Conservation Easements

Practice Description

Conservation easements are voluntary agreements that allow individuals or groups to limit the type or amount of development on their property. A conservation easement can cover all or just a portion of a property and it can be either permanent or temporary. Easements typically describe the resource they are designed to protect (e.g., agricultural, forest, historic, or open space easements), and they explain and mandate the restrictions on the uses of the particular property. Easements can relieve property owners of the burden of managing these areas. They do so by shifting responsibility to a private organization, such as a land trust or government agency, that is better equipped to handle maintenance and monitoring issues. In some cases, tax benefits might be realized by property owners who place conservation easements on some or all of their property.

Conservation easements may indirectly contribute to water quality protection. Land set aside in a permanent conservation easement has a prescribed set of uses or activities that generally restrict future development. The location of the land held in a conservation easement should be evaluated to determine its ability to provide water quality benefits. Property along stream corridors and shorelines can act as a vegetated buffer that filters out pollutants from stormwater runoff. The ability of a conservation easement to function as a stream buffer depends on the width of the easement and in what vegetated state the easement is maintained. Easements may also be used to provide tax benefits for other desirable practices, like tree and natural areas conservation (Center for Watershed Protection (CWP), 1998).

Planning Considerations

Conservation easements are designed to ensure that the land is preserved in its current state long after the original owners no longer control the property. By agreeing to give up or restrict development rights for a parcel of land, landowners can guarantee their property will remain in a prescribed state for perpetuity while receiving tax benefits.

Conservation easements have been used in all parts of the country, and many private groups (on both the national and local levels) exist to preserve natural lands and to manage the conservation easements. States also use conservation easements and land purchase programs to protect significant environmental features and tracts of open space.

Regardless of whether a conservation easement is held by a government agency or a private land trust, certain management responsibilities must be addressed by the easement holder. The following is a list of some of these management duties:

- Ensure that the easement's language is clear and enforceable.
- Develop maps, descriptions and baseline documentation of the property's characteristics.
- Monitor the use of the land on a regular basis.
- Provide information about the easement to new or prospective property owners.
- Establish review and approval processes for land activities stipulated in the easement.
- Enforce the easement's restrictions through the legal system, if necessary.
- Maintain property/easement-related records.

Design Criteria

Often, state agencies and private land trusts have specific qualifications for a property before they will enter into an easement agreement with landowners. Table 1 contains examples of criteria used by private land trusts to determine if a property is worth managing in a conservation easement.

Table 1 Typical criteria that land trusts use to determine feasibility of entering into conservation easement agreement

Criteria	Details
Natural resource value	Does the property provide a critical habitat or important environmental aspects worth preserving?
Uniqueness of the property	Does the property have unique traits worth preserving?
Size of land	Is the land large enough to have a natural resource or conservation value?
Financial considerations	Are funds available to meet all financial obligations?
Perpetuity	Is the conservation agreement a perpetual one?
Land trust's mission	Does the property align with the land trust's mission and the organization's specific criteria?

Maryland has been nationally recognized for its programs that provide funding for state and local parks and conservation areas. The state is one of the first to use real estate transfer taxes to pay for land conservation programs. Several programs are funded through this transfer tax of one-half of one percent ($5 per thousand) of the purchase price of a home or land, or other state funding programs. Conservation programs include these:

Program Open Space. This program is responsible for acquiring 150,000 acres of open space for state parks and natural resource areas, and more than 25,000 acres of local park land. Every county must create a Land Preservation and Recreation Plan that outlines acquisition and development goals in order to receive a portion of the 50 percent that is granted to local governments (USEPA, 2006b).

Maryland Environmental Trust. This trust is a state-funded agency that helps citizen groups form and operate local land trusts. It offers the land trusts technical assistance, training, grants for land protection projects and administrative expenses, and participation in the Maryland Land Trust Alliance (MNDR, 2001a).

Rural Legacy Program. This is a Smart Growth Initiative that redirects existing state funds into a focused and dedicated land preservation program specifically designed to limit the adverse effects of sprawl on agricultural lands and natural resources. The program purchases conservation easements for large contiguous tracts of agricultural, forest, and natural areas subject to development pressure, and purchases fee interests in open space where public access and use are needed (MNDR, 2001b).

Maintenance

A conservation area's pollutant removal efficiency depends on how much land is conserved, the techniques used to conserve it, and the specific nature of the easement. Conservation easements are assumed to contribute water quality benefits, but no national studies proving this have been released.

Table 2 Annual maintenance costs of different types of green space uses (CWP, 1998)

Land Use	Approximate Annual Maintenance Costs
Natural open space Only minimum maintenance, trash/debris cleanup	$75/acre/year
Lawns Regular mowing	$270 to $240/acre/year
Passive recreation	$200/acre/year

Development Districts

Practice Description

Development districts, often referred to as special zoning districts, are created for the purpose of permitting property development. Development districts are characterized by larger site areas (typically 5 or more acres), and their construction requires complex and coordinated rezoning, transportation, and planning efforts. Examples of special zoning districts include, but are not limited to, the following:

- Transit Oriented Development districts,
- Business Improvement Districts,
- Traditional Neighborhood Designs,
- Brownfields Redevelopment Projects, and
- Main Street Revitalization Districts.

A development district's stormwater handling performance is typically assessed at the site, neighborhood, regional or watershed levels. While the construction of a development district may involve a higher percentage of imperviousness than surrounding or conventional patterns, satisfying development needs on a smaller footprint brings benefits. In addition, the coordinated planning effort can help identify strategic opportunities for infiltration, stormwater recapture, and treatment.

Planning Considerations

A city, county or town's Planning or Zoning Department usually develops plans for development districts. Stormwater managers may need to meet with planning counterparts to coordinate plans, since the common, stand-alone elements found in stormwater management plans for individual sites (such as site coverage limitations, infiltration requirements, and rules discouraging sidewalks) can run counter to the urban design elements of successful development districts.

A development district's effectiveness can be viewed at the site, neighborhood, and watershed levels. Redevelopment can significantly reduce the demand for new development elsewhere in the watershed. Designs that repair existing infrastructure and treat stormwater on-site are particularly beneficial. Where urban redevelopment occurs on open lots that serve a stormwater handling function, the city and developer will need to assess the impacts neighborhood-wide and mitigate accordingly.

Clustering, open space, and other "green" designs offer stormwater and water quality benefits to communities considering new housing developments. However, the site's design needs to be combined with watershed and regional planning designs that curb uncontrolled, large-scale growth. It is important to consider neighborhood and watershed outcomes. Will new conservation development spur unplanned development? Does conservation development complement the community's overall conservation goals? How does the new development relate to jobs, schools, and services?

The costs of developing and implementing coordinated development districts vary. The primary drivers of these costs are consultant and staff time to develop or align plans; repair or establishment of water, sewer, and transportation infrastructure; and any incentives a city, county, or township provides to developers or public/private partnerships. For developers, costs can vary from a conventional site plan, dependent upon the combinations of BMPs and the relative cost of a more complex site development plan. However, many redevelopment projects command a premium market price due to their location or enhanced desirability.

Design Criteria

Development districts can be incorporated anywhere. One main consideration for rural areas might be a lack of zoning or other land use classification. Subdivision regulations or drainage district requirements may impede plans to establish a mix of uses or higher densities. For urban areas, look for designs that reuse existing impervious surface and infrastructure and provide opportunities to repair infrastructure or handle stormwater on-site. For conservation subdivisions or designs, look closely at the connections among transportation, community services, and jobs. The water quality benefits of conservation clustering can be negated if the new housing becomes part of a development pattern that includes dispersed uses, demands for upgrades to urban-level services and transportation, and a lack of connections among infrastructure elements.

Compact Project and Community Design

Compact project and community design is a powerful strategy for reducing a development's footprint and, hence, its stormwater impact. Reducing an individual building's footprint is another strategy, though there are circumstances that call for

greater lot coverage in districts where higher development intensity is needed (near transit stations, for example). Compact development also lends itself to more environmentally friendly transportation options, such as walking and biking, or shorter and less frequent automobile trips.

Street Design and Transportation Options

Well-designed, compact communities are served by a highly connected street and trail system designed for multiple modes of transportation. The pattern need not be a grid; in some areas, topography and environmentally sensitive areas will influence where roads go. A compact district also provides for more efficient use and reuse of infrastructure.

Mix of Uses

A community's transportation options increase when jobs, housing, and commercial activities are located close together. Efficiencies for providing infrastructure also emerge. Fewer auto trips reduce the need to accommodate standard parking requirements. Mixing daytime and nighttime uses increases the opportunities for businesses to share parking spaces.

Regional Applicability

Development districts can be large redevelopment efforts, infill projects, or new "greenfields" projects. The regional applicability is strong since successful development districts coordinate multiple objectives, including environmental protection and stormwater control. These districts also tend to handle more development intensity and a mix of uses on a smaller footprint; Thus, they also have applicability for watershed planning and source water protection.

Ultra-Urban Applicability

Although land constraints and large developable sites can be a challenge, certain types of development district planning, such as transit oriented development and business improvement districts, are common in urban areas.

Urban development and redevelopment projects are more likely to be served by heavier transit, follow a traditional street pattern, and be governed by a complex set of existing land development requirements. Municipalities can use a combination of policies to promote desired densities. Some of these policies include the following:

- Transfer of development rights receiving zones – A system in which a landowner in a "preservation area" or "sending zone" gets credits for forgoing development rights that he can sell or have a "bank" consolidate. Developers can buy and use these credits to gain permission for denser development in "receiving zones," which are areas targeted for denser development,

- Bonus densities – which permit developers who agree to complete projects or project additions that meet specific goals to increase density,

- Create mixed-use zoning,
- Create form-based zoning codes,
- Modify parking policies that, for example, create a maximum number of parking spaces allowed and have better management of on-street parking,
- Create sidewalk improvement programs,
- Encourage micro-detention stormwater handling areas such as use of rain gardens or stormwater BMPs that serve multiple purposes (i.e., green roofs),
- Encourage street tree canopy programs,
- Create financial incentives (tax-increment financing, vacant property reform),
- Enact or promote programs to enhance transit use,
- Enact rehabilitation codes for older buildings using proprietary devices (e.g., in-pipe filtration devices).

Suburban Settings

Suburban development districts are likely to take advantage of existing development and infrastructure, and require connections among older developed areas. In addition to some of the policies in urban settings, planners and developers in suburban settings could consider the following BMPs and policies to aid in protecting water resources:

- Promote Grayfields programs to redevelop underperforming malls and strip malls,
- Create highway corridor redevelopment programs,
- Enhance retail and housing districts around park and ride lots,
- Adopt Smart Growth street design standards at local and state levels,
- Establish infill policies,
- Adopt traditional neighborhood design manuals that integrate transportation.

Rural Settings

Rural development districts are likely to occur on undeveloped or sparsely developed land. Successful rural development districts will complement or spur rural employment opportunities, such as agriculture, manufacturing, or warehousing and distribution. To protect water resources on a regional scale, planners should encourage conservation of rural settings to offset increased impervious areas in urban and suburban settings.

Policies that encourage economic development while retaining rural character include:

- Create transfer of development rights sending zones,
- Establish water protection overlay zones,
- Connect housing with rural job and transportation centers,

- Create watershed-wide impervious surface trading programs,
- Create design manuals for rural housing or housing in environmentally sensitive areas,
- Encourage “Main Street” redevelopment programs in older downtowns.

Common Problems

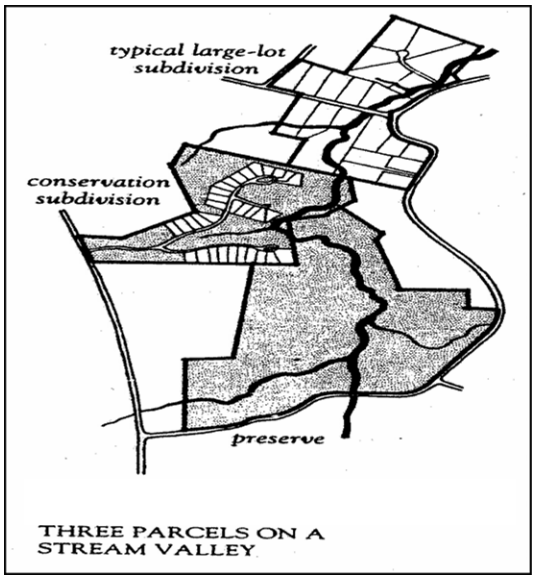
If the stormwater regulations for redevelopment districts are more stringent than those for greenfields, cities may find it difficult to attract developers. Rules for water protection and stormwater should be consistent watershed-wide.

During the site design process, pressures may develop to eliminate elements critical to a development district’s environmental performance. For example, a successful development district will shorten, combine, or eliminate auto trips. However, if pressure mounts to increase parking or decrease connections among uses, a city or county may be unable to reduce the amount of impervious surfaces, diminishing transportation and water benefits.

Maintenance

Various design elements will direct a development district’s maintenance plan, although it is likely to include a combination of BMPs. Comprehensive redevelopment plans include common urban design elements like tree-lined streets, water features, and landscaping. Planners and stormwater professionals should look to these features to achieve urban design and water quality goals, and plan their maintenance procedures accordingly.

Infrastructure Planning



Practice Description

Infrastructure planning involves changes in the regional growth planning process to contain "sprawl" development. Sprawl development is the expansion of low-density development into previously undeveloped land. The American Farmland Trust has estimated that the United States is losing about 50 acres an hour to suburban and exurban development (Longman, 1998). This sprawl development requires local governments to extend public services to new residential communities whose tax payments often do not cover the cost of providing those services. For example, in Prince William County, Virginia, officials have estimated that the cost of providing services to new residential homes exceeds what is brought in from taxes and other fees by $1,600 per home (Shear and Casey, 1996).

Infrastructure planning concentrates public services such as water, sewer, roads, schools, and emergency services in the suburban fringe and directs new growth into previously developed areas, discouraging low-density development. Generally, this is done by drawing a boundary or envelope around a community, beyond which major public infrastructure investments are discouraged or not subsidized. Meanwhile, economic and other incentives are provided within the boundary to encourage growth in existing neighborhoods. By encouraging housing growth in areas that are already provided with public services, communities not only save infrastructure development costs, but reduce the impacts of sprawl development on urban streams and improve water quality within the watershed.

Planning Considerations

Sprawl development occurs in all regions of the country and has recently become the subject of many new programs to counteract its impacts. These programs seldom focus on the water quality implications of sprawl growth, instead concentrating on economic and transportation issues. Even so, methods such as infrastructure planning can reduce

the impact of new development. Promoting the infill and redevelopment of existing urban areas in combination with other better site design techniques will decrease impervious cover levels and lessen the amount of pollution discharged to urban streams.

Sprawl development negatively impacts water quality in several ways. One of the most significant impacts comes from the increase in impervious cover that is associated with "sprawl" growth. Rooftops, extension of road systems, and additional paved surfaces from driveways create an overall increase in imperviousness. This increase in the impervious cover level of an area directly influences local streams and water quality by increasing the volume of stormwater runoff. These elevated runoff levels impact urban streams in several ways, including enlarging stream channels, increasing sediment and pollutant loads, degrading stream habitat, and reducing aquatic diversity (Schueler, 1995). Sprawl has been reported to generate 43 percent more runoff that contains three times greater sediment loads than traditional development (South Carolina Coastal Conservation League, 1995).

Design Criteria

Various techniques have been used to manage urban growth while conserving resources. Although none of these techniques specifically concentrates on infrastructure planning, each of the techniques recognizes that directing growth to areas that have been previously developed or promoting higher density development in areas where services exist prevents sprawl development and helps communities to mitigate the water quality impacts of economic growth. Two of these techniques are described below.

Urban Growth Boundaries

This planning tool establishes a dividing line that defines where a growth limit is to occur and where agricultural or rural land is to be preserved. Often, an urban services area is included in this boundary that creates a zone where public services will not be extended.

Infill/Community Redevelopment

This practice encourages new development in unused or underutilized land in existing urban areas. Communities may offer tax breaks or other economic incentives to developers to promote the redevelopment of properties that are vacant or damaged.

Common Problems

Intense development of existing areas can create a new set of challenges for stormwater program managers. Stormwater management solutions can be more difficult and complex in ultra-urban areas than in suburban areas. The lack of space for structural stormwater controls and the high cost of available land where structural controls could be installed are just two problems that program managers will face in managing stormwater in intensely developed areas.

Infrastructure planning is often done on a regional scale and requires a cooperative effort among all the communities within a given region in order to be successful. Stormwater managers will need to develop lines of communication with other state and local agencies and community leaders to ensure that infrastructure plans direct growth to those areas that will have the least impacts on watersheds and water quality.

Open Space Design

Practice Description

Open space design is an alternative site planning technique that concentrates development to preserve open areas and green space. This is a rethinking of typical residential site development practices in that it gives extra consideration to preserving the natural integrity of the site. By keeping some areas in an undeveloped state, this design strategy can reduce negative impacts from stormwater such as increased runoff from impervious surfaces and pollutant inputs. Open space design has been shown to reduce construction costs while increasing property values because of the desirable open space amenity that is preserved. Other costs associated with additional stormwater management measures, clearing costs, and downstream flooding due to increased runoff volumes can also be reduced using open space design.

Planning Considerations

The many misconceptions about open space design can be obstacles to its implementation. Some developers fear that designing to preserve open space will lead to longer plan reviews, higher costs, and lower market value. However, open space design can actually provide cost savings, as less area is cleared and fewer interventions are needed to manage stormwater. One open space development example (Liptan and Brown, 1996) demonstrated a cost savings of $800 per lot for site development. Other studies report cost savings for infrastructure ranging from 11 to 66%. Local ordinances may need to be revised to remove restrictions that stand in the way of implementing essential components of open space design.

According to the Center for Watershed Protection, open space designs have the following water quality advantages relative to a conventional development:

- Reduced impervious cover.
- Reduced pollutant loads to streams and other water resources.

- Reduced potential pressure to encroach on resource buffer areas.
- Reduced soil erosion potential by reducing the amount of clearing and grading on the site.
- Preservation of green space.
- Preservation of open space for recreation.
- Lower capital cost of development.
- Lower stormwater-management costs by concentration of runoff in one area and reducing runoff volumes.
- A wider range of feasible sites to locate stormwater BMPs.
- Lower costs of future public services needed by the development.
- Possible increase in property values.
- Creation of urban wildlife habitat "islands."
- Support for other community planning goals, such as pedestrian movement, neighborhood enhancement, farmland preservation, affordable housing, and architectural diversity (CWP, 1998).

The first step for many jurisdictions to encourage open space developments is to adopt a local ordinance that permits open space design in conventional residential zones, or to amend their current zoning ordinances to accomplish that goal. Essential elements of such an ordinance are described in the Design Criteria, Implementation, and Maintenance sections that follow. The Center for Watershed Protection has also developed an Open Space Model Ordinance to serve as a template for jurisdictions who wish to adopt such an ordinance (CWP, not dated). Whatever the method used to implement open space designs, it should include long-term provisions for the acceptable use and maintenance of the land that is preserved. With the proper regulations in place, the developer must create and follow a site plan for the project that meets the criteria below.

Design Criteria

Flexible Development Regulations

To implement open space design, the land use ordinance governing the area must allow for variations in site layout to help achieve a more compact development. Flexible and smaller lot sizes, varying setbacks, and frontage distances for the residential zone are

some of the specific features that a developer working within an open space framework will need (USEPA, 2006b).

Open Space and Natural Area Conservation Requirements

An open space design reduces the level of impervious cover as compared to a conventional development and preserves the maximum acreage for natural area conservation. To achieve stormwater benefits, the majority of the preserved open space must be contiguous. Some strategies to minimize the amount of paved area are unpaved walkways and the use of permeable paving materials. Open space can also be maximized by requiring narrower streets, smaller building setbacks, and shared driveways.

Consolidation and Use of Open Space

The typical open space development creates 10-50% less impervious cover and reduces the need to clear and grade 35-60% of the site. The remaining open space can serve multiple functions. The site layout may preserve some areas to meet environmental requirements for stormwater management and conservation and others to provide future residents with attractive recreational amenities. Some of the high-priority uses for the preserved open space are

- Resource buffers,
- High-quality forest resources,
- Individual trees,
- Critical habitat areas,
- High-quality soil resources (CWP, not dated)

Implementation

Delineation of Boundaries

The boundaries of designated open space areas, recreation areas, stormwater management facilities, and green space shall be clearly delineated on plans, including record plats, and marked to distinguish these areas from private property. Development in designated open spaces in the future is prohibited.

Density of Development

The total number of residential units allowable within an open space development shall not exceed the number of units that would otherwise be allowed in the existing zoning district using conventional development.

Preservation of Open Space

The majority of the land preserved for open space should be contiguous to achieve the maximum environmental and recreational benefits. The model ordinance proposes that up to 50% of open space be preserved as green space. If open space design is used as a BMP for stormwater management, all Mississippi state design, construction, maintenance, and public safety requirements must be met.

Common Problems

It is sometimes difficult to convince developers to adopt an open space design because of a concern that it will be both more expensive to develop and less marketable. The land use ordinances governing open space design must therefore foster development that

meets market demands while protecting the environment. Decisions also need to be made about the locations where it is most beneficial to direct open space development. Finally, the issue of management is crucial to the long-term success of open space design. Long-term maintenance is primary among the concerns, but the developer must also delegate the necessary authority for managing issues such as liability and emergency vehicle access to a responsible entity in the public or private sector.

Maintenance

Once established, common open space and natural conservation areas must be managed by a responsible party able to maintain the areas in a natural state in perpetuity. Typically, the open space is protected by one of these three strategies: a legally enforceable deed restriction, a conservation easement enforced by a local government or land trust, or maintenance agreements. In most communities, the authority for managing open space falls to a homeowner or community association or a land trust.

When managing open space as a natural area, annual maintenance costs are very low. The annual maintenance cost for managing an acre of natural area is less than $75 (CWP, 1998). It may be useful to develop a habitat plan for natural areas that may require periodic management actions.

Protection of Natural Features

Practice Description

Undeveloped sites often have natural features such as wetlands, riparian areas, floodplains, aquifer recharge areas, mature trees, woodlands, and other wildlife habitat, which provide environmental, aesthetic, and recreational benefits if preserved and protected from the impacts of construction and development. Restricted areas such as floodplains and steep slopes should also be protected from possible impacts from construction activities. Natural area protection is not limited to undeveloped land; properties that are being redeveloped might have attractive open space, well-drained soils, or riparian areas that should be identified and considered for preservation early in the planning process. The Better Site Design Handbook provides guidance on how a development can protect a site's natural features by reducing street lengths. It emphasizes the need for clearing and grading, applying open space design, promoting tree conservation, and taking advantage of conservation incentives (CWP, 1998).

Natural features and open space can be protected both during the development process and after a site is occupied through a combination of

(1) Site planning techniques,

(2) Construction site BMPs, and

(3) Measures employed after the site is in use.

Planning Considerations

Natural area preservation has been achieved in numerous developments nationwide that have been both environmentally and economically successful. For example, the Chapel

Run residential development in Sussex County, Delaware, was initially proposed as a conventional residential development containing 142 half-acre lots. Site designers chose to preserve a wooded area with highly permeable soils as a means to control stormwater. To accommodate this open space, lot sizes were reduced from a half-acre to a quarter-acre and condensed into a cluster design, resulting in the preservation of approximately 68 percent of the site. Total capital costs for the clustered development were estimated to be $1,174,716, whereas a traditional design would have cost $2,460,200, yielding an estimated cost savings of $1,285,484 (Delaware DNREC, 1997). Many developments with open, shared areas have seen a greater increase in property value than those in comparable, traditional developments.

Additional examples of successful open space preservation, as reported by the National Association of Homebuilders, are summarized in the table below (NAHB, 2006).

Location	Description	Result
Garnet Oaks, Bethel Township, PA	80 homes on 58 acres	51% of the land preserved as open space, including woodlands, tree specimens, and structures from the property's original estate Housing price premiums are based in part on the lots' proximity to open space
Newpoint, Beaufort, SC	124 single-family homes on 54 acres	Site layout preserved small wetlands and saved large existing trees, some in the greenway between street and sidewalk The Riverside green and community dock provide neighborhood access
Prairie Crossing, Grayslake, IL	337 single-family homes on 667 acres	350 acres devoted to prairies, pastures, farms, fields, gardens, marshes, lakes Community-supported organic garden The community is the western anchor of the Liberty Prairie Reserve, a 2,500-acre preserve of forest, marshes, prairies, and farmland
The Fields of St. Croix, Lake Elmo, MN	90 homes on 226 acres	60 percent of the community's land preserved as permanent open space Home sites are clustered near a wooded ridge overlooking the site's ponds and open space Historic Civil War-era barn was preserved and used as a community center Thirty acres of prairie restoration featuring native plants indigenous to the area Existing wooded slopes, which are home to oak trees and provide excellent wildlife habitat, preserved The open space is permanently guaranteed by a conservation easement granted to the Minnesota Land Trust

Cost consideration comparisons for preserving natural areas and open space versus traditional development are difficult to determine because the quantity and type of natural features vary from site to site. In general, however, additional costs can be incurred when

preserving natural areas because additional planning and inspections might be needed to meet local regulatory requirements using innovative site designs. Also, the need for smaller construction equipment could increase costs if equipment operators need to maneuver around trees and other protected features. These increased costs can be offset by decreased costs for clearing, grading, temporary erosion control, seeding, and landscaping because less area is disturbed. Savings can be substantial; the cost of clearing, grading, and installing stormwater control measures is estimated to be up to $5,000/acre, with annual maintenance costs adding an additional $800 to $1,500 (Schueler, 1997). Additionally, reduced infrastructure costs can be realized in developments that use clustering because of shorter road lengths, elimination of curbs and gutters, and the use of vegetated areas and swales instead of structural stormwater controls. Finally, long-term costs for landscape maintenance can be reduced because natural areas do not require the same level of maintenance as turf grass; eliminating the need to mow, fertilize, and perform other lawn maintenance activities can save a homeowner $1,000 to $1,500 annually (Delaware DNREC, 1997).

Developers can use conservation easements to maintain open space over the long term. This easement ensures that the land will not be developed and will remain protected.

Design Criteria

Developments can be planned around significant environmental features, which can then be marketed as amenities. In *Conservation Design for Subdivisions* (1996), Randall Arendt describes a process to delineate a "development envelope" where buildings and infrastructure can be placed to avoid impacting natural features. The first step in this process is to assemble background information, which includes the following:

- Determine the local context: is the area agricultural, forested, etc.?
- Map significant features as candidate conservation areas, including floodplains, slopes, soils, wildlife habitats, woodlands, farmland, historical/cultural sites, views, aquifer recharge areas, and others.
- Rank conservation areas based on how special, unique, irreplaceable, environmentally valuable, historic, or scenic they are.
- Identify areas where buildings and infrastructure should be placed that would minimally impact conservation areas.
- Establish the layout of buildings and infrastructure, employing such techniques as clustering buildings and using smaller lots, shared driveways, and narrower streets (Arendt, 1996).

This process of site evaluation and design can allow significant features to be preserved while maintaining the desired overall site density (although density in localized parts of the development will be higher when open space is set aside). Some negative perceptions are associated with protecting natural features. Developers want to achieve a particular development density when building subdivisions or commercial sites. Also, for residential developments, lot size is an important factor in determining lot prices. Setting aside natural areas can take up space that would otherwise be used for yards, parking, transportation infrastructure, and other built features. Developers can accommodate

overall site density using clustering techniques, smaller lots, and more efficient street layouts. To offset lost premiums from smaller individual lots, developers can market a lot's proximity to natural areas and attractive views as amenities.

Implementation

When areas of the property with environmental significance have been identified for protection, extra care is needed during site preparation to protect these features. Developers should indicate a limit of disturbance and the location of protected areas in construction site stormwater pollution prevention plans (SWPPPs) and on site maps. Also, they should post signs with prohibitions and educate workers about the importance of and special considerations for the protected areas. Without training and explicit signage, areas slated for protection could be damaged by vehicle traffic, stored materials, and other construction-related activities. Construction operators should check areas regularly to identify problems and determine if additional controls such as more training, more explicit signage, and more obvious barriers are needed. Operators should also look for signs of unintended consequences of construction activities on the natural areas, such as changes in hydrology, flooding, or accidental spills, and take appropriate actions to mitigate the damage.

The following sections describe specific practices that developers and construction site operators can employ to protect each type of resource.

Mature Trees or Woodlands

Surround the area to be protected with bright orange fencing placed at or beyond the tree's dripline. Prohibit clearing and grubbing, limit heavy equipment traffic, and prohibit material storage inside the barrier. Include signage that details specific prohibitions and educate employees. Visually monitor vegetation to ensure that it is not being damaged by construction activities (e.g., soil compaction from heavy equipment traffic might cause localized flooding in nearby natural areas).

Steep Slopes

Steep slopes and related vegetation should be protected. Fence off these areas and assess whether additional erosion control is needed to prevent erosion. Check erosion controls on upslope areas that will be cleared and graded, and ensure that runoff from these areas is diverted away from or around the slope, using either a pipe slope drain or a diversion placed at the top of the slope. Post signs prohibiting heavy vehicle traffic and educate crews about the sensitivity of steep slopes to erosion.

Well-Drained Soils and Aquifer Recharge Areas

Areas with well-drained soils and those that feed aquifers should be protected from compaction. Maintain vegetation if possible, or if the area is cleared, minimize heavy traffic by fencing the area and posting signs. Before planting permanent vegetation, aerate the soil to ensure that runoff infiltrates. These areas may be critical later to the success of post-construction BMPs by limiting the volume of runoff that needs to be treated.

Wetlands and Riparian Areas

Establish a buffer around marshes, swamps, or other wetlands and along stream corridors in which no construction activity occurs. Avoid stream crossings wherever possible.

When absolutely necessary, set up perimeter sediment controls (e.g., silt fence) and visually monitor the protected areas, especially after each storm, to check for damage from flooding and for signs of impacts from the construction activity, including sedimentation, vegetation dieback, erosion, dumping, or fish kills. Set up stream crossings to minimize disturbance of streamside vegetation and in-stream habitat. Post signs and educate workers about the sensitive nature of the area and include prohibitions for storing or dumping materials.

Wildlife Habitat

Contact a local wildlife authority if you find nests, dens, or other animal habitat on the property. These can be removed or relocated before construction begins.

The presence of threatened or endangered species or habitats critical to their survival on the site might require a consultation with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service. You should ensure that you are in compliance with all regulations, including the Endangered Species Act.

Floodplains

The placement of buildings in floodplains is typically restricted because of the risk of safety concerns and property damage, so these areas should remain outside the limit of disturbance. (Restrictions will vary from one municipality to the next, so check with local authorities about floodplain restrictions in your area.) Establish perimeter controls, including fencing, and post signage that prohibits dumping and material storage in these areas. Inspect protected areas on a regular basis to ensure that vegetation has not been disturbed and that no dumping has occurred.

Common Problems

Concerns about cost and local ordinances are the most likely barrier to implementing a site plan that protects existing natural features. Education about the many cost savings associated with this strategy as well as techniques to achieve the desired number of units while protecting natural areas may be helpful to overcoming developers' reluctance. Local zoning codes should also be reviewed for provisions that restrict the use of clustering, reduced road widths, and other techniques for natural area preservation. Developers should work with local regulatory agencies to determine whether they can obtain waivers to protect natural features.

Maintenance

Once a site is developed and occupied, natural areas become amenities for the site's occupants. These natural areas also become the responsibility of the owner or occupant. Developers should provide information about each natural area or protected feature, to describe the area's importance and outline the activities that should be prohibited to adequately protect the resource.

Developers should also provide guidance to occupants on how these areas should be maintained. For example, a preserved prairie or riparian stream buffer should not be mown or manicured like turf. Homeowners or maintenance crews would need to employ special procedures to preserve native species, such as using integrated pest management

practices like hand-weeding and limiting chemical use. The same practices should be used in areas where traditional landscape maintenance activities could threaten water quality, such as in or adjacent to wetlands and riparian areas or where endangered species are present. Interpretive signage can be posted to educate occupants and visitors about the significance of the features and to describe prohibited activities such as mowing, dumping, and vehicle traffic. Barriers can be installed to protect the natural areas from damage without detracting from their aesthetics and function. These barriers can include strategic placement of low fences, walls, bollards, or large rocks that unobtrusively limit access to the areas.

Redevelopment

Before

After

Practice Description

Redevelopment occurs in areas that have previously been developed for another use. These sites are likely to be highly impervious and of limited value to the stormwater management system. The definitions of development and redevelopment vary in stormwater guidance documents and National Pollution D- E- S- stormwater permits. In some states and localities, development and redevelopment are subject to the same stormwater management requirements. Redevelopment of already impervious surfaces, however, can be a key strategy for reducing net increases in impervious surfaces and associated degradation to receiving waters. By recycling these sites and granting them new life, governments reap the broader benefits of development on an existing property by reusing impermeable surface and mitigating developmental impacts on a green field site. Because redevelopment will take advantage of existing roadways and building sites, it is likely to follow many of the Better Site Design principles associated with street width and length. Its primary advantage for stormwater management, however, is that it provides opportunities for conserving natural areas in the surrounding community that might otherwise be subject to greater development pressure (CWP, 1998).

Planning Considerations

Redevelopment can be accomplished on a site-by-site basis, but it can also be part of a larger local or regional effort to spur investment and development activity. Many jurisdictions create redevelopment districts, such as business improvement districts, Main Street programs for older downtowns, brownfields programs, vacant property campaigns, and efforts to revive older, underperforming shopping malls. The transfer of development rights can help spur redevelopment by directing development demand to existing activity centers. In established development districts, infrastructure upgrades associated with redevelopment can be used for repairs such as replacing deteriorating pipes that are contributing to water quality impairments.

In districts with multiple redevelopment-ready properties, economic factors, such as location near amenities and proximity to transit, guide which properties are redeveloped

first. Because these properties may or may not be the ones that will deliver the highest succession of stormwater benefits, it is helpful to prioritize areas that can provide the greatest opportunities for detention facilities or other desired BMPs.

Although redevelopment can just maintain the current level of stormwater runoff, by employing a strategic series of BMPs, this new development may actually lead to a net improvement in regional stormwater.

Design Criteria

Design of redevelopment projects will vary considerably with land variations. Common land constraints include irregularly shaped properties, small lots, legacy contamination, and noncompliant building features/footprints. Water quality considerations can also influence the selection of structural BMPs used to manage the project's stormwater. In some cases, the main factor may be flow reduction, while in others cases the focus will be the filtration of nutrients or heavy metals.

Stormwater Retrofit

In areas with degraded waterways, redevelopment activity can complement efforts to improve the quality and reduce the quantity of stormwater runoff. The BMPs chosen for redevelopment, however, need to consider the unique circumstances of the redevelopment project. Micro-detention, urban forestry techniques and structured soils are often recommended for urban areas. Green building techniques and green roofs may also be good choices. As noted above, cities and counties will want to coordinate infrastructure repair and upgrades with redevelopment efforts so that water and wastewater capacity are not barriers to redevelopment.

Implementation

Redevelopment is highly useful in urban areas, especially where the area is fully built out. Some of the strategies for redevelopment are described below.

Green Roofs

Green roofs help reduce the urban "heat island" effect as well as peak stormwater flows by absorbing stormwater on-site. The vegetated cover also helps protect and insulate the roof, extending its life and reducing heating and cooling costs. See more discussion on green roofs in the *Site Design* section of this chapter.

Micro-Detention

Micro-detention techniques seek to absorb some or all stormwater runoff on the development site. Since the entire volume of stormwater generated on-site is rarely entirely infiltrated, micro-detention is typically only one of a series of BMPs. Common landscaping features, such as small garden areas, tree grates, perimeter hedges, and even rain gardens (also known as *Bioretention*) can enhance stormwater handling and micro-detention. In urban buildings with basements and underground garages, infiltration may occasionally not be an option. Pollutants that might be carried with infiltrating water should also be considered; hence, infiltrating techniques are not recommended for stormwater hotspots.

Alternative Pavers and Porous Pavement

Alternative pavers, porous asphalt, and permeable concrete reduce stormwater flows by allowing water to infiltrate their porous surfaces and soak into the ground beneath. Pervious pavers can reduce runoff volumes at a considerably lower cost than traditional storm drain systems.

Infrastructure Upgrades

Storm sewer overflows and leaking older pipes (referred to as inflow and outflow) can be significant environmental problems in urban areas. Redevelopment offers an opportunity, through enhanced tax revenues resulting from increased economic activity, to upgrade storm grates and pipes. However, capacity at wastewater treatment plants may be a barrier to redevelopment. In addition, the condition of receiving waters and total maximum daily limits can be hurdles to any development activity in an urban area.

In-pipe and Small Structural Devices

A growing number of devices are coming on the market that provide a range of mitigation functions. These devices commonly work to separate large debris collected in runoff, intercept sediments, and improve water quality. They range in size, cost, and maintenance needs. They can be included in the suite of structural and nonstructural BMPs chosen for redevelopment projects and districts.

Common Problems

As a stormwater strategy, redevelopment can require larger regional cooperation. To growing rural districts, a redevelopment strategy for established commercial centers might not be viewed as advantageous.

The BMPs required for redevelopment need to be compared to BMPs required for new development. Watersheds that choose redevelopment as a stormwater strategy should make sure the BMP cost and permit review requirements for redevelopment are comparable to those required for new development. Because redevelopment is often more complex than new development, design and building costs can be higher. Where infrastructure upgrades are needed, the costs can be considerable, particularly where treatment capacity or aging infrastructure is the limiting factor. However, in many cases, redevelopment projects can command a premium price, and some or all of the costs can be recovered.

Street Design and Patterns

Practice Description

The EPA, watershed researchers, and local governments have developed extensive guidance on the design of "green streets," which focuses on narrower widths, infiltration, and eliminating curbs and gutters. Streets designed to these specifications have substantial benefits for stormwater management. However, the underlying pattern of streets is just as influential, particularly as it relates to development patterns in a neighborhood and region.

Smart Growth street designs are based on a network of well-connected streets that support multiple transportation modes. Some Smart Growth approaches to street design include decreasing street widths, adjusting the vehicular level of service (LOS), creating LOS for other modes of transportation, and designing connected street networks to support multiple uses. The Better Site Design principles of the Center for Watershed Protection offer detailed guidance for how improvements to residential streets and parking lots can improve stormwater management in a community. Specific model development principles are offered with respect to street width and length, rights of way, driveways, cul-de-sacs, and alternative turnarounds (CWP, 1998).

Planning Considerations

A variety of agencies control street and road designs at the regional level. State Departments of Transportation (DOT) typically control the design and operations of highways and larger arterial streets. When developing streets, state DOTs often refer to manuals such as the American Association of State and Highway Transportation Officials' (AASHTO) "Green Book," or manuals developed by the Institute for Transportation Engineers (ITE). Conventional street layouts today tend to follow a hierarchical system, with a multitude of smaller roads that serve residential areas feeding into larger roads and arterials. These arterials funnel traffic onto larger regional roads and highways. This system is often highlighted for its role in congestion, since the funneling of traffic creates congested chokepoints and severely limits alternative routes from place to place. This

system also arose as part of a highly separated and dispersed land use system that is becoming less dominant in contemporary development.

As local governments and states demand connected, multi-modal street networks, AASHTO and ITE have recognized the need for alternative standards. In response, ITE has published "Traditional Neighborhood Development Street Design Guidelines" (1999) and "Neighborhood Street Design Guidelines" (2003). Public officials may also use the Better Site Design handbook (CWP, 1998) to conduct a review of their own codes and ordinances to determine if they allow for greener alternatives to the conventional street layout and network. The Model Development principles in that handbook are designed to facilitate changes to codes and ordinances where desired.

Design Criteria

Smart Growth street designs can be divided into two categories: street design in new projects and modification of existing street patterns. The main benefit of Smart Growth street design rests on the ability to support a higher level of development intensity on a smaller footprint. This benefit manifests itself well at the regional and neighborhood levels. Alternative types of street designs can cut costs as well, reducing the need for paving materials for longer streets and more parking. For both redevelopment and new development projects, installing conventional sidewalks, curbs, and gutters is typically more expensive than the installation of the roadway itself.

Street Design in New Projects

Smart Growth street designs incorporated into new projects are typically part of an overall site design that seeks to meet transportation, economic, and multi-modal objectives. On a local level, cities and counties such as Cary, North Carolina, and Portland, Oregon, have enacted "connected streets" policies so that new residential or mixed-use development projects have more than one link to neighboring retail, commercial, or transportation centers.

Standard road design practice has been to make decisions about stormwater BMPs after the roadway has already been designed. This not only limits options, but often focuses attention on end-of-pipe treatment BMPs rather than in-line measures or preventive measures, which are generally less expensive to build and maintain, and more effective at protecting water quality. For new development or redevelopment of any part of a transportation system, stormwater management features should be an integral part of the design, not "add-on" features. Though there is not one set standard, street designs should meet the following objectives:

- Support a mix of uses.
- Develop parking plans to optimize the number of spaces and layout for multi-modal connections.

- Incorporate features such as boulevard islands, rotary islands, parking lot islands, swales, and sidewalk tree and groundcover planters to capture, filter, and infiltrate runoff. These features may already be incorporated for aesthetics or traffic-calming purposes, and can be used to manage stormwater as well.

- Integrate sidewalks, crosswalks, and traffic-calming approaches to support bicycling, walking, and automobile traffic.

- Design for shorter block lengths.

- Engineer narrower street widths to facilitate pedestrian crossings and moderate automobile speed while meeting the needs of emergency responders.

- Provide access lanes, on-street parking and turning lanes to complement the land development design, sidewalks, and building setbacks.

Once the underlying layout has been established, transportation and stormwater engineers can look for additional strategies to further reduce stormwater volume and pollutants. Separate stormwater sewers typically discharge runoff with little or no treatment into receiving bodies. Thus, avoiding or minimizing the use of standard curb and gutter collection and conveyance systems should be a goal of any project.

Poorly draining soils do not have to preclude the use of these measures, as good designs and soil amendments can facilitate some level of infiltrative capacity almost anywhere. In areas with existing curb and gutter, and limited short-term options for major retrofits, the inlets and catch basins of storm sewers in a Smart Growth development or redevelopment project might require additional BMPs or design modifications.

Modification of Existing Streets

Local governments can use several methods to incorporate Smart Growth features and stormwater benefits to existing streets. Some of these strategies will include

- Connecting disconnected streets, lanes, and cul-de-sacs,

- Where a new street is impossible, adding paths to link housing and other uses,

- Using unused streetscape to add public parking, increase the number of spaces, and introduce bike lanes.

These strategies are often used in connection with site design features like tree planters and vegetated bulb-outs that can be designed to handle and treat stormwater. Where possible, a street retrofit should take advantage of opportunities to improve the drainage system or add structural and non-structural BMPs to lessen the flow of stormwater volumes or filter pollutants. This will require a new approach to street repair and retrofits. Departments of Public Works and stormwater engineers will need to consult with land-use planners and site designers on reducing volume and treating stormwater before runoff enters the public conveyance system. In some areas, the stormwater inlets can be retrofitted with trash separation and filtration controls. A connected system need not be a formal grid of streets. Often the connections are determined not only by the street layout, but by linkages among activity centers like schools, neighborhoods, and jobs. Site planners might need to avoid introducing streets and hardscape in or around environmentally sensitive land or water resources.

Effectiveness

The effectiveness of a Smart Growth street design can be at the street, neighborhood, and watershed levels. At the watershed level, the benefits of Smart Growth street designs for both redevelopment and new development emerge from absorbing development demand on a smaller footprint. During initial construction, less land disturbance results in less exposure and risk of sedimentation. Quantitatively, the best management practices will be preventative in nature since development takes place on a smaller area.

More transportation options mean that some car trips may be eliminated or shortened. The benefits of shrinking the footprint of parking and better managing existing street space are straightforward, but watersheds also benefit from reduced tailpipe-related deposits and from devoting what was single parking use to multi-use (shared parking and retail, for example). This efficiency also represents environmental benefits.

Implementation

The objective of this BMP is to minimize impervious surface at the watershed level through a more thoughtful approach to roadway design, parking requirements, and connections between streets and modes of traffic. This may involve concentrating development in urbanized areas to preserve green space elsewhere in the watershed. Smart Growth street designs can involve more coverage per acre in a district, but far less on a sub-watershed scale.

For construction standards with respect to road widths and parking ratios, consult the BMPs given in this manual for:

- Green Parking (see *Site Design* section of this chapter),
- Narrower Residential Streets (see *Site Design* section of this chapter),
- Redevelopment (see *Planning* section of this chapter).

Common Problems

As referenced, limitations to implementing innovative street designs might occur within the existing stormwater regulations. Blanket regulations that require land set-asides, mandatory infiltration, or swales can pose barriers to better site design. For example, mandated sizing requirements for swales might consume land needed for connections to a higher intensity transit district. While preserving these standards for certain parts of the watershed, incentives can be created for alternative street designs by modifying stormwater management requirements in targeted areas. In addition, there are reasonable, low-maintenance, stormwater-management measures that can be used (even in densely developed, highly impervious areas) that result in very low runoff.

Although most literature on stormwater management discourages “connected impervious surfaces,” local governments need to recognize that, as part of an overall Smart Growth design, “connected streets” confer stormwater benefits. The placement of intense and connected development is not appropriate in every part of a watershed. However,

concentrating growth and development in certain parts of the watershed to protect more sensitive areas, such as headwaters, can be a viable strategy.

Developers who are accustomed to a conventional, separate pattern of development may sometimes resist new rules that require connecting internal streets to neighboring projects, adding sidewalks or introducing a mix of uses. Likewise, residents on unconnected streets may oppose efforts to improve connections within existing neighborhoods.

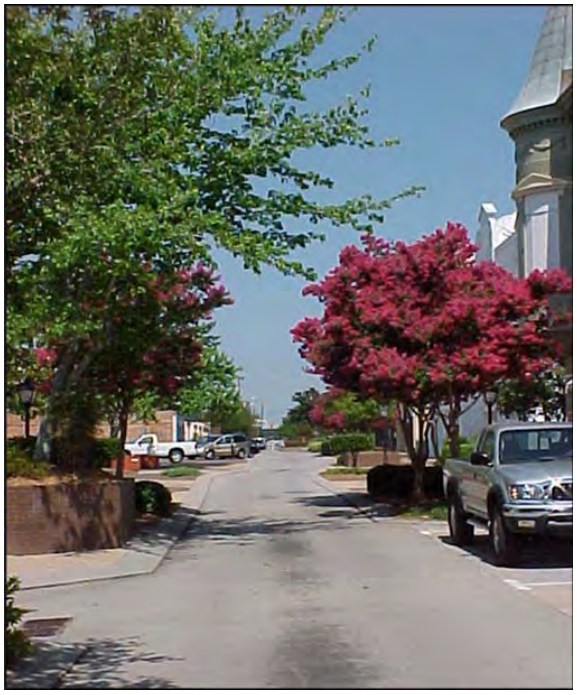
Finally, the street system alone will not bring about stormwater benefits. The relationship among the street layout, the development plan, and existing activity centers is crucial for obtaining stormwater benefits.

Maintenance

Even in circumstances where the overall surface area of a Smart Growth street layout results in less impervious coverage, there are maintenance considerations. Separate stormwater sewers typically discharge runoff with little or no treatment into receiving bodies. Thus, typical maintenance considerations for curb and gutter designs include street sweeping, catch basin cleaning, clearing blocked sewer lines, repairing and replacing failed pipes, and other aspects of maintaining buried, hard infrastructure.

Maintenance of aboveground bioretention/infiltration features such as swales and infiltration trenches largely includes vegetation maintenance. Depending on locations and designs, removal of accumulated sediment and debris is also usually necessary. Porous or pervious surface materials generally do not have additional maintenance requirements. In-line and end-of-pipe commercial swirl or filter devices require regular clean-out. All types of systems should have regular inspections to ensure they are functioning properly.

Urban Forestry



Practice Description

Urban forestry is the study of trees and forests located in and around towns and cities. Since trees absorb water, patches of forest and the trees that line streets can help provide some of the stormwater management required in an urban setting. Urban forests help break up a landscape of impervious cover, provide small but essential green spaces, and link walkways and trails.

Successful urban forestry requires a conservation plan for individual trees as well as forest areas larger than 10,000 sq ft. A local forest or tree ordinance is one technique for achieving conservation and, when specific measures to protect and manage these areas are included, urban forests and trees can help reduce stormwater management needs in urban areas. Guidance on conservation of natural areas in the Better Site Design handbook is useful for jurisdictions that wish to incorporate urban forestry in their stormwater management plan. Model development principles that apply to urban forestry include clearing and grading, tree conservation, riparian buffers, and stormwater outfalls (CWP, 1998).

Planning Considerations

From a stream preservation perspective, it is ideal to preserve as much contiguous forest as possible. However, this may not be an option in many urban areas. If forested areas are fragmented, it is ideal to retain the closest fragments together. In rapidly urbanizing areas, where clearing and grading are ongoing, tree preservation areas should be clearly marked.

Delineating lines along a critical root zone (CRZ) rather than a straight line is essential to preserving trees. It can also help reduce homeowner complaints about tree root interference into sewer or septic lines.

Numerous environmental and stormwater benefits result from urban forestry. Urban forests can act as natural stormwater management areas by filtering particulate matter (including pollutants, some nutrients, sediments, and pesticides) and by absorbing water. A study done by the U.S. Department of Agriculture's Center for Urban Forest Research found that a medium-sized tree can intercept 2,380 gallons of rain per year (CUFR, not dated).

Trees also absorb carbon dioxide, decrease temperatures, and provide habitat for urban wildlife. Urban forestry reduces noise levels and provides recreational benefits. There are numerous economic benefits to urban forests, including proven increases in property values. In addition, by preserving trees and forests, the costs of clearing and grading as well as erosion and sediment control can be reduced during construction. Maintenance costs are also minimized by keeping areas as natural as possible.

Annual maintenance costs of different types of green spaces (CWP, 1998)

Land Use	Approximate Annual Maintenance Costs
Natural Open Space *Only minimum maintenance, trash/debris cleanup*	$75/acre/year[1]
Lawns *Regular mowing*	$270 to $240/acre/year[2]
Passive Recreation	$200/acre/year[1]

[1] "Economic Impacts of Protecting Rivers, Trails and Greenway Corridors," 4th ed. 1995. Rivers, Trails and Conservation Assistance Program, National Park Service, Western Office, San Francisco, CA.
[2] "The Economic Benefits of Wildlife Habitat Enhancement on Corporate Lands." 1992. Wildlife Habitat Enhancement Council, Silver Springs, MD.

Design Criteria

An urban forestry plan should include measures to establish, conserve, or reestablish preservation areas. The basic building block of the plan is the critical root zone, or the area around a tree required for its survival. The CRZ is determined by tree size, species, and soil conditions. For isolated specimen trees, the CRZ can be estimated as 1/2 feet of radial distance for every inch of tree diameter. In larger areas of trees, the CRZ of forests can be estimated at 1 foot of radial distance for every inch of tree diameter, or a minimum of 8 feet.

Forest Preservation Ordinance

A forest preservation ordinance is one way to set design standards outlining how a forest should be preserved and managed. The ordinance should outline some basic management techniques and contain some of the following typical elements of a forest conservation plan:

- A map and a narrative description of the forest and surrounding area that includes topography, soils, streams, current forested and unforested areas, tree lines, critical habitats, and 100-year floodplain.
- An assessment that establishes preservation and reforestation areas.
- A forest conservation map that outlines forest retention areas, reforestation, protective devices, limits of disturbance, and stockpile areas.
- A schedule of any additional construction in and around the forest area.
- A specific management plan, including tree and forest protection measures.
- A reforestation and a forestation plan.

Site-Level Tree Preservation

An ordinance can also be developed that addresses tree preservation at the site level, both during construction and post-construction. This type of ordinance can be implemented on a smaller scale and integrated with a proposed development's erosion and sediment control and stormwater pollution prevention plans, which many communities require of new developments.

American Forests, a non-profit organization dedicated to preserving and restoring forests, adopted an ecosystem restoration and maintenance agenda in 1999. Their goal is to assist communities in planning and implementing tree and forest actions to restore and maintain healthy ecosystems and communities (American Forests, 2000). The agenda presents the organization's core values and policy goals as the basis for policy statements. It also provides information to help community-based partners prepare their own policy statements. Key policy goals include

- Increasing public and private sector investment in ecosystem restoration and maintenance activities;
- Promoting an ecosystem workforce through training, apprenticeship programs, and new job opportunities;
- Building support for innovative monitoring systems to ensure collaborative learning and adaptive management; and
- Encouraging a "civic science" approach to ecosystem research that respects local knowledge, seeks community participation, and provides accessible information for communities.

Common Problems

One of the biggest limitations to urban forestry is development pressure. Ordinances, conservation easements, and other techniques designed into management programs can help alleviate future development pressures. The size of the land may also limit the ability to protect individual trees. In such areas, a tree ordinance may be a more practical approach.

Forests may also harbor undesirable wildlife elements such as insects and other pests. If forests border houses, this may be a concern for residents.

Maintenance

Maintenance considerations for urban forests may require fringe landscaping and trash pickup. By using native vegetation and keeping the area as natural as possible, maintenance efforts can be minimized.