Green Infrastructure and Low Impact Development with 319 Funds

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Consequences of Development to Urban Streams

Large Storm

Higher and More Rapid Peak Discharge

More Runoff Volume

Lower and Less Rapid Peak

Gradual Recession

Higher Baseflow

Small Storm

Pre-development

Post-development
70% increase in peak flow.
170% increase in runoff volume.
Former instantaneous peak flow now lasts ~4 hours.
Increased rates and volumes of storm water discharges lead to stream widening and down-cutting, or incision.
What needs to change?
Paradigm Shift:
Rain is a Resource, Not a Waste

- Drinking water
- Ground water recharge
- Stream baseflow
- Trees & other plants
- Aesthetic qualities
Paradigm Shift: Get away from the curb and gutter, big basin approach

- Shift from the concept of moving stormwater as far away as quickly as possible in large, buried collection and conveyance systems.

- Shift towards the concept of managing stormwater the way mother nature would do it: where it falls; plants & soils.
Paradigm Shift:
Trifocal Approach to Stormwater Management
Approaches to Flow Management

- Good Site Design
- Good Neighborhood and Community Design
- Water Conservation & Reuse

Infiltration ~ Evapotranspiration ~ Capture & Use
Green Infrastructure and Low Impact Development (LID)

- Green infrastructure and LID uses vegetation and soils in urban and suburban areas to manage and treat precipitation naturally rather than collecting it in pipes.
- It preserves natural systems and uses engineered systems such as green roofs, rain gardens, and vegetated swales to mimic natural functions.
- Green infrastructure and LID includes approaches that capture and re-use stormwater.
Green Infrastructure Practices

- Amended soils
- Impervious cover removal
- Bioretention
- Permeable pavements
- Green roofs
- Cisterns & rain barrels
- Trees & expanded tree boxes
- Reforestation & restoration
- Redevelopment
- Infill development
- Alternative parking & street designs
- Water Conservation
Green Infrastructure and LID Benefits

- Cleaner water
- Stable hydrology/baseflow maintenance
- Reduced flooding
- Climate change mitigation and adaptation
- Cleaner air
- Reduced urban temperatures
- Jobs creation
- Water supply
- Energy savings
- Cost savings
- Habitat protection
- Community benefits (recreation, public health, crime prevention)
Low Impact Development Works Everywhere

- LID can be applied to new development, redevelopment, or as retrofits to existing development.
- LID has been adapted to a range of land uses from high density ultra-urban settings to low density development.
Bioinfiltration
Parking Lot Island Infiltration Areas
Rain Gardens
Planters
Permeable Pavements
Green Roofs
Green Walls
Pocket Wetlands
Vegetated Buffers & Native Landscaping
Rainwater Harvesting & Use
Tree & Canopy Programs

- Trees intercept, and evaporate significant amounts of water
- Trees filter pollutants
- Canopies shade and cool paved surfaces
Water Conservation

- High efficiency fixtures and appliances (low-flow toilets, urinals, showerheads, faucets)
- Water recycling and reuse of wastewater from sinks, kitchens, tubs, washing machines, and dishwaters for landscaping, flushing toilets, etc.
- Waterless technologies (composting toilets, waterless urinals)
- Rain harvesting (rain barrels, cisterns)
Even though “pollutant” is defined broadly in the Act to include virtually every imaginable substance added to surface waters, including heat, it has not traditionally been read to include water volume.

A more straightforward way to regulate stormwater contributions to waterbody impairment would be to use flow or a surrogate, like impervious cover, as a measure of stormwater loading .... Flow from individual stormwater sources is easier to monitor, model, and even approximate as compared to calculating the loadings of individual contaminants in stormwater effluent. Efforts to reduce stormwater flow will automatically achieve reductions in pollutant loading. Moreover, flow is itself responsible for additional erosion and sedimentation that adversely impacts surface water quality.
Study Findings

- SCMs that harvest, infiltrate, and evapotranspirate stormwater are critical to reducing the volume and pollutant loading of small storms.

- “It should be noted that there are important, although indirect, water quality benefits of all runoff-volume-reduction SCMs—
  1. the reduction in runoff will reduce streambank erosion downstream and the concomitant increases in sediment load, and
  2. volume reductions lead to pollutant load reductions, even if pollutant concentrations in stormwater are not decreased."
## National Example 95\textsuperscript{th} Percentile Storms

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Design Guidebooks

San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook
First Edition ~ January 2009

Stormwater Management Handbook
Implementing Green Infrastructure in Northern Kentucky Communities
May 2009
Designs to Maximize Retention

Overflow

Inflow

Overflow

Inflow
Designs to Maximize Retention
Designs to Maximize Retention
Designs to Maximize Retention

- Underdrain with Upturned Elbow on Right
- Stored Water to later Infiltrate

Infiltration/ Exfiltration

Drainage
Green Streets Guide

- Describes green approaches for:
  - Residential Streets
  - Commercial Streets
  - Arterial Streets
  - Alleys

- Includes concept designs

- Discusses functions and applications
Water Quality Scorecard

- Communities can evaluate local policies
- Can set goals or objectives for making modifications to local plans, codes or ordinances
- Provides information and suggestions on how plans, codes or ordinances may be improved
Green Infrastructure in Arid and Semi-Arid Climates

Adapting innovative stormwater management techniques to the water-limited West.

Forward-thinking communities in water-limited regions are increasingly recognizing green infrastructure as a cost-effective approach to stormwater management that conserves water.

When rain falls on natural landscapes, much of it either soaks into the ground or is returned to the atmosphere by plants or evaporation. Rain that is not absorbed into the soil flows into nearby washes, streams, or streams. By removing landscapes with parking lots, roads, and rooftops, we dramatically change this water balance. The loss of precipitation is absorbed into the soil, and much more flows across the land. When green infrastructure is integrated into the landscape, green infrastructure practices may not only be "green" of the landscape, but they also provide a range of benefits, including improved water quality, enhanced habitat, and reduced flooding.

Green infrastructure refers to a set of practices that mimic natural processes to retain and use stormwater. By promoting infiltration, evapotranspiration, and harvesting throughout the landscape, green infrastructure practices can restore the natural water balance, though many green infrastructure practices were first developed and applied in temperate regions, green infrastructure is perhaps the ideal solution for arid and semi-arid regions.
Look for local resources on Green Infrastructure and LID

- Watershed Management Group based in Tucson, AZ
- Has numerous trainings offered in Tucson and Phoenix
- Watershedmg.org
AridLID 2012 Conference

- Green Infrastructure and Low Impact Development in Arid Environments
- March 27-29, 2012
- Tucson, Arizona
- AridLID.org
Municipal Handbook

The Municipal Handbook is a series of guidance documents to help local officials implement green infrastructure in their communities. Modules include:

- Rainwater Harvesting Policies
- Green Streets
- Funding Options
- Retrofit Policies
- Municipal Incentives
Shakopee Mdewakanton Sioux Community Projects

- CWA Section 319 Competitive Grant Award has supported:
  - 15,000 square feet of pervious asphalt at tribal community center parking lot (reconstruction)
  - 3,900 square feet of bioretention areas located upstream of receiving wetlands

- Demonstrate to casino management that project is aesthetically pleasing and provides water quality benefits
Big Eagle’s Water Quality Improvement Project

Shakopee Mdewakanton Sioux Community

What is a Rain Garden?
Storm water runoff from the parking lot, rooftops, and sidewalks is diverted into the rain garden, which is filled with specially designed soil (70% sand, 30% compost), topped with 3 inches of mulch and planted with vegetation. Storm water pollutants are removed using physical, chemical, and biological processes. Treated water not used by the plants either infiltrates or flows through the drain tile to the storm sewer.

Benefits
- Absorbs water from impervious surfaces to reduce flooding
- Filters oil, grease, and toxic materials
- Helps recharge the aquifer
- Provides beneficial wildlife habitat

The Alternative
With no rain garden, storm water drains directly to our streams and pollutes the watershed.

1. Storm water collects pollutants from the roof and driveway.
2. The rain garden absorbs and filters runoff through unsedged soil layers and deep plant roots.
3. Rain gardens help our fish and other wildlife enjoy cleaner water.
Goal: to improve runoff water quality

Bioretention areas in high visibility locations
Other projects include:

- Vegetated roof on ice arena
- Vegetated roof on wastewater treatment facility
- Recycled pavers and bioretention areas at sport and fitness arena
- Bioretention areas at community center parking lot

Site tours and other outreach engages the tribal community and visitors

More information at http://www.smscland.org/lowimpact.html