Knife River
Sediment Reduction Projects

Jennifer Thiemann
April 22, 2013
<table>
<thead>
<tr>
<th>Impairment</th>
<th>Miles Impaired</th>
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<tbody>
<tr>
<td>Turbidity</td>
<td>5887</td>
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<tr>
<td>Mercury in Fish</td>
<td>4790</td>
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<td>Fecal Coliform</td>
<td>3265</td>
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<td>Fish Bioassessments</td>
<td>2067</td>
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<td>Dissolved Oxygen</td>
<td>1820</td>
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<tr>
<td>PCB(s) in Fish Tissue</td>
<td>1187</td>
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<tr>
<td>Escherichia Coli (E. Coli)</td>
<td>771</td>
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<td>Aquatic Macroinvertebrates Bio</td>
<td>553</td>
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<tr>
<td>Mercury in Water Column</td>
<td>434</td>
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<td>Chloride</td>
<td>205</td>
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</tbody>
</table>

Slide from Christopher Ellison, USGS. Source: EPA Attains data base, Oct. 2009
Problems with Sediment

- Degrades aquatic habitat
- Alters river morphology
- Exacerbates flooding
- Primary transporter of contaminants
- Degrades drinking water supplies
Knife River After a Rain Storm

( Photo courtesy of St. Paul Pioneer Press)
Knife River Sediment Sources

1. Streambanks (59%)
2. Bluffs (29%)
3. Tributaries (12%)

From “Assessment of Streambank and Bluff Erosion in the Knife River Watershed”, Nieber et al. 2008

Figure 5.5. 2004 mean daily flows and lab turbidity data for the Fish Trap monitoring site.
Why?
NATURAL CAUSES

- Sediment is natural. But how much?
- Clay soils
- North Shore Terrain
  - Most “storage” is in the headwaters (West Branch, Upper Knife).
  - Very little storage in the lower part of the watershed.
  - Lower parts of the river are steep and rocky.
  - Rivers are naturally “flashy”.
**Soil Types**

- **Sand**: Good drainage, Poor storage
- **Clay**: Poor Drainage, Good storage
- **Clay & Silt**: Most Erodible
PRIORITY EROSION SITES
LAND USE CHANGE

Ownership
50% Public
50% Private

Pine ➔ Aspen

Photos from the Minnesota Historical Society
HYDROLOGIC MODIFICATION

Streams: 181.1 miles

Roads: 80.1 miles
Climate Change - Trends

- Storm frequencies and intensities are changing.
- Heavy downpours are increasing.
- Heavy rains and tornados starting earlier in spring, ending later in fall.
- Winter 2011-2012 = warmest MN record.
- 2012 = warmest year on record nationwide, 3rd warmest in Minnesota.
- 2012 = record droughts nationwide.
CLIMATE CHANGE- LOCAL IMPACTS

- June 19-20, 2012 Flood- 10 inches
- Knife River peaked at an estimated 25,000 cubic feet per second (ft³/s) exceeding the previous peak of record of 7,440 ft³/s from May 1979.
- St. Louis River Flow Records:
  - June, 2012—Record high
  - November, 2012—Record low
- State record flood – July 17-19, 1867- estimated 30 to 36 inches in 36 hours, Chippewa Valley
Floods of June 2012 in Northeastern Minnesota

Figure 5. Provisional stage hydrographs at selected U.S. Geological Survey streamgages in northeastern Minnesota for June 10 through July 29, 2012.
FIVE COMPONENTS OF RIVERINE ECOSYSTEMS

1. Water Quality - chemistry and contaminants
2. Biology - bugs, fish, wildlife
3. Geomorphology - physical characteristics - channel type, soils
4. Hydrology - rainfall, stream flows, groundwater
5. Connectivity - how water gets into the river

Source: Instream Flow Council
Stream Stability

“Ability of a stream to transport the water & sediment of its watershed in such a manner as to maintain its dimension, pattern, and profile, over time, without either aggrading or degrading.”

Rosgen and Silvey, 1996
Slide from Karl Koller, DNR
LONGITUDINAL, CROSS-SECTIONAL and PLAN VIEWS of MAJOR STREAM TYPES

DOMINANT SLOPE RANGE

Aa+ > 10%
A 4 - 10%
B 2 - 4%
C < 2%
D < 4%
DA < 0.5%
E < 2%
F < 2%
G 2 - 4%

CROSS SECTION VIEW

PLAN VIEW

STREAM TYPES Aa+ A B C D DA E F G

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FLUVIAL GEOMORPHOLOGY

From California Rivers and Streams, Jeffrey F. Mount, 1995
Clean Water Fund 2010-2011

- South St. Louis SWCD
- $90,863 ($72,690 grant, $18,173 match)
- Tree planting on private land
- Ditch checks along Shilhon Rd.
- Valley View Rd. streambank stabilization (toe-wood)
STABILIZATION METHODS- TOE WOOD

© Wildland Hydrology
Stabilization Methods - Toe Wood

2011 Construction

2012 Post Flood
Sediment Reduction Projects Funded By:

Clean Water Fund
Grant: $282,634
Match: $94,212
April 2012-December 2016

Soil Erosion & Sediment Control Grant
Grant: $293,000
Match: $24,000
October 2012-September 2015
Knife River Watershed Protection Project - TMDL Turbidity Reduction

- Stabilize two high-priority sites
- Lake and St. Louis Counties
- Five landowners
- Reduce 697 lbs/phosphorus per year
- Reduce 606 tons/sediment per year (17% of annual sediment load)
- Toe wood and rock stream vanes

Clean Water Fund
Grant: $282,634
Match: $94,212
4/12-12/16
Knife River Watershed Protection Project - TMDL Turbidity Reduction
Clean Water Fund
Grant: $282,634
Match: $94,212
4/12-12/16
Knife River Watershed Sediment Reduction Project

- Stabilize three high-priority sites
- Lake and St. Louis Counties
- Reduce 750 tons/sediment per year (21% of annual sediment load)
- Toe wood and rock stream vanes
- Multiple sites
  - Two sites identified
    - (Pavek/State/Richter, 253 tons/year)

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KNIFE RIVER WATERSHED SEDIMENT REDUCTION PROJECT

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Knife River Watershed Sediment Reduction Project

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Knife River Watershed Sediment Reduction Project
Knife River Watershed Sediment Reduction Project Schedule

Winter 2012-Spring 2013: Identify Sites and Landowners
Summer 2013: Field Surveys
Winter 2013-2014: Permitting
Summers 2014-2015: Construction

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STABILIZATION METHODS

- Toe Wood
- Stream Vanes

![Woody Transplant Option Diagram](image)
STABILIZATION METHODS—STREAM VANE
STABILIZATION METHODS—J-HOOK VANE

Plan View

Profile View

Cross Section View

Flow Direction

0.9 \( \text{d}_{50} \)

2-7%

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PUBLIC OUTREACH

- www.co.lake.mn.us/swcd
- http://www.southstlouissswcd.org/
- Lake County Water Plan Revisions
- Newsletter (Edge of the Knife)?
- Public Events?
Thank You

for your time!

TH 61 Expressway - Knife River