BuZ

Buffer Zone

Description

"**Buffer Zone**" is a strip of dense undisturbed perennial native vegetation, either original or reestablished, that borders streams and rivers, ponds and lakes, wetlands, and seeps. Buffer zones are established for the purposes of slowing water runoff, enhancing water infiltration, and minimizing the risk of any potential nutrients or pollutants from leaving the upland area and reaching surface waters. Buffer zones are most effective when storm water runoff is flowing into and through the buffer zone as shallow sheet flow, rather than in concentrated form such as in channels, gullies, or wet weather conveyances. Therefore, it is critical that the design of any development include management practices, to the maximum extent practical, that will result in stormwater runoff flowing into and through the buffer zone as shallow sheet flow.

Buffer zones slow stormwater runoff, provide an area where runoff can permeate the soil, contribute to ground water recharge, and filter sediment. Slowing runoff also helps to prevents scour and bank erosions. It also provides flood protection, cools rivers and streams by creating shade, provides food and cover for wildlife and aquatic organisms, and reduces construction noise. Property owners may qualify for stormwater / water quality fee credits.

Selection Criteria

Where a project is located adjacent to designated high-water quality or sediment impaired waters, a buffer zone consisting of undisturbed existing natural vegetation should be left between the limits of construction and the edge of water. It should be noted that these waters could include streams, lakes, or wetlands. Note that buffer zones are also desirable for waters, which are not designated as high-quality or sediment-impaired.

The benefits of buffers can be amplified if they are managed in a forested condition. In some settings, buffers can remove pollutants in stormwater or groundwater. Shoreline and stream buffers situated in flat soils effectively remove sediment, nutrients and bacteria from stormwater runoff and septic system effluent. This was found in a variety of rural and agricultural settings along the East Coast and to a lesser extent in urban settings. Buffers can provide wildlife habitat and recreation (EPA website)). They can also be re-established in urban areas as part of an urban forest.

Buffers can be applied to new development though the establishment of specific preservation areas and by sustaining management through easements or community associations. For existing developed areas, an easement may be needed from adjoining landowners. Local governments may set specific criteria for buffers to achieve stormwater management goals.

Design Considerations

Key criteria to consider when establishing a stream buffer:

- Minimum Buffer width (25 to 60 feet)
- Three-zone buffer system (Filter Strips, Managed Forest and Unmanaged Natural Area)
- Preserve as much mature forest as possible
- Site conditions for increasing or reducing buffer width
- Clearly marked buffer boundaries (signs, markers) before, during, and after construction
- Provide proper access for crossing buffer
- Care taken to integrate buffer with other stormwater conveyances
- Possible minimum buffer width flexibility by averaging and regulatory review
- Buffer education, inspection, and enforcement

In general, a minimum width of at least 60 feet is recommended to provide adequate stream protection. The three-zone buffer system, consisting of Filter Strips, Managed Forest, and Unmanaged Natural Area is an effective technique for establishing a buffer. The zones are distinguished by function, width, vegetative target, and allowable uses. Note that buffer averaging may allow developers to narrow the buffer width at some points if the average width of the buffer and the overall buffer area meet the minimum criteria.

Filter Strips

The filter strip zone is the first to encounter runoff. It functions to prevent encroachment while slowing and filtering sheet flow. The filter strip's width is at least 20 feet, and while forest is encouraged turf-grass can be a vegetative target. The filter strip's uses are unrestricted. They can include lawn, garden, compost, yard wastes, and most stormwater BMPs.

Managed Forest

The managed forest zone provides distance between upland development and the filter strip zone. It is typically 50 to 100 feet (minimum of 20 feet) depending on stream order, slope, and 100-year floodplain. The vegetative target is managed forest. Usage is restricted to some recreational activities, some stormwater BMPs, and bike paths.

Unmanaged Natural Area

The unmanaged natural area zone protects physical and ecological integrity. It consists of a minimum of 15-feet plus wetland and critical habitats. The vegetative target consists of mature forest. Its allowable uses are very restricted (flood controls, utility right-of-ways, footpaths, etc.).

Limitations

Only a handful of studies have measured the ability of stream buffers to remove pollutants from stormwater. One limitation is that urban runoff concentrates rapidly on paved and hard-packed turf surfaces and often crosses the buffer as channel flow, effectively shortcutting through the buffer. To achieve optimal pollutant removal, the engineered buffer should be carefully designed with a stormwater depression area, grass filter, and forested strip.

Maintenance

An effective buffer management plan should include establishment, management, and distinctions of allowable and prohibited uses in the buffer zones. Buffer boundaries should be well defined and visible before, during, and after construction. Without clear signs or markers defining the buffer, boundaries become invisible to local governments, contractors, and residents. Buffers designed to capture urban stormwater runoff will require more maintenance if the first zone is designated as a bioretention or other engineered depression area.

Buffers need to be maintained. There should be systematic inspections of the buffer networks before and after construction, as well as increasing resident awareness about buffers.

Effectiveness

The pollutant removal effectiveness of buffers depends on the design of the buffer zone. While water pollution hazard setbacks are designed to prevent possible contamination from neighboring land uses, they are not designed for pollutant removal during a storm. With vegetated buffers, some pollutant removal studies have shown that their effectiveness varies widely (Table 1). Proper buffer design can increase the pollutant removal from stormwater runoff (Table 2).

Table 1
Pollutant Removal Rates in Buffer Zones

Reference	Buffer Vegetation	Buffer Width (meters)	Total % TSS Removal	Total % Phosphorous Removal	Total % Nitrogen Removal
Dillaha et al., 1989	Grass	4.6-9.1	63-78	57-74	50-67
Magette et al., 1987	Grass	4.6-9.2	72-86	41-53	17-51
Schwer and Clausen, 1989	Grass	26	89	78	76
Lowrance et al., 1983	Native hardwood forest	20-40	-	23	-
Doyle et al., 1977	Grass	1.5	-	8	57
Barker and Young, 1984	Grass	79	-	-	99
Lowrance et al., 1984	Forested	-	-	30-42	85
Overman and Schanze, 1985	Grass	-	81	39	67

Table 2
Factors that Enhance/Reduce Buffer Pollutant Removal

Factors that Enhance Performance	Factors that Reduce Performance
Slopes less than 5%	Slopes greater than 5%
Contributing flow lengths <150 feet.	Overland flow paths over 300 feet
Water table close to surface	Ground water far below surface
Check dams/level spreaders	Contact times less than 5 minutes
Permeable but not sandy soils	Compacted soils
Growing season	Nongrowing season
Long length of buffer or swale	Buffers less than 10 feet
Organic matter, humus, or mulch layer	Snowmelt conditions, ice cover
Small runoff events	Runoff events >2 year event.
Entry runoff velocity less than 1.5 feet/sec	Entry runoff velocity more than 5 feet/sec
Swales that are routinely mowed	Sediment buildup at top of swale
Poorly drained soils, deep roots	Trees with shallow root systems
Dense grass cover, 6 inches tall	Tall grass, sparse vegetative cover

Riparian Buffer Requirements

TDEC's, Tennessee General Permit No. TNR100000 ('Permit'), Storm Water Discharges Associated with Construction Activities, effective June 17, 2005 to May 30, 2010) requires that:

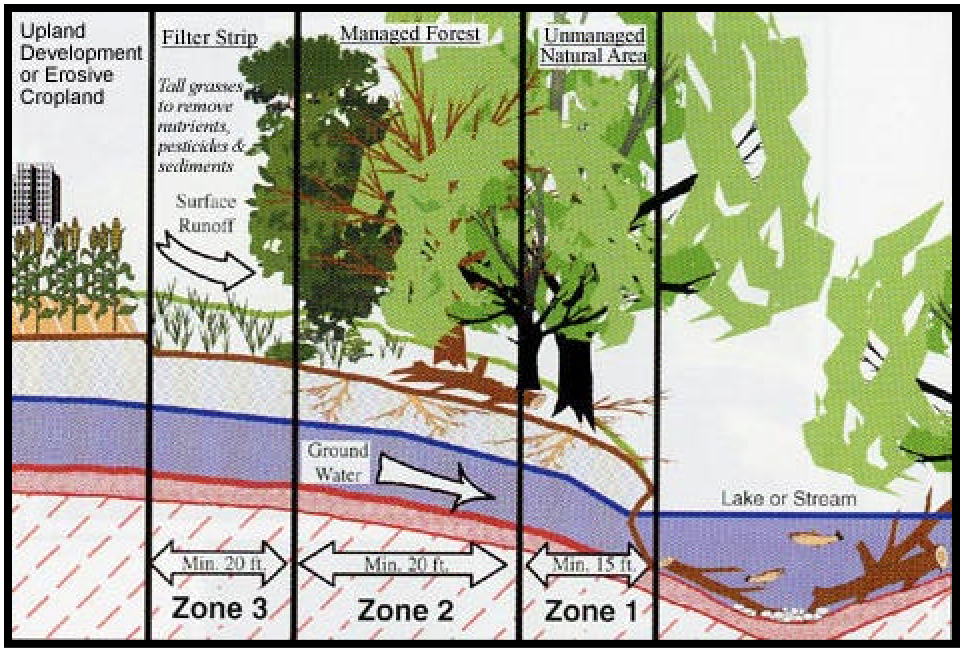
"A 60-foot natural riparian buffer zone adjacent to the receiving stream designated as impaired or high quality waters shall be preserved, to the maximum extent practicable, during construction activities at the site. The water quality buffer zone is required to protect waters of the state (e.g., perennial and intermittent streams, rivers, lakes, wetlands) located within or immediately adjacent to the boundaries of the project, as identified on a 7.5-minute USGS quadrangle map, or as determined by the director. Buffer zones are not sediment control measures and should not be relied upon as primary sediment control measures. Rehabilitation and enhancement of a natural buffer zone is allowed, if necessary, for improvement of its effectiveness of protection of the waters of the state. The buffer zone requirement only applies to new construction sites…

The riparian buffer zone should be established between the top of stream bank and the disturbed construction area. The 60-feet criterion for the width of the buffer zone can be established on an average width basis at a project, as long as the minimum width of the buffer zone is more than 25 feet at any measured location.

Every attempt should be made for construction activities not to take place within the buffer zone. BMPs providing equivalent protection to a receiving stream as a natural riparian zone may be used at a construction site. Such equivalent BMPs shall be designed to be as effective in reduction of sediment in storm water runoff as a natural riparian zone. A justification for use and a design of equivalent BMPs shall be included in the SWPPP [(Stormwater Pollution Prevention Plan) and other erosion control plans]. Such equivalent BMPs are expected to be routinely used at construction projects typically located adjacent to surface waters. These projects include, but are not limited to: sewer line construction, roadway construction, utility line or equipment installation, greenway construction, construction of a permanent outfall or a velocity dissipating structure, etc.

This requirement does not apply to any valid Aquatic Resource Alteration Permits (ARAP), or equivalent permits issued by federal authorities. Additional buffer zone requirements may be established by your local MS4 program."

Figure 1
Three Zone Buffer System



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