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3.1 Stream Buffers

A stream buffer or stream setback is a designated area around a stream, lake, or wetland left in a natural, densely vegetated state so as to protect the receiving water quality and provide space for the natural stream to meander. Within this designated area, development, construction practices, and land uses are restricted for a given width adjacent to a stream. A stream buffer preserves land adjacent to streams and wetlands rather than constructing an element to filter or treat stormwater, thus fitting the definition of a non-structural BMP.

3.1.1 Stream Buffer Policy Definition

Stream buffers are generally implemented through an agency's specific policy or ordinance. There are three major components to development of stream buffer policy and/or ordinance: application of the buffer, buffer width, and permittable land uses within the buffer. In order to define these components, an agency must determine

- Where in a watershed will a stream buffer apply?
- What width is the stream buffer?
- What land uses and/or construction activities are restricted or allowed within the stream buffer?

In general, the determination of stream buffer application, width, and land uses amounts to what is acceptable risk to an agency with regards to water quality and habitat preservation.

EPA Region 7 has a model stream protection ordinance that an agency can utilize. An example of this ordinance is included in Appendix E. This ordinance should be reviewed thoroughly by an agency and an agency's legal council before enactment.

3.1.2 A Typical Stream Buffer

A stream buffer's total width is typically divided into two to three zones. Zones closest to a stream have the most restrictions (inner zone). Zones further from the stream have increased flexibility of use (outer zone(s)). Permanent structures, including impervious surfaces, are typically not allowed in either the inner or first outer zone.

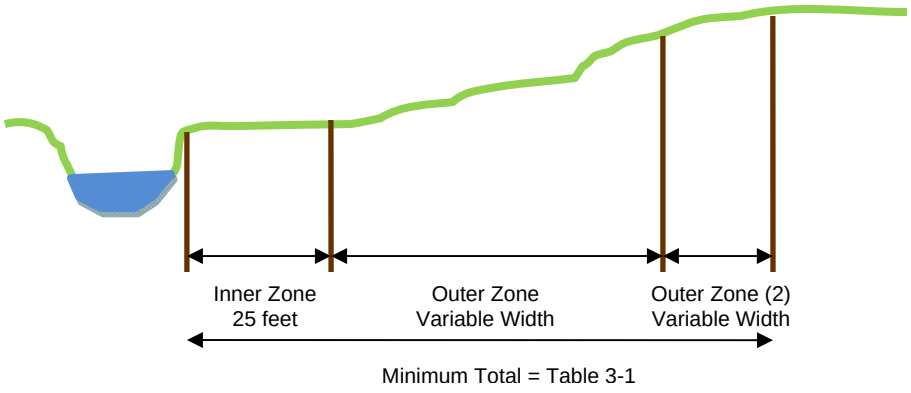
- Inner Zone. The inner zone extends from the stream centerline or from the edge of bank for a specified width to protect the immediate streamside area. Construction and land disturbance is prohibited in this zone, but if native vegetation establishment is needed, planting with fast growing tree and shrub species, native grasses, and wildflowers is recommended.

- Outer Zone(s). The outer zone extends from the limits of the inner zone for a width that may be set or variable. The variable width allows flexibility for an agency to apply a zone width based on different degrees of protection for different stream characteristics, such as floodplains and steep slopes. It is common to divide the outer zone into two zones based on floodplain location and/or permitted land use, with the least amount of restriction in the most outer zone. The advantage of multiple outer zones is that the transition from highly protected to minimally protected areas is more gradual. Construction and land use is restrictive in the outer zone(s). Park trail systems, utility construction, and residential landscaping could be permitted.

3.1.3 Proposed Stream Buffer Guidelines

The following are proposed recommended stream buffer guidelines. An example of stream buffer zones is demonstrated on Figure 3-1.

Figure 3-1 Example of Stream Buffer Zones



- **Application.** Streams with a drainage area exceeding 40 acres shall have a defined stream buffer. Should an agency choose, the minimum stream buffer width could also be used for drainage areas less than 40 acres.

- **Width.** Table 3-1 provides recommended minimum stream buffer total widths based on drainage area to a stream. This width is equal to the inner zone plus outer zone(s).

Table 3-1 Minimum Stream Buffer Width (Inner Zone plus Outer Zone(s))

Drainage Area (acres)	Minimum Buffer Width, from Edge of Stream Bank Outwards, Measured Separately in Each Direction (feet)
Less than 40	40
40 to 160	60
160 to 5,000	100
Greater than 5,000	120

- **Define Stream Buffer Inner Zone.** It is recommended that the width of this zone extend a minimum of 25 feet outward from the edge of the stream bank.

- **Define Stream Buffer Outer Zone(s).** This zone(s) will extend from the edge of the inner zone outward a variable distance. It is recommended that at a minimum this width include the FEMA 100-year floodplain and any defined floodplain by the local agency. Width of more than one defined outer zone can be correlated with permittable land use.

- **Permittable Land Use.** This will vary by agency. Land uses in the inner zone should follow recommendations presented in 3.1.2 for Inner Zone, with construction and land disturbance prohibited or severely restricted. Land uses in the outer zone(s) should follow recommendations presented in 3.1.2 for Outer Zone(s), with construction and land use restricted.

3.1.4 Implementation

To preserve a defined stream buffer's integrity adjacent to developed sites, temporary measures are necessary during construction stages. It is recommended to delineate a defined stream buffer boundary on the construction site with orange construction fence to ensure no access will occur that might disturb native vegetation. Depending on land disturbance adjacent to the stream buffer and the lay of the land, silt fence may also be required to prevent sedimentation from accumulating in the stream buffer area. Construction plans, including plans for public improvement, grading, building, site development, or other utility installation, should clearly show all stream buffer areas on a site and indicate that stream buffer areas are to be left undisturbed.

Permanent measures should also be implemented to ensure the long-term integrity of the stream buffer. As buffers can extend onto private property, there is a risk that this portion of the land may be changed over time by a property owner (i.e. installation of a fence). Survey pins may be installed to assist future property owners, contractors, or surveyors in delineating the original boundary of a stream buffer. In addition, it is recommended that an agency inspect their respective stream buffer a minimum of every three years for vegetation health and violations of permitted land use.

3.1.5 References

Black & Veatch. 2002. Stream Protection Guidelines, prepared for EPA Region 7.

EPA. 2006. Model Stream Buffer Ordinance. Available at: www.epa.gov/owow/nps/ordinance/buffers.htm

MARC and APWA. 2008. *Manual of Best Management Practices for Stormwater Quality*. Located at www.marc.org/environment/Water/bmp_manual.htm

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3.2 Preserve Existing Native Vegetation

To preserve existing native vegetation, land must be delineated prior to development and left completely undisturbed during construction (CASQA, 2003). This area may be utilized for non-invasive recreational uses post-development, but primarily must be left untouched. Many times native vegetation preservation can be designated in sights undesirable for development (steep slopes, watercourse). Public or private right-of-ways, utility easements, wetlands, and surface water bodies may not be considered for preservation purposes. Advantages of preserving a site with native vegetation include (IDEQ, 2005 and Stormwater Authority, 2009):

- Decreases stormwater runoff through interception, infiltration, and evapotranspiration
- Effective immediately, no time required for establishment
- Allows areas for wildlife to retain natural habitat
- Provides buffers and screens against noise or visual disturbances
- Protects natural resources for future generations.

Figure 3-2 is a photograph of preserved existing native vegetation.

Figure 3-2 Tall-grass Prairie Alongside McDowell Creek Road Outside of Manhattan, KS (City-Data.com)

3.2.1 Goals

The goal of native vegetation preservation is to maintain pre-development hydrologic patterns in the midst of development. Preserved land also provides habitat for wildlife. In addition, studies have shown that connected open space along stream corridors is the most beneficial for wildlife habitat.

3.2.2 Preservation Process

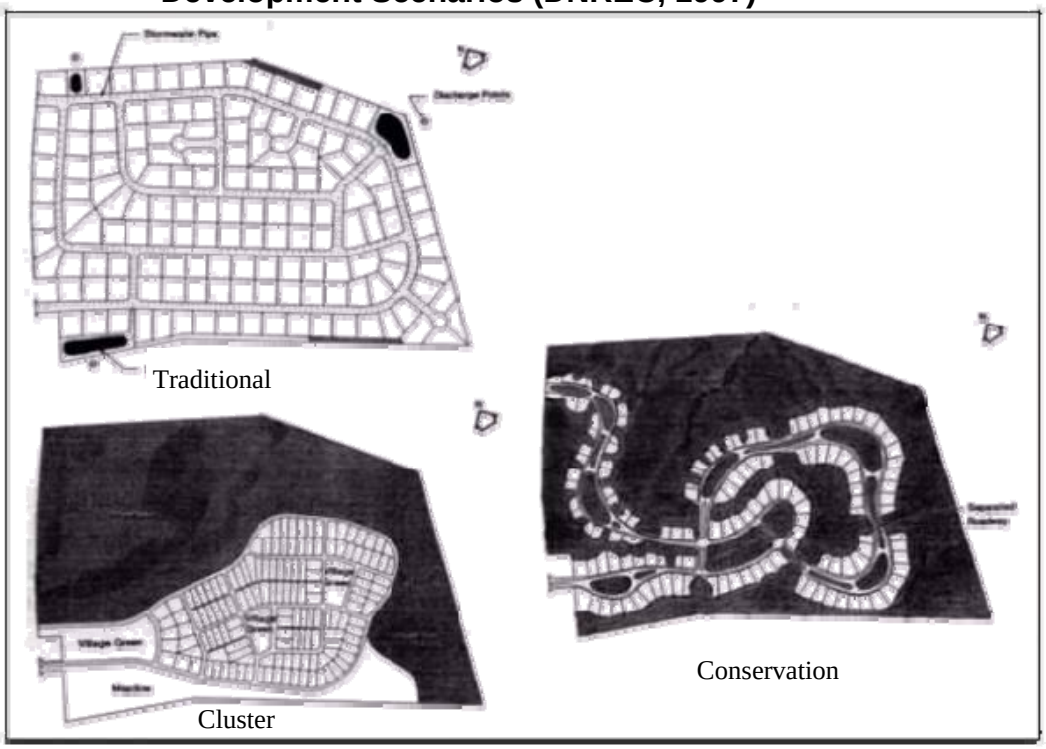
Preservation of existing native vegetation can be achieved in a number of ways:

- **Master Plan.** An agency can designate certain areas for preservation as part of their master plan process. This can be achieved through a land dedication process, through either easement or agency land acquisition. It is recommended that an agency investigate what percentage of their current land area is defined as preserved. This can establish a baseline from which an agency can increase land preserved. Goals might include increasing an agency's preserved land by a certain percentage over the next five years, or require a certain percentage of all new development sites to be preserved. Typical goals are 10 to 20-percent open space preservation.

- **Development Practices.** An agency can encourage cluster land development of a site. This method of development limits the amount of land disturbed on a site, by concentrating all utility, road, and building construction to a defined portion of the site. Often this is defined by limiting development to a certain percentage of the

site. Figure 3-3 shows three examples of a site that has been developed using three different methods.

Figure 3-3 Cluster Land Development Schedule With Schematics Of Development Scenarios (DNREC, 1997)



3.2.3 Maintenance

Manage construction activities to limit impacts on native vegetation in areas marked for preservation. It is recommended to delineate the preservation area boundary on the construction site with orange construction fence during construction to ensure no access will occur that might disturb native vegetation. Depending on land disturbance adjacent to the preservation area and the lay of the land, silt fence may also be required to prevent sedimentation from accumulating in the preservation area. Construction plans, including plans for public improvement, grading, building, site development, or other utility installation, should clearly show all preservation areas on a site and indicate that native vegetation areas are to be left undisturbed. Implement erosion control devices to limit sedimentation influx into preserved areas.

After development is complete, routinely check native vegetation preservation area to ensure stabilization and to check for sedimentation. In addition, it is recommended that an agency inspect their preservation areas a minimum of every three years for vegetation health and violations of permitted land use. As a preservation area could extend onto private property, there is a risk that this portion of the land may be changed over time by a property owner (i.e. installation of a fence). Survey pins may be installed to assist future property owners, contractors, or surveyors in delineating

the original boundary of a preservation area. Irrigation of the preserved landscaping may be needed to ensure survival during extended dry periods (IDEQ, 2005).

3.2.4 References

CASQA. 2003. *California Stormwater Quality Association Stormwater Best Management Practice Handbook*. Available at www.dot.ca.gov/hq/construc/stormwater/manuals.htm

IDEQ. 2005. *IDEQ Storm Water Best Management Practices Catalog*. Available at www.deq.state.id.us/

Stormwater Authority Organization. Available at www.stormwaterauthority.org

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3.3 Restoration of Native Vegetation

For instances where land has been disturbed, it can be advantageous to restore vegetation to its native condition. Native vegetation reduces stormwater runoff by intercepting rainfall in its canopy, reducing surface water velocity across the ground surface, and by increasing the infiltration capacity of the soil by extending deep roots and facility soil microbial interactions that create permeable soil structure. Restoration of native vegetation is beneficial at all scales. Advantages of restoring a site with native vegetation include (MARC 2008):

- Less maintenance with regards to watering, fertilizer or chemical maintenance.
- Deep roots provide increased infiltration and durability in extreme weather.
- Attracts wildlife and improves biological diversity.

An example of an area that has been developed and then restored back to native vegetation is shown in Figure 3-4.

Figure 3-4 Native Vegetation Area That Serves as a Stormwater BMP, Wildlife Habitat and Aesthetic Area (US Army Corps, 2000)

3.3.1 Goals

To restore an area to pre-development native vegetation, soil and land slope conditions must be met to establish pre-development hydrologic function.

3.3.2 Restoration Process

- **Restore Site Quality.** It may be necessary to augment soil to restore it to pre-development conditions with compost or other sub-soil additions (Pennsylvania, 2006). Exotic and invasive species should be removed (preferably mechanically, not chemically). Other non-native landscape features should also be removed (dams, tile drainage) and erosion should be contained (MARC, 2008).

- **Select Native Vegetation.** Based on the restoration site size, consider the desired aesthetic appearance of the BMP (plant height, mixes). A smaller site should use only a few native vegetation varieties, while a large site may be able to incorporate many varieties. Also determine the following characteristics specific to the restoration site:

    - Soil types (soil tests, soil maps in Appendix B)
    - Annual precipitation with dates for wet/dry season (Maps in Appendix A)
    - Ecoregion and corresponding native vegetation (Map and table in Appendix C)
    - Previous land use

Provide the soil type, precipitation, previous land use, and ecoregion information to a native vegetation expert for planting suggestions (native vegetation types, seeding rates, establishment procedures, maintenance procedures). Use the "typical vegetation by ecoregion" listed in Appendix C as a guideline to check final plant list. Native vegetation contacts and links are listed in Appendix C.

Preservation of existing native vegetation can be achieved in a master plan or in a development plan as outlined in 3.2.2 for native vegetation preservation.

3.3.3 Maintenance

Manage construction activities to limit impacts to areas designated for restoration. Implement erosion control devices to limit sedimentation influx into the defined area. After native vegetation planting is complete, routinely check to ensure stabilization of restored area and to check for sedimentation. Stormwater runoff to restored area may need to be rerouted around the area until native vegetation is densely established (70-percent of ground cover). Irrigation of the landscaping may be needed to ensure survival during extended dry periods (IDEQ, 2005). Reference maintenance guidelines outlined for vegetated BMPs in Appendix D.

3.3.4 References

MARC and APWA. 2008. *Manual of Best Management Practices for Stormwater Quality*. Located at www.marc.org/environment/Water/bmp_manual.htm

Pennsylvania. 2006. *Pennsylvania Stormwater Best Management Practices Manual*. Available at www.blairconservationdistrict.org/SWBMP.htm

IDEQ. 2005. *IDEQ Storm Water Best Management Practices Catalog*. Available at www.deq.state.id.us/