



# Section 2

## Stormwater Management Requirements

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### 2.1 Coordinating with other agencies

Many agencies may need input on development plans. The following table outlines the type of activity that may require approval or information from other agencies. A permit or application cannot be approved until documentation from those agencies has been received. Always consult regulations, ordinances, state & federal laws when accessing permit requirements as requirements change overtime. This list is not meant to be exhaustive of the potential permitting requirements.

Table 2.1-1 Other Agency Contact Information

Activity that may require information from another agency	Permit or approval	Contact
Disturbing an acre or more or disturbing less than one acre but part of a larger common development disturbing one acre or more.	KPDES General Permit	Surface Water Permits Branch Kentucky Division of Water 200 Fair Oaks Lane Frankfort, Kentucky 40601 Phone: 502-564-3410
Working in a stream or river	404 Permit	U.S. Army Corps of Engineers Mazzoli Federal Building 600 Dr. Martin Luther King Place Louisville, Kentucky, 40202 Phone (502) 315-6766
Stream crossings and riparian area development	401/Water quality certification	Water Quality Certification Section 200 Fair Oaks Lane Frankfort, KY 40601 Phone: 502-564-3410 Fax: 502-564-0111
Development in a floodplain or flood prone area	LOMR, CLOMR, Elevation Certificate, No-Rise Certification	City of Shelbyville, Floodplain Coordinator 787 Kentucky Street, Shelbyville, KY 40065 502-633-1094



## 2.2 Regulations

This section describes the regulations supporting the City's stormwater management program. It establishes the baseline requirements. More information about the policies and procedures in support of these regulations can be found in Section 3 and the appendices.

### 2.2.1 *Waterway Buffers*

Areas of new development and redevelopment require a 25- to 50-foot undisturbed no-build buffer zone from top of bank on both sides for the entire length of streams that are identified in the most recent USGS Quadrangle maps within the City of Shelbyville. Buffer zones are vegetated areas, including trees and shrubs which exist or are established to protect a stream system, lake, or reservoir area. These buffers also apply to other sensitive areas such as springs, wetlands and sinkholes as follows:

KYR10 requires buffer zones as described below:

For discharges to waters categorized as High Quality Waters or Impaired Waters (Non-construction related impairment) permittees are required to maintain a minimum a 25-foot buffer zone between any disturbance and all edges of the receiving water as means of providing adequate protection to receiving waters. For discharges to waters categorized as Impaired Waters (Sediment impaired, but no TMDL), permittees are required to maintain a minimum 50-foot wide buffer zone between any disturbance and all edges of the receiving water as means of providing adequate protection to receiving waters. If the buffer zone between any disturbance and the edge of the receiving water on all edges of the water body cannot be maintained, an adequately protective alternate practice may be employed. The SWPPP shall explain any alternate practices and how these practices are adequately protective. Such cases include but are not limited to stream crossings and dredge and fill areas. In these cases the permittee shall minimize disturbances in the buffer zones by using hand held or other low-impact equipment.

### 2.2.2 *Erosion Prevention and Sediment Control Requirements*

The City of Shelbyville, KY requires an Erosion Prevention and Sediment Control (EPSC) Plan for most types of construction. When preparing the EPSC Plan, the design engineer and/or developer should determine the best practices to protect the environment from the potential impacts from construction sites by selecting source control and sediment containment practices. Proper site planning and BMP selection are critical to the success of the erosion prevention and sediment control plan. The appendices contain plan submittal forms and checklists for your use.

Site characteristics such as soil types, topography, and on-site or nearby natural resources, and construction methods should be thoroughly reviewed when selecting BMPs to implement throughout the life of the project. The designer should plan for how the site will change throughout the project so that BMPs can be repaired, modified or replaced.

For more information regarding the required elements of an EPSC Plan, refer to Appendix D – EPSC Plans.

EPSC plans must incorporate the following concepts:

#### **Minimize Disturbed Areas - Phasing**

Construction planning and sequencing are the least expensive methods to reduce and control erosion and sediment. The following points should be considered to minimize disturbed areas:

- Do not disturb areas of the construction site and keep existing vegetation for as long as possible. Delay disturbing areas of the site until necessary for construction activities.
- Carefully schedule and phase construction. Avoid grading during wet months (December through May).



- Plan and implement permanent structures throughout the earlier phases of the project. This will maximize the BMP's effectiveness.
- Avoid delays and work expeditiously on any part of the site. Install landscaping and stabilize upon the completion of any sequence and prior to moving on to the next phase.

#### Focus on Erosion Control

- Erosion control is THE most effective practice used on a construction site. Temporary covers (mulch, temporary grains, plastic) are cost effective and should be used on any area of the construction site that has a high potential for discharging sediment off-site.
- Use temporary cover measures (seed or mulch) whenever construction ceases for 14 days.
- Phase site grading to limit the amount and time of an area is exposed. Exposed areas should be stabilized immediately following the completion of grading in that area.
- Any exposed soil is subject to erosion, even by a single rain drop. Designers and contractors should make every effort to stabilize the following highly susceptible areas at a construction site throughout construction:
  - Slopes
  - Highly erosive soils
  - Construction entrances and exits
  - Stream channels
  - Soil stockpiles

#### Manage Sediment

- Where erosion controls are impractical due to construction activities, sediment controls must be installed. Sediment controls are much less effective and have higher maintenance requirements than erosion control practices.
- The designer should consider sediment controls for the initial clearing and grubbing phase. Typically, these controls are perimeter controls, as follows:

Area of Concern	Site Perimeter Control
Disturbed areas or slopes that drain toward adjacent properties	Continuous berms, silt fences, sandbags
Stabilizing area after grading has been completed	Mulching, seeding, planting, emulsifiers, or a combination of two or more
Off site flows that enter the constructions site	Continuous berms, earth dikes, drainage swales and lined ditches
Concentrated flows that leave the construction site	Outlet control measures that will dissipate velocities
Construction traffic exiting onto a public right of way or other property	Construction exit to reduce mud tracking

Additional controls within the interior of construction site should supplement perimeter controls once rough grading is complete.

#### Internal Erosion and Drainage Design

Once the perimeter controls have been designed, the issue of internal erosion and drainage controls must be addressed for each phase or stage of construction. Internal practices are required early in the project until permanent practices can be implemented.

Some of the internal erosion and drainage design practices to be used include:

- Check dams, geotextile mats, and under extreme circumstances concrete channel lining.



- Terracing at regular intervals.
- Slope benches or ditches.
- Surface roughening or temporary seeding.
- Temporary sediment traps and basins.

### Maintenance and Inspection of Measures

Constant inspection and maintenance of the BMPs is critical for successful prevention of erosion and sediment transport. Maintaining a daily or weekly checklist of practices to inspect for deficiencies is critical. All areas of the active construction site must be inspected at least once every 7 calendar days, or at least every 14 calendar days and within 24 hours after any storm event of 0.5 inch or greater. These inspections must be documented in an inspection report. When maintenance needs are identified in an inspection, they must be addressed before the next rain event or as soon as practicable.

A simple way to ensure that all practices are compliant is for the EPSC Qualified Contractor to arrange a pre-construction meeting with the City of Shelbyville's Stormwater program. This meeting should take place after the Notice to Proceed, but prior to the mobilization of equipment.

All construction site BMPs require ongoing maintenance. At a minimum, sediment should be removed from the sediment storage area when the storage area is a third full. However, the contractor should demonstrate sound judgment and maintain the structures more frequently if necessary.

An inspection and maintenance strategy should include the following:

- ✓ Verify that sediment-laden stormwater flows to temporary sediment traps, basins or other sediment control devices.
- ✓ Runoff from undisturbed areas should be directed around disturbed areas and not directed into sediment control devices.
- ✓ Protect all existing or newly installed storm drainage structures from sediment clogging by providing inlet protection for area drains and curb inlets. Stormwater inlet protection can utilize sand bags, sediment traps, or other similar devices.
- ✓ Excavate permanent stormwater detention ponds early in the project, use them as sedimentation ponds during construction, remove accumulated sediment, and landscape the ponds when the upstream drainage area is stabilized.
- ✓ Inspect temporary sediment barriers such as silt fences, rock filters, and continuous berms after every rainfall. These barriers should only be used in areas where sheet flow runoff occurs. They are ineffective if the runoff is concentrated into rill or gully flow.
- ✓ Internal outlets must also be protected to reduce scour from high velocity flows leaving pipes or other drainage facilities.
- ✓ Protect sinkholes, drywells, yard inlets and other internal drainage features from sediment with inlet protection.

#### 2.2.3 NPDES Phase II EPSC Requirements

New requirements for small municipalities, NPDES Phase II stormwater requirements, became effective on March 10, 2003. In these requirements, certain municipalities and agencies that are owners or operators of their stormwater systems were required to apply for coverage under the Phase II permitting program enforced by the State. The City of Shelbyville is an NPDES Phase II regulated municipality and has coverage under the NPDES Phase II general stormwater permit, KYG20.

One of the requirements of the Phase II program is to develop a construction site runoff control program for new developments and redevelopments affecting one acre or more. The City's Stormwater Ordinance was developed in an effort to comply with this requirement. It parallels KDOW's stormwater general permit for construction activities, called KYR10, as well as the requirements within KYG20.



#### 2.2.4 *Complying with KYR10 Requirements and the City of Shelbyville's Stormwater Requirements*

The City's EPSC program mirrors KYR10. Whenever a construction site disturbs 1 acre or more, coverage under KYR10 is required, and the City will not issue a Land Disturbance Permit until a Notice of Coverage for the site in question has been submitted to the City. A summary of KYR10 requirements is in Table 2.2-1.

**Table 2.2-1 Summary of Major KYR10 Components**

<p>Land disturbing activities affecting 1 acre or more are required to obtain coverage under KYR10. For common plans of development, contiguous construction activities that cumulatively equal one or more acres of disturbance must have coverage. Non-contiguous activities (activities that are separated by 0.25 miles or more) that disturb one or more acres are considered separate activities. An applicant is required to submit a Notice of Intent for Stormwater Construction Activities (NOI-SWCA) for coverage under KYR10 and wait for a Notice of Coverage prior to beginning construction.</p> <p>The KPDES permit also requires permittees to develop and maintain stormwater pollution prevention plans (SWPPPs) for each permitted site. These plans do not have to be submitted with the NOI-SWCA. However, they must be made available to State and City inspectors during site inspections or as otherwise requested.</p> <p>EPSC measures must be designed, installed and maintained to effectively minimize discharges up to and including the 2-yr, 24-hr storm event. EPSC maintenance must be completed before the next storm event.</p> <p>Inspections must be performed by knowledgeable and qualified inspectors, either At least once every seven (7) calendar days <b>OR</b> At least every fourteen (14) calendar days and within 24 hours after any storm event of 0.5 inch or greater.</p> <p>All inspections must be documented and inspection reports kept with the SWPPP. Areas where construction has temporarily or permanently ceased must be stabilized within fourteen (14) days of the cessation of construction activities. EPSC measures must be implemented on disturbed critical areas within 24 hrs after completion of grading/disturbance.</p> <p>A 25-foot buffer zone must be maintained between construction activities and the edge of high quality and impaired streams. For sediment impaired streams, a minimum 50 foot buffer must be maintained.</p>
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The following sections provide detailed information regarding The City of Shelbyville's stormwater management program. These sections describe how the City's stormwater program meets the requirements of KYR10 and the City's Municipal Separate Stormwater System (MS4) Phase II permit, KYG20.

#### 2.2.5 *EPSC Plan Requirements*

Different levels of EPSC plans are required for different types of developments. Simple Plot Plans, for example, that do not include sinkholes or other sensitive features can address EPSC by completing the form found in Appendix D, Standard EPSC Plan for Plot Plan. Larger, more complex sites, such as non-residential buildings and subdivisions, are required to submit detailed EPSC plans.

The level of detail shown on the drawings depends on the size and complexity of the project. For single lots, a sketch may be all that is required to show the inspector. However for larger developments, such as a shopping center or industrial park, a plan sheet (or several) at an appropriate scale shall be submitted to the City for review.



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This is a list of required notes that must be added to every EPSC plan, large and small.

- ✓ As a minimum, all erosion prevention and sediment control practices will be constructed and maintained according to the standards located in the City of Shelbyville's Stormwater BMP Manual, Stormwater Ordinances, and as required by state and federal laws.
- ✓ A copy of the approved Erosion Prevention and Sediment Control Plan shall be maintained at the project site at all times or shall be made available to the City upon request.
- ✓ Prior to commencing land-disturbing activities in any area not on the approved erosion prevention and sediment control plan, the contractor shall submit a supplementary erosion control plan to the City of Shelbyville for review and approval.
- ✓ All erosion prevention and sediment control measures are to be placed prior to or as the first step in clearing and grading. The contractor is responsible for any additional erosion control measures necessary to prevent erosion and sedimentation.
- ✓ During dewatering operations water must be pumped through an appropriate filtering device. The City of Shelbyville may suspend dewatering operations if pollution is observed.
- ✓ The contractor shall inspect all erosion and sediment control devices at least once a week or at least once every fourteen calendar days and within 24 hours after any storm event 0.5 inch or greater. The contractor shall perform any repairs or maintenance prior to the next storm event or as soon as practicable in order to ensure effective erosion and sediment control.
- ✓ The contractor shall maintain a record of all inspections and maintenance activities. This record shall be made available to the City of Shelbyville upon request.
- ✓ Runoff sediment and construction waste from construction sites and parking areas shall not leave the site.
- ✓ Any sediments or other materials which are tracked off the site shall be removed immediately.

1. The EPSC plan shall include the following:

- a) A natural resources map identifying
  - soil types,
  - forest cover,
  - topography (1' contours), existing and proposed grades
  - receiving stream and other natural features of concern on the property or immediately adjacent to the property
  - location of any sinkholes within the property or immediately adjacent to the property

This map should be to scale equivalent to balance of submittal.

- b) A construction schedule for the development site, including stripping and clearing, rough grading, construction of utilities, infrastructure, final grading and landscaping. Sequencing shall identify the expected date on which clearing will begin, the estimated duration of exposure of cleared areas, areas of clearing, installation of temporary EPSC measures and establishment of permanent vegetation.
- a) All EPSC measures necessary shall be shown on the plan by location and referred to by a legend for all phases of construction. Depending upon the complexity of the project, the drafting of intermediate plans may be required for the close of winter season. Multiple EPSC plan sheets may be necessary to best convey requirements for each phase. Supporting calculations for the measures must be provided.



- b) Seeding mixtures and rates, types of sod, method of seedbed preparation, expected seeding dates, type and rate of lime and fertilizer application, and type and quantity of mulching for both temporary and permanent vegetative control measures.
  - c) Provisions for maintenance of control facilities, including easements and estimates of the cost of maintenance.
2. Modifications to the plan shall be processed and accepted or denied in the same manner as the review and issuance of the original permit application and may be authorized by the City of Shelbyville by written authorization to the permittee, and shall include:
- a) Major amendments of the EPSC plan require an engineer's signature and shall be submitted to the City of Shelbyville for acceptance prior to completion.
  - b) Field modifications of a minor nature shall require an engineer's signature and shall be noted and dated on the EPSC record drawings and available for review and acceptance by the City of Shelbyville within 14 calendar days after changes have been made in the field.

EPSC plans must be reviewed and approved prior to any land disturbing activity on the site.

### 2.3 Inspections by EPSC Qualified Contractor

An EPSC qualified contractor shall be responsible for overseeing the implementation and maintenance of all aspects of the plan and performing inspections. Whenever an Erosion Control Plan is required, a qualified contractor must be identified in the permit application package. The following information must be submitted with the application:

- ✓ Qualified Contractor's name, company name, address, phone number, and certification number.
- ✓ A statement signed by the contractor certifying that he/she will be the person responsible for the installation, inspection and maintenance of EPSC measures at the site and will be the point of contact for the City regarding EPSC questions or concerns for the permitted site.

On projects where numerous grading or site contractors are likely to be working, a representative of the contractor responsible for overseeing the initial grading and installation of initial EPSC practices must be identified as the Qualified Contractor when the Stormwater Pollution Prevention Plan is submitted to the City for review and approval. However, prior to obtaining any permits, the applicant must identify any new Qualified Contractor for the individual lot or certify that the overall Stormwater Pollution Prevention Plan (which includes the EPSC Plan) for the development will be followed and that the Qualified Contractor for the overall development will also serve as the Qualified Contractor for the individual lot.

Qualified Contractors are responsible for the following within the City of Shelbyville's jurisdiction:

1. Understand when an Erosion Prevention and Sediment Control Plan as required by the City and inform developers prior to beginning land-disturbing activities of the requirement for a plan.
2. Install or oversee the installation of erosion prevention practices (EPP), sediment management practices (SMP) and good housekeeping practices (GHP) before land disturbing activities begin.
3. Inspect EPP, SMP and GHP controls every 7 calendar days or every 14 days and within 24 hrs after a storm event of 0.5 inch or greater. Document the findings of the site inspections, inform the developer of the findings, and maintain inspection documentation for the permitted site.
4. Maintain EPP, SMP and GHP controls for the duration of the construction activities. Maintenance of controls must be conducted in accordance with the requirements identified in the City's *Best Management Practices Manual*.



5. Act as the site contact for the City regarding the EPSC plan, relaying information to the permit holder from the City.
6. Inform the City in writing of Qualified Contractor substitutions, deletions and/or additions.

The City of Shelbyville or its designated agent shall make inspections as deemed necessary to ensure the EPSC measures are being properly implemented and maintained during construction. If minimum requirements for the EPSC are not met, the permittee shall be notified and enforcement actions shall be taken.

## 2.4 SWPPP vs. EPSC Plan vs. Stormwater Management Plan

These terms can be confusing, but they reference components of the overall erosion prevention and sediment control, good housekeeping, and stormwater management plans. While stormwater management plans typically contain permanent treatment practices (PTPs) instead of temporary practices, the initial plan submittal must address permanent stormwater management including water quality. A general description of each type of plan follows:

**Stormwater Pollution Prevention Plan.** A Stormwater Pollution Prevention Plan (SWPPP) is a living document that is first submitted for approval to the City and to the KDOW. It should then be updated as development continues. Any land disturbing activities that disturbs 0.5 acres of land or more is required to submit a SWPPP to the office of the City Engineer. For all sites that disturb 1 acre or more, the SWPPP is required by KYR10 and a Notice of Intent (NOI) must be filed with the Kentucky Division of Water prior to any land disturbance. The SWPPP includes site map(s), an identification of construction/contractor activities that could cause pollutant discharges into stormwater and a description of measures or practices to control these pollutants. It includes the EPSC Plan and Stormwater Management Plan. The SWPPP shall be signed and certified in accordance with the signatory requirements in 401 KAR 5:065, Section 1(11). Once the development plan has been approved, a copy of the SWPPP must be maintained onsite and should include copies of all permits issued for the site. Inspection documentation and plan revisions must also be documented in the SWPPP once site development has begun.

**EPSC Plan.** Once the erosion prevention and sediment control (EPSC) plan has been approved, it becomes a component of the SWPPP. The EPSC Plan is a set of plans prepared by or under the direction of a licensed professional engineer detailing the specific measures and sequencing to be used to control sediment and erosion on a development site during and after construction. It includes supporting calculations, a construction schedule, and schematics and cross-sections for clarification, as well as any other material in support of the EPSC plan. As the project progresses, revisions and modifications should be tracked in the SWPPP, with major modifications requiring prior approval by the City before implementation.

**Stormwater Quality Management Plan.** The stormwater quality management plan (SWQMP) contains permanent water quality treatment devices, such as detention structures, outlet protection, stormwater conveyance devices, and bioretention areas. Once approved, the SWQMP becomes a component of the SWPPP. Most of these components will not be installed during initial construction activities. However, knowing the proposed locations during early construction activities can be beneficial so areas can be appropriately staged. For example, permanent detention structures can first function as sediment basins. Once permanent controls have been installed, they should be protected from sediment laden runoff, as many permanent water quality treatment devices rely on infiltration for treatment and can easily be overwhelmed.

## 2.5 Stormwater Management Plan

The City of Shelbyville is a permitted Phase 2 NPDES Municipal Separate Stormwater System (MS4) owner and is required to maintain coverage under the KPDES MS4 General Permit, KYG20. KYG20 requires all new development and redevelopment sites that disturb one acre or more (or less than an acre if part of a larger common plan of development) to develop and implement stormwater quality management plans. KYG20 provides minimal guidance to MS4s for developing stormwater quality treatment control programs. Instead, KDOW and EPA desire municipalities to develop programs that best suit each locale. The following criteria were established as minimum requirements in KYG20, issued in 2010:





- The City must develop a locally derived water-quality treatment standard that requires new development projects to implement controls to manage runoff through water-quality control structures. The standard shall be based, at a minimum, on an analysis of precipitation records to determine the equivalent surface depth of runoff produced from an 80th percentile precipitation event
- The City must develop procedures for the site-plan review and approval process and a required re-approval process when changes to stormwater management measures are required.
- The City must develop procedures for a post-construction process to demonstrate and document that post-construction stormwater measures have been installed per design specifications, which includes enforceable procedures for bringing noncompliant projects into compliance.
- The City must develop a long term maintenance program for new development and redevelopment to ensure structural controls are maintained and functioning perpetually.

KYG20 is primarily focused on stormwater quality. The City's stormwater management program is comprehensive and includes stormwater quantity management as well. The SWQMP encompasses both stormwater quality and quantity management goals. The following sections describe the City of Shelbyville's approach to the stormwater quality and quantity management program.

### **2.5.1 Stormwater Quantity Management Goals**

The following design requirements are applied to all proposed developments within the City of Shelbyville City Limits.

- Methods of determining storm water runoff discharge rate and volume. The volume of required storm water storage and discharge rate for drainage areas totaling 100 acres or less shall be calculated on the basis of the runoff from a 2, 10, 25, and 100-year frequency storm event with a 24 hour duration for pre and post development conditions. The calculations can be made in accordance with the instantaneous runoff factor method, the rational method, soil conservation service (SCS) method or other methods that may be deemed appropriate by the City Engineer. The Intensity Duration Curves for Louisville MSD may be used for Shelbyville. For larger drainage systems, the SCS hydrologic methods or the "Regional Method" of the Kentucky Transportation Cabinet, Department of Highways shall be used to determine peak runoff rates.
- Release Rate –
  - o All developments shall be done in such a way as to insure that storm water falling on a given site shall be absorbed or detained on site to the extent that the controlled release rate of storm water runoff from all developments shall not exceed the pre-development storm water runoff rate, unless it can be shown that no significant adverse downstream impacts will result from higher rates. The rate at which storm water runoff is delivered to a designated storm water storage area shall be unrestricted.
  - o In the event that the City Engineer determines that the natural downstream channel or storm sewer system is inadequate to accommodate the release rate provided above, then the allowable release rate shall be reduced to that rate permitted by the capacity of the downstream channel or storm sewer system.
- Development Design –
  - o Where it can be demonstrated by the developer that a higher storm water release rate will not be contrary to the purpose and intent of this manual and where such proposed release rate will not adversely affect properties in the downstream portion of the watershed, the City Engineer may permit such release to be used as deemed appropriate.
  - o Streets, blocks, lots, parks, and other public grounds shall be located and laid out in such a manner as to minimize the velocity of overland flow and allow maximum opportunity for infiltration of storm water into the ground, and to preserve and utilize existing and planned streams, channels, and detention basins, and include whenever possible, streams and floodplain within parks and other public grounds.



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- Excess Storm Water Passage
  - o An excess storm passage shall be provided for all storm water areas. Such passage shall have the capacity to convey through the proposed development the excess stormwater. The capacity for a passage shall be that it will be able to transport the peak rate of run-off from a 100-year, 24-hour return frequency storm.
  - o There shall be no buildings or structures constructed within excess storm water passage or within the elevation of the flood of record. Parking lots, playgrounds and park areas, which shall not impair or endanger the water holding capability of a development, shall be considered compatible uses.
  - o Appropriate land planning shall be undertaken to preserve the existing natural drainage of a proposed development as part of the excess storm water passage.
  - o Open channels shall be protected from erosion by appropriate vegetative cover, lining or other treatment and earthen channel side slopes shall be no steeper than three to one (3:1). Open Channels with lining shall have a maximum gradient on side slopes of 67% and channel side slopes steeper than 67% shall be designed as structural retaining walls.
- Stormwater storage/detention areas – The increased storm water runoff resulting from the proposed development may be accommodated by the provisions of appropriate detention facilities. Storage areas shall be designed to the satisfaction of the City Engineer and if possible provide secondary purposes for recreation, open spaces, parking lot or other types of use that will not be adversely affected by intermittent flooding. The following shall govern the design of detention facilities:

### Storage Volume:

- o The detention facility must be designed for periodic maintenance and energy dissipaters shall be provided at points necessary.
- o The ponding of stormwater runoff shall not exceed 12 inches in parking lot areas. Where these areas are used for ponding the maximum depth should occur in the most remote and least used areas.
- o The drainage and grading design shall be prepared to insure that in a 100 year storm the depth of water runoff in any street, alley or pedestrian area will not exceed the level of the first floor of any building. The finish floor elevation shall be set two (2) feet above the 100 year flood elevation for all new development and the minimum finished floor elevations for homes shall be stated on the record plat.
- o For wet pond storage areas when calculating the storage capacity, only the volume available to store excess storm water shall be considered. Permanent water storage does not constitute control of excess storm runoff.

### Release Rate:

- o At no time during the design storm shall the storm water runoff release rate exceed the allowable release rate as forth in the release rate requirements.
- o Detention basins shall be fully discharged within 36 hours after the storm event

### Release Velocity:

- o Detention facilities shall release stormwater at a non-erosive velocity. The protected channel receiving the detention discharge shall incorporate features to reduce velocity to non-erosive levels at the point where such discharge enters the unprotected channel. If release into a subsurface conduit the energy gradient in the receiving facility shall not be increased beyond the slope of the conduit.

### Spillway:

- o Overflow for each storm water storage area shall be provided in the event a storm in excess of the design capacity occurs.
- o Emergency spillways shall be sized to accommodate a flow equal to the design overflow of the 100 year storm post development discharge without overtopping the dam. The spillway dimensions shall be clearly dimensioned and protected from erosion.



Dam:

- o Detention facilities shall have adequate capacity to contain storage volume of tributary storm water runoff with at least one foot of freeboard above the water surface of flow in the emergency spillway in a 100 year storm or as required by state law.
  - o The dam slopes shall not exceed three to one (3:1) on the interior of the pond. The minimum width of the top of the dam shall be two (2) feet, and the back side of the dam shall not exceed a slope of two to one (2:1).
  - o The top of the dam shall be at least one foot below the lowest opening of any structure adjacent to and upstream of the dam.
  - o Discharge control structures shall be multi-stage and capable of limiting the 2, 10, 25 and 100 year post development discharges to predevelopment peak discharge rates or downstream system capacity.
  - o The basin outlet pipe must be placed no closer than 15 ft from an adjacent property line.
- .Retention basins shall be designed for the 3-hour 100-year storm. Computed high water elevation shall be recorded on the subdivision map. In areas where a proposed basin is connected with an existing basin, the recorded high water elevation shall be maintained.

**2.5.2 Stormwater Quantity Management Performance Standards**

Storm water channel location. Generally acceptable locations of storm water channels in the design of a subdivision may include but are not limited to the following:

- a) Adjacent to roadways
- b) In a depressed median of a divided roadway, provided the median is wide enough to permit slopes of one foot drop in six feet horizontal or flatter.
- c) Centered on lot lines or entirely within the rear yards of a single row of lots or parcels
- d) In each of the forgoing cases, a drainage easement with sufficient width to facilitate maintenance and design flow shall be provided and shown on the plat.

Storm Sewer Outfall. The storm sewer outfall shall be designed to provide adequate protection against downstream erosion and scouring.

Lot Lines. Whenever the plans call for the passage and/or storage of storm water runoff along lot lines, the grading of all such lots shall be prescribed and established for the passage and/or storage of waters, and no structure or vegetation which would obstruct the flow of storm water shall be allowed, nor shall any change be made to the prescribed grades and contours of the specified storm water channels.

Manholes. All utility sewer manholes constructed in an area designed for the storage or passage of storm water, shall be provided with either a watertight manhole cover or be constructed with a rim elevation of a minimum of one foot above the high water elevation of the design storm.

Easements. Permanent easements for the detention and conveyance of storm water, including easements of access to structures and facilities, shall be dedicated to the city.

Obstruction of drainage. The keeping or disposal of grass clippings, trash debris, obstructions or unwanted materials into the storm sewers or within or along storm water channels or in adjacent flood plain areas which may wash into sewers and channels is prohibited.

Maintenance. Required maintenance for detention basins or other structures shall be permanently provided by the developer with responsibility becoming that of the private landowner after complete development, subject to inspection of the City Engineer. Every detention basin or structure shall be legally defined on both deed and plat and the maintenance entity shall be specified.



### 2.5.3 Stormwater Quality Program Rationale

Land development projects and associated increases in impervious cover alter the hydrologic response of local watersheds and increase stormwater runoff rates and volumes, flooding, stream channel erosion, and sediment transport and deposition; Stormwater runoff contributes to increased quantities of water-borne pollutants. Stormwater runoff, soil erosion and nonpoint source pollution can be controlled and minimized through the regulations of stormwater runoff from development sites. The goal is to maintain or improve the quality of all streams within the MS4 boundaries and corporate limits, to meet their designated use.

In developing the post construction stormwater quality program, the City considered numerous factors related to the environment and the type of development common to the City of Shelbyville. It is the City's goal to protect surface and shallow subsurface drainages while minimizing flooding and maintenance needs. To that end, the City's post construction stormwater quality program has been built on the following premises:

1. The Kentucky Division of Water's 2010 Integrated Report, 305 (b) addressed the waters in the City of Shelbyville MS4 Community. Clear Creek is listed as having Impaired use of Aquatic Life (nonsupport) with pollutants of concern being sedimentation/siltation; organic enrichment (sewage) biological indicators; nutrient/Eutrophication Biological indicators with suspected sources of Livestock (grazing or feeding operation); crop production (crop land or dry land) and unspecified Urban Stormwater. No TMDL's have been developed but one is currently under development within the City of Shelbyville MS4 Community for Clear Creek into Bullskin from river mile 0.0 to 11.0.
2. The City must develop a locally derived water-quality treatment standard that states the water quality of stormwater produced from the 80<sup>th</sup> percentile rain event shall be addressed with best management measures that are built and maintained to treat, filter, flocculate, infiltrate, screen, evapo-transpire, harvest, and reuse stormwater runoff, or otherwise manage the runoff for all new and redeveloped sites. (The 80% rain event is based on past rainfall data and will continually change with future rain events, however it is not anticipated to vary drastically from one year to another.)
3. BMP's shall be designed to remove pollutants and reduce runoff volume. The designated use and any existing in-stream use of the stream being discharged to shall be protected. Some land uses produce higher concentrations of certain pollutants such as hydrocarbons or heavy metals, than those normally found in urban areas. These areas will be reviewed for effective removal of the particular pollutant which they discharge. Effective removal will be that which existed prior to development.
4. The City determined that the stormwater quality treatment goal of 80% TSS removal of the average annual post-development pollutant load constitutes MEP.
5. Low impact development principles are encouraged.
6. Multi-purpose BMPs are encouraged. For example, bioretention facilities can serve landscaping and stormwater quality treatment requirements, and stormwater detention facilities can be included in a treatment train to meet both stormwater quantity and quality requirements.

### 2.5.4 Stormwater Quality Management Plan

A Stormwater Quality Management Plan (SWQMP) shall be required for any new single-family residential developments having a gross aggregate area, including roads, utility right-of-way, and any other dedicated lands of five or more acres, and having a density of greater than one dwelling unit per acre or for any new commercial, multi-family residential, industrial, institutional, or utility development having a gross aggregate area of 0.5 acres or more. A plan shall also be required for any new development or redevelopment of fully developed areas.



A SWQMP may be required for the following:

- a) Any grading or excavation which would fill, obstruct, or otherwise alter any creek, storm water channel, or drainage facility.

#### **2.5.5 Stormwater Quality Management Plan Submittal Requirements**

The required Storm Water Quality Management plan shall contain, but not be limited to, the following information unless specifically excluded by the City Engineer.

- a) Total area of the site and total area of disturbance
- b) A topographic map of the project site and adjacent areas, of suitable scale and contour interval, which shall define the location of streams, the extent of flood plains and calculated high water elevations, the shoreline of lakes, ponds, swamps and detention basins including their inflow and outflow structures, if any.
- c) The location and flow line elevation of all existing sanitary or storm sewers.
- d) Detailed determination of runoff anticipated for the entire project site following development indicating design volumes and rates of proposed runoff for each portion of the watershed tributary to the storm drainage system, the calculations used to determine said runoff volumes and rates and restatement of the criteria which have been used by the project engineer throughout the calculations.
- e) A layout of the proposed storm water management system including the location and size of all drainage structures, storm sewers, channels and channel sections, detention basins, and analyses regarding the effect said improvements will have upon the receiving channel and its high water elevation.
- f) The slope, type and size of all existing and proposed storm sewers and other waterways impacting or impacted by the proposed development on the site.
- g) For all detention basins, a plot or tabulation of storage volumes with corresponding water surface elevations and of the basin outflow rates for those water surface elevations.
- h) For all detention basins, design hydrographs of inflow and outflow for the 2-year, 10-year 25-year and 100-year, 24 hour events for the site under existing and developed conditions.
- i) A profile and one or more cross sections of all existing and proposed channels or other open drainage facilities, showing existing conditions and the proposed changes thereto, together with the high water elevations expected from storm water runoff under the controlled conditions called by these regulations and the relationship of structures, streets, and other utilities to such channels.

#### **2.5.6 As-Built Certifications and Inspections**

In an effort to ensure that water quality management plans approved by the City are installed and maintained per the approved plans, the City requires certifications of the correct initial installation of BMPs, referred to as as-built certifications, as well as an annual certification of ongoing maintenance and operation of each BMP. This section describes the as-built certification requirements.



Prior to obtaining a Bond Release, two (2) complete copies of as-built drawings with the appropriate professional certifications must be provided to the City of Shelbyville for approval. The as-built drawings will be compared to the approved stormwater management plan for any irregularities or non-conformance with the approved plans. The as-built drawings must reflect the "as-constructed" condition of the development, and must include sufficient information to demonstrate conformance with the approved stormwater management plan. The City has the authority to request the submittal of additional information with the as-built plan as necessary to allow a thorough review of the as-constructed conditions. Omission of any required items shall render the plans incomplete, and they will be returned to the applicant, or their engineer, so that they may be completed. As-built certification checklists are provided in Appendix G and must be completed and submitted with the as-built certification.

As-Built Certifications must include sufficient design information to show that stormwater BMPs will operate as approved. This must include the existing (or before site development) peak flow discharges, the after site development peak flow discharges, and/or volumes of stormwater runoff based on the proposed site development, as well as all necessary computations used to determine the reduced peak flow rates for the design storms.

Plats, easements and BMP locations shown in the Operations and Maintenance Plan must be field checked by the property owner or developer prior to submitting the as-built certification to ensure that the field locations are approximately correct. A copy of the recorded Operations and Maintenance Plan must be submitted with the as-built certification. Information required in the Operations and Maintenance Plan can be found in Appendix H.

#### **2.5.7 Bonds for Stormwater Management BMPs**

The purpose of a bond is to ensure that the person(s) responsible for completing the land disturbing activities and/or construction work consistent with the design plans of the City's or County's standards. The bond provides assurance that the City will be reimbursed if it must assume the costs of corrective measures and/or work not completed by the responsible person(s) according to the required specifications and approved plans.

Prior to the release of a bond, an As-Built Certification (see Appendix G) must be provided to the City, showing that all drainage structures or facilities, facility volumes, sizes, slopes, locations, elevations, and hydraulic structures related to the stormwater management BMPs have been field verified, represent the as-built field conditions, and comply with the approved stormwater quality management plan(s). Features such as roadway lines, grades, cross slopes, locations, contours, and elevations should be provided to verify approved plans as required by the City of Shelbyville.

#### **2.5.8 Operation and Maintenance Plan**

All new developments with privately owned and operated stormwater BMPs must have an Operation and Maintenance (O&M) Plan recorded with the property. The Plan must contain enough information to locate the BMPs and perform inspections to document the functionality of the BMP perpetually. This information must then be recorded with the Shelby County Clerk's Office and track with the property so future property owners will be made aware of the locations of the BMPs and the requirement to perform inspections. The City will record the O&M plan after collecting the recording fee.

A draft final O&M Plan must be submitted with the construction plans for review. Once the plans are finalized and approved by the City and the BMPs constructed, an as-built certification must be completed. The O&M Plan must be recorded and submitted with the as-built certification.

The O&M Plan for a site with privately maintained BMPs contains the following elements:

1. An Inspection and Maintenance Agreement signed by the developer or BMP owner. This agreement states that the owner is responsible for maintaining the BMP perpetually and performing inspections.
2. A BMP location map clearly indicating the locations of all stormwater BMPs, drainage easements, access easements, roadways, and stormwater system components as they relate to the stormwater BMPs.
3. Schematics for each BMP. The schematics should be detailed enough to allow for future inspections of the BMP(s) and stormwater system. If more than one BMP is on the project site, schematics of each BMP must be provided.



4. Inspection and maintenance templates for each type of BMP or approved equivalent. For manufactured BMPs, the template must have maintenance items filled out in the template prior to submission to the City.
5. Annual BMP report template or approved equivalent. The form must be used by the BMP owner for the annual inspection of the BMP(s).

Templates and examples of these components can be found in Appendix H. All components must be included in the O&M Plan that is recorded with the Shelby County Clerk's Office.

The City's NPDES Phase II permit (KYG20) requires the City to ensure that permanent water quality BMPs are maintained perpetually.

## 2.6 Stormwater Quality Treatment

All types of development must provide treatment of the water quality volume.

### 2.6.1 Structural Stormwater Quality Treatment Design

Stormwater quality treatment for Shelbyville is defined as a goal of 80% total suspended solids (TSS) removal of the average annual post-development load. All stormwater BMPs shall be designed in a manner to minimize the need for maintenance and reduce the chances of failure, while maintaining the required function. The City's stormwater quality program requires new development and redevelopment to treat the runoff from up to the 80<sup>th</sup> percentile rain event in Shelbyville to a load reduction goal of 80% of the average annual post-development total suspended solids (TSS) based upon data in the Nationwide Urban Runoff Program. Treatment may be achieved using a single treatment method, such as a wet pond, or by using a treatment train. A treatment train achieves 80% removal of TSS using a combination of pretreatment and/or treatment methods.

It is presumed that a stormwater management system complies with this performance standard if:

- It is sized to capture and treat the prescribed water quality treatment volume, which is defined as the runoff volume resulting from the first 0.6 inches of rainfall from a site (see Equation 1).
- Appropriate structural stormwater controls are selected, designed, constructed, and maintained according to the specific criteria in this Manual to provide an 80% TSS removal of the average annual post-development load.
- Runoff from hotspot land uses and activities is adequately treated and addressed through the use of appropriate pre-treatment stormwater controls and pollution prevention practices.

Permanent BMPs should be proposed by the developer early in the planning stage of a project. For most projects, there will be no single BMP which addresses all the long-term stormwater quality problems. Instead, a multi-level strategy will be worked out which incorporates source controls, a series of on-site treatment controls, and community-wide treatment controls.

The Water Quality Volume (WQv) equation, which forms the foundation of the City's stormwater quality management program, establishes the volume that must be treated. The WQv is storage required to capture and treat stormwater runoff from 80% of the average annual rainfall, which is considered the "first flush". The 80<sup>th</sup> percentile storm event in Shelbyville is 0.6 inches. All storms greater than 0.6 inches must be routed non-erosively through the water quality treatment device or routed around it. The following equation shows that this value is equal to the product of precipitation, volumetric runoff coefficient and site area, divided by twelve.



Equation 1 Water Quality Volume Calculation

$$WQV = [P Rv](A)/12$$

Where,

*P* is the average rainfall in inches, (in the case of Shelbyville, is 0.6 inches);

*Rv* is the volumetric runoff coefficient, which is:

$Rv = 0.05 + 0.009(I)$ , where *I* is the percent impervious cover; and

*A* = the area in square feet

In the equation above, *I* is based upon the percent impervious cover proposed for the area to be disturbed, and *A* is the total area to be disturbed.

### 2.6.2 *Choosing the Right Permanent Treatment Practice (PTP)*

Table 2.6-1 is an “at-a-glance” table of all of the Permanent Treatment Practices found in Section 3. Use Table 2.6-1 for initial screening of potential measures based upon site constraints such as drainage area, landuse, pollutant removal needed, long term maintenance requirements, and surface area available. Once potential measures have been identified for a site, the design sheets in Section 3 outline detailed design criteria.

The designer may also refer to and use the Louisville and Jefferson County Metropolitan Sewer District (MSD) Green Infrastructure Design Manual –“Green Management Practices and Design Strategies to Manage Stormwater in our Community” for a detailed design criteria.





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Table 2.6-1 At-A-Glance Permanent Treatment Practices Decision Matrix

Structural BMP Category	BMP Type	Stormwater Treatment		Water Quality Performance			Implementation Considerations			
		Water Quality	Water Quantity	TSS/Sediment Removal Rate	Hotspot Application	Drainage Area (ac)	Residential	Commercial / Industrial	Unit Cost	Maintenance Burden
Filtration Systems	Surface Sand Filter	✓		80	✓	≤10		✓	Moderate	Moderate to High
	Underground Sand Filter	✓			✓	≤5		✓		
	Perimeter Sand Filter	✓			✓	≤2		✓		
	Organic Sand Filter	✓				≤5		✓		
	Pocket Sand Filter	✓			✓	≤5		✓		
	Bioretention	✓				≤5	✓	✓	Low	
Open Channel System	Dry Swale	✓		90		≤5	✓	✓	Moderate	Low
	Wet Swale	✓		75		≤5		✓		
Stormwater Ponds	Micropool Extended Detention Pond	✓	✓	80		≥10	✓	✓	Low	Low
	Wet Pond	✓	✓			≥25	✓	✓		
	Wet Extended Detention Pond	✓	✓			≥25	✓	✓		
	Multiple Pond System	✓	✓			≥25	✓	✓		
	Pocket Pond	✓	✓			≥25	✓	✓		
Stormwater Wetlands	Shallow Wetland	✓		75		≥25	✓	✓	Moderate	Moderate to High
	Extended Detention Shallow Wetland	✓				≥25	✓	✓		
	Pond/Wetland System	✓				≥25	✓	✓		
	Pocket Wetland	✓				5-10	✓	✓		
Infiltration Systems <sup>1</sup>	Infiltration Trench	✓		90		≤5	✓	✓	Moderate to High	Moderate
	Infiltration Basin	✓						✓		
Water Quality Units	Hydrodynamic Separators	✓		TBD <sup>2</sup>	✓	Minimal		✓	Moderate	Moderate to High
	Filtration	✓			✓			✓		
	Continuous Deflection	✓			✓			✓		
Grease Management					✓			✓	Low	High
Extended Detention/Retention Dry Basins	Detention Basin with Gravity Outfall	✓	✓	60		≤75	✓	✓	Low	Low
	Retention Basin with Drywell Outfall	✓	✓					✓		
Oil & Grease/Water Separator				40	✓			✓	Low	Moderate

Notes: 2) To be determined based upon City-approved testing



### 2.6.3 Weighted total suspended solids reduction

The City's stormwater quality management program is designed to give the developer flexibility in meeting the 80% TSS reduction goal on each site. The BMPs identified in Section 3 of this manual as Permanent Treatment Practices (PTPs) give the developer options to meet the water quality requirements in numerous ways. Calculations to verify the TSS reduction for each site are provided below.

The percent TSS removal (%TSS) that is achieved on a site can be calculated using the equation below. This equation is an area-weighted TSS reduction equation which accounts for the TSS reduction that is contributed from each stormwater treatment BMP that is utilized on the site.

Equation 2 Weighted TSS Reduction

$$\%TSS = \frac{\sum_n^1 (TSS_1 A_1 + TSS_2 A_2 + \dots + TSS_n A_n)}{\sum_n^1 (A_1 + A_2 + \dots + A_n)}$$

where:

$TSS_n$  = TSS removal percentage for each structural BMP located on-site (%);  
 $A_n$  = the area draining to each BMP (acres).

An example calculation of weighted TSS reduction on a project is provided below.

#### Example 1: Weighted TSS reduction example: Wetland and Dry Detention

A 20 acre site is divided into 2 subwatersheds: Subwatershed 1 has 12 acres and contains a constructed wetland for stormwater quality treatment. Subwatershed 2 has 8 acres and contains a dry detention facility. What is the %TSS reduction?

TSS reductions from Table 2.6-1:

Wetland = 75%

Dry detention = 60%

Step 1: Calculate % TSS removal for the site:

$$\%TSS = ((TSS_{dry} \times 8 \text{ acres}) + (\%TSS_{wetland} \times 12 \text{ acres})) \div 20 \text{ acres}$$

$$\%TSS = ((60\% \times 8 \text{ acres}) + (75\% \times 12 \text{ acres})) \div 20 \text{ acres} = 69\%$$

Therefore, the % TSS removal for the site is 69%. Additional BMPs must be constructed at the site to bring the TSS removal to 80%.

When two or more BMPs are used in series (stormwater discharges from one BMP into another), a different calculation is necessary. This scenario is called a **treatment train**. Stormwater discharging from the upper most BMP will be considerably "cleaner" than the influent, meaning TSS particle sizes will be much smaller. Pollutant removal rates for BMPs used in a treatment train are not additive. For pollutants in particulate form, such as TSS, the actual removal rate (expressed in terms of percentage of pollution removed) varies directly with the pollution concentration and sediment size distribution of runoff entering a facility. For example, a stormwater treatment pond will have a much higher pollutant removal percentage for very turbid runoff



than for relatively clear water. When two stormwater ponds are placed in series, the downstream pond will treat an incoming TSS load that is very different from the upstream pond. The upstream pond easily captures the larger solids, and discharges an outflow that has a lower concentration of TSS, but with a relatively higher proportion of fine particle sizes. Therefore, further TSS reduction will be difficult for the second and subsequent BMPs. Hence, the TSS removal capability of the downstream pond is considerably less than the upstream pond. Recent studies suggest that the downstream pond in a series can provide as little as half the removal efficiency of the upstream pond.

Note that manufactured treatment devices such as oil water separators and hydrodynamic units must be a first treatment BMP when used in a treatment train design. These units are most effective at capturing gross solids.

To calculate the total % TSS removal for a treatment train comprised of two or more structural BMPs, the following equation should be used.

**Equation 3 Treatment Train Calculation**

$$TSS_{train} = A + B - \frac{(A \times B)}{100}$$

where:

- TSS<sub>train</sub> = total TSS removal for treatment train (%)
- A = % TSS removal of the first (upstream) BMP, from Table 2.6-1 (%)
- B = % TSS removal of the second (downstream) BMP, from Table 2.6-1 (%)

For development sites where the treatment train provides the only stormwater treatment on the site, TSS<sub>train</sub> must be greater than or equal to 80%. For development sites that have other structural BMPs for stormwater treatment that are not included in the treatment train, TSS<sub>train</sub> must be included in Equation 2 in the calculation of the overall % TSS removal for the site. An example application of the latter situation is presented below.

**Example 2: Treatment Train Example: Wetland, Dry Pond, Bioretention**

A 20 acre site is divided into 2 subwatersheds: Subwatershed 1 has 12 acres and contains a constructed wetland for stormwater quality treatment. Subwatershed 2 has 8 acres and contains a bioretention area that discharges into a dry detention facility. What is the %TSS reduction?

TSS reductions per Table 2.6-1:

Control A (wetland) = 75%

Control B (bioretention) = 80%

Control C (dry detention) = 60%

Controls B and C are part of a treatment train.

Step 1: Calculate TSS<sub>train</sub>:

$$TSS_{train} = B + C - (B \times C)/100 = 80 + 60 - (80 \times 60)/100 = 92\% \text{ removal}$$

Step 2: Calculate % TSS removal for the site:

$$\%TSS = ((TSS_{train} \times 8 \text{ acres}) + (\%TSS_{wetland} \times 12 \text{ acres})) \div 20 \text{ acres}$$

$$\%TSS = ((92\% \times 8 \text{ acres}) + (75\% \times 12 \text{ acres})) \div 20 \text{ acres} = 82\%$$

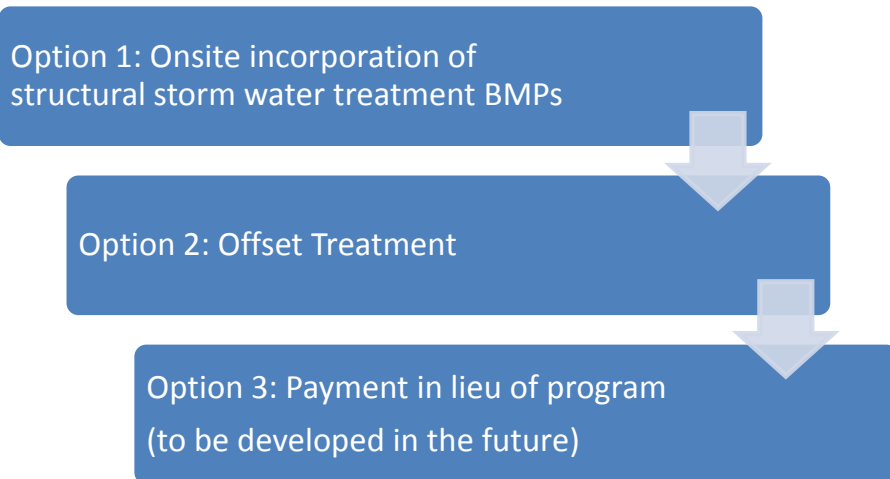
Therefore, the % TSS removal for the site is 82%. No other BMPs need to be constructed at the site.



**2.6.4 Redevelopment stormwater quality treatment strategies.**

Redevelopment projects in highly urbanized, built-out environments are desirable and encouraged forms of development, in that redevelopment projects typically do not need new infrastructure such as roadways to be constructed, reduce urban sprawl, and keep the overall imperviousness of a watershed the same. For the purposes of the Stormwater Quality Treatment Program, "redevelopment" is defined as any new construction on a site that has a pre-existing use on it. The preferred stormwater quality treatment strategies are outlined in Figure 2.6-1 below, in a prioritized order.

Figure 2.6-1 Stormwater Quality Treatment Strategy Steps



These strategies are described below.

***Option 1: Onsite incorporation of structural stormwater treatment BMPs.***

Structural stormwater quality treatment BMPs (PTPs) include bioretention, wet ponds, dry/wet swales and other practices as outlined in Section 3. These types of practices typically require some amount of surface land area for treatment, unless the system is a manufactured underground system. The WQv calculation in section 2.6.1 shall apply. Where a site has significant constraints such as limited surface area, setbacks, etc., option 2 or 3 (when developed) may be chosen for treating water quality.

***Option 2: Offset treatment.***

In the 2010 KYG20 Phase 2 MS4 Permit, KDOW included an allowance for developers to provide offset treatment where onsite treatment isn't feasible. The language from the permit is as follows:

*The off-site mitigation option entails infiltration/evapotranspiration/reuse measures that may be implemented at another location in the same sewershed/watershed as the original project, approved by the permittee(s). The permittee shall identify priority areas within the sewershed or watershed in which mitigation projects can be completed.*

The City of Shelbyville acknowledges the benefits of and need for pollutant trading credits, mitigation and/or offsets. Pollutant trading or offset isn't a new concept, as it has been applied to point source dischargers, specifically wastewater treatment facilities, for many years. Typically, trading or offsets occur within watersheds where a TMDL has been approved. However, the same approach for pollutant trading applied to TMDL watersheds can be applied to non-TMDL watersheds. The following section outlines the City's policy on pollutant offsets for new development or redevelopment. This policy is consistent with EPA's policy on water quality trading.



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Redevelopment typically occurs in highly urbanized areas, where surface area for treatment of the  $WQ_v$  is typically minimal or non-existent. In such areas where the developer can demonstrate the site limitations cause the first option to be impractical or infeasible, the City Engineer has the ability to approve on a case-by-case basis pollutant treatment offsets. Pollutant treatment offset is defined as providing water quality ( $WQ_v$ ) treatment adjacent to the existing redevelopment site such that, from a water quality perspective, there is no net gain of new impervious surfaces or TSS discharges. Note that the preference for water quality treatment is onsite treatment. The following factors will be considered when reviewing applications including pollutant treatment offsets:

1. The engineer and/or developer must provide an alternatives analysis that demonstrates the site constraints that make the onsite treatment of water quality impractical or infeasible. While the economic feasibility of onsite treatment versus offsite treatment can be considered, it cannot be the only constraint identified for treatment onsite.
2. The preferred pollutant treatment offset is to provide treatment of an equivalent amount of impervious surface on land contiguous to **and** within the same subwatershed of the redevelopment project.
3. Pollutant treatment offsets must occur within the same subwatershed as the location of the redevelopment site.
4. The pollutant treatment offset BMP must be located within a drainage easement, with access from a public right-of-way. An Operation and Maintenance Plan (O&M Plan) must be submitted to and approved by the City. In addition, the O&M Plan must be recorded with the deed for the offset treatment BMP. The City will not assume ownership of the offset BMP.
5. For pollutant treatment offsets providing treatment of impervious surfaces located contiguous to the development site and within the same subwatershed, the offset  $WQ_v$  treatment shall be 1:1.
6. Pollutant offset treatment is NOT allowable for new subdivisions of land, residential or non-residential.
7. Pollutant offset treatment is NOT allowable when areas on the development site are available, either above ground or below ground, to provide full treatment of the required  $WQ_v$ .

### **2.6.5 Hot Spot Landuse Treatment Requirements**

In addition to the treatment standards noted above, the City requires post construction stormwater management BMPs for “hot spot” locations. “Hot spot” landuses include the following:

**Table 2- 1 Hot Spot Landuse Treatment Recommendations**

<b>Landuse</b>
Automotive fueling
Automotive repair facilities
Vehicle washing/stream cleaning facilities
Auto recycling facilities
Restaurants with outside grease collection and disposal areas
Outdoor material storage areas
Loading and transfer areas
Landfills
Industrial sites
Other landuses as determined to have a high potential of pollutant discharge into the MS4 as determined by the City Engineer

Hot spot BMPs shall be designed to remove targeted pollutants based on land use and typical pollutant for the land use. This hot spot landuse treatment requirement is in addition to the 80% TSS reduction goal established for all new development. For



example, automotive fueling facilities are likely to have higher than normal loads of petroleum products, and the appropriate hot spot treatment device would likely be an oil/water separator in addition to other PTPs installed to meet the 80% TSS treatment goal. Most hot spot landuse treatment BMPs are pre-treatment devices, designed to remove gross solids, floatables and oils and grease. A 50% TSS reduction can be assigned to pre-treatment devices and included in the site's overall treatment train.

## 2.7 Approval and Design of Proprietary Stormwater Treatment Devices

The standard PTPs included in Chapter 3 of this manual are non-proprietary BMPs and can be designed to meet the water quality treatment design. The City of Shelbyville allows the use of other types of PTPs, though the approval and review process is more rigorous. Many proprietary treatment devices are designed based upon a peak flow rate as opposed to a volume of treatment. Non-proprietary treatment devices, such as detention ponds, bioretention, and wetlands, are designed based upon a treatment volume (for stormwater quality treatment) and peak flow (for flow attention). Therefore, a slightly different design approach is necessary for proprietary treatment devices. In addition, pollutant reduction rates are significantly impacted by the design flow rate.

### 2.7.1 Approval of Manufactured Treatment Devices

All treatment devices designed for stormwater quality or quantity treatment in the City of Shelbyville must be approved by the City Engineer prior to installing them. Many manufactured stormwater treatment devices are available to treat stormwater runoff. However, some of these BMPs do not have established pollutant removal data based on standardized testing methods. The City of Shelbyville considers proprietary BMPs as **Limited Application BMPs** because of a lack of historic pollutant removal data or because of high maintenance requirements.

Proprietary devices must be approved before they can be considered for use in the City of Shelbyville. Manufacturers' claims for BMP performance must be verified through data that is obtained in independent third party testing.

The City of Shelbyville recognizes two levels of treatments:

1. Pretreatment. Pretreatment devices do not meet the full 80% TSS reduction goal; however, they can be used in a treatment train approach with other BMPs to fully meet the treatment goal. In addition, pretreatment BMPs are required for hot spot landuse applications, as described in Section 2.6.5.
2. Full Treatment. Manufactured treatment devices that show through testing that they meet the full 80% TSS reduction goal are considered full treatment devices. If the manufactured treatment device is a flow-based device, the peak flow rate for the TSS reduction must be provided and cannot be exceeded in the design.

### 2.7.2 Design of Manufactured Treatment Devices

As noted above, most manufactured treatment devices are flow based devices. Applying the WQv equation (see Equation 1) is therefore not possible. The City developed the following design tools for use in sizing manufactured treatment devices. This design methodology is considered to provide an equivalent treatment as the treatment provided with the WQv methodology.

Most proprietary BMPs are flow based BMPs and rated for TSS removal based upon a specified flow rate. The WQv equation, which forms the foundation of Shelbyville's stormwater quality program, establishes a volume that must be treated. In an effort to simulate the WQv approach for proprietary BMPs, the following peak flow design equation must be used to develop the stormwater quality treatment required.



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Equation 4 Manufactured Device Stormwater Quality Design

$$Q_p = C * I * A$$

Where:

$Q_p$  = the peak flow through the proprietary BMP in cfs

$C$  = runoff coefficient

$I$  = rainfall intensity

$A$  = the contributing drainage area for the BMP, in acres