Stormwater Best Management Practice

Open Space Design

Minimum Measure: Post Construction Stormwater Management in New Development and Redevelopment
Subcategory: Innovative BMPs for Site Plans

Description

Open space design, also known as conservation development or cluster development, is a site design technique that concentrates dwelling units in compact areas to provide for open space and natural areas elsewhere on the development site. Each different zoning district has a set of requirements for minimum lot sizes, setbacks and frontage distances. Communities implementing an open space design can update these requirements to preserve and create more open space. Open space designs have many benefits compared to the conventional subdivisions that they replace: they can reduce impervious cover, stormwater pollutants, construction costs, grading and the loss of natural areas. Some communities may lack zoning ordinances to permit open space development, and even those that have enacted ordinances may want to revisit them occasionally to achieve greater water quality and environmental benefits.

Communities can amplify the benefits of open space design by combining it with other better site design practices such as installing narrower streets, eliminating curbs and gutters, installing grassed swales, and utilizing alternative turnarounds.

Applicability

Open space design widely applies to most forms of development. The greatest stormwater discharge and pollutant reduction benefits typically occur when applying open space design to residential zones that have larger lots (less than two dwelling units per acre). In these types of large-lot zones, shrinking lot sizes can create a great deal of natural or community open space. However, open space design may not always be viable for high-density residential zones, redevelopment or infill development, where lots are small to begin with and clustering will yield little open space. In rural areas, it may be necessary to adapt open space design, especially in communities where public health authorities do not currently allow shared septic fields.

Open space design principals concentrate dwelling units together in neighborhoods while preserving open spaces, such as a lakes and forests, for common use.

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Nearly all geographic regions of the country can use open space design, which results in the conservation of different types of open space (forest, prairie, farmland, chaparral or desert).

Siting and Design Considerations

The codes and ordinances that govern residential development in some communities do not allow developers to build anything other than conventional subdivisions. These communities could consider enacting a new ordinance or revising current development regulations to enable developers to use this design option. The following resources provide helpful information for updating codes and ordinances to incorporate approaches like open space design:

- The Center for Watershed Protection's updated Code and Ordinance Worksheet for improving local development regulations.
- The University of Wisconsin Sea Grant's *Tackling Barriers to Green Infrastructure: An Audit of Local Codes and Ordinances* report.

- EPA's *Incorporating Low Impact Development into Municipal Stormwater Programs* fact sheet.

Often, a first step is adopting a local ordinance that allows open space design within conventional residential zones. The Land Use Department of New Castle County, Delaware, was one of the first local government agencies to promote a conservation design approach, requiring any new development project to incorporate 50 percent open space (Clar et al., 2009). Similar ordinances may specify smaller lot sizes, setbacks and frontage distances for the residential zone. Other key elements of effective open space ordinances include requirements for consolidating and using open space, as well as enforceable provisions for managing the open space.

Limitations

A number of real and perceived barriers hinder wider acceptance of open space designs by developers, local governments and the general public. For example, despite strong evidence to the contrary, some developers still feel that open space designs are less marketable than conventional residential subdivisions. In other cases, developers contend that the review process for open space design is longer, more costly and potentially more controversial than that for conventional subdivisions—and thus not worth the trouble.

Local governments may be concerned that homeowner associations lack the financial resources, liability insurance or technical competence to adequately maintain open space. Additionally, the general public can be suspicious of cluster or open space development proposals, feeling that they are a "Trojan Horse" for more intense development, traffic and other local concerns. At the regional level, government entities need to carefully construct and implement open space design policies and ordinances so as not to lead to "leapfrogging," which is the creation of additional development in already built-up areas. An open space development that requires new infrastructure—such as roads, water and sewer lines, and commercial areas—can actually create more imperviousness at the regional level than it saves at the site level.

In reality, government entities can directly address many of these misconceptions by adopting a clear open space ordinance and by providing training and incentives to the development and engineering communities.

Maintenance Considerations

Following establishment, a responsible party who can maintain common open space and natural conservation areas in a natural state and in perpetuity should manage them. Typically, legally enforceable deed restrictions, conservation easements or maintenance agreements protect the open space. In most communities, the authority for managing open space falls to a property owner, community association or land trust. Annual maintenance tasks for natural open space areas are almost nonexistent, as their purpose is to allow natural processes to take place without obstruction. It may be useful to develop a habitat plan for natural areas that requires periodic management actions such as invasive or exotic species control.

Effectiveness

The effectiveness of open space design depends on the degree to which the design reduces impervious surface and maintains a site's natural hydrology. In a review of nearly 4,000 conservation development projects that incorporated various types of open space design, Milder and Clark (2011) found that development approaches like conservation subdivisions and conservation-oriented, master-planned communities were able to conserve a total of 90 percent of the land area those projects encompassed.

Research indicates that open space design can provide significant stormwater discharge and pollutant reduction benefits compared to the conventional subdivisions they replace. For example, the Center for Watershed Protection (1998) reported that nutrient export declined by 45 percent to 60 percent after the redesign of two conventional subdivisions as open space subdivisions. Clar et al. (2009) modeled the hydrologic effects of implementing the conservation design strategies outlined in *Conservation Design for Stormwater Management* (DE DNREC & Brandywine Conservancy, 1997). They found that implementing conservation design strategies—including open space design—in conjunction with other low impact development practices could effectively maintain predesign hydrologic conditions across a 60-acre development site.

Along with reducing imperviousness, open space designs provide a host of other environmental benefits that most conventional designs lack. These developments reduce the potential pressure to encroach on resource and buffer areas because they usually reserve enough open space to accommodate resource protection areas. Moreover, because open space designs clear less land during the construction process, they also greatly diminish the potential for soil erosion. Perhaps most importantly, open space design generally reserves at least 50 percent of the development site as green space that would not otherwise receive protection, preserving a greater range of landscapes and habitat "islands" that can support considerable diversity in mammals, songbirds and other wildlife.

Cost Considerations

Open space developments can be significantly less expensive to build than conventional subdivisions—mostly due to savings in road-building and stormwater management conveyance costs. The Conservation Research Institute (2005) reviewed the costs associated with conservation development approaches, including open space design techniques, and found that they could achieve significant savings compared to traditional development due to:

- Reduced construction costs associated with clearing and grading, stormwater and transportation infrastructure, and utilities when using clustering to preserve open space.
- Reduced installation costs of natural landscaping compared to turf grass applications.
- Reduced maintenance costs of natural landscaping compared to turf grass applications.
- Reduced paving costs.
- Reduced long-term stormwater infrastructure costs.

While open space developments are frequently less expensive to build, developers find that these properties often command higher prices than homes in more conventional developments. Using hedonic price analysis, a large body of research has established that proximity to open space increases property value (Anderson & West, 2006; Heal, 2001; Lutzenhiser & Netusil, 2001; Irwin, 2002). Often, this benefit is more prominent in high-density areas where proximity to open space provides greater contrast than low-density areas (Anderson & West, 2006). A review of over 60 studies showed that proximity to open spaces mostly increases property values, sometimes on the order of thousands of dollars, but that the magnitude depends on the size of the open space area, proximity to the property and the type of open space (Shoup & Ewing, 2010).

In addition to being aesthetically pleasing, the reduced impervious cover and increased tree canopy associated with open space development reduces the size and cost of downstream stormwater treatment facilities. The resulting cost savings can be considerable, as the cost to treat stormwater discharge from a single impervious acre can range from $15,000 to more than $200,000 (King & Hagan, 2011). The increased open space within a cluster development also provides a greater range of locations for more cost-effective stormwater practices.

The Mill Creek subdivision in Kane County, Illinois, uses mixed-use and cluster development principles. The site includes 1,500 acres with the goal of protecting natural wildlife habitats and maintaining open spaces to increase flood resiliency. The redevelopment project focused on reducing impervious spaces and maintaining 45 percent of the neighborhood as open space through cluster development. The developers conducted an economic study and determined that by increasing the density of housing within the community, cluster development saved about $3,700 per lot over conventional development approaches (CRI, 2005). In addition to reducing building footprints, using natural, existing or established vegetation and green ifrastructure practices reduced the amount of stormwater discharge, which in turn provided further cost savings by reducing drainage infrastructure costs.

Additional Resources

- Pennsylvania Department of Transportation, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Department of Community and Economic Development, & Pennsylvania Land Trust Association. (2011). *The official map: A handbook for preserving and providing public lands and facilities* (PUB 703).
- Sustainable Sites Initiative. (2009). *The case for sustainable landscapes*.
- U.S. Environmental Protection Agency. (2017 March 21). *Smart growth illustrated*. United States Environmental Protection Agency.

Additional Information

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

References

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Disclaimer

This fact sheet is intended to be used for informational purposes only. These examples and references are not intended to be comprehensive and do not preclude the use of other technically sound practices. State or local requirements may apply.