



Excellence in Engineering Since 1946

The Wisconsin River TMDL from the Discharger's Perspective

WWOA 48th Annual Conference

October 8, 2014





Outline of Presentation

- Wisconsin River TMDL Overview
- Wisconsin River Discharger Group (WRDG) Formation and Behind the Scenes
 - Who is WRDG?
 - WRDG's Role
- Next Steps

Wisconsin River TMDL Overview

- The Wisconsin River has experienced a long history of impaired water quality conditions, including low dissolved oxygen and severe algal blooms
- Algae blooms caused by excessive phosphorus loading from point and nonpoint sources in the watershed
- TMDL Goals:
 - Identify sources
 - Develop improvement plan



Wisconsin River TMDL Overview

- Wisconsin River Basin (WRB) TMDL study area extends from basin's headwaters in Vilas County to Lake Wisconsin (9,156 mi²)
- Utilizing a 4 year water quality monitoring effort throughout the WRB
- Modeling effort focused on two environments:
 - Upland loading, sediment transport, and nutrient loads
 - In-reservoir or in-lake processes

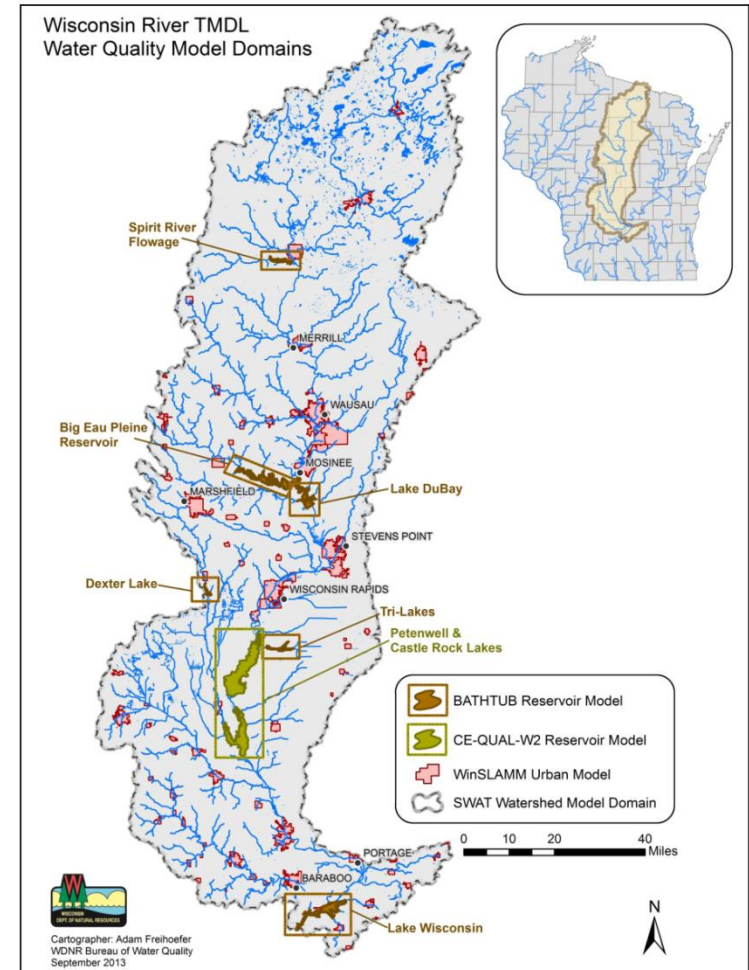
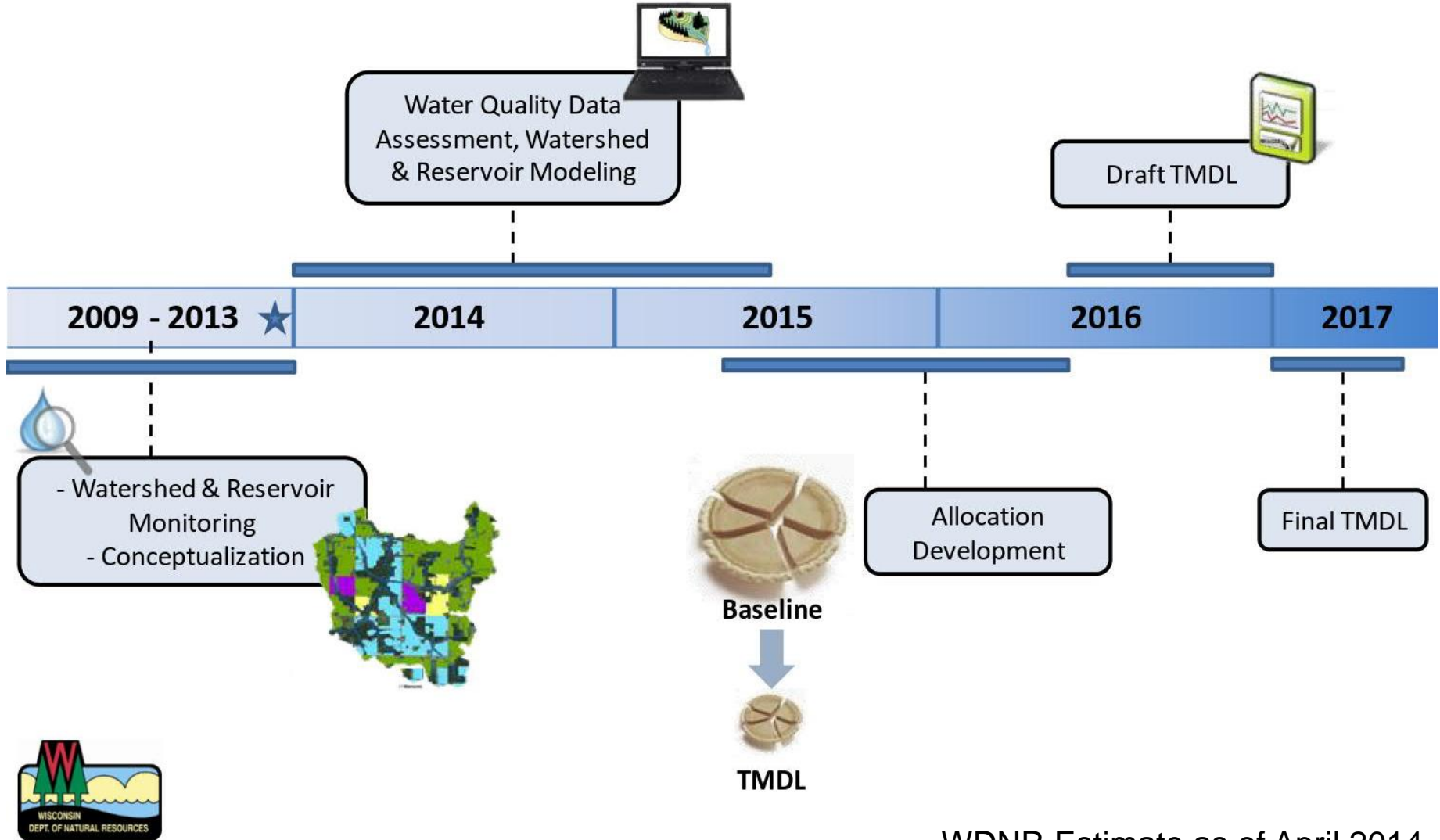


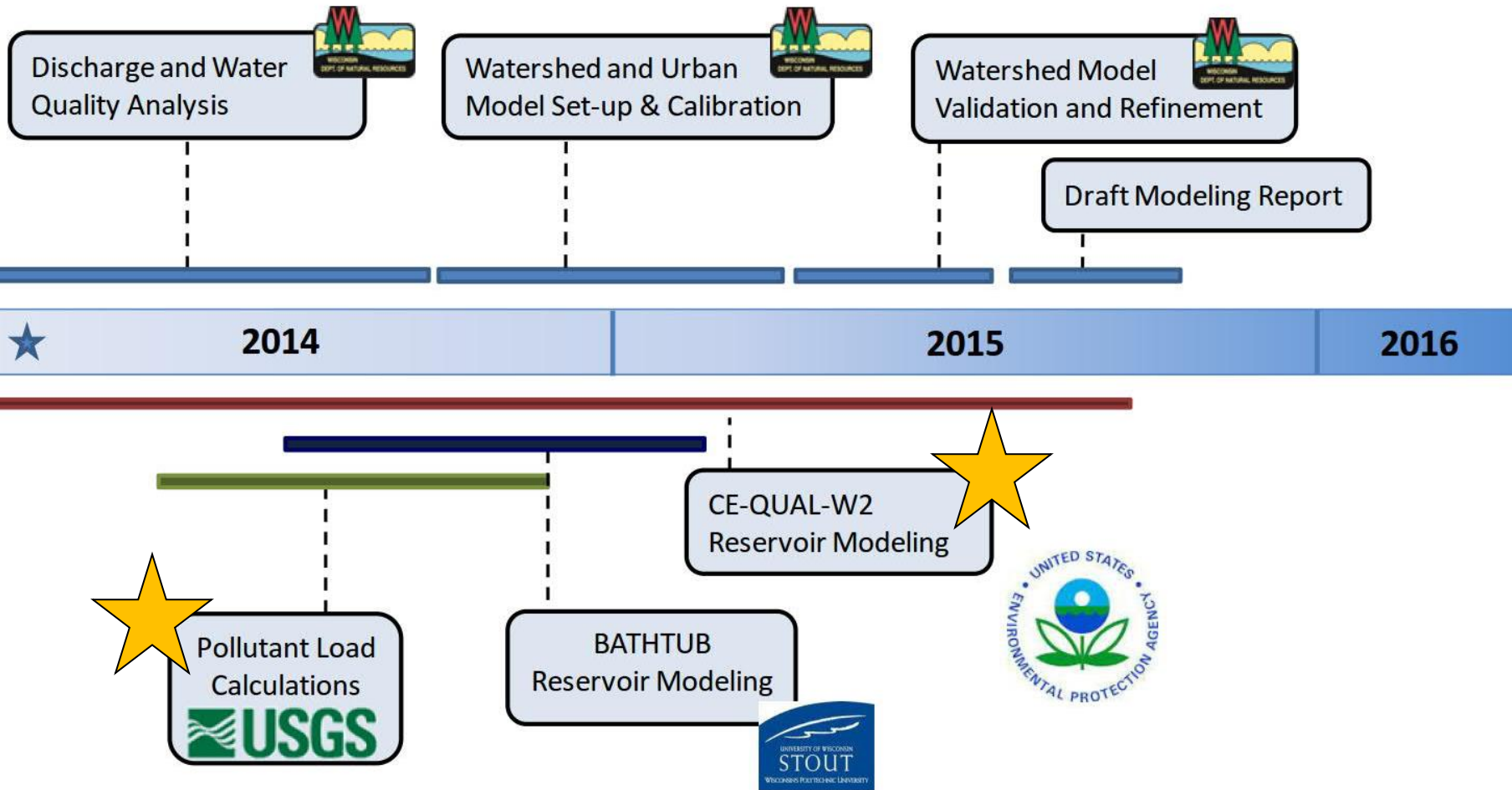
Figure 1 – Wisconsin River TMDL Water Quality Model Domains

Overall Project Timeline



WDNR Estimate as of April 2014

Detailed Technical Timeline



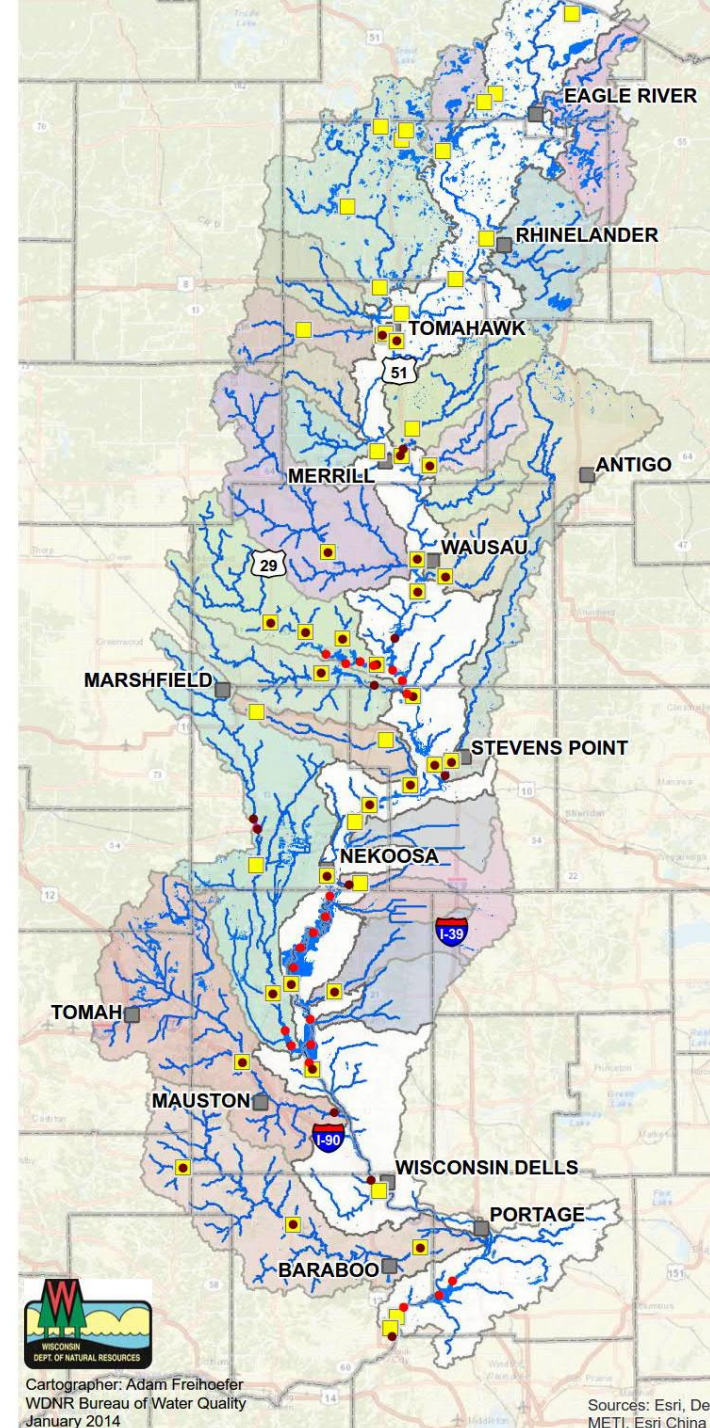
TMDL Monitoring Strategy

- Balance of needs and funding
- Mass balance principle: $\text{flow} \times \text{concentration} = \text{load}$
 - Used existing flow network (WVIC and USGS data) and seven new USGS sites
 - Concentrations measured over a fixed, semi-monthly period from April 2009 to November 2013
- Additional sampling and available data
 - Streams/rivers – watershed rotation data, long term trend data, 303(d) evaluation
 - Lakes/reservoirs – sediment cores, past modeling efforts, WVIC data, DNR data, citizen data, etc.

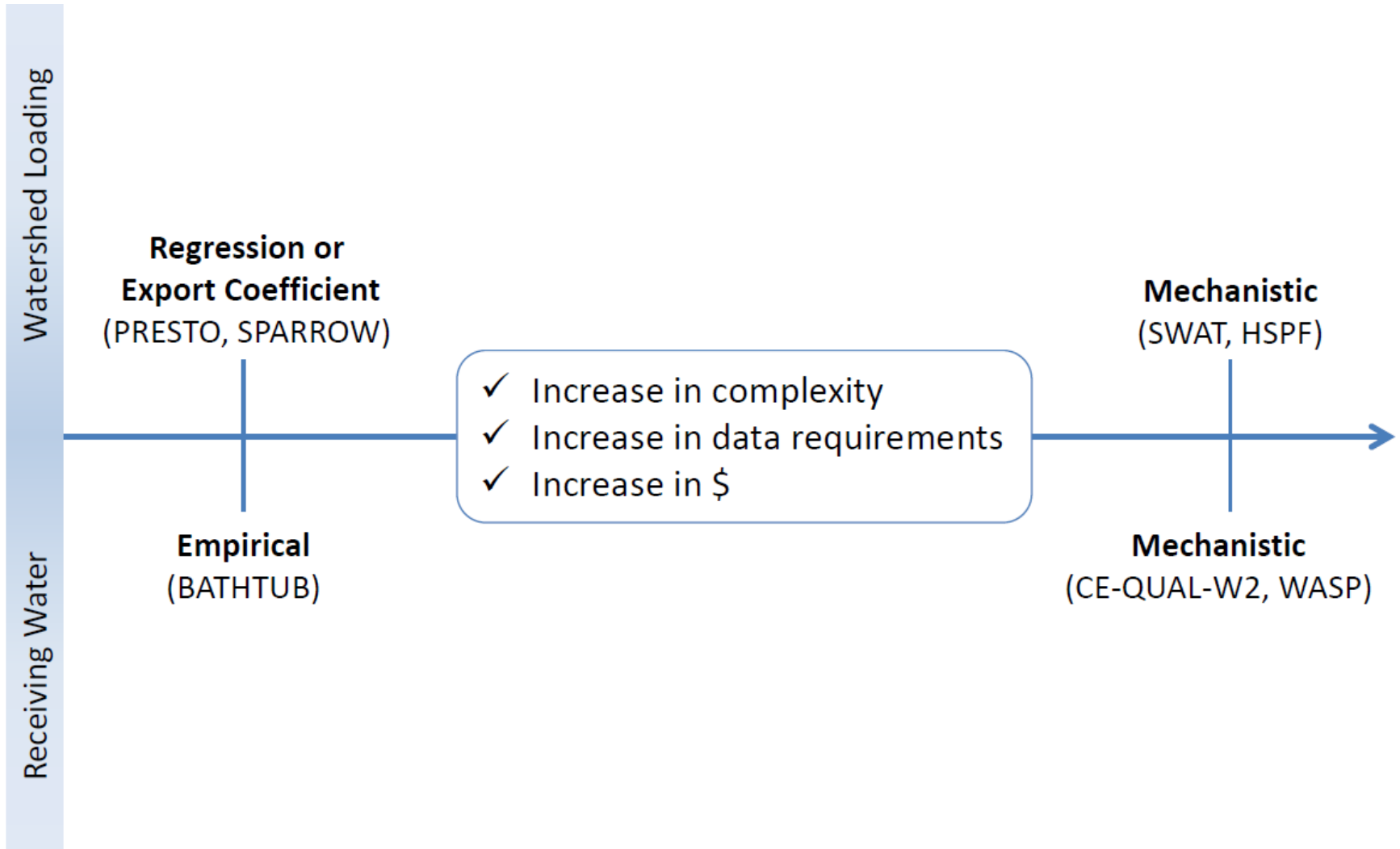
TMDL Monitoring Sites

TMDL Monitoring Site

- River / Stream Water Quality
- Reservoir Water Quality
- Lake Water Quality
- Daily Discharge
- City or Town
- ⊕ County Boundary
- ~ Hydrologic Network
- ☞ Tributary Drainage



TMDL Modeling Strategy – Model Types



TMDL Modeling Strategy – Model Domains

- Watershed Model (SWAT)
 - Entire basin
- Urban/Stormwater Model (WinSLAMM)
 - Urban areas (MS4, cities, and villages)
- Empirical Reservoir Response (BATHTUB)
 - Spirit River Flowage
 - Big Eau Pleine Reservoir
 - Lake DuBay
 - Dexter Lake
 - Tri Lakes
 - Lake Wisconsin
- Mechanistic Reservoir Response (*CE-QUAL-W2*)
 - Petenwell
 - Castle Rock

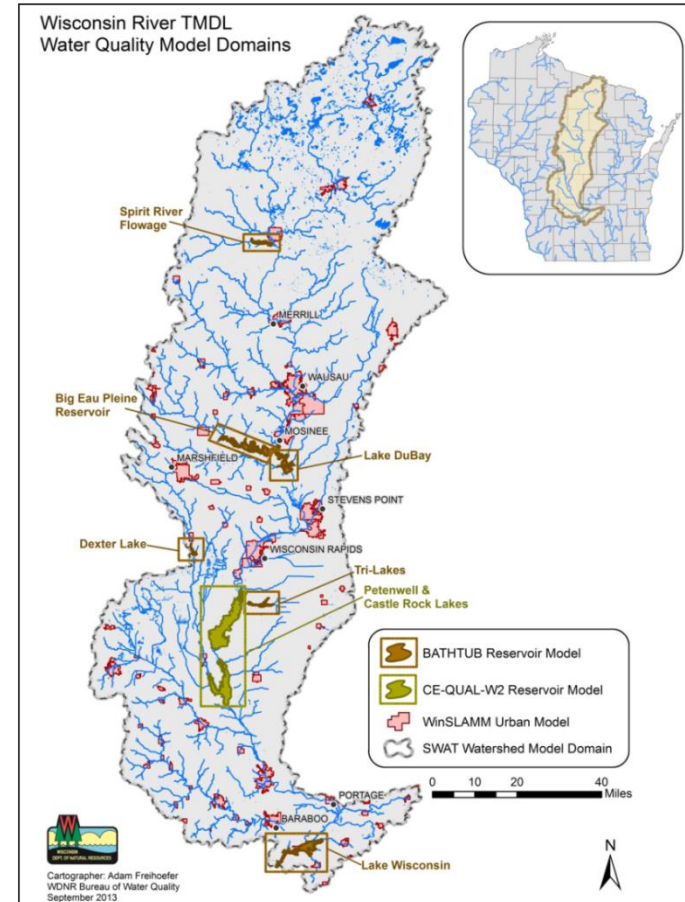


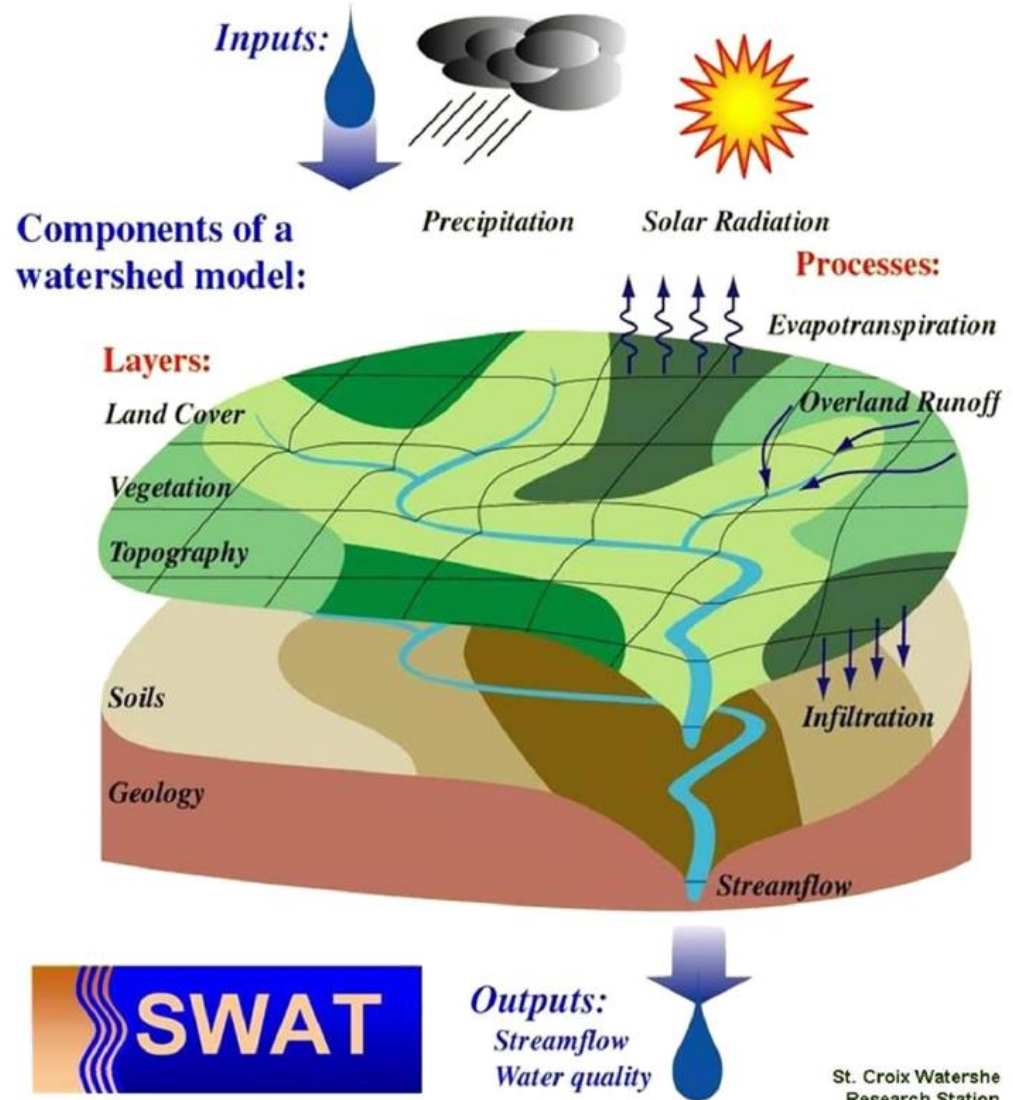
Figure 1 – Wisconsin River TMDL Water Quality Model Domains

Why is SWAT the best fit model?

- Public domain, open source code, user support
- GIS-based user interface
- Previously applied to TMDLs throughout Wisconsin and the United States
- Ability to incorporate heterogeneity of agricultural management
- Ability to simulate monthly nutrient loads

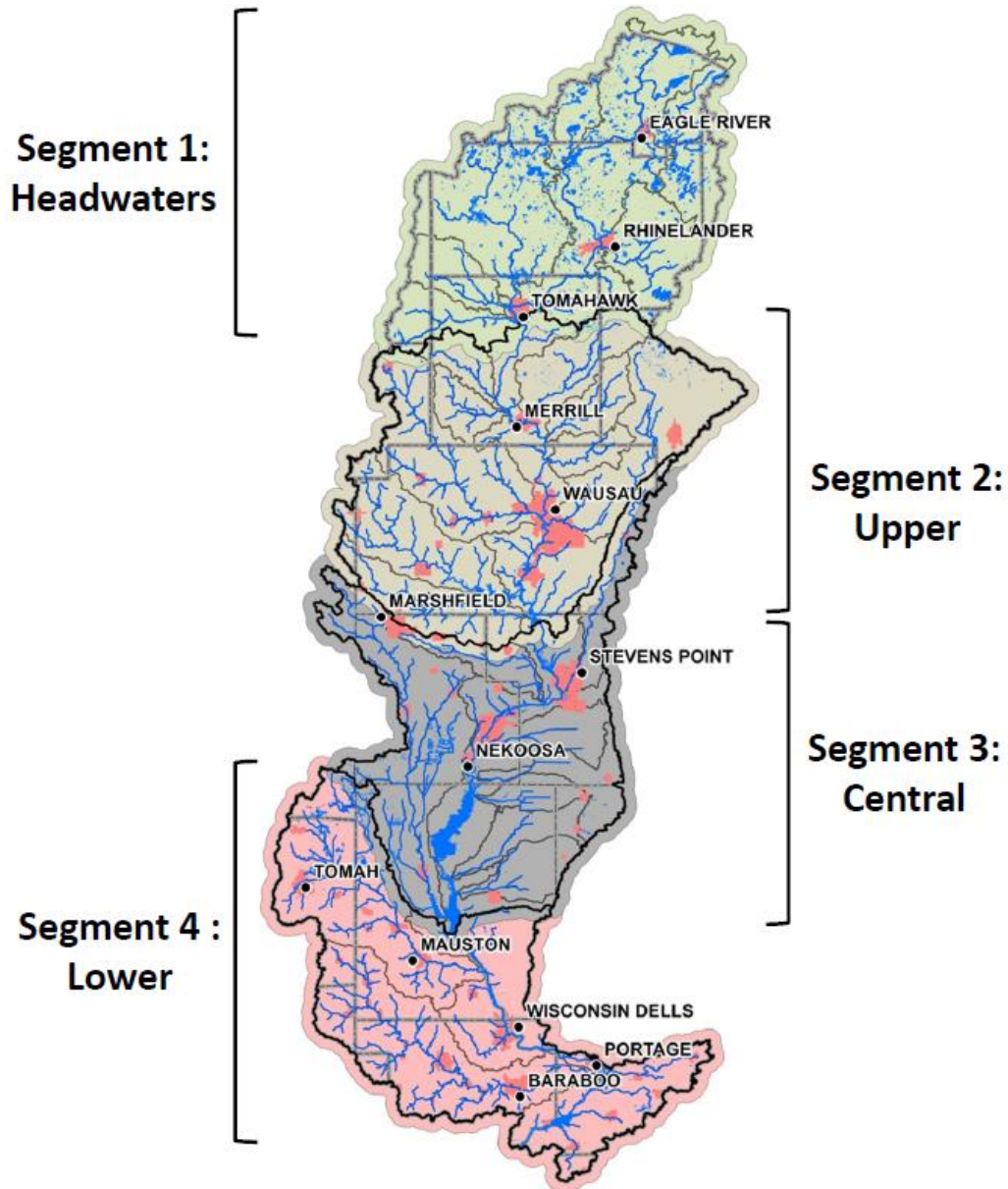
SWAT Model Details

- Simulates daily conditions based on climate data
- Input data, parameter intensive
- Outputs for each TMDL reach
- Outputs include crop yields, water balance, discharge, sediment, and water chemistry



St. Croix Watershe
Research Station

SWAT Model Configuration



WDNR Used Multi-Step Land Use Definition Process



Step 1:

Define annual crop change using satellite imagery

Step 2:

Categorize 5-year crop change into rotation types



Step 3:

Assemble local knowledge to further define rotations

Step 4:

Integrate local knowledge to land management layer

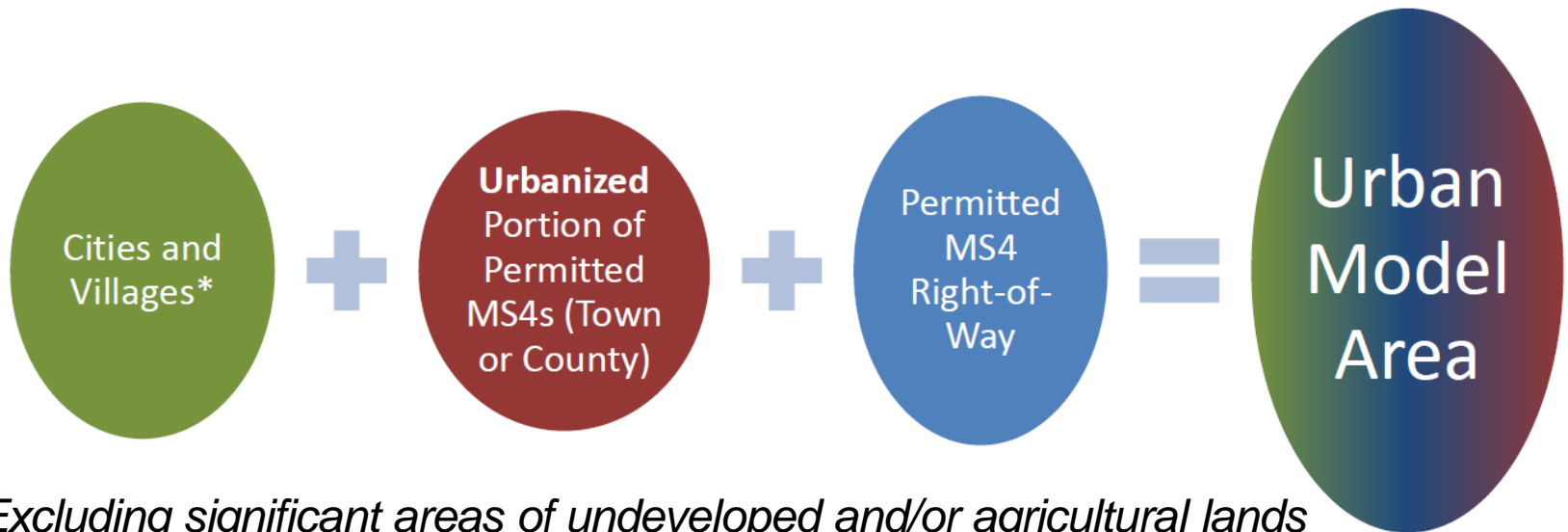


Step 5:

Confirm agricultural mgt. with available observed data

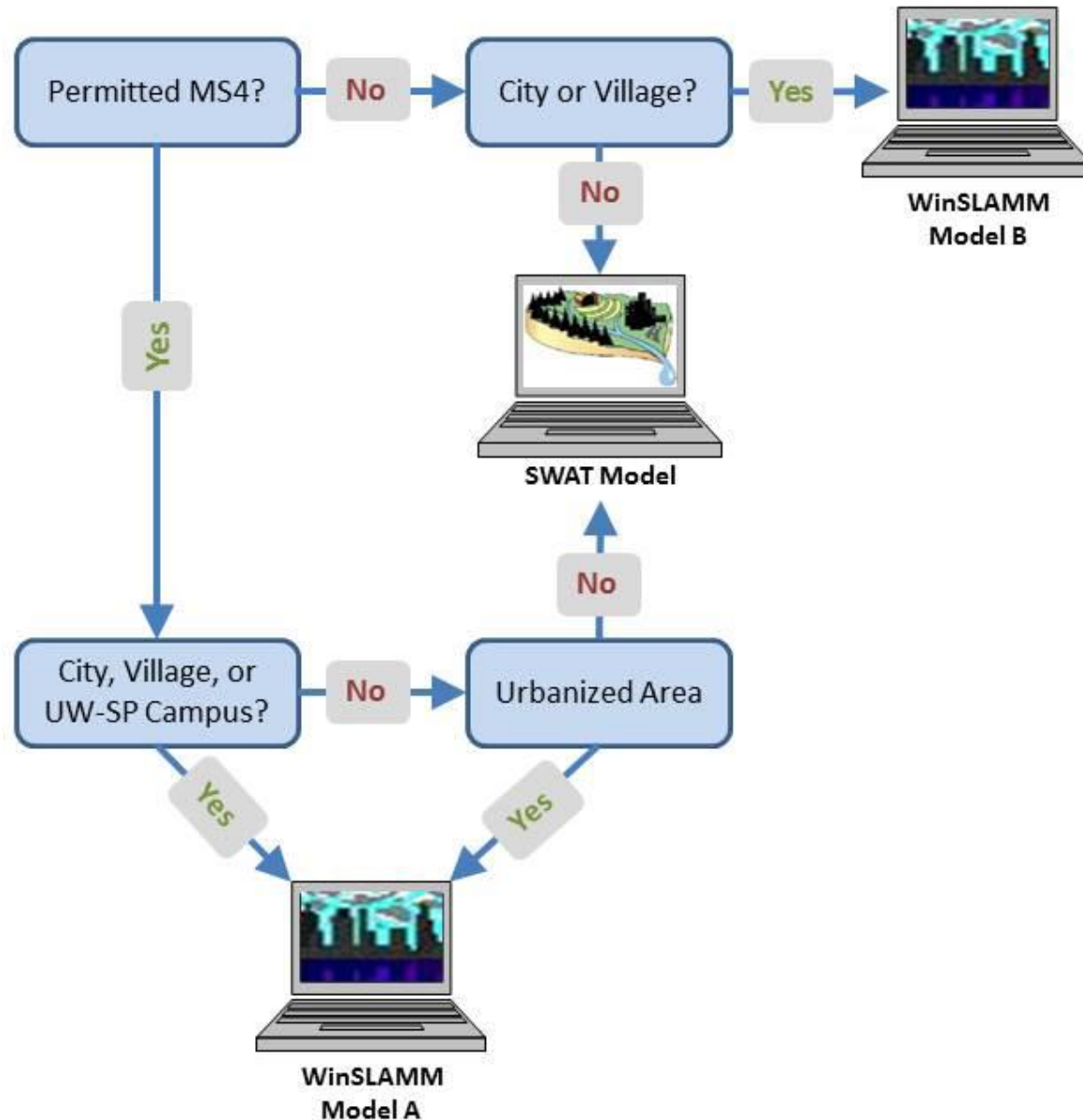
Urban Area Model Approach (WinSLAMM)

- WinSLAMM predicts stormwater flows and associated pollutant load generation and attenuation from urban areas
- WinSLAMM output data will be incorporated into SWAT model as monthly point source loads
- WinSLAMM model boundaries to be shared with MS4s



**Excluding significant areas of undeveloped and/or agricultural lands*

Delineating Urban Model Areas



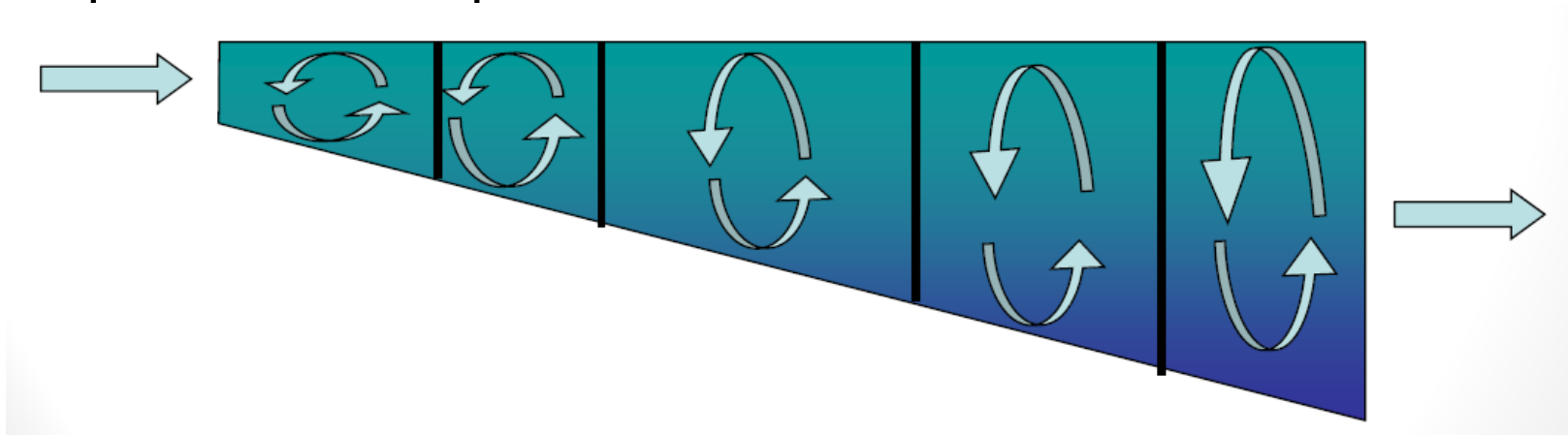
Reservoir Modeling Overview

- Important components of reservoir modeling:
 - Physical characteristics
 - Chemical characteristics
 - Diagnostic goals
 - Water balance
 - Critical conditions
 - Predictive goals
 - Cause and effect
 - Assimilative capacity



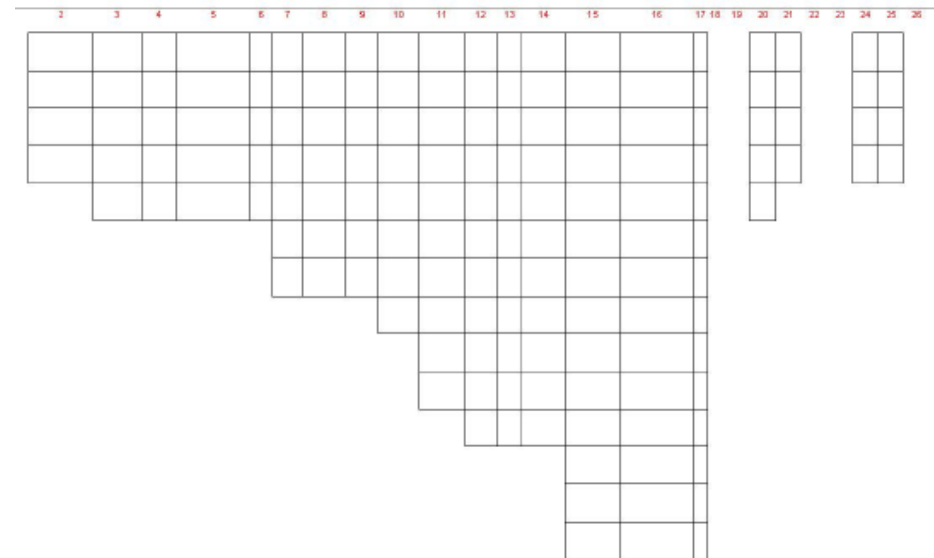
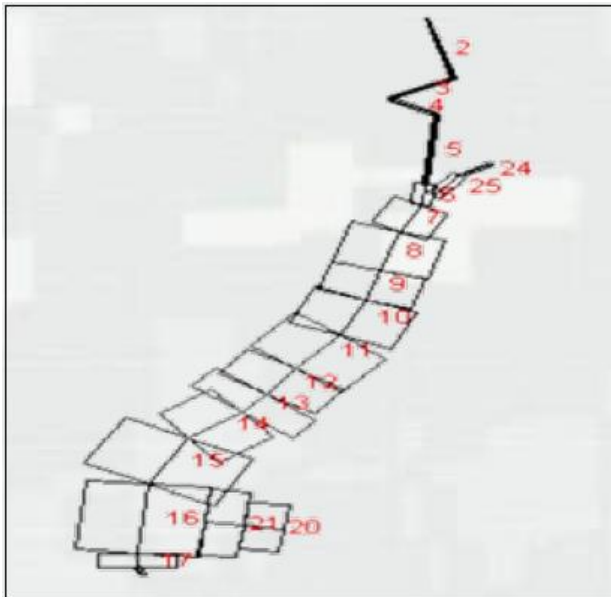
BATHTUB Model Details

- Data collection and inputs
 - Vertical profile(s), horizontal patterns, constituents of interest (temperature, nutrients, chlorophyll, transparency)
- Calculates variance estimates and confidence limits for each output variable
- Determines sensitivity of predicted concentrations to deposition and dispersion coefficients



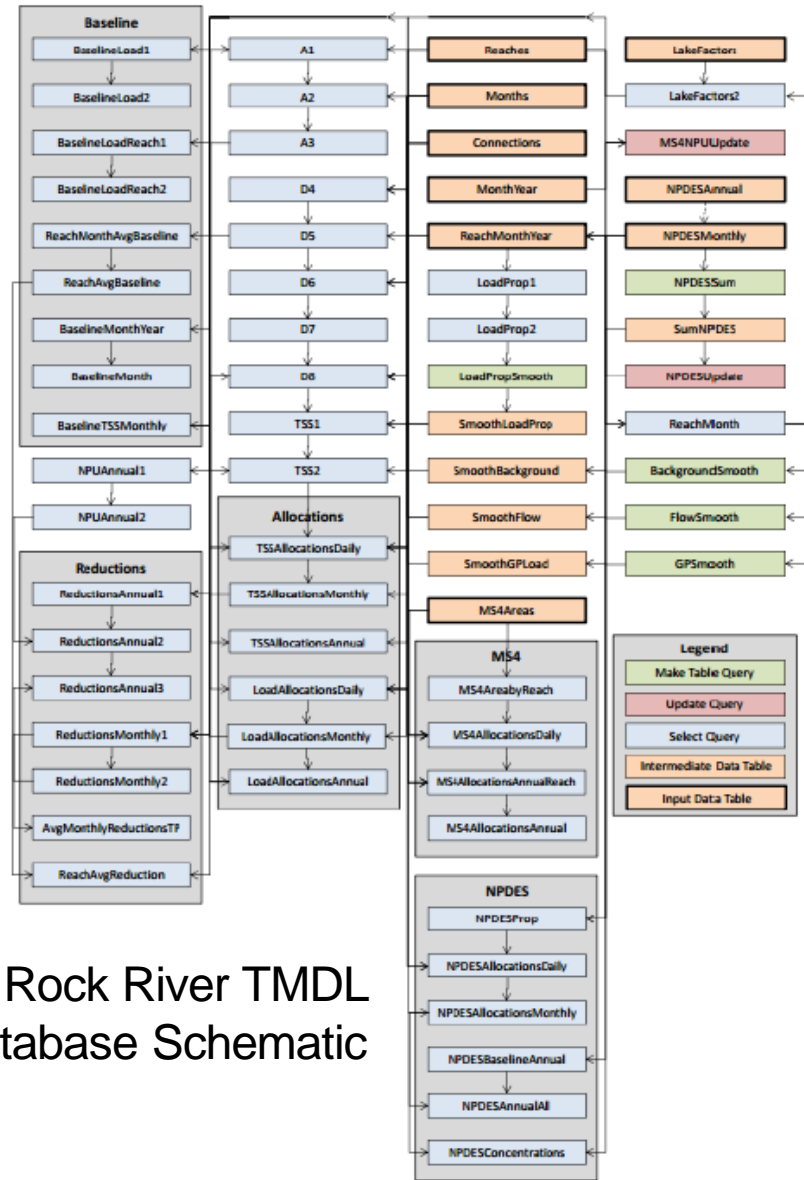
CE-QUAL-W2 Model Details

- Inputs – bathymetry, initial conditions, boundary conditions, calibration data, hydraulic parameters, kinetic parameters
- All water quality parameters are averaged laterally across a segment
 - Each layer within a segment acts as a fully mixed reactor for each time step



Model Integration Database

- Microsoft Access Database
- Platform for storing and organizing model inputs and outputs
- Record of complete multi-model architecture
- Will be used to calculate loading capacity, load allocations, and percent reductions



Rock River TMDL
Database Schematic

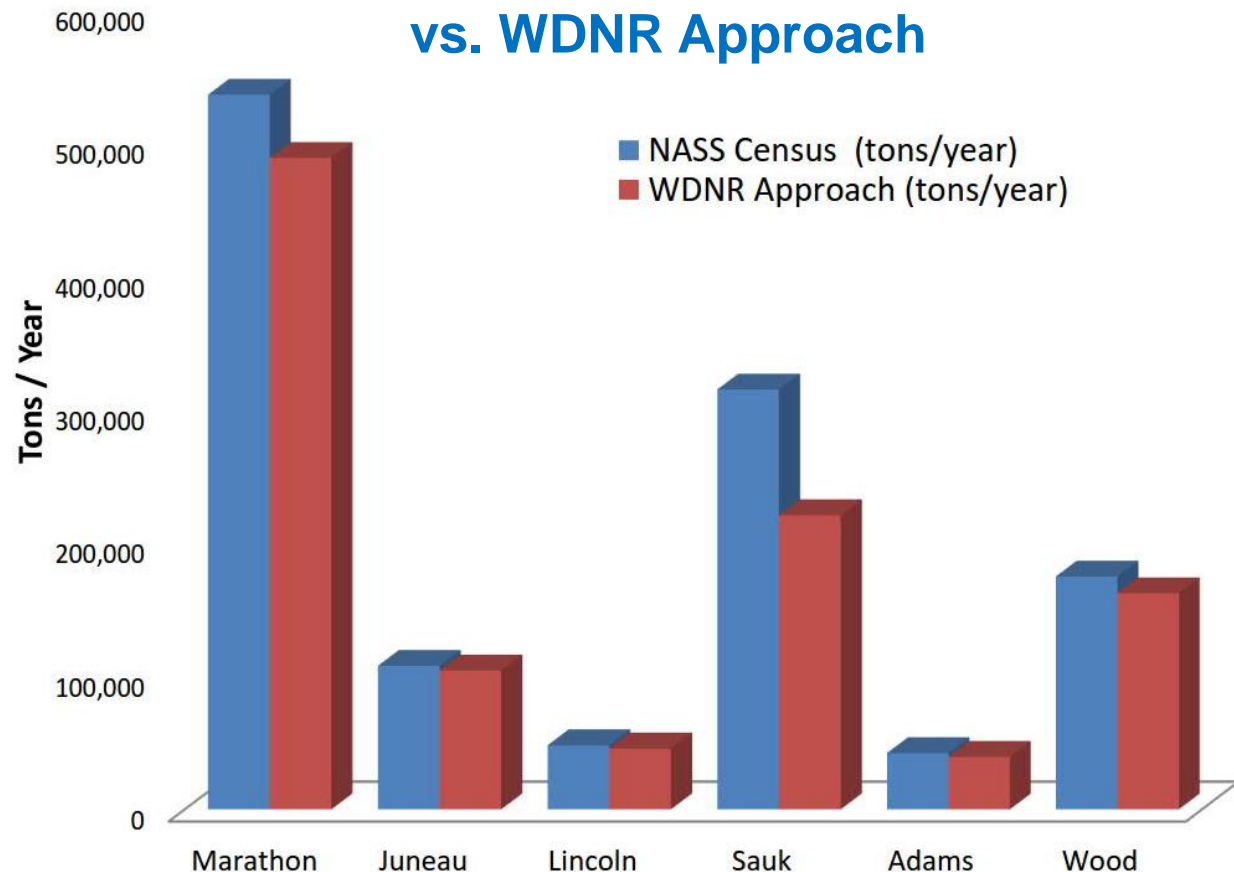
Current WDNR Status

- Released an updated Wisconsin River Improvement Project website
- Website includes a spatial data viewer tool (like Surface Water Data Viewer)
- Recently released a land cover and agricultural management definition within the Upper Wisconsin River Basin Technical Memo
- WRDG provided comments
- Will be meeting with WDNR to discuss project schedule, staffing changes, and modeling changes next month.

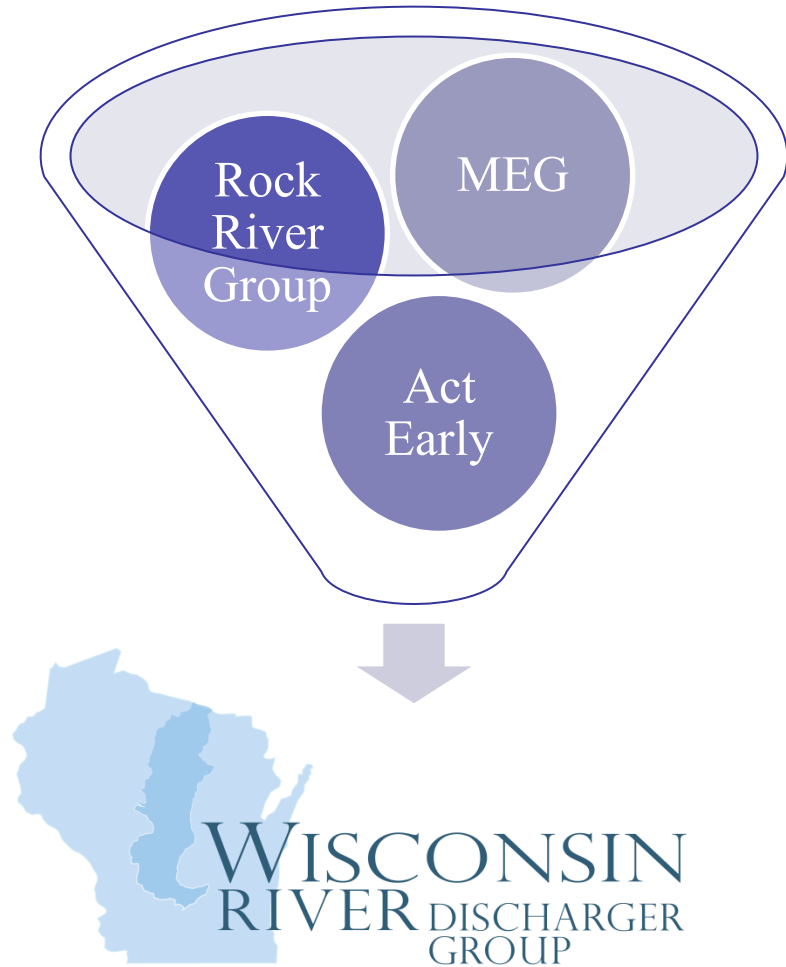
A Pound's A Pound, or Is It?

- Defined as closely aligning with each other.
- Approximately 330,000 pounds of phosphorus difference
- Industrial and municipal WWTPs discharged 256,000 pounds in 2011

DATCP Cattle Inventory Manure vs. WDNR Approach



Wisconsin River Dischargers Group



WRDG Unites the Voice

THE Stream
NEWSLETTER UPDATE
WISCONSIN RIVER DISCHARGER GROUP
VOLUME 1
APRIL 2014

Wisconsin River Water Quality Improvement Project TMDL Update

The WDNR Wisconsin River Water Quality Improvement team has been working on several initiatives.

- **New Website** - See the new website! <http://dnr.wis.gov/waterquality/wisconsin/>
- **Recent Presentation** - The WDNR gave a project update at the Government Affairs Seminar that captures their work to date. The WDNR reports that they are still on schedule and will be issuing a technical memo on Land Use soon. You can view or download the presentation from this link: <http://dnr.wis.gov/water/tmdl/wisconsin/CharterPresentations/GovernmentAffairs%20Seminar.pdf>
- **Spatial Viewer** - The spatial viewer shows some of the physical and monitoring features of the watershed. Explore it here: <http://dnr.wis.gov/topic/SurfaceWater/restorationviewer/>
- **Wisconsin River Water Quality Symposium** - Lastly, there have been some changes to the Wisconsin River TMDL team. The wastewater sector lead is Bart Chapman until the Arca TMDL team. The wastewater sector lead is Eric Donaldson, is filled. Adam Frieboer is Engineer position, formerly held by Eric Donaldson, and WDNR is actively working moving to a new position in the water department, and WDNR is actively working to fill his position as Modeling/Technical Lead. Ann Hircakur is the WDNR project manager.

Did You Know? The WDNR 303d list has been updated for 2014. Many new Wisconsin River watershed listings!
http://dnr.wis.gov/topic/impairedwaters/2014IR_IWLlist.html

Membership Update

Welcome Charter Members!

- Athens
- Baraboo
- Eloy
- Lakeland Sanitary District
- Marathon City
- Marshfield
- Mousten
- Necedah
- Nekoosa
- New Lisbon
- Plaver
- Port Edwards
- Portage
- Rhineland
- Rib Mountain Metropolitan Sewerage District
- Stevens Point
- Tomah
- Tomahawk
- Wausau
- Whiting
- Wisconsin Rapids

WRDG now consists of 21 communities, with a total population of 241,428*.

*Based on 2013 WI DOA estimates.

Help Needed

The Wisconsin River Water Quality Symposium is seeking a volunteer to serve on their planning committee to represent municipal wastewater treatment plants. **This is a great opportunity for our group's voice to be heard!** Please contact Rich Boden at 715.345.5259 if you are interested.

Legislative Update

Clean Waters, Healthy Economy Act (Act 283)

Several member community representatives were involved in the statewide effort to pass the Clean Waters, Healthy Economy Act. This act would provide additional variance alternatives for communities facing reduced phosphorus discharge limits. At the time of writing this bill passed both state houses and was awaiting the Governor's signature. This bill is supported by many statewide organizations including the Municipal Environmental Group (MEG).

If signed, several steps will still be necessary for utilities to be able to take advantage of this new compliance alternative. The Wisconsin Department of Administration (DOA) will need to prove that compliance will cause widespread economic hardship, and the USEPA will need to approve the proposed variance.

Lagoon Variance

Several communities and WDNR representatives gathered in Vesper in April to discuss alternatives for lagoon facilities. If the community has a lagoon based system, even if they have additional treatment such as an RBC for ammonia removal, they may qualify for the phosphorus lagoon variance after evaluating all options available to them and system optimization. A lower value effluent must be achieved which may become the new limit. If financial hardship is proven (bill exceeds 2% MHD), they have met the qualifications for a 5 year variance. In the next permit cycle numbers and technologies need to be rechecked. If that is met, then they will get another 5 year permit, with no sunset clause in the program. Therefore the new lower limits for phosphorus would not apply to them, nor would the TMDL limits.

Did You Know?

WDNR is working on a Site Specific Criterion (SSC) guidance document. SSCs can be used to create different compliance alternatives.

Education Opportunities

WDNR has conducted a four-part webinar series highlighting Water Quality Trading & Adaptive Management. The Webinars can be viewed online at any time: <http://dnr.wis.gov/topic/SurfaceWater/atlas.html>

Water Quality Trading & Adaptive Management Topics include:

- Overview
- Finding, Quantifying Credits
- Developing a Plan
- Implementing & Verifying Offsets

THE Stream NEWSLETTER UPDATE
Produced and distributed by:
STRAND ASSOCIATES, INC.*
910 W. Wingra Drive, Madison, WI
www.strand.com

As a member benefit for the: **WISCONSIN RIVER DISCHARGER GROUP**

Do you have an inquiry, comment, or suggestion? Please contact:
Rachel Lee, P.E. - 608.251.2129 x1064
rachel.lee@strand.com



The Fine Print

- Tax exempt status, 503 regs
- Needed to get a bank account and letterhead developed
- 20 current member communities, population ~200,000
- Can be challenging to get members to sign on the dotted line

Baraboo

Elroy

Lakeland Sanitary
District

Marathon City

Marshfield

Mauston

Necedah

Nekoosa

New Lisbon

Plover

Port Edwards

Portage

Rhineland

Rib Mountain MSD

Stevens Point

Tomahawk

Wausau

Whiting

WRDG Next Steps

- Encourage WDNR to keep efforts moving forward
- Monitor activities in watershed
 - Other user groups
 - Agricultural impacts
- Communicate with members



Questions and Answers

Thank you!

rachel.lee@strand.com

Thank you to WDNR for many graphics!



STRAND
ASSOCIATES®

Excellence in Engineering Since 1946