

Low Impact Development (LID) for Watershed and Site Protection and Runoff Management



Effects of Development on Urban Streams

Increases:

- **Impervious surface area**
- **Storm water volume**
- **Storm water velocity**
- **Deposition of pollutants**

Decreases:

- **Storm water quality**
- **Ground water recharge**
- **Baseflow**
- **Natural drainage systems including riparian vegetative cover**

Consequences of Development to Urban Streams

- **Increased rate and severity of flooding**
- **Increased erosion of stream banks and bottoms (stream widening and channelization)**
- **Increased sedimentation**
- **Increased chemical pollution**
- **Altered biological populations**
- **Degradation of riparian habitat**
- **Increased stream temperatures (loss of riparian cover)**

Impacts of Impervious Surfaces

- **Degradation of stream channel stability, habitat quality, and water quality**
- **CSO – Increased Frequency and Amounts**
- **Reduction of aquatic, fish and macro-invertebrate, biodiversity**
- **Greater Water Temperature and Heat Islands**





Disturbed Urban Soils during Land Development



Watershed Protection

Example practices

- Conservation easements
- Deed restrictions
- Stream buffers
- Cluster zoning



Stable Drainage Channels

One needed practice to reduce the adverse impacts of urban storm water is to provide stable drainage channels, riparian areas, and floodplains



Healthy Riparian Area

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.

Basic LID Principles

- 1. Conserve natural areas**
- 2. Minimize development impacts**
- 3. Maintain site runoff rate**
- 4. Use integrated management practices**
- 5. Implement pollution prevention, proper maintenance and public education programs**

LID Applications

- **Ecosystem Protection**
 - **Urban runoff/storm water control**
 - New and Existing Development
 - **CSO abatement**
 - Flow mitigation
 - Pollutant removal
- AQUIFER RECHARGE**

Benefits For Urban Areas

- **Storm water management**
 - Reduce volume of runoff
 - Innovative techniques (green roof, permeable pavers, etc)
- **Reduce urban heat island impacts/energy consumption**
- **Minimize waste**
 - Increase material durability and lifetime
 - Use recycled materials
- **Provide urban habitat**
- **Reduce air pollution**
- **Aesthetically pleasing**

Conserve Natural Areas



- Conservation of drainages, trees & vegetation
- Land use planning
- Watershed planning
- Habitat conservation plans
- Stream & wetland buffers

Comparing LID and Conventional Development

Conventional Development

LID Subdivision



What are the benefits of Conservation Development?

- Good for environment – obviously
- Helps reduce downstream flooding
- Improves downstream water quality
- More cost effective for developers
- Reduces long-term infrastructure maintenance expenses for municipalities
- Reduces landscaping cost and effort to homeowners

LID Site

- Delay in Discharge
- Reduced Peak Discharge
- Prolonged Groundwater Flow

Conventional

- Immediate Discharge
- Higher Peak Flows
- Flashy Hydrology

Bielinski Homes, Wisconsin : Cost Savings using Conservation Development vs. Conventional Development

- Laurel Springs-**
- \$778,329 or 24%**

- Prairie Glen**
- \$563,764 or 32%**

- Auburn Hills**
- \$1,288,646 or 26%**

Bielinski Homes: Largest Cost Savings

- **Grading**
- **Paving**
- **Storm Sewers**
- **Utilities**

Integrated Management Practices

- **Small-scale stormwater controls**
- **Distributed throughout site**
- **Maintain flow patterns, filter pollutants and re-create or maintain hydrology**

Common Integrated Management Practices

- Disconnectivity
- Bioretention
- Open Swales
- Permeable and Porous Pavements
- Green Roofs
- Planter Boxes
- Soil Amendment
- Sand Filters
- Inlet Retrofits

LID Practices

“Creative Techniques to Treat, Use, Store, Retain, Detain and Recharge”

- **Bioretention / Rain Gardens***
- **Strategic Grading***
- **Site Finger Printing**
- **Conservation***
- **Flatter Wider Swales**
- **Amended Soils***
- **Long Flow Paths**
- **Tree / Shrub Depression**
- **Turf Depression**
- **Landscape Island Storage**
- **Rooftop Detention /Retention**
- **Disconnection***
- **Parking Lot / Street Storage**
- **Smaller Culverts, Pipes & Inlets**
- **Alternative Surfaces**
- **Reduce Impervious Surface**
- **Surface Roughness Technology**
- **Rain Barrels / Cisterns / Water Use***
- **Catch Basins / Seepage Pits**
- **Sidewalk Storage**
- **Vegetative Swales, Buffers & Strips***
- **Infiltration Swales & Trenches**
- **Eliminate Curb and Gutter**
- **Shoulder Vegetation**
- **Maximize Sheet flow**
- **Maintain Drainage Patterns**
- **Reforestation**
- **Pollution Prevention**