# APPENDIX E:

# LOW IMPACT DEVELOPMENT (LID) PRACTICES

**ALTERNATIVE APPROACH FORMANAGING STORMWATER RUNOFF**

Natural hydrologic conditions can be altered radically by poorly planned development practices, such as introducing unnecessary impervious surfaces, destroying existing drainage swales, constructing unnecessary storm sewers, and changing local topography. A traditional drainage approach of development has been to remove runoff from a site as quickly as possible and capture it in a detention basin. This approach leads ultimately to the degradation of water quality as well as expenditure of additional resources for detaining and managing concentrated runoff at some downstream location.

The recommended alternative approach is to promote practices that will minimize post-development runoff rates and volumes and will minimize needs for artificial conveyance and storage facilities. To simulate predevelopment hydrologic conditions, infiltration is often necessary to offset the loss of infiltration by the creation of impervious surfaces. Preserving natural hydrologic conditions requires careful alternative site design considerations. Site design practices include preserving natural drainage features, minimizing impervious surface area, reducing the hydraulic connectivity of impervious surfaces, and protecting natural depression storage. A well-designed site will contain a mix of all those features.

Sometimes regulations create obstacles for an applicant interested in implementing low impact development techniques on their site. A municipality should consider examining their ordinances and amending the sections which limit LID techniques. For example, a municipality could remove parking space minimums and establish parking space maximums to reduce the area of impervious surface required. Other allowable regulations to promote LID includes permitting curb cuts or wheel stops instead of requiring curbs and allowing sumped landscaping where the runoff can drain instead of requiring raised beds. These small changes to ordinances can remove the barriers which prevent applicants from pursuing LID practices.

The following describes various LID techniques:

* + - 1. **Protect Sensitive and Special Value Resources**: See Section 5.4 of the *Pennsylvania Stormwater Best Management Practices Manual, Pennsylvania Department of Environmental Protection (PADEP) no. 363-0300-002 (2006).*
1. **Preserving Natural Drainage Features**. Protecting natural drainage features, particularly vegetated drainage swales and channels, is desirable because of their ability to infiltrate and attenuate flows and to filter pollutants. However, this objective is often not accomplished in land development. In fact, commonly held drainage philosophy encourages just the opposite pattern––streets and adjacent storm sewers are typically located in the natural headwater valleys and swales, thereby replacing natural drainage functions with a completely impervious system. As a result, runoff and pollutants generated from impervious surfaces flow directly into storm sewers with no opportunity for attenuation, infiltration, or filtration. Developments designed to fit site topography also minimizes the amount of grading on site.
2. **Protecting Natural Depression Storage Areas**. Depressional storage areas either have no surface outlet or drain very slowly following a storm event. They can be commonly seen as ponded areas in farm fields during the wet season or after large runoff events. Traditional development practices eliminate these depressions by filling or draining, thereby obliterating their ability to reduce surface runoff volumes and trap pollutants. The volume and release rate characteristics of depressions should be protected in the design of the development site. The depressions can be protected by simply avoiding the depression or by incorporating its storage as additional capacity in required detention facilities.
	* + 1. **Reduce Impervious Coverage**: See Section 5.7 of the *Pennsylvania Stormwater Best Management Practices Manual, Pennsylvania Department of Environmental Protection (PADEP) no. 363-0300-002 (2006).*
	1. **Avoiding Introduction of Impervious Areas**. Careful site planning should consider reducing impervious coverage to the maximum extent possible. Building footprints, sidewalks, driveways, and other features producing impervious surfaces should be evaluated to minimize impacts of runoff.
	2. **Disconnecting Impervious Surfaces (DIA’s):** Impervious surfaces are significantly less of a problem if they are not directly connected to an impervious conveyance system (such as storm sewer). Two basic ways to reduce hydraulic connectivity are routing of roof runoff over lawns and reducing the use of storm sewers. Site grading should promote increasing travel time of stormwater runoff, and should help reduce concentration of runoff to a single point in the development. (See Ordinance Appendix F for additional description)
	3. **Reducing Street Widths**. Street widths can be reduced by either eliminating on-street parking or by reducing roadway widths. Municipal planners and traffic designers should encourage narrower neighborhood streets which ultimately could lower maintenance.
	4. **Limiting Sidewalks to One Side of the Street**. A sidewalk on one side of the street may suffice in low-traffic neighborhoods. The lost sidewalk could be replaced with bicycle/recreational trails that follow back-of-lot lines. Where appropriate, backyard trails should be constructed using pervious materials.
	5. **Reducing Building Setbacks**. Reducing building setbacks reduces impervious cover associated with driveway and entry walks and is most readily accomplished along low-traffic streets where traffic noise is not a problem.
3. **Disconnect/Distribute/Decentralize:** See Section 5.8 of the *Pennsylvania Stormwater Best Management Practices Manual, Pennsylvania Department of Environmental Protection (PADEP) no. 363-0300-002 (2006).*
	* + - 1. **Routing Roof Runoff Over Lawns**. Roof runoff can be easily routed over lawns in most site designs. The practice discourages direct connections of downspouts to storm sewers or parking lots. The practice also discourages sloping driveways and parking lots to the street. By routing roof drains and crowning the driveway to run off to the lawn, the lawn is essentially used as a filter strip.
				2. **Reducing the Use of Storm Sewers**. By reducing use of storm sewers for draining streets, parking lots, and back yards, the potential for accelerating runoff from the development can be greatly reduced. The practice requires greater use of swales and may not be practical for some development sites, especially if there are concerns for areas that do not drain in a “reasonable” time. The practice requires educating local citizens and public works officials, who expect runoff to disappear shortly after a rainfall event.
4. **Cluster and Concentrate**: See Section 5.5 of the *Pennsylvania Stormwater Best Management Practices Manual, Pennsylvania Department of Environmental Protection (PADEP) no. 363-0300-002 (2006).* Cluster developments can also reduce the amount of impervious area for a given number of lots. The biggest savings occurs with street length, which also will reduce costs of the development. Cluster development “clusters” the construction activity onto less sensitive areas without substantially affecting the gross density of development.

In summary, a careful consideration of the existing topography and implementation of a combination of the above mentioned techniques may avoid construction of costly stormwater control measures. Benefits include reduced potential of downstream flooding, water quality improvement of receiving streams/water bodies and enhancement of aesthetics and reduction of development costs. Other benefits include more stable baseflows in receiving streams, improved groundwater recharge, reduced flood flows, reduced pollutant loads, and reduced costs for conveyance and storage.