

Using Enhanced Geospatial Water Quality Data Products for Prioritizing Subwatersheds and Catchments for the Placement of Conservation Best Management Practices and Targeting fields for Implementation

Decision Support for Water Quality Projects

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Presentation Outline

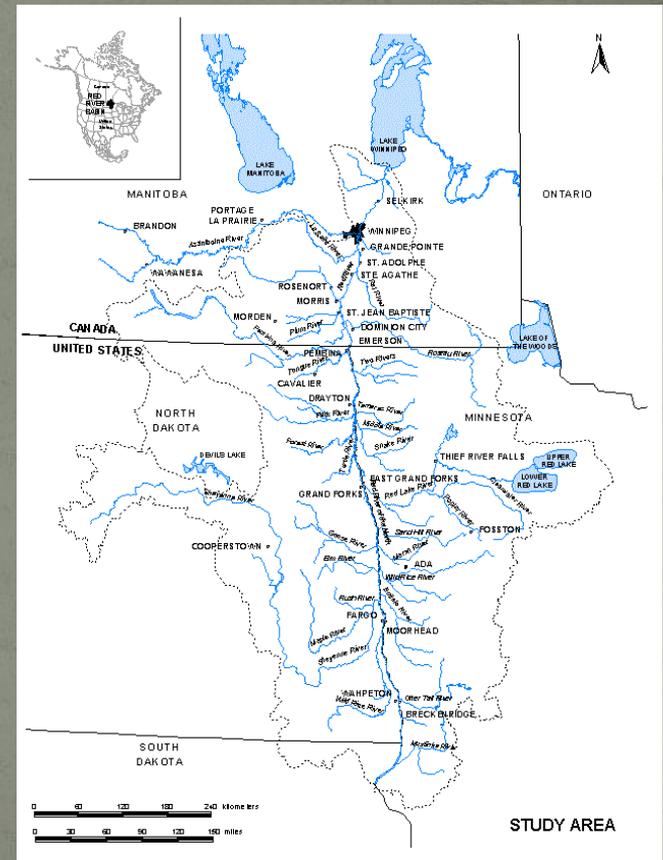
- International Water Institute Overview
- Decision Support
- Water Quality Projects Challenges
- Conceptual Prioritization Strategy
 - Water Quality Decision Support System
- Data / Portal
- Next Steps / Opportunities

1997 Red River of the North Flood

- International Flood Mitigation Initiative (IFMI) 2000

Mission:

- Watershed Research
- Watershed Education



DECISION SUPPORT

- Packaging and Disseminating New and Existing Information to Support Informed Decision-Making
- Internet-Based
- User Defined (non-technical)
 - Planning
 - Management
 - Operation

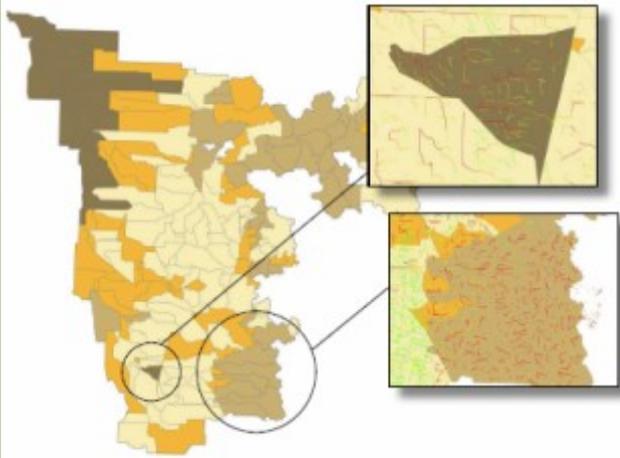


WQ Project Implementation Challenges

- How to prioritize implementation of:
 - nonpoint source best management practices (BMPs)
 - Conservation practices (CPs)
- How do you identify specific fields within the priority areas?
- How do you measure effectiveness of one or more BMP and/or CP?

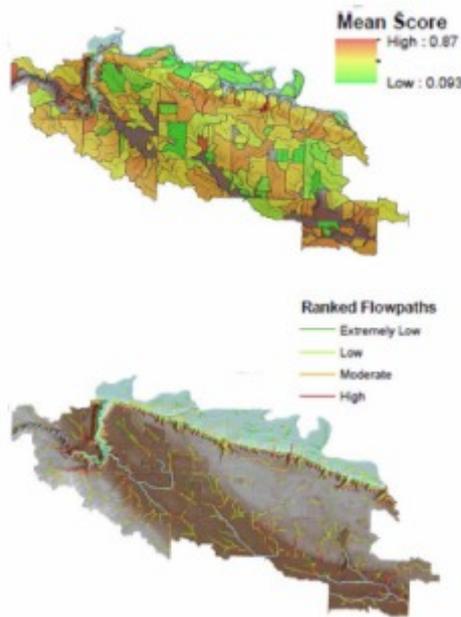
VISION

Prioritize



Subwatersheds for Implementation

Target



Project Locations Within Watershed at Fields Scale

Measure



Progress in Water Quality Improvement

[Go](#)

**Red River Basin**
Decision Information Network
Shared Tools for Regional Problem Solving

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Featured Tool

Water Quality Decision Support System



The Water Quality Decision Support Application (WQDSA) is a pilot project for the major watersheds located within the Minnesota Portion of the Red River Basin. The WQDSA is a shared vision among a diverse group of stakeholders lead by the International

[VIEW TOOL](#) | [MORE INFO](#)

Featured Project

Basin Technical and Scientific Advisory Committee formed to Study Surface Drainage

The International Water Institute has been charged with assembling the Basin and Technical Advisory Committee (BTSAC) to: Determine how to best manage the existing surface drainage system to increase or maintain drainage benefits and reduce flood flows. Determine best strategies for

[MORE INFO](#)

Organizations

- FM River Keepers
- International Water Institute
- MN Red River Watershed Management Board
- ND Red River Joint Water Resources District
- Red River Basin Commission
- Red River Retention Authority
- Red River Retention Authority
- US Army Corps of Engineers

Additional Tools

- River Watch Water Quality Database
- Regional Drought Decision Support System
- LiDAR Portal
- Interactive Flood Planning Map / Flood Forecast Display Tool

More Projects

- North Ottawa Flood Damage Reduction Project
- Basin Technical and Scientific Advisory Committee (BTSAC) – Tile Drainage Study
- Long Term Flood Solutions (LTFS)
- Regional Drought Decision Support System
- Watershed Planning Tool

News & Events

- 12/31/13 - Red River Watershed Center Opens in N Fargo
- 10/17/13 - FM Diversion Authority Releases New Diversion Alignment Map
- 9/18/13 - FM Diversion Project Included in Water Resources Reform and Development Act (WRRDA)

 **International Water Institute**
Supporting Flood Research and Watershed Education

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Tools

A core RRBDIN service to basin residents and resource managers is to provide decision support "tools" designed to disseminate important and relevant information to aid in local, state, and regional decision-making.

Interactive Flood Planning Map / Flood Forecast Display Tool

[VIEW TOOL](#) [MORE INFO](#)

Interactive flood planning map and real-time flood forecast inundation maps for the Fargo-Moorhead region

Lidar Viewer

[VIEW TOOL](#) [MORE INFO](#)

View and create customized elevation maps

LIDAR Portal

[VIEW TOOL](#) [MORE INFO](#)

Download LIDAR data and products

Regional Drought Decision Support System

[VIEW TOOL](#) [MORE INFO](#)

Drought and drought forecast information

River Watch Water Quality Database

[VIEW TOOL](#) [MORE INFO](#)

Water quality data, graphs and summary statistics

Basin Viewer

[VIEW TOOL](#) [MORE INFO](#)

Online mapping tool with a variety of layer viewing options.

Water Quality Decision Support System

[VIEW TOOL](#) [MORE INFO](#)

Watershed condition, water quality GIS products, pollutant source, load and BMP assessment

Watershed Planning Tool

[VIEW TOOL](#) [MORE INFO](#)

The Project Planning Tool (PPT) is designed to guide efforts to plan and evaluate flood damage reduction projects at a sub-watershed and watershed scale.

CRED

[VIEW TOOL](#) [MORE INFO](#)

Community reporting app to assist in flood monitoring.

Water Quality Decision Support Application

SITE TABLE OF CONTENTS

[Welcome Page](#)

Tools and Applications

- Interactive map to display water quality GIS products
- Download water quality GIS data products
- Access web services
- Identify pollutant sources(coming)
- Prioritize watersheds for BMP implementation(coming)
- Plan agricultural BMP implementation(coming)

Support Information

- Data Layer Description
- Collaborators
- TMDL process

Welcome to the Water Quality Decision Support Application (WQDSA)

The *Water Quality Decision Support Application (WQDSA)* is a pilot project for the major watersheds located within the Minnesota Portion of the Red River Basin. The WQDSA is a shared vision among a diverse group of stakeholders lead by the International Water Institute (IWI). The project is funded by a Clean Water Fund grant awarded to the IWI by the Board of Water and Soil Resources using dollars generated through the Legacy Act Amendment. The overarching goal is to create, distribute and demonstrate the use of water quality related products derived from high resolution topographic data collected using Light Detection and Ranging (LiDAR) technology in a structured decision making process. The pilot application demonstrates how these data can be used for describing and understanding the condition of a watershed, assessing pollutants sources, prioritizing sub-watersheds relative to Best Management Practice (BMP) implementation and developing a BMP implementation plan for agricultural landscapes.

This (WQDSA) provides land and water managers with geospatial data and online tools to prioritize, market, and implement actions on the landscape to achieve water quality objectives identified in local and state plans and ensure that decisions to spend public funds are strategic, defensible and transparent. Local and state water plans consistently identify two primary objectives: 1) reduce erosion and sediment in surface runoff from agricultural fields, and 2) reduce peak flow events that transport the largest sediment loads by accelerating rates of field and channel erosion. When fully developed, the WQDSA is envisioned to allow users to 1) identify the water quality problems, 2) establish goals and objectives, 3) reference planning documents, 4) interactively create maps of projects for demonstration and marketing, 5) save projects in a database for future refinement, and 6) potentially export relevant information in a format suited to existing planning and reporting tools (e.g. eLINK).

The products and applications developed through this project are one component of the Red River Basin Decision Information Network (RRBDIN). The vision for the RRBDIN is to serve as the home and repository for a number of shared applications and data to improve decision-making within the Red River Basin. Additional information can be obtained from the Principal Investigator, Mr. Charles Fritz, Director, International Water Institute, Phone: 701.388.0881, Email: charles@iwinst.org



Water Quality Viewer



Water Quality Decision Support Application

- MN Funding Support
 - MN Board of Soil and Water Resources
 - MN Clean Water Land and Legacy



- ND Funding Support

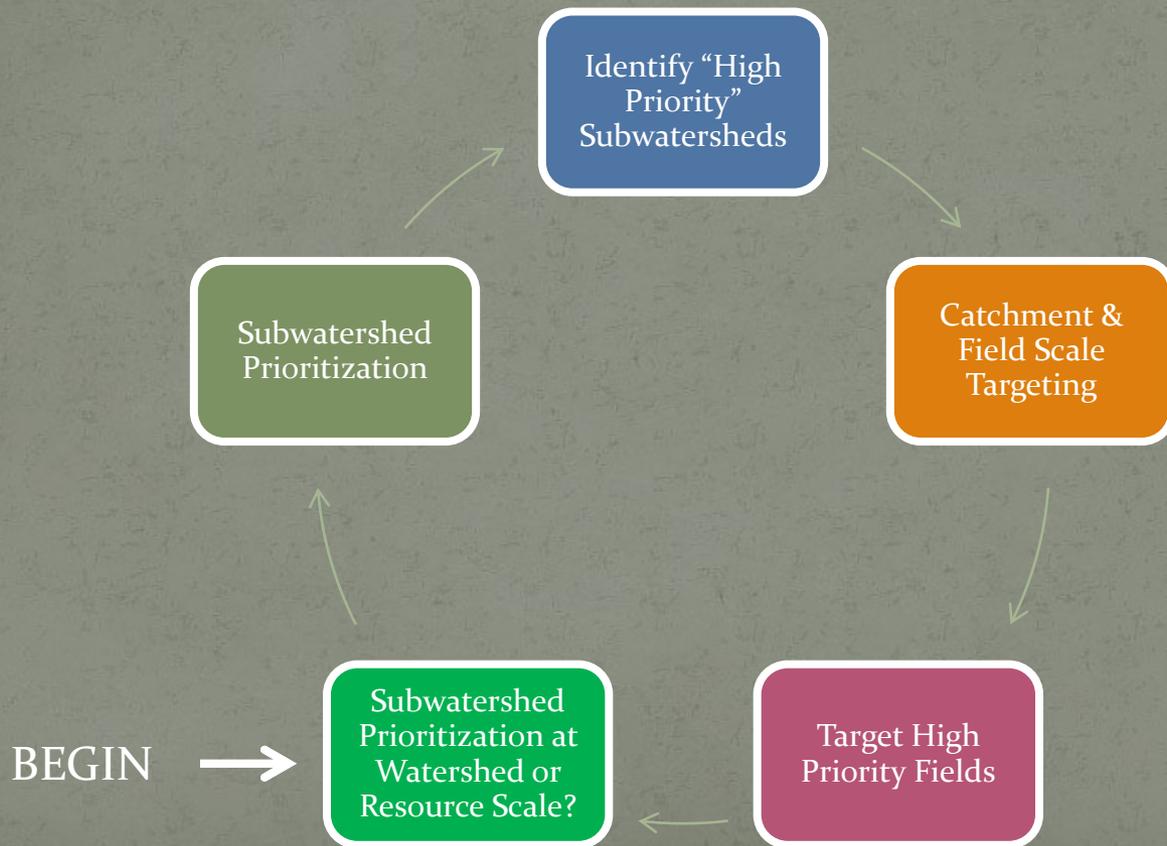


- Dickey/LaMoure Co. Soil Conservation District
- Richland Co. Soil Conservation District
- Stutsman Co. Soil Conservation District
- Wild Rice Soil Conservation District

WQDSA COMPONENTS

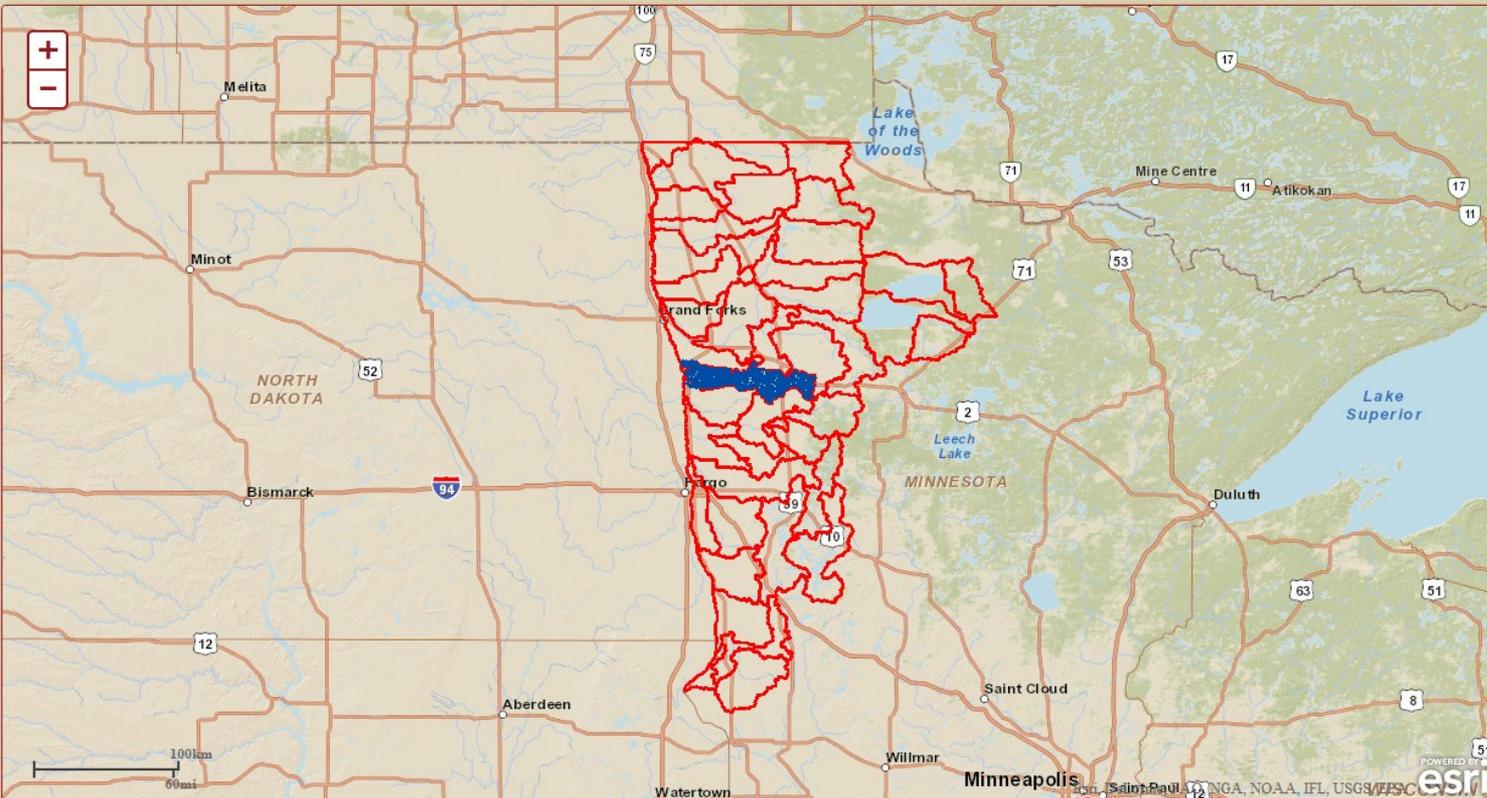
- Interactive map to display water quality GIS data
- Download water quality GIS data
- Web services
- Identify pollutant sources
- Prioritize watersheds and target *fields* for implementation of Best Management Practices (BMP) and Conservation Practices (CP)
- Evaluate effectiveness of agricultural BMPs and CPs (future)*

Watershed - Subwatershed - Catchment Prioritization - Field Targeting



Interactive Map – Water Quality Viewer

 **RRBDIN Nonpoint Source Sediment and Nutrient Viewer**
Information for Prioritizing and Targeting Best Management Practices



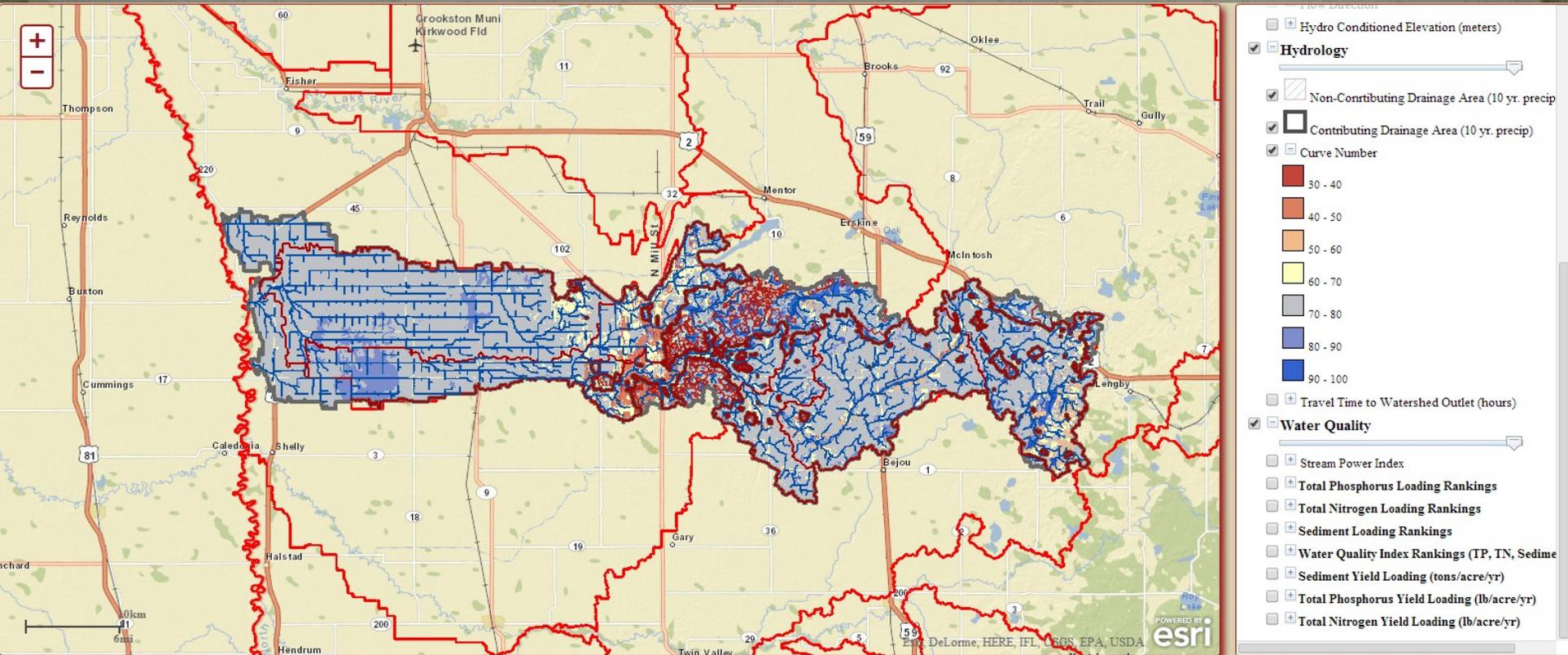
Map Layers

- Project (Major) Watersheds Boundary
- Project (Major) Watershed Boundary
- Hydro Conditioned DEM
 - Subwatershed Pourpoints
 - Overland Flow Path
 - Channel Flow Path
 - Channel
 - Landscape Depressions
 - Catchment Boundary
 - Subwatershed Boundary
 - Watersheds with Data
 - Flow Accumulation Raster
 - Flow Direction
 - Hydro Conditioned Elevation (meters)
- Hydrology
- Water Quality

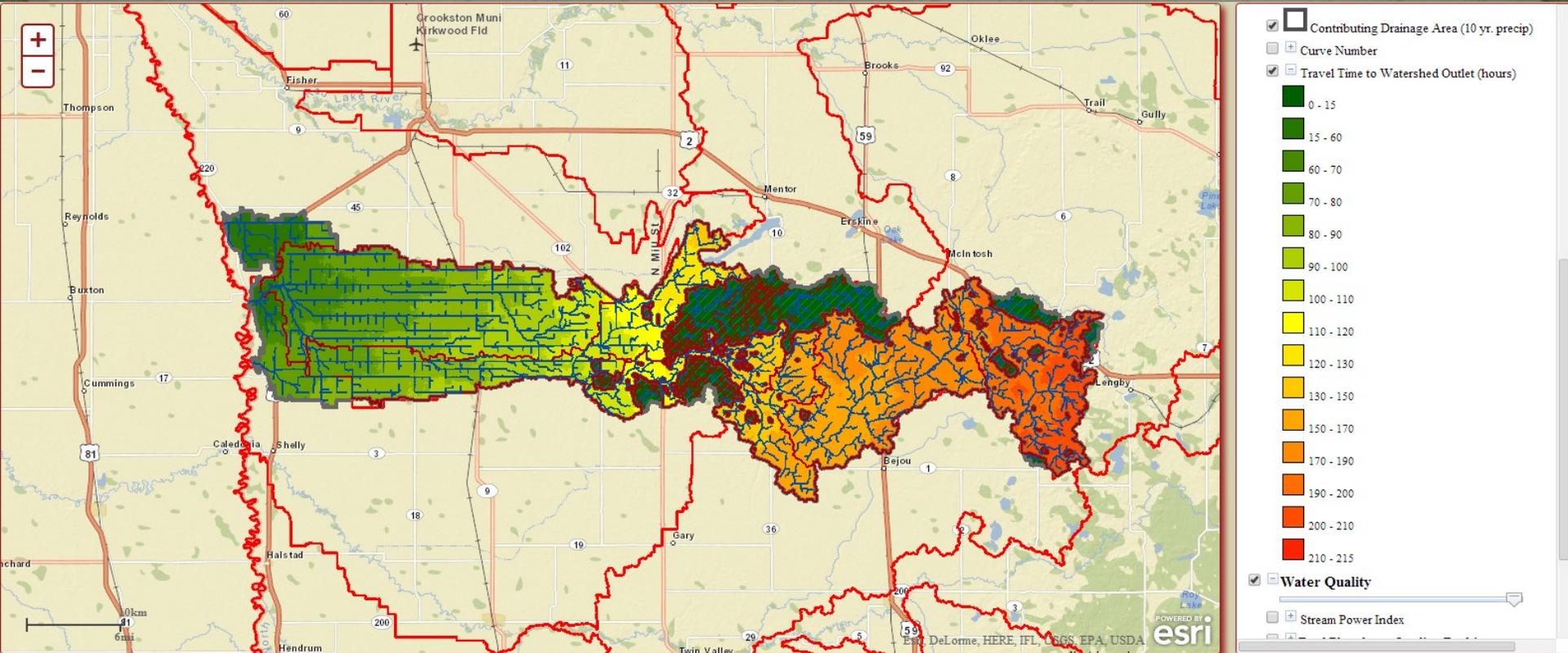
WQDSA Data Portal: Data Layers

- Non-Contributing Areas (10y/24hr)
- Time of Concentration (Travel Time)
- Channel Flow Paths/Catchments
- Stream Power Index
- RUSLE Inputs
 - Curve Number
 - Land Cover (USDA NASS)
 - Length Slope
 - Soil Erosivity
- Total Sediment, N, and P Load Rankings
 - RUSLE
- Total Sediment , N, and P Yield (tons/acre)
- Water Quality Index

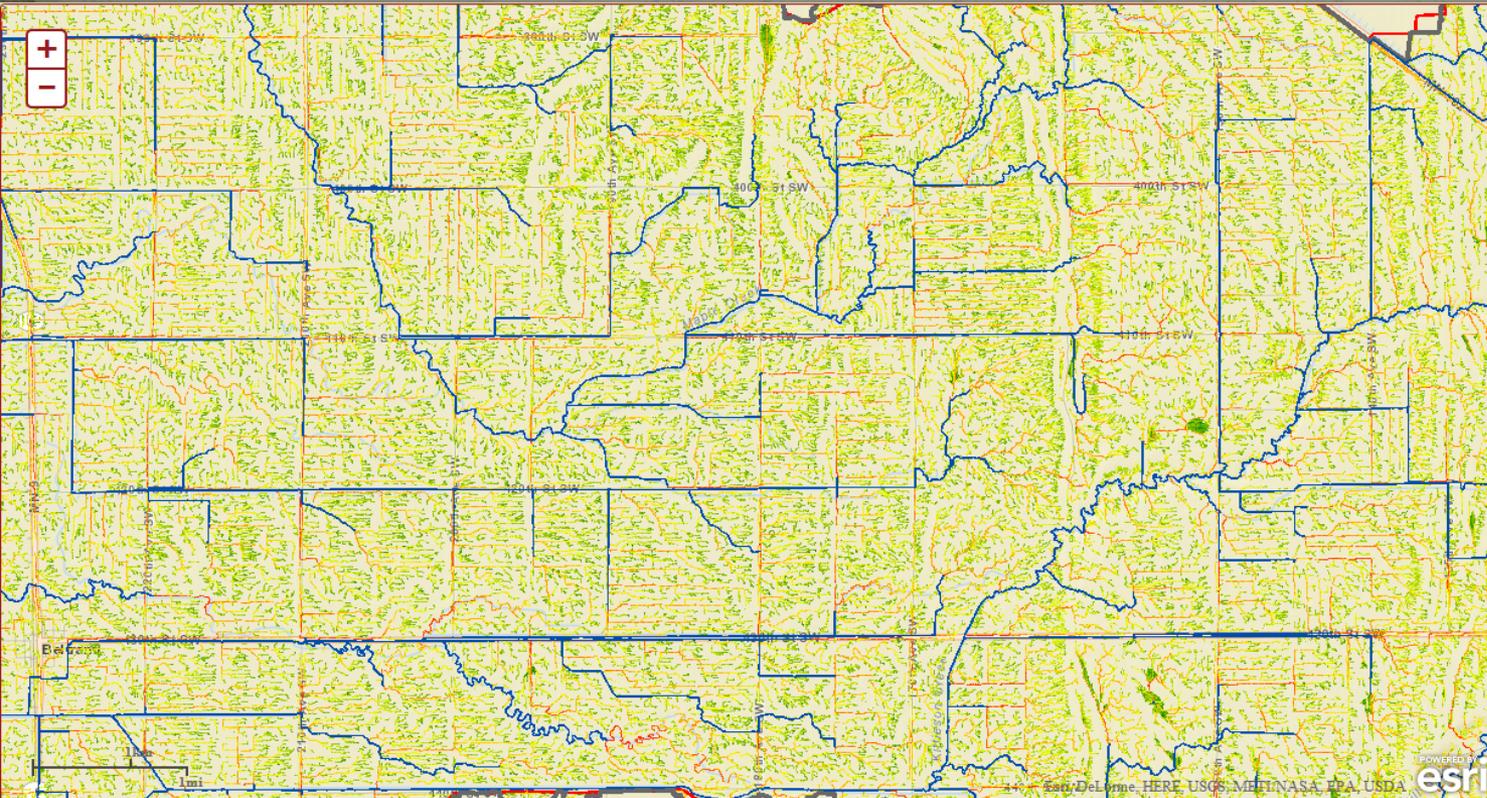
Curve Number Grid



Travel Time Grid



Stream Power Index



- Channel Flow Path
 - Channel
- Landscape Depressions
- Catchment Boundary
- Subwatershed Boundary
- Watersheds with Data
- Flow Accumulation Raster
- Flow Direction
- Hydro Conditioned Elevation (meters)

Hydrology

Non-Contributing Drainage Area (10 yr. precip)

Contributing Drainage Area (10 yr. precip)

Curve Number

Travel Time to Watershed Outlet (hours)

Water Quality

Stream Power Index

High : 4.06741

Low : -9.86043

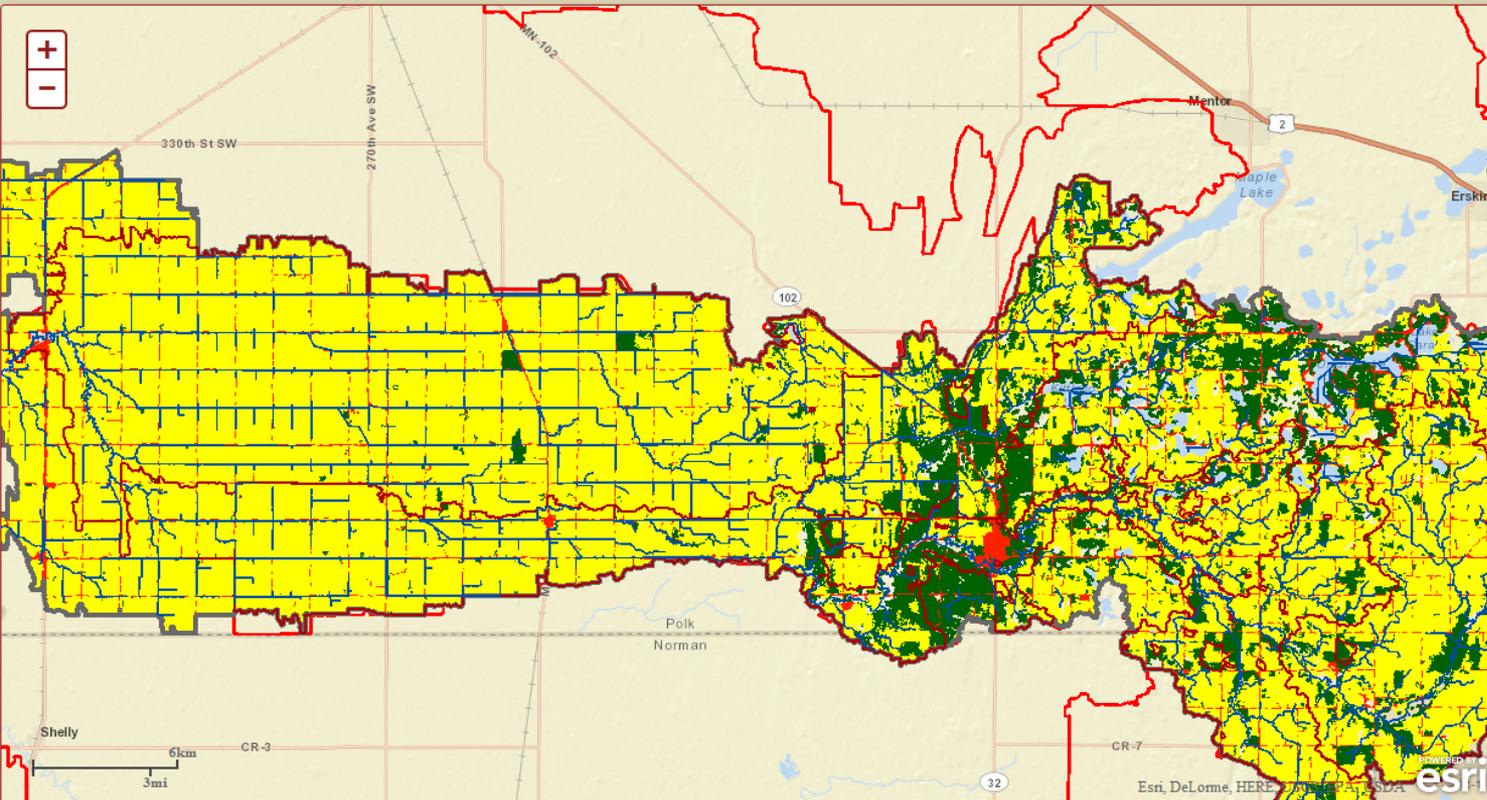
Total Phosphorus Loading Rankings

Total Nitrogen Loading Rankings

Sediment Loading Rankings

Total P Loading Ranking

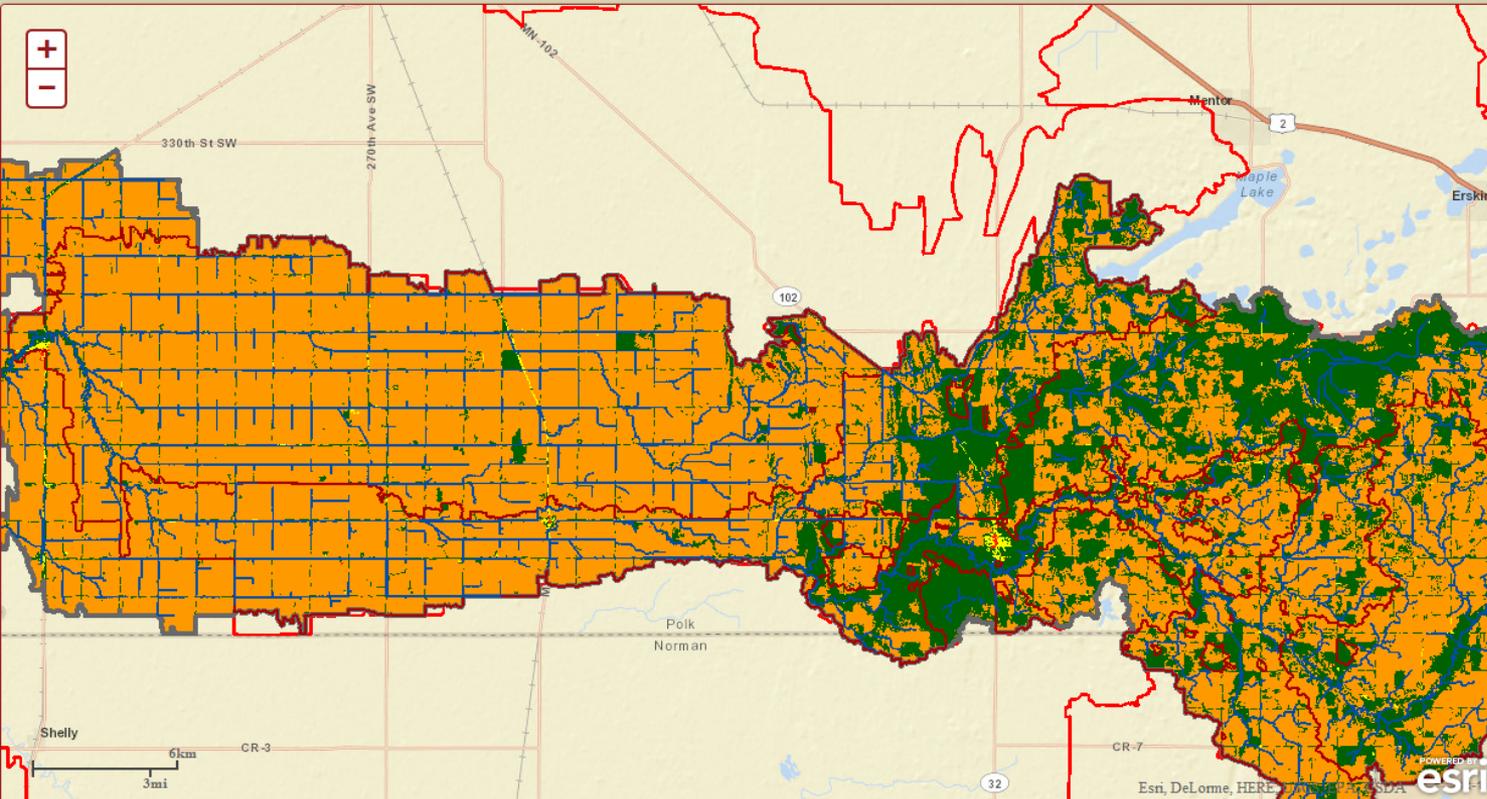
RRBDIN Nonpoint Source Sediment and Nutrient Viewer
Information for Prioritizing and Targeting Best Management Practices



- Catchment Boundary
- Subwatershed Boundary
- Watersheds with Data
 - Flow Accumulation Raster
 - Flow Direction
 - Hydro Conditioned Elevation (meters)
- Hydrology
 - Non-Contributing Drainage Area (10 yr. precip)
 - Contributing Drainage Area (10 yr. precip)
 - Curve Number
 - Travel Time to Watershed Outlet (hours)
- Water Quality
 - Stream Power Index
 - Total Phosphorus Loading Rankings
 - Leaving the Landscape Rank
 - Low Priority 0 - .2
 - Moderately Low Priority .2 - .4
 - Moderate Priority .4 - .6
 - Moderately High Priority .6 - .8
 - High Priority .8 - 1
 - Delivered to Catchment Outlet
 - Delivered to Subwatershed Outlet

Total N Loading Ranking

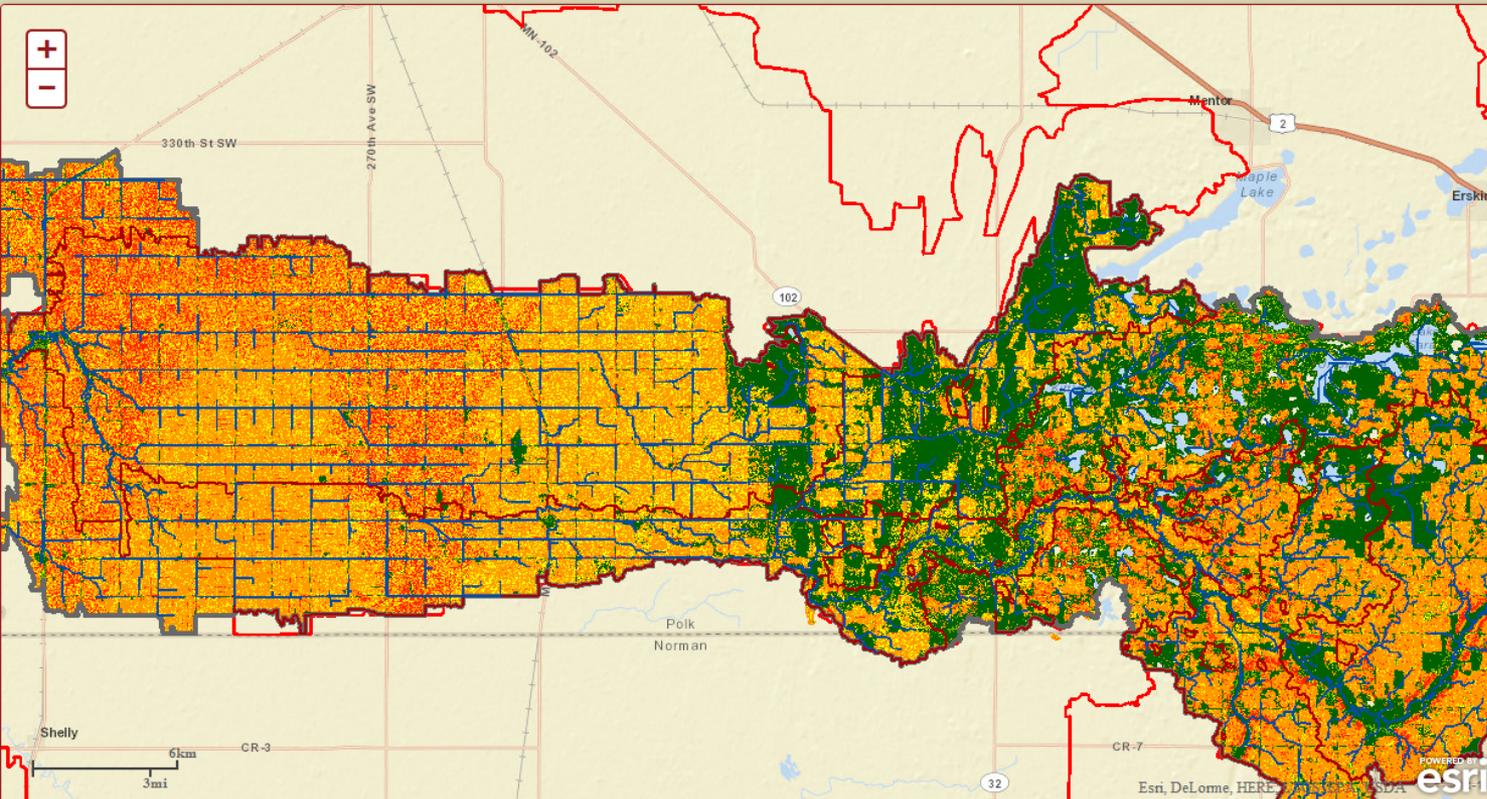
RRBDIN Nonpoint Source Sediment and Nutrient Viewer
Information for Prioritizing and Targeting Best Management Practices



- Flow Direction
- Hydro Conditioned Elevation (meters)
- Hydrology**
 - Non-Contributing Drainage Area (10 yr. precip)
 - Contributing Drainage Area (10 yr. precip)
 - Curve Number
 - Travel Time to Watershed Outlet (hours)
- Water Quality**
 - Stream Power Index
 - Total Phosphorus Loading Rankings
 - Total Nitrogen Loading Rankings**
 - Leaving the Landscape Rank
 - Low Priority 0 - .2
 - Moderately Low Priority .2 - .4
 - Moderate Priority .4 - .6
 - Moderately High Priority .6 - .8
 - High Priority .8 - 1
 - Delivered to Catchment Outlet
 - Delivered to Subwatershed Outlet
 - Delivered to Watershed Outlet
 - Sediment Loading Rankings
 - Water Quality Index Rankings (TP, TN, Sedime)
 - Sediment Yield Loading (tons/acre/yr)

Sediment Yield Ranking

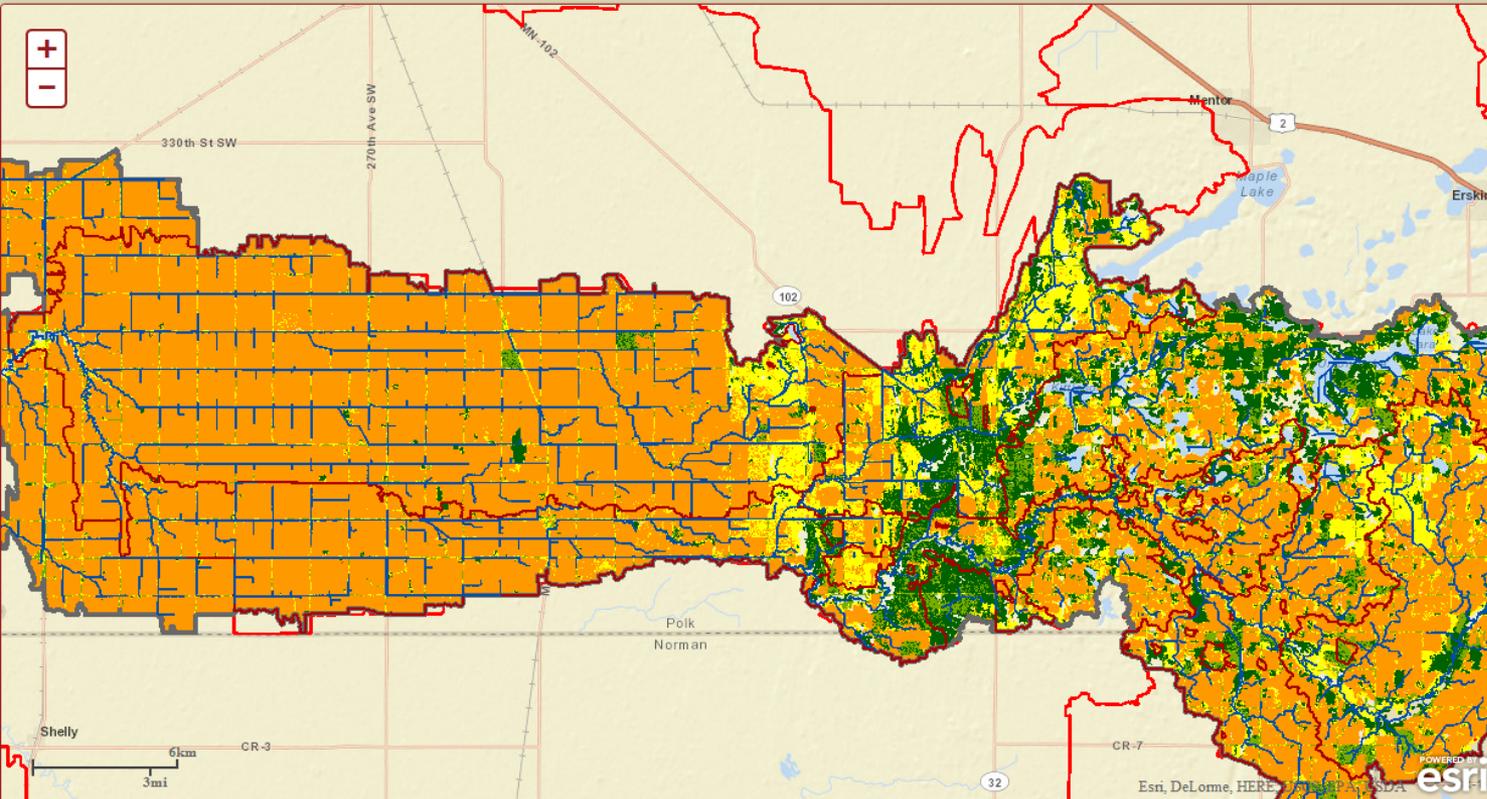
RRBDIN Nonpoint Source Sediment and Nutrient Viewer
Information for Prioritizing and Targeting Best Management Practices



- Flow Accumulation Raster
- Flow Direction
- Hydro Conditioned Elevation (meters)
- Hydrology**
 - Non-Contributing Drainage Area (10 yr. precip)
 - Contributing Drainage Area (10 yr. precip)
 - Curve Number
 - Travel Time to Watershed Outlet (hours)
- Water Quality**
 - Stream Power Index
 - Total Phosphorus Loading Rankings
 - Total Nitrogen Loading Rankings
 - Sediment Loading Rankings**
 - Leaving the Landscape Rank
 - Low Priority 0 - 2
 - Moderately Low Priority 2 - 4
 - Moderate Priority 4 - 6
 - Moderately High Priority 6 - 8
 - High Priority 8 - 1
 - Delivered to Catchment Outlet
 - Delivered to Subwatershed Outlet
 - Delivered to Watershed Outlet
 - Water Quality Index Rankings (TP, TN, Sedime
 - Sediment Yield Loading (tons/acre/yr)

WATER QUALITY INDEX (WQI)

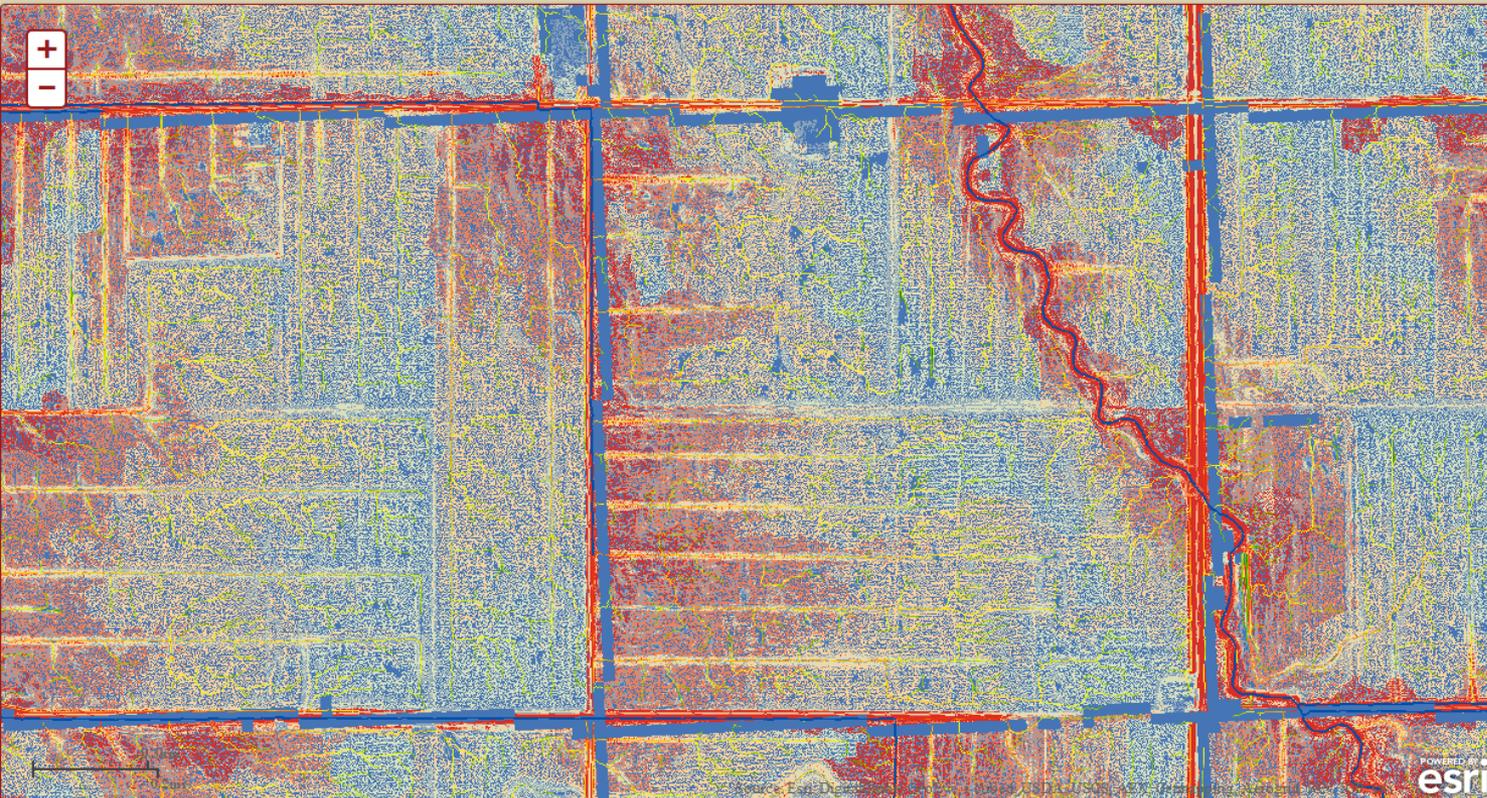
RRBDIN Nonpoint Source Sediment and Nutrient Viewer
Information for Prioritizing and Targeting Best Management Practices



- Flow Direction
- Hydro Conditioned Elevation (meters)
- Hydrology**
 - Non-Contributing Drainage Area (10 yr. precip)
 - Contributing Drainage Area (10 yr. precip)
 - Curve Number
 - Travel Time to Watershed Outlet (hours)
- Water Quality**
 - Stream Power Index
 - Total Phosphorus Loading Rankings
 - Total Nitrogen Loading Rankings
 - Sediment Loading Rankings
 - Water Quality Index Rankings (TP, TN, Sedime)**
 - Leaving the Landscape
 - Low Priority 0 - 2
 - Moderately Low Priority 2 - 4
 - Moderate Priority 4 - 6
 - Moderately High Priority 6 - 8
 - High Priority 8 - 1
 - Delivered to Catchment Outlet
 - Delivered to Subwatershed Outlet
 - Delivered to Watershed Outlet
 - Catchment Rank
 - Subwatershed Rank

$$0.25\% * TN \text{ rank} + 0.25\% * TP \text{ rank} + 0.5\% * Sed \text{ rank}$$

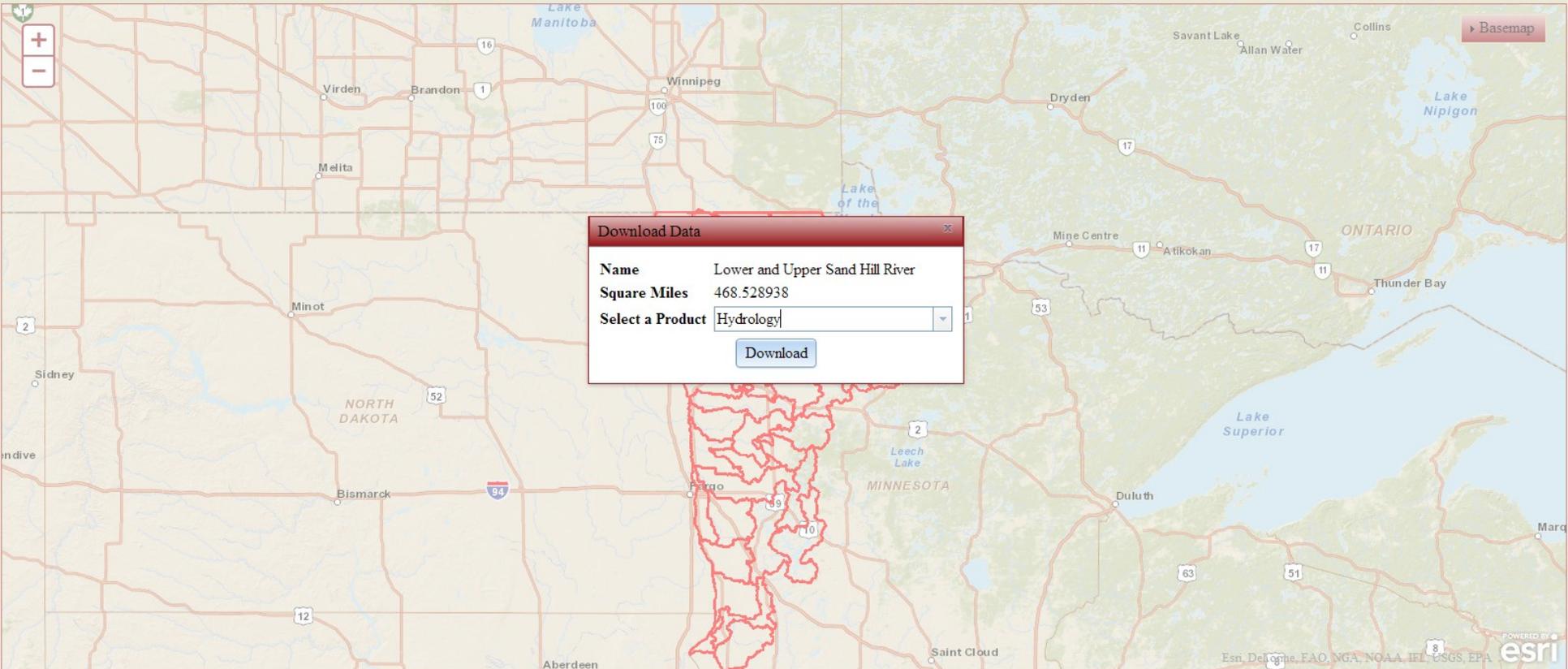
Field Targeting



- Low : -9.86043
- Total Phosphorus Loading Rankings
 - Total Nitrogen Loading Rankings
 - Sediment Loading Rankings
 - Water Quality Index Rankings (TP, TN, Sedime)
 - Leaving the Landscape
 - Delivered to Catchment Outlet
 - Delivered to Subwatershed Outlet
 - Delivered to Watershed Outlet
 - Catchment Rank
 - Subwatershed Rank
 - Sediment Yield Loading (tons/acre/yr)
 - RUSLE Sediment Mass - Unadjusted
 - Leaving the Landscape Calibrated to Ecoregi
 - Delivered to Catchment Outlet
 - Delivered to Subwatershed Outlet
 - Delivered to Watershed Outlet
- 0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
> 25
- Total Phosphorus Yield Loading (lb/acre/yr)
 - Total Nitrogen Yield Loading (lb/acre/yr)

WQDSA Data Portal

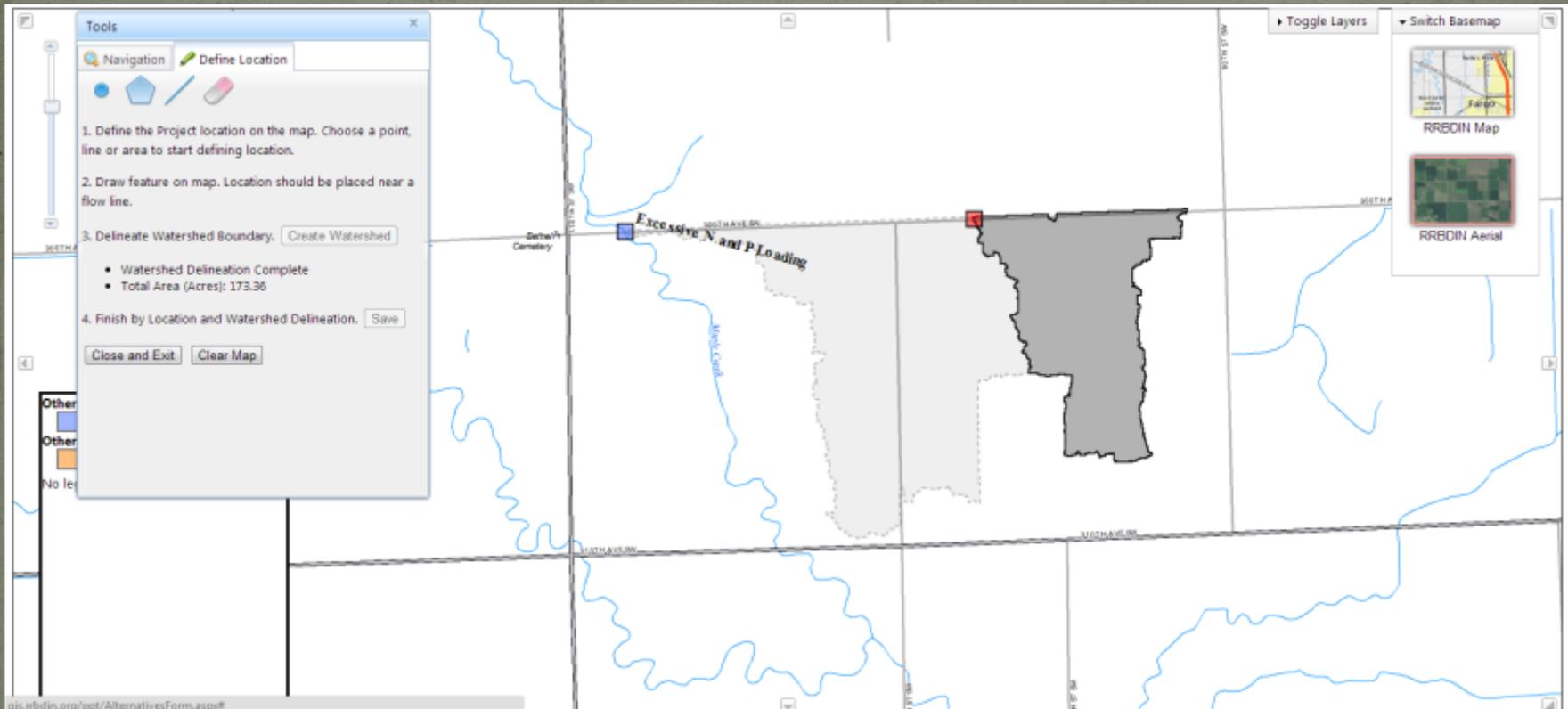
 **RRBDIN Enhanced Water Quality Geospatial Data Download Portal**
Information for Prioritizing and Targeting Best Management Practices



NEXT STEPS/OPPORTUNITIES

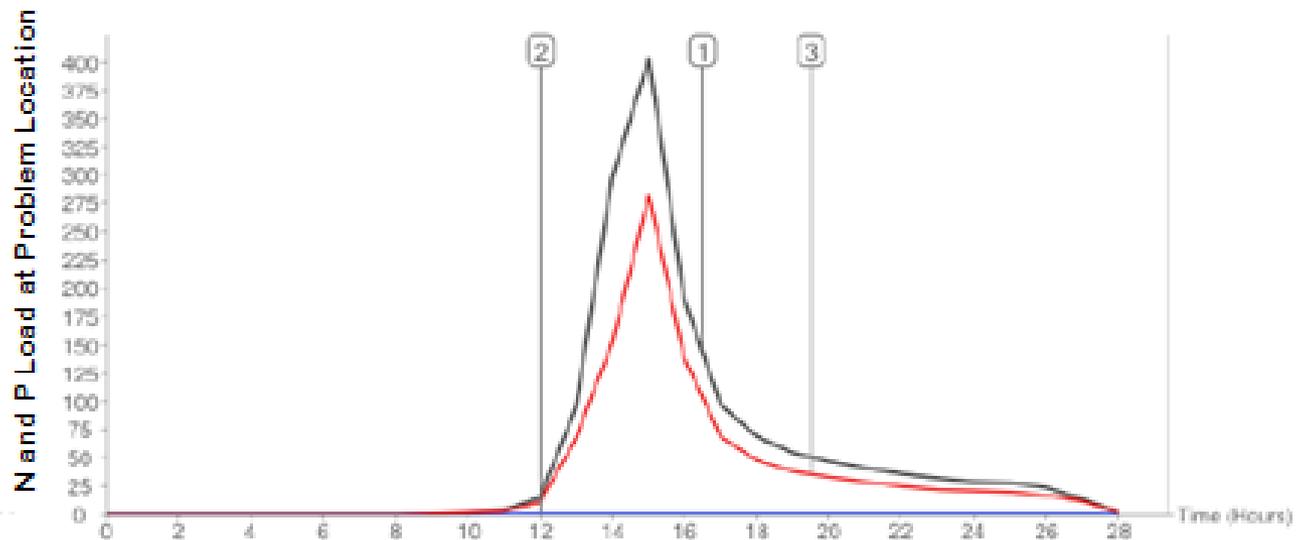
- Ingest Other WQ Model (E.g. HSPF) Results (water quality loadings)
- Dynamic Reports
 - Pollutant Source Assessment
 - Water Quality Risk Analysis
- Integrate with Watershed Planning Tool
- Expand Application
- BMP/CP Scenario Evaluations*

BMP/CP Scenario Evaluation (future)



Estimated Results for Cumulative Projects at Excessive N and P Loading Problem

100-year 24-hour Discharge Hydrographs



- 1: Excessive N and P Loading, Existing Condition, at Problem Location - Black
- 2: Sediment Basin, With-project Condition, at Problem Location - Blue
- 3: Excessive N and P Loading, With-project Conditions, at Problem Location - Red

www.rrbdin.org



Red River Basin
Decision Information Network

“Availability of good information lies at the heart of effective and equitable decision making”

(Allen and Kilvington 1999)

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