Community Impact & Metrics of Stormwater

Holly Austin, Penn High School
haustin@phm.k12.in.us

RET and High School Courses

AP and Advanced Environmental Science courses

- Multiple core connections between many course standards (pollution, watersheds, human impact, policy)
- Chemical assessment of stormwater and river water
- Data collection using Arduino
- Action plan targeting problems detected

General Chemistry

- Marginal connections that enhance the discussion of solutions
- Possible lab making assessment tool for chloride levels in runoff water

Themes of RET

Using technology to monitor stormwater conditions

- EmNet, LLC. started through BCe2 and is expanding to cities across the country to decrease combined sewer overflow by installing smart systems
- Taking the Arduino-based concept of this design into the classroom to monitor the stormwater in separate sewers on Penn High School campus
- In the future, data collected can potentially be used in a machine-learning scenario.

Themes of RET

Networking with stakeholders & community resources

- At BCe2, college and high school interns are guided to contact community leaders and address real problems
- Make resources available to high school students in my classroom and encourage asking questions that lead to contacting real people
  - Local government offices
  - School maintenance department
  - etc.

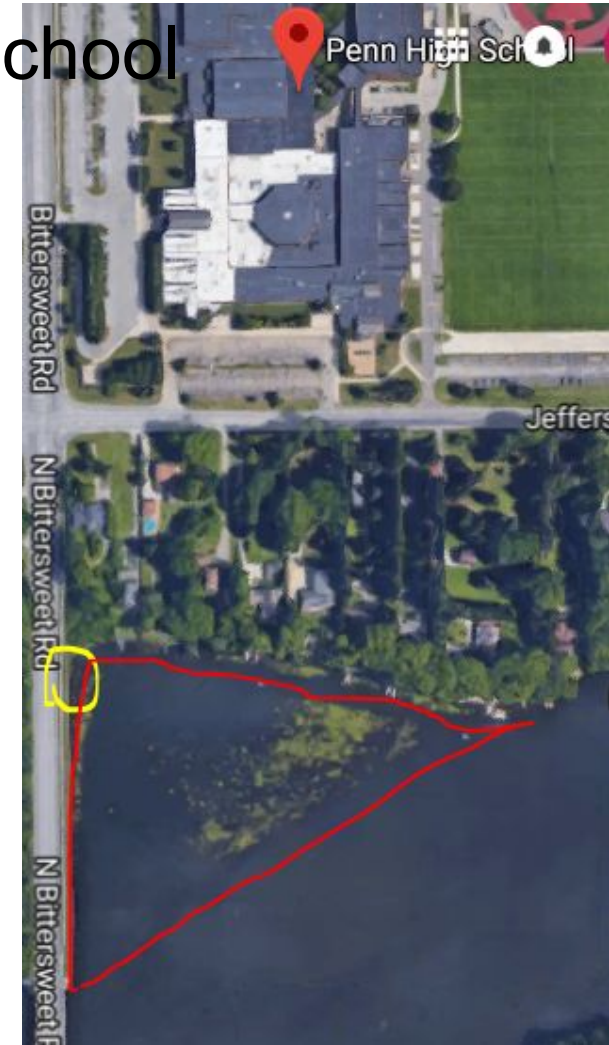
Themes of RET

An impasse is not a failure, but a pause

- Sometimes when trying to address a real problem, differing stakeholder interests prevent the desired outcome. At BCe2, this results in a change of course, not giving up.
- Students in the classroom can pursue a task that is impossible with the resources available. Perhaps they'll get farther than they thought, but the deliverable changes from a desired outcome to a report of the challenges and suggestions for future work.

Background of Lesson at Penn High School

- Penn is located in the County of St. Joseph, and is served by a Separate Storm Sewer System (not combined with wastewater).
- Stormwater from the Penn campus is discharged directly into the St. Joseph River on the upstream side of the Bittersweet Rd. bridge/ causeway, in the yellow circle
- River area including backwater (red triangle, roughly) is owned by Indiana Michigan Power, and is outside normal regulating by EPA due to being outside the current
- Homeowners report visible pollution effects at times of rainfall



Lesson Module

Day Zero: use existing curricula to assess land ecosystem health (not part of RET)

Day 1: Assessment of aquatic ecosystem health in causeway backwater

Day 2: Stormwater runoff from our school: how much water, and where does it go?

Day 3: Stormwater runoff from our school: what is in our runoff?

Day 4+: Environmental stewardship: what can we do?

Aquatic Ecosystem Health

- Use the directions and forms available from the Hoosier Riverwatch Volunteer Manual. Use testing equipment they recommend or other similar methods. Page 39. https://www.in.gov/idem/riverwatch/files/volunteer_monitoring_manual.pdf
- This information is relatively standard, and is used by many educators in the state.
- Supplies purchased with RET curricular money

Aquatic Ecosystem Post-discussion (for students)

Use the data we collected to research these questions for each measurement we made:

1. What is the healthy range, and how does our sample compare?
2. What are the typical causes of an out of range value?
3. What effects on the ecosystem are likely to come from an out-of-range value?
4. What are some actions that can return the value to its normal?

For the values that are out of range in our sample:

5. What are the probable sources of the problem?
6. What might be done in our local area to mitigate the problem?

Stormwater runoff from our school: how much water, and where does it go?

- Use MyMaps on google to use the area finding tool to measure the surface area of the Penn campus runoff zone. Calculate the gallons of rain in 1 inch, 2 inches, etc.
  - Depending on how detailed you want to make this, set different requirements of grass, parking lot, road, roof, etc. Use Percentage Imperviousness factor.
  - Depending on skills of students, request them to do this using unit conversion factors or Excel.
- Tour the school campus and surrounding area to see where water goes. Draw a diagram of where storm sewers, manholes, etc. are.
- If possible, scheduling this activity on a day when there has recently been rainfall would be helpful.

Stormwater runoff from our school: what is in it?

- Use Arduino system to record storm sewer levels and runoff water properties during a rainfall event.
  - Directions for building the device are currently under development
  - Secure the device within a storm drain or storm sewer line before a rainfall event
  - Collect data throughout the runoff event
- Use Excel to evaluate/graph the data.
  - Compare river data from corner of river and river current
  - Chart one or more variable over time

Data Evaluation (for students)

Your task is to make a claim about how Penn High School is affecting the River, and then support it with graph(s) and and data we have taken.

An example might be, “Penn High School is causing the water temperature to rise.” You would then need to use temperature data we collected to make one or more graphs to support your point.

Suggestions:

Change over time Bar graphs comparing sewer water with river water

Correlations of activities at Penn that you observe to be contributing (must be quantitative data (numbers, not descriptions)

Environmental Stewardship: what can we do?

1. Small groups of students brainstorm a method of improving something about the whole system
2. Write a proposal for what they want to do to fix it, were their resources unlimited. Include some basic steps
3. Each group meets with me to discuss the possible challenges. I supply resources as I am able and direct them where to go to move forward.
4. We move forward thus for a predetermined time (1-3 class days)
5. At the end of this time, students either have a proposed action plan to which someone has agreed, or else an Impasse Report documenting what they tried and suggesting areas of future work

RET funded purchases

- Arduino equipment to measure water within storm sewers
  - Collect data remotely
  - Constantly through duration of a rain event
- Vernier and similar handheld probes to measure river water