Low Impact Development Ideas and Effects in the Built Environment

Joe Sewards

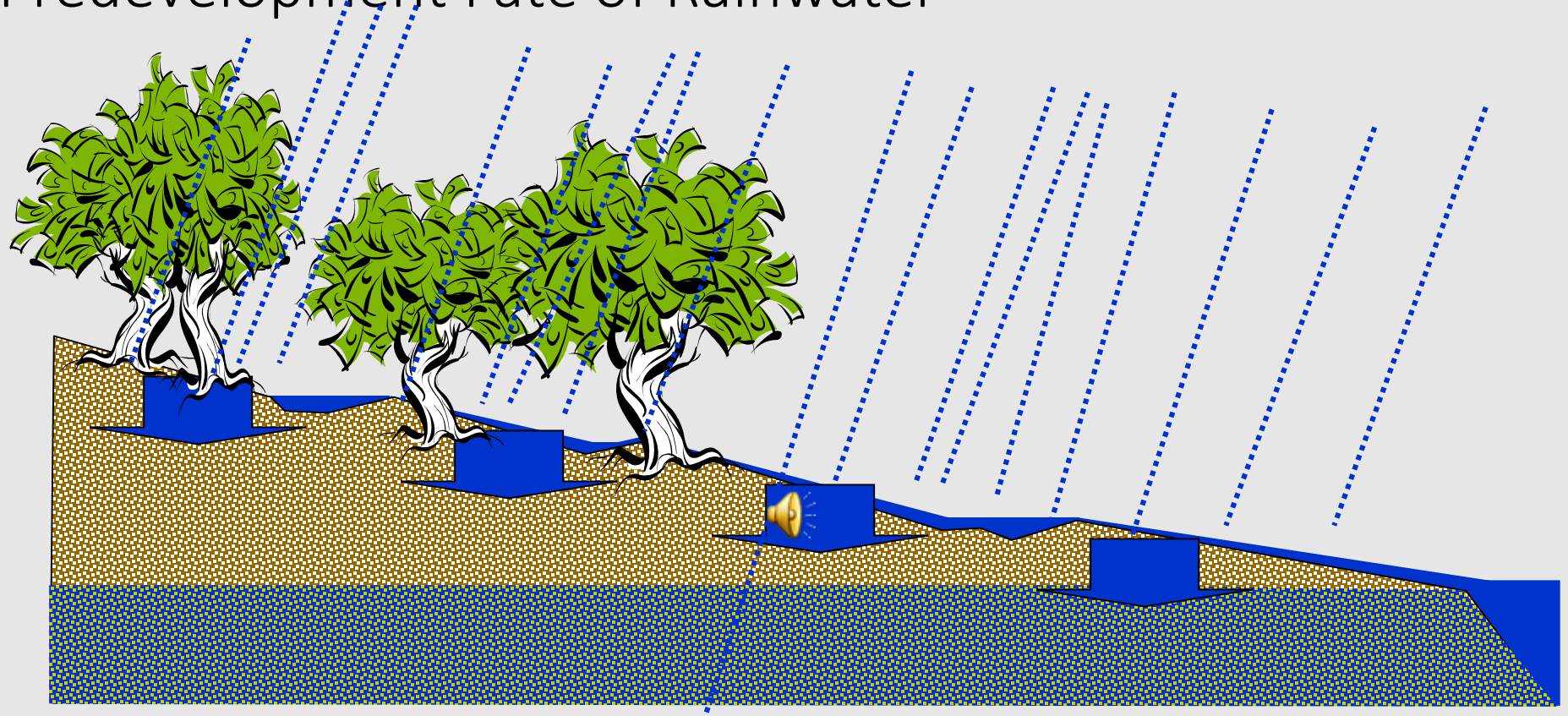
UF/IFAS Extension, Volusia county

Urban Horticulture agent and Master gardener coordinator

Presentation Outline

- Predevelopment Fate of Rainfall
- What is altered when we develop the landscape?
- What are limitations to our present approach to stormwater?
- Low Impact Development alternative

Predevelopment Fate of Rainwater



- Interception – rain that never hits the ground – lost to evaporation 5-35%
- Infiltration – soil composition (texture) & amount of compaction
- Depression storage – natural depressions throughout the landscape
- Runoff quantity – variable; difference between rainfall rate, infiltration rate & amount of depression storage
- Runoff rate – slow, dependent on slope & “roughness” of flow path

Reduction of Runoff by Trees

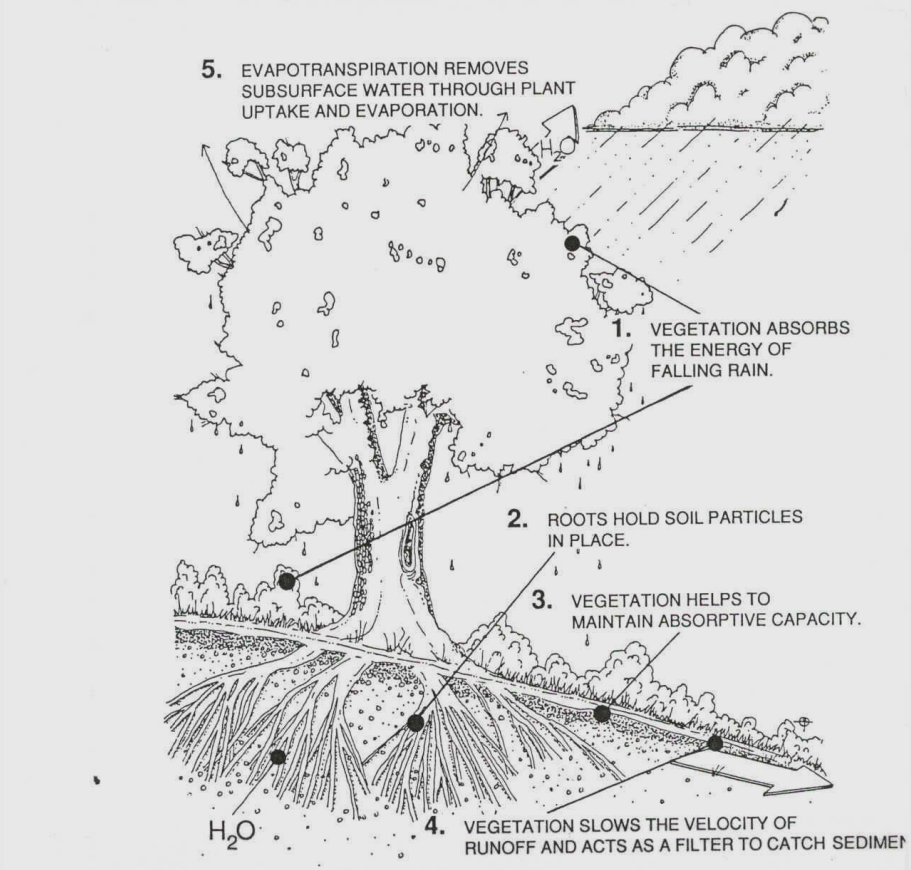
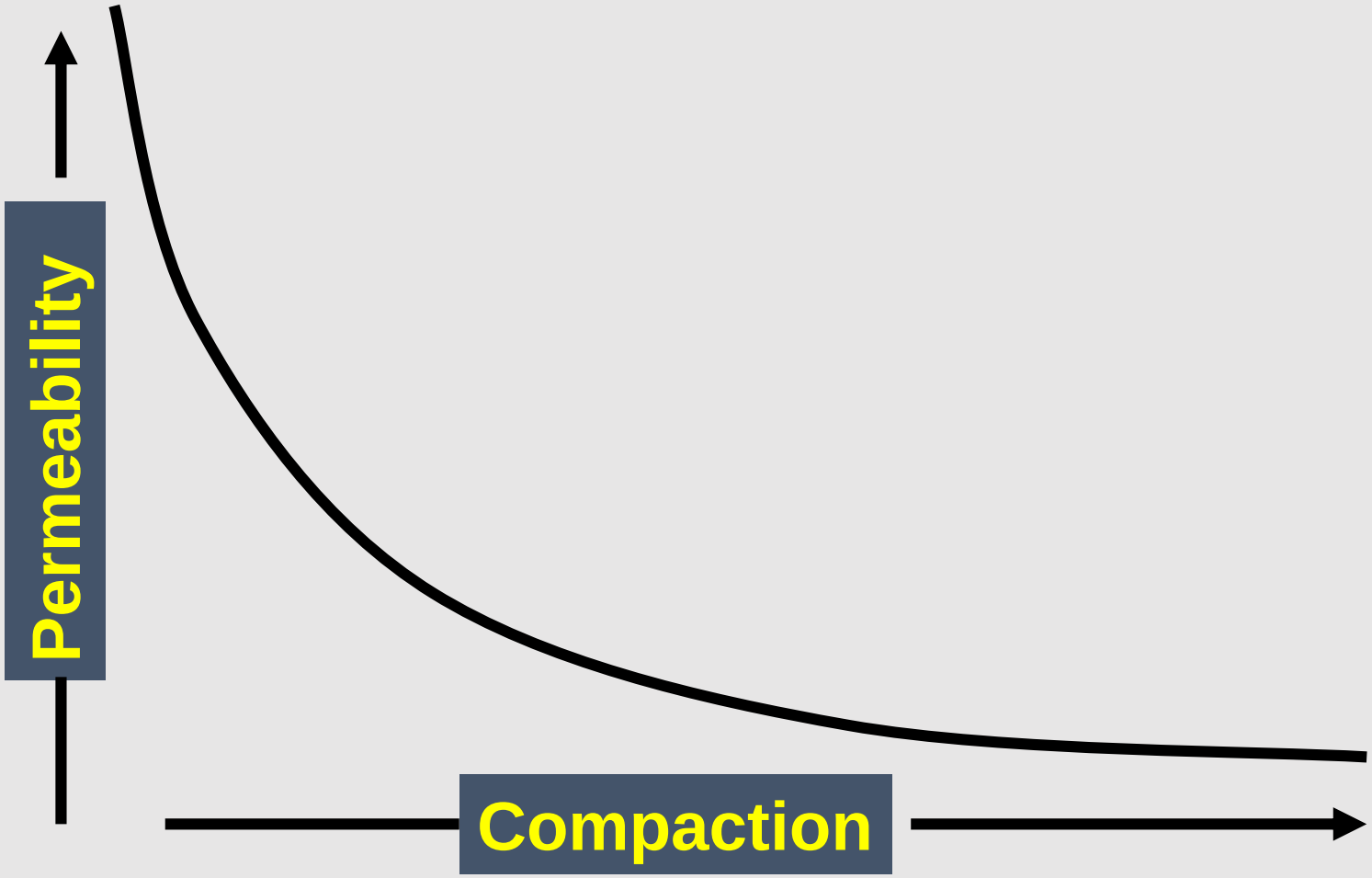


Figure . Erosion Control by Vegetation Cover (Livingston and McCarron 1992).

% Canopy Cover	% Runoff Reduction
8%	3%
35%	13%
45%	16%

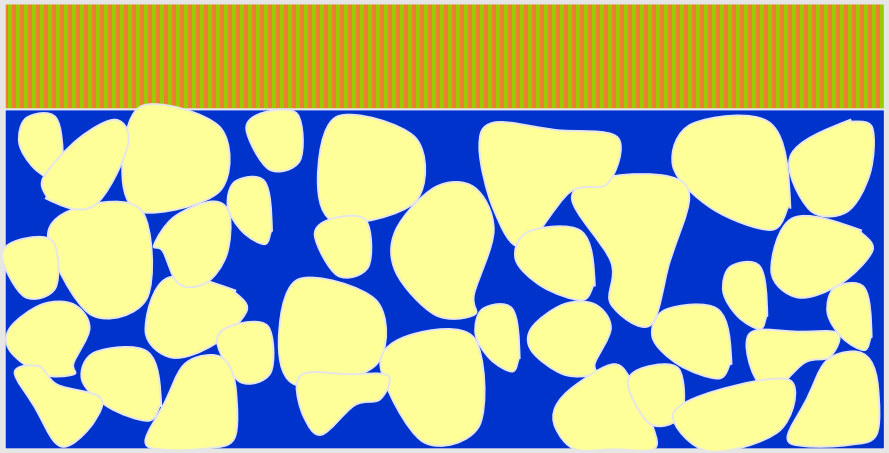
Source: American Forest
http://www.americanforest.org

Post Development Fate of Rainwater (Infiltration)



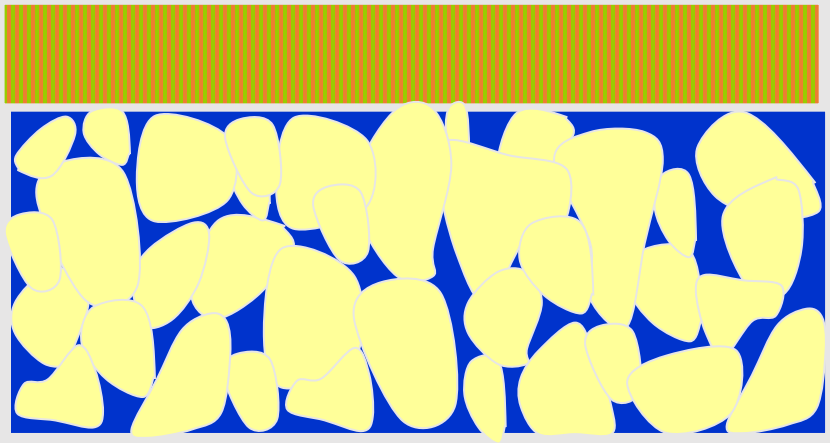
Loss of Soil Pore Volume

Uncompacted soil



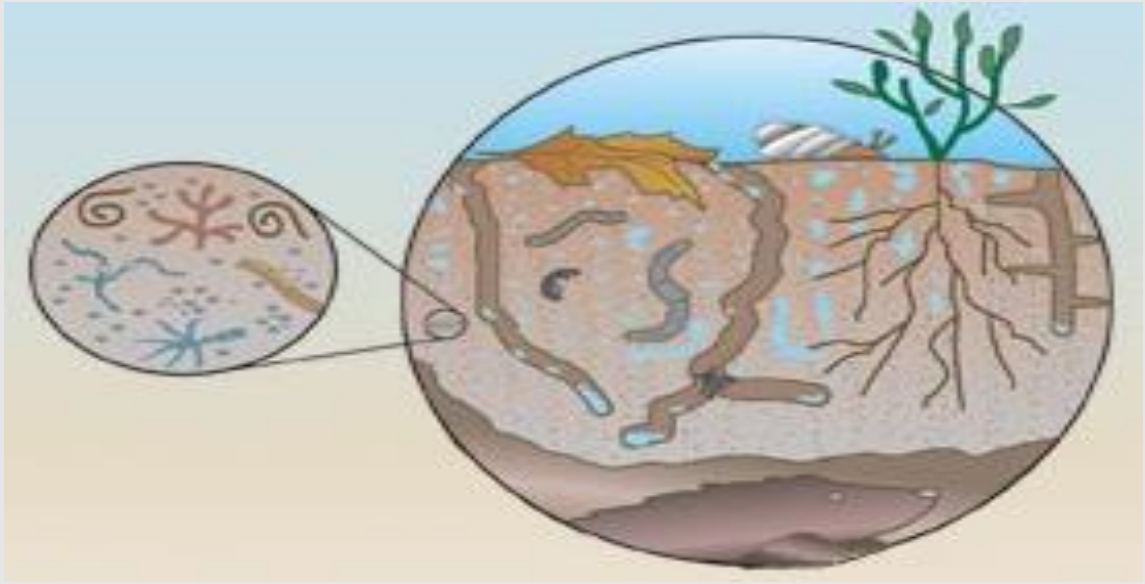
- 50 % solids
- 50 % pore space
  - 25% air
  - 25% water

Compacted soil

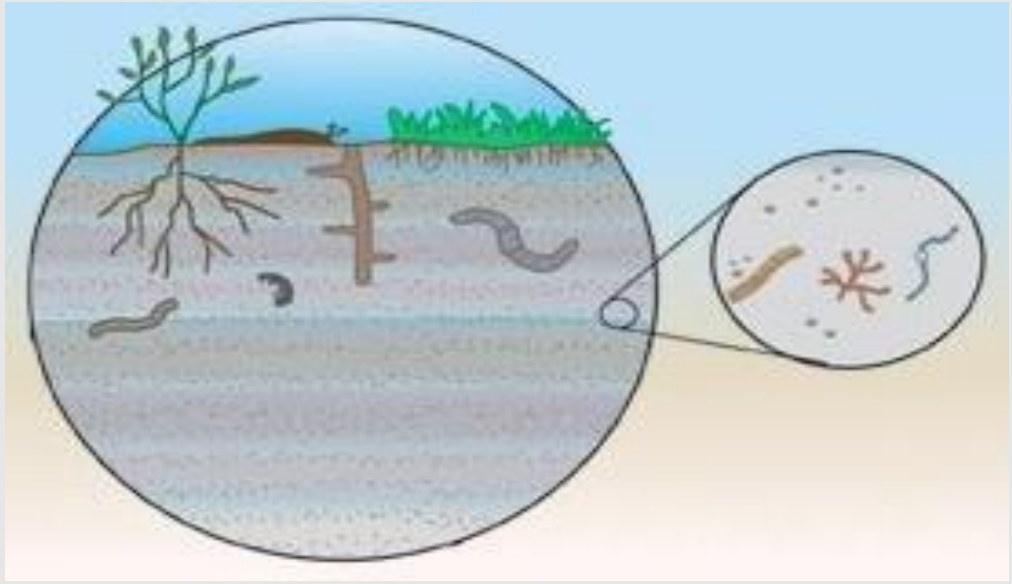


- Reduced Pore space
  - reduce plant vigor
  - less water storage
- Slower infiltration rate
- Faster runoff rate

Soil Structure Impacts



- Normal soil structure has more microbes, worms, stratification, organic matter and deeper plant roots



- Post-development (disturbed) soil has far fewer of these critical characteristics

Soil Compaction and Organic Matter

Restoration Methods

ACTIVITY	DECREASE BULK DENSITY (g/cm^3)	SOURCE
Tilling of soil	0.00 to 0.02	(1), (2)
Soil loosening	0.05 to 0.15	(3)
Selective grading	0.00	(1), (8)
Soil amendments	0.17	(2)
Compost amendment	0.25 to 0.35	(4)
Time	0.20	(5)
Reforestation	0.25 to 0.35	(7)

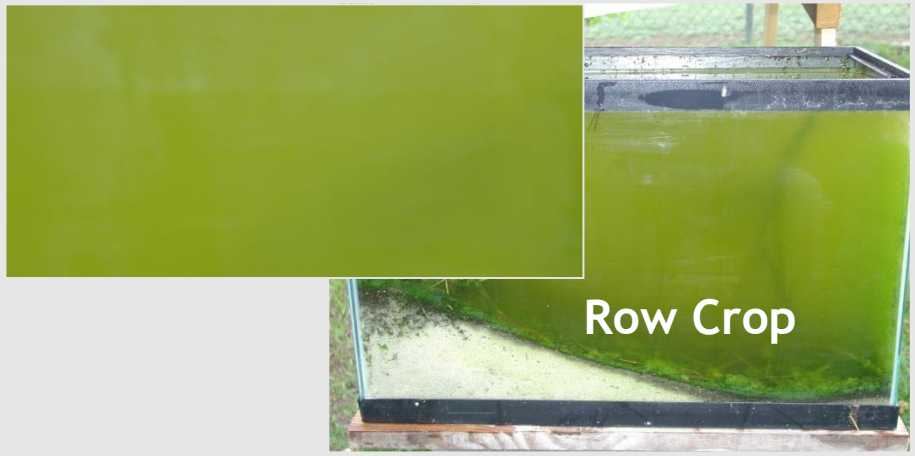
Visualization of Land Use Connection


Fertilized Turf


Unfertilized Turf


Row Crop

Visualization of Land Use Connection



Low Impact Development?

- *Stormwater and land development strategies at the parcel or subdivision scale that emphasis conservation and use of on-site natural features integrated with engineered, small scale hydrologic controls to more closely mimic pre-development hydrologic conditions.*

- Retain, Detain, Recharge, Filter, Use

Hydrologic/Contaminant Source Control (At the Lot Scale)

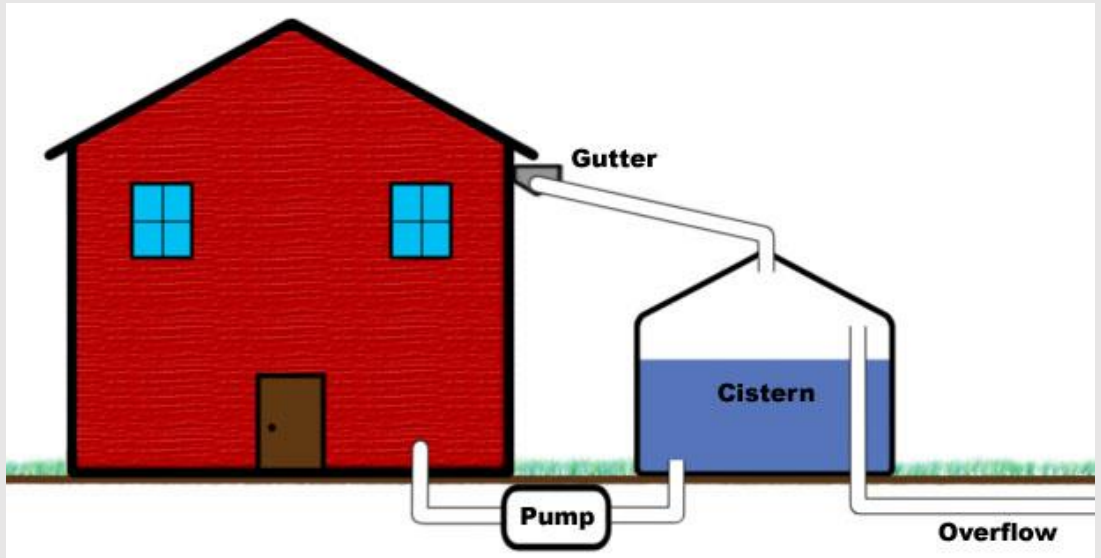
- Control stormwater at the source – *rain gardens*
- Prevent and treat contamination at the source – *FFL principles*
- Think micromanagement – *allow FFL in covenants*
- Reduce imperviousness – *permeable pavements*
- Minimize disturbance – *minimize clearing*
- Preserve and recreate natural landscape features – *utilize existing topography*
- Increase hydrologic disconnects – *multiple properties*
- Enhance off-line storage – *cisterns, rain gardens*
- Facilitate detention and infiltration opportunities – berms and swales instead of curb and gutter; rain gardens, permeable pavements, larger buffers and other undisturbed areas

Low Impact Development Practices

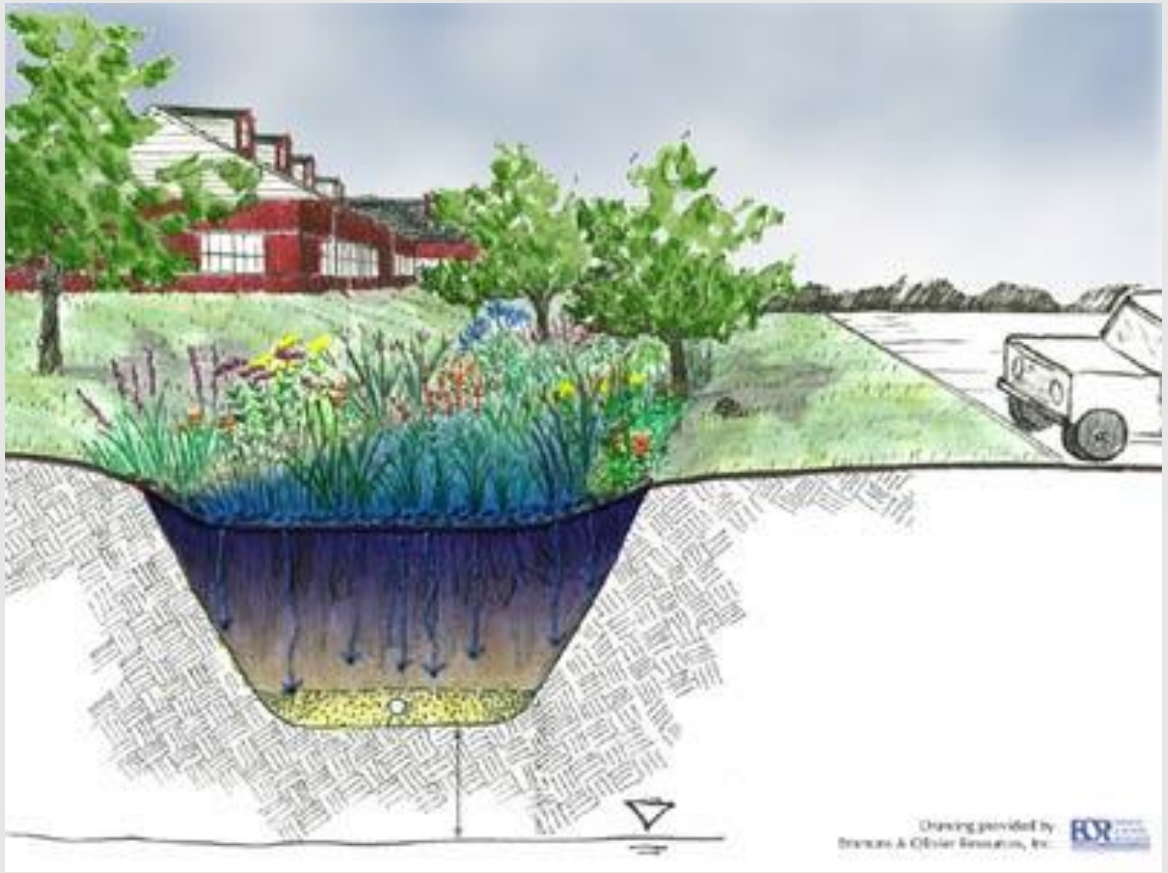
- Minimize Impervious Area
- Green Roofs
- Rainwater Harvesting
- Permeable Surfaces
- Depression storage
- Bioretention
- Soil filtration
- Vegetated Swales
- Enhance Stormwater Ponds

Rainwater Harvesting

- **Often cleanest water depending on location**
- **At the lot scale, typically represents the largest impervious area**
- **Depending on storage capacity, significant reduction in source**
- **Can be used for irrigation, and slowly released to infiltration,**
- **Flush toilets**



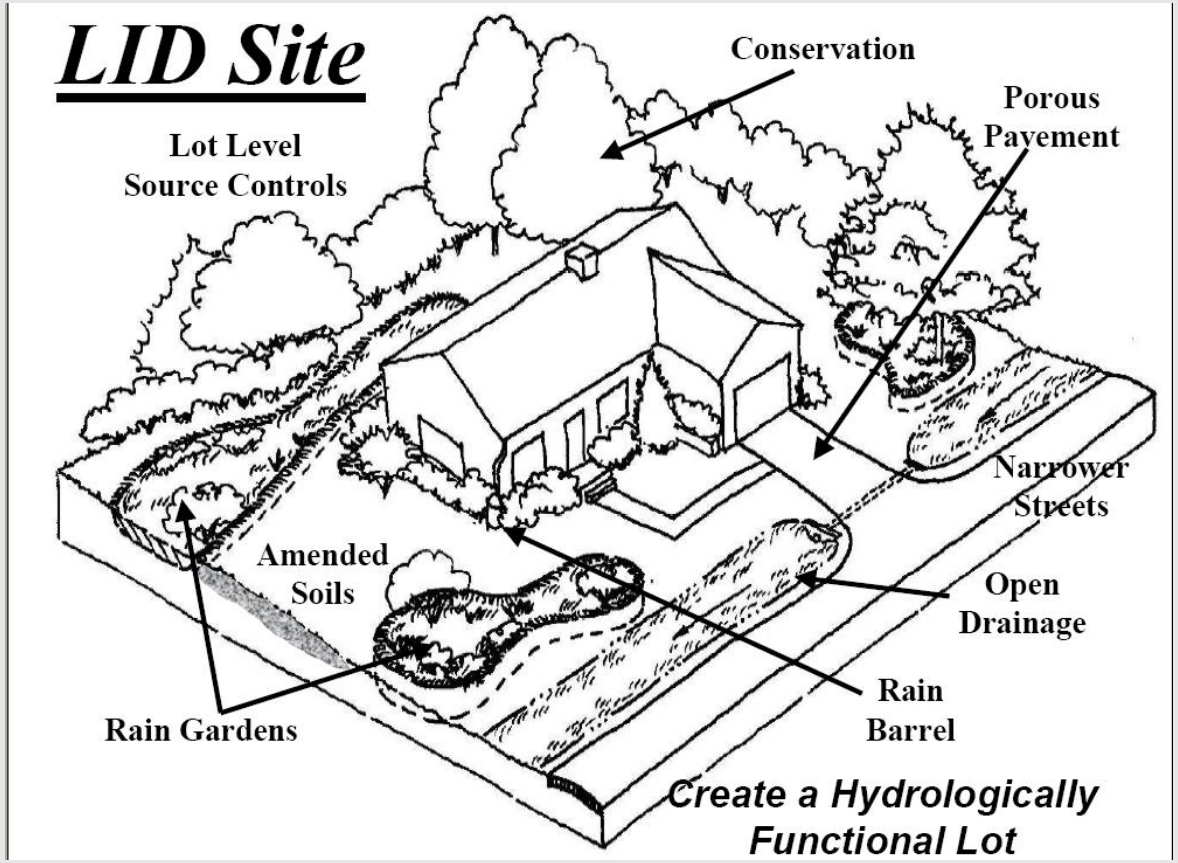
Depression Storage Rain Garden / Bioretention



Semipermeable Surfaces (Permeable Pavers)

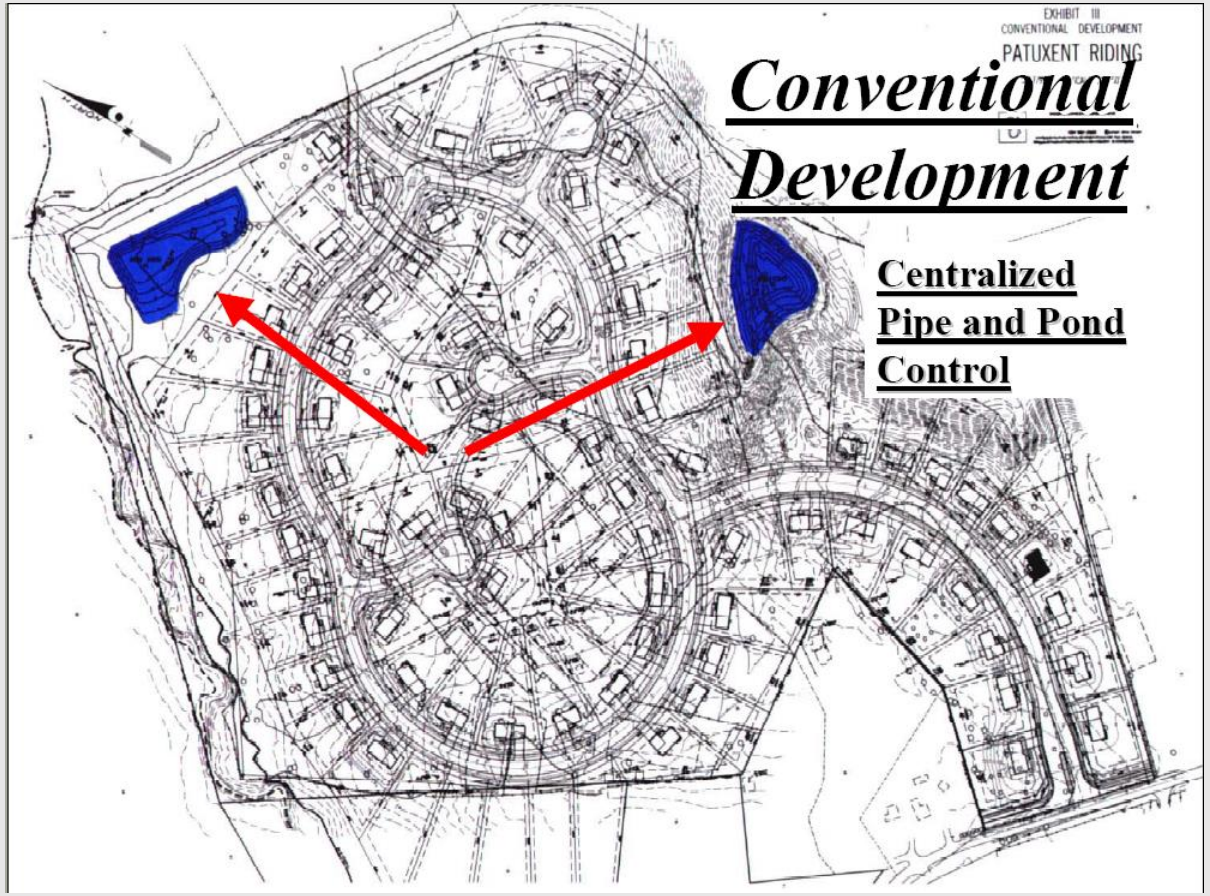
Residential Neighborhood Application (Trench Drain to Median)

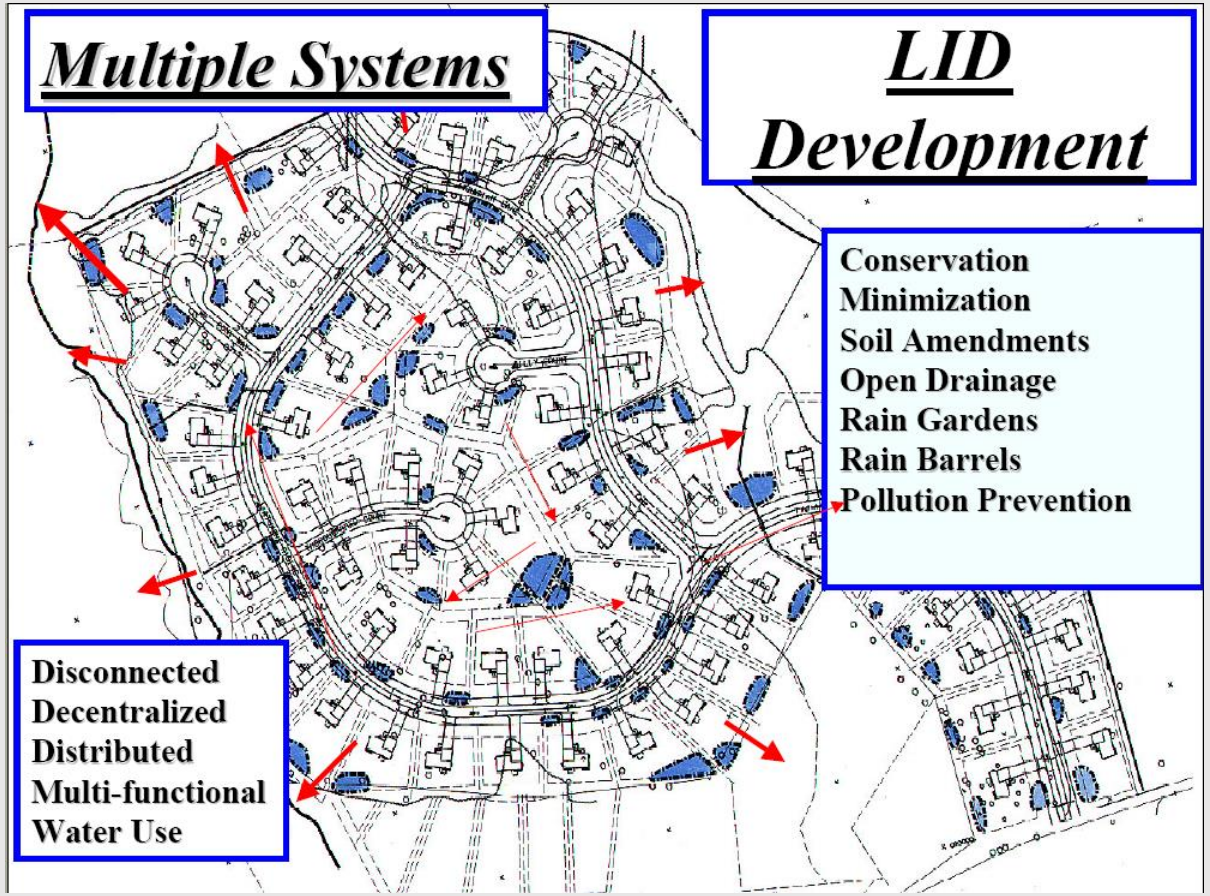
LID at the Parcel Scale



- Infiltration Based - NO Specific Slope Requirement
  - Bio-retention
  - Bio-filters
  - Infiltration Trenches
  - Seepage Pits
  - Pervious Pavement

Putting it together at the developmental scale





Summary

- Landscape development can result in significant changes in amount and spatial distribution of rainfall interception, infiltration, depression storage and runoff volume and rate.
- Typical approach to stormwater management is collect, convey, centralize, and control.
- Conventional centralized management can be very effective, however, there is often a tradeoff between quantity treatment efficiency and quality treatment efficiency.

Summary

- Low Impact Development attempts to address some of these issues using the following principles:
  - *Integrate stormwater management early in site planning activities*
  - *Use natural hydrologic functions as the integrating framework*
  - *Focus on prevention rather than mitigation*
  - *Emphasize simple, nonstructural, low-tech, and low cost methods*
  - *Manage as close to the source as possible*
  - *Distribute small-scale practices throughout the landscape*
  - *Rely on natural features and processes*
  - *Create a multifunctional landscape*

Thank you!!!!!

Questions???