Stormwater Best Management Practices

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Low Impact Development Technologies

Introduction

A. Low Impact Development: An Alternative Site Design Strategy

Low Impact Development (LID) is an alternative site design strategy that uses natural and engineered infiltration and storage techniques to control storm water where it is generated. LID combines conservation practices with distributed storm water source controls and pollution prevention to maintain or restore watershed functions. The objective is to disperse LID devices uniformly across a site to minimize runoff.

LID reintroduces the hydrologic and environmental functions that are altered with conventional storm water management. LID helps to maintain the water balance on a site and reduces the detrimental effects that traditional end-of-pipe systems have on waterways and the groundwater supply. LID devices provide temporary retention areas; increase infiltration; allow for nutrient (pollutant) removal; and control the release of storm water into adjacent waterways.

Some examples of LID technologies include:

- Engineered systems that filter storm water from parking lots and impervious surfaces, such as bioretention cells, filter strips, and tree box filters;
- Engineered systems that retain (or store) storm water and slowly infiltrate water, such as sub-surface collection facilities under parking lots, bioretention cells, and infiltration trenches;
- Modifications to infrastructure to decrease the amount of impervious surfaces such as curbless, gutterless, and reduced width streets;
- Low-tech vegetated areas that filter, direct, and retain storm water such as rain gardens and bio-swales;
- Innovative materials that help break up (disconnect) impervious surfaces or are made of recycled material such as porous concrete, permeable pavers, or site furnishings made of recycled waste;
- Water collection systems such as subsurface collection facilities, cisterns, or rain barrels; and
- Native or site-appropriate vegetation.

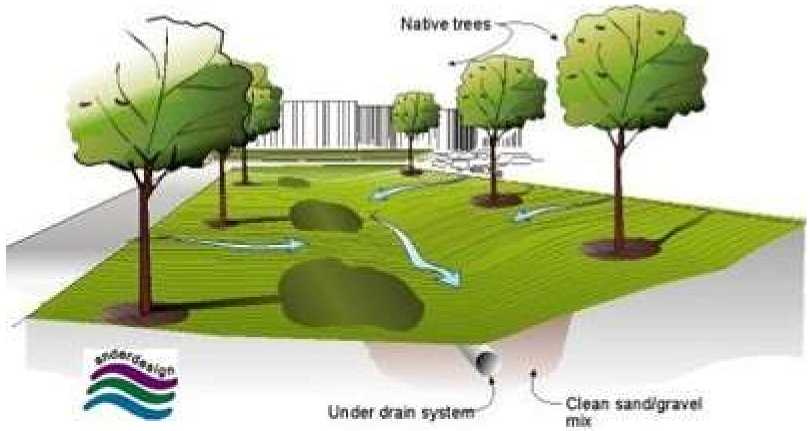

Fig. 1: Bio-swale schematic

B. Conventional Design

Fig. 2 Conventional site design

Conventional storm water management techniques direct all of the storm water to storm drains to remove it from the site as quickly as possible. End-of-pipe facilities are typically designed to store and detain runoff to reduce peak flows for storm events that are infrequent, such as the 10 year, 24-hour storm. Controls are often not in place to reduce flows for smaller, more frequently occurring events. Controls also are not structured to address non-point source pollution problems or to recharge the groundwater. Since runoff needs to be managed on the site, large ponds, or a series of ponds, are required. These controls take up a significant portion of land.

Storm water ponds are characteristically constructed with fences around the periphery for health and safety reasons. The outbreak of the West Nile virus and concern about fecal droppings of migratory birds has heightened concern about the suitability and maintenance of retention ponds. Ponds require annual maintenance and can require expensive long-term rehabilitation costs.

Fig. 3. LID site design

In contrast, the requirement for storm water retention is achieved with LID through the use of distributed controls. The retention areas are designed into the open space, or below existing infrastructure (such as parking lots), and create opportunities for new design configurations that are less dependent on inlets, pipes, and ponds. Additionally, LID technologies eliminate the need for costly maintenance contracts, typically requiring only routine landscape maintenance, with the exception of engineered systems such as tree box filters and sand filters.

The graphics show a conventional site design and a LID site design. The LID approach illustrates the potential for innovative site design alternatives with the elimination of retention ponds. The comparison exemplifies how land used for retention ponds could be allocated differently with the implementation of a distributed storm water program.

C. Economic Indicators and the "Greening" Movement

Economic indicators signify a shift in consumer and corporate purchasing toward "green" building. Homeowners are willing to pay a higher premium for homes that are more energy efficient and for properties that are adjacent to open space. Likewise, corporations are inclined to spend more on energy-efficient buildings with enhanced site amenities as they improve employee performance. This is causing builders, developers, and product manufacturers to take notice. LID can assist in reducing the bottom line while providing significant environmental benefits.

Some benefits of a LID site design strategy include:

- Reduced infrastructural costs for ponds, curbs and gutters, inlets, and pipes
- Increased lot yield,
- Reduced life-cycle costs,

Increased marketability, and

Increased property values.

D. Examples of Profitable LID Development

1) Somerset Community—A $916,382 Cost Savings

Fig. 4: Aerial view of Somerset Community

One of the oldest communities in the United States to implement LID on a large scale is the Somerset Community in Prince Georges County, Maryland. The developer successfully integrated LID technologies into the 60-acre development in 1995, where 199 homes were sited on 10,000 square foot lots. The alternative development pattern that used distributed storm water management systems yielded 6 additional lots, which resulted in increased revenues at $40,000 each. The final cost breakdown was:

a. $300,000 savings on LID vs. storm water ponds
   LID Cost: $100,000
   Conventional Cost: $400,000
b. $240,000 additional revenue on 6 additional lots (space previously allocated to ponds) 6 lots x $40,000 Net
c. $916,382 overall cost savings or $4,600 savings per lot

The streets in Somerset have no curbs or gutters and use shallow swales adjacent to the streets to store and infiltrate storm water. Every lawn has a bioretention cell (or rain garden). The swales and bioretention cells are important because they handle the first flush of a storm, which contains the greatest amount of pollutants, and they allow the water to be stored (for less than 24 hours) and infiltrate into the ground. A conventional system does not filter the storm water from the streets and sends large amounts of untreated water into nearby waterways, via one or more detention ponds.