CONSERVATION DRAINAGE
Innovative Drainage Concepts that Provide Win-Win Solutions

Chuck Brandel, PE
Principal, Senior Civil Engineer
Water Quality

Why Emphasis on Ag Drainage

Why Improvements

Why Repairs

Storage/Water Quality

WHY?
- Downstream Effects
- Adequacy of Outlets
- Increase in Flow from Improvements/System Tiling
- New Regulations on Water Quality
- More Emphasis on Downstream Flooding and Erosion

Hydraulic Capacity reductions due to age

Gulf Hypoxia

Stream Bank Erosion - Le Sueur River
Why Emphasis on Ag Drainage
Why Improvements

Hydraulic Capacity Reductions Due to Age
30-40% Reduction in Capacity

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Stream Bank Erosion – Le Sueur River
How to Develop Win-Win Solutions for:

Landowners/Supervisors/Commissioners:
- Need improvements to 100 year old infrastructure
- Increased drainage capacity
- Must be cost effective

Agencies:
- Want water quality benefits/storage
- Have funding available
- Need to understand costs
Multi-Purpose Drainage

Preventative
Conservative practices that can be applied towards the existing agricultural land without dramatically changing the layout of the landscape.

Control
Either conveys water, controls flow direction and rate, or maintains a desired water elevation.

Treatment
Treatment of runoff and drainage water by providing filtering through use of vegetative cover or water storage.
PREVENTATIVE

Conservative practices that can be applied towards the existing agricultural land without dramatically changing the layout of the landscape.
How to IDENTIFY Preventative Measures

Crops
Cover Rotation
Crop Management Nutrient Management
Residue
CONTROL

Either conveys water, controls flow direction and rate, or maintains a desired water elevation.
HOW TO IDENTIFY CONTROL MEASURES

Water Control Structures

Two-Stage Ditches

Tile/Inlet Control or Downsizing

Alternative Side Inlets

Grassed Waterways

Riparian Channel Vegetation

Controlled Subsurface Drainage

Toe Wood Sod Mats
Treatment of runoff and drainage water by providing filtering through use of vegetative cover or water storage.
HOW TO IDENTIFY TREATMENT MEASURES

Filter Strips

Wetland Restorations

Sediment Basins

Woodchip Bioreactors

Saturated Buffers
DRAINAGE AND WATER QUALITY
Case Study: Blue Earth County Ditch 57

BACKGROUND

KLEIN POND

RATE CONTROL WEIR

TWO STAGE DITCH

Key:
- Drainage Ditch
- Tile Improvements
- Two-Stage Ditch
- Native Plantings/Buffer Strip
- Drain Tile
- BECS Watershed Boundary
- Weir Structure Location
- Klein Pond/Surge Basin
- Sample Sites
- Flow Monitoring

Maple River
Hwy 30
Hwy 22
Big Cobb River
City of Mapleton

Watershed of Two-Stage Ditch
City Stormwater Pond
Watershed of Klein Pond

Finding provided by the Minnesota Outdoor and Natural Resource Trust Fund as amended by the LCDF.

ISG
I+S GROUP
BLUE EARTH COUNTY

LCDF IMPLANTATION:
www.lcdf.org/drainage/protectourwater/our_education_materials
BACKGROUND

GOALS
Tile System + Drainage Capacity + Water Quality + Reduce Peak Flows

HISTORY & EXISTING CONDITION
Failing System + Multiple Large Storms + 100 Year Old Design

PROPOSED IMPROVEMENT
Option to Upsize Systems + Outlet Options + Upstream vs Downstream

COMPROMISE OPTIONS
Funding Available + Add Storage + Increase Flow + Outlet + Review w/ DNR

LCCMR FUNDING
Review with Landowners + Determine Costs and Capacities
MAJOR 2013 RAINFALL EVENTS

Note: 1 YR = Rainfall Return Interval
KLEIN POND

Percent Reduction in Peak Flow

Average Percent Reduction

Peak Flow Rate (Q): 77%
Total Suspended Solids (TSS): 47%
Phosphorus (P): 63%
Nitrogen (N): 60%
Percent Reduction in Peak Flow

- 5/2/13 (0.90"-7.0 hr)
- 5/18/13 (0.85"-8.0 hr)
- 5/21/13 (1.22"-3.0 hr)
- 5/30/13 (0.73"-5.0 hr)
- 6/12/13 (2.63"-2.0 hr)
- 6/23/13 (1.02"-3.0 hr)
- 7/8/13 (1.10"-1.0 hr)
- 7/9/13 (1.29"-1.0 hr)
Average Percent Reduction

- Peak Flow Rate (Q): 77%
- Total Suspended Solids (TSS): 47%
- Phosphorus (K): 63%
- Nitrogen (N): 60%
DRAINAGE AND WATER QUALITY
Case Study: Blue Earth County Ditch 57

BACKGROUND

GOALS
- Erosion Control
- Habitat Restoration
- Water Quality Improvement
- Groundwater Protection

HISTORY & EXISTING CONDITIONS
- Previous Ditch Improvements
- Water Quality Issues
- Habitat Loss

PROPOSED IMPROVEMENTS
- Ditch Realignment
- Tile Improvements
- Native Plantings
- Weir Structures

FINANCIAL SUPPORT
- State and Federal Grants
- Local Matching Funds

LEGAL REQUIREMENTS
- Permits and Certifications

KLEIN POND

Watershed of Two-Stage Ditch
- 1,000 Acres

TWO STAGE DITCH
- Channel Realignment
- Flow Monitoring

RATE CONTROL WEIR
- Flow Control Structures

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND
- Funding Provided

Funding provided by the Minnesota Clean Water and Natural Resources Trust Fund as recommended by the LCBL.
TWO STAGE DITCH
Treats 2,450 acres

2013 TWO STAGE DITCH AVERAGE REDUCTIONS

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Reductions</th>
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<tbody>
<tr>
<td>10.5%</td>
<td>Total Suspended Solids (TSS)</td>
</tr>
<tr>
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Ditch 86
### 2013 Two Stage Ditch Average Reductions

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0% 20% 40% 60% 80% 100%
RATE CONTROL WEIR
Treats 6,000 acres

Sampling with weir at low flow (looking upstream)
Weir at high flow (looking upstream)
Weir after high flow (looking downstream)

June 12, 2013 Event 25 Year Hydrograph

- Modeled event data of existing conditions
- Recorded data from redesigned ditch

Peak flow of preexisting system
Stored runoff
Peak flow of constructed system
Backwater from Big Cobb River

0 hour 20 hour 40 hours 60 Hours 80 Hours 100 Hours
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KLEIN POND

Watershed of Two-Stage Ditch
City of Mapleton

Big Cobb River

Hwy 22

Hwy 30

Maple River

TWO STAGE DITCH

RATE CONTROL WEIR

Finding provided by the Minnesota Outdoor and Natural Resources Trust Fund as requested by the LC&DPA.
What's next?

- Continued education/coordination with land owners and drainage authorities
- Implementation of more pilot projects to show that they work
- Continued monitoring of CD57 and other projects