Conservation Design Strategy Paper

Chicago Metropolitan Agency for Planning

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Introduction

Today the Chicago metropolitan region is heir to a proud legacy of public conservation, but its tradition of robust development has often overwhelmed the conservation of natural areas on privately-owned land. In particular, land use regulations intended to guide development have often put up inadvertent barriers to environmentally responsible conservation development.

By contrast, conservation design is an integrated approach that facilitates development while also taking into account, and conserving, the natural landscape and ecology of the development site. It is a strategy that transcends traditional conceptions of development and conservation as a choice of "either/or," offering opportunities for "both/and" solutions that are both profitable for developers and encourage conservation of natural areas and systems.

The implementation of conservation design in the region may be limited, but local examples such as Prairie Crossing demonstrate the promise of the strategy—both at the level of a single subdivision and, if adopted on a much greater scale, region-wide. The benefits of conservation design correspond with the needs of the region and the priorities of CMAP, making it a relevant planning strategy to consider for the *GO TO 2040* Plan.

Conservation design is often thought of as a suburban and rural residential concept, with developments using greenfields or undisturbed land on the outer municipal boundaries. For these areas, conservation design does provide a more environmentally sensitive option to conventional suburban neighborhood development. However, conservation design is also highly adaptable and can be applied to all types of environments – urban, suburban and rural – and in residential, commercial and industrial sectors. Even though conservation design is not a comprehensive solution for all the challenges of urban, suburban and rural development, it does offer a more efficient and sustainable method to fulfill residential and commercial growth (NIPC 2003).

The following paper examines the strategies of conservation design, and assesses the likely benefits of implementation on a regional scale. The first section defines specific principles, practices and benefits of conservation design. The second outlines our main research questions, while the third provides an overview of existing conditions in the region. The fourth section considers the potential impacts of implementing conservation design on a series of key indicators chosen for the *GO TO 2040* Plan, and the fifth section examines challenges inherent to the strategy. Examples of similar and supporting concepts are explored in section six.

This paper is not intended to be an exhaustive guide to conservation design. It is intended to provide a brief summary of its principles while evaluating the impact of conservation design as a concept to potential indicator areas expected to be used for the *GO TO 2040* Plan. For this paper staff extensively relied on a previous Northeastern Illinois Planning Commission (NIPC) document, *Conservation Design Resource Manual*, published in March of 2003. For a more in-depth understanding of conservation design, this document can be found online at: http://www.nipc.org/environment/sustainable/content.htm .

Conservation Design Principles and Practices

The following definitions and principles are provided by the Conservation Design Resource Manual, 2003.

> **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.

The following 4 sections provide insight into these guiding principles. The fifth section, *Green Infrastructure: Connectivity of Green Space*, touches on the need to connect these green spaces both within and outside of conservation developments, in order to maximize the potential benefits of this strategy.

Principle 1: Site Design and Lot Size

Lot design standards, especially zoning and subdivision regulations pertaining to residential subdivisions, often limit site design options. This often leads to developments in which all land is divided up into building lots and streets, with natural areas and open space limited to undevelopable land and wetlands. In particular, minimum lot size requirements—often mandated to insure homeowners maximum private front, back, and side yards—tend to minimize the ability to conserve, enhance, or even recover natural areas within a site (NIPC, 2003).

By allowing flexible lot design standards that are density neutral, such as implementing standards for the *overall* density on a site without minimum lot size requirements, it is possible to meet the concerns of developers while conserving natural areas and systems. Through this strategy, an equivalent number of residences can be clustered, yielding an added benefit to developers by reducing the development costs of the site's infrastructure (roads, sewer, streetlights, water, etc.), as well as the long-term infrastructure maintenance costs carried by the public sector (NIPC, 2003). Site and lot design in more urban environments can be less flexible in order to incorporate existing infrastructure.

The diagrams below show the contrast between conventional and conservation design. Clustering and smaller lot sizes found in conservation design allow a site to maximize open space while maintaining the same number of lots.

Credit: Copyright Conservation Design Forum, Elmhurst, IL. www.cdfinc.com

But perhaps the key benefit of flexible lot design standards is its facilitation of designs that are sensitive to the unique natural features and systems of each development site. Randall Arendt, a national expert in conservation design, outlines the following four step process for arranging the development site:

1. *Identify all potential conservation areas,* taking into consideration all inherently unbuildable areas floodplains, wetlands, steep slopes), along with buildable areas that are environmentally sensitive (stream and wetland buffer areas, woodlands) or historically and culturally significant.

2. *Locate the house (or other building) sites,* taking care to maximize views and access to natural areas and other amenities (typically the developers will ensure that this is done, in order to maximize the value of each residence).

3. *Design the street and trail systems,* maximizing the efficiency of the street system and ensuring easy access to walkways and trail systems within the development.

4. *Draw in the lot lines.*

Principle 2: Protection and Management of Natural Areas

Conservation design encourages the dedication of open space that will protect and restore natural areas and resources, as well as provide for passive recreation where appropriate. (NIPC, 2003). Planning for open space and natural resource protection through conservation design must include short- and long-term management. 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 non-profit organization (i.e. a conservation land trust like the *Nature Conservancy*) whose primary purpose is in assisting with conservation development and design; or (4) The natural area may remain in the private ownership of the developer or another entity (NIPC, 2003).

Two terms are used interchangeably to describe the incorporation of plants which are native to a particular geographic area. "**Native landscaping"** refers to the use of prairie, woodland, wetland, and floodplain plants that flourished in northeastern Illinois prior to European settlement. However, for our purposes, we shall use the term "**natural landscaping**." Natural landscaping uses native plants but also broadly implies giving the "look" of the landscape prior to the mid-1800s and the beginning of sustained intense settlement and development. Additionally, natural landscaping implies an attempt at restoration or reconstruction of the landscape to look and function as it did in the time that Native Americans inhabited the land (NIPC, 2004). Natural landscaping is also essential for residential or commercial areas that utilize conservation features such as green roofs, bioswales, rain gardens, filter strips, and stormwater detention basins. As a part or a whole native landscaping is a versatile tool for conservation design.

Natural landscaping serves as a wise alternative to more conventional methods of landscaping. The predominant landscaping material of northeastern Illinois is "weed-free" turf grass lawn, brought to the United States by European settlers. This grass is short-cropped and short-rooted, which does not fare well in the harsher climates of northeastern Illinois. Turf grass lawns' roots grow to only a few inches, while natural landscaping uses native plants that have deep roots (from 5 to 10 feet in most cases, up to 15 feet). These deep roots are necessary to hold the soil together and prevent erosion. Even more, natural landscaping serves as a way to save money while still being aesthetically pleasing and environmentally friendly. Based on estimated costs in 2003 (assuming regular installation and maintenance practices for both natural landscaping and conventional turf grass) the total annual cost per acre of installing and maintaining natural landscaping, such as prairie grasses and forbs, was 63% less than the cost of installing and maintaining conventional turf grass with an irrigation system. Estimated cost savings continued to increase due to implementation on a large site, as demonstrated that over a ten-year period, and based on a 25-acre site, natural landscaping costs 66% less than conventional turf grass (Conservation Design Forum, from NIPC, 2004).

Root Systems of Prairie Plants
Note: Turf grass is the first plant from the left.

c 1995 Conservation Research Institute, Heidi Natura
http://www.dot.state.ia.us/pdf_files/roadside_vegetation_q_and_a.pdf

Additionally, there are many other benefits to using natural landscaping in lieu of turf grass. Natural landscaping improves water quality by increasing soil permeability, reducing runoff volumes while increasing the landscape's ability to retain nutrients, which in turn reduces the need for various forms of chemical fertilization. Natural landscaping increases aesthetic values and helps to create a distinct community image, adding to the desirability of an area's real estate and open space. Natural landscaping enhances native biodiversity, providing a habitat for birds, butterflies, and other wildlife, in addition to increasing educational and recreational opportunities throughout northeastern Illinois (NIPC, 2004)(The Nature Conservancy and Chicago Wilderness).

Principle 3: Reduction of Impervious Surface

The reduction of impervious surfaces is a principle of conservation design that yields multiple benefits when implemented. *Better Site Design* defines impervious surface as "any surface in the urban landscape that cannot effectively absorb or infiltrate rainfall (NIPC, 2003)." The progression of new development typically results in the conversion of natural land to impervious surface cover. Common impervious surfaces include sidewalks, parking lots, building footprints, roads, swimming pools, roof tops, garages, and patios. All of these surfaces can be designed or retrofitted to redirect stormwater runoff away from the sewers and either directly into the ground or into a holding mechanism-natural or man-made. By keeping excessive stormwater runoff out of the sewer system and closer to the point of origin, water quality is increased because the stormwater accumulates fewer pollutants on its shortened path. Additional benefits include

recharged soils, reduced flooding and reduced sewer overuse and related maintenance costs (NIPC, 2003).

Reducing impervious surface areas also has a substantial impact on the natural landscape. Increased impervious cover and the subsequent increased stormwater runoff can negatively impact stream functions, cause stream bank erosion, degrade stream habitats, increase pollutant loads in streams, deplete the surrounding wetlands and prairies, and lower the diversity of native fish species, insects, and fresh water organisms (Ibid).

The design of new development and its amenities should consider the reduction of impervious cover in the early stages of project conception. For example, interior roads within suburban developments can be narrowed and curbs reduced. Setbacks can also be reduced, and houses clustered, shortening roads and driveways, decreasing the amount of concrete poured and the cost to the developer for supplies and construction time. This also decreases the amount of water infrastructure needed to carry the stormwater runoff to the sewers. Based on 1997 costs, the Northeastern Illinois Planning Commission's *Reducing the Impacts of Urban Runoff* calculated an average savings of $910 per residence for reducing street width, sidewalk width, and driveway width in a new residential development. A particularly effective—and far-reaching—means of reducing impervious surfaces is for municipalities to design flexible ordinances that allow for the opportunity to utilize these conservation design techniques.

Green roofs, landscaped parking lots, and permeable pavement/pavers are a few practices that can also help reduce impervious cover and runoff. These are strategies especially beneficial to urban environments, where impervious surface is denser and less green space is available. These practices can also decrease the heat island effect found in many urban areas (The Nature Conservancy and Chicago Wilderness). According to the Environmental Protection Agency (EPA), the heat island effect can cause the air and surface temperatures to be 2-10 degrees warmer than surrounding rural areas, which can add to the effects caused by global warming.

Imagine that….in 2040, every roof top is a green roof….

City Hall, Chicago
http://www.greenroofs.com/projects/chichall/chichall1.jpg

New technology is being used to help monitor the degree of imperviousness on an individual site and even at the city level. This can be seen in the following example:

Innovation in Mapping:
Impervious Surface Mapping Using Satellite Remote Sensing
The Metropolitan Council of Minnesota is working with the University of Minnesota's Remote Sensing and Geospatial Analysis Laboratory to use satellite imagery to generate Imperious Surface Area maps. By integrating aerial photography and spectral-radiometric responses of Landsat TM imagery satellite data, the Metropolitan Council of Minnesota can calculate the imperious surface area percentage of a location as well as the degree of imperviousness ranging from 0%-100%. An example map of the Twin Cities is posted at http://rsl.gis.umn.edu/impervious.html

Principle 4: Sustainable Stormwater Management Techniques

Because so much of conservation design is focused on improving the way water relates to a site, implementing sustainable stormwater management techniques is the next logical principle to be applied in conservation design. The benefits include decreased flooding, improved water quality, decreased erosion and sedimentation, and improved groundwater recharge. These techniques seek to turn a source in need of disposal into a resource that nourishes.

Sustainable stormwater management techniques can be implemented in a variety of ways, depending on the characteristics of land as well as its surrounding environment and current ordinances. *Best Management Practices (BMPs)* 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," are often used to return water directly to the ground thus bypassing the sewer system. Biofilteration, filter strips, swales, infiltration trenches, green roofs, rain gardens, natural landscaping, naturalized detention basins, and permeable pavement/pavers are among the most common BMPs (NIPC, 2003).

Green Infrastructure-Connectivity of Green Space

Another important concept in conservation design is connectivity. Ideally, conservation design developments would not be implemented in isolation but connected to other preserved open space, sensitive green space, existing trails and parks, and other conservation developments. Linking green spaces together creates a system of "green infrastructure," much like transportation infrastructure (streets, highways, public transit), that allows continuous use by not only humans but wildlife as well. Connected green space also allows for increased biodiversity.

CMAP is looking to incorporate green infrastructure in the upcoming *GO TO 2040* Comprehensive Plan through the Green Infrastructure Vision (GIV) Plan. The regional Geographical Information Systems (GIS) database of green infrastructure coverages created through the GIV project can be used as a tool to help identify potential sites for development where green space is especially sensitive. Applying conservation design principles to these sensitive green spaces can minimize the negative site impacts while still allowing development to occur. The GIV plan has recognized conservation design's biodiversity conservation benefits, cost savings, protection of groundwater aquifers, and ability of reducing problems and costs associated with flooding and water quality degradation. In addition the GIV has stated that "Depending on the intended land use and site characteristics and constraints, appropriate elements of conservation design can and should be selectively tailored to each individual property" (NIPC, 2004).

Main Research Questions

A. What are the main principles and benefits of conservation design?
B. What are the current conditions in the region regarding conservation design?
C. What would happen regionally and in communities if conservation design elements were implemented on a large scale? What indicators would be significantly impacted?
D. What would be some challenges to wide-scale implementation?

Existing Conditions in the region

Conservation design and its principles are not new to our region and are present in both NIPC's 2040 Regional Framework Plan (NIPC Framework Plan) and the 2030 Regional Transportation

Plan (2030 RTP). A regional conservation design initiative could dramatically give action to the *Open Space* and *Greenways* components of the NIPC Framework Plan, as well as contribute to the *Green Infrastructure Vision Plan* (mentioned above) by adding to green space capacity and biodiversity opportunities. Conservation design can also take an active role in fulfilling several of the NIPC Framework Plan's strategies to encourage redevelopment, reuse and infill, promote livable communities, protect water resources, protect and enhance biodiversity, and enhance and connect green areas.

The 2030 RTP encourages projects that "promote effective stormwater management" and "enhance greenways, trails and open space," which are direct benefits of conservation design strategies. It also endorses the NIPC Framework Plan's recommendations for the treatment of green areas in addition to many other policies including natural landscaping, protection of natural groundwater recharge and the improvement of water quality.

Conservation design is also an active concept in the work of many non-profit environmental advocacy organizations in the region. Chicago Wilderness (CW), partnering with the Northeastern Illinois Planning Commission, created the comprehensive *Conservation Design Resource Manual* in 2003, which has served as a primary reference for this strategy report. CW has continued to promote conservation design through other reports, and has funded efforts such as the Sustainable Watershed Action Team (SWAT) composed of experts in conservation design, stormwater management, and use of native vegetation to work directly with local officials and/or developers on specific planning or development projects (Glosser, 2006). The Nature Conservancy has been an active partner in these and affiliated local efforts, as has Openlands.

Municipalities are also taking advantage of the benefits of conservation design developments. Some are even requiring all new municipal-owned buildings be built to LEED standards or incorporate aspects of conservation design. The Villa Park Police Station in DuPage County is one example in our region of emerging municipal interest in conservation design. The police station is an urban infill project, built on a former parking lot that incorporates bioswales, porous pavement and a green roof to drastically decrease runoff on the site. Native landscaping was also used on this LEED Silver rated site (Conservation Design Forum).

Many communities in northeastern Illinois have passed ordinances guiding land development that are based on the principles and techniques of conservation design. One of the more recent case studies in the region is McHenry County, which revised its subdivision ordinance by implementing formal "Conservation Design Standards and Procedures." A collaborative effort among the County Board, townships, municipalities, developers and conservation organizations, McHenry County's ordinance was tailored to find a balance between increased development and sensitivity to open spaces. One of the key features of the ordinance is the offer of density bonuses to developers if certain thresholds are met, such as amount of new open space, connectivity of new open space to pre-existing open space, housing type mix, and the restoration or enhancement of wetlands, among others (McHenry County, 2007; McHenry County, 2008). For a complete look at the McHenry County Ordinance, please visit: http://www.co.mchenry.il.us/common/CountyDpt/PlanDev/PDFDocs/ConservationDesignAddendum-February192008FinalVersionPDF.doc

Businesses can also implement elements of conservation design. Tellabs, Inc is a telecommunications equipment manufacturer located on 55 acres in Naperville. An exception to nearby businesses, Tellabs planted all natural landscaping on their property. In addition to cutting their maintenance costs in half, Tellabs now benefits from a fully functioning stormwater management system, which contains and filters stormwater on site through the use of bioswales, vegetated land strips, and a system of pipes, diffusing the stormwater runoff in to the ground. Although initial construction costs may have been higher than traditional landscaping, Tellabs enjoys decreased maintenance costs, in addition to many environmental benefits to the site (Matre, 2002).

There are several other programs and developments in our region which have chosen to implement selected conservation design principles. For example, the city of Chicago created the Green Alley Program to help solve the problem of flooding in Chicago's alleys. Many alleys were built without connections to the city's sewer system and as a result stormwater tends to pool rather than disperse, causing many secondary problems to home owners, local infrastructure and water quality. Instead of installing expensive connections to the sewers, the city implemented the Green Alleys Program. This program retrofits older, problematic alleyways with several possible combinations of permeable pavement materials, reflective concrete paving with recycled materials, optional drains and energy efficient dark sky compliant light fixtures (City of Chicago). Chicago has installed more than 40 Green Alleys since the program's pilot phase in 2006 (Chicago Sun Times, 2007). For more information, please see the Green Alley Handbook, City of Chicago http://egov.cityofchicago.org/webportal/COCWebPortal/COC_EDITORIAL/GreenAlleyHandbook.pdf

On a smaller scale, Plainfield Library has installed a butterfly and hummingbird native garden. Started three years ago, it is now home to dozens of species of butterflies and hummingbirds as well as a variety of native plants including purple coneflower, showy goldenrod and New England aster. The garden serves as a place of education for the children that use the library as well as those visiting from surrounding schools. The Plainfield Library's garden is part of a larger city initiative, called the Green Village Program, which also includes a monthly speaker series for residents that promotes greening of neighborhoods and backyards in Plainfield (Plainfield Library Staff). For more information on Plainfield's Green Village Program: http://www.plainfield-il.org/documents/InvitationtoGreenVillage2008Series.pdf

Our region boasts several successful conservation design developments. The map below displays the more well-known conservation design developments and a short description of each (where available).

(Map and descriptions will be added, mapped through Google map)

Indicator Research

With an understanding of the present, we can look toward the future and the potential role of conservation design on a regional scale. The following research describes the relationship

between conservation design and indicators related to the natural environment, energy use, community character, health and safety, economics, housing affordability, infill and infrastructure cost. This research will assist in the development of the *GO TO 2040* Plan.

Please note that the indicator research for conservation design compares conservation design on a specific site to conventional development practices.

Environment

Stormwater Quality and Quantity

The most obvious benefit of conservation design is the positive impact on stormwater quality and quantity. All the elements of conservation design contribute to improving this indicator. Site design that "clusters" lots together, leaving larger continuous open space, allows for natural drainage and cleansing of stormwater before it is introduced to conventional infrastructure. By design, more environmentally sensitive areas can be left undeveloped, as open space. This can include isolated streams, wetlands, high quality woodlands and prairies. Cluster design is most often seen in suburban or rural settings (The Nature Conservancy and Chicago Wilderness).

Natural landscaping can improve stormwater quality and quantity because of its deeper root system. Deep root systems stabilize the surrounding dirt which helps minimize erosion and sedimentation into waterways increasing water quality while also increasing the permeability of compacted soils. Healthy soil can hold more stormwater runoff, thus diverting it from the sewer systems while recharging the aquifer (NIPC, 2004). In addition deeper root systems require less water to maintain a healthy growth. Natural landscaping also uses less pesticides and fertilizers (NIPC, 2003). The U.S. EPA estimates that nearly 70 million pounds of active pesticides ingredients are applied to urban lawns each year with an average acre of lawn receiving 5-7 pounds of pesticides annually (The Stormwater Manager's Resource Center). These pesticides often find their way into waterways potentially through urban runoff or groundwater infiltration (NIPC, 2004). For more information visit: http://www.epa.gov/pesticides/

Reducing impervious surface areas also improves stormwater quality and quantity. Parking lots, rooftops, streets and sidewalks are a few examples of impervious surfaces. Precipitation falls on these surfaces and, instead of soaking into the ground at the point of impact, the water is diverted into a sewer system. En route to the sewer system, the runoff or discarded precipitation picks up pollutants, including car oil and gas as well as debris in the path of the runoff, compromising water quality (NIPC, 2003).

Incorrectly designed impervious surfaces can cause flooding and stream channel erosion. In bigger storm events in a high impervious surface area, the quantity of stormwater can also be a problem. Large amounts of water rush into the sewer and natural water systems overwhelming their capacity. If there is less impervious surface, there is less runoff to be managed and a reduced quantity of water to be diverted into these systems. Reduced runoff into the sewer systems saves energy due to decreased pumping and treatment (NIPC, 2004). Conservation design helps alleviate these issues by promoting narrower streets, reduced driveway length, green

roofs, and alternative walkway and parking lot design, and promotes the use of pervious pavement and pavers that allow water to pass into the ground onsite (NIPC, 2004).

Lastly, implementing sustainable stormwater management techniques will have a positive effect on stormwater quality and quantity. These techniques are similar to those used to reduce impervious surface and include greenroofs, bioswales, rain gardens, native landscaping and naturalized detention basins (The Nature Conservancy and Chicago Wilderness). On a larger scale, developments can tie all these techniques together in what is called an urban runoff mitigation plan. An urban runoff mitigation plan is a permanent structural solution to managing the maximum amount of stormwater onsite (NIPC, 2004). All of these techniques address water quality and quantity in some form.

For more information our Stormwater Strategy Paper

Biodiversity

Implementing the principles of conservation design can potentially increase biodiversity and thus have a positive effect. Conservation design promotes the creation, retention, and management of open space. This open space creates a habitat for many different ecosystems with wide varieties of animal and plant species. By preserving open space, biodiversity is also preserved (NIPC, 2003).

A simple definition of "biodiversity" is "biological diversity" (Chicago Region Biodiversity Council, 1999b). More so, "biodiversity" is the entire array of genes, species and ecosystems in a region. Biodiversity can be measured numerically, but it can also be measured by the variety of natural communities that exist side by side in any given area (i.e. the number of wetlands, meadows, and savannas in close proximity to each other) (Chicago Region Biodiversity Council, 1999a).

There are six principles to remember when using conservation design to create more biodiversity. First, open space that has already been preserved or marked for conservation has to be managed so that biodiversity is protected or restored. Second, preserving larger parcels of open space increases the potential for larger, more varied habitats. Third, water resource management policies should be developed and implemented, as proper water resource management promotes the sustaining of natural communities, therefore promoting biodiversity. Fourth, more research is necessary if we are to fully understand the effects of development and/or ecological restoration on biodiversity. Fifth, citizens should be better educated on biodiversity and its importance in our lives. Finally, local and regional development policies should place higher priority on the preservation of open space, natural areas, and biodiversity (Chicago Region Biodiversity Council, 1999b).

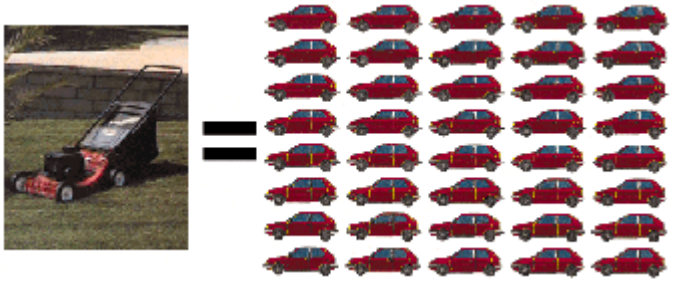
The northeastern Illinois region, like other regions nationally and globally, contains diverse animal and plant species (Daily, 1997). Increased biodiversity is important, beyond its aesthetic appeal and recreational opportunities, because society is dependent on healthy and productive ecosystems.

Air Quality and Greenhouse Gas Emissions

Conservation design improves air quality and reduces greenhouse gas emissions, which are gases shown to be a cause of climate change. Although reducing greenhouse gas emissions is a very complex problem that needs thoughtful and wide-reaching answers, we can start by addressing the design of our buildings and communities. Construction and modern lifestyle trends are very energy reliant and therefore very fossil fuel reliant. Conservation design seeks to relieve a portion of this energy use by opting for implementation of natural landscaping that reduces maintenance and naturally cleans the air.

Replacing conventional landscaping (turf grass) with natural landscaping reduces greenhouses gases by requiring 90% less maintenance (Illinois Green Government Coordinating Council). Landscaping maintenance equipment (mowers, weed edgers, leaf blowers, etc.) are powered by gasoline, electricity or battery, all which have either direct or indirect green house gas emissions including carbon monoxide (CO), carbon dioxide (CO_2), nitrous oxides (NOx), sulfur dioxide (SO_2), VOCs (volatile organic compounds) and air toxins such as benzene. Gasoline lawn and garden equipment account for up to 5% of ozone-forming VOCs in areas with smog problems (USEPA, Green acres).

"Each weekend, about 54 million Americans mow their lawns, using 800 million gallons of gas per year and producing tons of air pollutants." On an annual basis one gas mower emits 87 lbs. of CO2 and 54 lbs. of other pollutants into the air and over its life produces as much air pollution as 43 new cars, each being driven 12,000 miles (People Powered Machines).



Even the often accidental spillage of fuel while performing lawn maintenance has also become part of the problem. "The EPA estimates that 17 million gallons of fuel, mostly gasoline, are spilled each year while refueling lawn equipment. That's more than all the oil in spilled by the Exxon Valdez, in the Gulf of Alaska (People Powered Machines)."

In addition to cutting back landscaping maintenance, conservation design using natural landscaping provides an additional service as well. "Native plants help to reduce the amount of CO_2 in the atmosphere by taking in CO_2 and storing the carbon in the body of the plants, roots and soil. Native plants work much better than traditional mowed grass as a carbon sink due to their extensive root systems and increased ability to retain and store water (USEPA, Green acres)."

Energy consumption

The effect of implementing conservation design strategies on energy consumption is somewhat unclear. Conservation design strategies such as maximizing natural areas and minimizing paved areas can lead to a reduction in the overall ambient temperature, lowering cooling costs in the summer (Wade, 2000) (Stone, 2001). In addition conservation design often results in the preservation of trees which, in addition to lowering temperatures in the summer, can act as windbreaks that reduce heating costs in winter (McHenry County, 2008). Local sources state that the use of sustainable stormwater techniques reduces stormwater amounts that enter the sewer system which saves energy used for pumping and treating the additional water.

More directly, conservation design tends to encourage the clustering of dwellings, which has a number of energy benefits. For one, necessary infrastructure is reduced, indirectly reducing the energy consumed in the production of the materials used in that infrastructure, as well as the fuel expended in its construction. With clustering, fewer street lamps are required, and the energy necessary to light the community should be reduced. Energy normally lost traversing longer lengths of electrical wire, or fuel wasted driving longer distances within a subdivision, can be saved by clustering dwellings together, shortening distances and increasing efficiency (NIPC, 2003).

But a lingering reality of conservation designed subdivisions is that they tend to be built in greenfield areas that already possess the most attractive natural lands, have the greatest potential for the reintroduction of natural areas and systems, or where land is simply the least expensive (NIPC, 2003). Not surprisingly, this tends to encourage conservation designed developments that are farther from traditional centers and public transportation, contributing to greenfield development and greater dependence on the automobile, increasing VMT (Vehicle Miles Traveled)—and therefore increasing energy consumption.

With this in mind, Prairie Crossing was created next to a commuter rail station that is heavily used by the majority of the community's residents who work in downtown Chicago. But this tendency for conservation design to be located in or beyond the exurbs is problematic and underscores the need for the creation of conservation developments in pre-existing urban and infill areas, near traditional commercial and civic centers, and public transportation.

But perhaps the greatest reductions in energy consumption are gained by the fact that those who build and want to live in conservation design developments tend to be adherents to green design and methods of construction. Often beginning with materials created with less energy than conventional materials, wise green design can yield significant reductions in personal and community energy consumption over the long term. For example, homes at Prairie Crossing are models of energy efficiency, resulting in approximately 50 percent less energy use for heating and cooling than conventional homes (NIPC, 2004) (Town of Cary, 2000).

Community Character

Conservation design encourages community interaction and community character. Compared to traditional subdivisions with private yards, large homes and heavy automobile use that often isolates communities, conservation design cultivates social interaction through shared open space

and cluster design. Connected and shared open space can be used for a variety of activities including walking and biking trails, organized group activities such as picnics and soccer games and observation and educational opportunities to connect with preserved habitats, plants and wildlife. The use and required maintenance of natural landscaping also provides an opportunity for interaction. Although maintenance is usually handled through home owners associations, some developments use volunteers from the community to help with this shared responsibility (Local Sources). These formal and informal spaces create opportunities for meeting neighbors and for creating a larger social network within the community that can add to a person's or family's quality of life and connection with nature. In recent years, homebuyers have shown increased demand for this type of integrated environment (NIPC, 2003).

Additionally, local sources confirm that conservation development amenities also add to community character. For example Prairie Crossing has an organic farm onsite that allows for hands-on learning about organic farming as well as the option to purchase the locally grown produce. Moreover, the actual design of the community (smaller streets and lots, large areas of open space, etc) and the implementation of native landscaping can give the development a unique and aesthetic ambiance that sets it apart from conventional designed developments. This adds to community identity and character (NIPC, 2003). Perhaps one of the major benefits to community character is simply the flexibility in design to create what is appropriate and desirable in individual communities while satisfying the fiscal needs of the developer.

Public Health

There have been numerous studies that positively link public health and accessibility to nature. Conservation design utilizes large open spaces often with biking and walking trails, organized recreation options and preserved habitats that give direct and equal access to the community's residents. In more urban environments, roof top gardens, strategic native landscaping and city parks can provide direct accessibility to nature as well. Other CMAP strategy papers have already demonstrated the clear link between public health and walking, bicycling, and park access; conservation design serves as one more example.

These health benefits are especially important for children who are still developing both mentally and physically. The exposure to natural environments creates cognitive, social, and emotional benefits such as increased creativity, problem-solving, focus, self discipline, cooperation, flexibility and self awareness, stress reduction, reduced aggression and increased happiness all of which contribute to the overall health in children (Burdette, 2005). For example surveys show that change of scenery is directly connected to the severity of Attention Deficit Hyperactivity Disorder (AD/HD) symptoms. Activities such as playing sports or reading outdoors or in a green setting reduced AD/HD symptoms in comparison to the same activities indoors or in a non-green setting. AD/HD now affects up to 7% of children, who at times can display symptoms such as impulsive, outburst-prone and sometime aggressive behavior. Adding trees and vegetation can be a simple way to supplement conventional treatment while improving behavior and social functioning (Faber et al 2001, 54-77) (Kuo and Faber 2004, 1580-1586). Additionally, unstructured free play in a natural environment can physically improve the health of children. Today's concern about the "obesity epidemic" in young children is validated by the fact that in the past decade, the percentage of obese youth has tripled (The Children and Nature Network).

Local Spotlight: A current Chicago Wilderness initiative called *Leave No Child Inside* is embarking on the vital goal of reconnecting children to nature. One of the documented benefits of the program is improved health as a result of natural outdoor exposure. For more information visit: http://www.kidsoutside.info/index.htm

Economics and Land Value

Although the environmental benefits of conservation design have been widely documented and accepted, there is often debate over the cost-effectiveness of implementing conservation design principles. Although at times conservation design principles may cost more when initially compared to conventional development, most often over time they actually cost less due to decreased infrastructure construction and maintenance as well as decreased landscaping maintenance. Several cost analysis and studies conclude that conservation design is at least cost competitive if not more cost effective than conventional design (Conservation Research Institute, 2005).

It is important to provide stakeholders such as developers and local officials with evidence to show these principles can be cost competitive with conventional development principles. For most developers, conservation design is still perceived as "risky" if not for the perceived additional costs than for the additional time needed for zoning variances (Mohamed, 2006). However, conservation subdivisions can provide higher profits and marketability to developers and hold higher property values for buyers. Additionally conservation design lots are less expensive to build with a construction cost savings of up to 25% depending on the lot size and density (NIPC, 2003). To get a monetary estimate of this savings, the *Economics of Conservation Subdivisions* paper by Mohamed states "lots in conservation subdivisions cost on average about $7,400 less to produce than lots in conventional subdivisions."

Prairie Crossing and Tellabs are two examples in our region that have achieved positive economic gains from implementing conservation design despite there different development sector. Prairie Crossing, located in Grayslake, reported a $3,798 savings per lot in construction costs. This can be attributed to innovative stormwater management, reduced curb and gutter, reduced site paving and sidewalks and the use of natural landscaping. Also Tellabs Corporation, located in Naperville, reported a total savings of $564,473, or just over 12% associated with capital costs according to a pre-construction analysis comparing conservation design to conventional design for the same site. Although decreased site preparation accounted for almost having of the savings, integrated stormwater management also contributed to the savings through the collective use of bioswales, wetlands, and natural landscaping (Conservation Research Institute, 2005).

In general two conservation design techniques, clustered site design and naturalized stormwater management systems, seem to have the most consistent and straightforward cost benefits onsite. However the cumulative benefits and cost savings gained when combining multiple techniques often exceeds the individual benefits due to their integrated nature. In the 2005 Conservation Research Institute report, ten case studies were assessed based on their holistic conservation design portfolios and on average saved 36% over conventional design

Infrastructure

Another positive benefit of conservation design is the reduced need for infrastructure. In this case infrastructure can be defined as water, sewer, roadways/walkways and electric systems. The typical clustering of homes common in conservation design allows for lower construction and maintenance costs for the public and private sectors resulting from the reduced distance between connections and subsequent reduced need for piping, wiring, paving and fixtures like streetlights. CH2M Hill found that in clustered developments public service costs were 4%-8% lower than in large lot developments (NIPC, 2003).

Stormwater infrastructure (sewer connections) can also be reduced when natural stormwater techniques and natural landscaping are used to create bioswales, rain gardens, rain barrels, filter strips, green roofs, etc. These techniques retain a portion of the stormwater runoff on site or nearby, filtering out many pollutants and reducing the capacity needs for sewer infrastructure. Depending on how these techniques are realized and how much open space is available, conservation design developments can have a construction/infrastructure cost savings between 11% and 66% (Ibid). In more urban environments, conservation design can have a positive effect on existing infrastructure by reducing the amount of stormwater to enter sewer systems through the use of on site stormwater techniques. Local sources emphasize this can be especially important in communities that have a combined sewer system (water and wastewater) in which flooding in area can cause contamination in the other.

The reduction of impervious surface also supports reduced infrastructure needs. Impervious surface and stormwater runoff are directly related in terms of velocity and quantity. Impervious surface prevents stormwater from infiltrating the ground and carries the stormwater as it picks up speed to the sewer systems increasing the infrastructure capacity needs for that location and/or increasing the likelihood of flooding. Such practices can also reduce roadway/sidewalk infrastructure needs because conservation design calls for shorter driveways and sidewalks and narrower streets. By simply reducing the width of a 300 foot stretch of roadway from 28 feet to 18 feet, imperviousness is reduced by 35% and construction costs are reduced by $5,000(Ibid). As shown above, often conservation design techniques have multiple benefits for a site.

Challenges

Although the numerous benefits of conservation design often outweigh the potential challenges, there are still many challenges associated with implementing conservation design. The following sections explore the challenges of conservation design associated with ordinances, key players in the process, education, and on-going maintenance. If addressed, these challenges could be catalysts that lead to the wider use of conservation design in the region.

Ordinances

While there are excellent examples of ordinances that allow for the option of conservation developments, many current ordinances and development practices used in communities can also be a roadblock to implementing conservation design. Although many conservation design developments are implemented through a Planned Unit Development (PUD) which provides

extra guidance from the Planning Commission, it can be a somewhat difficult framework to navigate for the local planning staff and developers. According to NIPC's 2003 *Conservation Design Resource Manual,* "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" (NIPC 2003). By requiring project specific approvals, communities may unintentionally deter conservation design strategies. The manual goes on to suggest that "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 for conservation developments by right in the zoning code, so that no special approvals are required" (NIPC 2003).

The zoning codes are not the only local ordinances at odds with the concepts of conservation design. In many cases the subdivision, landscaping, stormwater, roadway, and other land use ordinances are not sufficiently flexibility for conservation design. The resource manual (referred above) is specifically designed to help alleviate these issues and was created through a partnership between NIPC and Chicago Wilderness. The full document can be found online at http://www.nipc.org/environment/sustainable/ .

Education: Homebuyers, Developers, Local Officials and the Community

A major challenge in the promotion of conservation design as a development policy is getting the four major stakeholder groups - homebuyers, developers, local officials and local communities - to see the benefits of such a policy. Although conservation design does not increase the number of overall units in a development, it does preserve more open space, which leaves individual units with smaller, more contained lots. Homebuyers who are looking for more land might at first bypass developments built with conservation design principles in mind. In addition, most communities do not have much experience with conservation design and may be hesitant to implement new land use policies that differ from conventional developments. As a result, developers often rely on more conventional development practices. Local officials may be following the community's inclinations or may be influenced by developers to opt for more conventional designs. These are some examples of potential and realistic scenarios that can prevent conservation design implementation in communities.

Many local experts agree that education for all stakeholder groups can provide a different perspective to these scenarios and provide information about the principles and benefits of conservation design. Education helps to alleviate and allow for focused discussion of the misconceptions and the realistic trade offs present between conventional development and conservation design practices. Education can be an equalizer that moves a community forward to making informed decisions about their development preferences.

Workshops, seminars and one-on-one meetings can help to open up the possibilities for conservation design through thoughtful dialogue between participating parties. Currently many organizations in northeastern Illinois including CMAP and members of the Chicago Wilderness consortium such as the Delta Institute are able to provide information on best practices for

conservation design, as well as advocate on behalf of conservation development policies (www.chicagowilderness.org)(www.delta-institute.org/).

On-going maintenance

Once a conservation design development is built, the communal open space and natural drainage systems in place need to be maintained. Local sources say that maintenance responsibility is one of biggest concerns with building a conservation design development. Conservation design developments use a variety of solutions to accomplish this. The most common solution is home owner's association fees, used to hire a contractor to maintain the open space and native landscaping with cyclical burns and light grooming. Developments can also partner with forest preserves, park districts and land trusts. The goal is to establish a long-term arrangement to care for the open space. It can take years before the native plants are established so maintenance is very important to the success of the open space.

On a smaller scale, such as with commercial spaces, usually the management is responsible for maintaining the site regardless of landscaping choice. Conservation design techniques including native landscaping are less expensive and require less frequent maintenance. In one study the annual maintenance cost of open space with natural landscaping was $75 per acre compared to a typical lawn maintenance that was about $225 per acre. In the middle is passive recreation (trails, bike paths) with a cost of about $200 per acre (NIPC, 2003).

Wide use of Conservation Design

The benefits of conservation design are amplified when widely used. This could lead to the interconnection of individual conservation design subdivisions so that the natural areas and natural systems of each would be extended and strengthened, aiding the protection of water quality, the reduction of flooding, and the expansion of habitat and biodiversity (Haines, 2002). Also, natural areas used for such recreational activities as walking and biking could be linked together or with public natural areas, expanding the range of trails beyond the confines of each subdivision's outer boundaries (Haines, 2002). By providing open spaces and buffers that require no public expenditures to obtain or protect, public funds can be used for preserving or purchasing other natural areas (NIPC, 2003).

Another practical benefit of the wide implementation of conservation design would be the reduction in the cost of financing conservation design developments. Prairie Crossing, which has proven the profitability of conservation design, required initial financing that was relatively expensive, due to the perception that it was a high-risk venture (Local Sources). Today, conservation design may be a less-foreign concept to potential lenders, some of whom may even recognize its economic benefits, but until it is widely implemented, they are likely to prefer familiar, conventional approaches to the design of subdivisions.

In addition, local sources say there would need to be a deeper understanding of the differences of implementing conservation design in different environments. In rural and less populated suburban environments, there is more open space to fully utilize the larger-scale natural stormwater management techniques and implement extensive natural landscaping and land

management. In more populated suburban and urban environments, where less open space is available green roofs, strategic natural landscaping and smaller scale stormwater management techniques can be utilized. More urban conservation design is often referred to as green infrastructure or low-impact development. In these environments, conservation design can be combined with other development strategies such as infill or brownfield redevelopment to utilize existing infrastructure and increase the land value while considering and enhancing the environmental aspects of the site. Additional considerations such as ph level found in soils and previous site contamination and degradation, have to be addressed when redeveloping land especially on brownfield sites. These factors directly affect the conservation design techniques that can be utilized on site but also opens up an opportunity for creative solutions.

Infill Snapshot Report
Brownfields Strategy Paper

Supporting and similar concepts

Although CMAP is focusing on conservation design, there are many similar and supporting concepts that could be used in conjunction with conservation design. The following sections touch on LEED Buildings, LEED-Neighborhood Design, Eco-villages, Low-impact Development, Smart Growth and New Urbanism.

LEED for Buildings

Changing the ways we design, build and operate our buildings and infrastructure is perhaps the most powerful way we can address the environmental challenges facing cities as well as the planet. In the United States, buildings account for 70% of all electric consumption, 39% of carbon dioxide emissions and 30% of landfill waste. In addition green buildings improve human health and productivity and make good economic sense. The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is a nationally recognized and widely applied third party certification program operated by the U.S. Green Building Council. LEED certification projects can be found in every U.S. state as well as 69 countries around the world. This holistic green building rating system measures performance in 5 key areas: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality (USGBC website).

LEED for Neighborhood Development

The U.S. Green Building Council, the Congress for the New Urbanism, and the Natural Resource Defense council have come together to develop the first national set of standards for neighborhood location and design based on the combined principles of smart growth, new urbanism, and green building. LEED-ND will continue to incorporate the same values and credits offered in the previous LEED products but in a much broader neighborhood scale to include new residential, commercial and mixed use developments. Additional emphasis will be placed on site selection and the relationships between the individual sites and the neighborhood and surrounding landscape as a whole. The three keys areas for certification are: smart location and linkage, neighborhood pattern and design, and green construction and technology (USGBC website).

Eco-villages

Eco-villages entail a more holistic approach to low-impact living in both urban and rural communities. Residents of eco-villages integrate social/community, ecological and cultural/spiritual realms into one community using various techniques including ecological design and building, permaculture, green production, alternative energy and community building practices (Global ecovillage network).

Robert Gilman in *The Eco-village Challenge* defines an eco-village as a "human-scale, full-featured settlement, in which human activities are harmlessly integrated into the natural world, in a way that is supportive of healthy human development and can be successfully continued into the indefinite future." In most cases food is grown onsite, power is provided by renewables (solar, wind, etc.), wastes are processed and reused on the land (organic and wastewater) and there is extensive recycling. Eco-villages in modern industrial societies usually have 100 or fewer residents however there are variations found worldwide. The main idea is to live a reduced ecological footprint lifestyle but still maintain the functions of modern society (Gilman, 2008).

Low-Impact Development

Perhaps the most closely linked concept to conservation design is low-impact development. The United States Environmental Protection Agency defines Low Impact Development (LID) as a set of practices that can be used to reduce runoff and pollutant loadings by managing the runoff as close to its source(s) as possible. LID promotes the use of natural eco-systems, and cost savings manifest themselves in less infrastructure, since the volume of runoff is manage naturally within eco-systems via infiltration and evapotranspiration. Conservation design incorporates several LID practices, including infiltration and filtration practices, runoff storage and conveyance practices and low impact landscaping. Often LID and conservation design techniques can be used interchangeably (United States Environmental Protection Agency, 2007; Guillette, 2007).

Smart Growth

Smart growth is an initiative that matured from the growing concern regarding conventional, low-density development patterns. The abandonment of existing infrastructure, rising development costs, degradation of prime farmland and growing commutes to work have led communities to look for alternatives. Smart Growth, which recognizes the connection between development and quality of life, positions itself as one of those alternatives. Even though Smart Growth communities are often different in the detail, the core principles for each development are uniform. These communities are more town-centered, transit and pedestrian oriented, and have a greater mix of housing, commercial and retail uses when compared to conventional growth which often separates functions and is more car-reliant and isolated (Smart Growth Network).

New Urbanism

New Urbanism is a development design alternative similar to Smart Growth but can be considered more of a movement that promotes and calls for a return to traditional city and village centers. These centers incorporate diversity in terms of both mixed use and population, promotes pedestrian, public transit and car accessibility, public open space and historical, environmental and agriculture preservation. Communities are scaled to be walkable, compact and interactive (Congress for the New Urbanism, 1996). While New Urbanism is "best known (and often

stereotyped) for its work at the neighborhood and town scale," in many ways its *Charter* was aimed at a regional strategy (Congress for the New Urbanism, 1996). As a result, in New Urbanism, truly natural areas are generally found on the periphery of the region, while its more immediate green spaces are more likely to be urban parks. By contrast, conservation design encourages smaller-scale natural areas that are more immediate and accessible to adjacent clustered development. It is reasonable to suggest that a hybrid of the two similar strategies could yield design strategies especially well-suited to a more urban version of conservation design development than is typically the case today.

Conclusion

The Brookings Institution projects that in 2030, "about half of the buildings in which Americans live, work, and shop will have been built after 2000 (Nelson, 2004)." In other words, nearly half of what will be the built environment in 2030 doesn't exist yet. An overwhelming 427 billion square feet of built space is needed to meet these projections (Ibid). These are sobering thoughts in terms of current development trends however it does leave a lot of potential for improvement and innovation. It is extremely important that communities thoughtfully and intentionally grow considering the needs of the present but also the impacts on the future. Many communities grow in a way that negates the initial qualities that attracted residents in the first place. The principles of conservation design teach us to work more closely with the natural processes that existed before growth was introduced. As more and more growth occurs, conservation design will be a valuable and practical tool to help communities responsibly grow in a resource-finite world.

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