Targeting BMPs to Critical Areas

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Need for Targeting

- Erosion and phosphorus loss do not happen uniformly across the landscape
- Some watersheds and agroecoregions contribute a disproportionate load of pollutants to Lake Pepin
- Within these watersheds and agroecoregions, there are critical areas that generate most of the loadings, these may represent less than 25% of total area
Critical Areas

- Generally have significant amounts of water flow to the mouth of watershed
- Are typically close (within 300 ft) of a stream, ditch or lake, unless a surface tile inlet is involved
- For sediment pollution, critical areas have both significant flow to surface water body and high rate of erosion
- For phosphorus pollution, critical areas have both significant flow to surface water body, a high rate of erosion or runoff, and a high concentration of P at soil surface
NRCS NRI Data Basics

- A compilation of natural resource information on non-Federal land in the United States
- 8,200 Primary Sampling Units (PSU’s) Statewide
- Land use from low altitude/high resolution aerial photography
- Slope, crop history, management by local NRCS field office
- Statistically significant at Major Land Resource Area Level (14 within MN)
Top 5 (soil loss per ac of hu):

- Cannon 2.4874
- Rush-Vermillion 2.4634
- Le Sueur 2.3029
- Blue Earth 2.1635
- South Fork Crow 1.9472
Minnesota River

- Disproportionate sediment loads to Lake Pepin (>85% of total load)
Total Suspended Solids Loads

- Lower Mn (26.35%)
- Blue Earth (19.03%)
- Le Sueur (20.72%)
- Cottonwood (8.14%)
- Middle Mn (8.59%)
- Wastonwan (4.28%)
- Upper Mn (2.08%)
- Pomme de Terre (0.66%)
- Lac Qui Parle (0.81%)
- Hawk - YM (4.32%)
- Chippewa (3.99%)
- Redwood (1.04%)
- Pomme de Terre (0.66%)
Sediment Contamination: Sources

- Intense rainstorms on steep soils
- Upland erosion of fine textured soils
- Surface tile inlet discharge from flat clayey soils
- Home and road construction projects
- Stream and ditch bank erosion
- Re-suspension of river bedload sediments
- River floodplain meandering
Sediment Contamination: Control Methods

- Conservation Tillage
- Terracing and contour farming
- Grassed waterways and field windbreaks
- Sediment control structures
- Riparian buffers and tree plantations
- Conservation Reserve Program
- Surface tile drain modifications
- Streambank stabilization
- Wetland restoration
- Construction site erosion management practices
- Floodplain management and sediment detention basins
P Index Based Ag P Loads

P Load (kg/yr)

- St. Croix R...
- Upper Miss..
- Lower Miss..
- Minnesota...

Dry
Average
Wet
Total Phosphorus Loads

- Lower Mn (32.49%)
- Le Sueur (16.69%)
- Blue Earth (14.57%)
- Watonwan (5.43%)
- Cottonwood (5.21%)
- Middle Mn (5.43%)
- Chippewa (5.55%)
- Redwood (2.13%)
- Hawk - YM (4.48%)
- Lac Qui Parle (1.85%)
- Pomme de Terre (1.34%)
- Upper Mn (4.82%)

Total Phosphorus Loads
MN River Average Flow Year

- Nonpoint
- Point
MN River Nonpoint Sources

- Ag Erosion
- Bank Erosion
- Tile Drainage
- Atm Deposition
- Urban Runoff
- ISTS
- Non-Ag Runoff
- Feedlots
- Deicing Chem
Nonpoint Sources of Phosphorus

- Transported to surface waters by overland flow and erosion, mainly from soils that are in close proximity to water.
- Occurs in two forms:
  - Particulate P in eroded sediment
  - Soluble P in runoff
- Most important sources:
  - Water erosion and runoff (snowmelt, rain)
  - Streambank erosion
  - Tile drainage
  - Wind erosion?
Voluntary Improvements Needed for Nonpoint Sources

- Conservation tillage
- Buffer strips
- Don’t apply manure to frozen soil or snow near surface waterbodies
- Reduced rates of P fertilizer in sensitive areas and where manure is applied
- Avoid building up soil test P levels
- Improved methods of manure application (injection better than incorporation better than surface application)
- Conversion of surface inlets to rock inlets
Cluster of Agroecoregions Based on Lake Water Quality

Mean Chlorophyll-a/Total P
- **Insufficient Data**
- **Very High**
- **High**
- **Medium**
- **Low**
- **Very Low**

Kilometers
Factors That Differ Across Agroecoregions

- Amount of runoff and drainage
- Erosion and slope steepness
- Density of ditches, streams and lakes
- Potential for restoration of wetlands
- Density of surface tile intakes
- Type of crop and animal systems
- Nitrogen BMPs, risk of P losses to water
- Suitability of conservation tillage
- Urban vs agricultural impacts on water
Agroecoregion BMPs

- Each agroecoregion has a specific combination of water quality risks, landscape features, and crop or animal management systems.
- These combinations can be associated with a suite of BMPs to improve water quality without compromising farm profitability.
MnRAP Level II Land Use Analysis

- Part of the overall MnRAP (Minnesota River Assessment Project) Completed in October 1993
- AGNPS and GLEAMS used to assess non-point source sediment/nutrient loadings from 10 small watersheds (2,760 acres to 11,480 acres)
- Detailed land use, tillage, fertilization data gathered on a 40 acre cell basis
MnRAP Level II Land Use Analysis
Major Findings

- Thinking beyond “T” – Off site water quality still at risk although treatment meets soil productivity tolerance
- Phosphorus loadings closely tied to tillage management
- Relatively high contribution from small percentage of cropland
- Importance of treatment adjacent to hydrologic pathways
Suggested BMP Implementation Strategy

- Critical component of any implementation strategy is selection of desired outcomes

- Must be:
  - Realistic
  - Consider economics
  - Be aware of lag times between implementation and realization of changes
  - Consider intended use of resources
Implementation Strategy

- Treatment Order for Sediment Reduction:
  1. Treat acres eroding above T
  2. Treat acres adjacent to main hydrologic pathways to a minimum of 30% residue cover
  3. Bring all cropland acres up to a minimum of 30% residue cover if agronomically feasible

- Nutrient Loading Reduction:
  1. Promote sediment reduction implementation
  2. Use UM Fertilizer and P Testing Guidelines and MDA Nitrogen Mgt Task Force Recommendations
Conclusions

- Place extra emphasis on watersheds and agroecoregions that transport the largest sediment and phosphorus loads
- Place extra emphasis on the largest sources of sediment and phosphorus
- Target BMPs within watersheds and agroecoregions
- Both point and nonpoint source reductions are important