Adaptive Management Planning for the City of Lodi

Wisconsin Wastewater Operators Association
49th Annual Conference
October 8, 2015 | Pat Morrow, P.E.

MSA PROFESSIONAL SERVICES

Overview

- Background
- Preparation of Adaptive Management Plan
- Outreach Website Development
- Q & A/Discussion

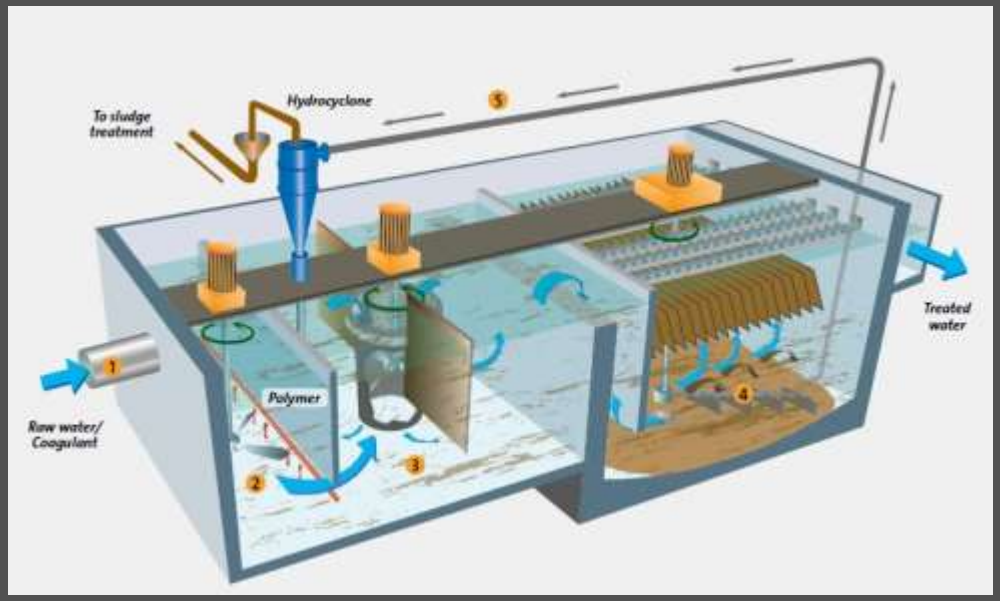
Background

- Lodi's WPDES Permit Phosphorus Limits
  - Current: 1 mg/L P
  - Future: 0.075 mg/L P

Background

WPDES Permit Compliance Schedule	
~~Submit Operations and Needs Review~~	~~December 31, 2012~~
~~Submit Facilities Planning Status Report~~	~~December 31, 2013~~
~~Submit Facility Plan~~	~~December 31, 2014~~
Refine Facility Plan	December 31, 2015
Construction Plan Submittal*	July 30, 2016*
Future Permit Requirements	
Comply with 0.075 mg/L Phosphorus Limits*	September 30, 2020*
* Items apply if upgrading the WWTF was the selected compliance option	

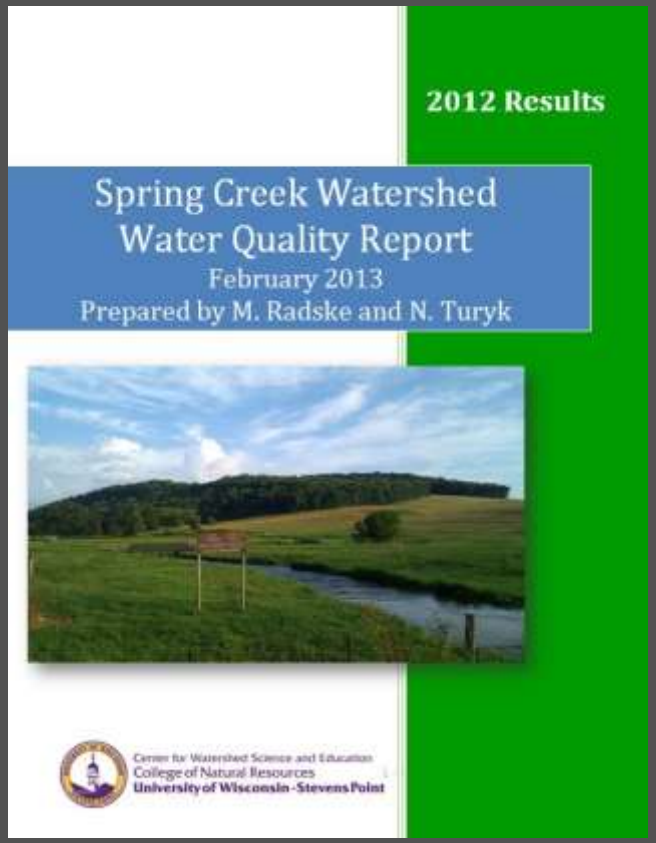
Wisconsin Phosphorus Rules

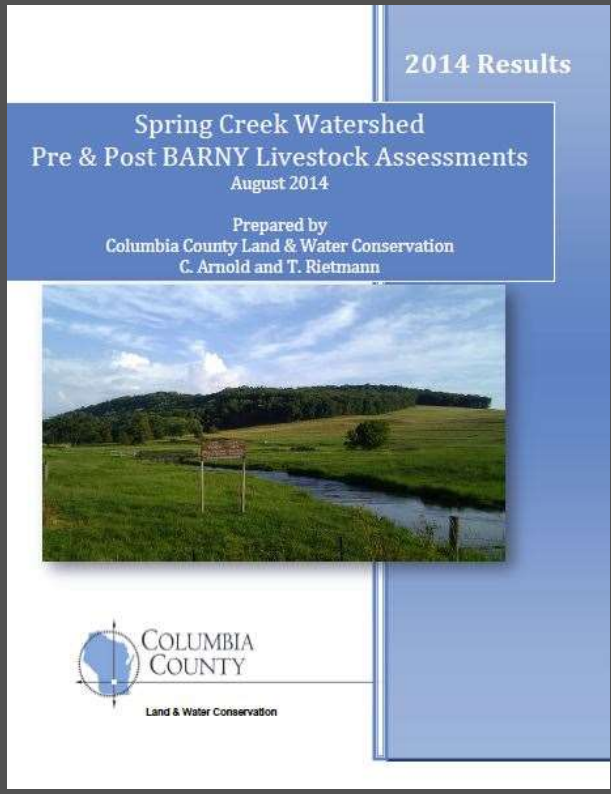


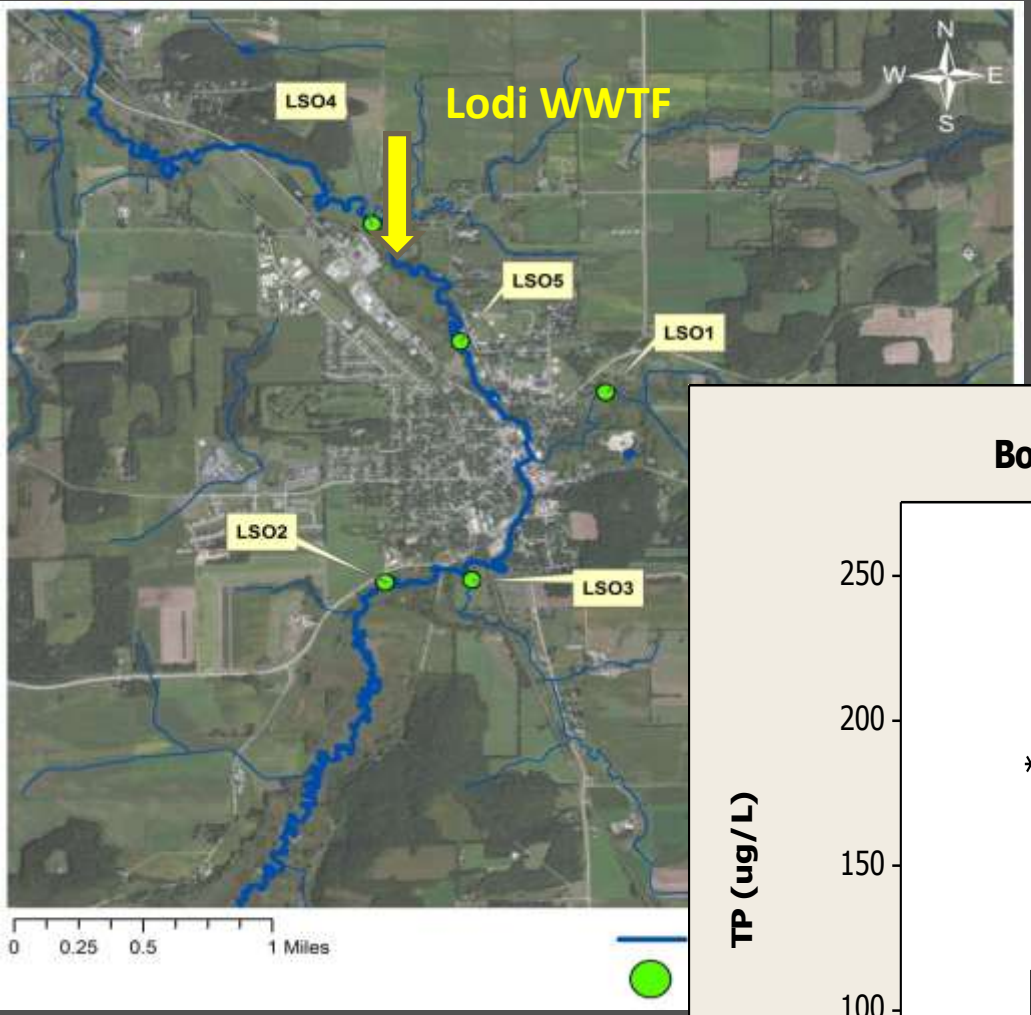
VS.

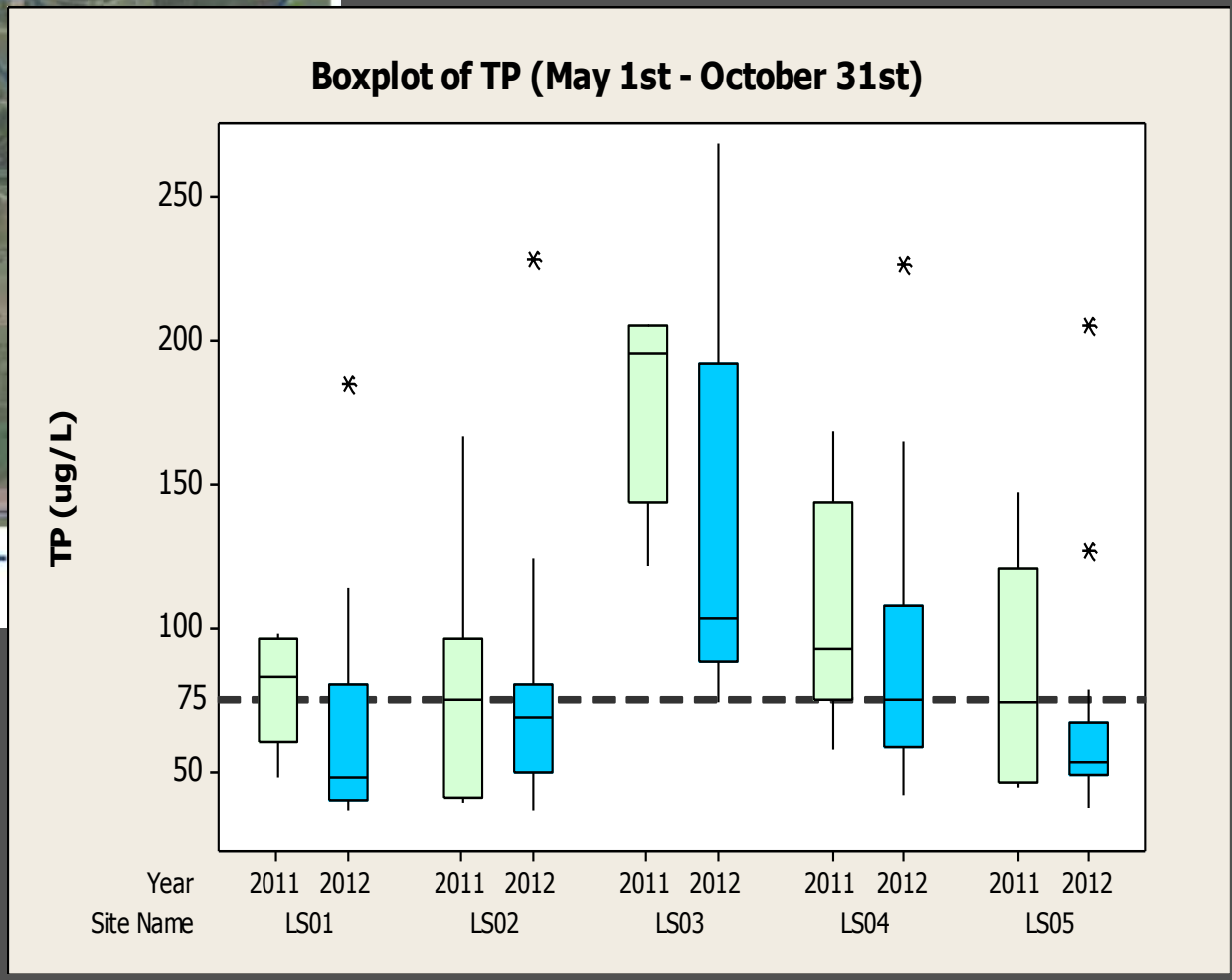
Adaptive Management

- Adaptive Management (AM)
  - Focus is on stream compliance by 2037 (20 years)
  - Spring Creek very close to limit (2011, 2012 data)
  - P reductions needed
    - ~ 600 lbs/year @current flow and A.M. interim limit
    - ~ 900 lbs/year @ design flow and A.M. interim limit



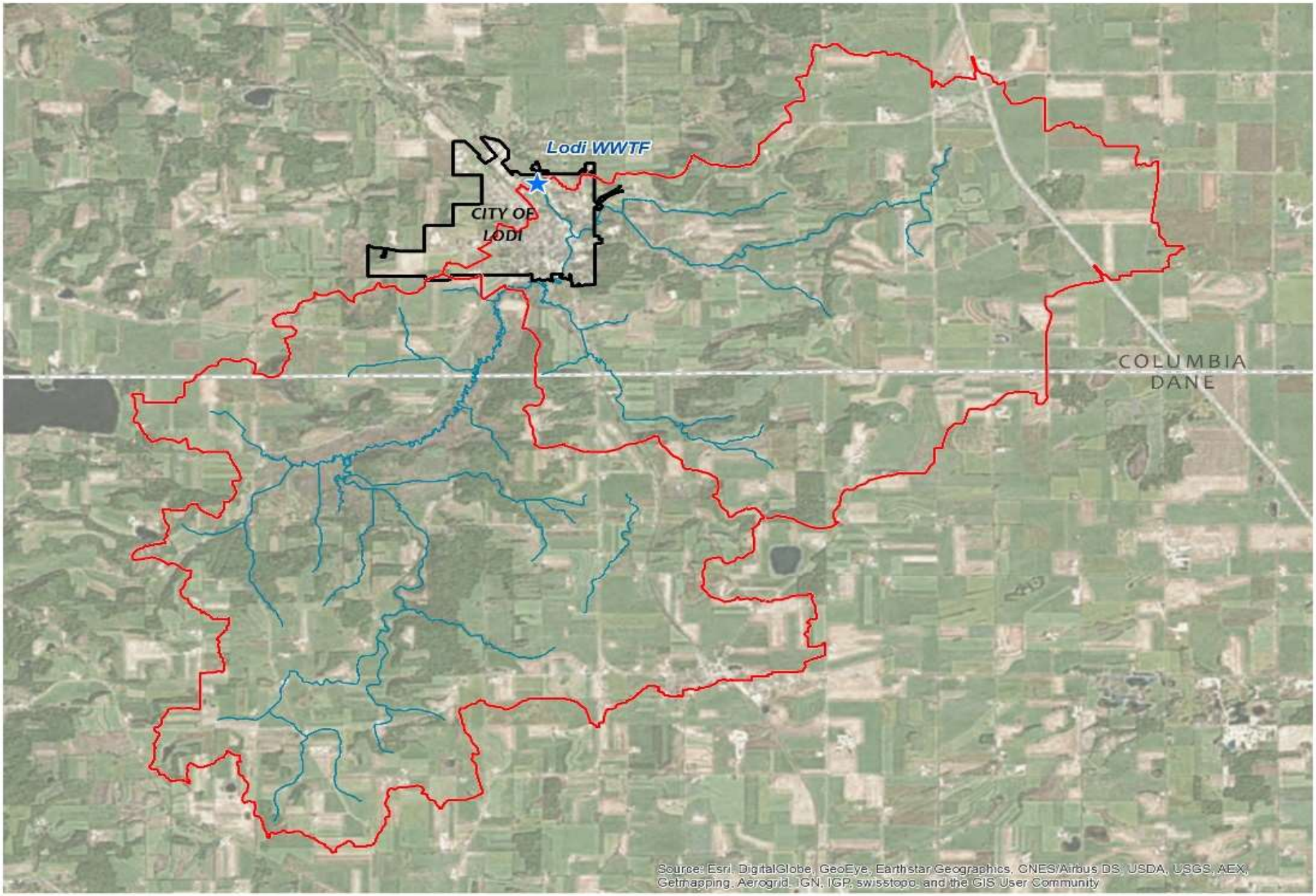






Preparation of Adaptive Management Plan

Summary of Year 4 Activities



Timeline

» Spring/Summer 2015

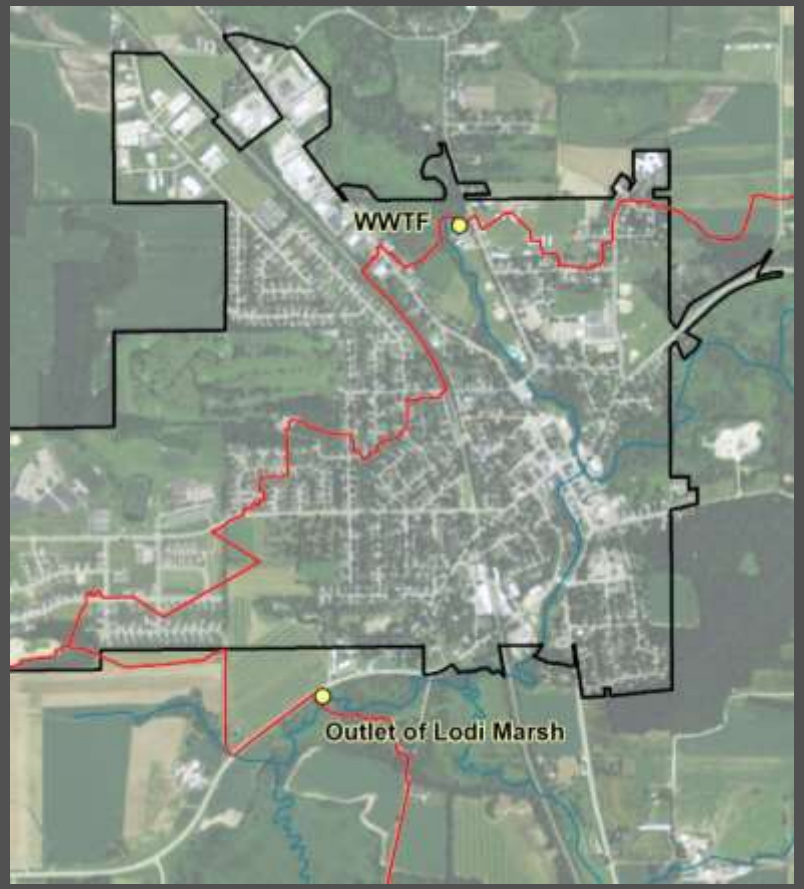
- Installed automated sampling equipment for storm events
- Began storm event sampling
  - Continue through at least fall 2016
- Staff began bi-weekly grab sampling, upstream and downstream of WWTF outfall
- Prioritize BMPs – both hard and soft practices

Timeline

- Fall/Winter 2015
  - Data analysis and review
    - Quantify Impacts from the Lodi Marsh
    - Quantify P-loading at the WWTF
  - Further meetings with landowners
  - Model Development and Refinement
    - Urban inputs – WinSLAMM
    - Watershed – DNR's SWAT model refinements
    - BMPs – SnapPlus for select locations

Automated Sampling Equipment for Storm Events

- Two ISCO automated samplers purchased and installed
  - Outlet of Lodi Marsh
  - Downstream of WWTF outfall
- Use storm event sampling and baseflow sampling to estimate P-loading
  - How much does Lodi Marsh contribute relatively?
  - Validity of BMPs upstream?



Sampler Installation
May 14th, 2015
WWTF

ISCO automated sampler
24 bottles, 8 currently collected per rain event

Pressure Transducer
Records continuous water level depth (ft)

Tipping bucket rain gage
Sensitive to 0.1 mm rainfall

Sampler Installation
May 14th, 2015
Lodi Marsh, along Hwy 60

ISCO automated sampler

24 bottles, 8 currently collected per rain event

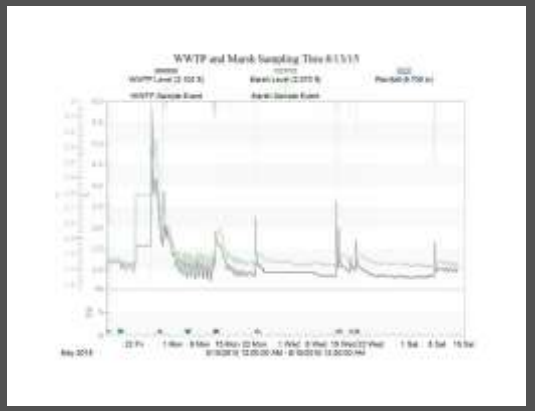
Pressure Transducer

Records continuous water level depth (ft)



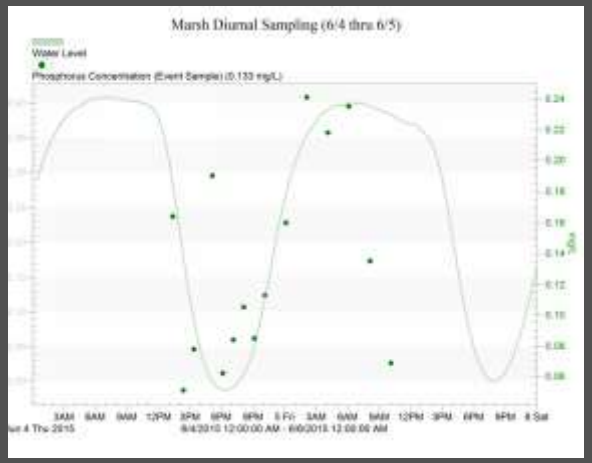


Preliminary Data Through September 18th

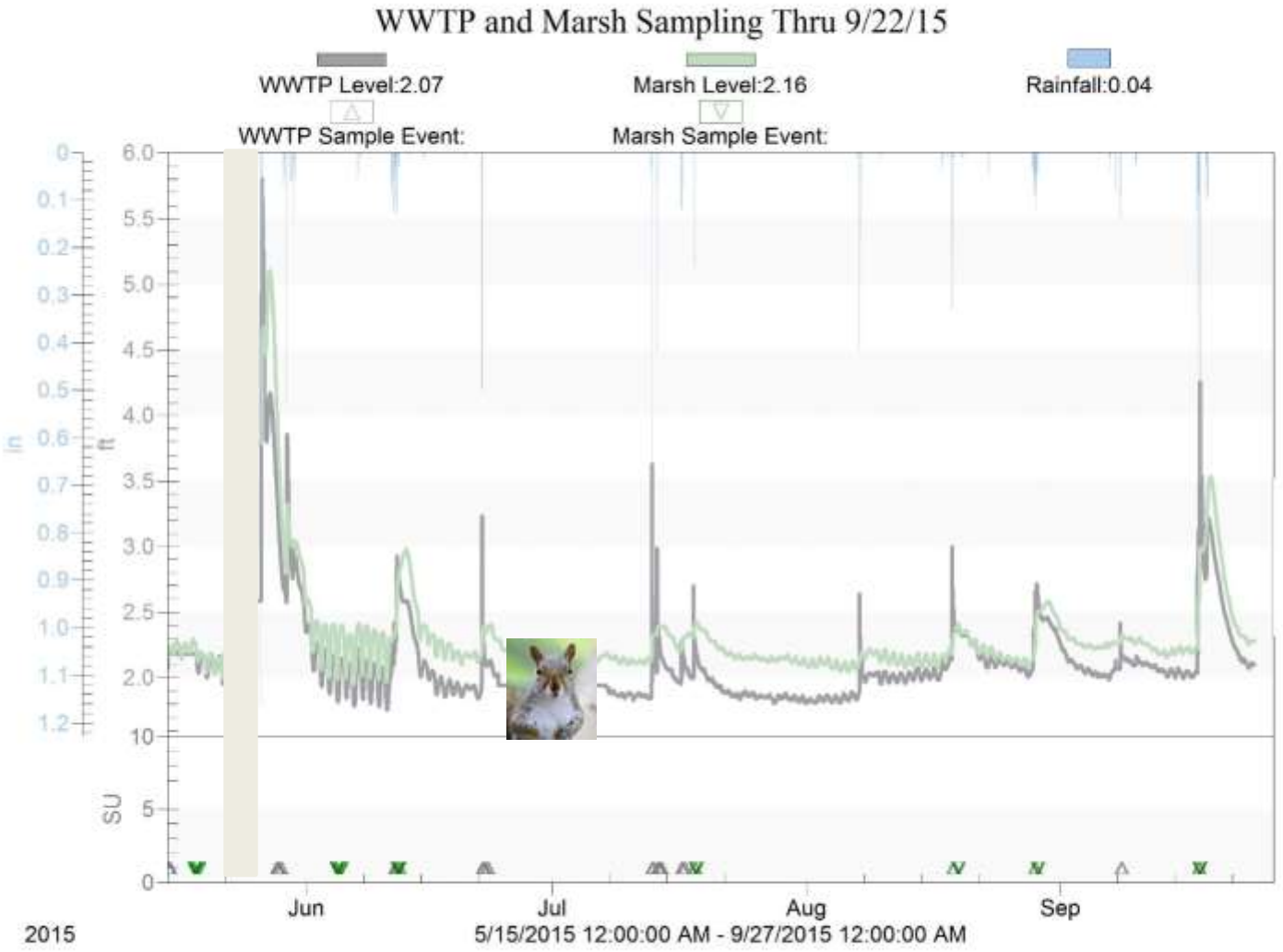


- WWTF
  - ISCO triggered 10 times
  - All were rain events
  - Two interruptions in water level data collection
    - ISCO's accidentally turned off (May)
    - Squirrel chewed through power lines (June)
  - Natural diurnal pattern is evident
    - Stream level is lower during the day
    - Stream level is higher at night

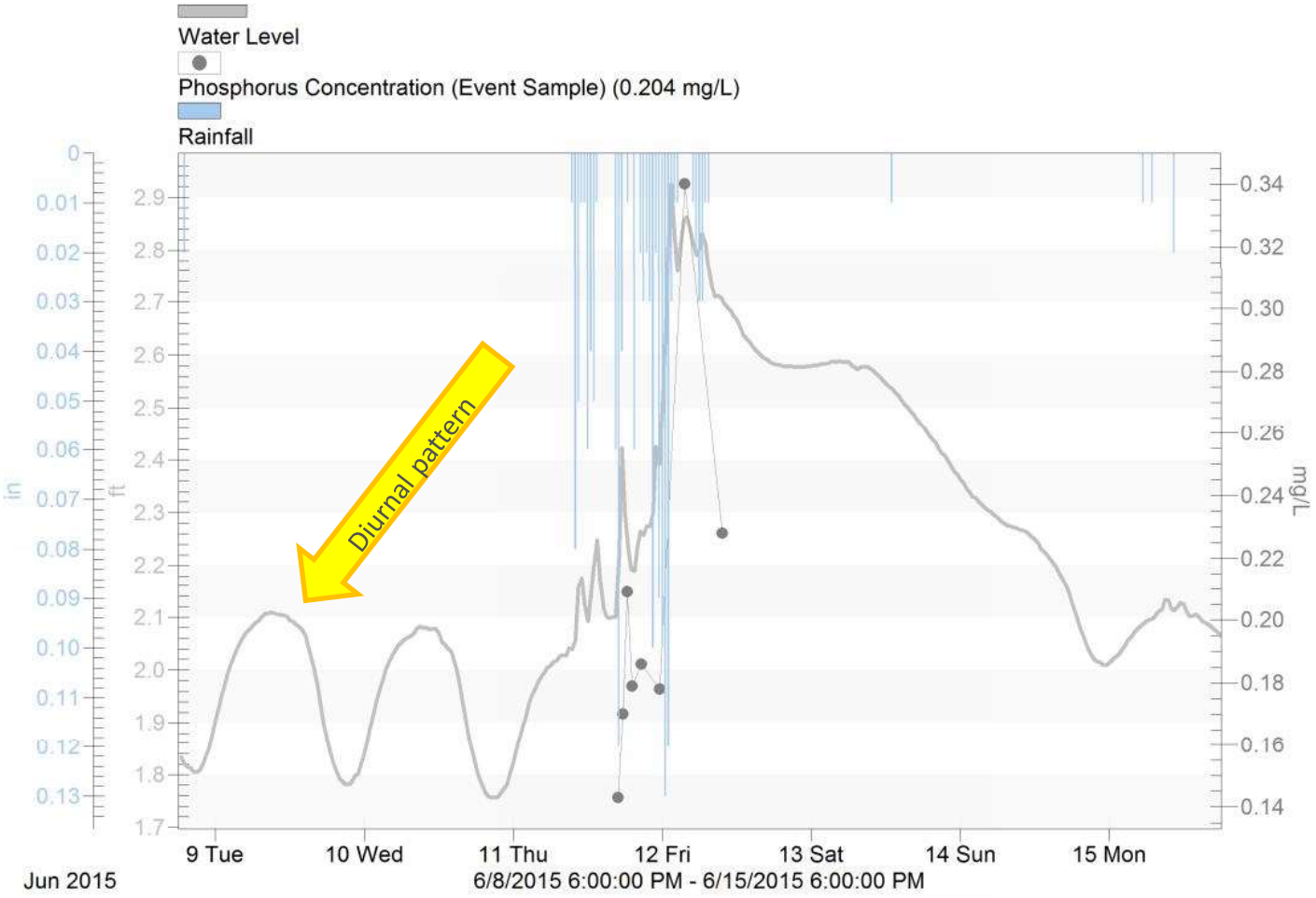
Preliminary Data though Sept 18th



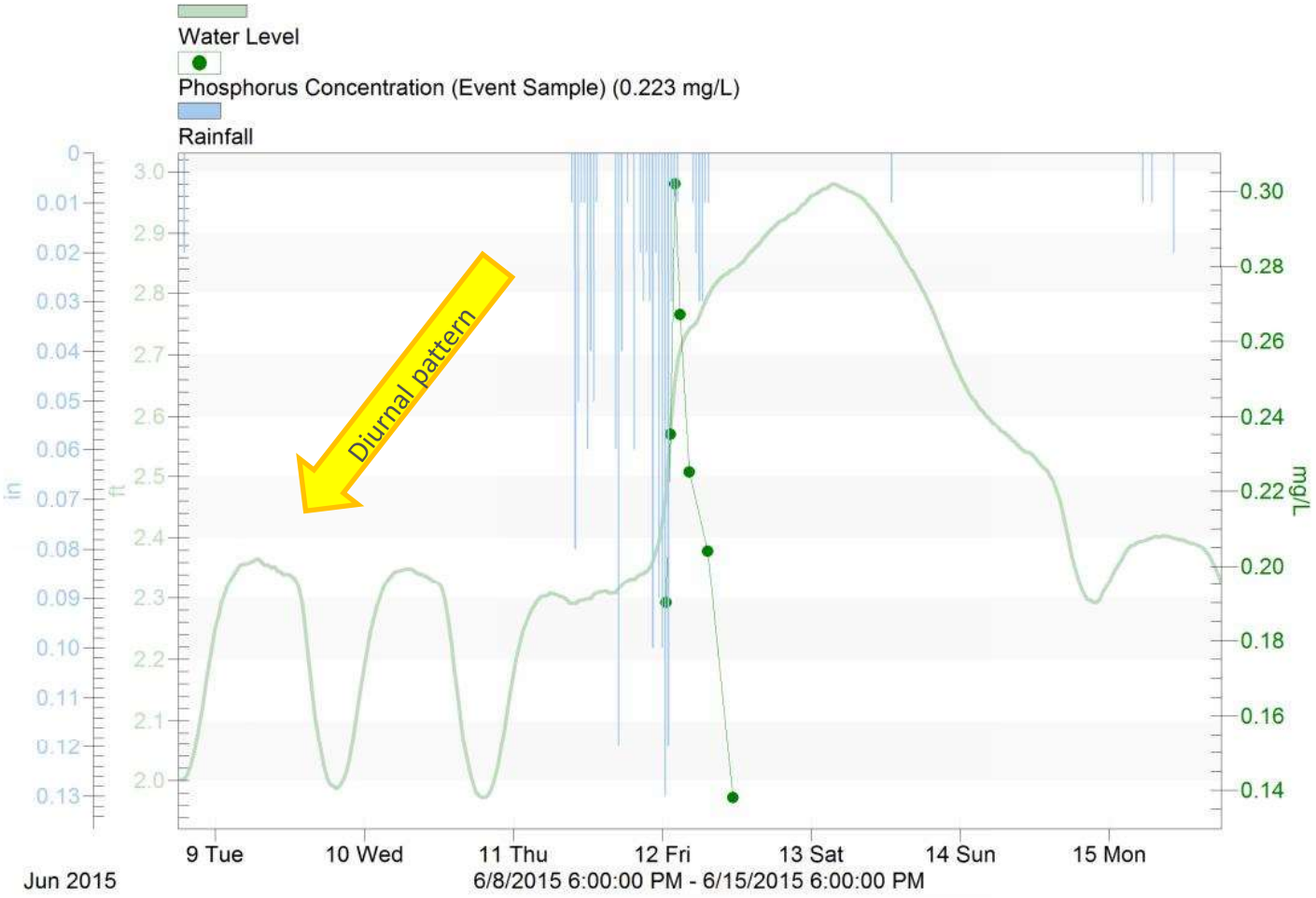
- Lodi Marsh
  - ISCO triggered 7 times
  - Same diurnal pattern
  - 2 events are due to diurnal water level variation
  - 5 were rain events
  - 6 events analyzed for P-concentrations
  - No breaks in water level depth data collection



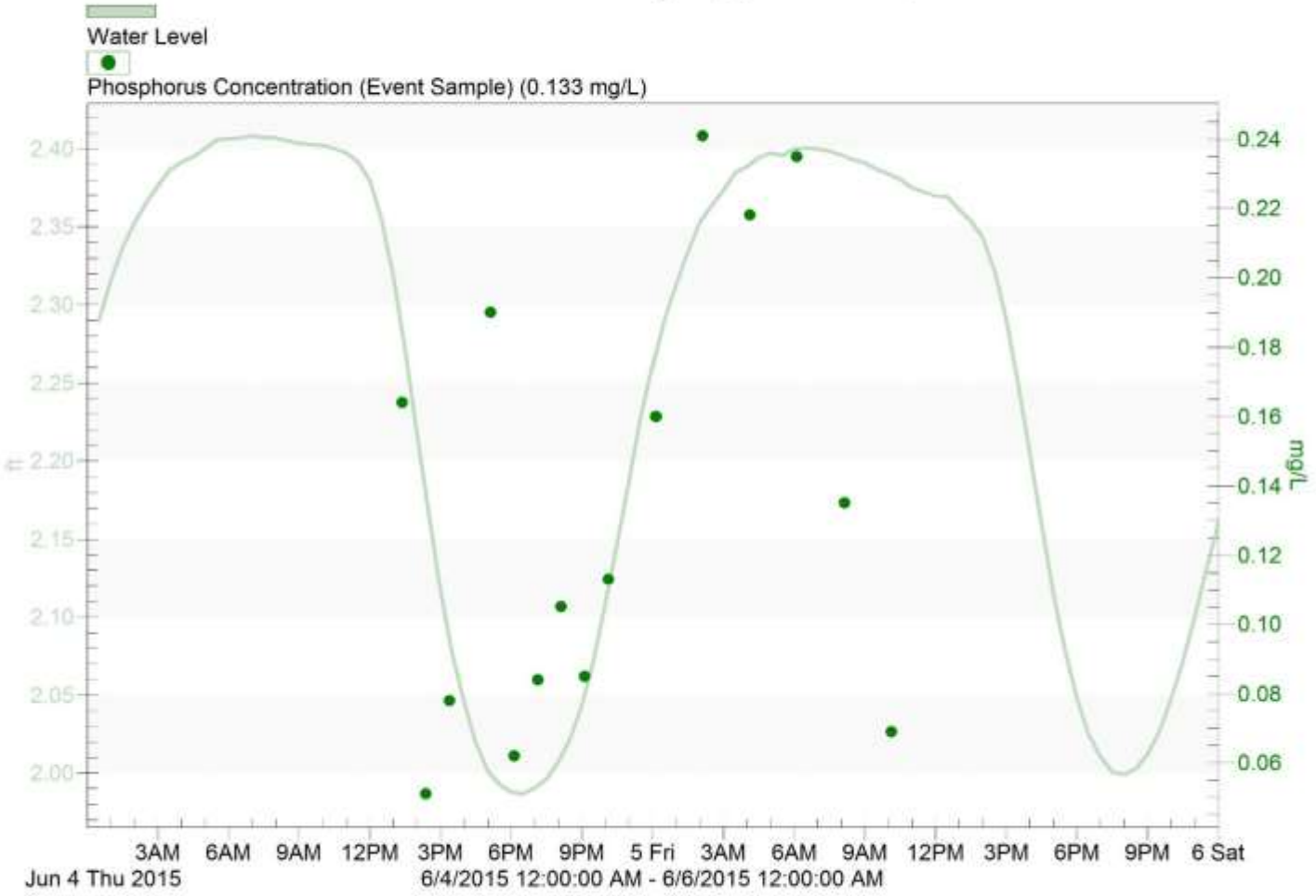
WWTP Event Sampling (6/11 - 6/12)

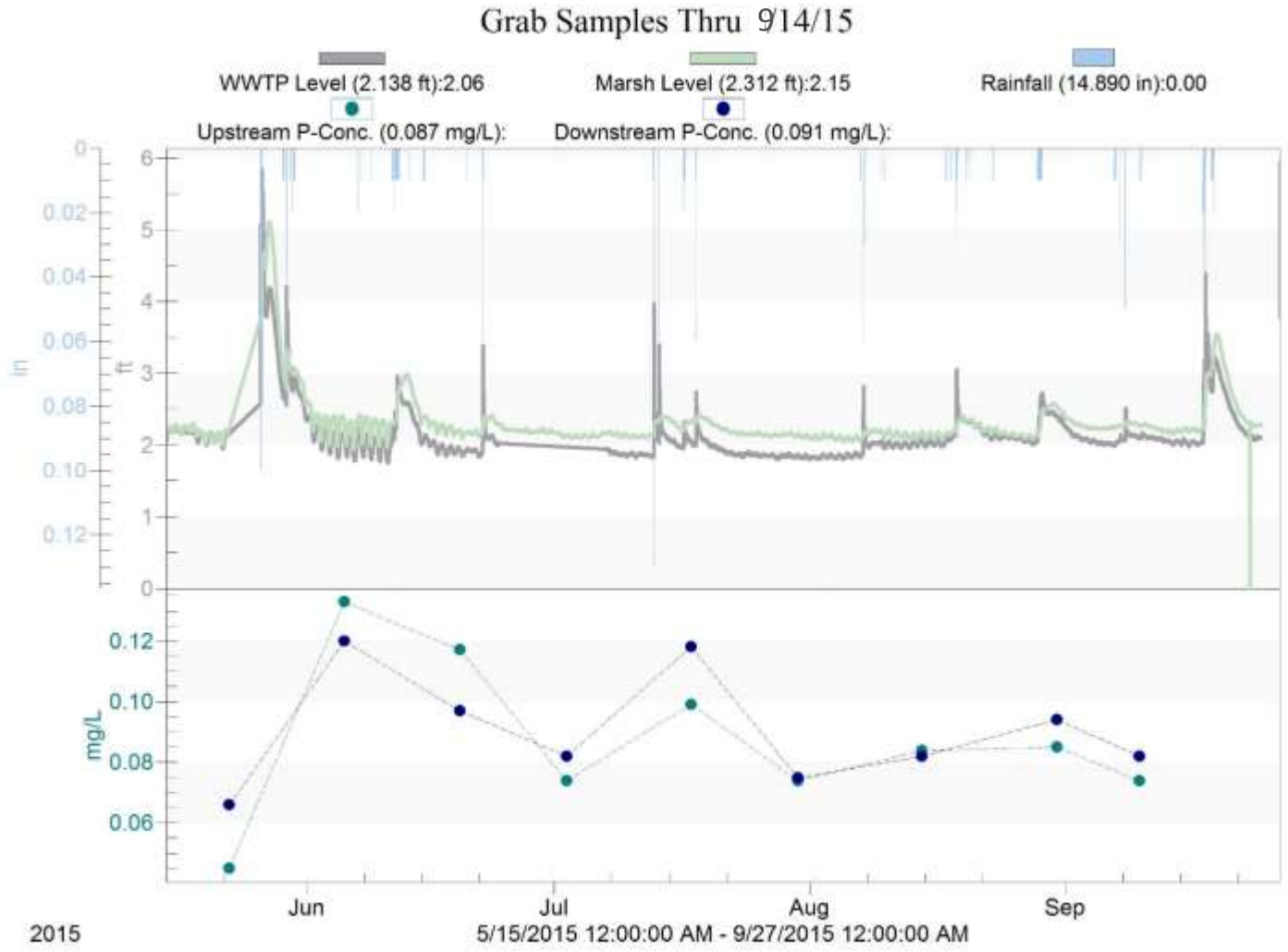


Marsh Event Sampling (6/12)



Marsh Diurnal Sampling (6/4 thru 6/5)





2015 Sample Results - Summary

	WWTP - Event	Marsh - Event	Marsh - Diurnal	WWTF Grab - Upstream	WWTF Grab - Downstream
Average	0.199	0.243	0.121	0.087	0.091
Median	0.148	0.225	0.113	0.084	0.082
Min	0.060	0.099	0.051	0.045	0.066
Max	1.770	0.745	0.241	0.133	0.12
Number of samples	82	31	27	9	9

Revised Estimate of P reductions needed based on the above

~ 1000 lbs/year @current flow and A.M. interim limit

~ 1400 lbs/year @ design flow and A.M. interim limit

Sampling/Modeling continues…

- Continue sampling efforts
- HEC-RAS model
  - Establish rating curves
  - Predict flow rate based on water level
- Flowmeter measurements
  - Verify model output

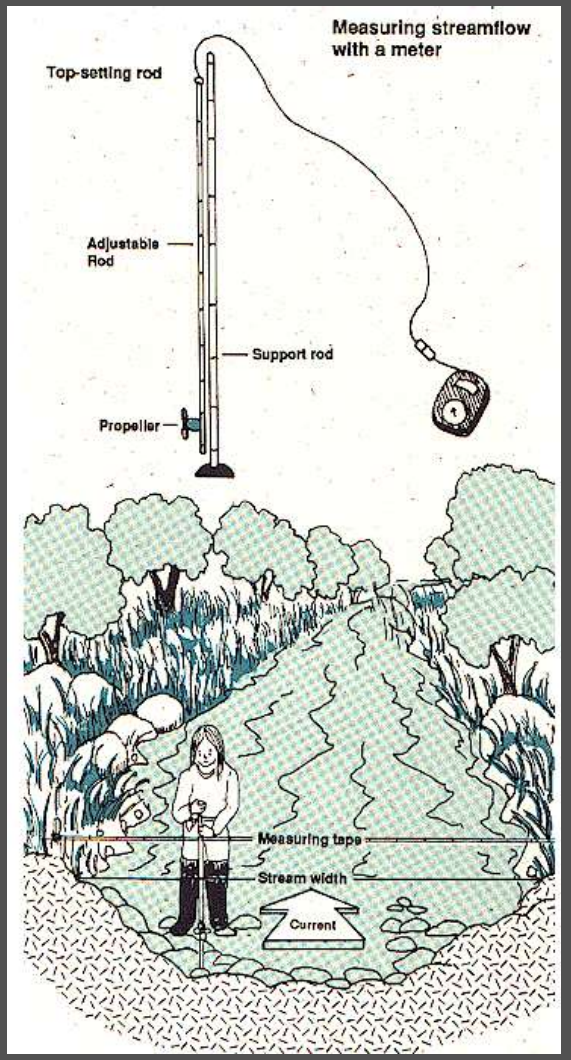
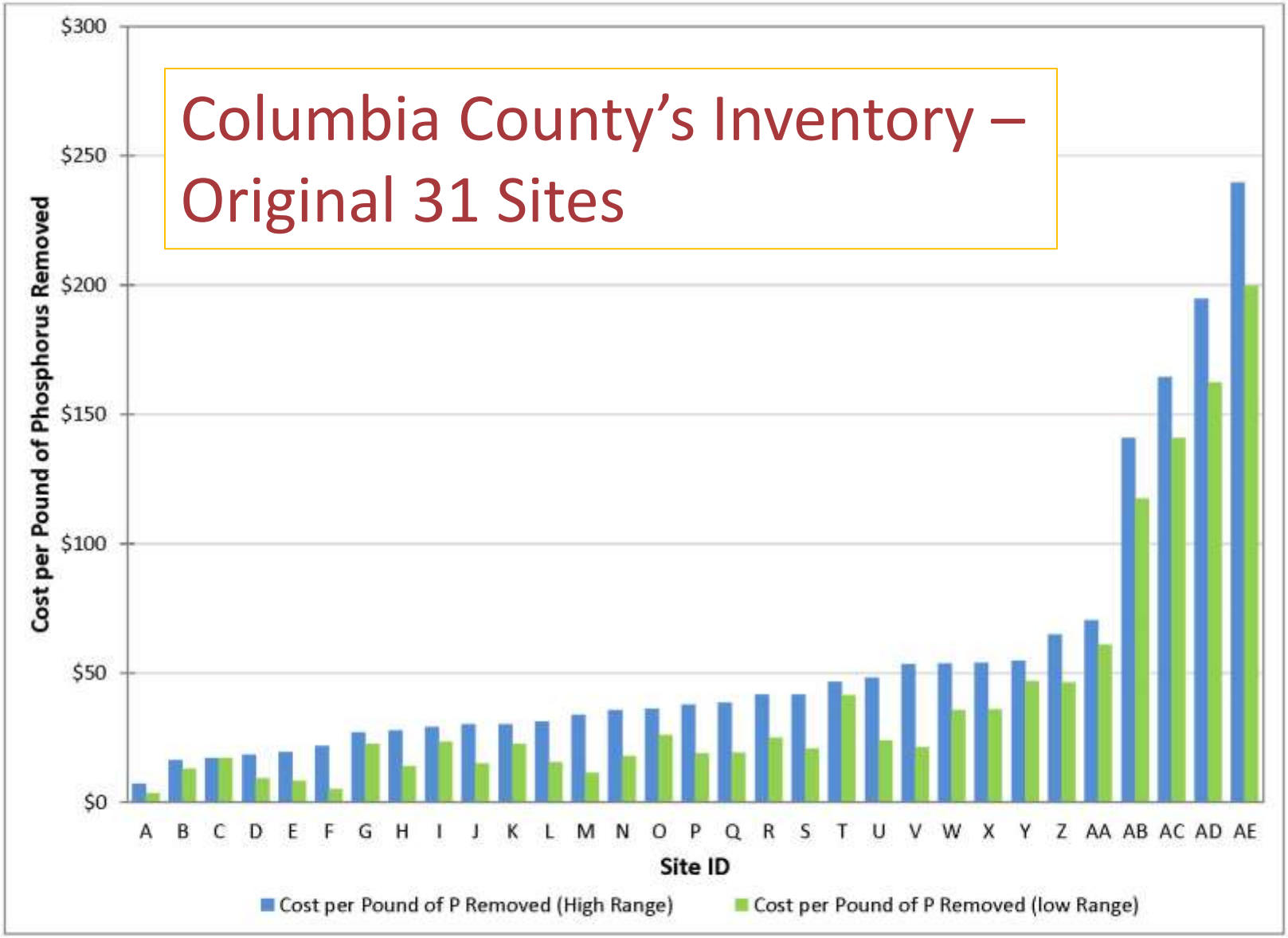


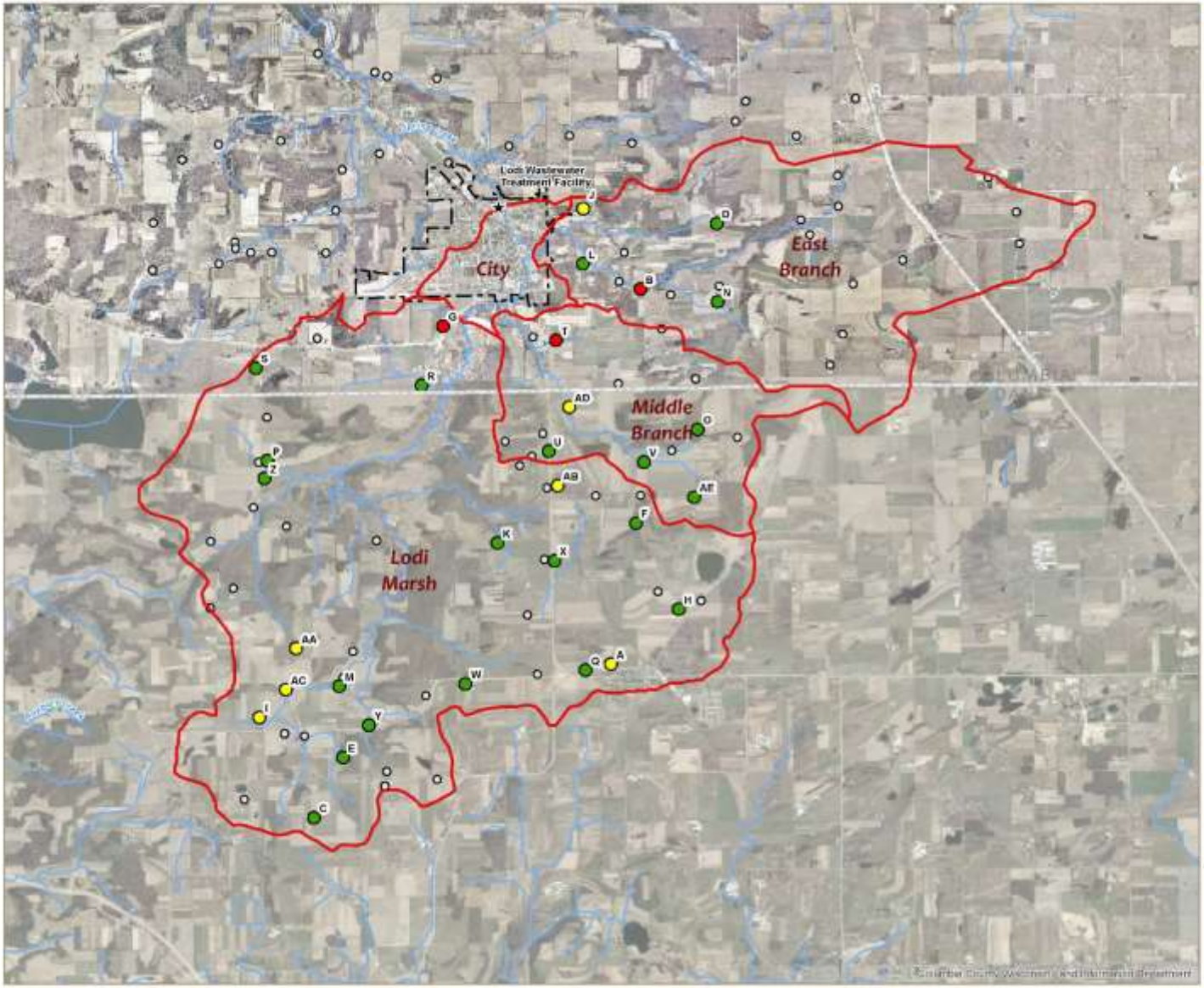
Photo credit: State of Washington, Dept of Ecology

Hard Practice Priority Areas

Building Upon CCLWCD's 2014 Livestock Inventories

Columbia County's Inventory – Original 31 Sites





BARNYARD ASSESSMENTS

County

Lodi

Lodi WWTF Outfall

Preliminary Watershed

River/Stream

BARNY Assessed Livestock Sites

Potential Phosphorus Reduction (lb/yr)

Low

Medium

High

Other BARNY Assessed Livestock Sites

COLUMBIA COUNTY

Land & Water Conservation

DATA SOURCES:
BARNYARD ANALYSIS COMPILED BY COLUMBIA COUNTY
AERIAL IMAGERY PROVIDED BY DANE AND COLUMBIA COUNTIES

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COLUMBIA COUNTY, WI

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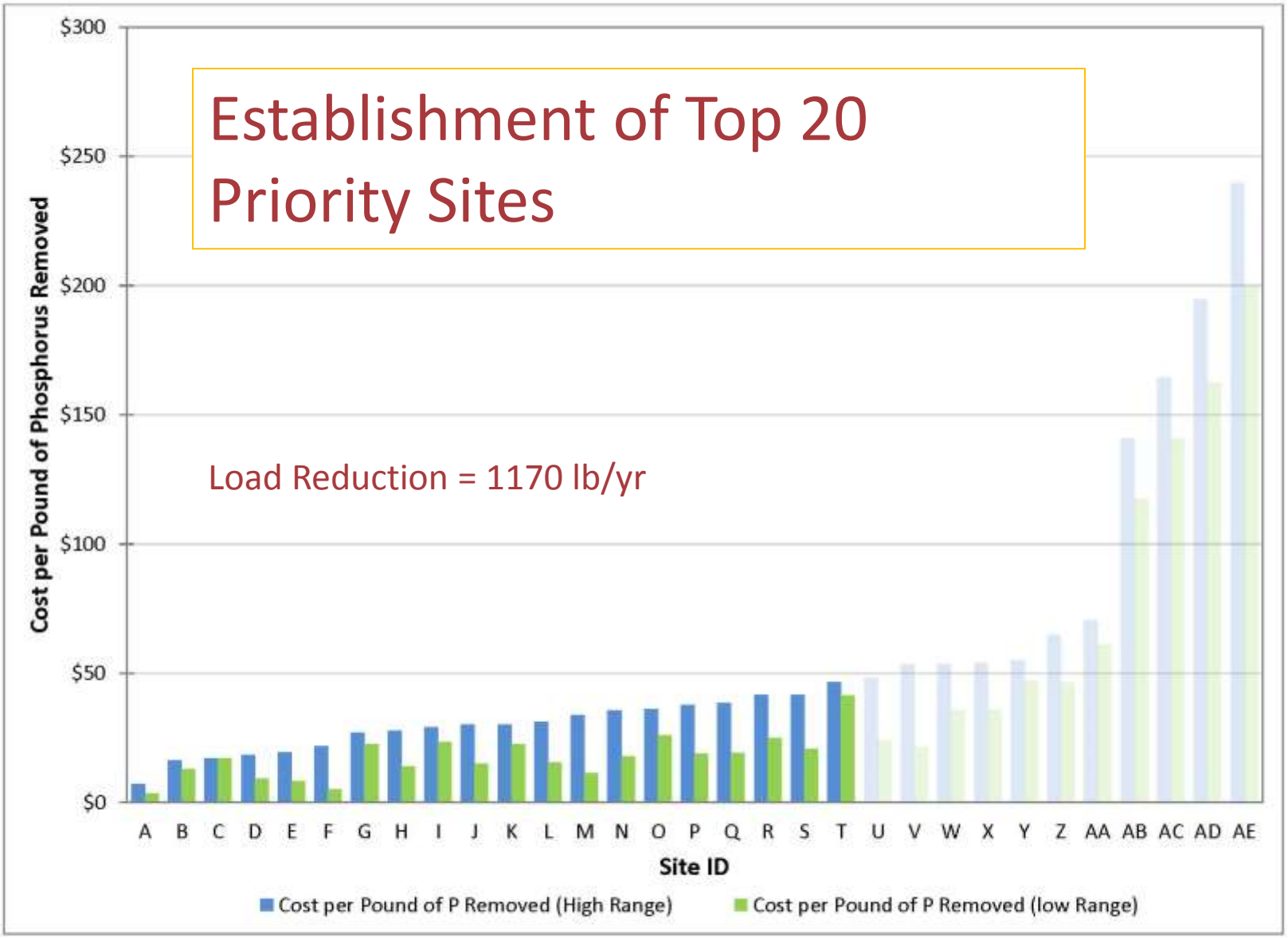
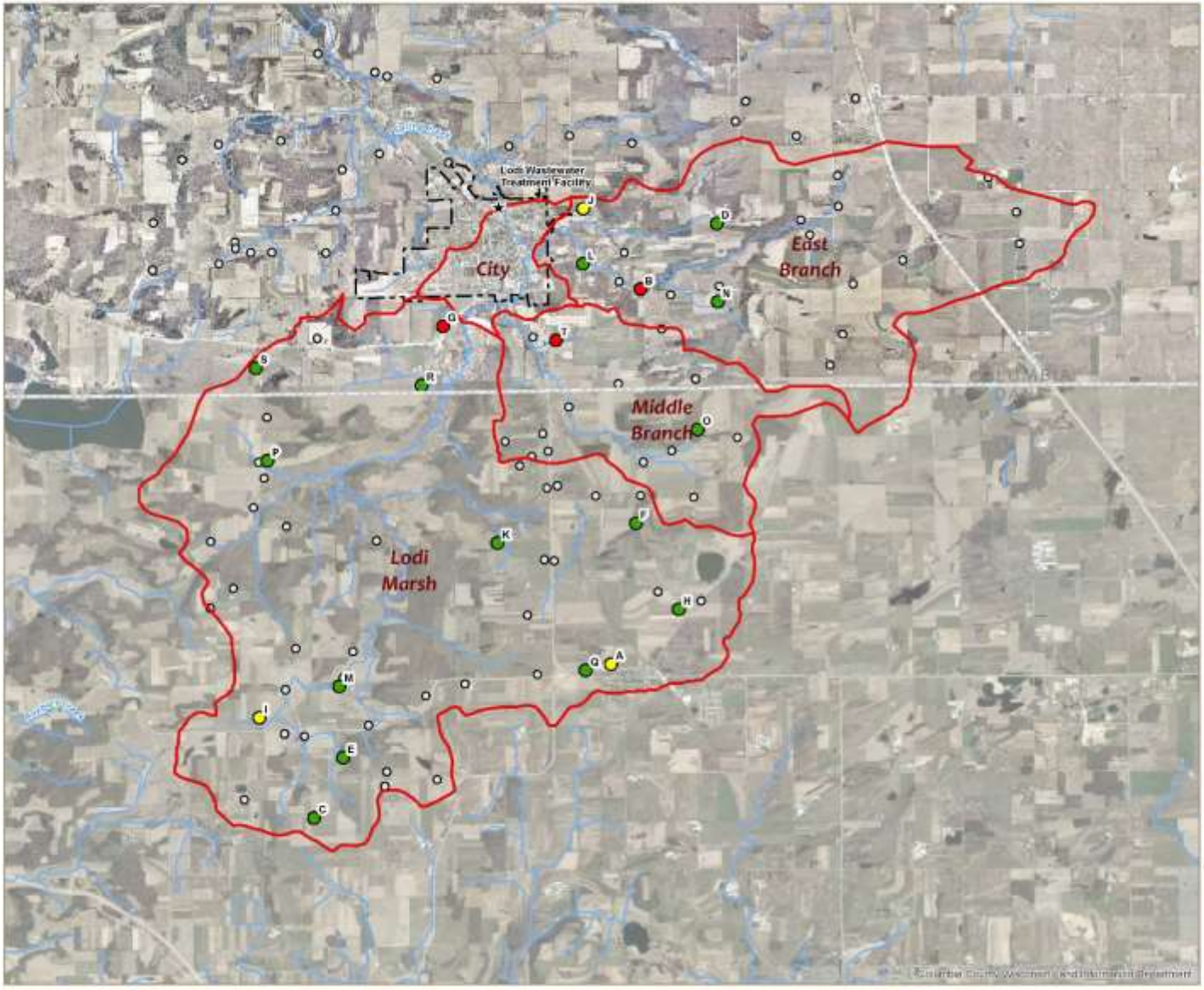
Establishment of Top 20 Priority Sites





BARNYARD ASSESSMENTS

County

Lodi

Lodi WWTF Outfall

Preliminary Watershed

River/Stream

BARNY Assessed Livestock Sites (Top 20)

Potential Phosphorus Reduction (lb/yr)

Low

Medium

High

Other BARNY Assessed Livestock Sites

COLUMBIA COUNTY

Land & Water Conservation

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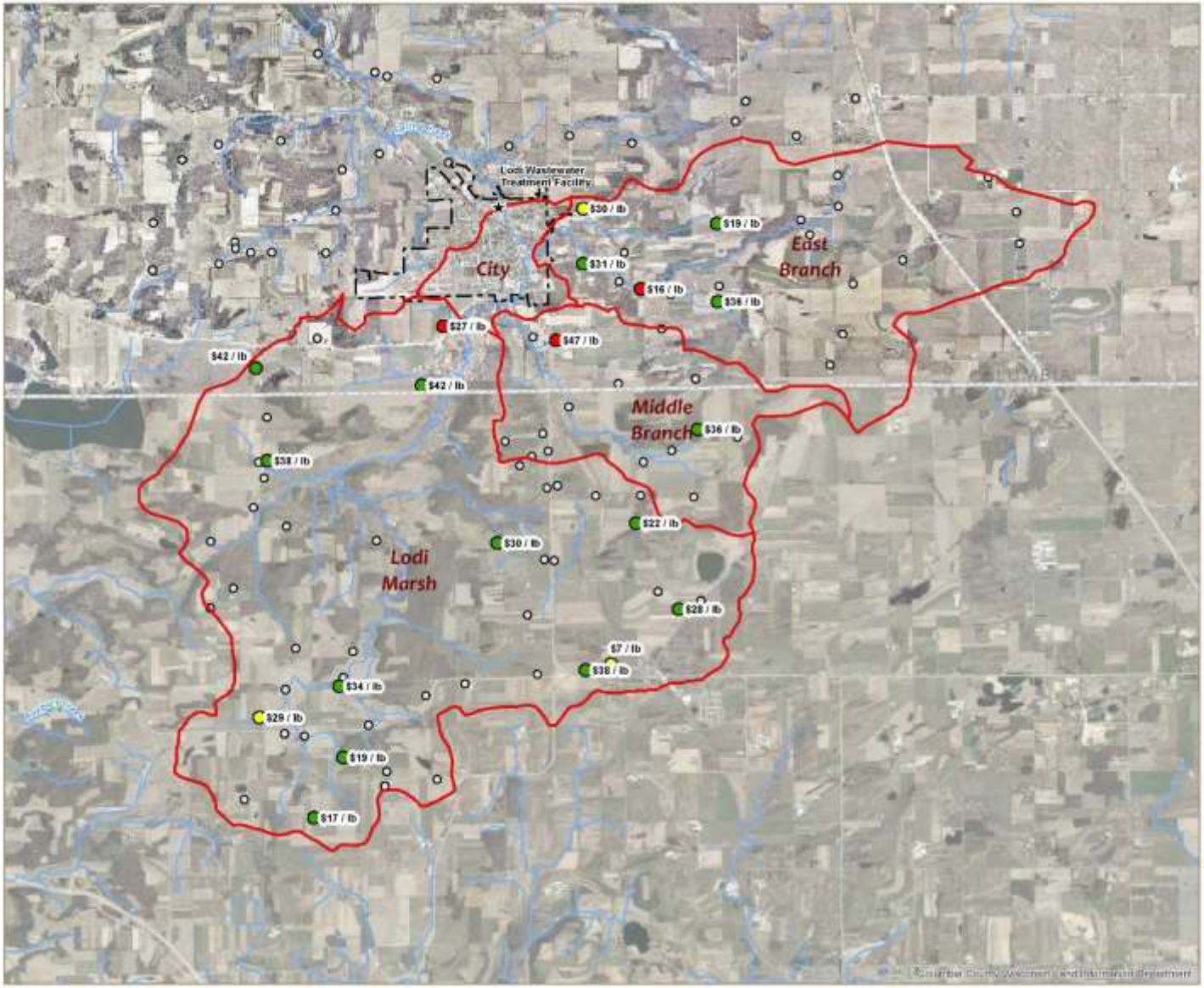

BARNYARD ASSESSMENTS

- County
- Lodi
- ★ Lodi WWTF Outfall
- Preliminary Watershed
- River/Stream

BARNY Assessed Livestock Sites (Top 20)

Potential Phosphorus Reduction (lb/yr)

- Low
- Medium
- High
- Other BARNY Assessed Livestock Sites

COLUMBIA COUNTY
Land & Water Conservation

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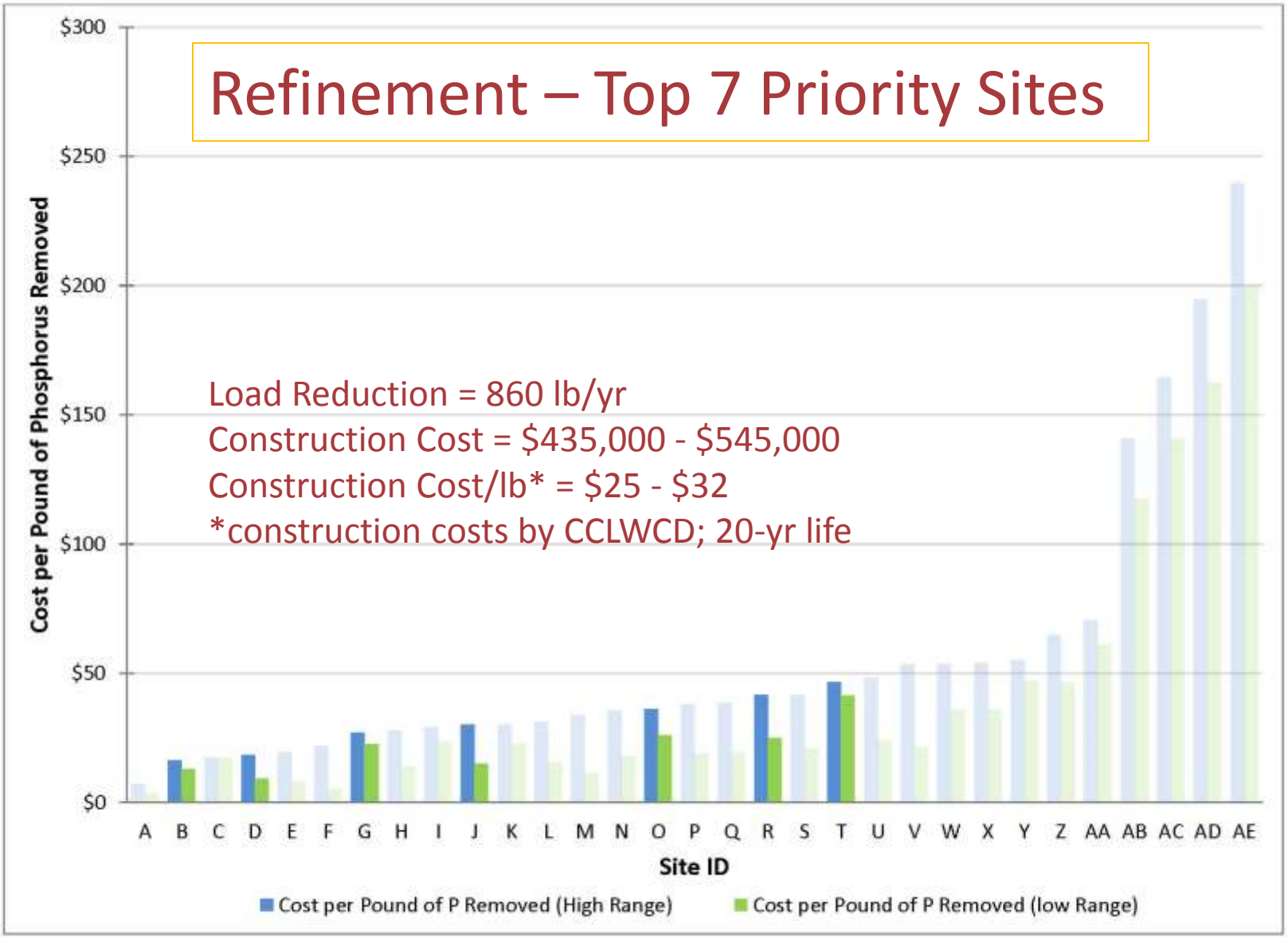
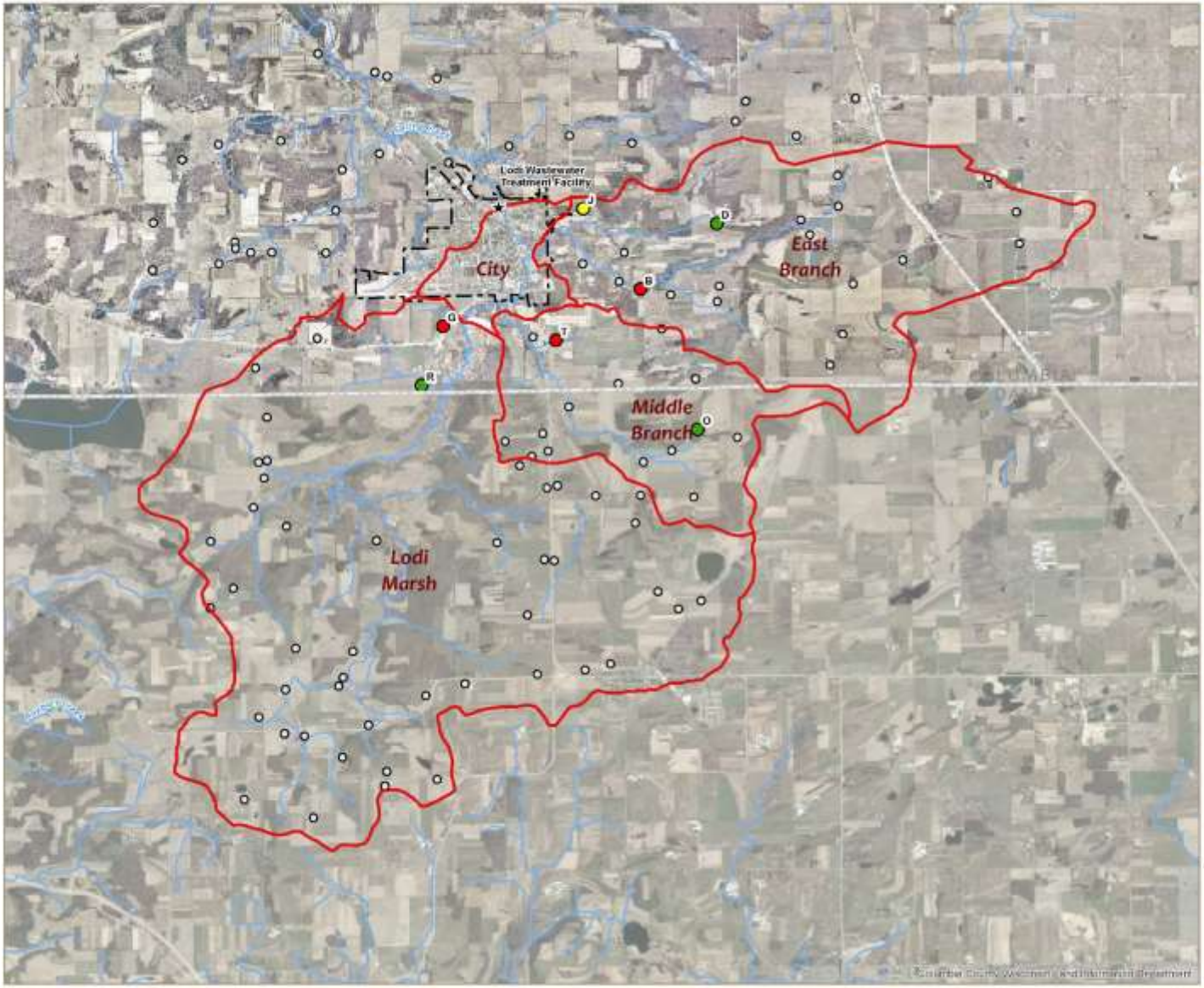
Refinement – Top 7 Priority Sites



Load Reduction = 860 lb/yr
Construction Cost = $435,000 - $545,000
Construction Cost/lb* = $25 - $32
*construction costs by CCLWCD; 20-yr life



BARNYARD ASSESSMENTS

County

Lodi

Lodi WWTF Outfall

Preliminary Watershed

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BARNY Assessed Livestock Sites (Top 7)

Potential Phosphorus Reduction (lb/yr)

Low

Medium

High

Other BARNY Assessed Livestock Sites

COLUMBIA COUNTY

Land & Water Conservation

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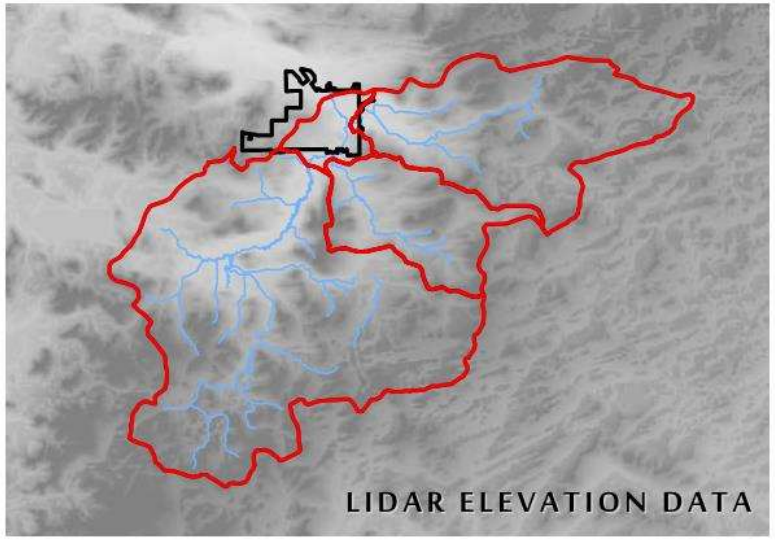
Soft Practice Priority Areas

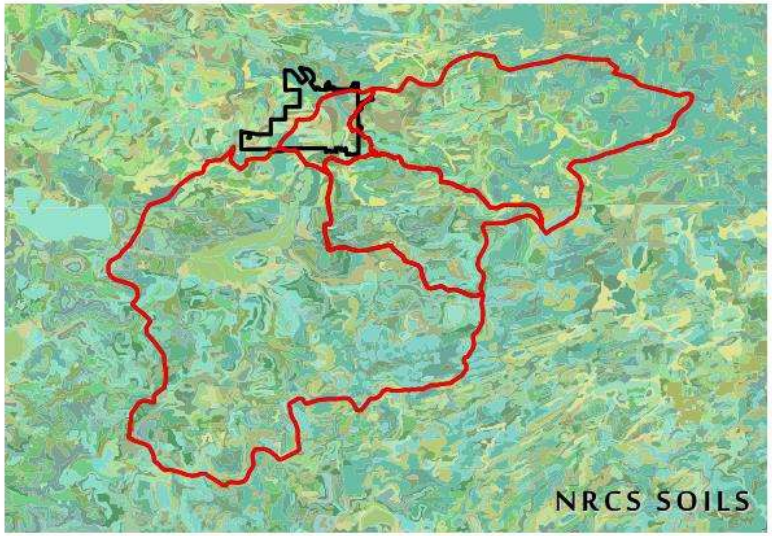
Erosion Vulnerability Assessment for Agricultural Lands (EVAAL) Model

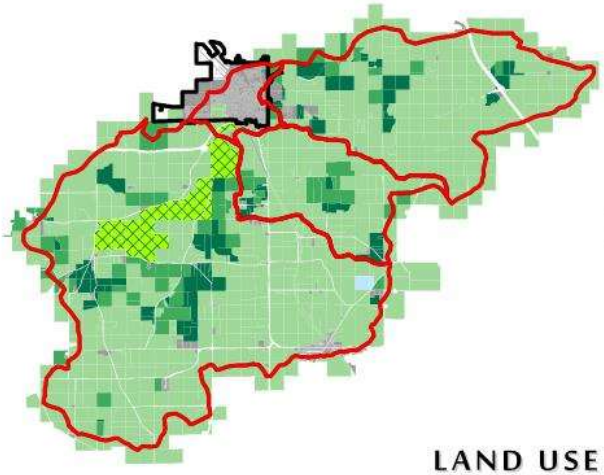
EVAAL

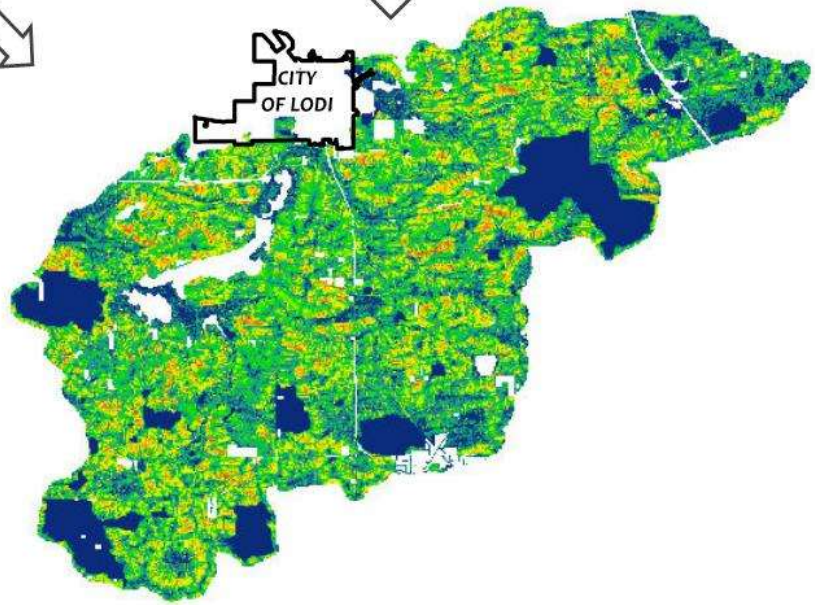
- WDNR model to identify areas potentially vulnerable to stormwater erosion
- Based on Universal Soil Loss Equation and Stream Power index
- Removes internally drained areas
- Uses publically available GIS data (land use)
- Creates an index specific for the watershed

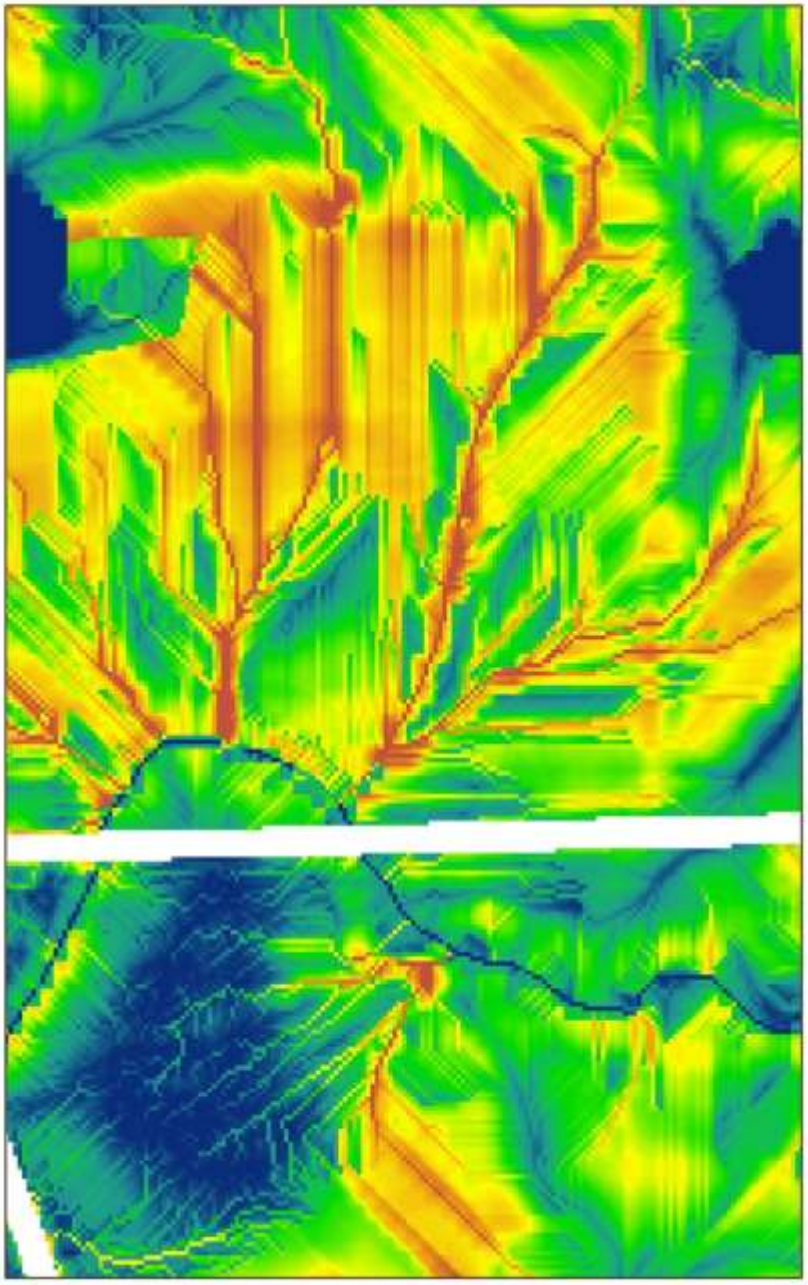
http://dnr.wi.gov/topic/nonpoint/evaal.html











Soft Practices

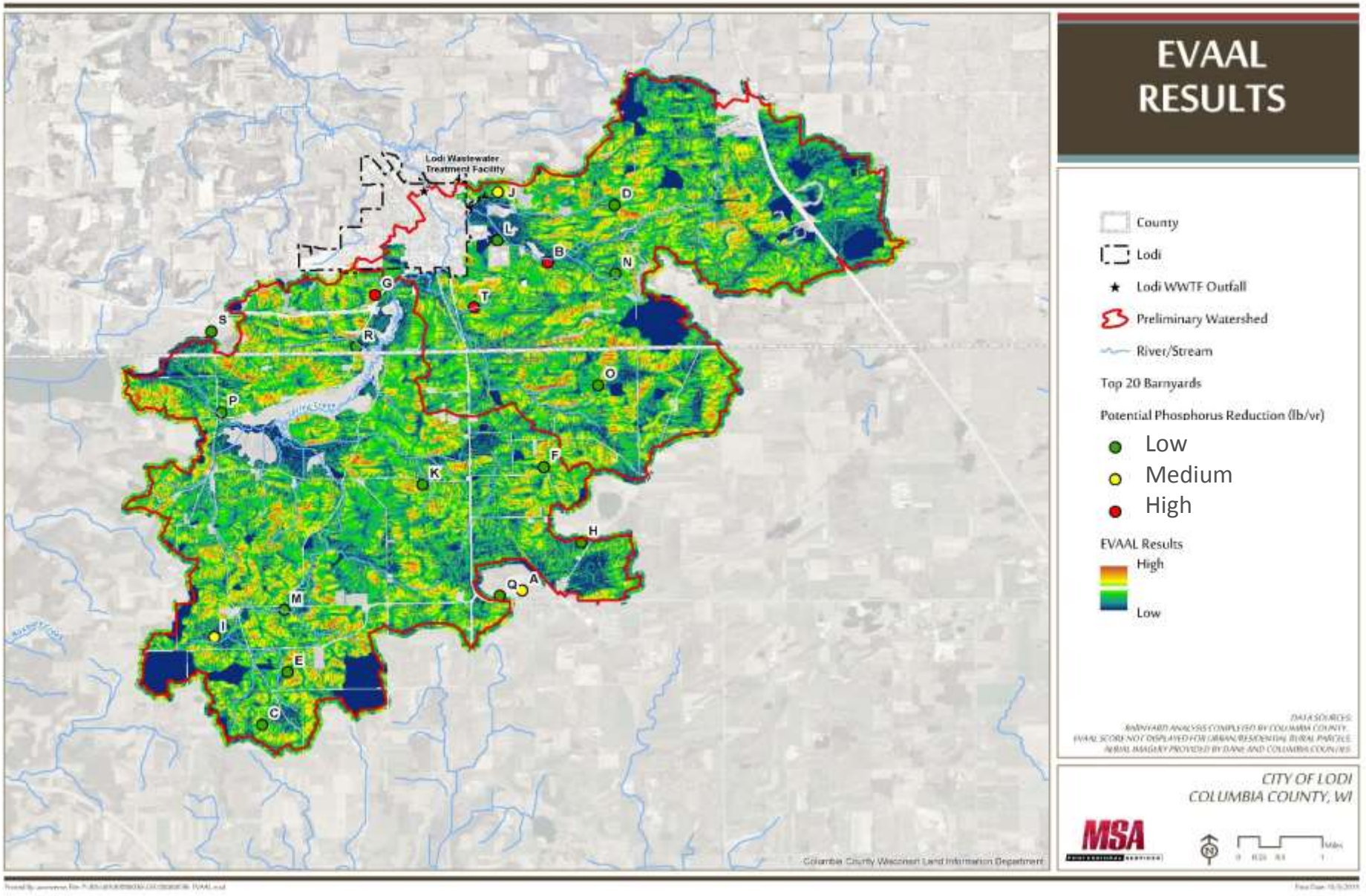
- Many locations far from barnyards
- Many are in a typical dairy rotation
- Potential for strip tillage, manure injection, cover crops
- Harvested Buffer Program to be investigated

Combined Priority Areas

BARNY modeling in tandem with EVAAL modeling

Identify combined priority areas

- Overlay Barnyard Assessments with EVAAL's erosion vulnerability index
- Landowners where both hard and soft practices may be feasible
- Reduce number of landowner agreements
- Reach P-reduction goals more efficiently



EVAAL RESULTS

County

Lodi

★ Lodi WWTF Outfall

Preliminary Watershed

River/Stream

Top 20 Barnyards

Potential Phosphorus Reduction (lb/yr)

- Low
- Medium
- High

EVAAL Results

High

Low

DATA SOURCES:
BARNYARD ANALYSIS COMPILED BY COLUMBIA COUNTY.
EVAAL SCORE NOT DISPLAYED FOR URBAN, RESIDENTIAL, RURAL PARCELS.
AERIAL IMAGERY PROVIDED BY DANE AND COLUMBIA COUNTIES

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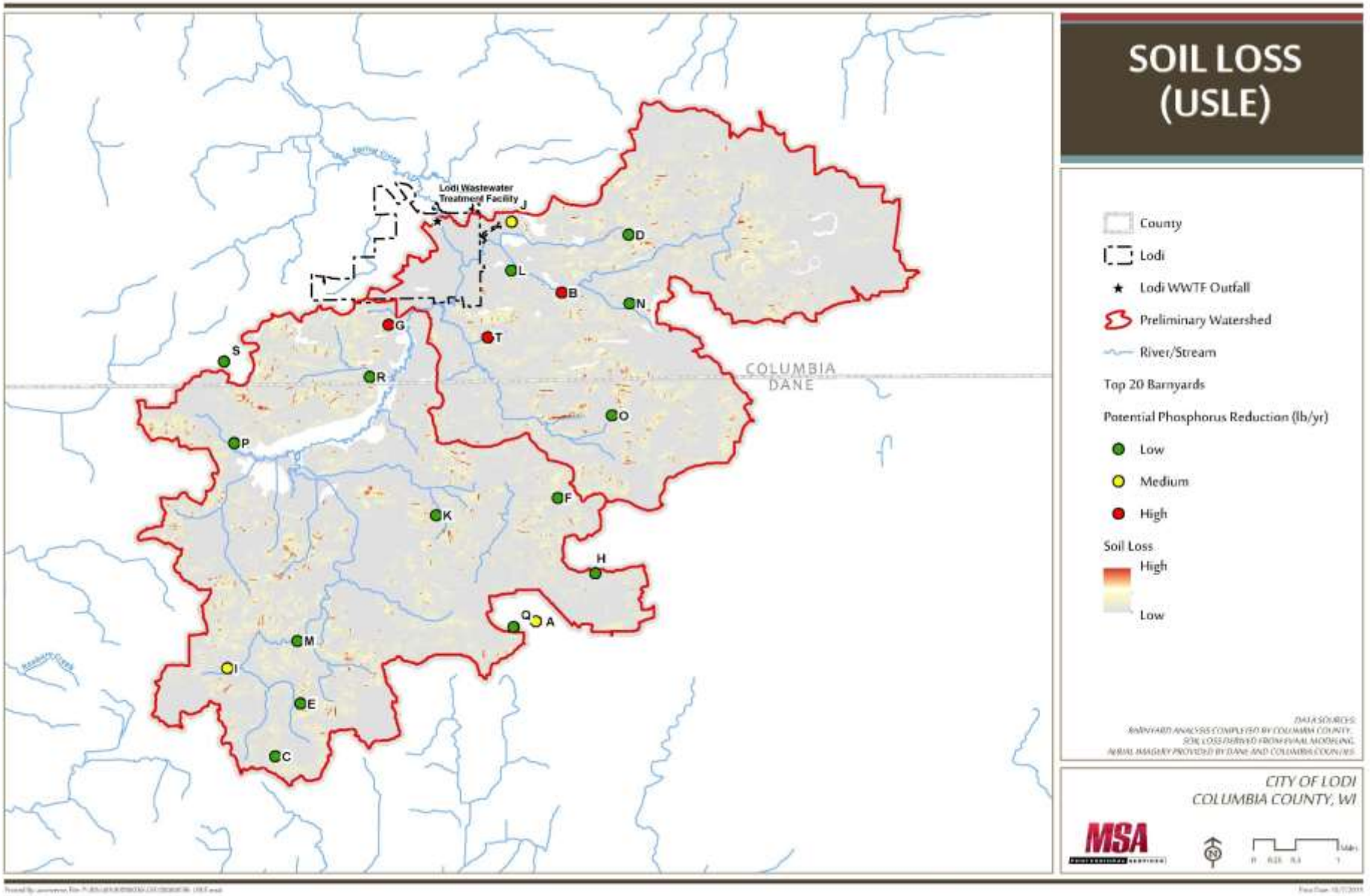

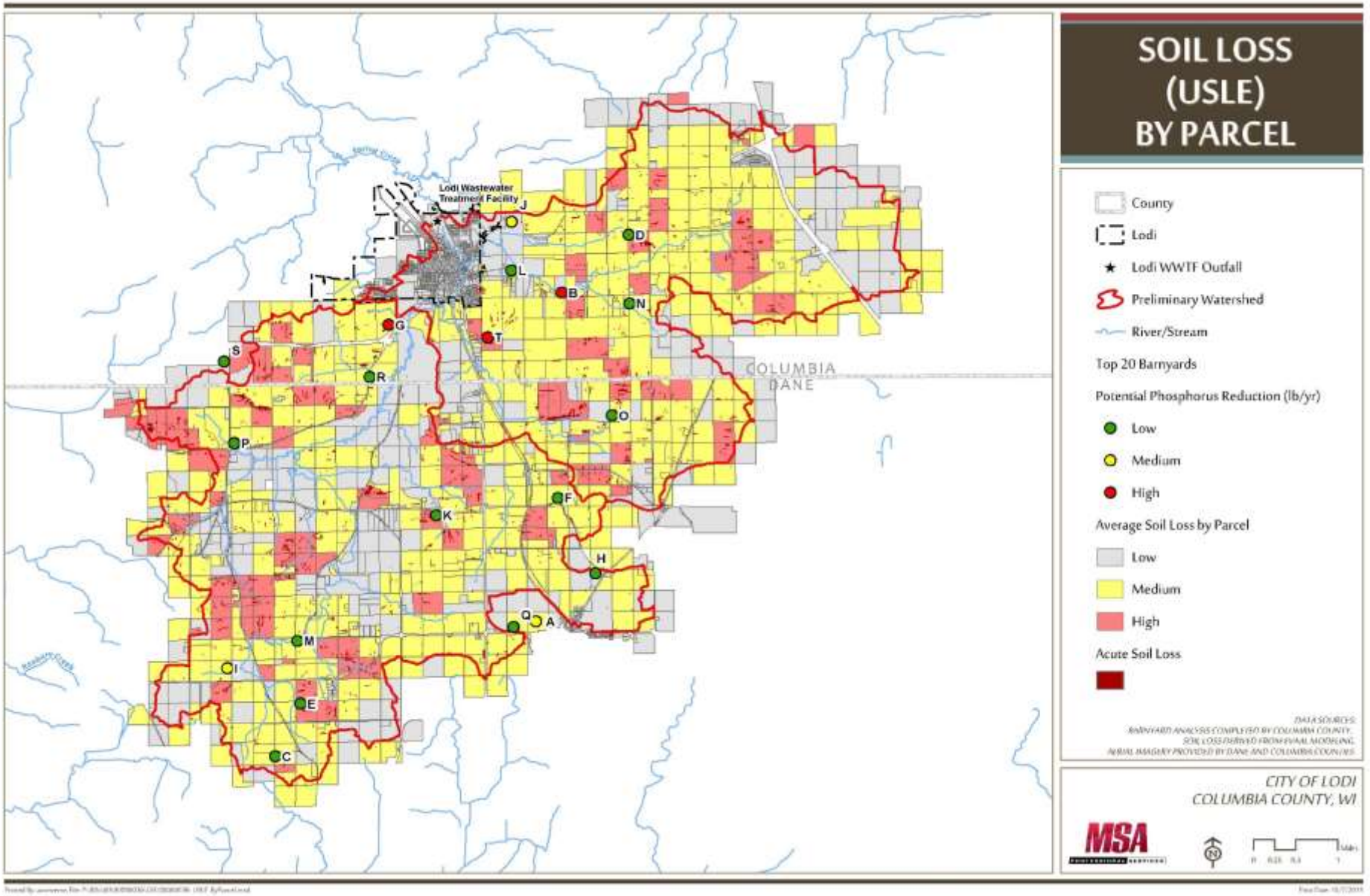

Public Outreach Materials

» Story Map
- Dynamic, online content describes the project
- Encourages public participation and engagement
- General information about Adaptive Management and provides links to outside resources
- Available via City website

http://arcg.is/1EeERtb

Next Steps

- Data collection & analysis
  - Diurnal Patterns and phosphorus concentrations
  - Quantify Impacts from the Lodi Marsh
  - Quantify P-loading at the WWTF
- Further meetings with landowners
- Model Development and Refinement
  - Urban inputs – WinSLAMM
  - Watershed – DNR's SWAT model refinements
  - BMPs – SnapPlus for select locations

Questions?