

## On Conservation Developments And Their Cumulative Benefits

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### **Abstract**

Conventional urban developments typically modify 85% to 100% of the site's land and natural resources. Open space, and land vegetated by native vegetation, usually are included within highly manicured parks or detention basins – or more likely – they are excluded from projects altogether. “Conservation developments” have tended to do the opposite: development of 5% to 60% of the land occurs while 40% to 95% is retained as open space. This open space may include manicured parks, restored and remnants of native plant communities, as well as highly integrated programs for human use and enjoyment of the open space systems. This presentation will discuss the cumulative benefits of such developments. The benefits include water quality enhancements involving reduced sediment, contaminant, and water yields compared to conventional developments; wildlife habitat benefits; opportunities for providing significant protection of rare species and declining natural resources; human quality-of-life benefits; and recreation and education benefits. This presentation will provide examples of how known and predicted benefits derived from several conservation development projects have been integrated into residential development within an ecological restoration context on a landscape scale.

### **Introduction**

Land development can be done differently. Recent trends in land use and development impacting natural resource systems suggest that several alternative approaches to planning, design, and development provide added benefits to developers, landowners, and purchasers of the developed property. In the absence of planning that considers natural resources systems early in the development process, the following trends become evident on a regional (and national) basis:

- 1) decline in the amount, quality, and ecological viability of open space;
- 2) decline in wildlife habitat area and quality of habitat that does remain;
- 3) decline in regional water quality;
- 4) increased flooding problems in association with increased impervious landscape elements (flooding becomes more prevalent both within developed landscapes and in downstream environments);
- 5) increased incompatibility between developed landscapes and remaining natural areas, and open space systems (most areas of incompatibility are directly related to threats from points 1-4 above); and
- 6) increase in human discomfort, costs of living, traffic grid-lock, and costs per capita to maintain developed infrastructure.

This paper will briefly identify alternatives to conventional land development that have been designed and incorporated into development projects for the mutual advantage of natural resources, human resources, the developed environment, and the financial community.

## **Fundamental Assumptions Directing Land Development**

Most land developments are driven by short-term economic analyses and perspectives. Thus, they are designed conscientiously to minimize financial risk and provide a favorable return in a planned, relatively short period of time. Consequently, long-term economics, quality of environment and human quality of life issues generally have not been addressed by the short, often rushed, time lines assumed by many land developments. If not directed or constrained by “time value of money” relationships, land development is also fundamentally affected by land valuation and money lending institutions and their process for assessing risk. The land valuation and development risk assessment process is fraught with a myriad of assumptions which fundamentally need to change if environment and human quality of life issues are to be addressed in the development process with a realistic and longer-term perspective.

Basic to the changes required is a need to treat environment as an asset of value beyond the conventional real estate appraisal process - which, for example, might simply value a buildable lot with a large tree more valuable than a lot without the tree. This market driven valuation perspective needs to be balanced with a more fundamental valuation of the intrinsic ecological values of resources, open space, and an economic line item for the functional ecological values (such as the current free services delivered by natural resources for water quality enhancement). This valuation process might, for example, equate water quality cleansing on a landscape scale to the individual per acre contributions in each area proposed for development. Thus, an added cost would be associated with development that did not take this important function into consideration by protecting the basic opportunity for the land and natural resources to continue providing this function. We all pay, and at great cost, for neglecting the intrinsic and enhanceable functional values of ecological resources in the land development process. The economics of retrofitting water quality enhancements and flood management programs *post facto* are examples of societal and natural resource costs that need to be weighed into the valuation process for each development and lot.

## **Cumulative Ecological Impacts**

For years, well-intentioned planning and engineering strategies have been used in the development of land. Throughout the country, and elsewhere, ordinances and regulations have guided the design and enforcement of local, state, and national programs of development. These documents, largely viewed as restrictions, often have only provided fundamental guidance to control development impacts. Ecological impacts have not been adequately addressed through this strategy, nor has compatibility of a development with adjacent open space, parks, and natural areas.

## **Collapse of Hydrological Systems**

Because water flows downhill, changes on uplands can be gauged by measurement of changes in regional aquatic systems including rivers, lakes, wetlands, and regional groundwater/surface water relationships. As a general rule, measurements in these aquatic systems provide a useful index of the condition or ecological health of tributary uplands. Health is indicated by a change from conditions with healthy populations of fishes, invertebrates, and other conditions including good water quality and habitat conditions which support these organisms, as well as providing quality human recreational, water use, and educational and scientific opportunities. Prior existing data on biological and human-use statistics repeated measurements of the same variables, thereby contributing to an understanding and measurement of change in ecological health.

Using data from key river systems that have their headwaters in rural areas and traverse urban areas, we have learned that piecemeal impacts from changing landuses have resulted and contributed to

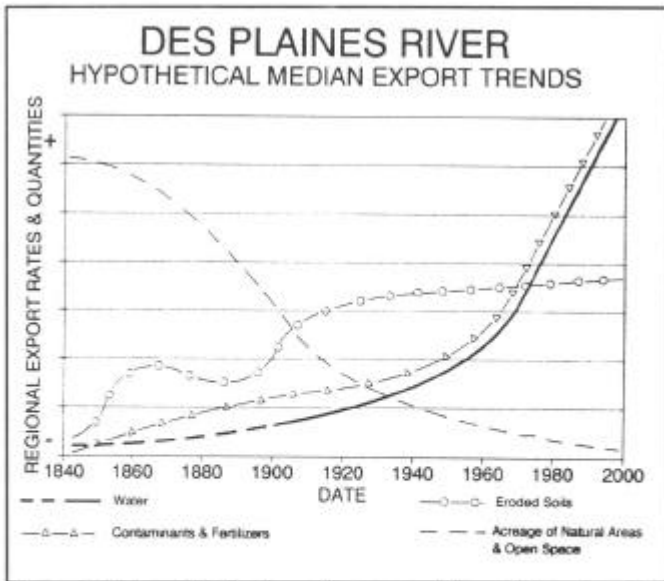


Figure 1. Hypothetical median export trends for the Des Plaines River, northeastern Illinois. The runoff curve was developed from median values from annual duration flow curves from the Riverside, Illinois gage data and data from the national archives (see Apfelbaum 1995).

large scale environmental impacts (Apfelbaum, unpublished data). Figure 1 provides an example of the resulting changes in hydrological systems. This interpretation suggests that regulations and ordinances (especially as they pertain to stormwater management) may not have worked as well as they could have. Increasingly frequent flooding, impaired human uses of the aquatic environment, and deteriorated water quality and biological communities are now commonplace in most river systems that traverse urban centers (or intense agricultural land-use areas). This also suggests that a fundamental change in our perspective and design for stormwater management in developments could benefit regional ecological, hydrological, and human systems.

### Our Public Trust Lands

Large investments have been made in many urban centers for the acquisition of public parks, open space. In many locations, the focus has been on purchasing (or protecting through creative means such as conservation easements, land-swaps, land trusts, etc.) parcels found valuable from an ecological, natural resource, and biological perspective that also may be used for public recreation. In urban metropolitan Chicago, counties have established an extensive forest preserve district system which includes approximately 15,000-70,000 acres of land in each county. This land has been purchased with a fundamental assumption that it would be protected and managed in perpetuity.

A recent study of 9,000 acres of the highest quality natural areas in one Chicago area county has concluded that a very large percentage of these valuable natural areas are deteriorating (Applied Ecological Services, Inc., 1996). The majority of the natural areas, especially the smaller sites (less than 250 acres), are very vulnerable and are severely degrading because of impacts from adjacent land-uses. Edge effects including biological threats (such as exotic plants and animals) from the developed landscapes produce threats to the natural areas. This investigation has documented that few natural areas are isolated from development impacts. It is likely that only the largest areas that include buffers are likely to be sustainable. This study also has clearly documented that smaller natural areas surrounded by development will have significantly higher management and maintenance costs because of cumulative impacts from development. The estimated costs for this county to manage its natural areas over the next ten years exceed \$30 million (assuming no new ecological problems develop and that all management strategies are effectively and efficiently administered – and are successful). A large percentage of this cost is directly related to the cumulative impacts from land-uses and development in adjacent parcels next to the natural areas.

This exercise found that primary impacts of adjacent land-uses were as follows:

- hydrological changes contributing to changes in vegetation types, tree mortality, and other problems including severe erosion and deposition;

- soil, water, nutrient and chemistry changes including the introduction of many contaminants directly associated with changes in plant and animal species and their populations, community structure, and biological diversity;
- inadvertent introduction of exotic plant and animal species from residential and commercial area; and
- incompatible intrusions including debris disposal, use as default open space by residents, directed sump pump waters, (etc.) into the preserves.

Cumulative impacts from each land development, or each residential lot, may be viewed to be minor by some, but their combined piecemeal effects are large and costly – and they will become increasingly costly over time. The incompatibility of conventional development with the public trust needs to be emphasized. Regionally, these lands are significant repositories for natural resources, and they provide key educational and scientific opportunities. Their value increases at an ever-increasing rate, not only from a conventional land value perspective, but also more importantly, as ecological resources and for human use and appreciation.

### **The Need for Retrospection**

The examples of cumulative impacts to important and valuable ecological and human systems (which are intricately inseparable) suggest that we need to question our basic assumptions, regulations, ordinances, and guiding principles that have been fundamental to the land-use design and development process. For example, to understand less costly ways to address stormwater management, do we need to question their performance and treat these like any performance-based process?

Are stormwater management standards appropriate? Regional stormwater management plans, ordinances, and regulations started with basic assumptions on water yields associated with different landuses. Release rates have largely been derived from modeling runs of hypothetical storm events and flood probabilities. The standards that have been used to develop release rates have used the prevailing conditions as the modeled starting conditions.

Because most sites have been grossly modified, hydrology may no longer be representative of the historic relationships between water and landscapes. We assert that even under the current regulations, regional export of water and other resources (including contaminants) as displayed in Figure 1 are likely to continue unless there is a fundamental change in thinking (and only if the reference for what is a pre-development condition for hydrology is redefined).

### **The Wrong Standard**

Preliminary evaluations of regional hydrology suggest that pre-settlement ecological systems at a landscape scale had significantly reduced stormwater runoff. With settlement, rapid changes in regional surface hydrology occurred. We typically use this changed condition today as the reference against which proposed development impacts are judged, reviewed, and approved under regulations and ordinances.

If we are to enhance overall quality of the aquatic resource and sustain quality resources of valuable ecological resources (especially aquatic systems), we must realize that the post-settlement disturbed landscape should not serve as the standard against which proposed changes should be judged. A fundamental re-thinking of regulations about stormwater management may be necessary. We do not suggest here that the pre-settlement conditions are achievable. However, the base standards against which all projects strive to achieve could be changed. Percent achievement by developments against more appropriate standards could be used as a basis of measurement of performance. Taxation and landuse ordinances could have sliding scales of costs and user fees, (or taxes) depending on the measurement of

the development's benefits. A performance credit system could be developed that would allow for transfer of opportunities to conscientious and environmentally responsible developers from developers who are less so inclined (for a fee). A regional stormwater plan could identify watersheds with various levels of priority for stormwater management.

### **Cumulative Benefits of Conservation Developments**

As has been previously documented (Apfelbaum et al. 1995), several benefits have been both predicted and realized from developments that have come to be called "conservation developments." Conservation developments can target various levels of involvement with ecological resources and provide environmental benefits to address the six regional declining trends associated with conventional regional developments. In particular, conservation developments can offer the following:

- 1) Significantly greater localized and regional stormwater management benefits for all storm events (compared to conventional developments);
- 2) Localized and regional water quality benefits through improved source management of contaminants and erosion and deposition;
- 3) Integration of open space for the benefit of the local environment and human use opportunities in the development;
- 4) Integration of open space and natural resources in a development designed to facilitate health in adjacent open space that might be private or public trust lands;
- 5) Revitalization of important human relationships with land and other natural resources through direct involvement by people in restoration, stewardship, and educational programming in a conservation development;
- 6) Redefinition of what might be more appropriate land development standards through example and measurement of their benefits with scientific investigations;
- 7) Redefinition and redirection of public perceptions and beliefs about appropriateness of land development standards through positive and win-win conservation development projects that target a quality human and natural environment as a fundamental development goal;
- 8) Redefinition of the lending institution risk assessment process, as it pertains to protection and integration with natural resources during the development process; and
- 9) Redefinition of the value (both short- and long-term) to society of natural resources – in real dollars.

Several conservation developments have been designed and developed in the United States. The Prairie Crossing project is highlighted as an example of how some of these nine potential benefits have been addressed.

### **Prairie Crossing – A Conservation Community**

Prairie Crossing is a new conservation community occupying 667 acres in central Lake County, 40 miles north of Chicago, Illinois. The site was farmed under an annual crop rotation and has deep silt

and clay loam soils from glacial till parent materials. The native landscape was significantly modified over the years by an extensive field tile system, agricultural tillage for perhaps 150 years, and pesticide use since the 1950s. This resulted in the elimination of native biological communities.



Figure 2. Layout of the Prairie Crossing residential development (Grayslake, Illinois). The stormwater treatment train is installed as an integral component throughout the project.

Started in 1994, Prairie Crossing will include 317 homes on 132 acres (20% of the site) with a high density “village center” and an outer area of cluster homes surrounded by open lands (Figure 2). The remainder of the residential site will be retained as open space and agricultural lands integrated with the residential development. The open space in and around the residential area is being restored to emulate historic functions and the aesthetics of pre-settlement prairies, wetlands, wet prairies, and savanna communities that occupied the site prior to and during the initial settlement by Indo-European immigrants in the 1830s. This restored landscape will provide a unique living environment for the residents of Prairie Crossing. The open space includes a newly constructed 22-acre lake, 13 acres of wetlands and 160 acres of created prairies. An additional 150 acres of agricultural are integrated to protect the

rural agricultural landscapes that, until recently, typified this area of Lake County, Illinois.

Over 10 miles of trails through the restored prairies and wetlands and around the farm provide an opportunity to engage residents and guests and encourage them to learn more about the benefits of natural areas. From reduced costs for common area maintenance (for the Prairie Crossing Home Owners Association) to wildlife observation opportunities, residents experiencing these benefits are becoming natural area advocates. Many are subsequently joining the Liberty Prairie Conservancy, a volunteer group dedicated to preserving and restoring the open space areas of the Liberty Prairie Reserve (a 2,500-acre open space area purposely connected to Prairie Crossing).

The open space at Prairie Crossing (Figure 2) is designed to provide stormwater management functions for the project (Figure 3). The stormwater system was designed as a treatment train with several components that each contribute in sequence to treat the water before it enters the central lake and leaves the site. Stormwater runoff from residential areas outside the village center is routed into swales. These swales convey runoff from roadways and residential lots into expansive prairies, while providing a mild

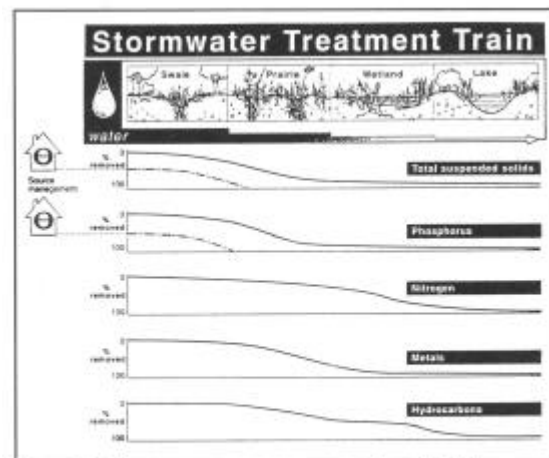


Figure 3. The stormwater treatment train at Prairie Crossing (Grayslake, Illinois) was designed to reduce runoff and increase quality of water in and that leaving the residential development.

amount of infiltration and settling of solids. The prairies are the second component of the treatment train. The prairies slowly convey stormwater as diffuse overland flow to the wetland systems bordering the lake. The prairies are expected to infiltrate and evapotranspire a substantial portion of the annual surface runoff volume due to their very deep root systems and productivity, and provide for additional solids settling. The wetlands are the third component of the treatment system and provide both stormwater detention and biological treatment prior to the runoff entering the lake. The final treatment component is the lake. The lake also will provide stormwater detention. The components of this stormwater treatment train management system are designed to increase the water quality of stormwater runoff and reduce the stormwater runoff peaks and volumes.

The system as installed allowed the developer to save over one-half million dollars when compared to installing a traditional storm sewer system with curb and gutter. Additional savings were available by reducing the area of impermeable surface.

Although not enough time has passed to fully evaluate the performance of the swales, mature prairies and wetlands for stormwater treatment and management, our modeling results predict a 65 percent reduction in runoff when compared to a conventional development with similar density (Apfelbaum et al, 1995). Projected water quality improvements show similar gains.

The improvement in water quality and stormwater management makes a direct contribution to regional stormwater management and natural resource conservation. Immediately downstream of Prairie Crossing is the 2,500-acre Liberty Prairie Reserve containing six Illinois State Nature Preserves. The water leaving Prairie Crossing flows through the nature preserves ultimately entering the Des Plaines River at the eastern edge of the Liberty Prairie Reserve. The improvements at Prairie Crossing allow these important natural areas to perform at significantly higher levels and contribute to an enhanced Des Plaines River (as compared to the predevelopment agricultural land-use scenario and a conventional development approach).

Because of our focus on water quality, some of the nine potential benefits of conservation developments have not been addressed in this paper. However, it is clear that projects such as Prairie Crossing are achieving many of the other benefits. Some, such as addressing lending institution risk, will be addressable only after several years of additional history, project sales performance and project costs become available.

### Hybernia and Sedgewood Cove

Hybernia and Sedgewood Cove (Highland Park and Lindenhurst, Illinois) are conservation developments that have addressed the integration of natural resource areas with residential developments in order to obtain



Figure 4. The Hybernia project includes a 27 acres state of Illinois dedicated nature preserve, a created waterway system that separates and buffers the developed lands from the preserve, and additional acreage of dedicated open space—some with high quality natural area. Hybernia project is 132 acres with 119 clustered homes. Approximately 50 percent of the acreage has been retained as open space.

conservation benefits. These developments exemplify the meshing of residential living with natural areas, while fulfilling the financial goals of the developer and the demand for new housing in Lake County, Illinois.

Both the land and the residents of Hybernia and Sedgewood Cove benefit from the conservation development approach. The land-use plans (Figures 4 and 5) incorporate the following features at Hybernia: ponds up to three acres size, a registered Illinois Nature Preserve, and numerous walking trails

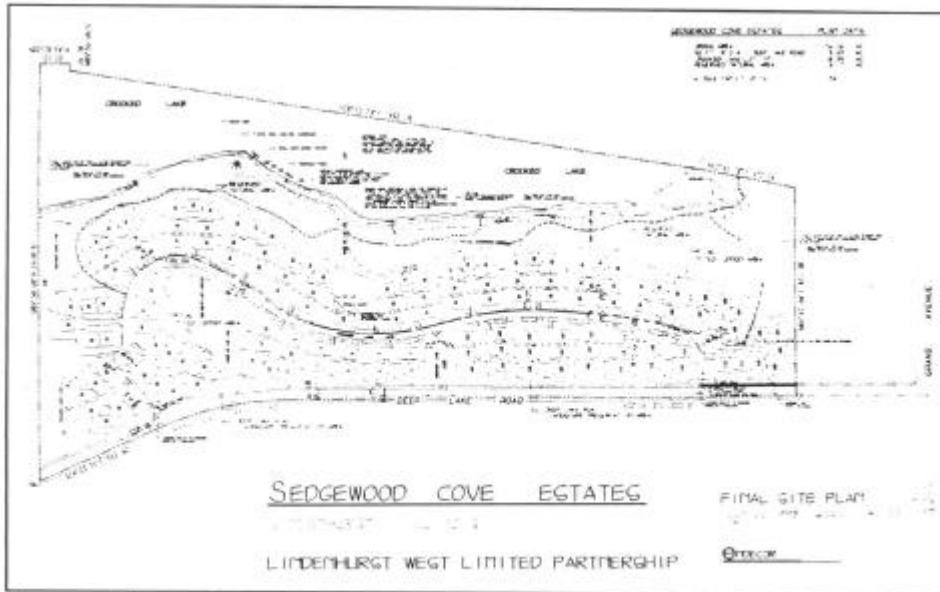


Figure 5. Sedgewood Cove protected a lake shore, created hydrologic buffers to protect the adjacent lake, and established a private nature reserve as an integral element of the project.

throughout the property. Hybernia's preserve has protected over 300 plant species including the federally endangered White Fringed Orchid. Additionally, Sedgewood Cove contains lake frontage on Crooked Lake, a nature reserve, and numerous walking trails. Thus, the preserves in both properties provide the opportunity for the residents to interact with nature within the developments.

For stormwater management, both projects have been designed to work within the framework of the land's existing hydrology. The waterway system at Hybernia retains water within the development and also buffers the hydrology of the developed areas from the nature preserve. At Sedgewood Cove, se stormwater is pretreated in managed wetlands before entry into the lake.

The residents are active in the monitoring, restoration, and preservation of the nature preserves. Homeowner's associations utilize the services of stewards to perform the monitoring and restoration of the preserve areas. Associations also are proactive in teaching residents about the preserve. For instance, at Hybernia, the residents have a nature preserve committee that schedules a variety of activities including nature walks with the preserve steward, seed collecting and non-indigenous plant life removal. Strict covenants that protect the open spaces, along with endowments, provide the financial assurance that restoration, management, monitoring, and education will continue in to the future. Thus, the projects help revitalize the relationship between nature and humans.

Conservation developments produce win-win results for both the developer and the residents of the developments. At Hybernia and Sedgewood Cove, the developer marketed the natural features as amenities which resulted in higher sales prices. A developer can also lower the institutional lender's risk because the concern over environmental liability is typically reduced in conservation development. In addition, the real value gained in these developments is in the dollar value of maintaining natural resources that would normally have been lost in a non-conservation development. Moreover, conservation developments help redefine the standards for appropriate land-use on vacant land rich with natural resources.

## **Conclusion**

Conservation developments offer an alternative approach in rapidly urbanizing areas to address land development and resource management/protection during design, construction, and thereafter. One can only speculate on the cumulative benefits from conservation developments if these types of projects became more prevalent.

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