**Building an EnviroDIY Monitoring Station** *Per lessons from the Delaware River Basin Day 1, Tuesday October 5, 2021, PA Watershed Specialist Meeting (virtual)* David Bressler, Stroud Water Research Center





# Today

# Goal: Understand what it takes to build an EnviroDIY monitoring station

- Programming
- Building
- Installing
- Case study from Cheryl Nolan



# Experience in the Delaware River Basin

• Support for developing EnviroDIY in the DRB from the Delaware River Watershed Initiative







# Mayfly Data Logger

• EnviroDIY is focused around the Mayfly Data Logger



The EnviroDIY Mayfly Data Logger is a powerful, userprogrammable microprocessor board that is fully compatible with the Arduino IDE software.

Designed by Shannon Hicks, Stroud Center engineer



## The Standard EnviroDIY Monitoring Station



Also designed by Shannon Hicks



### The Standard EnviroDIY Monitoring Station





### The Standard EnviroDIY Station, Logger Box and solar panel





# The Standard EnviroDIY Station, Mayfly

### Features of the EnviroDIY Mayfly Data Logger



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## The Standard EnviroDIY Station, Cell Board



# 4G/LTE cell board – transmit data to Monitor My Watershed



### The Standard EnviroDIY Station, Sensor Bundle











# The Standard EnviroDIY Station, Sensors



### CTD Sensor (Meter Hydros 21)

Turbidity Sensor (Campbell OBS 3+)

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### The Standard EnviroDIY Station, microSD card

### microSD card files are generally the most secure data





## The Standard EnviroDIY Station, data points

DateTime	TimeOffset	DateTimeUTC	Decagon_CTD-10_Cond	Decagon_CTD-10_Depth	Decagon_CTD-10_Temp	Campbell_OBS3_Turb-1	Campbell_OBS3_Turb-2	EnviroDIY_Mayfly_Batt
10/11/2019 14:20	-5:00	10/11/2019 19:20	177.2	158.7	15.4	48.07323	48.96716	4.078
10/11/2019 14:25	-5:00	10/11/2019 19:25	175.5	157.3	15.4	35.45782	36.75259	4.078
10/11/2019 14:30	-5:00	10/11/2019 19:30	179.3	158	15.4	21.93285	22.50054	4.078
10/11/2019 14:35	-5:00	10/11/2019 19:35	179.3	158.7	15.4	9.48896	9.19174	4.078
10/11/2019 14:40	-5:00	10/11/2019 19:40	176.3	158.8	15.47	9.56245	9.22499	4.078
10/11/2019 14:45	-5:00	10/11/2019 19:45	177.2	159.5	15.42	3.036	2.30191	4.078
10/11/2019 14:50	-5:00	10/11/2019 19:50	179.2	159.2	15.4	2.5979	1.83187	4.078
10/11/2019 14:55	-5:00	10/11/2019 19:55	179.3	158.5	15.4	3.16721	2.43511	4.078
10/11/2019 15:00	-5:00	10/11/2019 20:00	176.3	157.8	15.4	2.71445	2.00768	4.078
10/11/2019 15:05	-5:00	10/11/2019 20:05	178.3	158.5	15.4	3.75042	3.07139	4.078
10/11/2019 15:10	-5:00	10/11/2019 20:10	177.7	159	15.4	3.05485	2.32099	4.078
10/11/2019 15:15	-5:00	10/11/2019 20:15	177.5	157.8	15.4	2.31367	1.51385	4.078
10		10/11/2019 20:20	179	158.3	15.4	4.37304	3.73188	4.078
10		10/11/2010 20:25		453.3	45.0	3 7635	3.0761	4.070

### Data points collected every 5 minutes



### The Standard EnviroDIY Station, MonitorMW data portal

• Data sent in real-time to Monitor My Watershed data portal via cell signal





# ON TO THE MAIN PART





### Overview of the EnviroDIY building process

- Prepare for building
  - Register for EnviroDIY.org account
  - Register for Monitor My Watershed account
  - Confirm cellular capacity register for cellular account with cell plan provider (currently Hologram.io)
  - Gather necessary equipment and supplies
- Prepare Mayfly Data Logger
  - Install Arduino IDE
  - Connect computer to Mayfly
- Programming and Activating an EnviroDIY Monitoring Station
  - Install libraries
  - Create and upload sketches
- Assemble EnviroDIY Monitoring Station
  - From scratch or use EnviroDIY Monitoring Station Kit
- Install EnviroDIY Monitoring Station
  - Acquire installation equipment and supplies



### Overview of the EnviroDIY building process

Prepare - software, accounts, etc.

Solution My Watershed®

ARDUTNO 🕅 Hologram Program Mayfly to talk with CTD sensor and MonitorMW ater depth Provisi C 0 0

Last observation Sept. 27, 2021, 4:05 a.m. (UTC-05:00) 244.7

(mm)

Use EnviroDIY Monitoring Station Kit to assemble station



Use installation equipment/supplies to install EnviroDIY Monitoring Station



# PROGRAMMING





• Install Arduino IDE, https://www.arduino.cc/en/software

### Downloads

### Arduino IDE 1.8.16

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

Refer to the Getting Started page for Installation instructions.

#### SOURCE CODE

ΘĐ

Active development of the Arduino software is **hosted by GitHub**. See the instructions for **building the code**. Latest release source code archives are available **here**. The archives are PGP-signed so they can be verified using **this** gpg key. IDE = Integrated Development Environment









Connect Mayfly to computer and assign correct Port in Arduino IDE



#### 💿 sketch\_may04d | Arduino 1.8.2 File Edit Sketch Tools Help Auto Format Ctrl+T Archive Sketch sketch\_may04 Fix Encoding & Reload 1 /\*\*\*\*\*\* Serial Monitor Ctrl+Shift+M 2 DRWI LTE Serial Plotter Ctrl+Shift+L 4 Developme WiFi101 Firmware Updater 6 Software Board: "EnviroDIY Mayfly 1284p" 7 Copyrig Port and the Get Board Info 9 card and sending the data to Programmer: "AVRISP mkll" groups involved with 12 The Willi Burn Bootloader ed Initiative 13 14 DISCLAIMER: 15 THIS CODE IS PROVIDED "AS IS" - NO WARRANTY IS GIVEN. 16 17 19 // Defines for the Arduino IDE 20 // In PlatformIO, set these build flags in your platformio.ini 22 #ifndef TINY\_GSM\_RX\_BUFFER 23 #define TINY GSM RX BUFFER 64 24 #endif 25 #ifndef TINY GSM YIELD MS 26 #define TINY\_GSM\_YIELD\_MS 2 27 #endif



 Load support files (aka <u>libraries</u>) and <u>sketches</u> (programs written using Arduino Software, aka IDE via <u>github.com/envirodiy/libraries</u>)

∃ README.md

#### Libraries

This repository contains *links* to various libraries that are used to support functions and features of the EnvidoDIY Mayfly Data Logger board. Please note that these libraries are not maintained in this repository, but rather are independent repositories that are linked as submodules of this repository.

Please let us know if you have any trouble installing the libraries!

#### Installing Libraries in the Arduino.cc IDE:

The simplest way to use these libraries is to right-click on this carefully crafted -->->link<--<--, elect "save link as", and save the file somewhere on your computer. You can also click on "libraries.zip" in the file list above and then click the grey download button on that page to download the zip. In your the Arduino Software (IDE), import that zip file following the instructions for "*Manual Installation*" from https://www.arduino.cc/en/Guide/Libraries#toc5. You cannot directly import the zip using the Arduino Library Manager because it contains multiple libraries.

To update the libraries, you will need to re-download the zip file and overwrite the folders in your Arduino libraries folder.



- Upload and modify sketches for adjusting clock and reading current time
  - Setting internal clock is important for ensuring all data points are accurately stamped with date/time signature

ReadMe.md

This if for manually setting the DS3231 clock.

#### To synchronize the clock:

- 1. Ensure that you have the Sodaq library for the DS3231 available on your system.
- 2. Power your board and RTC chip. Attach your board to your computer and make sure it is visible to your system.
- 3. Download adjust.ino and open it in your IDE. Scroll to line 11. Modify the text in line 11 to be a date time about a minute in the future. Save and upload the sketch to your board.
- 4. Navigate to http://www.time.gov/ or look at another clock displaying the correct time. When the currrent time matches the time that you entered in the sketch, hit the reset button on your board.
- 5. Use the serial port monitor to verify that the time on your RTC is now correct. You may need to repeat steps 3 and 4 several times to get the time right.

### Programming and Activating an EnviroDIY Monitoring Station

- Registering a Station on MonitorMyWatershed.org
  - Register a site
  - Add sensors
  - Copy UUIDs (Universally Unique Identifier)
    - Will incorporate into code to program Mayfly (next slides) so Mayfly can directly communicate with MonitorMW

Monitor My Watershed My Sites Browse S	šites Time Series Analyst ⊠		Help 🗹 Admin 🌲 La		
Schuylkill River at 7	David Bressler         Stroud Water Research Center         July 27, 2020, 526 p.m.         July 29, 2020, 320 p.m.         40,042998         -75,249589         11.4	mental Education (PUSR4S)		<pre>const char "UUDS[] = {     "4de92e26-9978-409b-a260-0f7c6720802d", // Electrical conducti     "5ee8b3a-fcb-h991-b1cd-df8e10888acc", // Water depth (Decagor     "cdade6d1-d093-48eb-9d7b-8c0b11cCbc66", // Temperature (Decagor     "03266902-94b6-47e0-b78c-2021dA4708", // Turbidity (Campbell     "lada6f8f-e8f4-458-3b08f-af8dd7db4d00", // Turbidity (Campbell     "e51052e7-f2d8-4107-80b5-48fe0ef6bba4", // Oxygen, dissolved ()     "f5f41854-d4d9-4675-a3ba-2040f8ab66d", // Oxygen, dissolved ()     "e51052e7-f2d8-4107-80b5-48fe0ef6bba4", // Oxygen, dissolved ()     "f5f41854-d4d9-4675-a3ba-2040f8ab66d", // Oxygen, dissolved ()     "e51052e7-f2d8-4107-80b5-48fe0ef6bba4", // Temperature (Environ     "db615208-1820-4588-a399-c031745f076b", // Temperature (Environ     "a456d373-8559-4534-a888-f964d470cd4c", // Temperature (Environ     "a2980ef8-ce2d-4193-9fdc-8b98294f6bbd" // Percent full scale () } const char "registrationToken = "75043405-e1e8-4d16-bbda-876367121ect const char "samplingFeature = "19043757-0fde-4256-bea9-52781d644727"; </pre>	<pre>// UUID a /ity (Decagon_CT L_CTD-10_Depth) L_CTD-10_Temp) (0853_Turb) 0853_Turb) 0853_Turb) 18bna-Tech_D-022 rrcent of saturat (ech_D-02 D-optk riconTr_Mayfly_Temp) (01gi_Cellular_S 5"; // Device ; // Samplin </pre>

### Programming and Activating an EnviroDIY Monitoring Station

Uploading the EnviroDIY Monitoring Station Sketch to your Mayfly
 o Bring in e.g., DRWI\_LTE sketch from Arduino examples

EnviroDIY / ModularSensors (Public)	Image: Second state         →         →         →         ×           Image: Second state         →         →         ×         ×				
<> Code ① Issues 49 11 Pull requests 7 ④ Actions 凹 Projects 印 Wiki ① Security ビ Insights	File Edit Sketch Tools Help				
2 master - ModularSensors / examples / DRWI_CitSci / DRWI_CitSci.ino					
SRGDamia1 Some clean-up in the workflows	37 // ^ r 38 // Data Logger Settings 39 //				
At 1 contributor	<pre>8 40 // The name of this file 41 const char *sketchName = "DRWI_LTE.ino"; 6 (/ Lerror ID end have be and the set of the star of the star of the set o</pre>				
381 lines (323 sloc)   15.4 KB	42 // Logger ID, also becomes the prefix for the name of the data file on SD card 43 const char *LoggerID = "XXXXX"; 44 // How frequently (in minutes) to log data				
1 /** ==================================	<pre>45 const uint8_t loggingInterval = 5; 46 // Your logger's timezone.</pre>				
<ul> <li>4 *</li> <li>5 * @author Sara Geleskie Damiano <sdamiano@stroudcenter.org></sdamiano@stroudcenter.org></li> <li>6 * @copyright (c) 2017-2020 Stroud Water Research Center (SwRC)</li> <li>7 * and the EnviroDIY Development Team</li> </ul>	<pre>47 const int8_t time2one = -5; // Eastern Standard Time R 48 // NOTE: Daylight savings time will not be applied! Please use standard time! 49 50</pre>				
<ul> <li>8 * This example is published under the BSD-3 license.</li> <li>9 *</li> <li>10 * Build Environment: Visual Studios Code with PlatformIO</li> </ul>	51 //				
11 * Hardware Platform: EnviroDIY Mayfly Arduino Datalogger 12 * 13 * DISCLAIMER:	f 53 // 54 #include <sensors processorstats.h=""></sensors>				

### Programming and Activating an EnviroDIY Monitoring Station

 Edit the sketch with the LoggerID/SiteID and UUIDs as described at github.com/EnviroDIY/ModularSensors/tree/master/examples/DRWI Cit Sci.

💿 DRWI_LTE   Arduino 1.8.2 — [	⊐ ×	💿 DRWI_LTE   Arduino 1.8.2 — 🗆 🗡	
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# BUILDING



Using the EnviroDIY Monitoring Station Kit as your starting point <u>https://www.envirodiy.org/product/envirodiy-</u> <u>monitoring-station-kit/</u>





### Final inventory list for building a station

- Build and Deploy a station, Equipment and Supplies:
  - EnviroDIY Monitoring Station Kit from the Stroud Center (<u>https://www.envirodiy.org/product/envirodiy-</u> monitoring-station-kit/)
    - Plus lithium battery (have to buy separately)
  - CTD sensor from Meter Group (<u>https://www.metergroup.com/environment/pr</u> <u>oducts/hydros-21-water-level-monitoring/</u>)
  - Installation equipment and supplies (EnviroDIY manual: <u>https://www.envirodiy.org/mayfly-sensor-</u> <u>station-manual/#installation-equipment</u>)



EnviroDIY Monitoring Station Kit \$475.00









• Assembling the Mayfly Data Logger



• Logger box





• Solar panel









Sensor bundle









• A few other little steps get you to this:





### INSTALLING









# Finding the right spot

- Key considerations for station placement:
  - $_{\circ}\,$  Storms, high flow, and debris
  - Freezing damage
  - Low water
  - Vandalism
  - Access for maintenance



### Site Selection Considerations: Storm conditions
























#### Site Selection Considerations: Stream Morphology





#### Site Selection Considerations: Stream Morphology





#### Site Selection Considerations: Stream Morphology



- You can't always predict nature
- Unexpected things may happen
- Allow mistakes to be learning experiences



#### Ice Damage / Winter precautions









## Summer precautions





## Vandalism



## Access for maintenance (SAFETY)







## Now you're ready









#### Installation, Mounting parts for EnviroDIY Monitoring station

- <sup>3</sup>/<sub>4</sub>" Galvanized / Black pipe ( 2 different sizes varies based off of specific site )
- <sup>3</sup>⁄<sub>4</sub>" coupling
- <sup>3</sup>⁄<sub>4</sub>" cap
- Zip ties
- Tent stakes







#### Installation, Preparing the PVC for the sensor bundle





- Black rebar with predrilled holes
- <sup>3</sup>⁄<sub>4</sub>" PVC pipe
- Retaining clip
- Zip ties
- 2 <sup>1</sup>/<sub>2</sub>" Hose clamp
- 5/32" drill bit
- 3/16" drill bit





## Installation, Equipment

- Hammer
- 2 x 4 wood block (to hammer on)
- Wire cutters
- 7/16" wrench
- Power drill
- 5/32" drill bit
- 3/16" drill bit
- Two pipe wrenches
- PVC pipe cutter
- An extra steel rebar with holes : used to hammer a pilot hole in the stream bed and on the stream bank, avoid damage to the rebar and pipe.
- Tent stakes
- Gloves
- Nut driver (or screwdriver) that accommodates hose clamps





Hammering pilot hole with the test rebar, swapping out with final rebar, and hammering in the final rebar using a 2x4 wood block.





Hammer shorter length pipe into the ground with coupler attached, tighten coupler onto shorter pipe using wrenches, and hammer the shorter pipe the rest of the way after tightening coupler.



Attach longer pipe into the coupler. Then tighten longer pipe above ground into coupler, then test to make sure the pipes do not spin within the ground they are mounted in.







Then tighten longer pipe above ground into coupler, then test to make sure the pipes do not spin within the ground they are mounted in.



- 1in PVC pipe from Lowe's to support coupler in high flow conditions
  - Unfortunately only comes in 10ft long pieces.

Other options to support the weak point:

- hammer the coupler into the ground
- using 1 straight pipe with no couplet
  - Downside = really hard to hammer



#### Attach the small hose clamps to the mounting plate









Mount the logger box onto the above ground pipe using two small hose clamps and =nut driver tool











## Cut and measure the PVC pipe for the sensor bundle.







Attach sensors to PVC pipe using large hose clamp and red screwdriver.





Align hole of PVC to hole in black post — adjust sensors as needed in water to ensure facing the correct direction. Put zip ties on sensor wires attached to top of PVC and make sure the wires are secure so debris will not snag them.











Attach retaining pin to PVC pipe and the in stream rebar.













Leave enough slack so that the wire is not pulled too tight. If something comes by and hits it, it may snap if too tight.







Attach u-bolt and solar panel to the above ground pipe.



- Check the angle and direction of solar panel
- Solar panel direction may change depending on the time of year or as foliage changes





Connect solar panel wire







- Neatly secure sensor wires around logger box.
- Be careful not to crimp the wire too tight
- Do not bend or put a zip tie over the white vent







# Trim zip ties along pipe



## Installed!!!



#### Ways to build a station and guidance available

- Via EnviroDIY Build Workshop, https://www.envirodiy.org/events/
  - \*Next workshop in early 2022 contact D. Bressler if you'd like to be added to the early access list

February 2021

TUE 9

February 9 - February 10

Virtual Workshop: Building an EnviroDIY Monitoring Station

Online

Attendees will leave the workshop with a functional monitoring station equipped with a Conductivity/Temperature/Depth (CTD) sensor and cellular data transmission to the Monitor My Watershed data portal.


### Ways to build a station and guidance available

 Via EnviroDIY Monitoring Station Manual (<u>https://www.envirodiy.org/mayfly-sensor-station-manual/</u>)

5. Building an EnviroDIY Monitoring Station #

#### 5. Building A

- 5.1. Assembling the Data Logger
- 5.2. Pelican Case Assembly
- 5.3. Connecting Sensors
- 5.4. Mounting Parts/Solar Panel Attachment

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- 5.5. Sensor Bundle Parts
- 6. Programming and Activating 🔺
  - 6.1. Uploading the Sketch
  - 6.2. Registering on MonitorMyWatershed.org
  - 6.3. Activating Cellular Service
- 7. Installation 🔺
  - 7.1. Installation Equipment
  - 7.2. Choosing a Location

#### 5.1. Assembling the Mayfly Data Logger #

The electronic components of the EnviroDIY Monitoring Station are shown below. Plug the vertical microSD card adapter board provided in the Mayfly Data Logger Starter Kit into the SPI jack on the Mayfly Data Logger (near the main power switch, Figure 2.1). Insert the cellular SIM card into the slot on the cellular radio module (GPRSbee, 3Gbee, etc, Figure 2.1). Plug the cellular module into the Mayfly Data Logger's Bee port, making sure to get the pins lined up correctly. Connect the small JST power jumper cable between the cell module and one of the jacks labeled "LiPo Batt" on the Mayfly Data Logger (Figure 2.1). Solder the 2 mm JST connector with leads to the 18" solar panel power cable extension. Be sure to use small heat-shrink tubing on the two solder joints.

EnviroDIY Mayfly Data Logger Starter Kit: Includes waterproof enclosure with clear lid, 0.5 W solar panel, custom microSD connector board that plugs into Mayfly for easy access to the memory card, 4GB microSD card and adapter, one-meter microUSB cable, and two Grove cables. Vendor link/unit cost (2018)/quantity required: <u>Amazon/\$90.00/1</u>

CR1220 12 mm Diameter – 3 V Lithium Coin Cell Battery: Lithium batteries for the Mayfly board so they'll retain the clock time after programming. Vendor link/unit cost (2018)/quantity required: Adafruit/\$0.95/1

Lithium Ion Battery – 3.7 V 2000 mAh w/ pre-attached two-pin JST-PH connector: Basic battery for sunny location (option for bigger solar panel and longer mAh battery for shady locations). Vendor link/unit cost



### Ways to build a station and guidance available

• Via Video Tutorials (<u>https://www.envirodiy.org/videos/</u>)

#### Videos

➤ Programming and Building an EnviroDIY Mayfly Monitoring Station

➤ Installing an EnviroDIY Mayfly Monitoring Station

➤ Maintaining and Enhancing an EnviroDIY Mayfly Monitoring Station

➤ Troubleshooting an EnviroDIY Mayfly Monitoring Station

 $\checkmark$  Measuring and Predicting Discharge and Chloride and/or Sediment Loads

✓ Webinars



© STROUD WATER RESEARCH CENTER Building an EnviroDIY Monitoring Station: Virtual Workshop, Day 1

335 views • Sep 29, 2020

3 5 5 0 & SHARE =+ SAVE ...

### Ways to build a station and guidance available

 Via EnviroDIY.org forum (for situational support) (<u>https://www.envirodiy.org/forums/</u>)

Author	Posts
2021-09-27 at 1	12:04 PM <u>#15917</u>
Cheryl Nolan Participant	I've been getting sporadic data recording on my MMW site. I've noticed several discrepancies in the data. For example I looked first thing this morning and the last displayed/recorded data was yesterday (9/26). I just refreshed the page and the last displayed data has changed to 9/24. Another thing I noticed is that on one line of data there are two different dates in columns A and C. There are also gaps in the data but that, I realize, may have nothing to do with the MMW site. Any ideas as to what may be going on? Thanks
2021-09-27 at 1	12:48 PM #15918
<b>D</b> our	Your battery is too low. This is the same issue that was asked about last week: <u>https://www.envirodiy.org/topic/battery-</u> failing-in-the-middle-of-the-night/
<u>Shannon</u> Hicks	Anytime your battery voltage drops below 3.55v, the logger won't transmit, in order to save battery power and conserve enough energy to keep writing the data to the memory card even though it's not transmitting. It appears you station is



Hicks Participant enough energy to keep writing the data to the memory card even though it's not transmitting. It appears you station is extremely shaded since your battery voltage has been extremely low since June. Sometimes we see this in stations that have a lot of leaves during the summer, but the issue usually resolves itself in October once the canopy opens up and allows more light. You could also just buy a second Lipo battery and charger and swap them out a time or two during the summer to keep things at a higher level. You could also try increasing the size of your solar panel, however it's usually easiest to just

#### https://www.envirodiy.org/shop/



EnviroDIY Mayfly Data Logger (Pack of 5) \$0.00



EnviroDIY Mayfly Data Logger Board and Starter Kit (Pack of 5) \$0.00



EnviroDIY LTE Bee (Pack of 5) \$0.00



EnviroDIY OLED Halfshield (Pack of 5) \$0.00



EnviroDIY RS-485 Halfshield (Pack of 5) \$0.00



EnviroDIY Multipurpose 6pin Screw Terminal Grove Adapter (Pack of 5) \$0.00



#### Features of the EnviroDIY Mayfly Data Logger v1.0





Grove jacks for peripherals









## On to Cheryl!!!

#### TIPS & POINTERS

# My Experience Building an EnviroDIY Monitoring Station



#### The First EnviroDIY Unit

My background is in mechanical engineering technology, so computer program downloading and circuit board wiring were not even close to being my forte. So, the first thing I did was enlist the help of the most tech-savvy people I know, Mike Hewitt and Steve Cornia, from <u>Eastern Pennsylvania Coalition for Abandoned Mine Reclamation</u> (EPCAMR). Thankfully, Steve had some experience working with Arduino boards and sketches in the past. In addition, these two guys do a lot of electronic monitoring of abandoned mine drainage in northeast Pennsylvania, and they were willing to help out on the first unit.



### Thank You!

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

- Scott Ensign, ensign@stroudcenter.org, 610-268-2153 ext1223
- David Bressler, dbressler@stroudcenter.org, 410-456-1071
- Shannon Hicks, shicks@stroudcenter.org, 610-268-2153 ext1267
- Rachel Johnson, rjohnson@stroudcenter.org, 973-557-8995
- Christa Reeves, christa@musconetcong.org, 908-537-7060

#### Master Watershed Stewards, EnviroDIY-DRWI contacts:

- Carol Armstrong, mnem.np@gmail.com, 610-659-7477
- George Seeds, geoseeds@verizon.net, 484-886-9586

### Notes

#### Schedule Day 1 (Oct 5), 8:40-10:10 EnviroDIY program, website, costs, programming, building, install etc.- 8:40-9:30, Ensign/Bressler/Nolan (important - why do this? How will it help? describe types of problems it can help solve, examples - kent ag bmps, first state protect natural resource, wc trying to contribute to urban pollution convo; importance of time and personnel to keep function) Ensign (EnviroDIY, website, costs) - 8:40-8:55 Bressler (programming, building, installing) - 8:55-9:30 Cheryl Nolan case study (building) - 9:30-9:50 Questions 9:50-10:10 Day 2 (Oct 6), 8:35-10:05 EnviroDIY management and MonMW - 8:35-9:45, Bressler - 8:35-9:25 (important - why do this? How will it help? describe types of problems it can help solve, examples - kent ag bmps, first state protect natural resource, wc trying to contribute to urban pollution convo; importance of time and personnel to keep function) George Seeds case study (managing) - 9:25-9:45 Questions 9:45-10:05

