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Stream Restoration Project: Creating a Wetland

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Palustrine Scrub- Shrub Wetland

Definitions:

- Palustrine: related to inland wetlands
  - Non-tidal wetlands that are substantially covered in emergent vegetation
- Scrub-Shrub Wetland: wetlands dominated by woody vegetation less than 5 meters in height
  - Total vegetation coverage is greater than 20%
  - Characterized by small trees and shrubs

Why Scrub- Shrub?

- Endangered habitat
  - At risk of becoming emergent forested wetlands
  - At risk from human development
- Government subsidized funding
- Hosts endangered/ threatened species
  - eg: spotted turtle, button bush

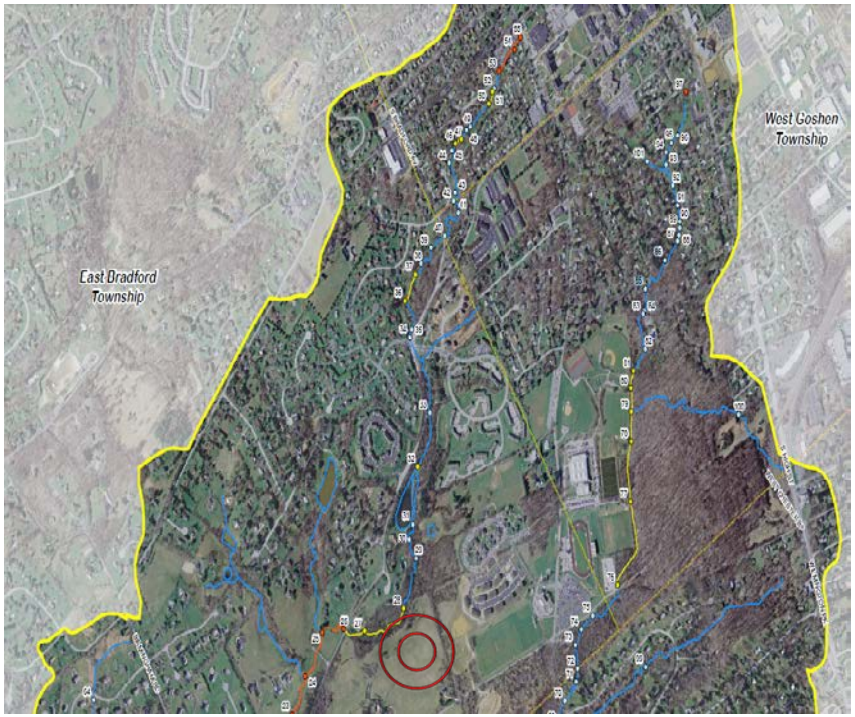
Wetland Benefits

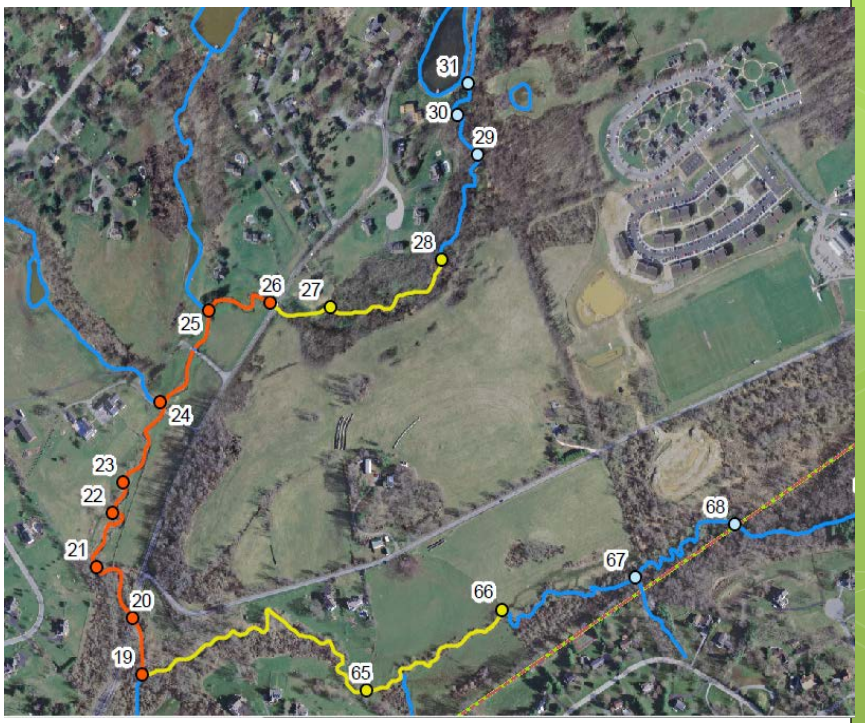
- Water quality enhancement
- Storm water attenuation
- Sediment erosion control
  - Bank stabilization
- Rare habitat
- Groundwater recharging

Project Goals

- To use land owned by West Chester to improve stream quality in far reaching areas of Plum Run
  - Improvement of water chemistry
  - Reduce the effects of sedimentation
- Increase threatened habitat
- Benefit West Chester University

Aerial View


West Goshen Township
East Bradford Township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Restoration Site

- Site 29 of the Plum Run tutorial
- Open space adjacent to stream
- 150ft of stream bank extending 50ft

The Game Plan

- Step one: Drying the stream
- Step two: Excavation
  - Grading the bank
  - Creating the wetland
- Step three: Planting
  - Grasses
  - Trees and shrubs
- Step four: lay down erosion blanket

The Budget

- Required rentals
  - Back hoe – $2,667
  - Gas pump - $495
- Necessary purchases
  - Erosion blanket -2 Big Daddy Roll about $200
  - Seed/plants- $655.19
- Total – $4017.19

FLYWAY EXCAVATING, INC.

- Includes:
  - Excavation costs
  - Stabilizing/grading the bank
  - Seeding
- Total = $14,139

Species of plants

- Sand Bar Willow – 50 (15) cuttings for $43
- Silky Dogwood - 7 for $84
- Swamp Rose - $15 for 1 oz. or 1,600 seeds
- Bottom Bush – 8 $99.92
- Pin Oak – 4 for $49.96
- Button bush – 7 for $105
- *Black Willow – 4 for $67.56
- Speckled Alder- 15 for $39.15
- Grasses- 2 lbs. of OBL Wetland Mix for $151.6

* = not endangered

Species Selection

- Shrub scrub requirements
- Species status
- Animal species requirements

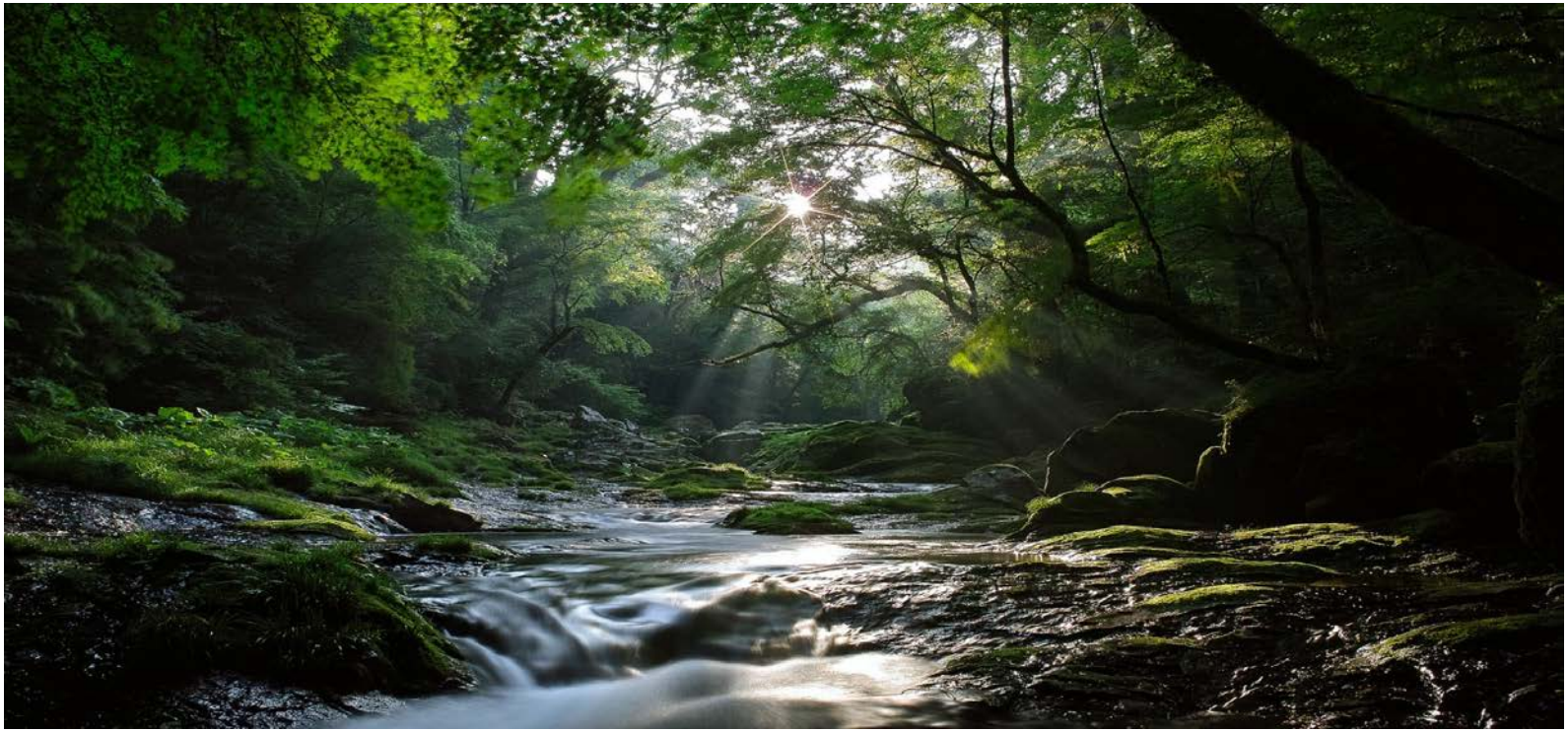
Potential Funding Sources

- Wetland Mitigation
- Growing Greener
  - Our plan
  - Why we deserve funding
- EPA's 5 Star restoration Progra

GROWING GREENER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Now that the restoration portion is complete, how will you gauge the success of the project??



Sampling Station

- Great way to record accurate data for stream flow and water-quality characteristics
- Gives you the ability to interpret developing trends
- Numerous floating stations will improve range of data

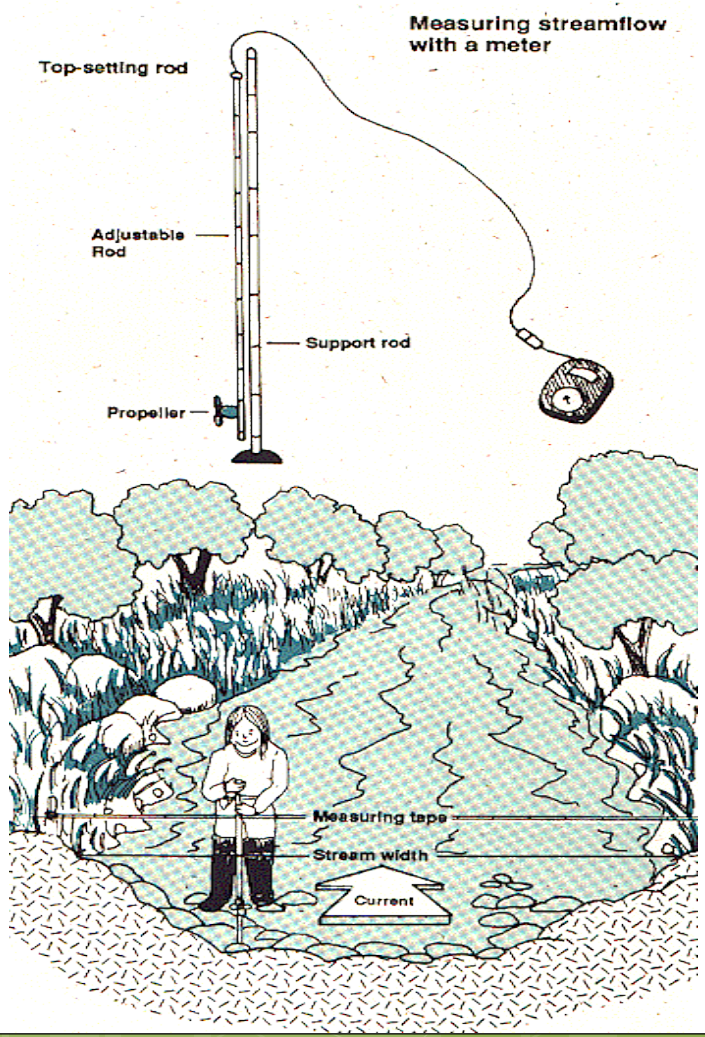
Monitoring Water Chemistry

YSI-6929 Multi-parameter probe

Flow Meter

- Determines flow velocity from the number of propeller revolutions over a given time interval
- Flow meter should be positioned just below mid-depth.

Measuring Discharge



- Tie a measuring tape across the stream to measure width.
- Start measuring at the edge then work your way across.
- Make sure to stand on the downstream of meter while measuring.
- Record total depth at each interval.

Calculating Discharge

- Interval width (constant value) x total depth x velocity = discharge
- The sum of the discharge for each interval = total discharge

Don’t be like these people!!

Monitoring Results- Invertebrates

- Use WCU ecology students to catch, sort and indentify different species.
- Specimens collected with Hess cylinders from riffle locations.
- Sort with dissecting scope to lowest possible taxonomic level.

- Overall stream quality is determined by the benthic macroinvertebrate community found at a site.
- Sites are graded by their Chester county index of biotic integrity scores (CC-IBI).

- IBI>90=Mayflies, Stoneflies, Caddisflies
- 90>IBI>50=Riffle beetles, Net-spinning caddisflies
- IBI<50=Midges, Worms

Mayfly larva

Riffle beetle larva

Midge larva

Table 9. Metric standardization values for the six metrics used to calculate the Chester County Index of Biotic Integrity value.

[EPT, Ephemeroptera, Plecoptera, Trichoptera; PTV, Pollution tolerance value]

Metric	Standardization value	Standardization percentile
Total taxa richness	50	95
EPT taxa richness (PTV 0–4)	19	95
Hilsenhoff Biotic Index	3.98	5
Beck's Index	26	95
Shannon Diversity Index	2.87	95
Percent sensitive individuals (PTV 0–3)	43.07	95

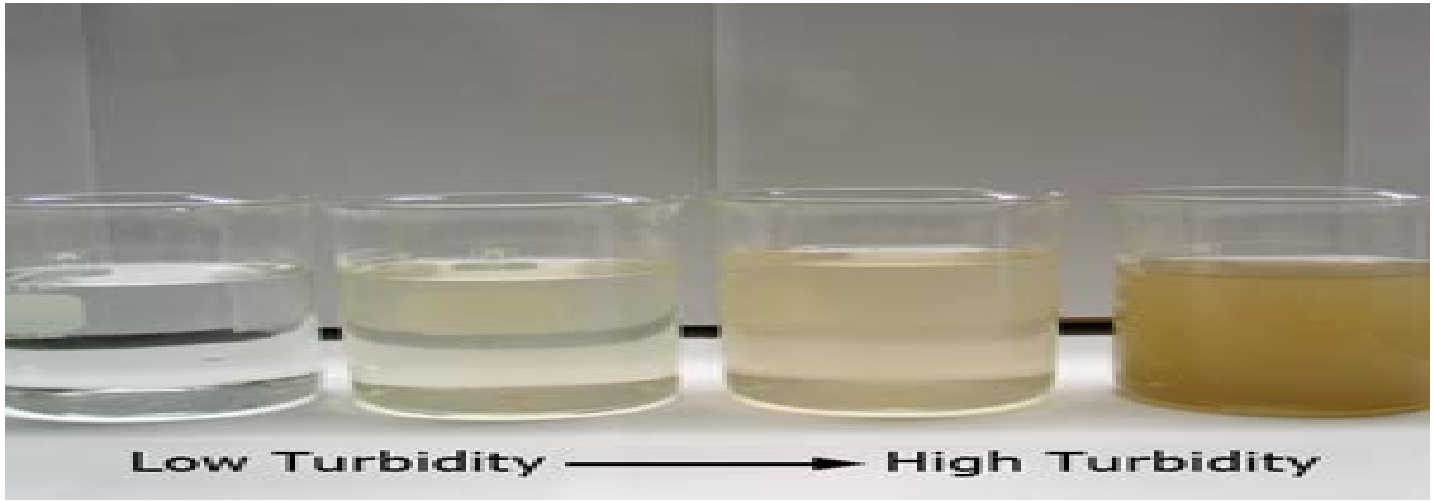
Table 11. Statistical summary of Chester County Index of Biotic Integrity scores from 18 fixed-location sites in the Stream Conditions of Chester County Biological Monitoring Network, Chester County, Pennsylvania, 1998–2009.

[USGS, U.S. Geological Survey; CC-IBI, Chester County Index of Biotic Integrity]

USGS station number	USGS site identifier	Stream	Number of samples	1998–2009 mean CC-IBI	Maximum CC-IBI	Minimum CC-IBI	Median CC-IBI
01472080	10	Pigeon Creek near Slonaker, Pa.	12	81.75	97.95	60.77	81.12
01472157	15	French Creek near Phoenixville, Pa.	12	88.92	96.45	74.60	90.26
01472190	5	Pickering Creek near Phoenixville, Pa.	12	73.72	86.57	59.24	74.14
01473169	52	Valley Creek at PA Turnpike Br. near Valley Forge, Pa.	12	42.83	52.66	36.45	42.09
01475850	53	Crum Creek near Newtown Square, Pa.	12	58.46	64.25	41.49	59.39
01476450	81	Ridley Creek at Rt. 3 near Willistown, Pa.	9	55.38	64.08	45.73	55.33
01476835	24	East Branch Chester Creek at Westtown, Pa.	12	45.91	59.14	38.32	44.78
01478120	28	East Branch White Clay Creek at Avondale, Pa.	12	53.06	66.63	45.13	51.02
01478230	58	Middle Branch White Clay Creek near Avondale, Pa.	12	58.87	75.03	44.30	58.54
01479700	55	West Branch Red Clay Creek near Kennett Square, Pa.	12	39.59	50.81	23.78	43.73
01479800	26	East Branch Red Clay Creek near Five Points, Pa.	12	50.01	59.59	41.19	49.11
01480300	57	West Branch Brandywine Creek near Honey Brook, Pa.	12	48.68	55.67	41.74	48.94
01480617	56	West Branch Brandywine Creek at Modena, Pa.	12	37.21	46.38	29.93	37.66
01480629	46	Buck Run at Doe Run, Pa.	12	81.24	95.39	66.95	81.94
01480653	42	East Branch Brandywine Creek at Glenmoore, Pa.	12	84.02	94.81	64.59	84.33
01480870	54	East Branch Brandywine Creek below Downingtown, Pa.	12	58.43	73.31	34.10	60.95
01494953	59	Big Elk Creek at Maple Grove, Pa.	12	42.70	58.37	26.41	44.02
01578347	60	East Branch Octoraro Creek near Steelville, Pa.	12	65.84	77.80	56.37	64.81

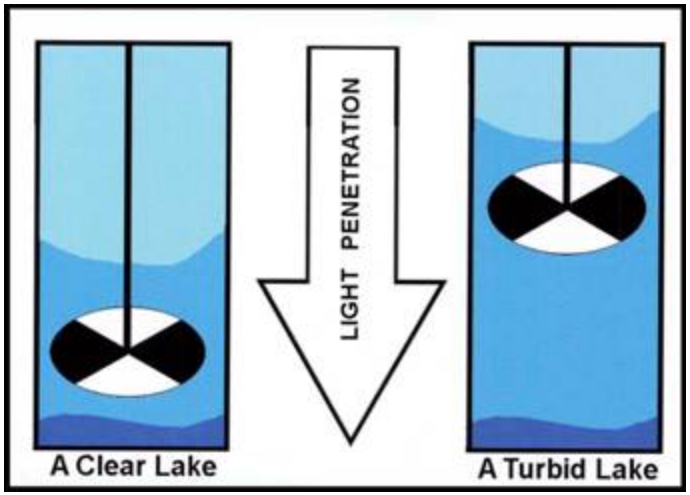
Monitoring Results-Turbidity

- Turbidity is a measurement of water clarity.
- It measures the amount of suspended material in the water which decreases light penetration.
- Turbidity can be monitored by using a Secchi disk or transparency tube.



Secchi Disk

- Lowered into water until it vanishes from sight.
- Move disk up and down at vanishing point to determine the exact length.
- Repeat measurement for quality results



Transparency Tube

- Clear, narrow, plastic tube with a dark pattern on bottom
- Water is poured in until the pattern disappears
- Measure the depth of the water column to find turbidity.

Monitoring Budget

- Cost of permanent sampling structure
  - Allot 10,000 $ for the creation of a solar powered permanent field sampling station
    - Solar panels
    - Data logger
      - Take daily readings at predetermined time
    - Permanent structure to house data logger
- Volunteer work/ participation from class will decrease cost

Benefit to the University

- Reduce West Chester University ecological footprint
- Aesthetically pleasing
- Stewardship towards endangered habitat and species
- Provide research experience to West Chester University students

Reference Sites

- www.aqua-terraenv.com/wetlands
- www.epa.gov/mrle/definitions.html
- www.dep.state.pa.us/dep/deputate/watermgt/wa/subjects
- http://www.chesco.org/DocumentCenter/View/3664