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Low Impact Development:
Permeable Surfaces

Introduction

Low impact development or LID is a technique designed to control stormwater runoff and pollution. LID is designed to use the natural environment to control stormwater for pre-development, development and redevelopment projects. This method is cost effective and brings the infrastructure to the surface as opposed to utilizing expensive subsurface piping and trenching.

The objective of LID is to minimize disturbance of both onsite and offsite resources, habitat disturbance or destruction, to preserve and recreate natural landscape features, reduce effective impervious covers, increase hydrologic disconnects and increase drainage paths, enhance off-line storage, and facilitate detention and infiltration opportunities. In addition to the objectives of LID there are several principles that should be considered, specifically prior to development of new construction projects.

- *Integrate stormwater management early in the site planning activities*
- *Use natural hydrologic functions as the integrated 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*

One of the primary goals of LID is to reduce the runoff volume by allowing rainwater and water from irrigation to infiltrate the groundwater and evaporate back into the atmosphere. LID is a combination of several techniques, technology and strategic planning. One such component is to create a pervious surface, which allows for the reduction of standing water, runoff, and increase the infiltration. The one most obvious area for improvement is impervious surfaces, such as parking lots, sidewalks, and streets.

Parking lots tend to be large spaces with little vegetative cover which allows little area for runoff. This is evident in areas with new construction where the parking lots have been planned for maximum capacity. There needs to be a paradigm shift where parking lots are planned. Prior to construction, the development designers need to draw actual usage from existing development to calculate usage for new construction. In considering the actual usage of not only parking lots, but also streets, driveways and

sidewalks, developers can have a better idea of how much area should be considered for such uses.

Some considerations should be to reduce the size of covered surfaces with narrow parking spaces, sidewalks, and driveways. Incorporate LID Best Management Practices (BMP) such as vegetate swales, strips and islands, bioretention areas, subsurface sand and organic filters, and stormwater planters. These BMPs can be incorporated into new construction projects as well as redevelopment projects to maximize the goals and principles of LID development techniques.

Applications

As previously mentioned, there are several applications for pervious surface technology. Large areas of convered surfaces such as parking lots are the most obvious area of application that needs to be addressed. Parking lots, particularly in areas of new development where traditional concrete and asphalt materials are being used which are creating heat islands need to be replaced with pervious surface materials. Not only are LID principles practical for commercial and industrial used, but also for residential. Driveways, sidewalks and alleyways are all areas that create impervious surface areas, which allow for runoff of pollutants into natural systems.

To reduce impacts from surface runoff there are several impervious surface materials that can be used for areas both small and large. Some such materials include grass pavers, paving stones, porous asphalt, pervious concrete and reinforced turf. These materials are designed to allow rainwater, stormwater and pollutants that tend to accumulate on impervious surfaces to infiltrate to the subsurface where pollutants can be filtered allowing infiltration of excess water into groundwater.

These techniques work best in areas with low subsurface clay and clay mixtures. Preparation of the subsurface in areas with low amounts of clay might be necessary to increase the rate of infiltration. In these areas the base material is a mixture of aggregate and sand/soil mixture up to 12 inches deep, which will increase infiltration and allow for pollutants to be naturally filtered.

Materials

As mentioned, there are several types of materials and methods that can be used in stormwater control. The first is grass pavers that use an interlocking plastic grid to stabilize the surface for foot traffic as well as car use. The grass pavers have large openings that are filled with a mixture of sand, compost and grass seeds. This material and similar materials are best used in wet climates where supplemental irrigation can be used during periods of dry conditions. The cost of the base material ranges from $3 to $4 per square foot installed; however, this cost does not reflect maintenance costs.

Pervious concrete and asphalt work in a similar way, in that they both allow water to infiltrate through the porous surface rather than allowing water to runoff into

stormwater systems. Pervious concrete is made up of gravel and small aggregate to allow for approximately 15 to 20 percent void area within the mixture. The typical inficlation rate of pervious concrete is approximately 250 to 300 inches per hour, based on best case scenario. There are some limitations to pervious concrete in that the material must be installed to the manufactures specifications to allow for adequate stormwater infiltration. The installation includes a four inch bed of gravel at least ¾ of an inch in diameter overlaying a layer of soils with an average percolation rate of half an inch per hour.

Pervious concrete materials are on average $6 to $9 per square foot, which is comparable to conventional concrete; however, it is much more durable than conventional concrete if installed and maintained properly. This material is most commonly used in large parking lots, streets, and sidewalk, and is becoming more common practice for residential uses.

The last material to be covered is pervious pavers. These materials are most commonly seen used for walkways, open market areas, and residential uses. Pervious pavers are generally interlocking blocks that require sand fill as opposed to a grout seal. Pervious pavers are best used on level surfaces to ensure that the blocks interlock. Unlike the pervious materials mentioned, pervious pavers require only one layer of fine gravel or sand that allows for an increase stormwater infiltration. The cost of pervious pavers is approximately $5 per square foot installed and can be used for parking lots, sidewalks, driveways and alleyways.

Feasibility

The cost of pervious surface materials can range from a few dollars to $10 per square foot. In general the cost is comparable to conventional surface materials. However, the cost associated with installation tends to be much higher depending on the materials being installed. Pervious concrete requires specific installation techniques to ensure that the product functions properly and may require specialized training. Generally the other materials addressed have been used in small and large scale landscaping, and can be installed by a low skill laborer.

Conclusion

Based on the research, pervious surface materials are a practical component of low impact development goals and principles that increase stormwater control. The cost and durability of the materials mentioned are comparable to conventional materials currently being used. In additional to reducing stormwater runoff there are other benefits to using a pervious surface material that includes reducing impact to natural systems, reducing the heat island effect, increasing green areas, and increasing groundwater recharge.

Additionally, compared with conventional materials, pervious surface materials are generally more aesthically pleasing and produce a welcoming environment. Such areas induce an increase sense of community by brining people out to such area that are

more inviting, increasing the "walkability" of not only a residential area, but also a commercial or industrial space that would normally be viewed as uninviting and cold.

In my opinion areas that are experiencing increased growth such as in Northern California, county and city government should take steps to amend general plan goals and policies, as well as amending ordinances to set standard to promote green development. As a planner, the standard mitigation measure would incorporate methods, materials and techniques that would not only reduce impacts, but possibly eliminate impacts that currently are considered unmitigable.

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