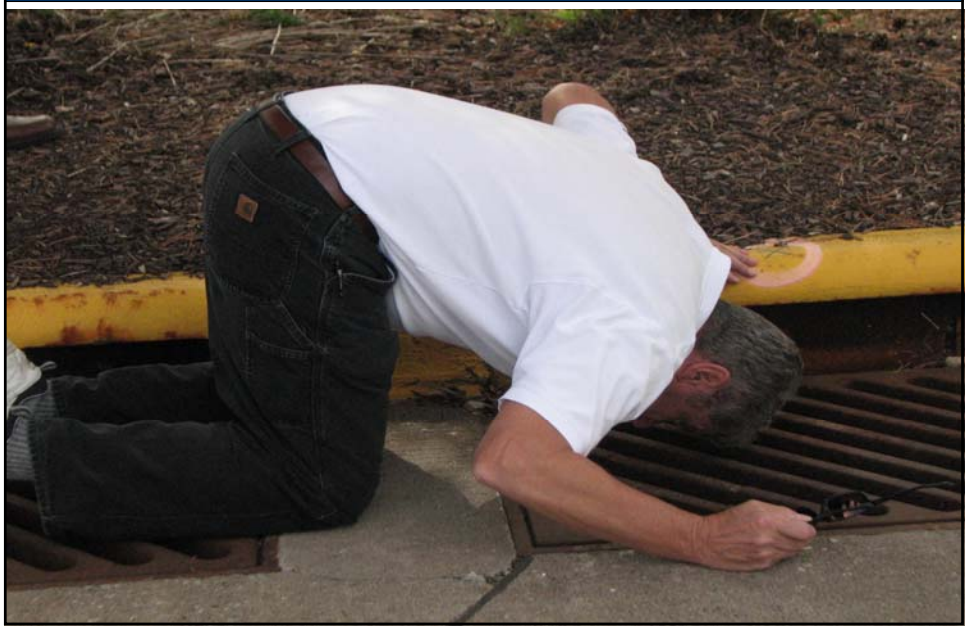
Who is this guy?



Introductions

A collaborative group of environmental and design professionals passionate about protecting our waters, restoring healthy ecosystems, and enhancing our community's unique sense of place.

watersheds and water resources | ecosystem restoration | civil engineering & landscape arch.

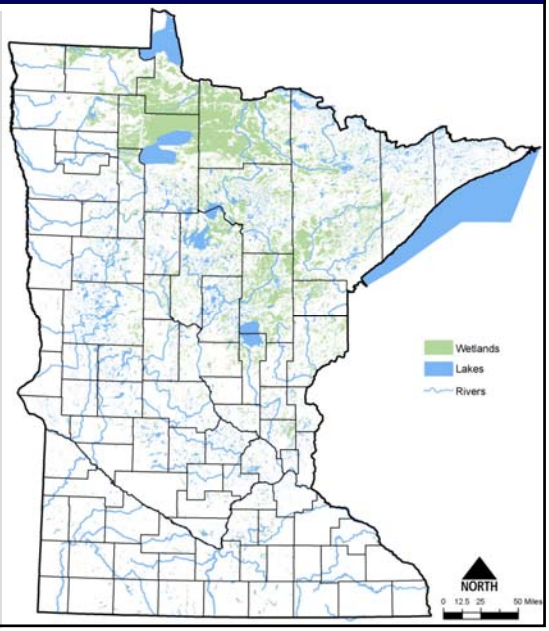

TIME
The Good Life In Minnesota
Gov. Wendell Anderson

The Land of 10,000 Lakes

11,642 lakes > 10 acres

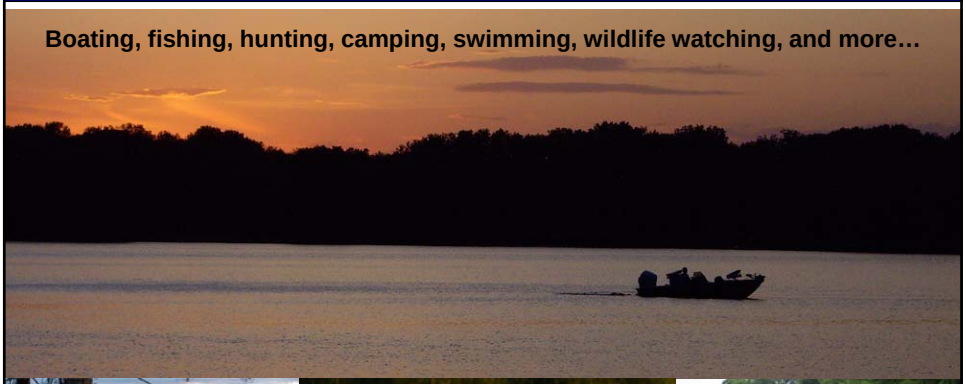
69,200 miles of rivers/ streams

9.3 million acres of wetland



TOURISM

Boating, fishing, hunting, camping, swimming, wildlife watching, and more…




$13 Billion


JOBS JOBS JOBS
250,000
JOBS JOBS JOBS

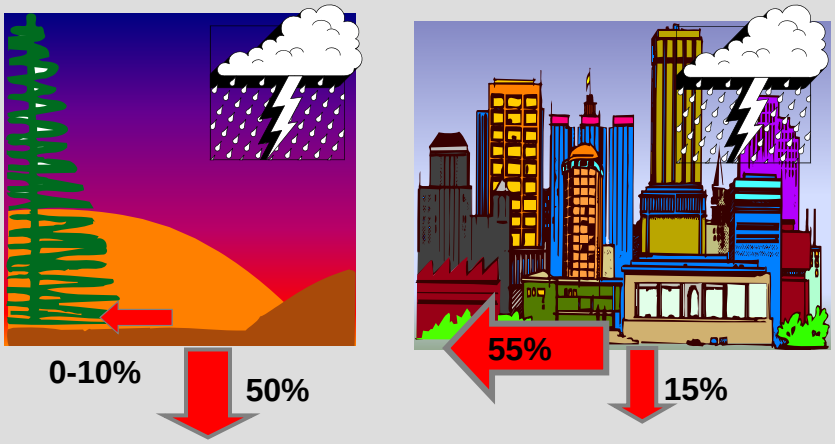
But all is not well…

40% OF MINNESOTA SURFACE WATERS ARE FOUND TO BE IMPAIRED

- **2008 Impaired Waters List (303d)**
  - **2,575 impairments**
- **2010 Impaired Waters List (303d)**
  - **3,049 impairments**
- **2012 Impaired Waters List (303d)**
  - **3,638 impairments**
- **2014 Impaired Waters List (303d)**
  - **4,122 impairments**
- **2016 Impaired Waters List (303d)**
  - **4,607 impairments**

WHY?

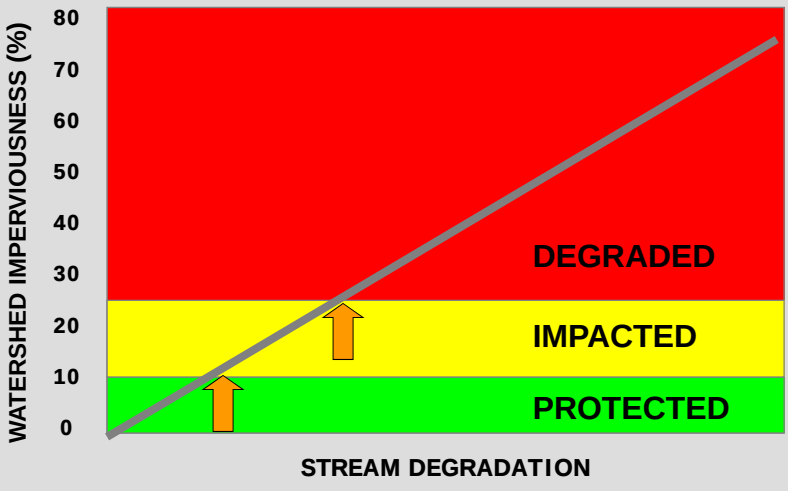
Development Impacts on the Water Cycle



IMPERVIOUS SURFACES

Materials like cement, asphalt, roofing, and compacted soil that prevent percolation of runoff into the ground.

WATERWAY HEALTH & IMPERVIOUSNESS

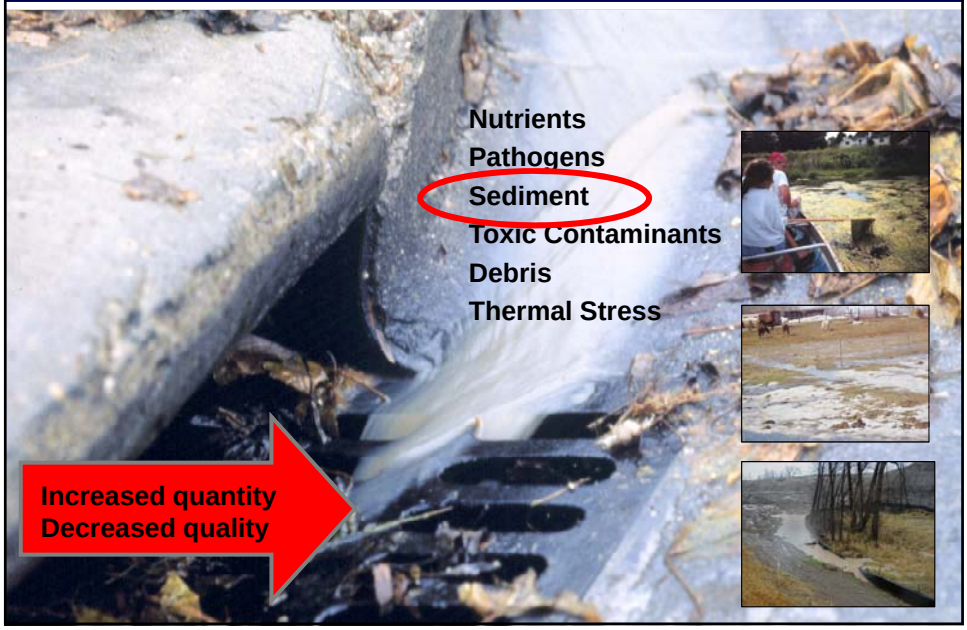


ADAPTED FROM SCHUELER, ET. AL., 1992

WATER *QUANTITY* IMPACTS

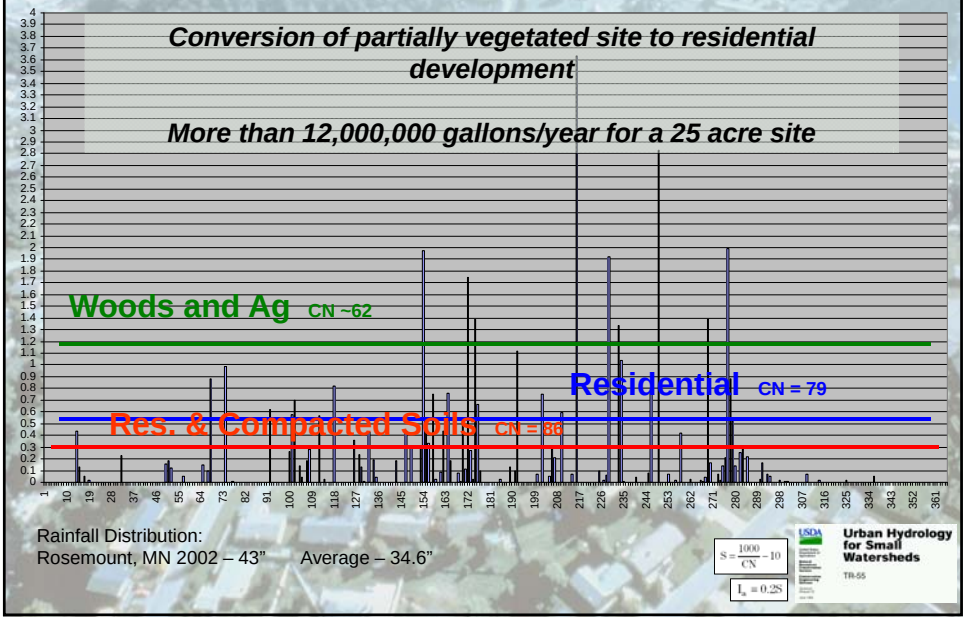
- Disruption of Natural Water Balance
- Increased Flood Peaks
- Increased Duration of Flows
- Streambank Erosion
- Habitat Loss
- Lower Summer Base Flows

WATER *QUALITY* IMPACTS



A BIG IMPACT…

How much water are we really talking about?



How much water are we really talking about?

More than 12,000,000 gallons/year for a 25 acre site

How much of this volume is reduced by using stormwater ponds?

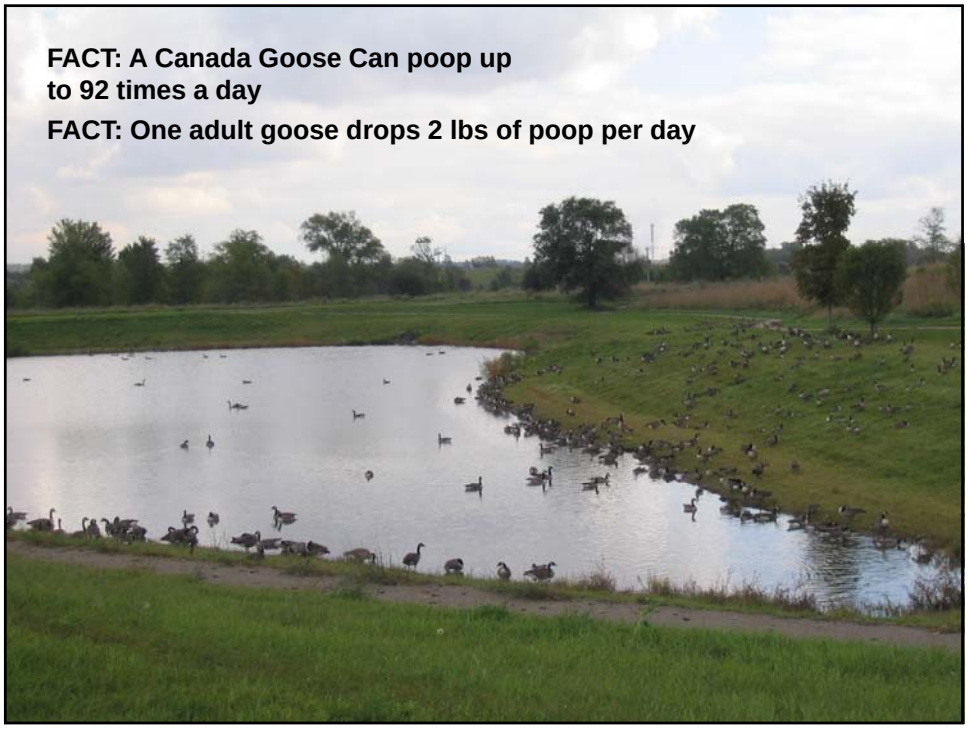
How does that effect phosphorus loading to a lake?

THE BEGINNING OF MANAGEMENT

National Urban Runoff Program

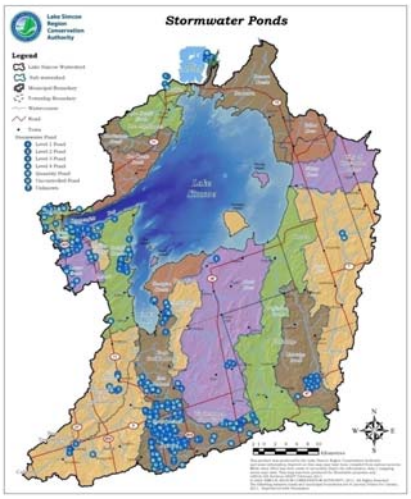
1983

- Technical studies that compiled data about urban runoff
- Resulted in treatment recommendations and easy to apply standards for design and review
- Led to proliferation of ponds



Need for Change: Current SWM Practices

- Since 1995 all new development has been required to install stormwater controls, (stormwater ponds),
- Despite this the health and quality of many urban rivers and streams continues to decline,
- In 2010 a study was conducted to answer the question: Are stormwater ponds working?



Are Stormwater Ponds Working?

Maintenance

- Lack of pond maintenance decreases the available storage volume increasing the risk of flooding.

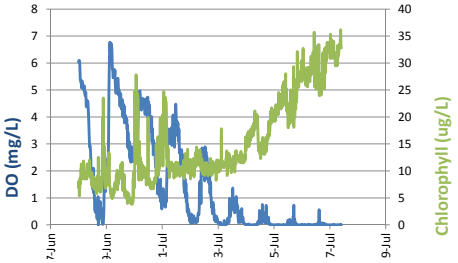
- 56 of the 98 ponds require maintenance at an estimated cost of $18.5 million.
- Assumes the 50,000 m^3 is not contaminated.

Nutrient Attenuation

- Lack of maintenance results in 1.1 T/y loading increase, 1.5% of total annual phosphorus load,

Anoxic Nutrient Release

- Under low oxygen soluble phosphorus can be released from the sediment turning stormwater ponds into nutrient sources.



29

Risk Management and Liability

- Municipalities and CA's have a legal obligations,
- Section 21 of the Conservation Authorities Act the LSRCA has the power to control surface waters to reduce their adverse impact and prevent flooding,
- Climate change is dramatically increasing this risk.

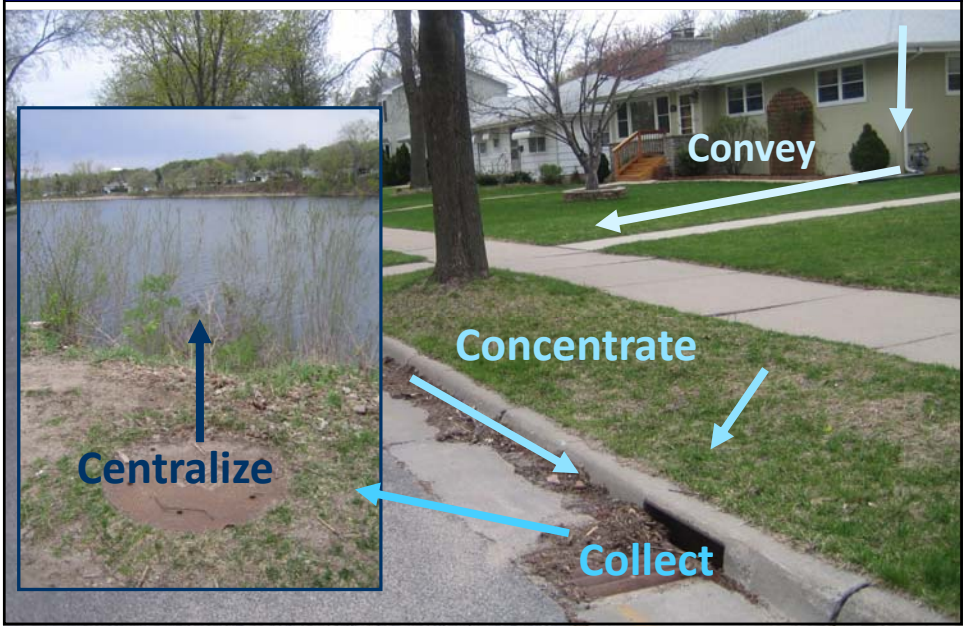
30

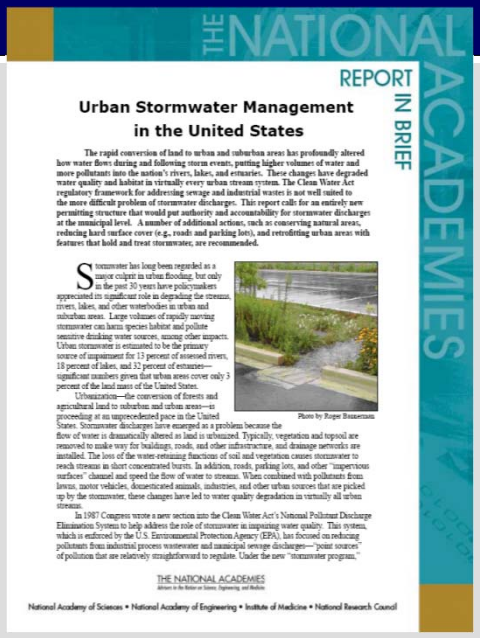
Recent Litigation

Minnesota cities sue refiners over cost of cleaning up polluted stormwater ponds

Seven cities say cleanup of carcinogenic chemicals should rest with manufacturers.
By Chris Serres Star Tribune
JANUARY 2, 2019 — 8:21PM

Traditional Stormwater Management




THE NATIONAL ACADEMIES
REPORT IN BRIEF

Urban Stormwater Management in the United States

The rapid conversion of land to urban and suburban areas has profoundly altered how water flows during and following storm events, putting higher volumes of water and more pollutants into the nation's rivers, lakes, and estuaries. These changes have degraded water quality and habitat in virtually every urban stream system. The Clean Water Act regulatory framework for addressing sewage and industrial wastes is not well suited to the more difficult problem of stormwater discharges. This report calls for an entirely new permitting structure that would put authority and accountability for stormwater discharges at the municipal level. A number of additional actions, such as conserving natural areas, reducing hard surface cover (e.g., roads and parking lots), and retrofitting urban areas with features that hold and treat stormwater, are recommended.

Stormwater has long been regarded as a major culprit in urban flooding, but only in the past 30 years have policymakers appreciated its significant role in degrading the streams, rivers, lakes, and other waterbodies in urban and suburban areas. Large volumes of rapidly moving stormwater can harm species habitat and pollute sensitive drinking water sources, among other impacts. Urban stormwater is estimated to be the primary source of impairment for 13 percent of assessed rivers, 18 percent of lakes, and 32 percent of estuaries—significant numbers given that urban areas cover only 3 percent of the land mass of the United States.

Photo by Roger Bannerman

Urbanization—the conversion of forests and agricultural land to suburban and urban areas—is proceeding at an unprecedented pace in the United States. Stormwater discharges have emerged as a problem because the flow of water is dramatically altered as land is urbanized. Typically, vegetation and topsoil are removed to make way for buildings, roads, and other infrastructure, and drainage networks are installed. The loss of the water-retaining functions of soil and vegetation causes stormwater to reach streams in short concentrated bursts. In addition, roads, parking lots, and other "impervious surfaces" channel and speed the flow of water to streams. When combined with pollutants from lawns, motor vehicles, domesticated animals, industries, and other urban sources that are picked up by the stormwater, these changes have led to water quality degradation in virtually all urban streams.

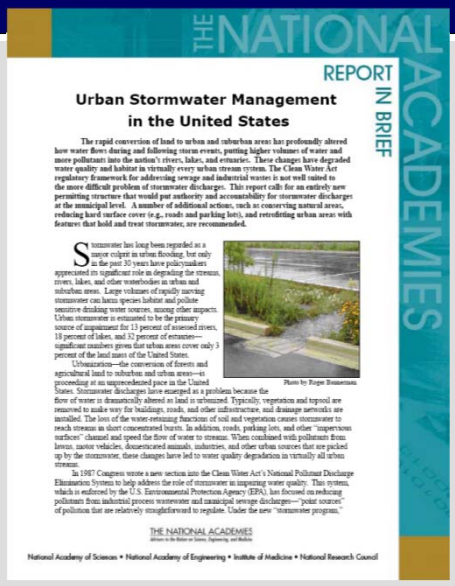
In 1987 Congress wrote a new section into the Clean Water Act's National Pollutant Discharge Elimination System to help address the role of stormwater in impairing water quality. This system, which is enforced by the U.S. Environmental Protection Agency (EPA), has focused on reducing pollutants from industrial process wastewater and municipal sewage discharges—"point sources" of pollution that are relatively straightforward to regulate. Under the new "stormwater program,"

THE NATIONAL ACADEMIES

National Academy of Sciences • National Academy of Engineering • Institute of Medicine • National Research Council

"Past practices…have been ineffective at protecting water quality in receiving waters and only partially effective in meeting flood control requirements"

"Stormwater control measures that harvest, infiltrate, and evapotranspirate stormwater are critical to reducing the volume and pollutant loading of small storms"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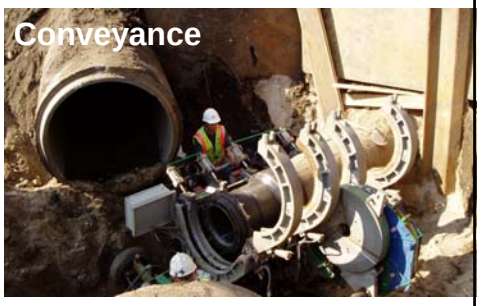
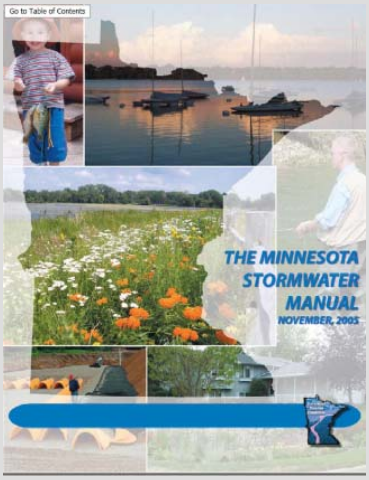
STORMWATER MANAGEMENT



A PARADIGM SHIFT

Now changing to focus on water quality, primarily through small event volume control.

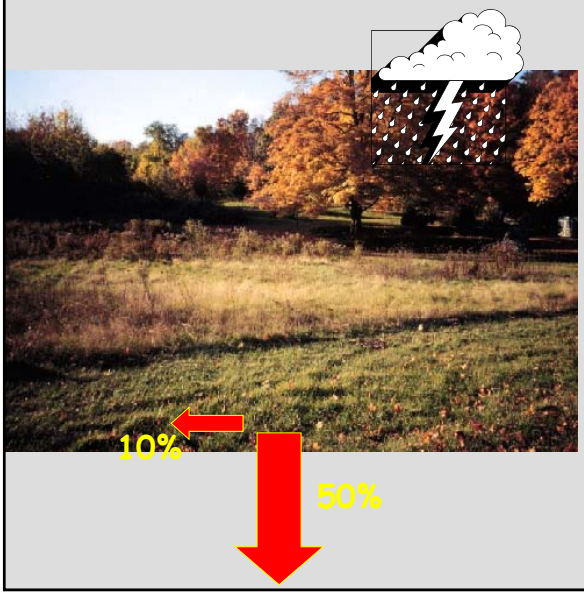
Rain events between .5 and 1.5 inches are responsible for about 75% of runoff pollutant discharge – "First Flush"



THE CHALLENGE: How do you make this…

Function like *this*?

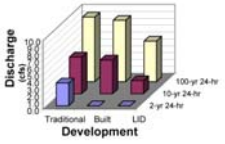
DESIGN PRINCIPLES



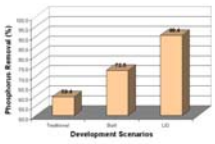
Retain & Restore the Natural Landscape

Low Impact Development (LID)

Conventional Development



Low Impact Development



PRIMARY GOAL OF LID

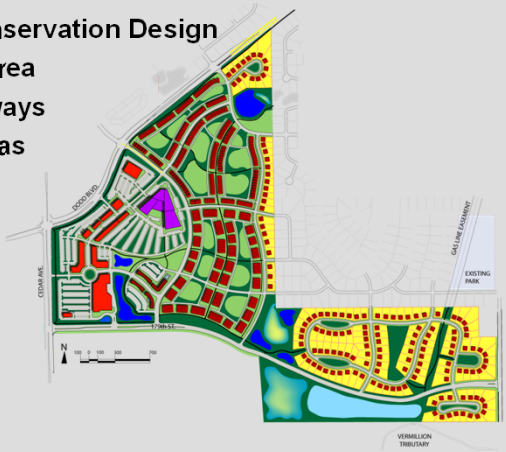
Design each development site to protect, or restore, the natural hydrology of the site so that the overall integrity of the watershed is protected. This is done by creating a "hydrologically" functional landscape.

Low Impact Development (LID)

Non-Structural LID Tools

Planning/ Design

- Cluster Development, Conservation Design
- Minimize total disturbed area
- Protect natural flow pathways
- Protect riparian buffer areas
- Protect sensitive areas
- Reduce impervious areas
- Impervious disconnection



Structural LID Tools

Infiltration practices

- Bioretention (rain gardens, urban forestry)
- Infiltration trenches
- Detention basins with infiltration design

Vegetated swales, filter strips, biofiltration

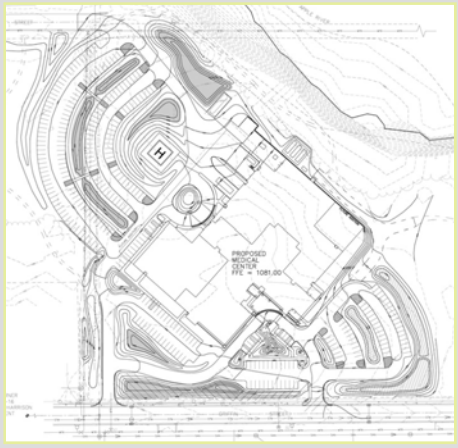
Vegetation: native landscaping, trees (uptake and evapo-transpiration)

Green Roofs

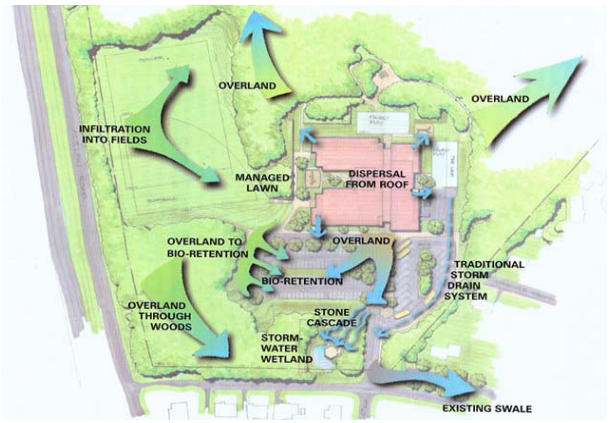
Capture / Reuse (cisterns, rain barrels, ponds)

Permeable hard surfaces (pavers, roads, parking, driveways, sidewalks)

Landscaping Soil Quality: protection or restoration (amendments, de-compaction)

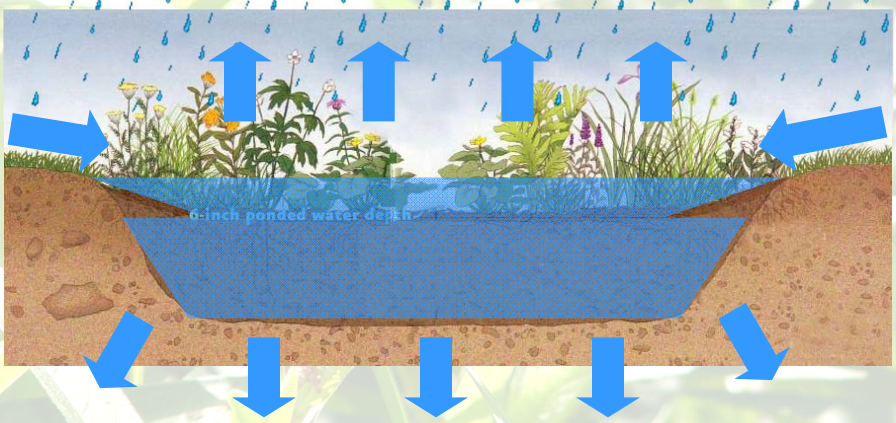


Creating Functional & Sustainable Landscapes



Bioretention / Raingardens

(Capture / Filtration / Infiltration / Evapotranspiration)

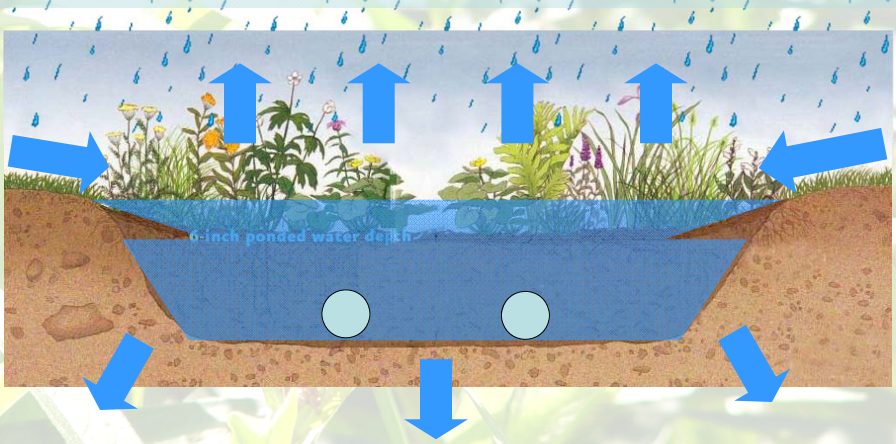


Just like a regular planting, but able to absorb rainwater and breakdown pollutants

Concept - Gregg Thompson, Illustration - Taina Litwak, Animation - Ron Struss

Bioretention / Raingardens

(Capture / Filtration / Infiltration / Evapotranspiration)



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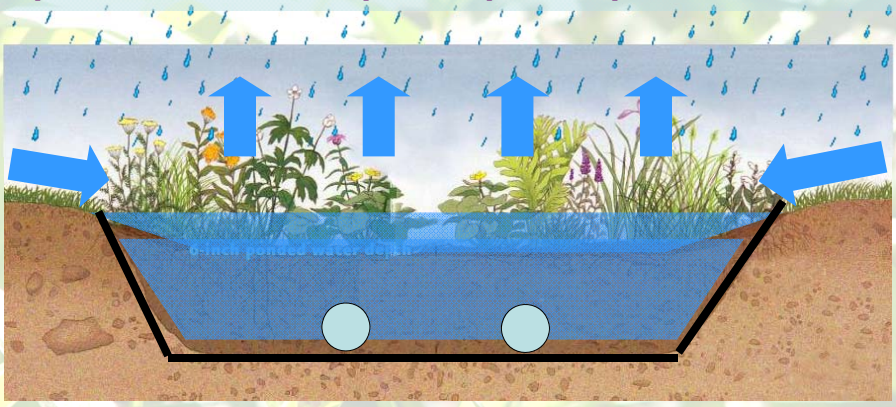

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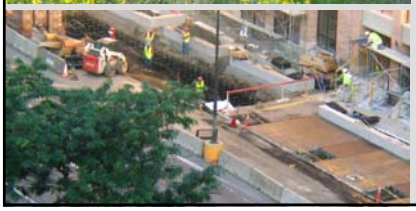
BIG BENEFITS



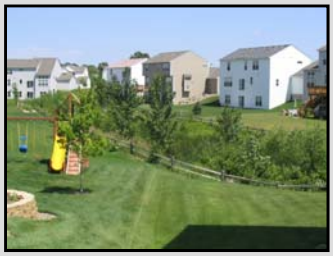
Research increasingly shows the benefits of:

vegetated vs. piped systems

open vs. closed systems

Infiltration/retention vs. detention

Engineered Swales

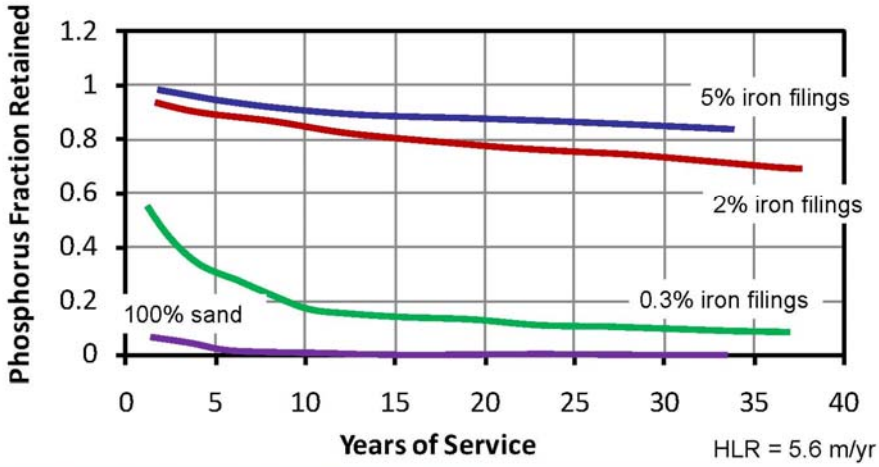


- **Open, above-ground systems are easier to maintain & troubleshoot**
- **Installation costs are favorable compared to piped drainage**

Vegetated Buffers

Constructed Filter Systems

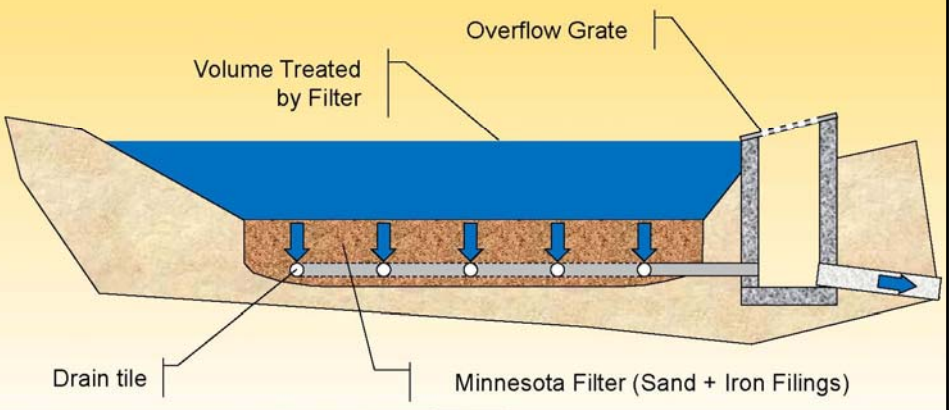
Experimental Results (iron)



St. Anthony Falls Laboratory
University of Minnesota

http://stormwater.safl.umn.edu/
http://www.cityofpriorlake.com/WaterResources.shtml

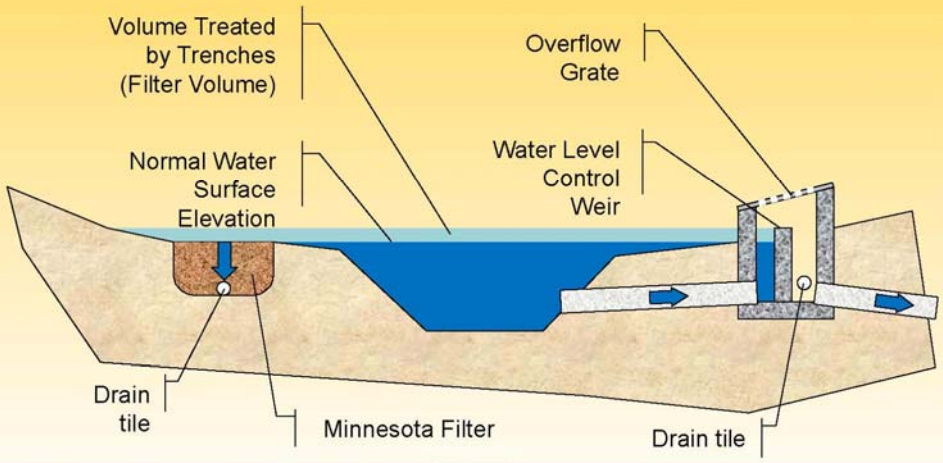
"Minnesota Filter" (sand with 5% iron filings, Maplewood, MN)



St. Anthony Falls Laboratory
University of Minnesota

http://stormwater.safl.umn.edu/
http://www.cityofpriorlake.com/WaterResources.shtml

Filter Trenches around wet detention ponds (Prior Lake, MN)



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Filter Trenches around wet detention ponds (Prior Lake, MN)

Photo Courtesy: A. Erickson

St. Anthony Falls Laboratory
University of Minnesota

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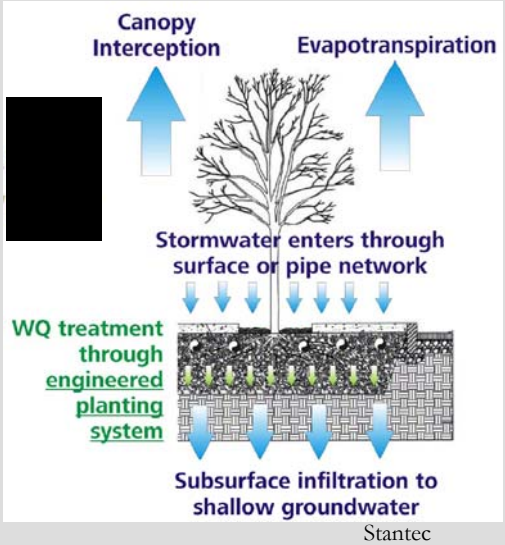
Pervious Pavememt

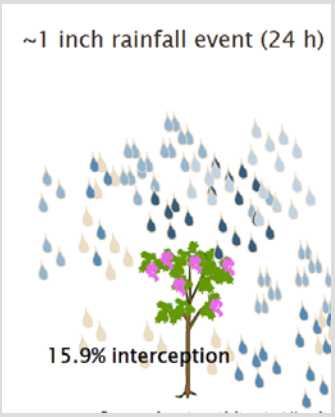
Pervious Asphalt
Pervious Concrete
Interlocking Concrete Pavers

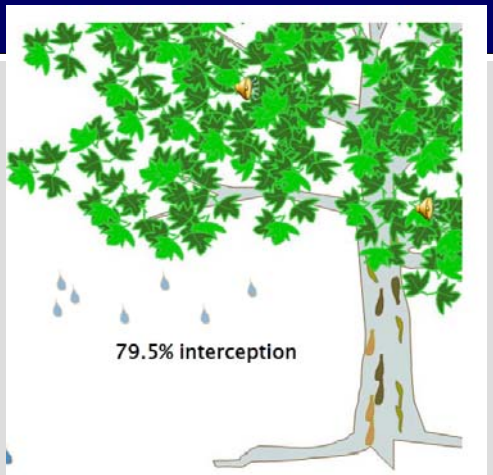
Urban Forestry



Stantec

Urban Forestry





Platanus xacerifolia

Xiao Q., and E.G. McPherson. 2003. Rainfall interception by Santa Monica's municipal urban forest. Urban Ecosystems

CRYSTAL LAKE: A Case Study

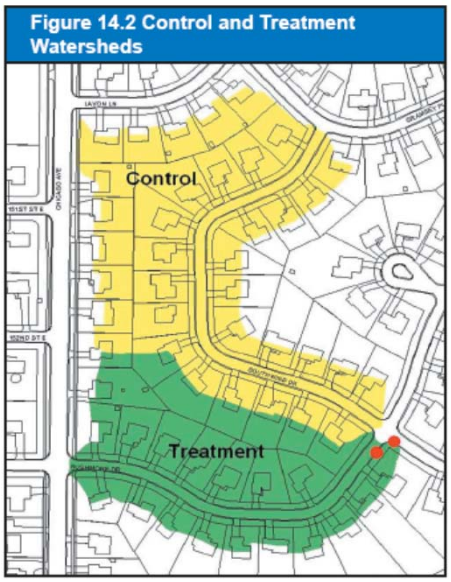
Burnsville, MN: Rushmore Street

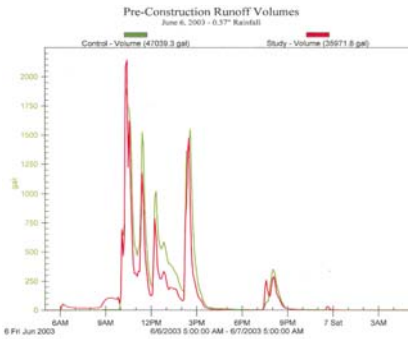
Burnsville – Rushmore Street

5.3 acres – 25 homes – 17 raingardens

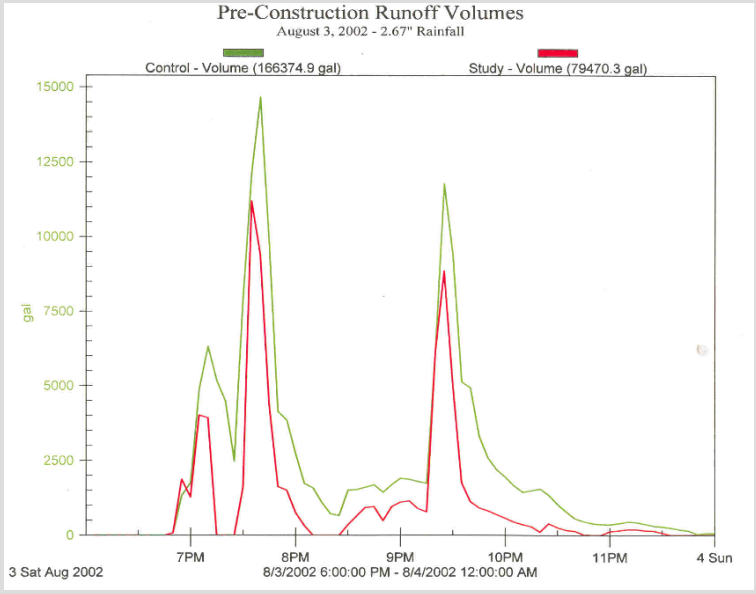
Designed by: Barr Engineering

MONITORING RESULTS

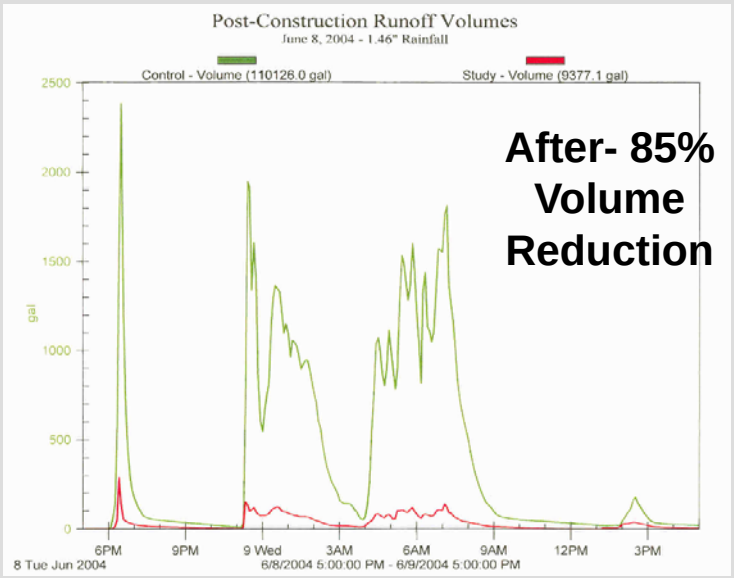




Pre-Construction Runoff Volumes



Post-Construction Runoff Volumes



After- 85% Volume Reduction


photo: City of Burnsville
BEFORE


photo: Fred Rozumalski
AFTER

THE GREEN LINE: A Case Study

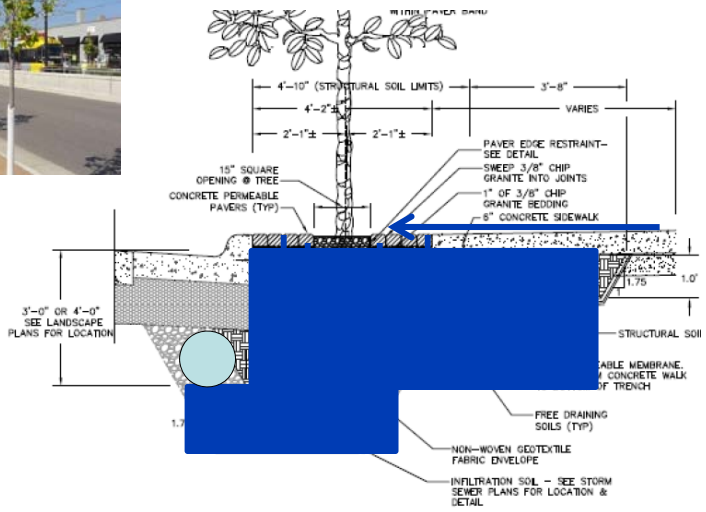
University Avenue Light Rail Project

Connecting Minneapolis to Saint Paul

6-mile Linear Project

Ultra Urban

LINEAR TREE TRENCHES



MAPLEWOOD MALL: A Case Study

1974: Mall Opened

2010: Parking Lot Stormwater Retrofit

BEFORE:

7 Acres Impervious

Severely compacted soils

Photos: Ramsey Washington Metro Watershed District

SUBURBAN PARKING LOT RETROFIT

- **55 Rainwater gardens (19 enhanced sand filters)**
- **6,733 SF Permeable Pavers**
- **1 Mile of Tree Trenches**
- **375 New Trees**
- **20 million gallons of stormwater intercepted each year (67% of total)**

Photos: Ramsey Washington Metro Watershed District

Minimal Impact Design Standards (MIDS)

The development of **Minimal Impact Design Standards is based on low impact development (LID) — an approach to stormwater management that mimics a site's natural hydrology as the landscape is developed.** Using the low impact development approach, stormwater is managed on site and the rate and volume of predevelopment stormwater reaching receiving waters is unchanged. The calculation of predevelopment hydrology is based on native soil and vegetation. (Minnesota Statutes, section 115.03, subdivision 5c).

Minimal Impact Design Standards (MIDS)

Minimal Impact Design Standards (MIDS) represents the next generation of stormwater management and contains three main elements that address the following challenges:

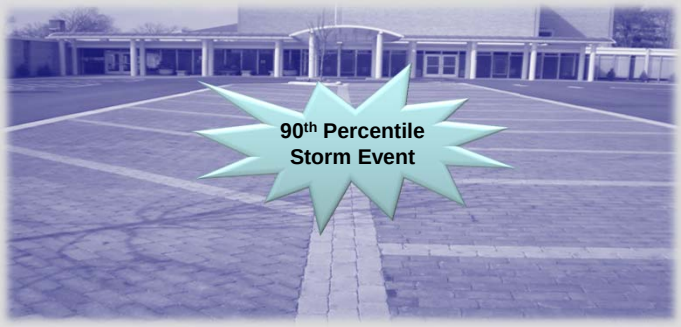
- A higher clean water **performance goal** for new development and redevelopment to provide enhanced protection for Minnesota's water resources.
- New **modeling methods and credit calculations** that will standardize the use of a range of innovative structural and nonstructural stormwater techniques.
- A **credits system and ordinance package** that will allow for increased flexibility and a streamlined approach to regulatory programs for developers and communities.

MIDS Workgroup

MIDS: Performance Goals

New development

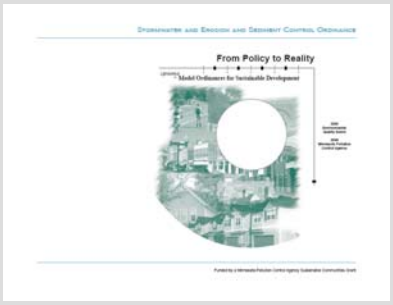
Redevelopment



Linear Projects

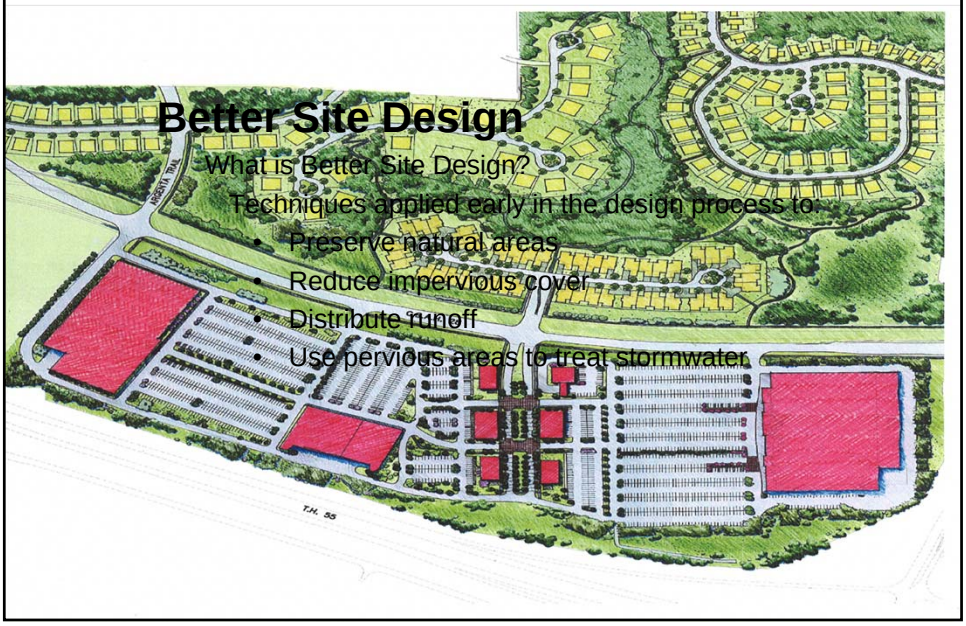
Flexible Treatment options – when a site just cannot meet the goal.

MIDS: Community Assistance Package



- **Background on MIDS**
- **How to use the package**
- **Long form stormwater and erosion control ordinance**
- **Short form stormwater and erosion control ordinance**
- **Illicit discharge ordinance**
- **Subdivision ordinance**
- **Conservation subdivision ordinance**
- **Shoreland standards (forthcoming)**
- **Development checklist**
- **Planning process checklist**
- **Sample adoption resolution for ordinance changes**

MIDS: Stormwater & Erosion Ordinance



The Beginning of the Lake Simcoe Effort

Lake Simcoe
Stormwater Management Policy Working Group

BILD & Local Consulting Firms
City of Barrie
City of Kawartha Lakes
City of Orillia
EOR
LSRCA
Ministry of the Environment
Municipal Affairs and Housing
Ryerson University
Town of Aurora
Town of Bradford West-Gwillimbury
Town of East Gwillimbury
Town of Georgina
Town of Innisfil
Town of Newmarket
Town of Uxbridge
Town of Whitchurch-Stouffville
Township of Brock
Township of King
Township of Oro-Medonte
University of Guelph
York Region

Policy Becomes Rule

- Stakeholder group meets monthly to contribute to and review draft language
- Model By-law (ordinance) developed
- Policy becomes effective September 1, 2016
- Sets the path for implementation of Lake Simcoe Phosphorous Offset Program January 1, 2018
- Requires developers to work toward zero phosphorous from new development
- Offset charge of establishes funding pool for retrofit of existing infrastructure

Ontario

Low Impact Development Stormwater Management Guidance Manual

Ministry of the Environment , Conservation and Parks

We can do this, lets make it happen!