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STREAMLINES

The North Carolina Division of Water Quality

A Newsletter for North Carolina Water Supply Watershed Administrators

TECHNIQUES FOR PRESERVING ECOLOGICAL CONNECTIVITY

Ecological connectivity is important for the health of our environment, and if it is maintained, it can add to the appeal and livability of our communities. The Division of Water Quality's Water Supply Watershed Protection Program views this concept as key in protecting drinking water supplies, as it generates a coherent and enlarged environmental buffer between development and water.

This article will discuss the concept of ecological connectivity, its benefits and three implementation tools found in the state water supply rules that can be used to achieve it.

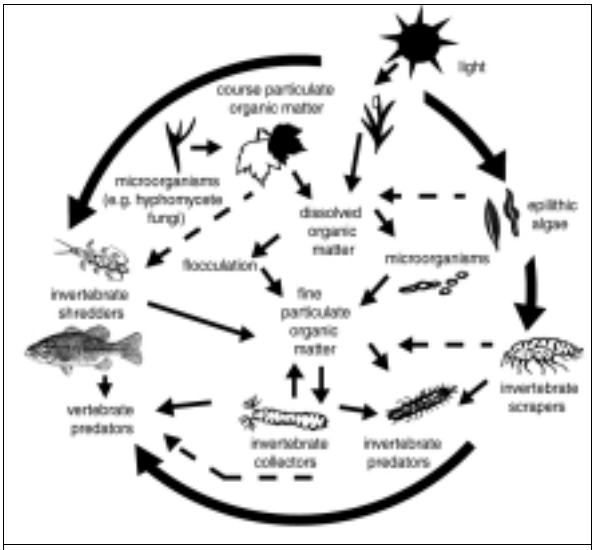
Note: Those words found in italics are referenced in a glossary section at the end of the article.

WHAT IS ECOLOGICAL CONNECTIVITY?

Ecological connectivity is maintaining a connected system of open space throughout an *ecosystem*. Not only is a contiguous line of open space maintained, but specific natural systems are kept in tact. Ecological connectivity relies on maintaining *ecotones,* the linkages between different ecological regions.

One type of ecotone is a riparian buffer, the zone between a river or stream, and an upland area. Another is the littoral zone of a coastal area which is made up of both beach and dune and is regularly subjected to the influence of tidal, wind and solar conditions. Both areas are home to many specialized plants and animals that respond to changes in aquatic or terrestrial influences, and which actually depend on this rapidly changing environment to function and survive.

The concept of ecological connectivity requires that this sensitive transitional zone between ecotones be maintained over time to ensure productive function of the plant and animal species that contribute to the overall health of the area.



Food chain illustrating linkages represented within a riparian zone ecotone.

These transitional zones must be maintained in both a linear and vertical manner for adequate function. Riparian corridors that are interspersed with abrupt changes in the landscape, either through clearing or development, will not ensure that the linear relationship that exists along the river-upland interface is maintained. This has the effect of restricting movement and feeding patterns of the species that rely on the region for their function. Additionally, if this ecotone is impacted vertically through the loss of forest canopy, then heavy sunlight can reduce the functional capacity of the forest floor to support the wildlife that depend on shade for their existence.

Ideally, when development occurs, these transitional zones can be identified early in the planning and design process, such that ecological function of these areas can be maintained and protected without altering transportation, zoning or development plans for an area.

THE BENEFITS OF MAINTAINING ECOLOGICAL CONNECTIVITY

Watersheds rely on multiple variables to function properly. Ecological connectivity is at the root of those variables and is critical to the overall health of a watershed. Many of the species that benefit from larger connected habitats perform functions in watersheds not visible to humans. For example, species that live on the forest floor can be collectors or shredders of the organic debris that comes from other riparian species. These organisms break down the debris, which aids in nutrient removal and uptake, and also provide food for other species within the system. (The illustration provided above represents the species diversity and relationship to the riparian areas.) As mentioned earlier, if ecological connectivity is not maintained on an appropriate scale within the watershed,

(See Q & A on page 2)

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Q & A (Continued from page 1)

certain components of the watershed will cease to function, causing stress on the other parts of the system.

IMPLEMENTATION TOOLS TO PROMOTE ECOLOGICAL CONNECTIVITY

Local governments have a number of implementation tools that support ecological connectivity. A good source of technical information is the book, Conservation Design for Subdivisions by Randall Arendt (1996). This work provides many examples of how conservation design techniques including those supported in the watershed protection program can be implemented to meet a variety of subdivision needs. (A review of this book is highlighted in the center of this page.)

The July issue of *Streamlines* focuses on three techniques available in the Water Supply Watershed Protection Rules for maintaining ecological connectivity within watersheds. These techniques are: clustering; built upon area - density averaging; and density averaging of non-contiguous parcels.

The use of the tools described in this article offer a local government an additional opportunity to maintain ecological connectivity within a region. Sometimes there are ecological systems important for protection but not covered in the rules.

For example, in most water supply watersheds, *intermittent streams* and springs are not protected by a mandatory buffer zone. These hydrologic features are important parts of the landscape, and removing them can cause future hardships on the rest of the system. These sensitive areas should be preserved into perpetuity. A commonly used technique for long-term preservation is a conservation easement attached to a development plan identifying small isolated wetlands, steep slopes, mature forests, and areas with sensitive species.

Each technique provides local governments an opportunity to protect and preserve sensitive areas within a watershed without compromising the rights of individual landowners.

CLUSTERING

Clustering is an alternative to *conventional subdivision design.* The intention is to develop a more compact and less environmentally intrusive site, and incorporate the practice of conservation design into the final site plans. Clustering concentrates the development onto a portion of a project without increasing overall density.

Water supply watershed clustering requires a portion of the developed site to remain undeveloped in perpetuity through the use of conservation easements or other management mechanisms. It is through these provisions a local government can integrate ecological connectivity into their neighborhoods. Since clustering seeks to position development on only a portion of a site, but at a higher concentration, landowners/developers can benefit from numerous construction and infrastructure savings. Clustering also encourages a better mix of uses and building sizes.

The clustering provision in the watershed protection rules states: developed densities can be no higher than those that would be allowed for the overall site; buffers must meet or exceed overall state standards; areas of concentrated development should be located in upland areas and away from surface waters and drainageways; and the remainder of the tract must remain in a vegetated or natural state [15A NCAC 2B .0104(s)].

In order to implement a cluster plan that achieves continued ecological connectivity between a site and the region, a process should be established. The process described in "Conservation Design for Subdivisions" is worth considering.

BUILT UPON AREA – DENSITY AVERAGING

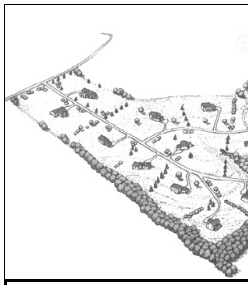
Where clustering of activities is not an option, a development could consider using built upon area averaging as an option for preserving sensitive areas within a site. Averaging of built upon area over a site works like clustering but without the permanent dedication of open space. The core concept in BUA averaging lies in the configuration and placement of impervious surfaces.

If minimum lot size requirements are not prescribed or allowed to be eliminated, and prescribed setbacks are not exces-

"The loss of a forest o
it is replaced by a villag
subdivision or a shopping
– Andres Duany

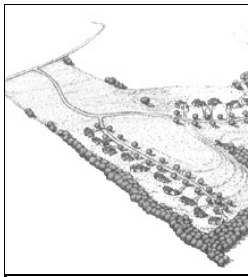
BOOK REVIEW - CONSERVATIO

Conservation Design for Subdivisions is a handbook for local governments to use in developing alternatives to th more land consumptive "conventiona subdivision design" techniques common throughout the nation. Written by Randall Arendt, author of Rural By Design (see Streamlines, Fall 2000) and published in 1996, this document provides the basic steps of designing subdivisions and developments in a less land consumptive fashion. Arendt provides the basic steps for maximizing open space with out reducing overall density.



Site as allowed under c in fragme

Conservation Design for Subdivisions revolves around five key points. First conservation design is one alternative for improving the impact of residentia development in rural areas. Second, conservation design is the principal technique for the conservation of open space. Third, conventional zoning has the sole purpose of setting rules for orderly conversion of natural land into developed land, and does not address conservation or open space practices. Fourth, conservatio design practices provide a local government with techniques to develop a greener vision, particularly in rural ar-



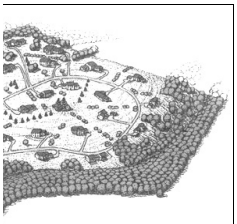
Site using conservation connected

farm is justified only if
To replace them with a
r is not an even trade.'
Suburban Nation.

ESIGN FOR SUBDIVISIONS

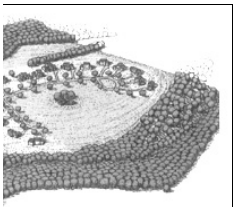
s. And fifth, controversial and
stly down-zoning practices are not
cessary in all cases.

dditionally, Conservation Design for Subdivisions promotes the belief that the practice can be density neutral. This means that land can be utilized more efficiently by permanently protecting important areas as open space hile not reducing the maximum mber of building lots that may be lowed under existing zoning plans.



ional zoning resulting abitats.

rendt also promotes this concept as way to provide interconnected ar- s of habitat. Using this technique r developing a series of connected eas within the rural areas surround- g urban and suburban environ- ents will provide the region with improved natural areas and promote better livability. Using the technique of conservation design for subdivisions provides an economic benefit for regions as well. Arendt provides several se studies from around the country at highlight the beneficial outcomes ustrating this point. The book is ailable from the Island Press or lanners Press.



practices – results in t areas.

sive, built upon area averaging can provide significant flexibility. This technique locates concentrated built upon area on portions of the site with the fewest negative impacts. If done at an appropriate scale, the opportunity for preserving ecological connectivity is greater.

Consider a 100 acre site supporting 24 percent built upon area, meaning development standards allow 24 acres to be "paved over." This site also contains a number of constraints, such as steep slopes, wetlands, poor soils, etc. As a result, the buildable acreage is limited to 20 acres, and the development potential cannot be maximized. By using built upon area averaging, the built upon area can be concentrated in specific locations at rates greater than 24 percent and the property owner can maximize the yield. This practice works especially well for mixed developments with additional benefit provided by reducing infrastructure costs.

This same approach can be used with the density options included in the rules. For example, if in a WS-IV watershed a developer is allowed to build two dwelling units per acre on a 100 acre site, 200 units are allowable. In reality, due to physical and regulatory constraints, the site might not have the capacity for 200 units using conventional subdivision standards. However, all 200 units can still be achieved using built upon area averaging by reducing the size of some units and increasing the size of others.

It is important to note that local governments using built upon area averaging will have to include this language in their water supply watershed protection ordinance and submit it for state approval.

DENSITY AVERAGING OF NON-CONTIGUOUS PARCELS

Density averaging permanently links non-contiguous parcels thereby allowing an increased density on one parcel in return for density reduction on another. These parcels do not have to be near each other. They can be used to allow for a more appropriate use of land and can aid in the long term preservation of ecotones, which in turn, preserves the ecological connectivity of water supply watersheds. Built upon area can also be used with the density averaging process.

Density averaging is an option a local government must request and gain approval to implement. It has required guidelines and practices which must be adhered to, and it requires the submittal of a separate ordinance for review and approval by the Water Quality Committee of the Environmental Management Commission. For more information and a copy of the guidelines, call our unit at 919-733-5083 x566.

Density averaging offers an option in areas wanting to increase urban densities, while limiting rural growth common in metropolitan areas. Additionally, density averaging allows for the most efficient use of space within areas that may be the most expensive, while preserving areas from urban growth. Density averaging also allows the preservation of connected ecological zones without interference with suburban growth pressures.

Ecological connectivity spans jurisdictions and thus should be managed as such. When the environments within a watershed are treated as individual, discrete units, the connections between systems – the ecotones – are lost and the potential for long-term damage is greater. Preserving these ecological systems can reduce the need for future complicated and costly restoration projects. An ounce of prevention, is truly worth a pound of cure.

GLOSSARY

Conventional Subdivision Design - a type of development design that tends to use maximum space for development, does not mix land uses and prioritizes cars over pedestrians.

Ecotone - A habitat created by the juxtaposition of distinctly different habitats; an edge habitat; or an ecological zone or boundary where two or more ecosystems meet [http://www.epa.gov/trs/index.htm].

Ecosystem - An interactive system that includes the organisms of a natural community association together with their abiotic physical, chemical and geochemical environment [http://www.epa.gov/trs/index.htm].

Intermittent Streams - A well-defined channel that contains water for only part of the year, typically during winter and spring when the aquatic bed is below the water table. The flow may be supplemented by stormwater runoff. An intermittent stream often lacks the biological and hydrological characteristics associated with the conveyance of water [15A NCAC 2B .0233(2)(g)].

Watersheds - A drainage area or basin in which the land and water areas drain or flow toward a central collector such as a stream, river or lake at a lower elevation [http://www.epa.gov/trs/index.htm].

For more information see:
Arendt, Randall. Rural by Design. Chicago: APA Planners Press, 1994.

This article was authored by Milt Rhodes of the Local Government Assistance Unit.

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Check us out at: http://h2o.enr.state.nc.us/wswp/

Due to budget constraints, Streamlines may not be mailed out in the future. Please continue to look for it at: http://h2o.enr.state.nc.us/wswp/. Streamlines is published quarterly in January, April, July and October.

WHAT'S HAPPENING?

Environmental Management Committee
September 13
Archdale Building, Raleigh
http://h2o.enr.state.nc.us/admin/emc/

EMC Water Quality Committee
September 12
Archdale Building, Raleigh
http://h2o.enr.state.nc.us/admin/emc/committees/wq/index.htm

Proposed Reclassification Hearings
Neuse River in Lenoir County to WS-IV.
September 6, 7 p.m.
Lenoir Community College, Kinston

North Toe River in Avery and Mitchell counties to WS-V.
October 9, 2 p.m.
Department of Social Services Building, Newland
Elizabeth Kountis, 919-733-5083 x369

Ninth National Nonpoint Source Monitoring Workshop
"Monitoring and Modeling Nonpoint Source Pollution in Agricultural Landscapes"
August 27 - 30
Hyatt Regency, Indianapolis, Indiana
http://www.ctic.purdue.edu/CTIC/Conferences/NPSCall.html

Introduction to Zoning
August 27 - 31
Friday Center, Chapel Hill
http://ncinfo.iog.unc.edu/calendar/3nov2000dec2001.htm#pzon

DID YOU KNOW?

The state model ordinance for the Water Supply Watershed Protection Program calls for local watershed administrators to send the Division of Water Quality, Local Government Assistance Unit a copy of any locally-adopted amendment made to their local Water Supply Watershed Protection Ordinance. Hence, we respectfully request that you send us copies of any amendments made to your ordinances. Thank you to the communities that are already doing so.

The International City/County Management Association through a grant from the U. S. Environmental Protection Agency, has developed a source water awareness tool kit that can be used to help raise community awareness about drinking water protection issues. The tool kit is available on-line and includes guidelines and sample promotional materials for launching a successful media campaign. For more information, contact Dorothy Morrison at dmorrison@icma.org or 202-962-3585, or see http://www.lgean.org/html/_tooldetail.cfm?id=43.

The N.C. State University Water Quality Group offers "A Decision Support System for Nonpoint Source Pollution Control" called WATERSHEDSS (Water, Soil, and Hydro-Environmental Decision Support Systems). WATERSHEDSS can be used to research and designate the most appropriate water quality BMPs for your locally impaired streams. http://h2osparc.wq.ncsu.edu/

Please note that the Water Supply Watershed Protection Rules require, for low density development, that stormwater runoff from development shall be transported by vegetated conveyances to the maximum extent practicable. This requirement is called for in the rules, but it is not specifically spelled out in the Model Ordinance.

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