



**THINK OUTSIDE THE BOUNDARIES: WHY  
WISCONSIN'S NEW PHOSPHORUS  
REGULATIONS WILL CREATE NEW  
PARTNERSHIPS**

LODI SPRING CREEK FISHERY AREA  
Lodi

**GIL HANTZSCH, P.E. – MSA PROFESSIONAL SERVICES, INC.**

**FEBRUARY 28, 2013**



Wisconsin



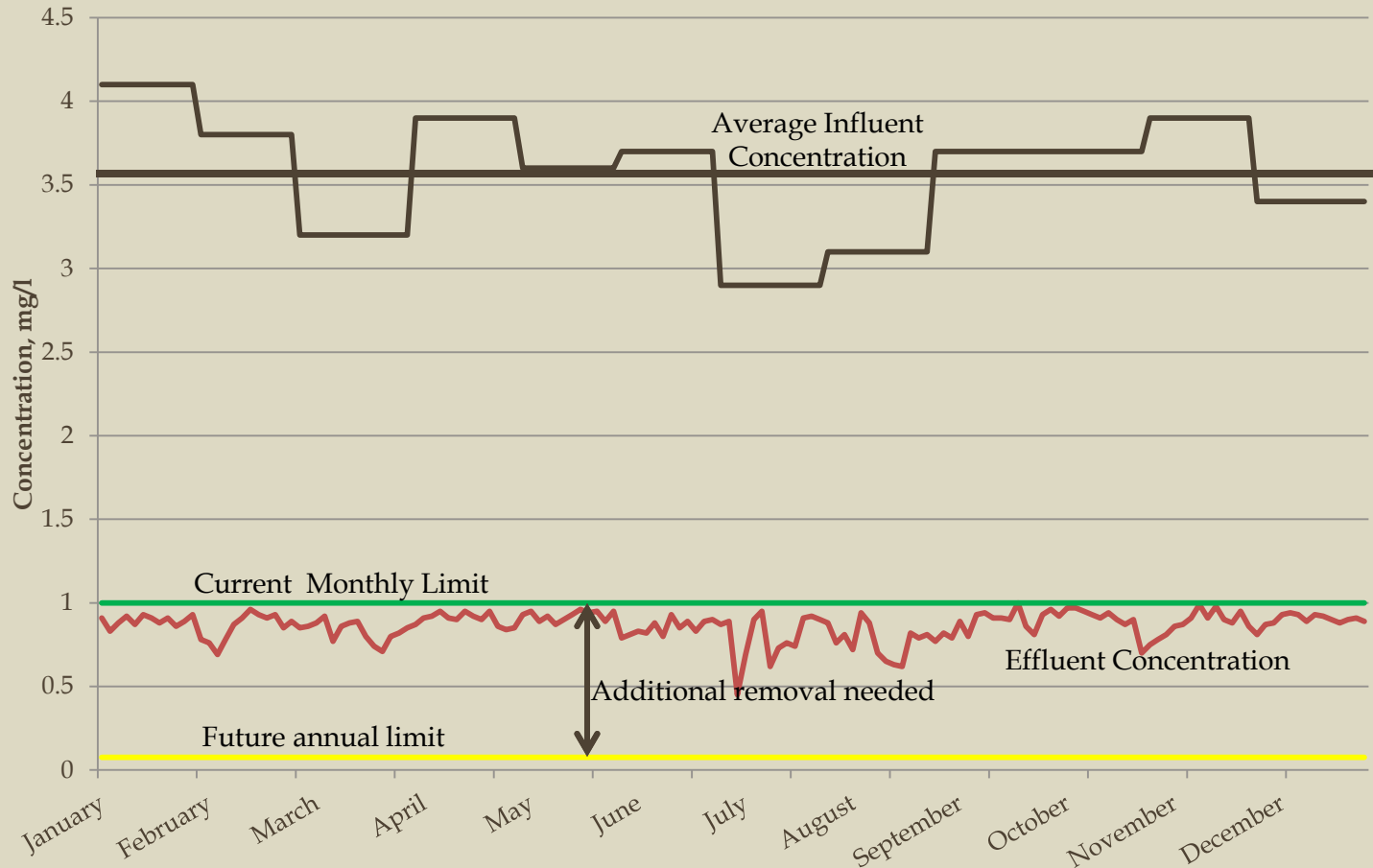
# City of Lodi

- Lodi's WWTF
  - Treats 350,000 gal/day
  - Currently meeting 1 mg/l P limit
- Lodi's WPDES Permit
  - Reissued November 1, 2011
  - Identifies future P limit as:
    - ✦ 0.075 mg/l P – annual ave.
    - ✦ 0.22 mg/l – monthly ave.



# WWTF Performance

## 2011 Lodi WWTF Phosphorus Data



# City of Lodi

- WPDES Compliance Schedule
  - Submit Operations and Needs Review October 31, 2012
  - Submit Facilities Planning Status Report October 31, 2013
  - Submit Facility Plan October 31, 2014
  - Refine Facility Plan October 31, 2015
  - Construction Plan Submittal July 30, 2016
- Future Permit Requirements
  - Comply with limits September 30, 2020

# City of Lodi

- Recommendations to City
  - Move ahead with Operations and Needs Review immediately
  - Evaluate initial feasibility of watershed-based alternatives
    - ✦ Do either Adaptive Management or Water Quality Trading appear to be worth pursuing in more detail?



# City of Lodi

- Political Reaction
  - Why are we first?
  - Can't we wait?
  - This is somebody else's problem!
  - We don't want to pay more!
- Regarding watershed-based compliance:
  - We don't want to spend rate-payer's money outside of the City!



# City of Lodi

- But cooler heads eventually prevailed...
  - Began working on ONR in April 2012



# Lodi Case Study

- Goals of ONR
  - Identify cost of meeting WQBEL via treatment
  - Determine whether either Adaptive Management (AM) or Water Quality Trading (WQT) offer potential cost savings

# Stakeholders

- City of Lodi
- Friends of Scenic Lodi Valley
- UW-Stevens Point
- Columbia County LWCD
- DNR
- Landowners (eventually)



# What Are Our Assets?

- Stream sampling data
  - Friends group, UW Stevens Point, Columbia County
  - DNR funding
- Mapping and agricultural practice inventory
- Engaged LWCD staff

## Spring Creek Watershed Survey

River Grant Project No. RP-157-09



Project Sponsor – Friends of the Scenic Lodi Valley

Prepared by

Ron Martin

Friends of the Scenic Lodi Valley

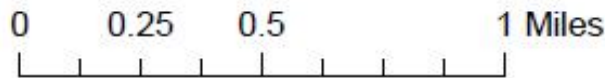
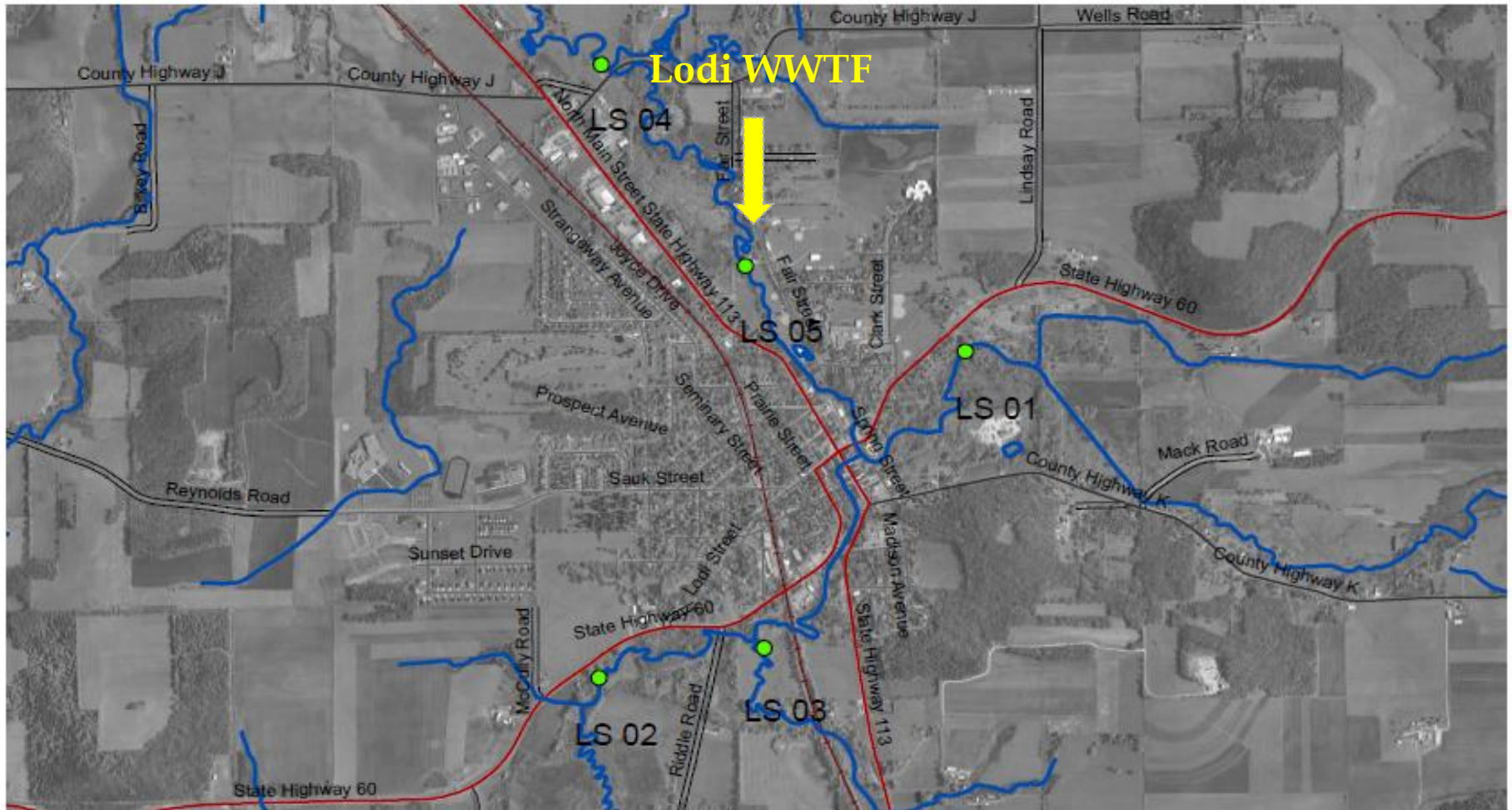
And

Jean Unmuth

Wisconsin department of Natural Resources

February, 2012

Figure 5-1 *Spring Creek Watershed*  
Monitoring Locations



*Legend*

-  Watershed Boundary
-  Monitoring Locations
-  State Trunk Highway
-  County Trunk Highway
-  Local Road - Township

# Stream Quality

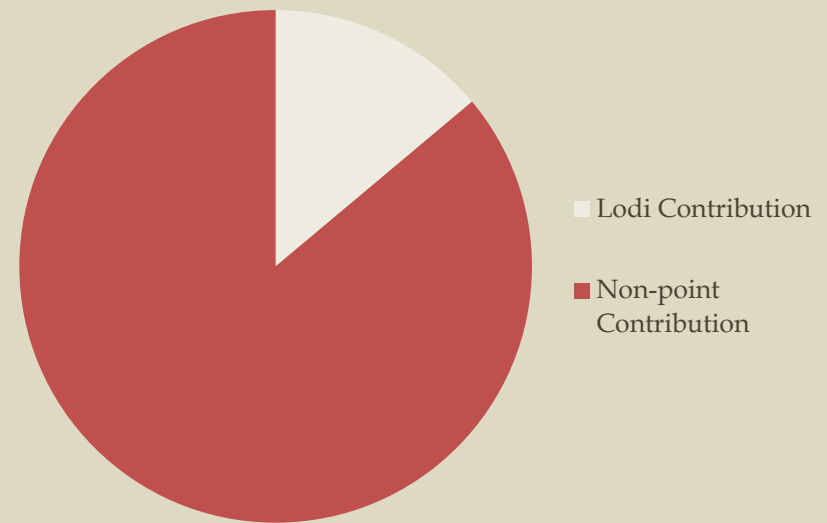
- Monitoring Point LS05 –  
Upstream of WWTF
  - Mean concentration (2011-  
Aug 2012) 0.076 mg/l
    - ✦ *Just above the criterion!*
      - Limit = Criterion (0.075  
mg/l)
      - Adaptive Management is  
potentially an option
    - Mass in stream = 5,133  
lb/year at this location



# Phosphorus Loading

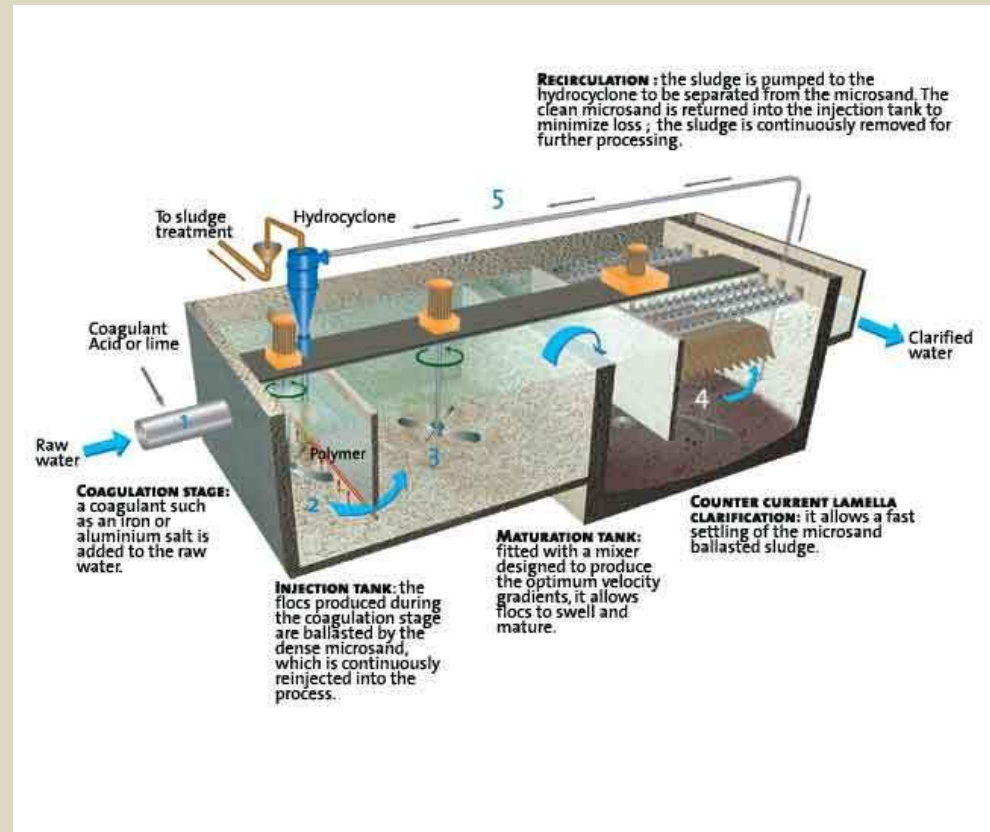
- Lodi WWTF currently removes about 5,000 lb P/year
  - Discharges 828 lb P/year to Spring Creek (85% removal)
  - City is 14% of total P load to stream

## Spring Creek Phosphorus Load



# Treatment Option

- Treatment Plant Addition Required
  - Effluent pump station
  - Ballasted sand clarification
- Estimated cost
  - \$3.4 million capital
  - \$4.2 million 20-yr PV
- Must be constructed and meeting limit in 7-9 years



# Treatment Option

- Additional removal needed to meet limit
  - Meeting 0.075 mg/l limit would require removal of >750 pounds/year of additional phosphorus (of the current 830 lb/year discharge)
  - Incremental cost of P treatment for next 20 years = \$280/pound P

# Watershed Based Compliance Options

- Adaptive Management Evaluation



# Adaptive Management

- What is required to be eligible:
  - Stream is above the water quality criterion (0.075 mg/l)
  - More than 50% of P loading to stream is of non-point origin
  - Filtration or equivalent required to meet WQBEL



# Adaptive Management

- Time allowed for compliance:
  - Permit term 0 (years 1-5):
    - ✦ Complete Adaptive Management Plan by year 4
  - Permit term 1 (years 6-10)
    - ✦ Offset at least the community's proportion of the excess phosphorus loading
  - Permit term 2 (years 11-15)
    - ✦ Offset enough phosphorus such that stream meets the water quality criteria 3 of the 5 years
  - Permit term 3 (years 16-20)
    - ✦ Compliance window may be extended if the stream is close to meeting its criterion

# Adaptive Management

- Required Initial P offset for Lodi

- Current stream P load above outfall 5,133 lb/year
- Current Lodi P discharge 828 lb/year
- Total load below outfall 5,961 lb/year

- Lodi's portion of the overall loading =  $828/5961 = 14\%$

- Allowable Spring Creek P loading (below outfall) is 5,138 lb/year
  - ✦ Based on a concentration of 0.075 mg/l P

- Excess P =  $5,961 - 5,138 = 823 \text{ lb/yr}$

- Lodi's proportionate share =  $823 \text{ lb P/yr} \times 0.14 = \mathbf{114 \text{ lb P}}$  to be offset in years 6-10 (**DNR Minimum**)

# Adaptive Management

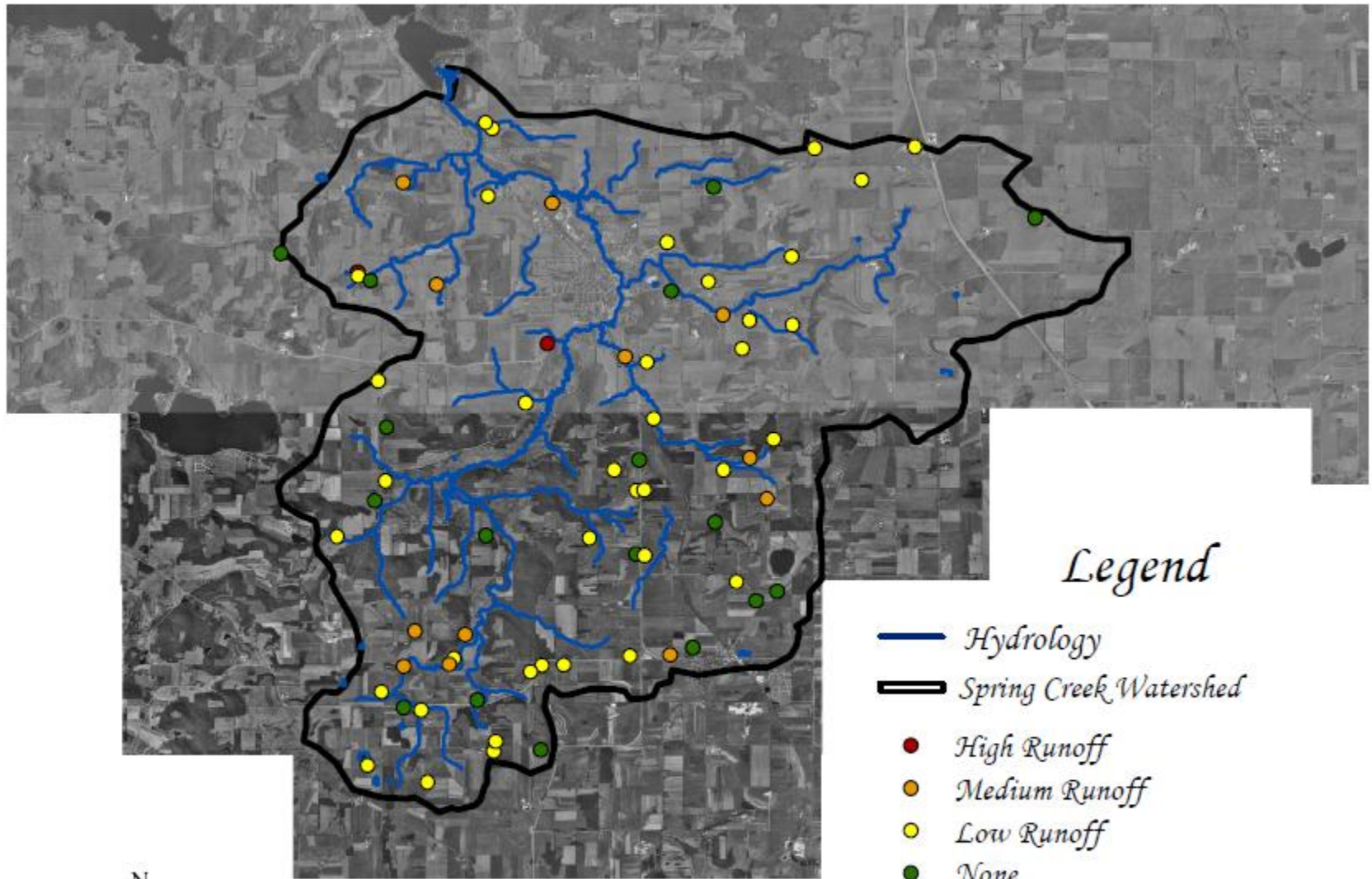
- Interim P offset required to meet stream quality in years 11-15
  - In order to meet stream quality, Lodi will need to
    - ✦ Reduce effluent P concentrations to 0.6 mg/l or below
    - ✦ Eliminate at least **570 lb P/year** from the watershed
- Ultimate P offset required for Lodi
  - At design flow and future interim limit of 0.5 mg/l, Lodi will need to
    - ✦ Reduce effluent P concentration to 0.5 mg/l or below
    - ✦ Eliminate at least **870 lb P/year** from the watershed

# Adaptive Management

- How do we eliminate phosphorus from the watershed?
  - Direct runoff from barnyards and feedlots
    - ✦ Highest mass discharge
    - ✦ Easiest to address by diverting runoff around barnyard
  - Columbia County Land and Water Conservation inventory and priority of Direct Runoff (DRO) sites
    - ✦ Previously analyzed 69 livestock sites in the Spring Creek Watershed

# Spring Creek Watershed

*Direct Runoff from Barnyards*



## Legend

- Hydrology
- Spring Creek Watershed
- High Runoff
- Medium Runoff
- Low Runoff
- None

*Columbia & Dane County Aerial Photograph*



# Adaptive Management

- Arriving at the Cost of P Reduction
  - First need to estimate how many sites are needed to effect sufficient P reductions
    - ✦ Would need to model each barnyard using BARNY model
      - Livestock inventory
      - Lot size
      - Roof area
      - Slopes
      - Distance to stream
    - ✦ Not feasible for this preliminary study

# Adaptive Management

- Simplifying Direct Runoff (DRO) assumptions

Runoff Category	Phosphorus Range (lbs/yr)	Estimated Avg P DRO (lbs/yr)	Estimated High P DRO (lbs/yr)	Estimated Average P DRO Reduction (lbs/yr)	Estimated High P DRO Reduction (lb/yr)
1	> 50	75	100	60	85
2	15 -50	32.5	49	17.5	34
3	< 15	na	na	na	na

Table courtesy of Columbia County Land and Water Conservation Dept.

Best Management Practices assumed to reduce P discharges to 15 lb/year for each site

# Adaptive Management

- DRO Sites and Potential P Reductions

Runoff Category	Livestock Sites	Estimated Average P DRO Reduction (lbs/yr)	Estimated High P DRO Reduction (lb/yr)	Estimated Total Available DRO P Reduction at Average Range (lbs/yr)	Estimated Total Available DRO P Reduction at High Range (lbs/yr)
1	14	60	85	840	1190
2	38	17.5	34	665	1292
3	17	na	na	na	na
Totals	69	-	-	1505	2482

Table courtesy of Columbia County Land and Water Conservation Dept.

1,505 lb P removal potential from 52 sites > 870 lb/year  
**Sufficient P removal can be obtained through barnyards alone**

# Adaptive Management

- How much does it cost?
  - Nutrient Management Planning – critical first step
    - ✦ 47 sites totaling 15,000 acres
    - ✦ DATCP cost is \$40/acre
    - ✦ Minimum cost share of 70% needed to enforce NR 151 (runoff rule) requirements
    - ✦ Assume the following cost sharing to incentivize farmers
      - 25% acreage at 100%
      - 25% acreage at 90%
      - 25% acreage at 80%
      - 25% acreage at 70%
  - Estimated cost \$580,000

# Adaptive Management

- How much does it cost?
  - Best Management Practices (BMP) Installation
    - ✦ Assume 14 of 14 Category 1 sites = 840 lb P/year
    - ✦ Assume 10 of 38 Category 2 sites = 175 lb P/year
    - ✦ Targeting 1,015 lb P/year (117% of offset needed at capacity)
  - Estimated cost
    - ✦ Assume \$24,000 of improvements per site
    - ✦ 24 sites x \$24,000 = \$576,000

# Adaptive Management

- How much does it cost?
  - Manure storage facilities
    - ✦ Estimate 4 needed to implement Nutrient Management Plans
    - ✦ Estimated cost = \$690,000

# Adaptive Management

- Total Estimated Capital Cost = \$2,500,000
- Total 20-year Present Value = \$2,739,000
  - Incremental cost of P treatment for next 20 years = \$135/pound P
  - Compare to treatment at \$280/pound

# Adaptive Management

- Why this example is conservative
  - Targeting 17% more P than theoretically needed
  - Treatment plant has demonstrated ability to discharge lower levels of P
    - ✦ P offsets required should be lower
  - Costs will be incurred incrementally, not all at once
  - Outside cost sharing may be available to implement watershed-based solutions
    - ✦ DNR Grants
      - Targeted Runoff Management (TRM)
      - Lake Planning Grants
      - Lake Protection Grants
    - ✦ Interest Groups – Clean Wisconsin, Trout Unlimited, etc.

# Adaptive Management

- Risks and Uncertainties in Estimate
  - Actual P discharge from each site
  - Unit Costs of BMP's
  - Response of stream to reduced P load
    - ✦ P inventory in stream bed may release (“legacy phosphorus”)
  - Cooperation of landowners

# Adaptive Management

- If water quality criteria is met:
  - maintenance/continuation of new practices
- If water quality criteria is not met:
  - Enter into Water Quality Trading
  - Construct WWTF upgrade to meet original WQBEL (since stream quality still exceeding criteria)
  - Demonstrate that stream quality cannot be further improved (use attainability study)
- **Adaptive Management presents risk**

# Summary

- Economic Comparison
  - Treatment Present Value: \$4.2 million
  - Adaptive Management Present Value \$2.7 million
- Non-Economic Factors
  - Can incrementally address P sources
  - Can change from Adaptive Management to Trading or Treatment in a future permit term
  - Risk that some type of treatment may be needed, but can potentially defer construction 20 years
  - Spring Creek is very close to the water quality criterion

# Next Steps

- Become an Adaptive Management Pilot Project for the DNR
- Begin Facility Planning to further refine the assumptions and estimates
  - Validate assumptions with field measurements, modeling and sampling
  - Make site-specific cost estimates
  - Resolve how the City, County and Landowners would work together to implement the measures
  - Determine how the efforts would be funded

# Next Steps

- If the assumptions & estimates hold up, prepare Adaptive Management Plan by October 31, 2015
- Implement Nutrient Management Plans and Best Management Practices (2016-2021)
  - In partnership with Columbia County LWCD
- Demonstrate compliance with criterion (2021-2026)
- Additional permit period may be available (2026-2031)
- If construction necessary, may not be until 2033 or so

# Take-Aways

- Start Early
  - Test receiving water upstream and downstream
    - ✦ Include tributaries
  - Contact County LWCD
    - ✦ What are your assets?
    - ✦ Who are your potential partners?
  - Optimize plant for P removal
  - DON'T WAIT FOR YOUR DRAFT PERMIT!!
- Be open-minded to new relationships
  - Watershed based compliance may benefit your residents
  - Will require non-traditional relationships and activities

# Acknowledgements

- City of Lodi
- Columbia County Land and Water Conservation Dept.
- Friends of the Scenic Lodi Valley
- UW Stevens Point
- Wisconsin DNR