


# Storm Water Management for Stream Integrity:

an integrated, holistic *data driven* approach.

A presentation to the NACWA Storm Water Committee  
July 15, 2013  
Cincinnati, Ohio

Matt Wooten – M.S. Aquatic Biologist, Sanitation District No. 1 (SD1)




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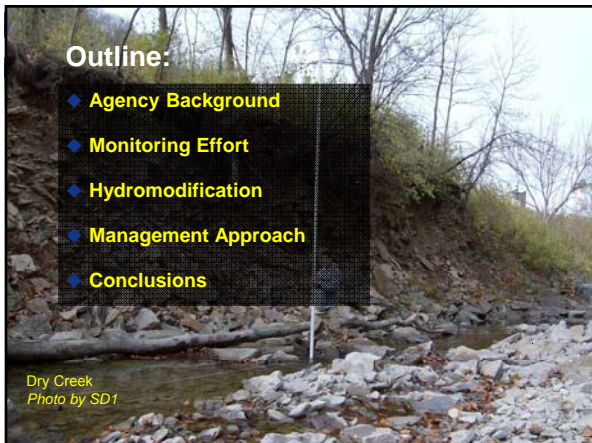
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## Outline:

- ◆ Agency Background
- ◆ Monitoring Effort
- ◆ Hydromodification
- ◆ Management Approach
- ◆ Conclusions

Dry Creek  
Photo by SD1




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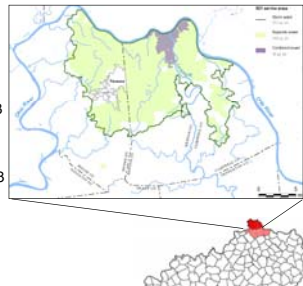
## Sanitation District No. 1 (SD1)

### Wastewater Utility

- Consolidated sanitary/combined sewers under SD1 in 1995
- 34 jurisdictions (31 cities and 3 counties)
- 176 square mile service area
- 1700 miles of sewer, 130 PS & 3 WWTPs

### Storm Water Utility

- Formed regional utility in 2003
- 30 cities and 3 counties
- 223 square mile service area
- 400 miles of storm lines
- 30,000 structures




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## Storm Water Utility

- Storm water surcharge
  - \$4.68/ERU, \$11 million annually
- Land disturbance permitting for new development and redevelopment projects in storm water service area
  - Sediment & Erosion Control
  - Storm Water Design Criteria
  - Post-Construction Runoff Control Standards
  - Inspection and Maintenance
- Illicit Discharges and Connections
- Enforcement

NORTHERN KENTUCKY  
REGIONAL STORM WATER  
MANAGEMENT PROGRAM  
RULES AND REGULATIONS  
  
SARVANA DISTRICT NO. 1  
1000 KENTUCKY DRIVE  
PARK WOOD, KY 40137  
AUGUST 2011

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## Why do we manage storm water runoff ?

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### Why do we care about Storm Water runoff?

- CSOs & SSOs
- Flooding
- Because unmitigated impervious surface can cause:
- Stream instability (Hydromodification)
  - More erosive flows, channel enlargement & widening
  - Infrastructure impacts
  - Excess Sedimentation
  - Poor water quality, habitat loss, & biological degradation



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### Water Quality in Northern Kentucky

- Approximately 1,500 miles of streams
- Approximately 110 Miles of impaired streams
- Primary Pollutants of Concern:
  - Bacteria
  - Nutrients
  - Sediments



**Sediment/Siltation is the No. 1 Pollutant of Kentucky Rivers and Streams**  
(KDOW, 2006, 305b Report to Congress)

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### Stream Assessment Program

- Comprehensive program to assess stream conditions
  - Water Quality
  - Biology
  - Physical Habitat
  - Stream Stability (Hydromod)
- Conduct monitoring activities during 5-year rotating cycles
- NKY watersheds, 590 miles<sup>2</sup> at approximately 75 sites




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### Field Monitoring Program Revealed Significant Stream Degradation



Dry Creek  
Photo by SD1

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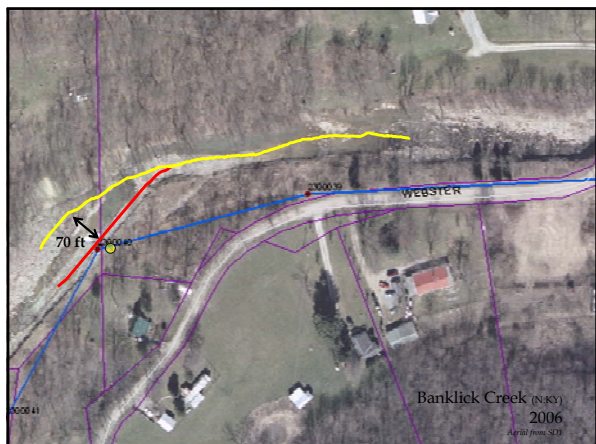
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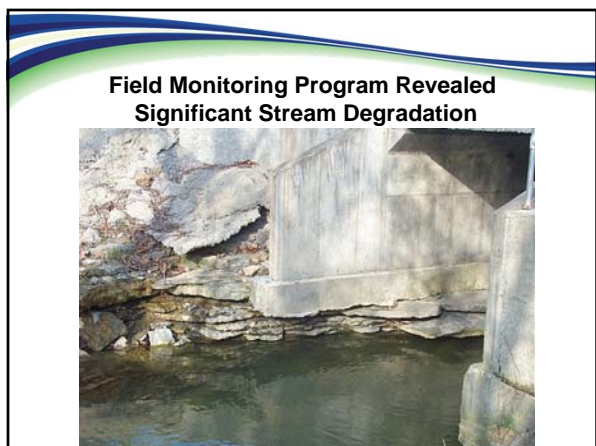
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**Field Monitoring Program Revealed Significant Stream Degradation**



Even Concrete Walls Can Fail if Streams Continue Downcutting

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Pre-failure

Bank Failure

Repair

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**Why Is Hydromodification So Prevalent?**



Boone County - 1995

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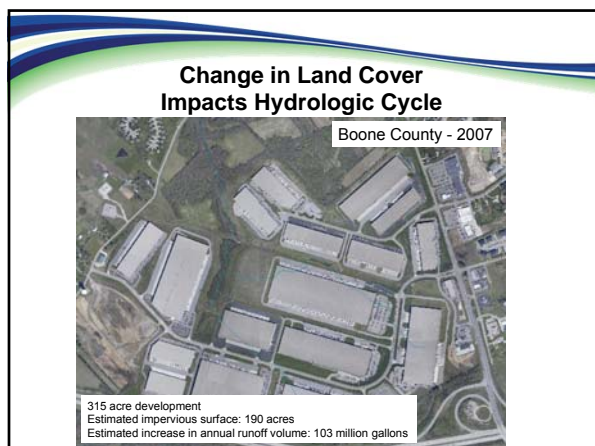
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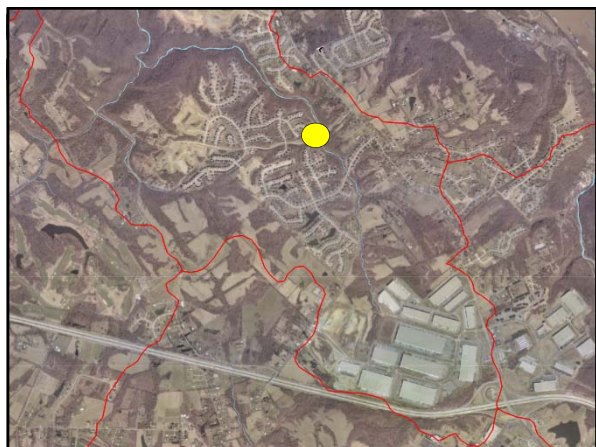
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### How Sensitive are the Systems to Improperly Managed Storm Water?

Rain Event- 11/16/10  
Magnitude – 0.45"  
Duration – 2 hours

< 2 month storm  
(2 hour/2 month = 0.81")



Looking upstream a 1<sup>st</sup> order ephemeral tributary to Pleasant Run  
~100 acre basin

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### Impact of Hydromodification on Water Quality

Channel Instability/Bank Failure is a Dominant Source of Fine Sediment  
(Simon and Klimetz, 2008; Trimble, 1997; Wilson et al., 2007)

Monitoring Results:

- 2 feet of bank retreat in 8 months
- approximately 14,000 tons of sediment per year per stream mile




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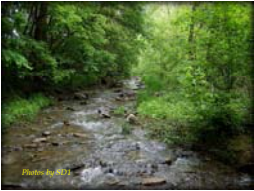
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### Undeveloped vs. Developed Watersheds



Middle Creek (3.3 mi<sup>2</sup>)  
Undeveloped (0.6% Impervious)



Owl Creek (3.7 mi<sup>2</sup>)  
Developing (9% Impervious)

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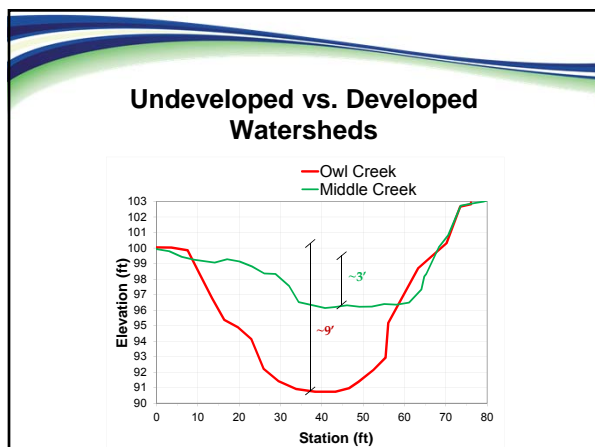
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### How are we managing storm water runoff today?


For new developments ≥1 acre of disturbance:

**Peak Flow Control**

- Pre = Post for 2, 10, 25, 50, 100
- Intended to minimize flooding

**Water quality treatment**

- "Manage" the WQv
- Focus on storms ≤ 0.8"
- Generically requires extended hold times/ volume reduction
  - BMP's



99% of storms currently passing through

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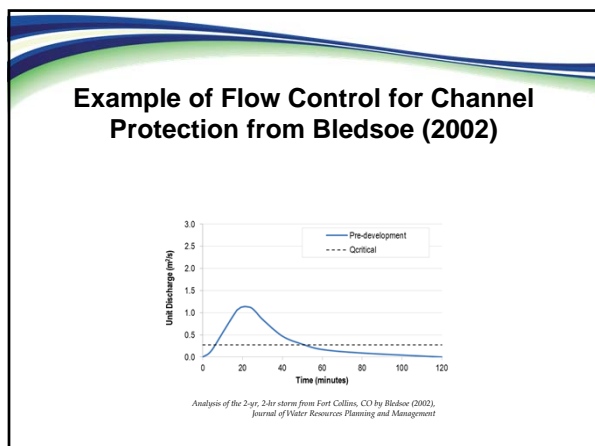
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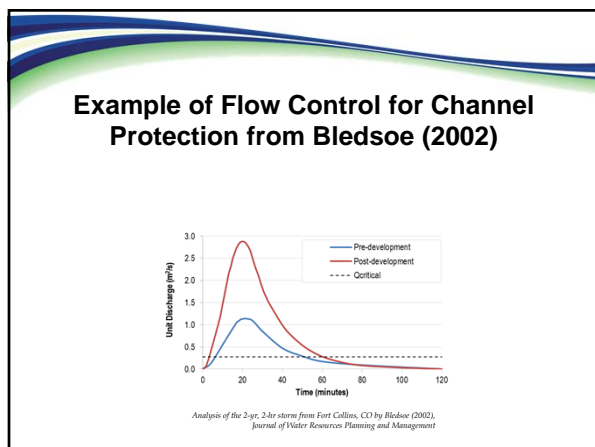
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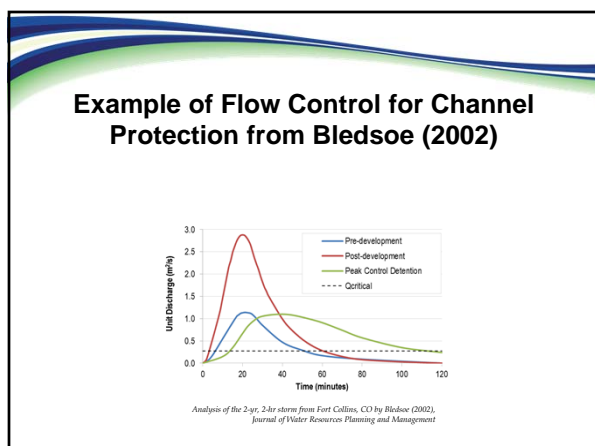
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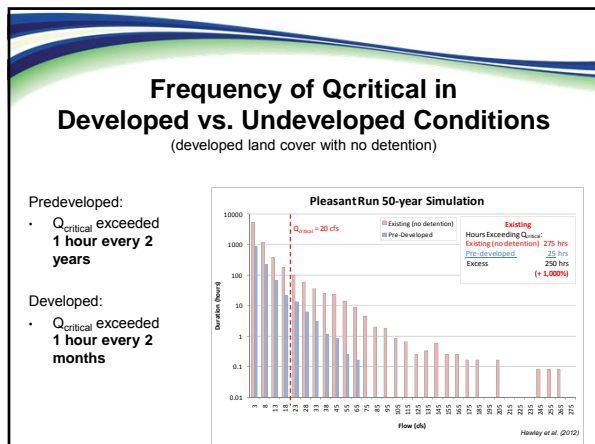
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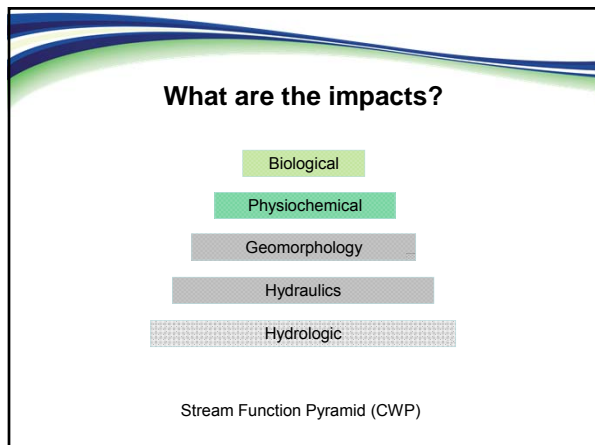
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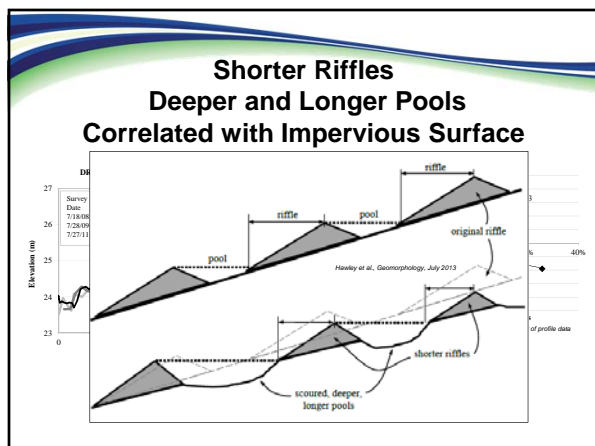
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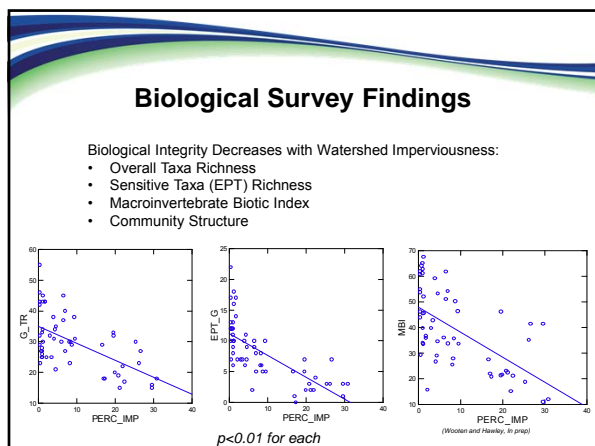
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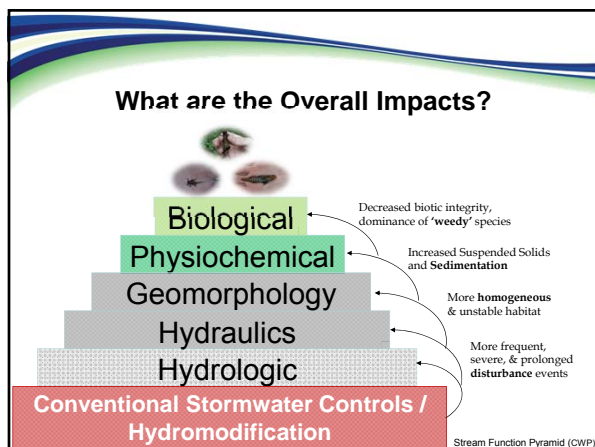
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### So, How Do We Implement?

- Credit Policy
  - BMP Manual
  - Up 50%
- Demonstration projects
  - SD1 campus
  - Constructed wetland
  - Reforestation project
- Local Watershed group partnerships
  - 319 Grants ( > \$3 mil.)
  - Detention basin retrofit(s)

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### So, How Do We Implement (cont.)?

- New Development
  - Potentially cost neutral relative to current MS4 post-construction requirements
- Recent Development (>1990s)
  - Minimal Costs to Retrofit Existing Controls
- Old Development (<1990s)
  - Requires creativity/pragmatism to install controls in heavily developed areas

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### Recognition from Regulators

- Invited presentations to
  - EPA Headquarters, Washington, D.C. , September 2012
    - Open to regional calibration
  - KDOW, Frankfort, KY Spring 2013
    - Encouraging local participation to set regional benchmarks

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### What is the Future of Storm Water Management?

Integrated solutions that address the spectrum of storm water related issues:

- Flooding
- Water quality
- Stream Stability
- Ecological Function

Stream Function Pyramid (CWP)

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### Acknowledgments

- Dr. Robert Hawley, P.E.  
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– Katie MacMannis, P.E.
- John Lyons – Strand Associates
- Colleagues and Leadership @ SD1





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Discussion?

Photo by SD1

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