Appendix C

What is a Riparian Buffer?[1]

Riparian buffers are specific types of greenways that focus on ecological functions along the water's edge. Specifically, they are areas of vegetation, usually trees accompanied by shrubs and other vegetation, which are adjacent to a body of water and managed to benefit water quality, soil conservation, and wildlife habitat. Such benefits focus on maintaining the integrity of stream channels and shorelines, reducing the impact of pollutants from upland sources, and supplying food, cover, and thermal protection for both aquatic and terrestrial wildlife. The concept behind a riparian buffer is to put the natural functions of riparian areas to work in non-point source pollution control.

Forests are the most effective type of riparian buffer available—more effective than grasslands, meadows, shrub borders, etc. They offer the broadest range of benefits and provide the greatest degree of effectiveness. These linear strips of forest serve as a stream's last line of defense against the intensive activities we undertake in managing the land, such as agriculture, grazing, and urban development. Unlike most best management practices, the high value of forests to wildlife and fish helps these buffers accomplish habitat benefits at the same time as they improve water quality.

Cumberland County Policy on Riparian Buffers

Cumberland County has adopted a policy to support riparian buffer establishment through its Comprehensive Plan (2003). *The Goals and Objectives for Natural Resource Management* lists riparian buffer and greenway planning among the top 5 priorities of the County and of each of the three sub-county regions. The Plan suggests riparian buffer and greenway planning as a technique for achieving floodplain management, stormwater management, wildlife habitat conservation, wetland and woodland preservation, and the mitigation and prevention of environmental degradation—a technique that is appropriate countywide.

Designing Riparian Buffers

Riparian buffers will vary in character, effectiveness and size based on the environmental setting, land use, proposed management, level of protection desired and landowner objectives. Several federal, state and regional resource and environmental agencies have published guidelines or standards for the designation of riparian buffers.

[1] The Chesapeake Bay Program. www.chesapeakebay.net.

Federal Design Guidance

The Federal Interagency Stream Corridor Restoration Working Group developed a list of ten practical performance criteria to guide how buffers are to be sized, managed, and crossed. The criteria were published as part of *Stream Corridor Restoration: Principles, Processes, and Practices*.[2] The criteria are listed here in brief; full descriptions are available in the referenced document.

Criteria 1: Minimum total buffer width - The total buffer width establishes the setback of the built environment from the stream centerline or waterline.

Criteria 2: Three-zone buffer system - Effective urban stream buffers have three lateral zones—stream side, middle core, and outer zone. Each zone performs a different function, and has a different width, vegetative target and management scheme.

Criteria 3: Predevelopment vegetative target - The predevelopment vegetative target is the native natural condition of the landscape. Throughout most of Pennsylvania, this condition is a forest landscape.

Criteria 4: Buffer expansion and contraction - One or all of the three zones may be adjusted to protect features specific to the site, e.g., the extent of the 100-year floodplain, steep slopes, and any adjacent delineated wetlands or critical habitats.

Criteria 5: Buffer delineation - Buffers need to be delineated rationally and consistently. Three key decisions must be made when delineating the boundaries of a buffer. At what mapping scale will streams be defined? Where does the stream begin and the buffer end? And from what point should the inner edge of the buffer be measured? Clear and workable delineation criteria should be developed.

Criteria 6: Buffer crossings - Some provision must be made for linear forms of development that must cross the stream or the buffer, such as roads, bridges, fairways, underground utilities, enclosed storm drains or outfall channels, as well as livestock access in agricultural landscapes.

Criteria 7: Stormwater runoff - Buffers can be an important component of the stormwater treatment system at a development site. They cannot, however, treat all the storm water runoff generated within a watershed. Therefore, some kind of structural BMP must be installed to treat the quantity and quality of storm-water runoff from the remaining 90% of the watershed.

Criteria 8: Buffers during plan review and construction - The limits and uses of the stream buffer systems should be well defined and documented during each stage of the development process—from initial plan review, through construction.

2 Stream Corridor Restoration: Principles, Processes, and Practices available at www.nrcs.usda.gov/technical/stream_restoration/PDFFILES/CHAPTER8.pdf

Criteria 9: Buffer education and enforcement - The future integrity of a buffer system requires a strong education and enforcement program. Thus, it is important to make the buffer "visible" to the community, and to encourage greater buffer awareness and stewardship among adjacent residents.

Criteria 10: Buffer flexibility - Buffers can be a significant hardship for a landowner whose property is adjacent to a stream. Many communities are legitimately concerned that stream buffer requirements could represent an uncompensated "taking" of private property. These concerns can be eliminated if a community incorporates several simple measures to ensure fairness and flexibility when administering its buffer program.

USDA Forest Service Guidance

Very specific specifications have been established by the USDA Forest Service – Northeastern Area for riparian forest buffers that serve to "Protect and Enhance Water Resources". These standards outline the location, purpose and functional requirements (filtration, denitrification, etc.), dominant vegetation, and forest management (timber harvest, livestock access, etc.).

State Guidance

Pennsylvania has not adopted such specific policy on riparian buffer dimensions; therefore local governments must determine their own standards or guidelines. Several western states have developed legal dimensions for riparian buffers.[3] These are offered as examples of how dimensions can be based on various stream classification methods.

In the eastern states, regional resource and environmental agencies have led the promotion of riparian conservation. The Chesapeake Bay Program has published papers, handbooks, fact sheets, and videos to promote environmental stewardship of the Bay and its tributaries. Throughout these publications, a three-zone management concept is recommended for riparian buffers. Excerpts from these publications are included here to illustrate the concept and its applications.

[3] Stream Corridor Restoration: Principles, Processes, and Practices available at www.nrcs.usda.gov/technical/stream_restoration/PDFFILES/CHAPTER8.pdf

State	Stream Class	Buffer Strip Requirements		
		Width	Shade or Canopy	Leave Trees
Idaho	Class I*	Fixed minimum (75 feet)	75% current shade[a]	Yes, number per 1000 feet, dependent on stream width[b]
	Class II**	Fixed minimum (5 feet)	None	None
Washington	Type 1, 2, and 3*	Variable by stream width (5 to 100 feet)	50%, 75% if temperature > 60°F	Yes, number per 1000 feet, dependent on stream width and bed material
	Type 4**	None	None	25 per 1000 feet, 6 inches diameter
California	Class I and Class II*	Variable by slope and stream class (50 to 200 feet)	50% overstory and/or understory; dependent on slope and stream class	Yes; number to be determined by canopy density
	Class III**	None[b]	50% understory[e]	None[e]
Oregon	Class I**	Variable, 3 times stream width (25 to 100 feet)	50% existing canopy, 75% existing shade	Yes; number per 1000 feet and basal area per 1000 feet by stream width
	Class II special protection**	None[f]	75% existing shade	None

* Human water supply or fisheries use.

** Streams capable of sediment transport (CA) or other influences (ID and WA) or significant impact (OR) on downstream waters.

[a] In ID, the shade requirement is designed to maintain stream temperatures.

[b] In ID, the leave tree requirement is designed to provide for recruitment of large woody debris.

[c] May range as high as 300 feet for some types of timber harvest.

[d] To be determined by field inspection.

[e] Residual vegetation must be sufficient to prevent degradation of downstream beneficial uses.

[f] In eastern OR, operators are required to "leave stabilization strips of undergrowth... sufficient to prevent washing of sediment into Class I streams below."

Source: USDA Forest Service

The Three-Zone Management Concept

How Wide is Your Buffer?[4]

The width of a riparian forest buffer can vary. While there is general agreement that wider is better, opinions differ over the minimum width necessary to provide a functional forest buffer. Many factors, including slope, soils, watershed and hydrology, can influence the effectiveness of the forest buffer. The Chesapeake Bay Program has established a minimum width of 35 feet for the "2010 by 2010" initiative.

A three-zone buffer concept has been proposed to assist technical professionals and landowners with the planning and design of riparian forest buffers. This three-zone concept provides a conceptual framework in which water quality, habitat, and landowner objectives can be accomplished.

The three zones are a streamside zone (Zone 1), a middle zone (Zone 2), and an outer zone (Zone 3). Zone 1 protects the physical and ecological integrity of the stream ecosystem. The vegetative

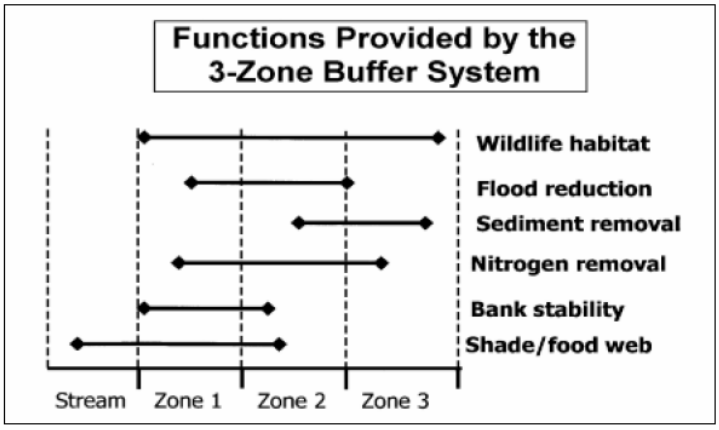
[4] A Watershed Primer for Pennsylvania: A collection of essays on watershed issues edited by Janette M. Novak and William H. Woodwell, Jr.

target is mature riparian forest that can provide shade, leaf litter, woody debris, and erosion protection to the stream.

Zone 2, the middle zone, extends from the outward boundary of the stream side zone, and varies in width, depending on stream order, the extent of the 100-year floodplain, adjacent steep slopes, and protected wetland areas. Its key functions are to provide further distance between upland development and the stream. The vegetative target for this zone is also mature forest, but some clearing may be allowed for stormwater management, access, and recreational uses.

The outer zone, Zone 3, is the buffer's "buffer," an additional 25-foot setback from the outward edge of Zone 2 to the nearest permanent structure. In most instances, it is a residential backyard. The vegetative target for Zone 3 is usually turf or lawn, although the property owner is encouraged to plant trees and shrubs, and thus increase the total width of the buffer. Very few uses are restricted in this zone. Indeed, gardening, compost piles, yard wastes, and other common residential activities often will occur in the outer zone.

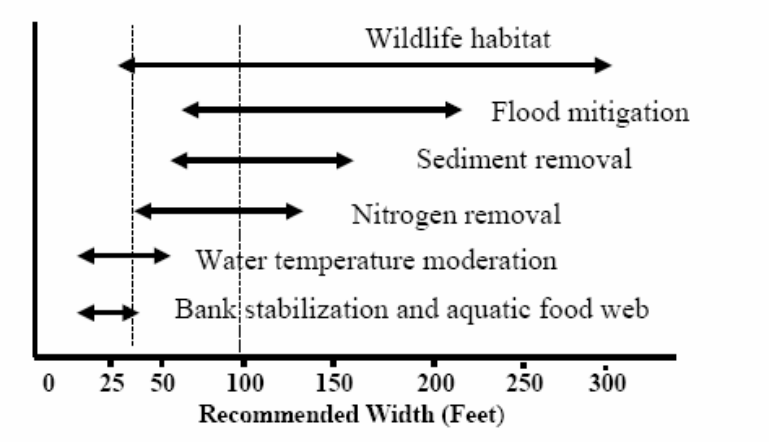
While the buffer as a whole performs many functions, each zone independently provides a more limited number of ecological benefits. These illustrations from the *Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers*[5] show the relationship between zone width function, and buffer width and function



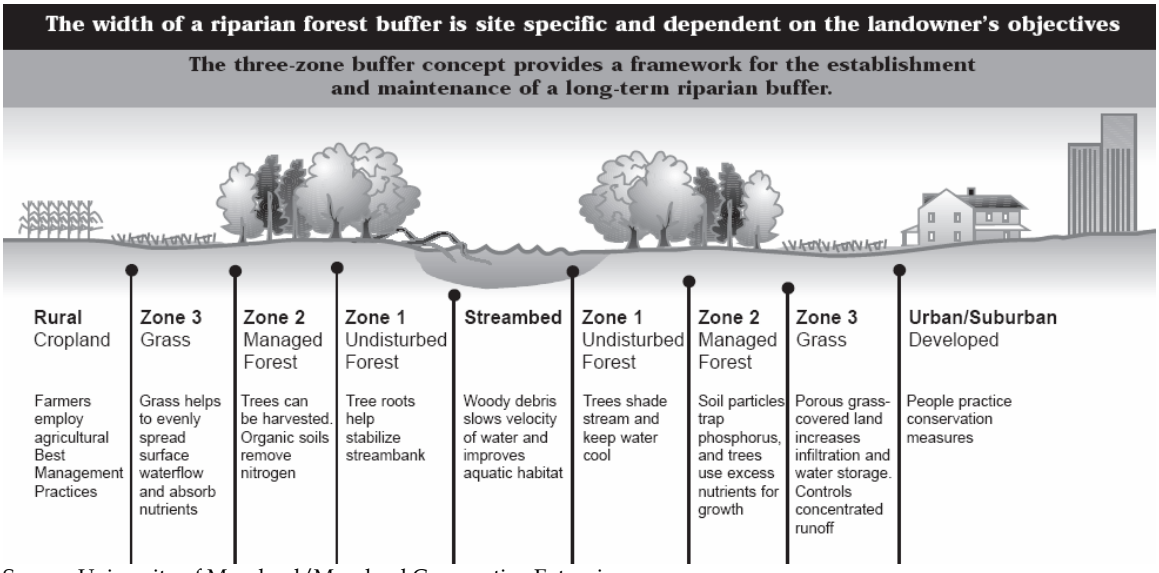
Source: Chesapeake Bay Riparian Handbook

[5] http://www.chesapeakebay.net/pubs/subcommittee/nsc/forest/handbook.htm

Minimum Recommended Buffer Widths for Different Functions



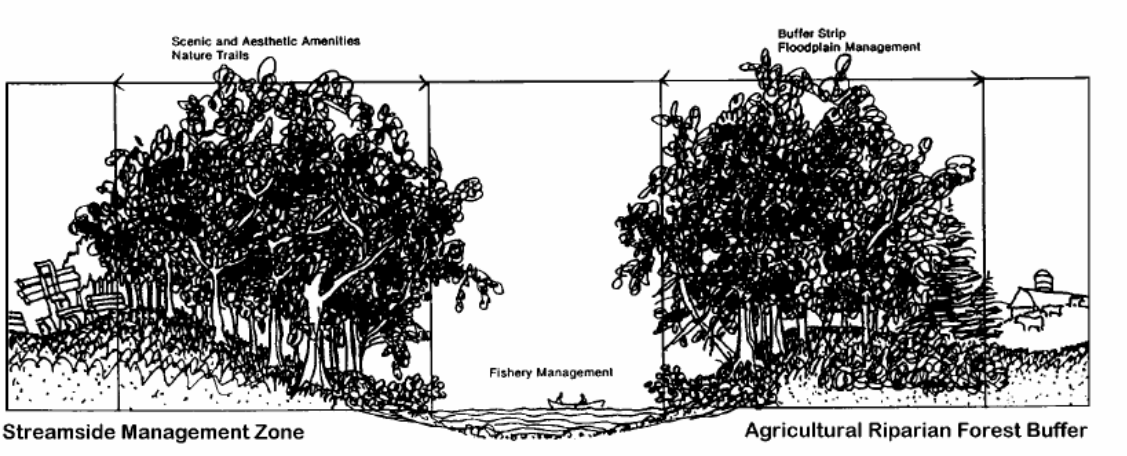
Source: Chesapeake Bay Riparian Handbook

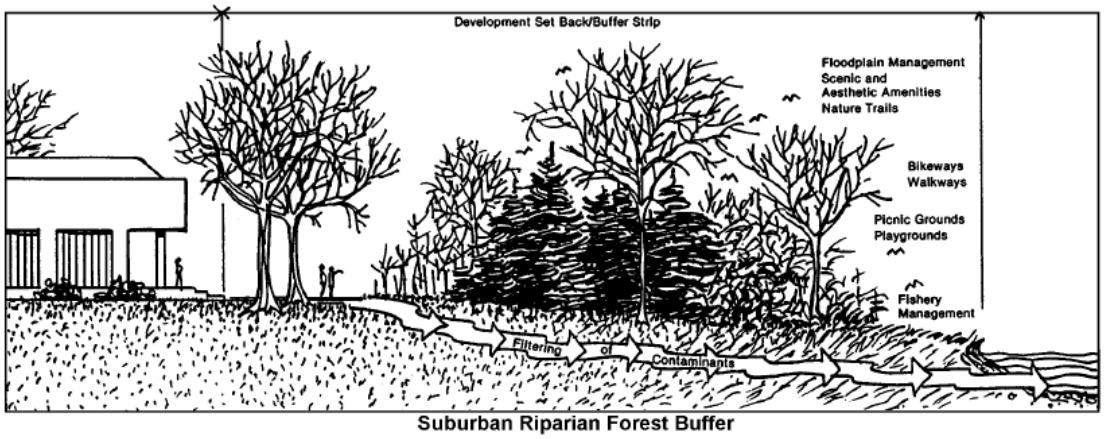


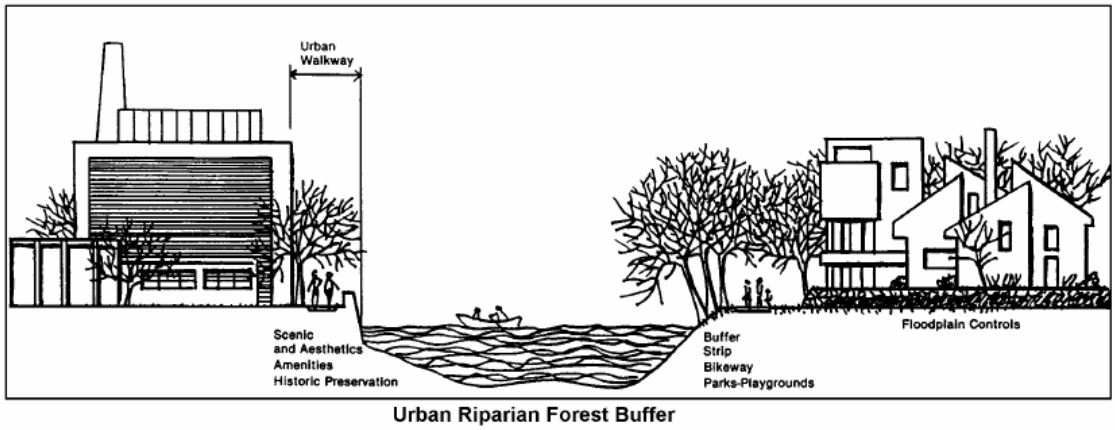
Source: University of Maryland/Maryland Cooperative Extension

The three zone buffer concept is applicable to urban/suburban and rural settings, as shown in the illustration above.[6] The following illustrations from the Chesapeake Bay Riparian Handbook highlight the ecological functions as well as the recreational and cultural amenities that are compatible with riparian buffers.

[6] An Introduction to the Riparian Forest Buffer. Fact Sheet. http://www.riparianbuffers.umd.edu/PDFs/FS725.pdf







Source: Chesapeake Bay Riparian Handbook

Riparian Buffers Regulations and Buffer Ordinances

Pennsylvania

Two municipalities in Cumberland County have adopted riparian buffer provisions through scenic river overlay ordinances: Dickinson and South Middleton Townships. These provisions are intended to protect the scenic qualities of the Yellow Breeches streambanks *and* to protect water quality in the stream and its tributaries that supports recreational activities. Dickinson Township's standards require a 50-foot buffer and South Middleton Township's regulations require a 100-foot buffer.

Several other municipalities in Pennsylvania with riparian buffer ordinances are listed below. This list is not exhaustive and is meant to provide an assortment of examples for reference.

Municipality	Ordinance Title	How to obtain a Copy
Upper Salford Township Montgomery County	RCC – Riparian Corridor Conservation Overlay District	Upper Salford Township Phone: (610) 287-6160 Web: http://www.dvrpc.org under Regional Planning, then Municipal Natural Resource Protection
Horsham Township Montgomery County	Stream Corridor Protection Ordinance	Horsham Township Phone: (215) 643-3131 Web: http://www.dvrpc.org under Regional Planning, then Municipal Natural Resource Protection
Kennett Township Chester County	Natural Resource Protection Ordinance	Kennett Township Phone: (610) 388-1300 Web: http://www.dvrpc.org under Regional Planning, then Municipal Natural Resource Protection
Warwick Township Lancaster County	Riparian Buffer Easement section of Stormwater Ordinance	Warwick Township (717) 626-8900
Radnor Township Delaware County	Riparian Buffer Conservation Ordinance	Radnor Township Phone: (610) 688-5600 Web: http:// www.radnor.com then New Additions

Upper Salford Township - Upper Salford Township in Montgomery County adopted a Riparian Corridor Conservation Overlay in 1999. This very specific ordinance establishes an overlay district along waterways and wetlands. A working group with the help of the Montgomery County Planning Commission drafted the ordinance. It is a very detailed and specific ordinance that defines clearly the types of water bodies and watercourses that are covered by the overlay district. Township officials have found that the specific language has prevented legal challenges to the ordinance. The ordinance separates the riparian area into two zones, with Zone 1 being a minimum of 25 feet and Zone 2 a minimum of 50 feet.

Permitted land use in each zone is itemized in the ordinance, as are prohibited uses.

Horsham Township - Horsham Township in Montgomery County passed a Riparian Corridor Preservation Ordinance in 1998 as part of its Environmental Ordinance. At the time the ordinance was enacted, the township was approximately 60% developed. A board of interested parties was formed to develop the ordinance and address citizen concerns in its initial draft. The ordinance uses the Horsham Township Open Space Plan to identify all waterways protected by the ordinance. Like the Upper Salford ordinance, two zones are defined with a minimum width of 25 feet for Zone 1 and a minimum width of 50 feet for Zone2. Land uses and prohibitions are specified by zone. The Zoning Hearing Board is responsible for hearing petitions for exceptions. Horsham Township has put a lot of effort into encouraging citizens to restore riparian vegetation. They have incorporated citizen groups into local park riparian restorations and used these plantings as models for other organizations. Free consultation is also given to citizens to help them design riparian plantings. A display about riparian vegetation has been placed in the Township building's lobby.

Kennett Township - Kennett Township in Chester County protects sensitive natural areas including streams with a Natural Resource Protection Ordinance. The ordinance restricts development within two zones delineated as a riparian corridor, prohibits filling, building, or channeling the floodplain and requires Pennsylvania DEP and U.S. Army Corps of Engineers approval of restricted activities in a delineated wetland.

Warwick Township - Warwick Township is located in Lancaster County in the Lititz Run watershed. As part of Warwick's Storm Water Ordinance, a Riparian Buffer Easement provision was enacted to control land use along riparian corridors. The easement requires a minimum 35-foot zone (measured from the centerline of the watercourse) and requires the preservation of existing vegetation and "the planting of additional native trees, shrubs and other plant material as determined necessary in order to create a suitable riparian canopy and understory" within the buffer easement. The planting requirements are based on published practices and guidelines. The easement is incorporated into the deed of all newly developed property and in some cases is also written as a separate specific agreement between the landowner and township. When the easement provision was enacted in 1999, it codified and mandated what had been initially a voluntary riparian buffer restriction in the township. Township officials have found that early intervention in the planning stage of land development is key to acceptance of the easement by developers. The township will identify properties with applicable riparian areas and work with the developer in the early planning stages to protect and perhaps restore the riparian zone. Open space and trails along waterways in a newly developed property have been well-received amenities by homebuilders and developers.

Radnor Township - On December 8, 2003, The Riparian Buffer Conservation Ordinance was adopted by the Board of Commissioners. This new zoning ordinance in Radnor Township, Delaware County was designed to protect streams, wetlands, pond edges, lake shore or any area of hydric soil. Though the township is almost completely built-out, the new ordinance imposes flexible setbacks for established homes and regulates any further development of larger properties in the township by establishing a mandatory buffer of 35 feet. An initial public hearing enabled citizens to express concern about the impact of the proposal. The township revised the ordinance to reflect these concerns and held a second hearing before adopting the ordinance.

Beyond Pennsylvania

Several states and local jurisdictions in the mid-Atlantic region have developed standards or funded research in support of better decision-making concerning land management and water quality. The following examples highlight these efforts and also include several other innovative approaches to buffer regulation from states and beyond the mid-Atlantic region.

Illinois - The state has adopted a five-sixths property tax exemption for vegetated buffers managed in accordance with a plan approved by the county conservation district. The protected zone must be at least 66 feet wide and "contain vegetation that 'has a dense top growth, forms a uniform ground cover, [and] has a heavy fibrous root system,'" (NPSN 4/5 1998, p. 11).

Maryland –

- **Montgomery County -** Montgomery County laws mimic the State law in the requirement of a 25-foot buffer around nontidal wetlands, and a 100-foot buffer around wetlands of special state or county concern. These buffers can also include steep/highly erodible slopes adjacent to wetlands.
- **Prince George's County -** Development is restricted in or near the 100-year floodplain. New subdivisions with land in the 100-year floodplain may not use floodplain land to meet minimum lot sizes, and residential buildings must be located 25 feet back from the edge of the floodplain. Additionally, 100-year floodplain land in a subdivision must be designated as a floodplain easement, with restrictions on activities. Floodplains to watercourses with less than 50 acres of watershed upstream may be excluded from identification of the floodplain area. The County also mandates 50-foot buffer zones from each bank around perennial streams. This buffer can be extended to include the 100-year floodplain, slopes of 25% or greater, and erodible soils on slopes of 15% or greater. The 25-foot State wetlands buffer can also be expanded to include slopes of 25% or greater, and erodible soils on slopes of 15% or greater.

- **Queen Anne's County -** Queen Anne's County has established the Resource Protection Area (RPA). The RPA includes 100% of rivers, floodplains, and wetlands, 100% of streams and buffer zones (80% in agricultural land), 60% of woodland acres (50% in agricultural land), and 100% of all steep slopes (>5%). Development is restricted in the RPA. The County also enforces the State Critical Area law.

Massachusetts - The state's new Rivers Protection Act establishes a 200-foot wide buffer zone along the state's perennial rivers and streams (NPSN 4/5 1998, p. 11).

New Jersey - The New Jersey Agricultural Experiment Station has developed a five-zone model for determining buffer widths for the protection of surface waters from NPS pollution.

North Carolina - The state has adopted a 50-foot protected, vegetated zone on each side of the Neuse River (NPSN 4/ 5 1998, p. 11). In North Carolina's coastal zone management program, the portion of the coastal zone that lies within 75 feet of the water's edge is subject to permit approval for development purposes.

Ohio - The Ohio State University Extension Service calculated the costs associated with creating vegetated filter strips on agricultural land. One of the costs they found was for tree planting and maintenance. The planting of seedlings in a filter strip adds about $0.45 per seedling to the total installation cost. Mowing only the filter strip once per month during May through September of the first 2 years adds $7/acre for each mowing operation. Filter strips provide both economic and non-economic benefits to the farmer, landowner, and surrounding areas. Filter strips can cause a reduction in ditch maintenance costs that are assessed to landowners. In 1985 Ohio had 4,615 miles of open ditch under county maintenance programs. The costs of ditch maintenance in those counties with 50 miles or more of maintained ditch averaged $328/mile/year. The total estimated costs would exceed $1.5 million per year.

Since the filter strip is an edge-of-the-field best management practice, which reduces the potential for sediment movement into water resources, most of the economic pollution control benefits occur off the farm. Based on a 1987 estimate, sediment added an extra $0.32/ton to water treatment costs. When considering all the communities in Ohio, a 25 percent reduction in the amount of sediment entering surface water supplies would save $2.7 million per year in water treatment costs.

South Carolina -

- **Beaufort -** To protect water quality and habitat, "a buffer strip of 50 feet from the OCRM[7] critical line was established in 1995 on all waterfront property. The buffer strip must be maintained as an undeveloped landscape or undisturbed

[7] Office of Ocean and Coastal Resource Management (OCRM)

natural area with some restricted uses allowed in the area. The River Protection District also establishes development setbacks of 50, 100, and 150 feet from the OCRM critical line, depending on the intended development."[8]

- **Beaufort's Buffer Regulations -** "[A] buffer strip of existing or planted vegetation is established within the District, extending fifty feet perpendicular to and in a horizontal plane from the OCRM Critical Line. The purpose of this buffer strip is to:

    1. Provide a natural filtration system for runoff from adjoining development that may enter the waters;
    2. Minimize erosion and help stabilize the streambank;
    3. Provide a natural habitat for the flora and fauna that exist in this important transition area between wetland and upland areas... The entire buffer must be maintained as an undeveloped landscaped area." **"**No development is permitted in the buffer with the exception of the following six uses:

        - Pedestrian and/or vehicular access ways leading to docks, fishing piers, boat landings... provided that only permeable... or semi-permeable materials ... are used for vehicular access ways…
        - [the structures that the vehicular access ways lead up to]
        - Use of grassed swales rather than drainage pipes is required...
        - Approved flood control and erosion control devices...
        - Utility lines serving approved water/marsh uses or crossing the water/marsh...
        - Installation of playground equipment or benches, picnic tables or other similar outdoor furniture." "Roads leading to bridges that cross the waterway [are allowed] provided the roads are placed approximately perpendicular to the line of the buffer and provided all shoulders are grassed."

  "The following uses within the River Protection Overlay District shall be set back a minimum of fifty feet from the OCRM Critical Line: agricultural uses... regulation golf courses... recreational parks and playgrounds...drainage systems and retention ponds." "The following require a one

[8] ***Beaufort*** *County River Protection Overlay District Ordinance, an objective of the* Beaufort County Special Area Management Plan.

hundred-foot setback: detached single family residential units, multifamily and attached residential units, parking areas and driveways, garages, [civic buildings] not larger than four thousand square feet, parking lots with no more than [6 spaces or 1000 square feet], ... and ROW of two-lane road." Any uses not specified in the River Protection District must be set back a minimum of one hundred fifty feet (Beaufort County River Protection Overlay District Ordinance, pp. 3-6).

Virginia -

- **The City of Alexandria -** requires buffers in all designated Resource Protection Areas (RPAs). Buffer must reduce 75% of sediments and 40% of nutrients. Buffers of 100 feet are considered adequate to achieve this standard, and smaller widths may be allowed if they can be proven to meet sediment and nutrient removal requirements. "Indigenous vegetation removal is limited to that necessary to provide reasonable sight lines, access paths, general woodlot management, and BMP implementation," (USEPA, 1993, pp. 4-48).

- **Fairfax County, Virginia -** adopted a comprehensive plan policy in 1982 to protect water quality and sensitive lands along watercourses from encroachment. The *environmental quality corridor (EQC)* policy established a "sensitive lands EQC" that provides for all presently mapped 100-year floodplains (and those mapped during the subsequent development process); all floodplain soils or soils with high water table, poor bearing strength, or other severe development constraints; wetlands adjacent to the streams; and steep slopes (defined as 15 percent or greater) adjacent to the floodplains, soils, or wetlands.

  Where the floodplains, soils, and wetlands cover only a narrow area, a minimum buffer width of 50 feet plus a factor of 4 times the percent slope is provided. The policy has resulted in protection of substantial portions of Fairfax County stream valleys. However, because it is only a policy rather than an ordinance, it can be implemented in an enforceable manner only on land uses that must be found to be in conformance with the county's comprehensive plan.

Chesapeake Bay – Maryland and Virginia - The states of Maryland and Virginia have buffer programs in effect to protect the Chesapeake Bay. Both states require a 100-foot vegetated buffer along the shoreline of the Bay and its tributaries. In Maryland, the buffer requirement is only applicable to new development; however, the requirement may be waived if "good conservation practices" are utilized at the shoreline. Virginia's Chesapeake Bay Preservation Act does provide for limited use within the buffer, generally allows for marinas and docks within the buffer, and can grant variances for utilizing land within the buffer area; however,

no variance will result in a vegetated buffer of less than 50 feet (except for agricultural uses) (Desbonnet *et al.*, 1994).

Tools that Promote Conservation and Restoration of Riparian Buffers

Article V of the Municipal Planning Code grants municipalities the power to control the development of subdivisions. Municipalities can take a regulatory or incentive-based approach to protect riparian areas in new developments. The degree of riparian area protection is likely to vary with the approach. Best results occur when a municipality identifies riparian areas to protect early in the planning stage of a new development. Intervention during early planning stages often promotes goodwill efforts from the developer. Amenities such as greenways or trails along stream corridors that result from municipal intervention can benefit the developer as well as protect the water resource as these green spaces can enhance the desirability of property within a new development.

Conservation Development/Open Space Development

Conservation or open space development provides the developer with the option to develop a property using smaller lot sizes and/or providing for higher densities in return for retaining open natural space. Minimum lot sizes, setbacks and frontage distances are relaxed to provide common open space. When carefully designed, open space developments can be compatible with adjacent land uses, preserve natural areas and be highly desirable places to live. A property may be developed in such a way that the upland areas are developed, leaving an adjacent riparian corridor undeveloped. Sensitive natural resources such as stream corridors can be part of the "net-out" of environmentally constrained lands during development. These areas are deducted from the total land to be developed before permitted density for the land is calculated. Under the Growing Greener initiative developed by the Natural Lands Trust and addressing conservation subdivision design, a variety of density options are designed to fit zoning districts that are nearly urban to nearly rural. Training programs conducted by the Natural Lands Trust are available to municipalities to learn how to apply these open space principles to local ordinances. A Conservation Planning Workbook provides a wealth of technical information and examples of municipalities that have adopted this approach.

Transferable Development Rights

A tool to be aware of when introducing new zoning restrictions is Transferable Development Rights (TDR). TDR is based on the concept that development should be redirected from areas where it is not appropriate (sending zone), to areas where it is more appropriate (receiving zone). This redirection of development rights, usually expressed as residential dwelling units, are sold to developers in the same manner that land is sold. TDR provides off-site rather than on-site density compensation. The right to develop

can be sold from one property and applied to another less environmentally sensitive property that could accommodate increased development densities. This technique is newly authorized in Pennsylvania and has been utilized by several local jurisdictions.

Corridor Management Planning

A corridor management plan may be required of any new development to ensure protection of sensitive riparian corridors during the planning stage. It addresses the long term objectives and management of the riparian corridor.

Density Bonuses and Penalties

Developers can be awarded increased building densities for developments that conserve natural areas, such as riparian corridors. Conversely, municipalities can employ density penalties to encourage conservation of natural areas. A jurisdiction could establish a minimum and maximum density and permit the higher density to a developer that plans for natural areas and open space techniques while lowering the allowable density for developments that do not incorporate preservation of natural areas.

Stormwater Credits

A stream buffer can be used as a stormwater credit, which is a technique that developers can use to reduce their stormwater management costs. These techniques reduce runoff volumes, which helps to avoid the construction of costly stormwater management facilities. A stormwater credit for a stream buffer would be given when runoff from upland areas is treated by a grass or wooded buffer. Pennsylvania's new stormwater management protocol now allows for stream buffer credit areas. Runoff treated with a stream buffer may be deducted from the calculation of total site area when computing the volume of stormwater runoff that must be stored and treated.

Stream and Riparian Area Restoration

In areas where agriculture has been active, streambank fencing is one of the most cost-effective restoration techniques. Fencing out livestock restores excellent habitat for fish and wildlife while reducing erosion and nutrient inputs into the stream. Fencing costs $0.75 per linear foot to install.

The Partners Program, an outreach program of the US Fish and Wildlife Service, provides the equipment and labor to manage livestock access to streams and streamside habitat. The Partners Program also provides tree seedlings to landowners to establish woody riparian buffers and aims to use locally grown native tree stock, wherever possible. Woody riparian buffers cost $1.50 per linear foot to plant.

Additional Resources

Allegheny Land Trust. "Land Conservation Handbook." Pittsburgh, PA. 1995

Alliance for the Chesapeake Bay. "Streamside Buffer Monitoring Protocol: For Maryland's Tributary Strategies Teams." Baltimore, MD. 1999.

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