Conservation Cooperation: Working Together at All Levels to Reduce Nutrient Runoff

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Stormwater Conference
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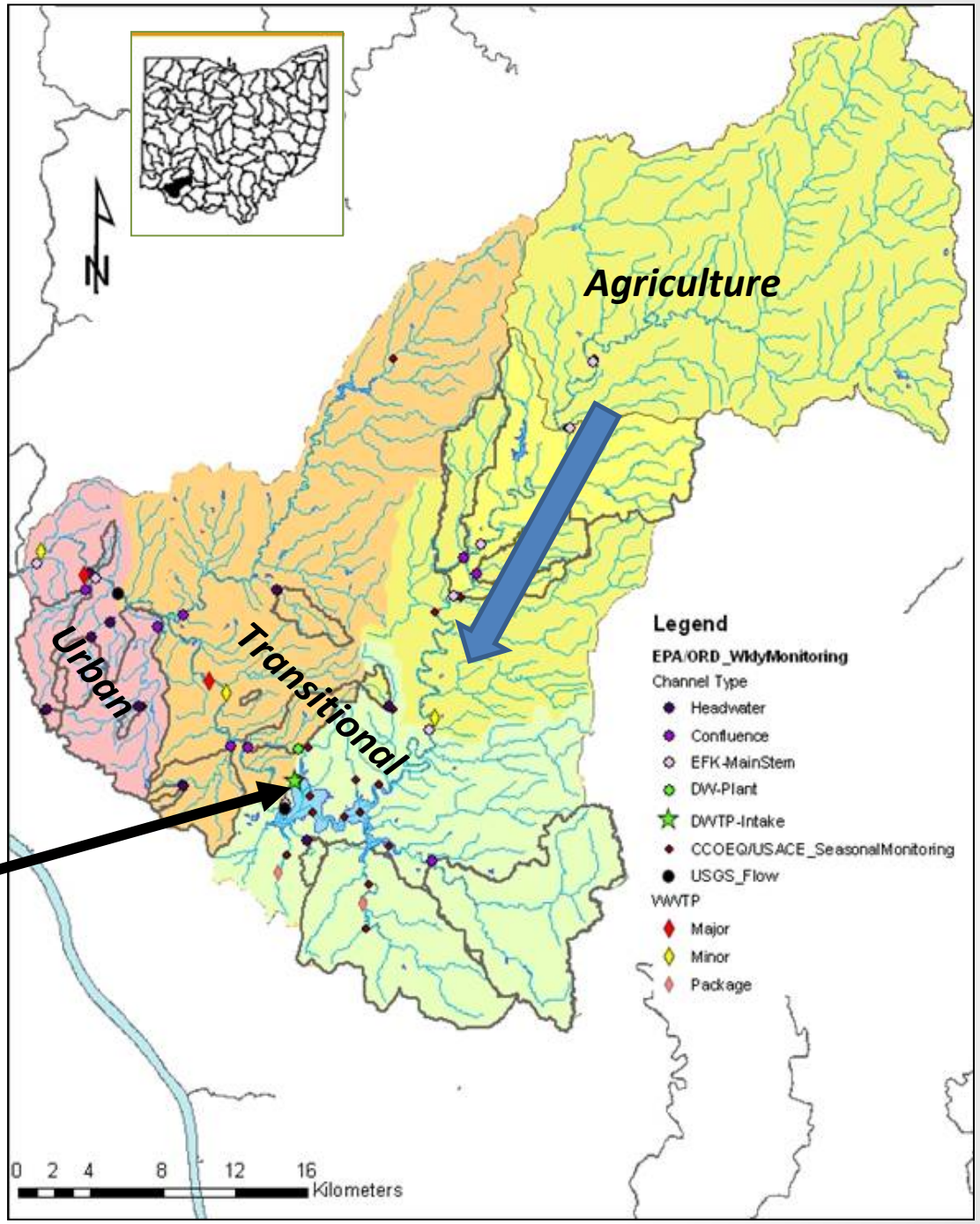
East Fork Lake

2000 acre water surface
345 mi^2 of upland drainage
- 64% agriculture
- avg. farm 8 acres
- 1.5 % imperviousness

4 uses
- flood control
- drinking water source
- recreation (State Park, 2 beaches)
- downstream protection (min 30 cfs discharge)

20 MGD DWTP



Cooperative Effort

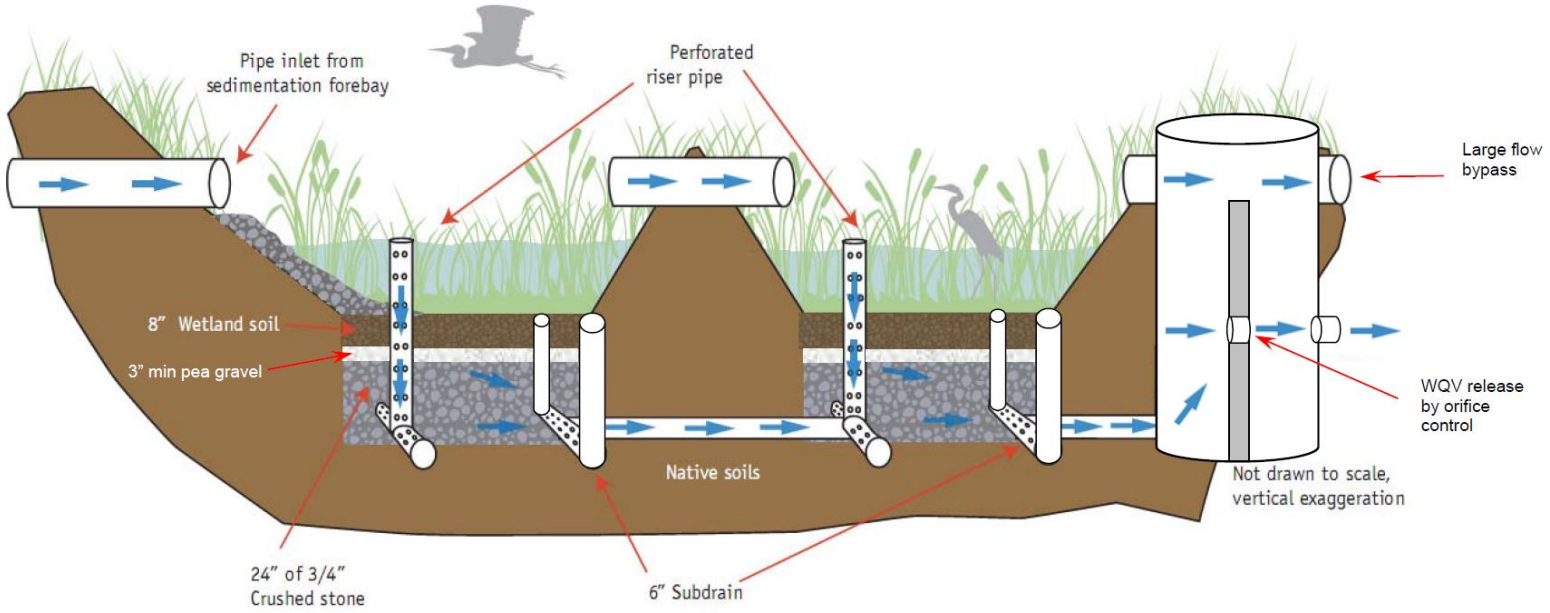
- Many agencies have combined their efforts to study and make water quality decisions in the EF Watershed.
- This collaborative consists of federal, state, local, and private partners to collect data and implement projects.
- In 2011 this collaborative partnered with Hazen and Sawyer with a grant from USDA to study an innovative BMP.

Goals of Project

Capture Nutrients in an Agricultural Setting

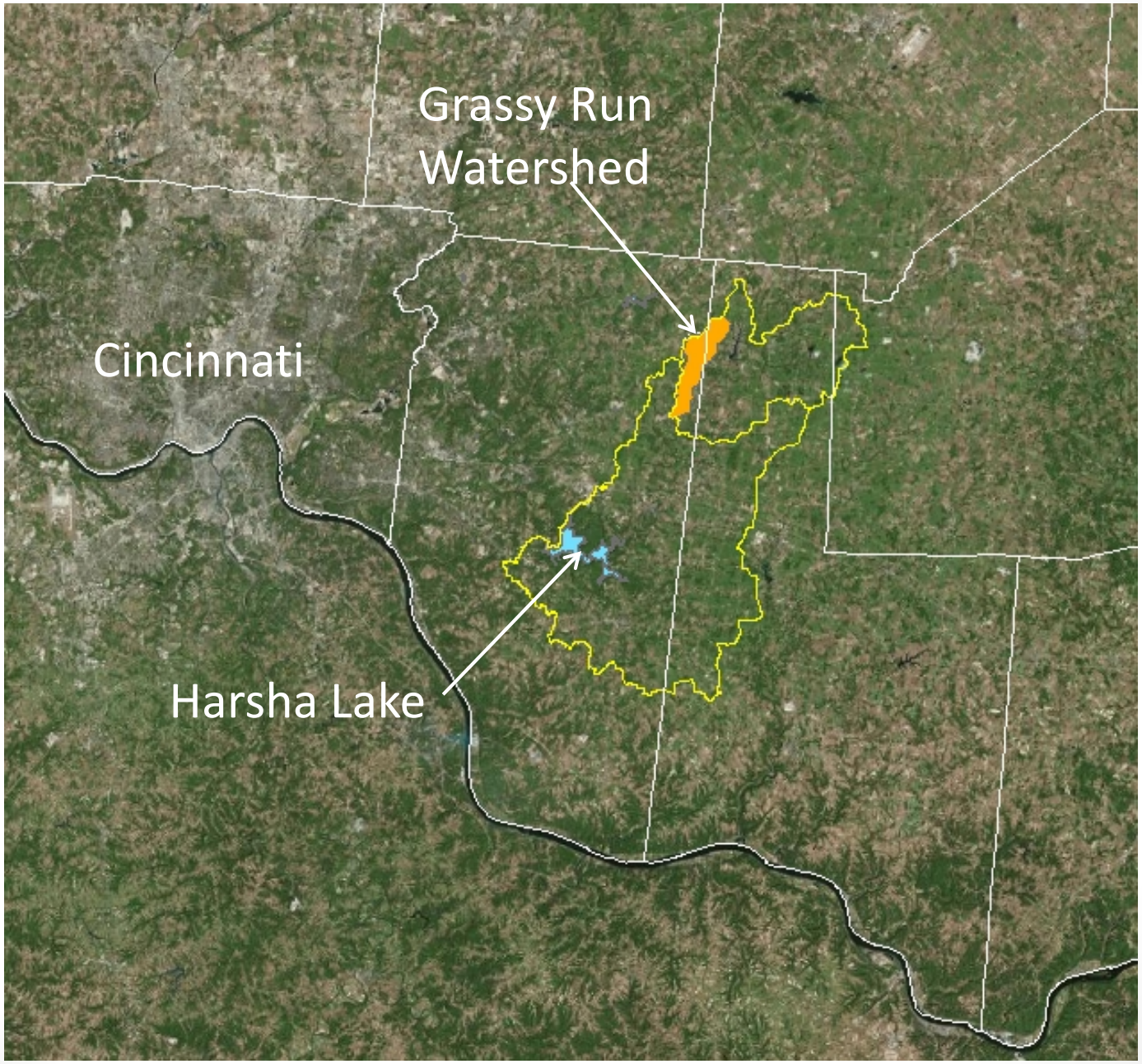
Use a Modified Urban Stormwater Basin to Remove Sediments, Phosphorus, AND **Nitrogen**

Submerged Vegetative Wetland



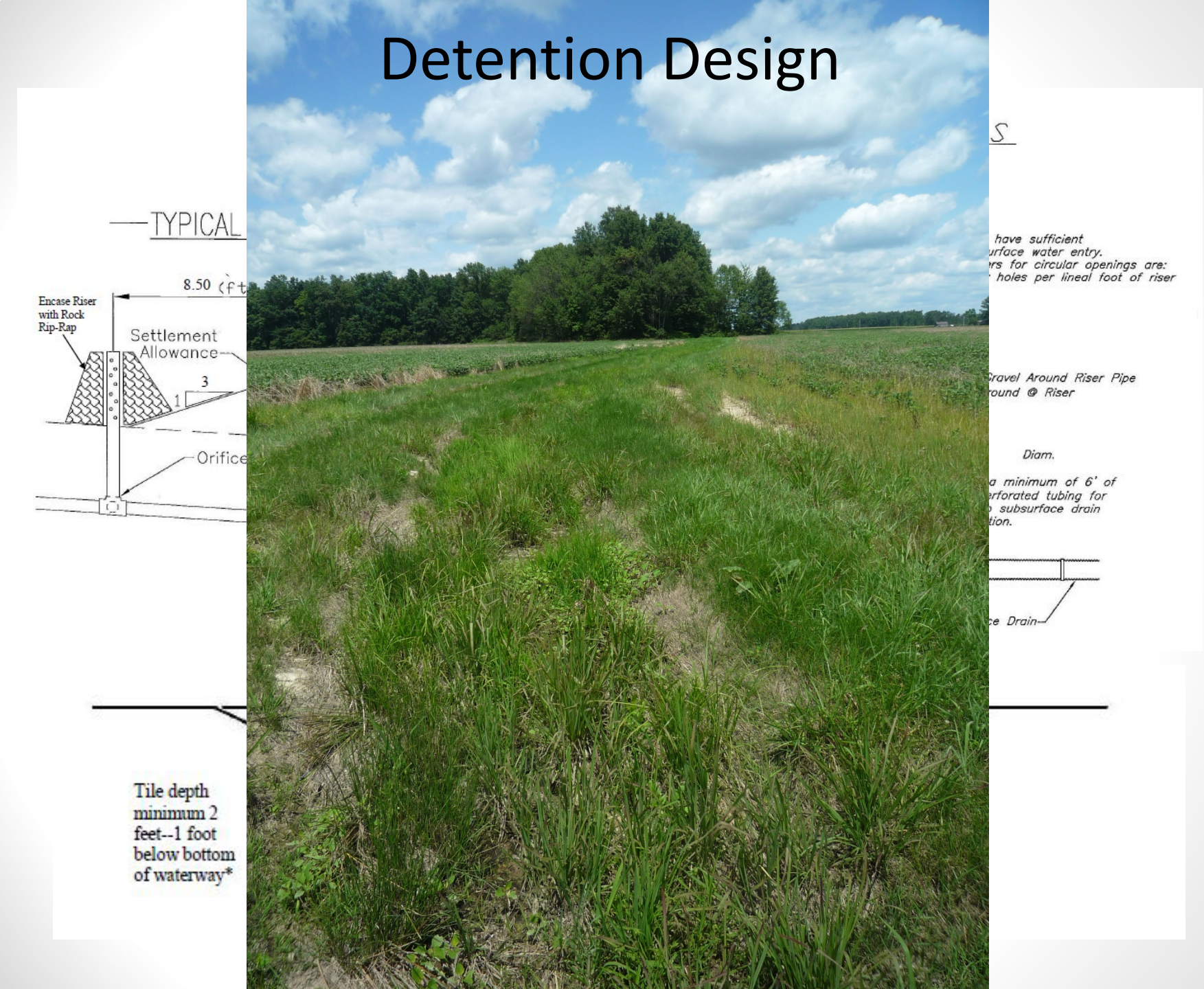
University of New Hampshire Stormwater Center (UNHSC)
Gregg Hall • 35 Colovos Road • Durham, New Hampshire 03824-3534 • http://www.unh.edu/erg/cstev

Project Area

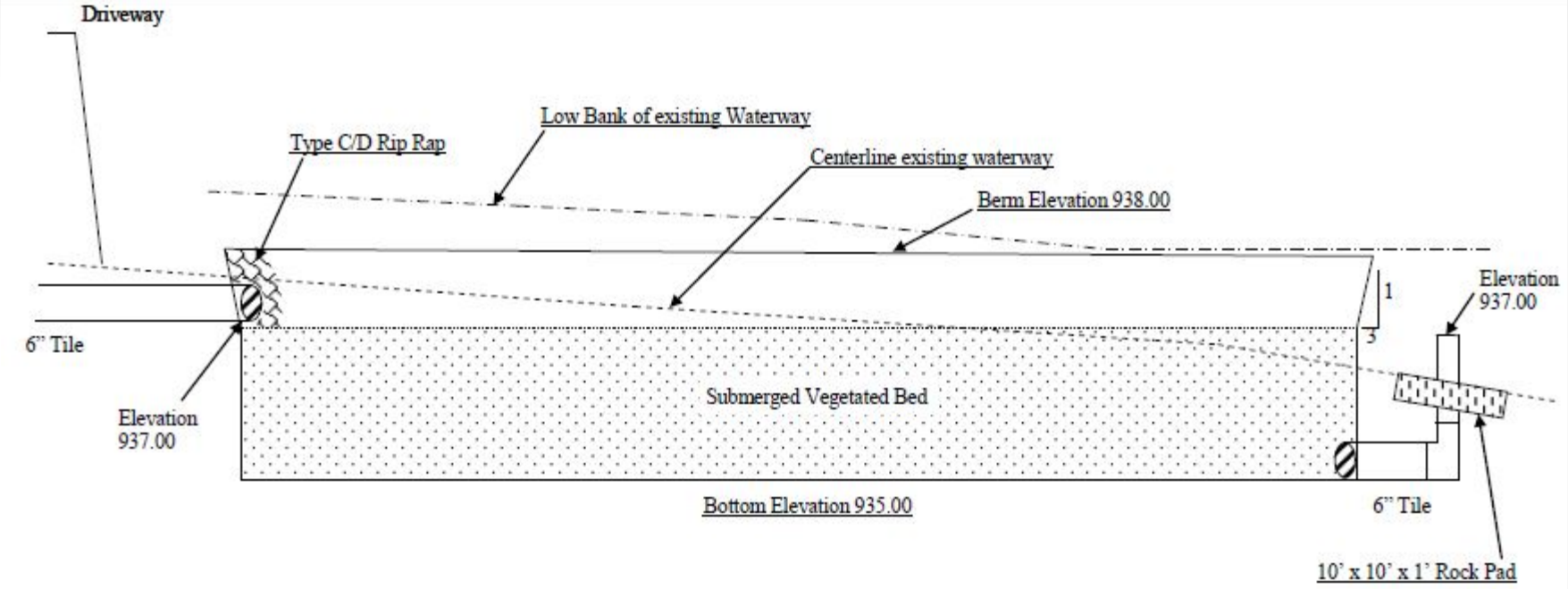


Project Layout

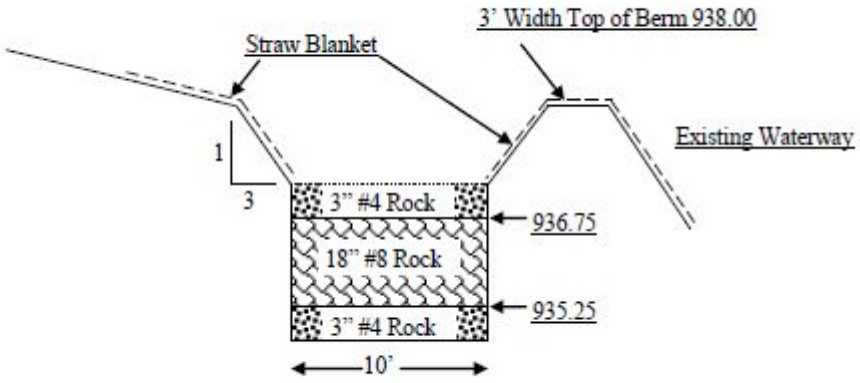
Detention Design



Submerged Vegetative Bed Design



Typical Profile of Submerged Bed

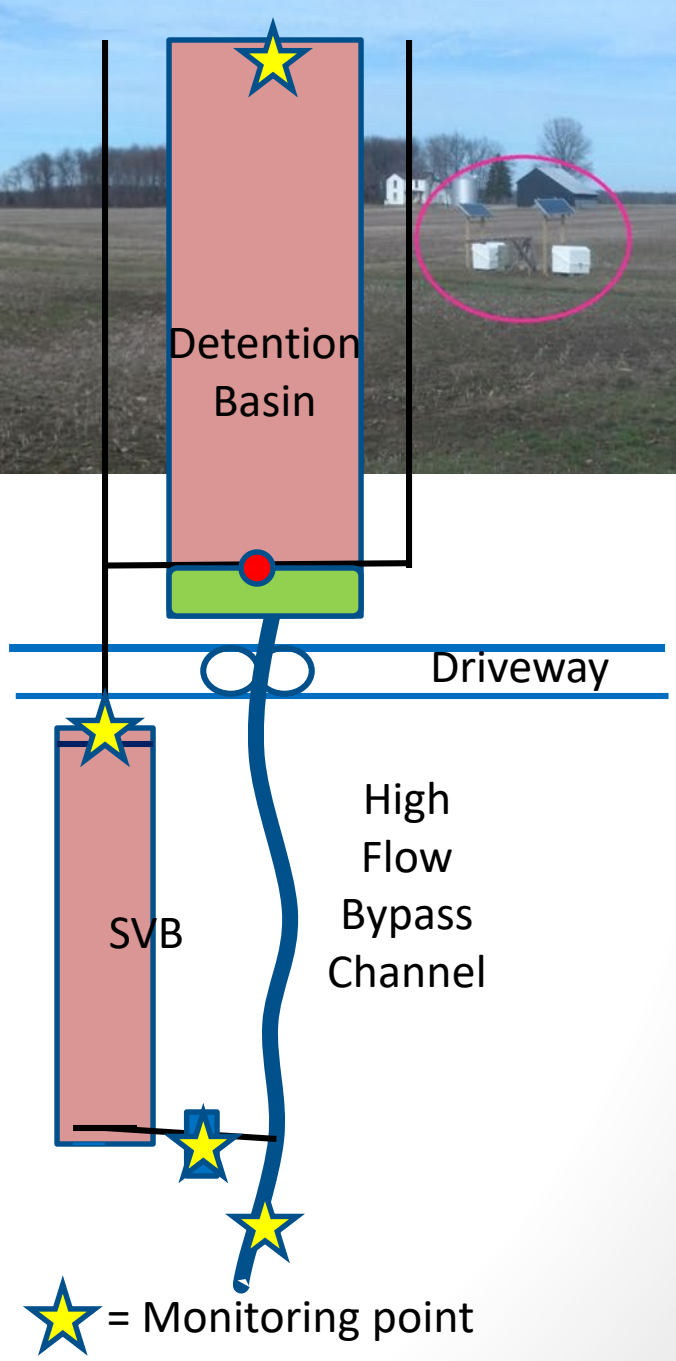



DEERE
333D

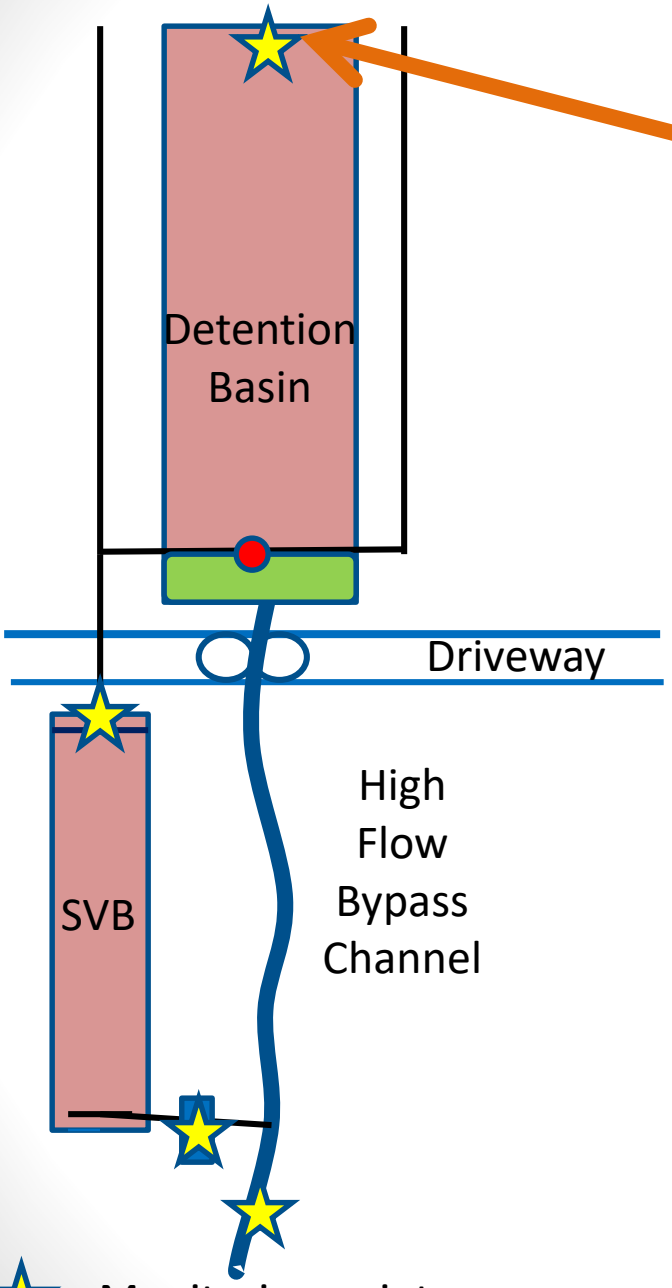

05/19/2014

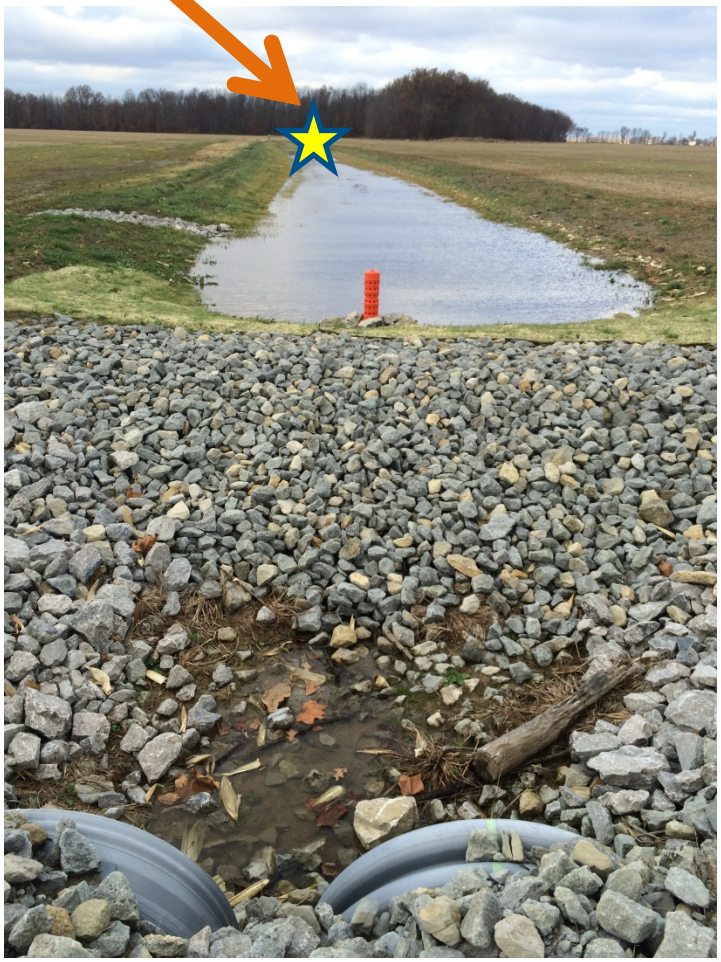
Research Questions

1. What is the nutrient removal efficiency?
   - Of the submerged vegetated bed (SVB)?
   - Of the entire system?
2. Is the system a cost effective BMP for nitrogen and/or phosphorus removal?



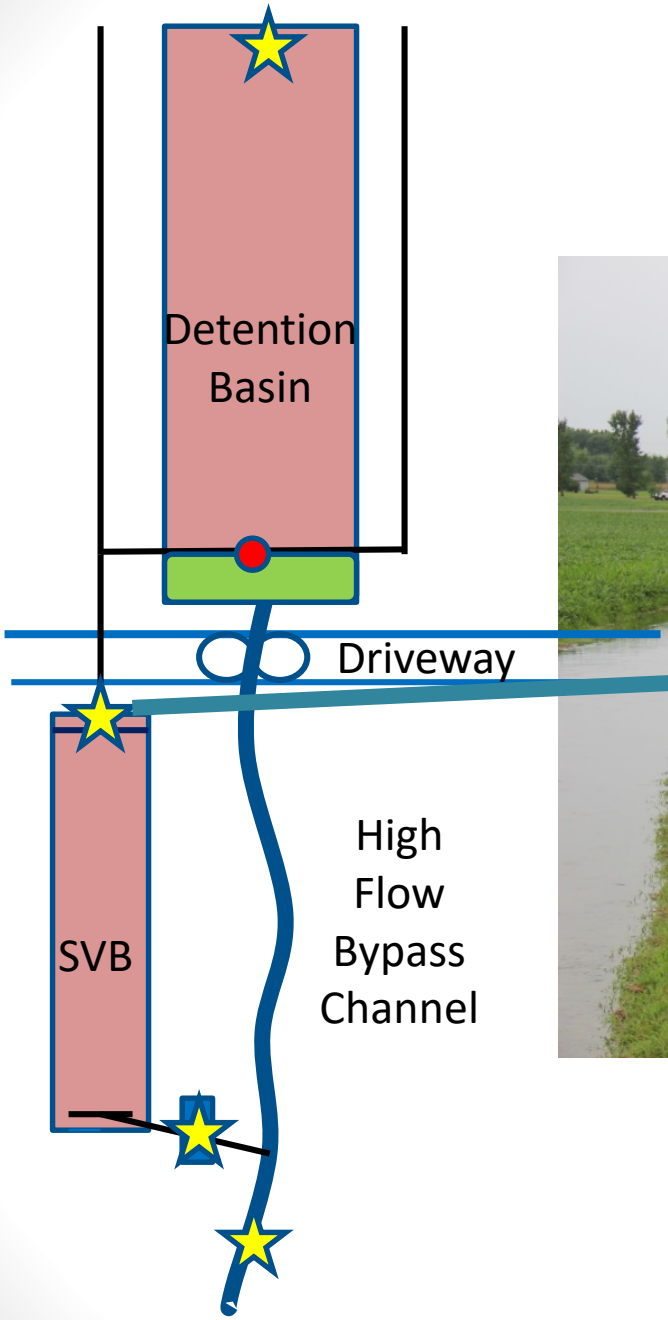
Four Monitoring Stations:
1. Upstream (CWLUS)





136 ACRE DRAINAGE

2. Influent (SVBINF)

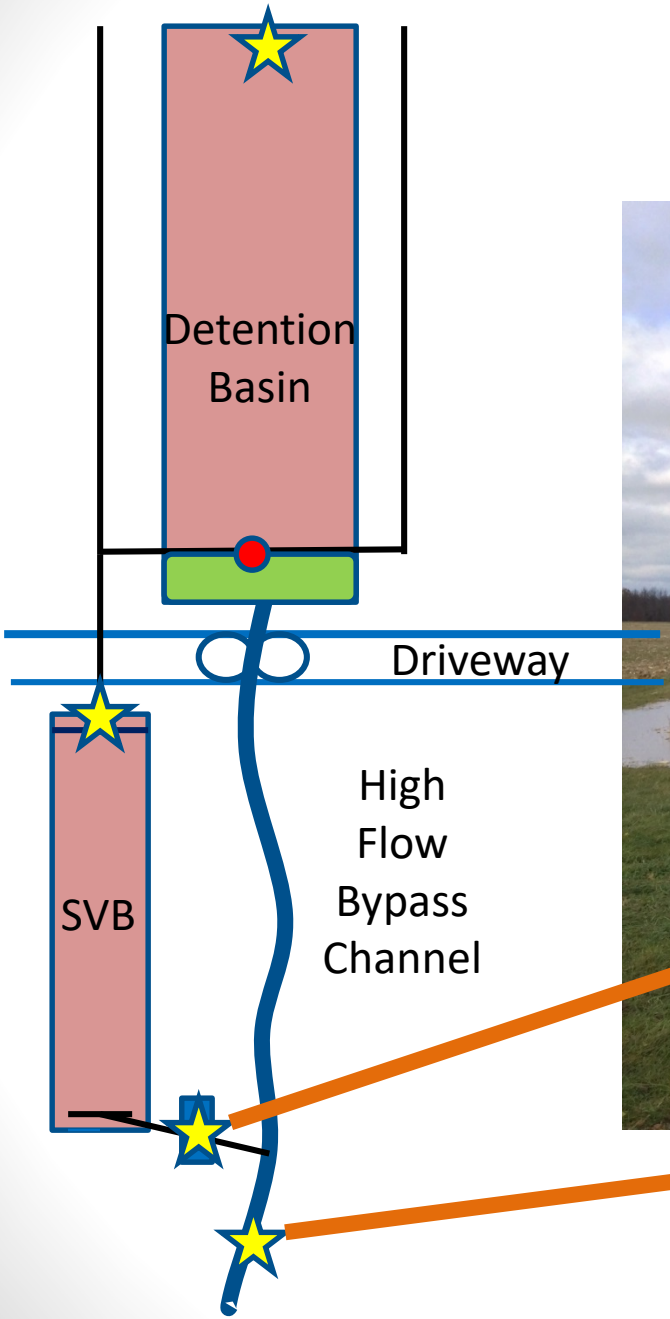


Dam is bypassing

174 ACRE DRAINAGE

3. Effluent (SVBEFF)
4. Downstream BMP (CWLBP)

190 ACRE DRAINAGE



Dam not bypassing

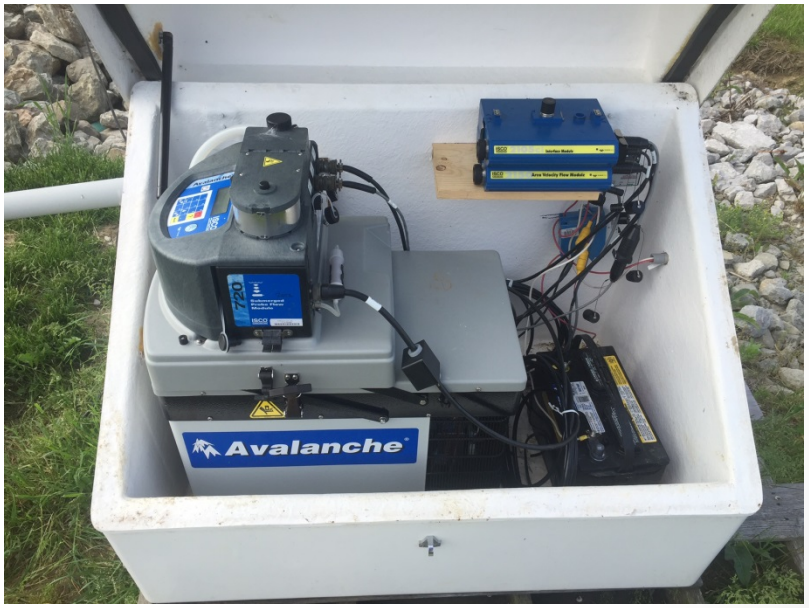
Monitoring Removal Efficiency

- Nutrient loading important to assess impact on systems downstream
- Continuous flow data
- Autosamplers

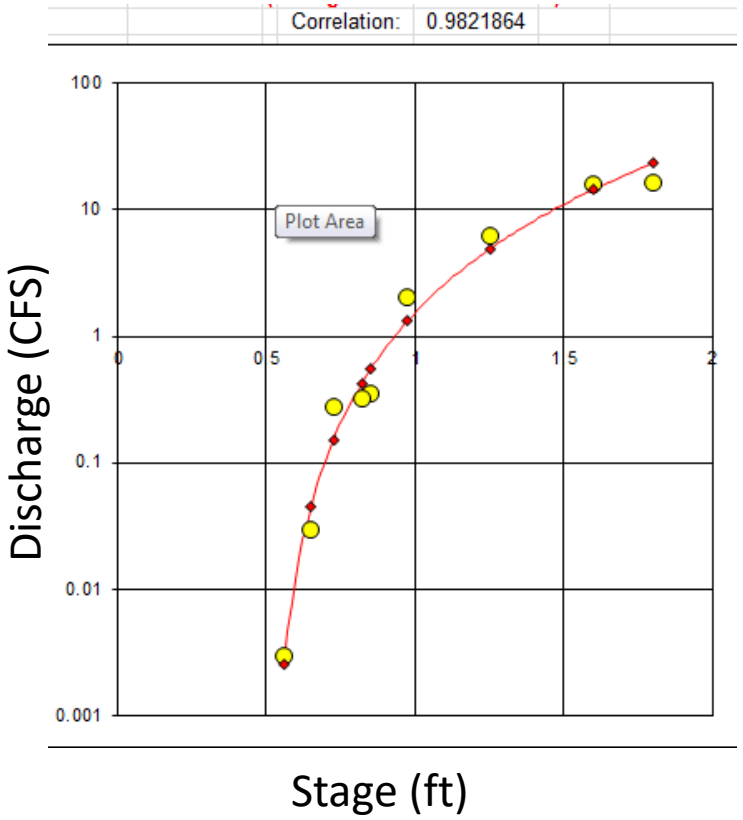
  triggered by flow
- NH_3, NO_2NO_3, TON, P_{DISS}, TP, SS
- Time paced discrete samples

  -composites
- Flow paced compositing

- Automatic samplers
- Flowmeters
- Cellular modems
- Solar Panels
- Rain Gauge

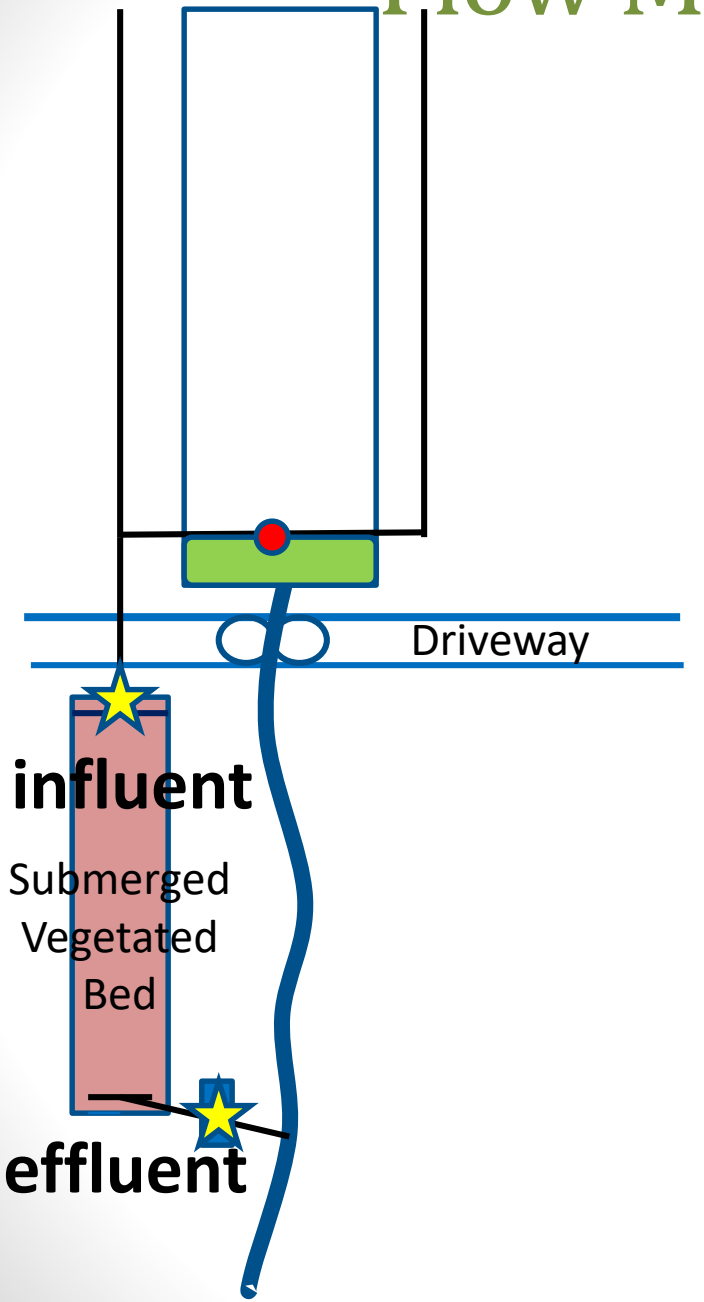


Flow Measurement-Channel Sites



- Level Sensors
  - Discharge rating curves

Flow Monitoring-SVB

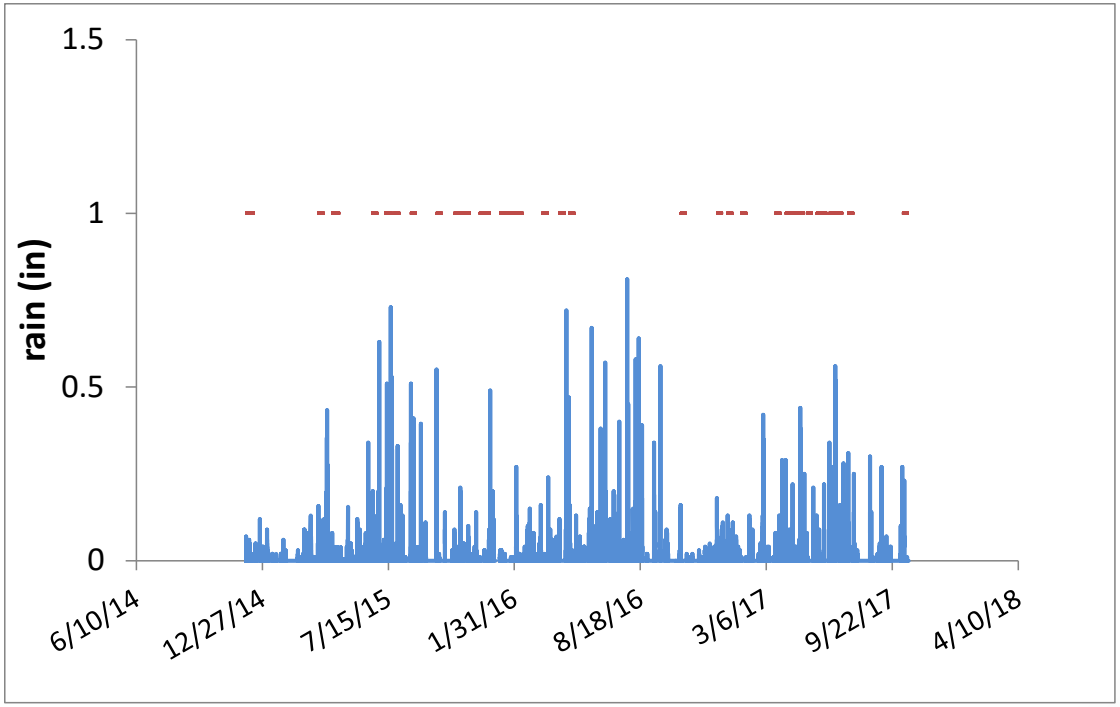


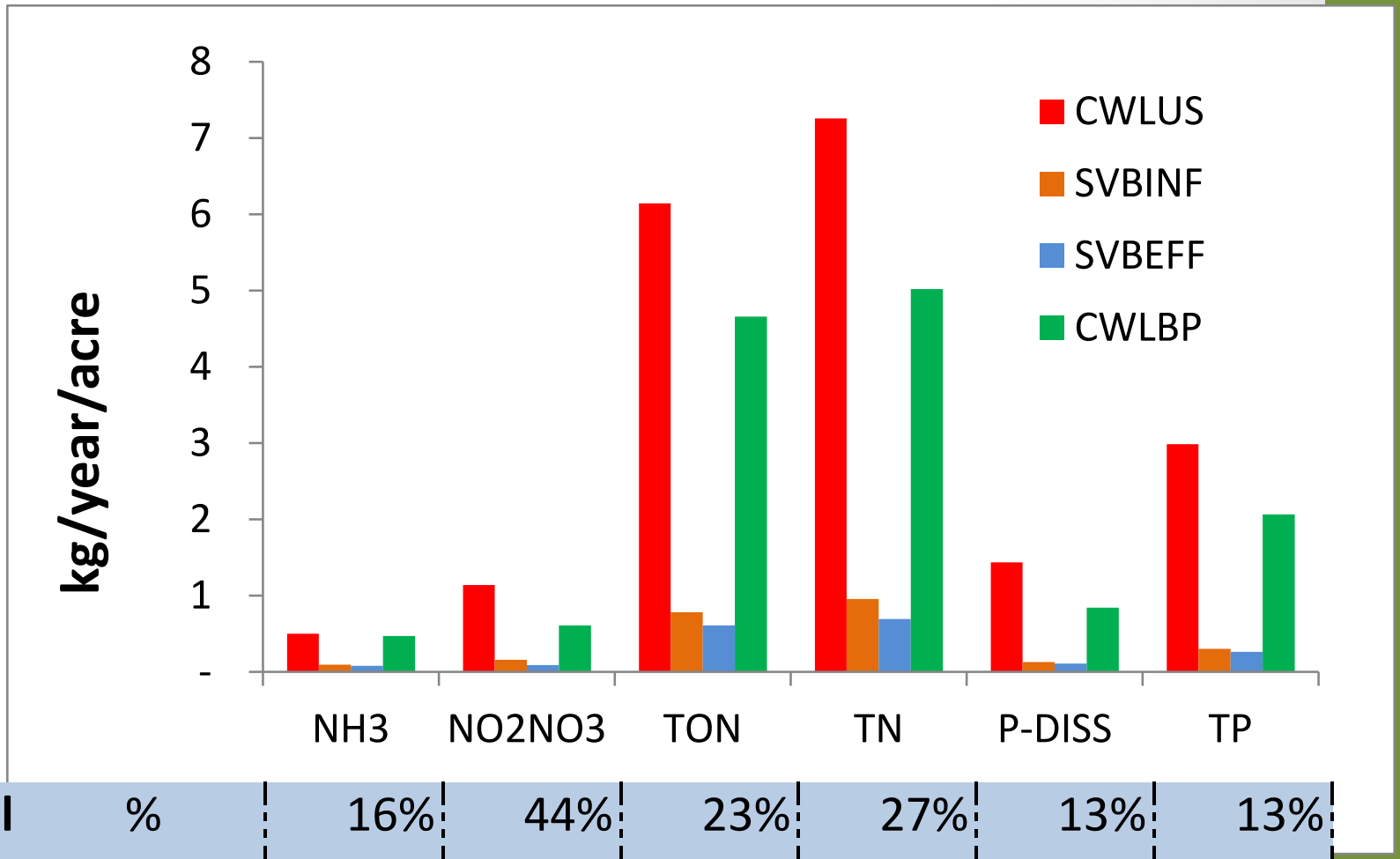
- No slope
- pressurized conditions

- 2015 Installed AVM
  - Stage
  - Velocity
  - Discharge

Results

- Summarized 48 sampling events 12/2014-10/2017
- Time paced (hourly) and flow paced composite samples
- Annual loads extrapolated
  - Event mean concentrations
  - Seasonal means (statistical differences in S/S, W, & F)

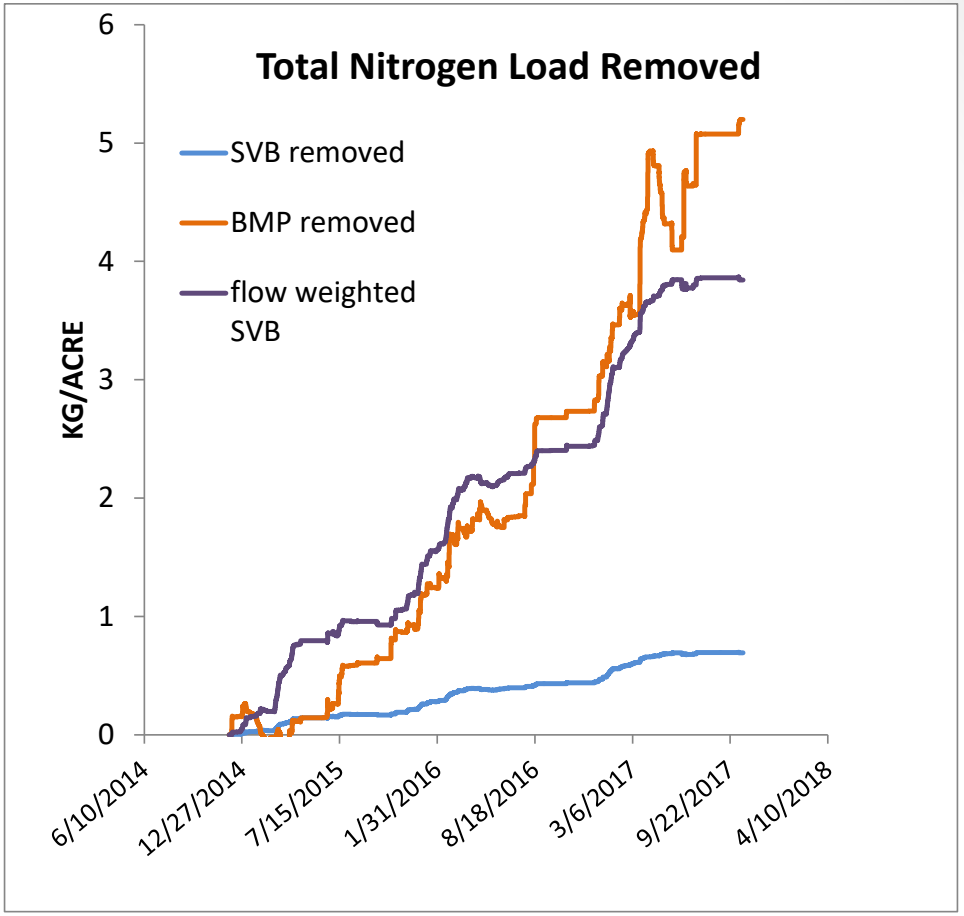




SVB removal	%	16%	44%	23%	27%	13%	13%
	kg/yr/ac	0.02	0.07	0.18	0.26	0.02	0.04
BMP removal	%	3%	40%	21%	27%	40%	30%
(excluding SVB)	kg/yr/ac	0.02	0.46	1.31	1.97	0.57	0.88
total system	%	6%	46%	24%	31%	41%	31%
removal:	kg/yr/ac	0.03	0.53	1.49	2.23	0.59	0.92

What if the SVB was sized appropriately?

- Only treats 18% of flow
- Design storm:
  - 1” rain
  - 1.5 month frequency



		NH_3	NO_2NO_3	TON	TN	$P\text{-}_{DISS}$	TP
SVB removal	kg/yr/ac	0.09	0.40	0.98	1.46	0.10	0.21
BMP removal	kg/yr/ac	0.02	0.46	1.31	1.97	0.57	0.88
total system removal:	% removal	21%	75%	37%	47%	47%	37%

Cost Effectiveness

Practice	TN ($/kg/ac.)	TP ($/kg/ac.)
Cover Crop + No Till	$ 38.02	$ 60.35
AgBMP	$ 4.32	$ 10.48

In Summary:

- It works!
- Next Steps:
  - Seasonality of nutrient removal
  - Lifespan of practice:
    - 17 (3 SVB) tons of sediment removed per year
    - Phosphorus removal efficiency
    - Structural integrity
  - EQIP practice
    - Transferability? - We saved $ with labor & wetland plant installation.

Thanks!

- Federal Partners
  - U.S. Office of Research and Development
  - USDA
  - US Army Corps of Engineers®
- State Partners
  - Ohio EPA
  - Ohio Department of Natural Resources
  - USDA ARS
- Local Partners
  - Clermont S.W.C.D. Soil & Water Conservation District
  - Farmers
  - Hazen & Sawyer
  - Clermont County Water & Sewer
  - Clermont County, Ohio Office of Environmental Quality