Major Natural Stream Restoration Projects In the Midwest
How sediment load and particle size affect natural design

Is Sediment Load Known??

Figure 1.13: Factors affecting channel equilibrium. At equilibrium, slope and flow balance the size and quantity of sediment particles the stream moves.
Nippersink Creek was returned to original meandering channel.

The lake traps stream sediment and reduces flood peaks.
Moved stream flow back into old stream channel

Filled channelized reach
Geomorphologist from NIU determined excessive erosion in meanders -
Sand deposition builds on point bars from channel scour since Wonder Lake Dam traps over 90 percent of sediment.
USCOE added riffles after flood discharges from upstream Wonder Lake increased channel erosion in meanders.
Indianapolis airport expansion
Near I-70 with stream restoration

What can go wrong in a natural stream design in an urban setting
cross-vane as a rock riffle
Bankfull channel dimensions at riffle do not transport bed materials and recreate instream habitat.
Note bedload deposition over cross vane and bank scour around mid channel bar.
Brown Deer Stream and Wetland Restoration at Iowa City after record floods in 2007 and 2008
stream after major floods in Iowa
Diverse native prairie on bank with rock toe

Low point bar – start of veg growth

Muddy Creek, Iowa City 2006
Sand deposition limits prairie grass growth

high point bar deposition
Vegetation growth through sand deposition on point pools narrow and deepens.
The Grove on Kickapoo Creek

EPA National Non-Point Pollution Monitoring Project

Change Rowcrop Drainage to Stormwater Detention in a prairie stream/wetland park

2007

West Branch

2009

East Branch
Row crops of corn and soybeans are the dominant landuse in the 14.8 sq mi watershed above the Grove West Branch agricultural ditch.
Grove waterways in the 1800’s

The larger East Branch existed as a slough. The steeper West Branch had large stream meanders.

The Grove Housing Development Area

West Branch had large meanders

East Branch slough without defined channel

The larger East Branch existed as a slough. Steeper West Branch had large stream meanders.
The prairie slough is a defined channel now.

The agricultural ditches transport floodwaters, sediment, and nutrients quickly downstream.
Phase 1: Temporary wetland basin storage above the undersized Grove Park Bridge. Pictured during second summer of prairie/wetland growth.
To reduce downstream flooding, runoff is detained in the park floodplains and wetlands by the undersized bridge.

Shave the peak off larger floods but reduce sedimentation.
2010 had rain for the prairie seedings but no major floods.

2008 and 2009 had Eight floods > 2 yr flood peak.

With strong growth of native prairie and wetlands in 2010, improvements of water quality in the Grove are beginning.
Large scale earth moving on steep bluffs is an large construction erosion problem.
SIAM - Reach Conceptual Model

Very important - the sediment transport model tested
Red is sediment yield from rowcrops
Black is total sediment yield measured

Red based on agricultural sediment yields at upstream USGS gages.

<table>
<thead>
<tr>
<th>Year</th>
<th>West</th>
<th>East</th>
<th>Upstream</th>
<th>Ireland Grove</th>
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<td>WY2007</td>
<td>1,976</td>
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<td>WY2008</td>
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<td>4,167</td>
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<td>WY2009</td>
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<td>14,552</td>
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<td>Total</td>
<td>12,579</td>
<td>8,908</td>
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Construction Erosion? 5000 tons from 200 acres?
Outflow from sedimentation basin
Into West Branch – 10-30-2009
Stream should move sediment load through wetland prairie detention basin

HEC-RAS 4 beta mobile bed sediment transport
IDNR and IEPA fall surveys of E2 riffle pools find pollution sensitive aquatic insects and fast growing bass along a prairie floodplain

Stream agrees so far
Only one individual showed up in years of pre-restoration sampling, so far 22 have been collected post-restoration.
Phase 2: East Branch remeandered and wetlands pictured (7-26-2010) in the first summer of prairie/wetland growth.
East Branch – Phase 2 Site
Environmental Excellent Award received by The American Council of Consulting Engineering Companies of Illinois, the first ever for stream restoration or green infrastructure for stormwater management.
Best award - presence of local wildlife
Natural riffle is the granite boulders and cobbles from the outwash of glacial melting.

Served as a fixed hard grade control to channel incision after stream was channelized.
Design (Tim Straub - this afternoon)
Enhance riffle/pool habitat and prairie grass/rock banks