




Conservation Design Resource Manual

Language and Guidelines for Updating Local Ordinances

A planning tool from the Northeastern Illinois
Planning Commission and Chicago Wilderness

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 **northeastern illinois planning commission**


CHICAGO WILDERNESS

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Overview

This Conservation Design Resource Manual has been funded in large part by Chicago Wilderness in keeping with its goal of involving local governments in the processes of restoring and maintaining regional biodiversity.

The Resource Manual is written for use by local governments interested in modifying local comprehensive plans, zoning and subdivision ordinances, and other ordinances to accommodate the principles and practices of conservation design. In many cases, communities are committed to enhancing local residents' quality of life through natural resource conservation. However, outdated plans and ordinances may work in opposition to these conservation goals. In this document, four principles and 13 practices for conservation design are identified and discussed. For each of the 13 practices, model ordinance language is offered. Local governments can adapt this language to update their own local ordinances.

Local governments, communities, developers, and homeowners all can contribute to the protection of biodiversity by observing the four principles identified here:

- Develop Flexible Lot Design Standards
- Protect and Create Natural Landscape and Drainage Systems
- Reduce Impervious Surface Areas
- Implement Sustainable Stormwater Management Techniques

The goal of this Resource manual is to provide ample information about conservation design principles and practices, and to provide the necessary language to enable communities to implement conservation design at varying levels. The document is structured by practice, so that communities new to conservation design can begin with cautious modifications, while more experienced communities can more fully implement the ordinance revisions, which ultimately will lead to more comprehensive change. Communities that choose to implement conservation design will see a variety of benefits, including reduced flooding, improved water quality, enhanced biodiversity, higher property values, higher property tax revenues, and greater community cohesion.



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Chapter 1

Introduction

This is one of a series of planning aids and manuals prepared by the Northeastern Illinois Planning Commission (NIPC) as a service to local governments.

The primary aim of this Conservation Design Resource Manual is to assist communities in northeastern Illinois in creating regulations conducive to conservation design.

Conservation design is a density neutral design system that takes into account the natural landscape and ecology of a development site and facilitates development while maintaining the most valuable natural features and functions of the site.

The intent of this document is to provide practical alternatives to conventional zoning, subdivision, weed-control, and other development-related ordinances. In many cases, conventional ordinances conflict with the goals of conservation design. With thoughtful revision, most existing ordinances can be modified and updated to not only allow, but encourage residential, commercial, and mixed-use development that is sensitive to both the natural ecology of the development site and economic needs of the community, land owner, and developer.

Several practices outlined here apply most directly to residential subdivision design. However, conservation design is by no means limited to residential subdivisions. The principles apply to the design and construction of any type of development, and should be applied as widely as possible.

A Regional Conservation Perspective: Chicago Wilderness

In 1999, the Chicago Region Biodiversity Council, or Chicago Wilderness, published its Biodiversity Recovery Plan for the northeastern Illinois region. The Biodiversity Recovery Plan is now a guiding document for the organization and its more than 160 members; Chicago Wilderness seeks to support various projects that further the goals outlined in the Plan. Chicago Wilderness recognizes the importance of restoring, protecting, and managing natural resources for the benefit and enjoyment of the residents of the Chicago region, for the economic growth that results from resource conservation, and for the environmental benefits realized.

The Biodiversity Recovery Plan notes that while traditional land management agencies, such as forest preserve and conservation districts, have a clear mandate to protect biodiversity, the involvement of local governments also is critical if the goals of the Plan are to be achieved. This conclusion is born out by the fact that while 200,000 acres of natural land are protected under the umbrella of Chicago Wilderness, that leaves 90 percent of the landscape subject to the planning, development, and management decisions of local governments.

With the importance of local government participation in mind, the Biodiversity Recovery Plan states the following **Goal for Local Governments**:

- Local and regional development policies should reflect the need to restore and maintain natural areas and biodiversity.

Three **Objectives for Local Governments** are offered as methods of pursuing this goal:

- Inventory sensitive habitats and identify opportunities for open space preservation and restoration.
- Modify comprehensive plans, ordinances, and engineering practices to consider the impacts of development on biodiversity.
- Incorporate provisions for biodiversity protection and restoration in the design plans for new development and redevelopment

For more information about Chicago Wilderness and the Biodiversity Recovery Plan, visit Chicago Wilderness on the web at www.chicagowilderness.org. For more information on an array of programs and techniques, see NIPC's publication Protecting Nature in Your Community. (Available on the web at http://www.nipc.cog.il.us/protecting_2001%20.htm.)

What is Conservation Design?

Conservation design is a design system that takes into account the natural landscape and ecology of a development site and facilitates development while maintaining the most valuable natural features and functions of the site. Conservation design includes a collection of site design principles and practices that can be combined to create environmentally sound development. The main principles for conservation design are:

1. flexibility in site design and lot size,
2. thoughtful protection and management of natural areas,
3. reduction of impervious surface areas, and
4. sustainable stormwater management.

A similar term, **conservation development**, is used to describe a development that is designed and constructed using the principles of conservation design. Conservation design is one of many tools available to communities committed to implementing sustainable development practices. **Sustainable development** is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

In the context of this ordinance, conservation design is **density neutral**, meaning that designers plan development such that there is no overall loss of buildable units despite the conservation goals achieved on the site. Existing community standards for density and land use are not challenged here; rather, the practices given here offer alternative design strategies that are more environmentally friendly while maintaining existing densities and land uses.

In a residential conservation subdivision, for example, house lot size is substantially decreased, so that large areas of contiguous natural areas can be conserved with no net loss of housing units. In contrast, conventional development techniques often involve carving the development site into parcels such that the lots and road rights-of-way consume nearly all developable land without regard for the natural conditions on the site. Developments constructed this way often have wide roads, minimal pedestrian access, and may be similar in character and design to many other neighborhoods. While development pressures are heavy in urban and urbanizing areas, increasing attention has been given to the necessity of preserving rural, agricultural, and important environmental lands even as development continues.

The two graphics below (Conservation Design Forum, 2003) show the difference between conventional and conservation design. Figure 1 shows a conventional subdivision layout, where the entire site is converted to roads and building lots. Figure 2 shows the same site with the same number of building lots laid out using conservation design practices. Note that natural areas and features of the site are preserved in the conservation design model, where this preservation is not possible using conventional design.



Figure 1: Conventional Subdivision Layout (Conservation Design Forum, 2003)



Figure 2: Conservation Subdivision Layout (Conservation Design Forum, 2003)

What are the Benefits of Conservation Design?

Through conservation design techniques, development and a healthy natural environment need not be mutually exclusive. The benefits of conservation design are substantial. Communities, developers, and homeowners all can benefit from well planned and implemented conservation design. The environment is another major beneficiary; while it may be difficult to quantify the value of an expanse of habitat, an undisturbed streambank, or a panoramic view protected from careless development, there is little disagreement that conserving these resources is an important aim.

The benefits of conservation design fall roughly into three categories, quality of life benefits, environmental and biodiversity benefits, and economic benefits. Chapter 2, Economic Benefits of Conservation Design, lists in detail many economic benefits of the conservation design practices.

Quality of Life Benefits

Conservation design addresses concerns about community interaction and access to the natural environment. In addition to potentially conserving large areas of valuable natural resources, conservation design may create a variety of formal and informal public spaces within developments. These spaces create opportunities for neighbors and residents to meet and to build community together. Conservation design offers a variety of recreational prospects which may include organized group activities such as picnics or soccer games, biking or walking in natural areas, or observing the plants and wildlife that thrive in preserved habitats. For residents of conservation developments, these amenities can make a noticeable difference in the quality of daily life.

Increasingly, notice is being given to the importance of community and social interaction in residential neighborhoods. Large homes, private backyards, and automobiles work together to make it possible for residents of conventional suburbs to spend all their time in private space without interacting with neighbors. While this type of privacy was once considered an advantage, many people now seek alternatives to the conventional subdivision lifestyle. Conservation design offers just such an alternative, and experience has shown that homes in these developments will be increasingly valuable as homebuyers increasingly demand access to nature and community along with the residences they purchase.

Environmental and Biodiversity Benefits

Thoughtfully implemented conservation design practices are beneficial to the natural environment in a number of ways.

- Protected water quality
- Reduced flooding
- Protected habitat and biodiversity
- Protected and recharged aquifers

In short, while conventional development practices have historically led to flooding, degraded water quality, and habitat destruction, conservation design practices work together to counteract these negative consequences of development. Through the practice of conservation design, communities can protect valuable natural resources even while growing and expanding.

Economic Benefits

There are various economic benefits of conservation design. Communities, homeowners, and developers all can benefit economically from the use of the conservation design practices presented here. For a detailed discussion of these economic benefits, see Chapter 2, *Economic Benefits of Conservation Design*.

Why Update Local Ordinances?

The community, environmental, and economic benefits of conservation design are clear, and for most communities, the use of conservation design makes sense for at least some types of development. While there are many ways to approach conservation design, the most effective way is to update local comprehensive plans, codes, and ordinances to reflect the community's commitment to conservation. Most importantly, conservation design should be allowed *by right* and should be the preferred option for many development projects.

Presently, conservation design projects in most communities are approved through the Planned Unit Development (PUD) process. While the PUD process has the advantage of allowing the Plan Commission to maintain close oversight of unconventional development projects, the process is burdensome for both developers and planning staff. A major benefit of updating local ordinances to allow conservation design by right is that it reduces the approval time for projects. This saves time and aggravation for all parties involved in the development process, and as a result also saves money.

Conservation Design and Sprawl

An occasional critique of conservation design is that while it is presented as an environmentally responsible development form, it encourages development of previously undisturbed (greenfield) sites on the urban fringe and ultimately leads to sprawl, albeit more responsible sprawl. Several responses can be made to this critique.

First, development on the urban fringe is inevitable. Conservation design recognizes this inevitability and defines methods by which development can be sensitive to the natural areas and systems of the development site.

Second, conservation design does not position itself as a comprehensive solution to the challenges of urban and suburban development. The more inclusive umbrella of "sustainable development" seeks to address these challenges more fully, while conservation design addresses specific situations. In keeping with this limitation, please keep in mind that this resource manual is not a comprehensive treatment of sustainable development practices. A comprehensive document would include discussion and ordinance language for Traditional Neighborhood Development, mixed-use development, urban infill development, New Urbanism, brownfield redevelopment, energy efficiency, farmland preservation, and other practices. This resource manual focuses exclusively on conservation design. While a comprehensive resource manual is beyond the scope of this project, it is anticipated that future projects will address other aspects of sustainability.

Finally, the development principles and practices offered here are highly adaptable. While all practices may not be relevant to all development projects, certainly the environmental impact of nearly any development can be reduced through the employment of conservation design practices. When planning revisions to local codes and ordinances, consider that while some practices may be applicable only in lower density zones, others may apply to all development regardless of its location.

How to Use This Resource Manual

This resource manual is meant as a guide and is not intended to be adopted “as-is.” Rather, it allows each community to adapt the language and concepts to best fit the unique circumstances of that community.

The model ordinance language has not been organized by type of ordinance (subdivision, zoning, etc.). Rather, in order to respond to the unique regulatory environment of each community, the information has been organized by the principles and practices of conservation design. To use the resource manual, begin by selecting the practices that would be most applicable to your community, then adapt the model language given with each concept to update the appropriate existing ordinance. Communities desiring to implement conservation design in place of the Planned Unit Development process should consider incorporating all or nearly all of the practices into the zoning and subdivision ordinances. This large scale adoption is most helpful in creating a predictable development approval process, which will encourage developers to utilize the conservation design practices.

To facilitate the amendment of local ordinances, introductory language to be added to zoning and subdivision ordinances is also provided. Again, although several of the practices apply most directly to residential subdivision developments, most of the suggested practices offered here can be adapted to enhance nearly any type of development.

Chapters 3 and 4 of this resource manual contain the majority of the information and language for conservation design. Chapter 3, Integrating Conservation Design Principles into Local Plans and Ordinances, addresses the basics of enabling conservation subdivision design in your local comprehensive plan and development ordinances. Chapter 4, Site Design Practices for Conservation Design, gives detailed information about the principles and practices suggested for conservation design, including ordinance language to enable each practice. Chapter 4 also lists several additional references for the four major conservation design principles; these references should be consulted by communities wishing to conduct additional research into the principle. Additional information is provided in the Appendices. Of particular interest is Appendix A, which contains a list of definitions for conservation design. Appendices B – E provide expanded technical discussions of key concepts.

While most ordinances contain a section on the development review process, such language was not included here because the review process varies widely by locality.

Text in [brackets] indicates terms that need to be written specifically for the local jurisdiction, such as the jurisdiction name. Similarly, blank lines (_____) in the model ordinance language should be filled in. Suggestions for filling these blanks will be provided in the commentary. Definitions may need to be added to the appropriate portion of the local code if they are not elsewhere used or if they are used in a different context. Depending on the structure of the local code, some elements of the ordinance may need to be inserted into the zoning code and others may need to be added to the subdivision or development ordinance.

It is impossible to draft a model ordinance to fit perfectly into all of the innumerable varieties of regulatory programs that exist at the local government level. The ordinance language given here is designed to be adapted to the unique characteristics of each local government organization. The ordinance language can be combined with or replace existing ordinances, such as weed ordinances, which address issues covered by the resource manual. It is presumed that some provisions of the ordinance will be modified or possibly even rejected altogether. Some provisions may have to be added.

Introduction to Principles and Practices for Conservation Design

The following four principles have been identified as essential considerations in the Conservation Design process:

- 1. Develop Flexible Lot Design Standards**
- 2. Protect and Create Natural Areas and Drainage Systems**
- 3. Reduce Impervious Surface Areas**
- 4. Implement Sustainable Stormwater Management Techniques**

Thirteen specific site design practices are presented to implement these principles. A list of these appears below. The practices are organized by principle, with each practice being listed under the subsection for the most relevant principle. The practices are designed to have specific suggestions, guidelines, and language for implementation. The principles and practices outlined here are discussed in detail in Chapter 4.

Principle A. Develop Flexible Lot Design Standards

- Practice 1. Lot Size, Density, and Suggested Open Space
- Practice 2. Arranging the Development Site
- Practice 3. Building Setbacks

Principle B. Protect and Create Natural Landscapes and Drainage Systems

- Practice 4. Natural Area Protection and Conservation
- Practice 5. Natural Landscape Sensitivity
- Practice 6. Natural Landscaping
- Practice 7. Open Space Management

Principle C. Reduce Impervious Surface Areas

- Practice 8. Roadway Design
- Practice 9. Parking Lot Design
- Practice 10. Vegetated Swales
- Practice 11. Walkways
- Practice 12. Driveway Design
- Practice 13. Roof Runoff Management

Principle D. Implement Sustainable Stormwater Management Techniques

- Urban Runoff Mitigation Plan

Chapter 2: Economic Benefits of Conservation Design

The economic benefits of conservation design are interrelated among the various conservation design principles. Few principles have stand alone economic benefits, but rather one benefit often produces another, typically producing environmental benefits as well; as a result it is useful for readers to consider the benefits across all four principles, below. In addition, the economic benefits of conservation design accrue to communities, homeowners, and developers.

According to Arendt (1999), the primary economic benefits of conservation design can be summarized as:

- greater areas of preserved open space,
- lower construction and maintenance costs associated with reduced infrastructure,
- real estate value appreciation, and
- a marketing and sales advantage.

Actual economic benefits in real dollar terms are difficult to present in a one-size-fits-all basis and cannot be presented herein. Local costs of supplies, labor, and equipment vary across the Chicago metropolitan region, and net costs are affected by the size of a particular development and the extent to which it incorporates the various conservation design practices. In addition, specific long-term maintenance costs need to be considered.

As a result, each section below provides examples of economic benefits realized by various communities that have employed the conservation design practices detailed in the next chapter. By illustrating the factors involved, the scale of the benefit, and how they accrue to the community, homeowners, and developers, communities can formulate how the economic benefits will apply to them.

Please note that many of these benefits cross over various principles.

Benefits of Principle A—Develop Flexible Lot Design Standards

Practice 1. Lot Size, Density, and Suggested Open Space

Practice 2. Arranging the Development Site

Practice 3. Building Setbacks

Community Benefits

- Minimizes stormwater runoff and its negative impacts.
- Preserves natural resources and features.
- Produces a broader range of marketable housing.
- Clarifies and simplifies the development review process.
- Reduces the municipal cost of open space, since natural areas are acquired more economically through conservation design than through outright purchase.
 - ◊ Conservation design provides open spaces and buffers without the need to incur direct public expenditures to obtain or protect such areas. This results in a significant cost savings for municipalities while still deriving the social benefits of open space. Furthermore, municipalities can increase the value and the size of any existing public parkland by implementing zoning and other ordinances that specify adjacent parkland buffers as a required design element in new subdivisions (Arendt 1999).

- Reduces long-term maintenance and development costs, since infrastructure (roads, sewer, streetlights, water, etc.) is reduced.
- More compact layouts result in shorter sewer and water connections and arterial roads. This reduces the public sector's long-term infrastructure maintenance costs. CH2MHill found that although demand for public services is relatively insensitive to lot size or density, the public service costs of compact cluster developments were still 4 to 8 percent lower than the cost for large lot developments (CWP 1995).
- Increases the community real estate tax base. It has been found that property values in conservation developments are considerably higher than conventional developments (see Homeowner Benefits below). As property values increase, so too do real estate property taxes, which are often a municipality's prime sources of funds.

Homeowner Benefits

- Increases property values.
 - ◇ Property values in developments where houses are grouped together have been found to appreciate more rapidly than homes in conventional developments. For example, a Massachusetts study compared two subdivisions where homes in developments of similar densities (two dwellings per acre) initially sold for similar prices. Over a 20-year period, the conservation development homes (built on quarter-acre lots) sold for an average \$17,000 more than their counterparts (built on half-acre lots). This resulted in a 13% price differential attributable to the 36-acre open space amenity available at the grouped development (Arendt 1999).
 - ◇ In an Ohio conservation designed subdivision, open space and lot buffering added a 10% price premium over other homes within the same subdivision. Further, these homes (on 0.6-acre lots) had a 3% price premium over larger 1-acre lots in a nearby conventional subdivision. Home buyers in this case were willing to pay a premium for smaller lots when the value of open space was associated with a home purchase (The Countryside Program 1998).
 - ◇ A variety of real estate appraisal studies across the country have found that real estate values of individual properties are higher the closer they are to open space. For example, in 1974 a study was conducted in Philadelphia of properties located near a 1,300-acre park. The study found that properties at a distance of 2,500 feet from the park had values that were 4.2% higher than properties located farther away. Properties located 1,000 feet from the park had values that were 9% higher, and a property only 40 feet from the park had a 33% higher value. The study also concluded that each acre of parkland generated about \$2,600 in increased property values (Brabec 1992).
 - ◇ Similarly, a 1978 study in Boulder, Colorado, found that house prices declined by an average of \$4.20 for each foot of distance away from a greenway. Homes adjacent to the greenway were found to be valued 32% higher than similar residences located 3,000 feet away (Brabec 1992).
- Enhances access to recreational opportunities is enhanced, as more natural areas are created.
 - ◇ Home buyers value the social and recreational amenities associated with the open space. This creates an additional economic benefit to households by reducing automotive transportation that would otherwise be needed to travel to social and recreational opportunities (Arendt 1999).
- Reduces landscape maintenance needs. (See Principle B, below, for specific examples.)

Developer Benefits

- Increases predictability of development approval process.
- Enhances marketability of homes.
- Lowers development costs.
 - ◇ The primary economic benefits of grouping homes are the reduced construction costs associated with developments. In general, construction cost savings of 25% or more have been realized throughout the

country when grouping large lot (1 acre or more) developments. These cost savings are not as great when smaller, half-acre lots are grouped, where a cost savings of about 10% has been realized (CWP 1995).

- ◇ In 1992, CH2MHill found that as the distance between individual dwelling units decreases, the total cost of subdivision infrastructure declines proportionally (CWP 1995).
- ◇ Depending on how open space is incorporated into residential site design and how stormwater is managed, construction/infrastructure cost savings of between 11% and 66% can be realized (CWP 1998).
- Enhances design flexibility.
- Saves development costs when natural areas are transferred to the community.

Benefits of Principle B—Protect and Create Natural Landscapes and Drainage Systems

Practice 4. Natural Area Protection and Conservation

Practice 5. Natural Landscape Sensitivity

Practice 6. Natural Landscaping

Practice 7. Open Space Management

Community Benefits

- Reduces flooding and stormwater management costs.
 - ◇ Buffers provide temporary storage of floodwaters in headwater streams, which reduces the height of a flood crest and the subsequent cost damages to downstream communities (CWP 1995).
- Reduces long-term maintenance costs.
 - ◇ Unlike storm sewers, curbs, gutters, and sewer inlets, swales and filter strips theoretically never need to incur replacement costs (except in cases of extreme erosion), but rather require periodic maintenance consisting of sediment or debris removal and general cleaning (NIPC 1997a).
 - ◇ Filter strips may reduce maintenance costs for components of downstream drainage systems because they remove sediment and other pollutants (NIPC 1997a).
 - ◇ Swale maintenance costs can be reduced if upstream sources of sediment—particularly from construction activities—are well controlled, and if local ordinances are enforced prohibiting homeowners from dumping materials into swales (NIPC 1997a).
- Meets increasing demand for public open space.
 - ◇ Natural landscaping can serve as a buffer to existing preserved natural areas, thereby increasing the size of the natural area. This provides a continuous natural ecosystem setting and enhances the “connection to nature” that is important to communities (The Countryside Program 1998).
- Allows connections to existing natural areas, open space, greenways, and trails.
- Reduces soil erosion.
- Reduces need for fertilizer and pesticides.
- Conserves local, often rural, areas of biodiversity.
- Preserves rare, threatened, and endangered species.
- Increases opportunity for passive recreational and educational activities -- fosters health and fitness of residents.

- Improves air and water quality, and controls urban heat.
 - ◇ The Chicago urban forest canopy covers about 11 percent of the city's total land area. This canopy removes 15 metric tons of carbon monoxide, 84 metric tons of sulfur dioxide, 89 metric tons of nitrogen dioxide, 191 metric tons of ozone, and 212 metric tons of particulates. This saves the municipal government more than \$1 million annually in what would otherwise be spent on traditional pollution mitigation efforts (Scheer 2002).

Homeowner Benefits

- Increases property values. (See Principle A, above.)
- Decreases maintenance costs. (Also see community benefits, above.)
 - ◇ Turf grasses require fertilizers, water, pesticides and other measures annually to keep lawns in quality condition (The Countryside Program 1998). Native landscapes require weed control and minimal watering in the first few years to get established, then occasional mowing or controlled burns for long-term management (Pizzo & Associates 2001).
 - ◇ Smaller yards that have natural landscaping require less maintenance thereby not only reducing costs but also allowing people more free time to spend enjoying the open space amenities located around them (Arendt 1999).
- Enhances aesthetics.
- Maintains productive land uses.
 - ◇ Natural area protection can conserve highly productive agricultural land. For example, Prairie Crossing has a 10-acre, community-supported organic farm from which 100 member families receive a bushel of fresh produce and cut flowers each week during the 20-week growing season for an annual subscription of \$400. Thus, the conservation effort is able to generate revenues (Brabec 1992).

Developer Benefits

- Reduces landscaping and other installation costs.
 - ◇ Installation and maintenance costs are lower for natural (native) landscaping compared with common turf grasses. Pizzo compared the installation and maintenance costs of new turf grass lawn from seed with the costs of native landscaping with seed in an area less than one acre. He found that installation costs were \$5,330 for native landscaping and \$8,190 for turf grass. Thus, native landscaping installation showed a 35 percent cost savings over turf grass. Over a 10-year period, the cost to install and maintain native plantings came to \$14,152. The same costs for turf grass came to \$47,497. Thus, native landscaping installation and long-term O&M costs showed a 70 percent cost savings over turf grass (Pizzo & Associates 2001).
 - ◇ In a 1996 study, the cost to install and maintain native plantings over a 10-year period came to \$9,800 per acre. The same costs for Kentucky blue grass came to \$59,400 per acre. Thus, native landscaping installation and long-term O&M costs showed an 83 percent cost savings over turf grass (NIPC 1997b).
 - ◇ A comparison of annual maintenance costs found that open space costs about \$75 per acre to manage, lawns cost about \$255 per acre, and passive recreation areas (trails, bike paths, etc.) cost about \$200 per acre (CWP 1998).
- In a California development, virtually all the runoff flows into a gravel-filled infiltration trench meandering through open areas behind most of the homes. This natural stormwater management design saved approximately \$800 per household in engineering and construction costs, which enabled the developer to increase the landscaping budget by a like amount.
- Enhances marketing potential.
 - ◇ The marketability of a development is enhanced by the lower maintenance aspects associated with native landscaping and smaller lawns. A 1995 Newsweek survey found that two-income families prefer smaller lawns in order to reduce their lawn maintenance activities (CWP 1998).
- Enhances developer reputation for innovative development.

Benefits of Principle C—Reduce Impervious Surface Areas

Practice 8. Roadway Design

Practice 9. Parking Lot Design

Practice 10. Vegetated Swales

Practice 11. Walkways

Practice 12. Driveway Design

Practice 13. Roof Runoff Management

Community Benefits

- Decreases demand for stormwater runoff management.
- Reduces municipal maintenance costs.
 - ◇ Reduced residential street widths and lengths reduce the associated long-term operation and maintenance costs of local infrastructure (CWP 1998). These costs include 1) road repair and replacement, 2) utility repair and replacement, 3) snow removal, 4) inspections, and 5) street sweeping.
- Reduces municipal energy costs.
 - ◇ Impervious surfaces such as roads and roofs are known to create heat islands, trigger chemical reactions that produce smog, and boost energy demand. Reduced impervious surfaces (along with natural area landscaping with trees) can reduce energy costs (American City & County 2000).
- Improves water quality and quantity.
 - ◇ In the Chicagoland area, Lake Michigan water is not available to most newly developing areas, and water rates are increasing to the existing populations served. Reducing impervious surface area allows more stormwater to infiltrate into the ground and recharge groundwater aquifers. This provides a valuable natural resource, which could lead to greater water supplies in developing areas.

Homeowner Benefits

- Increases chances of friendly interaction with neighbors, since compact transportation network boosts proximity to neighbors.
- Increases biodiversity in nearby wetlands and water bodies, since impervious areas are reduced, saving habitats.
- Reduces residential street widths that allow parking tend to slow drivers down, creating safer roads.
 - ◇ A 1998 study by Peter Swift illustrates that as street width widens, accidents per mile per year increases exponentially, and that the safest residential street width is 24 feet (Swift 1998).

Developer Benefits

- Decreases development costs.
 - ◇ Reduced impervious surface area immediately results in reduced infrastructure engineering and construction costs. To the extent that street pavement is reduced, the size and cost of stormwater management facilities also can be lessened (Arendt 1999). For each increment of impervious cover that is reduced, developers gain a proportional reduction in infrastructure construction costs (CWP 1995).
 - ◇ The cost of a curb-and-gutter/storm drain pipe system ranges from \$40 to \$50 per running foot in 1990 dollars, which is about 2 to 3 times more expensive than an engineered swale (CWP 1998).
 - ◇ Roadside swales with culverts at road and driveway crossings are generally less costly to construct than curb-and-gutter storm sewers. In a Lake County, Illinois study the cost savings were about \$70,000 per mile of road for a typical residential subdivision with half-acre lots, or nearly \$800 per residence (NIPC 1997a).

- ◇ Construction costs for paving are approximately \$15 per square yard in 1998 dollars. Reducing the width of a 300 foot long residential street from 28 feet to 18 feet would reduce overall imperviousness by 35% and construction costs by \$5,000 (CWP 1998).
- ◇ The cost savings associated with eliminating just one parking space is about \$1,100 (in 1990 dollars). Additional cost savings can be realized in the form of lower costs for storm drains, Best Management Practices (BMPs), and associated maintenance (CWP 1995).

Benefits of Principle D—Implement Sustainable Stormwater Management Techniques

Urban Runoff Mitigation Plan

- Increases marketability - developments with improved stormwater management facilities are more marketable because they provide aesthetic features such as rain gardens, wet detention basins, and natural drainage areas that attract wildlife.
- Because stormwater management benefits cross the various principles and practices, only the above economic benefit is listed here. Other benefits related to stormwater management are distributed throughout Principles A, B, and C.

Chapter 3

Integrating Conservation Design Principles into Local Plans and Ordinances

We recognize that the communities that choose to enable conservation design in local ordinances will have a variety of regulatory environments. For that reason, this resource manual is structured to offer ordinance language for various site design techniques. Each community will choose which practices to adopt, and then through review of existing ordinances may find it necessary to update the most relevant sections of zoning, subdivision, or other regulations.

A few concepts will apply to nearly every regulatory environment. These are given here as preparatory work to be undertaken by any community embarking on the process of updating local ordinances for conservation design.

For communities looking for a more in-depth discussion of the processes involved in planning and enabling conservation design, refer to Randall Arendt's books *Growing Greener* and *Conservation Design for Subdivisions*.

The sections that follow will address Conservation Design as it relates to:

- Comprehensive Plans
- Zoning Ordinances
- Subdivision Ordinances
- Other Existing Ordinances
- Other Local Departments and Agencies

A. Comprehensive Plans

Update the community comprehensive plan to reflect a commitment to conservation design goals.

A comprehensive plan establishes a community's goals, objectives, and policies, and shows an overall pattern of land use that a community believes will help achieve these goals. Updating and maintaining a current comprehensive plan is an important way to maintain communication between the many stakeholders in the development of your community. The comprehensive plan sets the tone for the type of improvements and developments that your community is seeking, and gives cues to residents and developers about the kinds of projects that are likely to be supported.

For those communities interested in protecting unique local natural, agricultural, cultural and historical elements through conservation design practices, the comprehensive plan provides an opportunity to create a strong foundation for regulatory changes.

Strategies

1. Provide background information, including information about the heritage of the community, and the natural, agricultural, historical, and cultural resources that define the quality of life for community residents.
2. Include conservation goals and objectives in the goals and objectives section of the plan. These may include protection of sensitive natural areas, habitat protection, sustainable water resource management, and other goals.

3. Complete a community resource inventory and include this information in the plan.
4. Include a greenway or green infrastructure plan for the community within the comprehensive plan.
5. Be certain that the plan is formally adopted as a blueprint to guide future development in the community.
6. Wherever possible, repeat language from the comprehensive plan in the regulatory ordinances. (Arendt 1999, 20).

For more technical information, NIPC's *Environmental Considerations in Comprehensive Planning* and *Protecting Nature in Your Community* provide detailed practical advice for updating the community comprehensive plan to include environmental considerations. Copies of these documents are available from NIPC's publications department; call (312) 454-0400 with inquiries. *Protecting Nature* also is available on the web at http://www.nipc.cog.il.us/protecting_2001%20.htm.

B. Zoning Ordinances

Ensure that conservation design is encouraged under the community zoning ordinance.

Zoning ordinances must be reviewed and updated to allow conservation design in appropriate districts. In most communities, conservation design currently can be accomplished only through the Planned Unit Development (PUD) process. The PUD process has some major advantages. By requiring unconventional developments to go through this process, the community maintains a high level of control. Also, the public has a greater opportunity to review and comment on proposals. However, one of the primary reasons developers give for avoiding conservation design is the time consuming and uncertain nature of this process. In most cases, no special review or approval is required to build conventional developments, while it is complicated and time intensive to build conservation developments. With regulations like these in place, communities may inadvertently create obstacles to progressive growth strategies such as conservation design.

The minimum goal of updating the zoning ordinance is to create a level 'playing field,' where conservation design enjoys regulatory support equivalent to conventional development. Communities that are committed to the outcomes of conservation design may wish to strengthen the language even more, enough to tilt the 'playing field' toward conservation. The recommended approach is to allow conservation development **by right** in the zoning, so that no special approvals are required.

The following are three recommended approaches to including conservation design in a local zoning ordinance. Any of these zoning options creates a regulatory environment where conservation design is permitted by right. In all cases, the conservation zoning is in place, and the conservation design option is available for the property owner to utilize. Since no additional time or expense is needed to legislatively create the enabling conservation zoning, there is greater opportunity that this option will be selected over the standard subdivision option. Additionally, the community has indicated to its residents where and under what conditions conservation design is appropriate. In each option, once the property is zoned, subsequent project review occurs administratively by the planning department or similar administrative body. In some cases communities may choose to combine two or more of these options to meet the conservation needs of different areas of the community.

Option 1:

The municipality or county adds conservation design (in conjunction with a particular set of land uses) to the list of permitted uses in an existing district.

Option 2:

The municipality or county creates a Conservation Design District and applies it as an “overlay” district to those selected locations that the community deems suitable for conservation design. In this option, the property owner has the option of developing the land according to the underlying standard district regulations or the overlay conservation design option. With the overlay district, conservation design is only an option in those locations with the overlay designation. (See Appendix C, *Conservation Design Incentives*, for a discussion of how developers might be encouraged to choose to exercise the conservation design option.)

Option 3:

The municipality or county designates certain districts on the zoning map as Conservation Design Districts; conservation design is the required design practice in these areas. This more aggressive strategy requires conservation design practices to be utilized in designated areas.

Other strategies exist, but the above three are recommended. Strategies not recommended include creating a conservation design district that can be utilized at the request of the property owner and establishing conservation design as a conditional use in some districts. These strategies do not allow conservation design as a permitted use and as such are not suggested as long term solutions.

To determine where conservation zoning should be applied, each community will consider the following questions through the comprehensive planning process:

1. What resources in the community are most important to conserve?
2. Where is the application of conservation design most beneficial?
3. What standards are appropriate in the conservation design regulations to conserve the natural resources and otherwise achieve the community's objectives?

Conservation Design in Every Project

Whatever decision is made regarding conservation zoning, some combination of the site design practices outlined in Chapter 4 is appropriate for all types of development. Whether or not a proposed development is formally considered a conservation design under the zoning code, all of the practices should be encouraged or required where appropriate. For this reason, as each community reviews its ordinances, many practices may be enacted for all development, regardless of zoning classification.

The following model zoning ordinance language can be adapted to add conservation design to the existing zoning ordinance in conjunction with particular land uses in appropriate zoning districts. This language allows conservation design as outlined in Option 1, above. Introductory language is also provided that can be adapted to formally introduce the community's commitment to conservation principles.

Model Zoning Ordinance Language

(Adapted from the Countryside Program)

Purpose

The primary objective of conservation design zoning is to promote the health and safety of the community through the application of flexible land development techniques in the arrangement and construction of dwelling units, roads, surface drainage, and underground improvements. Such flexibility is intended to retain for the property owner the development rights (the number of residential dwelling units) that are permitted under the existing conventional zoning for the property while encouraging environmentally responsible development.

These regulations are intended to achieve these corollary purposes:

- A. To maximize protection of the community's natural resources by recognizing the following goals:
 1. Protect and enhance biodiversity as stated in the Chicago Wilderness Biodiversity Recovery Plan;
 2. Minimize development on and destruction of sensitive natural resource areas and wildlife habitats;
 3. Reduce the quantity and improve the quality of stormwater runoff from expected development;
 4. Provide a wider range of feasible sites to locate stormwater Best Management Practices (BMPs);
 5. Minimize impervious surface area;
 6. Reduce potential pressure to encroach on resource buffer areas;
 7. Reduce soil erosion potential;
 8. Reduce the capital cost of development;
 9. Reduce the cost of public services required by the development; and
 10. Increase future property values.
- B. To reduce the time and effort required for administrative review of conservation design proposals, for the benefit of both the planning department and the developer.

Commentary

These objectives should be carefully worded to include the specific characteristics within the community that have been determined to be priorities for conservation.

Points 1-10 are examples of the types of conservation goals a community may wish to set. Each community can select the goals that best match its own, or can draft new statements better suited to community goals and intentions. (Note: Because of road and stormwater design, these goals should be listed in the subdivision ordinance language as well; it is strongly suggested to repeat the language in both places and to make the list of goals identical.)

Model Zoning Ordinance Language (continued)**Commentary****Permitted Uses**

The following uses shall be permitted based on the type of development proposed:

- A. Conservation design in accordance with the regulations set forth in Sections ___ through ___, inclusive:
1. Detached single-family dwellings;
 2. Single-family cluster dwellings;
 3. Single-family attached dwellings;
 4. Multi-family dwellings;
 5. Recreation facilities;
 6. Commercial, industrial, and office facilities;
 7. Natural areas;
 8. Combinations of the above, known as mixed-use development.

B. [OTHER PERMITTED USE]

C. [OTHER PERMITTED USE]

The section references here should be completed with numbers of the sections of the zoning or subdivision ordinances that define conservation design.

See definition of “dwelling” for more information, or use community’s existing land use definitions. The more flexibility the applicant has in the arrangement of units, the greater the ability to effectively group the units and conserve meaningful natural areas and environmental resources, thus achieving the conservation objectives. Attached units are strongly suggested when the permitted density is two units per acre or higher, otherwise it may not be possible to achieve significant open space or to aggregate the natural areas in a desirable manner.

Depending on the zoning district, some of the uses listed here may not be appropriate.

Conservation design is added to the list of permitted uses if used in conjunction with a specific set of land uses within designated zones. The other permitted uses (single-family residential, mixed-use, agriculture, etc.) remain in effect as well.

C. Subdivision Ordinances

Rewrite sections of the subdivision ordinance to ensure sufficient flexibility for conservation design.

Language is offered in Chapter 4 for updating ordinances with regard to specific site design practices. The following model ordinance language can be incorporated into the subdivision ordinance to formally introduce the community’s commitment to conservation design.

Model Subdivision Preamble Language

(Adapted from the Countryside Program)

Purpose

The [Municipality or County] has established (or may establish) conservation design standards and procedures within [Municipality or County] zoning resolutions. Therefore, it is intended that subdivision regulations are sufficiently flexible to carry out the conservation design objectives while ensuring that such development is consistent with the underlying purposes of these subdivision regulations.

Conservation design is intended to encourage more efficient use of land and public services through unified development that is principally intended to protect biodiversity, conserve community resources, preserve natural areas, and protect the health and safety of the community. These objectives are accomplished through land development techniques set forth in municipality or county zoning resolutions that permit flexibility in the arrangement and construction of dwelling units, roads, and other built elements. Therefore, this Chapter establishes reasonable standards and criteria to likewise permit sufficient flexibility in the development of subdivisions to be consistent with municipality or county conservation design regulations, to maximize the achievement of conservation design objectives and to promote the following corollary purposes:

1. Protect and enhance biodiversity as stated in the Chicago Wilderness Biodiversity Recovery Plan;
2. Minimize development on and destruction of sensitive natural resource areas and wildlife habitats;
3. Reduce the quantity and improve the quality of stormwater runoff from expected development;
4. Provide a wider range of feasible sites to locate stormwater Best Management Practices (BMPs);
5. Minimize impervious surface area;
6. Reduce potential pressure to encroach on resource buffer areas;
7. Reduce soil erosion potential;
8. Reduce the capital cost of development;
9. Reduce the cost of public services required by the development; and
10. Increase future property values.

Commentary

This statement of purpose is offered as an example. Language should be adapted and revised to suit the goals of each community.

Similar to the introductory language above, points 1-10 are examples of the types of conservation goals a community may wish to set. Each community can select the goals that best match its own, or can draft new statements better suited to community goals and intentions. (Note: These goals may be listed in the zoning ordinance language as well; it is strongly suggested to repeat the language in both places and to make the list of goals identical.)

D. Additional Local Ordinances to Review for Compatibility and Conflicts

Review all relevant municipal development ordinances for consistency with conservation design goals.

In the process of updating zoning and subdivision ordinances, it is beneficial to review other existing municipal ordinances for consistency. Work with your municipal attorney to determine if changes should be made to other ordinances. While it may be challenging to address the various ordinances in place in the community, this is an important step for the success of conservation design. Working with these ordinances will require working with the various boards and agencies that administer them.

For example, if you have added a section to your subdivision ordinance encouraging or requiring natural landscaping, review any existing landscaping or weed ordinances. Do these contain language contradictory to the revised subdivision ordinance? Similarly, community stormwater ordinances often encourage natural drainage Best Management Practices (BMPs), but often the subdivision ordinances of these same communities require curb and gutter construction and storm sewers. Remove any of these types of contradictions or obstacles to conservation design. Replace these sections with updated language. Consider consolidating ordinances that are repetitious.

Ordinances to consider

- Landscaping ordinance
- Weed ordinance
- Stormwater ordinance
- Floodplain and wetland ordinances
- Highway access control ordinance
- Roadway design standards
- Wastewater ordinance
- Historic preservation ordinance
- On-street parking ordinance
- Soil erosion and sediment control ordinance
- Tree preservation ordinance
- Fire code
- Building code

E. Working with Other Local Agencies

Work closely with other agencies and departments.

It is important for planning departments to be aware of the effect that ordinance changes such as the ones suggested here have on other municipal departments.

For example

- as street width and turning radius requirements are adjusted, the fire department may express concerns about safe passage in case of emergency,
- the engineering department will be substantially affected when stormwater management practices are changed,
- the local Health Department should be consulted if developments include innovative wastewater treatment practices.

For these reasons, it is important to encourage wide involvement in the update processes. Through communication and cooperation, most concerns can be effectively addressed and resolved. Conversely, if other departments are not included in the revision process, you may find that your revised ordinances will not pass final review.

Chapter 4

Principles And Practices For Conservation Design

Principle A. Develop Flexible Lot Design Standards

Flexible lot design standards can lead to attractive, comfortable developments while simultaneously optimizing the protection of natural systems and conserving natural areas.

Discussion

Standard requirements for lot size, density, dispersion, and lot setbacks often put up inadvertent barriers to environmentally responsible conservation development. This is especially true of zoning and subdivision regulations pertaining to residential subdivisions, but this discussion is pertinent for all types of development. Often, traditional regulations lead to developments where all the land is divided into building lots and streets. Natural areas in such developments are often limited to strictly undevelopable wetlands, steep slopes, floodplains, and stormwater management areas.

Conventional lot design requirements are based on the idea that homeowners require large expanses of lawn (in the form of private front, back, and sideyards) between themselves and their neighbors, and that the more spacious the individual lot, the more desirable the property will be. In fact, comfortable home sites do not require large lots, long setbacks, and wide spacing between buildings. When lot design is approached with new flexibility, it becomes possible to design developments that maximize both the number and the attractiveness of buildings while simultaneously optimizing the protection of natural systems and conserving natural areas. These results can be achieved with very simple changes to local zoning and subdivision ordinances. The three practices described in this section offer technical suggestions for modifying these local codes to increase design flexibility.

Here we introduce the concept of density neutral development. Developers and landowners unfamiliar with conservation design often express concern that natural area and open space set-asides translate to an overall reduction in buildable lots. In reality, however, a major aim of conservation design is to conserve the total number of buildable lots. (See Appendix B, Determining the Allowable Density for Conservation Design.) The flexible lot design standards outlined in this section are the tools that make density neutral conservation design possible; for this reason, these practices are particularly important to the economic viability of conservation design and should be included in any ordinance updates.

Benefits, Examples, and Resources

Updating lot design standards and regulations can be beneficial to the local community, future homeowners, and the developer of the site. See Chapter 2 for a full discussion of the economic benefits of this principle.

Community Benefits

- Stormwater runoff and its negative impacts are minimized.
- Natural resources and features are preserved.

Homeowner Benefits

- Property values increase.
- Access to recreational opportunities is enhanced by increased natural areas.

Developer Benefits

- Increased predictability of development approval process.
- Marketability of homes is enhanced.

Practice 1: Lot Size, Density, and Suggested Open Space

Eliminate minimum lot size requirements; rather, regulate overall density of development.

Rather than controlling density by increasing lot size requirements, conservation design experts recommend implementing standards for overall density on a given site without regulating the lot size. With this method, the developer is permitted to construct a fixed number of housing units regardless of lot size. In other words, conservation design is density neutral. (For a detailed discussion of density in conservation developments, see the Appendix B, Determining the Allowable Density for Conservation Design.)

By eliminating minimum lot size requirements, communities encourage creative developments designed to be both profitable and sensitive to the pre-development character of the development site and the community at large. Ordinances without minimum lot size requirements make way for increased natural areas within developments. These natural areas provide opportunity for recreation, maintain habitats, preserve scenic views, and enhance community open space networks.

Figures 3 and 4, below, (Teska Associates, Inc., 2000) show example configurations that can be used to arrange the same number of housing units on a development site, with the resulting differences in building massing and natural areas.



*Figure 3: Conventional Layout on Development Site
Teska Associates, Inc. - 2000*



Figure 4: Conservation Design Layout on Development Site Teska Associates, Inc. - 2000

Some conservation design experts recommend the implementation of a maximum lot size to impose an absolute limit on oversized lots. This resource manual, however, advocates that all lot size restrictions be removed from the zoning ordinance, to make way for creative solutions such as a single lot development with all housing managed as condominiums.

Lot Size, Density, and Open Space

The basic principle underlying the practice of conservation design is the protection of natural and cultural resources through design flexibility. This flexibility involves the reduction of lot sizes in a development in exchange for setting aside the remainder of the property as significant amounts of natural, open space land.

In addition to allowing design flexibility, some experts argue that communities should mandate ambitious open space set asides as well. For example, to meet the definition of conservation design, a development would be required to have a certain percentage of the development site set aside as open space. The open space requirement for conservation design would likely be higher than open space requirements elsewhere in the community.

There are two approaches to mandating the open space percentage. The first is to look to the community plan to determine a reasonable set aside for a development site, based on the features and characteristics of the site. The second is to mandate a percentage open space for all developments. For convenience, both approaches are addressed in the model ordinance language.

Residential Wastewater Treatment and Conservation Design

Standard septic leach fields, particularly in areas of poor soils such as those in some areas of northeastern Illinois, require a relatively substantial amount of land in order to function properly and meet minimum spacing standards. Standard large-lot subdivisions have become the norm in order to meet the necessary requirements for wastewater disposal via standard septic leachfields, limiting the ability to conserve resources.

For many areas in northeastern Illinois, the extension of public sewer facilities is not desirable or cost effective. Standard septic systems are in place and some alternatives are owned and operated by public agencies such as park systems. Small community wastewater alternatives treat wastewater near the location where it is generated, reducing the need for costly pipe networks and mechanical / chemical based solutions.

There are several alternatives to the standard septic leach field that would permit more flexible project layouts. Some of them require less space; others serve several units at once, and can be located in common areas. Many of these alternatives are capable of reducing the environmental impact of wastewater disposal while meeting water quality standards. Although technology has produced system alternatives which would be effective in our region, critical issues regarding system design, ownership, management, and approval still need to be developed and clarified at the local, county, and state levels.

For the purposes of conservation design practices, the most useful technologies for small scale sewage treatment facilities are those that perform effectively with the minimum amount of necessary attention. The low-maintenance, alternative systems available rely on biological rather than highly mechanized or chemical treatment, followed by various forms of land application. Cost is often greater than the standard septic leach field but higher treatment standards can be achieved, which increases the environmental quality of a project with regard to water resources.

A detailed discussion of these alternative wastewater treatment strategies is beyond the scope of this project. For more information, coordinate with the local health department, or see NIPC's publication *Protecting Nature in Your Community* (Chapter 7).

(The bulk of the material in this discussion of wastewater treatment was adapted from material prepared by the Countryside Program. (<http://www.countrysideprogram.org>))

Model Ordinance Language

The following model ordinance language can be adapted to modify existing local codes and ordinances. Blanks and bracketed ([]) sections should be filled in with language appropriate for each community.

Model Ordinance Language

(Adapted from the Countryside Program)

Either

- A 1. The minimum open space / natural area for a given development shall be determined by looking to the community comprehensive plan to determine existing standards for open space.

Or

- A 2. At least _____ % of the development shall be set aside as natural area / open space. (See recommended requirements in commentary.) The natural area counted toward this set-aside shall not include parkways, landscape islands, or similar features and should meet the definition of natural area given in [Appendix A]. The natural area set-aside shall not include wetlands, floodplains, or other inherently unbuildable areas.

Commentary

The amount of natural area that can realistically be set aside is related to the density and type of units permitted. The higher the density, the more difficult it is to achieve a large percentage of natural areas unless sufficient flexibility is available in terms of dwelling types and setback requirements (i.e., allowing attached single-family units). It also should be noted that a minimum open space requirement may not be appropriate in all zones. In residential zones with low to moderate density, the requirement will likely be helpful. In commercial zones or zones with intentionally high residential density, an open space requirement may constitute enforced sprawl. Two options are give below for addressing the open space requirement.

The first option assumes that flexible lot design will lead to open space set asides without a mandated percentage. In order to create a truly noticeable difference between a standard subdivision and a conservation design, in no case should the open space requirement be less than is required in similar zones elsewhere in the community. Beyond this guideline, this option assumes that no restriction is necessary since natural areas will naturally expand as lot sizes are reduced and other conservation design practices are introduced. This option is preferred for non-residential zones.

If a mandated open space percentage is selected, the community must decide the appropriate percentage. This may vary by residential zone, and is recommended for residential areas only. Some examples of recommended percentages are given below.

Kane County's 2020 Land Resource Management Plan (p. 79) calls for the preservation of 40% open space in all new development.

Lake County's Unified Development Ordinance (http://www.co.lake.il.us/elibrary/ordinances/planning/Complete_UDO.PDF) requires 30% in most residential zones, and 40% in zones with .45 du/acre or lower density.

Model Ordinance Language (continued)

- B. The real property described herein must be maintained in perpetuity for [tailor to local purpose] only and shall not be improved with any building, structure, or appurtenant facility. This restriction shall run with the land and be binding on successors and assigns of Grantee.
- C. No minimum or maximum lot size shall be imposed.
- D. The maximum density shall be that of the underlying or pre-existing zoning, in dwelling units per acre.
- E. The maximum number of dwelling units permitted in a conservation development shall be calculated by:
 - 1. Deducting the following from the total project area:
 - a. Any public right-of-way within the project boundary existing at the time the development plan is submitted; and
 - b. The area of land within a floodplain, designated wetland, or existing waterbody that exceeds the minimum acreage required for restricted open space (if such a requirement exists). Where floodplains and wetlands overlap, they shall be counted only once.
 - 2. Multiplying the result of Subsection 1 by the maximum density permitted per acre as set forth in this Section above.

Commentary

Will County's Land Resource Management Plan (<http://www.willcountylanduse.com/lrmp/lrmpmain.html>) sets an overall goal of 20% of the land in the county being set aside as open space.

Language should be included to restrict future development of the open space, to ensure that the open space remains undeveloped in perpetuity.

Lot size restrictions are eliminated completely to make way for creative design solutions.

Each municipality or county must establish the precise density for conservation design based on the prevailing characteristics in the municipality or county. Normally, this will be the net density of the zoning district now in place in the areas where conservation design is desired. The net density of a subdivision is usually lower than the gross density (which is derived from the minimum lot area divided by one acre or 43,560 square feet) because of land area devoted to roads and the fact that some of the lots are larger than the minimum required. (A detailed discussion of the distinctions between the net density and the gross density is included in Appendix B, Determining the Allowable Density for Conservation Design.)

One of the principles of conservation design is to be density neutral when comparing the number of potential units under conservation design to the number of potential units under conventional development. However, it is recognized that floodplains, wetlands, and waterbodies are natural features that affect the development capacity of a site. At the same time, it is possible that in a standard subdivision, especially a larger lot subdivision, much of the area within floodplains, wetlands and smaller ponds could be included in the rear yards of individual lots, thereby not reducing or only moderately reducing the overall development capacity of the site. Therefore, the Model recommends that there be a reduction in density for projects that are substantially impacted by floodways, wetlands, and/or waterbodies. When the area of these key environmental open space components exceeds the number of open space acres that are required to

Model Ordinance Language (continued)**Commentary**

3. Development incentives may be granted at the discretion of the community.

be set aside, the acreage that is in excess of the open space requirement is to be deducted from the total project area, and the density is to be based on the net area. (See Appendix B for an example of how this deduction is calculated.) Additional natural resource characteristics (i.e. steep slopes, prime farmland, drainage courses outside designated floodways, etc.) could also be deducted depending on the priorities of the community.

See Appendix C, Conservation Design Incentives, for a detailed discussion of development incentives and when they are appropriate.

Practice 2: Arranging the Development Site

Maintain critical natural areas by designing the site with sensitivity. Group buildable lots together to maximize the area of undisturbed land.

How should the buildable lots be arranged on a development site? The process of laying out lots, roads, and natural areas is one of the most important aspects of conservation design. Conservation design advocates for a sensitive approach to the landscape, an approach which treats each development site as a unique challenge to be approached with the complementary goals of developing the maximum allowable number of lots AND conserving natural lands and processes to the greatest possible extent. (Note: This practice is most applicable to large development sites on previously undeveloped land. However, even on smaller development sites or sites which have existing development, the basic strategy of seeking to conserve and restore the most valuable natural resource areas can be employed.)

Each community will benefit from a comprehensive planning process that identifies and maps the natural features of the community. With such an inventory in place, the community can quickly identify whether proposed developments meet community conservation goals. Comprehensive planning is discussed briefly in Chapter 3. More in depth information about community comprehensive planning can be found in NIPC's *Environmental Considerations in Comprehensive Planning and Protecting Nature in Your Community*. These publications provide detailed practical advice for updating the community comprehensive plan to include environmental considerations. Copies are available from NIPC's publications department; call (312) 454-0400 with inquiries. Protecting Nature is also available on the web at http://www.nipc.cog.il.us/protecting_2001%20.htm.

Randall Arendt, a national expert in conservation design, outlines the following four step process for arranging the development site (Arendt 1996).

1. **Identify all Potential Conservation Areas.** This will include all inherently unbuildable areas (floodplains, wetlands, steep slopes) and also buildable areas that are sensitive environmentally (natural areas, stream and wetland buffer areas, woodlands, etc.), significant historically and culturally, or important for conservation for some other reason. The developer will be responsible for identifying the conservation areas; a community resource inventory or comprehensive plan can be a valuable tool in monitoring the protection of conservation areas.
2. **Locate the House (or other building) Sites.** At this point, only the specific sites for buildings to be constructed should be located. To maximize the revenue potential of the sites, the developer will take care to locate the sites to maximize views and access to natural areas and other amenities.
3. **Design the Street and Trail Systems.** Determine how to most efficiently lay out the street system to access every home. Similarly, homes should have easy access to walkways and trail systems within the development.
4. **Draw in the Lot Lines.** This is the final step and should be almost trivial once the building sites and street system have been identified.

For a more in depth discussion of Arendt's suggested design process, refer to *Conservation Design for Subdivisions*, pages 41-48.

Although not explicitly stated in Arendt's model, an important characteristic of nearly any conservation development is the grouping of building sites. Certainly, grouping alone does not lead to conservation. It is an important element, however, of most conservation developments, and should result naturally from the employment of Arendt's design process. Grouping the buildings together allows for the creation of contiguous natural areas. Grouping also ensures the development of compact neighborhoods that are amenable to walking, cycling, and interaction between neighbors.

Model Ordinance Language

The following model ordinance language can be adapted to modify existing local codes and ordinances. Blanks and bracketed ([]) sections should be filled in with language appropriate for each community.

Model Ordinance Language

(Adapted from UW Extension Model Ordinance)

Commentary

- A. Lots and buildings should be grouped.
- B. Groups should be located to minimize negative impacts on the natural, scenic, and cultural resources of the site and conflicts between incompatible uses.
- C. Groups should avoid encroaching on rare plant communities, high quality habitats, or endangered species identified by the Illinois Department of Natural Resources.
- D. Whenever possible, open space should connect with existing or potential open space lands on adjoining parcels and local or regional recreational trails.
- E. Groups should be sited to achieve the following goals:
 - 1. Minimize disturbance to woodlands, wetlands, grasslands, mature trees, and steep slopes.
 - 2. Prevent downstream impacts due to runoff through adequate on-site storm water management practices.
 - 3. Protect scenic views of open land from adjacent roads. Visual impact should be minimized through use of landscaping or other features.
 - 4. Protect archaeological sites and existing historic buildings or incorporate them through adaptive reuse.
 - 5. Encourage sense of community.
 - 6. Minimize impacts to prime farmland soils and large tracts of land in agricultural use, and avoid interference with normal agricultural practices.
- F. Landscaping around the building group may be necessary to reduce off site views of buildings. Landscaping around the group should utilize native plant species, ideally based on pre-settlement vegetation communities found on the site.

Practice 3: Building Setbacks

Eliminate setback requirements for the interior of development sites while maintaining expectations on the perimeter.

Conventional ordinances generally require large setback distances between homes and adjacent homes, streets, and lot lines. In order to meet conventional requirements, lots must be of substantial size, where the house is located at the center with generous spaces on all sides.

Conservation design discourages this approach to configuring homes and lots. Rather than having large front, back and side yards for individual homes, conservation design calls for smaller yards in exchange for larger expanses of contiguous natural areas. To accomplish this, most setback requirements must be substantially reduced or eliminated.

The ordinance language offered here differentiates between requirements for the perimeter of the development site and requirements for the interior of the site or individual lots. In general, it is recommended that the perimeter of the site be developed in such a way that consistency with surrounding development is maximized. For most communities, a priority in approving new development is to minimize complaints or opposition from existing residents and neighbors. By developing conservation sites with sensitive perimeter setbacks, context is respected and conflict with neighboring developments is reduced.

In contrast, setback requirements for the interior of the development site can be extremely permissive. This model ordinance recommends eliminating minimum lot sizes altogether, allowing for creative solutions to site design such as condominium arrangements where the entire site is commonly owned. Further, because existing building codes address health and safety requirements for the spacing between buildings, it is not necessary to address this spacing in the zoning ordinance. In fact, setback requirements in conventional zoning ordinances often serve to enforce large-lot developments which are built in opposition to many conservation design principles.

Model Ordinance Language

The following model ordinance language can be adapted to modify existing local codes and ordinances. Blanks and bracketed ([]) sections should be filled in with language appropriate for each community.

Model Ordinance Language

(Adapted from the Countryside Program)

Buildings, structures, pavement, and streets shall be located in compliance with the following development and site planning standards.

A. Lot Requirements

1. Dwelling units are not required to be on lots. However, when lots for standard detached single-family dwellings or sublots for single-family group or attached dwelling units are included as part of a conservation development, such lots or sublots shall be of sufficient size and shape to accommodate dwelling units in compliance with the spacing requirements of this section.

B. Perimeter Building Regulations

1. The minimum setback from an existing public street shall be that which is previously established in the zoning ordinance or subdivision regulations.
2. The minimum setback from the project boundary shall be that which is previously established in the zoning ordinance or subdivision regulations.

C. Interior Building Setback/Spacing Regulations

1. Interior setbacks are left to the discretion of the developer, but must meet all existing building and fire code requirements.

Commentary

A key to successful conservation design is flexibility in area and yard standards. If the municipality or county chooses to include minimum lot and yard standards, sufficient reductions from the existing lot area, width, and yard requirements must be made in order to achieve goals of conservation design. If lots are not used, buildings will be managed condominium style, where owners own the building but not the underlying land.

Perimeter Setback: *The perimeter regulations apply to the exterior boundary (the perimeter) of the development site.*

The setback from existing public streets AT THE PERIMETER OF THE SITE should be the same as the front yard setback in the standard single-family district zoning regulations (to maintain consistency). Acceptance of conservation design is increased when expectations are maintained on the perimeter.

Similar to setbacks from existing streets, setbacks from the project boundary should maintain the status quo established by subdivision regulations and existing development.

Interior Setback: *The interior setback requirements apply to setbacks from streets, lot lines (if using), and other buildings on the INTERIOR of the development site (as opposed to on the perimeter).*

The municipality or county is encouraged to eliminate interior setback or separation requirements above and beyond building and fire code requirements. However, it is also recommended that any approvable development plan be required to indicate what those setbacks and separations will be.

Principle B. Protect and Create Natural Landscapes and Drainage Systems

Facilitating conservation design and fostering stewardship of natural areas and natural communities is critical to achieving regional biodiversity goals.

Discussion

The northeastern Illinois landscape has been dramatically transformed from its original pre-settlement form to be made suitable for agriculture. Today a great deal of new construction involves the conversion of former agricultural lands into residential subdivisions and commercial areas. If the land is still fertile and active in production, there may be great value in maintaining its current condition. A second vital consideration is the restoration of the natural landscape, and/or preservation of natural landscape remnants through conscientious design practices. Conservation design facilitates these practices to a far greater degree than conventional development due to the amount and contiguous nature of the natural resource areas potentially preserved.

As the primary decision makers on land development, local officials and staff can play a lead role in the conservation and restoration of natural areas and landscapes. Facilitating conservation design and fostering stewardship of natural areas and natural communities, which are the foundation of the region's environmental health, is critical to achieving the short and long term goals outlined in the regionally adopted Biodiversity Recovery Plan. The overall goal of this Plan is "to protect the natural communities of the Chicago region and to restore them to long-term viability, in order to enrich the quality of life of its citizens and to contribute to the preservation of global biodiversity."

Benefits, Examples, and Resources

Protecting and creating natural landscapes and drainage systems can be beneficial to the local community, future homeowners, and the developer of the site. See Chapter 2 for a full discussion of the economic benefits of this principle.

Community Benefits

- Reduces flooding and stormwater management costs.
- Reduces long-term maintenance costs.

Homeowner Benefits

- Increases property values.
- Decreases maintenance costs.

Developer Benefits

- Reduces landscaping and other installation costs.
- Enhances marketing potential.

Results of a study conducted in 1994 for the real estate industry showed that 77.7 per cent of all home buyers and shoppers in the study rated natural open space as either "essential" or "very important" in planned communities. Walking and bicycling paths ranked third. A research spokesperson noted that consumers are increasingly putting a higher premium on interaction with the environment through inclusion of natural, open space and nature paths. These findings differ greatly from the 1980's preferences, which included tennis courts, swimming pools, and golf courses (San Francisco Chronicle, January 8, 1995).

From: "Economic Impacts of Protecting Rivers, Trails and Greenway Corridors" National Park Service, 1995, Washington DC page 1-3

Additional Resources

Chicago Wilderness. 1999. *Biodiversity Recovery Plan*. Chicago.

Chicago Wilderness. 1999. *An Atlas of Biodiversity*. Chicago.

The Conservation Foundation website: <http://www.theconservationfoundation.org>.

Diehl, J. and T. Barrett. 1988. *The Conservation Easement Handbook*. Washington DC: Washington D.C: Land Trust Alliance.

Northeastern Illinois Planning Commission. 2000. *Protecting Nature in Your Community*. Chicago.

Northeastern Illinois Planning Commission. 1997b. *Natural Landscaping for Public Officials: A Source Book*. Chicago.

Northeastern Illinois Planning Commission. 1997c. *Northeastern Illinois Regional Greenways and Trails Plan*. Chicago.

USDA-Natural Resource Conservation Service, Illinois Environmental Protection Agency. 2002. *Illinois Urban Manual: A Technical Manual Designed for Urban Ecosystem Protection and Enhancement*. <http://www.il/nrcs.usda.gov/engineer/UrbManBro.html>, Champaign.

United States Environmental Protection Agency. 2002b. *Weedlaws*. <http://www.epa.gov/grtlakes/greenacres/weedlaws>

United States Environmental Protection Agency. 2002c. *Landscaping with Native Plants, Wild Ones Handbook, Landscaping with Native Plants, and Great Lakes Plants*. <http://www.epa.gov/grtlakes>

Practice 4: Natural Area Protection and Resource Conservation

Update ordinances to substantially restrict development on or near natural areas, and require or encourage undeveloped buffers around these areas.

Conservation design encourages the dedication of open space on a site that will protect and restore natural areas and resources, and provide for passive recreation where appropriate. Through a conscientious site design process, the development can be configured to maximize the areas that are protected and conserved.

Possible areas to evaluate for protection include hydric soils, streams, lakes, wetlands, floodplains, steep slopes, significant wildlife habitats, remnant prairies, woodlands, farmland, and sensitive aquifers and their recharge areas (Arendt 1996). Certain sensitive areas, including floodways, flood fringes, non-isolated wetlands, isolated wetlands, and threatened and endangered species habitats may be protected by federal, state, and local statute, but each community must decide the extent to which it will protect natural areas that do not benefit from legal protection.

Natural area buffers are an important strategy for protecting sensitive natural areas. The model ordinance language given in this section enables the use of buffers around natural areas. The following list enumerates several benefits resulting from the use of buffers:

- Slows water runoff.
- Removes up to 50% or more of nutrients and pesticides in runoff.
- Removes up to 60% or more of pathogens in runoff.
- Removes up to 75% or more of sediment in runoff.
- Reduces noise and odor.
- Serves as a source of food, nesting cover, and shelter for wildlife.
- Stabilizes streambanks and reduce water temperature in stream.
- Reduce downstream flooding.

Greenways, or linear corridors of green, can function to preserve natural resources and in some cases define or link a trail system. Linking and providing connections to existing and proposed trails and greenways provides additional benefits to natural resource protection. Existing local greenways may be protected by municipal, park, forest preserve, or conservation districts, and county transportation departments. Regional, state, and federal greenways and trails are documented in NIPC's 1997 *Northeastern Illinois Regional Greenways and Trails Plan* map. Communities also may decide to include significant historic and cultural assets in designated open space areas. Through the comprehensive planning process, communities will determine which of these areas are most relevant and important for conservation.

Model Ordinance Language

The following model ordinance language can be adapted to modify existing local codes and ordinances. Blanks and bracketed ([]) sections should be filled in with language appropriate for each community.

Model Ordinance Language

Natural Area and Buffer Protection and Conservation

The [Municipality or County] recognizes the ecological, geological, educational, scenic, economic, and aesthetic importance of preserving natural areas in public or private ownership. A **natural area** is an area of land, not necessarily undisturbed, which either retains or has been substantially restored to its original natural or native character.

The [Municipality or County] recognizes the importance of **buffers** that preserve, provide access to, or otherwise serve as necessary adjuncts to natural areas by protecting streams, lakes, and wetlands. Buffers include, but are not limited to, areas of predominantly deeply rooted native vegetated land adjacent to channels, wetlands, or lakes for the purpose of stabilizing banks, reducing contaminants including sediments in storm water that flows to such areas.

The function of the buffer is to create a transition to the area targeted for protection. The buffer absorbs and withstands the impact of harming activity. For this reason, the ongoing healthy function of the buffer must be assured. Accordingly, the harmful activity cannot be allowed to overpower the buffer.

Natural areas and buffers shall be preserved on the site, including, without limitation, native vegetation, wetlands, natural floodplain storage, or other valuable environmental and biological resources.

A. An area designated for natural area and buffer protection purposes may be:

1. preserved or restored to its natural state,
2. designed and intended for the passive use and/or enjoyment of residents of the proposed development, or

Commentary

The natural area definition is partly adapted from the "Illinois Natural Areas Preservation Act" (525 ILCS 30/3.10). The act establishes state policy to protect and maintain a register of natural areas and buffer areas, provides certain forms of protection and control, and encourages and assists in the preservation of natural areas and features.

Selected language on buffers, buffer widths, and buffer averaging is adapted from the Kane County Code. (<http://www.co.kane.il.us>)

Strategically placed buffer strips in the landscape can effectively mitigate the movement of sediment, nutrients, pesticides, and other pollutants.

Model Ordinance Language (continued)

3. preserved in order to expand and extend the usefulness of existing preserved open space and natural areas.
- B. Dedicated buffers and natural areas shall be designed and located to conserve significant natural features located on the site.
- C. Dedicated natural areas shall be interconnected with open space areas, greenways, and trails on abutting parcels where possible and appropriate.

Commentary

Greenways, or linear corridors of green, can function to preserve natural resources and in some cases define or link a trail system. Linking and providing connections to existing and proposed greenways and trails provides additional benefits to natural resource protection. Existing local greenways may be protected by municipal, park, forest preserve, or conservation districts, and county transportation departments. Regional, state, and federal greenways and trails are documented in NIPC's 1997 Northeastern Illinois Regional Greenways and Trails Plan map.

Practice 5: Land Compatible Design

Encourage developers to design sites to fit the topography, features, and soils of the natural landscape.

Excess stormwater runoff, and the resultant flooding and erosion, arise from development and alteration of the natural landscape. For this reason, it is highly desirable to preserve or restore features of the natural, pre-development landscape whenever possible. Careful consideration of the pre-development landscape can vastly improve the drainage and stormwater runoff performance of a development.

On sites that have been altered through grading, engineered drainage systems, and agricultural conversions, developers should be encouraged to study the original landscape and design the landscape using the original as a guide. On sites that have not been substantially altered from their natural form, developers should be encouraged to preserve this form.

Generally, substantial alteration of the existing site landscape is discouraged. Special consideration should be given, however, to proposals which seek to restore a site to its original natural form through careful and conscientious study. Restoration of the natural landscape will not be appropriate in all cases, but should be permitted unless there is a compelling agricultural or ecological reason to avoid it.

Much of the language pertaining to natural landscape sensitivity may be currently addressed in other existing regulations. If not, NIPC's model ordinances for *Soil Erosion and Sedimentation Control*, *Stormwater Management*, and *Streams, Lakes, and Wetlands Protection* will be of assistance in developing language for an ordinance. (Full citations for these documents are given in the bibliography. To obtain copies, contact NIPC's publications department, (312) 454-0400.)

Model Ordinance Language

The model ordinance language given in this section is adapted from the City of Napa Valley, California, Riparian Habitat Areas section of their ordinance. It can be adapted to modify existing local codes and ordinances to require land compatible design for all developments or for conservation developments only. Blanks and bracketed ([]) sections should be filled in with language appropriate for each community.

Model Ordinance Language

Commentary

The [Municipality or County] recognizes that natural drainage patterns, native vegetation, and stabilization of soil during construction are important factors in the prevention of flooding and degradation of water quality. Priority shall be placed on site design that maintains natural drainage patterns and watercourses. Alterations to natural drainage patterns shall not create flooding or degradation in water quality for adjacent or downstream property. A natural landscape sensitivity plan (NLS) must be prepared to insure protection of the natural contours and vegetation on a development site.

A. A natural landscape sensitivity plan (NLS) shall address the following requirements:

1. Site development shall be fitted to the topography and soil so as to create the least potential for vegetation loss and site disturbance;
2. Vegetation removal shall be limited to that amount necessary for the development of the site;
3. Vegetation native to the site or plant community shall be restored in areas affected by construction activities. Temporary vegetation, sufficient to stabilize the soil, may be required on all disturbed areas as needed to prevent soil erosion. New planting shall be given sufficient water, fertilizer if necessary, and protein to ensure reestablishment.
4. Site design shall minimize the disturbance and loss of vegetation.

Model Ordinance Language (continued)

Commentary

B. A natural landscape sensitivity plan shall be drawn to scale and shall be of sufficient clarity to indicate the nature and extent of the work and restoration efforts proposed. An NLS plan shall include the following information:

1. Existing contours of the site, as well as finished contours to be achieved by grading. Contours shall be sufficiently detailed to define the topography over the entire site;
2. Delineation of areas to be cleared during development activities;
3. Restoration of vegetation proposed for all surfaces to be exposed during development activities, including any dredged, filled, or graded areas;
4. The location and extent of natural area buffers and method of implementation; any use restrictions and method of implementation.

C. All approved measures to mitigate the loss or impact to the natural landscape shall become conditions for approval of the project. In addition all approved NLS measures shall be carried out prior to final issuance of the building permit or concurrently with the installation of site improvements in the case of a final plat of subdivision.

D. The planning director may waive some or all of the requirement for projects which will not result in disturbance to the land or where on-site conditions clearly demonstrate that the site would not effectively respond to revegetation.

E. The NLS must be approved by the Municipal Engineer (or equivalent).

The Illinois Urban Manual provides detailed information and direction on sound planning procedures and principles for more than 40 conservation practices designed to reduce erosion and address water quality and stormwater management problems. Technical specialists can assist in the development of soil erosion and sediment control, stormwater management, and natural area protection plans. (USDA Natural Resources Conservation Service and Illinois Environmental Protection Agency's Illinois Urban Manual is available on-line as well in document form at <http://www.il.nrcs.usda.gov/engineer/UrbManBro.html>)

Practice 6: Natural Landscaping

Update landscaping ordinances to encourage the use of plant materials native to northeastern Illinois. Require natural landscaping in and around stormwater facilities, wetlands, lakes, and streams.

Natural landscaping is the design, construction, and maintenance of landscapes that provide the beneficial natural functions that are lost through installation of conventional lawns or agriculture. Natural landscaping stresses the preservation and reintroduction of plants native to our area. The native plants used in natural landscaping are hardy and attractive. They can be used to stabilize soil, reduce flooding, absorb pollutants, and sustain wildlife (NIPC, 1997b).

Native landscaping has been defined as the use of plants—for example, prairie, woodland and wetland plants—that flourished in northeastern Illinois prior to settlement. Natural landscaping is a more popular and broader concept because it implies the use of native plants but also suggests landscaping to give the “look” of the landscape that existed before the mid-1880s. In addition, there also may be an attempt to restore or reconstruct the landscape to look and function more as it did before settlers, other than Native Americans, lived here.

Presently, the predominant landscaping material of the Chicago region is the turf grass lawn. The lawn is borrowed from the heavily grazed, short grass pastures and formal gardens of Europe, and provides aesthetic appeal and recreational space. This modern landscape contrasts sharply with the predominant landscape prior to European settlement. Then, prairies were interspersed with woodlands, savannas, and wetlands. Hundreds of species of plants could be found on every acre of land.

While interest is growing in natural landscaping, in many communities the conventional turf grass landscape has been virtually mandated by local weed and landscaping ordinances. In these circumstances, the first step is to revise the local ordinances to allow natural landscaping (NIPC, 2000).

Natural landscapes are not a threat to safety or public health. In fact, enforcement of weed ordinances against natural landscapes increases wind-borne allergenic pollen and other health hazards. For example, ragweed thrives in disturbed soil recently developed or degraded. Perennial native plants and native grasses are generally not producers of wind-borne allergenic pollen. By contrast, the chemicals used to maintain a turf lawn pose health risks, such as harmful level of nitrate in drinking water (John Marshall Law Review).

To allow natural landscaping, a city or village should examine their local weed and/or landscaping laws and create, add to, or amend the language to ensure that natural landscaping is not prohibited.

Figure 6, below shows the root system of native plants, which can be up to ten feet deep, in contrast to the root system of turf grass, which is only a few inches deep.

Perception

Native vegetation may harbor undesirable wildlife and insects.

Fact

In a 1988 survey of wildlife acceptance, some 65% of the adult population reported that they enjoyed seeing or hearing wildlife while pursuing other activities around the home.

Fact

Natural vegetation does not provide a steady supply of the sort of food required to sustain a population of vermin.

(From *Better Site Design*)

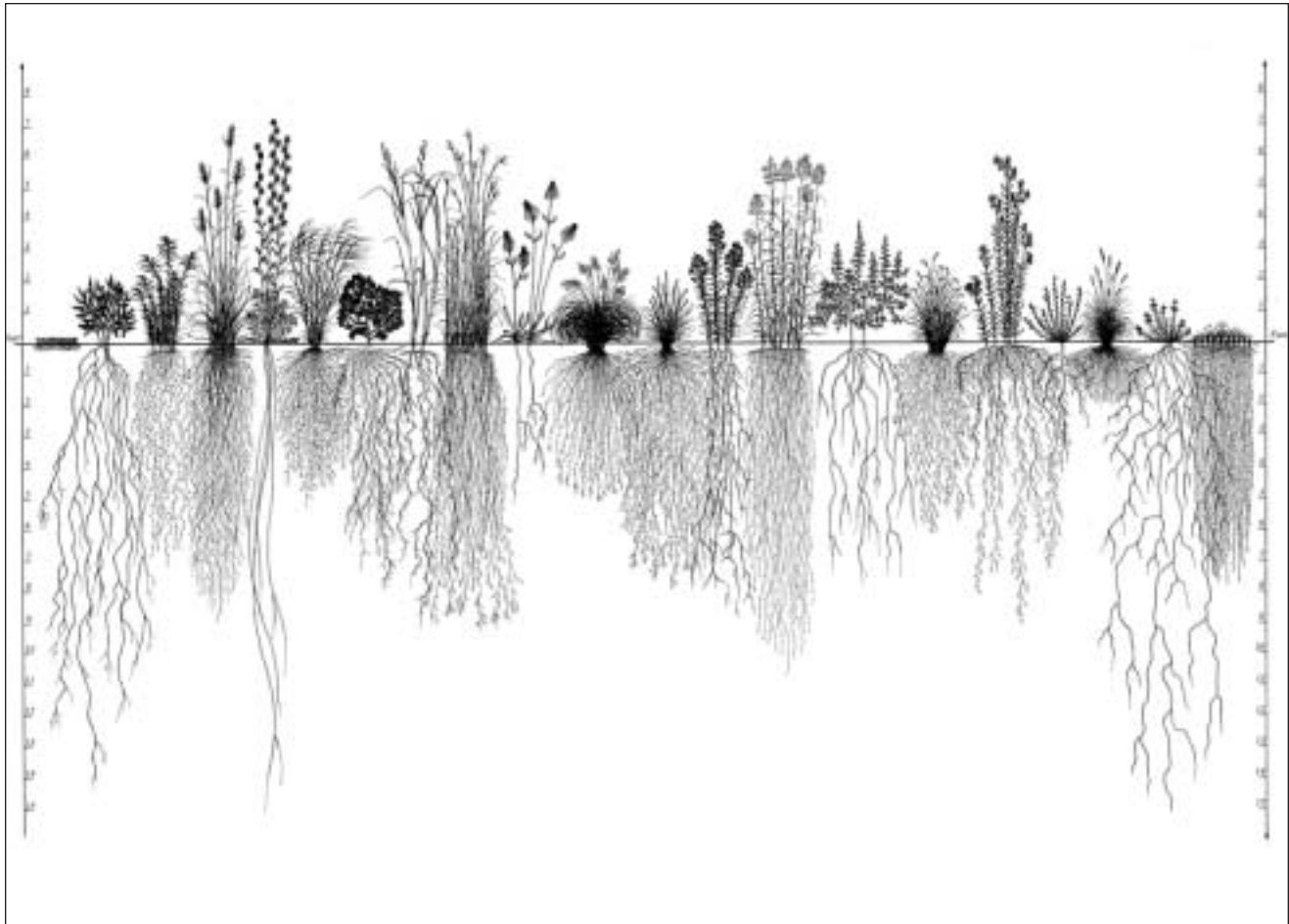


Figure 6: Root Systems of Native Plants (Conservation Research Institute, Heidi Natura, 1995)

Model Ordinance Language

The following language is adapted from the proposed natural landscape ordinance from the National Wildflower Research Center in Austin, Texas (as reprinted in NIPC's Natural Landscaping for Public Officials). It provides a broad legislative purpose to support natural landscaping and then establishes the right to landscape naturally, and can be adapted to modify existing local codes and ordinances. Blanks and bracketed ([]) sections should be filled in with language appropriate for each community.

Model Ordinance Language**A. Rights of Landowners to Pursue Natural Landscaping**

1. Within the [municipality or county], the use of natural plant materials for landscaping is permitted.
2. The [municipality or county] recognizes the importance of the preservation and restoration of natural plant communities, and encourages the protection and enhancement of these communities within its boundaries.

B. Establishment of Native Vegetation for Resource Protection in New Development

1. New development must include establishment of vegetation using the Native Plant Guide for Streams and Stormwater Facilities in Northeastern Illinois, NRCS, et al., (as amended) as a minimum standard for:
 - a. drainage swales,
 - b. perimeters of detention basins, and
 - c. edges of streams, lakes, and wetlands.
2. In addition, natural landscaping is encouraged in other areas such as common areas.

C. A landscape plan should be **submitted with the final plat of subdivision****Commentary**

In addition to weed and landscaping laws, ordinances that relate to tree preservation, fire codes, and pest control should be examined for compatibility.

Section A permits the use of natural landscaping materials within the municipality or county.

Section B acknowledges the importance of native vegetation in the protection of natural resources, prevention of flooding, and quality and quantity of water resources, and requires the use of native vegetation under some circumstances.

Practice 7: Natural Area Management

Require clear specification of how natural areas will be managed, and designate a legal entity responsible for maintenance for all natural areas.

Planning for open space and natural resource protection in conservation design must include short and long term management for both routine and remedial maintenance. The maintenance responsibility should be detailed as part of an agreement between the property owner or the homeowner's association and the local government so that the local government has a record of who is liable for such maintenance. Such an agreement should be incorporated into the approval of a development.

There are four approaches to managing natural areas.

1. The natural area may be dedicated to the municipality or county, or another public agency such as a park district, forest preserve, or conservation district.
2. A homeowners association may take possession of the natural area.
3. A conservation easement can be granted to the government (local, state or federal) or to a not-for-profit whose primary purpose is in keeping with conservation development and design, such as the Nature Conservancy. The benefits of a conservation easement are its flexibility, the potential for income tax reduction, estate tax reduction, and property tax reduction for homeowners. A sample conservation easement agreement is available; contact NIPC to obtain a copy.
4. The natural area may remain in the private ownership of the developer or another entity.

If a public agency is designated to own and/or manage the dedicated natural area, it may be necessary to levy a special tax to support management and maintenance. This has been done in Kane County, Illinois through the use of a Special Service Area (SSA) designation. Even in cases where the natural area remains in private ownership or is owned by the homeowners' association, the municipality or county may wish to establish a backup SSA to provide funding if the owning entity cannot properly manage the natural area over time. (See Appendix D, *Special Service Area Financing*, for more information on this funding strategy.) Model language from the Kane County ordinance is included in the second part of the model ordinance text that follows.

Model Ordinance Language

The following model ordinance language can be adapted to modify existing local codes and ordinances. Blanks and bracketed ([]) sections should be filled in with language appropriate for each community.

Model Ordinance Language

(Adapted from the Countryside Program)

Commentary

A. Ownership and Management of **Dedicated** Natural Areas

Natural areas in a conservation development may be owned by the municipality or county, and association, a land trust or other conservation organization recognized by the municipality or county, or by a similar entity, or may remain in private ownership.

1. **Public Ownership and Management.** The municipality or county may, but shall not be required to, accept dedication in the form of fee simple ownership of the designated natural area.
2. **Homeowners Associations.** Restricted natural areas may be held in common ownership by a Homeowners' Association, Community Association, or other similar legal entity, or the individual members of a Condominium Association as tenants-in-common. The municipality or county's legal advisor shall determine that, based on documents submitted with the development plan, the association's bylaws or code of regulations specify the following requirements:
 - a. Membership in the Association shall be mandatory for all purchasers of lots in the development or units in the condominium.
 - b. The Association shall be responsible for maintenance, control, and insurance of common areas, including the dedicated natural areas.
3. **Creation of Conservation Easements.** A property owner can create a conservation easement restricting the use of property to protect or preserve its natural features. If the property owner chooses to grant a conservation easement to [the unit of local government], [the unit of local government] can accept this grant provided that:

A sample conservation easement agreement is available; contact NIPC to obtain a copy.

Model Ordinance Language (continued)

Commentary

- a. The provisions of the conservation easement are acceptable to the municipality or county; and
- b. Continuing maintenance and management responsibilities are established.

4. Private Ownership of Dedicated Natural Areas.

Dedicated natural areas may be retained in ownership by the applicant or may be transferred to other private parties.

B. Public Management of Dedicated Natural Areas.

If a public agency will manage a common natural area, either by designation or necessity, a funding procedure may be established through the creation of a **Special Service Area** ordinance to cover the costs of maintenance. The ordinance authorizes the levy of taxes to pay the costs of providing the required services.

This language is adapted from Kane County, Illinois Special Service Area ordinance. (<http://www.co.kane.il.us/kccodes.htm>)

- 1. **Purpose** The purpose of establishing the Special Service Area is to provide services to a designated area of the [local government] (the "Area") including the operation, maintenance, repair, rehabilitation, replacement, restoration and reconstruction of any site runoff storage area, drainage way, ditch, swale, storm sewer, other stormwater facility, or natural areas; related administrative costs; permit fees; public liability insurance; other consulting services including but not limited to the costs of design, engineering, surveying, landscaping and legal services (collectively, the "Services").

Model Ordinance Language (continued)

Commentary

2. Provisions

- a. authorization to levy or impose additional taxes upon Areas for provision of Services;
- b. that the area will benefit specially from the Services to be provided by the [local government] and the Services are unique;
- c. that the cost of providing the Services shall be paid by the levy of a direct annual ad valorem tax upon all taxable property within the Area;
- d. that the procedure calling for public hearing and objection petition is followed according to Illinois law governing special service area tax.

Principle C. Reduce Impervious Surface Areas

Reducing the impervious cover in new developments can substantially improve on-site stormwater management, leading to improved water quality.

Discussion

Impervious Cover: Any surface in the urban landscape that cannot effectively absorb or infiltrate rainfall (CWP, Better Site Design).

Impervious cover (also called impervious surface) includes roads, parking lots, sidewalks, swimming pools, roof tops, garages, patios, and any other surfaces through which water cannot pass. This section argues for an overall reduction of impervious surface area. However, imperviousness varies by development type. While there may be simple ways to reduce impervious cover in larger-lot residential developments, denser residential areas and commercial areas will have a higher percentage of impervious cover, and it will be difficult, or even counterproductive, to reduce this in many cases. A densely developed area with a high percentage of imperviousness may protect natural areas in another location. For these reasons, it is essential to consider impervious surface area reduction goals within the context of the development type.

When land is developed, the surface of the land often is transformed from natural cover to impervious cover. This transformation adversely impacts the natural environment, especially natural water resources. Rainfall that was initially absorbed by the landscape can no longer be absorbed. The excess water becomes stormwater runoff, and, without adequate controls, this runoff causes increased flooding, channel erosion, and severe water pollution in downstream lakes and rivers.

In *Better Site Design*, the Center for Watershed Protection gives a list of twenty “Impacts to Aquatic Resources Due to Impervious Cover.” These effects start when the impervious cover is as low as ten percent. The effects include:

- higher peak discharge rates and greater flooding,
- lower stream flow during dry weather,
- enlargement of the stream channel,
- greater streambank erosion,
- degradation of stream habitat structure,
- greater loads of stormwater pollutants,
- lower diversity of aquatic insects and freshwater mussels,
- lower diversity of native fish species, and
- decline in wetland plant and animal diversity.

(See *Better Site Design* for complete list.)

Just as rapid expansion of impervious cover leads to increased runoff and numerous adverse effects to the natural environment, reducing the impervious cover in new developments can substantially reduce runoff quantities and pollutant loads. The flexible lot design standards suggested in Principle B can reduce impervious cover. In addition, this section introduces alternative practices for road design, parking lot design, walkway design, and driveway design. Updating local codes to encourage or require designs with lower overall impervious cover is a direct and practical approach to pollution reduction, water resource protection, biodiversity support, and other conservation benefits.

In addition to the substantial water quality and biodiversity benefits of impervious surface area reduction, there are substantial community and economic benefits to these practices. Increasingly, public officials, developers and neighborhood activists are viewing the streetscape—the external built environment of a development—as key determinants of neighborhood quality. Traditional

Neighborhood Development (TND) and New Urbanism are two visible movements in contemporary planning that advocate for narrower streets and reduced building setbacks. These movements value these design practices not for their benefits to the natural environment but for their community benefits—more intimate neighborhood settings with better pedestrian amenities (NIPC 1997a).

Finally, the impervious surfaces of a new development: roads, sidewalks, and parking lots; are very expensive to construct. Reducing the overall area of these features can translate into substantial savings for the developer. There are various ways to calculate these savings. Based on 1997 costs, NIPC's *Reducing the Impacts of Urban Runoff* calculates a savings of \$910 per residence for reducing street width, sidewalk width, and driveway width in a new residential development. Other savings, such as reduced construction time, shorter utility runs, and increased marketability through improved aesthetics also can be considered, though these are more difficult to directly quantify.

Benefits, Examples, and Resources

As we have seen, updating standards and regulations for impervious surfaces can be beneficial to the local community, future homeowners, and the developer of the site. See Chapter 2 for a full discussion of the economic benefits of this principle.

Additional Resources

American Association of State Highway and Transportation Officers. 2001. *A Policy on Geometric Design of Highways and Streets*.

Center for Watershed Protection. 1998. *Better Site Design: A Handbook for Changing Development Rules in Your Community*. Ellicott City, Maryland.

Center for Watershed Protection, Stormwater Manager's Resource Center. 2002. *Better Site Design Fact Sheet: Alternative Pavers*. <http://www.stormwatercenter.net>.

Center for Watershed Protection, Stormwater Manager's Resource Center. 2002. *Stormwater Management Fact Sheet: Porous Pavement*. <http://www.stormwatercenter.net>.

Kulash, Walter M. 2001. *Residential Streets, 3rd Edition*. Urban Land Institute, National Association of Home Builders, American Society of Civil Engineers, Institute of Transportation Engineers.

Northeastern Illinois Planning Commission. 1997a. *Reducing the Impacts of Urban Runoff: The Advantages of Alternative Site Design Approaches*. Chicago.

Green roof information

Greenroofs.com. <http://www.greenroofs.com/>.

Pennsylvania State University. Center for Green Roof Research web site. http://hortweb.cas.psu.edu/research/greenroofcenter/about_ctr.html.

Community Benefits

- Decreased demand for stormwater runoff management.
- Reduced municipal maintenance costs.

Homeowner Benefits

- Increases biodiversity in nearby wetlands and water bodies.
- Proximity to neighbors increases chances of friendly interaction.

Developer Benefits

- Decreased development costs.
- Decreased development time.

Practice 8: Roadway Design

Enact flexible standards for road length, width, right-of-way, and design. Require the minimum amount of paved surface area while maintaining safe and sufficient support of travel lanes, on-street parking, and emergency and support vehicle access.

While streets and roadways often are viewed primarily as transportation facilities, conservation design recognizes that streets are a major element of the built environment. For this reason, conservation design seeks to maximize the functional effectiveness of roadways without overbuilding, and while considering the aesthetics of the street. Narrower streets not only reduce overall impervious surface area, leading to improved stormwater management, but also encourage slower traffic speeds which creates a safer and more livable street for residents. A 1998 study by Peter Swift concluded that “[There is] a clear relationship between accident frequency and street width and curvature. The findings support the theory that narrower ... streets are safer than standard width residential streets.”

Residential Streets, Third Edition lists the following principles of roadway design:

- Street planning should relate to overall community planning, including pedestrian and bicycle activity.
- The street is an important component of the overall community design. Properly scaled and designed streets can create more attractive communities and can contribute to a clearly defined sense of place.
- Wherever possible, street pavement layouts should be planned to avoid excessive stormwater runoff and to avoid heat buildup.
- Streets can function socially such as meeting places and centers of community activity.
- The overdesign of streets should be avoided. Excessive widths or undue concern with geometries more appropriate for highways encourages greater vehicle speeds.
- Different streets have different functions and need to be designed accordingly. Blanket guidelines are inappropriate.

The conservation design model naturally shortens road lengths by grouping developed areas where feasible. Care should be taken to carry on this natural reduction of road area through the road design process. Minimizing paved surface area is important; a second important consideration in roadway design is the conservation of scenic views and vistas. This is especially relevant in rural, conservation development communities.

The goal of a compact, pedestrian-friendly neighborhood can be undermined if the typically wider road and right-of-way standards of conventional suburban developments are used. As outlined in the introduction to this section, wide streets are wide swaths of impervious cover and as such, also can contribute to excess stormwater runoff.

Perception

The need for adequate turning radii for school buses and maintenance and emergency vehicles requires large cul-de-sacs.

Fact

Fire trucks with 30-40 foot turning radii are available.

Fact

Many newer large service vehicles are being made with tri-axles which allow for sharper turns.

Fact

A smaller minimum turnaround radius of 30 feet has been suggested by several organizations.

Fact

School buses do not typically enter cul-de-sacs.

(From *Better Site Design*)

The goal of narrowing and minimizing paved street area must be carefully balanced with basic requirements for health and safety. A common concern is that reduced street widths and rights-of-way result in reduced accessibility for emergency vehicles, especially large fire trucks. The suggested widths and rights-of-way given in the following model ordinance language are adapted from *Residential Streets*. This publication has the endorsement of the American Society of Civil Engineers, the Institute of Transportation Engineers, and the National Association of Home Builders and the suggestions are in compliance with the guidelines given by the American Association of State Highway and Transportation Officers (AASHTO) in the 2001 edition of *A Policy on Geometric Design of Highways and Streets*, commonly called the AASHTO Greenbook.

Conventional developments generally include curb-and-gutter edging for new roads. Alternative edge construction and vegetated swales (see Practice 10) are other ways not only to reduce overall imperviousness but also to support the goals of impervious surface area reduction and improved stormwater management.

Model Ordinance Language

The following model ordinance language can be adapted to modify existing local codes and ordinances. Blanks and bracketed ([]) sections should be filled in with language appropriate for each community.

Model Ordinance Language

(Adapted from UW Extension Model Ordinance and Residential Streets)

- A. Neighborhood streets may take the form of a two-way street, a pair of one-way streets on either side of a landscaped median, or a one way loop street around a small neighborhood green. Streets shall be developed according to standards that promote road safety, assure adequate access for fire and rescue vehicles, and promote adequate vehicular circulation.

- B. The applicant must demonstrate by submitting a traffic study that access to the development has the capacity to handle traffic generated by the proposed project, and will not endanger the safety of the general public.

- C. Streets shall have the following design standards
 - 1. Right-of-way widths. The right-of-way width for each road shall not exceed the width of the street pavement specified in C.2 of this Section in addition to width for all public services including: drainage, sidewalks, bicycle trails, street trees, trails and walkways, utilities, snow storage, and grading. In residential developments, the right-of-way width shall not provide an allowance for future widening.

 - 2. Travel lane widths for local roads shall be determined by the expected use and shall be within the following ranges: (Residential Streets pp. 25-26)

Commentary

As described earlier, narrow streets often generate safety concerns. By demonstrating ahead of time that these basic requirements will be met, the developer can work to allay these fears.

While collector streets may later need to be widened, residential streets should not require widening.

The widths given here are in compliance with the AASHTO Greenbook recommendations. In general, widening roads by a few additional feet does not increase the capacity of the road, but it does encourage higher driving speeds.

24-26 feet is adequate width for either parking on both sides of the street with a single lane for traffic (i.e. one-way traffic flow, or where oncoming cars must yield), or for parking on one side with two slow moving traffic lanes.

Recommended Pavement Widths	
Local Streets	
No parking expected	16-18 feet
Restricted parking	22-24 feet
Normal residential parking	24-26 feet
Residential Collector	Follow local standards

Model Ordinance Language (continued)

Commentary

D. Additional Standards

1. Cul-de-sacs should be designed as semi-circular and circular loop roads. Minimum 30' outside radius around a landscaped island with a minimum 10' radius. The center landscaped areas should be depressed and potentially can be designed for stormwater storage.

Connectivity is an important goal of residential street design. Connected streets reduce overall vehicle trips by eliminating the need to backtrack. Connected streets also encourage and support pedestrian circulation. However, connected streets also increase overall impervious area. In residential street design a balance must be found between impervious surface reduction and user-friendly design. With this balance in mind, this model recommends that the cul-de-sac, which generally does not encourage connectivity, should be used sparingly. Incorporating center landscaped areas into the stormwater management scheme is a good way to offset the use of cul-de-sacs. Cul-de-sac design will require working with local emergency personnel for safe access to adjacent land uses.

2. Sidewalks shall have a maximum width of six (6) feet in high pedestrian traffic areas and a maximum width of five (5) feet in general pedestrian traffic areas. Trails and other walkways with less pavement shall be encouraged where feasible.

6-foot sidewalks are most comfortable for pedestrian use. While narrower sidewalks may be adequate in some circumstances, wider widths should be required in high traffic areas.

- E. Streets that serve as collectors, interconnecting subdivisions and other major traffic generators, shall be designed according to the [city/village/town/county]'s standards for collector roads.

This model does not include recommendations for collector streets – however, the principles of building to minimum standards and reducing overall imperviousness still should be observed.

- F. The developed area should have walkways on at least one side of the street.

For standard conservation design, the recommendation is to use walkways on one side only to reduce imperviousness. It is worth noting, however, that other systems such as Traditional Neighborhood Design call for sidewalks or walkways on both sides to encourage pedestrian flows. The decision about the use of walkways and sidewalks must be made in context with the development.

- G. The use of enclosed drainage curb and gutter systems is discouraged in favor of vegetated swales, where feasible.

See Practice #10, Vegetated Swales, for more detailed information on the use of this practice.

Practice 9: Parking Lot Design

Enact flexible standards for parking lot design in multi-family housing developments, commercial, and business areas. Require stormwater treatment for parking lot runoff using bioretention areas, filter strips, and/or other practices that can be integrated into required landscaping areas and traffic islands.

There are several techniques that communities can use to reduce the volume and increase the quality of stormwater generated at parking lots. These include:

- Reducing minimum parking requirements to allow smaller lots to be built;
- Allowing developers to use pervious materials for spillover parking;
- Promoting the use of parking garages which expose less impervious cover to rainfall; and
- Designing drainage and landscape systems that filter & infiltrate runoff.

Adequate parking is a necessity for retail, commercial, and multi-family housing developments. The interpretation of 'adequate' varies widely from community to community and project to project. In practice, parking lots are sometimes overbuilt and oversized due to municipal parking requirements and perceived demand. With a few simple modifications, parking requirements can be updated to discourage or prohibit overbuilding while still meeting actual demand for parking. These improvements can make a substantial reduction in impervious cover and as a result substantially reduce the negative impacts of runoff from parking lots.

Communities commonly determine minimum parking ratios by either adopting and modifying the requirements of neighboring communities or by referring to informational publication by the Institute of Transportation Engineers or other agencies. In many cases, these parking ratios result in far more spaces than are actually required. This occurs because ratios are typically set as minimums and not maximums. Therefore, builders and developers are free to provide excess parking. The excess parking is provided to prevent complaints from residents, employees, and customers regarding inadequate parking. Commercial landowners, reluctant to risk losing customers due to lack of parking, are particularly sensitive to this issue (Better Site Design).

However, oversized parking lots are expensive at many levels. They are expensive to construct and maintain. More parking means more impervious cover, which in turn leads to increased stormwater runoff and decreased groundwater recharge. Increased runoff is expensive to manage, and as seen earlier, has a number of adverse environmental impacts. For more sustainable site design, parking codes should be updated to make calculated parking ratios a **maximum** possible number of impervious parking spaces that can be built on a project. This measure will not only decrease impervious surface area on the project, but also reduce overall costs. In cases where parking above the maximum is desired, additional spaces should be created either by building parking structures or by using pervious paving materials such as gravel or permeable pavers.

Reductions in overall parking lot size can be achieved in a number of ways including reduction of the number of spaces required, reducing the size of individual parking stalls, designated spaces for compact cars, motorcycles and bicycles, and sharing parking between adjacent uses. Although not directly addressed in this section, the opportunities to reduce parking demand through improved pedestrian and public transportation access also should be considered.

The use of permeable paving blocks, gravel, or grass can be a viable alternative for low traffic parking areas, emergency access roads, and driveways to increase infiltration and reduce runoff volumes. In addition to reducing parking requirements and imposing maximum parking allotments, ordinances should permit the use of per-

meable pavers or other alternative surfaces in appropriate parking situations. (See the Center for Watershed Protection's *Stormwater Manager's Resource Center*, <http://www.stormwatercenter.net>, for fact sheets on alternative pavers and porous pavement.)

Another recommendation is to require onsite stormwater reduction techniques. Existing landscaped areas in parking lots should be used to provide stormwater filtering or infiltration.

Bioretention areas are landscaping features adapted to treat stormwater runoff on the development site. They are commonly located in parking lot islands or in peripheral drainage swales. Surface runoff is directed into shallow, landscaped depressions. These depressions are designed to incorporate many of the pollutant removal mechanisms that operate in wetland or prairie ecosystems. During storms, runoff infiltrates through the mulch and soil in the system. Runoff from larger storms begins to pond and may be diverted through or past the bioretention area to the storm drain system. The remaining runoff slowly filters through the mulch and prepared soil mix. A portion of the filtered runoff may be collected in a perforated underdrain and conveyed to a detention basin. Bioretention requires seasonal landscaping maintenance.

Grassed filter strips (also known as vegetated filter strips, filter strips, and grassed filters) are vegetated areas that are intended to treat sheet flow from adjacent impervious areas. Filter strips function by slowing runoff velocities and filtering out sediment and other pollutants, and providing some infiltration into underlying soils. With proper design and maintenance, filter strips can provide relatively high pollutant removal. Filter strips are best suited to treating runoff from roads and highways, roof downspouts, and small parking lots. Typically, filter strips are used to treat very small drainage areas.

For specific design criteria for these practices refer to the list of additional resources at the beginning of this section.

Model Ordinance Language

The Technical Advisory Committee developed the following guidelines to assist local governments in modifying parking requirements. Because parking requirements extend beyond the scope of residential conservation design (the emphasis of this document), often into commercial conservation design, the language provided below is advisory and will require substantial adaptation based on community's needs.

Perception

The cost to provide on-site stormwater management may be more expensive than providing off-site management at one regional facility.

Fact

The use of bioretention facilities and other on-site stormwater management facilities can significantly reduce the need for storm sewers, thus reducing stormwater infrastructure costs.

Fact

Filter strips, bioretention facilities, and dry swales may be placed in dead space areas such as setbacks and traffic islands, minimizing impacts to usable (i.e., buildable) land.

(From *Better Site Design*)

Model Ordinance Language

- A. Reduce parking requirements for low impact uses.
- B. The number of parking spaces shall be not less than (____) and not more than (____). In cases where additional spaces are desired, these shall be provided by building structured parking or using pervious materials, where groundwater will not be adversely affected by the use of such materials.
- C. New parking lots and structures shall include a percentage of designated spaces for compact cars, motorcycles, and bicycles. Compact car spaces shall be smaller than typical spaces. Motorcycle spaces shall be smaller still, and racks or other facilities shall be provided for bicycles.
- D. In cases where adjacent businesses or other uses can reasonably share parking spaces, such as when businesses have staggered needs according to peak times (at the discretion of the Planning Director), such sharing is permitted.
- E. Where groundwater will not be adversely affected by the use of such materials, alternative paving materials, such as permeable pavers or gravel, are permitted for overflow parking and other low volume parking areas.
- F. Businesses served by public transportation may apply for reductions in parking space requirements.
- G. All off-street parking facilities for (____) or more vehicles, not contained in a building or structure, shall be effectively buffered from adjacent uses, especially residential areas.
- H. Bio-infiltration, filter strips, and other practices shall be included in all off-street parking facilities for (____) or more vehicles.
- I. The use of enclosed drainage curb and gutter systems is discouraged in favor of vegetated swales, where feasible.

Commentary

The parking section of the zoning or subdivision (usually zoning) ordinance should be reviewed and cases of excessive parking requirements should be corrected.

To eliminate overbuilding, the minimum and maximum parking requirements can be set. In cases where businesses desire parking beyond the maximum, alternatives to conventional parking lots must be used. (See the Center for Watershed Protection's Stormwater Manager's Resource Center, <http://www.stormwater-center.net>, for fact sheets on alternative pavers and porous pavement.)

Uses that can comfortably share parking often have different peak periods. For example, a restaurant and a medical clinic will draw peak numbers of patrons at different times of day. Shared parking reduces situations where overbuilt parking lots sit empty most of the time.

While not appropriate for high volume parking areas, alternative materials are adequate in many situations. See the Stormwater Manager's Resource Center (cited above) for more information.

Practice 10: Vegetated Swales

Require that vegetated swales be used in street rights-of-way, parking lots, and other paved areas to convey and treat stormwater runoff.

Discussion

The term "swale" (a.k.a., grassed channel, dry swale, wet swale, biofilter) refers to a series of vegetated, open channel practices that are designed specifically to treat and attenuate stormwater runoff for a specified water quality volume. As stormwater runoff flows through the channels, it is treated through filtering by the vegetation in the channel, filtering through a sub-soil matrix, and/or infiltration into the underlying soils. Maintenance of grassed channels mostly involves maintenance of the grass or wetland plant cover. Swales may be used in the street right-of-way and throughout the site.

Most jurisdictions require that curb and gutter systems be installed along residential streets to convey stormwater runoff. Curb and gutter systems, however, provide no stormwater treatment and quickly discharge stormwater directly into streams. By contrast, open vegetated swales that could provide better treatment are usually discouraged or prohibited. Unlike curb and gutter systems, which move stormwater with virtually no treatment, open vegetated swales remove pollutants by allowing infiltration and filtering to occur. Open swales also encourage groundwater recharge, and can reduce the volume of stormwater runoff generated from a site. (Better Site Design, CWP)

Compared to roadside ditches, vegetated swales have a wider bottom, gentler slopes, and denser vegetation. They are designed to detain stormwater flows for ten to twenty minutes to allow sediment and heavy particles to filter out. Vegetated swales are relatively easy to construct and maintain. If applied under the right conditions, and installed properly, grass channels experience few of the nuisance problems associated with roadside ditches.

It should be noted that the feasibility of using swales at a development site is determined by a number of factors, including drainage area, slope, length, housing density, and street type. In general, open channel systems are most appropriate for smaller drainage areas, mildly sloping topography, and housing density less than four dwelling units per acre.

For specific design criteria for these practices refer to the list of additional resources at the beginning of this section.

Perception

Snow removal may be more difficult when swales are used.

Fact

Roadside swales increase snow storage at the road edge. Smaller snow plows are available.

(From *Better Site Design*)

Perception

Open channel BMPs (like swales) may harbor pests and standing water may interfere with homeowners' ability to mow their front yards.

Fact

The potential for snakes and other vermin can be minimized by more frequent mowing.

Fact

Grass channels are not designed to detain water for any length of time. Properly designed dry swales will drain within 24 hours.

(From *Better Site Design*)

Model Ordinance Language

Improved sites.

All sites shall be dedicated in a condition ready for full service of electrical, water, sewer, and streets (including **vegetated swales** or enclosed drainage and curb and gutter) as applicable to the location of the site, or acceptable provision made therefore. **The use of swales vegetated with native materials is encouraged as a method of stormwater conveyance to decrease runoff velocity, allow for biofiltration, allow suspended sediment particles to settle, and remove pollutants.**

Commentary

Existing language with suggested additional language in bold.

Other references to curb/gutter construction may be found in the subdivision ordinance, the planned development ordinance, and in ordinances pertaining to new road design and parking lot design. These references can be updated similarly to the improved site reference given here.

Practice 11: Walkways

Establish flexible design standards for walkways.

The typical form of pedestrian circulation in residential subdivisions is the sidewalk. A sidewalk system adds a social as well as a transportation element to a community. It is a unified linear element that provides a common space within a neighborhood. However, sidewalks may not always be appropriate. They increase the amount of impervious surface on a site, which increases stormwater runoff. For conservation design, the preferred approach is to mandate 'walkways' within developments. These walkways can take various forms, from traditional sidewalks to rustic trails, depending on the nature of the development.

In densely developed or urban areas, sidewalks are generally the most appropriate form of walkway. In certain cases, where sidewalks are necessary, the total impervious surface area can be reduced by constructing sidewalks on only one side of the street.

In cases of less dense development, sidewalks can be replaced with a trail system through the development, connecting homes to open space. Materials also may be varied; for an informal walkway system, materials such as gravel, mulch, wood chips, or grass clippings can effectively replace asphalt or concrete. Further, a trail system can be designed to take advantage of contiguous open space on other development sites, connecting through multiple sites for a community-wide trail network, where ownership arrangements and easements permit (Countryside Program, 3C).

Any conservation development must find a balance between providing a sufficient walkway system to support pedestrian uses, and minimizing impervious surfaces.

The key to successfully updating local ordinances is to provide for flexibility in walkway design. The exact nature of the walkway system depends ultimately on community preferences and the nature of the development site.

Model Ordinance Language

The following model ordinance language can be adapted to modify existing local codes and ordinances. Blanks and bracketed ([]) sections should be filled in with language appropriate for each community.

Perception

The Americans with Disabilities Act (ADA) requires sidewalks on both sides of the street.

Fact

The ADA requires at least one accessible route from public streets, parking areas, and passenger loading zones along a route that generally coincides with that of the general public. There are no specific restriction on roadway sidewalks.

(From *Better Site Design*)

Perception

Residents want sidewalks on both sides of the street.

Fact

There is no appreciable market difference between houses that are directly served by sidewalks (i.e., the sidewalk is on the same side of the street) and houses that are not directly served (i.e., the sidewalk is on the opposite side of the street). Some residents do prefer to have access to a sidewalk in front of their property, while others prefer no sidewalks. The types of preferences are logically resolved at the time buyers purchase the property.

(From *Better Site Design*)

Model Ordinance Language

- A. Walkways shall be provided to connect residential areas to common open space areas and to provide convenient pedestrian access throughout the conservation development and from the conservation development to other areas of the community.
- B. When the proposed walkway system provides pedestrian access equal to or better than the provision of sidewalks along street rights-of-way, sidewalks along public streets are not required.
- C. Unless a development is 'urban' in character, sidewalks or walkways are not required on both sides street rights-of-way, as long as sufficient access to homes and businesses is provided.
- D. Walkways, or a portion of the walkways, should be constructed of pervious materials such as gravel, wood chips or other similar material.

Commentary

When is a development "urban" in character? This decision must be made within the context of each community—as a general rule of thumb, densities requiring curb and gutter construction are probably "urban" and will likely benefit from sidewalks on both sides of the street.

Walkways, more similar to trail systems than conventional sidewalks, will not require the same snow removal practices as conventional sidewalks. The pervious materials suggested can be shoveled or simply packed down through use.

E. Walkways should be maintained similarly to the common open space within the development. See Practice #7, Natural Area Management, for more information.

Practice 12: Driveway Design

Update ordinances to eliminate length and width requirements for driveways, and to permit alternative driveway surfaces and shared driveways that connect two or more homes together.

Like roadways in general, driveway lengths are naturally shortened by the form of conservation design. Homes are located closer together and closer to roads and streets. As a result, long driveways are rarely necessary to provide adequate access to homes and garages. Thoughtful techniques can be employed to further reduce driveway surface areas. In many cases, common residential drives serving 2-5 housing units are appropriate. Because driveways can be constructed to reduced standards with regard to design speed, alignment, compaction, and pavement or gravel surfaces, this is a low impact way to save on impervious surface area.

Ordinances should be updated to remove length and width requirements for driveways, since these can be built to minimum standards. Since conservation design encourages the use of on-street parking, it is less important to provide overflow parking in private driveways.

While permeable paving blocks are only sometimes appropriate for parking areas and public roadways, they are nearly always appropriate for driveways. Allow the use of permeable pavers, gravel, or other pervious surfaces for driveways in conservation subdivisions. (See the Center for Watershed Protection's Stormwater Manager's Resource Center, <http://www.stormwatercenter.net>, for fact sheets on alternative pavers and porous pavement.)

Model Ordinance Language

The following model ordinance language can be adapted to modify existing local codes and ordinances. The language given here is advisory in nature and will require substantial adaptation to be effective in local ordinances.

Perception

Alternative driveway surfaces make snow removal more difficult.

Challenge

Paver blocks can be damaged by snowplows and stone, gravel, or cobble driveways are difficult to plow. Brick, porous asphalt, and pervious concrete will perform similarly to conventional pavement although sand cannot be used on porous pavement.

(From *Better Site Design*)

Model Ordinance Language

A. **Private Drives:** Private drives shall be in compliance with the following requirements:

1. Private drives shall be built to the minimum length and width necessary to serve the residence.
2. Private drives, where feasible, shall be built with alternative surfaces such as gravel or permeable pavers, and also can use alternative construction forms such as the two-track form. These materials should be used only when groundwater will not be adversely affected by their use.

B. **Common Drives:** Common drives shall be permitted in compliance with the following requirements:

1. A common drive can serve multiple units.
2. Common drives shall be built to the minimum length and width necessary to serve the residences.
3. Common drives, where feasible, should be built with alternative surfaces such as gravel or permeable pavers, and can also use alternative construction forms such as the two-track form. These materials should be used only when groundwater will not be adversely affected by their use.
4. A common drive shall extend from a public or private street and shall not connect to any other existing or planned public or private street.

Commentary

Detailed standards are not necessary for driveway construction.

Alternative surfaces can reduce overall imperviousness.

Common drives are a type of private street. The distinction is that common drives must comply with the standards for residential driveways, which is a lesser standard than that required for private streets. The municipality or county is not responsible for the maintenance of common drives.

This requirement is necessary because common drives are built to lower standards than other types of private street. This assures that common drives are not misused in the development process.

Practice 13: Roof Runoff Management

Discourage discharge of rooftop runoff into storm sewers. Require or encourage alternative roof runoff management techniques. Encourage green roof designs.

In most conventional developments, stormwater from rooftops is piped into a storm drain that directly leads into an engineered stormwater management facility. Roofs are one of the most important sources of concentrated runoff from developed sites. One of the best ways to decrease the need for stormwater management systems is to manage rooftop runoff on site, instead of moving stormwater through a conveyance system. Redirecting rooftop runoff is a significant measure for reducing downstream impacts and can decrease annual runoff volumes by as much as 50% for medium and low density land uses. It also can significantly reduce the annual pollutant load. In addition to achieving specific stormwater runoff management objectives, rooftop runoff management also is aesthetically and socially beneficial.

Although there are a wide variety of rooftop runoff treatment options, they all can be classified into one of three categories: 1) practices that infiltrate rooftop runoff; 2) practices that divert runoff or soil moisture to a pervious area; and 3) practices that store runoff for later use. The best option depends on the goals of a community, the feasibility at a specific site, and the preferences of the homeowner.

The practice most often used to infiltrate rooftop runoff is the dry well. In this design, the storm drain is directed to underground rock-filled trenches. French drains or Dutch drains also can be used for this purpose. In these designs, the relatively deep dry well is replaced with a long trench with a perforated pipe within the gravel bed to distribute flow throughout the length of the trench.

Runoff can be diverted to a pervious area or to a treatment area using site grading, channels, and berms. Treatment options can include **grassed swales**, **bioretention**, or **filter strips**. Alternatively, rooftop runoff can simply be diverted to pervious lawn areas, as opposed to flowing directly to the street, and thus the storm drain system.

Practices that store rooftop runoff, such as cisterns and rain barrels, are the simplest in design of all rooftop runoff treatment systems. Some of these practices are available commercially and can be applied in a wide variety of site conditions (*Center for Watershed Protection*, www.cwp.org).

One important design consideration for rooftop runoff practices is to locate infiltration areas sufficiently far from house foundations to prevent undermining the foundation or seepage into basements. These practices should be separated at least ten feet from the house to prevent these problems.

Vegetated roof covers, also called green roofs and extensive roof gardens, involve blanketing roofs with a veneer of living vegetation. These systems can reduce roof runoff as well as provide an aesthetic benefit to homeowners and communities.

For specific design criteria for these practices refer to the list of additional resources at the beginning of this section.

Perception

Re-directed rooftop runoff may increase a property owner's maintenance burden.

Fact

When designed properly, on-lot bioretention areas provide an attractive landscaping feature that does not require supplemental water.

(From *Better Site Design*)

Perception

Wet basements will result from re-directing rooftop runoff.

Fact

These conditions can be minimized by setting specific criteria regarding the distance that downspouts must discharge from foundations, minimum adjacent slopes away from houses, and adequate construction inspection.

(From *Better Site Design*)

Model Ordinance Language

- A. Direct rooftop runoff and sump pumps to pervious areas such as yards, open channels, or vegetated areas, and avoid routing rooftop runoff and sump pumps to the roadway and the stormwater conveyance system.
- B. Rooftop drainage should be illustrated on the engineering plan necessary for building permit issuance
- C. Green roofs may be used to reduce stormwater runoff.

Commentary

A green roof is the modern equivalent of the roof garden or sod roof. While these older technologies were heavy and cumbersome, today's green roofs are lightweight and include sufficient drainage and roof protection. Green roofs are new technology; as new techniques emerge accepted practice for green roof use may change. It is the responsibility of the applicant to review the state of the art for green roof technology when submitting applications for their use.

Principle D. Implement Sustainable Stormwater Management Techniques

Sustainable stormwater management techniques can decrease flooding, improve water quality, decrease erosion and sedimentation, and improve groundwater recharge.

Discussion

Sustainable stormwater management is perhaps the most important benefit of conservation design. Nearly every conservation design practice contributes to improved stormwater management in some way. The stormwater benefits outlined in Principles A-C are summarized here. In addition, this section also includes model ordinance language for the implementation of an Urban Runoff Mitigation Plan, a general strategy for improving stormwater management.

Stormwater runoff has been traditionally treated as a by-product of development to be disposed of as quickly and efficiently as possible. The result often has been increased flooding, degradation of water quality, soil erosion and sedimentation, and reduced groundwater recharge.

Stormwater Ordinances

Most of the counties in the region have adopted or are close to adopting countywide stormwater ordinances. It is not the intent of this ordinance to replace those ordinances but rather to integrate the goals of countywide and municipal ordinances with the goals of conservation design. The countywide stormwater management ordinances may be found on the following web sites:

DuPage County: <http://www.dupageco.org/dec/SWOrd2000.pdf>

Lake County: <http://www.co.lake.il.us/smc/wdo/wdodoc.pdf>

Will County: <http://www.willcountylanduse.com/engineering/index.html>

McHenry County: <http://www.co.mchenry.il.us/CountyDpt/plandev/WaterShedOrd2002.pdf>

Kane County: <http://www.co.kane.il.us/kcstorm/Draft/revadoptord.pdf>

Cook County: Contact your municipality.

Best Management Practices

It is the intent of conservation design to encourage the use of Best Management Practices (BMPs) which are defined as structural, vegetative, or managerial approaches designed to reduce stormwater runoff volume, maximize natural groundwater recharge, and treat, prevent, or reduce degradation of water quality due to stormwater runoff. All development projects subject to review under the requirements of this ordinance should be designed, constructed, and maintained using BMPs. The particular facilities and measures required on-site shall reflect and incorporate existing grade, natural drainage and storage features, and wetlands on the site to the maximum extent feasible.

It is assumed that a municipality will have a stormwater ordinance in place or will make reference to a county ordinance as well as a guidance manual for BMP design and implementation. The design manual should contain information on sizing criteria, performance criteria, and guidance on selection and location of BMPs. Currently there is not a technical reference manual for the practices in this ordinance but there are several references given in each section of Chapter 4. Both Kane and Lake Counties have Technical Reference Manuals available on-line for their stormwater ordinances and the State of Maryland has one available that includes many of the practices listed in this ordinance (see additional resources).

Stormwater Treatment Train

The open space and permeable landscapes within a conservation development should be creatively used to infiltrate, filter, and store runoff. Open space areas can be situated along natural drainage patterns and a series of diverse landscapes convey water through a natural treatment process. The channeling of runoff through a series of natural landscapes can result in the retention of stormwater on site, settling and pollutant removal, and lower runoff volume and velocity. Stormwater management plans can incorporate design solutions that direct runoff to grass swales that feed into a prairie or woodlands. In some cases, the sequence could be extended to a constructed wetland (The Countryside Program).

Benefits, Examples, and Resources

Implementing sustainable stormwater management techniques can be beneficial to the local community, the developer of the site, and homeowners, the eventual end-users of the new development. See Chapter 2 for a full discussion of the economic benefits of this principle.

Developments with improved stormwater management facilities are more marketable because they provide aesthetic features such as rain gardens, wet detention basins, and natural drainage areas that attract wildlife.

Additional Resources

Center for Watershed Protection. 1998. *Better Site Design: A Handbook for Changing Development Rules in Your Community*. Ellicott City, Maryland.

Center for Watershed Protection. 1996. *Design of Stormwater Filtering Systems*, Prepared for: Chesapeake Research Consortium Solomons, MD and US EPA Region V Chicago, IL.

Kane County Department of Environmental Management. 2001. *Kane County Stormwater Technical Guidance Manual*. http://www.co.kane.il.us/kcstorm/Draft/Technical_FINAL.pdf, January 15, 2003.

Lake County Stormwater Management Commission. 1992. *Technical Reference Manual*. <http://www.co.lake.il.us/smc/tac/trm.htm>, January 15, 2003.

Maryland Department of the Environment. 2000. *2000 Maryland Stormwater Design Manual Volumes I & II*. Baltimore. http://www.mde.state.md.us/Programs/WaterPrograms/SedimentandStormwater/stormwater_design/index.asp, January 15, 2003.

Northeastern Illinois Planning Commission. 1997a. *Reducing the Impacts of Urban Runoff: The Advantages of Alternative Site Design Approaches*. Chicago.

Prince George's County Department of Environmental Resources. 1997. *Low Impact Development*. Laurel, MD.

Urban Runoff Mitigation Plan

An overarching theme in the design of conservation developments is the management of water resources. If applied, most of the practices discussed in this resource manual affect the rate, volume, and quality of the water managed on-site and directed off-site. In recognition of this fact and in order to fully integrate water management into site design, it is suggested that communities revise their subdivision ordinances by including the requirement for an Urban Runoff Mitigation Plan. Rather than dictate exactly what standards are necessary in a conservation development, this is a performance criterion that provides a flexible mechanism to encourage the use of practical techniques when considering site-specific conditions.

The purpose of an Urban Runoff Mitigation Plan is to permanently modify the structural causes of urban runoff pollution. This includes the reduction of both runoff volume and runoff contamination from existing residential and nonresidential properties and from future developments. This is accomplished by ensuring that project sites maximize on-site infiltration of runoff and ensuring that stormwater is directed or contained so as not to become polluted by passage through contaminating material.

A community may not use all of the practices listed in this ordinance but many will be needed to reach the goal. For example, while there is not necessarily a mandated percent open space in conservation developments because of the potential inflexibility given some smaller or infill sites, it is assumed that in order to meet the runoff mitigation goals listed below a large percentage of land will be left undeveloped or developed in a manner that reduces the amount of stormwater runoff.

Model Ordinance Language

The following model ordinance language can be adapted to modify existing local codes and ordinances to include the requirement for an Urban Runoff Mitigation Plan to be submitted and approved in connection with any new development. Blanks and bracketed ([]) sections should be filled in with language appropriate for each community.

Model Ordinance Language

Urban runoff reduction requirements for new subdivisions

The following urban runoff reduction requirements shall apply to all persons submitting applications for new development within the [Municipality or County].

- A. At the time of submittal of an application for a new development project, an applicant shall be required to submit an Urban Runoff Mitigation Plan to the [Department of Engineering].

- B. In developing an Urban Runoff Mitigation Plan, an applicant shall design for infiltration and treatment of projected runoff for the new development such that there is no increase in runoff volume for all events up to the 2-year storm event. The design elements utilized by an applicant shall include an appropriate combination of those provided on the list below so long as the required projected runoff infiltration or treatment is achieved:
 1. Utilize permeable areas to allow more infiltration of runoff into the ground through such means as:
 - a. Biofiltration;
 - b. Filter strips;
 - c. Swales;
 - d. Infiltration trenches;
 - e. Green roofs; and
 - f. Permeable pavement.

 2. Direct runoff to permeable areas and/or utilize stormwater storage for reuse or infiltration by such means as:
 - a. Orienting roof runoff towards permeable surfaces, drywells, French drains, or other Best Management Practices (BMPs) rather than directly to driveways or non-permeable surfaces so that runoff will penetrate into the ground instead of flowing off-site.

 - b. Grading impervious surfaces to direct runoff to permeable areas, utilizing level spreaders or other methods to distribute the impervious runoff over pervious surfaces.

Commentary

Many stormwater ordinances include language similar to this, while subdivision ordinances include contradictory requirements such as curb and gutter construction, elevated landscape islands, the use of roads as primary drainage elements, and other similar techniques. The practices that follow offer specific guidance and language for updating sections of the subdivision ordinance to eliminate these contradictions.

See Vegetated Swales, Roadway Design, Parking Lot Design, Driveway Design, and Roof Runoff Management.

See Roof Runoff Management

See Roadway Design and Parking Lot Design

Model Ordinance Language (continued)**Commentary**

c. Using cisterns, retention structures, or rooftops to store precipitation or runoff for reuse.

See Roof Runoff Management

d. Removing or designing curbs, berms or the like so as to avoid isolation of permeable or landscaped areas.

See Vegetated Swales, Roadway Design

3. The applicant also must meet release rate standards of the [stormwater ordinances]. The detention calculations may reflect the influence of BMPs used to achieve the runoff volume standard of this ordinance.

4. The Urban Runoff Mitigation Plan also must include the applicant's plan for the maintenance of all BMPs requiring ongoing maintenance.

5. All Urban Runoff Mitigation Plans must include the applicant's signed statement accepting responsibility for all structural and treatment control BMP maintenance. The transfer of property subject to an Urban Runoff Mitigation Plan must include as a written condition to the transfer that the transferee assumes full responsibility for maintenance of any structural, and/or source or treatment control BMPs.

C. All computations within the Urban Runoff Mitigation Plan shall calculate runoff from hydraulically connected impervious and pervious surfaces separately. Composite Runoff Curve Numbers shall not be used to calculate runoff from areas containing both pervious and hydraulically connected impervious surfaces. Impervious surfaces may be considered hydraulically disconnected when the impervious runoff is distributed over an area at least as large as the impervious surface. In these cases, a composite curve number may be used.

Runoff captured within infiltration trenches, dry wells, or similar infiltration based BMPs may be subtracted from site runoff volume calculations up to the storage volume of the infiltration practice.

Model Ordinance Language (continued)

Commentary

Vegetated green roof systems with a minimum 3-inch growing medium may be assumed to have similar runoff characteristics as hydrologic soil group "C" soils.

D. The [Municipality or County Director of Engineering] shall review the proposed Urban Runoff Mitigation Plan for compliance with the standards set forth in subsection (B) of this Section.

E. The Director of the [Department of Engineering] or his or her designee shall approve or disapprove the plan. If the plan is disapproved, the reasons for disapproval shall be given in writing to the developer. Any plan disapproved by the Director of the [Department of Engineering] or his or her designee must be revised by the developer and resubmitted for approval.

F. A waiver from subsection (b) of this Section may be issued by the Director of the [Department of Engineering] or his or her designee if the petitioner shows impracticability of implementing these requirements. Recognized circumstances demonstrating impracticability include: (i) extreme limitations of space for treatment; (ii) unfavorable (i.e. hydrologic soil group "D" soils) or unstable soil conditions at a site to attempt infiltration; and (iii) risk of groundwater contamination because a known unconfined aquifer lies beneath the land surface or an existing or potential underground source of drinking water is less than ten feet from the soil surface.

G. If a waiver is granted for impracticability, the petitioner will be required to transfer the savings in cost, as determined by the Director of the [Department of Engineering], to a [Municipality or County] stormwater mitigation fund to be used to promote regional or alternative solutions for urban runoff pollution in the storm watershed, which may be operated by a public agency or a non-profit entity.

H. No building permit or other planning approval shall be issued until an Urban Runoff Mitigation Plan has been approved by the [Department of Engineering].

Bibliography

--- . February 2000. Putting the Freeze on Heat Islands. American City and County.

American Association of State Highway and Transportation Officers. 2001. *A Policy on Geometric Design of Highways and Streets*.

Arendt, Randall G. 1996. *Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks*. Washington D.C.: Island Press.

Arendt, Randall G. 1999. *Growing Greener: Putting Conservation into Local Plans and Ordinances*. Washington D.C.: Island Press.

The Biodiversity Project. No Date. *Getting on Message/About Sprawl: Economic Costs at a Glance Fact Sheet*.

Brabec, Elizabeth. 1992. On the Value of Open Spaces. *Scenic America Technical Information Series*, vol. 1, no. 2.

Center for Watershed Protection. 1998. *Better Site Design: A Handbook for Changing Development Rules in Your Community*. Ellicott City, Maryland.

Center for Watershed Protection. 1996. *Design of Stormwater Filtering Systems*, Prepared for: Chesapeake Research Consortium Solomons, MD and US EPA Region V Chicago, IL.

Center for Watershed Protection. 1995. *Site Planning for Urban Stream Protection*.

Center for Watershed Protection, Stormwater Manager's Resource Center. 2002. *Better Site Design Fact Sheet: Alternative Pavers*. <http://www.stormwatercenter.net>, December 19, 2002.

Center for Watershed Protection, Stormwater Manager's Resource Center. 2002. *Stormwater Management Fact Sheet: Porous Pavement*. <http://www.stormwatercenter.net>, December 19, 2002.

Center for Watershed Protection, Stormwater Manager's Resource Center. 2002. *Open Space Model Ordinance*. http://www.stormwatercenter.net/Model%20Ordinances/open_space_model_ordinance.htm, December 20, 2002.

Chicago Wilderness. 1999a. *Biodiversity Recovery Plan*. Chicago.

Chicago Wilderness. 1999b. *An Atlas of Biodiversity*. Chicago.

City of Kenosha, Wisconsin. *Zoning Ordinance for the City of Kenosha, Wisconsin, Section 6.0 Parking and Loading Requirements*. Kenosha.

City of Napa, California. *Ordinance on Riparian Habitat Areas*. <http://www.stormwatercenter.net/Model%20Ordinances/napa-buffer>, January 15, 2003.

The Conservation Foundation website. <http://www.theconservationfoundation.org>, January 15, 2003.

Conservation Research Institute. 2001. *TCSP—Route 47/Kishwaukee River Transportation Corridor Project Preliminary Master Plan—Long Version*.

The Countryside Program. 1996. *Balancing Conservation & Development in Northeast Ohio*.

The Countryside Program. 1998. *Conservation Development Resource Manual*. Ohio: Western Reserve Resource Conservation and Development Council.

Crompton, John L. 2001. *Parks and Economic Development, Planning Advisory Service Report Number 502*. Chicago: Planners Press.

Diehl, J. and T. Barrett. 1988. *The Conservation Easement Handbook*. Washington DC: Washington D.C: Land Trust Alliance.

Greenroofs.com. <http://www.greenroofs.com/>, February 17, 2003.

Gibbons, Jim. *Technical Paper #5, Parking Lots*. Connecticut: UConn Cooperative Extension Land Use.

Illinois Department of Transportation. 1999. *Rural Two-Lane/Multilane State Highways*.

Johnson County, Iowa. *Conservation Subdivision Design Ordinance*. <http://www.johnson-county.com/zoning/sensitiveareas/csd.htm>, December 20, 2002.

Kane County, IL. 2002. *Kane County Code*. <http://www.co.kane.il.us>, January 15, 2003.

Kane County Department of Environmental Management. 2001. *Kane County Stormwater Technical Guidance Manual*. http://www.co.kane.il.us/kcstorm/Draft/Technical_FINAL.pdf, January 15, 2003.

Kendall County, IL. 2002. *Kendall County Zoning Ordinance, Section 8.00 Residential District*.

Kulash, Walter M. 2001. *Residential Streets, 3rd Edition*. Urban Land Institute, National Association of Home Builders, American Society of Civil Engineers, Institute of Transportation Engineers.

Lake County Stormwater Management Commission. 2001. *Watershed Development Ordinance*.

Lake County Stormwater Management Commission. 1992. *Technical Reference Manual*. <http://www.co.lake.il.us/smc/tac/trm.htm>, January 15, 2003.

Lerner, Steve, and William Poole. 1999. *Economic Benefits of Parks and Open Space*. San Francisco: The Trust for Public Land.

Maryland Department of the Environment. 2000. *2000 Maryland Stormwater Design Manual Volumes I & II*. Baltimore. http://www.mde.state.md.us/Programs/WaterPrograms/SedimentandStormwater/stormwater_design/index.asp, January 15, 2003.

Mengler, Jeffrey. 1997. *Native Plant Guide for Streams and Stormwater Facilities in Northeastern Illinois*. Chicago: USDA Natural Resources Conservation Service.

- Metropolitan Area Planning Council (Boston). 2000. *Open Space Residential Development or Conservation Subdivision Design* (CSD) Model Bylaw. Boston.
- Minnesota Planning Environmental Quality Board. 2000. *From Policy to Reality: Model Ordinances for Sustainable Development*. Minnesota.
- Murphy, H. Lee. September 23, 2002. Wetlands No Longer Soak Plans for Many Builders. *Crain's Chicago Business*.
- National Park Service. 1995. *Economic Impacts of Protecting Rivers, Trails and Greenway Corridors*. Washington D.C.
- Northeastern Illinois Planning Commission. 2000. *Protecting Nature in Your Community: A Guidebook for Preserving and Enhancing Biodiversity*. Chicago.
- Northeastern Illinois Planning Commission. 1997a. *Reducing the Impacts of Urban Runoff: The Advantages of Alternative Site Design Approaches*. Chicago.
- Northeastern Illinois Planning Commission. 1997b. *Natural Landscaping for Public Officials: A Source Book*. Chicago.
- Northeastern Illinois Planning Commission. 1997c. *Northeastern Illinois Regional Greenways and Trails Plan*. Chicago.
- Northeastern Illinois Planning Commission. 1996. *Model Floodplain Ordinance for Communities Within Northeastern Illinois*. Chicago.
- Northeastern Illinois Planning Commission. 1994. *Environmental Considerations in Comprehensive Planning: A Manual for Local Officials*. Chicago.
- Northeastern Illinois Planning Commission. 1991. *Model Soil Erosion and Sediment Control Ordinance: A Guide for Local Officials*. Chicago.
- Northeastern Illinois Planning Commission. 1990. *Model Stormwater Drainage and Detention Ordinance: A Guide for Local Officials*. Chicago.
- Northeastern Illinois Planning Commission. 1988. *Model Stream and Wetland Protection Ordinance for the Creation of a Lowland Conservancy Overlay District: A Guide for Local Officials*. Chicago.
- Oregon Transportation and Growth Management Program. 2000. *Model Development Code and User's Guide for Small Cities*. Oregon.
- Packard, S., and C. Mutel, editors, 1997. *The Tallgrass Restoration Handbook*. Washington D.C.: Society for Ecological Restoration.
- Pennsylvania Department of Conservation and Natural Resources. 1997. *Growing Greener: A Conservation Planning Workbook for Municipal Officials in Pennsylvania*. Pennsylvania.
- Pennsylvania State University. Center for Green Roof Research web site. http://hortweb.cas.psu.edu/research/greenroofcenter/about_ctr.html, February 17, 2003.

Pizzo & Associates, Ltd. 2001. *Cost Comparison New Turf Grass Lawn from Seed Vs. Native Landscape from Seed*. Leland, Illinois.

Prince George's County Department of Environmental Resources. 1997. *Low Impact Development*. Laurel, MD.

Rappaport, Brett. 1993. As natural landscaping takes root we must weed out the bad laws – how natural landscaping and leopolds's land ethic collide with unenlightened weed laws and what must be done about it. *The John Marshall Law Review*, vol. 26, no. 4.

Rivers, Trails and Conservation Assistance. 1995. *Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors*. Washington, D.C.: National Park Service.

Scheer, Roddy. April 11, 2002. Urban Forests Make Environmental and Economic Sense. *E the Environmental Magazine*.

Shoup, Donald C. 1995. An Opportunity to Reduce Minimum Parking Requirements. *Journal of the American Planning Association*, vol. 61, no. 1.

Susnjara, Bob. October 1, 2002. Why Your Water Rates Might be Increasing. *Daily Herald*.

Swift, Peter. 1998. *Residential Street Typology and Injury Accident Frequency*. Swift and Associates. <http://members.aol.com/Phswi/Swift-street.html>, December 11, 2002.

USDA-Natural Resource Conservation Service Chicago Metro Urban and Community Assistance Office, US Environmental Protection Agency, Region 5, US Fish and Wildlife Service, Chicago Field Office, US Army Corps of Engineers, Chicago District. 1997. *Native Plant Guide for Streams and Facilities in Northeastern Illinois*. Naperville

USDA-Natural Resource Conservation Service, Illinois Environmental Protection Agency. 2002. *Illinois Urban Manual: A Technical Manual Designed for Urban Ecosystem Protection and Enhancement*. Champaign.

United States Environmental Protection Agency. 2002a. *Model Ordinances Language for Open Space Development*. <http://www.epa.gov/owow/nps/ordinance/mol3.htm>, December 20, 2002.

United States Environmental Protection Agency. 2002b. *Weedlaws*. <http://www.epa.gov/grtlakes/greenacres/weedlaws>, January 15, 2003.

United States Environmental Protection Agency. 2002c. *Landscaping with Native Plants, Wild Ones Handbook, and Landscaping with Native Plants, and Great Lakes Plants*. <http://www.epa.gov/grtlakes>, January 15, 2003.

University of Wisconsin Extension. 2000. *An Ordinance for a Conservation Subdivision*. Wisconsin.

Wenger, Seth and Laurie Fowler. *Conservation Subdivision Ordinances*. Atlanta Regional Commission.

Will County. 2002. *Will County Stormwater Management Ordinance*.

Wilson, Richard W. 1995. Suburban Parking Requirements: A Tacit Policy for Automobile Use and Sprawl. *Journal of the American Planning Association*, vol. 61, no. 1.

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Northeastern Illinois Planning Commission

222 South Riverside Plaza, Suite 1800
Chicago, IL 60606
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Chicago Wilderness

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The Center for Watershed Protection

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The Conservation Foundation

10 South 404 Knoch Knolls Road
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(630) 428-4500
<http://www.theconservationfoundation.org>

Campaign for Sensible Growth

25 East Washington, Suite 1600
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McHenry County Planning and Development Department

2200 N. Seminary Avenue
Woodstock, IL 60098
(815)334-4560
<http://www.co.mchenry.il.us/CountyDpt/plandev/default.asp>

Kane County Department of Environmental Management

719 Batavia Avenue
Geneva, IL 60134
(630) 208-5118
<http://www.co.kane.il.us/Environment/index.htm>

Will County Land Use Department

58 East Clinton St.
Suite 500
Joliet, Illinois 60432
(815) 727-8631
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DuPage County Department of Environmental Concerns

421 N County Farm Road
Wheaton Illinois 60187
(630) 682-7220
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Cook County Department of Planning and Development

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Appendix A: Definitions

Definitions

These definitions are intended to be incorporated into existing ordinances. Many of these terms may already be defined in the ordinances, in which case care must be taken to ensure that conflicting definitions are eliminated and terms are used consistently throughout each ordinance, and throughout the collection of ordinances that define each community's development process.

For the purpose of these regulations the following terms, whenever used in these regulations, shall have the meaning herein indicated:

Active Recreation: Leisure time activities characterized by repeated and concentrated use of land, often requiring equipment and taking place at prescribed places, sites, or fields. Examples of active recreation facilities include golf courses, tennis courts, swimming pools, softball, baseball, and soccer fields. For the purpose of these regulations, active recreation facilities do not include paths for bike riding, hiking, and walking and picnic areas.

Association: A legal entity operating under recorded land agreements or contracts through which each unit owner in a conservation development is a member and each dwelling unit is subject to charges for a proportionate share of the expenses of the organization's activities such as maintaining restricted open space and other common areas and providing services needed for the development. An association can take the form of a homeowners' association, community association, condominium association or other similar entity.

Best Management Practices ("BMP"): Practices principally applicable to construction sites, parking lots, and new developments that reduce the toxicity contained in, and the volume of, water that runs into storm drains, treatment facilities, and waterways.

Bioretention: Retention of stormwater through the use of vegetated depressions engineered to collect, store, and infiltrate runoff.

Building Envelope: An area within a conservation development that is designated as a location within which a dwelling unit is to be placed in compliance with the building setback and spacing requirements established by the zoning regulations. A building envelope may or may not be located within a subplot and may or may not have frontage on a public street.

Buffer: A buffer preserves, provides access to, or otherwise serves as necessary adjunct to natural areas by protecting streams, lakes, wetlands, soil, air, and habitat. Buffers include, but are not limited to, areas of predominantly deeply rooted native vegetated land adjacent to channels, wetlands, or lakes for the purpose of stabilizing banks, reducing contaminants including sediments in storm water that flows to such areas.

Land Use Buffer: Land area used to separate or visibly shield and/or screen one use from another.

Riparian Buffer: A naturally vegetated area located adjacent to streams and rivers that is intended to stabilize banks and limit erosion.

Wetlands Buffer: An area of undisturbed natural vegetation located adjacent to the perimeter of the wetlands.

Common Area: Any land area, and associated facilities, within a conservation development that is held in common ownership by the residents of the development through a Homeowners' Association, Community Association or other legal entity, or which is held by the individual members of a Condominium Association as tenants-in-common.

Common Drive: A private way which provides vehicular access to at least two but not more than _____ dwelling units.

Conservation Development: A contiguous area of land to be planned and developed as a single entity, in which buildings are accommodated under more flexible standards, such as building arrangements and setbacks, than those that would normally apply under conventional regulations, allowing for the flexible grouping of structures in order to conserve open space and existing natural resources.

Conservation Easement: A legal interest in land which restricts development and other uses of the property in perpetuity for the public purpose of preserving the rural, open, natural or agricultural qualities of the property.

Dwelling, Detached Single-Family: A building designed for, or used exclusively for, residence purposes by one family situated on a parcel having a front, side, and rear yard.

Dwelling, Single-Family Attached: Dwelling units that are structurally attached to one another, side by side, and erected as a single building, each dwelling unit being separated from the adjoining unit or units by a party wall without openings extending from the basement floor to the roof with each unit including separate ground floor entrances, services, and attached garages.

Fen: A wetland that receives some drainage from surrounding mineral soil and usually supports marshlike vegetation.

Floodplain: That land adjacent to a body of water with ground surface elevations at or below the 100-year frequency flood elevation.

Floodway: That portion of the floodplain (sometimes referred to as the base floodplain or Special Flood Hazard Area) required to store and convey the base flood. The floodway is the 100-year floodway as designated and regulated by the Illinois Department of Transportation / Division of Water Resources. The remainder of the floodplain which is outside the regulatory floodway is referred to as the flood fringe or floodway fringe.

Gross Density: Density calculated by dividing the project area by the lot size, with no adjustment made for roads, off-sized lots, etc. For example, if the standard zoning requires a minimum lot size of one-quarter acre, the GROSS density—calculated by dividing one acre (43,560 square feet) by the minimum lot size of $\frac{1}{4}$ acre (10,890 sf)—is four units per acre.

Isolated Waters Of _____ : All waters such as lakes, ponds, streams (including intermittent streams), farmed wetlands, and wetlands that are not under U.S. Army Corps of Engineers Jurisdiction.

Impervious Surface: Any surface in the urban landscape that cannot effectively absorb or infiltrate rainfall.

Land Trust: A non-profit, tax-exempt entity whose primary purpose includes the preservation of open space, natural land, rural land, or agricultural land, and which is permitted to hold conservation easements.

Natural Area: An area of land, not necessarily undisturbed, which either retains or has been substantially restored to its original natural or native character.

Natural Feature: An existing component of the landscape maintained as a part of the natural environment and having ecological value in contributing beneficially to air quality, erosion control, groundwater recharge, noise abatement, visual amenities, the natural diversity of plant and animal species, human recreation, reduction of climatic stress, and energy costs.

Net Density: Density calculated by taking into account roadways, oversized lots, environmental constraints, etc. For example, if the lot size is $\frac{1}{3}$ acre, then after deducting the above features, the NET density may be 3 to 3.2 dwelling units per acre.

Open Space: An area that is intended to provide light and air. Open space may include, but is not limited to, meadows, wooded areas, and waterbodies. See also Restricted Open Space.

Perennial Stream: A natural waterway that contains water throughout the year except in severe drought.

Private Street: A local private way which provides vehicular access to two or more residential structures that is not and will not be dedicated to public use, but which is owned and maintained by the Association.

Project Boundary: The boundary defining the tract(s) of land that is included in a development project to meet the minimum required project area for a conservation development. The term "project boundary" shall also mean "development boundary".

Public Improvement: Any roadway, sidewalk, pedestrian way, tree lawn, lot improvement, or other facility for which the local government may ultimately assume the responsibility for maintenance and operation, or that may affect an improvement for which responsibility by the local government is established.

Restricted Open Space: Open space within a conservation development that is of sufficient size and shape to meet the minimum zoning requirements that is restricted from further development according to the provisions of this chapter.

Setback: The required distance between a building and a lot line, street right-of-way, pavement, stream or riverbank, wetland or other delineated site feature.

Special Service Area: Special service area (SSA) financing can be used to finance special services such as general property or natural area maintenance, free parking, snow removal from sidewalks, ambulance service, security, advertising and promotion activities and business attraction.

Stream Bank or River Bank: The ordinary high water mark of the stream or river, otherwise known as the bankfull stage of the stream or river channel. Indicators used in determining the bankfull stage may include changes in vegetation, slope or bank materials, evidence of scouring, and stain lines.

Urban Runoff Mitigation Plan: A plan that shall be required to be approved in connection with any new development.

Walkway: A public way for pedestrian use only, which may or may not be located within the street right-of-way.

Wetland: Wetlands are land that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, under normal conditions, a prevalence of vegetation adapted for life in saturated soil conditions (known as hydrophytic vegetation). A wetland is identified based upon the three attributes: 1) hydrology, 2) soils, and 3) vegetation as mandated by the current Federal wetland determination methodology.

Appendix B: Determining the Allowable Density for Conservation Design

Note: The bulk of the information in this appendix was prepared by the Countryside Program; the information has been adapted for use by Illinois Communities. The Countryside Program is in the process of updating the original materials. For the most current information, see the Countryside Program's web site, <http://www.countrysideprogram.org>.

Determining the Allowable Density for Conservation Design

Introduction

Conservation design is an alternative form of land development. It is generally believed that in order to be accepted as a viable alternative, conservation design should be accomplished at "approximately the same density" as a similar conventional development. In fulfilling that objective, two issues need to be addressed:

1. What is "approximately the same density" and how is it established? and
2. Is a "density incentive" necessary to encourage property owners to utilize the conservation design option?

Without a density incentive (i.e. the opportunity to develop more units that would otherwise be possible in a conventional subdivision), the property owner might choose to pursue the standard subdivision option and the advantages of utilizing conservation design techniques will be lost.

This appendix discusses the methods of calculating densities and the merits and disadvantages of each method.

Understanding Gross and Net Density

"Density" is the term used to describe the number of dwellings that can be constructed on an acre of land. The permitted number of lots – or density – in a conventional development is based on lot size. The larger the required minimum lot size, the lower the density. However, considering lot size alone does not give a true indication of the actual densities that will likely occur. Three other factors need to be considered as well. First, an allowance must be made for roads. Second, in a typical conventional development, the size and shape of the site often results in some lots being larger than the required minimum size. Third, natural environmental constraints may further result in larger lots than the minimum required or dictate that portions of the site be set aside and not be part of a standard subdivision lot. All of these factors reduce the project's density.

For example, if the standard zoning requires a minimum lot size of one-quarter acre, the GROSS density – calculated by dividing one acre (43,560 square feet) by the minimum lot size of $\frac{1}{4}$ acre (10,890 sf) – is four units per acre. However, when all factors are considered – roads, larger lots, and environmental constraints – the NET density may be 3 to 3.2 dwelling units per acre.

Depending on the extent of environmental constraints, the net density of a development may be considerably lower than the gross density.

Key Issues and Recommendations

When considering factors which influence whether the conservation design option will be utilized, the community should be aware that most property owners want to know up front, "How many units can I construct on the land?" An owner is not likely to spend time and money pursuing design alternatives without knowing the number of units permitted. Therefore, it is recommended that the community incorporate into its zoning regulations a specific numerical or objective density standard. Several options are possible.

1. The gross density can be used (i.e. 1 unit/acre when the minimum lot size is one acre). This is, in effect, a bonus or incentive to the property owner, since the gross density is higher than the net density which can be achieved with a standard subdivision. Of all the options, it offers the greatest likelihood that the conservation design option will be selected by the property owner over a standard subdivision.
2. The estimated net density can be used (i.e. .75 units/acre, or .80 units/acre when the standard lot size is one acre). This most closely approximates the net density or yield that will be achieved in a standard single-family subdivision.
3. The standard or net density method can be applied to the "net buildable area." In this option, areas with significant environmental limitations are deducted from the total project area. The density is then based on the net area available for development. Since this option requires subjective judgments on the part of the community, it should be considered with caution. In many instances, particularly when large lot sizes are required, a portion of the standard subdivision lot may actually be in an environmentally sensitive area. For example, rear lot lines may parallel a stream, or a rear yard may extend down a steep slope or into a wetland. In these cases, the resource may be adequately protected, and the property owner continues to achieve the otherwise "net densities." If the resource areas are deducted prior to calculating the density, the property owner may be penalized and be permitted fewer units than can be achieved in the standard subdivision. In this option, the application of the conservation design option may be discouraged.

On the other hand, on some properties, environmentally sensitive areas may be so large that the single-family subdivision results in significantly fewer lots than the calculated "net" density. Therefore, granting density credit for these areas could result in substantially more units than are achieved in a conventional subdivision. Determining a fair environmental reduction to remain density neutral is very subjective and may vary considerably from project to project based on the project's size, the minimum lot sizes required, and the characteristics of the environmental features. Experience has shown that the most reliable way to achieve "approximately the same density" in these cases where large environmentally sensitive features are present is to deduct the entire area of the feature(s) from the project area before calculating the number allowable units. This is especially important in cases where the conventional lot size is 1/2 acre or smaller.

While these methods of calculation yield somewhat different densities, they are all consistent with the two fundamental principles of conservation design:

- That conservation design should occur at approximately the same density as a similar conventional development; and
- That, from the community's perspective, conservation design should be viewed as a preferable method of development and, therefore, incentives should be offered so that this option is selected by property owners over a conventional subdivision.

The Yield Plan

Some reference books advocate the use of a yield plan to determine the density for conservation design.

The yield plan is a sketch subdivision that depicts how a parcel can be developed. It includes (most importantly) the number of lots that will fit on the site in compliance with the zoning and subdivision regulations. The yield plan becomes the basis for determining the equivalent number of units that can then be permitted in the alternative conservation design. It unequivocally assures that conservation design is, in fact, density neutral.

However, for several reasons, this approach for determining density is not recommended. First, it requires an investment by the property owner to create the yield plan. Second, since the investment has been to create the plan (and no more units are possible with conservation design), the owner may decide it is “easier to stick with the yield plan.” Third, the yield plan is subjective and requires numerous judgments as to whether a lot is buildable and whether the subdivision has maximized preservation of natural features to the greatest extent possible. Ironing out these “details” and determining the final number of units requires considerable time and meetings between the property owner and the community even before the unit count for conservation design is known. This may be a disincentive for conservation design, since the property owner is spending considerable time and money just to determine the units permitted.

Resources

Arendt, Randall. 1994. *Rural by Design: Maintaining Small Town Rural Character*. Chicago, IL: American Planning Association.

Brandywine Conservancy, Environmental Management Center. 1995. *Environmental Management Handbook*, Vols One and Two. Chadds Ford, PA: Brandywine Conservancy.

Meck, Stuart, and Kenneth Pearlman. 1997. *Ohio Planning and Zoning Law*. St. Paul, MN: Banks-Baldwin Law Publishing Co. – West Group.

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Appendix C: Conservation Design Incentives

Conservation Design Incentives

Introduction

The purpose of establishing a credit or bonus system is to provide incentive to developers, designers, builders, and municipal officials to implement better site design and locate new development in a manner that causes less impact to natural resources. The credit or bonus system may be related to the overall conservation development process or specifically to stormwater or impervious surface management.

Examples Conservation Design Incentives

1. More Predictable Approval Process

One of the best incentives for developers to design conservation developments is to increase the predictability of the approval process. A process patterned after the conventional zoning process is preferable to one patterned after the Planned Unit Development (PUD) process. A community may wish to include one of these suggestions to clarify the approval process for conservation developments:

- Create a list of design standards that, if included, will automatically get approval.
- Incorporate a system similar to the Conservation Development Evaluation System (CeDES – Appendix C). A project's approval process will be predictable based on its CeDES rating.

2. Special Designations

A community may provide incentives for which only conservation designs can qualify such as, eligibility for Special Service Area (SSA) designation (see Appendix D)

3. Density Bonuses

If open space is dedicated to public use including, but not limited to, trails, parks, and other active recreation facilities, the developer may be eligible for a density bonus of up to X%. (Density bonuses also may be permitted for affordable housing, but that is a separate issue).

4. Impact Fee Reduction

To the extent that conservation design reduces development impact, the municipality may consider reducing relevant impact fees.

Example Stormwater Credits

[Adapted from: *The Stormwater Manager's Resource Center* (2002). <http://www.stormwatercenter.net/> (3 January 2003).]

Stormwater credits may be tied directly to the *Recharge, Water Quality, Channel Protection, and Flood Control* volume requirements. For example, if there is a detention volume requirement, then credits can be given for site design practices that reduce the volume of runoff generated by a site (e.g., establishing naturally vegetated conservation areas). Site conditions also will determine which credits can be applied. For example, a stream buffer credit may not be implemented on upland sites with no perennial or intermittent streams.

The following five options for stormwater credits can be applied within a community. Each community needs to select both stormwater sizing criteria and stormwater credits that best meet its economic, social, and resource protection needs. In addition the specific numerical calculation of credits can vary. The credit can be expressed as a volume, or a fraction representing, for example, the fraction of the detention volume met by the credit. In all of the examples presented here, the credits are calculated as volumes that are based on the fraction of the total site area or site impervious area affected by the credit. Channel protection and flood control credits are typically accounted for by adjusting hydrologic parameters. It is crucial that when an area is subtracted from the total site impervious cover resulting in requiring a smaller detention basin, that there be a mechanism to ensure that the technique is maintained in the long-term. Additional information, example calculations or applications, suggested criteria for implementation, and guidance on the best application for each credit can be found at <http://www.stormwatercenter.net/> under "Manual/Credits."

The following lists specific design goals and possible credits:

1. Conservation Design

Goals:

- Preserve natural and recreational open space
- Encourage more compact development to reduce the total impervious cover created on site.
- Encourage the use of non-structural treatment measures to treat stormwater runoff on-site

Credit: A density bonus may be permitted if certain criteria (such as the CeDES system) are met such as (to be defined by community):

- Grass channels shall be used to convey runoff on at least X% of the road length (suggest 75%).
- At least X% of the site area is conserved by a protective easement or other mechanism such as a natural conservation area (suggest 25%).
- Rooftops and other impervious surfaces are disconnected or implement green rooftops.
- A minimum of X% of the site area is preserved as open space (dependent on density of development).

2. Conservation of Natural Areas

Goal: Encourage the preservation of natural areas and critical resources on site.

Credit: Subtract conservation areas from total site area when computing detention volume.

3. Revegetation

Goals:

- Encourage revegetation of cleared areas with native plants
- Encourage additional native vegetation for development in agricultural fields.

Credit: A revegetation credit shall be applied where native vegetation is used to supplement existing vegetative cover, or to compensate for areas cleared during development. The credit may be given by adjusting the pre- and post-development curve numbers. In order to receive credit, the following example criteria must be met: species used for revegetation shall be native to (Municipality) and selected from a list of approved species identified in the "Native Plant Guide for Streams and Stormwater Facilities," (NRCS et al).

4. Rooftop Disconnection

Goal: Encourage the use of overland flow or infiltration areas to treat rooftop runoff.

Credit: Disconnected rooftops are subtracted from the total site impervious cover as long as the runoff is infiltrated on-site. Note: The use of this credit should be accompanied with an educational program to ensure that disconnected areas are not "reconnected" by residents over time.

5. Green Rooftops

Goal: Encourage the use of vegetated cover on rooftops to detain and treat rooftop runoff.

Credit: Green rooftops are subtracted from the total site impervious cover.

Appendix D: Special Service Area Financing

Special Service Area Financing

(The bulk of this Appendix has been adapted from an Illinois Municipal League publication.)

Introduction

Special service area (SSA) financing can be used to finance special services such as general property or natural area maintenance, free parking, and/or snow removal from sidewalks. It also can be used for physical improvements such as parking lots or garages, streets and sidewalks, water and sewer facilities, landscaping, street furniture, decorative lighting, plazas, and outdoor malls. Special service area projects provide special improvements or services for a specific area of the municipality that does not have them and which derives benefits from them beyond any benefit those services or improvements might indirectly provide to the municipality as a whole. Special service area financing has been used extensively throughout Illinois.

Special service area financing differs significantly from special assessment financing. In a special service area, all real estate is taxed at the same rate. This rate is based upon the equalized assessed value as are other local property taxes. In contrast, special assessment financing involves a court procedure and each property is assessed a payment individually based on expected benefits accruing to each property owner. A special service area tax may be imposed for an indefinite term and may be supplemented by other taxes authorized by the Illinois constitution or applicable state laws.

Special Service Area Financing for Open Space Management

Special service area funding can be used for open space management. There are two ways that this can be implemented. If the municipality or county takes management responsibility for the open space, then an active special service area can be created to generate funds to manage the open space.

A more common implementation, however, is the use of a backup SSA. Communities often are concerned that the homeowners or other association designated to manage a conservation development open space will not maintain this management over time. The financial responsibility for management will then fall to the local government, which may cause an economic hardship. A backup SSA can be created to ensure against this. The backup SSA will not impose any additional costs on landowners as long as the association is effectively managing the open space. However, if the open space is neglected or mismanaged, the SSA can be activated and the costs of the local government intervention will be covered by the special taxes imposed on the residents.

Establishing a Special Service Area

A major advantage of special service area financing is the ease with which it may be established. The steps in Illinois are as follows:

1. Determine the nature and scope of the project – the types of service(s) or improvement(s) to be made, their cost, who should share in the cost and the boundaries of the special service area.
2. Based on the project cost, determine the tax that will be required to finance the project.
3. Pass an ordinance proposing the special service area and hold a public hearing.
4. Wait 60 days during which time a petition may be filed to defeat the special service area proposal. If a petition is filed within this 60-day period that is signed by at least 51 percent of the electors residing in the special service area and by at least 51 percent of the property owners in the special service area, the proposal is defeated for a two year period.
5. After 60 days, if a petition with adequate signatures is not filed, an ordinance is passed officially creating the special service area, levying the special service area tax and implementing the project.

The first two steps concerning the nature, cost, and financing of the project usually need to be undertaken with close cooperation between the local government and the affected taxpayers and/or property owners. The remainder of the process involved in establishing the special service area is the responsibility of the local government.

Language for implementing an SSA is included in the Model Ordinance Language for Practice 7, Natural Area Management.

Appendix E: CeDES System

CeDES System

This system was created by The Conservation Fund as a tool for communities to use to review conservation developments. It has been used in an awards program, as part of a community's plan review process, and as a method for developers to evaluate whether or not they are designing their developments with the appropriate components to protect the on-site and surrounding natural resources. **It is included here as a tool to adapt and incorporate into a community's plan review process.** It includes the evaluation of many of the goals and practices listed in this document.

Conservation Development Evaluation System

As public pressure on developers mounts to create more "environmentally friendly" developments, a tool is needed to encourage developers and communities to change development designs and to evaluate their effectiveness. The Conservation Development Evaluation System (CeDES) is a rating system created to evaluate a conservation development over the development's lifetime with an emphasis on the water quality and landscape impacts of the development. The purpose is to get developers to think about environmental concerns earlier in the planning process.

CeDES looks at "conservation development" in the context of four specific areas:

- site design and construction practices,
- stormwater management,
- preservation of open space, and
- protection of natural resources.

It does not address all of the issues which are important to make development more sustainable overall, although CeDES strongly supports this objective. For example, although they are not the focus of this evaluation system, the groups that developed CeDES favors infill and brownfield development, mixed-use, pedestrian-centered, or transportation efficient designs, as well as protection of cultural and scenic landscapes and rural character. The CeDES system is not intended to achieve these broader goals, but it does not preclude and can even help to advance them.

CeDES was developed by The Conservation Fund in cooperation with members of the Conservation Development Alliance (see description below) and with input from many professionals skilled in planning and evaluating conservation developments. The Conservation Development Alliance currently is being formed as part of this effort and to assist in regional workshops on conservation development. Potential partners include representatives from local, state, and federal government, national associations (e.g., National Association of Home Builders, Urban Land Institute), professional associations (e.g., American Society of Civil Engineers, American Planning Association), environmental groups, land owners, research institutions (e.g., The Center for Watershed Protection), and others. The CeDES evaluation will be maintained and updated by the Conservation Development Alliance. Ideally, local professionals, such as Soil and Water Conservation District (SWCD) staff, will be brought in to provide an independent review of projects using CeDES.

CeDES is intended to provide a starting point and a tool that communities, developers, conservationists and consumers can use in evaluating "conservation" claims in terms of watershed and habitat protection. It is designed to provide a general evaluation system and should be customized for specific areas based on topography, soils, vegetation types, and sensitive natural areas that are a priority to protect. Ideally, each criterion will be related to an accepted industry standard that also provides for differences in landscape setting, soils, vegetation, etc. The system is designed to be comprehensive in scope, yet simple in operation. Some important criteria are too site-specific to set general standards, such as vegetated buffers to protect surface waters and other sensitive features from impacts of development. Developers should be expected to design these important elements into their projects (e.g., minimum 50-ft. buffers along streams, lakes, and wetlands), CeDES is intended primarily for areas of the eastern and Midwestern U.S. not the arid West, where water resource and land cover issues may differ substantially.

This system is designed for rating new and existing developments. It is a feature-oriented system where points are awarded or deducted for satisfying a specified criterion. CeDES recognizes that in communities with already restrictive development standards some developments may not score as well. Further, the CeDES ratings are much more stringent than the norm for many typical developments. Therefore, even a "1-Leaf" rating should be considered a step in the right direction. CeDES' intent is to encourage developers to strive to meet these rigorous standards and achieve multiple "leaf" ratings for their developments.





Rating System Criteria

Eligibility: All residential and commercial developments greater than 10 acres (sewered) and 20 acres (unsewered) are recommended for evaluation as a Conservation Development using CeDES.

Compliance Criteria: For classification as a Conservation Development, applicants must satisfy all of the prerequisites and earn a certain number of points to attain specified Conservation Development classifications. Having satisfied the basic prerequisites of the program, the applicant development is then rated according to the scoring system listed below.

Scoring: CeDES' scoring system is based on the premise that developments always should meet certain basic standards. *Positive* points will be awarded to developments that employ practices that go beyond basic standards to minimize impacts on water quality and natural resources. Negative points will be assessed for aspects of developments that do not meet basic standards. Examples of negative practices include encroachments into wetlands or 100-year floodplains with fill or structures, and regrading or developing on steep slopes (e.g., >10%, depending on soil erodability).

A total of 20 points are available under the Conservation Development Evaluation System with four categories of certification:

-  Conservation Development for developments that earn 80% or greater (16 or more) of the available points.
-  Conservation Development for developments that earn 60% or greater (12 or more) of the available points.
-  Conservation Development for developments that earn 40% or greater (8 or more) of the available points.
-  Conservation Development for developments that earn 20% or greater (4 or more) of the available points.

Please note: When reporting the scoring please include the following language: “This score was determined using The Conservation Fund’s Conservation Development Evaluation System (CeDES) version 10.1.99. CeDES is meant as a planning tool and is not a formal certification. The scoring for this development project was not reviewed or approved by The Conservation Fund.”

The Conservation Fund’s Conservation Development Evaluation System (CeDES)

I. Overview of the System

- Presents a method of evaluating Conservation Developments.
- Recognizes the site-specificity of each development and limitations on planning and design.
- Relies on the development of a baseline (“0” score) to which to compare the proposed development.
- Assumes that most developments being evaluated were somewhat disturbed or managed landscapes before development (e.g., agricultural land).
- Is not intended for sites comprised entirely of undisturbed land or high-quality natural areas that require more rigorous protections.
- Understands that each category may not apply to every development.
- Emphasizes impact on water quality.

II. Prerequisites

Evidence that the site design process includes a review and analysis of the site’s sensitive natural features and that the site plan reflects that review. One approach to this process is outlined in the Natural Lands Trust’s “Growing Greener” approach (see attached).

III. Core Criteria

Each development will be judged on the following core criteria. Please circle the appropriate response. Use the comment section after each criterion to elaborate on your response, as appropriate. If a criterion does not apply, explain why.

1. Site Design and Construction Practices

1a. Percent Impervious Surfaces Relative to Conventional Development

Rationale: The greater the impervious surface percentage, the greater the amount and level of contamination of runoff and the lower the infiltration for natural replenishment of groundwater. This criterion also will be an indicator for the decrease in nutrient loadings, which have been proven to correlate well with percent impervious surfaces.

Measurement: The percent decrease in street, sidewalk, and driveway surfaces compared to a conventional design for the site (e.g., based on national averages for conventional design: streets >22 ft. widths; cul-de-sacs > 40 ft. radius; sidewalks > 4 ft. width; driveways unshared between homes, and > 9 ft. one-lane or > 18 ft. two-lanes)

- 2. No decrease
- 0. Greater than 15% decrease
- +1. Greater than 35% decrease
- +2. Greater than 60% decrease
- X Does not apply

Comments on site-specific constraints

1b. Preservation of Natural Features/Land Form Change

Rationale: Generally, the less disturbance there is, the lower the impact of the project on water quality and natural resources. This criterion is intended to measure the disturbance of the land during construction and encourages road and lot design to fit with the existing topography.

Measurement: Relative levels of cutting and filling (It is understood that there may be sites where dredging a silted-in area would be beneficial).

- 2. Mass disturbance/grading, more than 80% of parcel being developed
- 1. Significant/large contiguous areas of grading, 50-80% of parcel being developed
- 0. Minimum cut and fill, no large areas of grading
- +1. Grading less than 30% of parcel being developed; cut and fill depth and area minimized around structures or streets
- +2. Design and implementation of grading/cut & fill activities create minimum disturbance of natural land forms and least possible disturbance and compaction of soils
- X Does not apply

Comments on site-specific constraints

1c. Sediment and Erosion Control

Rationale: Minimizing erosion and other sediment transport during and immediately after construction minimizes a major source of damage to water quality and watershed's ecological health.

Measurement: Relative use of sediment and erosion controls using strong local or region-specific soil erosion control manuals. (Note: Professionals with the National Resource Conservation Service (NRCS) or other local soil experts should be consulted to ensure that local regulations are strict enough to achieve the intent of the standards below, otherwise fewer points should be given for meeting less-stringent local control ordinances.)

- 2. No controls
- 1. Required construction erosion controls in place but failing
- 0. Required construction controls in place, monitored, and in compliance
- +1. Required construction controls exceeded
- +2. No measurable soil loss
- X Does not apply

Comments on site-specific constraints

2. Stormwater Management

2a. Runoff Rate

Rationale: Reducing the velocity of runoff from a development site, by retaining more on-site and allowing it to infiltrate, allows more runoff to infiltrate, and reduces erosion. Reduction in runoff rate may be attained by many methods including grass swales, buffers, reduction of impervious surfaces, etc..

Measurement: Rate of runoff as compared to immediately prior pre-development land-use conditions for the 10-year design storm using locally approved stormwater runoff models (e.g. TR-55). Please provide support for your response.

- 2. >15% increase in runoff rate
- 1. 0-15% increase in runoff rate
- 0. No increase in rate of runoff
- +1. 0-30% decrease in runoff rate
- +2. >30% decrease in runoff rate
- X Does not apply

Comments on site-specific constraints

2b. Runoff Volume

Rationale: Reducing the total volume of runoff from a development site, by retaining more on-site and allowing it to infiltrate, reduces erosion, sedimentation, and other impacts on surrounding bodies of water. Reduction in runoff volume may be attained by many methods including grass swales, buffers, reduction of impervious surfaces, on-site detention, infiltration basins, etc..

Measurement: Volume of runoff as compared to immediately prior pre-development land-use conditions for the 2-year design storm using locally approved stormwater runoff models (e.g. TR 55). Please provide support for your response.

- 2. >15% increase in runoff volume
- 1. 6-15% increase in runoff volume
- 0 0-5% increase volume of runoff
- +1. No increase in runoff volume
- +2. Decrease in runoff volume
- X Does not apply

Comments on site-specific constraints

3. Open Space

3a. Management of Open Space

Rationale: Generally, the more contiguous open space that is preserved in a natural state, the lower the project's impact on the ecosystem.

Measurement: Ratio of open space adjusted for vegetation and management to total open space. Please provide calculations with your response.

Adjusted Open Space Ratio

Points	Density in units/ac				
	> 4	>2 – 4	>1 – 2	0.5 – 1	< 0.5
-2.	0-9%	<15%	15-24%	25-34%	>40%
-1.	10-14%	15-24%	25-34%	35-49%	>50%
0.	15-24%	25-34%	35-49%	50-59%	>60%
+1.	25-30%	35-40%	50-55%	60-70%	>70%
+2.	>30%	>40%	>55%	>70%	>80%
X	Does not apply				

Open space calculated as follows:

$$\frac{(A \times 0.2) + (B \times 0.2) + (C \times 0.5) + (D \times 1.0)}{E} \times 100 = \text{Adjusted open space ratio}$$

Where

A = Acres of open space with managed landscape

B = Acres of open space in agriculture with annual crops

C = Acres of open space in agriculture with perennial crops

D = Acres of open space with native habitat

E = Total undeveloped acres of open space

	Example Development	Your Development
Total Site Acreage	50 acres	
Buildable Acreage	40 acres	
Built	15 acres (40 homes)	
Remaining buildable acreage	25 acres (12 acres turf grass and 13 acres restored native habitat)	
Unbuildable acreage	10 acres (floodplain, wetland, steep slopes)	

A = Managed landscape	12 acres (turf grass and non-native ornamentals)	
B = Agriculture with annual crops	0 acres	
C = Agriculture with perennial crops	0 acres	
D = Native habitat	23 acres (10 unbuildable and 13 restored)	
E = Total undeveloped acreage	35 acres (10 unbuildable and 25 buildable)	

Example Development:

$$\frac{(12 \times 0.2) + (0 \times 0.2) + (0 \times 0.5) + 23 \times 1.0}{35} \times 100 = 72.6\%$$

Based on the project's 0.8-unit density per acre (40 homes ÷ 50 acres), the adjusted open space ratio would earn a ranking of +2 using the table above.

Your Development:

$$\frac{(A \times 0.2) + (B \times 0.2) + (C \times 0.5) + (D \times 1.0)}{E} \times 100 = \text{adjusted open space ratio}$$

Comments on site-specific constraints:

3b. Environmentally Constrained Open Space

Rationale: There should be no building, grading or clearing in certain sensitive areas including wetlands, floodplain, and steep slopes. A development that adequately protects such areas through easements and by designation as protected, undivided open space could receive a high score under this criterion.

This criterion recognizes development that provides long-term protection of these sensitive areas through easements and other development restrictions.

Measurement: relative percentages of environmentally constrained open space preserved, adjusted for degree of protection. **Please provide calculations with your response.**

- 2. < 50%
- 1. 51 – 70%
- 0. 71 - 80%
- +1. 81 – 90%,
- +2. 91 – 100%
- X Does not apply

Open space calculated as follows:

$$\frac{(A \times 0.5) + (B \times 1.0)}{C} \times 100 = \text{Adjusted environmentally-constrained open space}$$

Where

A = Acres of environmentally-constrained open space undivided into lots (i.e., common open space)

B = Acres of open space with permanent protection (e.g., conservation easement)

C = Total acres of open space

Example Development

Given: The development has 5 acres of wetlands protected under a conservation easement, 3 acres with > 25% slope, and 2 acres of floodplain, for a total of 10 acres of environmentally constrained open space. All the wetlands and steep slopes are undeveloped but half of the floodplain is developed.

Example Development

Environmentally Constrained Resource	Open Space (acres)	Open Space with Permanent Protection (acres)	Developed (acres)	Total
Wetlands	0	5	0	5
Floodplain	1	0	1	2
Steep slopes	3	0	0	3
Other	0	0	0	0
Total	4	5	1	10
Variable	A	B		C

$$\frac{(4 \times 0.5) + (5 \times 1.0)}{10} \times 100 = 70\%$$

The adjusted rating would be -1 because the steep slope areas were not protected by permanent conservation easements and floodplain was partially developed.

Your Development

Environmentally Constrained Resource	Open Space (acres)	Open Space with Permanent Protection (acres)	Developed (acres)	Total
Wetlands				
Floodplain				
Steep slopes				
Other				
Total				
Variable	A	B		C

$$\frac{(A \times 0.5) + (B \times 1.0)}{C} \times 100 = \text{Adjusted environmentally-constrained open space}$$

Comments on site-specific constraints:

4. Protection of Natural Resources

4a. Development of Natural Resources Protection Plan

Rationale: A site's entire set of resources needs to be considered holistically and protected in an integrated manner.

Measurement: Degree of natural resource-based site planning and long-term protection

- 2. No natural resource inventory or management/protection plan
- 1. Natural resource inventory conducted, but no significant linkage to site design
- 0. Natural resource inventory conducted, natural areas linked into continuous open space system
- +1. Natural resource inventory conducted, natural areas linked, permanent protection of natural areas/open spaces (e.g., easements)
- +2. Natural resource inventory conducted, natural areas linked, permanent protection of natural areas and adjacent open spaces (e.g., conservation easement), management/protection plan in place, long-term management/protection plan in place
- X Does not apply

Comments on site-specific constraints:

4b. Existing Vegetation: Tree and Native Plant Conservation

Rationale: Generally, if mature trees or other native plants, such as prairie plants, are present on the site, preserving those plants lowers the impact of the project on local ecosystems.

Measurement: Loss of mature trees or other native plants

Pre-Development Tree/Native Plant Cover on Site

Points	<u>10-35%</u>	<u>35-50%</u>	<u>50-75%</u>	<u>75-100%</u>
-2.	loss >10%	loss >30%	loss >50%	loss >70%
-1.	loss 0-10%	loss 20-30%	loss 30-50%	loss 60-70%
0.	no net loss	loss 0-20%	loss 10-30%	loss 50-60%
+1.	no absol. loss	no net loss	loss 0-10%	loss 40-50%
+2.	no absol.loss and additional planting	no absol.loss	no net loss	loss <40%
X	Does not apply			

Comments on site-specific constraints:

4c. Newly Planted Vegetation: Other Landscaping

Rationale: The amount and type of vegetation designed into a site's landscaping greatly influences the land's ability to catch, filter and infiltrate stormwater. Generally, the larger the percentage of native vegetation on the site, the more positive the ecological and water quality benefits to the environment.


Measurement: Use of different types of vegetation

- 2. Plant turf grass
- 1. Use of native vegetation only in buffer areas, turf grass and non-native landscaping elsewhere
- 0. Use of native vegetation in 50% of open space, turf grass and non-native landscaping elsewhere
- +1. Use of native vegetation in 50% of open space, turf grass and non-native landscaping elsewhere, and provision in homeowner's association rules to encourage the use of native vegetation on individual lots
- +2. Use of native vegetation greater than 50% in open spaces, and native vegetation encouraged or required in homeowner covenants/deed restrictions
- X Does not apply


Comments on site-specific constraints:

Total available points = 20

Development Example

A 80-acre conservation development to be built on an old farm minimizes paved areas and reduces stormwater runoff. The proposed development also protects contiguous open space, but pays little attention to landscaping with native plants. The development scores 7 points (39%) under the CeDES evaluation system, earning it a  rating overall. Scoring on each criterion and the development's overall rating calculation are shown below:

- 1a. Percent Impervious Surfaces Relative to Conventional Development = **+1**
(40% decrease in streets, sidewalks, and driveway surfaces compared to a conventional design for the site)
- 1b. Preservation of Natural Features/Land Form Change = **+1**
(Grading of less than 30% of parcel and cut and fill minimized)
- 1c. Sediment and Erosion Control = **+2**
(No measurable soil loss)
- 2a. Stormwater Runoff Rate = **+2**
(>30% decrease in runoff rate)
- 2b. Stormwater Runoff Volume = **+1**
(No increase in runoff volume)
- 3a. Buildable Open Space = **+2**
(See example on p. 6)
- 3b. Environmentally Constrained Open Space = **-1**
(See example on p. 8)
- 4a. Development of Natural Resources Protection Plan = **0**
(Natural resource inventory conducted with linkage to site design)
- 4b. Existing Vegetation: Tree and Native Plant Conservation = **X (no score)**
Does not apply: site was nearly entirely in use as a farm with few trees and no native vegetation with the exception of a small wetland
- 4c. Newly Planted Vegetation: Other Landscaping = **-1**
Use of native vegetation only in buffer areas, turf grass and non-native landscaping elsewhere

Final calculation: 7 total points out of 18 possible (39%) =  Rating
(20 available points minus 2 points for 4b. which did not apply)