Chapter 6
TECHNICAL GUIDELINES AND CRITERIA

6.1 Adequate Stormwater Management Systems

Adequate stormwater management systems shall be designed to accomplish the following:

1. Account for both offsite and onsite stormwater.

2. Maintain natural topographic and watershed divides.

3. Convey stormwater to a stream, natural channel, or other existing facility in a manner that does not cause flooding or erosion.

4. Discharge stormwater into the natural channel by connecting the channel at natural elevations, or by discharging the stormwater into an existing facility of sufficient capacity to receive it, or by discharging into an approved drainage well.

5. Treat stormwater quality consistently on new development and significant redevelopment sites to the pollutant reduction goal of 80 percent of total suspended solids, as measured on an average annual basis, from post-construction stormwater runoff (i.e., after construction on a site is completed).

Determination of the size and capacity of an adequate stormwater management system shall take into account the future development in the watershed or affected portions thereof. The design must not adversely affect adjacent or neighboring properties. Any alterations or additions to the Metro stormwater management system require the approval of MWS.

It is the responsibility of the developer or property owner to pick up or acceptably handle the quantity of runoff as it flows onto his or her property from the watershed above, and conduct it through the property to an adequate outfall at the lower property line or beyond. The outfall must be sufficient to receive the runoff without causing deterioration of the downstream channel and the conveyance across the property must be located in a public utility and drainage easement.

The stormwater management system for new developments and significant redevelopment shall be designed to meet stormwater quality for runoff from the development site only and shall be designed to convey stormwater from other properties draining onto the development. If a downstream regional stormwater quality facility serves the runoff from the site then the developer may, with approval from the Metropolitan Department of Water and Sewerage Services (MWS), limit the extent to which runoff quality is controlled. If it is infeasible to implement an on-site stormwater quality Best Management Practice (BMP) then the developer may, with approval from MWS, design a system that controls quality for an equivalent portion of runoff entering from the watershed above.

6.1.1 Minor Systems

The design of the minor stormwater management system shall be based on a storm frequency of 10 years. This criterion shall be applied to both closed conduit and open channel systems. However, if the 10-year design flow for an open channel system is greater than 100 cubic feet per second (cfs), then the open or closed system shall be capable of passing the 100-year design flow within the drainage easement. Systems relying on sinkholes or drainage wells for discharge shall be capable of passing the 100-year design flow within the drainage easement, assuming plugged conditions (0 cfs drawdown) for the sinkhole.

In residential subdivision developments where the average lot size is less than 20,000 square feet, the following general guidelines shall be observed in the design of the minor system:

1. Design surface runoff across lots shall not have erosive velocities (see Volume 2).

2. Quantities of surface runoff greater than 4 cfs that flow through lots shall be collected and conveyed in a system of open channels, closed conduits, or a combination of both.

3. Lots should generally be graded in such a manner that surface runoff does not cross more than three lots before it is collected in a system of open channels, closed conduits, or a combination of both. However, runoff will be permitted to cross more than three lots before it is collected if the system is designed to achieve stormwater quality benefits and does not pose a risk of erosion or other damage to public or private property. This may only be performed with approval from MWS.

Design flows may be determined by the methods identified in Volume 2 of this manual.

6.1.2 Major Systems

Wherever possible, natural waterways serving the major system should remain undisturbed, with proposed development situated wisely and accordingly. Detention may be required to avoid discharges that exceed the capacity of natural waterways. Channelization and other related modifications to the natural waterways are discouraged. Improvements to natural open channels that are to function primarily as the major system shall be designed to pass the 100-year design flow without damage to the channel. Man-made channels designed to function as the major system (trunk line system) shall be capable of carrying a 100-year design flow. Where man-made channels are necessary, the channels should be located as far away from buildings or structures as possible and preferably in established greenways or other conservation corridors.

The onsite major stormwater management system for most developments is the natural backup system and consists of the less obvious drainageways. Ideally, this major system should provide relief such that no building will be flooded with a 100-year design flow even if the minor system capacity is exceeded. The 100-year frequency storm shall be used to compute runoff for the design of the onsite major stormwater management system. This system shall be designed to

provide relief for flow in excess of the 10-year design flow. The following guidelines pertain to design of the onsite major stormwater management system:

1. Areas should be graded in such a manner or buildings located or constructed in such a manner that if the capacity of the minor system is exceeded, no building will be flooded by the design flow.

2. Critical areas to consider are sumps, relatively flat areas, and areas where buildings are located below streets or parking lots.

3. The 100-year frequency storm for the duration equivalent to the time of concentration shall be used to compute runoff for the major stormwater management system.

4. For the first trial, the same time of concentration values shall be used that were used in designing the minor stormwater management system and the minor system should be assumed to be completely inoperable. If no building will be flooded based on these assumptions, then the analysis can be considered complete.

5. If buildings will be flooded based on the assumptions used in the preceding item, more precise hydrologic and hydraulic computations are required. The minor system, overland relief swales, or surface storage should be designed so that no building will be damaged by flooding.

6. In general, the minor stormwater management system should not be oversized as a basis for providing major system capacity. The major stormwater management system should be in the form of area grading or the location and construction of buildings in such a manner that overland relief swales or surface storage will provide adequate flood protection.

The major stormwater management system should be evident on the drainage plan, including overland relief swales and areas that may be affected by surface storage for a 100-year design storm. Calculations performed for major system design should be submitted with the drainage plan.

6.2 Open Channels

6.2.1 Channel Capacity

Open channel capacity shall be determined by Manning's equation. Appropriate Manning's n values as presented in Volume 2 shall be used for design and are subject to approval from MWS.

6.2.2 Lined Channels

Open channels may be designed as hard-armored, geosynthetic or soil bioengineering lined channels. Geosynthetic and soil bioengineering techniques are described in Volume 4 – Best Management Practices Manual. Acceptable lining materials must be placed in accordance with applicable subdivision regulations. Approval of lining materials is subject to review by MWS.

Channel lining shall be required when the design velocity exceeds the allowable, non-erosive velocity for a given channel reach and no other erosion control measures provide adequate protection. Allowable, non-erosive velocities for various soil types are presented in Volume 2.

6.2.3 Grassed Channels

The design of grassed channels shall consider the variable degree of retardance generated by different types of cover (see Volume 2).

Temporary erosion control shall be utilized during non-growing seasons and during grass cover establishment. The engineer shall note on the drawings or in the specifications that "All grassed channels must be in a well-stabilized condition and show no sign of erosion at the time of final acceptance by MWS."

6.2.4 Easement Width

All open channels shall be located within the right-of-way of a public utility and drainage easement. Minimum easement width shall be determined from Table 6-1. Public drainage easements for open channels must be properly sized, labeled and identified on all plats submitted for review. Furthermore, the applicant must illustrate and label the respective tops of banks on any plat submitted for review.

Table 6-1
Minimum Easement Width for Open Channels

Top Width of Channel	Easement Width
Less than 5 feet	10 feet centered over channel
5 - 20 feet	10 feet greater than top width of channel, with minimum of 5 feet on one side
Greater than 20 feet	15 feet greater than top width of channel, with minimum of 5 feet on one side

6.3 Storm Pipes and Culverts

6.3.1 Conduit Capacity

Closed conduits shall be designed for the total flow intercepted by the inlets during the design storm event. The minimum diameter for all storm drains shall be 15 inches. Cross-drains shall be a minimum of 18 inches in diameter. The two materials for pipes allowed within Right of Ways (or pipes that carry public water) are concrete and corrugated metal. Corrugated metal pipe (CMP) systems should be Aluminized Steel – Type 2. Corrugated metal pipe underground detention systems and corrugated metal pipe culverts must be Aluminized Steel – Type 2, unless they are open-bottom culverts. All reinforced concrete pipes (RCP) with inverts less than 18 feet shall be Class III.

6.3.2 Pressure Flow

Storm drain systems should generally be designed as non-pressure systems. However, pressure flow systems, if coordinated with MWS during the preliminary design phase, may be allowed. The hydraulic gradient for pressure flow systems shall not exceed the following criteria:

1. An elevation greater than one foot below the established ground surface, or

2. More than five feet above the crown of the conduit.

6.3.3 Easement Width

Minimum allowable easement width for storm water pipes and culverts shall be determined from Table 6-2. Public drainage easements for all storm water infrastructures must be properly sized, labeled and identified on all plats submitted for review. Easement widths presented in Table 6-2 are calculated based on the assumption that maintenance will be performed, if necessary, using the open-cut method with laid back slopes. The easement widths are calculated in accordance with the Occupational Safety & Health Administration (OSHA) Technical Manual dated January 20, 1999, Section V, Chapter 2. Easement widths presented are rounded up to the nearest 5-foot increment and the use of shoring was not considered.

Initial easement width requirements must be determined from Table 6-2 assuming an OSHA soil category of “B”. In order to use OSHA soil category “A” for easement width determination, a field investigation to determine the presence of type “A” soils will be required. Following the field investigation, a certification by a licensed professional must be submitted to MWS for review and approval. If at any point during design or construction, it is determined that site conditions warrant the assignment of OSHA soil category “C”, easement width requirements must be determined from Table 6-2 using soil category “C”. In the event that easement width requirements change after plans have been approved by MWS, plans showing the corrected easement width must be submitted to the MWS for review and approval.

Table 6-2 Minimum Easement Width for Storm Drains.

Conduit Width (inches)	Invert Depth (feet)	Minimum Total Easement Width (feet) For OSHA Soil Categories		
		A	B	C
15-18 inches	0-5	15	15	20
	5-10	20	25	35
	10-15	30	35	50
	15-20	35	45	65
21-33 inches	0-5	15	15	20
	5-10	20	25	35
	10-15	30	35	50
	15-20	35	45	65
36-48 inches	0-5	15	20	25
	5-10	25	30	40
	10-15	30	40	55
	15-20	40	50	70
54-72 inches	0-5	N/A	N/A	N/A
	5-10	25	30	40
	10-15	35	40	55
	15-20	40	50	70

OSHA soil categories are defined in the OSHA Technical Manual and in Appendix B of this manual.

6.3.4 Inlets

Inlets shall be designed to convey the 10-year frequency, time of concentration storm event.

6.3.5 Culverts

Culverts are to be designed with upstream and downstream headwalls. The design flow for culverts shall be based on the following return frequencies:

1. 100-year for residential collector and commercial road crossings.

2. 10-year for residential roads and crossings.

In addition, building elevations shall be checked for flooding caused by the 100-year, 24-hour storm.

6.4 Outlet Protection

The design discharge at the outlet of stormwater management systems shall not result in velocities that equal or exceed the erosive velocity of the receiving channel, unless energy dissipation and permanent erosion protection measures are placed at the outlet. Energy dissipation and erosion control devices shall have no overfall at the terminal end and shall discharge onto a stable section. The terminal section shall be considered stable if the terminal section design velocity is less than the erosive velocity.

6.5 Bridges

All bridges shall be designed for the 100-year, 24-hour storm event. The design flow shall consider runoff from the total tributary area and will require stream channel routing, as appropriate.

6.6 Stormwater Quantity Detention

The purpose of stormwater detention is to protect downstream properties from flood increases due to upstream development. The design is required to control peak flow at the outlet of a site such that post-development peak flows are equal to or less than pre-development peak flows for the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year design storms. However, detaining the discharge from a site can sometimes exacerbate flooding downstream due to the flow peak timing or the increased volume of runoff coming from a site. If water quantity control (detention) structures are indiscriminately placed in a watershed and changes to the flow timing are not considered, the structural control may increase the peak discharge downstream. Another impact of new development is an increase in the total runoff volume of flow. Thus, even if the peak flow is effectively attenuated, the longer duration of higher flows due to the increased volume may combine with downstream tributaries to increase the downstream peak flows. Metro has developed a no adverse impact policy to help mitigate any potential flooding impacts from new development and significant redevelopment.

6.6.1 No Adverse Impact Policy

MWS has adopted the policy that runoff from new development will not adversely affect downstream properties. In determining whether runoff from the new development causes an impact, the following policies may be used:

- Attenuate post-development peak discharge to a level not to exceed the pre-development discharge.
- Apply the “ten percent” rule. This rule recognizes that in addition to controlling the peak discharge from the outlet of a detention facility, these facilities change the timing of the entire outflow hydrograph for the stream or river in question. Where required, channel routing calculations must proceed downstream to a confluence point where the drainage area being analyzed represents ten percent or less of the total

drainage area. At this point, if the effect of the hydrograph routed through the proposed storage facility on the downstream hydrograph is assessed and shown not increase flows in downstream hydrographs, detention can be waived. If increased flows are found, then backwater calculations and determination of flood elevations for the areas impacted by increased flows, if any, must be prepared. Where downstream increases in peak flows or flood elevations are shown, detention will be required on site to attenuate storm flows from post-development to pre-development rates.

In the event that Metro has developed a master plan for the area, the recommendations within the master plan will establish the requirements for detention.

Metro retains the right to require detention in areas of known flooding when detention will not exacerbate downstream flooding.

The release rate from any detention facility should approximate that of the site prior to the proposed development for the 2-year through 100-year storm events, with emergency overflow capable of handling at least the 100-year discharge except where waived or altered by MWS. Detention systems must be constructed during the first phase of major developments to eliminate damage to adjacent properties during construction. In this regard, the detention systems shall be designed to function as sediment traps and cleaned out to proper volumes before completion. If siltation has occurred, detention systems must be restored to their design dimensions after construction is complete and certified as part of the as-built submittal (see Section 3.9).

6.7 Stormwater Quantity & Quality Best Management Practice (BMP) Maintenance

Care must be taken to ensure that any required detention facilities do not become nuisances or health hazards. Stormwater quality management practices generally require more maintenance than stormwater quantity management practices. Detention facilities should be designed to require minimal maintenance, and maintenance responsibility must be clearly stated on the plans. Detention facilities may be designed to serve multiple purposes whereby runoff may be detained under wet-weather conditions, but also serve as common or recreational areas during dry-weather conditions. Where multi-purpose facilities are provided, or where flat grades or poorly draining soils are encountered, provisions for adequate low flow stormwater management system may be required. Where the retention/ detention facility is planned to be used as a lake, pond or stormwater quality management practice with a permanent pool, water budget calculations shall be performed and submitted to demonstrate that an adequate pool is expected during dry summer months. More detailed specifications on detention structures can be found in Volume 4 Section 6.

All stormwater quantity and/or quality control BMPs must be located within public utility and drainage easements and must be maintained by the landowner or the homeowner's association.

6.7.1 BMP Maintenance Document

A Maintenance Document must be submitted with the Grading Permit application and must include the following:

1. Either an Inspection and Maintenance (I&M) Agreement, which includes an easement requirement, or a Declaration of Restrictions and Covenants, whichever is appropriate as determined by Stormwater staff[1], signed by the current owner. Copies of the two alternative forms may be found in Appendix C.
2. A long-term maintenance plan prepared by the design engineer. The maintenance plan must include a description of the stormwater system and its components, inspection priorities and inspection schedule for each component, and BMP schematics for each BMP.
3. A system location map to enable MWS to locate BMPs, which include water quality buffers, as needed.

The Maintenance Document must be recorded prior to final Grading Permit approval. If the final configuration of the stormwater system components or BMP differs from the original configuration proposed with the Grading Permit application, the Maintenance Document must be revised, finalized, and rerecorded. Failure to follow the Maintenance Document could result in enforcement action. Nothing in these regulations alters, amends, or negates requirements under existing detention pond agreements between the Metropolitan Government and property owners.

6.7.2 Inspection and Maintenance Responsibilities

The long-term maintenance plan within the Maintenance Document contains the inspection priorities and schedule for the stormwater system components and BMPs. The BMP owner is responsible for inspecting the stormwater system, including BMPs, according to the schedule and annually submitting completed inspection reports to MWS to document that inspections have been completed and necessary maintenance has been performed. MWS must be notified through the annual inspection process of any BMP ownership changes. Failure to file annual inspection reports and perform required BMP maintenance could result in enforcement action.

[1] In making this determination, staff will take the following into consideration. The Declaration of Restrictions and Covenants may be permissible in lieu of an Inspection and Maintenance Agreement /Easement where the potential impact the stormwater system components in question could have on the public stormwater system is minimal or where the signatory to the Maintenance Document is an established institution that can reasonably be expected to continue to hold the property where the stormwater system components are located for the foreseeable future. Examples of such instances would include an urban highrise with a green roof or a similar BMP, or BMPs proposed to be maintained on the property of an established educational institution or hospital. An example of a situation in which it would not be appropriate would be where public water would need to flow through the stormwater system components across private property, in which case an easement would be required.

6.8 Sinkholes and Drainage Wells

In alignment with Planning Commission policy, sinkholes and their associated floodplains are to be included in open space. Metro defines sinkholes as follows:

> *A sinkhole is a depression that occurs naturally in a karst area with no surface outflow of water and shall be identified by the first closed contour on 2-foot contour interval map or as designated by the Tennessee Department of Environment and Conservation.*

If a party disagrees with a sinkhole as determined by a contour map or as identified by MWS, the party may appeal to TDEC for review. If TDEC determines the feature not to be a sinkhole, Metro will defer to TDEC's determination.
All stormwater management systems discharging to sinkholes or drainage wells shall be designed using the 100-year storm. A geologic investigation and report as described in Section 4.2.2.4 is required, along with a demonstration that development will not occur within the area flooded by the 100-year storm. The project must also comply with all state and federal sinkhole permitting requirements.

The floodplain of a sinkhole is defined as follows:

a. If there is no surface outflow of water below the 100-year flood elevation, the sinkhole floodplain is to be defined as the 100-year flood elevation, assuming no draw down through the sinkhole throat.
b. If there is an existing surface outlet for water to flow away from the sinkhole below the 100-year flood elevation, the sinkhole floodplain is to be defined by the storm event at which there is surface outflow, assuming no draw down through the sinkhole throat.
c. If there is a surface outlet that drains one sinkhole into another, sinkhole floodplains must be identified for each sinkhole, assuming no draw down through the sinkhole throat.

No cutting or filling is allowed below the contour elevation that defines the storage equal to 50 percent of the 100-year, 24-hour sinkhole floodplain storage volume, unless a surface outlet is available at a lower elevation or the cut or fill provides for surface overflow to another conveyance. Cut and fill must be balanced to maintain adequate storage volume without raising the floodplain elevation.

A surface outlet may be provided to prevent stormwater from rising above the 100-year flood elevation. No development will be allowed within the basin of a sinkhole if such development will lead to any additional increase in flood levels within that or adjacent basins. Special care will be required during construction to prevent eroded soil or debris from being washed into the sinkhole. Any cutting or filling below the contour elevation that defines the storage equal to 50 percent of the 100-year, 24-hour sinkhole floodplain storage volume, unless satisfied by the existing surface outlet criteria, will require a variance from the Stormwater Management Committee.

6.9 Water Quality Buffers

6.9.1 Identification of Community Waters and Application of Buffers

New development, significant redevelopment, and sites needing a Grading Permit are required to preserve water quality buffers along Metro's community waters. Buffers shall be clearly marked on site development plans, Grading Permit applications, plats and/or concept plans. Community waters include the following:

1. Intermittent and perennial streams (and their source springs)

2. Lakes and ponds with hydrologic connectivity (stream leading into/out of the pond or obvious spring input)

3. Wetlands that have been identified by the U.S. Army Corps of Engineers, TDEC, or MWS staff.

An alteration to a community water requires a variance from the Stormwater Management Committee. Wet weather conveyances as defined by TDEC are not community waters and do not have to be buffered. Rule 1200-4-3-.04 of the Rules of the Tennessee Department of Environment and Conservation specifies that "wet weather conveyances are man-made or natural watercourses, including natural watercourses that have been modified by channelization, that flow only in direct response to precipitation runoff in their immediate locality, the channels of which are above the groundwater table and which do not support fish or aquatic life and are not suitable for drinking water supplies."

Intermittent streams are natural or man-made watercourses (streams), which may cease to flow for sustained periods during a normal rainfall year (typically during the later summer through fall months). Perennial streams generally flow year-round, however they too may also run dry during years of extreme drought. Both intermittent and perennial streams will be collectively referred to as "streams" throughout this manual.

In addition to buffering all community waters, streams identified on Metro's GIS stream layer must be buffered unless the developer can clearly demonstrate that the watercourse in question does meet the criteria necessary to classify it as a stream. Stream definitions can be found in the Hydrologic Determination Policy developed by MWS in conjunction with TDEC. Please contact MWS to obtain information about the stream layers and the Hydrologic Determination Policy. The developer must use qualified staff and the Hydrologic Determination Policy to make a determination on the water feature and will bear the burden of proof for a determination that a conveyance is not a stream. If a conveyance is not identified on Metro's GIS stream layer *but* has a drainage area of 40 acres or more, the developer, again, must use the Hydrologic Determination Policy to make a determination on the water feature and will bear the burden of proof for a determination that a conveyance is not a stream. If the developer is unsure about the designation of a community water, MWS or TDEC staff can make the determination. Designations made by MWS during drier months will be deemed community waters and must be buffered.

Where Metro's Water Quality Buffer requirements differ from TDEC's Construction General Permit (CGP) buffer requirements on streams impaired by sediment as identified in the 303(d) list, the more restrictive requirement shall apply. Furthermore, the Grading Permit plans must address how and when the transition from the CGP buffer requirement to Metro's buffer requirement will transpire on the site.

6.9.2 Buffer Widths

The following buffer widths and zones shall be applied to community waters, as described in Section 6.9.1. **Zone 1** for all buffers shall be considered a "no disturb zone", where the vegetation cannot be disturbed, removed or replanted unless a buffer restoration plan has been approved by MWS. **Zone 2** can consist of managed vegetation, meaning the buffer zone can be disturbed and planted with grass or other vegetation. However, no structures or impervious surfaces shall be placed in Zone 2. In defining the inner limits of stream buffers, top of bank is defined as the uppermost limit of the active channel of a stream during "bank full" conditions, usually marked by a break in slope. The tops of bank must be properly illustrated and labeled on plats submitted for review.

<u>Streams</u>

1. Streams draining < 100 acres: 30' from top of bank; Zone 1=30' (See Figure 6-1)
2. Streams draining ≥ 100 acres, but < 1 square mile: 50' from top of bank; Zone 1=30' and Zone 2=20' (See Figure 6-2)
3. FEMA studied streams, streams with a Local Flood Study, or streams with a drainage area ≥ 1 square mile: 75' from the floodway, Zone 1=floodway + 50' and Zone 2=25' (See Figure 6-3). MWS staff may allow a large undisturbed floodway to count towards the buffer requirement in consultation with Metro Parks and Greenways if the undisturbed area complies with the requirements of the floodplain overlay district and if staff determines that the undisturbed area would adequately serve water quality functions.

<u>Ponds</u>

Ponds with hydrologic connectivity (stream leading into/out of the pond or obvious spring input): 25' from normal water pool, with Zone 1 = 10' and Zone 2 = 15'

<u>Wetlands</u>

25' from the wetland delineation line (accepted by USACOE, TDEC, or MWS), with no disturbance allowed within the 25'.

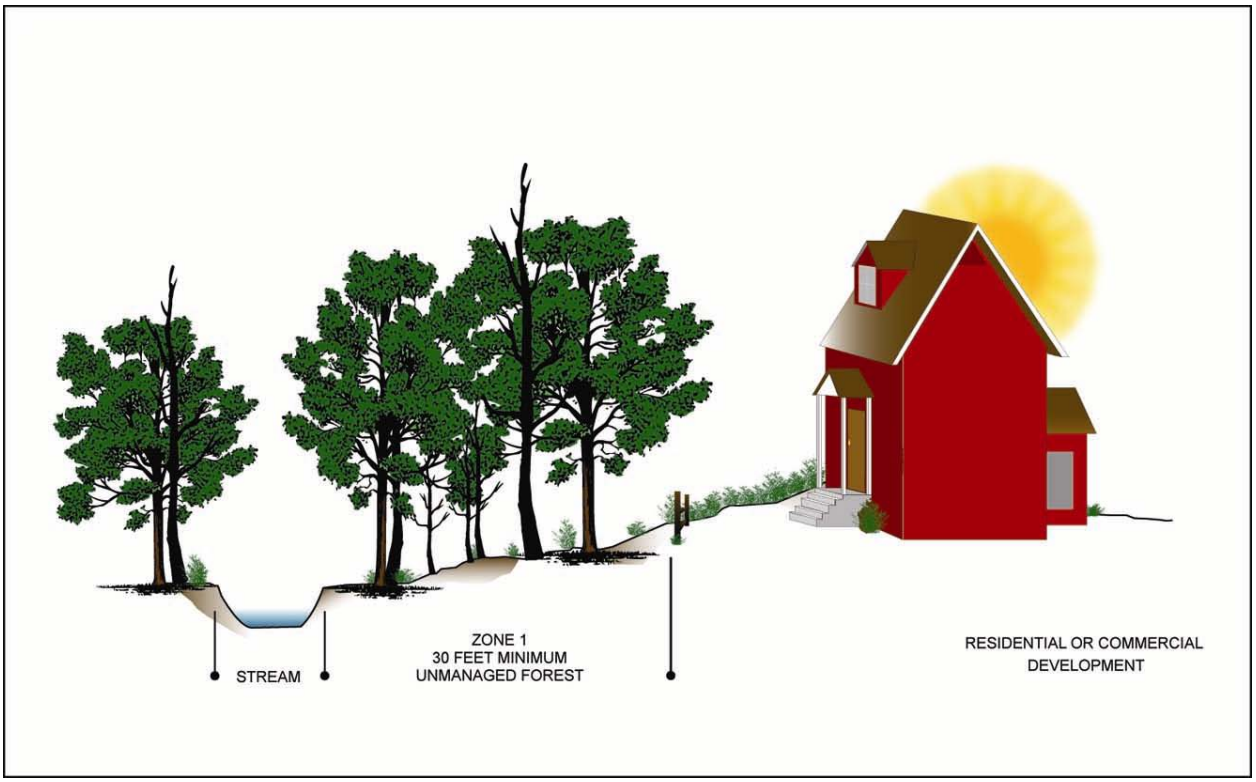

Figure 6-1 Buffer Example for Streams with Drainage Area < 100 acres

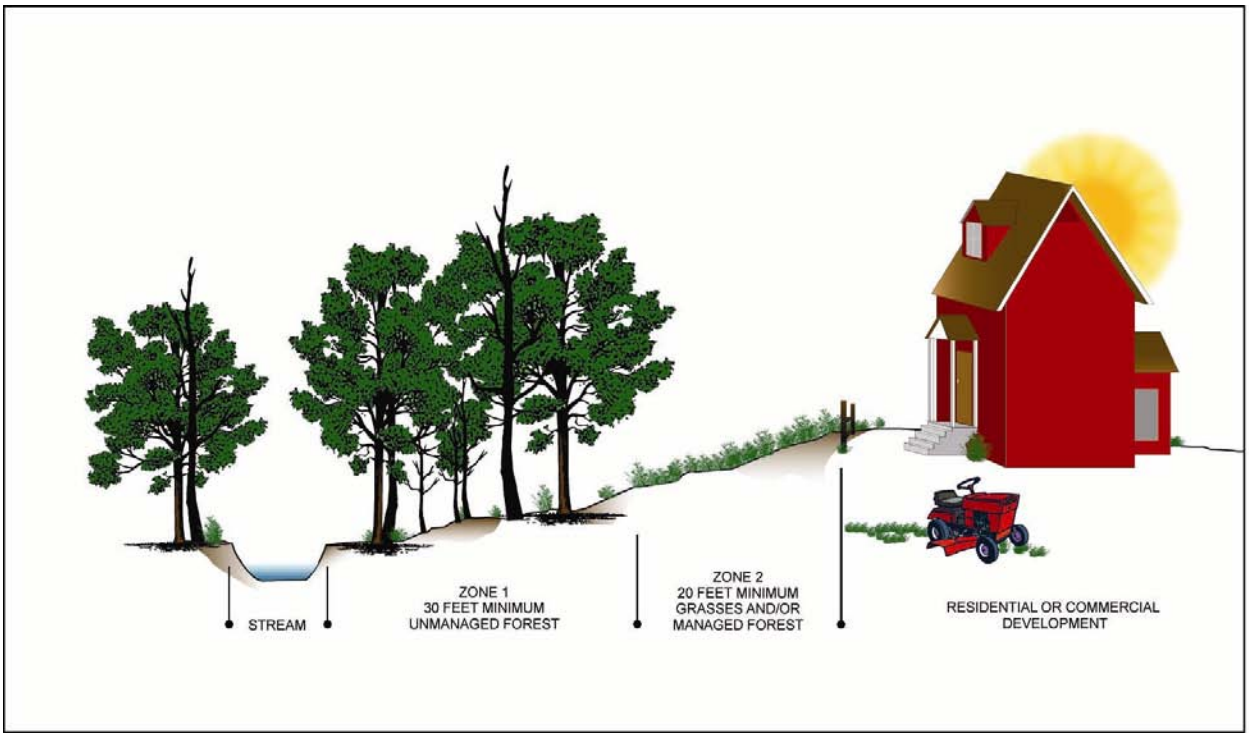

Figure 6-2 Buffer Example for Streams with Drainage Area ≥ 100 acres

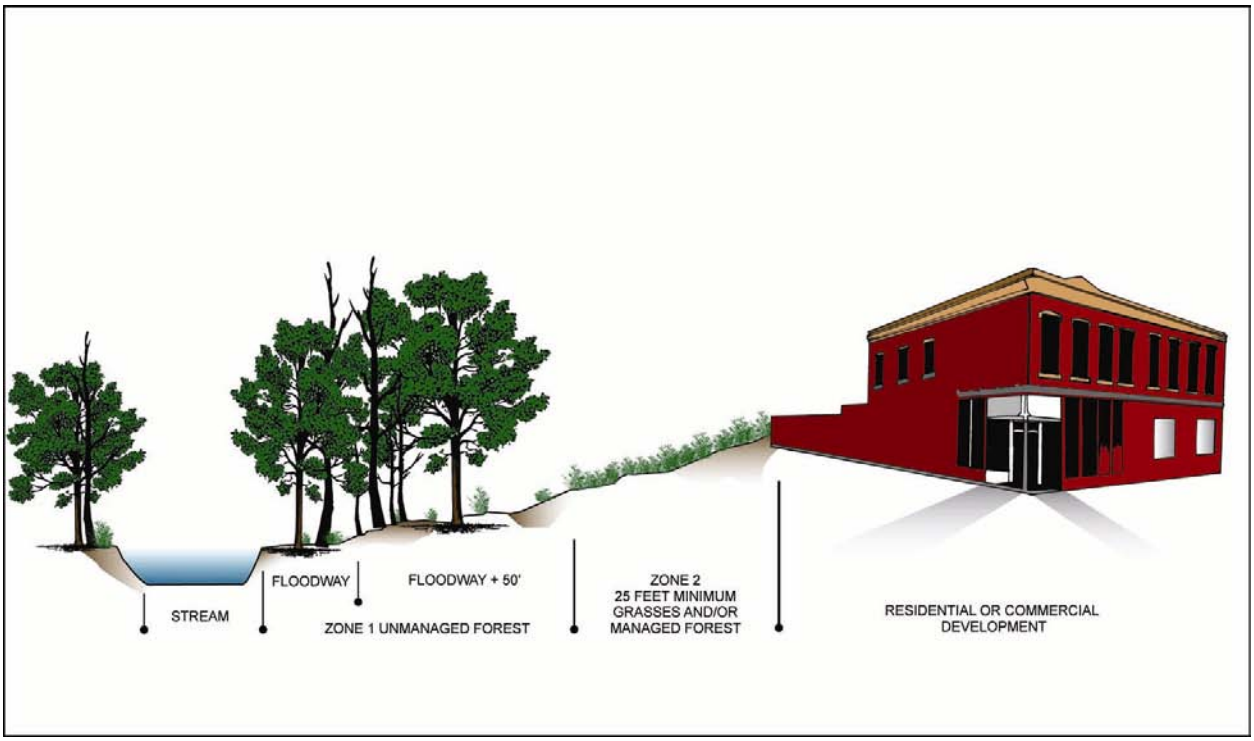

Figure 6-3 Buffer Example for Streams with Floodways

6.9.3 Preservation of Water Quality Buffers

Buffers shall be preserved both during development and perpetually after development.

1. During development, Zone 1 of all buffers shall be clearly marked and protected from construction activities. Zone 2 may be disturbed and revegetated.
2. Water quality buffers shall be placed in open space easements recorded with the deed for the property.
3. Prior to the release of the Stormwater Bond or Stormwater Use & Occupancy Permit sign-off, water quality buffer limits shall be clearly marked with permanent signs placed every 100 feet along the outside edge of Zone 1 (the edge furthest from the stream). The number of required buffer signs should be indicated along the buffer line on the Grading and Drainage plans. More detailed information about the signs can be found at www.nashville.gov/stormwater/WQBuffers.asp.
4. Projects that disturb buffers for enhancement or restoration shall be allowed with prior approval from MWS.

When the application of the buffer area would result in the extreme loss of buildable area, modifications to the width of the buffer area may be allowed through the Stormwater Management Committee appeals process. Additional information on the variance process is found in Section 3.6 and Appendix F.

6.9.4 Maintenance of Water Quality Buffers

In order to maintain the functional value of the buffer area, indigenous vegetation may be removed as follows:

a. Dead, diseased, or dying trees that are in danger of falling and causing damage to dwellings or other structures may be removed at the discretion of the landowner.
b. Debris in the buffer area that is caused by storm damage may be removed.
c. Invasive plant species may be removed if they are replaced by native species that are equally effective in retarding runoff, preventing erosion, and filtering nonpoint source pollution from runoff. A buffer restoration plan for removal of invasive species must be approved by MWS. See section 6.9.6 for buffer restoration plan requirements.
d. Woody vegetation growing on a levee or within 15 feet of the levee toe may be removed to protect the integrity of the levee.
e. Vegetation may be maintained in certain areas so as to not conflict with other Metro Code (i.e. Chapter 13 – Traffic and Parking) relating to "sight distances" for ROW, roadway maintenance, driveways, or other paths of travel.

6.9.5 Uses in the Buffer that are Permissible with Conditions

Some buffer impacts are inevitable with development. In order to minimize variance requests, Metro has identified allowable or permissible disturbances or uses of the buffer that can be approved at the staff level. Table 6-3 outlines permissible buffer impacts and the appropriate conditions for each impact type. Impacts to the buffer that do not meet these conditions are required to request a variance.

Table 6-3 Permissible Buffer Impacts, with Conditions

Permissible Activities with Conditions	**Stream Drainage Area < 100 acres** **Zone 1 = 30'**	**Stream Drainage Area ≥ 100 acres** **Zone 1 = 30'** **Zone 2 = 20'**	**Stream Drainage Area ≥ 1 sq mile** **Zone 1 = floodway+50'** **Zone 2 = 25'**	**Wetland Buffers** **Zone 1 = 25'**	**Pond Buffers** **Zone 1 = 10'** **Zone 2 = 15'**
Greenways and trails, including trails in accordance with Metro's approved Greenway Plan	Permissible with the following conditions: Minimize impacts to buffer based on Staff approval.				
Wildlife and fisheries management	Permissible if activity is approved through TN Wildlife Resources Association or US Fish & Wildlife Service.				
Water dependent structures (boat docks, piers, marinas)	Permissible with the following conditions: Minimize disturbance and stabilize disturbed areas. Contain all pollutants related to boating activities such as oil and gas, boat sewage, solvents, antifreeze, detergents, and toxic metals.				
Driveway crossings	**Not permissible except under the following conditions:** At least 1,000 feet between crossings, three sided culvert or span is used and the width of the buffer impact perpendicular[1] to stream = road width + slope area over pipe (fill slope of 3:1 or flatter) + 10' from toe of fill on either side of crossing (for construction purposes)			Permissible when there are no other feasible alternatives	Permissible when there are no other feasible alternatives
Road crossings	**Not permissible except under the following conditions:** Only when there are no other feasible alternatives and at least 1,000 feet between crossings; three sided culvert or span is used and the width of the buffer impact perpendicular[1] to stream = road width + slope area over pipe (fill slope of 3:1 or flatter) + 10' from toe of fill on either side of crossing (for construction purposes)			Permissible when there are no other feasible alternatives	Permissible when there are no other feasible alternatives
Drainageway Improvements	Permissible with conditions: 1) necessary approvals from MWS and/or TDEC 2) with an MWS approved buffer reestablishment plan.				
Underground utility lines associated with new development[1]	**Zone 1: Only when there are no other feasible alternatives; preferred crossing is perpendicular** Zone 2: Permissible			Permissible when there are no other feasible alternatives	Permissible when there are no other feasible alternatives

[1] *Crossings that are within 15 degrees of being perpendicular to the stream can be approved by staff without a variance. Proposed crossings that vary more than 15 degrees from perpendicularity must go through the Stormwater Management Committee.*

The benefits of buffers are maximized in unbroken corridors along streams rather than in interrupted, segmented buffers. Therefore, the buffer program promotes minimizing stream crossings. For buffer crossings proposed in plans, the developer must show that there is not a feasible alternative to the crossing

6.9.6 Buffer Restoration and Enhancement

Buffer restoration is required when a buffer is disturbed without approval from MWS or the Stormwater Management Committee. A developer or property owner may also wish to enhance a buffer to bring it closer to an optimal, undisturbed native forest condition. Prior to reestablishing or planting the buffer, a restoration or enhancement plan must be submitted to and approved by MWS.

6.9.6.1 Buffer Restoration and Enhancement Plan Requirements

Buffer restoration and/or enhancement plans must include the following:

1. *A drawing or plan* that shows the location of the buffer in relation to the existing or planned development and to the buffered community water; the disturbance limits for the planned buffer restoration; direction of flow of runoff from the site and flow within the community water feature; erosion prevention and sediment control measures to be installed to protect the community water; any existing or proposed stream crossings; existing or proposed streambank stabilization measures; access to a water source for the purposes of watering vegetation; and other pertinent information. The plan(s) must be stamped by a registered landscape architect.

2. *A plan in visual or narrative form that describes the vegetation plan for the buffer*. Zone 1 of buffers must be planted with native trees, shrubs, and grasses that will not be mowed. Suitable native plants may be found at the Tennessee Valley Authority's native plant finder (www.tva.com/river/landandshore/stabilization/plantsearch.htm), Tennessee Exotic Pest Plant Council's Landscaping with Native Plants [in] Middle Tennessee (www.tneppc.org/Landscaping/Middle_Tennessee.htm) or from the Natural Resources Conservation Service. (Please contact MWS if these sites are unavailable). Zone 2 may be planted with fescue or Bermuda grasses, at a minimum, but can also be planted as described for Zone 1.

3. The schedule for when plantings will occur and a two year survival guarantee provided by the responsible party.

6.10 Erosion Prevention and Sediment Control Measures

By policy, Metro's requirements for Erosion Prevention and Sediment Control (EPSC) measures are consistent with those of TDEC's CGP. Some of the more crucial design requirements are outlined in this section. Wherever the Metro and CGP requirements are in conflict, the more restrictive requirements should be applied.

EPSC measures shall be designed according to the size, slope, and soil type of disturbed or drainage areas to prevent erosion and to capture sediment. In addition, for sites discharging to streams impaired by sediment (as indicated on the most recent 303(d) list maintained by TDEC Water Pollution Control) or TDEC designated high quality streams, EPSC measures shall be designed for the 5-year, 24-hour storm event, at a minimum. EPSC measures for sites that do **not** discharge into streams impaired for sediments (as indicated on the most recent 303(d) list maintained by TDEC) must be designed for the 2-year, 24-hour storm event. The approximate values for the corresponding storm events for Nashville are 3.39 inches for the 2-year, 24-hour storm event and 4.5 inches for the 5-year, 24-hour storm event.

An EPSC plan shall identify the erosion prevention and sediment control measures that are appropriate for the actual site conditions. These plans should be drawn upon existing site contours without the final grading lines. In addition, the appropriate schedule of implementation shall be identified. Particular attention is required for concentrated stormwater flows. Either concentrated stormwater flows shall be avoided or the conveyance system shall be protected sufficiently to prevent significant erosion. Sediment control measures are required at all points where sediment has the potential to leave the site. The plan shall identify provisions including but not limited to the following.

- Erosion prevention on denuded areas;
- Non-structural management practices to be implemented;
- Perimeter controls;
- Permanent stormwater conveyance structures;
- Temporary and final stabilization methods and schedule;
- Provision for removing temporary control measures;
- Stabilization of the site where temporary measures are removed;
- Maintenance requirements for temporary management practices including minimum inspection requirements;
- Maintenance requirements for any permanent measures.

Additional guidance for selecting, designing and implementing appropriate erosion prevention and sediment control practices is presented in Volumes 2 and 4.

6.10.1 Disturbed Areas

Disturbed area shall be limited to 50 acres. For projects in which over 50 acres of soil will be disturbed, construction must be phased. Temporary or permanent stabilization must be completed no later than 15 days after construction activity in that portion of the site has temporarily or permanently ceased. Steep slopes shall be stabilized not later than 7 days after construction activity on the slope has temporarily or permanently ceased. Exceptions to this requirement include:

1. Where the initiation of stabilization measures by the seventh day is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable; and
2. Where construction activity on a portion of the site is temporarily ceased, and earth-disturbing activities will be resumed within 15 days, temporary stabilization measures do not have to be installed on that portion of the site.

Soil stabilization refers to measures that protect soil from the erosive forces of raindrop impact and flowing water. Applicable practices include but are not limited to vegetative establishment, mulching, geotextiles, and the early application of gravel base on areas to be paved. Selected soil stabilization measures should be appropriate for the time of year, site conditions, and estimated duration of use.

Soil stockpiles shall be stabilized if left undisturbed for 15 or more days. They shall be protected with sediment trapping measures that may include sediment traps or detention ponds to prevent soil loss from the project site throughout the life of the soil stockpiling practice.

6.10.2 Final Stabilization

Final stabilization is achieved when all soil disturbing activities at the site have been completed, no further construction activity is planned, and perennial vegetation and/or a permanent non-erodible surface has been established on the entire area of disturbance. Permanent vegetation shall not be considered established until a ground cover is achieved that, in the opinion of MWS, is mature enough to control soil erosion satisfactorily and to survive severe weather conditions. Also, there should be no signs of accelerated erosion on steep slopes. Channels and concentrated flow paths shall be completely stabilized.

6.10.3 Protection of Adjacent Properties

Properties adjacent to the site of a land disturbance shall be protected from sediment deposition. This may be accomplished by preserving a well-vegetated buffer strip around the lower perimeter of the land disturbance; by installing perimeter controls such as sediment barriers, filters, diversion berms, or sediment basins; or by a combination of such measures.

6.10.4 Timing and Stabilization of Sediment Trapping Measures

Sediment basins and traps, perimeter diversion berms, sediment barriers and other measures intended to trap sediment onsite shall be constructed as a first step in grading, and be made functional before upslope land disturbance takes place. All sediment control practices at hydraulic outlets from the site must be installed before additional construction may take place. Earthen structures such as dams, dikes, and diversions shall be seeded and mulched within 15 days of installation.

6.10.5 Sediment Basins

Stormwater runoff from tributary areas with 5 acres or greater disturbed area shall pass through a sediment basin or other suitable sediment control measure until final stabilization of the site. This basin must be designed for the calculated runoff from a 5-year, 24-hour storm if the site discharges to impaired or high quality waters as determined by TDEC. Otherwise, the basin must treat the runoff from a 2-year, 24-hour event. Runoff from any undisturbed acreage should be diverted around the disturbed area and the sediment basin. Diverted runoff can be omitted from the volume calculation for the sediment basin size. *Metro reserves the right to request/require more stringent controls if the proposed or existing controls are deemed inadequate.*

6.10.6 Cut and Fill Slopes

Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion. Consideration must be given to the length and steepness of the slope, the soil type, upslope tributary area, groundwater conditions, and other applicable factors. As a minimum, all slopes at 3 to 1 or steeper shall be stabilized with rock riprap, geosynthetic material, or other method approved by MWS.

6.10.7 Construction Exits

A stabilized stone pad shall be placed at any point where traffic will be leaving a construction site to a public right-of-way, street, alley, or parking lot. Stone pads shall contain two to three inch stone, be six inches thick, and be a minimum of 100 feet long and 20 feet wide. Detailed requirements for construction exits are presented in the Volume 4 of this manual.

6.10.8 Litter and Construction Waste Materials

Grading Permittees shall control site wastes such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary wastes at their construction site that may cause adverse impacts to water quality. “Control” shall constitute BMPs addressing the aforementioned site issues and should be being depicted on the EPSC sheet of the site’s approved Grading Permit plan as well as being implemented and maintained on the project site as required to prevent pollution from being lost from the site.

A Grading Permit must be obtained for any parcel of land accepting 100 cubic yards of fill or more. Transporting/disposing of excess or unwanted fill on a site that does not already hold a valid Grading Permit will result in the issuance of a Notice of Violation (NOV), a Stop Work Order (SWO), a penalty, or the revocation of the Grading Permit for the project that is the source of the fill material.

6.10.9 Deficient Performance

If at any time it is determined by MWS, that the erosion prevention and sediment control practices as originally designed are not capable of preventing sediment from leaving the site, then the EPSC plan shall be revised and submitted for approval to MWS and additional controls shall be implemented. If MWS inspectors determine that adequate inspections and maintenance procedures are not being performed or the controls as designed are not meeting performance objectives presented in this chapter, then MWS may issue a SWO, NOV with penalty, rescind a Grading Permit, or take other appropriate legal actions. See Section 3.7 of this Volume for additional information.

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