Low Impact Development

A sedimentation solution

What is stormwater pollution runoff? It is the rain and melting snow that flows off streets, rooftops, lawns, and farmland. The flowing water carries salt, sand, soil, pesticides, fertilizers, leaves…

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Frank Lopez, P.E., Water Resources Engineer, Rick Engineering

Why Not Sustainable Development?

Definitions:
A stormwater management strategy that focuses on maintaining or restoring natural hydrologic functions of a site to achieve natural resource protection objectives and fulfill environmental regulatory requirements – (LID Guidance Manual, Kitsap County)

A stormwater management and land development strategy applied at the parcel and subdivision scale that emphasizes conservation and use of on-site natural features integrated with engineered, small-scale hydrologic controls to more closely mimic predevelopment hydrologic functions—(*LID Technical Guidance Manual, Puget Sound Action Team).*

LID Tour: Western U.S.

Try to make this…

…function like this

Why Seattle?

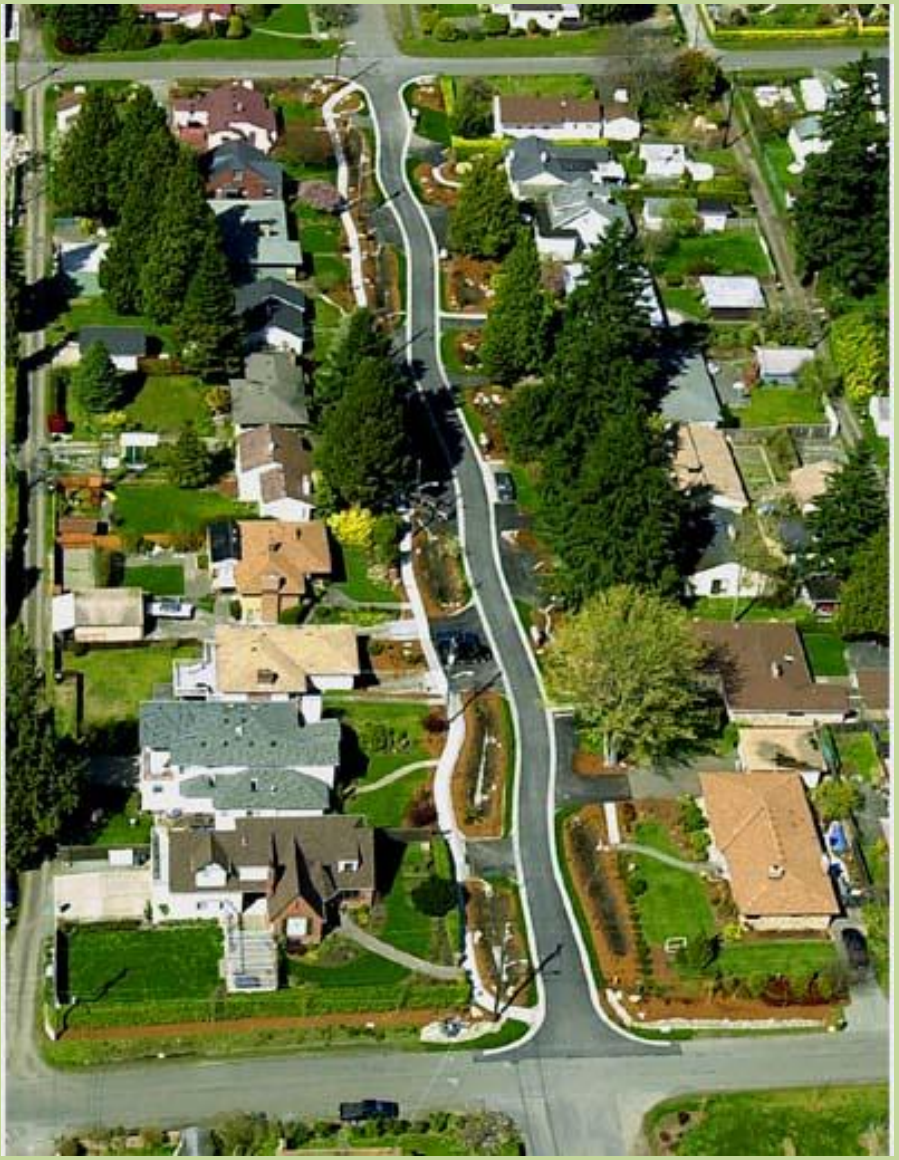
- Using LID since ’01
- Lessons Learned
- Templates Borrowed
- Precip. Difference Doesn’t Matter…same concept.

Retrofits are always more expensive than pre-treatments

SEA Street Project

After Completion - January 2001

Before



After

SEA St: 2nd Ave NW between 117th & 120th Streets, aerial looking north

Amending Construction Site Soils

Amended Native, Bioretention Soil, Engineered Soil, etc

Broadview Green Grid

Before

After

LID Design Procedure Highlights

- Site Analysis
- Determine Design Storm
- Maintain Flow Patterns and Tc
- Conservation and Prevention
- Develop LID CN
- Compensatory Techniques. Stress Volume Control then Detention or Hybrid for Peak

LID Techniques and Objectives

Low-Impact Development Technique

Low Impact Development Objective	Flatten Slope	Increase Flow Path	Increase Sheet Flow	Increase Roughness	Minimize Disturbance	Larger Swales	Flatten Slopes on Swales	Infiltration Swales	Vegetative Filter Strips	Constricted Pipes	Disconnected Impervious Areas	Reduce Curb and Gutter	Rain Barrels	Rooftop Storage	Bioretention	Re-Vegetation	Vegetation Preservation
Increase Time of Concentration	X	X	X	X					X	X	X	X	X	X	X		
Increase Detention Time							X			X			X	X			
Increase Storage						X		X	X						X	X	X
Lower Post Development CN					X						X				X	X	X

Agriculture can do better at mimicking natural conditions too…

Why LID Works

- Cumulative Impacts (Think Small)
- On-Site Treatment
- Uniform Distribution (Mimics)
- Promotes Resources Conservation
- Economically Sustainable (Small Scale)
- Public Participation / Education
  - Responsibility (Property Owner)
  - Vested Interest in Property Values

Conventional vs. Low-Impact Development

Conventional

- "End-of-the-Pipe" Control
- Maintaining Peak Discharge Only
- Very Limited Control on Small Storms
- "Stuck in the 60's"

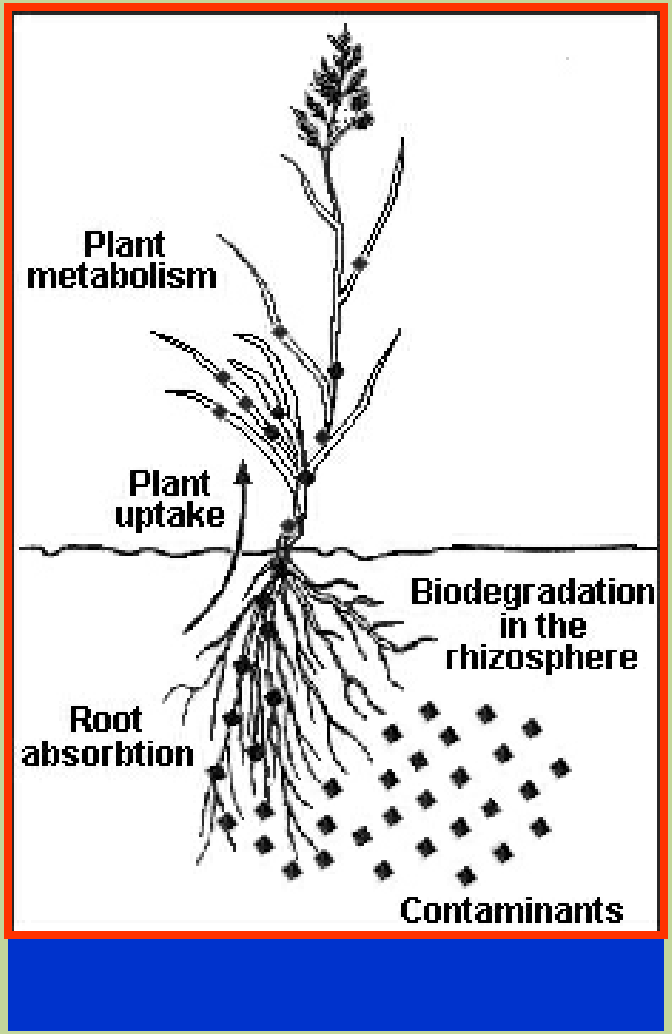
Low-Impact

- Source Control
- Mimic Pre-Development Hydrologic Conditions
- Full Control on Small Storms
- Pollution Prevention

Biological Pollutant Removal

Plant / Soil Flora / Soil Chemistry

- Phytoremediation
  - Translocate
  - Accumulate
  - Metabolize
  - Volatilize
  - Detoxify
  - Degrade
    - Exudates
- Bioremediation



Pollution Removal by Depth in Bioretention Facilities

		Removal (%)						
		Cu (☞g/L)	Pb (☞g/L)	Zn (☞g/L)	P (mg/L)	TKN (mg/L)	NH_4^+ (mg/L)	NO_3^- (mg/L)
Large Box	Upper	90	93	87	0	37	54	(-97)
	Middle	93	>97	>96	73	60	86	(-194)
	Lower	93	>97	>96	81	68	79	23
Field		97 ± 2	>95	>95	65 ± 8	52 ± 7	92 ± 7	16 ± 6

Swale Bottom Surface Area

LID Maintenance

- Keep it simple
- Who is responsible?
  - Property Owners (small scale maintenance)
  - Private Parties (widest range of LID projects in size/scope)
  - Jurisdictions (will handle most public LID infrastructure)
- Structure maintenance cycle for each technique and conduct training for those who will do it
- Select support strategies (see handout) to ensure quality maintenance is carried out:
  1. Conduct Education & Outreach
  2. Explain Incentives
  3. Remind about Regulations

~Maintain Inspections~

Central Coast (Region 3)
Draft Post-Construction Requirements

- Watershed Based
- Minimum Requirements
  - Performance Requirements
  - Hydrologic Analysis

Watershed Based

- Watershed Management Zones (WMZs)
  - Region 3 is broken into 10 WMZs, which are aligned with specific stormwater control requirements to address development impacts on watershed processes and beneficial uses.

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WHAT?

Watershed Based

- Watershed Processes
  - Overland Flow
  - Infiltration
  - Interflow (i.e. shallow groundwater movement)
  - Evopotranspiration
  - Delivery of sediment and organic matter to waterbody
  - Chemical/biological transformations

Watershed Based

- Beneficial Uses
  - Over 20 standard categories
    - Municipal and Domestic Supply (MUN)
    - Agricultural Supply (AGR)
    - Ground Water Recharge (GWR)
    - Warm Fresh Water Habitat (WARM)
    - Cold Fresh Water Habitat (COLD)

http://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/docs/basin_plan_2011.pdf

Minimum Requirements

- Apply to certain projects on public or private land that fall under the planning and building authority of a Permittee including:
  - Commercial
  - Industrial
  - Residential Housing
  - Mixed-Use
  - Roadways

Minimum Requirements

New and Redevelopment projects shall be required to comply with Performance Requirements. New development projects must implement requirements for the entire project. Redevelopment projects must implement requirements for the new and/or replaced impervious surface.

Minimum Requirements

Performance Requirement #1: Site Design Measures

- All development projects, **which create and/or replace > 2500 ft^2 of impervious surface**…will utilize one or more of the following site design measures:
  - Limit disturbance of natural waterbodies and drainage systems
  - Minimize compaction of highly permeable surfaces
  - Conserve natural areas
  - Minimize impervious surfaces
  - Direct roof runoff into cisterns for reuse or into vegetated areas

Minimum Requirements

<u>Performance Requirement #2: Water Quality Treatment</u>

- All development projects, **<u>which result in a net addition of 5000 ft^2 of impervious surface</u>** shall meet the following Performance Requirements:
  - Volume Approach – Treat stormwater runoff volume
    - Equal to 1.5 times the volume of runoff produced by the 85th percentile 24-hour storm event.
  - To achieve at minimum 80% of Total Suspended Solids (TSS)removal

Minimum Requirements

Performance Requirement #3: Retention

- All development projects that **create ≥ 15,000 ft^2 of new and/or replaced impervious surface,** the WMZ specific requirements are:
  - Retain the 95th percentile precipitation event. This volume must be infiltrated, evaporated/transpired, or harvested for later use to the maximum extent technically feasible.

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  This requirement is dependent upon the WMZ. Not all locations can infiltrate the 95th percentile storm event.

Minimum Requirements

Performance Requirement #4: Peak Management

- All projects that **create and or replace ≥ 22,500 ft^2 of new and/or replaced impervious surface and are located in a WMZ where runoff control is a concern** shall meet the following:
  - Post development peak flows shall not exceed pre-development peak flows for the 2 through 100-year storm events.
  - Performance Requirements 1, 2, and 3 apply

Minimum Requirements

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Peak Management only applies to specific WMZs.

Minimum Requirements

Minimum Requirement #5: Special Circumstances

- Highly altered streams, channels, or presence of downstream control measure (e.g. detention pond)
- Discharges into a concrete-lined or hardened/armored channel from the discharge point to a lake, large river, or ocean
- Continuous underground storm drain system discharging directly to lake, large river, or ocean
- Presence of existing flow control facilities, that regulate flow volumes and durations.

Required Hydrologic Analysis

For projects between 5,000 ft2 and 22,500 ft2, single-event based analyses can be utilized

For projects >22,500 ft2 use a calibrated continuous simulation hydrologic model is required to calculate runoff, retention, infiltration, and water quality treatment performance

Example Projects

- Parking Lot Expansion - Newhall, CA
- Commercial Redevelopment – West Covina, CA
- Streetscape – National City, CA
- Parking Garage/Commercial Redevelopment – Los Angeles, CA

Parking Lot Expansion
Newhall, CA

<u>Project Information:</u>

Project Area = 3.0 acres

<u>LID Components:</u>

Pervious Pavement

Bioretention

Pervious Pavement

Pervious Pavement

Bioretention

Bioretention

Commercial Redevelopment West Covina, CA

Project Information:

Project Area = 8.5 acres

LID Components:

Pervious Pavement w/Underdrain

Filterra Bioretention Units

Pervious Pavement

Pervious Pavement

Pervious Pavement

Filterra Bioretention

Streetscape
National City, CA

Project Information:

Project Area = 10 acres

LID Components:

Pervious Pavement w/Underdrain

Bioretention w/Underdrain

Pervious Pavement

Pervious Pavement

Parking Garage/Commercial Redevelopment
Los Angeles, CA

<u>Project Information:</u>

Project Area = 0.7 acres

With Offsite Mitigation = 2 acres

<u>LID Components:</u>

Bioretention Planter Box w/Underdrain

Offsite Mitigation

Bioretention Planter Box