EnviroDIY Troubleshooting Workshop

How to approach the most common EnviroDIY monitoring station issues



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Overview of the most common problems

- 1. Monitoring Station is offline
- 2. Loss of cell transmission
- 3. Fouling or sensor malfunction
- 4. -9999 communication problem between Mayfly and sensor
- 5. Battery voltage levels







General process to follow for all issues

For all issues, this is the basic general process you should follow:

- 1. Check Monitor My Watershed daily.
- 2. If you notice an issue, visit the station to further investigate.
 - Bring a charged battery, a spare microSD memory card, cleaning brush, and QC supplies.
- 3. Turn the Mayfly Logger off, wait for all lights to turn off (except charge light), then turn it back on again.
- 4. If the issue can be fixed on the spot, do so.
- 5. If the issue needs replacement parts or extra help:
 - Fill out Troubleshooting Request Form For DRWI support only
 - Email Dave, Rachel, and Shannon with the microSD memory card file and name of the station if necessary
- 6. Fill out Field Visit Data sheet and enter online.





1. Station is offline (Data are not live on MonitorMW)



Possible issues:

- Power issues (battery below 3.5 volts)
- Hologram data plan not paid or SIM card failure
- Bad cell board (Digi LTEbee)
- MonitorMW issues

 Website experiencing technical issues

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• Dropped cell coverage

### 2. Loss of cell transmission (not live on MonitorMW)

#### Issues:

- Cell board or SIM card failure
  - Things to check:
    - Confirm cell plan is paid by checking Hologram dashboard
    - Restart Mayfly and check microSD memory card
      - If data current, then cell board issue
      - If data not current, then issue with data card, battery, or Mayfly





### Loss of cell transmission (not live on MonitorMW) cont.

Light patterns on cell board / LTE adapter as a diagnostic tool-

- Blue light is solid when it's looking for a connection and then blinks when it makes a connection and transmits
- If any light on the LTE adapter is on between 5 minute interval - this means that the cell board is hung up and needs to be reset or may be broken







# 3. Sensor fouling or malfunction

- Fouling or sensor malfunction
  - How to diagnose (patterns on MonitorMyWatershed)
  - Failing versus fouled sensor
  - How to check (i.e., quick cross checks)
  - Data outside normal range (e.g., high turb in baseflow conditions or flatline in storm conditions)

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## Sensor fouling vs. failure

Clean sensors first before trying to troubleshoot issue. If sensor reading values are still fouled after cleaning, it may be indicative of a sensor malfunction.





## Sensor Fouling

- Being buried
- Bio fouling (algae)
- Debris fouling (leaves/sticks)
- Chemical reaction fouling





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### Hydros 21 CTD Sensor





### CTD Sensor fouling



# \*Pause for a short break if needed\* (5-10 mins ?)



• During baseflow conditions



BCTR1S: Taylor Run - upstream of West Chester Taylor Waste Water Treatment Plant



During storm events



BCTR1S: Taylor Run - upstream of West Chester Taylor Waste Water Treatment Plant



### • During storm events



MSAC1S: Angelica Creek at St Bernadine Street



During storm events



MSSR4S: Schuylkill River at Schuylkill River Greenways



### Common Depth Issues

- Depth/Temp Correlation
- Depth out of range
- Dramatic changes in depth followed by unstable values
- Fouling





## Depth / Temperature correlation

| S Monit             | or My Waters               | hed <sup>®</sup> Time Series Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |                                                                         |
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MSPR2S: Punches Run in Nolde State Forest



### Depth out of range

#### **Negative Values**



PUCC2S: Cobbs Creek Tributary at McCall Golf and Country Club



### Depth out of range

Dramatic increase in depth, usually after a storm, caused by sediment or other debris wedged against the pressure sensor





### Depth out of range

#### Dramatic increase in depth, followed by invalid data



PUPC2S: Primrose Creek at Solebury School



### Depth QC measurements



As a quality check of your sensor depth, Take a measurement by hand, using a metric ruler.

Place the end of the ruler at the bottom of the opening in the CTD and measure to the water surface.

QUALITY CONTROL - WATER LEVEL DATA (Rec frequency: quarterly and/or more frequently as needed)

| *Staff Gauge Height (m):                        | Time:                | AM/PM?         | EST/EDT?   |
|-------------------------------------------------|----------------------|----------------|------------|
| Sensor Station Water Depth (mm):                | Time (military):     | Not applicable | Always EST |
| PQC Sensor Station Water Depth (mm):            | Time:                | AM/PM?         | EST/EDT?   |
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Offset (=Staff Gauge Height - Sensor Station Water Depth)(mm):

a - Staff Gauge Height and Sensor Station Water Depth readings should be from about the same time (+/- 5 minutes).

b - Use metric ruler to measure from pressure transducer (white disc in CTD sensor) to water surface. Note - this depth measure may be slightly different from the sensor-measured depth but should be consistent over time.



### Depth QC measurements

### Staff gauge

### QC Depth Rebar





### **Turbidity Sensor Fouling**



## **Turbidity Sensor Fouling**

 When the turbidity sensor is buried in fine sediment, it can show a pattern similar to a failing sensor. The turbidity measurements will stay around 0-2NTU and will not respond during storms



### Turbidity sensor failure



## Turbidity sensor malfunction





### 4. -9999 communication problem between mayfly and sensor

#### Possible issues:

- Bad headphone jack
- Grove cable problem
- Sensor wire problem (damage/cut)
- Sensor reading out of expected sensor output range
- Internal sensor failure

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## 5. Battery voltage Levels

- Review of proper battery levels
- Swapping batteries
- Poor solar charging
- Damaged/disconnected battery
- Sensors, Cell board, or solar panel interference can drain batteries







## Spare battery and battery charger details

- Note\*\* Only buy the battery charger & batteries that the Stroud Center suggests – Most sold on amazon have backwards polarity wires and will damage your battery or Mayfly logger.
- Links to purchase charger are provided in the EnviroDIY online manual in <u>section 8.2.6</u>
  - (<u>https://www.envirodiy.org/mayfly-sensor-station-manual/#power-management</u>)









Lithium Ion Battery Pack –SparkFun LiPo ChargerUSB 2.0 Cable A to C – 3USB Wall Charger – 5V, 1A3.7V 4400mAh.Plus.Foot.(Black)



### Mayfly Monitoring Station: Battery Overview



### Basic overview of the EnviroDIY monitoring station functionality:

- The solar panel charges the Lithium Ion Polymer (LiPo) battery.
- The LiPo battery powers the mayfly data logger.
- The Mayfly data logger records data collected from the sensors.
- If there is cellular telemetry, the cell board sends data to online portal (MonitorMyWatershed.org).



### Solar Panel Extension Cable





### Battery Overview cont.



Where the battery plugs into the Mayfly Data Logger :

 There are two identical JST connectors on the mayfly data logger labeled LIPO BATT. The battery can plug in to either one of these to power the mayfly.



## Battery voltage

How to interpret the battery voltage of your station

### **Basic rule of thumb to follow:**

- 4.0V or above: fully charged battery
- **3.9V-3.7V:** sufficiently charged battery
- 3.7V is the nominal voltage (Nominal voltage is the default, resting voltage of a battery pack). The middle ground between fully charged and the low voltage cutoff
- **3.5V-3.7V:** start to keep an eye on the battery pattern
- 3.5V or below: if it stays at or below 3.5V for an extended period of time you may want to replace your battery. If you see that your station has dropped offline and your battery is below 3.5V, your battery died and needs to be charged or replaced.



# Battery Charging



- When both the battery and the solar panel are connected to the mayfly, a tiny yellow-orange LED light will shine showing that the battery is being charged
- The LED light will not shine for two reasons
  - 1.) the battery is full and therefore does not need to be charged
  - 2.) There is a malfunction that is not allowing the battery to charge.



# Failing Battery Patterns



### **Punches Run in Nolde State Forest :** You can see the end of April the charging pattern is normal, staying between 4.0V and 4.2V.

Then once the vegetation starts to come in, in May, the battery has trouble keeping up. The spikes represent when the battery was replaced.





**Sandy Run PUSR1S** – downward trend with no charging shown at all. This indicated there is no solar panel connected. Either the solar panel wire / connector got damaged or possibly an indicator of vandalism



### Battery Failure

Exposure to moisture over time can lead to corrosion of the LiPo battery. If this happens the battery may fail and need to be replaced.

- It is important to have spare batteries and charger as a backup
- if your battery is not being recharged, it may have failed entirely
- This usually happens over a decent amount of time (2+ years in most cases).





## Review EnviroDIY purchase options list

#### Purchase options for maintenance and quality control list

EnviroDIY Mayfly Monitoring Station Help Resources

Manual

EnviroDIY Mayfly Monitoring Station Manual

#### **Quick Guides**

- EnviroDIY Mayfly Monitoring Station Management Roles and Responsibilities Quick Guide
- EnviroDIY Mayfly Monitoring Station Maintenance Quick Guide
- EnviroDIY Mayfly Monitoring Station Quality Control Quick Guide
- EnviroDIY Mayfly Monitoring Station Data Patterns Quick Guide
- EnviroDIY Mayfly Monitoring Station Time Zone Guide
- <u>Understanding Your EnviroDIY Mayfly Monitoring Station Data</u>

Video Tutorials

Visit the EnviroDIY Videos page.

#### Support Supplies

EnviroDIY Mayfly Monitoring Station purchase options for maintenance and quality control



### EnviroDIY Monitoring Station: Service Request Form

• <u>Service Request Form</u> – For DRWI support only

The more information you can provide in the Request Form, the better we will be able to assist you.



### EnviroDIY Monitoring Station Service Request Form

Please complete this form with as much information as possible to assist Stroud Water Research Center technicians in troubleshooting your problem. For extremely urgent issues please contact the Stroud Center team directly (<u>rjohnson@stroudcenter.org</u>; <u>shicks@stroudcenter.org</u>; <u>dbressler@stroudcenter.org</u>)

\* Required

# Questions ?



