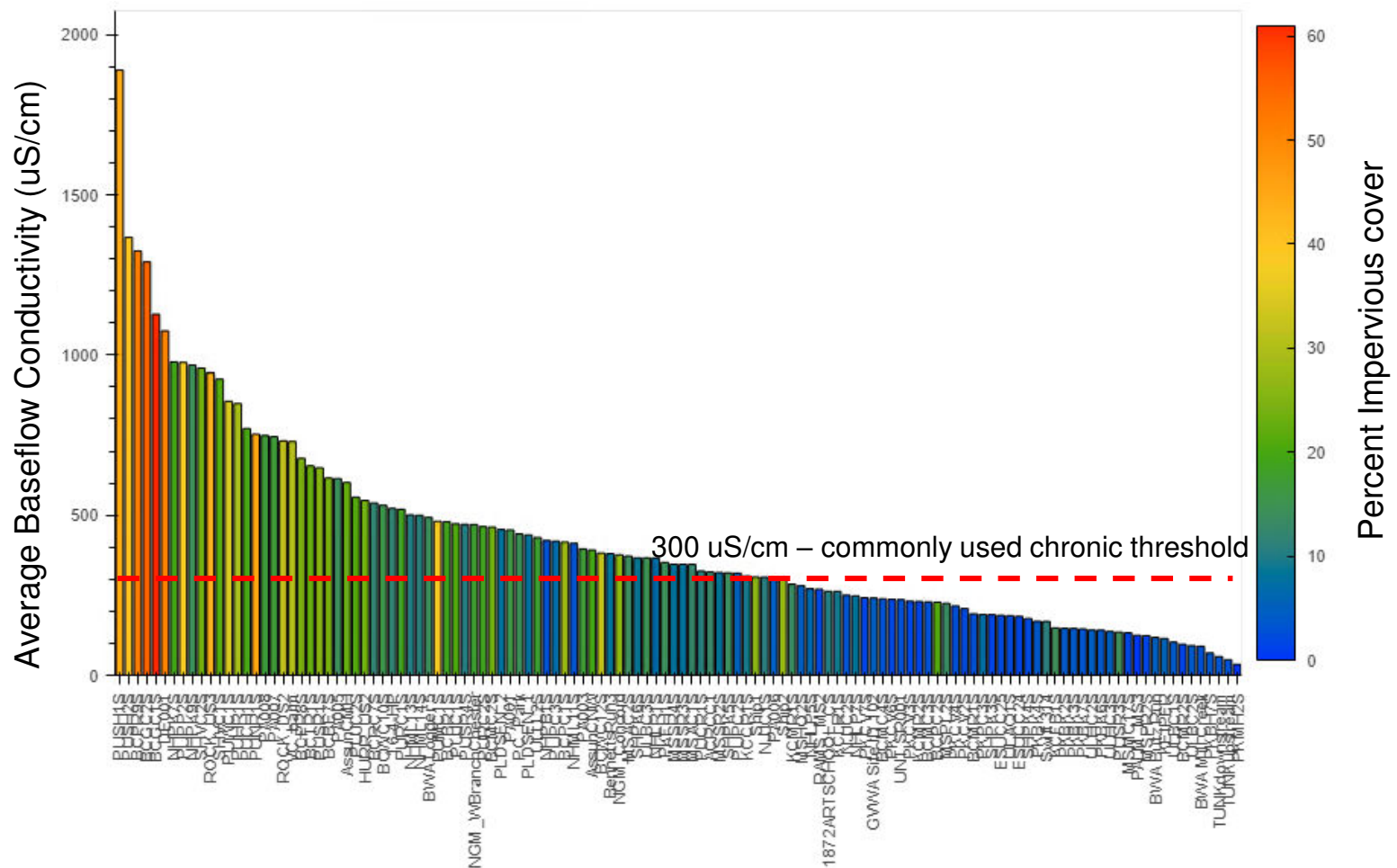
# Across the DRB

- Average chloride (via Conductivity) at EnviroDIY sites in DRB



*\*Preliminary data*

- Average conductivity at EnviroDIY sites in DRB

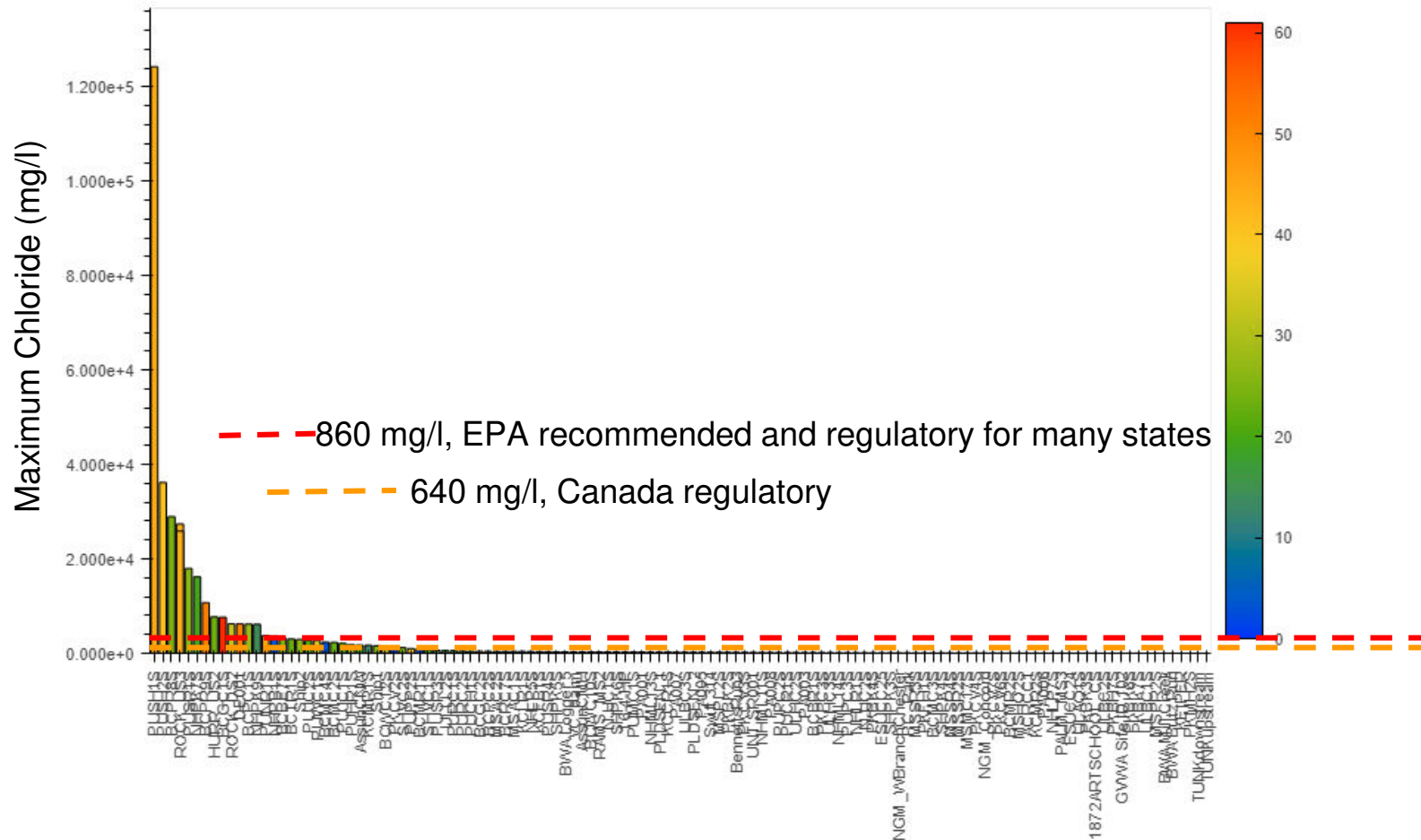


\*Preliminary data



# Across the DRB

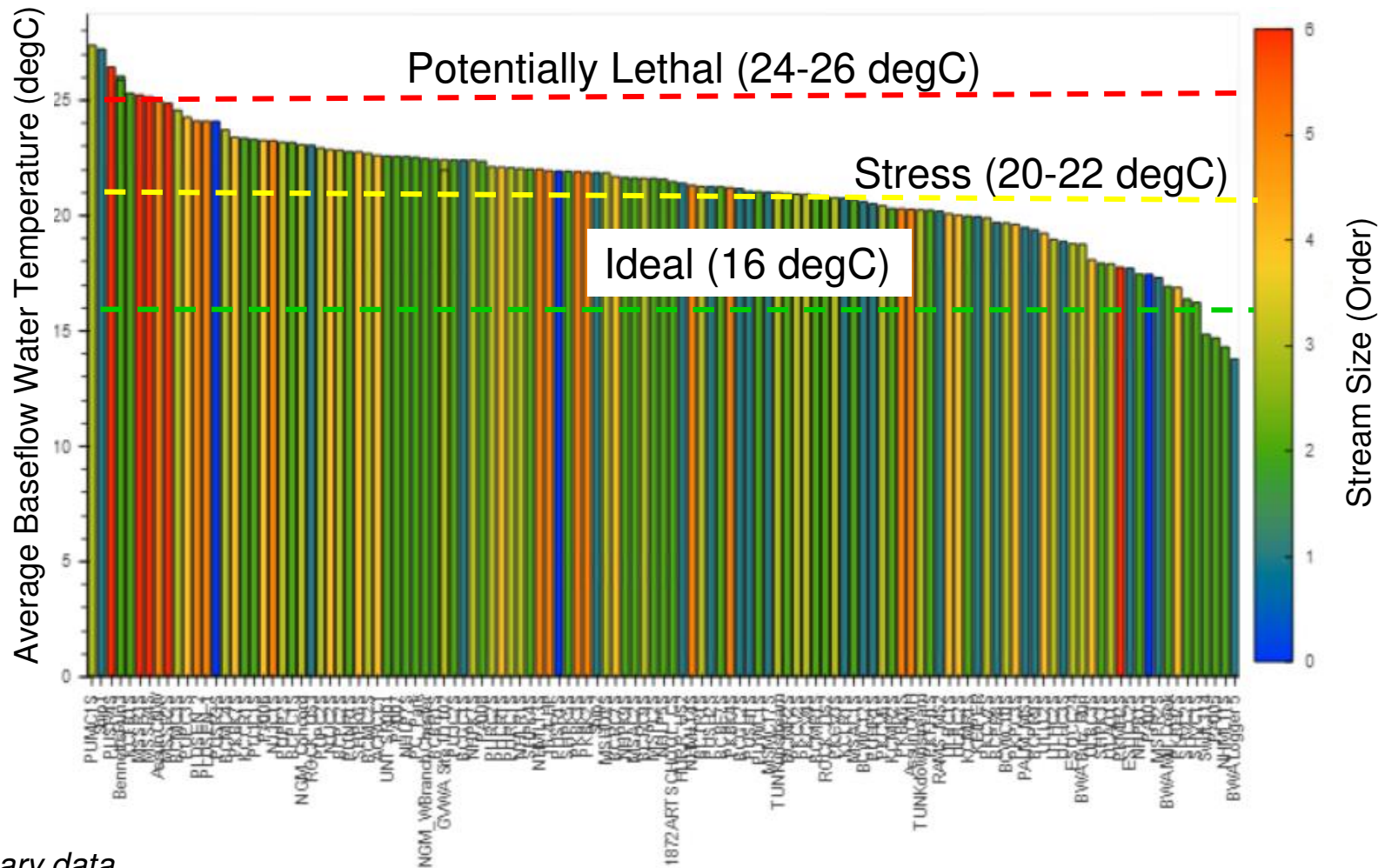
- Maximum chloride (via Conductivity) in relation thresholds/criteria



*\*Preliminary data*

# Across the DRB

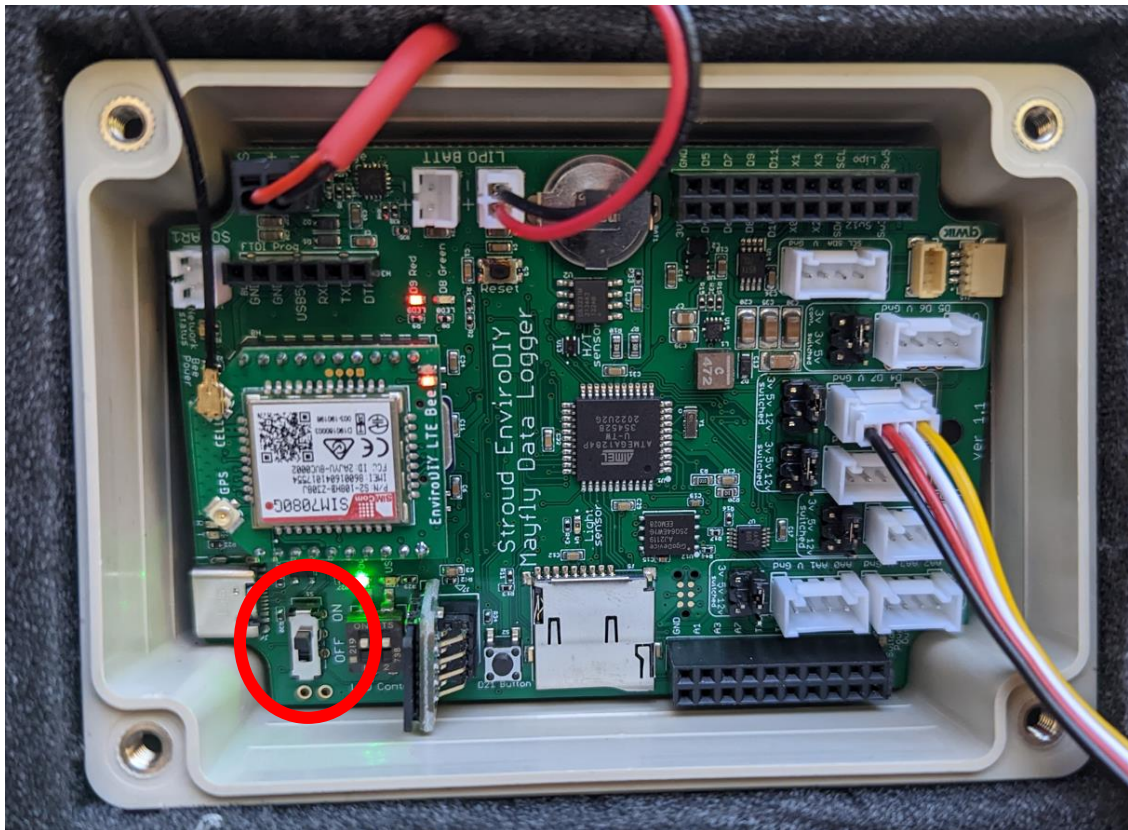
- Average summer water temperature in relation to trout thresholds



*\*Preliminary data*

# Reminders

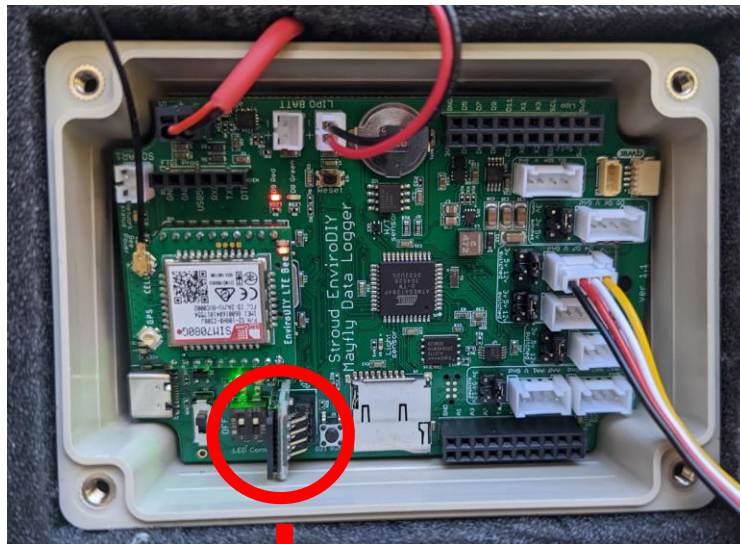
- If station goes offline, cycle power
  - Just like your computer sometimes turning off and on works!





# Reminders

- If station is offline and you're concerned about missing data:
  1. Swap MicroSD card
  2. Look at data file on your computer,
  3. Send MicroSD card files to Stroud if you need feedback or help troubleshooting an issue.



	A	B	C	D	E	F	G
1	Data Logger: SL082_RamseyRun						
2	Data Logger File: SL082_RamseyRun_2022-10-21.csv						
3	Sampling Feature UUID: 85d2450f-a802-4c4f-8664-be32277d3c08						
4	Sensor Name:	MeterHydros21	MeterHydros21	MeterHydros21	MaximDS3231	EnviroDIY	Calculated
5	Variable Name:	specificConduct	temperature	waterDepth	temperature	batteryV	signalPercent
6	Result Unit:	microsiemenPe	degreeCelsius	millimeter	degreeCelsius	volt	percent
7	Result UUID:	de4a6bf7-3def-ff3ec931-3fe3-4e48623f5-44ec-4a9fb6aa5-79a9ad8e5fe7bd50ed4-2e50					
8	Date and Time in UT	Hydros21cond	Hydros21temp	Hydros21depth	BoardTemp	Battery	signalPercent
9	10/21/2022 11:00	245.5	11.3	229.5	16.25	4.169	55
10	10/21/2022 11:05	245.1	11.33	229.5	16.25	4.169	55
11	10/21/2022 11:10	244.9	11.4	229	16.25	4.169	55
12	10/21/2022 11:15	244.6	11.4	229.3	16.25	4.169	58
13	10/21/2022 11:20	244.5	11.4	229.7	16.5	4.154	61
14	10/21/2022 11:25	244.4	11.4	228.8	16.75	4.169	55
15	10/21/2022 11:30	244.2	11.5	228.5	16.75	4.366	58
16	10/21/2022 11:35	244	11.5	228	17	4.169	61
17	10/21/2022 11:40	244	11.5	228.2	17.75	4.154	58
18	10/21/2022 11:45	243.8	11.5	228.2	18.25	4.169	58
19	10/21/2022 11:50	243.7	11.5	227	18.75	4.169	58
20	10/21/2022 11:55	243.5	11.6	226.2	18.75	4.169	58
21	10/21/2022 12:00	243.4	11.6	227	18.75	4.154	58
22	10/21/2022 12:05	243.2	11.6	226.5	18.75	4.169	58
23	10/21/2022 12:10	243.1	11.6	226.8	18.5	4.154	58
24	10/21/2022 12:15	242.9	11.7	227.2	18.5	4.154	58
25	10/21/2022 12:20	242.8	11.7	226	18.25	4.154	58
26	10/21/2022 12:25	242.7	11.7	225.3	18.25	4.154	52
27	10/21/2022 12:30	242.4	11.7	225.7	18.25	4.154	58
28	10/21/2022 12:35	242.3	11.8	225.7	18.25	4.154	61
29	10/21/2022 12:40	242.2	11.8	225.7	18.25	4.154	58
30	10/21/2022 12:45	241.9	11.8	225.3	18.25	4.154	58
31	10/21/2022 12:50	243.5	11.8	225.3	18.25	4.154	58
32	10/21/2022 12:55	244.9	11.85	224.8	18.25	4.154	58
33	10/21/2022 13:00	245.5	11.9	224.3	18.25	4.154	61
34	10/21/2022 13:05	245.4	11.9	224.7	18.25	4.154	58

# Reminders

- Cellular data payments (Station Owners)
  - Check Hologram \$ balance (at least once yearly)
  - Schedule date(s) to reload money
    - Hologram emails sometimes go to spam so check your account proactively and then know when reload is necessary

The screenshot displays the Hologram account management interface. On the left is a dark sidebar with navigation links: Home, Devices, Usage, Billing (highlighted), Routes, and Settings. The main content area has a top navigation bar with 'Account', 'Statements', 'Transaction history', and 'Orders'. Below this, the 'Account Balance' section shows a balance of \$104.02 with a breakdown: Original Balance (\$104.02), Pending Charges (\$0.00), Promotional Credit (\$0.00), and Ending Balance (\$104.02). Below the balance is a section for adding a one-time balance recharge via credit card or promo code, with buttons for 'Add Balance' and 'Apply Promo Code'. The 'Account auto-refill' section features a graph showing the balance dropping to a threshold and then being refilled. Below the graph, it states 'Add \$300.00 to my balance as soon as it drops below \$5.00.' with buttons for 'Edit auto-refill' and 'Disable auto-refill'. The 'Payment Method' section shows a VISA card ending in [redacted] with a 'Remove' button.

# Reminders

- **Sensor cleaning**
  - Frequency – weekly to start, then situational
    - Always look at data before and after cleaning – fine tune frequency accordingly



Generation 1 Hydros 21 CTD



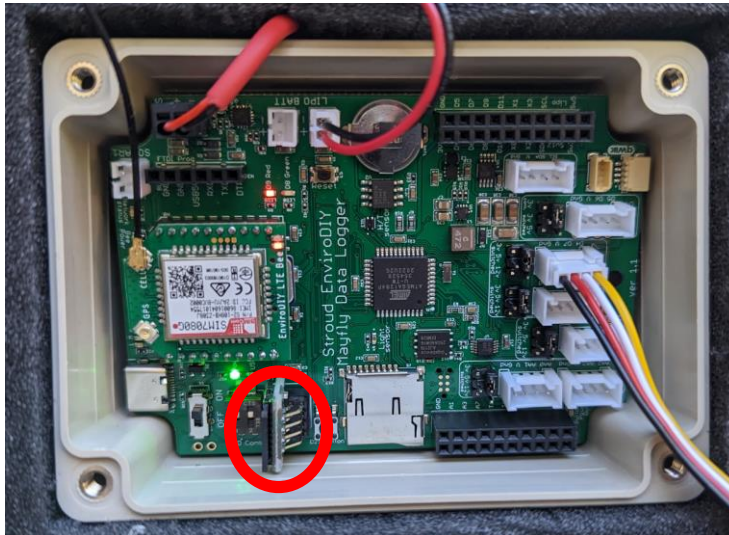
Generation 2 Hydros 21 CTD (slot on bottom)





# Reminders

- **Quality Control** (i.e., making sure the station is getting accurate data)
  - Frequency – every three months (and situationally)
  - Conductivity and water temperature – crosscheck with a handheld meter
  - \*Depth – crosscheck with metric ruler
  - Swap SD card if online data is incomplete

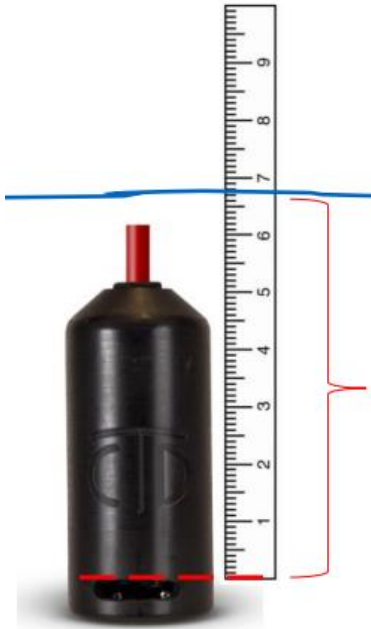


# Reminders

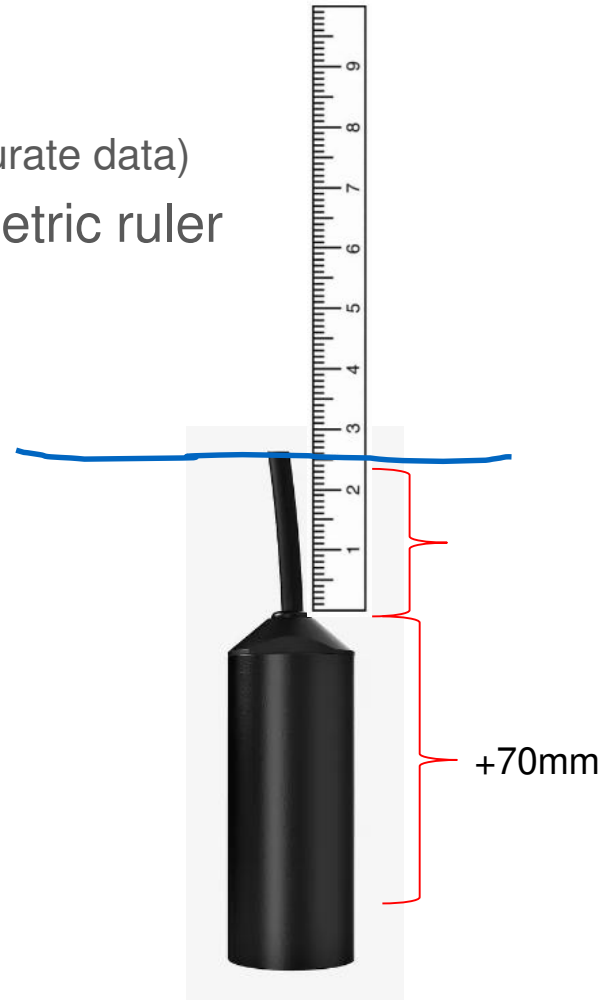
- **Quality Control**

(i.e., making sure the station is getting accurate data)

- \*Depth – crosscheck with metric ruler



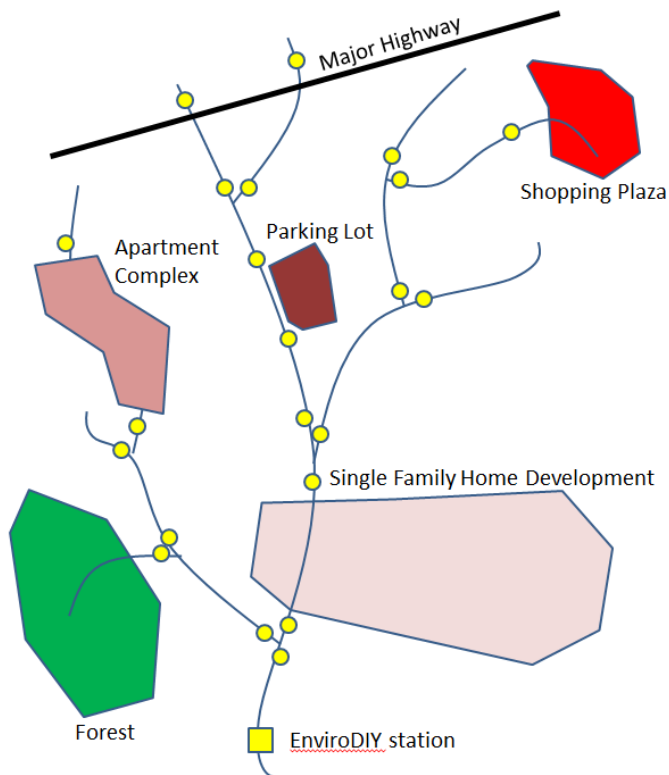
Generation 1 Hydros 21 CTD



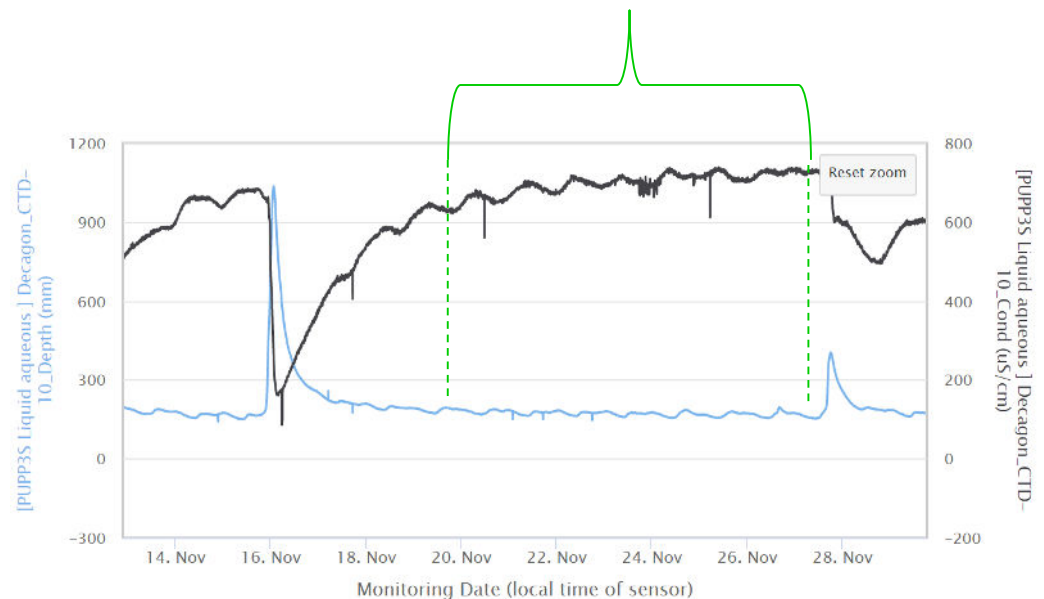
Generation 2 Hydros 21 CTD (no side slot)

# Reminders

- **Additional monitoring** - Synoptic sampling (aka snapshots, blitzes) and similar approaches to get more information about contamination patterns and sources

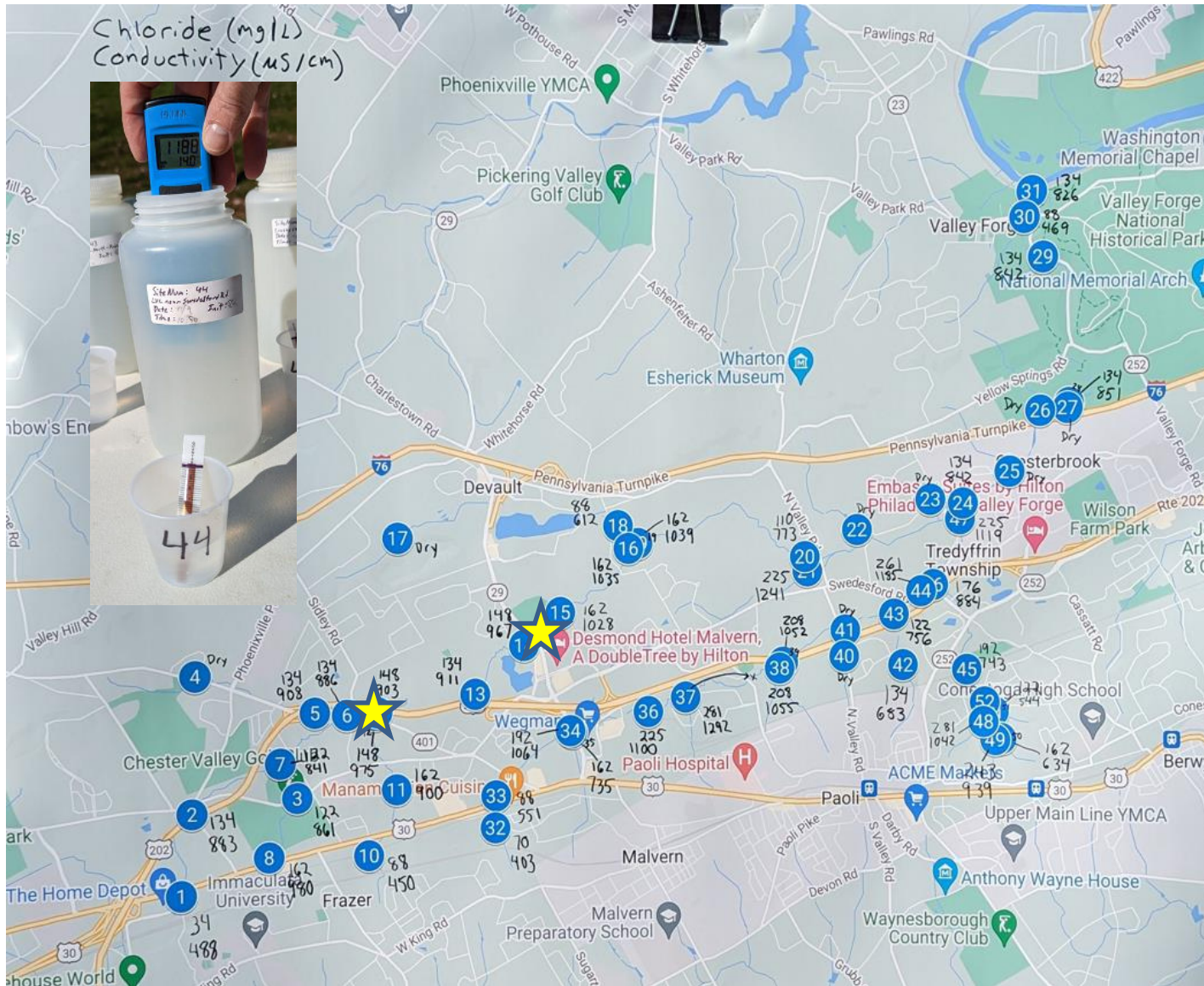


Use continuous data to sample at the right time – e.g., for understanding year-round salt contamination sample during baseflow (when conductivity and depth are flat-ish)





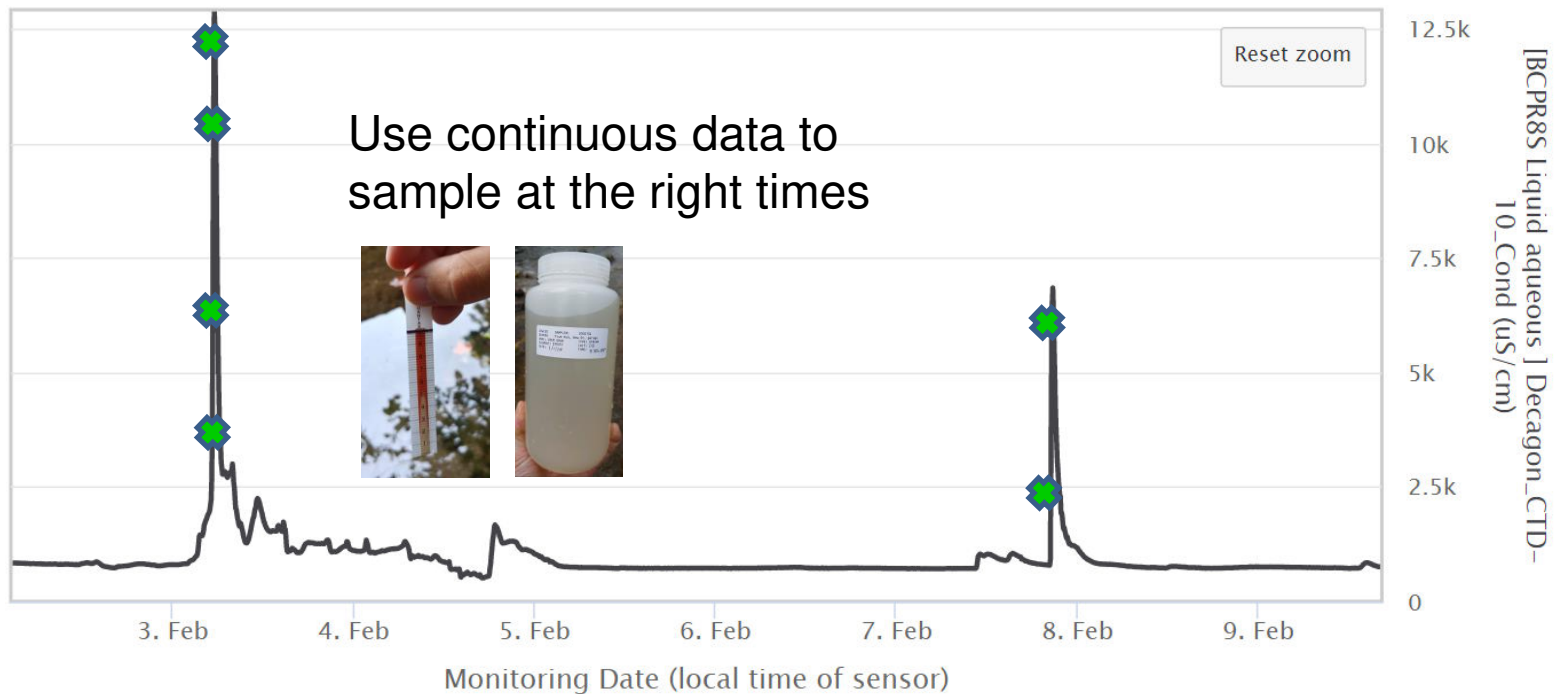
# Reminders



★ Continuous data  
(EnviroDIY)

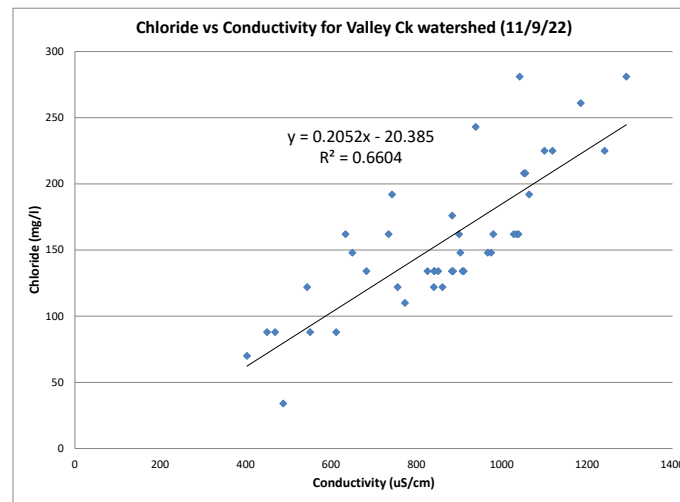
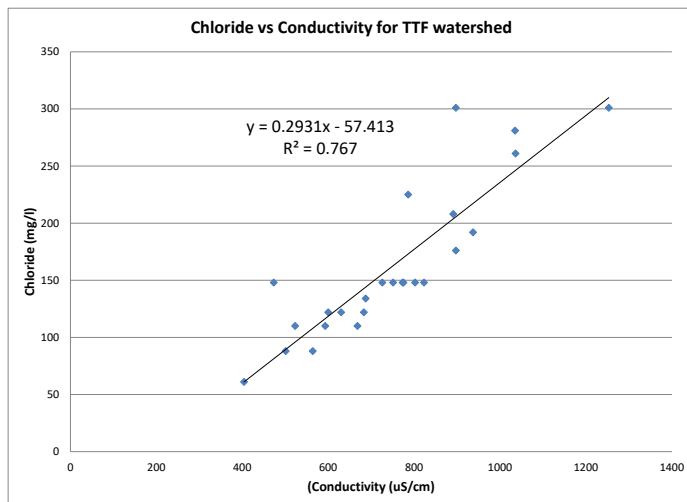
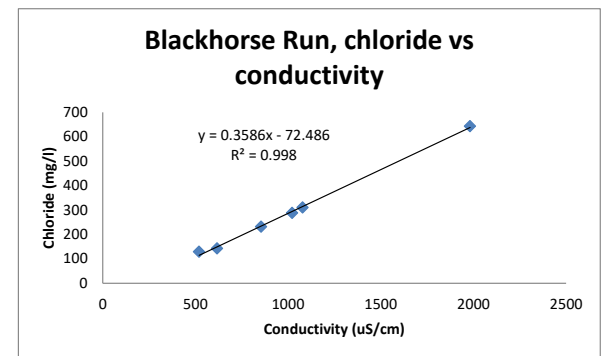
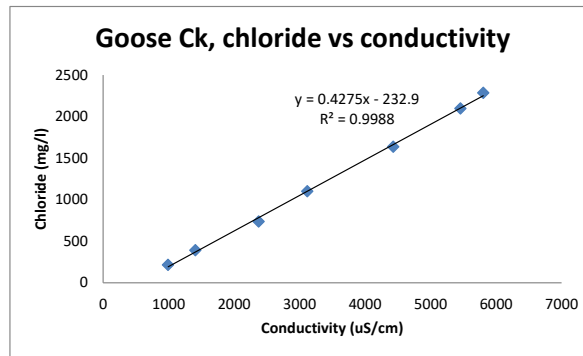
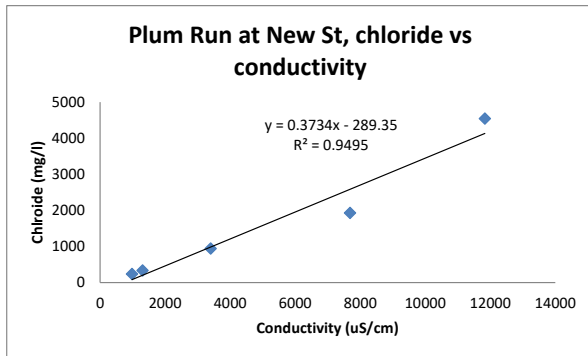
# Reminders

- **Additional monitoring** – Targeted sampling to describe events (e.g., road salt flushes)



# Reminders

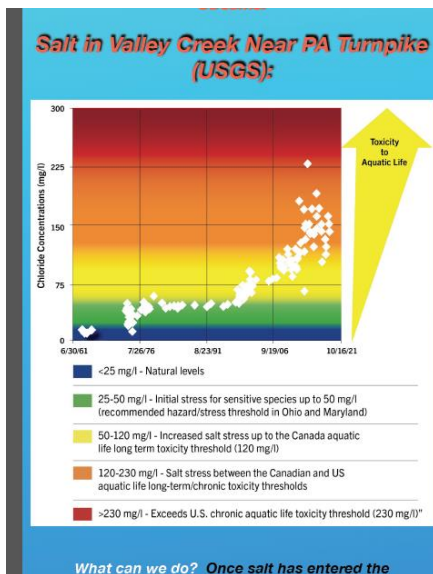
- Use synoptic and targeted event sampling to develop rating curves
  - Rating curve allows you to use conductivity to estimate chloride





# Reminders

- Data communication products – templates available, be in touch if you'd like assistance



## State & Municipal:

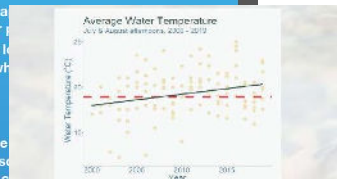
- Brine. Consider making brine an integral component pre-storm AND during-storm treatment.
- Apply pre-wetted salt at approved rates for the conditions.
- Consider application efficiency - evaluate equipment calibration and function to potentially reduce waste and over application.
- Consider developing training programs or updating existing ones - plan for the long term.
- Get the word out to contractors, businesses, and homeowners. Salt pollution is getting worse. Drinking water and stream health are in danger.

## Private Contractors:

- Brine if equipment is available. Upgrade equipment if possible.
- Apply pre-wetted salt at approved rates for the conditions.
- Store salt properly under cover.
- Reach out to clients and let them know to reduce salt application when possible.

## Homeowners:

- Use the right amount; one driveway or 10 sidewalk squares.
- Consider mixing sand or calcium chloride with the salt or even just using the sand.
- Don't use products containing



## What Can You Do?

If you choose your watered with a lower population, one of the best ways to preserve the cold temperature is to add more trees and shrubs in your property. By keeping your yard cooled with a diversity of plants, you not only provide habitat for wildlife, but will also reduce the amount of water runoff. This runoff can be directed into the stream or a nearby water body, which can then be used for irrigation. Another great way to reduce water runoff is to use mulch. Mulch can help retain moisture in the soil, which can help reduce the amount of water runoff. Another great way to reduce water runoff is to use mulch. Mulch can help retain moisture in the soil, which can help reduce the amount of water runoff.

What if you're a homeowner and the local government is not doing enough? You can contact your local government and let them know about the problem. You can also contact your local government and let them know about the problem. You can also contact your local government and let them know about the problem.

Trout are incredibly sensitive to water temperature. If the water temperature is too high, trout will not survive. This is why it is important to keep the water temperature low. You can do this by adding more trees and shrubs to your property. This will help to cool the water and keep the temperature low.

This document is provided by the Pennsylvania Department of Environmental Protection. It is not intended to be used as a substitute for professional advice. It is provided for informational purposes only.



## Salt is a problem in the Tookany-Tacony/Frankford watershed

- Most TTF streams are contaminated with salt
- Salt levels in local streams are 10-30 times higher than natural levels, even in the summer. During winter storms, levels rise to 50-100 times higher than natural (TTF and USGS)



The amount of salt in TTF streams is shocking

**11,000+ TONS**  
of salt applied by humans  
flow through the watershed every year  
**=**  
**30+ TONS PER DAY**

## Salt (as chloride) in TTF streams



## Brodhead Creek

Are Waters Getting Too Warm for Trout?



## What is the Brodhead Creek?

The Brodhead Creek, located in the Delaware County, Pennsylvania, is a tributary of the Delaware River. It is a 10-mile long stream that flows through the Delaware County, Pennsylvania, and is a popular spot for fishing. The stream is known for its clear water and abundant trout population. The stream is also a popular spot for hiking and bird watching.

## Trout in the Creek

All along the Brodhead Creek, you can find trout. These fish are a popular sport for anglers and are also a important part of the local ecosystem. The trout population in the creek has been declining in recent years due to a variety of factors, including habitat loss and water pollution.

Higher water temperatures can cause the trout to become stressed and more susceptible to disease. This is why it is important to keep the water temperature low. You can do this by adding more trees and shrubs to your property. This will help to cool the water and keep the temperature low. The trout population in the creek has been declining in recent years due to a variety of factors, including habitat loss and water pollution.

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# Final things to consider, from George Seeds

- It All Turns on Affection – book by Wendell Berry
- “We have the world to live in on the condition that we will take good care of it. And to take good care of it we have to know it. And to know it and to be willing to take care of it, we have to love it.”  
– Wendell Berry
  - Technical stuff is necessary, but it’s not everything
    - Use the tech and data to know the landscape for yourself
    - Data can help clarify your observations/suspicions
  - *Learn how it all connects* – “that’s how you start to care about things” (George Seeds)

# Mentors currently available

- Carol Armstrong (MWS), [mnem.np@gmail.com](mailto:mnem.np@gmail.com), 610-659-7477
- George Seeds (MWS), [geoseeds@verizon.net](mailto:geoseeds@verizon.net), 484-886-9586
- Rachel Johnson (Stroud Center), [rjohnson@stroudcenter.org](mailto:rjohnson@stroudcenter.org), 973-557-8995
- Christa Reeves (Stroud Center)(in the north, situational), [christa@musconetcong.org](mailto:christa@musconetcong.org), 727-520-5849

***\*Anyone else interested? If so get in touch with Stroud Center or Carol or George***



# Conclusion

Next month's meeting will be on:

**Thursday January 19, 2023**  
**2:30-3:30p**



# Onward!

## Stroud Water Research Center, EnviroDIY-DRWI contacts:

- David Bressler, [dbressler@stroudcenter.org](mailto:dbressler@stroudcenter.org), 410-456-1071
- Shannon Hicks, [shicks@stroudcenter.org](mailto:shicks@stroudcenter.org), 610-268-2153 x267
- Rachel Johnson, [rjohnson@stroudcenter.org](mailto:rjohnson@stroudcenter.org), 973-557-8995
- Christa Reeves, [christa@musconetcong.org](mailto:christa@musconetcong.org), 908-537-7060

## Master Watershed Stewards, EnviroDIY-DRWI contacts:

- Carol Armstrong, [mnem.np@gmail.com](mailto:mnem.np@gmail.com), 610-659-7477
- George Seeds, [geoseeds@verizon.net](mailto:geoseeds@verizon.net), 484-886-9586