

Case Study: Watershed-Scale Restoration within 4 Years – RES Robinson Fork Mitigation Bank

Session K

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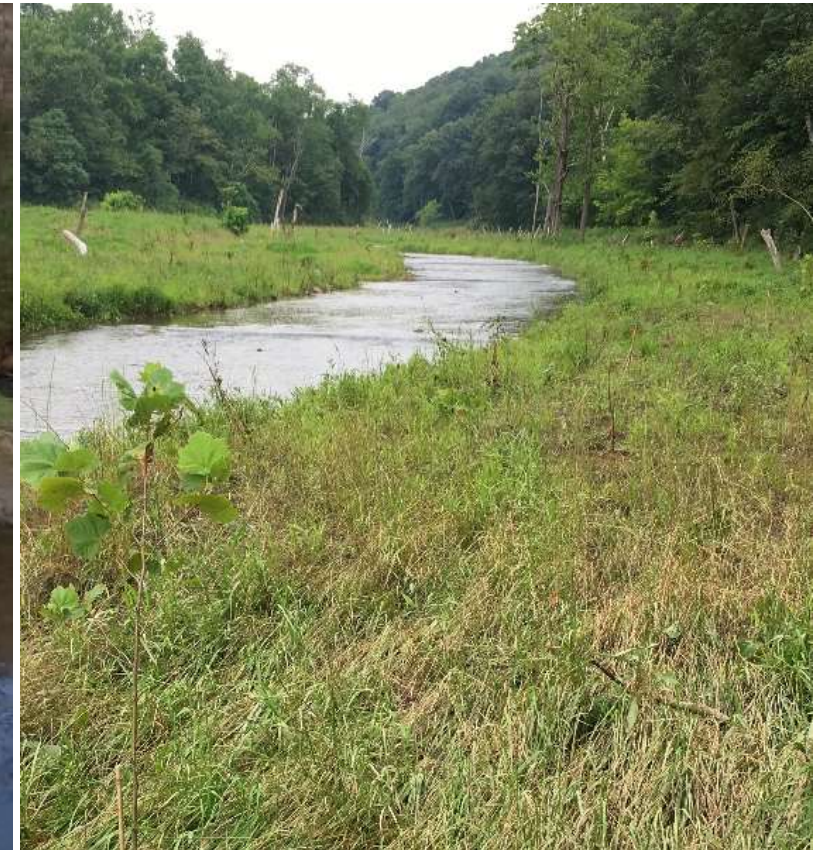


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Team

- Presenters



Mike Sachs

General Manager, Northeast



Ward Oberholtzer

Engineer of Record

- Full Team



- Land
- Ecology
- Regulatory
- Design
- Construction
- Maintenance
- Monitoring

Goals

Compensatory Mitigation & Ecological Uplift

- Restore and preserve self-sustaining, functional streams, wetlands, and riparian corridors
- Replace the functions and values lost from adverse impacts
- Restoration of an integrated and dynamic stream and floodplain system
 - Restored localized groundwater aquifers and reconnected floodplains to the water table and streams
 - Diversified habitat while also creating a hydrologic system that allowed for the retention of nutrients, stream bed material, and organic carbon.

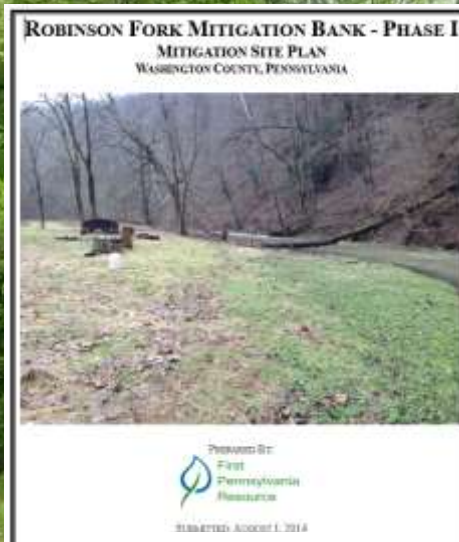
Table 2: Credit Release Summary

Project Phase	Stream Credit Release Requested	Wetland Credit Release Request
Administrative Release (R1)	11,668.94	7.33
Administrative Modification based on Final Design (R2)	2,547.15	(1.73)
1 st As-Built Release (R2)	5,768.47	2.00
2 nd As-Built and Monitoring Release (R3)	14,753.09	6.86
3 rd As-Built and Monitoring Release (R4)	35,082.75	12.94
4 th Monitoring Release (R5)	15,476.12	6.24
5 th Monitoring Release (R6)	9,213.67	9.54
Current Total Releases	94,510.19	43.18
Remaining Releases	0.00	1.18
Current Requests (R7)	Not Applicable	1.18

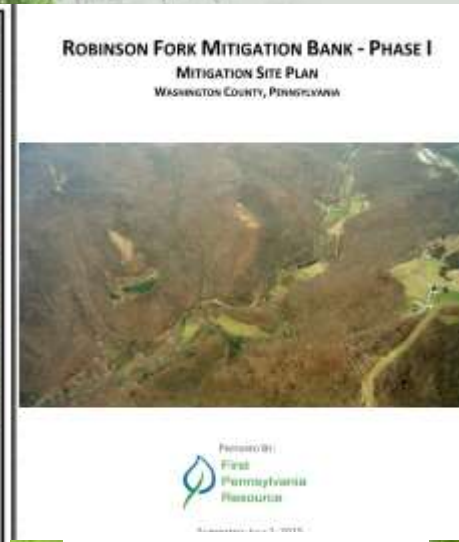
Goals

“Watershed-scale features, such as aquatic habitat diversity, habitat connectivity, and other landscape scale functions”





Planning
2014



Permitting
2014 - 2015

Table 4: Construction Completion Summary

Reach Name	Construction Completed
UNT 4D	Fall 2015
McCulley	Fall 2016
Upper Molinari (Main Stem 1)	Winter 2016/2017
Molinari Trib	Winter 2016/2017
Lebanik (Main Stem 2)	Summer 2017
Lake Reach (Main Stem 2)	Summer 2017
Beham	Summer 2017
UNT 2	Winter 2016/2017
Curry	Summer 2017
UNT 4	Summer 2017
UNT 4C	Summer 2017
Lower Molinari (Main Stem 1)	Summer 2017
UNT 0	Summer 2017
E1	Spring 2016
E2	Spring 2016
E3	Spring 2016
E4	Spring 2016
E5	Spring 2016
E6	Summer 2016

Construction
2016 - 2017



Monitoring
2017-2021

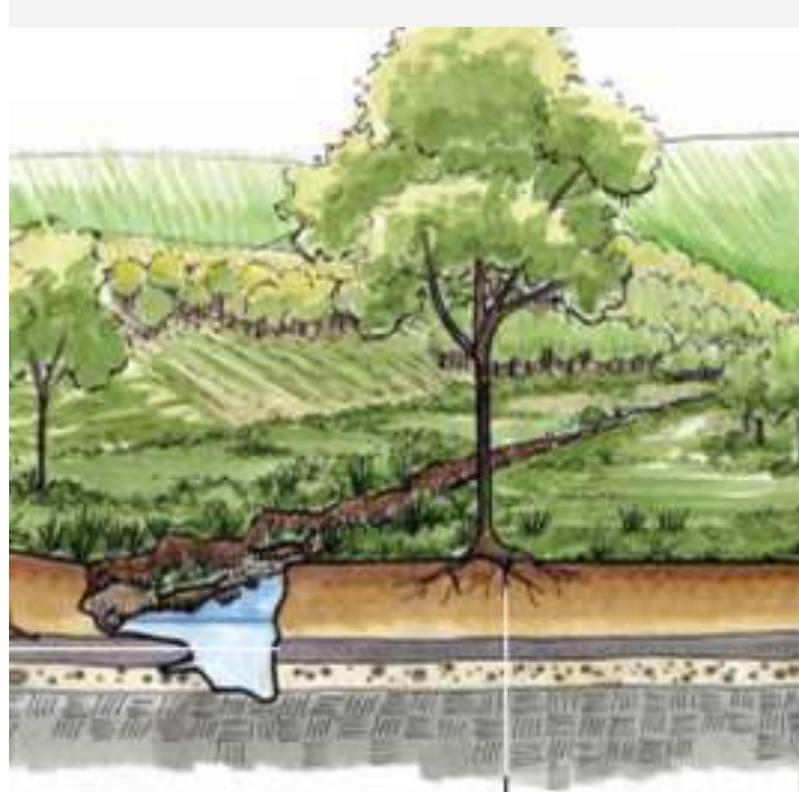
Goals

Accelerated Schedule

Approach



Causes of Impairment



Pre-Restoration
Conditions



Restoration Approach

Prototypes



Enhancement
Tributary



Rehab.
Tributary



Rehab.
Mainstem



Restoration
Medium to
Large Stream



Alluvial Fan
Restoration



Headwaters
Restoration

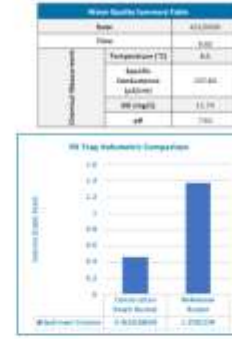
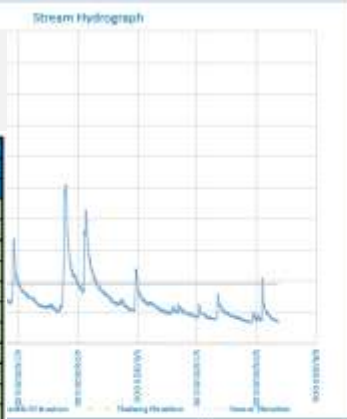
Results

Performance Standards

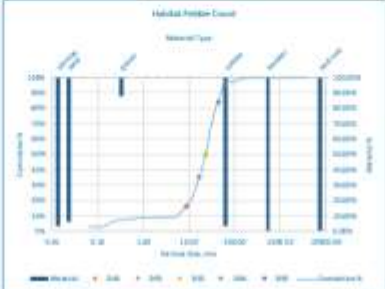
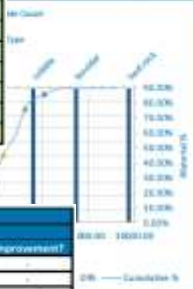
Data Collection for Permit Compliance

Comparison of Baseline to Post-Construction

Reach	Cross-section	Baseline	2017		2018		2019		2020	
			Value	Improvement?	Value	Improvement?	Value	Improvement?	Value	Improvement?
			Value	Improvement?	Value	Improvement?	Value	Improvement?	Value	Improvement?
4D	1	Extn	35.10		47.53	Yes	Not Sampled	49.54	Yes	
McCully	1	Hj	49.92		37.08	-	49.58	-	67.46	Yes
McCully	2	Hj	40.77		42.76	Yes	60.10	Yes	73.59	Yes
Upper Molinari	1	Hj	47.52		65.16	Yes	Not Sampled	55.29	Yes	
Upper Molinari	2	Hj	47.52		52.38	Yes	Not Sampled	62.33	Yes	
Molinari Trib	1	Very	48.32		62.61	Yes	Not Sampled	68.25	Yes	
Molinari Trib	2	Hj	35.19		70.73	Yes	Not Sampled	65.61	Yes	
Lebanik	1	Hj	37.08		Not Sampled		56.82	Yes	56.73	Yes
Lebanik	2	Hj	42.83		Not Sampled		42.97	Yes	47.08	Yes
Lebanik	3	Mod	42.83		Not Sampled		45.56	Yes	48.18	Yes
Lake Reach	1	Hj	42.41		Not Sampled		39.07	-	50.77	Yes
Lake Reach	2	Mod	33.65		Not Sampled		46.57	Yes	71.70	Yes
Beham	1	Very	62.67		Not Sampled		47.91	-	62.69	Yes
Beham	2	Mod	54.48		Not Sampled		57.37	Yes	66.89	Yes
UNT2	1	Extn	53.16		Not Sampled		47.72	-	67.38	Yes
Curry	1	Hj	31.63		Not Sampled		51.99	Yes	66.37	Yes
UNT4	1	Hj	50.53		Not Sampled		51.18	Yes	65.10	Yes
UNT4C	1	Extn	35.1		Not Sampled		66.71	Yes	49.64	Yes



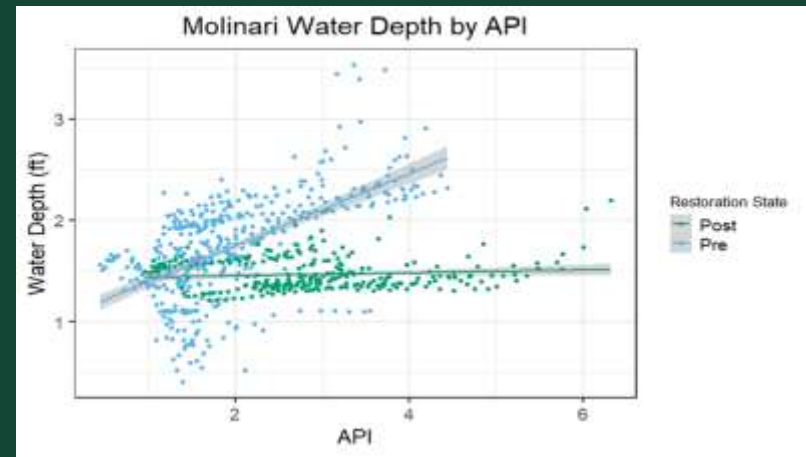
Parameter	Observed	Permit
Turbidity	1.2	1.0
Total Suspended Solids	150	100
Dissolved Oxygen	8.5	8.0



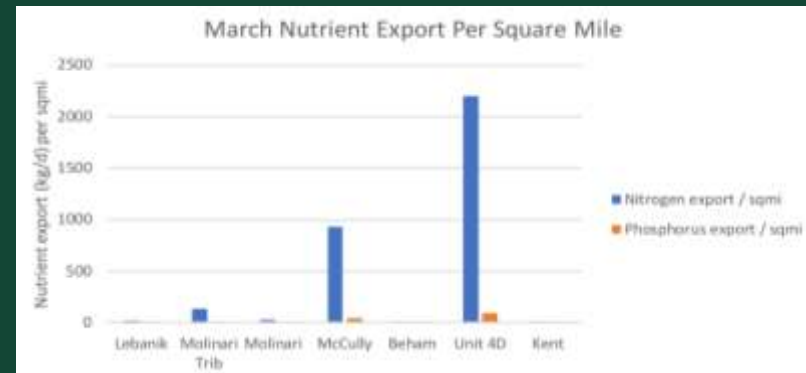
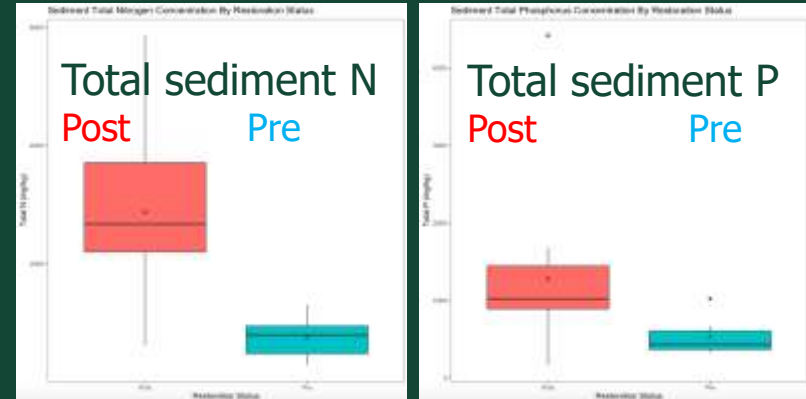
Floodplain Reconnection:

- Tends to reduce “flashy” storm response, limiting erosion

Illustrated by plots of historical Annual Precipitation (2013-2019) and water depth. This stream is less influenced post restoration (green) by periods of high precipitation compared to pre-restoration (blue)



- Retains fine grained sediments and sediment nutrients post restoration
- Retains phosphorus in floodplain wetlands
- N and P export per sq mi varies by site, month
- Algal biomass correlated more with stream size than restoration status...but supported greater scraper-grazer and collector-filterer macroinvertebrate biomass and fish densities
- Current work includes instream woody debris and functional measures of leaf litter dynamics



Dr. Natalie Kruse-Daniels

Jen Bowman

Nora Sullivan

Dr. Kelly Johnson

Students:

Annika Gurrola, Jordan Pazol, Ashley Widener, Jacob South,

Tatiana Burkett, Kelly Love



Results

Highlights – Restoring the Systems

- Wetland soils in under 5 years
- Floodplain connectivity and frequent interaction
- Baseflow sustained, groundwater connectivity
- Bank stability
- Riparian buffers, vegetation and site protection
- Substrate improvements, by prototype

Highlights – Restoring Biodiversity

- High diversity of hydrophytic vegetation and very low invasive cover
- Macroinvertebrates indices improved
- Fish range expanded and population increased
- Mountain chorus frog, RTE species



Beham, Narrow Prototype

Approach

Regulatory FAQs

1. “How can the stability be assured without reliance on the Natural Channel Design techniques and detailed bank stabilization and grade control structures?”
 - Response: Hydrologic/hydraulic design for sustainable vegetative stabilization, designing for 100-yr storm event
 - Validation: BEHI, pebble counts, pit trap data, profile and cross-section surveys, estimates of sediment and carbon deposits



Lebanik, 9 Months Post Construction



Molinari, 18 Months Post Construction

Approach

Regulatory FAQs

2. “If the post-restoration system retains sediment, how can it maintain its geometry given deposition?”
 - Response: Low volume of coarse sediment, suspended sediment accumulation in floodplain
 - Validation: Monitoring surveys, visual observations



Molinari, Coarse Sediment in
Transition Pool



Molinari, Beaver Activity Year 6

Approach

Regulatory FAQs

4. “Will biodiversity be limited if the design does not layout bed facets?”
- Response: Hydrologic/hydraulic design for very low bedload transport, bedform diversity by design but with little specificity in drawings, LWD
 - Validation: long-pro surveys, LWD data, macroinvertebrate and fish sampling results



Molinari, Existing Condition Bedrock Substrate



Molinari, Post Restoration Substrate
and Bed Facets

Approach

Regulatory FAQs

6. “Is the type of resource being created out-of-kind with the resources being impacted?”
- Response: Lost functions and values, ecosystem services, historic wetlands buried below sediments
 - Validation: Ecological functional assessments, wetland delineation, estimation of invasive cover, native vegetation



Enhancement Reach, Low Disturbance



McCulley, Gulley Fill

Approach

Community FAQs

2. “Will the un-mowed site and large woody debris look abandoned and unattractive?”
 - Response: Temporary abandoned look, eventually mature, diverse native vegetation
 - Validation: Vegetation monitoring data



Molinari, Valley-Wide Restoration

Approach

Community FAQs

3. “Will the clearing of trees harm the environment?”

- Response: Temporary disturbance to a degraded resource.
- Validation: Ecological functional assessments, wetland delineation, estimation of invasive cover, native vegetation



UNT 4D, 6 Years Post Construction



UNT 4, Surrounding Landscape

“Watershed-scale features, such as aquatic habitat diversity, habitat connectivity, and other landscape scale functions”

Approach

Community FAQs

4. “Why is it necessary to excavate so much of the valley?”
 - Response: Distance from existing floodplain surface to groundwater, sustainable hydrology/hydraulic, excavate to coarse substrate
 - Validation: Monitoring surveys, vegetation monitoring, wetland delineation



Lake Reach, Valley-Wide Restoration


Questions & Answers

For more information:

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Stop by booth #20

 Follow @Resource Environmental Solutions

