Low Investment, Low Impact (Sustainable Water Management Techniques)

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Low impact development (LID) is an innovative approach to stormwater management for land development or redevelopment projects. These techniques mimic a site's redevelopment characteristics by handling stormwater close to the source rather than conveying runoff to costly stormwater disposal areas.

LID systems can involve everything from protecting vegetated open space and treating stormwater though vegetated swales or bioretention areas to rainwater harvesting and sustainable plant selection. Local and state agencies in the U.S. have required that LID techniques be used over traditional systems as an alternate approach to protect the environment. While some charged with enforcing this mandate have criticized it as burdensome or unnecessary, LID techniques can actually offer significant potential cost savings.

Comparing traditional systems to eco-friendly alternatives

Consider a road or access drive with a traditional curbing and closed drainage conveyance system. The road will have curbing on each side, two catch basins and one drain manhole per every 300 feet, with a minimum 12-inch drainage pipe along the entire length.

Now consider the same roadway with a vegetated conveyance swale on each side. The roadway incorporating LID techniques requires no curbing, no traditional drainage structures and no piping. An owner can expect to pay up to US$155 per linear foot for the traditional closed drainage system versus around US$58 per linear foot for the vegetated swale option, a savings of almost 300 percent.

Most municipalities require a certain percentage of parking areas to be landscaped with internal islands to break up large pavement regions. In the past, it was common to use raised landscape islands surrounded by large amounts of curbing to meet this requirement. The parking lot would also require catch basins, manholes and drainage pipes. This closed drainage system would then need to convey the stormwater to a detention basin or an underground storage and infiltration system.

Instead, consider using bioretention areas to meet both landscaping requirements and drainage needs. This "two-for-one" deal can save significant costs on curbing and drainage structures while preserving natural buffers in areas that would otherwise be planned for detention basins.

Bioretention areas can also eliminate the need for underground storage, which results in large savings in detention chambers, crushed stone, excavation and precast drainage structures. Since bioretention areas provide advanced stormwater quality treatment, owners can avoid purchasing costly proprietary treatment structures.

Consider the following two scenarios, each consisting of a half-acre parking lot flowing to a stormwater management system.

- In the first scenario, runoff from the parking lot will flow to concrete catch basin structures, enter a mechanical separator device for water quality treatment, discharge through a manifold and flow into a subterranean stormwater system consisting of plastic or concrete chambers surrounded by crushed stone. Finally, the runoff will flow through a concrete outlet control structure where it will be detained prior to its ultimate discharge. On top of all this, it will still be necessary to provide a landscape island to meet zoning regulations and provide for traffic circulation. The owner and FM team could expect to pay around US$65,000 for the system as described.

- Now consider that runoff from the parking surface flowing instead toward a bioretention area which acts as landscape and a traffic circulation measure all in one. Bioretention requires no catchbasins or mechanical treatment structures; it consists solely of an engineered soil medium on top of crushed stone overlaid with hardwood bark mulch. It is planted with herbaceous perennials, shrubs and occasional understory trees; all of which can tolerate both ponding and drought and are resistant to road salt. Occasionally, bioretention areas are underdrained and may contain an overflow structure as necessary. The estimated cost for this type of system, which handles the same amount of runoff and provides better treatment of stormwater, is around US$40,000.

Bioretention areas are also a great alternative to mechanical separators for the treatment of total suspended solids, nitrogen and phosphorous. Phosphorous removal is becoming an increasingly high priority with permitting authorities throughout the U.S. Phosphorous deposits into rivers, streams and lakes are mainly introduced by fertilizers, pesticides and decayed plants entering the stormwater system. This can cause algae blooms and generate eutrophication that is detrimental to ecosystems and drinking water quality.

Phosphorous treatment has become a lucrative business with many new filter products recently hitting the market. Many of these products have shown sufficient results and offer valid solutions. However, depending on the site's size, anticipated phosphorous load and treatment requirements, facility professionals could expect to pay as much as US$80,000 for some of these new devices. Bioretention areas offer equal or superior water quality treatment with enormous cost savings.

Permeable surfaces, such as porous asphalt or permeable pavers, can be used in place of infiltration and/or detention basins. This can lead to more space for development, which equates to more potential revenue. The pavement areas can actually be used for stormwater mitigation, which saves on space since it negates the need to construct both a paved area and a detention basin and leaves the area open for alternate uses. Depending on design parameters, the use of permeable surfaces can result in a greater up-front cost of roughly 10 percent for hardscape areas. However, the resultant revenue-generating building space can greatly outweigh this initial cost over time.

Site selection

Proper site selection can minimize disturbance to wetlands and endangered species habitats, therefore reducing costs of mitigation efforts. Typical mitigation of species habitat land includes purchasing or restricting by deed at least 1.5 times as much land that has been altered within the habitat. For example, to develop 10 acres within a habitat area, you would need to purchase 15 acres of non-habitat and undeveloped area to set aside that can never be developed.

Similarly, disturbance to wetland areas typically requires costly replication measures at a ratio of 2:1 and sometimes as much as 3:1 depending on local regulations. The grading, soil amendments, plantings and establishment measures associated with mitigation and/or replication can quickly “unhinge” a development pro forma. Avoiding construction within wetlands and habitats will also save vast amounts of time and money on permitting and design fees and can promote public good will.

Proper site selection can limit dewatering efforts, costly erosion control measures and overall site construction complexity. Also, contractors can often reclaim existing asphalt and pavement bases which can be of significant savings. Depending on the nature of the site, there could be existing infrastructure available for reuse.

Native plantings have adapted to their regional climate, soil conditions and sunlight for thousands of years. Incorporating locally grown plants limits travel, fuel costs and contractor markups during construction. Many indigenous plants are also drought tolerant, which minimizes or eliminates the need for irrigation, thus saving on installation costs and water usage. Sustainable planting practices further eliminate the need for fertilizers, pesticides and continuous maintenance, resulting in significant savings to yearly maintenance budgets.

Collected versus purchased water

Harvesting rainwater in lieu of paying for municipal water can result in significant savings for large facilities. A university with a typical natural grass playing field (approximately 90,000 square feet) requires approximately 1 inch of water per week to maintain root health and a safe playing surface. Watering this facility over a 20-week period in a year expends more than 1 million gallons of water, which amounts to around US$8,500 per year, or more than US$150,000 in a 20-year lifespan. Rainwater harvesting can also be used at larger buildings, such as schools and hospitals, to flush toilets, irrigate lawns and gardens, wash exterior equipment and suppress fires. A well-designed and considered rainwater harvesting system can significantly supplement your watering needs and will pay for itself in a fraction of your facility's life expectancy.

Each of these approaches is supported by the U.S. Green Building Council and can be used to gain increasingly important LEED credits for sites and buildings. It should also be noted that incorporating LID techniques can facilitate a much smoother and faster permitting experience and increase public support. Regulatory agencies are much more likely to approve a project that integrates environmentally friendly design considerations, and residents and stakeholders are far less likely to oppose the project. This can save owners and developers months or years in the approval process. The added benefit to the environment and the cost savings to facility managers truly make LID a win-win for all parties.