REGULATIONS AND SPECIFICATIONS PERTAINING TO ROADWAY & DRAINAGE DESIGN

CITY OF SOMERSET, KENTUCKY

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1.0 GENERAL INTRODUCTION:

The purpose of this manual is for use in the design, construction, and maintenance of streets and roadways in the City of Somerset. The manual draws upon and references the accepted Subdivisions of the City, the zoning ordinances, and nationally recognized standards.

This manual is intended to be used by the City of Somerset, Engineers doing work in the City, Developers, and contractors.

1.1 DEFINITIONS:

To ensure equivalent use and interpretation the terms and definitions are drawn from common use from the Kentucky Department of Highways (KYDOH) and the City Subdivision Regulations. Should a word or phrase be not specifically defined in this section, or in the terms and definitions of the KYDOH, or other referenced engineering standards, then it shall be assumed that the standard English definitions shall apply.

For brevity, definitions currently defined in the City Subdivision Regulations shall not be repeated.

AUTHORIZED ENFORCEMENT AGENCY: Employees or designees of the director of the municipal agency designated to enforce this chapter.

BASE COURSE. The base course is the layer, or layers, of a specified material of designed thickness placed on the granular base. In the case of an asphalt pavement, the base course further serves as a foundation course to support the surface course. In the case of a Portland cement pavement, there is only one course of pavement material and the base course and surface course are one and the same.

BEST MANAGEMENT PRACTICES (BMPs). Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures and other management practices to prevent or reduce the discharge pollutants directly or indirectly to stormwater, receiving waters or stormwater conveyance systems. BMPs also include treatment practices, operating procedures and practices to control site runoff spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

CLEAN WATER ACT: The federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.), and any subsequent amendments thereto.

CONSTRUCTION ACTIVITY: Activities subject to NPDES construction permits. These include construction projects resulting in land disturbance of 1 acre or more. These activities include but are not limited to clearing and grubbing, grading, excavating and demolition. Farming activities are not included as CONSTRUCTION ACTIVITY.

GRANULAR BASE: Constructed on top of the subgrade. It consists of granular material such as crushed stone or gravel. The specifications for the granular base are more rigorous than that for the subgrade in terms of strength, hardness, gradation, and aggregate types. The granular base layer is placed on the subgrade to support an asphalt base course or a Portland cement slab.

MODIFIED SUBGRADE: Layer designed to augment the subgrade strength. This layer is only used when subgrade strength is below a particular level. It consists of chemically altered or compacted subgrade materials, often in combination to achieve certain strength characteristics required in specific conditions. Additionally, modified subgrade acts to reduce frost and water intrusion actions.

PAVEMENT: Pavement refers to the materials used to cover the ground surface along roadways. It is a combination of granular base, base course, and surface course placed on a subgrade to support the traffic load and distribute the load to the roadbed.

Pavement (Asphalt): A flexible pavement structure consisting of mineral aggregates bound together with asphalt material. The structure maintains intimate contact with and distributes loads to the subgrade and depends on aggregate interlock, particle friction, and cohesion for stability.

Pavement (Concrete Slab): A rigid pavement structure that distributes loads to the subgrade. The pavement consists of one course of Portland cement in a concrete slab. This slab has relatively high bending resistance

STORM DRAINAGE SYSTEM: Publicly-owned facilities by which stormwater is collected and/or conveyed, including but not limited to any roads with drainage systems, municipal streets, gutters, curbs, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and human-made or altered drainage channels, reservoirs and other drainage structures.

STORMWATER: Any surface flow, runoff and drainage consisting entirely of water from any form of natural precipitation, and resulting from the precipitation.

STORMWATER POLLUTION PREVENTION PLAN: A document which describes the best management practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to stormwater, stormwater conveyance systems and/or receiving waters to the maximum extent practicable.

SUBGRADE: The natural soil material upon which the upper roadway layers are constructed.

SURFACE COURSE: The purpose of the surface course is to accommodate the traffic load, provide a smooth riding surface, resist the wear and tear from traffic, provide skid resistance to vehicles, and prevent excessive water from penetrating into the base course. In the case of asphalt pavement, the surface course of the pavement section consists of a mixture of mineral aggregates and asphalt materials. In the case of a Portland cement pavement, there is only one course of pavement material and the base course and surface course are one and the same.

WASTEWATER: Any water or other liquid, other than uncontaminated stormwater, discharged from a facility.

1.2 PERMITS:

This manual shall be used in conjunction with all pertinent federal, state, and local permitting requirements and laws. This manual in no way replaces or supersedes any federal, state, and local permitting requirements and laws. The latest referenced standards, permits, laws, and ordinances shall apply.

1.3 DRAWINGS AND SPECIFICATIONS:

References to typical drawings, specifications are in reference to the KYDOH standard drawings, the City of Somerset Standard Drawings, the KYDOH specifications, and the City of Somerset Specifications. When an apparent discrepancy or conflict occurs, the more stringent of the two shall apply.

1.4 REFERENCES:

The following Technical documents were used in reference in the development of this document, which is designed specifically for use in the City of Somerset:

AASHTO, A Policy on Geometric Design of Highways and Streets. “The Green Book.”

American Association of State Highway and Transportation Officials (AASHTO), Washington, DC, 1994 (metric) and 1990 (English units).

AASHTO, Guide for Design of Pavement Structures. American Association of State Highway and Transportation Officials (AASHTO), Washington, DC, 1993.

Complete Stormwater Best Management Practices, City of Somerset, December 2007

KYDOH. Division of Design Guidance Manual. Kentucky Transportation Cabinet Department of Highways, Frankfort, Kentucky.

KYDOH. Division of Traffic Guidance Manual. Kentucky Transportation Cabinet Department of Highways, Frankfort, Kentucky.

KYDOH. Standard Drawings. Kentucky Transportation Cabinet Department of Highways, Frankfort, Kentucky.

KYDOH. Standard Specifications for Road and Bridge Construction, 1994 Manual on Uniform Traffic Control Devices (MUTCD), U.S. Department of Transportation, Federal Highway Administration, 2009

MSD Design Manual, Louisville and Jefferson County, Metropolitan Sewer District, Effective date November 1, 2002

Roadway Manual, Lexington Fayette Urban County Government, Lexington, KY, January 1, 2005

Roadway Manual, City of Georgetown, 2002

Storm Water Management Ordinance, City of Somerset, February, 2005

Stormwater Manual, City of Georgetown, 2002

Subdivision Regulations, City of Somerset, July 2000.

Urban Drainage Design Manual, Third Edition, U.S Department of Transportation, Federal Highway Administration, 2009

Zoning Ordinance, City of Somerset

2.0 STREET STANDARDS:

Proposed streets and roadways shall conform to the City of Somerset standards. Variances from these standards shall be granted only when deemed necessary by the City Engineer for the betterment of the public in general.

It is assumed that practicing Engineers involved with preparing roadway plans have adequate knowledge of the recommended procedures. There is, therefore, no attempt in this Design Manual to provide step-by-step calculation methodologies.

All streets shall conform to the applicable geometric, cross- section and sight triangle standards of the City of Somerset.

Streets shall be related to topography and shall generally provide for the continuation of existing or dedicated streets in adjoining or nearby tracts, and provide for connection to adjoining un-subdivided tracts, especially those which would otherwise be land-locked. Freeways and arterials shall not penetrate or bisect existing or proposed neighborhoods, but rather, shall be located as appropriate boundaries for such. Collectors shall carry traffic from arterials into neighborhoods. Locals shall carry traffic from collectors into the neighborhood for the primary purpose of access to individual properties.

2.1 STREET CLASSIFICATION:

For clarification the classification of roads and streets that correspond to the Exhibits are as follows:

Residential Local Streets: Local streets are the primary connection for the traveling public from home, offices, stores, work, and finally to connect to collector streets. Pedestrian use is encouraged along the sidewalks. The typical Cross Sections are as shown in Exhibit of Typical Cross Section. Cross sections not shown may be approved on a project basis by the City Engineer. Minimum pavement thicknesses shall be 1” asphalt surface, 2” asphalt base, and 9” DGA (or crushed stone) base. All thicknesses are compacted thickness. The City of Somerset shall have the right to core drill proposed city streets to confirm as-built depths of the pavement. This core drilling and repair of the roadway shall be done completely at the Developer’s expense. Spacing of intersections shall comply with the City of Somerset Regulations. Final spacing shall be per the approval of the City of Somerset’s Engineer.

Residential Local Street Cul-de-sacs: Cul-de-Sacs shall not generally be longer than one thousand (1,000) feet, including the turnaround which shall be provided at the closed end with a right-of-way radius of fifty (50) feet, curb radius of forty (40) feet, and a transition curve radius of seventy-five (75) feet. Alternate turn around designs depicted in these regulations (See Exhibit) shall also be permitted because of unusual topographic or other conditions and, in such cases the Planning Commission may require additional paving width if necessary to prevent overloading of street capacity. Temporary turnarounds may be required at the end of stub streets as long as they are retained within the street right-of-way.

Residential Collector Streets: These streets are designed to accept connections from local streets and to connect areas of the city together. The collector eventually feeds the traffic to a larger, even higher volume roadway, the Arterial. Collector streets when compared to local streets have a higher traffic volume, and the typical cross sections are wider. The typical Cross Sections are as shown in Exhibit of the Typical Cross Sections. Cross sections not shown may be approved on a project basis by the City Engineer. Minimum pavement thicknesses shall be 1.5” asphalt surface, 2.5” asphalt base, and 9” DGA (or crushed stone) base. All thicknesses are compacted thickness. The City of Somerset shall have the right to core drill proposed city streets to confirm as-built depths of the pavement. This core drilling and repair of the roadway shall be done completely at the Developer’s expense. Spacing of intersections shall comply with the City of Somerset requirements. Final spacing shall be per the approval of the City Somerset’s Engineer.

Arterials (Non Residential): These high volume, high traffic roadways serve to primarily move vehicles from one area to another. City bypasses and main inter-area roadways fall into this category. The typical cross sections are as shown in Exhibit 6-2, Typical Cross Section. Cross sections not shown may be approved on a project basis by the City Engineer. Minimum pavement thicknesses shall be 1.5” asphalt surface, 2.5” asphalt base, and 9” DGA (or crushed stone) base. All thicknesses are compacted thickness. The City of Somerset shall have the right to core drill proposed city streets to confirm as-built depths of the pavement. This core drilling and repair of the roadway shall be done completely at the Developer’s expense. Spacing of intersections shall comply with the City of Somerset Subdivision requirements. Final spacing shall be per the approval of the City of Somerset’s Engineer.

Final pavement design shall be approved by the City Engineer.

PAVEMENT DESIGN PROCEDURE

1. Determine the number of ESALs (Equivalent Single Axle Loads) from the table in this section.

2. Based on the soil CBR value, determine the required Structural Number from the table in this section.

3. Check the calculated Structural Number against the minimum Structural Number for Residential Streets below, the larger of the two numbers shall be used to design the pavement section.

    a. Residential Local : SN=2.40

    b. Residential Collector: SN = 2.84

4. Determine the required thickness of asphalt, DGA, and No. 2 stone to achieve the required Structural Number. The layer coefficients are listed below:

    - Asphalt – 0.44
    - DGA – 0.12
    - No. 2 Stone – 0.08

Acceptable methods of determining ESAL’s are listed below:

- ESALs Per House Method: 105 ESALs per House.
- ESALs per Street Method (for Residential Subdivision): 45,000 ESALs per street.

When No. 2 stone is used, a layer of separation fabric shall separate the compacted soil sub-grade from the No. 2 stone.

	Structural Number						
ESALs	CBR 1	CBR 2	CBR 3	CBR 4	CBR 5	CBR 6	CBR 7
1,000	2.15	1.65	1.39	1.23	1.09	1.01	1.00
2,000	2.38	1.84	1.58	1.39	1.27	1.17	1.08
3,000	2.54	1.97	1.69	1.50	1.36	1.26	1.17
4,000	2.65	2.07	1.77	1.58	1.44	1.33	1.24
5,000	2.74	2.14	1.84	1.64	1.50	1.39	1.30
6,000	2.81	2.20	1.89	1.69	1.55	1.43	1.34
7,000	2.88	2.26	1.94	1.74	1.59	1.47	1.38
8,000	2.94	2.31	1.99	1.78	1.63	1.51	1.42
9,000	2.99	2.35	2.02	1.81	1.66	1.54	1.45
10,000	3.03	2.39	2.06	1.85	1.69	1.57	1.47
20,000	3.35	2.65	2.30	2.07	1.90	1.77	1.67
30,000	3.55	2.82	2.44	2.20	2.03	1.89	1.79
40,000	3.70	2.94	2.55	2.31	2.13	1.99	1.87
50,000	3.81	3.03	2.64	2.39	2.20	2.06	1.94
60,000	3.91	3.12	2.71	2.45	2.27	2.12	2.00
70,000	3.99	3.19	2.78	2.51	2.32	2.17	2.05
80,000	4.07	3.25	2.83	2.56	2.37	2.22	2.10
90,000	4.13	3.30	2.88	2.61	2.41	2.26	2.14
100,000	4.19	3.35	2.93	2.65	2.45	2.30	2.17
200,000	4.60	3.70	3.24	2.94	2.72	2.55	2.42
300,000	4.86	3.91	3.43	3.12	2.89	2.71	2.57
400,000	5.04	4.07	3.57	3.25	3.01	2.83	2.69
500,000	5.19	4.19	3.68	3.35	3.11	2.93	2.78
600,000	5.31	4.30	3.78	3.44	3.20	3.01	2.85
700,000	5.42	4.39	3.86	3.52	3.27	3.08	2.92
800,000	5.51	4.47	3.93	3.58	3.33	3.13	2.98
900,000	5.60	4.54	4.00	3.64	3.39	3.19	3.03
1,000,000	5.67	4.60	4.06	3.70	3.44	3.24	3.07
2,000,000	6.19	5.04	4.45	4.07	3.79	3.57	3.40
3,000,000	6.51	5.31	4.70	4.30	4.01	3.78	3.60
4,000,000	6.75	5.51	4.88	4.47	4.17	3.93	3.74
5,000,000	6.93	5.67	5.03	4.60	4.30	4.06	3.86
7,000,000	7.23	5.92	5.25	4.81	4.49	4.25	4.04
10,000,000	7.55	6.19	5.50	5.04	4.71	4.45	4.24

Minumum Design Required

5. Non Residential ESAL's

Land Use	Gross Floor Area (sq ft) x 1000									
	1	5	10	20	40	60	80	100	200	500
General Light Industrial (15% trucks)	80,000	115,000	159,000	246,000	418,000	586,000	752,000	915,000	1,681,000	3,515,000
General Heavy Industrial (20% trucks)	3,000	16,000	31,000	63,000	126,000	188,000	251,000	314,000	628,000	1,570,000
Warehousing (25% Trucks)	32,000	123,000	219,000	389,000	692,000	968,000	1,229,000	1,479,000	2,629,000	5,623,000
General Office Building (2% trucks)	1,000	8,000	17,000	35,000	70,000	105,000	141,000	176,000	354,000	885,000
Retail <200,000 Sq. Ft. (2% trucks)	21,000	102,000	201,000	393,000	745,000	1,056,000	1,327,000	1,557,000	2,100,000	-
Retail >200,000 Sq. Ft. (2% trucks)	-	-	-	-	-	-	-	-	-	3,923,000

11. City Streets and proposed streets that will be dedicated to the City shall meet or exceed the minimum paving thickness as specified above.

It shall be the Developer's responsibility to acquire CBR's for paving designs for future city streets. Streets shall be proof rolled per the City Specifications. Should subgrade fail during the proof roll, soil stabilization shall consist of one of the following options:

- Option 1 - Undercut soil 8", place 6 oz woven separation filter fabric on the compacted subgrade, install 8" of No. 2 stone. Provide 4" perforated pipe at edge to daylight or to connect to storm sewer structure. Construct appropriate pavement design.

- Option 2 – Undercut soil 4", place Tensar TX 5, install 4" DGA. Provide 4" perforated pipe at edge to daylight or to connect to storm sewer structure. Construct appropriate pavement design. No substitution of material for Tensar TX 5 shall be considered without written acceptance from the City Engineer.

2.2 STREET GEOMETRICS:

Street Geometric design standards are shown on the following Exhibit. These design elements in conjunction with the typical cross section define the characteristics of the roadway, and to a great extent the character of the surrounding area.

EXHIBIT 2-1: STREET GEOMETRICS

			LOCAL STREETS		
STREET DIMENSIONS	COLLECTOR STREET	CONTINUING	LOOP/CUL-DE-SAC	SERVICE RD	NON-RES
Right-of–Way Width	60' RES. 70' NON RES	50'	50'(*3)	40'-50'	60'
Roadway Width (face to face)	40' RES 40'/50' NO N RES	30'	27-30'(*3)	30'	36'
Curbs and Gutters	Yes	Yes	Yes	Yes	Yes
Sidewalk (width and sides)	4' (both)	4' (both)	4' (both)	4' (*1)	4' (both)
Driveway Access	(*1) Yes	Yes	Yes	Yes	Yes
Double-Frontage Lots	(*1) No	No	No	No	No
Street Grade (Maximum)	6%	8%	8%	6%	6%
Street Grade (Minimum)	0.8%	0.8%	0.8%	0.8%	0.8%
Pavement Cross Slope	¼" per ft.	¼" per ft.	¼" per ft.	¼" per ft.	¼" per ft.
Cut Slopes (Maximum)	2:1	2:1	2:1	2:1	2:1
Fill Slopes (Maximum)	2:1	2:1	2:1	2:1	2:1
STREET ALIGNMENT					
Horizontal Curve Radius	500'	250'	100'	150'	300'

Stopping Sight Distance	250’	200’	200’	200’	200’
Crest Vertical Curve Formula	L=45A	L=22A	L=22A	L=22A	L=22A
Crest Vertical Curve (Minimum)	100’	100’	100’	100’	100’
Sag Vertical Curve Formula	L=60A	L=35A	L=35A	L=35A	L=35A
Sag Vertical Curve (Minimum)	100’	100’	100’	100’	100’
STREET INTERSECTION					
Maximum Street Legs	4	4	4	4	4
Intersection Angle (Preferred and Minimum)	90° - 80°	90° - 80°	90° - 80°	90° - 80°	90° - 80°
Intersection Spacing	(*2)	(*2)	(*2)	(*2)	(*2)
Curb Radius Along Street	(*1)	20’	20’	20’	20’
Max. Grade within 50’ of Intersecting Gutter	3%	3%	3%	3%	3%
Max. Tangent Offset within 100’ of Intersecting Gutter	8.3’	11.3’	11.3’	11.3’	11.3’

(*1) As approved by the Planning Commission.

(*2) Intersection spacing shall apply as described in Section 2-11

(*3) Alternate dimensions of 22’ (face to face) roadway may be utilized as described in Exhibit 2.12

(*4) On collector streets, grades from 6-8% may be approved for short distances provided that no crest sight distance problems exists. Steeper grades may be approved by the Planning Commission on a case by case basis.

Note: Typical cross sections applications are described in Exhibit 2-13.

EXHIBIT 2-2: TYPICAL STREET CROSS SECTIONS

EXHIBIT 2-3: ALTERNATE CUL-DE-SAC DESIGNS

2.3 INTERSECTION AND ACCESS SPACING

The following guidelines shall be the basis for the determination of proper spacing for street intersections and driveway access for subdivisions. It is recognized that these guidelines will not be able to be adhered to in all cases, especially in areas where existing development is present. The Planning Commission shall attempt in all cases, however, to apply these guidelines to the greatest extent feasible in order to create safe and efficient traffic movement systems.

SPACING MEASUREMENT DEFINITION:

Distance shall be defined as the distance between the center lines of intersecting streets and roads. However, in the case of an interchange, distances shall he measured from the center line of any intersecting roadway to the closest near edge (projected) of the ramp roadway or in the case of a free flow ramp terminal to the gore of the nearest ramp.

ACCESS STANDARDS BY FUNCTIONAL CLASSIFICATION:

A. EXPRESSWAYS: Expressways shall have intersections with arterials and/or other expressways. There shall be no intersections with lower type facilities. All intersections shall be of the grade-separation interchange type. The spacing of interchanges on expressways within the City shall be determined jointly by the City Council and the Kentucky Department of Transportation.

B. PRINCIPAL ARTERIALS: Principal arterials shall have intersections with expressways: other principal arterials, minor arterials and collector streets. Intersections shall be signalized as warranted. Any access to a principal arterial must be located at a minimum of one thousand six hundred (1,600) feet from any other access along that principal arterial (i e., principal arterials, minor arterials, collectors, major commercial or industrial driveway accesses). No new residential driveway access shall be allowed on a principal arterial. Protected left and right turn lanes with ample storage space must be provided at all intersections. The Kentucky Department of Transportation will be consulted when state maintained roads are involved.

C. MINOR ARTERIAL: Minor arterials shall have intersections with expressways, principal arterials, other minor arterials and collector streets. Intersections shall be signalized as warranted. No new residential driveway access shall be allowed on a minor arterial. Commercial or industrial driveways shall be treated according to the non-residential spacing formula. Adequate provisions for left and right turn lanes shall be determined by the City Engineer and the Kentucky Department of Transportation for state maintained facilities. The spacing of intersections along a minor arterial shall be as follows:

   1. Between an intersection with an expressway and an intersection with a principal or minor arterial: the distance shall be a minimum of one thousand six hundred (1,600’) feet.
   2. Between an expressway and a collector: minimum one thousand four hundred (1,400’) feet.
   3. Between one principal or minor arterial and another: minimum one thousand four hundred (1,400’) feet.
   4. Between a principal or minor arterial and a collector: minimum one thousand two hundred (1,200’) feet.
   5. Between a collector and another collector: minimum one thousand (1,000') feet.

D. COLLECTOR STREET: Collector streets shall have intersections with arterials, collectors and locals. Collector streets shall be designed for system continuity and traffic flow. The spacing of intersections along collectors shall be as follows:

1. Between a principal or minor arterial and another: the distance shall he a minimum of one thousand four hundred (l,400’) feet.

2. Between a principal or minor arterial and a collector: minimum one thousand (1,000) feet.

3. Between one collector and another: minimum eight hundred (800) feet.

4. Between one principal or minor arterial and a local: minimum five hundred (500) feet.

5. Between a collector and a local: minimum four hundred (400) feet.

BETWEEN A LOCAL AND ANOTHER LOCAL:

A. A minimum of two hundred fifty (250) feet.

B. LOCAL STREETS: Local streets shall have intersections with collectors and other local streets. Some designs may warrant exceptions. The spacing of intersections on local streets shall be as follows:

   1. Between one collector and another collector: minimum eight hundred (800) feet.

   2. Between a collector and a local: minimum two hundred fifty (250) feet.

   3. Between a local and another local: minimum two hundred fifty (250) feet.

LAND USE ACCESS:

A. RESIDENTIAL: All single-family residential structures shall be allowed one (1) access per lot. An additional point of access may be permitted for corner lots, loop driveways, or other instances where public safety will not be impaired by utilizing a second point of access. Duplexes and fourplexes shall be permitted two (2) accesses. Subdivisions shall be designed such that these uses have no direct driveway to either principal or minor arterials.

   1. Apartment complexes, condominium developments, as well as all other developments which are accessed through a common private drive or street system may be allowed access to arterials provided that the private driveways allowed are consistent with the access spacing standards governing the access of collector streets to minor arterial streets.

B. NON-RESIDENTIAL: All non-residential land uses may have access to principal arterial streets via service roads. Non-residential land uses may also have access to minor arterials and to collector streets. Non-residential land uses shall generally not have access to residential local roads.

EXHIBIT 2.12: CORNER SIGHT DISTANCE AT INTERSECTIONS

TYPE OF ROADWAY (*1)	PUBLIC OR PRIVATE STREET (*2)	DRIVEWAY (*2)
MAJOR ARTERIAL	325L/150R/15M(*3)	325L/150R/15M
MINOR ARTERIAL	275/150R/15M	275/150R/15M
COLLECTOR	200L/150R/15M	200L/150R/15M (non-res)
		150L/120R/15M (res.)
LOCAL	175L/130R/15M	75L/55R/10M

(*1) THIS COLUMN CONSIDERED AS "MAJOR" STREET OR INTERSECTION

(*2) THIS COLUMN CONSIDERED AS "MINOR" STREET OR INTERSECTION

(*3) 325L/150R/15M – SIGHT TRIANGLE TO THE LEFT / SIGHT TRIANGLE TO THE RIGHT / DISTANCE FOR EDGE OF CURB ON MINOR STREET OR DRIVE APPROACH.

NOTE: THIS TABLE ASSUMES RIGHT ANGLE INTERSECTIONS AND STRAIGHT MAJOR STREET MOVEMENT WITHIN THE SIGHT DISTANCE. SITUATIONS INVOLVING SKEWED INTERSECTIONS, CURVILINEAR STREETS AND OTHER MITIGATING FACTORS SHALL HAVE SIGHT DISTANCES DETERMINED BY THE ADMINISTRATIVE OFFICIAL OR CITY ENGINEER.

2.4 ROADWAY IMPROVEMENT

GENERAL:

A. Any substantial development of subdivided property may reasonably be anticipated to create a burden on existing public roads, thereby posing a traffic and safety hazard. In order to ameliorate that hazard and to advance the public's interest in having safe and adequate roadways, the following requirements shall apply whenever a subdivision is proposed for property abutting an existing public roadway which does not meet the right-of-way and pavement width standards for the functional classification of that street:

   1. PROPOSED SUBDIVISION WHICH ABUT LOCAL OR COLLECTOR STREETS: Whenever a subdivision is proposed for property which abuts a local or collector street as defined in these Subdivision Regulations, the developer shall be required to dedicate right-of way along the entire street frontage to a width which will provide one-half (1/2) of the total right of-way necessary to comply with the standards as set out in the Subdivision Regulations. It is assumed that the same right-of-way dedication will be required on the opposite side of the roadway at such time as that property develops, thereby providing the full necessary right-of-way width, Construction of roadway widening improvements (including paving, curb, gutter and sidewalk where appropriate) shall also be required as necessary to bring the roadway up to full cross-section requirements as set forth in the Subdivision Regulations. The Commission may permit a long term performance bond or letter of credit to be posted in lieu of construction of such improvements where such are intended to augment programmed improvements to be made by the government.

   2. PROPOSED SUBDIVISION OF PROPERTY ABUTTING AN ARTERIAL STREET: Whenever a subdivision is proposed for property which abuts an arterial highway which is, or is proposed to be four (4) lanes or more in width, the developer may be required to dedicate sufficient right of-way to permit any necessary widening, In consideration of the fact that such dedication requirement may exceed that which would ordinarily be required for subdivisions abutting local or

collector streets, the developer shall not be required to construct roadway widening improvements for the full road frontage, but rather, improvements such as turn lanes for new intersecting streets or other access points may be required when necessary to provide as safe a situation as possible under the circumstances.

PRIVATE STREETS

A. Private streets may be permitted by the Commission. Subdivision plans containing private streets shall conform to all other subdivision regulations, unless different requirements are listed in the following:

1. NO DISRUPTION TO THROUGH MOVEMENT: Private streets may be permitted only if they meet the definition of “local” streets; if they provide absolutely no present of future impediment to necessary through traffic movement in the general area; and, if adjoining properties and the general area already have, or are capable of providing a proper, efficient and safe street system that will in no way depend upon the private streets.

2. RIGHT-OF-WAY AND SETBACK: Private street right-of-ways and building setback lines shall be shown on the plat and shall meet at least the minimum requirements of these subdivision regulations and the Zoning Ordinance as required for public streets to assure conformance if such streets are ever accepted for public dedication at a later date.

3. STREET IMPROVEMENT STANDARDS: Any permitted private street also shall conform to the following improvement standards, at a minimum; (a) roadway pavement shall be at least twenty (20) feet wide, and cul-de-sacs shall have a minimum of forty (40) foot radius; (b) roadway paving and base construction shall conform to the requirements for public streets, and a cross section drawn on the plan (driveway and parking areas shall not be considered to be streets, and shall not be required to conform to the street construction standards), (c) curbs, gutters, and sidewalks may be omitted to the extent deemed feasible by the Commission; (d) improvement plans may be required by the Commission; (e) all private street improvements (excepting only the final course of asphalt as noted in subsection (f) below) shall be constructed in compliance with the approved subdivision plan and shall be inspected, and approved by the City Engineer before the final Subdivision plan is recorded, (f) for the Final course of asphalt only, the developer shall be permitted to post a bond or letter of credit in favor of the final maintenance association responsible for the private street and shall note such requirement on the final plat of the property, and (g) private "marginal access" streets and service roads especially in nonresidential areas, shall conform to requirements of a public marginal access street.

4. FUTURE ACCEPTANCE BY GOVERNMENT: Any plan containing permitted private streets shall have such streets so labeled and shall contain the following signed certification by the owner: Private Street Responsibilities of Owners - The owners of this property and any successors in title hereby agree to assume full liability and responsibility for any construction, maintenance, reconstruction, snow removal, cleaning or other needs related to the private streets so designated on this plan, and do hereby fully relieve the City Government from any such responsibility. The owners understand that the private streets will not result in any reduction in taxes required by and payable to the City Government. Furthermore, if the owners in the future should request that the private streets be changed to public streets, the owners do fully agree that, before acceptance of such streets by the City Government, the owners will bear full expense of reconstruction or any other action necessary to make the streets fully conform to the requirements applicable at that time for public streets prior to dedication and acceptance. Finally, the owners also agree that these streets shall be dedicated to public use without compensation to the owners and without the owners expense in making such streets conform to the requirements applicable at that time for public streets, if at some future date, the City Government so requests. *(Signed and Dated by Owners.*)

5. GOVERNMENT AND UTILITY ACCESS: Any plan containing permitted private streets shall show and label all other easements normally required; shall conform to all other applicable sections of these subdivision regulations and other local ordinances; and shall contain the owners signed certification; "Government and Utility Access - The owners of this property hereby agree to grant full rights of access to this property over the designated street, utility, and other easements for governmental and utility agencies to perform their normal responsibilities." (*Signed and Dated by Owners.*)

6. MAINTENANCE RESPONSIBILITY: A homeowners' association or other mechanism which provides for equitable common responsibility for private street maintenance and repair shall be required to be established by the developer. The developer's responsibility to create such a mechanism shall be noted on the final plat of the subdivision. A requirement that each property owner be individually responsible for maintenance and repair of the portion of the street abutting the lot shall not be considered as acceptable for fulfilling the requirements of this section.

2.5 ROADWAY DRAINAGE:

Curbs and Gutters are required for all new streets and roadways in the City of Somerset. Curb inlets, catch basins, surface inlets, and other appropriate drainage structures shall be utilized to intercept flow.

Design of storm sewers shall be per the City of Somerset regulations and guidelines.

2.6 SIDEWALK DESIGN:

Sidewalks shall be constructed in accordance with the City of Somerset Standards and Specifications. Sidewalks shall be a minimum 4' wide. Should a 4' sidewalk be constructed, bump outs or widening to an area of 5'x5' shall occur every 200' to allow a passing zone per the applicable provisions of the Americans with Disabilities Act.

The sidewalk shall be concrete with a swept broom finish perpendicular to the direction of travel, to provide a roughened texture for traction. Concrete sidewalks and walkways shall be constructed on a thoroughly compacted sub grade and shall be four and one half (4 1/2`) inches in thickness and a minimum width of four (4') feet. Expansion joints shall be placed at thirty-two (32') foot intervals. Concrete shall meet the specifications for Class "A", Kentucky Department of Transportation, Bureau of Highways, Standard Specifications, Current Edition. Sidewalks shall be placed adjacent to the street right-of-way line. Slope toward curb shall be one-quarter (1/4) of an inch to the foot.

For sidewalk parallel to the roadway and located in public right of way, the sidewalk grade shall follow the roadway grade. The engineer shall utilize the latest PROWAG (public right of way accessibility guidelines) for design of sidewalks in the public right of way. In areas where the sidewalk is not parallel or contiguous to the roadway, the maximum slope of the sidewalk shall be 5%. Sidewalk ramps shall be a maximum of 1:12 (or 8.33%). The maximum cross slope of a sidewalk shall be 2%. Curb cuts shall comply with the latest American with Disabilities Acts Accessibility Guidelines (ADA Guidelines.) Tactile warnings shall be installed at the curb cuts and be mortared in place or otherwise permanently fixed to the sidewalk.

3.0 PLAN PREPARATION:

COVER SHEET

The layout sheet is the cover or title sheet for the set of plans. The layout sheet shall contain the following information:

- Proper headings and Project title
- Sheet Index
- Vicinity map with North arrow
- Standard Symbols and Legend
- Project limits, begin, and end stations (if applicable)
- Design Professional's seal, signature, and Date

SITE DEVELOPMENT PLAN LIST FOR THE CITY OF SOMERSET, KENTUCKY

A. Existing contours at 1 foot intervals (lines shall be dashed).

B. Finish contours at 1 foot intervals (lines shall be solid).

C. Show Drainage Plan

1. Calculate predevelopment runoff using grass cover and 25 year 24 hour storm event .
2. Calculate post-development runoff using 25 year 24 hour storm event.
3. Runoff in CFS post-development shall not exceed runoff in CFS predevelopment (use piping and/or detention basin to control CFS).
4. Check drainage design using 100 year 24 hour storm event.
5. Drainage plan must be prepared and signed by professional engineer.

D. Include Separate Erosion Control Plan Sheet in compliance with BMP.

E. Show parking layout and traffic flow as outlined in zoning ordinance.

F. Show landscaping as outlined in zoning ordinance.

G. Show all on-site utility connections.

H. Show all adjacent utilities.

I. City utility managers must approve utility connections prior to approval.

J. Drainage maps

K. Show building footprint.

L. Show property and easement lines.

M. Three (18 x 24) copies of all maps and calculations must be provided at least one week prior to meeting for board members to review.

N. If site is one acre or more, an application from the Division of Water for a Notice of Intent must be obtained prior to issue of a building permit.

O. As built certification for site development must be submitted to the City Engineer before any building permits are issued.

ROADWAY PLAN AND PROFILE SHEET(S)

Plan and Profile sheets may either consist of separate plan sheets and separate profile sheets, or the conventional half-plan/half-profile sheets. Standard information that shall be shown include at a minimum:

Plan View

- North Arrow and Scale
- Alignment Stationing and equations at intersections.
- Sheet Number
- Contours (existing and proposed)
- Benchmarks (Horizontal and Vertical information)
- Curve Data (PI Stations, Delta Angle, Tangent Distance, Length of Curve, Radius of Curve, External Distance, PT Station, PC Station)
- Centerline of Roadway, curb lines, sidewalks, and right of ways.
- Drainage structures and systems
- Design Professional's seal, signature, and Date

Should a striping plan and utility plan not be on separate sheets the roadway plans shall designate:

- Pavement striping and signage
- Existing Utilities
- Proposed Utilities

Profile View

- Sheet Number
- Scale (Horizontal and Vertical)
- Existing profile grade line (dashed)
- Proposed profile grade line (solid) with Stationing, vertical curve data, tangent grades
- Utility Crossings

STORM WATER PLAN AND PROFILE SHEET(S)

Plan and Profile sheets may either consist of separate plan sheets and separate profile sheets, or the conventional half-plan/half-profile sheets. Standard information that shall be shown include at a minimum:

Plan View

- North Arrow and Scale
- Alignment Stationing and equations at intersections.
- Sheet Number
- Contours (existing—dashed; proposed--solid)
- Benchmarks (Horizontal and Vertical information)
- Centerline of Roadway, curb lines, sidewalks, and right of ways.
- Drainage structures and systems. Each drainage structure shall have a specific designation for easy reference.

    - Type of structure (detail reference)
    - Rim or grate (gutter line) elevation
    - Invert elevation(s)
- Utility crossings and Sanitary sewer crossings
- Design Professional's seal, signature, and date

Profile View

- Sheet Number
- Scale (Horizontal and Vertical)
- Existing profile grade line (dashed)
- Drainage Structures including: Catch basins, Surface Inlets, Drop Inlets, Curb inlets, Manholes with grate and invert elevations
- Pipes shall be labeled with size, type material, length, and slope in percent (%)
- All known Utility Crossings

The Storm Sewer Plan shall have a post construction management plan detailing responsibility of maintenance of detention basins and other common areas.

3.1 AS-BUILT RECORD DRAWINGS:

A record drawing of the roadways and storm sewers shall be submitted to the City Engineer at the end of construction. Plan view drawings shall be at a conventional scale (1"=50') that shall be readable and convey the necessary information. Profile sheets shall be at conventional exaggerated scale (1"=20') horizontal, 1"=2' vertical; 1"=50' horizontal, 1"=5' vertical). Standard sheet size shall be 24"x36" in size. As-builts shall be certified by a Kentucky Professional Engineer/Professional Land Surveyor (as appropriate) that the project has been constructed according to plans and specifications. Should field discrepancies and/or changes from approved plans be found, these changes shall be documented on the as-builts and all calculations certified or resubmitted to match as-builts. Revised calculations shall comply with requirements. As built drawings shall be stamped and signed by a Licensed Engineer or Surveyor in the State of Kentucky. One paper copy and one electronic copy on compact disk shall be required. Electronic media shall be on state plane coordinates and be in AutoCAD compatible format.

3.2 POST CONSTRUCTION INSPECTION REQUIREMENTS:

After the pipe is installed, the trench shall be backfilled in accordance with the provisions Section "Trenching". All pipes shall undergo visual inspection during and after installation to insure conformance to these specifications. Final visual inspections for all pipes shall be conducted no sooner than 30 days after completion of installation and final fill. Final visual inspections shall be conducted from the inlet and outlet ends of all pipe with sufficient hand held lighting to observe any defects.

In addition to visual inspection, the following tests shall be performed not less than 30 days following completion of pipe installation and final fill placement. All post installation inspections and test shall be observed by City of Somerset personnel or their representatives. A minimum of forty–eight (48) hours shall be given to the City of Somerset prior to inspection activity.

FLEXIBLE PIPE (HIGH DENSITY POLYETHYLENE (HDPE) AND POLYVINYL CHLORIDE (PVC) PIPE AND CORRUGATED METAL PIPE (CMP):

The contractor shall be responsible for conducting a deflection test, (mandrel, laser, or manual), on at least 10 percent of the total number of pipes representing a minimum 10 percent of the total project footage including a minimum of one run of each pipe size. The City of Somerset shall randomly select installations to be tested to determine whether the internal diameter of the barrel has been reduced more than 5 percent. If any installation is determined to have deflected more than 5 percent, all pipe installations shall be evaluated for deflection. Documentation of station, pipe size, and deflection results shall be provided to the City of Somerset.

RIGID PIPE (REINFORCED CONCRETE PIPE (RCP)):

All RCP shall be visually inspected for deflection, alignment, cracking, and joint construction during and after installation. Any installations where visual inspections detect poor construction techniques shall be further evaluated as directed by the City of Somerset. Hairline cracks equal to or less than 0.01 inches in width are considered minor and only need to be noted in the inspection report. Cracks greater than 0.01 inches in width shall be kept on file for monitoring conditions during subsequent inspections. Cracks greater than 0.1 inches shall be repaired or replaced at the direction of the City of Somerset.

All flexible pipes with deflections greater than 5 percent of the nominal pipe diameter, undue, misalignment, or poor joint construction shall be replaced by the Contractor at his expense. Any excavation or additional work including, but not limited to, base stone or asphalt removal and replacement, required to replace a pipe installation due to poor construction techniques shall be at the Contractor's expense. As visual and deflection test dictate, the City of Somerset may request additional inspections at the Contractor's expense.

4.0 HYDROLOGY:

INTRODUCTION:

This chapter will define requirements to mitigate stormwater runoff quantity and quality for new construction in the City of Somerset. This chapter will also address stormwater mitigation that may be necessary for existing developments within the City. In most cases stormwater quantity and quality designs will be performed by a licensed professional engineer currently registered to do practice in the Commonwealth of Kentucky.

The design engineer may refer to the Kentucky Transportation Cabinet Drainage Guidance Manual for design methodology for storm sewers. See section 4.05 for the appropriate design storms to be used for the different stormwater system elements.

Materials for all items of construction of any description or nature shall conform to standards set out in the Kentucky Department of Transportation specifications (KDOT), except as herein set out and described. Sources such as the American Society for Testing and Materials (ASTM), and the American Association of State Highway Officials (AASHTO), or other nationally recognized sources may be used in determining actual requirements.

GENERAL DESIGN GUIDELINES FOR STORM SEWERS:

Storm sewers in the right of way, or that will be dedicated or maintained by the City of Somerset shall adhere to the following minimum guidelines summarized below:

- Storm pipe material in the City or State Right of Way shall be HDPE, RCP or CMP.
- Storm pipe material on private property may be RCP, CMP, or HDPE. Exceptions may be made on a case by case basis by the City Engineer.
- The minimum pipe diameter within the City Right of Way shall be 15”.
- The minimum curb inlet spacing shall be such that the maximum gutter depth of stormwater runoff in a sag curb shall be 6” during the 100 year - 1 hour event.
- The gutter spread shall not exceed 50% of the traveled lane in a 10 year - 1 hour event.
- Overflow swales shall be designed and constructed in all roadway sags as an emergency overland flow route.
- Maximum spacing for storm inlet structures regardless of pipe size shall be 300’.

  Storm inlets shall be sized not to surcharge for the 25 year -1 hour storm.
- Storm pipes shall be sized to flow under gravity (no surcharging) for the 10 year 1 hour storm.
- A storm sewer structure will be installed at:
  - the beginning and end of all storm sewer pipelines
  - whenever maximum pipe spans are exceeded
  - when the pipe changes in slope or alignment
  - when the pipe material changes
- The crowns of inlet and outlet pipes in a single structure shall be equal in elevation.

- End treatments shall include, but not be limited to headwalls, impact stilling basins, and energy dissipating headwalls. All pipes that daylight shall receive an end treatment.

- Open channels at the end of a pipe system must be designed to convey the 100 year 24 hour event and the channel must be lined with appropriate treatment consisting of rip rap, erosion control blocks, or turf reinforcement mats.

- No stormwater drainage system may be designed, constructed or connected so as to flow into any public or private sanitary sewer system.

- Portland cement concrete for all items of construction shall conform to requirements for "Class A", concrete, Kentucky Department of Transportation, Bureau of Highways, Standard Specifications, and Current Edition.

HYDROLOGY DESIGN METHODS:

Acceptable methods of surface water hydrology design include, but are not limited to, the rational method, the modified rational method, and the SCS TR-20 and TR-55 methods. The application of the differing methods is discussed below.

RUNOFF CALCULATION METHODOLOGY APPLICATION:

- If the total tributary area to an existing or proposed stormwater facility on the project site is 25 acres or less, or storage design is required for a site containing 1 acre or less, the Modified Rational Method of runoff calculation and detention sizing shall be acceptable.

- If the total project drainage area is greater than 25 acres, or storage design is required for a site containing more than 1 acre, a discharge hydrograph must be calculated using one of the SCS methods.

- The Rational Method may be used to design through drainage channels if the drainage area of the channel is 50 acres or less, otherwise, the channel shall be designed by SCS runoff calculation methodology or another accepted engineering method.

RETURN PERIOD FREQUENCY:

The selection of a design storm is the basis for all runoff calculations and facility design for a project site. The facility specific requirements and associated check frequencies are found below. The City Engineer may require additional storm return period frequencies to be checked at their sole discretion.

- 10 year – 1 hour: Storm Sewer Pipes, Detention/Retention Basins, Roadways
- 10 year – 24 hour: Detention / Retention Basins
- 25 year – 1 hour: Storm Sewer Inlets, Detention/Retention Basins
- 25 year – 24 hour: Channel Linings, Detention/Retention Basins
- 100 year – 1 hour: Roadways
- 100 year – 24 hour: Detention Ponds, Constructed Channels, Floodplains, Culverts

The elevation of the 100-year pre and post development discharge shall be checked for all drainage system designs to assure conformance with the guidelines of the FEMA Program. In areas of the County not covered by a flood insurance study, the design engineer must determine the pre-development 100 year Flood Elevation.

The elevation for the 100-year post development discharge shall be conveyed within the limits of the proposed easement.

The 100-year-24 hour discharge elevation must be checked for all locations to avoid flood damage to adjacent structures.

RAINFALL DURATION:

The minimum design storm duration for planning and design is dependent upon the runoff method used:

- The Rational Method rainfall duration equals the project area time of concentration. The minimum time of concentration (Tc) for overland flow to the first inlet or structure of any facility shall be 5 minutes.

- The SCS Method will utilize the SCS Type II - 24 hour rainfall distribution.

RAINFALL DEPTH:

Rainfall Intensity-Duration Curves, shall be utilized in the Rational Method to determine rainfall depths and storm intensities. Rainfall intensity may also be computed as described in the Kentucky Transportation Cabinet Drainage Guidance Manual, dated August 3, 1993.

Rainfall depths can be found at the National Oceanic and Atmospheric Administration (NOAA) website at http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ky. The numbers provided by NOAA shall be utilized to determine total rainfall depths using the SCS methods.

RAINFALL DISTRIBUTION:

Synthetic rainfall distributions shall be used for design storm generation. When critical storm analyses are not required, the distributions shall match the SCS Type II curve as published in SCS Technical Report 55, with 5-minute time steps.

SURFACE CONDITION DATA:

Maps depicting the SCS Hydrologic Soil Groups may be obtained from the USDA/NRCS in printed form, and online at http://websoilsurvey.nrcs.usda.gov/app/. Existing Land Uses, and Projected Land Use for each watershed may be obtained from Planning and Zoning.

RATIONAL METHOD:

The Rational Method equation is as follows:

- Q = CIA

Where:

- Q = Peak runoff (cubic feet per second)
- C = Runoff coefficient (refer to table in Appendix)
- I = Rainfall intensity (inches per hour)
- A = Contributing area (acres)

The rainfall intensity, I, should be obtained from the Rainfall Intensity-Duration Curves, for the appropriate design storm, and the calculated time of concentration, Tc.

The runoff coefficient, C, must represent a composite of the surface condition tributary to the point under consideration. To determine the appropriate C-Factor, the hydrologic soil group, and land use for each surface condition must be obtained. The C- Factors given may be used directly when the project site exhibits these land surface characteristics. If the site deviates from these conditions, an appropriately weighted C-Factor must be determined and reviewed by the design engineer. Where the project site conditions differ significantly from those used as the basis for the C-Factor values, the Design Engineer must develop a composite C-Factor for the area.

To determine the composite C-Factor for the entire project site, a weighted average must be calculated based upon the percentages of the areas. Large areas of imperviousness shall be separated into subbasins. Composite C-Factors should be applied only in cases where the land use is mostly homogeneous. For areas where no hydrologic soil group data is available, the C- values for soil group “C” should be used.

The time of concentration, Tc, shall be determined by calculating the time for a particle of water to travel from the most hydrological remote point of the project area to the point of interest.

Time of concentration to the first inlet or structure may be estimated by using the Kirpich Equation:

- $T_C = 0.0078\left(\frac{L^{0.77}}{S^{0.385}}\right)$,

Where:

- L = length of travel (ft)
- S = slope (ft/ft)

The minimum Tc shall not be less than 5 minutes. Manning’s Equation should be used to estimate any in-pipe or channel travel.

Other methods to derive time of concentration such as the Kinematic Wave method are acceptable.

SOIL CONSERVATION SERVICE (SCS) METHOD:

The SCS Methods are required for runoff calculation procedures for project sites where:

- The total project drainage area is greater than 25 acres.
- Storage design is required for a site containing more than 1 acre. The Design Engineer must use the SCS Methodology in model preparation.

The SCS Methods include the TR-20 and TR-55 Methods. Detailed descriptions, example calculations, and worksheets for these methods are available in:

- *Project Formulation - Hydrology, Technical Release No. 20 User's Manual;*
- *Urban Hydrology for Small Watersheds, Technical Release No. 55*; and
- *A Guide to Hydrologic Analysis Using SCS Methods.*

CURVE NUMBER:

The curve number is a whole number, similar to the Rational Method C-Factor in that it is based on the surface condition and land use of the project site. For through drainage systems, post developed curve numbers shall be based on a fully developed watershed as zoned at the time of design.

4.1 STORMWATER FACILITIES DESIGN GUIDELINES

Stormwater facilities constructed in the City shall meet minimum guidelines as set forth below. In general stormwater facilities shall be capable of conveying stormwater runoff from sites in such a manner so as to not cause flooding of structures, roads, and private property. In some storm events, portions of roadways with curb and gutter may retain water for short periods of time. In these conditions, minimum widths of roadways, defined by the gutter spread, must be left exposed for emergency vehicle access.

In all cases of pipe installation, the designer shall consult manufacturer's recommendations for minimum and maximum cover heights over pipes.

ALLOWABLE PIPE MATERIALS

Storm pipe material in the City or State Right of Way shall be HDPE, RCP or CMP. Storm pipe material on private property may be RCP, CMP, or HDPE. Exceptions may be made on a case by case basis by the City Engineer.

End treatments shall be utilized at the end of all pipe runs that daylight. Design of end treatments shall consider traffic safety. *No plastic pipe shall be used when the drainage pipe daylights.*

ROUGHNESS COEFFICIENTS "N"

The following values will be used for roughness coefficients in Manning's equation:

Material	Manning's Roughness Coefficient
Concrete (Pipe or Finished)	0.015
Plastic (smooth interior wall)	0.011
Corrugated metal pipe	0.024
Sod	0.030
Placed riprap	0.030
Dumped riprap	0.035
Gabions	0.028
Other	*accepted coefficients from published sources

PIPE DESIGN CHARACTERISTICS

The following are minimum design characteristics for pipes that will be installed in the City right of way or that will be dedicated to the City.

- Minimum pipe size used in the City right of way shall be 15 inches.
- Manhole spacing in storm sewer systems is based on the diameter of the pipe being used and shall be as follows:

1. For pipes less than 18" in diameter - 400'
2. For pipes 18" to 30" in diameter - 500'
3. For pipes 33" and greater in diameter - 600'

- All pipes that daylight are to have end treatments.

- Stubs for storm sewers when required shall be one foot long measured from the outside of the manhole or surface inlet for PVC and PE pipe or one length of pipe for concrete pipe. Stubs shall be plugged and capped with appropriate material. Stub shall be marked with rebar extending to grade for future location.

- Manning's Equation is recommended to calculate pipe flow and velocity under gravity flow conditions.

- The storm sewer hydraulic grade line shall be at least one foot below the ground surface or building drain elevation at all points for the design event. Where the storm sewer hydraulic grade line does not coincide with the pipe crown, it must be shown on the Profile Drawing.

- Losses at all inlets, junction structures and bends are to be considered.

- Pipes on grades greater than or equal to 20% shall have anchors at each pipe joint. The design engineer shall check to ensure that all pipes have sufficient cover and that all structures, inlets and manholes have sufficient dimension to receive pipe ends, pipe bells, frames, and grates.

CURB INLET MAXIMUM ALLOWABLE HEADWATER DESIGN PROCEDURE

The design engineer may utilize any software or design tool that is based on the hydraulic methods originally developed by the FHWA for highway drainage. For equations and example solutions, please refer to FHWA Urban Drainage Design Manual (HEC-22), Third Edition.

The minimum curb inlet spacing shall be such that during the 100 year - 1 hour event the maximum stormwater runoff depth in the gutter, in a sag situation, shall be 6”. During the 10 year - 1 hour storm the gutter spread shall not exceed 50% of the traveled lane. Overflow swales shall be designed and constructed in all roadway sags as an emergency overland flow route.

Maximum spacing for storm inlet structures shall be 300’ regardless of pipe size.

DESIGN OF CONVENTIONAL CHANNELS AND DITCHES

Open channels at the end of a pipe system must be designed to convey the 100 year 24 hour event. The channel must be lined with appropriate treatment which may include rip rap, erosion control blocks, turf reinforcement mats or other commonly accepted erosion control devices approved by the City Engineer. The lining shall be designed to withstand the critical shear force and permissible velocity in the channel for the 25 year 24 hour event. Manning’s equation or appropriate software shall be utilized to design open channels. The tractive forces shall be checked along the open channel at appropriate intervals to ensure that the lining extends to the point that a grass lined channel is sufficient. The tractive force shall follow FHWA Hec-15. Manufacturers’ data and software shall also be an acceptable measure for calculation.

Table 1 Summary of Critical Tractive Forces for Various Protection Measures

Protective Cover	$Tractive\ Force,\ \tau_c(\frac{lbs}{ft2})$
Grass or Grass legume Mixture. Good stand	1.0
Jute Net	0.45
Straw with Net	1.45
Curled Wood Mat	1.55
Turf Reinforcement Matting (TRM)	6-10
Riprap:	
D_{50}= 6 inches	2.50
D_{50}= 12 inches	5.00

Trapezoidal or rectangular paved channels shall have bottom slopes no less than 1:12 sloping either to the center or to one side of the channel to provide self-cleansing.

The step by step design procedure shown below is taken from the Kentucky Transportation Cabinet's Drainage Design Manual. Additional information is taken from the Federal Highway Administration's HYDRAIN software documentation manual.

The design procedure as shown assumes steady uniform flow with the energy slope equal to the bed slope and flow calculated using Manning's equation. For conditions other than these, the designer should consult additional references; one of which is HEC-11, which focuses on natural channels with irregular cross sections, varying bottom slopes, and flows exceeding 50 cfs. When analyzing riprap and gabion lined channels, additional considerations are necessary and HEC-15 and HEC-11 should be consulted. The maximum shear stress on the side slopes is always less than or equal to that on the channel bottom and does not limit the design of a single, rigid, vegetative, gabion, or temporary lining, but may affect the design of composite linings (Federal Highway Administration's HYDRAIN Software Documentation (GKY and Associates, Inc.). The designer is alerted to this situation and should consult the previously noted references.

CONSTRUCTED CHANNEL DESIGN

Where open channels or ditches are used as the method of storm drainage conveyance, in lieu of underground pipes, and the tractive forces in the channel could cause erosion, the developer will be required to provide a channel lining.

The lining shall be designed to withstand the critical shear force and permissible velocity in the channel for the 25 year 24 hour event, based on the results from Manning's equation or an appropriate software utilized to design open channels. The tractive forces shall be checked along the open channel at appropriate intervals to ensure that the lining extends to the point that a grass lined channel is sufficient.

The following steps should be taken when designing a channel:

A. Determine Drainage Area Contributing to the Channel.

B. Select Channel Cross Section - Side Slopes and Bottom Width

C. Determine Channel Longitudinal Grade

D. Calculate Design Flow - Adjust channel cross section and grade as necessary for capacity.

E. Select Channel Lining

- Determine maximum permissible shear stress **(p)** for the selected lining. See Table 5-3 in the KTC Drainage Manual for a summary list of various protection measures.
- Estimate flow depth in the channel.
- Determine Manning's "n" for selected lining and depth of flow.
- Calculate flow using Manning's equation and the estimated flow depth.
- If calculated flow varies from design flow, repeat steps (b) and (d) until flows agree.
- Calculate actual shear stress **(d)** where:

$$d = 62.4\,\frac{lbf}{ft^3} * d_n * s$$

Where:

d_n = flow depth in ft.

s = energy slope (bed slope); ft/ft

If d <p, the lining selected is acceptable

If d >p, consider the following:

- Select a lining with a higher permissible shear stress
- Decrease the channel slope
- Increase the channel width and/or flatten side slopes

4.2 DETENTION BASINS AND STORMWATER DISPOSAL STANDARDS

Every subdivision shall provide satisfactory drainage of storm water by means of underground sewer pipes and/or surface ditches, provided that such storm water drainage system conforms to the requirements of this manual and the Pulaski County Health Department. *The basic standard of design for drainage systems for subdivisions will be to keep run-off characteristics after development at the same level as existed prior to development.* To achieve these objectives, storm water retention and/or detention systems will be required in most cases. The proposed drainage shall be in conformance with the overall drainage plan for the City and the City's drainage ordinance.

The City Engineer shall approve all designs for such facilities. Such facilities shall be designed so that no standing water will remain in the basin during dry weather, unless a permanent pond is to be constructed of sufficient size that the standing water will not stagnate and present health hazards. In certain cases, other non-basin retention/detention techniques such as underground vault storage may be utilized when approved by the City's Engineer.

This section describes the technical criteria necessary to design stormwater detention basins. Detention basins are typically designed to remain empty during dry weather and to backup or detain excessive runoff generated during a storm. Due to nuisance issues, detention basins shall empty within 24 hours of the end of a rain event.

A minimum basin volume shall be the difference in runoff volume discharged from the project area to the basin site between the pre-development and post-development 25-year 24 hour storm, or such volume to sufficiently reduce post-development discharges to pre-development rates.

GENERAL DETENTION BASIN GUIDELINES:

All detention basins in the City of Somerset shall be designed such that:

- Maximum basin side slopes shall be 3:1, unless paved.
- All detention basins shall have constructed within them a paved low flow channel extending along the longest length dimension of the detention basin. Low flow channels may be grassed if:
    - the channel grade is greater than 2%
    - the channel grade is greater than 0.50% and an underdrain system of stone, perforated pipe and non-woven filter fabric is utilized.
- Basin design must address maintenance responsibility and accessibility.
- Basins with dam heights over 25’, or impounding over 50-acre feet of water will be required to be permitted through the Division of Water. They will also only be permitted by special exception of the City Engineer.
- The Design Engineer shall address provisions for anti-seep collars, extended detention basins, wet ponds, soil bioengineering, baffles, outlet protection and length to width ratios.
- Detention basins and sinkholes shall be shown as a non-buildable lot on development plans and plats.

DISCHARGE REQUIREMENTS:

Detention/Retention Basins that are constructed within the City shall meet the following discharge requirements:

- Discharge control structures shall be multi-stage and capable of limiting the 10 year 24 hour and the 25 year 24 hour design storms discharges to pre-development peak discharge rates or downstream system capacity.
- Discharge structures shall be constructed of reinforced concrete or an approved alternate.
- The emergency spillway shall be sized to accommodate a flow equal to the design overflow of the 100-year 24 hour storm post-development discharge without overtopping the dam.
- Erosion protection must be provided for the spillway and receiving stream.
- There shall be a minimum of one foot of freeboard remaining in the detention / retention pond
- at the peak water surface elevation created by the 100 year – 24 hour storm.

The detention basin shall be the first item of construction and must be designed to function as a sediment basin through the construction period. *The basin design must be checked for adequate capacity due to accumulated sediment generated by disturbed site conditions until permanent stabilization of the site is reached.*

4.3 FLOODPLAIN DETERMINATION

Construction within the 100-year FEMA floodplain shall comply with the Zoning Ordinance and the requirements of the Commonwealth of Kentucky. For developments that contain the 100-year FEMA floodplain, the Developer shall determine the 100-year post-development floodplain using the procedures as published by the Kentucky Division of Water, the Army Corps of Engineers, and FEMA.

The following minimum requirements shall apply to the use of open channels:

- The Flood Protection Elevation shall be based on the 100-year post-development floodplain elevation or on the FEMA base flood elevation (BFE), whichever is higher.

- The 100-year FEMA floodplain and the 100-year post-development floodplain shall be shown on the Improvement Plans, Record Drawings, and on Plats.

- If the developer wishes to place fill in the 100-year FEMA floodplain, the activity must be permitted by the authority having jurisdiction, (KYDOW, Army Corps of Engineers, etc.). At a minimum, an equal amount must be excavated in the 100-year FEMA floodplain as what has been filled in the same. No filling or excavation is allowed within the 100-year post-development floodplain.
- In accordance with FEMA regulations, the developer shall obtain a Conditional Letter of Map Revision (CLOMR) from FEMA before beginning construction if fill is proposed in a FEMA floodway that causes any increase in the 100 year FEMA BFE. Where fill is proposed in a Zone AE floodplain where a floodway has not been determined, a CLOMR must be obtained if the 100 year FEMA BFE is increased more than one foot. A CLOMR is not required for Zone A floodplains (FEMA has not established BFEs or floodways for Zone A floodplains). The City Engineer shall review the CLOMR before it is submitted to FEMA.
- In accordance with FEMA regulations, a Letter of Map Revision (LOMR) shall be obtained from FEMA if there are changes to the BFE because of construction in the flood fringe (that part of the floodplain outside of the floodway). The LOMR shall be submitted to FEMA within 6 months of changes to the floodplain. The City Engineer shall review the LOMR before it is submitted to FEMA

FLOOD PROTECTION ELEVATION

All residential, commercial, and industrial structures shall be constructed at or above the Flood Protection Elevation. The Flood Protection Elevation (FPE) shall be determined by the Engineer and shall be all of the following:

- two feet above the calculated 100-year-post development floodplain elevation, or two feet above the FEMA base flood (100-year) elevation, whichever is higher
- two feet above the 100-year storm elevation in constructed channels
- two feet above the 100-year storm elevation at low points in streets if there is no overflow channel
- two feet above the 100-year, 24-hour storm elevation in detention ponds and wet ponds
- two feet above the embankment crest of detention ponds and wet ponds

For all new structures, the lowest floor elevation that is above ground level shall be at or above the FPE. Crawl space entrances, foundation vents, basement windowsills, the top landing of outside stairways lea

SETBACK FROM FLOODPLAIN

Developments shall be designed so that the wall of any principal or accessory structure is located a minimum of 25 feet from the 100-year 24-hour post-development floodplain.

4.4 STORMWATER QUALITY REQUIREMENTS

This section addresses regulations required by the Federal Clean Water Act, and in particular the potential contamination of water bodies due to the pollutants that are generated from stormwater in the built environment. The City of Somerset, more so than other communities, relies on clean water as an asset to its economy. By protecting the waterbodies in this area, we are protecting our livelihood.

Most water quality devices will be designed such that flows generated from rainfall events greater than 0.64 inches will bypass the water quality device.

PURPOSE

The requirements set forth in this section are intended to protect the general health, safety, and welfare of the citizens of the City of Somerset, Pulaski County, and the surrounding area known as Lake Cumberland, in the following manner:

- To protect and enhance the water quality of watercourses and water bodies in a manner pursuant to and consistent with the Federal Clean Water Act by addressing storm water runoff from new development projects and existing developments that discharge into the municipal separate storm sewer system (MS4), community waters and waters of the Commonwealth.
- Prohibit illicit discharges and connections to the MS4.
- Regulate the contribution of pollutants to storm water discharges to the MS4 by any user control or eliminate soil erosion and sedimentation from construction site storm water runoff related to land disturbing activities within the City's jurisdictional limits; and
- Control or eliminate waste from construction site operators that may cause adverse impacts to water quality.

PERMITTED DISCHARGES

The following discharges are at the current time are exempt from permitting:

- A discharge or flow of fire protection water that does not contain oil or hazardous substances or materials that any regulatory Fire Code requires to be contained and treated prior to discharge.
- A discharge or flow from lawn watering, or landscape irrigation.
- A discharge or flow from a diverted stream flow or natural spring.
- Uncontaminated discharge or flow from a foundation drain, crawl space pump or footing drain.
- A discharge or flow from air conditioning condensation.
- A discharge or flow from individual residential car washing.
- A discharge or flow from a riparian habitat or wetland.
- Dechlorinated drainage from a private residential swimming pool containing no harmful quantities of chlorine or other chemicals.
- A discharge or flow from any other water source not containing pollutants.
- Upon verbal notification to the Enforcement Agency and prior to time of the test, a discharge or flow from dye testing.

NOTE: No discharge shown above will be allowed if it has been determined to be a source of a pollutant or pollutants to the MS4, community waters or waters of the Commonwealth. Written notice of such determination shall be provided to the discharger.

STORMWATER QUALITY DESIGN

Storm water quality devices shall be designed to remove pollutants including oil, grease, sediment, trash, fecal coliform, nitrogen, phosphorous, heavy metals, and other harmful pollutants from site stormwater runoff prior to being discharged to the MS4. These substances have proven to be harmful to water bodies and aquatic life and have a direct impact on the quality of the waters of the Commonwealth, and the waters of the United States.

Storm water quality devices differ from erosion and sediment control devices in that they will remain on site after construction has been completed to continue to filter pollutants from the site.

Storm water quality design will be based on determining the associated water quality volume, (WQV) for the site. The WQV is the volume of water that needs to be treated to effectively remove pollutants from 80% of the rainfall occurring over the course of a year. The rainfall depth associated with the 80th percentile rain event in Pulaski County is 0.64 inches. In simpler terms, it has been determined that rainfalls with 0.64” of depth or less statistically account for 80% of the rainfall events that occur in the County on a yearly basis.

A simplified procedure has been produced to determine the water quality volume based on the sites impervious area.

In the table below, enter the column that describes the sites percentage of impervious area, and multiply the total site acreage by the corresponding area factor to get the appropriate water quality volume for the site in cubic feet. Linear interpolation may be used to determine the area factor for sites that have impervious area percentages other than those shown.

The formula for this method is WQV = Area Factor * (Total Site Area)

Site Impervious %	10	15	20	25	30	35	40	45	50	55
Area Factor	325.2	429.8	534.3	638.9	743.4	848.0	952.5	1057.1	1161.6	1266.1

Site Impervious %	60	65	70	75	80	85	90	95	100
Area Factor	1370.7	1475.2	1579.8	1684.3	1788.9	1893.4	1998.0	2102.5	2207.0

Example: (New Development)

To determine the water quality volume for a 50 acre site that is 60% impervious, find the area factor that corresponds to a site with 60% impervious area. In this case the area factor is 1370.7. Multiply this number times 50, (the total number of acres on site) and the corresponding water quality volume in cubic feet is: *1370.7 X 50 = 68,535 cubic feet.*

A 20% reduction in the water quality volume is available for redevelopment sites. Therefore in the above example if the site were being redeveloped the corresponding water quality volume would be:

Example: (Re-Development)

68,535 c.f. X (1-0.20) = 54,828 cubic feet.

Note: Sites with less than 10% impervious area do not have to address water quality.

WATER QUALITY DEVICES

Once the water quality volume is determined, the designer will pick appropriate water quality BMP(s) that will address this volume. In most cases, multiple water quality BMP’s will be used to achieve treatment of the water quality volume that is required.

Each water quality BMP will have an associated water quality volume credit that must be determined. These water quality credits will be used against the total water quality volume of the site, until enough water quality BMP’s have been designed to address all of the sites water quality volume.

Water quality credits can be gained immediately by incorporating simple measures into the design such as using swales instead of piping and letting downspouts drain directly to grass instead of picking up their flow in a piped drainage system. The following sections describe some of the more common water quality devices that can be utilized to achieve the water quality volume for a proposed development.

Other methods to address water quality may be used when accompanied by design documentation or if approved by the City Engineer.

BUILDING DOWNSPOUTS/ROOF LEADERS DRAIN TO GRASS

Discharging downspouts from roofs onto grassed yards encourages infiltration and reduces direct discharge to impervious areas such as driveways. The grass area shall be greater than or equal to the roof area. The lot must be graded so that the downspout discharge travels at least 30 feet over grass before reaching any impervious surface.

- The infiltration credit for downspouts that discharge to grass is **1 cubic-foot for every 4.4 square feet of roof area**.

MODULAR/PERMEABLE PAVEMENT

Modular and permeable pavement consists typically of concrete having regularly interspaced voids that are filled with pervious materials such as sand, gravel, or sod, or open void space in the case of pervious concrete. Modular pavements can be used as driveways or as overflow parking in areas that are used less frequently than the main parking areas for civic, commercial, and industrial facilities. Pervious pavements may make up the entire parking area.

- Any area that is paved using modular or pervious pavement can be treated as pervious when calculating the WQV and the post-development peak runoff, as long as the appropriate design guidelines and construction specifications are met.

Design Guidelines

Large void spaces in modular pavement shall represent at least 30 percent of the total surface area of the pavement. Voids shall be filled with silty soil and vegetated with permanent grass. If vegetation is inappropriate, voids may be filled with sand or gravel, but the material shall be clean and uniform (poorly graded) to ensure high permeability.

SWALES

Swales are typically vegetated parabolic or trapezoidal channels with a large width to depth ratio that are used for conveying stormwater runoff. Swales can act both as vegetated filters and infiltration practices because they tend to slow runoff rates and allow for both particle settling and stormwater infiltration. Swales are encouraged wherever they can be used as an alternative to narrower, deeper channels that tend to convey flow at higher velocities. Swales are especially effective in reducing water quality impacts when used for roadside drainage instead of the traditional curb inlet/storm sewer system. In this application, curb cuts are used instead of drop inlets in the gutter.

- *The infiltration credit for swales is **1 cubic foot for every 4 square feet of swale**.* To obtain this credit, the area draining to the swale must be at least three times the area of the swale considering that the swale itself is part of the drainage area. For calculation purposes, the width will be the average water surface width corresponding to the depth associated with the 100-year storm.

Design Guidelines

To be considered a swale, a channel must have a width to depth ratio of at least 6:1, have a bed slope of not greater than 4 percent, and be vegetated. When swales are used for roadside drainage, curb cuts shall be provided no less frequently than one per each 100 feet of curb. Drop inlets in swales shall be spaced no closer than once per each 300 feet in order to obtain the infiltration credit. Grassed channels that do not satisfy the design criteria to be considered swales may be given an infiltration credit only for the channel bottom, if the bed slope does not exceed 4 percent.

BERMED SWALES

A bermed swale or infiltration swale is a grassed swale constructed with berms or swale blocks across the swale to impound shallow pools of water, slowing flow and providing additional opportunities for particle settling and stormwater infiltration.

- ***The infiltration credit for a bermed swale is 1 cubic foot foe every 3.5 square feet of swale.***

Design Guidelines

Swale blocks or earthen berms built across the swale shall be constructed with a 2-inch diameter PVC pipe through the berm to prevent long-term ponding of water. Berms shall be no taller than 8 inches and spaced no closer than 60 feet. Drop inlets in swales shall be spaced no closer than once per each 300 feet in order to obtain the infiltration credit.

Grassed channels that do not satisfy the design criteria to be considered swales may be given an infiltration credit only for the channel bottom, if the bed slope does not exceed 4 percent.

TERRAFORMING

Terraforming is a term for special grading practices such as terracing and berming that are intended to promote infiltration. Bermed swales are a special case of terraforming. Terraforming can range from a small depression in permeable soil to an extensive series of bermed terraces.

- ***The infiltration credit for terraforming is 1 cubic foot for every 3.5 square feet of terraformed area.***

INFILTRATION BASINS

Infiltration basins may be used in locations that have at least 5 feet of soil, with a permeability of at least 0.5 inches/hour underlying the device. The underlying 5 feet of soil must also be above the seasonal high water table.

If soils do not meet the permeability requirement, they can be modified by mixing sand and gravel in the top 5 feet of the soil underlying the device. If native soils are to be modified with sand or gravel, provide a design that shows the depth of soil to be modified and the total quantity of gravel or soil to be added. Include soil test data documenting the permeability of the soils before and after modification.

If desired, large infiltration basins can be designed much like an extended detention pond for storm peak control. The outlet structure and detention storage volumes are designed to be above the level needed to store the design WQV. The difference is that an infiltration basin does not have an extended detention outlet. Instead, the WQV is allowed to infiltrate into the soils underlying the basin. If the infiltration basin is not intended for peak flow control, it shall be designed so that volumes exceeding the WQV can discharge through an overflow weir or pipe.

- ***The infiltration credit for an infiltration basin is equal to the volume designed to be impounded before overflow or discharge to a spillway.***

Design Guidelines

- Test soils prior to designing an infiltration basin to ensure that the site is capable of infiltration. Obtain a minimum of three soil test borings or test pits to verify that the soil is at least 5 feet deep below the base elevation and has a permeability of at least 0.5 inch/hour.
- Design the floor of the basin to be as flat as possible to promote infiltration. Provide side slopes not greater than 3:1 (h:v).
- Provide a sediment forebay at the inlet to the basin with a depth of at least 4 feet and a volume of at least 10 percent of the WQV.
- Size the basin to store the design WQV before discharging through the peak flow control outlet. If the basin is intended only for water quality treatment, design an outlet that allows volumes in excess of the WQV to discharge to a surface water conveyance.
- If a base flow will be discharged into the infiltration basin, design a low flow orifice to allow base flow to pass through. Adjust the storage depth so that the basin will completely drain the WQV in 72 hours.

When using an infiltration basin for peak flow control, provide a minimum of 1 foot of freeboard above the 100-year design storm high water elevation.

- Impoundment depths shall not exceed 15 feet and storage volumes shall not exceed 25 acre-feet.
- Design earthen embankments with side slopes not steeper than 3:1 (horizontal to vertical).
- Design basins to be placed outside the receiving stream except when a basin is designed as a regional detention basin and the City has approved its use as a regional basin.
- Reserve adequate access from public or private right-of-way by establishing a maintenance easement. Design the access to be at least 10 feet wide, with a slope not greater than 5:1

VEGETATED FILTER STRIPS

A vegetated filter is a practice that relies upon the use of vegetation to filter out sediment and other pollutants from stormwater runoff. These filters also provide an opportunity for stormwater runoff to infiltrate. While this water quality device will seldom provide enough filtration to satisfy an entire development, filters can be used for small subareas of a larger development in order to reduce the total volume to be treated by other devices. A filter strip is a practice that relies upon sheet flow across the entire width of the vegetated area. The vegetation is typically grass; however, other ground cover can be used if it provides for dense vegetation. Filter strips are typically used at the edge of a parking lot or other paved surface.

Design Guidelines
Design the filter strip to have a width matching the width of the area draining to the filter. Design a filter strip to have a smooth transition with the area draining to it so that sheet flow can be developed across the filter. Design filter strips to have a minimum slope of 2 percent and a maximum slope of 6 percent. Provide a dense turf or other comparable vegetated ground cover over the whole filter area. When the contributing area draining to the filter strip is impervious, do not allow the overland flow length of the impervious surface to exceed 75 feet. When the contributing area draining to the filter strip is pervious, do not allow the overland flow length of the contributing surface to exceed 150 feet.

- ***The infiltration credit for vegetated filters is 1 cubic foot for every 13.5 square feet of filter.***

PREFABRICATED TREATMENT DEVICES

Pre-fabricated devices are manufactured by several companies. The treatment devices should be capable of demonstrating compliance with EPA mandates that a minimum of 80% of TSS (Total Suspended Solids) occurs. Each device should be evaluated by the design engineer for suitability to the site, the potential pollutants, and the maintenance requirements of the particular device. The design storm for first flush shall be 0.5” storm with a minimum time of concentration of 5 minutes.

Prefabricated devices are made by several manufacturers and will have differing levels of performance in regards to pollutant removal. Calculations specific to each manufacturer shall be supplied to the City Engineer.

STORMWATER QUALITY MAINTENANCE

Almost all stormwater quality devices require maintenance, and that maintenance requirement will fall upon the individual land owner. As such, the City will require that the property owner enters into a stormwater quality maintenance agreement with the City which will define the scope and frequency of on-site stormwater quality BMP’s. Failure to enter into this agreement with the City may prevent the land owner to secure a building permit or approval of plans for construction.

4.5 EROSION PREVENTION AND SEDIMENT CONTROL

Erosion prevention and sediment control techniques go hand in hand with stormwater quality. Unlike stormwater quality measures, they are aimed at controlling erosion during construction. They include items of construction such as rock check dams, silt fencing, inlet protection, diversion swales, sediment traps, stabilized construction entrances, concrete washout pits, or any other measure that prevents soil erosion in site runoff from entering the MS4.

LAND DISTURBANCE ACTIVITY

Land Disturbance Activity includes, but is not limited to, the following:

- Any activity disturbing one (1) or more acres of soil is subject to the provisions of this section and such activity shall not take place without an authorized EPSC, (Erosion Prevention and Sediment Control), Permit issued by the City of Somerset.
- Land disturbance activities that disturb less than one (1) acre on individual lots or parcels which are determined by the City of Somerset to be part of a larger common plan of development.
- Unless determined to be a problem by the Enforcement Agency, the following activities are exempt from obtaining an EPSC permit and are further exempt from the provisions of this section:
    - Emergencies posing an immediate danger to life or property, substantial flood or fire hazards, or natural resources.
    - Underground utility repairs in paved areas, home gardens, minor repairs, maintenance work, installation of fence, sign, telephone, and electric poles and other kinds of posts or poles.
    - Agricultural operations required to adopt and implement an individual agriculture water quality plan pursuant to the requirements set forth in the Kentucky Agriculture Water Quality Act. (KRS 224)
    - Usual and customary site investigations, such as geotechnical explorations, clearing for surveying work, monitoring wells and archaeological explorations, responsible for EPSC measures for land disturbance activity on the individual lot or parcel until the City determines that 80% build-out of the development has been reached.
    - Building improvements on existing residential dwellings. (garages, additions, porches, etc.)
- The City may exempt, on a project-by-project basis, other minor land disturbance activities not specifically identified in the exemptions above.

NOTE: Complying with the provisions of this section and issued EPSC Permit does not exempt the Permittee from obtaining coverage from the Kentucky Division of Water (KDOW) under the KPDES Storm Water General Permit for storm discharges related to construction activities that disturb one (1) acre of more. The Permittee is still required to obtain coverage under the KPDES Storm Water General Permit and shall provide a copy of the Notice of Intent filed with KDOW to the City Engineer.

EPSC PLAN REQUIREMENTS

Sites where land disturbance activities are proposed will require an EPSC Plan prepared by an Engineer licensed to practice in the Commonwealth. The EPSC Plan is a site specific document and shall include erosion prevention measures, sediment control measures, and other site best management practices necessary to prevent the discharge of sediment and other pollutants into waters of the Commonwealth.

The owner/developer/contractor shall perform all clearing, grading, drainage, construction and development in strict accordance with the approved EPSC Plan and this manual.

A current copy of the EPSC Plan shall be readily available at the construction site from the date of project Notice of Initiation (NOI) to the date of Notice of Termination (NOT).

The EPSC Plan shall include the following information:

A. The name, address, and telephone number of the owner and/or developer of the property where the land disturbance activity is proposed.

B. Site Description – At a minimum the following information shall be described:

- Function of the project
- Total acreage of the site
- Acreage to be disturbed by construction related activities
- Impervious and Pervious percentages of the existing and proposed property
- Property lines and easement locations

C. A chronological construction schedule and time frame for the following construction activities:

- Clearing and grubbing
- Construction of erosion control devices
- Installation of permanent and temporary stabilization measures
- Excavation and filling operations
- Building, parking lot and site construction
- Establishment of final grade, landscaping, or stabilization
- Removal of temporary erosion control devices.
- All other requirements of an EPSC Plan as defined in the current KPDES general permit for construction activities.

D. Site Map of sufficient scale to depict the following:

- Existing contours at 1 foot intervals.
- Finish contours at 1 foot intervals.

E. Stormwater Runoff Values:

- List pre-development runoff flowrate based on grass cover over the entire site and the runoff flowrate generated from the 25 year 24 hour storm event.
- List post-development runoff flowrate using 25 year 24 hour storm event.

F. Signature and Stamp of Licensed Professional Engineer

G. Building footprint location(s).

H. Description and location of any discharges associated with industrial activity other than construction.

I. Location of all erosion prevention measures, sediment control measures, and other site management measures utilized to reduce pollutants from stormwater discharges associated with the construction site.

J. Maintenance schedule of all erosion and sediment control measures

It shall be noted in the EPSC Plan that revisions shall be made whenever erosion prevention measures, sediment control measures, or other site management practices are significantly modified in response to the project.

EPSC INSPECTION FREQUENCY

The Permittee shall provide to the City regular inspection reports of the site at the intervals as required by the City. Such intervals shall include, but are not limited to the following:

- Once every seven (7) calendar days or at least once every fourteen days and within 24 hours after any storm event of 0.5 inches or greater.
- Construction entrances and exits shall be inspected daily and the Permittee shall take necessary steps to remove mud and dirt from public roadways as needed. Bulk clearing of sediment shall not include flushing the area with water. Cleared sediment must be redistributed or disposed of in a manner that is in compliance with all applicable statutes and rules.
- Completion of perimeter erosion and sediment controls
- Completion of cleaning and grading.
- Installation of temporary erosion controls.
- Completion of final grading and ground stabilization.

The City of Somerset may increase or decrease the number of required inspections as deemed necessary to ensure an effective EPSC Plan and has the right to enter the property of the Permittee without notice pursuant to the City's stormwater Ordinance.

EPSC INSPECTION REQUIREMENTS

The City of Somerset or their designee shall make periodic inspections of land disturbing activities subject to this manual at various stages of construction in order to ensure compliance with the approved EPSC Plan and verify that selected control measures are adequate. These periodic inspections due not relieve the Permittee from performing self-policing of the site stormwater and erosion control BMP's, and the Permittee shall correct or remedy any EPSC measures that are not effective or functioning properly during the various phases of construction. It is the permittee's responsibility to keep a maintenance log of the BMP's performance, and any remedial measures that have been taken to maintain the BMP's during the construction period.

- A visual inspection to determine if stormwater measures are properly installed, properly maintained, and performing as designed
- If excessive pollutants are entering the drainage system.

Inspection reports shall include:

- Date of inspection
- Name of inspector and company represented
- Pertinent weather information including current conditions and conditions since the last inspection
- Location(s) of any pollutant discharges
- Locations of any stormwater management measures that require maintenance
- Locations of any stormwater management measures that were inadequate or failed
- Locations requiring any additional stormwater management measures

- Identify any actions taken in response to inspection findings
- Identify any incidents of non-compliance with the EPSC

A copy of each inspection report shall be kept at the job site at all times and a copy shall be filed with the City of Somerset monthly.

EPSC REQUIREMENTS FOR INDIVIDUAL LOTS

Although no EPSC permit is required for individual lots disturbing less than one (1) acre which are not part of a larger common plan of development, a formal storm water review may be required by City Engineer prior to the issuance of a Building Permit by any agency authorized to issue such permits in the Commonwealth. The developer may be required to submit all or a portion of an EPSC Plan as defined in this section.

The following information must be submitted to the City of Somerset for review and approval prior to the issuance of a Building Permit for an individual lot as described in the Zoning Ordinance:

- A site location plan showing the individual lot and all adjacent lot dimensions, elevations, drainage patterns and swales.
- An erosion and sediment control plan which at a minimum includes the following measures:
    - Installation and maintenance of a stable construction site entrance / exit.
    - Installation and maintenance of appropriate perimeter sediment control measures prior to land disturbance.
- Self-monitoring program, including a plan and procedures.
- Certification of Compliance stating that the individual lot plan is consistent with the storm water management criteria identified within this section.

Sediment discharge and tracking from a lot must be minimized throughout the land disturbing activities until permanent stabilization has been achieved. Sediment that is either tracked or washed onto roads must be cleaned. Bulk clearing of sediment shall not include flushing the area with water. Cleared sediments must be redistributed or disposed of in a manner that is in compliance with all applicable statutes and rules. Adjacent lots disturbed by an individual lot operator must be repaired and stabilized with temporary or permanent surface stabilization. The individual lot operator is responsible for the installation and maintenance of all erosion and sediment control measures until the site is stabilized by permanent vegetative cover, pavements, or roofs.

EPSC PERMIT SUBMITTAL REQUIREMENTS

Land disturbance activities subject to the provisions of this Chapter shall not take place without an authorized EPSC Permit. Required submittal information may include, but is not limited to, the following.

For land disturbance activities that are <1 acre and are not part of a common plan of development:

- Completed Plot Plan
- Plan Review Fee based on the number of lots below:

1 to 4 lots: $350

5 to 25 lots: $500

26 to 75 lots: $1,000

76 to 150 lots: $1,500

150 or more lots: $2,500

For land disturbance activities that are part of a commercial development:

- Permit Application
- EPSC Plan
- Plan Review Fee based on the number of lots below:

Up to 5.0 acres: $500

5.1 to 10.0 acres: $1,200

10.1 to 25.0 acres: $2,000

25.1 or more acres: $2,500

Applications submitted under this chapter shall contain the information required by the City and shall be made on the form found in the appendices of this manual. The City may take up to 30 days to review and approve/disapprove the EPSC plan.

4.6 SINKHOLES

For the purposes of this section, the following definitions shall apply:

Sinkhole: Any closed depression formed by removal (typically underground) of water, surficial soil, rock or other material. The existence of a sinkhole shall be as indicated by the closed depression contour lines on topographic maps or other documents. Its actual limits may, however, be determined by field measurements with concurrence of the City's Engineer.

Immediate Sinkhole Drainage Area: Any area that contributes surface water directly to the sinkhole(s); this does not include areas which contribute surface water indirectly to a sinkhole (via streams).

Sinkhole Cluster Area: Any area that contributes surface water other than by way of a stream to a sinkhole which is located in a group of two or more sinkholes clustering together.

PLAN REQUIREMENTS

A sinkhole, the immediate sinkhole drainage area, a sinkhole cluster area or portions of such items shall be shown on the site plan and drainage plan submitted to the City for plan approval.

DEVELOPMENT IN SINKHOLE DRAINAGE AREAS

Development may occur in the immediate sinkhole drainage area if the developer provides alternative surface drainage away from the sinkhole, designed by a professional engineer or professional geologist. The design shall keep water in the same surface drainage basin, and the surface water shall not go into another sinkhole drainage area on or off the subject property or into another stream of known flooding problems.

SINKHOLE SURFACE DRAINAGE ANALYSES

The sinkhole can be used for surface runoff drainage of a proposed development if the conditions of either of the following alternatives are met:

ALTERNATIVE 1:

A sinkhole can be used for surface runoff of a proposed development with or without retention or detention facilities as recommended by a consulting engineer and a consulting hydrogeologist provided that any increase in the quantity of surface runoff due to development of the entire sinkhole drainage area in question will not aggravate flooding on the proposed development adjacent existing development, or connected/adjacent sinkhole subsurface systems. Such engineering and geological report must be substantive and based on state of the art field studies and evaluation of the specific sinkhole system. The Planning Commission shall not approve development proposals subject to Alternative 1 provisions unless the study findings meet the requirements of this subsection.

ALTERNATIVE 2:

A sinkhole can be used for surface drainage if all of the following conditions and provisions are met:

- That the runoff from the development area is either (1) completely retained in a retention basin or (2) retained in a detention basin. The flow rate out of the above basins shall be regulated so that it is no greater than the flow rate into the sinkhole of the development area prior to development for each of the following storms: ten (10) year/one (1) hour, twenty five (25) year/twenty-four (24) hour storm or a one hundred (100) year/one (1) hour storm. The out flow rate shall not aggravate flooding on downstream properties for any of these storms.
- The developer may elect to divert enough of the sinkhole drainage area so that the development of the remaining area does not increase the total quantity of runoff into the sinkhole. Where additional runoff is anticipated, a consulting engineer and a hydro geologist shall evaluate and show the effect of any additional quantity of runoff to the sinkhole and sinkhole system. For approval, the study must show the development will not aggravate flooding on the proposed development, adjacent lands, or connected/adjacent sinkhole systems.
- Where the sinkhole outlet is offsite, either the runoff leaving the subject property must be shown to be no greater in flow or in quantity than that which existed before development or written approvals must be submitted from owners of the property where any increase in flow or quantity of water must go to reach the sinkhole outlet. Easement areas shall be approved by the Planning Commission, based upon the developer's engineer calculations of proposed ponding elevation.

FILLING IN SINKHOLES AND SINKHOLE DRAINAGE AREAS

Development may involve some filling of the sinkhole drainage area or sinkhole upon approval by the City Engineer. However, no principal or accessory buildings with soil bearing foundations shall be permitted to be constructed on fill within the limits of any sinkhole.

PERMITTING

An improved sinkhole shall have a permit application by the Developer to the EPA for all Class V injection wells. The Developer shall provide a copy of the application to the City Engineer and a copy to the Planning Commission for their files.

WATER QUALITY DEVICES IN SINKHOLE AREAS

Where sinkholes are known to exist on a site, and water quality devices are proposed on the site special precautions shall be taken to ensure that the water quality design will not aggravate the condition of the on-site sinkhole. The use of any water quality device that would infiltrate water into the soil or rock underlying the site shall be accompanied by a report from a qualified engineer or hydrogeologist stating that the sinkhole, or any connected sinkholes will not be affected by the water quality device.

4.7 ENVIRONMENTALLY SENSITIVE AREAS

An environmentally sensitive areas is defined as any area which due to its natural or physical setting may have environmental problems with regard to development. This is not to say that the land cannot he developed; but if it is determined that development can occur, then some safeguards such as detailed site planning will be necessary to overcome the physical limitations of the land.

Lands in question shall include (but shall not be limited to) areas of steep slope (over 15%), floodplains, sinkholes, areas of poor soils, improper fill, wetlands, cliff areas, significant areas of tree stands, aquifer recharge areas, etc.

4.8 BRIDGES

Bridges shall be designed by a structural engineer. A copy of all permits shall be submitted to the City Engineer prior to construction for final City approval. Bridge structures are to be used at creek and stream crossings where base flow conditions do exist. These structures are to be designed to convey the 1% event flow rate unimpeded, and allow the 1% water surface elevation to be one foot below the bottom of the slab. All proposed bridges are to be certified by the designer after construction. Prior to construction all permits are to be obtained from the Corps of Engineers and/or Division of Water, if applicable.

Design considerations that apply to bridges are listed in the following:

1. Live load considerations for anticipated construction traffic, fire service vehicles, refuse trucks, commercial vehicles, etc.
2. Public protection for pedestrian and bicycle traffic, if applicable.
3. Headwalls for the upstream and downstream sides of proposed culverts. Fences or railing are to be provided for headwalls that are for 30 inch lines or greater.
4. Railing design for bridges.
5. End treatments for culverts to minimize erosion and sediment transport.
6. Scouring protection for bridge piers and abutments.
7. Fish passage.
8. Streambank stabilization designs for backwater areas and accelerated flows downstream.
9. Flooding of upstream properties shall not occur over existing levels.
10. Structures shall be designed for at least HS-20 loading. The backfilling of any box culvert shall be done in layers not exceeding six (6) inches and each layer shall be thoroughly compacted.

5.0 TRAFFIC CONTROL DEVICES

The Traffic control devices in the City of Somerset shall be based on the Manual on Uniform Traffic Control Devices (MUTCD). This includes stop bars, stop signs, way finding signage, posted speed limit signage, and signalization. All plans that affect a state maintained or controlled roadway shall be reviewed and approved by the KYDOH prior to construction activities.

5.1 STREET LIGHTING

Roadway lighting shall be provided in a development. The developer/contractor of public streets shall provide underground conduit(s) with two pull strings for street lighting (see specifications). The developer/contractor shall also provide a poured concrete base meeting the specifications of the local utility company. Spacing of the pole bases shall be determined by the City Engineer. Street lights along state roadways shall comply with KYDOH specifications for lighting, setbacks, and illumination.

The Developer/Contractor shall contact and coordinate requirements with Kentucky Utilities and/or South Kentucky RECC as applicable:

LG&E and Kentucky Utilities Company Contact:

LG&E and KU Services Company
2889 West Leestown Road
P.O. Box 4490
Midway, KY 40347
T 859-367-1397

F 502-217-2522

South Kentucky RECC Contact:

Kevin Newton
Engineering Team Leader
South Kentucky RECC
knewton@skrecc.com
(606)678-4121
(606)451-4185 direct line

In areas served by South Kentucky RECC, SKRECC will provide the anchor bolts, ground rod, 10 feet of ground wire, and set the poles and fixtures along with pulling the wire. The developer is responsible for the conduit and foundations built to SKRECC specifications. In underground served subdivisions, SKRECC requires the developer to install the conduit system and fiberglass pads for the pad-mounts to their specification. SKRECC will design the layout, set the pad-mount transformers, and pull the underground wire. Developers should contact the staking department at South Kentucky RECC at (606) 678-4121 prior to development.

6.0 SURVEYING AND MONUMENTATION STANDARDS

The following standards shall be applicable to all major subdivision plans.

A. All vertical measurements shall be based upon the North American Vertical Datum of 1983, or latest revision or adjustment.

B. Any required horizontal control monuments to be placed shall meet a minimum of third order accuracy. Third order accuracy is defined to be one foot per five thousand feet (1:5000').

   1. Number of azimuth courses between azimuth checks not to exceed fifty (50).

   2. Azimuth closure at azimuth check points not to exceed thirty (30) seconds times the square root of the number of angles or eight (8) seconds per station.

   3. Each distance measurement to be accurate within one foot (1) in seven thousand five hundred (7,500) feet.

   4. After azimuth adjustment, closing error in position not to exceed one foot per five thousand feet (1:5,000).

   5. Any vertical control monuments to be placed shall have the unadjusted vertical distances not exceeded by 0.05’ times the square root of miles.

   Orders and classification of surveys (vertical and horizontal) are as defined by the latest publications of the National Geodetic Survey.

C. The starting point of the traverse must be tied to the nearest permanent control monument of the third order or better. The coordinates shown shall be the Kentucky State Plane, single zone.

D. The subdivision control monument herein described, shall have maximum spacing of three thousand (3000) feet.

   Every boundary corner location which is determined by a land survey on the subdivision boundary or within the subdivision property will be monumented or witness monumented with rebar, steel pipe, stone markers etc. as described and required of every registered Land Surveyor in Kentucky as specified in "Minimum Standards of Practice for Land Surveying in Kentucky" effective October 1, 1980, and available from the Kentucky State Board of Registration for Engineers and Land Surveyors.

E. There shall be a minimum of four subdivision control monuments placed on the subdivision boundary.

F. Where corners are found to coincide with a previously set permanent control or subdivision monument, the designation on the previously set monument shall be shown on the plat.

G. A subdivision control monument with both horizontal and vertical control shall be required to be set at every intersection of a collector street, with an arterial street in a location shown on the final subdivision plat.

   If another monument station is not intervisible, an azimuth mark shall be set which is visible and shall be the same as a subdivision control monument or cultural feature which is permanent, suitable, and easily identified, such as spires, towers, stacks, or similar objects. An azimuth mark shall be at a distance of one thousand (1,000) feet or more away from the station monument so as to assure that a hearing determined from the permanent station marker for which it applies shall not vary from true bearing more than fifteen (15) seconds of arc.

H. The location and designation of all control monuments and azimuth markers shall be shown on the final subdivision plat. Data sheets on each subdivision control monument shall be submitted to the City Engineer.

   The corner or location chosen should be one that will not be likely to be disturbed. Original ground or excavated ground should be used for locating the control monument. A monument should never be placed in a new fill area without special precautions to make the monument permanent as approved by the City Engineer. The final placement of monuments shall occur alter substantial completion of subdivision construction.

I. DEFINITIONS: The following terms shall have the meaning indicated for the purposes of this section:

   1. Permanent Control Monuments, both vertical and horizontal, shall be substantial concrete monuments, set under the supervision of governmental agencies and within third order accuracy, or better.

   2. Subdivision Control Monuments, both vertical and horizontal, shall be substantial concrete monuments, established by third order methodology, by traverse or loops originating from and closing on permanent control monuments, as previously indicated.

   3. Control Monuments shall be construed as either permanent or subdivision control monuments.

   4. Boundary Location Monuments shall be rebar, steel pipe, stone markets, etc. as described in the "Minimum Standards of Practice for Land Surveying in Kentucky."

TABLES

Table A – SCS Curve Numbers for Differing Hydrologic Soil Groups

SCS Curve Numbers for Urban Areas					
Cover Description		Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition	Average Percent Impervious Area[2]	A	B	C	D
Fully Developed Urban Areas (Vegetation Established)					
Open Space (Lawns, Parks, Golf Courses, Cemeteries, etc.):					
Poor condition (grass cover <50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover >75%)		39	61	74	80
Impervious Areas:					
Paved Parking Lots, Roofs, Driveways, etc.					
(excluding right-of-way)		98	98	98	98
Streets and Roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Urban Districts:					
Commercial and business	85%	89	92	94	95
Industrial	72%	81	88	91	93
Residential Districts by Average Lot Size:					
1/8 acre or less (town houses)	65%	77	85	90	92
1/4 acre	38%	61	75	83	87
1/3 acre	30%	57	72	81	86
1/2 acre	25%	54	70	80	85
1 acre	20%	51	68	79	84
2 acres	12%	46	65	77	82
Developing Urban Areas					
Newly Graded Areas:					
(pervious areas only, no vegetation)		77	86	91	94

SCS Curve Numbers for Cultivated Agricultural Lands (average)						
Cover Description			Curve Numbers for Hydrologic Soil Group			
Cover Type	Ground Treatment	Hydrologic Condition (Well draining?)	A	B	C	D
Fallow	Bare Soil	-	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Raw Crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR+CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C+CR	Poor	69	78	83	87
		Good	64	74	81	85
Small Grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR+CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
Close-Seeded	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80
Pasture, Grassland, or Range - Continuous Forage for Grazing[2]		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
Meadow - Continuous Grass, Protected from Grazing and Generally Mowed for Hay		-	30	58	71	78
Brush - Brush-Weed-Grass mixture with Brush the Major Element		Poor	48	67	77	83
		Fair	35	56	70	77
		Good	30	48	65	73
Woods - Grass Combination (Orchard or Tree Farm)		Poor	57	73	82	86
		Fair	43	65	76	82
		Good	32	58	72	79
Woods		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	30	55	70	77
Farmstead - Buildings, Lanes, Driveways, and Surrounding Lots		-	59	74	82	86

Low Impact Developments:						
Technique:			**A**	**B**	**C**	**D**
Permeable Pavers / Porous Concrete / Pervious Asphalt with Standard Design			39	61	74	80
Permeable Pavers / Porous Concrete / Pervious Asphalt with Standard Design plus an additional 6" of No. 2 Stone with edge drains (the additional stone may count toward site specific storage requirements)			30	52	65	71
Raingardens			30	48	65	73

Table B – Rational Method C Values for Differing Hydrologic Soil Groups and Slope Ranges

Rational Method Table of Runoff Coefficients versus Hydrologic Soil Group (A,B,C,D) and Slope Range													
	Storm	A			B			C			D		
Land Use	Intervals	0 - 2%	2 - 6%	6%+	0 - 2%	2 - 6%	6%+	0 - 2%	2 - 6%	6%+	0 - 2%	2 - 6%	6%+
Cultivated Land	1-25	0.08	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	25-100	0.14	0.18	0.22	0.16	0.21	0.28	0.2	0.25	0.34	0.24	0.29	0.41
Pasture	1-25	0.12	0.2	0.3	0.18	0.28	0.37	0.24	0.34	0.44	0.3	0.4	0.5
	25-100	0.15	0.25	0.37	0.23	0.34	0.45	0.3	0.42	0.52	0.37	0.5	0.62
Meadow	1-25	0.1	0.16	0.25	0.14	0.22	0.3	0.2	0.28	0.36	0.24	0.3	0.4
	25-100	0.14	0.22	0.3	0.2	0.28	0.37	0.26	0.35	0.44	0.3	0.4	0.5
Forest	1-25	0.05	0.08	0.11	0.08	0.11	0.14	0.1	0.13	0.16	0.12	0.16	0.2
	25-100	0.08	0.11	0.14	0.1	0.14	0.18	0.12	0.16	0.2	0.15	0.2	0.25
Residential Lot Size 1/8 Acre	1-25	0.25	0.28	0.31	0.27	0.3	0.35	0.3	0.33	0.38	0.33	0.36	0.42
	25-100	0.33	0.37	0.4	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Residential Lot Size 1/4 Acre	1-25	0.22	0.26	0.29	0.24	0.29	0.33	0.27	0.31	0.36	0.3	0.34	0.4
	25-100	0.3	0.34	0.37	0.33	0.37	0.42	0.36	0.4	0.47	0.38	0.42	0.52
Residential Lot Size 1/3 Acre	1-25	0.19	0.23	0.26	0.22	0.26	0.3	0.25	0.29	0.34	0.28	0.32	0.39
	25-100	0.28	0.32	0.35	0.3	0.35	0.39	0.33	0.38	0.45	0.36	0.4	0.5
Residential Lot Size 1/2 Acre	1-25	0.16	0.2	0.24	0.19	0.23	0.28	0.22	0.27	0.32	0.26	0.3	0.37
	25-100	0.25	0.29	0.32	0.28	0.32	0.36	0.31	0.35	0.42	0.34	0.38	0.48
Residential Lot Size 1 Acre	1-25	0.14	0.19	0.22	0.17	0.21	0.26	0.2	0.25	0.31	0.24	0.29	0.35
	25-100	0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.4	0.31	0.35	0.46
Industrial	1-25	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.7
	25-100	0.85	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	1-25	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
	25-100	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.9	0.89	0.89	0.9
Streets	1-25	0.7	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78
	25-100	0.76	0.77	0.79	0.8	0.82	0.84	0.84	0.85	0.89	0.89	0.91	0.95
Open Space	1-25	0.05	0.1	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
	25-100	0.11	0.16	0.2	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Parking	1-25	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
	25-100	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97

Table C – Rainfall Depths for Somerset, Kentucky for Differing Recurrence Intervals and Storm Durations

POINT PRECIPITATION FREQUENCY ESTIMATES

FROM NOAA ATLAS 14

SOMERSET 2 N, KENTUCKY (15-7510) 37.1167 N 84.6167 W 1056 feet

Precipitation Frequency Estimates (inches)

Average Recurrance Interval (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr
1	0.34	0.54	0.68	0.93	1.16	1.37	1.49	1.81	2.19	2.65	3.18
2	0.4	0.64	0.8	1.11	1.39	1.64	1.77	2.15	2.61	3.16	3.81
5	0.46	0.74	0.94	1.33	1.71	2	2.16	2.62	3.18	3.85	4.65
10	0.52	0.82	1.04	1.51	**1.96**	2.29	2.48	3.01	3.65	4.41	5.34
25	0.58	0.92	1.17	1.74	2.31	2.7	2.93	3.57	4.33	**5.2**	6.31
50	0.63	1	1.27	1.91	2.59	3.04	3.3	4.04	4.89	5.84	7.09
100	0.68	1.08	1.37	2.09	**2.88**	3.39	3.68	4.53	5.49	**6.51**	7.92

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SECTION 02000 - GEOTECHNICAL INVESTIGATION REPORT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Geotechnical Investigation and Report:

1. The Contractor/Developer shall be solely responsible for obtaining a Geotechnical Report for portions of the property to be located within the public right-of-way.

B. Use of Data:

1. The City of Somerset takes no responsibility for the conclusions that individual contractors or developers may reach upon review.

2. The Geotechnical Report shall contain CBR values for all proposed roadways that are intended to be dedicated to the City. These will ultimately define the pavement section.

1.2 QUALITY ASSURANCE

A. A geotechnical engineer shall be retained by the Developer to observe performance of work in connection with excavating, trenching, filling, backfilling, and grading, and to perform compaction tests per the latest Edition of Kentucky Building Code Chapter 17 Requirements.

B. The Subcontractor shall readjust work performed that does not meet the above requirements.

END OF SECTION 02000

SECTION 015713 TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

1.2 RELATED DOCUMENTS

A. Documents affecting work of this section include but are not necessarily limited to Kentucky Storm Water General Permit, Kentucky Erosion Prevention and Sediment Control Field Guide.

B. City of Somerset, Complete Stormwater Best Management Practices, current edition.

C. KYDOH Specification Section 213 “Water Pollution Control.”

D. The Stormwater and Grading Ordinances of the City of Somerset – See appendices

1.3 PERFORMANCE REQUIREMENTS

A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), Phases I and II.

B. Comply with the stormwater and grading ordinance found in the appendices of this chapter.

C. Also comply with all more stringent requirements of State of Kentucky Erosion and Sedimentation Control Manual.

D. Develop and follow an Erosion and Sedimentation Prevention Plan.

E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

G. Storm Water Runoff: See Section 4 of this manual.

H. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.

1. Control movement of sediment and soil from temporary stockpiles of soil.
2. Prevent development of ruts due to equipment and vehicular traffic.

I. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.

1. Prevent windblown soil from leaving the project site.
2. Prevent tracking of mud onto public roads outside site.

3. Prevent mud and sediment from flowing onto sidewalks and pavements.

4. If erosion occurs due to non-compliance with these requirements, restore eroded areas.

J. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately; remove deposited sediments; comply with requirements of authorities having jurisdiction.

2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

K. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately; remove deposited sediments; comply with requirements of authorities having jurisdiction.

L. Open Water: Prevent standing water that could become stagnant.

1. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.4 SUBMITTALS

A. NOI: Submit NOI to KPDES Branch, Division of Water. A copy of the submitted NOI form shall be sent to the City Engineer.

B. BMP: Submit Best Management Practices Plan to City Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mulch: Use one of the following:

1. Straw or hay.

2. Wood waste, chips, or bark.

3. Biodegradable erosion control matting or netting.

B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

C. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:

1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D 4751.

2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D 4491.

3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D 4355 after 500 hours exposure.

PART 3 - EXECUTION

3.1 CONTINUOUS SERVICE

A. The sediment and erosion control items are to be installed prior to the commencement of all other construction activities on site. Continuous maintenance shall be required until the next contract has been signed. To transfer the Notice of Intent, a letter is to be written and signed by the new contractor. Once this letter has been received and approved by the Division of Water the Contractor's responsibility shall be relieved.

3.2 PREPARE DAILY FIELD REPORTS PER BMP REQUIREMENTS.

A. Submit to regulatory agency as required.

3.3 PREPARE EROSION AND SEDIMENT CONTROL INSPECTION AND MAINTENANCE REPORT FORM WEEKLY PER BMP REQUIREMENTS.

A. Submit to regulatory agency as required.

3.4 Remove temporary erosion sediment control measures when site is 95% stabilized.

A. Seed and protect any disturbed areas with permanent grass protect mixture.

3.5 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.6 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.

1. Width: As required; 20 feet, minimum.
2. Length: 50 feet, minimum.
3. Provide at each construction entrance from public right-of-way.
4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fences.

1. Provide linear sediment barriers:
   a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
2. Space sediment barriers with the following maximum slope length upslope from barrier:
   a. Slope of Less Than 2 Percent: 100 feet..
   b. Slope Between 2 and 5 Percent: 75 feet.
   c. Slope Between 5 and 10 Percent: 50 feet.
   d. Slope Between 10 and 20 Percent: 25 feet.

e. Slope Over 20 Percent: 15 feet.

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:

1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.

2. Straw bale row blocking entire inlet face area; anchor into pavement.

E. Storm Drain Drop Inlet Sediment Traps

F. Soil Stockpiles: Protect using one of the following measures:

1. Cover with polyethylene film, secured by placing soil on outer edges.

2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

G. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.

1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.

H. Temporary Seeding: Use where temporary vegetated cover is required.

3.7 INSTALLATION

A. Construction Site Entrance

1. Excavate minimum of 6 inches.

2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.

3. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.

B. Silt Fences

1. Store and handle fabric in accordance with ASTM D 4873.

2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.

3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.

4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.

5. Install with top of fabric at nominal height and embedment as specified.

6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.

7. Fasten fabric to wood posts using one of the following:

a. Four 3/4 inch diameter, 1 inch long, 14 gage nails.

b. Five 17-gage staples with 3/4 inch wide crown and 1/2 inch legs.

8. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.

C. Straw Bale Rows:

1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.

2. Install bales so that bindings are not in contact with the ground.

3. Embed bales at least 4 inches in the ground.

4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.

5. Fill gaps between ends of bales with loose straw wedged tightly.

6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

D. Temporary Seeding:

1. When hydraulic seeder is used, seedbed preparation is not required.

2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.

3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.

4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.

5. Incorporate fertilizer into soil before seeding.

6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.

7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.

8. Repeat irrigation as required until grass is established.

3.8 MAINTENANCE

A. Inspection of all erosion and sediment control items shall occur at least once every seven (7) days OR at least once every 14 days, AND within 24 hours after 1/2 inch rainfall.

B. Repair deficiencies immediately.

C. Silt Fences

1. Promptly replace fabric that deteriorates unless need for fence has passed.

2. Remove silt deposits that exceed one-third of the height of the fence.

3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:

1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.

2. Remove silt deposits that exceed one-half of the height of the bales.

3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

3.9 CLEAN UP

A. Remove temporary measures after permanent measures have been installed.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 016525 - ROADWAY LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing roadway lighting system.

B. Testing, painting, restoration and salvage.

1.2 STREET LIGHTS ON PRIVATE ROADWAYS

A. Streetlights may be required on private roadways serving more than 4 residences or serving a commercial use, as determined by the City Engineer. For planned developments, residential, commercial, and industrial developments where the internal streets are private, a private street lighting system will be required for the internal nondedicated streets, in addition to public street lighting provided by the Developer on the external public street frontage.

1.3 DEVELOPER'S RESPONSIBILITY

A. Existing streetlights which must be relocated or repositioned as a result of the construction of new streets or driveways into a development shall be the responsibility of the Developer.

B. A new service can with a step-down transformer, required as a result of the modification, replacement or relocation of an existing utility service pedestal shall be the responsibility of the Developer.

C. It shall be the responsibility of the Developer to ensure that the existing street light system remains operational until the new street light system to replace it is completed and functioning correctly.

D. The Developer shall coordinate with the electric utility for planning, design, preparation of plans, financing (pay all fees and costs) and operation, as required to install new streetlights. The Developer shall submit joint trench utility plans to the City showing the installation of streetlights.

E. All streetlights will be publicly owned (by City) and maintained by the electric utility via standard LS-series rate charges. Any existing private streetlight to be relocated as part of the project shall be converted to a publicly owned light, or replaced with a new streetlight of the same model and manufacturer, at the discretion of the City Engineer. In certain limited cases, the lights may be owned and maintained by the electric utility, as directed by the City Engineer.

1.4 GENERAL PLAN DETAILS

A. The plans shall show and identify all street lights to be installed, all existing lights in the immediate vicinity of the project, all conduit and conductor runs, service points, trees, and all applicable provisions and details specified in these standards.

B. On subdivision projects, a separate plan sheet shall be included for the street lighting system. This plan sheet may be combined with a signage plan. In addition, joint trench composite plans shall be submitted. Pole bases shall be provided by the developer and the spacing determined by the City Engineer.

C. Street lights (exclusive of other required information) shall also be shown on street plan and profile sheets. In addition to the above, the following shall be required on the street light portion of subdivision plans, even though duplications may be involved:

1. All details of street light construction.

2. Utility lines and public utility easements.

3. Names of adjacent subdivisions.

4. Intersecting property lines of adjacent properties.

5. Legend indicating electrical symbols.

6. A North arrow and appropriate scale. (1" = 10' to 1" = 100')

7. All existing street lights on both sides of any streets.

8. All new tree installations shall be more than 10' from street lights.

9. All trees within the vicinity of the conduit runs or proposed streetlights.

10. Street lights shall be located at least 15 feet away from any fire hydrant.

1.5 DESIGN STANDARDS

A. Street lighting shall be designed in conformance with the "American National Standard Practice for Roadway Lighting" of the American National Standards Institute (ANSI/IESNA RP-8). The following table may be used as guidance for small projects, as determined by the City Engineer.

STREET LIGHTING GUIDE					
Street Classification	Width (Face of Curb to Face of Curb)	Typical Pole Height (feet)	HighPressure Sodium Lamp (Watts)	Typical Spacing	Maintained Illuminance (Ft. Candles)
Local Residential	24-40	25	70	200-250	.47
Collector	30-64	30	100	200-250	.87
Industrial	40-64	30	100	200-250	.41
Arterials shall be per KYTC Guidelines and Specifications					
Note:					
Standard Cobra style with 8’ standard mast arms shall be typical. Post top style/decorative lighting shall be designed by a Professional Engineer/Manufacturer’s Engineer toconfirm illuminance requirements are meet. Open Space, commercial sites, bike paths, etc. shall be calculated by lighting designer (ProfessionalEngineer/Manufacturer’s Engineer)					

B. Data and calculations indicating compliance shall be submitted for review, when required by the City Engineer. The electrical system shall be designed for 120 volts single phase. In special circumstances, the design voltage may be increased to 240 volts. Voltages higher than 240 will not be allowed. Electronic copies of light photometric distribution patterns shall be provided for any non-standard lights.

C. Lumens used to calculate the Average Illuminance shall be based on 80% of the manufacturer’s value for the lamp. The luminaire depreciation factor (dirt accumulation) shall be 60%.

D. Lamps other than High Pressure Sodium are not allowed unless written permission by the City Engineer is granted.

E. Light Spacing may be adjusted ±10% to allow for driveways and other physical obstacles.

F. Open space design criteria shall be reviewed and approved by the City Engineer on a case by case basis.

G. A luminosity plan shall be provided to the City Engineer.

H. Provide shields on house-side of luminaire.

I. Intersections: Intersections shall have at least one streetlight.

J. Cul-de-sacs: All cul-de-sacs exceeding 130 feet in length, measured from the street light location at the intersection to the right-of-way line at the end of the cul-de-sac, shall have a streetlight within the bulb.

K. The developer/contractor of public streets shall provide underground conduit(s) with 2 pull strings for use for street lighting (see specifications). The developer/contractor shall also provide a poured concrete base meeting the specifications of the local utility company. Street lights along state roadways shall comply with KYDOH specifications for lighting, setbacks, and illumination.

1.6 SUBMITTALS

A. A written notice from the serving utility company, stating that line clearance and service have been checked and that the street lighting design meets utility standards and will be served by the utility, shall be submitted to the City Engineer for all developments.

1.7 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS

A. Notify Engineer of Record, City of Somerset, and Owner of System (for example, Kentucky Utilities, SKRECC, etc.) prior to performing any work on existing systems.

B. Allow 20-feet minimum overhead clearance across thoroughfares and 12-feet minimum clearance above sidewalk areas. Do not run temporary conductor on top of the ground or across any sidewalk area unless protected in an electrical raceway and barricaded.

C. Maintain existing electrical systems or approved temporary replacements, in effective operation for the benefit of the traveling public during the progress of the Work, except when shutdown is permitted to allow for alteration or removal of the systems. Do not interfere with the regular lighting schedule.

1.8 UTILITY COMPANY CONTACTS

A. The Developer/Contractor shall contact and coordinate requirements with Kentucky Utilities and/or South Kentucky RECC as applicable:

LG&E and Kentucky Utilities Company Contact:
LG&E and KU Services Company2889 West Leestown Road
P.O. Box 4490 Midway, KY 40347
(859) 367-1397
Fax (502) 217-2522

South Kentucky RECC
Contact: Kevin Newton
Engineering Team Leader
South Kentucky RECC
knewton@skrecc.com
(606)678-4121
(606)451-4185 direct line

B. In areas served by South KY RECC, South Kentucky RECC will provide the anchor bolts, ground rod, 10 feet of ground wire, and set the poles and fixtures along with pulling the wire. The developer is responsible for the conduit and foundations built to South Kentucky RECC specifications. In underground served subdivisions, SKRECC requires the developer to install the conduit system and fiberglass pads for the pad-mounts to their specifcation. SKRECC will design the layout, set the pad-mount transformers, and pull the underground wire. Developers should contact the staking department at South Kentucky RECC at (606)678-4121 prior to development.

PART 2 - PRODUCTS

2.1 EXISTING MATERIALS

A. Where existing systems are to be modified, incorporate existing material in revised system; salvage or abandon as indicated.

2.2 CONDUCTORS

A. Materials: Solid or stranded copper of size indicated conforming to ASTM B 3 and ASTM B 8. Insulation; RHH- RHW-USE grade cross link polyethylene compound.

B. Splicing: Compatible with cable insulation and water seal for underground use. Comply with UL code.

C. Company.

2.3 POLES AND LUMINAIRE SUPPORTS

A. Provide poles and luminaire supports conforming to the height, type, configuration, and base detail indicated on drawings and/or per Utility Company details and specifications.

2.4 JUNCTION BOXES

A. Buried type per Utility Company and as follows.

1. Precast reinforced concrete in paved surfaces.

2. Plastic in landscaped surfaces.

B. Cover Stencil: "Street Lighting". Where box contains street lighting voltage greater than 600 volts, stencil "High Voltage."

2.5 INSULATING TAPE

A. Type 1 vinyl chloride per ASTM D 2301.

2.6 LUMINAIRE

A. Luminaire: Die cast aluminum housing complete with reflector, refractor, lamp socket, slipfitter, replaceable air filter, ballast components or as indicated.

1. Lamp wattage, voltage, and IES distribution type as indicated.

2. Not less than 10 degrees of adjustment above a horizontal position, and not less than 5 degrees of adjustment from a vertical position.

3. Lower housing door assembly removable with quick disconnect plugs to permit field maintenance or upgrading to other lamp types.

4. Glare shields when indicated.

B. Mercury Constant Wattage Regulated Ballasts: Prewired ballast with minimum primary power factor of 90- percent with normal secondary load with sufficient open circuit voltage to start lamps at minus 20 deg. F. Ballast shall provide regulation within 5-percent variation in lamp watts with a 10-percent variation in primary voltage.

C. High Pressure Sodium Lamps: 250 or 400 watts as indicated.

D. Bonding and Grounding: Copper wire strap No. 6 AWG minimum.

E. Paint: None.

2.7 CONTROL EQUIPMENT

A. Photo-electric control sensitive between 1 and 5 foot candles, minimum.

B. Failure of any electrical component will energize the lighting circuit.

C. Control Relay Contacts Rating: Switch on at 3,000 watts minimum.

D. Remote Control Relays: Normally open.

E. Relays: Either mechanical armature type or mercury tube type, single or double pole, or as indicated.

1. Mechanical armature type: An operating coil (120 volts), a laminated core, a laminated armature, terminals and silver alloy contacts.

2. Mercury tube type: An operating coil, hermetically sealed mercury tubes and terminals. Contacts shall be made either mercury to mercury or between mercury and alloy resistant to arcing and mercury amalgamation.

F. Enclosure: NEMA 250 Type 4 with dead front panel, keyed padlock

G. Paint: Waterproof paint.

2.8 POLYSULFIDE BASE, SINGLE COMPONENT SEALANT

A. Chemical curing; capable of being continuously immersed in water, withstand movement up to 20-percent of joint width, and satisfactorily applied throughout a temperature range to 40 to 80 deg. F.; Shore A hardness of minimum 15 and maximum 50; nonstaining and non-bleeding; color as selected by ENGINEER.

2.9 CONCRETE AND GROUT

A. Concrete: Class 3000.

B. Grout.

PART 3 - EXECUTION

3.1 PREPARATION

A. Contractor/Developer shall coordinate utility locations.

B. Excavate and backfill.

C. Do not disturb roadway surface, sidewalk, curb, gutter, or other obstructions without approval.

D. Do not block or restrict pedestrian traffic, vehicle traffic, drainage or utilities.

E. Barricade all excavations in traveled ways.

F. Compact excavated trench material to the requirements of the adjacent areas.

G. After backfilling excavations, maintain smooth and well-drained surfaces until permanent repairs are effected.

H. Legally dispose of all excess or waste material.

3.2 POLE FOUNDATION

A. Construct foundation per details indicated and specifications of the Utility Company having jurisdiction.

3.3 CONDUIT INSTALLATION

A. Use rigid steel conduit in areas subject to vehicular load, on the surface of structures, inside of structures and foundations, between structures, and the adjacent pull boxes located next to structures.

B. Place conduit as follows.

Location	Depth of Burial
In front of curb faces	36" to 60" below gutter grade line Back of the back of curb 24" to 36" below top back of curb
Railroad tracks	36" to 60" below bottom of ties Primary power cables 40" minimum

C. Use sizes of conduit indicated or use larger sizes for any run at no additional cost to City of Somerset, or OWNER. No expanding or reducing fittings will be permitted.

D. Make field cuts square and true so that the ends will come together for full circumference. Paint threads on all rigid steel conduit with rust preventive paint before couplings are made. Repair damaged coating on galvanized steel conduit.

E. Cap all conduit ends with standard pipe caps until wiring is installed. When caps are removed from metallic conduit, provide threaded ends and approved conduit bushings.

F. Clean all existing underground conduit to be incorporated into new system with a mandrel and blow out with compressed air. Where existing rigid steel conduit systems are to be modified or extended, install rigid steel conduit.

G. Make changes in direction by bending the conduit to a radius which will meet code or, preferable, by the use of standard bends or elbows.

H. Install a No. 12 AWG pull wire or equivalent strength cord in all conduits which are to receive future conductors. Leave at least 2-feet of pull wire extending beyond each end of the conduit run and secure.

I. Center conduit ends within the bolt circle of traffic signal poles or pedestals.

J. Pack conduit ends with sealant after conductors are installed.

K. Cap all conduit terminated without a pull box and identify its location by monumenting.

3.4 CONDUCTOR INSTALLATION

A. Install wiring per the appropriate articles of NFPA 70. Neatly arrange wiring within cabinets, junction boxes, etc.

B. Splice only at junction boxes, transformer leads, in pole bases, or at control equipment. Splice conductors as per manufacturer's recommendations and codes. Provide a fused connector between the line and the ballast, accessible at the hand holes located in the poles.

C. Provide conduit to separate low-voltage conductors from high-voltage conductors in the same raceway (i.e. poles).

D. Splice insulation shall consist of layers of vinyl chloride, electrical insulating tape applied to a thickness equal to and well lapped over the original insulation to provide uninterrupted underwater operation.

E. Leave 2-feet of slack at each pole. Leave 18-inches of slack above top of pull box grade.

F. Mark termination of each conductor. Where circuit and phase are clearly indicated by conductor insulation, bands need not be used, otherwise use bands.

3.5 GROUNDING INSTALLATION

A. Effectively ground metallic cable sheaths, metal conduit, nonmetallic conduit grounding wire, ballast and transformer cases, service equipment, anchor bolts, metal poles, and pedestals, and make mechanically and electrically secure to form a continuous system. Use a copper wire strap for bonding and grounding jumpers of the same cross-sectional area as No. 6 AWG for all lighting systems.

B. Ground one side of the secondary circuit of series-multiple and step-down transformers. Ground metal conduit, service equipment, and neutral conductor at service point as required by NEC and electricity company with grounding conductor No. 6 AWG or larger.

C. In all nonmetallic (PVC) type conduit, provide a No. 8 AWG bare copper wire continuously and ground at each junction box.

D. At each multiple service point, unless otherwise indicated, furnish a ground electrode. Use copper coated ground electrodes of steel or iron in one piece lengths at least 3/4 inch in diameter. Do not use electrodes of nonferrous materials less than 1/2 inch in diameter.

E. Bond metal poles by means of a No. 8 AWG bonding wire attached from a grounding bushing to a foundation bolt or to a 3/16 inch or larger brass or bronze bolt installed in the lower portion of the pole.

F. On wood poles, ground all equipment mounted less than 8-feet above the ground surface.

G. Ground metallic conduit or bonding conductor system at intervals less than 500-feet to one of the following:

1. 1 inch galvanized pipe driven 8-feet deep.

2. 1/2 inch copper rod driven 8-feet deep.

3. Metal water main with the approval of the water company. Clean water main thoroughly prior to connection.

H. Use galvanized grounding bushings and bonding jumpers for bonding of metallic conduit in a concrete pull box. Use lock nuts for bonding of metallic conduit in steel pull boxes, one inside and one outside of the box.

3.6 JUNCTION AND PULL BOX INSTALLATION

A. Install at the locations indicated, and at additional points when conduit runs are more than 200-feet.

B. Rest bottom of pull box firmly on a 12-inches thick bed of 1-inch crushed rock extending a minimum of 6-inches beyond the outside edge of box.

C. Establish grade of top of boxes as for foundations.

D. Place long side of box parallel to curb unless indicated.

E. Use box extensions if ballasts or transformers are installed in box.

F. Do not install boxes in driveway aprons.

3.7 LUMINAIRES AND BALLASTS INSTALLATION

A. Immediately prior to installation, clean all light control surfaces, refractors, and reflectors to provide the maximum lumen output possible. Clean per the luminaire manufacturer's recommendations.

B. Mount at the height indicated.

C. Adjust luminaires uniformly to give the optimum light distribution.

3.8 PAINTING

A. Apply coatings per Utility Company Specifications.

B. Recoat all painted equipment when relocated.

C. Use 2 coats of paint on relocated and new work.

3.9 FIELD QUALITY CONTROL

A. Conduct the following tests on all lighting circuits and record the date and time of test.

1. Test for continuity of each circuit.
2. Test for grounds in each circuit.
3. Megger test at 500 volts DC on each completed lighting circuit. The insulation resistance to ground shall be not less than 10 megohms.
4. Test voltage and current on each circuit.

B. Functional Test:

1. Perform a functional test in which it is demonstrated that each and every part of the system functions as specified or intended.
2. A functional test for each new or modified electrical system will consist of not less than 5 days of continuous, satisfactory operation. If unsatisfactory performance of the system develops, correct the condition and repeat the test until the 5 day continuous satisfactory operation is obtained.
3. Do not start functional tests or turn-ons on Friday, or on the day preceding a legal holiday.
4. Shutdowns caused by factors beyond CONTRACTOR's control will not constitute discontinuity of the functional test.

C. Replace or correct any material revealed by these tests to be faulty.

D. Provide equipment, personnel, cable connections, and electrical energy for testing. Certify that each circuit has been completely tested and testing procedures are satisfied.

3.10 SALVAGE

A. Terminate all conduit abandoned in place at least 5-inches below finished grade and verified that it no longer has power.

B. Exercise care in removing equipment to be reused or salvaged so that it will remain in the condition existing prior to its removal.

3.11 RESTORATION

A. Replace damaged equipment, concrete work or other fixtures disturbed or damaged by the installation.

B. Restore or replace roadway pavement cuts.

C. Restore or replace disturbed plantings in landscaped areas.

END OF SECTION

OUTH KENTUCKY RURAL ELECTRIC COOPERATIVE

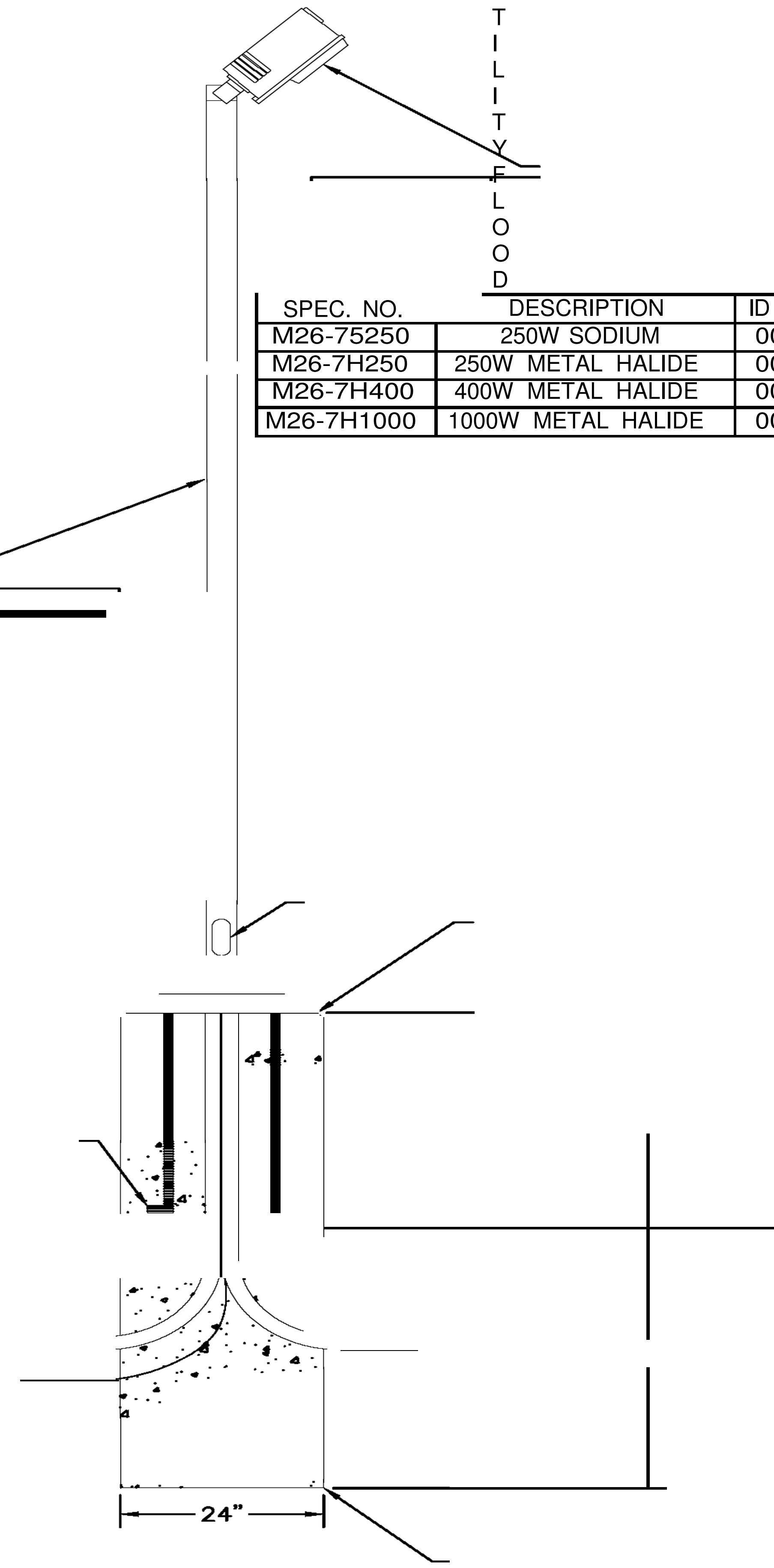
UTILITY FLOOD LIGHTING / METAL

UTILITY FLOOD

SPEC. NO.	DESCRIPTION	ID NUMBER
M26-75250	250W SODIUM	00504560
M26-7H250	250W METAL HALIDE	00504574
M26-7H400	400W METAL HALIDE	00504575
M26-7H1000	1000W METAL HALIDE	00504576

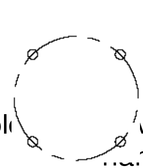
METAL POLE

SPEC. NO. DESCRIPTION ID NUMBER P30PKGMSQ30FT



Square Pole

TOP VIEW OF ANCHOR BASE



Handhole, beveled formed edges and rubbed concrete 30" above ground.

BASE

SPEC. NO.	DESCRIPTION	ID NUMBER
UM1-10PKLOT	PARKING LOT LIGHTING BASE	NON-INVENTORY

S

SECTION 310001 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. City of Somerset Manuals, Regulations, and Ordinances.

B. Section Includes:

1. This Section includes all work; labor, machinery, disposal and replacement of unsuitable soil, removal of rock and any materials encountered to plan bottom depth/ subgrade for all earthwork related items. These items shall include, but are not limited to, earthwork procedures for drives, parking lots, pavements, and utility trenches, etc., that will be dedicated to the City or located within the right of way.

2. The following is a list of the items, which are included as a part of this work:

a. Preparing subgrades for walks, pavements, lawns, and plantings.

b. Subbase course for concrete walks and pavements.

c. Base course for asphalt paving.

d. Subsurface drainage backfill for walls and trenches.

e. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

3. Placement of topsoil.

1.2 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Subbase Course: Aggregate layer placed between the subgrade course and base courses.

D. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

E. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

F. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

H. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, structures, drainage fill, drainage course, or topsoil materials.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Topsoil: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on the site and /or amend existing surface soil to produce topsoil. Supplement with imported topsoil when quantities are insufficient to achieve the grading effort as shown on the drawings. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

L. Utilities: On-site underground pipes, conduits, ducts, and cables.

1.3 QUALITY ASSURANCE

A. Blasting is not allowed in the City without written permission from the City Engineer.

B. Geotechnical Testing Agency Qualifications: An independent testing agency obtained by the Owner qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

C. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction. Prepared aggregate subbase shall comply with the Kentucky Transportation Cabinet (KTC) standard specifications, latest edition and with the local governing regulations, if more stringent than herein specified.

1.4 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Utility Locator Service: Notify “Call 811 Before You Dig" for the area where Project is located before beginning earth moving operations.

C. Do not commence earth-moving operations until temporary erosion- and sedimentation-control measures are in place.

D. Existing Utilities: Do not interrupt utilities serving occupied facilities unless permitted in writing by City Engineer and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify City Engineer not less than 7 days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Engineer's written permission.

3. Contact utility-locator service for area where Project is located before excavating.

4. Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

5. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the utility owner's satisfaction at no cost to the Owner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soils: Soil Classification Groups CL, GW, GP, SW, SP, and SM according to ASTM D 2487 or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

B. CH soils not meeting the requirements above may be considered as satisfactory soils when modified in accordance with the Kentucky Transportation standard specifications Section 208 “Chemically Stabilized Roadbed”, and upon review by the Geotechnical Engineer, and the City Engineer.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups not approved or recommended by on-site Geotechnical Engineer.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

2. All unsatisfactory soil beneath pavement shall be remediated in accordance with recommendations from a Geotechnical Engineer. All soil remediation actions including excavation, proof rolling, soil placement, compaction, and lime modification, shall be monitored by the on-site Geotechnical Engineer.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C 33; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
6. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 50 gpm per sq ft per, minimum; ASTM D 4491.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
6. Apparent Opening Size: No. 30 (0.6-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch (10-mm)] nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Delete subparagraph below for low-density, controlled low-strength material using foaming agent.

7. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. (480 to 576 kg/cu. m)) at point of placement, when tested according to ASTM C 138/C 138M.

2. Compressive Strength: 80 psi (550 kPa) 10 psi (965 kPa), when tested according to ASTM C 495.

2.4 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric.

2. Yellow: Gas, oil, steam, and dangerous materials.

3. Orange: Telephone and other communications.

4. Blue: Water systems.

5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.

2. Yellow: Gas, oil, steam, and dangerous materials.

3. Orange: Telephone and other communications.

4. Blue: Water systems.

5. Green: Sewer systems.

2.5 GEOGRID REINFORCEMENT

A. Geogrid Reinforcement: A biaxial polymeric grid formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth to function primarily as reinforcement.

B. The geogrid shall be integrally formed and deployed as a single layer having the following characteristics (ALL VALUES ARE MINIMUM AVERAGE ROLL VALUES UNLESS A RANGE OR CHARACTERISTIC IS INDICATED):

Property	Test Method	Units	Type 1	Type 2
Aperture Stability Modulus at 20 cm kg (2.0 m-N)	Kinney 2001	m-N/deg	0.32	0.65
Rib Shape	Observation	N/A	Rectangular or Square	Rectangular or Square
Nominal Aperture Size	Calipered	in(mm)	0.03(0.76)	0.05(1.27)

Junction Efficiency	GRI-GG2-87	%	93	9
Flexural Rigidity	ASTM D1388-96	mg-cm	250,000	750,000
Minimum True Initial Modulus in Use	ASTM D6637-01			
MD		lb/ft(kN/m)	17,140 (250)	27,420(410)
CMD		lb/ft(kN/m)	27,420(400)	44,550(620)

2.6 CHANNEL PROTECTION TRANSITION MATS

A. A transition mat is a biotechnical alternative for rip rap. It is a mechanically-anchored 4 ft. X 4 ft. X .5 inch semi-rigid, polymer mat designed with voids throughout the structure which enable vegetative growth. The synergy of mechanical protection and vegetation enables this BMP system to resist much higher shear stresses and velocities than vegetation alone or rock rip rap.

1. Transition mats must be used in combinations with other soil covers: 1) sod, 2) sod and turf reinforcement mat combinations (TRMs), or 3) hybrid TRMs, such as: High-Performance turf reinforcement mats (HP TRMs), and geotextile/TRM combinations where vegetation is unlikely. Transition mats do not dissipate energy by impact, but rely on the expansion area downstream to dissipate scour forces. Specified anchors are essential to performance.

2. Transition mats provide immediate and long term soil-loss protection as a no-maintenance post-construction BMP. Transition mats are part of a Stormwater Treatment Practice (STP) incorporating scour protection and a vegetated swale promoting pollutant filtration and groundwater recharge, supporting the Phase II MS4 minimum requirements. Formulated with 10+ years, and with UV protection which colors it a dark green. A permanent installation once vegetated, the mat is mostly shielded from the sun and undetectable.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Protect subgrades and foundation soils from freezing temperatures and frost. Provide protective insulating materials as necessary.

E. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

3.4 EXCAVATION--GENERAL

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

2. Cut and protect roots.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

   1. For pipes carrying liquids subject to freezing below 32 degrees Fahrenheit, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

   1. Clearance: 12 inches (300 mm) each side of pipe or conduit

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

   1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

   2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.

   3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.

   4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 6 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

   1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

F. If Engineer and Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed on site geotechnical engineer representative.

G. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.7 SUBGRADE INSPECTION

A. Notify Owner and Geotechnical Engineer when excavations have reached required subgrade.

B. If the City or the Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed by on site geotechnical engineer representative.

C. Proof-roll subgrade below the pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

3. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for Record Documents.

3. Testing and inspecting underground utilities.

4. Removing concrete formwork.

5. Removing trash and debris.

6. Removing temporary shoring and bracing, and sheeting.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Roadways: Provide 6-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 3 Section "Cast-in-Place Concrete.

D. Place and compact initial backfill of subbase material free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

H. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.11 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Refer to geotechnical report.

C. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. This does not relieve the contractor from meeting topsoil requirements. Refer to landscape specifications.

D. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 SOIL MOISTURE CONTROL

A. Refer to the percentages as stated in the geotechnical engineer's written recommendations.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Fill to contours and elevations indicated using unfrozen materials.

B. All Fill operations shall comply with the Geotechnical Engineers Recommendations.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

H. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are overexcavated.

1. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to 100 percent of maximum dry density.

2. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:

1. Under paving, slabs-on-grade, and similar construction: 97 percent of maximum dry density.

2. At other locations: 95 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 0.1 ft.

2. Walks: Plus or minus 0.05 ft.

3. Pavements: Plus or minus 0.05 ft.

3.15 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 95 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

2. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.

3.16 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. The developer will adhere to KYDOH Specifications for Roadways, current edition, when performing work on state maintained roads in lieu of these specifications.

B. Install separation fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends where indicated on construction drawings.

C. Under pavements and walks, place subbase course on separation fabric according to fabric manufacturer's written instructions.

D. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

E. On prepared subgrade, place subbase course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends where indicated on construction drawings.

2. Place base course material over subbase course under hot-mix asphalt pavement.

3. Shape subbase course to required crown elevations and cross-slope grades.

4. Place subbase course 6 inches (150 mm) or less in compacted thickness in a single layer.

5. Place subbase course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.

6. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

F. Pavement Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.17 FIELD QUALITY CONTROL

A. Special Inspections and Quality Assurance: The Contractor shall engage a qualified testing agency perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.

2. Determine that fill material and maximum lift thickness comply with requirements.

3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of controlled fill.

5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly.

6. Meet requirements of 2007 KBC chapter 17.

B. Quality Assurance Testing: Owner shall engage a qualified geotechnical engineering testing agency to perform quality assurance testing and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Special Inspections: Owner shall hire testing agency for state required special inspections.

1. Meet Requirements of 2007 KBC chapter 17.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D698, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by geotechnical engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soils, waste materials, including trash, and debris, and legally dispose of.

END OF SECTION

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill Material: As specified in Section “Grading”, “Fill”, and “Earthwork”

PART 3 - EXECUTION

3.1 SITE CLEARING

A. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

B. Protect and maintain benchmarks and survey control points from disturbance.

C. Locate and clearly flag trees and vegetation to remain or to be relocated.

3.2 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

E. Minimize interference with adjoining roadways, streets, walks, and other adjacent facilities during site clearing operations.

3.3 VEGETATION

A. Scope: Remove trees, shrubs, brush, stumps, and root masses in areas to be covered by building structure, paving, playing fields, lawns, and planting beds.

B. Do not begin clearing until vegetation to be relocated has been removed.

C. Tree Protection: Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain:

1. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
2. Around other vegetation to remain within vegetation removal limits.
3. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
4. Do not store construction materials, debris, or excavated material within drip line of remaining trees.

D. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.

1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.

2. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.

3. Sod: Re-use on site if possible; otherwise treat as specified for other vegetation removed.

4. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.

E. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to City.

1. Employ a qualified arborist, licensed in the jurisdiction where the project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.

2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

F. Existing Trees shall be protected. The following table shall be used to assess damages if trees are removed without written permission.

1. Cross sectional areas of trees and their base value based on $48 per square inch.

Diameter	Cross Section Square Inches	Base Value $48/Sq. In.
6	28.3	$1,358
12	113.1	$5,429
24	452.4	$21,715
26	530.9	$25,483
28	615.8	$29,558
30	706.9	$33,931
32	804.3	$38,606
34	907.9	$43,579
36	1017.9	$48,859
38	1134.1	$54,437
40	1256.6	$60,336
48	1809	$86,832

G. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to the excavation as possible.

1. Cover exposed roots with burlap and water regularly.

2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.

4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

3.4 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 312200 - GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for paved areas (roads and parking).

C. Finish grading.

1.2 RELATED DOCUMENTS

A. City of Somerset Grading and Stormwater Ordinances – See Appendices

1.3 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with State of Kentucky, Highway Department standards.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: See Section “Fill”.

B. Topsoil: Conforming to State of Kentucky, Highway Department standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Notify utility company to remove and relocate utilities.

E. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

F. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

G. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

3.3 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove remainder from site.

B. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.5 FINISH GRADING

A. Before Finish Grading:

   1. Verify building and trench backfilling have been inspected.

   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

E. Place topsoil in areas where seeding are indicated.

F. Place topsoil to the following compacted thicknesses:

G. Place topsoil during dry weather.

H. Remove roots, weeds, rocks, and foreign material while spreading.

I. Near plants spread topsoil manually to prevent damage.

J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

K. Lightly compact placed topsoil.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

B. Top Surface of Finish Grade: Plus or minus 1/2 inch.

3.7 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.8 FIELD QUALITY CONTROL

A. See Section “Fill” for compaction density testing.

3.9 CLEANING

A. Remove unused stockpiled topsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping if indicated. Otherwise prepare and seed as indicated in seeding specification.

END OF SECTION

SECTION 312316 – TRENCHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building to utility main connections.

1.2 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.3 SUBMITTALS

A. Compaction Density Test Reports.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. General Fill: Conforming to State of Kentucky Highway Department standard.

B. Structural Fill: Conforming to State of Kentucky Highway Department standard.

C. Concrete for Fill: As specified in Section 033000; compressive strength of 2500 psi.

D. Granular Fill: Coarse aggregate, conforming to State of Kentucky Highway Department standard.

E. Topsoil: See Section “Fill”.

PART 3 - EXECUTION

3.1 PREPARATION

A. Locate, identify, and protect utilities that remain and protect from damage.

B. Notify utility company to remove and relocate utilities.

C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Protect plants, lawns, rock outcroppings, and other features to remain.

3.2 TRENCHING

A. Cut trenches wide enough to allow inspection of installed utilities.

B. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

C. Stockpile excavated material to be re-used in area designated on site in accordance with Section “Grading”.

3.3 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.4 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

H. Compaction Density Unless Otherwise Specified or Indicated:

1. Under paving, slabs-on-grade, and similar construction: 90 percent of maximum dry density.

I. Reshape and re-compact fills subjected to vehicular traffic.

3.5 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Utility Piping, Conduits, and Duct Bank:

1. Bedding: Use granular fill.
2. Cover with general fill.
3. Fill up to subgrade elevation.
4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.

C. At Pipe Culverts:

1. Bedding: Use granular fill.
2. Place filter fabric over compacted bedding.
3. Cover with granular fill, see trench details.
4. Fill up to subgrade elevation.
5. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.

D. At French Drains:

1. Use granular fill.
2. Fill up to 8 inches below finish grade.
3. Compact to 95 percent of maximum dry density.

3.6 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.7 FIELD QUALITY CONTROL

A. Conform to all OSHA (Occupational Safety and Health Administration) requirements, training and guidelines.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: at each compacted initial and final backfill layer, at least one test for each 150 linear feet or less of trench length, but no fewer than two tests.

3.8 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 312316 - EXCAVATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation for paving, site utility structures, and utilities.

B. Trenching for utilities outside the building to utility main connections.

1.2 PROJECT CONDITIONS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 PREPARATION

A. See Section “Grading” for additional requirements.

B. Locate, identify, and protect utilities that remain and protect from damage.

C. Notify utility company to remove and relocate utilities.

D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Protect plants, lawns, rock outcroppings, and other features to remain.

3.2 EXCAVATING

A. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

B. Cut utility trenches wide enough to allow inspection of installed utilities.

C. Hand trim excavations. Remove loose matter.

D. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.

E. Grade top perimeter of excavation to prevent surface water from draining into excavation.

F. Remove excavated material that is unsuitable for re-use from site.

G. Remove excess excavated material from site.

3.3 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

END OF SECTION

SECTION 312500 - EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Documents: Documents affecting work of this section include but are not necessary limited to Kentucky Storm Water General Permit, Kentucky Erosion Prevention and Sediment Control Field Guide, and other sections of the manual.

C. KYDOH Specification Section 213 “Water Pollution Control”

1.2 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. In general, the section includes all of the sediment and erosion control items needed to satisfy the regulatory authorities and may include, but not be limited to the following:

1.3 SUMMARY

A. In general, the section includes all of the sediment and erosion control items needed to satisfy the regulatory authorities and may include, but not be limited to the following:

1. Sign and obtain the Notice of Intent.
2. Prepare and maintain a Best Management Practice Plan (BMP).
3. Termination of the Notice of Intent.

1.4 PERFORMANCE REQUIREMENTS

A. Submit Notice of Intent: Fill out, sign and submit the Notice of Intent for the Division of Water. Sample form is attached.

B. Prepare a Best Management Practice Plan (BMP): Prepare and maintain, for the each construction phase, a BMP Plan. Update periodically as site conditions change. A guideline entitled “NPDES Best Management Practices Guideline Document” is available online at http://cfpub.epa.gov/npdes/stormwater/swppp.cfm.

C. Weekly inspection of all erosion and sediment control items. Inspection is also required after rainfalls of 0.5 inches or more. Sample inspection report forms are attached.

D. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for the 2003 Construction General Permit (CGP), whether the project is required by law to comply or not.

E. Also comply with all more stringent requirements of State of Kentucky Erosion and Sedimentation Control Manual.

F. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

G. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

H. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

I. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.

   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.

J. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.

   1. Control movement of sediment and soil from temporary stockpiles of soil.

   2. Prevent development of ruts due to equipment and vehicular traffic.

   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas.

K. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.

   1. Prevent windblown soil from leaving the project site.

   2. Prevent tracking of mud onto public roads outside site.

   3. Prevent mud and sediment from flowing onto sidewalks and pavements.

   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas.

L. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

   1. If sedimentation occurs, install or correct preventive measures immediately; remove deposited sediments; comply with requirements of authorities having jurisdiction.

   2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

M. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

   1. If sedimentation occurs, install or correct preventive measures immediately; remove deposited sediments; comply with requirements of authorities having jurisdiction.

N. Open Water: Prevent standing water that could become stagnant.

   1. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.5 SUBMITTALS

A. NOI: Submit NOI to KPDES Branch, Division of Water, per attached instructions. A copy of the submitted NOI form shall be sent to the City Engineer.

B. BMP: Submit BMP to the City Engineer of Somerset.

C. Subcontractor Signatures: Signatures of all subcontractors for approval stating that they have read, understand and that they intend to comply with the BMP. A copy of the signatures shall be submitted to the Architect and the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mulch: Use one of the following:

1. Straw or hay.
2. Wood waste, chips, or bark.
3. Erosion control matting or netting.

B. Grass Seed for Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

C. Bales: Air dry, rectangular straw bales.

1. Cross Section: 14 by 18 inches, minimum.
2. Bindings: Wire or string, around long dimension.

D. Bale Stakes: One of the following, minimum 3 feet long:

1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
2. Wood, 2 by 2 inches in cross section.

E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:

1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D 4751.
2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D 4491.
3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D 4355 after 500 hours exposure.
4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D 4632.
5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D 4632.
6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D 4533.
7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
8. Manufacturers:

F. Silt Fence Posts: One of the following, minimum 5 feet long:

PART 3 - EXECUTION

3.1 Continuous Service: The sediment and erosion control items are to be installed prior to the commencement of all other construction activities on site. Continuous maintenance shall be required.

3.2 Prepare Erosion and Sediment Control Inspection and Maintenance Report Form weekly perBMP requirements. Submit to regulatory agency as required.

3.3 Remove temporary erosion sediment control measures: when site is 95% stabilized. Seed andprotect any disturbed areas with permanent grass protect mixture.

3.4 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.5 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.6 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.

1. Width: As required; 20 feet, minimum.
2. Length: 50 feet, minimum.
3. Provide at each construction entrance from public right-of-way.
4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fences.

1. Provide linear sediment barriers:
   a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
2. Space sediment barriers with the following maximum slope length upslope from barrier:
   a. Slope of Less Than 2 Percent: 100 feet..
   b. Slope Between 2 and 5 Percent: 75 feet.
   c. Slope Between 5 and 10 Percent: 50 feet.
   d. Slope Between 10 and 20 Percent: 25 feet.
   e. Slope Over 20 Percent: 15 feet.

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:

1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.

2. Straw bale row blocking entire inlet face area; anchor into pavement.

3. Stone Bags

4. Storm Drain Drop Inlet Sediment Traps

E. Soil Stockpiles: Protect using one of the following measures:

1. Cover with polyethylene film, secured by placing soil on outer edges.

2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

F. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.

1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.

G. Temporary Seeding: Use where temporary vegetated cover is required.

3.7 INSTALLATION

A. Traffic-Bearing Aggregate Surface:

1. Excavate minimum of 6 inches.

2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.

3. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.

B. Silt Fences:

1. Store and handle fabric in accordance with ASTM D 4873.

2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.

3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.

4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.

5. Install with top of fabric at nominal height and embedment as specified.

6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.

C. Straw Bale Rows:

1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.

2. Install bales so that bindings are not in contact with the ground.

3. Embed bales at least 4 inches in the ground.

4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.

5. Fill gaps between ends of bales with loose straw wedged tightly.

6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

D. Temporary Seeding:

1. When hydraulic seeder is used, seedbed preparation is not required.

2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.

3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.

4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.

5. Incorporate fertilizer into soil before seeding.

6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.

7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.

8. Repeat irrigation as required until grass is established.

3.8 MAINTENANCE

A. Inspection of all erosion and sediment control items shall occur at least once every seven (7) days OR at least once every 14 days, AND within 24 hours after 1/2 inch rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:

1. Promptly replace fabric that deteriorates unless need for fence has passed.

2. Remove silt deposits that exceed one-third of the height of the fence.

3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:

1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.

2. Remove silt deposits that exceed one-half of the height of the bales.

3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

3.9 CLEAN UP

A. Remove temporary measures after permanent measures have been installed.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 321123 - AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate base course.

B. Paving aggregates.

1.2 RELATED REQUIREMENTS

A. State of Kentucky Highway Department Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Coarse Aggregate: Coarse aggregate, conforming to State of Kentucky Highway Department standard.

B. Fine Aggregate: Sand; conforming to State of Kentucky Highway Department standard.

C. Geotextile Fabric: Non-biodegradable, woven.

2.2 SOURCE QUALITY CONTROL

A. Where aggregate materials are specified using ASTM D 2487 classification, test and analyze samples for compliance before delivery to site.

B. If tests indicate materials do not meet specified requirements, change material and retest.

C. Provide materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

C. Proof roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 m.p.h..

2. Proof-roll with a loaded 10-wheel, tandem axel dump truck weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.3 INSTALLATION

A. Place aggregate in maximum 4 inch layers and roller compact to specified density.

B. Level and contour surfaces to elevations and gradients indicated.

C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content. The water content of the compacted soil shall be within 95% of the optimum moisture content as determined by a geo-technical engineer.

E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation From Design Elevation: Within 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556.

C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("Standard Proctor").

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade.

3.6 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate base course.

B. Single course bituminous concrete paving.

C. Double course bituminous concrete paving.

D. Surface sealer.

1.2 RELATED REQUIREMENTS

A. State of Kentucky Highway Department specifications.

B. KYTC Plant Certification.

C. Asphalt Contractors shall be Pre-Qualified with the Kentucky State Department of Highways.

1.3 REFERENCE STANDARDS

A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; 1994.

B. AI MS-19 - A Basic Asphalt Emulsion Manual; The Asphalt Institute; Third Edition.

C. ASTM D 946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 1982 (Reapproved 2005).

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with State of Kentucky Highways standard.

B. Mixing Plant: Conform to State of Kentucky Highways standard.

C. Obtain materials from same source throughout.

D. Testing Agency Qualified according to ASTM D 3666 for testing indicated.

E. Preinstallation Conference to be held at project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following.

    a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.

    b. Review condition of subgrade and preparatory work.

    c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

    d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for paving work on public property.

1.6 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Asphalt Cement: ASTM D 946.

B. Aggregate for Base Course: In accordance with State of Kentucky Highways standards.

C. Aggregate for Binder Course: In accordance with State of Kentucky Highways standards.

D. Aggregate for Wearing Course: In accordance with State of Kentucky Highways standards.

E. Fine Aggregate: In accordance with State of Kentucky Highways standards.

F. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

G. Primer: In accordance with State of Kentucky Highways standards.

H. Tack Coat: Homogeneous, medium curing, liquid asphalt.

I. Seal Coat: AI MS-19, sand type.

2.2 ASPHALT PAVING MIXES AND MIX DESIGN

A. Base Course: 3.0 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

B. Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

C. Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

D. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.3 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with AI MS-2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct and all unsatisfactory conditions have been corrected.

3.2 BASE COURSE

A. Place and compact base course.

3.3 PREPARATION - PRIMER

A. Apply primer in accordance with manufacturer's instructions.

B. Apply primer on aggregate base or subbase at uniform rate of 1/3 gal/sq yd.

C. Use clean sand to blot excess primer.

3.4 PREPARATION - TACK COAT

A. Apply tack coat in accordance with manufacturer's instructions.

B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd.

C. Coat surfaces of manhole frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

D. Avoid smearing or staining adjacent surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with State of Kentucky Highways standards.

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Place to thickness identified in schedule at end of Section.

D. Install gutter drainage grilles and frames in correct position and elevation.

E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

F. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.6 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Place asphalt binder course within 24 hours of applying primer or tack coat.

B. Place binder course to thickness identified in schedule at end of section.

C. Place wearing course within two hours of placing and compacting binder course.

D. Place wearing course to thickness identified in schedule at end of section.

E. Install gutter drainage grilles and frames in correct position and elevation.

F. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

G. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.7 SEAL COAT

A. Apply seal coat to surface course in accordance with AI MS-19.

3.8 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch for the base course and 1/8 inch for the surface course measured with 10 foot

B. Compacted Thickness:

1. Base course within plus or minus 1/2 inch of specified or indicated thickness.

2. Surface course within plus or minus 1/4 inch of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch.

3.9 FIELD QUALITY CONTROL

A. Provide field inspection and testing. Take samples and perform tests in accordance with AI MS-2.

B. Asphalt Contractors shall be Pre-Qualified with the Kentucky State Department of Highways.

C. Replace and compact hot mix asphalt where core tests were taken.

D. Remove and replace or install additional hot mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 2 days or until surface temperature is less than 140 degrees F.

3.11 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from project site and legally dispose of them in an EPA approved landfill.

B. Do not allow milled materials to accumulate on site.

END OF SECTION

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete sidewalks, stair steps, integral curbs, gutters, median barriers, parking areas, roads, and ramps.

1.2 RELATED REQUIREMENTS

A. NPCA Certified for Precast.

B. KYTC Plant Certification.

C. Contractors shall be Pre-Qualified with the Kentucky State Department of Highways.

1.3 SUBMITTALS

A. Product Data: Provide data on joint filler, admixtures, and curing compound.

B. Design Data: Indicate pavement thickness, designed concrete strength, reinforcement, and typical details.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

    a. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

2. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

3. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

4. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

5. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 PAVING ASSEMBLIES

A. Comply with applicable requirements of ACI 301.

B. Concrete Sidewalks and Median Barrier: 4000 psi 28 day concrete, 4 inches thick, buff color Portland cement, exposed aggregate finish.

C. Parking Area Pavement: 4,500 psi 28 day concrete, 5 inches thick, 6/6 - 6 x 6 inch mesh reinforcement, wood float finish.

2.2 REINFORCEMENT

A. Reinforcing Steel and Welded Wire Reinforcement

B. Fiber Reinforcement

1. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 inches long.

C. Reinforcing Steel: ASTM A 615/A 615M Grade 40 (280); deformed billet steel bars; unfinished finish.

D. Steel Welded Wire Reinforcement: Plain type, ASTM A 185/A 185M; in flat sheets; unfinished.

E. Dowels: ASTM A 615/A 615M Grade 40 (280); deformed billet steel bars; unfinished finish.

2.3 CONCRETE MATERIALS

A. Obtain cementitious materials from same source throughout.

B. Concrete Materials: From certified supplier.

C. Exposed Aggregate: Gravel washed natural mineral aggregate, 0.5 inch minimum and 1.0 maximum size, natural grey color, from a single source to be approved by owner.

D. Fly Ash: ASTM C 618, Class C or F.

E. Water: Clean, and not detrimental to concrete.

F. Chemical Admixtures: ASTM C 494/C 494M, Type A - Water Reducing, Type C - Accelerating, and Type G - Water Reducing, High Range and Retarding, only on approval of the City Engineer

2.4 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1, as required by authorities having jurisdiction, and at rates recommended by manufacturer.

D. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.

E. Concrete Properties:

1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4500 psi.

2. Water-Cement Ratio: Maximum 40 percent by weight.

3. Total Air Content: 4-1/2 percent, ±1.5 percent, determined in accordance with ASTM C 173/C 173M.

4. Maximum Slump: 4 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.2 SUBBASE

A. Prepare subbase in accordance with State of Kentucky Highways standards.

3.3 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

3.4 REINFORCEMENT

A. Place reinforcement as indicated.

B. Interrupt reinforcement at contraction joints.

C. Place dowels to achieve pavement and curb alignment as detailed.

D. Provide doweled joints as indicated on center at interruptions of concrete. Lubricate or asphalt coat one half of dowel length to prevent concrete bonding to one side of joint.

E. Install welded wire reinforcement and fabricated bar mats in lengths as long as possible.

3.5 COLD AND HOT WEATHER CONCRETING

A. Follow recommendations of ACI 305R when concreting during hot weather.

B. Follow recommendations of ACI 306R when concreting during cold weather.

C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.6 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Do not place concrete when base surface is wet.

C. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

E. Place concrete to pattern indicated.

F. Apply surface retarder to all exposed surfaces in accordance with manufacturer's instructions, including follow-up applications per manufacturer's specification .

3.7 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Align curb, gutter, and sidewalk joints.

B. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

C. Place 1/2 inch wide expansion joints at 20 foot or as indicated, intervals and to separate paving from vertical surfaces and other components and in pattern indicated.

1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.

2. Secure to resist movement by wet concrete.

D. Provide scored joints:

1. At 4 feet intervals, minimum.

2. Between sidewalks and curbs.

3. Between curbs and pavement.

E. Saw cut contraction joints 1/4 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.8 FINISHING

A. Area Paving: Light broom, texture perpendicular to pavement direction.

B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.

C. Median Barrier: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.

D. Curbs and Gutters: Light broom, texture parallel to pavement direction.

E. Inclined Vehicular Ramps: Broomed perpendicular to slope.

F. Place sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.9 JOINT SEALING

A. Per KYTC specifications.

3.10 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests.

1. Provide free access to concrete operations at project site and cooperate with appointed firm.

2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

4. Perform additional tests when concrete consistency appears to change.

B. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.

1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

2. Perform one slump test for each set of test cylinders taken.

C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

D. Concrete pavement will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting at contractor's expense, will be performed to determine compliance of replaced or additional work if specified requirements.

3.11 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian or vehicular traffic over pavement until 75 percent design strength of concrete has been achieved.

C. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 321413- CAST-IN-PLACE TACTILE TILES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies furnishing and installing cast-in-place tactile tiles.

1.2 PRODUCTS

A. Use only cast-in-place tactile tiles approved by the City of Somerset.

1.3 QUALITY ASSURANCE

A. Provide cast-in-place tactile tiles and accessories as produced by a single manufacturer. Installer's Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project. Manufacturer's supervisor shall be present at initial installation.

B. Americans with Disabilities Act (ADA): Provide tactile warning surfaces which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES) or through equivalent facilitation.

C. Precast Polymer Concrete (PPC) cast-in-place tiles shall be a precast polyester polymer concrete composition with the following physical properties.

1. Water Absorption of Tile when tested by ASTM-D 570 not to exceed 0.25%.
2. Slip Resistance of Tile when tested by ASTM-C1028 the combined wet/dry static co-efficient of friction not to be less than 0.80.
3. Compressive Strength of tile when tested by ASTM-C109 not to be less than 14,000 psi.
4. Tensile Strength of Tile when tested by ASTM-D570 not to be less than 1,800 psi.
5. Flexural Strength of Tile when tested by ASTM – C384 not to be less than 3,000 psi.
6. Abrasive Wear of Tile when tested by ASTM-C501 not more than 0.01 inches
7. Fire Resistance: When tested to ASTM E84 Class A.

D. Precast Polymer Concrete (PPC) cast-in-place tiles embedded in concrete shall meet or exceed the following test criteria:

1. Accelerated Aging and Freeze Thaw Test of Tile when tested to ASTM-C666 shall show no evidence of cracking, delamination, warpage, checking, blistering, color change, loosening of tiles or other defects.
2. Tile to Concrete Bond Strength when tested to ASTM-C482 shall have no failure at bond line.
3. Impact Strength of bonded Tiles to Concrete when tested to ASTM-D2444 not less than 100 ft lbs.

PART 2 - EXECUTION

2.1 INSTALLATION

A. During all concrete pouring and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

B. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Cast-In-Place Tile System. An overly wet mix will cause the Cast-In-Place Tile System to float, therefore under all conditions suitable weights such as concrete blocks or sandbags (25 lb) shall be placed on each installed tactile tile.

C. Prior to placement of the Cast-In-Place Tile System, the manufacturer’s shop drawings shall be reviewed and the installation contractor shall resolve the issues related to pattern repeat, tile cuts, expansion joints, control joints, platform curves, platform end returns and platform surface interferences.

D. The concrete shall be poured and finished level, true and smooth to the required dimensions prior to tile placement. Immediately after pouring concrete, a mason’s line should be strung parallel to track to act as a reference line for placement of tile, and then the tile assembly shall be placed true to the platform edge and to each other on the concrete. Prior to placing the tiles in the concrete remove approximately ½ inch of concrete in the placement area to prevent tiles from floating. The Cast-In-Place tiles shall be tamped or vibrated into the fresh concrete to ensure that the field level of tile is flush to the adjacent concrete or platform edge surface. The shop drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes. The tolerance for elevation differences between tile and adjacent surface is 1/16".

E. Immediately after tile placement, the tile elevation is to be checked to adjacent concrete or rubbing board heights with a steel straight edge. The tile elevation should be set consistent with shop drawings to permit water drainage to or away from track as the platform design dictates.

F. While concrete is workable a steel edging trowel 1/8" radius x 3/16" return is to be used to edge the tile to adjacent concrete surfaces running parallel to track. While edging, ensure that a clean edge definition is created between tile and adjacent concrete and that tile to concrete elevations meet the shop drawing tolerances.

G. The placement of Cast-In-Place Tiles to each other and to the mason’s line or form edge shall be true and parallel to develop a true line consistent with the platform edge. A tight tile to tile placement can best be achieved by raking out the concrete at the butting edge to avoid trapping concrete or aggregate between tiles and/or form edge.

H. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external forces placed on the tile to rock the tile, causing a void between the underside of tile and concrete.

I. Following tile placement, review installation tolerances to shop drawings and adjust tile before the concrete sets, suitable weights of 25 lb. shall be placed on each tile and additional weights at tile to tile assemblies as necessary to ensure solid contact of tile underside to concrete.

J. Following the curing of the concrete, if concrete bleeding occurs between tiles, a stiff bristle brush with water will clean the residue without damage to the tile surface.

2.2 CLEANING AND PROTECTING

A. Protect tiles against damage during construction period to comply with tactile tile manufacturer’s specification.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tiles by method specified by manufacturer.

END OF SECTION

SECTION 321414 - PERMEABLE INTERLOCKING CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Permeable Interlocking concrete paver units.

B. Open grid concrete paver units.

C. Crushed stone bedding material.

D. Open-graded subbase aggregate.

E. Open-graded base aggregate.

F. Bedding and joint/opening filler materials.

G. Edge restraints.

H. Geotextiles

1.2 ENVIRONMENTAL REQUIREMENTS

A. Do not install in rain or snow.

B. Do not install frozen bedding materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Paver Installation Subcontractor Qualifications:

1. Utilize an installer having successfully completed concrete paver installation similar in design, material and extent.

2.2 DELIVERY, STORAGE, AND HANDLING

A. Substitutions: That meet the specified requirements.

1. General: Comply with Division 1 Product Requirement Section.

2.3 ENVIRONMENTAL REQUIREMENTS

A. Thickness: 3-1/8 inches nominal.

B. Do not install in rain or snow.

1. Style: As selected by Owner.

C. Do not install frozen bedding materials.

1. Color: Selected from manufacturer's full range.

2.4 MAINTENANCE

A. Compressive Strength: Minimum of 7200 psi.

B. Open Grid Pavers: Precast concrete units complying with ASTM C 1319.

1. Compressive Strength: 5000 psi average, with minimum of 4500 psi.
2. Absorption: Maximum of 10 lb per cubic ft averaged over three units.
3. Net Area: Minimum 50 percent.
4. Thickness: 3-1/8 inches.
5. Color: Natural.

C. Granular Setting Bed: Clean crushed stone complying with gradation requirements of ASTM C 33 for fine aggregates.

D. Aggregate Fill: Open-graded aggregate for filling voids and joints in open grid paver units, conforming to requirements of ASTM C 33 for No. 9 or No. 10 crushed stone.

E. Edging: Concrete curb, as detailed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate is level or to correct gradient, smooth, capable of supporting pavers and imposed loads, and ready to receive work of this Section.

B. Verify gradients and elevations of substrate are correct.

3.2 INSTALLATION OF PERMEABLE PAVER UNITS

A. Maintain uniform joints between paver units not more than 1/8 inch wide.

B. Cut paver units at edges with masonry saw.

C. Compact and seat paver units into screeded setting bed using low amplitude plate compactor capable of at least 5,000 lb centrifugal compaction force.

D. Vibrate and compact pavers again while sweeping aggregate fill or topsoil into joints and openings in pavers, stopping when fill material is within 1/2 inch from top surface of units. Do not compact within 3 ft of unrestrained paver edges.

E. Completely fill voids in pavers with aggregate fill. Remove excess material.

F. General

1. Any excess thickness of soil applied over the excavated soil subgrade to trap sediment from adjacent construction activities shall be removed before application of the geotextile and subbase materials.
2. Keep area where pavement is to be constructed free from sediment during entire job. Base and bedding materials contaminated with sediment shall be removed and replaced with clean materials.
3. Do not damage drainpipes, overflow pipes, observation wells, or any inlets and other drainage appurtenances during installation.

3.3 PERMEABLE INTERLOCKING CONCRETE PAVERS AND JOINT/OPENING FILL MATERIAL

A. Lay the pavers in the pattern(s) and joint widths shown on the drawings or as selected by the Owner. Maintain straight pattern lines.

B. Fill gaps at the edges of the paved area with cut units. Cut pavers subject to tire traffic shall be no smaller than 1/3 of a whole unit.

C. Cut pavers and place along the edges with a masonry saw.

D. Fill the openings and joints with 3/8” chips.

E. Remove excess aggregate on the surface by sweeping pavers clean.

F. Compact and seat the pavers into the bedding material using a low-amplitude, 75-90 Hz plate compactor capable of at least 4,000 lbs (18 kN) centrifugal compaction force. This will require at least two passes with the plate compactor.

G. Do not compact within 6 ft (2 m) of the unrestrained edges of the paving units.

H. Apply additional aggregate to the openings and joints, filling them completely. Remove excess aggregate by sweeping then compact the pavers. This will require at least two passes with the plate compactor.

I. All pavers within 6 ft (2 m) of the laying face must be left fully compacted at the completion of each day.

J. The final surface tolerance of compacted pavers shall not deviate more than ±3/8 (10 mm) under a 10 ft (3 m) long straightedge.

K. The surface elevation of pavers shall be 1/8 to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.

END OF SECTION

SECTION 321714 - RECYCLED PLASTIC PARKING BUMPERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Recycled plastic parking bumpers and anchorage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Parking Bumpers: Recycled plastic parking bumpers, conforming to the following:

1. Nominal Size: 4 inches high, 6 inches wide, 6 feet long.
2. Profile: Manufacturer's standard.
3. Color:
    a. Accessible parking stalls - blue or blue and white.
    b. General parking stalls - concrete gray.
4. Composition: 97% LDPE, 3% colorant.

B. Mounting Hardware: Three Steel Spikes with flat head, 1/2 inch diameter, with 12 inch long, pointed tip or as provided by the Manufacturer meeting the manufacturer's standards and specifications for installation of the recycled plastic vehicle stop.

C. Adhesive: Epoxy type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Clean surfaces thoroughly prior to installation.

B. Install units without damage to shape or finish. Replace or repair damaged units.

C. Install units in alignment with adjacent work.

END OF SECTION

SECTION 321723 - PAINTED PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Parking lot markings, including parking bays, crosswalks, arrows, handicapped symbols, and curb markings.

B. Roadway lane markings and crosswalk markings.

C. "No Parking" curb painting.

D. Thermoplastic shall be used at intersection markings (Stop Bars, Crosswalks, Turn Arrows, Bike Lane Markings, etc.).

1.2 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Line and Zone Marking Paint: MPI No. 97 Latex Traffic Marking Paint; color(s) as indicated.

1. Roadway Markings: As required by authorities having jurisdiction.
2. Parking Lots: White.
3. Handicapped Symbols: Blue.
4. Crosswalks: Safety Yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

3.2 PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean surfaces thoroughly prior to installation.

1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.

D. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

E. Temporary Pavement Markings: When required or directed by the City Engineer, apply temporary markings of the color(s), width(s) and length(s) as indicated or directed.

1. After temporary marking has served its purpose, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that surface to which the marking was applied will not be damaged.

3.3 INSTALLATION

A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F or more than 95 degrees F.

C. Apply in accordance with manufacturer's instructions.

D. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov).

E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

F. Roadway Traffic Lanes: Use suitable mobile mechanical equipment that provides constant agitation of paint and travels at controlled speeds.

1. Conduct operations in such a manner that necessary traffic can move without hindrance.

2. Place warning signs at the beginning of the wet line, and at points well in advance of the marking equipment for alerting approaching traffic from both directions. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic.

3. If paint does not dry within expected time, discontinue paint operations until cause of slow drying is determined and corrected.

4. Distribute glass beads uniformly on the paint lines within ten seconds without any waste, applied at rate of 6 pounds per gallon of paint.

3.4 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

END OF SECTION

SECTION 321731 - STEEL GUARDRAIL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Steel guardrail and steel posts.

B. Excavating for post bases.

1.2 RELATED REQUIREMENTS

A. KYTC Standard Specifications

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable code for rail height or location restrictions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Guardrail Beam: AASHTO M 180 Class A Type I; W profile; rolled steel sections, die punched bolt holes for site assembly and attachment to posts, formed steel curved terminating sections.

B. Steel Posts: ASTM A 36/A 36M rolled steel shapes.

2.2 ACCESSORIES

A. Concrete: Type specified in Section 033000.

B. Hardware: Steel, bolts, nuts and washers to suit rail profile.

2.3 FINISHES

A. Components: Galvanized in accordance with ASTM A 123/A 123M.

B. Hardware: Hot-dip galvanized to weight required by ASTM A 153/A 153M.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install rails and posts and accessories in accordance with manufacturer's instructions.

B. Set top of rail at height indicated by authorities having jurisdiction.

C. Space posts at intervals not exceeding 10 feet.

D. Drive posts plumb to correct elevations.

E. Attach rails securely to posts with anchoring hardware.

3.2 TOLERANCES

A. Posts - Maximum Variation From Plumb: 1/2 inch.

B. Rail - Maximum Offset From True Position: 1 inch.

C. Rail - Maximum Variation From True Height: 1/2 inch.

D. Components shall not infringe adjacent property lines.

END OF SECTION

SECTION 329219 - SEEDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Seeding

B. Hydroseeding, mulching and fertilizer.

C. Maintenance.

1.2 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.3 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: March 1st through April 15th.

2. Fall Planting: September 1st through October 15th.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.4 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.

a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

A. Fresh, clean, dry, new-crop seed complying with AOSA's Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Mixture:

1. Turf Type Fescue (Festuca arundinacea): 70 percent. Minimum two types of the following cultivars:

a. Falcon II

b. Apache II

c. Crossfire II

d. Rembrandt

e. Houndog V

2. Perennial Ryegrass (Lolium perenne): 20 percent. Minimum two types of the following cultivars:

a. Legacy II

b. Brightstar II

c. Catalina

d. Majesty

e. Prelude III

3. Annual Ryegrass (Lolium multiflorum): 10 percent.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.

2. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch (12.5-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. (2.4 kg/cu. m) of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. (4 kg/cu. m) of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.5 SOIL MATERIALS

A. Topsoil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with off-site topsoil when on-site quantities are insufficient.

B. Topsoil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.

2.6 ADDITIONAL MATERIALS

A. Mulching Material:

1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

2. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

3. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

4. Organic Matter Content: 50 to 60 percent of dry weight.

    a. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

5. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

B. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

C. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

D. Pesticides: Registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

E. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

F. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

G. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

H. Erosion Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 4-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the work include, but are not limited to the following:

    a. North American Green; SC-150.

    b. Invisible Structures, Inc.; Slopetame 2

    c. Presto Products Company, a business of Alcoa; Geoweb.

    d. or equivalent.

2.7 TESTS

A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

B. Submit minimum 10 oz sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this Section.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare subgrade in accordance with Section 310001 - Earthwork.

B. Place topsoil in accordance with Section 310001 - Earthwork.

C. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.

2. Protect grade stakes set by others until directed to remove them.

D. Install erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Mix lime with dry soil prior to mixing fertilizer.

C. Apply directly to subgrade before loosening. Spread topsoil, apply soil amendments and fertilizers on surface, and thoroughly blend planting soil.

1. Delay mixing fertilizer with topsoil if planting will not proceed within a few days.

D. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

E. Mix thoroughly into upper 2 inches of topsoil.

F. Lightly water to aid the dissipation of fertilizer.

3.4 SEEDING

A. Apply seed at a rate of 6 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. All disturbed areas shall be seeded for lawn.

D. Do not sow immediately following rain, when ground is too dry, or during windy periods.

E. Roll seeded area with roller not exceeding 112 lbs.

F. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.

G. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

H. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.5 HYDROSEEDING

A. Apply seeded slurry with a hydraulic seeder at a rate of 34 lbs per 1000 sq ft evenly in two intersecting directions.

B. Do not hydroseed area in excess of that which can be mulched on same day.

C. Immediately following seeding, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.

D. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

E. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.6 PROTECTION

A. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36 inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.7 MAINTENANCE

A. Provide maintenance at no extra cost to City; City will not pay for water.

B. Provide maintenance of seeded areas for three months from Date of Substantial Completion.

C. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.

D. Neatly trim edges and hand clip where necessary.

E. Immediately remove clippings after mowing and trimming.

F. Water to prevent grass and soil from drying out.

G. Roll surface to remove minor depressions or irregularities.

H. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

I. Immediately reseed areas that show bare spots.

J. Protect seeded areas with warning signs during maintenance period.

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Owner’s representative:

1. At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90% over any 10' sq. ft. and bare spots not exceeding 5 by 5 inches.

END OF SECTION

SECTION 329223 - SODDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation of subsoil.

B. Placing topsoil.

C. Fertilizing.

D. Sod installation.

E. Maintenance.

1.2 QUALITY ASSURANCE

A. Sod Producer: Company specializing in sod production and harvesting with minimum five years' experience, and certified by the State of Kentucky.

B. Installer Qualifications: Company approved by the sod producer.

1.3 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of fertilizer and herbicide mixture.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration.

B. Do not deliver more sod than can be laid within 24 hours.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Turfgrass Sod

1. Turfgrass Sod: Certified, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

a. Turf Type Fescue (Festuca arundinacea): 100 percent. Minimum two types of the following cultivars:

(1) Falcon II

(2) Apache II

(3) Crossfire II

(4) Rembrandt

(5) Houndog V

(6) or equivalent cultivar

2.2 ACCESSORIES

A. Wood Pegs: Softwood, sufficient size and length to ensure anchorage of sod on slope.

B. Wire Mesh: Interwoven hexagonal metal wire mesh of 2 inch size.

C. Edging: Galvanized steel.

2.3 SOURCE QUALITY CONTROL

A. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this section.

3.2 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil and prior to installation of sod.

C. Apply fertilizer no more than 48 hours before laying sod.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.3 MAINTENANCE

A. Provide maintenance at no extra cost to City; City will not pay for water.

B. Provide maintenance of sodded areas for three months from Date of Substantial Completion.

C. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.

D. Neatly trim edges and hand clip where necessary.

E. Immediately remove clippings after mowing and trimming.

F. Water to prevent grass and soil from drying out.

G. Roll surface to remove irregularities.

H. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

I. Immediately replace sod to areas that show deterioration or bare spots.

J. Protect sodded areas with warning signs during maintenance period.

3.4 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Landscape Architect:

1. At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas (not exceeding 3"x3"), and surface irregularities.

END OF SECTION

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation of subsoil.

B. Topsoil bedding.

C. New trees, plants, and ground cover.

D. Mulch and Fertilizer.

E. Maintenance.

F. Tree Pruning.

1.2 REFERENCE STANDARDS

A. ANSI/ANLA Z60.1 - American Standard for Nursery Stock; 2004.

B. ANSI A300 Part 1 - American National Standard for Tree Care Operations -- Tree, Shrub and Other Woody Plant Maintenance -- Standard Practices; 2001.

1.3 SUBMITTALS

A. Maintenance Data: Include cutting and trimming method; types, application frequency, and recommended coverage of fertilizer.

1.4 QUALITY ASSURANCE

A. Nursery Qualifications: Company specializing in growing and cultivating the plants with three years documented experience.

B. Measurements: Measure plants according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks / canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements six inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.

1.5 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Plant Materials: Certified by federal department of agriculture; free of disease or hazardous insects.

1.6 FIELD CONDITIONS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.

B. Do not install plant life when wind velocity exceeds 30 mph.

1.7 WARRANTY

A. Provide one year warranty.

B. Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within the specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by the owner, or incidents that are beyond the Contractor's control.

    b. Structural failures including plantings falling or blowing over.

C. Include the following remedial actions as a minimum:

1. Immediately remove dead plants and replace unless required to plant in succeeding planting season.

2. Replace plants that are more than 25 percent dead or in an unhealthy condition at the end of the warranty period.

3. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.

4. Provide extended warranty for period equal to original warranty period, for replaced plant material.

D. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

PART 2 - PRODUCTS

2.1 PLANTS

A. Plants: Species and size identified in plant schedule, grown in climatic conditions similar to those in locality of the work.

B. Trees: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.2 SOIL MATERIALS

A. Topsoil: Excavated from site or from clean source.

2.3 SOIL AMENDMENT MATERIALS

A. Fertilizer: Containing fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis..

B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.

C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.

D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

E. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of plants.

2.4 ACCESSORIES

A. Wrapping Materials: Burlap.

B. Wrapping: Waterproof fabric.

2.5 TOP SOIL MIX

A. A uniform mixture of 1 part peat and 3 parts topsoil by volume.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that prepared subsoil are ready to receive work.

B. The contractor shall verify that each tree or shrub planting pit will percolate (drain) prior to adding topsoil and installing trees or shrubs.

1. Fill the bottom of selected holes with 6 inches of water.
2. Water should percolate out within a 24-hour period.
3. If soil at a given area does not drain properly the contractor shall contact the Landscape Architect for further instructions.

C. Verify that required underground utilities are available, in proper location, and ready for use.

3.2 PREPARATION OF SUBSOIL

A. Protect structures, utilities, sidewalks, pavements, other facilities, lawns, and existing plants from damage caused by planting operations.

B. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested and obtain Architect's acceptance of layout before planting. Make minor adjustments as required.

C. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

D. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.

E. Scarify subsoil to a depth of 3 inches where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

F. Dig pits and beds two times the size in inches larger than plant root system.

3.3 PLACING TOPSOIL

A. Spread topsoil to a minimum depth of 4 inches over area to be planted. Rake smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

E. Install topsoil into pits and beds intended for plant root balls, to a minimum thickness of 6 inches.

3.4 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after initial raking of topsoil.

C. Mix thoroughly into upper 2 inches of topsoil.

D. Lightly water to aid the dissipation of fertilizer.

3.5 PLANTING

A. Set plants vertical.

B. Remove non-biodegradable root containers.

C. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth of 6 inches under each plant. Remove burlap, ropes, and wires, from the root ball.

D. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in 6 inch layers. Maintain plant life in vertical position.

E. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.6 TREE PRUNING

A. Perform pruning of trees as recommended in ANSI A300.

B. Prune newly planted trees as required to remove dead, broken, and split branches.

3.7 FIELD QUALITY CONTROL

A. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.8 MAINTENANCE

A. Provide maintenance at no extra cost to Owner.

B. Maintain plant life immediately after placement and until plants are well established and exhibit a vigorous growing condition. Continue maintenance until termination of warranty period.

C. Irrigate sufficiently to saturate root system and prevent soil from drying out.

D. Remove dead or broken branches and treat pruned areas or other wounds.

E. Neatly trim plants where necessary.

F. Immediately remove clippings after trimming.

G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.

H. Control insect damage and disease. Apply pesticides in accordance with manufacturer’s instructions.

I. Remedy damage from use of herbicides and pesticides.

J. Replace mulch when deteriorated.

K. Maintain wrappings, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.

END OF SECTION

SECTION 330513 – STORM SEWER MANHOLES AND STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Monolithic concrete manholes with masonry transition to lid frame, covers, anchorage, and accessories.

B. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

C. Masonry manhole sections with masonry transition to lid frame, covers, anchorage, and accessories.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. NPCA Certification for Precast Suppliers.

C. KYTC Plant Certification.

1.3 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 or applicable building code, whichever is more stringent.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C 478 (ASTM C 478M), with resilient connectors complying with ASTM C 923 (ASTM C 923M).

B. Manhole Sections: ASTM D 3753, glass-fiber reinforced polyester with integral steps.

C. Concrete: As specified in Section 033000.

D. Mortar and Grout: Type S.

E. Concrete Reinforcement: As specified in Section 033000.

2.2 COMPONENTS

A. Lid and Frame: ASTM A 48/A 48M, Class 30B Cast iron construction, machined flat bearing surface, removable lockable lid, closed lid design; live load rating of meeting or exceeding H-20 loading; sealing gasket; lid molded with identifying name ;.

B. Manhole Steps: Formed galvanized steel rungs; 3/4 inch diameter. Formed integral with manhole sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into Work.

C. Verify excavation for manholes is correct.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.3 MANHOLES

A. Place concrete base pad, trowel top surface level.

B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.

C. Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, build in connections as necessary.

D. Cut and fit for pipe.

E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

F. Set cover frames and covers level without tipping, to correct elevations.

G. Coordinate with other sections of work to provide correct size, shape, and location.

END OF SECTION

SECTION 334111 - SITE STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories.

B. Connection of drainage system to municipal sewers.

C. Catch basins, lawn area drains, paved area drainage, site surface drainage, detention tank, and detention basin.

1.2 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

B. NPCA Certification for Precast Manufacturers.

PART 2 - PRODUCTS

2.1 SEWER PIPE MATERIALS

A. Cast Iron Soil Pipe: ASTM A 74, Extra Heavy grade, inside nominal diameter as shown on plans, hub and spigot end.

B. Cast Iron Pipe Joint Device: ASTM C 564, rubber gasket joint devices.

C. Concrete Pipe: Reinforced, ASTM C 76 (ASTM C 76M), Class III with Wall type A; mesh reinforcement; inside nominal diameter as shown on plans, bell and spigot end joints.

D. Reinforced Concrete Pipe Joint Device: ASTM C 443 (ASTM C 443M) rubber compression gasket joint.

2.2 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

C. Filter Fabric: Non-biodegradable, woven.

D. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Storm Sewer Service" in large letters.

2.3 CATCH BASIN, CLEANOUT, AND AREA DRAIN COMPONENTS

A. Lids and Drain Covers: Cast iron, hinged to cast iron frame. Include gray-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Catch Basin

    a. Lid Design: Per City of Somerset Standard Details or as approved Details on plans.

2. Cleanout

    a. Lid Design: Per City of Somerset Standard Details or as approved Details on plans.

3. Area Drain

    a. Lid Design: Per City of Somerset Standard Details or as approved Details on plans.

B. Shaft Construction and Concentric Cone Top Section: Reinforced precast concrete pipe sections, lipped male/female dry joints, nominal shaft diameter of as required for construction.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section “Trenching.”

B. Cover: As specified in Section “Trenching.”

PART 3 - EXECUTION

3.1 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.

1. Plastic Pipe: Also comply with ASTM D 2321.

    a. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

    b. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

    c. Install continuous trace wire 6 inches above top of pipe; coordinate with Section 312316.13.

3.2 INSTALLATION - CATCH BASINS AND CLEANOUTS

A. Installation of precast catch basins preferred.

B. Form bottom of excavation clean and smooth to correct elevation.

C. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with City of Somerset requirements.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

1. Deflection Test: Per KYTC specifications for pipe.

3.4 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 334900 - STORM DRAINAGE STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes storm drainage infrastructure improvements.

1.2 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers of precast storm drain structures include, but are not limited to:

1. Sherman Dixie Precast Concrete Products, Lexington, KY
2. Cloud / Oldcastle Concrete
3. NEENAH Construction Castings
4. J.R. Hoe and Sons, Louisville, KY
5. Barry Pattern and Foundry Company, Inc, Birmingham AL.
6. McNichols Co, Tampa FL.

2.2 CATCH BASINS AND MANHOLES

A. Precast Concrete Catch Basins and Manholes: ASTM C 478, precast, reinforced concrete, of depth shape and dimensions indicated, with provision for rubber gasketed joints, and as required by authorities having jurisdiction

B. Cast-in-Place Concrete, Catch Basins and Manholes: Construct of reinforced concrete; designed according to ASTM C 890 for structural loading; of depth, shape, dimensions, and appurtenances indicated.

1. Bottom, Walls, and Top: Reinforced concrete.
2. Channels and Benches: Concrete.

C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for heavy-duty service, unless otherwise shown on the drawings. Include flat grate with small square or short-slotted drainage openings.

2.3 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening per plans and details, of materials and dimensions according to plans, details, and utility standards.

B. Gutter Inlets: Made with horizontal gutter opening, per plans and details, of materials and dimensions according to plans, details, and utility standards. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings per plans and details, of materials and dimensions according to plans, details, and utility standards. Include heavy-duty frames and grates.

D. Frames and Grates: Heavy duty

2.4 DRAINS

A. Gray-Iron Area Drains: ASME A112.21.1M, round, gray-iron body with anchor flange and round, secured, gray-iron grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated. Use units with top-loading classifications according to the following applications:

1. Medium Duty: In paved foot-traffic areas.

2. Heavy Duty: In vehicle-traffic service areas.

2.5 PIPE OUTLETS

A. Head Walls: Cast-in-place or precast reinforced concrete, with apron (as shown on the drawings.)

B. Riprap Basins: Broken, irregular size and shape, graded stone.

1. Average Size: KTC, Class II channel lining.

C. Filter Stone: KTC #8, #9 or 9M graded stone.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Installer List: Qualified installers shall be contractors who have successfully installed and performed on 5 previous similar scale projects.

3.2 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

B. Embed drains in 4-inch (100-mm) minimum depth of concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

3.3 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 4 inches (450 by 450 by 100 mm) deep. Set with tops flush with the surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.4 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.

1. Use concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

3. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.5 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

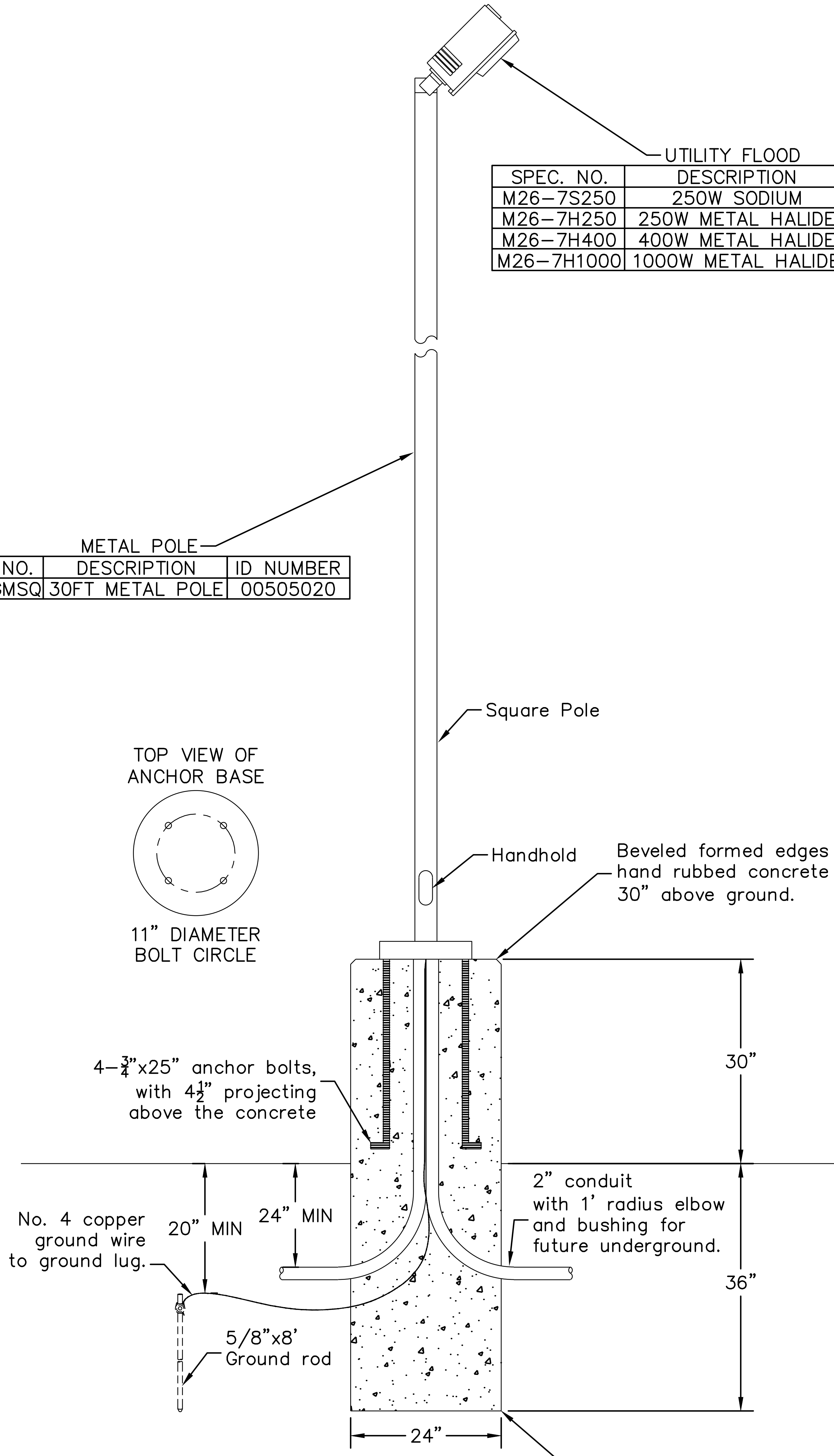
A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.

2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Structures: Excavate around structure as required and use one procedure below:

END OF SECTION



UTILITY FLOOD

SPEC. NO.	DESCRIPTION	ID NUMBER
M26-7S250	250W SODIUM	00504560
M26-7H250	250W METAL HALIDE	00504574
M26-7H400	400W METAL HALIDE	00504575
M26-7H1000	1000W METAL HALIDE	00504576

METAL POLE

SPEC. NO.	DESCRIPTION	ID NUMBER
P30PKGMSQ	30FT METAL POLE	00505020

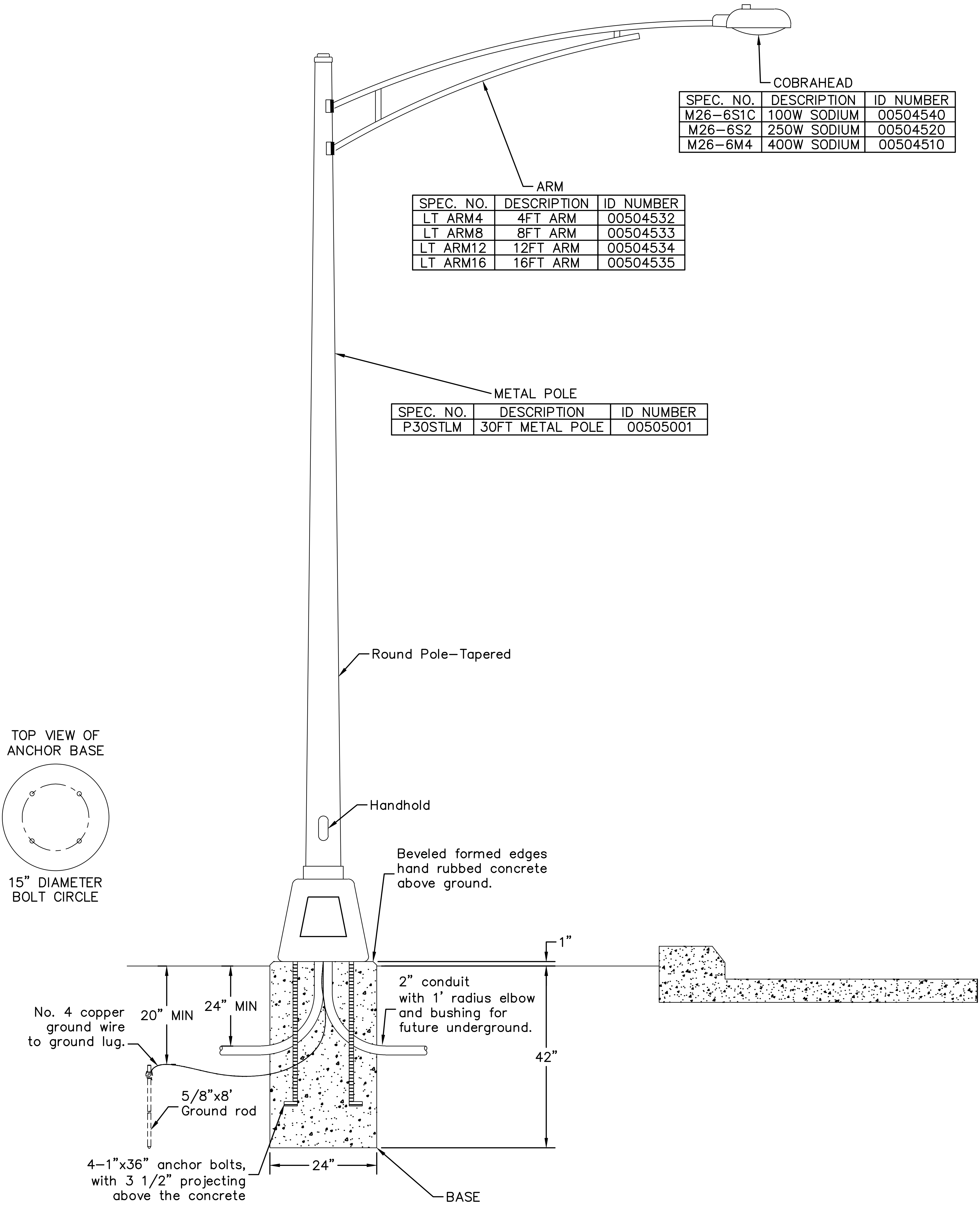
BASE

SPEC. NO.	DESCRIPTION	ID NUMBER
UM1-10PKLOT	PARKING LOT LIGHTING BASE	NON-INVENTORY

SOUTH KENTUCKY RURAL ELECTRIC COOPERATIVE

UTILITY FLOOD LIGHTING / METAL POLE

JUNE 2003	LIGHT	BRACKET	METAL POLE
PAGE 113	M26______-SK	LT BRKT	P30PKGMSQ



COBRAHEAD

SPEC. NO.	DESCRIPTION	ID NUMBER
M26–6S1C	100W SODIUM	00504540
M26–6S2	250W SODIUM	00504520
M26–6M4	400W SODIUM	00504510

ARM

SPEC. NO.	DESCRIPTION	ID NUMBER
LT ARM4	4FT ARM	00504532
LT ARM8	8FT ARM	00504533
LT ARM12	12FT ARM	00504534
LT ARM16	16FT ARM	00504535

METAL POLE

SPEC. NO.	DESCRIPTION	ID NUMBER
P30STLM	30FT METAL POLE	00505001

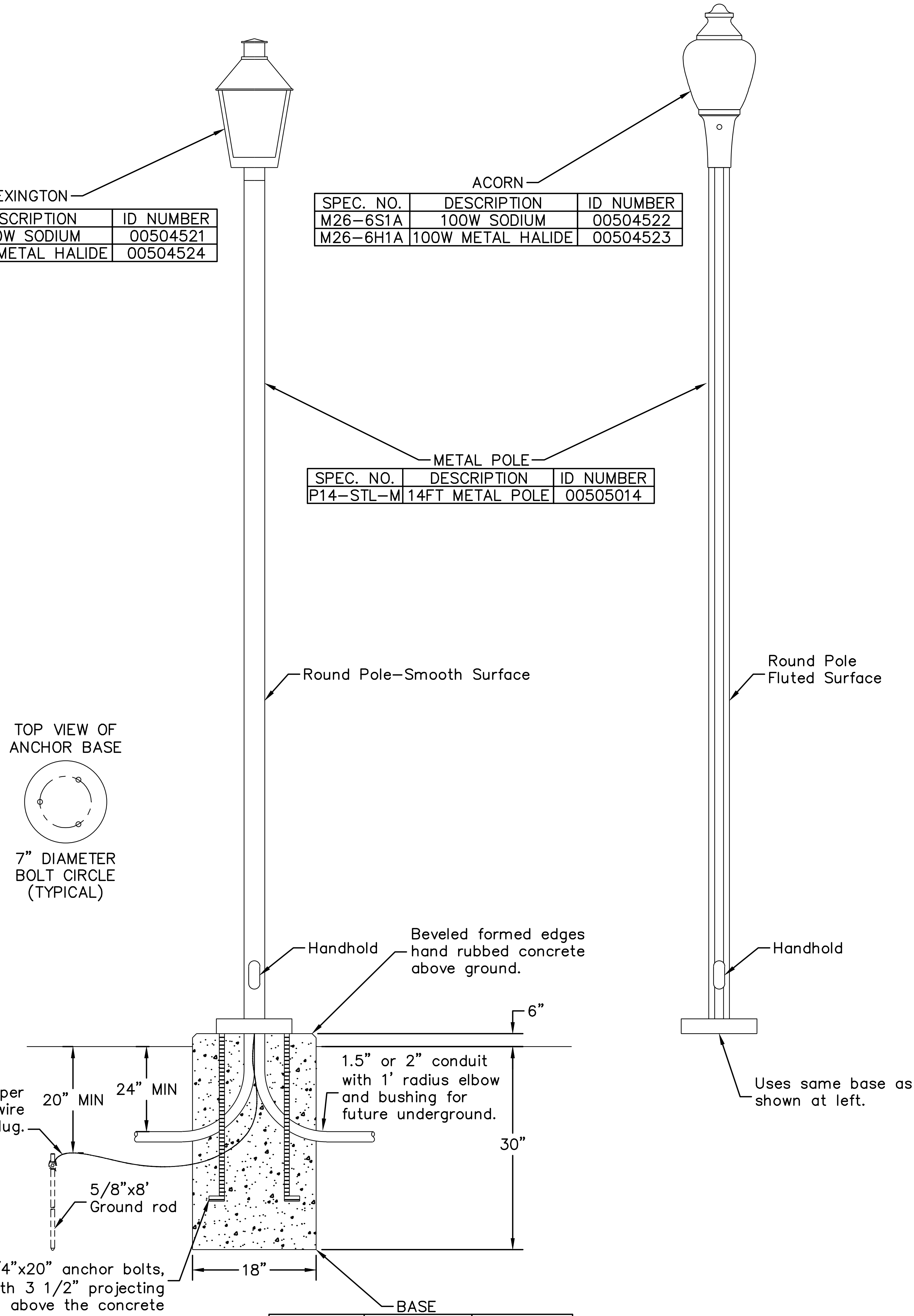
BASE

SPEC. NO.	DESCRIPTION	ID NUMBER
UM1–10ST	STREET LIGHT BASE	NON–INVENTORY

SOUTH KENTUCKY RURAL ELECTRIC COOPERATIVE

STREET LIGHTING / METAL POLE

JUNE 2003	COBRAHEADS	ARMS	METAL POLE
PAGE 110	M26–____–SK	LT ARM__–SK	P30STLM–SK



LEXINGTON

SPEC. NO.	DESCRIPTION	ID NUMBER
M26-6S1L	100W SODIUM	00504521
M26-6H1L	100W METAL HALIDE	00504524

ACORN

SPEC. NO.	DESCRIPTION	ID NUMBER
M26-6S1A	100W SODIUM	00504522
M26-6H1A	100W METAL HALIDE	00504523

METAL POLE

SPEC. NO.	DESCRIPTION	ID NUMBER
P14-STL-M	14FT METAL POLE	00505014

BASE

SPEC. NO.	DESCRIPTION	ID NUMBER
UM1-10DEC	DECORATIVE LIGHT BASE	NON-INVENTORY

SOUTH KENTUCKY RURAL ELECTRIC COOPERATIVE

DECORATIVE LIGHTING / METAL POLE

JUNE 2003	LEXINGTON	ACORN	METAL POLE
PAGE 111	M26-____-SK	M26-____-SK	P14STL-M-SK

Section 4

Post-Construction Best Management Practices

This section contains fact sheets for the following BMP categories:

- Section 4.1: Stormwater Pollution Prevention (Non-structural) - SPP
- Section 4.2: Stormwater Pollution Treatment Practices (Structural) - PTP

Somerset, Kentucky
Stormwater Best Management Practices (BMPs)
Stormwater Pollution Prevention (Non-Structural)

SPP-01

Activity: Education

PLANNING CONSIDERATIONS:

Design Life:
Program life

Acreage Needed:
N/A

Estimated Unit Cost:
Varies

Training Programs:
Annual/biannual, new employee training

Description

Education is a key nonstructural BMP that supports both structural and nonstructural practices. Education programs are the first step in achieving proper operational procedures and incorporating practices into daily activities to minimize the potential for contributing pollutants to become incorporated into stormwater runoff. Nonstructural practices such as this can cost-effectively compliment other BMPs and reduce pollutant loads that contribute to stormwater pollution. Two educational practices discussed in this fact sheet include:

- Training
- Standard operating procedures

Suitable Applications

A stormwater education program can have a wide range of applications and audiences. Any homeowner or municipal, commercial or industrial facility that impacts stormwater could benefit from practices achieved by this BMP. Examples of suitable applications include the following:

- Schools
- Public service organizations
- Municipal employees
- Commercial or industrial businesses
- Facilities with outdoor storage
- General Public

Activity: Education	SPP-01

Approach

The effectiveness of an education program stems from the leadership of government departments and the involvement and proactive participation of individuals and target audiences. Government departments such as the Public Works Department perform highly visible activities in the community such as maintaining roadways, sewers, and sinkholes. If municipal departments such as this take on a leadership role, it can improve the community-wide acceptance of adopting and implementing educational program.

Educational programs can facilitate employee awareness of stormwater pollutants, runoff flow characteristics, spill prevention and control measures and proper operation and maintenance practices. Education is generally most effective when a target audience can clearly see the relationship between their daily activities and the associated stormwater quality impacts. Making this connection can result in changed habits and behaviors that can improve water quality in and outside of the workplace. Employee education programs should not only focus on workplace activities, but should also include ways that employees can reduce the potential water quality impacts in their homes and communities. Public education programs can also enhance community responsiveness, which may increase inquiries or reporting when spills or illicit discharges occur.

Training as part of an educational program can take many forms, including the following:

- Municipal/commercial training
- New staff training
- Refresher training

Standard operating procedures consist of choices that public (or private) employees make that can reduce the impact that pollutants have on local streams and waterways. Standard operating procedures can be incorporated by:

- Adding to daily/routine activities
- Supplying the BMP reference manual for frequent and infrequent activities available for employees
- Encouraging employees and target groups to adopt standard operating procedures

Training

Stormwater education programs should be conducted in a variety of forms, and at regular intervals throughout an individual's employment. Possible program activities may include:

- A stormwater briefing session held for approximately a half-hour to update employees on proper practices, reflect on a recent incident or discuss a case study/what-if scenario.
- Partnering with local volunteer groups or schools to provide tours of the Department of Public Works facilities with a focus on practices that minimize stormwater quality impacts.
- Distributing or making brochures or stormwater information available on a periodic basis.
- Local TV or radio PSA's.

Standard Operating Procedures

Standard operating procedures should be integrated into daily tasks to reduce the potential for stormwater pollution. Standard operating procedures should not only be adopted by municipal facilities, but also by private businesses. They can include moving or cleaning equipment to prevent rainfall from washing pollutants into streams, clearing litter or debris from parking lots storing potential pollutants under cover, and educating to not over-use pesticides or herbicides.

Activity: Education	SPP-01

Standard Operating Procedures (cont.)	The following activities can impact stormwater quality and should have associated standard operating procedures to control the source of the pollutant before it comes in contact with runoff: ➢ Vehicle and equipment maintenance or washing ➢ Cleaning tools and equipment ➢ Roadside litter and street sweeping ➢ Storage yards ➢ Mowing and landscaping ➢ Pesticide and herbicide use, delivery, and storage ➢ Sand, salt, or chemical storage and loading ➢ Use of floor drains ➢ Hazardous material storage ➢ Handling bulk liquids ➢ Septic system maintenance ➢ Solid waste and dumpster use ➢ Disposal of waste oils, filters, fuels, and tires ➢ Disposal of concrete and metal waste ➢ Annual surveys of employee practices meeting/not meeting standard operating procedures.

Somerset, Kentucky
Stormwater Best Management Practices (BMPs)
Stormwater Pollution Prevention (Non-Structural)

SPP-02

Activity: Low-Impact Development

PLANNING CONSIDERATIONS:

Design Life:
Permanent

Acreage Needed:
Varies

Estimated Unit Cost:
Varies

Annual Maintenance:
Varies

LID

LID

Target Pollutants

Estimated Bioretention Pollutant Removal Rates:
Total Suspended Solids (TSS); 91%
Nutrients – Total Phosphorous/Total Nitrogen removal; 67/92%
Metals – Cadmium, Copper, Lead, and Zinc removal; 80-90%

General Description

Low-impact development integrates a variety of small-scale measures to closely maintain pre-development hydrology and reduce nonpoint source pollution caused by development. It is based on controlling runoff volume and mimicking the original hydrologic regime.

Low-impact Development includes:

- Landscaping and vegetative control practices;
- Disconnecting impervious surfaces;
- Bioretention and infiltration techniques;
- Alternative pavements that promote infiltration;
- Impervious surface area reduction; and
- Urban Forestry.

The basis for design is hydrology. Low-impact development applications have shown to be cost effective and cheaper than using traditional stormwater management alternatives. For additional information on low-impact development, visit http://www.epa.gov/nps/lid.

Applications

These practices are applicable to most land uses, and can be very efficient in the following applications:

- In conjunction with structural stormwater BMPs.
- Storage practices that contain runoff until it can be used for other purposes.
- Areas where visual enhancement is desired.

Siting & Design Considerations

Landscaping and Vegetative Control Practices

Landscaping and vegetative control practices can be applied to any land use type, but the following site-specific criteria should be considered to properly select a plant species or landscape options:

Siting & Design Considerations (Cont.)

- Climate
- Topography
- Soil Types
- Wind exposure
- Soil drainage and moisture conditions
- Available light or shade tolerance
- Planned use of the area
- Degree of maintenance desired
- Planting season

Certain criteria may be targeted for landscaping and vegetative control practices for their added stabilization benefits or support of other BMPs. Targeted areas may include:

- Steep Slopes
- Drainage channels with natural cover
- Streams and creeks (nearby)
- Areas connected to catch basins
- Buffer zones
- In conjunction with various structural BMPs (i.e., detention/retention ponds, wetlands, swales, etc.)

Bioretention and Infiltration Techniques

Suitable for nearly all residential, commercial or industrial lots.

- Storage Practices
  - Cisterns and rain barrels have the fewest site constraints.
  - Design and use should have some contingency for overflow or freezing.
  - Best suited for applications with an interest in reusing the water.
  - Pretreatment usually requires a wire mesh filter at the top of the cistern or barrel.
- Infiltration
  - Bioretention and grassed swales are common infiltration techniques.
  - Design and use should consider the peak flow demands, topography, and soil types.
  - In areas where local soils do not readily support infiltration, sand filtration systems can be used to discharge treated stormwater to a stream or storm sewer.
- Rain Gardens
  - Rain gardens are landscaped bioretention facilities that soak up runoff displaced by the impervious area of a structure. Runoff is trapped during a storm event, infiltrating slowly into the soil where it is treated by vegetation and microbes. Rain gardens can increase the aesthetic qualities of a development, and offer a greater benefit than traditional gardens. Rain gardens can have substantial environmental and water quality benefits.
  - Infiltration requires layers of soil, sand and organic mulch. In areas where local soils do not readily support infiltration, rain gardens can be modified to be underlain with a sand filtration system and underdrain that discharges treated stormwater to a storm sewer.
  - Rain garden vegetation should include indigenous plants and can be integrated into current or future landscaping using grasses, ferns or flowering plants.
  - Rain gardens should be at least 10 feet away from a structure to prevent groundwater seepage into the foundation. Rain gardens should be built level into a gentle slope that drains runoff.
  - Do not place rain garden directly over septic system.
  - Build the rain garden in areas of full or partial sun.

Siting & Design Considerations (Cont.)

Impervious Surface Area Reduction

Applying techniques to reduce the impervious surface area of new development and redevelopment is often dependent on the applicability, cost, and maintenance of those techniques. Green Parking techniques reduce the impervious area of parking lots and consequently, the amount of stormwater runoff. Likewise, Green Rooftop reduces the impervious area of rooftops and consequently, the amount of stormwater runoff.

Green Parking techniques include:

- Shared parking in mixed use areas and structured parking.
- Building additional parking upwards or downwards (ie., parking garages).
- Design around average parking demands instead of conventional parking requirements. Provide an overflow lot utilizing grass or alternative pavers for peak demand parking. For more information on alternative pavers, visit http://www.stormwatercenter.net.
- Minimizing parking space dimensions by reducing the length and width of spaces.
- Parking areas restricted to compact cars.
- Incorporate bioretention areas in parking lot design to effectively treat stormwater runoff.
- Use pervious surfaces.

Green Rooftop is a layer of vegetation, shrubs, or trees planted on rooftops to absorb stormwater runoff. In the summer, Green Rooftops retain approximately 70 to 100% of the precipitation that falls on them. In the winter, they retain approximately 40 to 50%. A green rooftop generally consist of:

- A waterproofing membrane
- Insulation
- Protection layer
- Drainage layer
- Filter mat
- Soil layer
- Vegetation
- The load-bearing capacity of the rooftop should be identified prior to green rooftop design. It is recommended to consult a structural engineer before designing or installing a green rooftop. If the projected live load of a green rooftop is greater than 17 lbs per square foot, consultation with a structural engineer is required.
- An internal drainage network that directs flow away from the roof to inhibit ponding should be included in the design.
- Green rooftops can be successfully built on slopes up to 30 degrees.

Urban Forestry

Urban Forestry is frequently engineered to treat stormwater before it enters streams, lakes, or wetlands and is designed from a combination of vegetation, shrubs, and trees. Advantages of urban forestry include:

- Cover and absorption during precipitation events.

Siting & Design Considerations (Cont.)

- Filter pollutants from stormwater runoff or groundwater.
- Recycle carbon dioxide into oxygen.
- Provide shade along waterways and sustain the integrity of stream ecosystems and habitats.

Forestry is commonly used as an aquatic buffer. The benefits of buffers are increased in a forested condition.

Costs

Low-impact development costs vary depending on the application, area, and land use. A few general guidelines used to estimate costs are listed below.

- Approximately $100 for a rain barrel and up to $200 for a dry well.
- Bioretention areas cost about $6.40 per cubic foot of quality treatment.
- Initial costs of a green roof can be 30% greater than a conventional roof. However, long-term maintenance, energy cost and stormwater utility savings can offset initial costs and increase the lifespan by as much as 50%. Green rooftops can be warranted up to 15 years.

Maintenance

Landscaping and Vegetative Control Practices

- Irrigation, fertilization, and mulching are variable maintenance practices dependant on the plant species, soil conditions, and topography.
- Established vegetation and landscaping may need periodic seasonal trimming to maintain aesthetic appearance.
- Mow or weed as necessary.

Bioretention and Infiltration Techniques

- Practices require frequent, but small efforts to maintain, such as draining a rain barrel after a large wet weather event, cleaning debris out of the infiltration practices, or keeping the vegetation in the rain garden from overgrowing. Weeding and watering will be needed in the first two years of establishing a rain garden, and thinning of plants in the following years as they mature.
- Maintenance is dependent on the owner’s efforts. Can be maintained by commercial landscaping firms.

Impervious Surface Reduction

- Alternative pavers generally have a moderate cost of maintenance associated with them and snow removal can be difficult.
- Clear debris or blockage from internal drainage network to prevent overflow and ponding on green roofs.
- Established vegetation on green roofs may need periodic seasonal trimming to maintain aesthetic appearance.

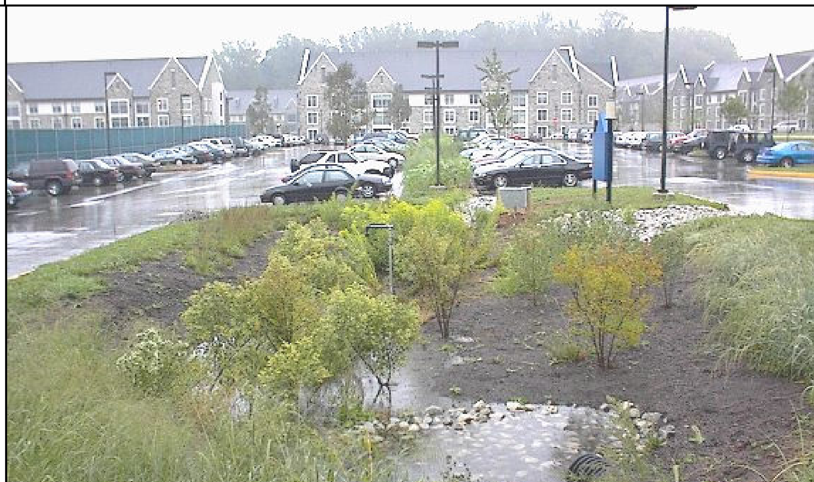
Urban Forestry

- Established vegetation, shrubs and trees may need periodic seasonal trimming or pruning to maintain aesthetic appearance.

Somerset, Kentucky
Stormwater Best Management Practices (BMPs)
Stormwater Pollution Treatment Practices (Structural)

PTP-01

Activity: Filtration Systems



FS

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PLANNING CONSIDERATIONS:

Design Life:

Acreage Needed:
Minimal

Estimated Unit Cost:
Moderate

Annual Maintenance:
Moderate to High; Low (Bio-retention)

Target Pollutants; Pollutant Removal

Total Suspended Solids (TSS); 80%
Nutrients – Total Phosphorous/Total Nitrogen removal; 50/25%
Metals – Cadmium, Copper, Lead, and Zinc removal; 50%
Pathogens – Coliform, Streptococci, E.Coli removal; 40%

Description

Filtration systems are structural water quality control devices that capture and temporarily store, treat, and release stormwater runoff. Filtration systems consist of two main components: a pretreatment basin and filtration chamber. The pretreatment basin removes floatable materials and heavy sediments, and helps reduce flow velocities. The filtration chamber traps and strains pollutants, and allows the microbial removal of pollutants. Target pollutants for filtrations systems include suspended solids, suspended particulates, biochemical oxygen demand (BOD), fecal coliform bacteria, and others. Filtration devices may also employ organic materials such as peat or compost combined with sand, and others add plantings and mulch to the surface layer. This may allow additional pollutant removal via bacterial decomposition and vegetation uptake of nutrients. The two main structures of filtration systems (the pretreatment basin and filtration chamber) may include or be enhanced by the following components:

- Grass buffer strips
- Ponding area
- Surface of mulch and plantings
- Sand bed
- Organic layer
- Plant material
- Exfiltration zone or collection system to return stormwater to a conveyance system

Filtration systems documented in this fact sheet include:

- Surface sand filters
- Underground sand filters
- Perimeter sand filters
- Organic sand filters
- Pocket sand filters
- Bioretention systems (shown above)

Activity: Filtration Systems | PTP-01

Suitable Applications

Filtration systems are often used to manage stormwater runoff from urban areas where space is limited, and can be applied to areas where retrofit is needed, and are typically suitable in the following applications:

- Small drainage areas (2 to 10 acres maximum)
- Typically requires 2 to 6 feet of head
- Impervious area runoff
- Retrofit applications

Filtration systems should only be applied to stabilized drainage areas, as heavy sediment loads from construction areas will clog and disable the filter. Likewise, they should not be used in areas where stormwater has potential for high silt or clay content, and areas with a high water table. As a guide, sites implementing filtration systems should have over 50% impervious cover in the drainage area.

Filtration systems should typically be designed for off-line use to capture the first flush of runoff. A diversion structure such as a flow splitter or weir may be necessary to separate and route the first flush to the filtration system for water quality control, and route the remaining stormwater to a water quantity control device downstream. Filtration systems are most effective when turbulent flow is minimized and the flow is spread uniformly across the filter media.

Installation Procedures

- Site slope should be less than 6% across the filter location
- The minimum head (or elevation difference on the site from the point of inflow to point of outflow) required is:
    - 5 feet for surface sand filters
    - 2-3 feet for perimeter sand filters
- Allow at least 2 feet between the bottom of the sand filter to the high water table elevation
- Variable soils can be used, but Group A soils generally require exfiltration (surface sand filter earthen structures)
- Hotspot runoff requires an impermeable liner to protect groundwater
- In karst areas, an impermeable membrane should be used to seal the bottom of an earthen surface sand filter, or alternatively, a watertight filtration system structure may be used

Maintenance

Maintenance access should be provided for appropriate equipment, vehicles, and personnel. Filtration systems installed below grade should have access grates available to inspect and maintain the filter bed. For bioretention systems, additional maintenance considerations are listed in the biofiltration section of this fact sheet.

Monthly

- Remove trash or debris
- Inspect the filter for clogging (sand filters – rake the first inch of sand)

Quarterly/After Major Storm Events

- Monitor water level in sand filter chamber (underground sand filter)

Activity: Filtration Systems	PTP-01

Maintenance (cont.)

Annually

- Remove sediment as necessary
- Repair or replace any damaged structural parts
- Stabilize any eroded areas

As Needed

- Replace sand filter media or filter fabric
- Clean out sedimentation chamber when sediment depth reaches 12 inches (underground sand filter)
- Remove accumulated oil and floatables from the sedimentation chamber (underground sand filter)
- For clogged or partially clogged sand beds, remove the first 3 inches of sand from the surface, till, or cultivate the bed, and replace with fresh sand meeting the appropriate design specifications
- Properly dispose of any material generated during maintenance activities.

Inspection Checklist

Monthly

- [ ] Contributing area, facility, inlets, and outlets are clear of debris
- [ ] Contributing area is stabilized and mowed, with clippings bagged or removed
- [ ] Filter surface is not clogging – also inspect after moderate/major storm events
- [ ] Activities in the drainage area minimize oil/grease and sediment entering the system
- [ ] Permanent water level is not present (for perimeter sand filter)
- [ ] For filtration systems utilizing a permanent pool, chamber or vault does not leak, and normal pool water surface elevation is retained

Annually

- [ ] Filter bed is clean of sediment, and the sediment chamber contains no more than 6 inches or 50% depth of sediment, whichever is less (or 12 inches for underground sand filters)
- [ ] No evidence of deterioration, spalling, or cracking is present on concrete
- [ ] Inspect grates, where applicable
- [ ] Inlets, outlets, and overflow spillways or diversion structures show no evidence of erosion or deterioration
- [ ] Flow is not bypassing the filtration system
- [ ] No noticeable odors are detected outside of the facility

As Needed

- [ ] Filtration system (sand bed, filter fabric, etc.) is not clogged or partially clogged

Activity: Filtration Systems / Surface Sand Filters	PTP-01.1

Surface Sand Filters

Surface sand filters are open-air structures constructed level with the grade primarily to serve as off-line water quality systems. The two main system components include a pretreatment sediment forebay and filter bed chamber. Flow is routed to the sediment forebay where settlement of heavier sediment particles occurs. A perforated standpipe is used to move pretreated runoff to the filtration chamber. The runoff passes through the filter bed and is collected by the perforated pipe and gravel underdrain system.

Drainage areas can range up to 10 acres for surface sand filters to effectively remove pollutants. Designs vary from riprap to an excavation with earthen embankments to a concrete or block structure. See Figures PTP-01-01 and PTP-01-02 for the typical surface sand filter schematics. Surface Sand Filters should not be used for residential applications.

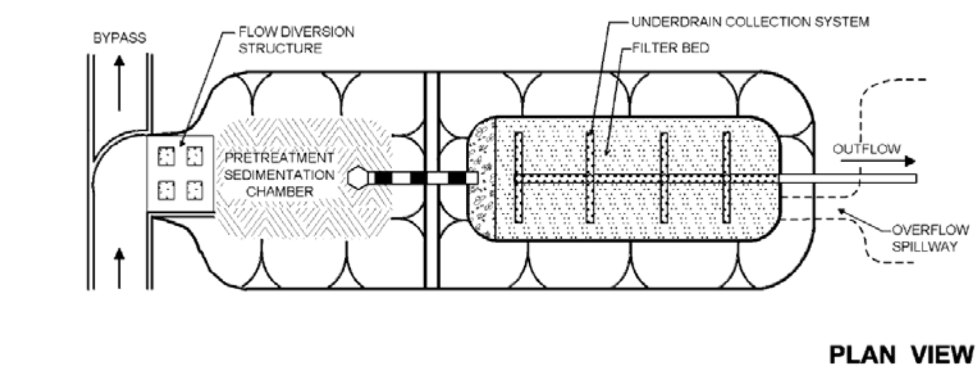


Figure PTP-01-01
Source, Georgia Stormwater Management Manual

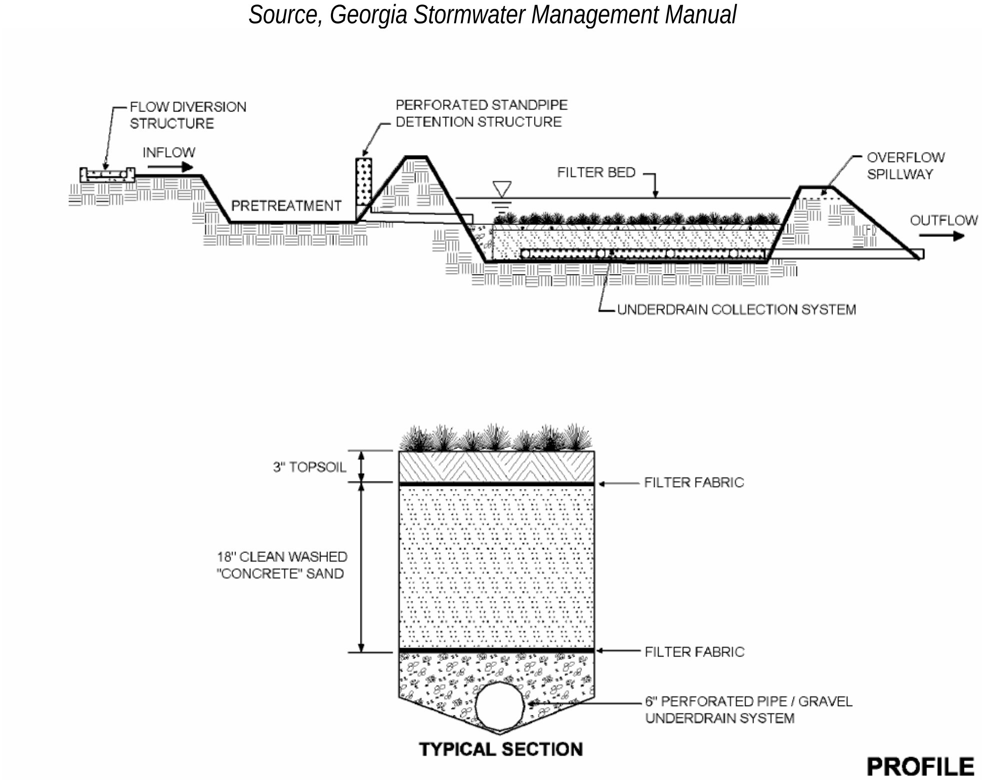


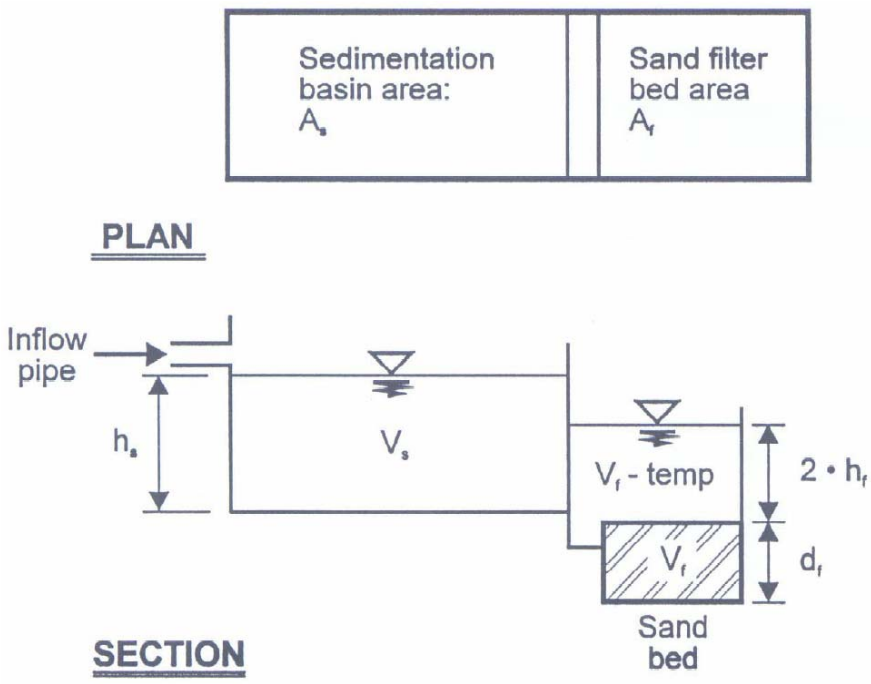
Figure PTP-01-02
Source, Georgia Stormwater Management Manual

Surface Sand Filters (cont.)

Design Criteria

- Contributing drainage area should be less than 10 acres
- Use in areas with urban land uses and high percentage of impervious area (greater than 50% impervious)
- Disturbed areas draining to the sand filter should be identified and stabilized as soon as possible as they may clog the filter bed
- Surface sand filters should be configured off-line, so that flows greater than the water quality volume (WQ_v) capacity can be diverted downstream
- Flow should not be continuous, and the filter should be designed to drain completely and reaerate between rainfall events
- The filtration system must be designed to temporarily hold a capacity equal to or greater than 75% of the water quality volume (WQ_v) of the system prior to filtration. Figure PTP-01-03 shows the distribution of treatment volume (0.75 WQ_v).
- The sedimentation chamber must have a capacity to hold 25% of the water quality volume (WQ_v), and have a ratio of 2:1 (H:V)
- Inlet and outlet structures should be constructed at opposite ends of the sedimentation chamber
- Use Darcy's law to size the filter bed area, using a coefficient of permeability, k, of 3.5 ft/day for sand. Typically, filter beds should drain within 40 hours.
- The filter media should be placed around the underdrain system, and should include an 18-inch layer of clean, washed, medium sand (ASTM C-33 concrete sand). A layer of permeable filter fabric should be placed both above and below the sand layer to prevent clogging of the sand filter and underdrain system.
- The surface sand filter should incorporate a 6-inch perforated PVC pipe (AASHTO M 252) underdrain in a gravel layer. Requirements for the underdrain include:
  - A minimum grade of $^1/_8$-inch per foot (1% slope)
  - Holes spaced approximately 6 inches apart with diameters of $^3/_8$-inch
  - Gravel specifications are clean, washed aggregate at a diameter no greater than 3.5 inches and no less than 1.5 inches. Voids should make up approximately 40% of space. Do not use gravel that has been contaminated with soil.
- The outer structure of the surface sand filter can vary. Concrete or earthen embankments are common. If earthen embankments are used, a permeable filter fabric should be used to line the bottom and side slopes of the earthen walls before installing the underdrain and other filtration system components.

Surface Sand Filters (cont.)



V_s = Sedimentation basin volume
V_f = Volume of voids in the filter bed
$V_{f\text{-}temp}$ = Temporary volume stored above the filter bed
A_s = Surface area of the sedimentation basin
A_f = Surface area of the filter media
h_s = Depth of water in the sedimentation basin
h_f = Average depth of water above the filter media
d_f = Depth of the filter media

Figure PTP-01-03
Source, Georgia Stormwater Management Manual

Perimeter Sand Filter

Perimeter sand filters are constructed just below grade with two enclosed parallel chambers. Typically, perimeter sand filters are installed along the perimeter of a parking lot for off-line treatment. Runoff from impervious area enters the sedimentation chamber via an inlet grate and spills through a weir and into the filtration chamber. The sand bed filters runoff, and runoff is then collected by the perforated pipe and gravel underdrain system. See Figures PTP-01-04 and PTP-01-05 for typical perimeter sand filter schematics.

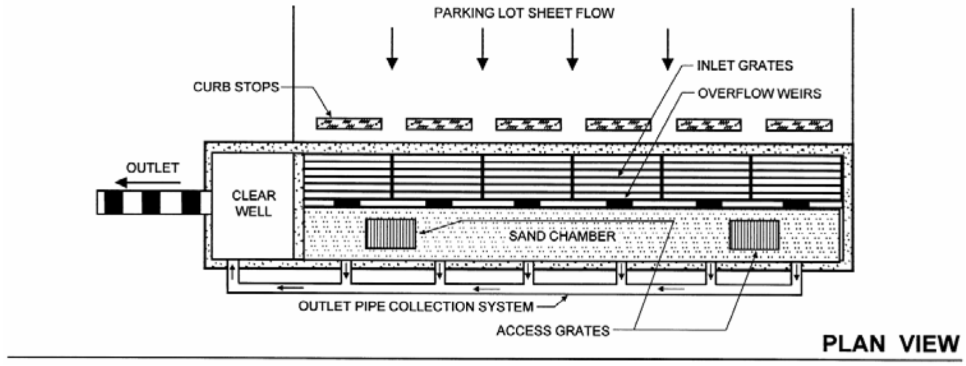


Figure PTP-01-04
Source, Georgia Stormwater Management Manual

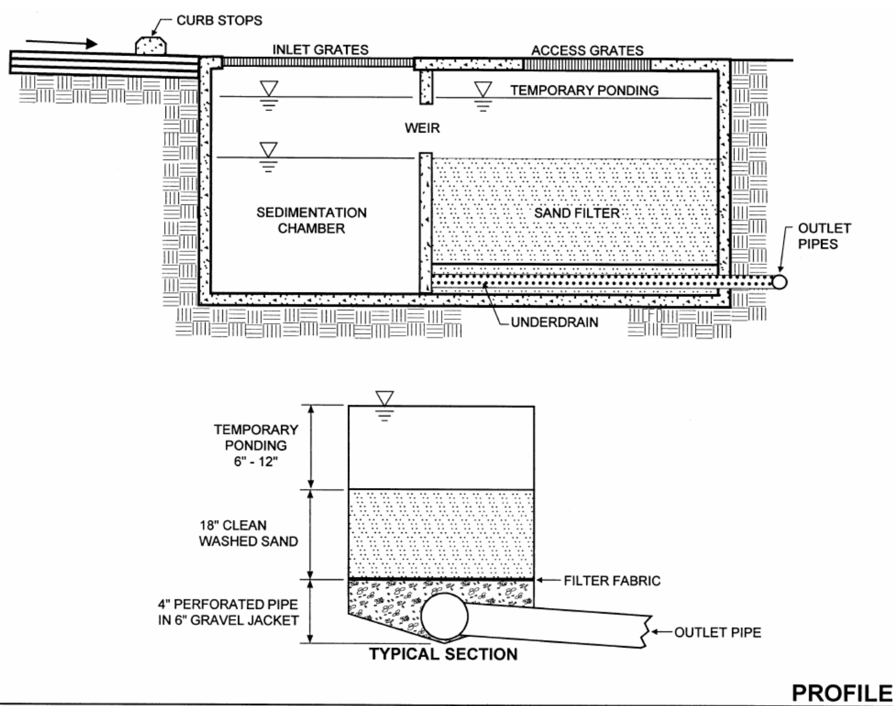
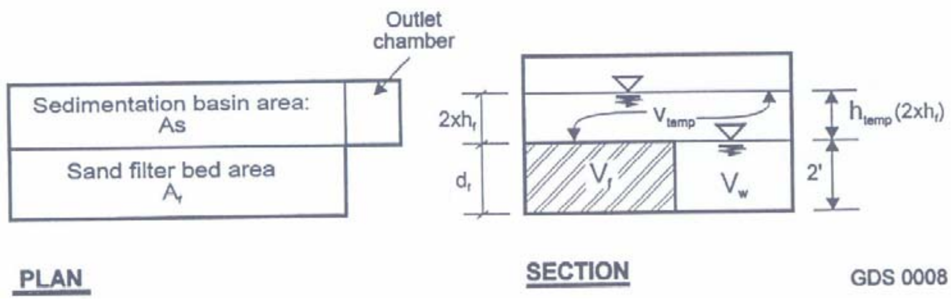


Figure PTP-01-05
Source, Georgia Stormwater Management Manual

Perimeter Sand Filter (cont.)

Design Criteria

- Contributing drainage area should be less than 2 acres
- Use in areas with urban land uses and high percentage of impervious area (greater than 50% impervious)
- Disturbed areas draining to the sand filter should be identified and stabilized as soon as possible as they may clog the filter bed
- Perimeter sand filters should be configured off-line, so that flows greater than the water quality volume (WQ_v) capacity can be diverted to an overflow conveyance
- Construct perimeter sand filters along the boundary, or perimeter, of an impervious area, i.e., a parking lot
- Flow should not be continuous, and the filter should be designed to drain completely and reaerate between rainfall events
- The filtration system must be designed to temporarily hold a capacity equal to or greater than 75% of the water quality volume (WQ_v) of the system prior to filtration. Figure PTP-01-06 shows the distribution of treatment volume (0.75 WQ_v).
- The sedimentation chamber should be sized to accommodate at least 50% of the calculated WQ_v.
- Use Darcy's law to size the filter bed area, using a coefficient of permeability, k, of 3.5 ft/day for sand. Typically, filter beds should drain within 40 hours.
- The filter media should be placed above the underdrain system, and should include a 12- to 18-inch layer of clean, washed, medium sand (ASTM C-33 concrete sand). See Figure PTP-01-07 for a typical perimeter sand filter cross section of media placement.



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V_w = Wet pool volume of the sedimentation basin
V_f = Volume of voids in the filter bed
V_{temp} = Temporary volume stored above the filter bed
A_s = Surface area of the sedimentation basin
A_f = Surface area of the filter media
h_s = Depth of water in the sedimentation basin
h_f = Average depth of water above the filter media (½ h_{temp})
d_f = Depth of the filter media

Figure PTP-01-06
Source, Georgia Stormwater Management Manual

Perimeter Sand Filter (cont.)

Design Criteria (cont.)

- The perimeter sand filter should incorporate a 4-inch perforated PVC pipe (AASHTO M 252) underdrain in a gravel layer. Requirements for the underdrain include:
  - A minimum grade of $^{1}/_{8}$-inch per foot (1% slope)
  - Holes spaced approximately 6 inches apart with diameters of $^{3}/_{8}$-inch
  - A permeable filter fabric should be placed between the gravel layer and the filter bed material.
  - Gravel specifications are clean, washed aggregate at a diameter no greater than 3.5 inches and no less than 1.5 inches. Voids should make up approximately 40% of space. Do not use gravel that has been contaminated with soil.

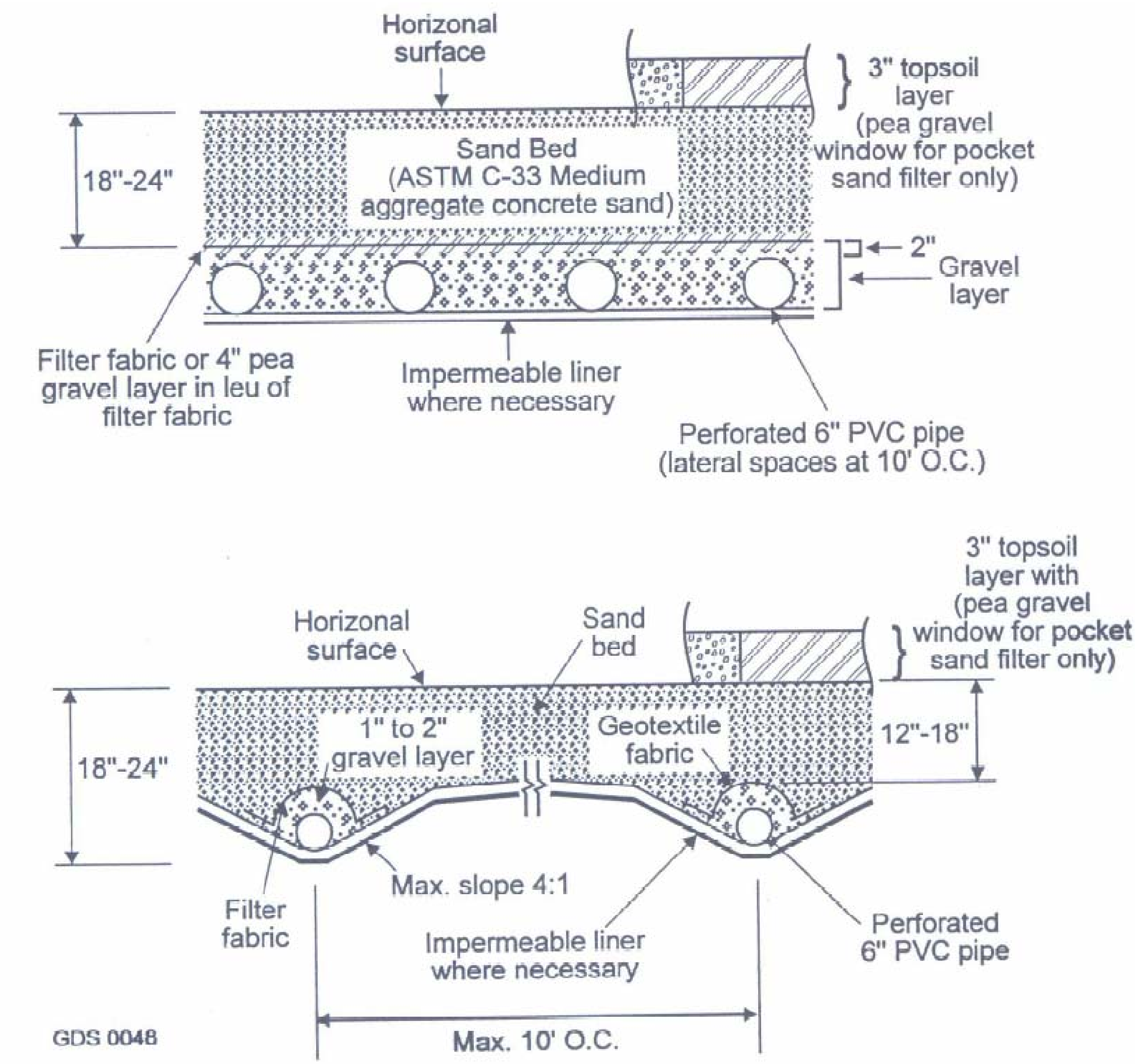


Figure PTP-01-07
Source, Georgia Stormwater Management Manual

Activity: Filtration Systems / Underground Sand Filter

PTP-01.3

Underground Sand Filter

Underground sand filters are designed for applications with extreme space constraints or high density areas where a surface sand filter cannot be constructed due to space limitations. They are typically used as on-line systems for impervious areas of 1 acre or less. An underground sand filter should not be designed to treat a drainage area greater than 5 acres.

This type of filtration system utilizes a three-chamber vault, where the first two chambers temporarily store and treat runoff, and the third chamber collects filtered runoff. This first chamber is a sedimentation chamber with a wet pool that stores and pretreats runoff. This is connected to the second chamber, the sand filter, by a submerged wall which provides an obstruction for oil and floatables. The filter bed should be approximately 18 to 24 inches deep. Permeable geotextiles or a gravel screen can be used to prevent clogging of the sand bed. The second chamber also contains a perforated drain pipe to collect the filtered runoff. This underdrain system transfers the filtered runoff to the third chamber, where runoff is collected. An overflow weir is necessary to divert excess flow through the system. See Figures PTP-01-08 and PTP-01-09 for schematics of a typical underground sand filter.

Design Criteria

- Contributing drainage area should be less than 5 acres. Underground sand filters are commonly used for impervious areas of approximately 1 acre.
- Typically constructed as on-line systems, but can be off-line systems. Off-line construction omits the overflow structure between the second and third chambers.
- The minimum wet pool volume required in the sedimentation chamber should be calculated using the following equation:

$$V_w = A_S * 3 \text{ feet minimum}$$

Where V_W = wet pool storage
A_S = area from Camp-Hazen equation

Please reference perimeter sand filter design criteria for remaining requirements of filter sizing and system design.

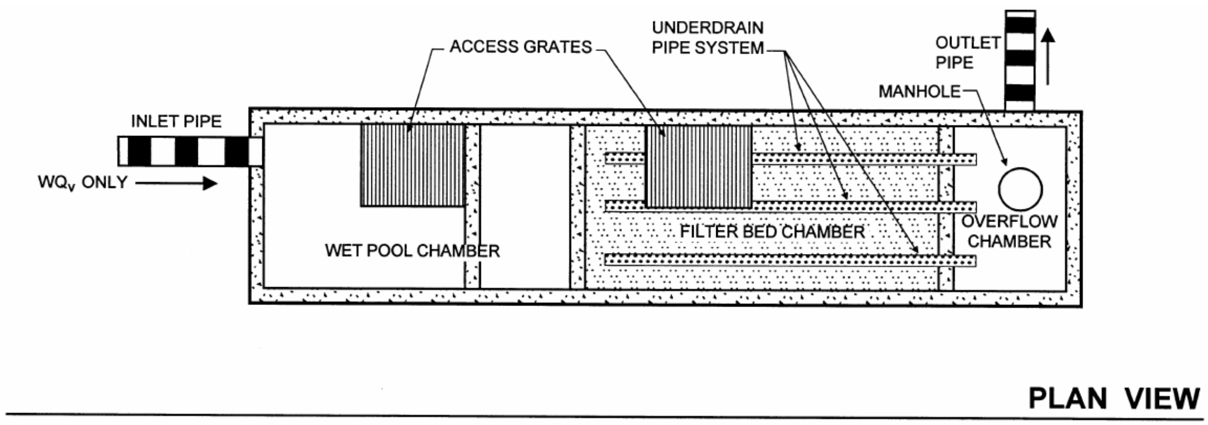


Figure PTP-01-08
Source, Georgia Stormwater Management Manual

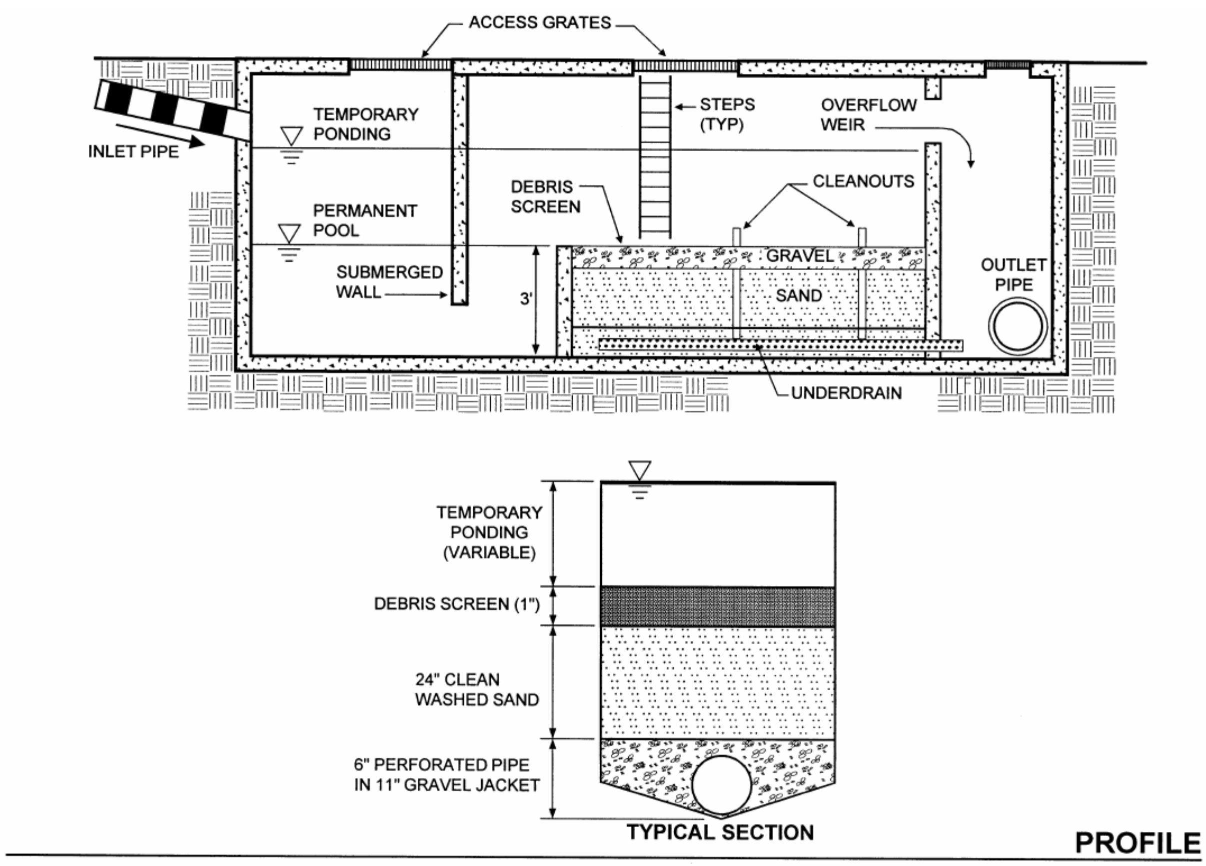


Figure PTP-01-09
Source, Georgia Stormwater Management Manual

Activity: Filtration Systems / Organic Sand Filter	PTP-01.4

Organic Sand Filter

The organic sand filter is a variation of the surface sand filter, utilizing organic materials in the filter media. Organic materials typically used are leaf compost or a peat/sand mixture. These materials enhance pollutant removal capabilities, absorbing soluble metals, hydrocarbons, and other organic chemicals.

The organic sand filter system is constructed with a layer of organic material placed above permeable filter fabric and the gravel and perforated underdrain system. The filter bed should be separated from soil layer by an impermeable layer such as a concrete structure or impermeable liner to prevent groundwater contamination.

Organic filters, like surface sand filters, are typically used in highly urban areas, most notably where enhanced pollutant removal is needed. Maintenance for organic sand filters is generally more tedious than surface sand filters due to higher propensity to clog the degredation of the organic filter media. See Figures PTP-01-010 and PTP-01-011 for schematics of a typical organic sand filter.

Design Criteria

- Minimum head required is 5 to 8 feet (the difference in elevation between the point of inflow to the point of outflow)
- Drainage area should be designed to serve a maximum of 10 acres
- Organic materials can vary, but typical filter media composition are:
    - Peat/sand filter – 18-inch 50/50 ratio of peat/sand mix over a 6-inch layer of sand. Can also be covered by a layer of sopsoil and vegetation
    - Compost filter – an 18-inch compost layer
- Peat types used impact the pollutant removal efficiency of the system. Fibric peat, where undecomposed fibrous organic material is easily seen within the peat mixture, is preferred. Hemic peat, which contains more decomposed material, may also be used. Sapric peat, which is almost fully decomposed matter, should not be used, and is not suited for this application.
- Organic sand filters remove dissolved pollutants more effectively than other sand filters. Pollutant removal capability is listed below:
    - TSS; 80%
    - Nutruents – Total Phosphorous/Total Nitrogen; 60/40%
    - Fecal Coliform; 50%
    - Heavy Metals; 75%
- Organic sand filters are generally constructed as off-line systems, diverting the water quality volume (WQ_v) into the filtration system, and the remaining volume downstream.

Please reference the design criteria from the surface sand filter for detailed sizing and design requirements.

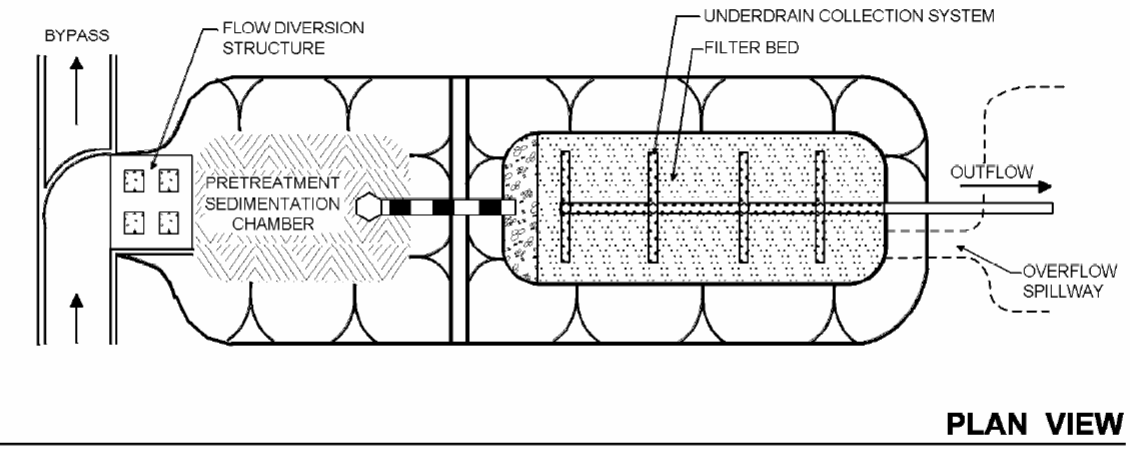


Figure PTP-01-010
Source, Georgia Stormwater Management Manual

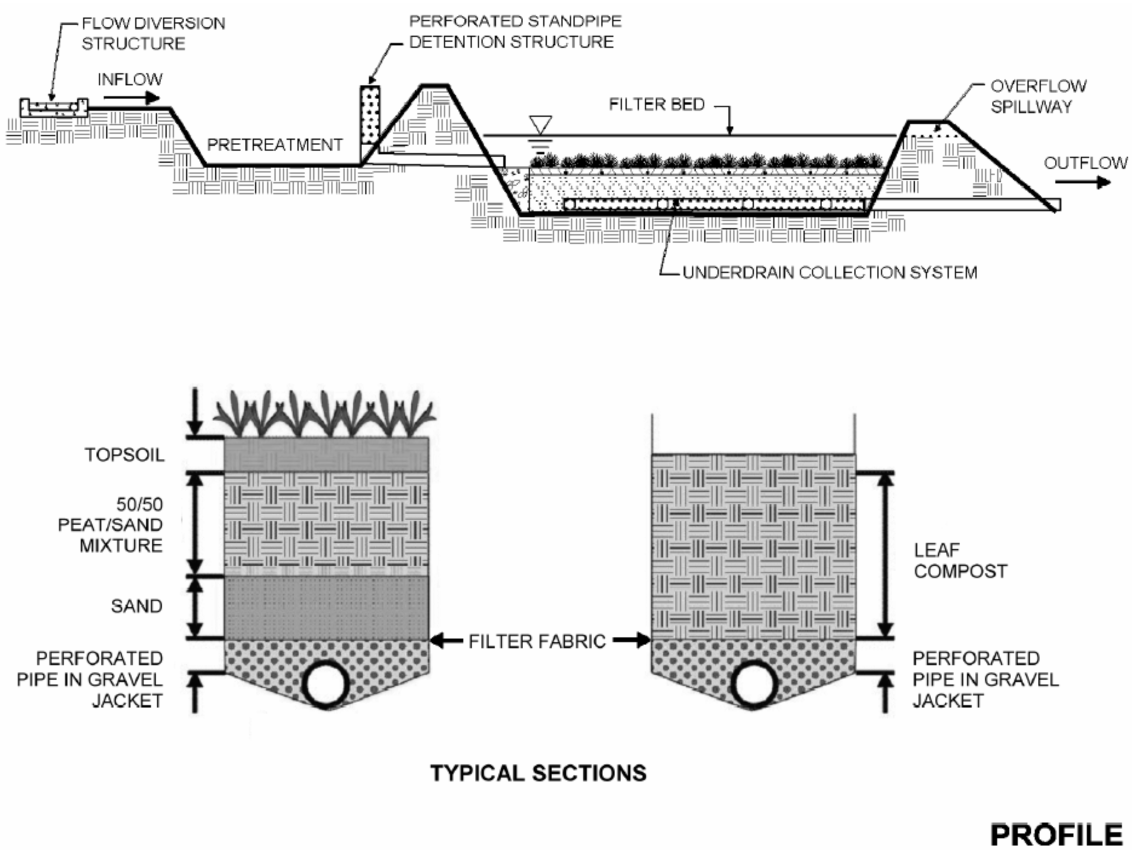


Figure PTP-01-011
Source, Georgia Stormwater Management Manual

Activity: Filtration Systems / Pocket Sand Filter	PTP-01.5

Pocket Sand Filter

Pocket sand filters utilize a more simplified design, allowing them to be used on smaller sites. Runoff is typically diverted into the filtration system via a manhole and pipe where the runoff is pretreated by a concrete flow spreader, a grass filter strip, and a plunge pool. The filter bed is constructed by a shallow excavation where the sand layer is placed. On the surface, a soil layer with grasses is placed above the sand layer. A pea gravel "window" should be constructed, as well as a cleanout/observation well to facilitate maintenance and inspection of clogging.

Design Criteria

- Pocket sand filters are off-line systems, constructed with a diversion structure to separate the water quality volume (WQ_v) and route it to the filter, while directing the remaining flow downstream.
- Drainage area should be designed to serve a maximum of 2 acres
- A gravel layer with an underdrain system should be constructed to facilitate drainage.
- A permeable filter fabric should be placed between the filter bed material and soil layer.

Activity: Filtration Systems / Bioretention Systems	PTP-01.6

Bioretention Systems

Bioretention practices are water quality control devices that capture, temporarily store, treat, and release stormwater runoff. A properly designed area will replicate a small, dense forest floor.

Bioretention is typically used for drainage areas from 1 to 5 acres. Such suitable applications include, but are not limited to:

- off-line facilities adjacent to parking lots
- along road drainage swales
- within larger landscaped pervious areas
- landscaped islands in impervious or high-density environments (i.e. parking lots)
- retrofitting exiting parking lot islands/off-line facilities

Biofiltration systems should **not** be placed in areas with mature trees, sites with slopes greater than 5:1 (H:V), areas that experience continuous or frequent flows, or locations with unstable soil. When considering this control for a karst area, use a collection system to carry flow to another conveyance element.

Design Criteria

- The size of the drainage area typically dictates the size of the bioretention practice. These areas should be limited to a maximum contributing drainage area of five (5) acres. One-half to two acre areas are preferred. Multiple bioretention areas may be required for larger drainage areas.
- Bioretention areas should be at least 10-feet wide and 15 feet long.
- The area should be designed such that it is drained within 48 hours
- The maximum recommended ponding depth is 6-inches.
- See Figure PTP-01-06 for a typical detail

Design Components

- *Grass Buffer Strip* - Reduces velocity of runoff and filters particles in the stormwater.
- *Sand Bed* – Reduces runoff velocities and spreads over perimeter of basin. Filters water as it seeps through sand
- *Ponding Area or Pretreatment Basin* – Runoff is detained to settle particulates suspended in stormwater.
- *Organic Layer* – A layer of mulch or another organic cover filters pollutants out of the stormwater and protects soil from eroding. Layer can also sustain a nutrient rich environment with microbes that can break down petroleum-based contaminants.
- *Planting Soil Layer* – Used to provide nutrients and store water for the areas plantings. Clay material can absorb heavy metals, hydrocarbons and other pollutants.
- *Plant Material* – Consider surrounding environment, climate, maintenance requirements and types of pollutants that the plants must withstand and treat, while maintaining a positive aesthetic enhancement.
- *Underdrain/Collection System* – Necessary to collect and send flows to a stormwater conveyance system.

Bioretention Systems (cont.)

Landscaping & Maintenance

- Consult with a landscaping professional to select vegetation which fits into the landscape, is appropriate for the hardiness zone, and can tolerate conditions found in bioretention areas (short durations of 6 inch ponding water).
- A dense and vigorous vegetative cover should be established over the contributing pervious drainage areas BEFORE runoff can be accepted into the facility.
- The bioretention area should be vegetated to resemble a terrestrial forest ecosystem, with a mature tree canopy, subcanopy of understory trees, scrub layer, and herbaceous ground cover. Three species each of both trees and scrubs are recommended to be planted.
- The tree-to-shrub ratio should be 2:1 to 3:1. On average, the trees should be spaced 8 feet apart. Plants should be placed at regular intervals to replicate a natural forest. Woody vegetation should not be specified at inflow locations.
- After the trees and shrubs are established, the ground cover and mulch should be established.
- Choose plants based on factors such as resistance to drought and inundation, cost aesthetics, maintenance, etc. Planting recommendations for bioretention facilities are as follows:
    - Native plant species should be specified over non-native species.
    - Vegetation should be selected based on a specified zone of hydric tolerance.
- A selection of trees with an understory of shrubs and herbaceous materials should be provided.
- Pruning and weeding to maintain appearance.
- Mulch replacement when erosion is evident.
- Remove trash and debris.

As needed

- Inspect inflow points for clogging (off-line systems). Remove any sediment.
- Inspect filter strip/grass channel for erosion or gullying. Re-seed or sod as necessary.
- Trees and shrubs should be inspected to evaluate their health and remove any dead or severely diseased vegetation.

Semi-annually

- The planting soils should be tested for pH to establish acidic levels. If the pH is below 5.2, limestone should be applied. If the pH is above 7.0 to 8.0, then iron sulfate plus sulfur can be added to reduce the pH.

Annually

- Replace mulch over the entire area.
- Replace pea gravel diaphragm if warranted every 2 to 3 years.

Bioretention Systems (cont.)

Cost Considerations

Bioretention areas can be expensive. However, costs can be offset if the bioretention area meets multiple uses, such as open space requirements or landscaping requirements. The following equation has been used to calculate and approximate cost for this practice.

$C = 7.30\ V^{0.99}$

Where,
C = Construction, design, and permitting cost ($)
V = Volume of water treated by the practice (ft^3)

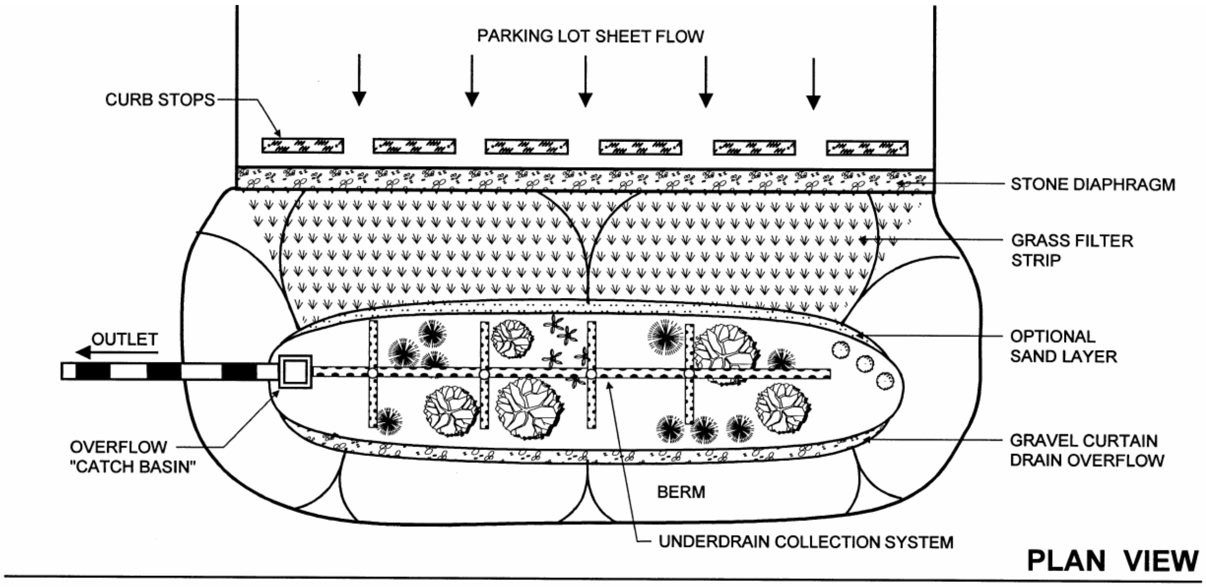


Figure PTP-01-012
Typical Bioretention Area
(Source, Georgia Stormwater Management Manual)

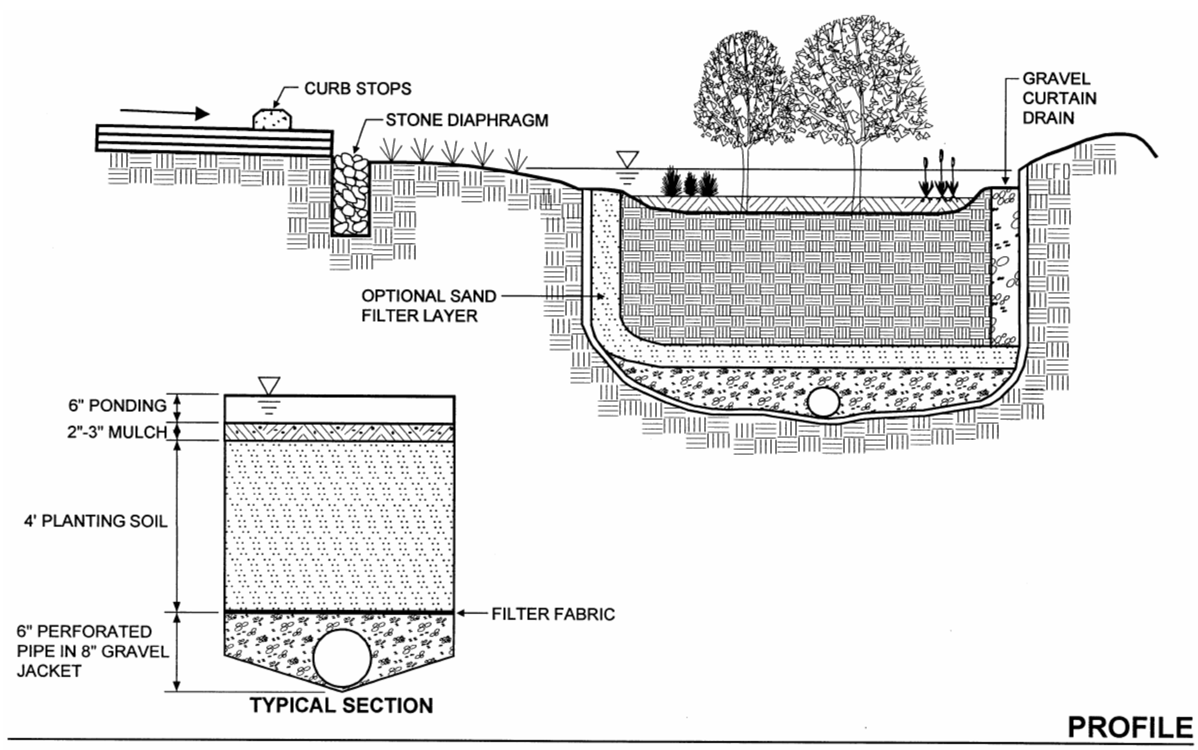


Figure PTP-01-013
Typical Bioretention Area
(Source, Georgia Stormwater Management Manual)

Sand Filter Design Procedures

Step 1. Compute runoff control volumes.

Calculate the Water Quality Volume (WQ_v), Channel Protection Volume (C_{pv}), Overbank Flood Protection Volume (Q_p), and the Extreme Flood Volume (Q_f).

Step 2. Determine if the development site and conditions are appropriate for the use of a surface or perimeter sand filter.

- Soil Type
- % Impervious Area
- Intermittent Flow
- Sufficient Flow Elevation Difference
- Is development commercial, industrial, or institutional

Step 3. Confirm local design criteria and applicability

Consider any special site-specific design conditions/criteria (Additional Site-Specific Design Criteria and Issues). Check with local officials and other agencies to determine if there are any additional restrictions and/or surface water or watershed requirements that may apply.

Step 4. Compute WQ_v peak discharge (Q_{wq})

The peak rate of discharge for water quality design storm is needed for sizing of off-line diversion structures.

- Using WQ_v, compute CN
- Compute time of concentration using TR-55 method
- Determine appropriate unit peak discharge from time of concentration
- Compute Q_{wq} from unit peak discharge, drainage area, and WQ_v.

Step 5. Size flow diversion structure, if needed

A flow regulator (or flow splitter diversion structure) should be supplied to divert the WQ_v to the sand filter facility.

Size low flow orifice, weir, or other device to pass Q_{wq}.

Step 6. Size filtration basin chamber

The filter area is sized using the following equation (based on Darcy's Law):

$$A_f = (WQ_v)\ (d_f)\ /\ [(k)\ (h_f + d_f)\ (t_f)]$$

where:

A_f = surface area of filter bed (ft^2)
d_f = filter bed depth (typically 18 inches, no more than 24 inches)
k = coefficient of permeability of filter media (ft/day) (use 3.5 ft/day for sand)
h_f = average height of water above filter bed (ft) (1/2 h_{max}, which varies based on site but h_{max} is typically 6 feet)
t_f = design filter bed drain time (days) (1.67 days or 40 hours is recommended maximum)

Sand Filter Design Procedures (cont.)

Set preliminary dimensions of filtration basin chamber. See Design Criteria for filter media specifications.

Step 7. Size sedimentation chamber

Surface sand filter: The sedimentation chamber should be sized to at least 25% of the computed WQ_v and have a length-to-width ratio of 2:1. The Camp-Hazen equation is used to compute the required surface area:

$$A_s = -(Q_o/w) * \ln(1\text{-}E)$$

Where:

A_s = sedimentation basin surface area (ft2)
Q_o = rate of outflow = the WQ_v over a 24-hour period
w = particle settling velocity (ft/sec)
E = trap efficiency

Assuming:

- 90% sediment trap efficiency (0.9)
- particle settling velocity (ft/sec) = 0.0033 ft/sec for imperviousness < 75%
- particle settling velocity (ft/sec) = 0.0004 ft/sec for imperviousness ≥ 75%
- average of 24 hour holding period

Then:

As = (0.066) (WQ_v) ft2 for I < 75%
As = (0.0081) (WQ_v) ft2 for I ≥ 75%

Set preliminary dimensions of sedimentation chamber.

Perimeter sand filter: The sedimentation chamber should be sized to at least 50% of the computed WQ_v. Use same approach as for surface sand filter.

Step 8. Compute V min

$V_{min} = 0.75 * WQ_v$

Step 9. Compute storage volumes within entire facility and sedimentation chamber orifice size

Surface sand filter:

$$V_{min} = 0.75\ WQ_v = V_s + V_f + V_{f\text{-}temp}$$

- Compute V_f = water volume within filter bed/gravel/pipe = $A_f * d_f * n$, where: n = porosity = 0.4 for most applications
- Compute $V_{f\text{-}temp}$ = temporary storage volume above the filter bed = $2 * h_f * A_f$
- Compute V_s = volume within sediment chamber = $V_{min} - V_f - V_{f\text{-}temp}$
- Compute h_s = height in sedimentation chamber = V_s/A_s
- Ensure h_s and h_f fit available head and other dimensions still fit – change as necessary
- in design iterations until all site dimensions fit.
- Size orifice from sediment chamber to filter chamber to release V_s within 24-hours average release rate with 0.5 h_s as average head.

Sand Filter Design Procedures (cont.)

- Design outlet structure with perforations allowing for a safety factor of 10.
- Size distribution chamber to spread flow over filtration media – level spreader weir or orifices.

Perimeter sand filter:

- Compute V_f = water volume within filter bed/gravel/pipe = A_f * d_f * n
- Where: n = porosity = 0.4 for most applications
- Compute V_w = wet pool storage volume As * 2 feet minimum
- Compute V_{temp} = temporary storage volume = V_{min} – (V_f + V_w)
- Compute h_{temp} = temporary storage height = V_{temp} / (A_f + A_s)
- Ensure h_{temp}. 2 * h_f, otherwise decrease h_f and re-compute. Ensure dimensions fit available head and area – change as necessary in design iterations until all site dimensions fit.
- Size distribution slots from sediment chamber to filter chamber.

Step 10. Design inlets, pretreatment facilities, underdrain system, and outlet structures according to Design Criteria.

Step 11. Compute overflow weir sizes

Surface sand filter:

- Size overflow weir at elevation h_s in sedimentation chamber (above perforated stand pipe) to handle surcharge of flow through filter system from 25-year storm.
- Plan inlet protection for overflow from sedimentation chamber and size overflow weir at elevation h_f in filtration chamber (above perforated stand pipe) to handle surcharge of flow through filter system from 25-year storm.

Perimeter sand filter: Size overflow weir at end of sedimentation chamber to handle excess inflow, set at WQ_v elevation.

Somerset, Kentucky
Stormwater Best Management Practices (BMPs)
Stormwater Pollution Treatment Practices (Structural)

PTP-02

Activity: Open Channel Systems

PLANNING CONSIDERATIONS:

Design Life:
Life

Acreage Needed:
High

Estimated Unit Cost:
Moderate

Annual Maintenance:
Low

Target Pollutants; Pollutant Removal

Total Suspended Solids (TSS); 75% (Wet Swale), 90% (Dry Well)
Nutrients – Total Phosphorous/Total Nitrogen removal; 50/50%
Metals – Cadmium, Copper, Lead, and Zinc removal; 50%
Pathogens – Coliform, Streptococci, E.Coli removal; 40%

Description

Open channel systems are vegetated swales that are designed to capture, treat, and release stormwater runoff. Open channel systems consist of treatment via dry or wet cells created through the installation of check dams or berms. Wet swales and dry swales are two types of open channel systems. Dry swales typically utilize a permeable soil layer, and wet swales typically have wetland plants. Open channel systems treat stormwater while also acting as a stormwater runoff conveyance system. They incorporate water quality features that typical drainage channels do not offer. Installation costs are less expensive than a curb and gutter system, although maintenance costs are typically higher.

Open channel systems must be designed with limited longitudinal slopes to reduce runoff velocities and allow particulates to settle. Berms or check dams placed perpendicular to the flow path also aid in reducing velocities and promoting infiltration.

Inlets to open channel systems can be enhanced through the use of the following options:
- Riprap or other energy dissipaters
- Pretreatment through a sediment forebay
- Flow spreader for situations of direct and concentrated flow

Outlet structures for open channel systems should discharge into the storm drainage system or a stable outfall. For wet swales, outlet protection should be used to prevent scour and downstream erosion.

Activity: Open Channel Systems	PTP-02

Suitable Applications

Open channel systems are designed to manage stormwater runoff in water quality situations, with the limited ability to provide benefits of channel protection. Open channel systems are typically suitable in the following applications:

- Residential subdivisions of low to moderate density (dry swales)
- Small impervious area in the contributing drainage area
- Along roads and highways (off right-of-way)
- Adjacent to parking lots
- Small drainage areas (less than 5 acres)
- Landscaped commercial areas (wet swales)

Installation Procedures

- Longitudinal slopes should be less than 4%, with a 1-2% slope recommended.
- Bottom width should be approximately 2 to 8 feet.
- Side slopes should be 3:1 (H:V) or less, where 4:1 (H:V) is recommended.
- Design should convey the 25-year storm event with a minimum of 6 inches of freeboard.
- Geotextile fabric should be placed around underdrain.

Maintenance

Adequate access should be provided to allow for inspection and maintenance.

- Grass heights should be maintained at heights of approximately 4 to 6 inches for dry swales
- Sediment should be removed from forebay and channel regularly and disposed of properly

Dry Swale

Dry swales are open channel systems that convey stormwater runoff through vegetation and a filter bed. Sizing for dry swales should allow the entire water quality volume to be filtered or infiltrated through the swale, such that there is no standing water between rain events. Dry swales are the preferred option in residential areas.

Dry swales are made up of an open conveyance channel with a filter bed of prepared soil that overlays an underdrain system. Flow is conveyed into the main channel of the swale where it is filtered by the soil bed. Runoff is then collected and passes into a perforated pipe and gravel underdrain system to the outlet.

Design Criteria

- Size to store a water quality volume with less than 18 inches of ponding
- Maximum ponding time is 48 hours, design for 24 hours
- Bed material should be permeable soil at least 30 inches deep, with an infiltration rate of at least 1 foot per day (1.5 feet per day maximum)
- Soil should have a high organic content to allow pollutant removal
- Underdrain should consist of a 4 inch diameter PVC pipe, installed longitudinally in a 6 inch gravel layer
- Permeable filter fabric installed encompassing the stone underdrain
- Channel excavation should not result in soil compaction

See Figures PTP-02-01 and PTP-02-02 for example drawings of a dry swale.

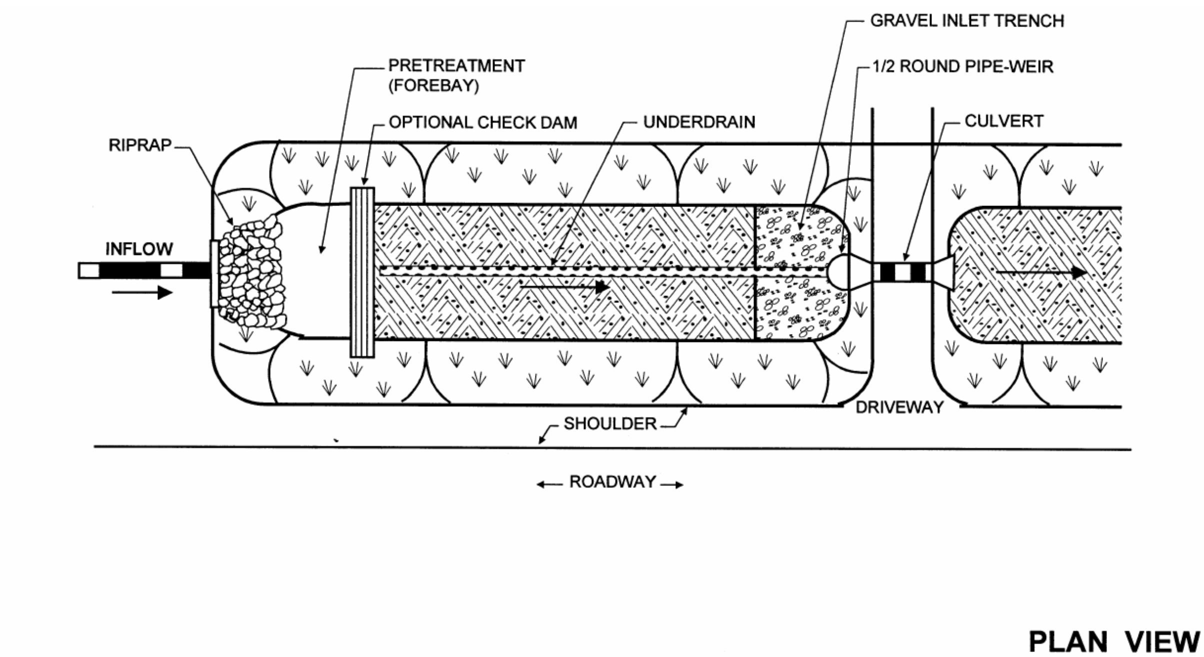


Figure PTP-02-02
Source, Georgia Stormwater Management Manual

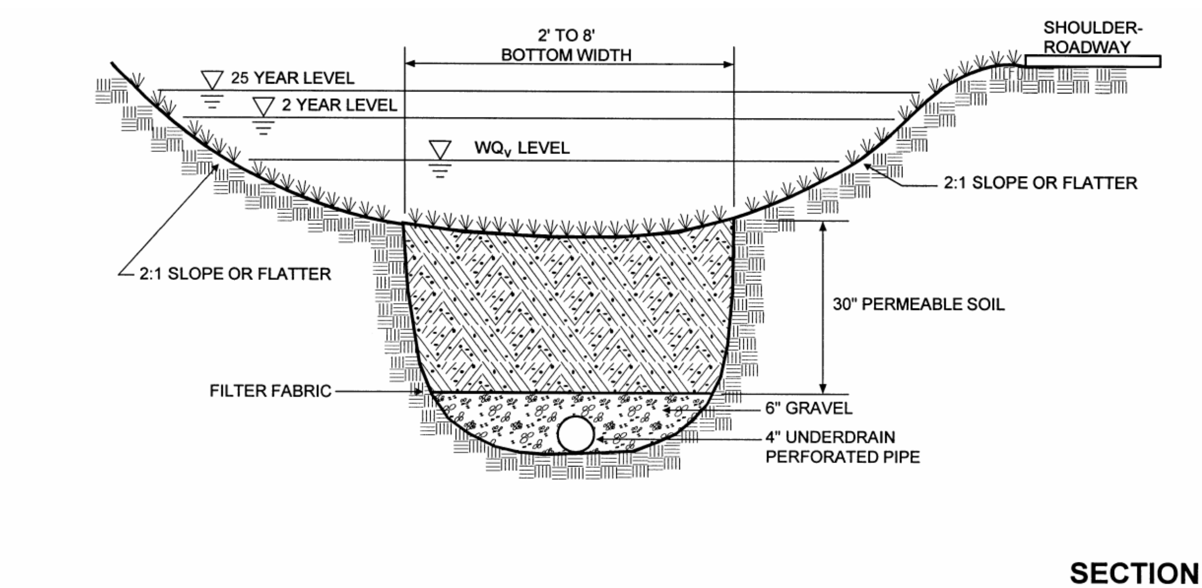


Figure PTP-02-02
Source, Georgia Stormwater Management Manual

Wet Swale

Wet swales are also referred to as wetland channels. Like the dry swale, wet swales are vegetated channels that treat stormwater runoff. They differ in that wet swales are designed to retain water, imitating marshy conditions and supporting wetland vegetation. A high water table or soils that retain water are necessary to retain water in the system. In these regards, a wet swale is much like a wetland, with a shallow and linear design.

Wet swales are constructed by excavating the channel to the water table or to poorly drained soils. Check dams are installed to create wetland "cells". These cells contain the runoff similar to a shallow wetland.

Design Criteria

- Size to store the entire water quality volume with less than 18 inches of ponding at the maximum depth point.
- Check dams and wetland plantings should be installed to form wetland cells. Flow direction can be achieved through the use of V-notch weirs in the check dams.

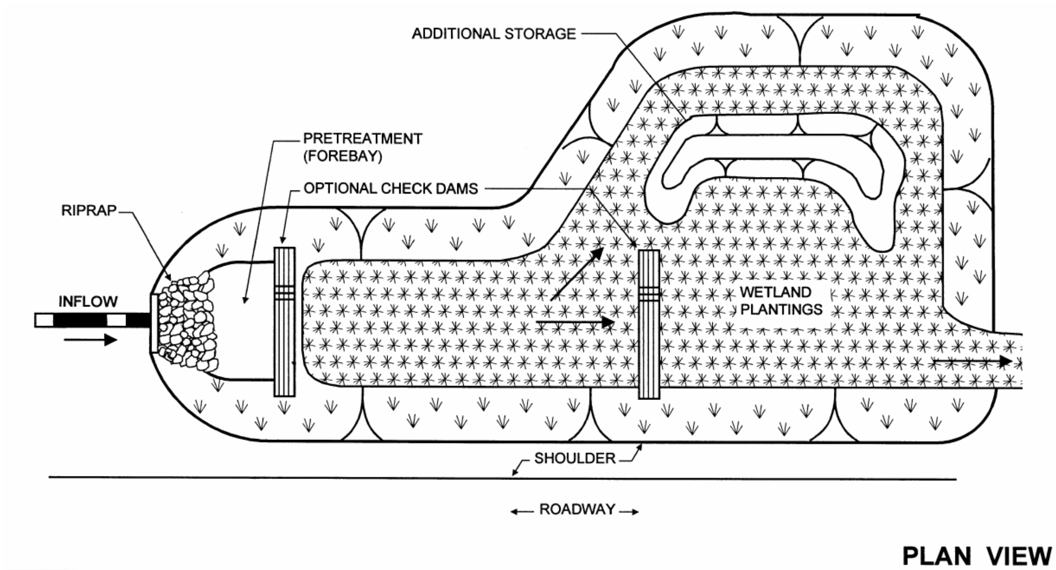


Figure PTP-02-03
Source, Georgia Stormwater Management Manual

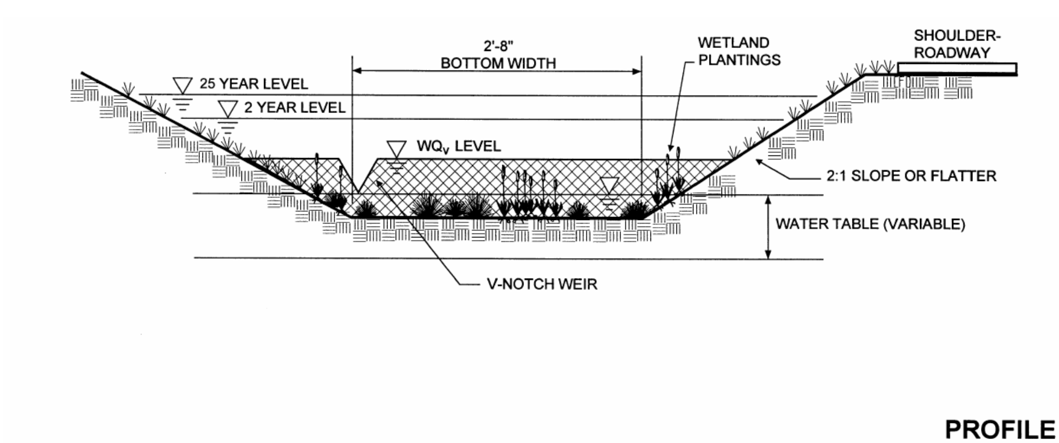


Figure PTP-02-04
Source, Georgia Stormwater Management Manual

Swale Design Procedures

Step 1. Compute runoff control volumes.

Calculate the Water Quality Volume (WQ_v), Channel Protection Volume (Cp_v), Overbank, Flood Protection Volume (Q_p), and the Extreme Flood Volume (Q_f).

Step 2. Determine if the development site and conditions are appropriate for the use of an enhanced swale system (dry or wet swale).

- Topography?
- % Impervious Area?
- Low to moderate density area?
- Type of development?

Step 3. Confirm local design criteria and applicability.

Consider any special site-specific design conditions/criteria (Additional Site-Specific Design Criteria and Issues). Check with local officials and other agencies to determine if there are any additional restrictions and/or surface water or watershed requirements that may apply.

Step 4. Determine pretreatment volume.

The forebay should be sized to contain 0.1 inches per impervious acre of contributing drainage. The forebay storage volume counts toward the total WQ_v requirement, and should be subtracted from the WQ_v for subsequent calculations.

Step 5. Determine swale dimensions

Size bottom width, depth, length, and slope necessary to store WQv with less than 18 inches of ponding at the downstream end.

- Slope cannot exceed 4% (1 to 2% recommended)
- Bottom width should range from 2 to 8 feet
- Ensure that side slopes are no greater than 2:1 (4:1 recommended)

See Design Criteria for more details.

Step 6. Compute number of check dams (or similar structures) required to detain WQ v

Step 7. Calculate draw-down time

Dry swale: Planting soil should pass a maximum rate of 1.5 feet in 24 hours and must completely filter WQ_v within 48 hours.

Wet swale: Must hold the WQ_v.

Swale Design Procedures (cont.)	Step 8. Check 2-year and 25-year velocity erosion potential and freeboard Check for erosive velocities and modify design as appropriate. Provide 6 inches of freeboard. Step 9. Design low flow orifice at downstream headwalls and checkdams. Design orifice to pass WQv in 6 hours. Use Orifice equation. Step 10. Design inlets, sediment forebay(s), and underdrain system (dry swale). See Design Criteria for more details. Step 11. Prepare Vegetation and Landscaping Plan A landscaping plan for a dry or wet swale should be prepared to indicate how the enhanced swale system will be stabilized and established with vegetation. The appropriate grass species and wetland plants should be chosen based on the site location, soil type, and hydric conditions.

Somerset, Kentucky
Stormwater Best Management Practices (BMPs)
Stormwater Pollution Treatment Practices (Structural)

PTP-03

Activity: Stormwater Ponds

PLANNING CONSIDERATIONS:

Design Life:
Life

Acreage Needed:
Moderate to High

Estimated Unit Cost:
Low

Annual Maintenance:
Low

W

SP

Target Pollutants

Total Suspended Solids (TSS); 80%
Nutrients – Total Phosphorous/Total Nitrogen removal; 50/30%
Metals – Cadmium, Copper, Lead, and Zinc removal; 50%
Pathogens – Coliform, Streptococci, E.Coli removal; 70%

Description

Stormwater ponds are detention ponds containing a permanent pool (or micropool) that allows the treatment of stormwater runoff, while also contributing to the aesthetic value of the area. Stormwater ponds addressed in this fact sheet include micropool extended detention ponds, wet ponds, wet extended detention ponds, multiple pond systems, and pocket ponds.

Stormwater ponds enhance water quality through settling and biological uptake, and offer a control for sediment, heavy metals, and floatables. They also may provide benefits in reducing impacts due to nutrients, oxygen demanding substances, oil and grease, and bacteria and viruses.

Stormwater ponds consist of the following components: a sediment forebay, permanent pool, runoff control volume storage, and a shallow littoral zone, or aquatic bench, along the edge of the permanent pool. Other design considerations include an emergency spillway, maintenance access and landscaping.

Suitable Applications

- Areas where high particulate control is needed
- Suitable for large, regional tributaries; minimum contributing drainage area is 25 acres, or 10 acres for a micropool extended detention pond
- Provides multiple benefits for passive recreation such as bird watching, and wildlife habitat
- To control both stormwater quantity and quality issues

Typically, stormwater ponds are not feasible for dense or urban land uses due to large land requirements and areas with steep or unstable slopes.

Activity: Stormwater Ponds	PTP-03

Maintenance

Frequently (3-4 times a year)

- Clean and remove debris from inlet and outlet structures.
- Remove floatables and sediment build-up.
- Mow side slopes (more often if needed).

As Needed

- Repair undercut or eroded areas
- Pond vegetation need to be trimmed or harvested as appropriate, grassy areas frequently mowed and repairs made to signage, walkways, picnic tables, or any other public recreation equipment.

Annual

- Remove invasive vegetation.
- Inspect for damage to the embankment and inlet/outlet structures.
- Monitor and record sediment accumulation.

Sediment Removal

- The sediment accumulation rate is dependant on a number of factors including watershed size, facility sizing, construction upstream, industrial or commercial activities upstream, etc. Sediment contents should removed and disposed of properly.
- Most sediment collected is innocuous (free of pollutants other than "clean" soil) and can be used as fill material, cover or land spreading. It is important that this material not be placed in a way that will promote or allow resuspension in storm runoff. The sediment should not be placed within the high water level area of the stormwater pond or another BMP, creek, waterway, buffer, runoff conveyance device, or other infrastructure. Some demolition or sanitary landfill operators will allow the sediment to be disposed at their facility for use as cover.
- Sediment should be removed when 10 to 15% of the storage capacity has been lost.

Inspection Checklist

- ☐ Concern for mosquito population growth and maintaining oxygen in ponds
- ☐ In cases where a stormwater pond is used for large detention facilities, the structural integrity of the impounding embankment should also be evaluated. The embankment should be protected against catastrophic dam failure and comply with any required dam permit.
- ☐ Maintenance of vegetation
- ☐ Inlet pipe condition
- ☐ Evidence of scouring
- ☐ Removal of trash and sediments

Activity: Stormwater Ponds / Wet Pond	PTP-03.1

Wet Pond

Wet ponds maintain a permanent pool to treat incoming stormwater. Treatment occurs through settlement of suspended particles and uptake of dissolved contaminants by aquatic plants between storm events. Wet ponds are constructed with two storage area. A permanent pool, or “dead” storage area is based on the water quality volume calculation. During storm events, runoff displaces the water existing in the permanent pool. A temporary, or “live” storage area can be provided above the permanent pool to accommodate larger flows and control erosion.

Design Criteria

The following sizing design considerations should be made for wet ponds:

- The permanent pool should have a hydraulic residence time of at least 2 to 4 weeks
- The maximum depth of the permanent pool is generally less than 12 feet, although greater depths are possible with artificial mixing or aerators at maximum depth. The objective is to avoid thermal stratification that could result in odor problems associated with anaerobic conditions. Gentle artificial mixing may be needed in small ponds because they are effectively sheltered from the wind.
- The outlet of the facility should be restricted so as to detain a treatment design storm in a “live” pool on top of the permanent pool for 24 to 60 hours. The effect of restricting the outflow is to reduce the overflow rate during the storm reducing downstream erosion, flood control and slightly increasing the capture of settleable solids.
- Water quality detention ponds should be sized to collect the first flush of stormwater runoff. For this area, the first flush is generally the first 0.5 to 1.1 inches of runoff over the tributary area.
- About 10 to 25% of the surface area determined in the above procedure should be devoted to the forebay. The forebay can be distinguished from the remainder of the pond by one of several means: a lateral sill with rooted wetland vegetation, two ponds in series, differential pool depth, rock-filled gabions or retaining wall, or a horizontal rock filter placed laterally across the pond. A baffle box or water quality inlet(s) can be used in lieu of a forebay.

Sizing the “Live” Pool

The following two methods should be used to calculate the “live” pool volume. The most conservative (largest volume) should be selected.

- The recommended performance goal is at least 85 to 95% capture of the annual average runoff volume. The live pool may be calculated using long-term hourly hydrologic data and runoff capture simulation curves that consider a runoff coefficient for land use to determine a unit basin storage volume (v).

$$V_L = (A_T * v)/12$$

where: V_L = pond volume (acre-feet);
A_T = Total Tributary Area (acres); and
v = unit basin storage volume – taken from Figure STP-02-03 (0.5 to 1.1 inches)

Wet Pond (cont.)

- Alternatively, the live pool portion of the wet pond can also be designed to capture the "maximized storm runoff capture volume," and drain over a 24-60 hour period. The maximized storm runoff capture volume can be calculated by:

$$V_L = (a \cdot C) \cdot P_6$$

where:

V_L = maximized capture volume determined using either the event capture ratio or the volume capture ratio as its basis, watershed in.;

a = regression constant from least-square analysis;

Event capture ratio: 1.299 for 24-hour drain time,

Volume capture ratio: 1.582 for 24-hour drain time (for approximately 85th percentile runoff event – 82-88%).

C = runoff coefficient

P_6 = mean storm precipitation volume, watershed in.

- Using this technique, the desired removal efficiency and land use characteristics can be applied to local hydrologic data to determine the optimal live pool volume. Note that A_T and the runoff coefficient selected can be modified to consider Directly Connected Impervious Area (DCIA) if the data is available.
- This live pool volume will add to the overall volume and will benefit the downstream waterways by reducing erosive velocities, providing flood control and an incremental increase in treatment.

Sizing the Permanent Pool

- Two methods are available for the sizing of the permanent pool portion of the wet detention ponds, with one proposed on the removal of phosphorus (Florida, 1988; Maryland, 1986). It provides a detention time of 14 days based on the wettest month to allow sufficient time for the uptake of dissolved phosphorus by algae and the settling of fine solids where the particulate phosphorus tends to be concentrated. The following two methods should be used to calculate the permanent pool volume. The most conservative (largest volume) should be selected.
- Size the permanent pool portion of the wet pond using the wettest 14-day period using the following formula:

$$V_p = (CA_TR)/12$$

Where: V_p = permanent pool volume (acre-ft)

C = contributing area weighted average runoff coefficient

A_T = Total Tributary Area (acres)

R = 14 day wet season rainfall (inches)

The second method predicts the removal of particulate contaminants only (USEPA, 1986). It relates the removal efficiency of suspended solids to pond volume. Using this method, the volume of the permanent pool may be calculated as follows:

$$V_P = V_{B/R}S_dA_i43560/12 = 10890S_dA_i$$

Wet Pond (cont.)

where: V_P = permanent pool volume (ft^3)
$V_{B/R}$ = Ratio of Basin to Runoff Volume (Figure PTP-03-06)
(a value of at least 4.0 should be used)
S_d = mean storm depth (inches)
A_i = impervious acres in the tributary watershed

- For A_i the engineer may use directly connected impervious acres because it more correctly represents the area being treated and would allow a smaller facility. Although impervious area and directly connected impervious area are not the same, they are reasonable given the uncertainty of the methodology and expected pond performance.
- Wetland vegetation, occupying 25-50% of water surface area.
- Side slopes should be 6:1 (H:V) or flatter to provide a littoral shelf and safety bench from the side of the facility out to a point 2 to 3 feet below the permanent pool elevation. Side slopes above the littoral zone should be no steeper than 4:1 (H:V). Side slopes below the littoral zone can be 2:1 (H:V) to maximize permanent pool volumes where needed. A short (1.0 ft) drop-off can be constructed at the edge of the pond to control the potential breeding of mosquitoes.
- Pretreatment – Facilities that receive stormwater from contributing areas with greater than 50 percent impervious surface or that are a potential source of oil and grease contamination must include a baffle, skimmer, and grease trap to prevent these substances from being discharged from the facility.
- The permanent pool may be excavated into bedrock for a wet or dry detention pond, but the cost may be prohibitive. Furthermore, if there is highly fractured bedrock or karst topography, then the modification of a detention pond should be carefully considered because it may not hold water and the additional water flow and/or weight could intensify karst activity.
- The interaction with other utilities must be considered as it may not be practical to develop a permanent pool in an area that is needed by another utility. Furthermore, the cost of designing around utilities or utility relocation must be considered.
- A 5:1 (H:V) access must be considered to account for maintenance crews and public interaction. Maintenance crews must have access to the site for proper maintenance. Ponds that are not designed with access for maintenance crews often become more of a nuisance than a beneficial part of a stormwater management program. It may also be desirable to encourage or discourage access for the public. Public education and recreation may be facilitated by access to the pond, provided public safety is sufficiently addresses.
- Design to minimize short-circuiting by including energy dissipaters on inlets, shape the pond with at least a 3:1 length to width ratio, and locate the inlets as far away from the outlet as possible. It should be noted that a length to width ratio of up to 7:1 is preferred. The inlet and outlet can be placed at the same end if baffling is installed to direct the water to the opposite end before returning to the outlet. If topography or aesthetics requires the pond to have an irregular shape, the pond area and volume should be increased to compensate for the dead spaces.

Wet Pond (cont.)

- Except for very small facilities, include a forebay, baffle box, or other pretreatment BMPs to facilitate maintenance. However, note that a forebay will require less frequent maintenance.
- To maintain the wet pool to the maximum extent possible, excessive losses by infiltration through the bottom must be avoided. Depending on the soils, this can be accomplished by compaction, incorporating clay into the soil, or an artificial liner.
- Place an antiseep collar around the outlet pipe with an earthen embankment.
- The outlet should incorporate an antivortex device if the facility is large (a 100-year storm must safely pass through or around the device).
- The slope of an earthen embankment should be vegetated to avoid erosion. Drought tolerant groundcover species should be used if irrigation can not occur during the summer.
- Ponds that serve smaller local site runoff do not offer as much recreational benefit as ponds serving larger regional runoff. Regional facilities can often be landscaped to offer recreational and aesthetic benefits. Jogging and walking trails, picnic areas, ball fields, and canoeing or boating are some of the typical uses. For example, portions of the facility used for flood control can be kept dry, except during floods, and can be used for exercise areas, soccer fields, or football fields. Wildlife benefits can also be provided in the form of islands or preservation zones, which allow a view of nature within the park schemes.
- The public's safety must be a foremost consideration. For the design of wet detention ponds, this usually takes place in the grading, fencing, landscaping, pipe cover, grating and signage. The most important design feature affecting public safety during a pond's operation is grading. The contours of the pond should be designed to eliminate "drop-offs". When possible, terraces or benches are used to transition into the permanent pool. Within the permanent pool, it is desirable to have a wet terrace 12 to 18 inches below the normal pool level. In some cases there is not sufficient room for grading of this type and the pond may require a perimeter fence.

Outlet Design

- Proper hydraulic design of the outlet is critical to achieving good performance of the stormwater pond. The two most common outlet problems that occur are: 1) the capacity of the outlet is too great resulting in partial filling of the basin shorter drawdown time and reduced pollutant removal and 2) the outlet clogs because it is not adequately protected against trash and debris. To avoid these problems, two alternative outlet types are recommended for use: 1) V-notch weir, and 2) perforated riser. The V-notch weir will not clog as easily.

Wet Pond (cont.)

Flow Control Using a "V" Notch Weir

- The outlet control "V" notch weir should be sized using the following formula (Merritt et.al., 1996).

$$Q = C_1 H^{5/2} \tan\left(\frac{\theta}{2}\right)$$

Where

θ = notch angle

H = head or elevation of water over the weir, ft

C_1 = discharge coefficient (see Figure PTP-03-06)

The notch angle should be 20° or more. If calculations show that a notch angle of less than 20° is appropriate, then the outlet should be designed as a uniform width notch. This will generally necessitate some sort of floatables control such as a skimmer on the outlet or trash rack on the inlet.

Flow Control Using a Single Orifice

- The outlet control orifice should be sized using the following equation (GKY, 1989).

$$a = \frac{2A(H-H_o)^{0.5}}{3600CT(2g)^{0.5}} = \frac{(7x10^{-5})A(H-H_o)^{0.5}}{CT} \qquad (1)$$

where: a = area of orifice (ft2)
A = average surface area of the pond (ft2)
c = orifice coefficient
T = drawdown time of full pond (hrs.)
g = gravity (32.2 ft/sec2)
H = elevation when the pond is full (ft)
Ho = final elevation when pond is empty (ft)

With a drawdown time of 40 hours the equation becomes:

$$a = \frac{(1.75x10^{-5})A(H-H_o)^{0.5}}{CT} \qquad (2)$$

Table PTP-03-01
Perforated Outlet Riser Pipe Orifices
(Source: Austin, 1988)

Riser Pipe	Vertical Spacing Between Rows (center to center)	Number of Perforations	Perforation Diameter
6 in.	2.5 in.	9 per row	1 in.
8 in.	2.5 in.	12	1 in.
10 in.	2.5 in.	16	1 in.

Wet Pond (cont.)

Flow Control Using the Perforated Riser

- For outlet control using the perforated riser as the outflow control, it is recommended that the procedure illustrated in PTP-03-03 and PTP-03-04. This design incorporates flow control for the small storms in the perforated riser but also provides an overflow outlet for large storms. If properly designed, the facility can be used for both water quality and drainage control by: 1) sizing the perforated riser as indicated for water quality control; 2) sizing the outlet pipe to control peak outflow rate from the 2-year storm; and 3) using a spillway in the pond berm to control the discharge from larger storms up to the 100-year storm.

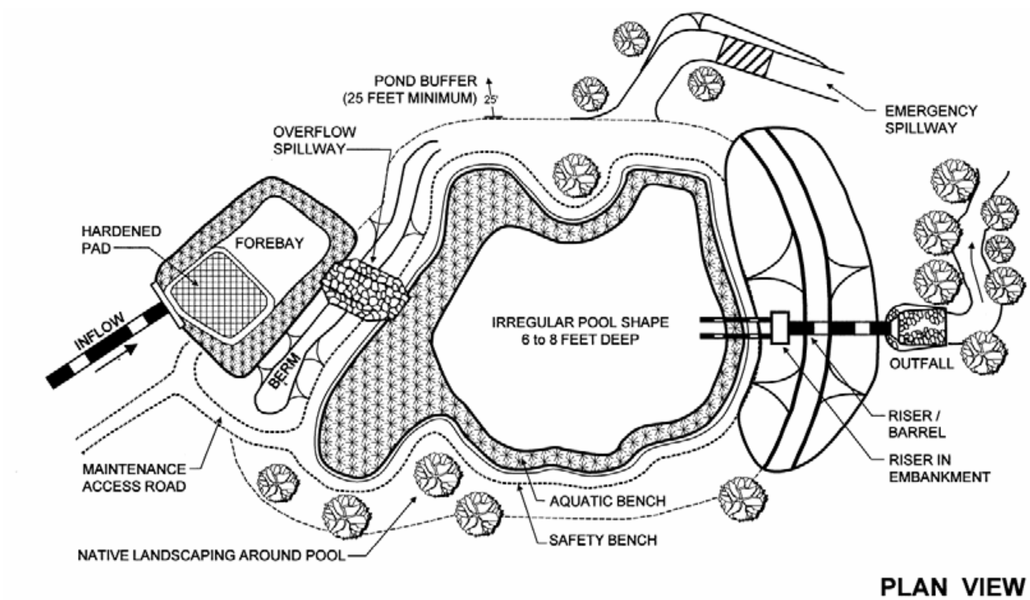


Figure PTP-03-01
Source, Georgia Stormwater Management Manual

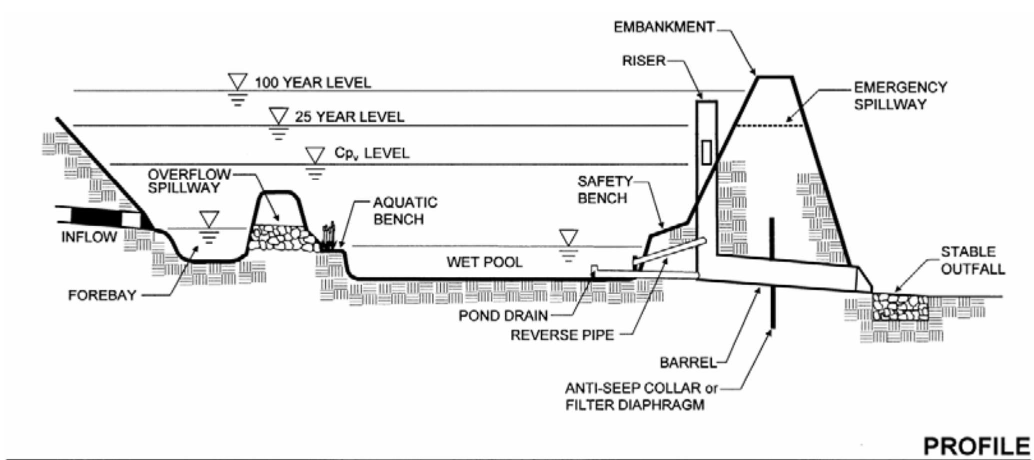
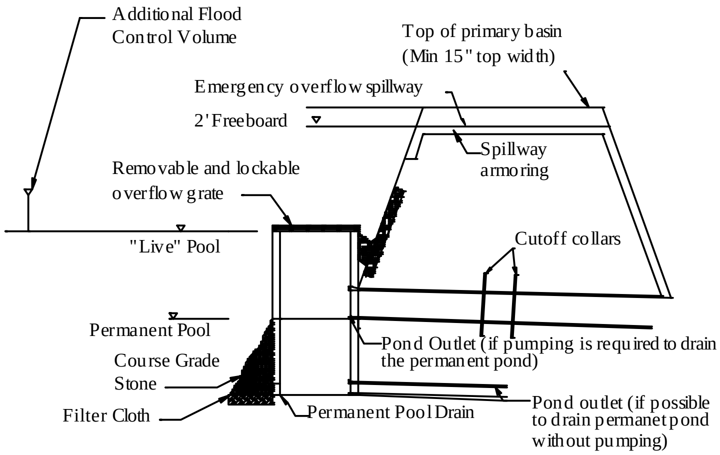
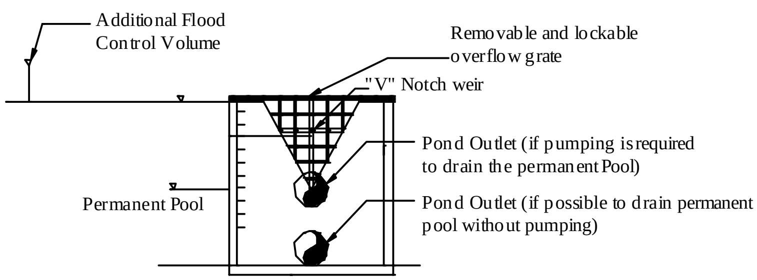


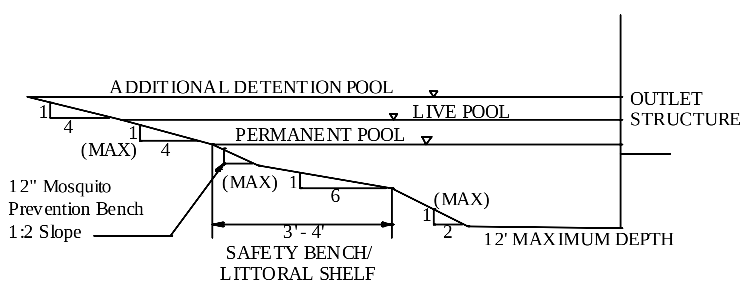
Figure PTP-03-02
Source, Georgia Stormwater Management Manual



SECTION OUTLET STRUCTURE
NTS

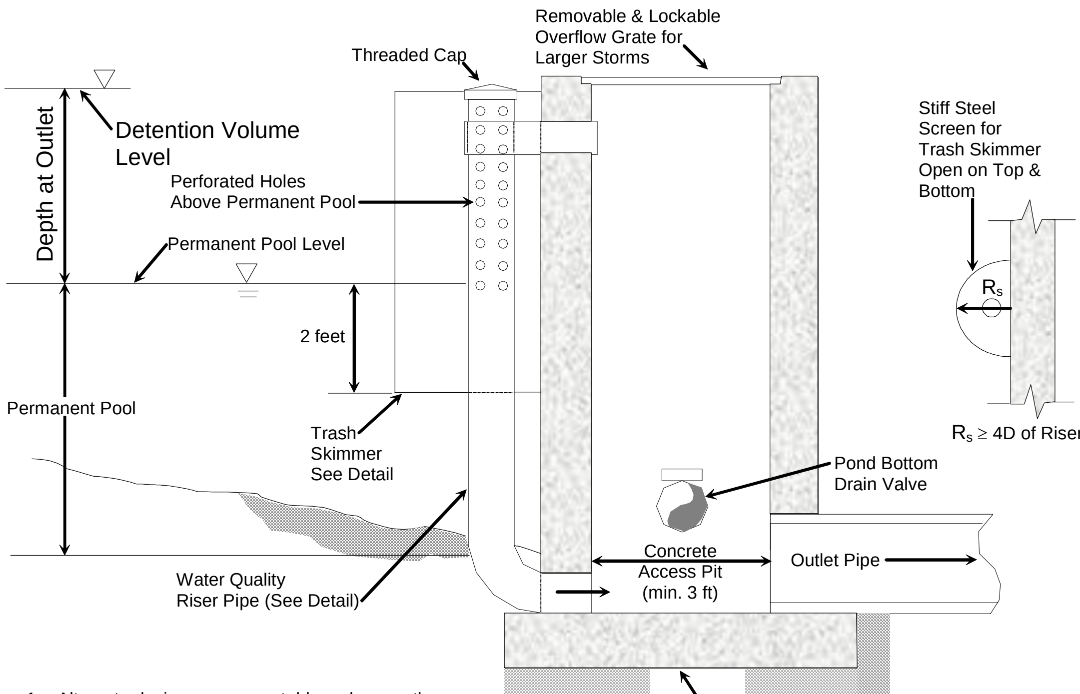


PROFILE OUTLET STRUCTURE
NTS



POND GRADING
NTS

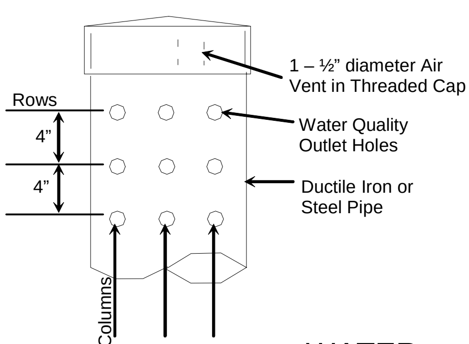
Figure PTP-03-03
"V" Notch Weir Outlet Structure



Notes: 1. Alternate designs are acceptable as long as the hydraulics provides the required emptying times.
2. Use trash skimmer screens of stiff green steel material to protect perforated riser. Must extend from the top of the riser to 2 ft. below the permanent pool level.

OUTLET WORKS
NOT TO SCALE

Notes: 1. Minimum number of holes = 8
2. Minimum hole diameter = 1/8” Dia.



WATER
QUALITY
RISER PIPE

Maximum Number of Perforated Columns				
Riser Diameter (in.)	Hole Diameter, inches			
	¼”	½”	¾”	1”
4	8	8	-	-
6	12	12	9	-
8	16	16	12	8
10	20	20	14	10
12	24	24	18	12

Hole Diameter (in.)	Area (in.^{2})
1/8	0.013
1/4	0.049
3/8	0.110
1/2	0.196
5/8	0.307
3/4	0.442
7/8	0.601
1	0.785

Figure PTP-03-04
Perforated Riser Pipe Outlet Structure

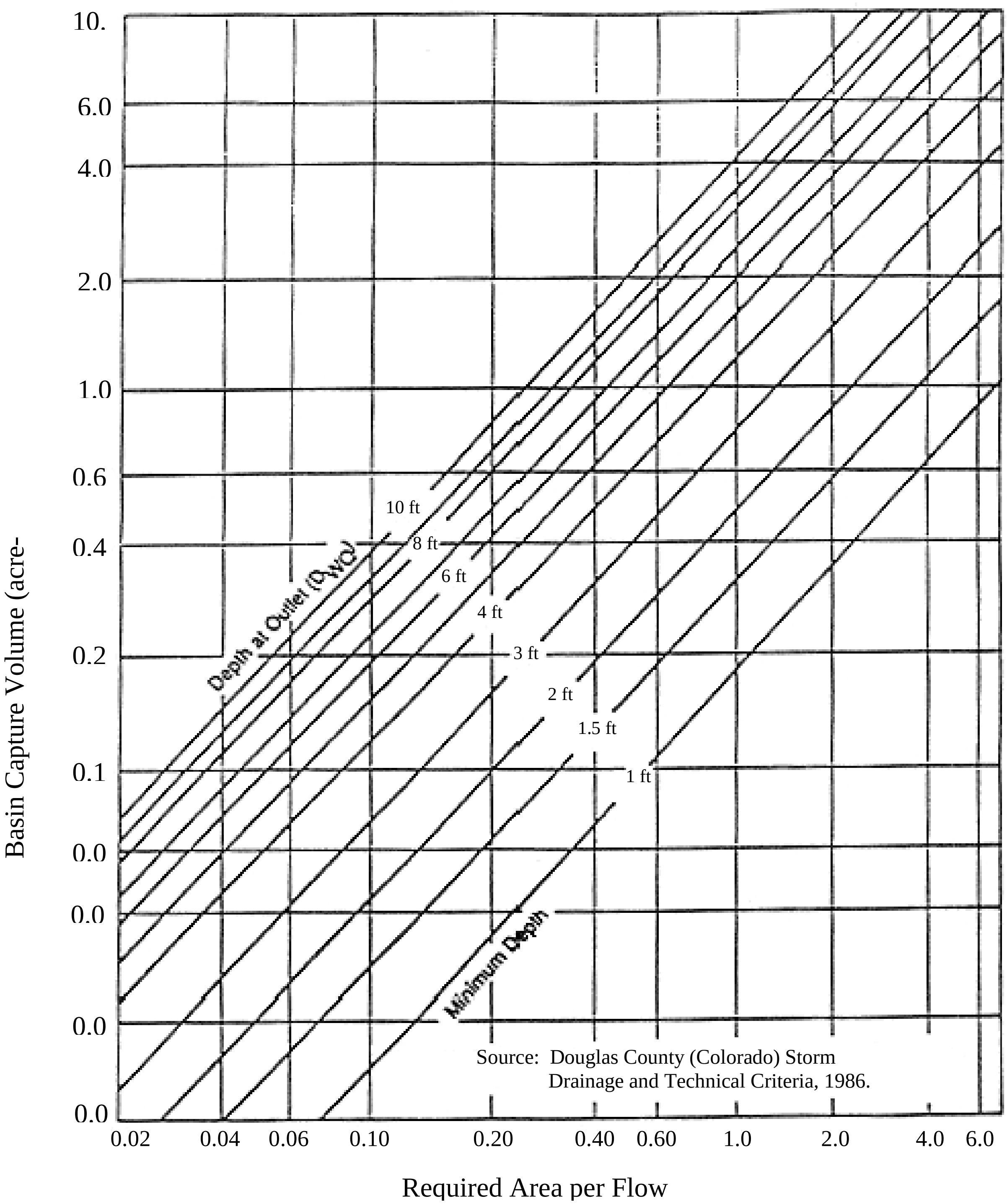
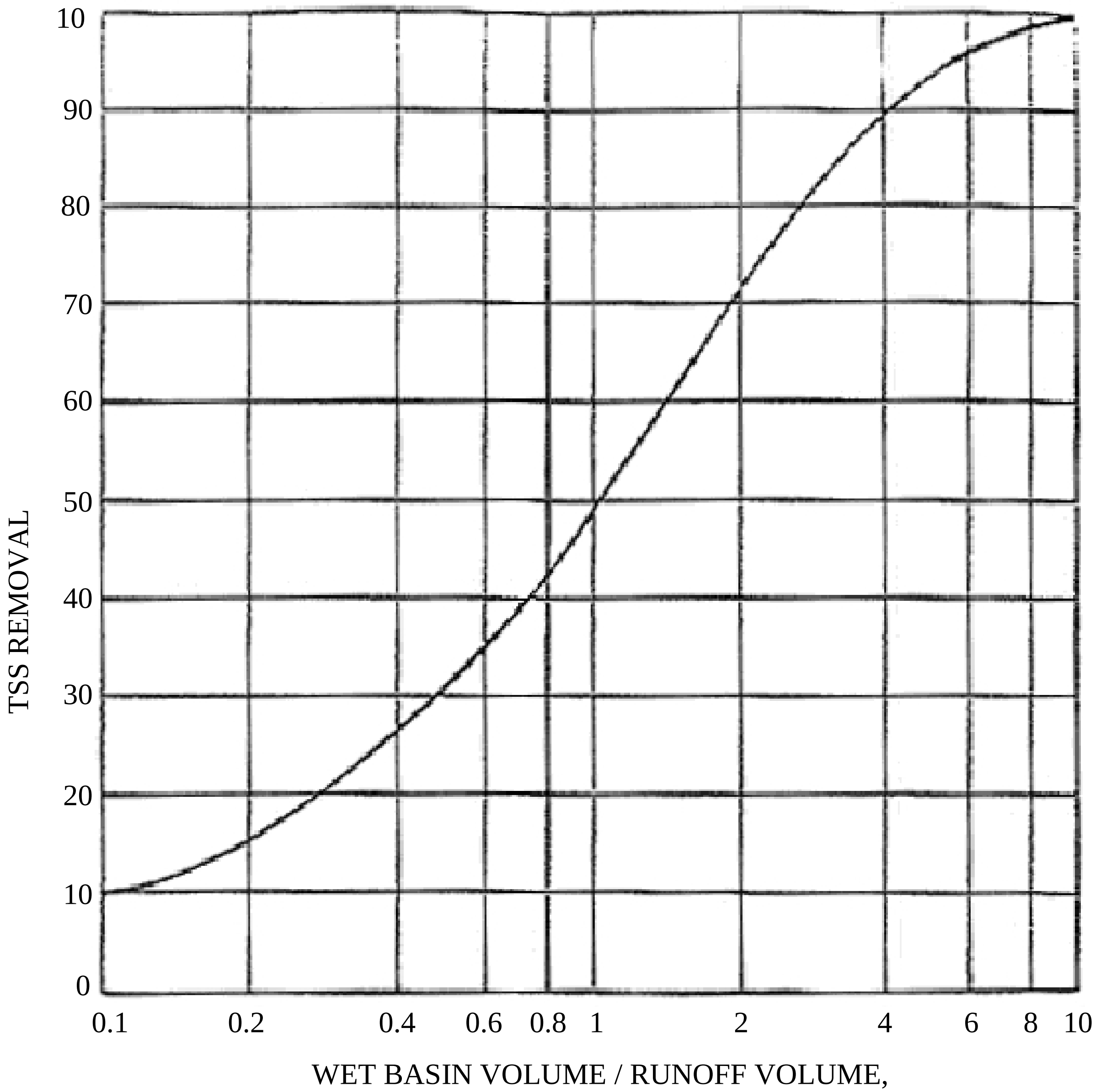


Figure PTP-03-05
Water Quality Outlet Sizing, Extended Detention Basin
(40-hour drain time of capture volume)



Source: FHWA

Figure PTP-03-06
TSS Removal Efficiency vs. V_B/V_R Ratio

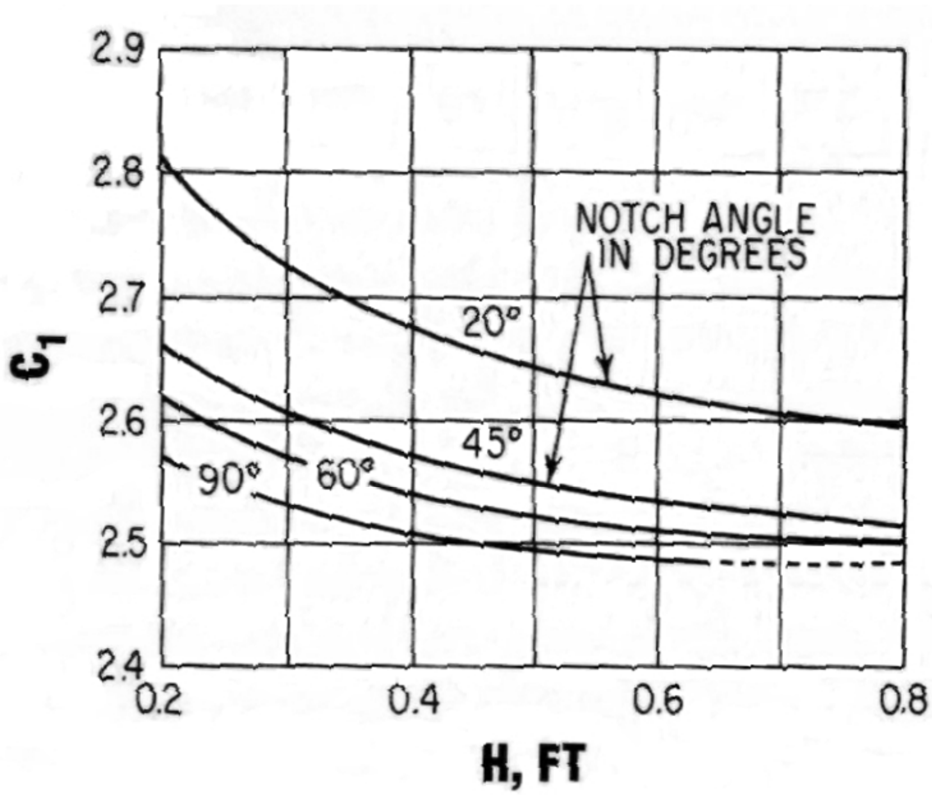


Figure PTP-03-07
Sharp Crested V-Notch Weir Discharge Coefficients

Activity: Stormwater Ponds / Wet Extended Detention Pond	PTP-03.2

Wet Extended Detention Pond

A wet extended detention (ED) pond is a wet pond where the basin is designed to hold the water quality volume divided evenly permanent pool and the extended detention area. During a rain event, water is held in the extended detention area and released over a 24 hour period. Wet ED ponds typically have smaller land area requirements compared to wet ponds.

The permanent pool volume for a micropool extended detention pond should be sized to contain 50% of the water quality treatment volume. See PTP-03-08 and PTP-03-09 for a schematic of a typical wet ED pond. See Wet Pond for more detailed design parameters.

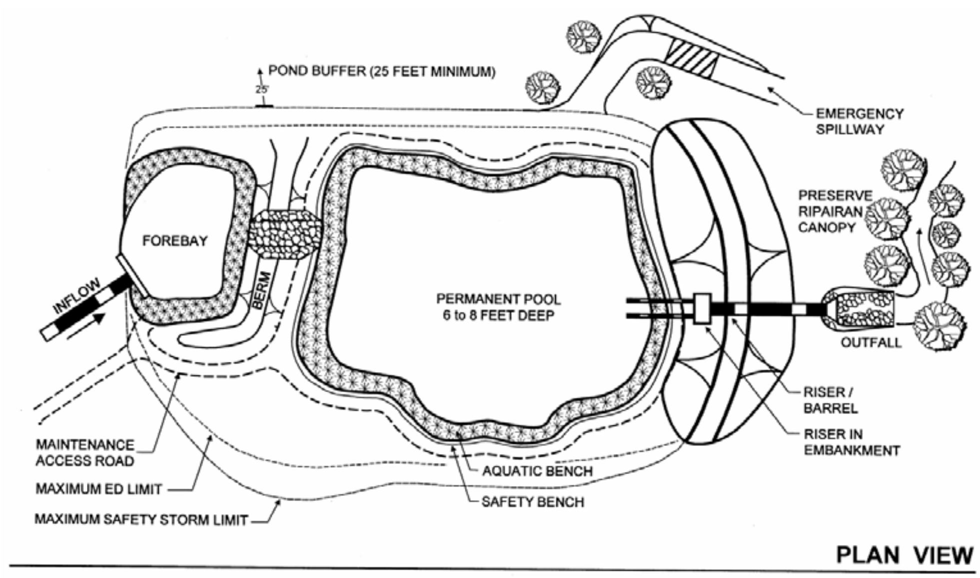


Figure PTP-03-08
Source, Georgia Stormwater Management Manual

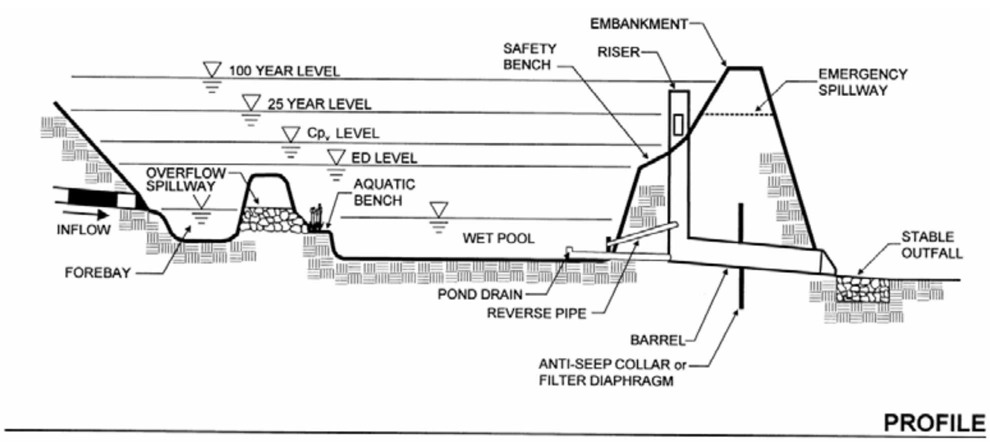


Figure PTP-03-09
Source, Georgia Stormwater Management Manual

Micropool Extended Detention Pond

A micropool extended detention pond is a basin where a small micropool is permanently maintained at the outlet. The outlet structure is designed to detain the water quality volume for 24 hours and prevents resuspention of sediment particles and clogging of the low flow orifice.

Larger stormwater ponds provide more pollutant removal efficiency than micropool extended detention ponds. However, micropools are ideal for areas where large open stormwater ponds cannot be used. Large open stormwater ponds may be undesirable due to thermal impacts on receiving streams, safety concerns in residential areas, or limited contributing drainage area.

The permanent pool volume for a micropool extended detention pond should be sized to contain 0.1 inch per impervious acre of contributing drainage. See PTP-03-10 and PTP-03-11 for schematics of a micropool ED pond. See Wet Pond for more detailed design parameters.

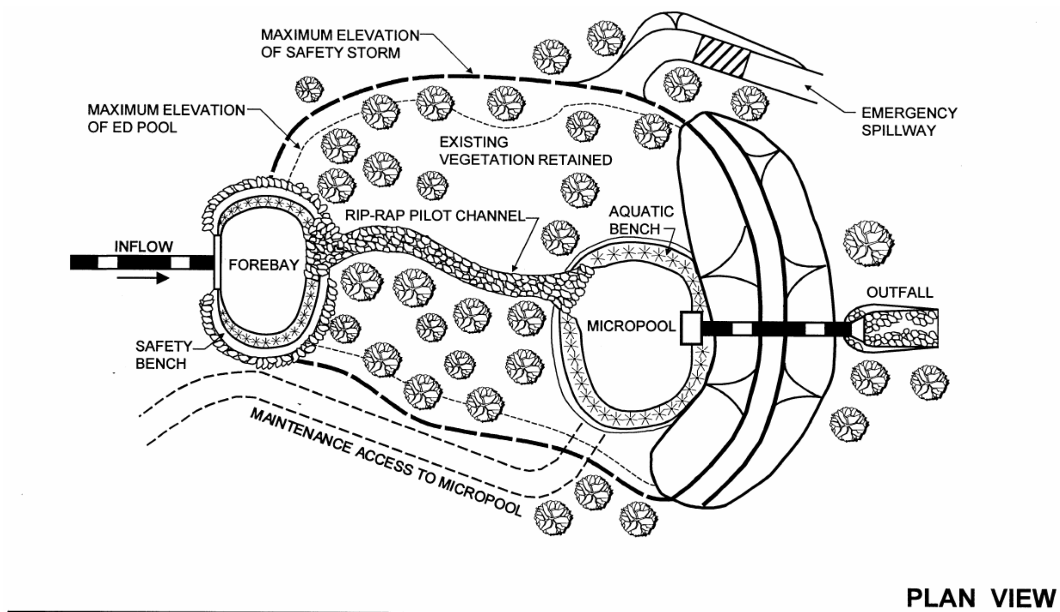


Figure PTP-03-10
Source, Georgia Stormwater Management Manual

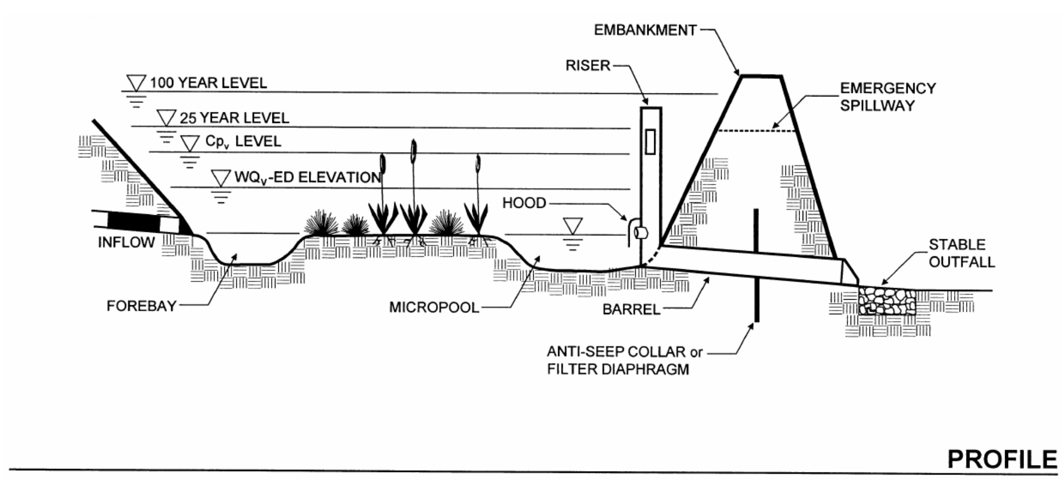


Figure PTP-03-11
Source, Georgia Stormwater Management Manual

Multiple Pond System

A multiple pond system provides water quality treatment as well as water quantity storage facilities through the use of multiple cells. The combination of two or more stormwater ponds in series can extend the pollutant removal pathway and treatment time and improve downstream channel protection.

The permanent pool volume for a multiple pond system should be sized according to the specific cell types used. See PTP-03-12 and PTP-03-13 for schematics of a typical multiple pond system. See Wet Pond for more detailed design parameters.

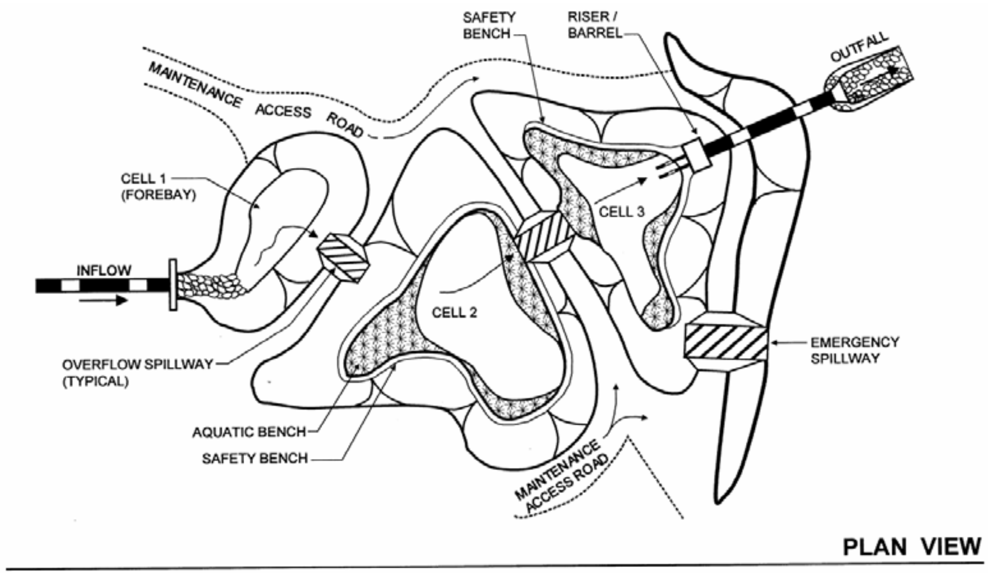


Figure PTP-03-12
Source, Georgia Stormwater Management Manual

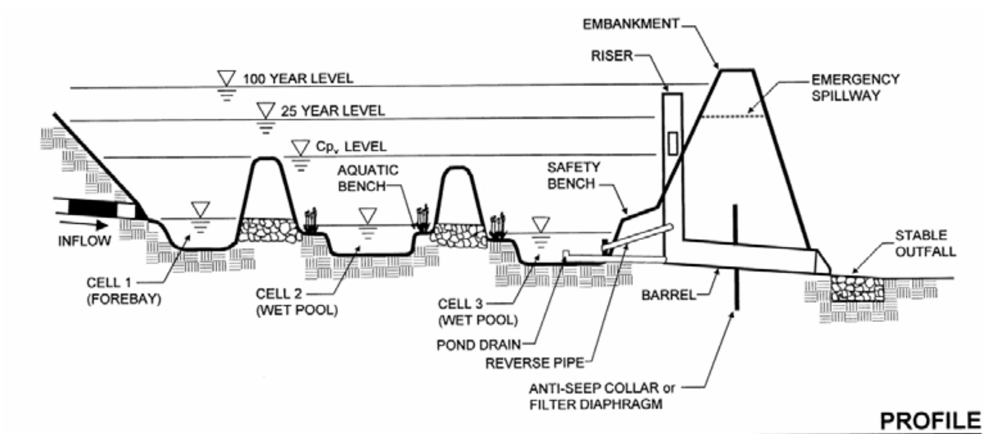


Figure PTP-03-13
Source, Georgia Stormwater Management Manual

Pocket Pond

Pocket ponds are designed to have smaller contributing drainage areas than traditional stormwater ponds. This results in little or no base flow during dry weather. Normal pool elevations are maintained through interaction with the water table. Pocket ponds do not have the pollutant removal capabilities that traditional stormwater ponds do, but they may be better suited for a location with limited available land area. If excavation to groundwater could impact drinking water supplies due to surrounding land use drainage, avoid connecting the pond to groundwater sources. See PTP-03-13 and PTP-03-14 for schematics of a typical pocket pond. See Wet Pond for more detailed design parameters.

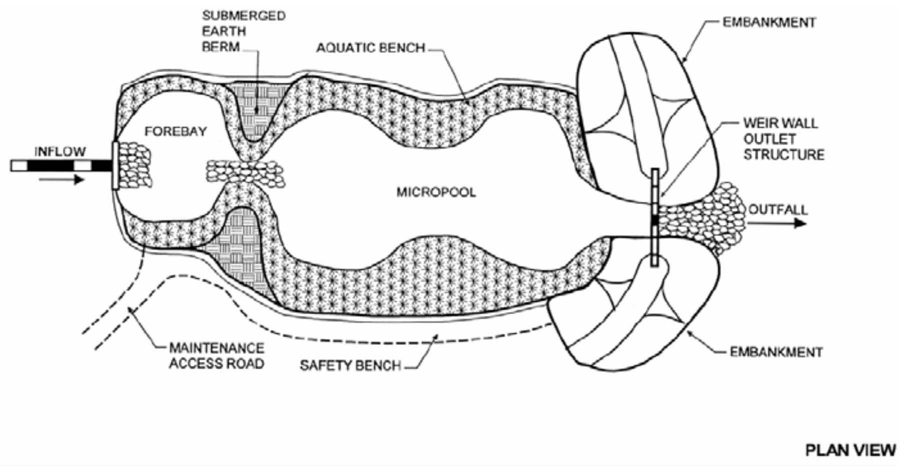


Figure PTP-03-14
Source, Georgia Stormwater Management Manual

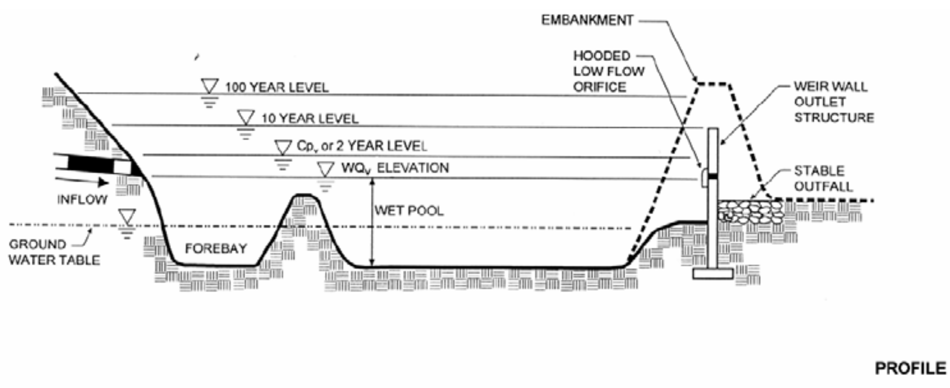


Figure PTP-03-15
Source, Maryland Stormwater Design Manual

Activity: Stormwater Ponds	PTP-03

Wet Pond Design Procedures

Step 1. Compute runoff control volumes.

Calculate the Water Quality Volume (WQ_v), Channel Protection Volume (Cp_v), Overbank, Flood Protection Volume (Q_p), and the Extreme Flood Volume (Q_f).

Step 2. Determine if the development site and conditions are appropriate for the use of a stormwater pond.

- Type of development?
- Greater than 25 acre watershed?
- Stable slopes < 15% Grade?
- Does pond location utilize natural topography at site and setback requirements for stormwater pond facilities?
- Are utilities located outside pond site?

Step 3. Confirm local design criteria and applicability.

Consider any special site-specific design conditions/criteria such as soils, topography constraints, groundwater, and downstream conditions. Check with local officials and other agencies to determine if there are any restrictions and/or surface water or watershed requirements that may apply.

Step 4. Determine pretreatment volume.

A sediment forebay must be provided at each inlet, unless the inlet provides less than 10% of the total design storm inflow to the pond. The forebay should be sized to contain 0.1 inches per impervious acre of contributing drainage and should be 4 to 6 feet deep. The forebay storage volume counts toward the total WQv requirement and may be subtracted from the WQ_v for subsequent calculations.

Step 5. Determine permanent pool volume (and water quality ED volume)

- Wet Pond: Size permanent pool volume to 1.0 WQ_v
- Wet ED Pond: Size permanent pool volume to 0.5 WQ_v. Size extended detention volume to 0.5 WQ_v.
- Micropool ED Pond: Size permanent pool volume to 25 to 30% of WQ_v. Size extended detention volume to remainder of WQ_v.
- Pocket Pond: Dependent on ground water connection.

Step 6. Determine pond location and preliminary geometry.

Conduct pond grading and determine storage available for permanent pool (and water quality extended detention if wet ED pond or micropool ED pond). This step involves initially grading the pond (establishing contours) and determining the elevation-storage relationship for the pond.

- Include safety and aquatic benches and access.
- Set WQ_v permanent pool elevation (and WQ_v-ED elevation for wet ED and micropool ED pond) based on volumes calculated earlier.

See Design Criteria for more details.

Wet Pond Design Procedures (cont.)

Step 7. Compute extended detention orifice release rate(s) and size(s), and establish Cp v Elevation.

Wet Pond: The Cp_v elevation is determined from the stage-storage relationship and the orifice is then sized to release the channel protection storage volume over a 24-hour period (12-hour extended detention may be warranted in some cold water streams). The channel protection orifice should have a minimum diameter of 3 inches and should be adequately protected from clogging by an acceptable external trash rack. A reverse slope pipe attached to the riser, with its inlet submerged 1 foot below the elevation of the permanent pool, is a recommended design. The orifice diameter may be reduced to 1 inch if internal orifice protection is used (i.e., an over-perforated vertical stand pipe with ½-inch orifices or slots that are protected by wirecloth and a stone filtering jacket). Adjustable gate valves can also be used to achieve this equivalent diameter.

Wet ED Pond and Micropool ED Pond: Based on the elevations established in Step 6 for the extended detention portion of the water quality volume, the water quality orifice is sized to release this extended detention volume in 24 hours. The water quality orifice should have a minimum diameter of 3 inches and should be adequately protected from clogging by an acceptable external trash rack. A reverse slope pipe attached to the riser, with its inlet submerged 1 foot below the elevation of the permanent pool, is a recommended design. Adjustable gate valves can also be used to achieve this equivalent diameter. The Cp_v elevation is then determined from the stage-storage relationship. The invert of the channel protection orifice is located at the water quality extended detention elevation, and the orifice is sized to release the channel protection storage volume over a 24-hour period (12-hour extended detention may be warranted in some cold water streams).

Step 8. Calculate Q_{p25} (25-year storm) release rate and water surface elevation.

Set up a stage-storage-discharge relationship for the control structure for the extended detention orifice(s) and the 25-year storm.

Step 9. Design embankment(s) and spillway(s).

Size emergency spillway, calculate 100-year water surface elevation, set top of embankment elevation, and analyze safe passage of the Extreme Flood Volume (Q_f). At final design, provide safe passage for the 100-year event.

Step 10. Investigate potential pond hazard risks and regulatory classifications.

Step 11. Design inlets, sediment forebay(s), outlet structures, maintenance access, and safety features. See Design Criteria for more details.

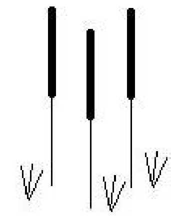
Step 12. Prepare Vegetation and Landscaping Plan.

A landscaping plan for a stormwater pond and its buffer should be prepared to indicate how aquatic and terrestrial areas will be stabilized and established with vegetation.

Somerset, Kentucky
Stormwater Best Management Practices (BMPs)
Stormwater Pollution Treatment Practices (Structural)

PTP-04

Activity: Stormwater Wetlands



SW

PLANNING CONSIDERATIONS:

Design Life:
Life

Acreage Needed:
Moderate to High (Minimum - 1% of total drainage area)

Estimated Unit Cost:
Medium

Annual Maintenance:
Moderate to High

Target Pollutants

Total Suspended Solids (TSS); 75%
Nutrients – Total Phosphorous/Total Nitrogen removal; 40/30%
Metals – Cadmium, Copper, Lead, and Zinc removal; 50%
Pathogens – Coliform, Streptococci, E.Coli removal; 70%

Description

Stormwater wetlands are constructed basins that have a pool of water throughout the year (or at a minimum, throughout the wet season). They differ from wet ponds primarily in being shallower and having greater vegetation coverage. They are considered among the most effective stormwater practices in terms of pollutant removal and offer aesthetic value. As stormwater runoff flows through the wetlands, pollutant removal is achieved through settling and biological uptake within the wetland. Flow through the root systems forces the vegetation to remove nutrients and dissolved pollutants from stormwater.

Suitable Applications

- Stormwater wetlands are recommended for the following locations:
  - Small outfalls with soil conditions that will support the establishment and growth of wetland vegetation.
  - Large industrial and commercial sites with enough space and soil conditions favorable towards the establishment and growth of wetland vegetation.
  - Adjacent to greenways, parks, and recreational areas or other locations amenable towards the promotion of wetland vegetation.
- Low and high visibility sites are conducive towards the establishment of stormwater wetlands, so long as the problem of stagnant or standing water is minimized.
- Stormwater wetlands provide a practice that:
  - Remove nutrients from stormwater runoff
  - Establish wildlife habitats
  - Lower maintenance costs

Activity: Stormwater Wetlands	PTP-04

Approach

The design of a stormwater wetland should consider:

- The type of wetland and its characteristics
- The hydrologic characteristics of the wetland
- The vegetation planted within the wetland
- The type and volume of nutrients and pollutants entering the wetland prior to treatment
- Soil texture

Design Criteria

Several examples of stormwater wetland designs are shown in Exhibits 1 thru 4. These include shallow wetlands, extended detention (ED) shallow wetlands, pond/wetland systems, and pocket wetlands. Throughout this fact sheet the following plant community "zones" will be used to describe constructed wetlands. These zones are shown in Exhibit 5. These exhibits are found at the end of this fact sheet.

Location and Siting:

Stormwater wetlands should normally have a minimum contributing drainage area of 25 acres or more. For a pocket wetland, the minimum drainage area is 5 acres.

The wetlands' vegetation will require a continuous base flow or high water table. A water balance should be calculated to demonstrate that a stormwater wetland can withstand a 30-day drought at summer evaporation rates completely drawing down the structure.

Stormwater wetlands cannot be located within navigable water of the United States, including wetlands, without obtaining a Section 404 permit under the Clean Water Act, and any other applicable State permit. In some isolated cases, a wetlands permit may be granted to convert an existing degraded wetland in the context of local watershed restoration efforts.

Minimum setback requirements for stormwater wetland facilities:

From a property line – 10 feet

From a private well – 100 feet; if the well is down gradient from a hotspot land use then the minimum setback is 250 feet

From a septic system tank/leach field – 50 feet

General Design:

A stormwater wetland should consist of:

- Shallow marsh areas of varying depths with wetland vegetation
- Permanent micropool at the outlet
- Overlying zone in which runoff control volumes are stored
- A sediment forebay at the inflow(s)
- Emergency spillway
- Maintenance access
- Safety bench
- Wetland buffer
- Indigenous wetland vegetation and landscaping

Physical Specification/Geometry:

In general, wetland designs are unique for each site and application. However, there are a number of geometric ratios and limiting depths for the design of a stormwater wetland that must be observed for adequate pollutant removal, ease of maintenance, the support of wetland vegetation, and improved safety. Table PTP-04-01 provides the recommended physical specifications and geometry for the various stormwater wetland design variants.

Design Criteria (cont.)

Table PTP-04-01 Recommended Design Criteria for Stormwater Wetlands

(*Modified from Massachusetts DEP, 1997; Schueler, 1992)*

Design Criteria	Shallow Marsh	ED Wetland	Pond/ Wetland	Pocket Wetland
Length:Width (min)	2:1	2:1	2:1	2:1
Extended Detention (ED)	No	Yes	Optional	Optional
Allocation of WQ_v Volume (pool/marsh/ED) in %	25/75/0	25/25/50	70/30/0	25/75/0
Allocation of Surface Area (deepwater/low marsh/high marsh/semi-wet)	20/35/40/5	10/35/45/10	45/25/25/5 (includes pond surface area)	10/45/40/5
Forebay	Required	Required	Required	Optional
Micropool	Required	Required	Required	Required
Outlet Configuration	Reverse-slope pipe or hooded broad-crested weir	Reverse-slope pipe or hooded broad-crested weir	Reverse-slope pipe or hooded broad-crested weir	Hooded broad-crested weir

Depth:
Deepwater: 1.5 to 6 feet below normal pool elevation
Low Marsh: 6 to 18 inches
High Marsh: 6 inches
Semi-wet zone: Above normal pool elevation

The stormwater wetland should be designed with the recommended proportion of “depth zones.” Each of the four wetland design variants has depth zone allocation which are given as a percentage of the stormwater wetland surface area. Target allocations are found in the table above:

Deepwater zone

From 1.5 to 6 feet deep. Includes the outlet micorpool and deepwater channels through the wetland facility. This zone supports little emergent wetland vegetation, but may support submerged or floating vegetation.

Low marsh zone

From 6 to 18 inches below the normal permanent pool or water surface elevation. This zone is suitable for the growth of several emergent wetland plant species.

High marsh zone

From 6 inches below the pool to the normal pool elevation. This zone will support a greater density and diversity of wetland specie than the low marsh zone. The high marsh zone should have a higher surface area to volume ratio than the low marsh zone.

Semi-wet zone

Those areas above the permanent pool that are inundated during larger storm events. This zone supports a number of species that can survive flooding.

A minimum dry weather flow path of 2:1 (length to width) is required from inflow to outlet across the stormwater wetland and should ideally be greater than 3:1. This path may be achieved by constructing internal dikes or berms, using marsh plantings, and by using multiple cells. Finger dikes are commonly used in surface flow systems to create serpentine configurations and prevent short-circuiting. Microtopography (contours along the bottom of a wetland or marsh that provide a variety of conditions for different species needs and increases the surface area to volume ratio) is encouraged to enhance wetland diversity.

Design Criteria (cont.)

- A 4- to 6-foot deep micropool must be included in the design at the outlet to prevent the outlet from clogging and resuspension of sediments.
- Maximum depth of any permanent pool areas should generally not exceed 6 feet.
- The volume of the extended detention must not comprise more than 50% of the total WQ_v, and its maximum water surface elevation must not extend more than 3 feet above the normal pool. Storage for larger events can be provided above the maximum WQv elevation within the wetland.
- The perimeter of all deep pool areas (4 feet or greater in depth) should be surrounded by safety and aquatic benches similar to those for stormwater ponds.
- The contours of the wetland should be irregular to provide a more natural landscaping effect.

Pretreatment / Inlets

- Sediment regulation is critical to sustain stormwater wetlands. A wetland facility should have a sediment forebay or equivalent upstream pretreatment. A sediment forebay is designed to remove incoming sediment from the stormwater flow prior to dispersal into the wetland. The forebay should consist of a separate cell, formed by an acceptable barrier. A forebay is to be provided at each inlet, unless the inlet provides less than 10% of the total design storm inflow to the wetland facility.
- The forebay is sized to contain 0.1 inches per impervious acre of contributing drainage and should be 4 to 6 feet deep. The pretreatment storage volume is part of the total WQ_v requirement and may be subtracted from WQ_v for wetland storage sizing.
- A fixed vertical sediment depth marker should be installed in the forebay to measure sediment deposition over time. The bottom of the forebay may be hardened (e.g., using concrete, paver blocks, etc.) to make sediment removal easier.
- Inflow channels are to be stabilized with flared riprap aprons, or the equivalent. Inlet pipes to the pond can be partially submerged. Exit velocities from the forebay must be nonerosive.

Outlet Structures

- Flow control from a stormwater wetland is typically accomplished with the use of a concrete or corrugated metal riser and barrel. The riser is a vertical pipe or inlet structure that is attached to the base of the micropool with a watertight connection. The outlet barrel is a horizontal pipe attached to the riser that conveys flow under the embankment (see Figure PTP-04-01). The riser should be located within the embankment for maintenance access, safety and aesthetics.
- A number of outlets at varying depths in the riser provide internal flow control for routing of the water quality, channel protection, and overbank flood protection runoff volumes. The number of orifices can vary and is usually a function of the wetland design.

Design Criteria (cont.)

- For shallow and pocket wetlands, the riser configuration is typically comprised of a channel protection outlet (usually an orifice) and overbank flood protection outlet (often a slot or weir). The channel protection orifice is sized to release the channel protection storage volume over a 24-hour period (12-hour extended detention may be warranted in some cold water streams). Since the water quality volume is fully contained in the permanent pool, no orifice sizing is necessary for this volume. As runoff from a water quality event enters the wet pond, it simply displaces that same volume through the channel protection orifice. Thus an off-line shallow or pocket wetland providing only water quality treatment can use a simple overflow weir as the outlet structure. In the case of a extended detention (ED) shallow wetland, there is generally a need for an additional outlet (usually an orifice) that is sized to pass the extended detention water quality volume that is surcharged on top of the permanent pool. Flow will first pass through this orifice, which is sized to release the water quality ED volume in 24 hours. The preferred design is a reverse slope pipe attached to the riser, with its inlet submerged 1 foot below the elevation of the permanent pool to prevent floatables from clogging the pipe and to avoid discharging warmer water at the surface of the pond. The next outlet is sized for the release of the channel protection storage volume. The outlet (often an orifice) invert is located at the maximum elevation associated with the extended detention water quality volume and is sized to release the channel protection storage volume over a 24-hour period (12-hour extended detention may be warranted in some cold water streams). Alternative hydraulic control methods to an orifice can be used and include the use of a broad-crested rectangular, V-notch, proportional weir, or an outlet pipe protected by a hood that extends at least 12 inches below the normal pool.
- The water quality outlet (if design is for an ED shallow wetland) and channel protection outlet should be fitted with adjustable gate valves or other mechanism that can be used to adjust detention time.
- Higher flows (overbank and extreme flood protection) pass through openings or slots protected by trash racks further up on the riser.
- After entering the riser, flow is conveyed through the barrel and is discharged downstream. Anti-seep collars should be installed on the outlet barrel to reduce the potential for pipe failure.
- Riprap, plunge pools or pads, or other energy dissipaters are to be placed at the outlet of the barrel to prevent scouring and erosion. If a wetland facility daylights to a channel with dry weather flow, care should be taken to minimize tree clearing along the downstream channel, and to reestablish a forested riparian zone in the shortest possible distance.
- The wetland facility must have a bottom drain pipe located in the micropool with an adjustable valve that can completely or partially dewater the wetland within 24 hours.
- The wetland drain should be sized one pipe size greater than the calculated design diameter. The drain valve is typically a hand wheel activated knife or gate valve. Valve controls shall be located inside of the riser at a point where they (a) will not normally be inundated and (b) can be operated in a safe manner.

Design Criteria (cont.)

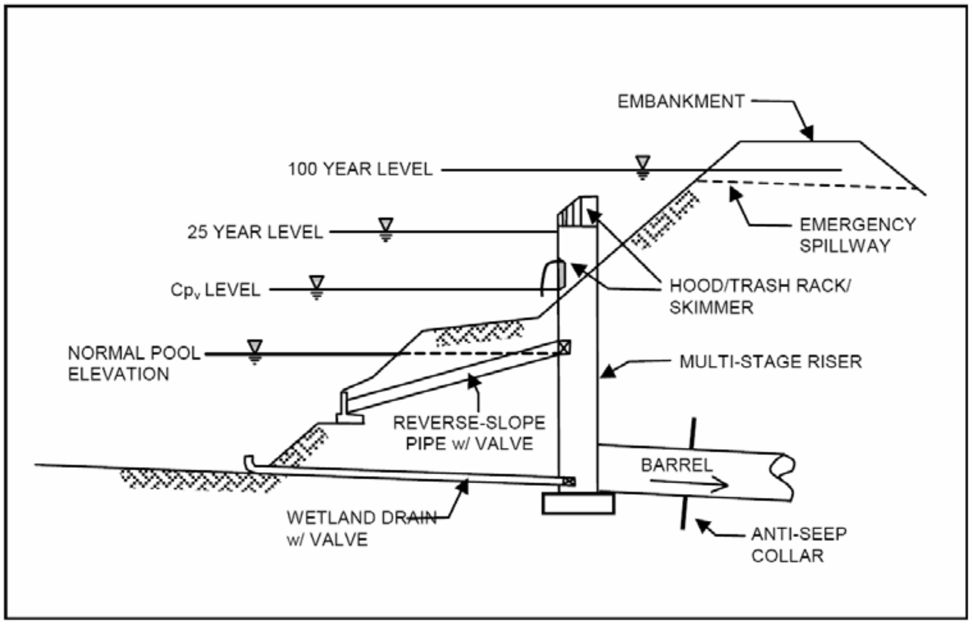


Figure PTP-04-01 – Typical Wetland Facility Outlet Structure

EMERGENCY SPILLWAY

- An emergency spillway is to be included in the stormwater wetland design to safely pass flows that exceed the design storm flows. The spillway prevents the wetland's water levels from overtopping the embankment and causing structural damage. The emergency spillway must be located so that downstream structures will not be impacted by spillway discharges.
- A minimum of 1 foot of freeboard must be provided, measured from the top of the water surface elevation for the extreme flood to the lowest point of the dam embankment, not counting the emergency spillway.

MAINTENANCE ACCESS

- A maintenance right of way or easement must be provided to the wetland facility from a public or private road. Maintenance access should be at least 12 feet wide, have a maximum slope of no more than 15%, and be appropriately stabilized to withstand maintenance equipment and vehicles.
- The maintenance access must extend to the forebay, safety bench, riser, and outlet and, to the extent feasible, be designed to allow vehicles to turn around.
- Access to the riser is to be provided by lockable manhole covers, and manhole steps within easy reach of valves and other controls.

SAFETY FEATURES

- Fencing of wetlands is not generally desirable, but may be required by the local review authority. A preferred method is to manage the contours of deep pool areas through the inclusion of a safety bench (see above) to eliminate drop-offs and reduce the potential for accidental drowning.
- The principal spillway opening should not permit access by small children, and endwalls above pipe outfalls greater than 48 inches in diameter should be fenced to prevent a hazard.

Design Criteria (cont.)

ADDITIONAL SITE-SPECIFIC DESIGN CRITERIA AND ISSUES

Physiographic Factors - Local terrain design constraints

- Low Relief – Providing wetland drain can be problematic
- High Relief – Embankment heights restricted per Kentucky Division of Water
- Karst – Requires poly or clay liner to sustain a permanent pool of water and protect aquifers; limits on ponding depth; geotechnical tests may be required

Soils

- Hydrologic group “A” soils and some group “B” soils may require liner (not relevant for pocket wetland)

Maintenance

Frequently (3-4 times a year)

- Clean and remove debris from inlet and outlet structures.
- Mow side slopes.

As Needed

- Repair undercut or eroded areas.

Semi-annual Inspection (first 3 years)

- Monitor wetland vegetation and perform replacement planting as needed.

Annual

- Inspect stability of the original growth zones and microtopographical features.
- Inspect for invasive vegetation and remove when and where possible.
- Inspect for damage to the embankment and inlet/outlet structures.
- Monitor and record for sediment accumulation in facility and forebay.
- Harvest wetland plants that are overgrown. Remove any harvested vegetation from the wetland.

5 to 7 years or after 50% of forebay capacity has been diminished

- Removal of sediment from forebay

10 to 20 years or after 25% of wetland volume has been lost

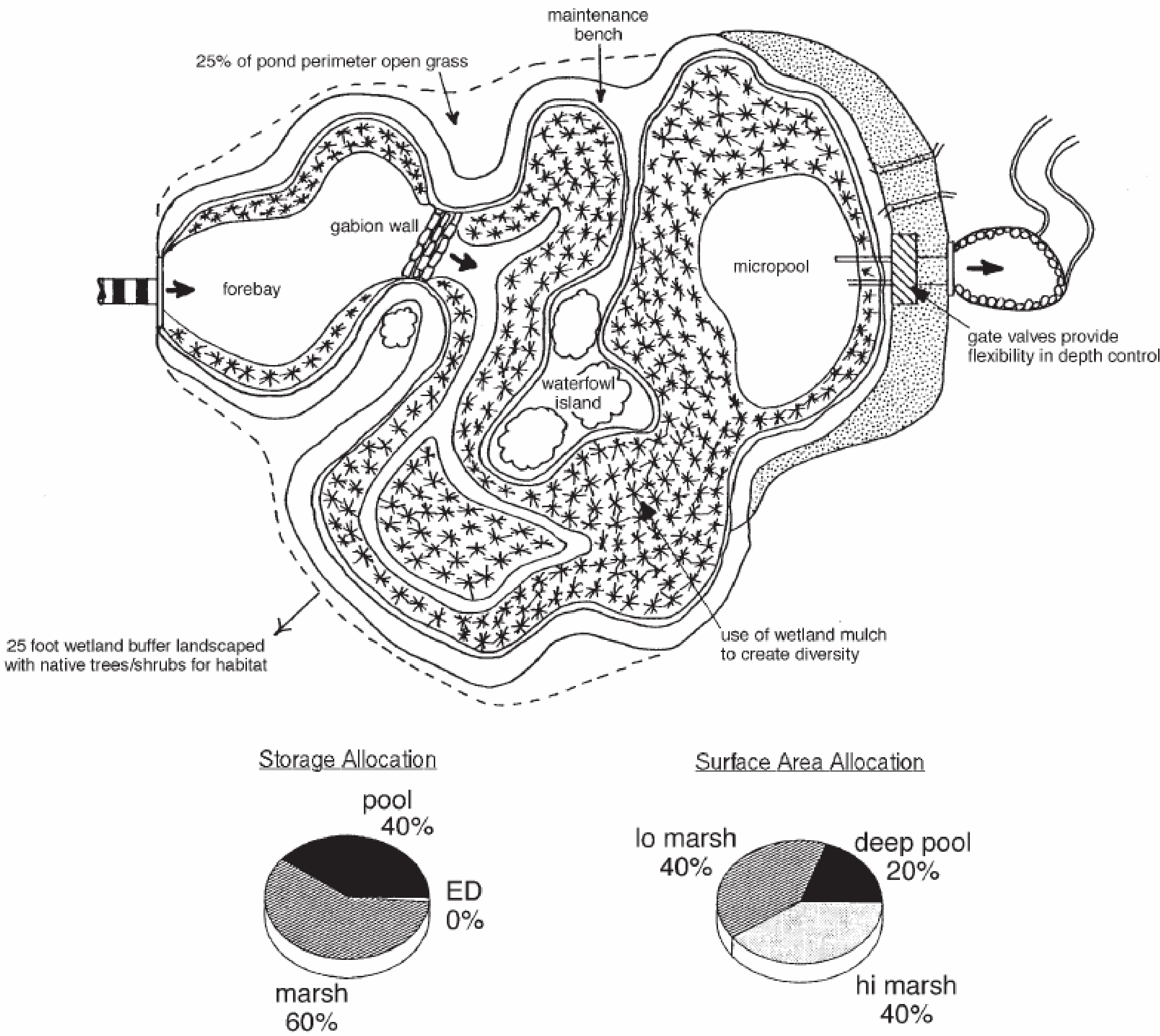
- Monitor sediment accumulations, and remove sediment when the pool volume has become reduced significantly, plants are “choked with sediment”, or the wetland becomes eutrophic.

One time Activity

- Replace wetland vegetation to maintain at least 50% surface area coverage in wetland plants after the second growing season.

Regular inspections and maintenance are critical to the effective operation of constructed wetlands. Maintenance responsibility for a wetland facility and its buffer should be vested with a responsible authority by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval.

Exhibit 1
The Shallow Marsh System

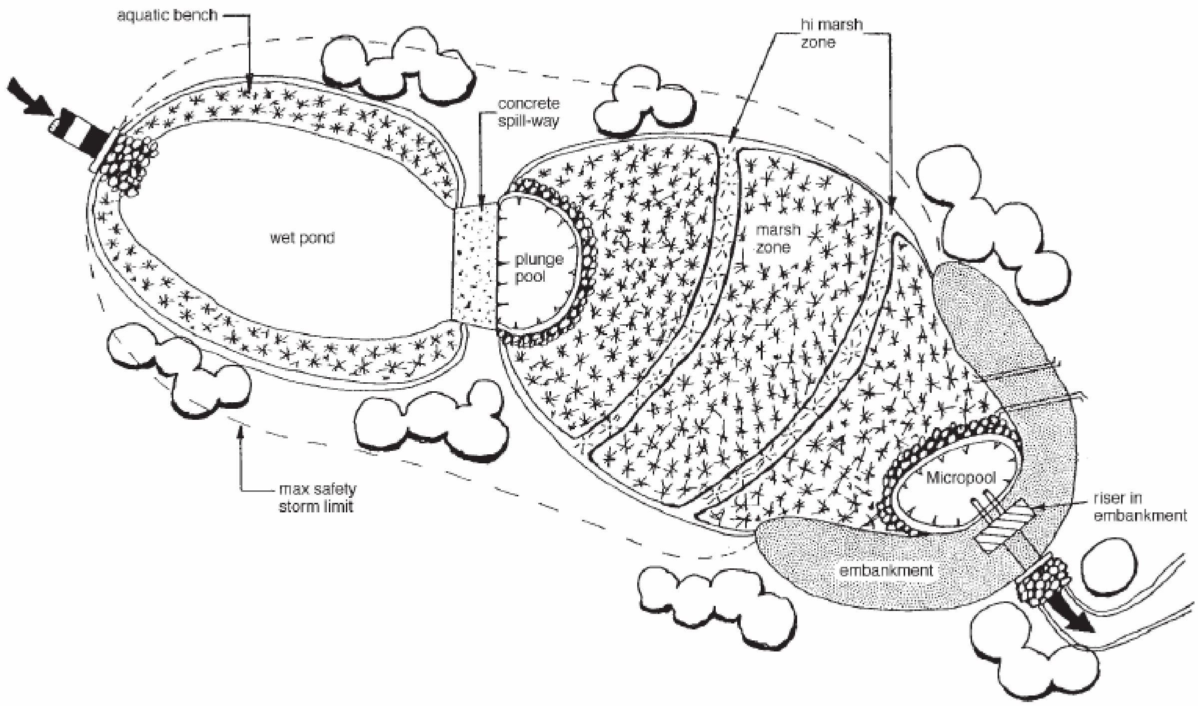


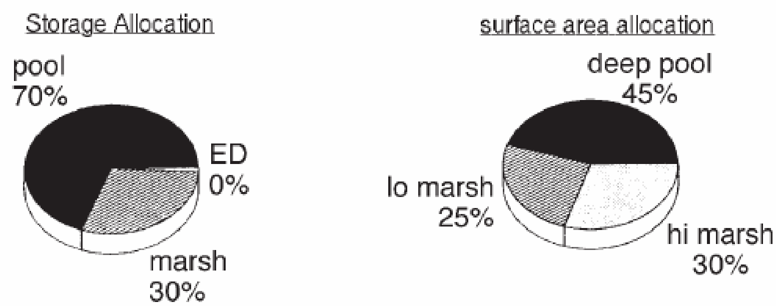
The majoriy of the shallow marsh system is zero to eighteen inches deep, which creates favorable conditions for the growth of emergent wetland plants. A deeper forebay is located at the major inlet, and a deep micropool is situated near the outlet.

Source: "Design of Stormwater Wetland Systems: Guidelines for Creating Diverse and Effective Stormwater Wetland systems in the Mid-Atlantic Region." Anacostia Restoration Team, Department of Environmental Programs, Metropolitan Council of Government.

Exhibit 2

The Pond/Wetland System



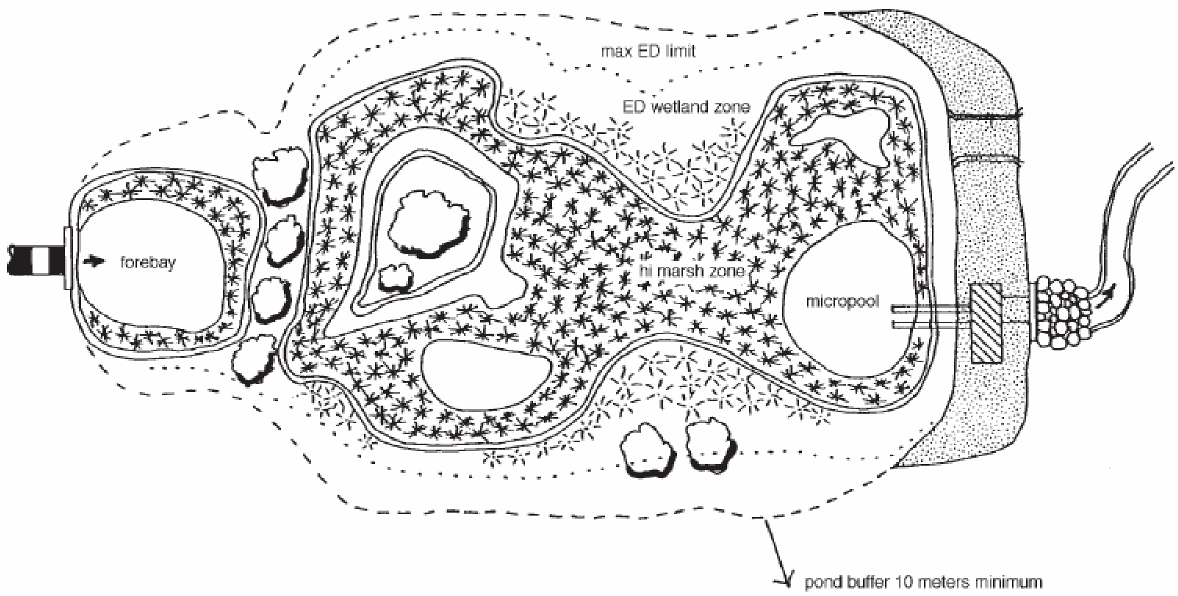


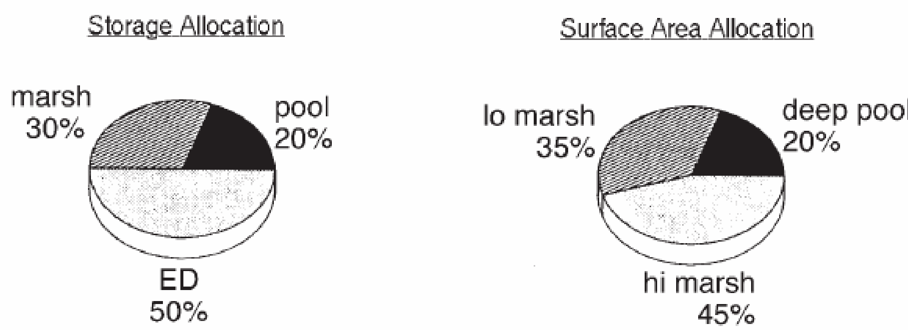
The pond/wetland system consists of two separate cells — a deep pond leading to a shallow wetland. The pond removes pollutants, and reduces the space required for the system.

Source: "Design of Stormwater Wetland Systems: Guidelines for Creating Diverse and Effective Stormwater Wetland systems in the Mid-Atlantic Region." Anacostia Restoration Team, Department of Environmental Programs, Metropolitan Council of Government.

Exhibit 3

The Extended Detention Wetland

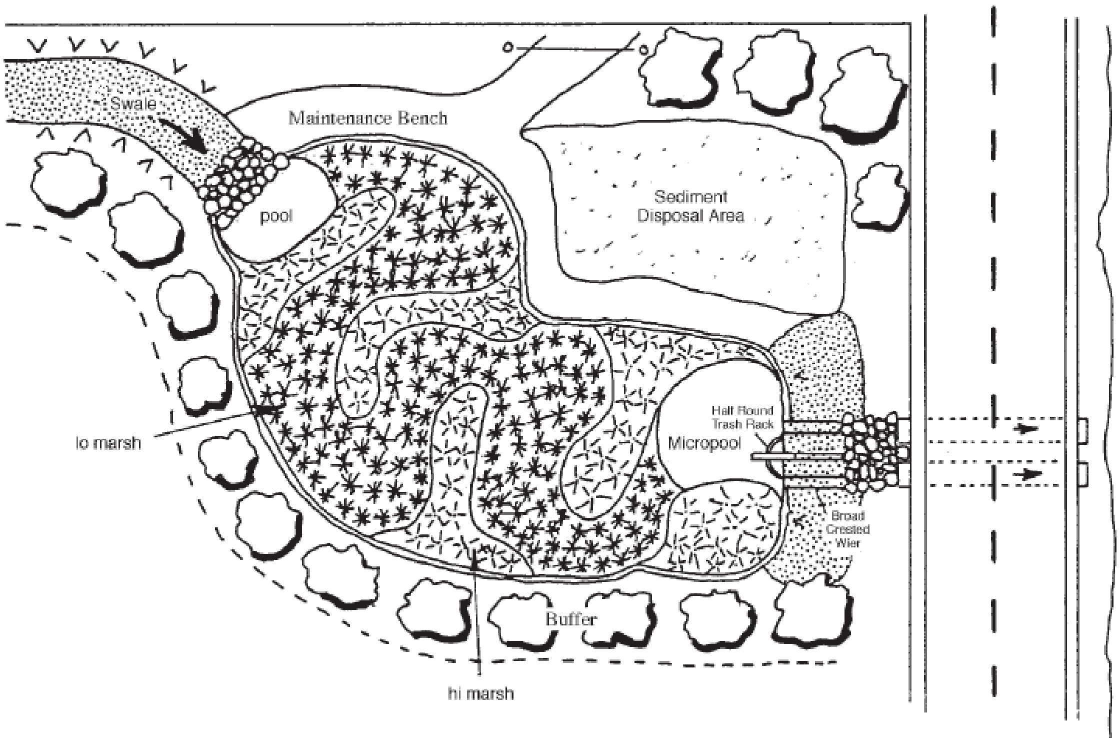


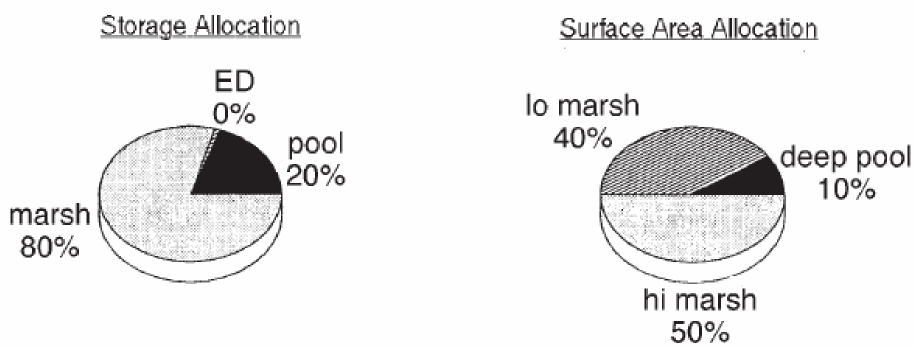


The water level within an ED wetland can increase by as much as three feet after a storm event, and then returns to normal levels within 24 hours. As much as 50% of the total treatment volume can be provided as ED storage, which helps to protect downstream channels from erosion, and reduce the wetland's space requirement.

Source: "Design of Stormwater Wetland Systems: Guidelines for Creating Diverse and Effective Stormwater Wetland systems in the Mid-Atlantic Region." Anacostia Restoration Team, Department of Environmental Programs, Metropolitan Council of Government.

Exhibit 4
The Pocket Stormwater Wetland



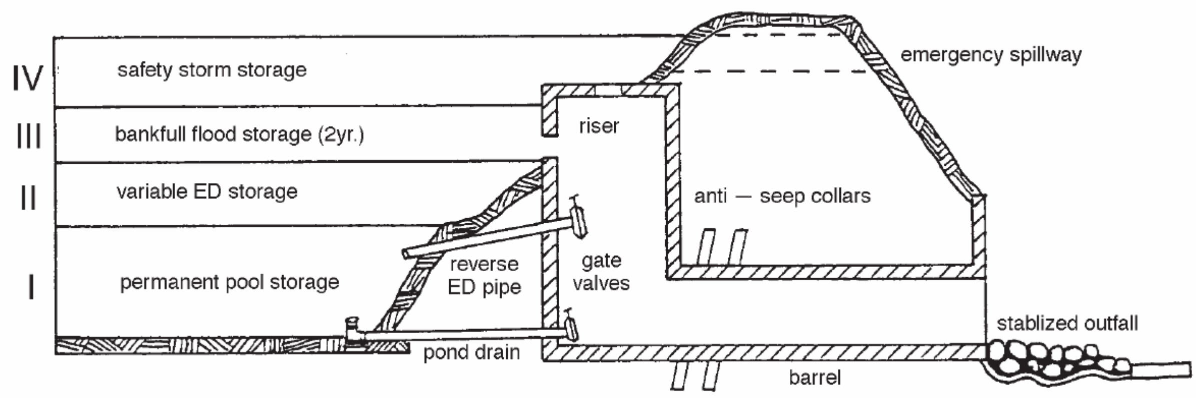


Pocket wetlands seldom are more than a tenth of an acre in size, and serve development sites of ten acres or less. Due to their size and unreliable water supply, pocket wetlands do not possess all of the benefits of other wetland designs. Most pocket wetlands have no sediment forebay. Despite many drawbacks, pocket wetlands may be an attractive BMP alternative for smaller development situations.

Source: "Design of Stormwater Wetland Systems: Guidelines for Creating Diverse and Effective Stormwater Wetland systems in the Mid-Atlantic Region." Anacostia Restoration Team, Department of Environmental Programs, Metropolitan Council of Government.

Exhibit 5

Extended Detention Wetland Outlet Structure



Source: "Design of Stormwater Wetland Systems: Guidelines for Creating Diverse and Effective Stormwater Wetland systems in the Mid-Atlantic Region." Anacostia Restoration Team, Department of Environmental Programs, Metropolitan Council of Government.

Activity: Stormwater Wetlands	PTP-04

Stormwater Wetland Design Procedures

Step 1. Compute runoff control volumes.

Calculate the Water Quality Volume (WQ_v), Channel Protection Volume (Cp_v), Overbank Flood Protection Volume (Q_p), and the Extreme Flood Volume (Q_f).

Step 2. Determine if the development site and conditions are appropriate for the use of a stormwater wetland.

Consider the Application and Design Criteria.

Step 3. Confirm local design criteria and applicability.

Consider any special site-specific design conditions in Design Criteria. Check with local officials and other agencies to determine if there are any additional restrictions and/or surface water or watershed requirements that may apply.

Step 4. Determine pretreatment volume.

A sediment forebay is provided at each inlet, unless the inlet provides less than 10% of the total design storm inflow to the pond. The forebay should be sized to contain 0.1 inches per impervious acre of contributing drainage and should be 4 to 6 feet deep. The forebay storage volume counts toward the total WQ_v requirement and may be subtracted from the WQ_v for subsequent calculations.

Step 5. Allocate the WQ_v volume among marsh, micropool, and ED volumes.

Use recommended criteria from Table PTP-04-01.

Step 6. Determine wetland location and preliminary geometry, including distribution of wetland depth zones.

This step involves initially laying out the wetland design and determining the distribution of wetland surface area among the various depth zones (high marsh, low marsh, and deepwater). Set WQ_v permanent pool elevation (and WQ_v-ED elevation for ED shallow wetland) based on volumes calculated earlier.

Step 7. Compute extended detention orifice release rate(s) and size(s), and establish Cp_v elevation.

Shallow Wetland and Pocket Wetland: The Cp_v elevation is determined from the stage/ storage relationship and the orifice is then sized to release the channel protection storage volume over a 24-hour period (12-hour extended detention may be warranted in some cold water streams). The channel protection orifice should have a minimum diameter of 3 inches and should be adequately protected from clogging by an acceptable external trash rack. A reverse slope pipe attached to the riser, with its inlet submerged 1 foot below the elevation of the permanent pool is a recommended design. The orifice diameter may be reduced to 1 inch if internal orifice protection is used (i.e., an over-perforated vertical stand pipe with ½-inch orifices or slots that are protected by wirecloth and a stone filtering jacket). Adjustable gate valves can also be used to achieve this equivalent diameter.

Stormwater Wetland Design Procedures (cont.)

ED Shallow Wetland: Based on the elevations established in Step 6 for the extended detention portion of the water quality volume, the water quality orifice is sized to release this extended detention volume in 24 hours. The water quality orifice should have a minimum diameter of 3 inches, and should be adequately protected from clogging by an acceptable external trash rack. A reverse slope pipe attached to the riser, with its inlet submerged one foot below the elevation of the permanent pool, is a recommended design. Adjustable gate valves can also be used to achieve this equivalent diameter. The Cpv elevation is then determined from the stage-storage relationship. The invert of the channel protection orifice is located at the water quality extended detention elevation, and the orifice is sized to release the channel protection storage volume over a 24-hour period (12-hour extended detention may be warranted in some cold water streams).

Step 8. Calculate Q_{p25} (25-year storm) release rate and water surface elevation.

Set up a stage-storage-discharge relationship for the control structure for the extended detention orifice(s) and the 25-year storm.

Step 9. Design embankment(s) and spillway(s).

Size emergency spillway, calculate 100-year water surface elevation, set top of embankment elevation, and analyze safe passage of the Extreme Flood Volume (Qf). At final design, provide safe passage for the 100-year event. Attenuation may not be required.

Step 10. Investigate potential pond/wetland hazard classification.

The design and construction of stormwater management ponds and wetlands are required to follow the latest version of the State of Kentucky dam safety rules (www.water.ky.gov/damsafety).

Step 11. Design inlets, sediment forebay(s), outlet structures, maintenance access, and safety features. See Design Criteria.

Step 12. Prepare Vegetation and Landscaping Plan.

A landscaping plan for the wetland facility and its buffer should be prepared to indicate how aquatic and terrestrial areas will be stabilized and established with vegetation.

Somerset, Kentucky
Stormwater Best Management Practices (BMPs)
Stormwater Pollution Treatment Practices (Structural)

PTP-05

Activity: Infiltration Systems

PLANNING CONSIDERATIONS:

Design Life:
Short

Acreage Needed:
Low to High

Estimated Unit Cost:
Moderate to High

Annual Maintenance:
Moderate

IS

IS

Target Pollutants

Total Suspended Solids (TSS); 90%
Nutrients – Total Phosphorous/Total Nitrogen removal; 60/60%
Metals – Cadmium, Copper, Lead, and Zinc removal; 90%
Pathogens – Coliform, Streptococci, E.Coli removal; 90%

Description

Infiltration systems are depressions with no outlet used to detain stormwater for a short period of time until it percolates into the groundwater table. Runoff flows into the system, is stored in the voids between stones and is slowly infiltrated through soil layers. Pollutants are filtered out of the stormwater runoff as it infiltrates the soil. Infiltration systems also provide groundwater recharge and preserve baseflow in nearby streams. Two types of infiltration systems that will be addressed here include: infiltration trenches (Figures PTP-05-01 and PTP-05-02) and infiltration basins (Figures PTP-05-03 and PTP-05-04).

Suitable Applications

Infiltration systems can be used to manage stormwater runoff from urban areas, where they can be used to treat sheet flow from impervious areas. Sheet flow should enter the infiltration system perpendicular to its main axis, and channel flow should enter parallel to the main axis of the direction of flow. Infiltration systems are typically suitable for the following applications:

- Offline systems
- Impervious area runoff
- Areas where removal of suspended solids, pathogens, metals, and nutrients is needed
- Small drainage areas of generally less than 5 acres

Infiltration systems should only be applied to stabilized drainage areas, as heavy sediment loads from construction areas will clog and disable the infiltration media. Likewise, they should not be used in areas where stormwater has the potential for high silt or clay content.

Infiltration systems are *not* recommended to treat sites where runoff could contribute to groundwater contamination. Sites with high pesticide or pathogen levels, manufacturing or industrial sites, and combined sewer overflows are not suitable applications for this BMP.

Suitable Applications (cont.)

Infiltration systems should typically be designed for off-line use to capture the first flush of runoff. A diversion structure such as a flow splitter or weir may be necessary to separate and route the first flush to the infiltration system for water quality control, and route the remaining stormwater to a water quantity device downstream. Infiltration systems are most effective when turbulent flow is minimized and the flow is spread uniformly across the filter media.

Feasibility Criteria

The following feasibility criteria should also be considered:

- To be suitable for infiltration, underlying soils shall have an infiltration rate (f) of 0.52 inches per hour or greater, as initially determined from NRCS soil textural classification and subsequently confirmed by field geotechnical tests. The recommended geotechnical testing is one test hole per 5000 square feet, with a minimum of two borings per facility (taken within the proposed limits of the facility).
- Soils should have a clay content of less than 20% and a silt/clay content of less than 40%.
- Infiltration cannot be located on slopes greater than 15% or within fill soils.
- To protect groundwater from possible contamination, runoff from designated hotspot land uses or activities should not be infiltrated without proper pretreatment to remove hydrocarbons, trace metals, or toxicants.
- Infiltration systems should be constructed with a minimum of 4 feet distance between its base and the water table or bedrock to allow for infiltration to occur. Care must especially be taken in karst areas where the potential for groundwater contamination should be considered. If a site overlies karst geology, the local approval authority should be consulted for specific design requirements.
- Infiltration facilities should be located at a minimum of 100 feet horizontally from any water supply well.
- The maximum contributing area to an individual infiltration practice should generally be less than 5 acres.
- Infiltration practices should not be placed in locations that cause water problems to downgrade properties. Infiltration facilities should be set back 25 feet (10 feet for dry wells) down gradient from structures.

Design Criteria

Infiltration Conveyance Criteria

- A conveyance system shall be included in the design of all infiltration practices in order to ensure that excess flow is discharged at non-erosive velocities.
- The overland flow path of surface runoff exceeding the capacity of the infiltration system shall be evaluated to preclude concentrated flow that causes erosion. If computed flow velocities do not exceed the non-erosive threshold, overflow may be accommodated by natural topography.
- Infiltration systems should be designed to fully de-water the entire WQ_v within 48 hours after the storm event.

Design Criteria (cont.)

Infiltration Pretreatment Criteria

To ensure the long term effectiveness of infiltration systems, preventative measures should be taken to minimize clogging. Pretreatment is generally most effective when multiple BMPs are placed in series. These may include vegetated filter strips, swales, sedimentation basins, or sediment traps.

Pretreatment Volume

- A minimum of 25% of the WQ_v must be pretreated prior to entry to an infiltration facility. If the infiltration rate for the underlying soils is greater than 2.00 inches per hour, 50% of the WQ_v shall be pretreated prior to entry into an infiltration facility. This can be provided by a sedimentation basin, stilling basin, sump pit or other acceptable measures. Exit velocities from pretreatment shall be non-erosive during the two-year design storm. The Camp-Hazen equation may be used as an acceptable alternative for determining infiltration pretreatment requirements. The Camp-Hazen equation accounts for the effects of turbulent flow to compute the required minimum surface area for pretreatment, A:

$$A_s = \frac{Q_o}{W} \times E'$$

Where:
A_s = sedimentation basin surface area (ft^2)
Q_o = discharge rate from basin = (WQv) / (24 hr)
W = particle settling velocity (ft/s); for percent impervious, I <= 75%, use W = 0.0004 ft/s, for I > 75%, use W = 0.0033 ft/s
E' = sediment trapping efficiency constant; for sediment trapping efficiency, E, of 90%, E' = 2.30 [2]

Pretreatment Techniques to Prevent Clogging

Each system shall have redundant methods to protect the long term integrity of the infiltration rate. The following techniques, at least three per trench and two per basin, should be installed in infiltration systems:

- Grass channel
- Grass filter strip (minimum 20 feet and only if sheet flow is established and maintained)
- Bottom sand layer
- Upper sand layer (6” minimum) with filter fabric at the sand/gravel interface.
- Use of washed bank run gravel as aggregate

The sides of infiltration trenches should be lined with an acceptable filter fabric that prevents soil piping but has greater permeability than the parent soil.

Infiltration Treatment Criteria

- Infiltration practices should be designed to exfiltrate the difference between the WQ_v minus the exfiltration volume. Infiltration practices are best used in conjunction with other BMPs and often downstream detention is still needed to meet the Cp_v and Q_p sizing criteria. Experience has shown that the longevity of infiltration practices is strongly influenced by the care taken during construction.

Design Criteria (cont.)

Infiltration Landscaping Criteria

- A porosity value "n" ($n=V_v/V_t$) of 0.40 should be used in the design of stone reservoirs for infiltration systems.
- Establish a dense and vigorous vegetative cover over the contributing pervious drainage areas before runoff can be accepted into the facility. Infiltration trenches should not be constructed until the contributing drainage area has been finally stabilized.
- An infiltration trench should have a 2 to 10 foot excavation lined with a sand base beneath filter fabric and filled with coarse stone aggregate. The surface layers should consist of filter fabric and a layer of 2 inch pea gravel (See Figures PTP-05-01 and PTP-05-02). The empty spaces between the stones provide temporary storage for runoff as it filters through the soil at the bottom of the trench.
- An infiltration basin is typically 3 to 12 feet in depth with a maximum depth dependant on soil type. Basins should be designed to hold runoff from the design storm. Typical drainage areas range from 5 to 50 acres, with slopes less than 20%. The basin itself should be located at least 50 feet away from slopes greater than 20%. An emergency spillway should be provided to direct overflows from storms exceeding the design strom capacity.

Infiltration Maintenance Criteria

- Infiltration practices should not be used for a sediment control device during the site construction phase.
- A perforated pipe should be installed in the infiltration trench to monitor water levels and drawdown time. The pipe should be flush with the bottom of the trench. An anchored six-inch diameter perforated PVC pipe with a lockable cap is recommended for the observation well.
- It is recommended that infiltration designs include dewatering methods in the event of failure. This can be done with underdrain pipe systems that accommodate drawdown.
- Direct access should be provided to all infiltration practices for maintenance and rehabilitation.
- Infiltration practices should not be covered by an impermeable surface.

Maintenance

When not properly maintained, infiltration systems have a high failure rate. Maintenance and inspections should be conducted regularly to ensure the long term functionality of the system.

An observation well should be installed in trenches to determine how quickly it drains after a storm event and to observe sediment buildup.

Semi-Annual Maintenance

- Check observation wells following 3 days of dry weather (failure to infiltrate within this time indicates clogging).
- Inspect pretreatment devices and diversion structures for sediment buildup and structural damage.

Standard Maintenance

- Remove sediment and oil/grease from pretreatment devices and outflow structures.

Maintenance (cont.)

5-Year Maintenance

- Utilize bypass capability to provide an extended dry period, if available. This may allow the system to regain the infiltration rate in the short term.

Upon Failure

- Total rehabilitation of the system to maintain storage capacity.
- Excavate trench walls to expose clean soil.

Infiltration Trench

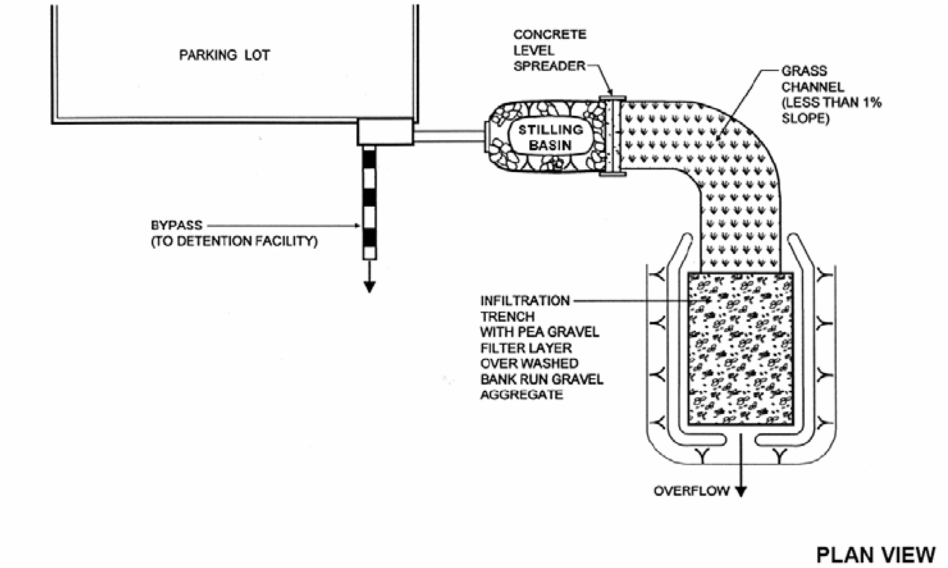


Figure PTP-05-01 Infiltration Trench Schematic
Source: Maryland Stormwater Design Manual

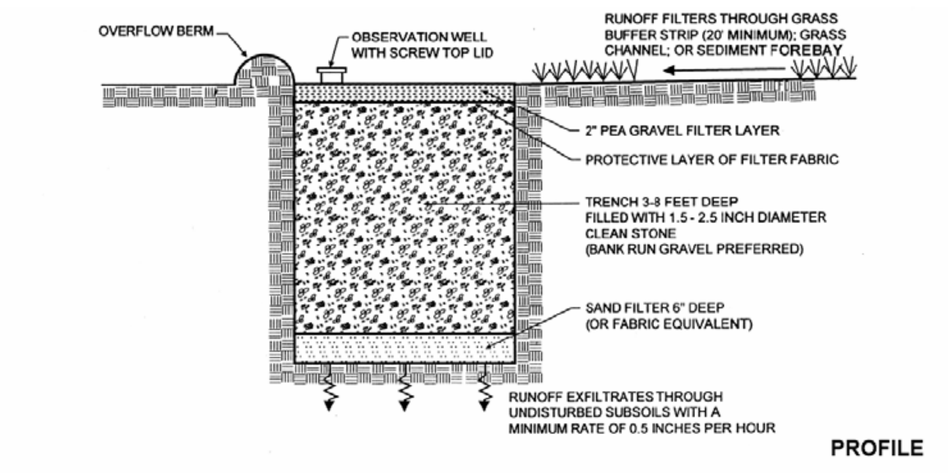


Figure PTP-05-02 Infiltration Trench Schematic
Source: Maryland Stormwater Design Manual

Infiltration Basin

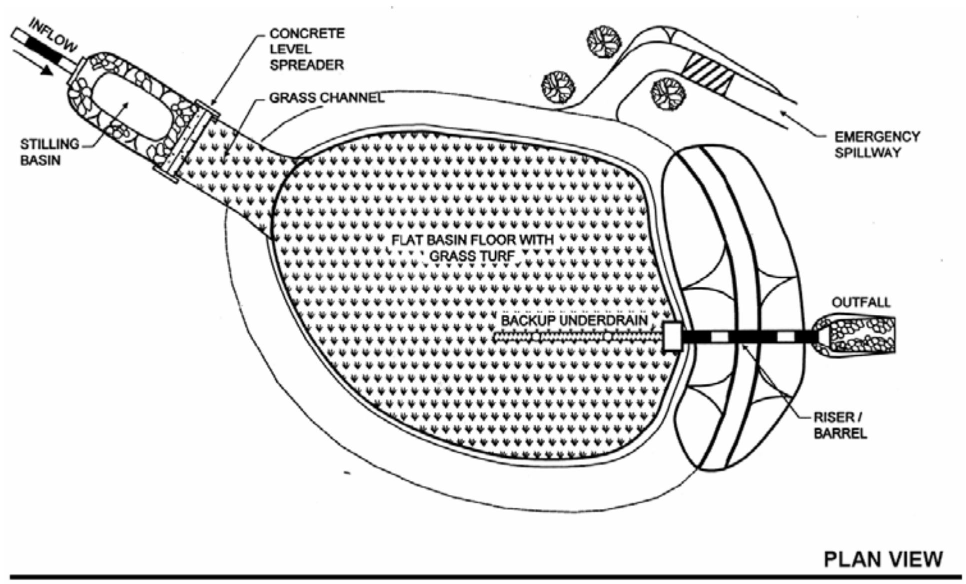


Figure PTP-05-03 Infiltration Basin Schematic
Source: Maryland Stormwater Design Manual

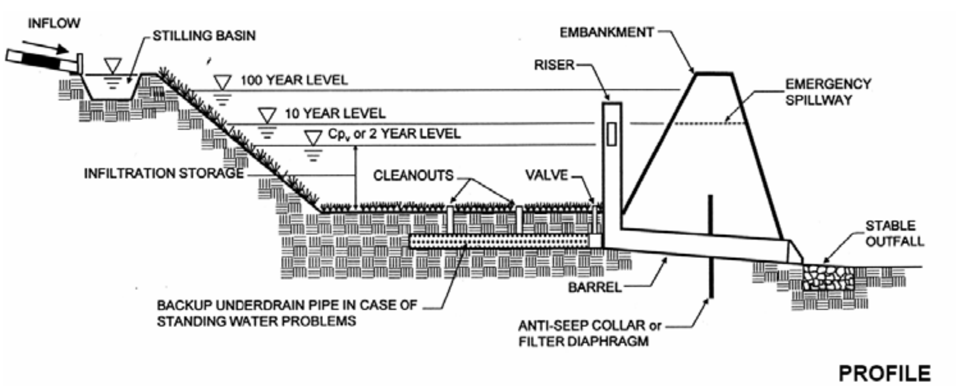


Figure PTP-05-04 Infiltration Basin Schematic
Source: Maryland Stormwater Design Manual

Infiltration Trench Design Procedures

Infiltration Trench Design Procedures

Step 1. Compute runoff control volumes.

Calculate the Water Quality Volume (WQ_v), Channel Protection Volume (Cp_v), Overbank Flood Protection Volume (Q_p), and the Extreme Flood Volume (Q_f).

Step 2. Determine if the development site conditions are appropriate for the use of an infiltration trench.

- Type of development?
- Permeable subsoils?
- Low water table?
- Low sediment load?
- Karst area?

Step 3. Confirm local design criteria and applicability

Consider any special site-specific design conditions/criteria (Additional Site-Specific Design Criteria and Issues). Check with local officials and other agencies to determine if there are any additional restrictions and/or surface water or watershed requirements that may apply.

Step 4. Compute WQv peak discharge (Q_{wq}).

The peak rate of discharge for water quality design storm is needed for sizing of off-line diversion.

- Using WQ_v (or total volume to be infiltrated), compute CN.
- Compute time of concentration using TR-55 method.
- Determine appropriate unit peak discharge from time of concentration.
- Compute Q_{wq} from unit peak discharge, drainage area, and WQ_v.

Step 5. Size flow diversion structure, if needed

A flow regulator (or flow splitter diversion structure) should be supplied to divert the WQ_v to the infiltration trench.

Size low flow orifice, weir, or other device to pass Q_{wq}.

Infiltration Trench Design Procedures (cont.)

Step 6. Size infiltration trench

The area of the trench can be determined from the following equation:

$$A = (WQ_v) / (nd + kT/12)$$

Where:

- A = Surface Area
- WQ_v = Water Quality Volume (or total volume to be infiltrated)
- n = porosity
- d = trench depth (feet)
- k = percolation (inches/hour)
- T= Fill Time (time for the practice to fill with water), in hours

A porosity value n = 0.32 should be used. All infiltration systems should be designed to fully dewater the entire WQv within 24 to 48 hours after the rainfall event. A fill time T=2 hours can be used for most designs.

Step 7. Determine pretreatment volume and design pretreatment measures.

Pretreatment facility should be sized to treat 25% of the water quality volume (WQ_v) for off-line configurations.

Step 8. Design spillway(s).

Adequate stormwater outfalls should be provided for the overflow exceeding the capacity of the trench, ensuring nonerosive velocities on the down-slope.

Somerset, Kentucky
Stormwater Best Management Practices (BMPs)
Stormwater Pollution Treatment Practices (Structural)

PTP-06

Activity: Water Quality Units

WQ

WQ

PLANNING CONSIDERATIONS:

Design Life:
35 years

Acreage Needed:
Low

Estimated Unit Cost:
Moderate

Annual Maintenance:
Moderate to High

Target Pollutants

Litter and Debris
Total Suspended Solids (TSS); 20%
Nutrients – Total Phosphorous removal; 17%
Metals – Lead/Zinc/Copper removal; 24/17/0%

Description

Water quality units target urban areas and provide water quality benefits at stormwater inlets. Units are generally designed as compact below grade systems constructed of precast concrete. Units often employ a swirling motion that causes sediments and particulates to settle out and a chamber to capture floatable material. Water quality units included here are hydrodynamic separators, filtration units, and continuous deflection separators.

Hydrodynamic separators are flow-through systems with a separation cylinder unit to promote the settlement of sediments and other pollutants. No outside power source is required as the system is designed to utilize the energy of flowing water. Means of separation vary between hydrodynamic separator units, which may employ a swirl action or indirect filtration.

Filtration units are devices inserted into storm drains to filter or absorb sediment, pollutants and oil and grease. Filter media cartridges are commonly used to collect and dispose of pollutants.

Continuous deflection separators treat runoff by screening sediment and debris via a vortex of water that deflects sediment and debris into a sump while water flows through a screen.

Suitable Applications

Water quality units are most suitable for highly impervious sites. Because of their limited removal ability of soluble pollutants and fine particles, these devices should be used as a pretreatment device, and should not act as a stand-alone practice for new development. However, when space is limited, water quality units are ideal for retrofit applications. Site types may include automotive lots, parking lots, roadways, road salt storage facilities, hazardous substance facilities and rooftop runoff.

Suitable Applications (cont.)

Water quality units are typically suitable for the following applications:

- Impervious area runoff
- Retrofit applications
- In conjunction with other stormwater BMPs

Target Pollutants

Target pollutants and removal effectiveness may vary widely between the unit type and manufacturer. If available, independent data should be used to consider a water quality unit brand or manufacturer. Independent studies suggest that water quality units primarily target litter and debris with limited pollutant removal capacity, particularly for fine particles and soluble pollutants. Target pollutant information for this fact sheet was based on data from the Environmental Protection Agency's fact sheet, *Manufactured Products for Stormwater Inlets*, referencing S.S. Greb and R. Waschbusch's study, "Evaluation of Stormceptor® and multi-chamber treatment train as urban retrofit strategies", 1998. This study investigated 45 precipitation events over a 9-month period and calculated percent removal rates to reflect overall efficiency, accounting for pollutants in bypassed flows.

Design Criteria

The sizing and design for water quality units should be based on the manufacturer's product specifications. Units are generally designed according to the peak flow rate for a given design storm event at the inlet. Units may have features designed to reduce the velocity of the stormwater flow entering the unit, which increases the capacity of sediment removal of the system. See Figure PTP-06-01 for a sample schematic for general features of a water quality unit.

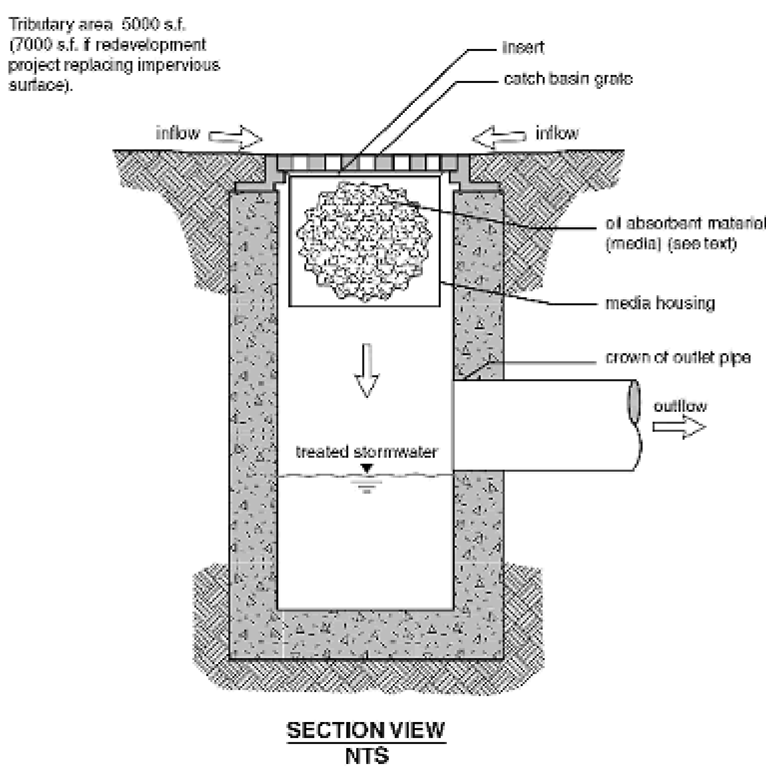


Figure PTP-06-01 Water Quality Unit Schematic
Source: Environmental Protection Agency

Cost

Costs for water quality units vary by type and manufacturer. In general, costs for water quality units increase for sites requiring treatment for high peak flows or where pre-manufactured units are not available. If pre-manufactured units cannot accommodate the site or design conditions, cost may increase for a customized unit.

Product Examples

The City of Somerset does not endorse the manufacturers or brand product names listed below. The following examples are meant to facilitate the evaluation of specifications for water quality units in general and to provide the user with a cross-section of water quality unit products available on the market.

Hydrodynamic Separator: *Vortechs® System, a product by Vortechnics®, Inc.*

This hydrodynamic separator (Figure PTP-06-02) is designed to promote gravitational separation of particles using a swirl action in a cylindrical tank. The tank has compartments separated by baffle walls to control floatables at low, medium and high flows. The unit size is based on site area, runoff coefficient and time of concentration, regional precipitation intensity distribution, and anticipated pollutant characteristics. This data is applied to the Rational Method to estimate pollutant removal efficiency. The Rational Method works well for designing this system for most sites due to small site area and impervious surface characteristics. Flow rates calculated for each rainfall intensity are used to generate an operating rate for the Vortechs® System unit. Pollutant removal efficiencies can then be paired with operating rates based on laboratory tests and pollutant types and loads expected for the site.

The design incorporates the following features:

- Cylindrical grit chamber
- Baffle wall
- Flow control wall

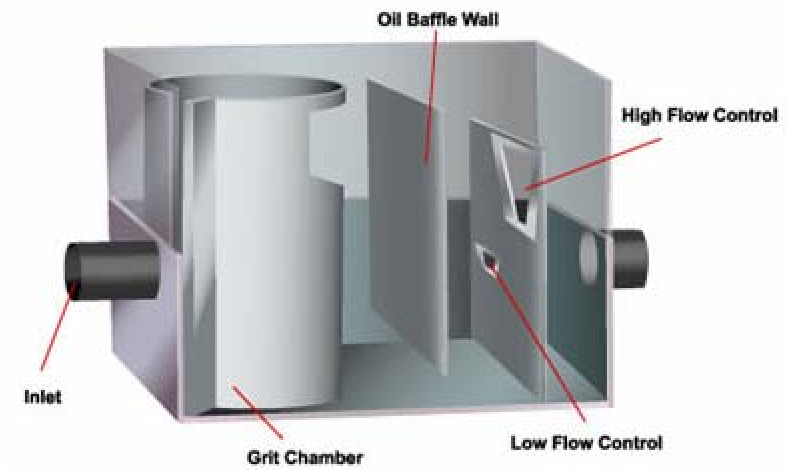


Figure PTP-06-02 Hydrodynamic Separator, Vortechs® System Schematic
Source: University of Massachusetts Amherst Stormwater Technologies Clearinghouse, www.mastep.net.

Product Examples (cont.)

Removal efficiency performance is compared in Table PTP-06-01.

Table PTP-06-01 Performance Comparison

Source: University of Massachusetts Amherst Stormwater Technologies Clearinghouse, www.mastep.net.

Pollutants Addressed	Manufacturer's Removal Efficiency Claim (%)	Minimum Particle Size	Tested Removal Efficiency (%)
Suspended sediment concentration	35-85%	63	61 %
Total suspended solids	35-85%	63	35 %
Total dissolved solids	-	-	-110 %
Total volatile solids	-	-	-
Total solids	35-85%	0	-
Oil and grease	35-85%	-	-
Debris - floatables	35-85%	-	-
Debris- sinking	35-85%	-	-
Zinc	0-80%	-	24 %
Copper	0-80%	-	33 %
Lead	0-80%	-	-
Iron	0-80%	-	-
Chromium	0-80%	-	-
Mercury	0-80%	-	-
Cadmium	0-80%	-	-
Hydrocarbons	35-85%	-	-
Organic contaminants	0-80%	-	-
Salt	0-80%	-	-
Fecal coliform	0-80%	-	-
E. coli	0-80%	-	-
Enterococcus	0-80%	-	-
Total nitrogen	0-80%	-	-
Total Phosphorus	0-80%	-	21 %
Suspended sediment concentration	35-85%	63	61 %
Total suspended solids	35-85%	63	35 %
Total dissolved solids	-	-	-110 %
Total volatile solids	-	-	-
Total solids	35-85%	0	-
Oil and grease	35-85%	-	-
Debris - floatables	35-85%	-	-
Debris- sinking	35-85%	-	-
Zinc	0-80%	-	24 %
Copper	0-80%	-	33 %
Lead	0-80%	-	-
Iron	0-80%	-	-
Chromium	0-80%	-	-

Product Examples (cont.)

Table PTP-06-01 Performance Comparison (continued)

Pollutants Addressed	Manufacturer's Removal Efficiency Claim (%)	Minimum Particle Size	Tested Removal Efficiency (%)
Mercury	0-80%	-	-
Cadmium	0-80%	-	-
Hydrocarbons	35-85%	-	-
Organic contaminants	0-80%	-	-
Salt	0-80%	-	-
Fecal coliform	0-80%	-	-
E. coli	0-80%	-	-
Enterococcus	0-80%	-	-
Total nitrogen	0-80%	-	-
Total Phosphorus	0-80%	-	21 %

Filtration Unit: *StormFilter®, a product by Stormwater Management®, Inc.*

This filtration unit (Figure PTP-06-03) utilizes rechargeable media filter cartridges to remove pollutants from stormwater as it flows into the vault and passes through the filter. Inflow to the filter media is controlled by an orifice disk that can be adjusted from 5 to 15 gallons per minute. After traveling through the filter media, stormwater is released to discharge into a pipe. The unit is sized according to peak flow designed for treatment. The peak flow is based on hydrologic characteristics of the contributing watershed and the design storm. The unit size is indirectly related to the peak flow; size increases for additional filter cartridges required to treat larger peak flows.

The design incorporates the following features:

- Rechargeable media-filter cartridges
- Flow control orifice disk at base of cartridge
- 5 basic design configurations

Product Examples (cont.)

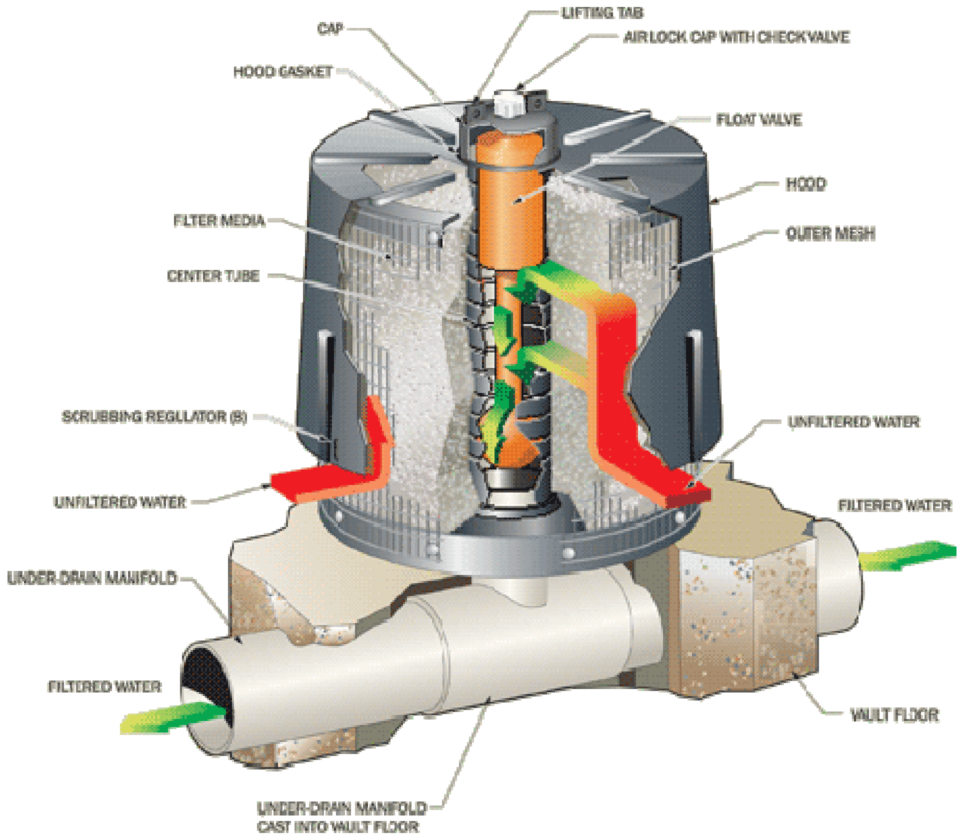


Figure PTP-06-03 Filtration Unit, StormFilter® Schematic
Source: University of Massachusetts Amherst Stormwater Technologies Clearinghouse, www.mastep.net.

Removal efficiency performance is compared in Table PTP-06-02.

Table PTP-06-02 Performance Comparison
Source: University of Massachusetts Amherst Stormwater Technologies Clearinghouse, www.mastep.net.

Pollutants Addressed	Manufacturer's Removal Efficiency Claim (%)	Minimum Particle Size	Tested Removal Efficiency (%)
Total suspended solids	50-85%	-	79 %
Zinc	20-60%	-	64 %
Copper	20-60%	-	59 %
Hydrocarbons	74%	-	-

Product Examples (cont.)

Continuous Deflection Separator: *CDS® Inline Unit, a product by CDS Technologies®, Inc.*

This continuous deflection separator unit (Figure PTP-06-04) is installed beneath one manhole access point. The unit promotes gravitational separation of particles using a swirl action in its cylindrical tank and through a screen. Sediments settle into the separation chamber at the base of the unit. For flows greater than the treatment capacity, a bypass through the system is available.

The design incorporates the following features:

- Cylindrical grit chamber
- Flow bypass
- Separation chamber
- Small footprint area required

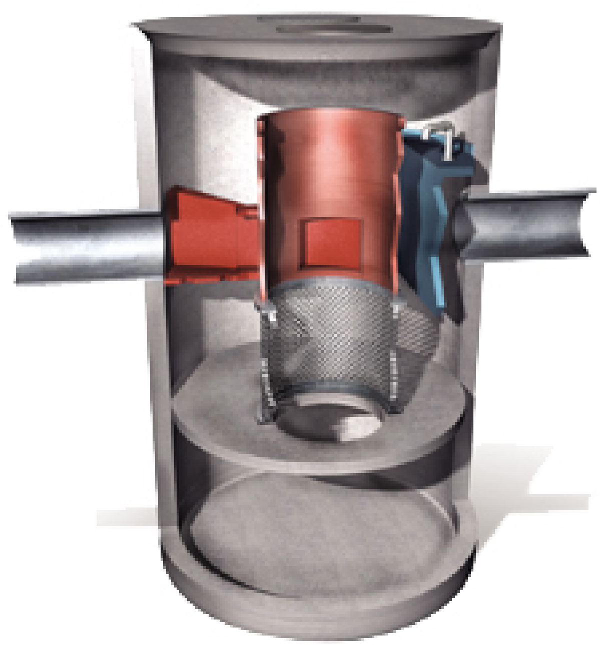


Figure PTP-06-04 Continuous Filtration Separator Unit, CDS® Inline Unit Schematic
Source: University of Massachusetts Amherst Stormwater Technologies Clearinghouse, www.mastep.net.

Product Examples (cont.)

Removal efficiency performance is compared in Table PTP-06-02.

Table PTP-06-03 Performance Comparison

Source: University of Massachusetts Amherst Stormwater Technologies Clearinghouse, www.mastep.net.

Pollutants Addressed	Manufacturer's Removal Efficiency Claim (%)	Minimum Particle Size	Tested Removal Efficiency (%)
Total suspended solids	80%	-	73.7 %
Oil and grease	83-86%	-	-
Debris - floatables	100%	-	-

Installation

A representative from the company who manufactured the water quality unit should be present during installation activities. Installation of the water quality unit should be conducted by a qualified individual under the supervision of the representative from the unit's manufacturer.

Maintenance

Water quality units are reliable and relatively low maintenance systems due to their design with no moving parts. Maintenance is primarily needed to clean the system of debris and pollutants to keep it working properly. When not properly maintained, water quality units have a high failure rate.

Maintenance and inspections should be conducted regularly after storm events to ensure the long term functionality of the system. By inspecting the unit before and after a significant rain event, the amount and the types of materials being captured can be monitored. This practice can aid in scheduling maintenance based on physical observation and attention to rainfall frequency. Consideration should also be placed on droughts or dry periods, where accumulation of pollutants can build up and create large amounts of floatables, debris, sediment, oils, hydrocarbons, and other pollutants during first-flush events.

Access to manholes should be clear and unobstructed to allow vacuum trucks to perform maintenance to the unit.

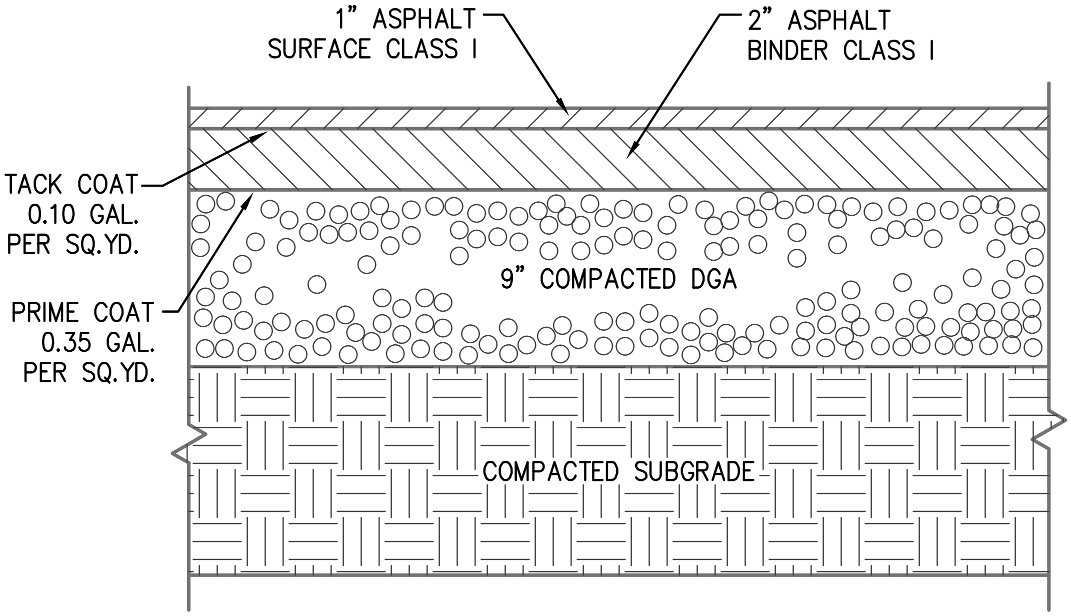
Semi-Annual Maintenance

- Inspect unit for sediment buildup and structural damage

Standard Maintenance

- Remove sediment and debris from unit via vacuum truck, sump vac or other means
- Increase maintenance schedule to remove debris during heavy leaf fall or other seasonal accumulation of trash or debris

Standard Drawing Table of Contents



NOTES:

1. DGA SHOULD BE COMPACTED A MINIMUM OF 98 PERCENT OF THE MAXIMUM STANDARD PROCTOR DRY DENSITY AS PER ASTM D–698 OR A MINIMUM OF 85 PERCENT RELATIVE DENSITY AS PER ASTM D4253 AND D4254.

2. SUBGRADE MATERIAL SHALL BE COMPACTED TO 98 PERCENT OF THE MAXIMUM STANDARD PROCTOR DRY DENSITY AS PER ASTM D–698. MOISTURE CONTENT SHALL BE WITHIN 3% OF OPTIMUM.

3. THICKNESS OF EACH LAYER SHALL BE PER ROADWAY TYPE AND FINAL ENGINEERING DESIGN. THICKNESS SHOWN ON DRAWING FOR EXAMPLE ONLY.

DATE	BY	REVISION

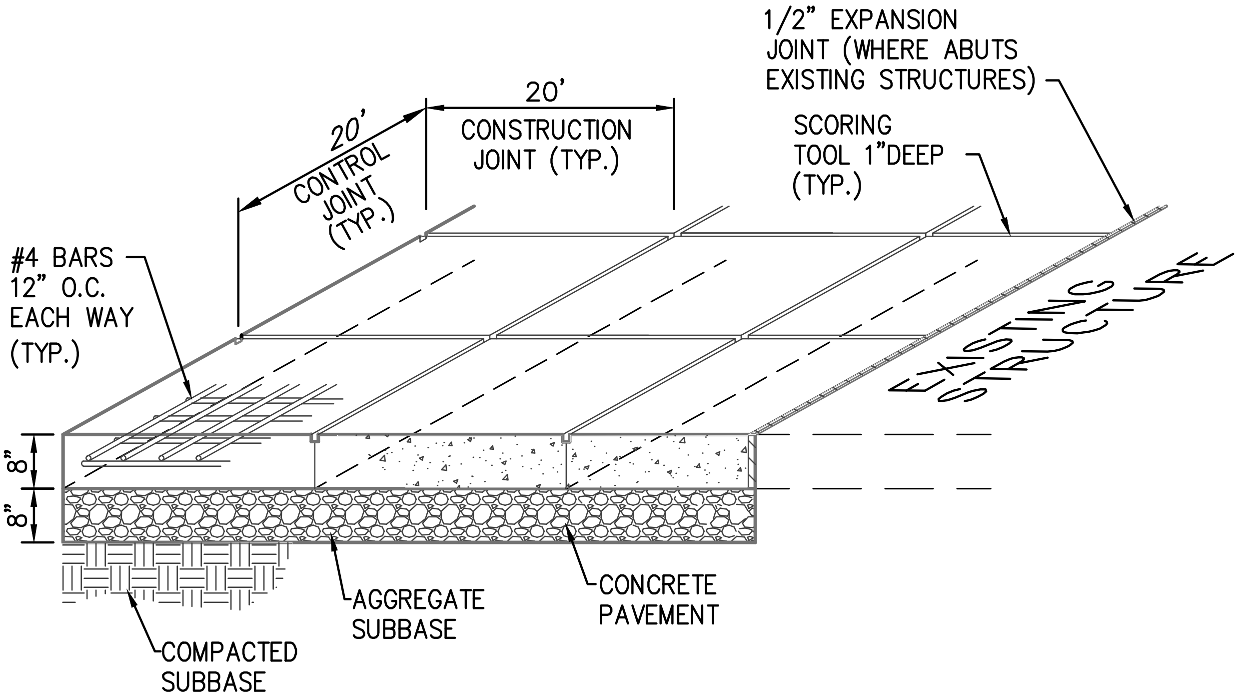
CITY OF SOMERSET
SOMERSET, KENTUCKY

TYPICAL ASPHALT
PAVEMENT DETAIL

DWG NO. P1

NOT TO SCALE

DETAIL BY BTM ENGINEERING



NOTES:

1. DGA SHOULD BE COMPACTED A MINIMUM OF 98 PERCENT OF THE MAXIMUM STANDARD PROCTOR DRY DENSITY AS PER ASTM D-698 OR A MINIMUM OF 85 PERCENT RELATIVE DENSITY AS PER ASTM D4253 AND D4254.

2. SUBGRADE MATERIAL SHALL BE COMPACTED TO 98 PERCENT OF THE MAXIMUM STANDARD PROCTOR DRY DENSITY AS PER ASTM D-698. MOISTURE CONTENT SHALL BE WITHIN 3% OF OPTIMUM.

3. THICKNESS OF EACH LAYER SHALL BE PER ROADWAY TYPE AND FINAL ENGINEERING DESIGN. THICKNESS SHOWN ON DRAWING FOR EXAMPLE ONLY.

DATE	BY	REVISION

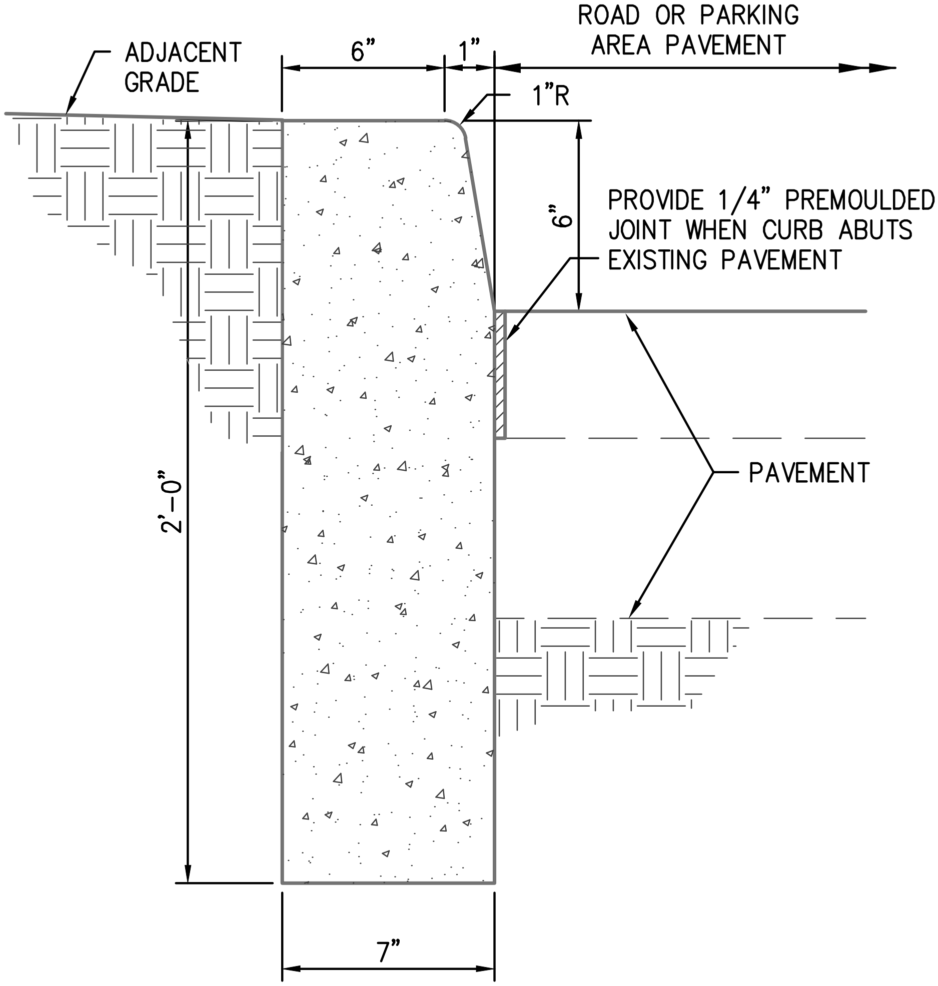
CITY OF SOMERSET
SOMERSET, KENTUCKY

TYPICAL CONCRETE
PAVEMENT DETAIL

DETAIL BY BTM ENGINEERING

NOT TO SCALE

DWG NO. P2



NOTES:

1. CONCRETE SHALL BE 3500 PSI.
2. PROVIDE 1/4" EXPANSION JOINT WITH PREMOULDED FILLER STRIP AT 20' MAX SPACING IN CURB.
3. PROVIDE 1" DEEP, TOOLED CONTROL JOINTS AT 5' ON CENTER IN CURB.
4. PROVIDE EXPANSION JOINT CONTINUOUS WHERE CURB ABUTS CONCRETE STRUCTURES.

DATE	BY	REVISION

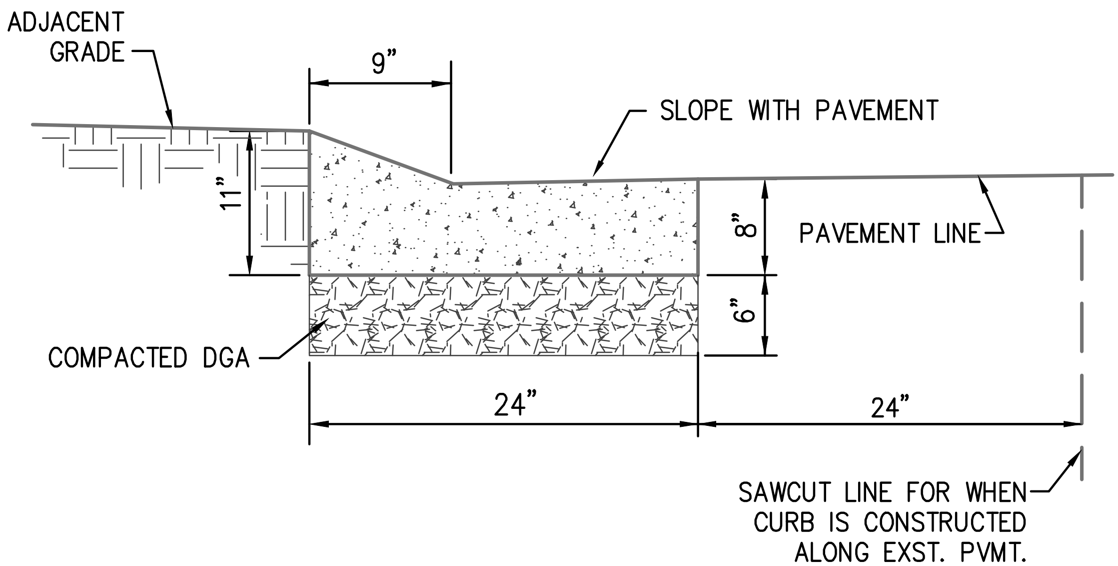
CITY OF SOMERSET
SOMERSET, KENTUCKY

CONCRETE HEADER CURB

NOT TO SCALE

DETAIL MODIFIED FROM KYTC BY BTM ENGINEERING

DWG NO. CB1



DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

LIP CURB AND GUTTER

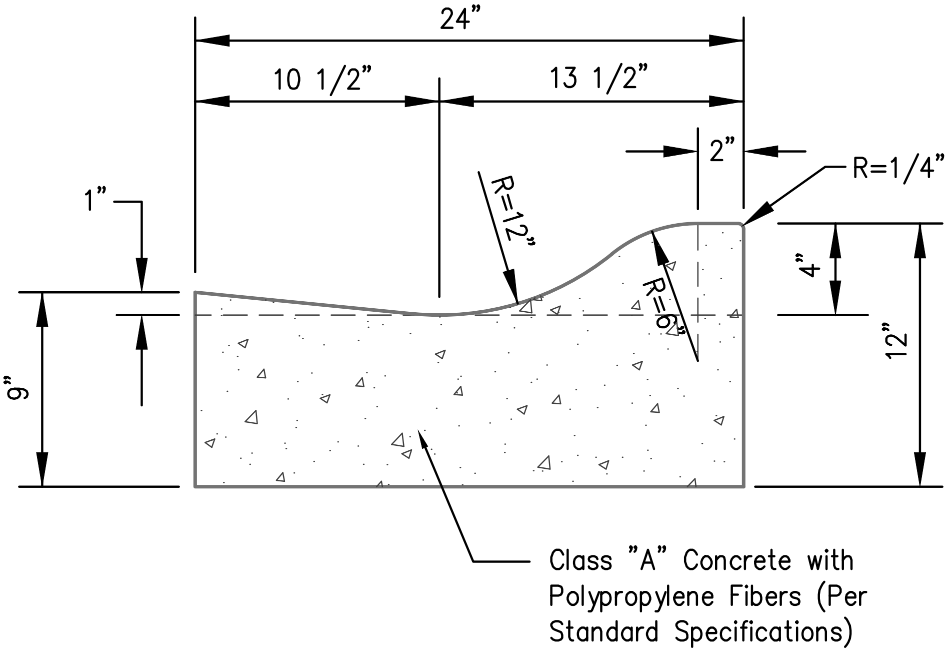
DWG NO. CB2

NOT TO SCALE

DETAIL MODIFIED FROM KYTC BY BTM ENGINEERING

NOTES:

1. Curb and Gutter shall have a broom finish perpendicular to flow of traffic.



DATE	BY	REVISION

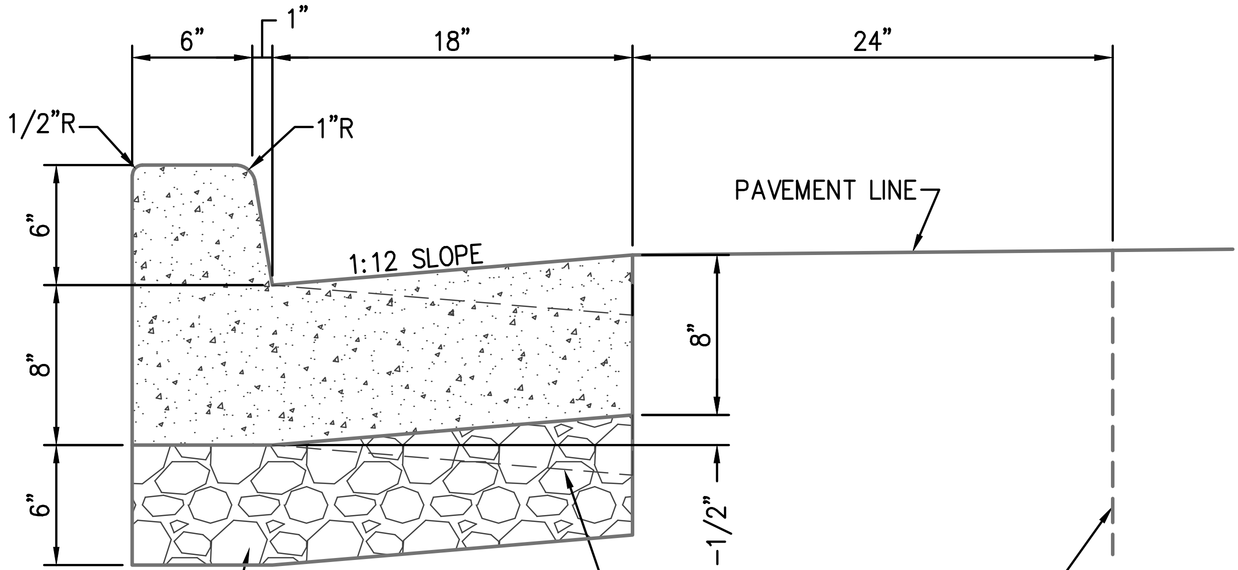
CITY OF SOMERSET
SOMERSET, KENTUCKY

STANDARD ROLL
CURB AND GUTTER

NOT TO SCALE

DWG NO. CB3

DETAIL MODIFIED FROM KYTC BY BTM ENGINEERING



NOTES:

1. CONCRETE SHALL BE 4000 PSI.
2. PROVIDE "FORTA FERRO" FIBER REINFORCEMENT AT A RATE OF 4 LBS. PER CUBIC YARD OF CONCRETE.
3. PROVIDE 1" DEEP, TOOLED CONTROL JOINTS AT 5' ON CENTER IN CURB.
4. PROVIDE 1/4" EXPANSION JOINT CONTINUOUS WHERE CURB ABUTS EXISTING OR PROPOSED CONCRETE OR STORM STRUCTURES. SEE DETAIL #XX, SHEET CX.X.
5. DGA SHOULD BE COMPACTED A MINIMUM OF 98 PERCENT OF THE MAXIMUM STANDARD PROCTOR DRY DENSITY AS PER ASTM D-698 OR A MINIMUM OF 85 PERCENT RELATIVE DENSITY AS PER ASTM D4253 AND D4254.

DATE	BY	REVISION

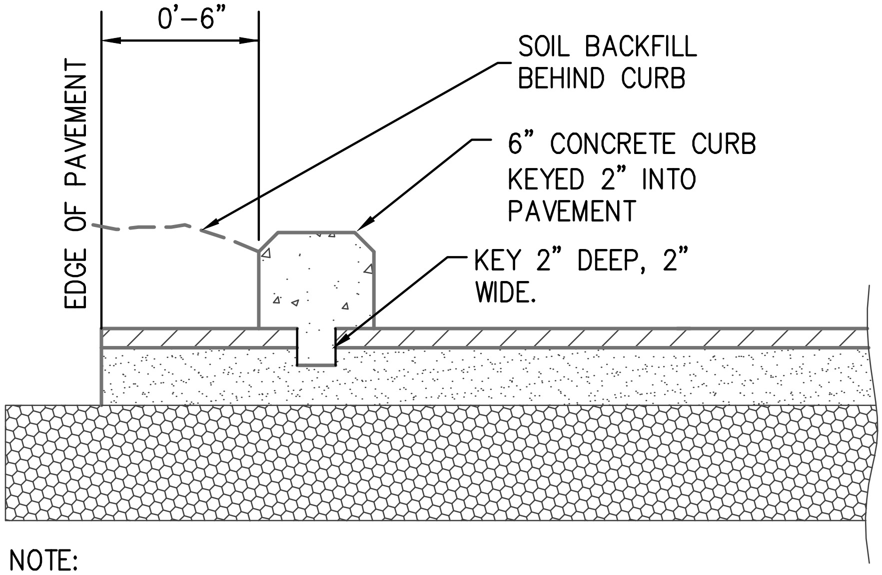
CITY OF SOMERSET
SOMERSET, KENTUCKY

STANDARD
CURB AND GUTTER

NOT TO SCALE

DWG NO. CB4

DETAIL MODIFIED FROM KYTC BY BTM ENGINEERING



NOTE:
CURB SHALL BE 4000 PSI CONCRETE. KEY SHALL BE FORMED BY SAW CUTTING CLEAN, STRAIGHT EDGES INTO PAVEMENT.

CITY ENGINEER SHALL APPROVE USE AND SUITABILITY OF THIS CURB ON A CASE BY CASE BASIS ONLY.

DATE	BY	REVISION

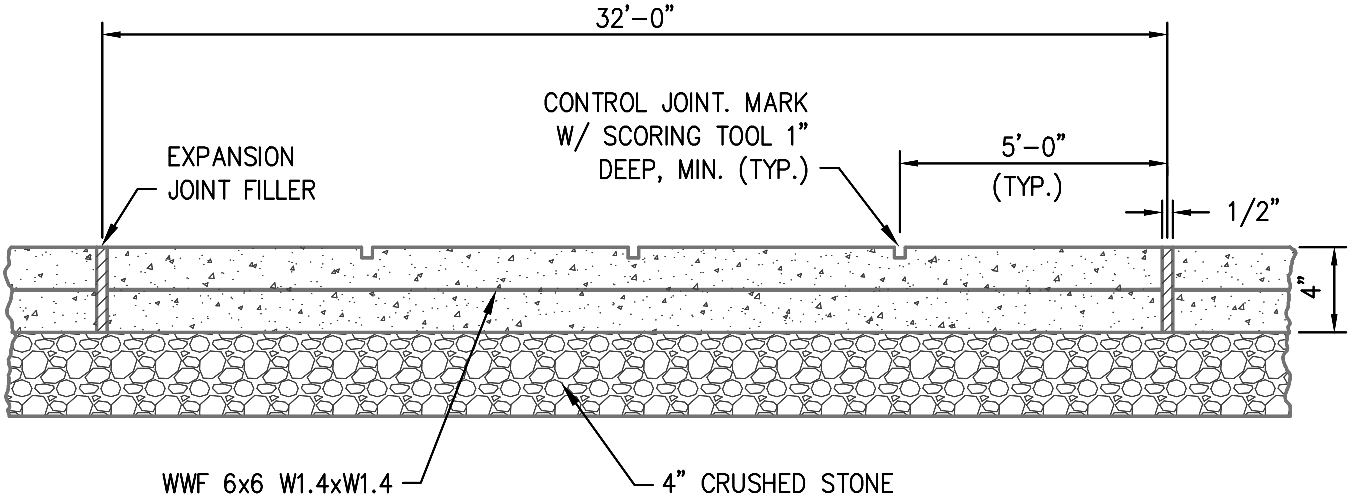
CITY OF SOMERSET
SOMERSET, KENTUCKY

KEYED CURB

DWG NO. CB5

NOT TO SCALE

DETAIL BY BTM ENGINEERING



NOTES:
1. CONCRETE SHALL BE 3500 PSI.
2. MINIMUM SIDEWALK WITH SHALL BE 4'
3. PROVIDE 1/4" EXPANSION JOINT WITH PREMOULDED FILLER STRIP AT 32' MAX SPACING IN WALK.
3. PROVIDE 1" DEEP, TOOLED CONTROL JOINTS AT 5' ON CENTER IN WALK.
4. PROVIDE EXPANSION JOINT CONTINUOUS WHERE WALK ABUTS CONCRETE STRUCTURES.
5. PROVIDE EDGE EXPANSION JOINT AT DOOR LOCATIONS AND EDGE OF BUILDING.
6. ON PUBLIC STREETS, 4" CRUSHED STONE AND WOVEN WIRE MAY BE WAIVED BY CITY ENGINEER IN LIEU OF COMPACTED SOILS TO 95% STANDARD PROCTOR AND 4000 PSI CONCRETE.

DATE	BY	REVISION

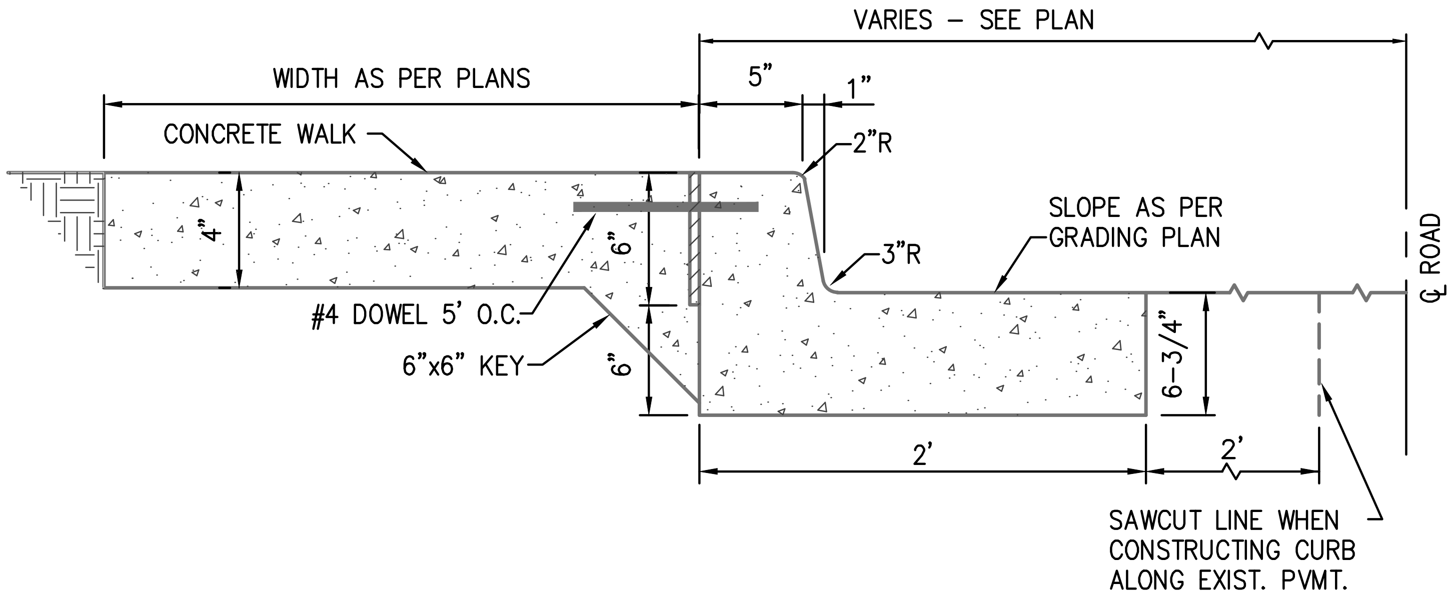
CITY OF SOMERSET
SOMERSET, KENTUCKY

STANDARD SIDEWALK DETAIL

NOT TO SCALE

DETAIL BY BTM ENGINEERING

DWG NO. SW1



DATE	BY	REVISION

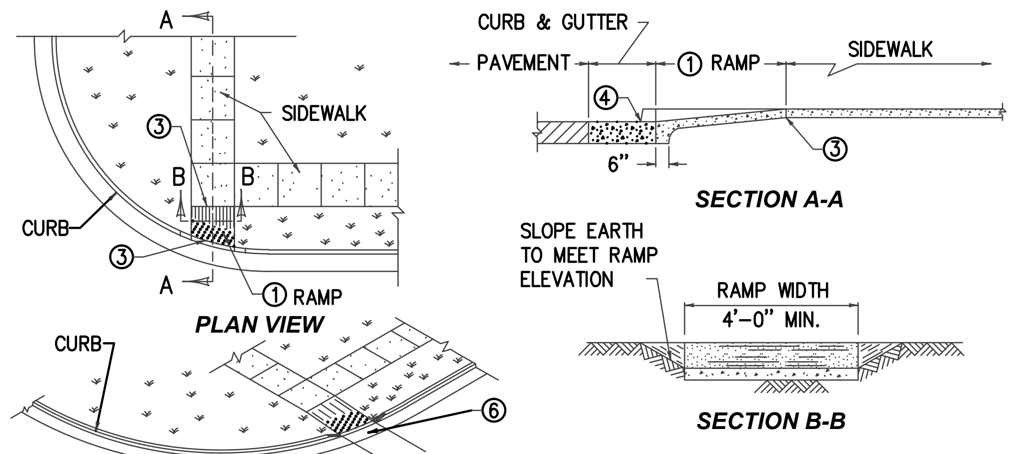
CITY OF SOMERSET
SOMERSET, KENTUCKY

MONOLITHIC SIDEWALK AND CURB AND GUTTER

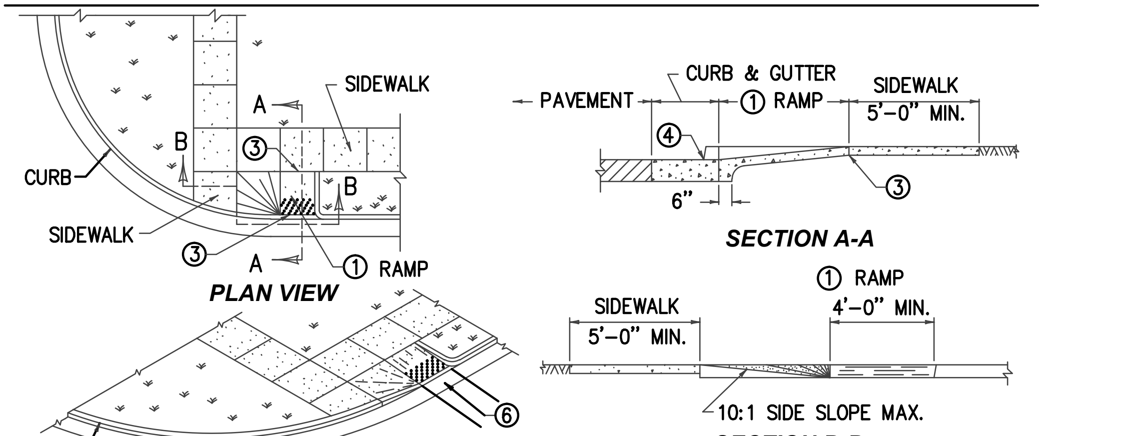
NOT TO SCALE

DWG NO. SW2

DETAIL MODIFIED FROM KYTC BY BTM ENGINEERING



RAMP TYPE 1



RAMP TYPE 2

NOTES

RAMPS SHALL BE PAID PER SQ. YARD OF 4" CONC. SIDEWALK AND THE UNIT PRICE SHALL INCLUDE ALL MATERIALS, FORMS, CURB BEHIND RAMP AND LANDING, AND INCIDENTALS NECESSARY FOR CONSTRUCTION.

THE RAMP SHALL BE CONSTRUCTED OF CLASS "A" CONCRETE. A BROOM FINISH OR EQUAL NON-SKID FINISH IS REQUIRED. **DETECTABLE WARNINGS SHALL BE A SEPARATE BID ITEM.**

THE NORMAL GUTTER LINE SHALL BE MAINTAINED THROUGH THE AREA OF THE RAMP.

RAMPS SHOULD BE LOCATED WITHIN MARKED LIMITS OF CROSSWALKS.

USE RAMP TYPE 3 WHEN POINT A TO B IS LESS THAN 20 FEET.

USE RAMP TYPE 4 WHEN POINT A TO B IS 20 FEET OR MORE.

① CURB RAMP GRADE SHALL NOT EXCEED 12:1, CROSS SLOPE SHALL NOT EXCEED 2%. **ON RETROFIT CURB RAMPS, GRADES OF 12.5% for 2'-0" OR 10% FOR 5'-0" ARE PERMISSABLE.**

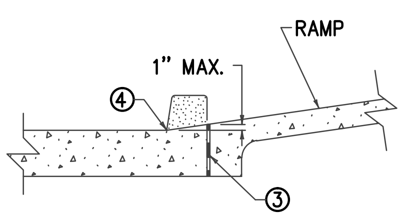
② CURB RETURN REQUIRED WHEN UTILITY STRIP IS 4 FEET OR GREATER. FOR UTILITY STRIPS LESS THAN 4 FEET, THE AREA IS TO BE SURFACED WITH SIDEWALK WITHIN THE RAMP.

③ 1/2" EXPANSION JOINT AT BACK OF CURB LINE AND AT SIDEWALK LINE.

④ NO BUMP PERMITTED. SAME SLOPE AS RAMP AND NOT TO EXCEED 1" IN HEIGHT. RAMPS SHALL BE CONSTRUCTED SO THAT WATER WILL NOT ACCUMULATE ON WALKING SURFACES.

5. ALL SIDEWALK RAMPS REQUIRE DETECTABLE WARNINGS.

⑥ LANDINGS WILL PROVIDE A LEVEL AREA (LESS THAN 2% GRADE OR CROSS SLOPE) AT APPROXIMATE STREET ELEVATION. A 4 FOOT SQUARE LEVEL LANDING IS THE REQUIRED MINIMUM.



DROP CURB FOR RAMP

DETAIL
SIDEWALK RAMPS

(MODIFIED FROM KENTUCKY DEPARTMENT OF HIGHWAYS STANDARD DRAWING NO. RPM-170-06)

NOT TO SCALE

DATE	BY	REVISION

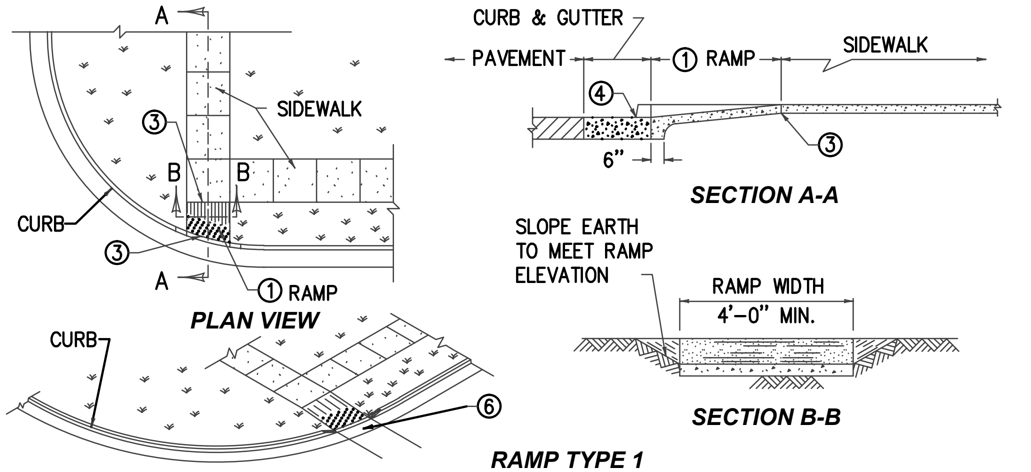
CITY OF SOMERSET
SOMERSET, KENTUCKY

ADA DETAIL
SIDEWALK RAMPS

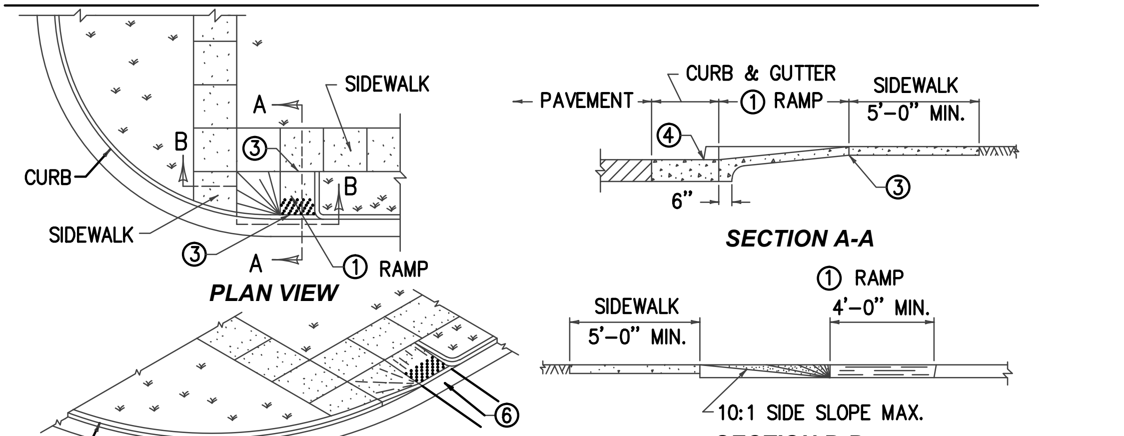
NOT TO SCALE

DWG NO. SW3 (1)

DETAIL MODIFIED FROM KYTC BY BTM ENGINEERING



RAMP TYPE 1



RAMP TYPE 2

NOTES

RAMPS SHALL BE PAID PER SQ. YARD OF 4" CONC. SIDEWALK AND THE UNIT PRICE SHALL INCLUDE ALL MATERIALS, FORMS, CURB BEHIND RAMP AND LANDING, AND INCIDENTALS NECESSARY FOR CONSTRUCTION.

THE RAMP SHALL BE CONSTRUCTED OF CLASS "A" CONCRETE. A BROOM FINISH OR EQUAL NON-SKID FINISH IS REQUIRED. **DETECTABLE WARNINGS SHALL BE A SEPARATE BID ITEM.**

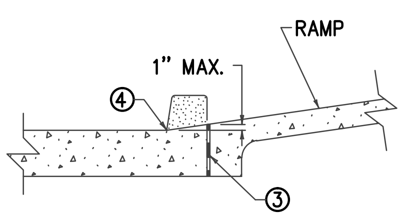
THE NORMAL GUTTER LINE SHALL BE MAINTAINED THROUGH THE AREA OF THE RAMP.

RAMPS SHOULD BE LOCATED WITHIN MARKED LIMITS OF CROSSWALKS.

USE RAMP TYPE 3 WHEN POINT A TO B IS LESS THAN 20 FEET.

USE RAMP TYPE 4 WHEN POINT A TO B IS 20 FEET OR MORE.

1. CURB RAMP GRADE SHALL NOT EXCEED 12:1, CROSS SLOPE SHALL NOT EXCEED 2%. **ON RETROFIT CURB RAMPS, GRADES OF 12.5% for 2'-0" OR 10% FOR 5'-0" ARE PERMISSABLE.**
2. CURB RETURN REQUIRED WHEN UTILITY STRIP IS 4 FEET OR GREATER. FOR UTILITY STRIPS LESS THAN 4 FEET, THE AREA IS TO BE SURFACED WITH SIDEWALK WITHIN THE RAMP.
3. 1/2" EXPANSION JOINT AT BACK OF CURB LINE AND AT SIDEWALK LINE.
4. NO BUMP PERMITTED. SAME SLOPE AS RAMP AND NOT TO EXCEED 1" IN HEIGHT. RAMPS SHALL BE CONSTRUCTED SO THAT WATER WILL NOT ACCUMULATE ON WALKING SURFACES.
5. ALL SIDEWALK RAMPS REQUIRE DETECTABLE WARNINGS.
6. LANDINGS WILL PROVIDE A LEVEL AREA (LESS THAN 2% GRADE OR CROSS SLOPE) AT APPROXIMATE STREET ELEVATION. A 4 FOOT SQUARE LEVEL LANDING IS THE REQUIRED MINIMUM.



DROP CURB FOR RAMP

DETAIL
SIDEWALK RAMPS

(MODIFIED FROM KENTUCKY DEPARTMENT OF HIGHWAYS STANDARD DRAWING NO. RPM-170-06)

NOT TO SCALE

DATE	BY	REVISION

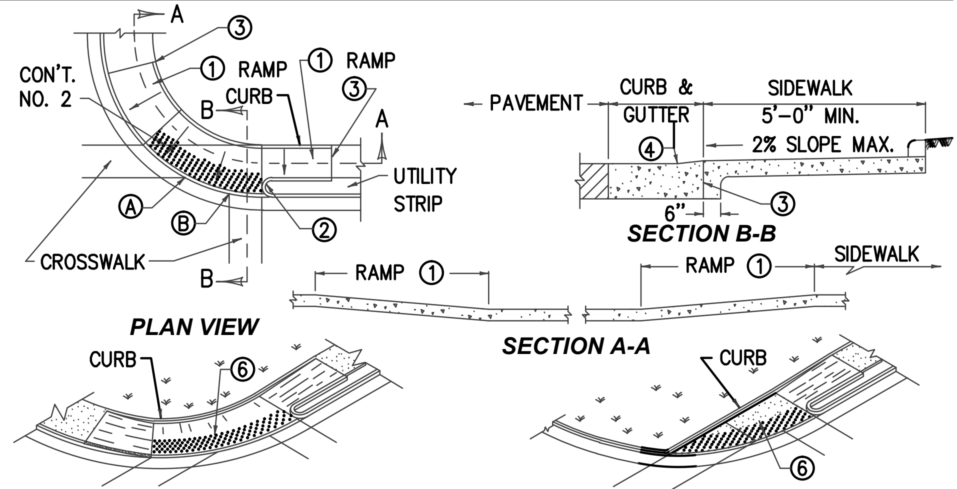
CITY OF SOMERSET
SOMERSET, KENTUCKY

ADA DETAIL
SIDEWALK RAMPS

NOT TO SCALE

DWG NO. SW3 (1)

DETAIL MODIFIED FROM KYTC BY BTM ENGINEERING



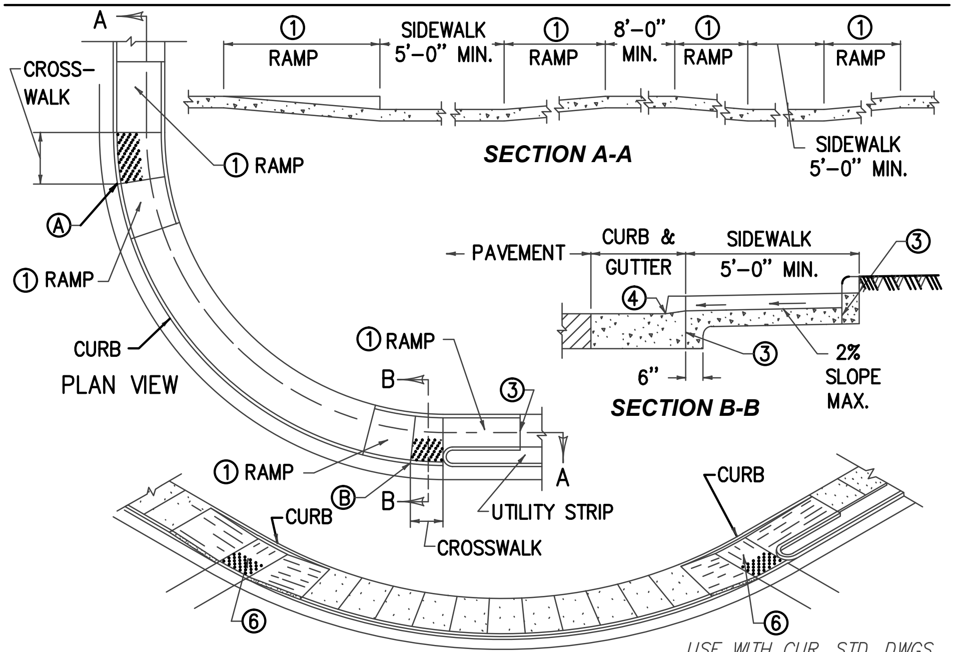
CONDITION NO. 1 — RAMP TYPE 3 — CONDITION NO. 2

NOTES

RAMPS SHALL BE PAID PER SQ. YARD OF 4" CONC. SIDEWALK AND THE UNIT PRICE SHALL INCLUDE ALL MATERIALS, FORMS, CURB BEHIND RAMP AND LANDING, AND INCIDENTALS NECESSARY FOR CONSTRUCTION.

THE RAMP SHALL BE CONSTRUCTED OF CLASS "A" CONCRETE. A BROOM FINISH OR EQUAL NON-SKID FINISH IS REQUIRED. **DETECTABLE WARNINGS SHALL BE A SEPARATE BID ITEM.**

THE NORMAL GUTTER LINE SHALL BE MAINTAINED THROUGH THE AREA OF THE RAMP. RAMPS SHOULD BE LOCATED WITHIN MARKED LIMITS OF CROSSWALKS. USE RAMP TYPE 3 WHEN POINT A TO B IS LESS THAN 20 FEET. USE RAMP TYPE 4 WHEN POINT A TO B IS 20 FEET OR MORE.



RAMP TYPE 4

① CURB RAMP GRADE SHALL NOT EXCEED 12:1, CROSS SLOPE SHALL NOT EXCEED 2%. **ON RETROFIT CURB RAMPS, GRADES OF 12.5% for 2'–0" OR 10% FOR 5'–0" ARE PERMISSABLE.**

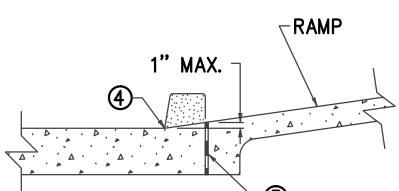
② CURB RETURN REQUIRED WHEN UTILITY STRIP IS 4 FEET OR GREATER. FOR UTILITY STRIPS LESS THAN 4 FEET, THE AREA IS TO BE SURFACED WITH SIDEWALK WITHIN THE RAMP.

③ 1/2" EXPANSION JOINT AT BACK OF CURB LINE AND AT SIDEWALK LINE.

④ NO BUMP PERMITTED. SAME SLOPE AS RAMP AND NOT TO EXCEED 1" IN HEIGHT. RAMPS SHALL BE CONSTRUCTED SO THAT WATER WILL NOT ACCUMULATE ON WALKING SURFACES.

⑤ ALL SIDEWALK RAMPS REQUIRE DETECTABLE WARNINGS.

⑥ LANDINGS WILL PROVIDE A LEVEL AREA (LESS THAN 2% GRADE OR CROSS SLOPE) AT APPROXIMATE STREET ELEVATION. A 4 FOOT SQUARE LEVEL LANDING IS THE REQUIRED MINIMUM.



DROP CURB FOR RAMP

DETAIL SIDEWALK RAMPS

(MODIFIED FROM KENTUCKY DEPARTMENT OF HIGHWAYS STANDARD DRAWING NO. RPM-170-06)

NOT TO SCALE

DATE	BY	REVISION

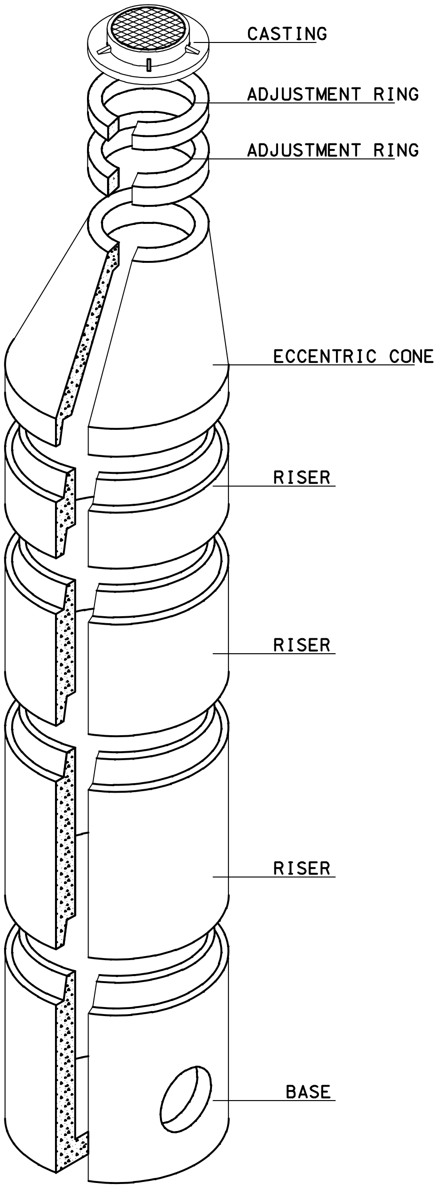
CITY OF SOMERSET
SOMERSET, KENTUCKY

ADA DETAIL
SIDEWALK RAMPS

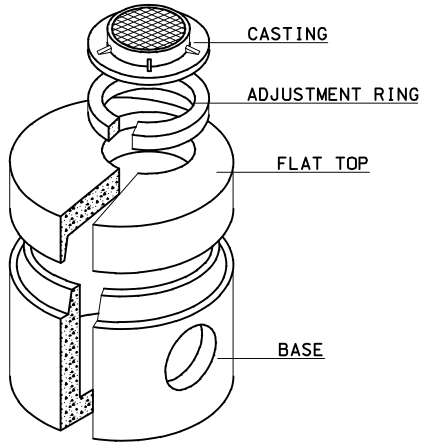
NOT TO SCALE

DWG NO. SW3(2)

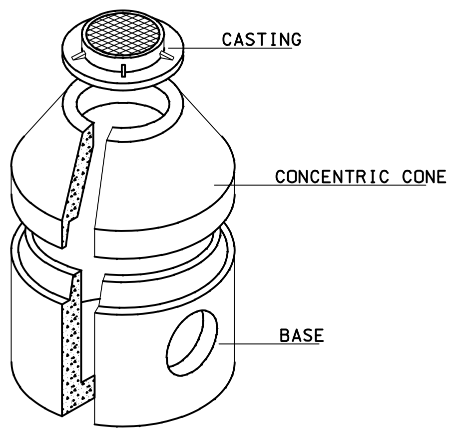
DETAIL MODIFIED FROM KYTC BY BTM ENGINEERING



DEEP INSTALLATION



SHALLOW FLAT TOP
INSTALLATION



SHALLOW CONCENTRIC
CONE INSTALLATION

NOT TO SCALE

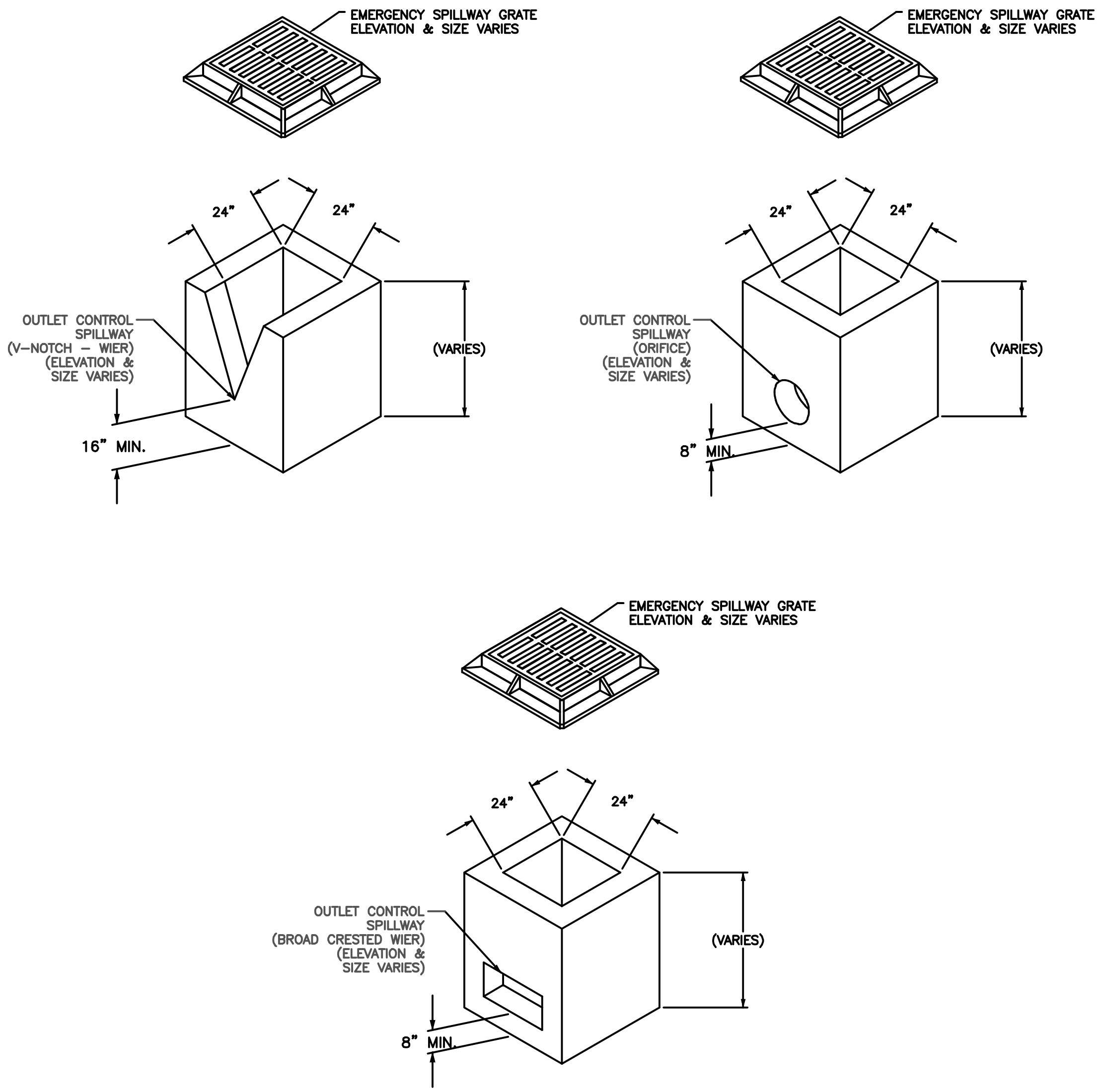
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

TYPICAL MANHOLE
COMPONENTS

DWG NO. MH1

DETAIL USED BY PERMISSION OF SHERMAN DIXIE CONCRETE, INC.



GENERAL NOTES:

1. STEEL REINFORCEMENT & CONC. STRENGTH PER ASTM C913.

NOT TO SCALE

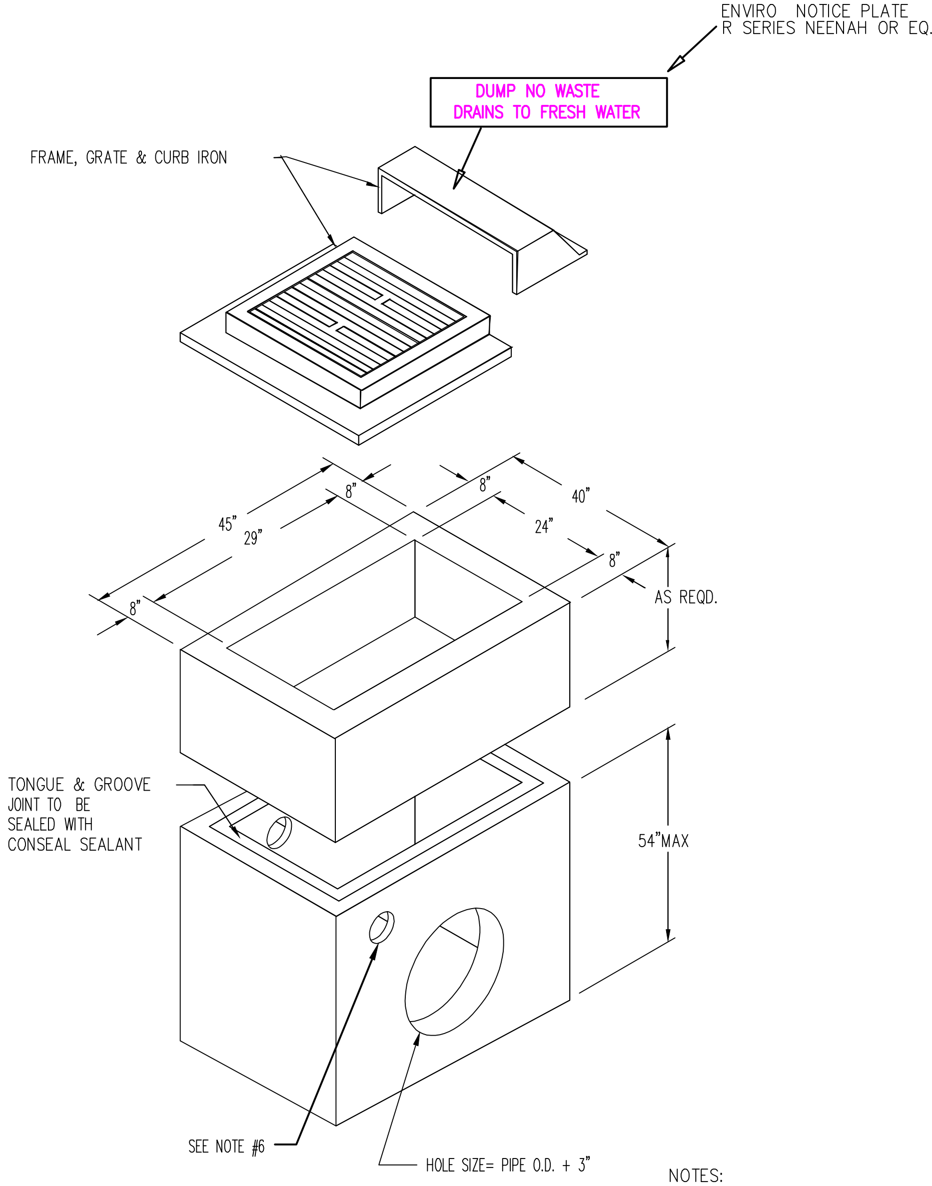
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

TYPICAL DETENTION POND
OUTLET STRUCTURES

DWG NO. DS1

DETAIL USED BY PERMISSION OF SHERMAN DIXIE CONCRETE, INC.



NOTES:

1. NO. 5 REINF. STL. SHALL BE USED THROUGHOUT ON 12" CENTERS
2. ALL REINF. STL. SHALL HAVE A MIN. 2" CLEARANCE TO CONC. FACE
3. NO REINF. STEEL IS REQ'D. IN THE BOTTOM SLAB
4. ALL VERTICAL REINF. STL. SHALL EXTEND 4" INTO BTM. SLAB
5. CURB INLET GRATE SHALL NEENAH CAT. NO. R-3246-A OR EQUAL PRIME AND PAINT CAST IRON INLET TOP.
6. CATCH BASINS / CURB INLETS / DROP INLETS ON GRADE SHALL HAVE 25' OF PERFORATED PIPE IN THE UPHILL DIRECTION AND CATCH BASINS IN A SAG SHALL HAVE 50' OF PERFORATED PIPE EXTENDING IN EACH DIRECTION FOR SUBGRADE DRAINAGE.

GENERAL NOTES:

1. STEEL REINFORCEMENT & CONC. STRENGTH PER ASTM C913.

WEIGHT: BASE-5,658 LB. MAX
RISER-1,150 LB./VERT. FT.

SINGLE CATCH BASIN

NOT TO SCALE

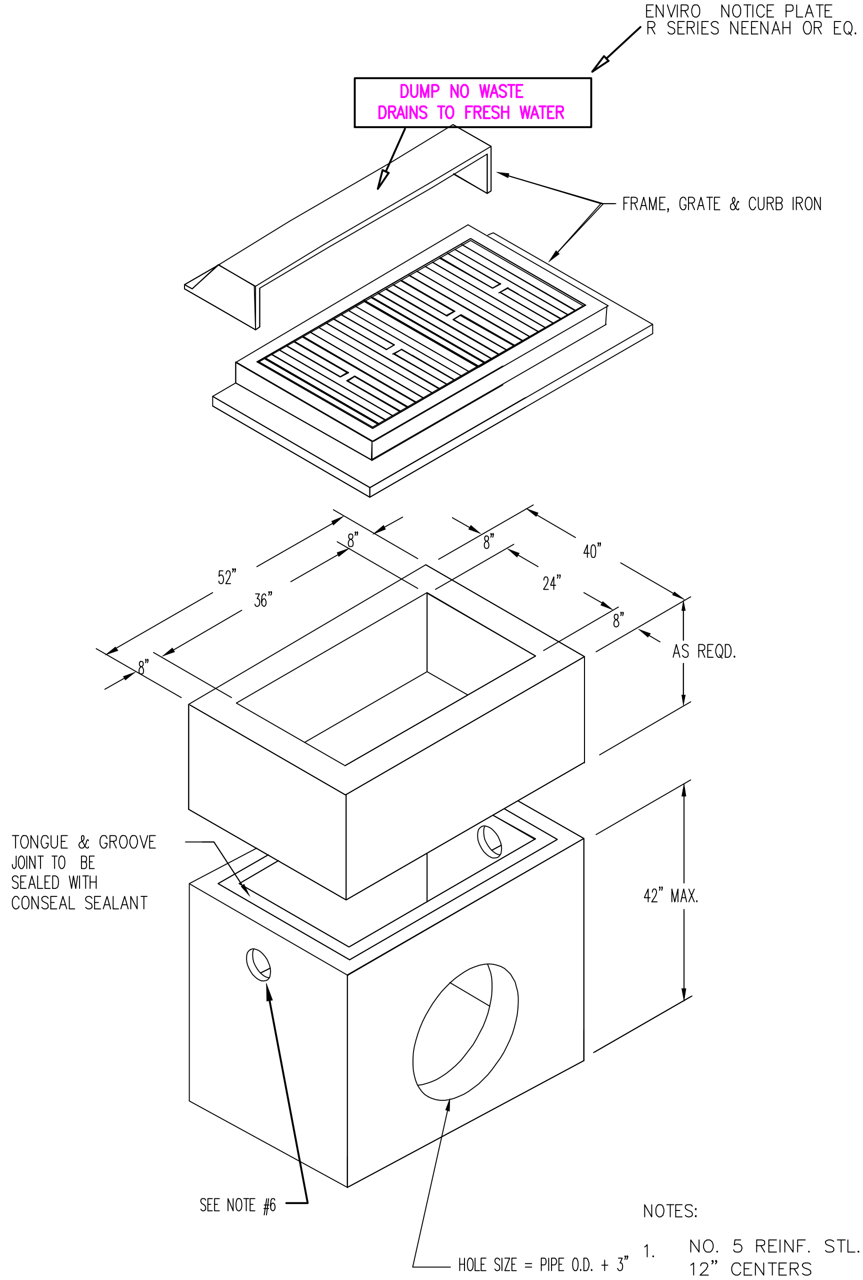
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

SINGLE GRATE INLET
CURB INLET

DWG NO. CI1

DETAIL USED BY PERMISSION OF SHERMAN DIXIE CONCRETE, INC.



NOTES:

1. NO. 5 REINF. STL. SHALL BE USED THROUGHOUT ON 12" CENTERS
2. ALL REINF. STL. SHALL HAVE A MIN. 2" CLEARANCE TO CONC. FACE
3. NO REINF. STEEL IS REQ'D. IN THE BOTTOM SLAB
4. ALL VERTICAL REINF. STL. SHALL EXTEND 4" INTO BTM. SLAB
5. CURB INLET GRATE SHALL NEENAH CAT. NO. R-3246-A OR EQUAL PRIME AND PAINT CAST IRON INLET TOP.
6. CATCH BASINS / CURB INLETS / DROP INLETS ON GRADE SHALL HAVE 25' OF PERFORATED PIPE IN THE UPHILL DIRECTION AND CATCH BASINS IN A SAG SHALL HAVE 50' OF PERFORATED PIPE EXTENDING IN EACH DIRECTION FOR SUBGRADE DRAINAGE.

GENERAL NOTES:

1. STEEL REINFORCEMENT & CONC. STRENGTH PER ASTM C913.

WEIGHT: BASE-3,600 LB. MAX.
RISER-900 LB./VERT. FT.

DOUBLE CATCH BASIN

NOT TO SCALE

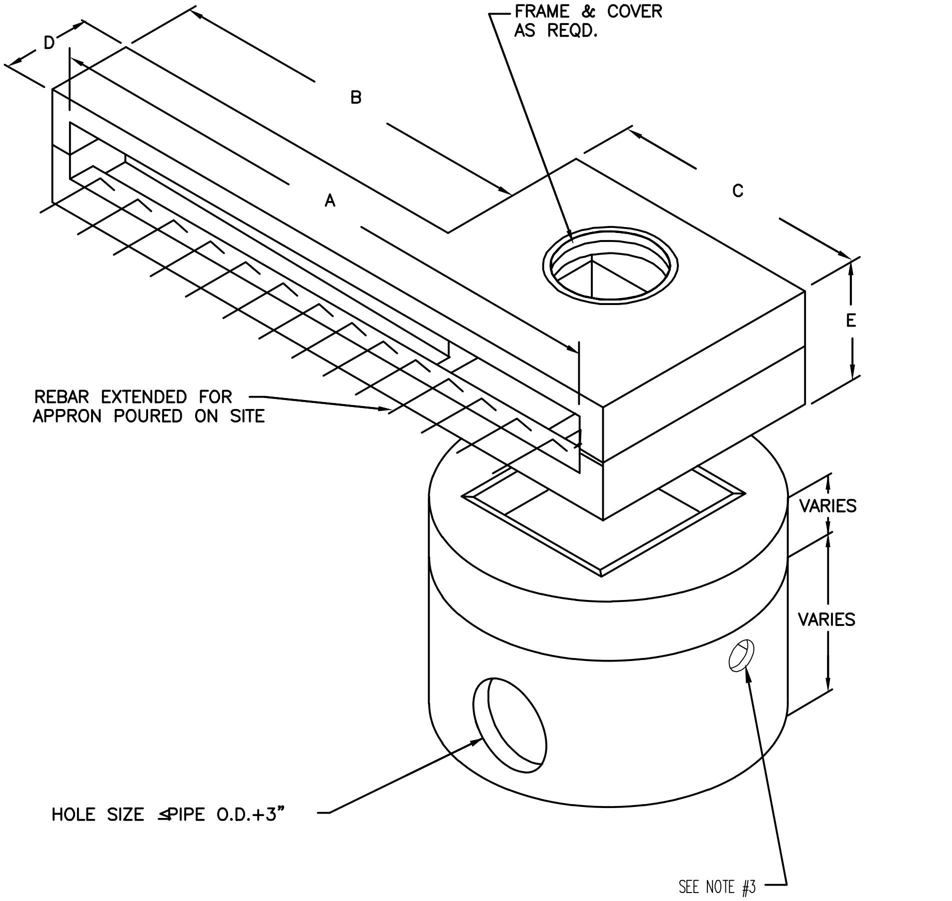
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

DOUBLE GRATE INLET
CURB INLET

DWG NO. CI2

DETAIL USED BY PERMISSION OF SHERMAN DIXIE CONCRETE, INC.



THROAT SIZE	DIMENSIONS						
	A	B	C	D	E	F	WEIGHT
10'	10'	6'	5'	2'	2'-6"	11'	8,658#
15'	15'	11'	5'	2'	2'-11"	16'	12,482#

GENERAL NOTES:

1. ALL MATERIAL, DESIGN, MANUFACTURING, PHYSICAL TEST REQUIREMENTS, FINISH MARKING, INSPECTIONS, REJECTION & REPAIRS TO MEET SPECIFICATIONS FOR PRECAST REINFORCED MANHOLE RISERS & TOPS PER ASTM C-478 LATEST REVISION.

2. BASE WILL BE MANUFACTURED TO MEET "STANDARD SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS" (ASTM C478-ROUND) OR "STANDARD SPECIFICASTION FOR PRECAST CONCRETE

3. CATCH BASINS / CURB INLETS / DROP INLETS ON GRADE SHALL HAVE 25' OF PERFORATED PIPE IN THE UPHILL DIRECTION AND CATCH BASINS IN A SAG SHALL HAVE 50' OF PERFORATED PIPE EXTENDING IN EACH DIRECTION FOR SUBGRADE DRAINAGE.

4. BASE WILL BE MANUFACTURED TO MEET "STANDARD SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS" (ASTM C478-ROUND) OR "STANDARD SPECIFICASTION FOR PRECAST CONCRETE WATER AND WASTEWATER STRUCTURES" (ASTM-C913-SQUARE/RECTANGLE).

* RADIUS TOP SLABS AVAILABLE IN 25' RADIUS

NOT TO SCALE

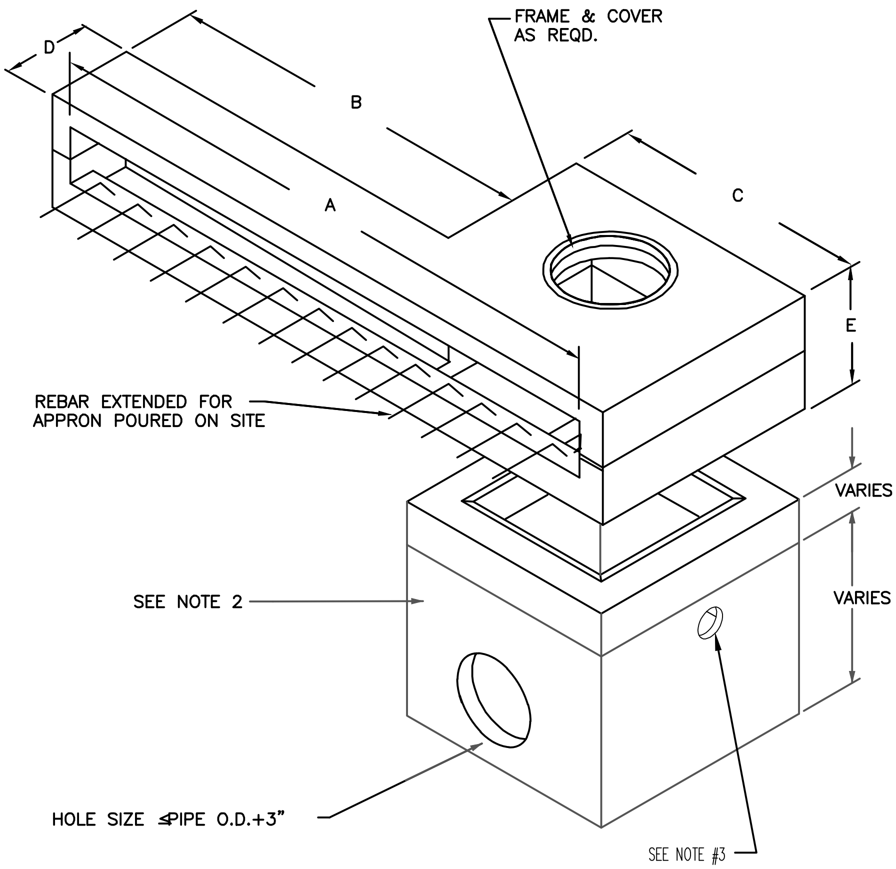
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

THROATED CURB INLET
ROUND BASE

DWG NO. CI3

DETAIL USED BY PERMISSION OF SHERMAN DIXIE CONCRETE, INC.



THROAT SIZE	DIMENSIONS						
	A	B	C	D	E	F	WEIGHT
10'	10'	6'	5'	2'	2'-6"	11'	8,658#
15'	15'	11'	5'	2'	2'-11"	16'	12,482#

* RADIUS TOP SLABS AVAILABLE IN 25' RADIUS

GENERAL NOTES:

1. ALL MATERIAL, DESIGN, MANUFACTURING, PHYSICAL TEST REQUIREMENTS, FINISH MARKING, INSPECTIONS, REJECTION & REPAIRS TO MEET SPECIFICATIONS FOR PRECAST REINFORCED MANHOLE RISERS & TOPS PER ASTM C-478 LATEST REVISION.
2. BASE WILL BE MANUFACTURED TO MEET "STANDARD SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS" (ASTM C478-ROUND) OR "STANDARD SPECIFICASTION FOR PRECAST CONCRETE WATER AND WASTEWATER STRUCTURES" (ASTM-C913-SQUARE/RECTANGLE).
3. CATCH BASINS / CURB INLETS / DROP INLETS ON GRADE SHALL HAVE 25' OF PERFORATED PIPE IN THE UPHILL DIRECTION AND CATCH BASINS IN A SAG SHALL HAVE 50' OF PERFORATED PIPE EXTENDING IN EACH DIRECTION FOR SUBGRADE DRAINAGE.

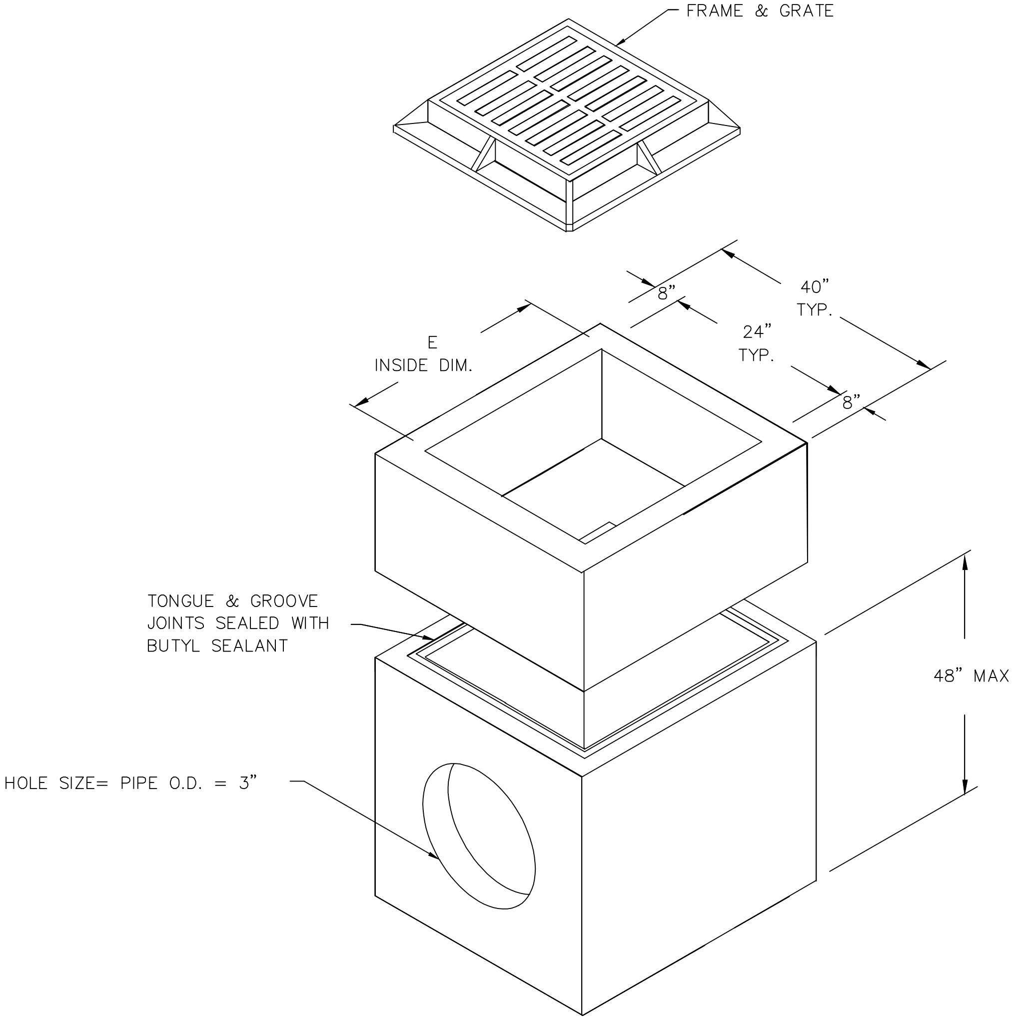
NOT TO SCALE

DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

THROATED CURB INLETS
SQUARE BASE

DWG NO. CI4



GENERAL NOTES:

1. STEEL REINFORCEMENT & CONC. STRENGTH PER ASTM C913.

YARD DRAIN

NOT TO SCALE

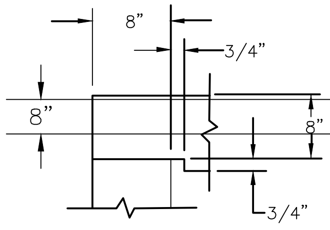
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

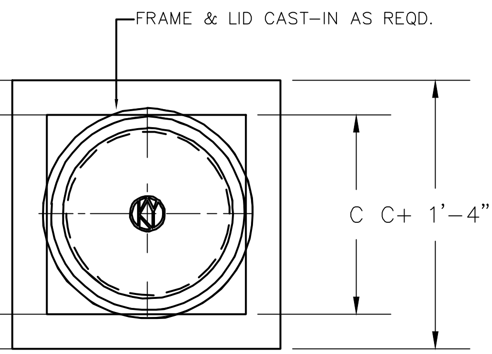
YARD DRAIN

DWG NO. YI1

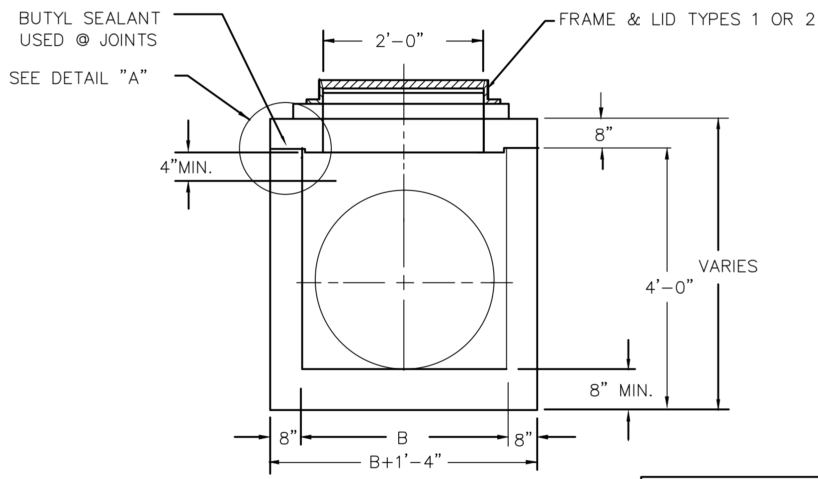
DETAIL USED BY PERMISSION OF SHERMAN DIXIE CONCRETE, INC.



DETAIL "A"



TOP VIEW



INLET SIZE			PIPE
NO.	B	C	MAX. DIA.
1	2'-0"	2'-0"	12"
2			15"
3			18"
4	3'-0"		21"
5		3'-0"	
6		2'-0"	24"
7		3'-0"	

GENERAL NOTES:

1. Steel reinf. & concrete strength per ASTM C 913
2. Base slab thickness may be increased to acc. larger pipe
3. Conforms to KDOH std drawing No RDX-005-02

JUNCTION BOX TYPE B

NOT TO SCALE

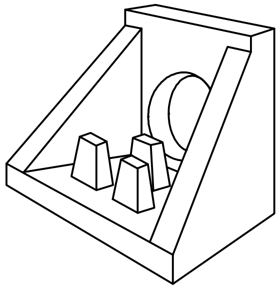
DATE	BY	REVISION

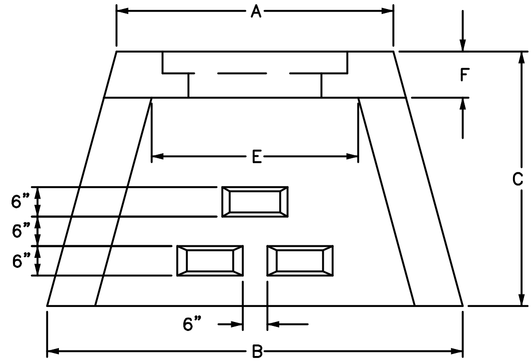
CITY OF SOMERSET
SOMERSET, KENTUCKY

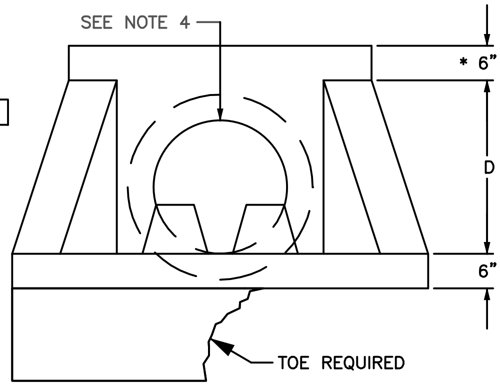
JUNCTION BOX

DWG NO. JB1

DETAIL USED BY PERMISSION OF SHERMAN DIXIE CONCRETE, INC.



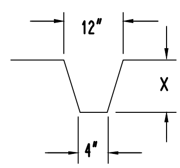




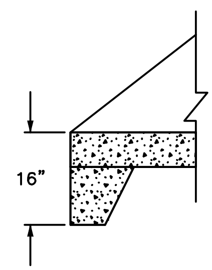
* 0" ON AW HEADWALL

* 6"to 27" ON DW HEADWALL

SIZE	AW	BW	CW	DW
A	32"	48"	80"	99"
B	48"	72"	102"	120"
C	30"	44"	54"	56"
D	26"	36"	54"	60"
E	24"	36"	64"	83"
F	6"	8"	8"	8"
MAX.OPENING	22"	32"	55"	75"
WT/LB	1,380	3,100	8,100	11,400



WEIR DETAIL



TOE DETAIL

GENERAL NOTES:

1.1 MAT OF #5 BARS @ 8" O.C. EACH WAY
WITH EXCEPTION OF OVER OPENING
WHICH WILL BE #5 BARS @ 4" O.C. EACH WAY
2.f'c – 4,500 Psi
3.fy – 60 Ksi
4.PIPE OPENING IN FACE OF WALL WILL EQUAL PIPE I.D.
FOR 12"–36" DIA. PIPE
5.ENERGY DISSIPATORS, AS NEEDED (12"x6"x12")

NOT TO SCALE

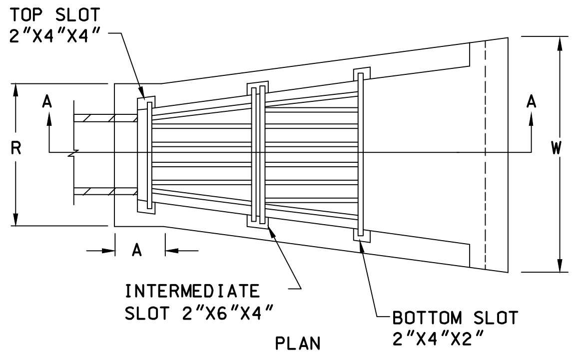
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

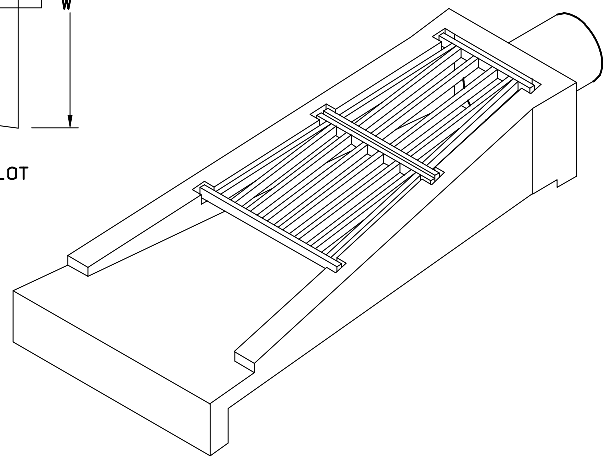
PRECAST HEADWALL
WITH ENERGY DISSIPATORS

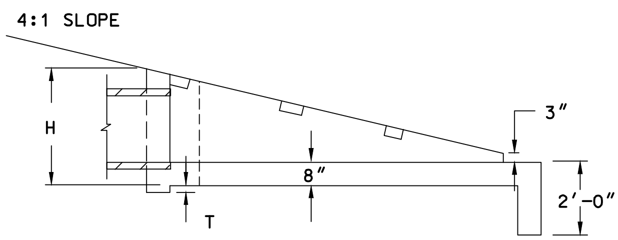
DWG NO. HW1

DETAIL USED BY PERMISSION OF SHERMAN DIXIE CONCRETE, INC.



PLAN





ELEVATION

T= PIPE WALL THICKNESS

DIMENSIONS						
PIPE DIA.	H	L	R	W	A	WEIGHT
18"	3'- 0"	8'- 6"	2'- 11 1/2"	7'- 3"	1'- 3"	7,300lbs.
24"	3'- 7"	10'- 8"	3'- 6 1/2"	8'- 11"	1'- 3"	11,000lbs.
30"	4'- 2"	12'- 10"	4'- 1 1/2"	10'- 7"	1'- 3"	15,400lbs.
36"	4'- 9"	15'- 0"	4'- 8 1/2"	12'- 3"	1'- 3"	20,655lbs.

GRATES	
2'	3'
2	—
—	2
1	2
2	2

GENERAL NOTES:

1. CONCRETE 4500 PSI @ 28 DAYS
2. 2" CONCRETE COVERGRADE 60
3. REINF. #5 REBAR 12"C.C.EA.WAY
4. 3/4" CHAMFER ON ALL EXPOSED EDGES
5. 8" WALL UNLESS OTHERWISE NOTED
6. CONFORMS TO KDOH STD DRAWONG NO RDH-105-05

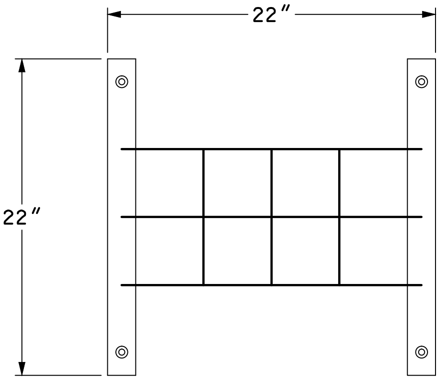
NOT TO SCALE

DATE	BY	REVISION

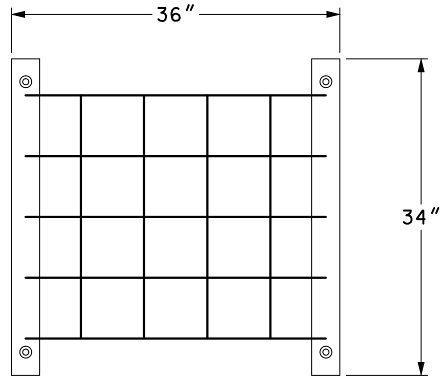
CITY OF SOMERSET
SOMERSET, KENTUCKY

PRECAST SLOPED AND
FLARED BOX INLET/OUTLET

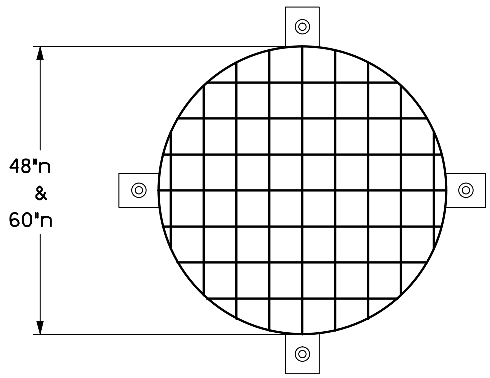
DWG NO. HW2

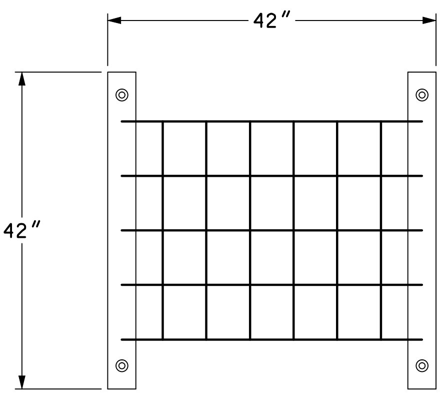


AW HEADWALL

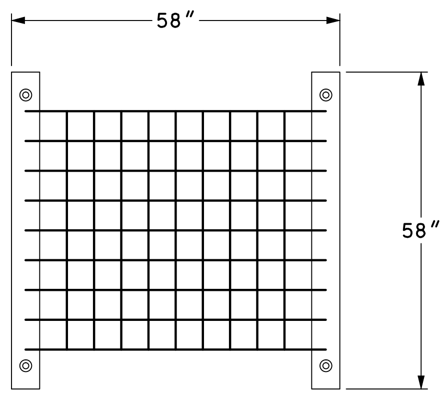


BW HEADWALL
OR
28″ X 28″ BASE





CW HEADWALL (30″ & 36″)
OR
32″ X 32″ BASE



CW HEADWALL (42″ & 48″)
OR
48″ X 48″ BASE

GENERAL NOTES:

1. GRATES: #5 REBAR – 4″ O.C. – BITUMINOUS COATED INSTALLED WITH "REDHEAD" ANCHORS

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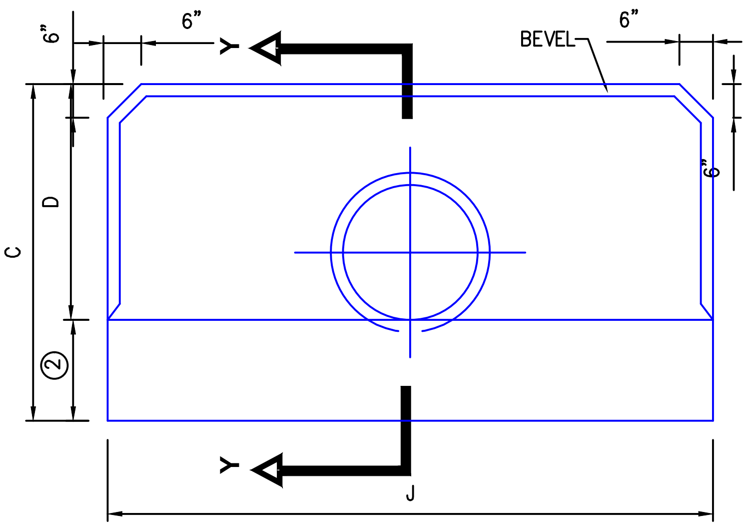
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

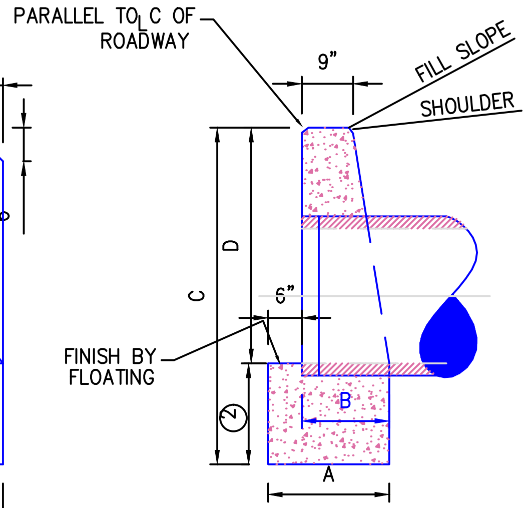
SAFETY/TRASH GRATES FOR HEADWALLS OR CATCH BASINS

DWG NO. HW3

DETAIL USED BY PERMISSION OF SHERMAN DIXIE CONCRETE, INC.



ELEVATION



SECTION Y-Y

HEADWALL TYPE	DIAMETER OF PIPE	HEADWALL DIMENSIONS									CUBIC YARDS CONCRETE FOR ONE HEADWALL ②	
		A	B	C	D	E	F	G	H ①	J	EARTH	ROCK
STANDARD	12"	1'-8"	1'-2"	4'-0"	2'-6"	–	–	–	–	6'-0"	1.05	0.87
	15"	1'-8 1/2"	1'-2 1/2"	4'-3"	2'-9"	–	–	–	–	6'-9"	1.25	1.03
	18"	1'-9"	1'-3"	4'-6"	3'-0"	–	–	–	–	7'-6"	1.48	1.23
	21"	1'-9 1/2"	1'-3 1/2"	4'-9"	3'-3"	–	–	–	–	8'-3"	1.73	1.46
	24"	1'-10"	1'-4"	5'-0"	3'-6"	–	–	–	–	9'-0"	1.99	1.69
	27"	1'-10 1/2"	1'-4 1/2"	5'-3"	3'-9"	–	–	–	–	9'-9"	2.27	1.93
RAISED	12"	1'-8"	1'-2"	4'-6"	3'-0"	–	–	–	–	7'-6"	1.45	1.23
	15"	1'-8 1/2"	1'-2 1/2"	4'-9"	3'-3"	–	–	–	–	8'-3"	1.69	1.43
	18"	1'-9"	1'-3"	5'-0"	3'-6"	–	–	–	–	9'-0"	1.96	1.67
	21"	1'-9 1/2"	1'-3 1/2"	5'-3"	3'-9"	–	–	–	–	9'-9"	2.25	1.93
	24"	1'-10"	1'-4"	5'-6"	4'-0"	–	–	–	–	10'-6"	2.54	2.19
	27"	1'-10 1/2"	1'-4 1/2"	5'-9"	4'-3"	–	–	–	–	11'-3"	2.88	2.49
STANDARD ELL	12"	1'-8"	1'-2"	4'-0"	2'-6"	2'-0"	3'-8"	3'-0"	2'-6"	4'-8"	1.19	0.99
	15"	1'-8 1/2"	1'-2 1/2"	4'-3"	2'-9"	2'-3"	3'-11 1/2"	3'-6"	2'-9"	5'-2 1/2"	1.42	1.19
	18"	1'-9"	1'-3"	4'-6"	3'-0"	2'-6"	4'-3"	4'-0"	3'-0"	5'-9"	1.67	1.41
	21"	1'-9 1/2"	1'-3 1/2"	4'-9"	3'-3"	2'-9"	4'-6 1/2"	4'-6"	3'-3"	6'-3 1/2"	1.93	1.63
	24"	1'-10"	1'-4"	5'-0"	3'-6"	3'-0"	4'-10"	5'-0"	3'-6"	6'-10"	2.22	1.89
	27"	1'-10 1/2"	1'-4 1/2"	5'-3"	3'-9"	3'-3"	5'-1 1/2"	5'-6"	3'-9"	7'-4 1/2"	2.52	2.15
RAISED ELL	12"	1'-8"	1'-2"	4'-6"	3'-0"	2'-9"	4'-5"	3'-9"	3'-3"	5'-5"	1.62	1.37
	15"	1'-8 1/2"	1'-2 1/2"	4'-9"	3'-3"	3'-0"	4'-8 1/2"	4'-3"	3'-6"	5'-11 1/2"	1.88	1.59
	18"	1'-9"	1'-3"	5'-0"	3'-6"	3'-3"	5'-0"	4'-9"	3'-9"	6'-6"	2.16	1.85
	21"	1'-9 1/2"	1'-3 1/2"	5'-3"	3'-9"	3'-6"	5'-3 1/2"	5'-3"	4'-0"	7-0 1/2"	2.47	2.12
	24"	1'-10"	1'-4"	5'-6"	4'-0"	3'-9"	5'-7"	5'-9"	4'-3"	7'-7"	2.79	2.41
	27"	1'-10 1/2"	1'-4 1/2"	5'-9"	4'-3"	4'-0"	5'-10 1/2"	6'-3"	4'-6"	8'-1 1/2"	3.14	2.72

NOT TO SCALE

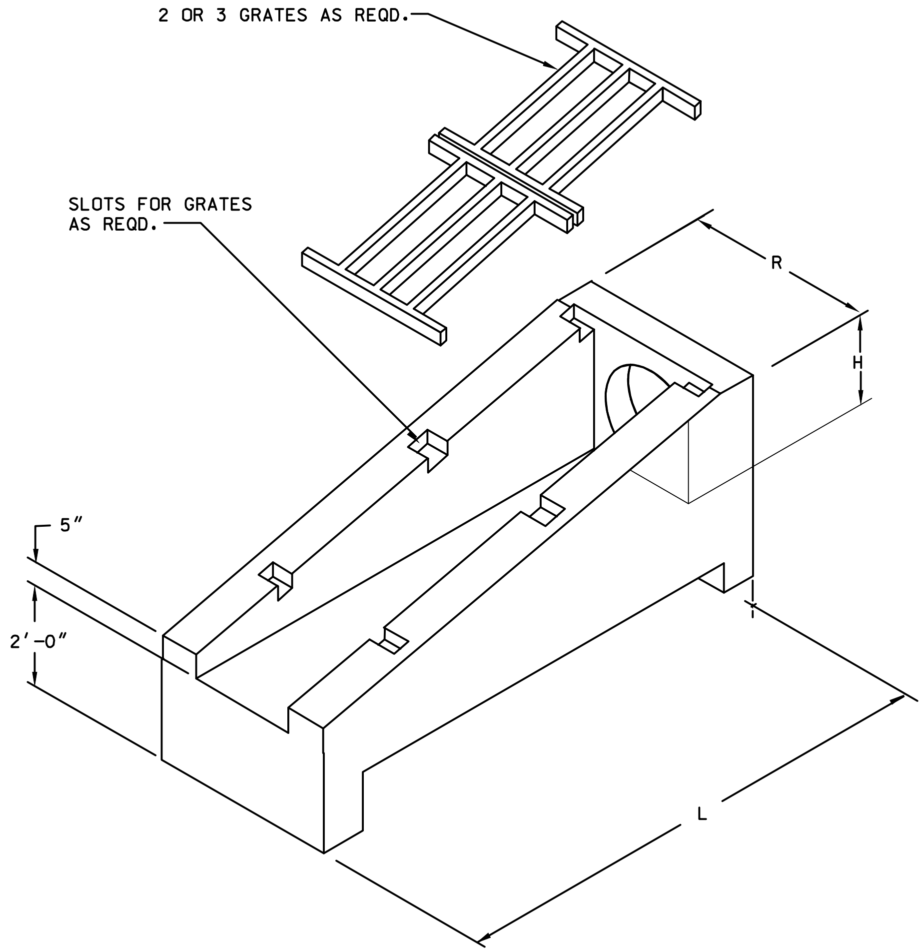
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

STRAIGHT HEADWALL

DWG NO. HW4

SHOULD PRECAST BE USED, PRECAST SHALL CONFORM TO LATEST KYTC DETAIL.



DIMENSIONS				
PIPE DIA.	H	L	R	WEIGHT
15″ & 18″	2′- 3 1/2″	8′- 2″	3′- 3″	4,860#
24″	2′- 10″	10′- 1 1/2″	3′- 10″	8,000#

GRATES REQD.	
2′- 0″	3′- 0″
1	1
2	1

GENERAL NOTES:

1. CONCRETE 4,500 PSI@ 28 DAYS
2. 2″ MIN CONCRETE COVER
3. REINFORCEMENT #5 REBAR 6″ C.C. EA. WAY
4. 8″ WALLS UNLESS OTHERWISE NOTED
5. 3/4″ CHAMFER ON ALL EXPOSED EDGES
6. CONFORMS TO KDOH STD DRAWING NO. RDH-100-04

NOT TO SCALE

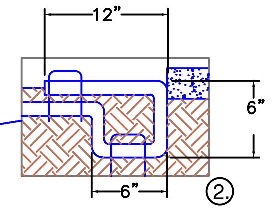
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

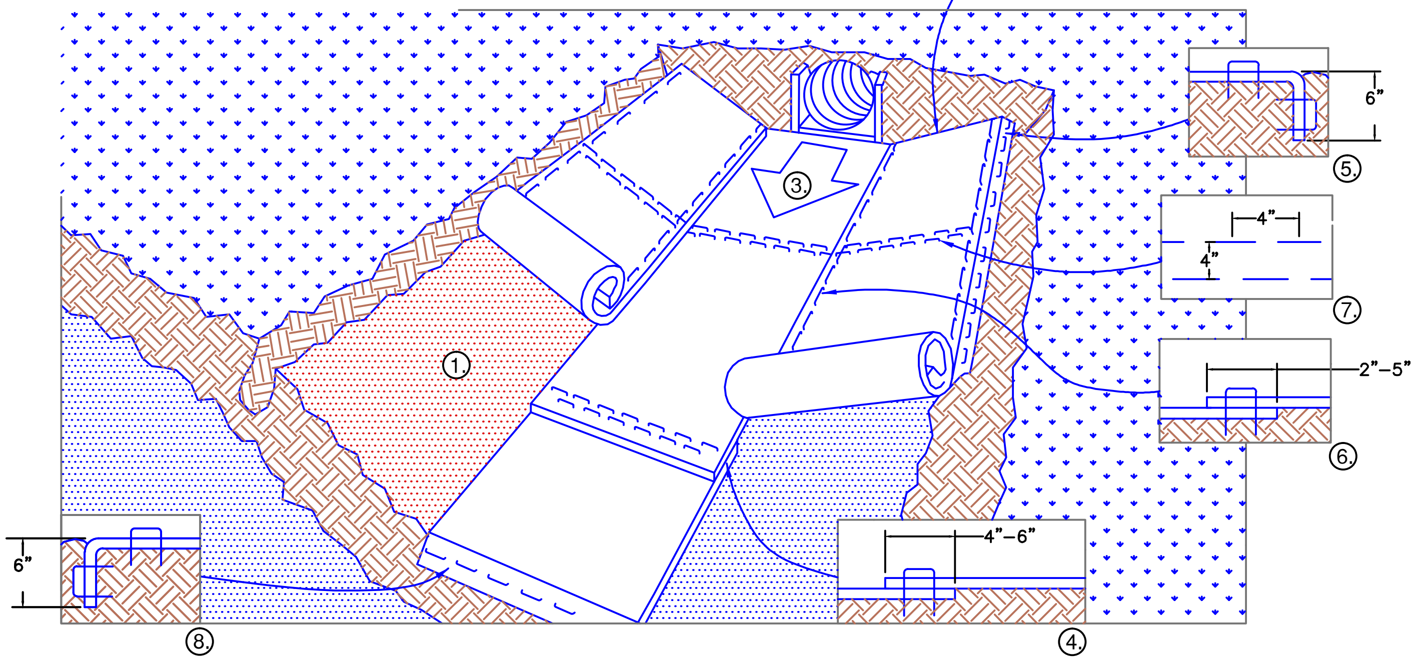
PRECAST SLOPED AND
PARALLEL INLET/OUTLET

DWG NO. HW5

DETAIL USED BY PERMISSION OF SHERMAN DIXIE CONCRETE, INC.

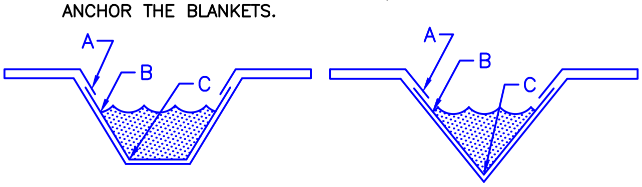


CHANNEL INSTALLATION



1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL–O–SEED DO NOT SEED PREPARED AREA. CELL–O–SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE CHANNEL BY ANCHORING THE BLANKET IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH WITH APPROXIMATELY 12" (30 CM) OF BLANKET EXTENDED BEYOND THE UP–SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMAPCT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30 CM) PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30 CM) ACROSS THE WIDTH OF THE BLANKET.
3. ROLL CENTER BLANKET IN DIRECTION OF WATER FLOW IN BOTTOM OF CHANNEL. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM , STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. PLACE CONSECUTIVE BLANKETS END OVER END (SHINGLE STYLE) WITH A 4" – 6" (10 CM –15 CM) OVERLAP. USE A DOUBLE ROW OF STAPLES STAGGERED 4" (10 CM) APART AND 4" (10 CM) ON CENTER TO SECURE BLANKETS.
5. FULL LENGTH EDGE OF BLANKETS AT TOP OF SIDE SLOPES MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
6. ADJACENT BLANKETS MUST BE OVERLAPPED APPROXIMATELY 2" – 5" (5 CM –12.5 CM) (DEPENDING ON BLANKET TYPE) AND STAPLED.
7. IN HIGH FLOW CHANNEL APPLICATIONS, A STAPLE CHECK SLOT IS RECOMMENDED AT 30 TO 40 FOOT (9 M – 12 M) INTERVALS. USE A DOUBLE ROW OF STAPLES STAGGERED 4" (10 CM) APART AND 4" (10 CM) ON CENTER OVER ENTIRE WIDTH OF THE CHANNEL.
8. THE TERMINAL END OF THE BLANKETS MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.

NOTE: * IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 CM) MAY BE NECESSARY TO PROPERLY ANCHOR THE BLANKETS.



CRITICAL POINTS

A. OVERLAPS AND SEAMS
B. PROJECTED WATER LINE
C. CHANNEL BOTTOM/SIDE SLOPE VERTICES

NOTE:

* HORIZONTAL STAPLE SPACING SHOULD BE ALTERED IF NECESSARY TO ALLOW STAPLES TO SECURE THE CRITICAL POINTS ALONG THE CHANNEL SURFACE.

** IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 cm) MAY BE NECESSARY TO PROPERLY ANCHOR THE BLANKETS.

NOT TO SCALE

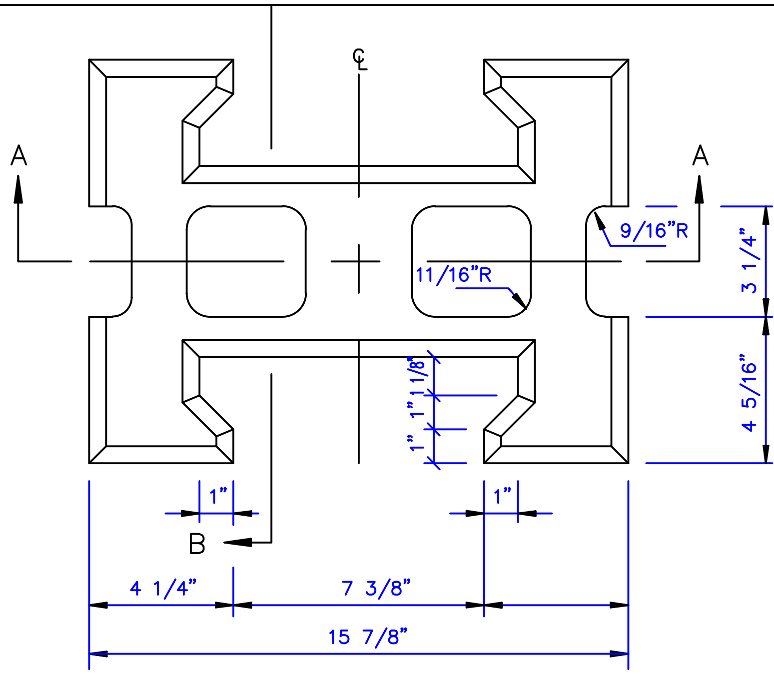
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

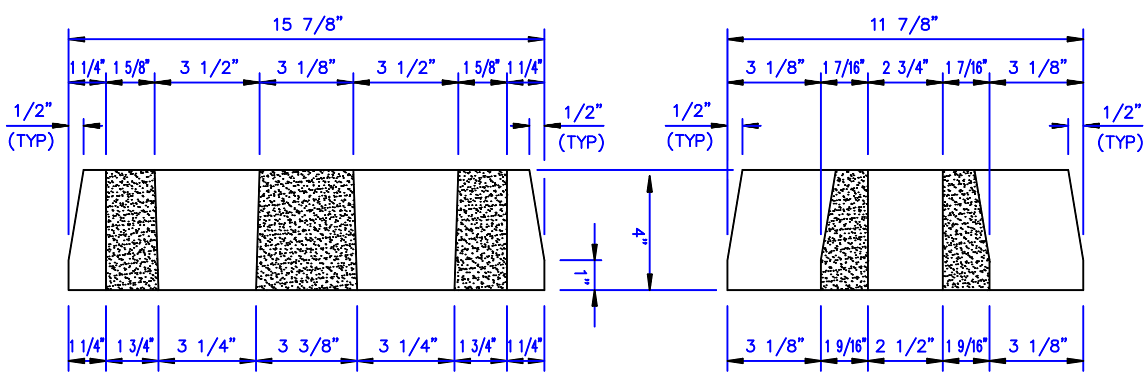
REINFORCED CHANNEL INSTALLATION

DWG NO. ET1

DETAIL USED BY PERMISSION OF NORTH AMERICAN GREEN.



TOP VIEW

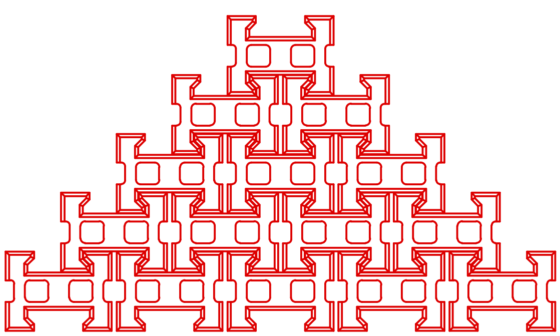


SECTION A–A

SECTION B–B

ARMORTEC ARMORLOC BLOCK DETAIL
(CL 3510 UNIT OR EQ.)

NOT TO SCALE



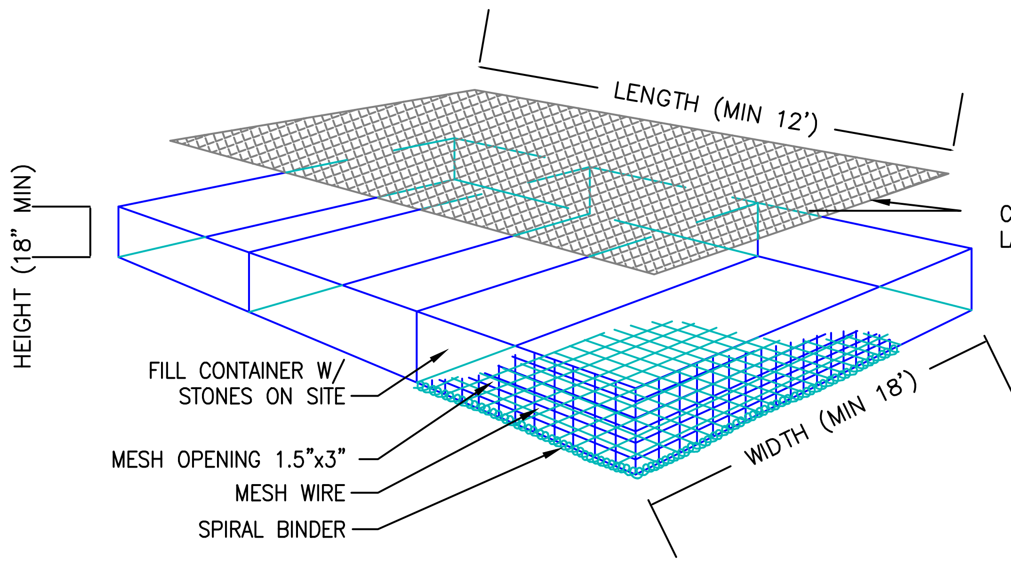
TYPICAL PARTIAL INSTALLATION PATTERN

DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

EROSION CONTROL BLOCK
END TREATMENT

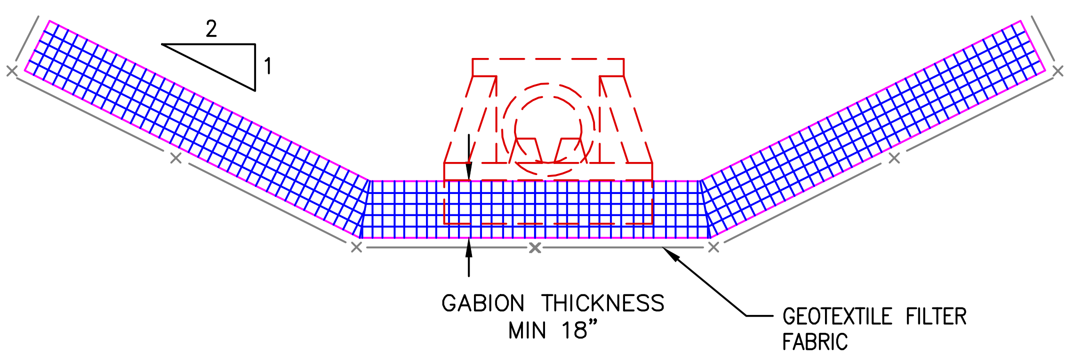
DWG NO. ET2



GABION MATTRESS

NOTES:

1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
2. FOR OUTLETS OF 36 INCHES (WIDTH OR DIAMETER) OR LESS, THE LENGTH OF THE GABION MATTRESS SHALL BE 12 FEET. FOR OUTLETS GREATER THAN 36 INCHES, THE GABION MATTRESS LENGTH SHALL BE 4 TIMES THE WIDTH OR HEIGHT OF THE OUTLET, WHICHEVER IS GREATER.
3. FOR OUTLETS OF 36" (WIDTH OR DIAMETER) OR LESS WIDTH SHALL BE 18'+DIAMETER OF OUTLET. FOR OUTLET 36" OR GREATER THE WIDTH SHALL BE 2XLENGTH+DIAMETER OF PIPE.



NOT TO SCALE

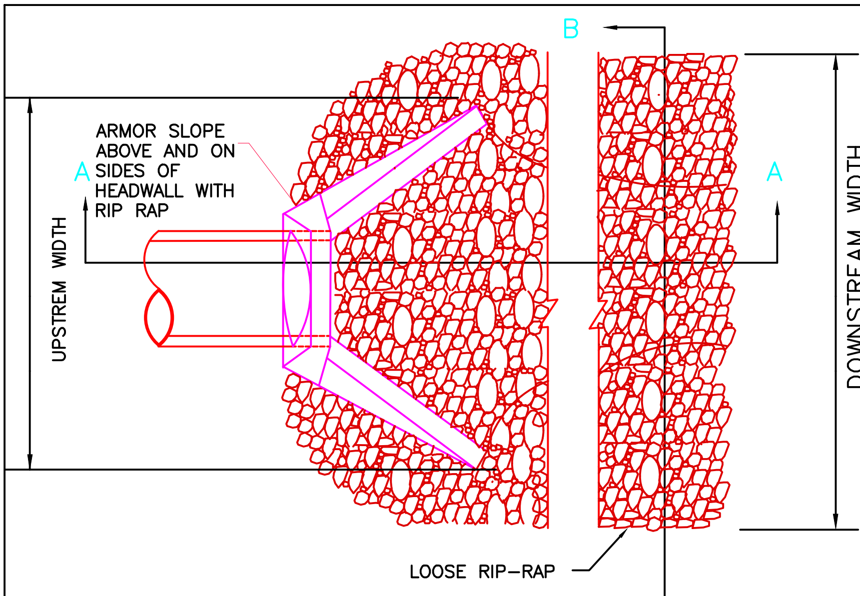
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

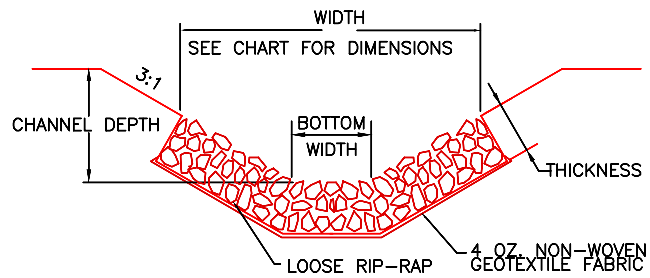
RIP RAP/GABION MATTRESS
END TREATMENT

DETAIL MODIFIED FROM KYTC BY BTM ENGINEERING

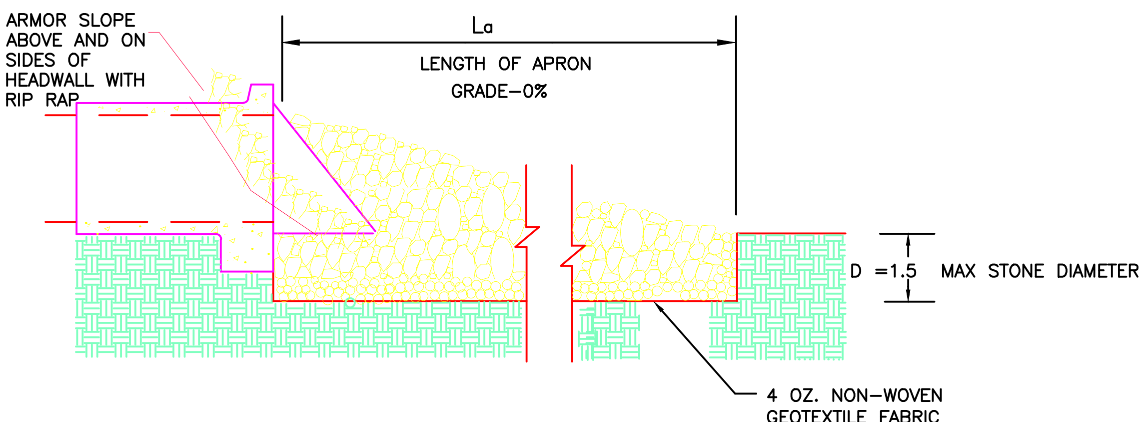
DWG NO. ET3



PLAN
NOT TO SCALE



SECTION B-B
NOT TO SCALE



SECTION A-A
NOT TO SCALE

TABLE - ROCK OUTLET PROTECTION APRON DIMENSIONS

PIPE Do	UPSTREAM WIDTH	DOWNSTREAM WIDTH	La*	THICKNESS	GRADED RIP-RAP d50 (AVERAGE ROCK DIAMETER)
8"	3'	10'	6'	12"	3"
12"	3'	13'	12'	18"	6"
18"	5'	18'	16'	24"	9"
24"	6'	22'	20'	24"	9"
30"	8'	24'	22'	24"	9"
36"	9'	27'	24'	30"	12"
42"	10'	30'	26'	36"	18"
48"	14'	32'	32'	36"	18"

* HIGH FLOW PRESSURE HEAD CULVERTS

* DETAIL MODIFIED FROM USDA/NRCS TYPICAL DETAIL FRO ROCK OUTLET PROTECTION BELOW A CULVERT.

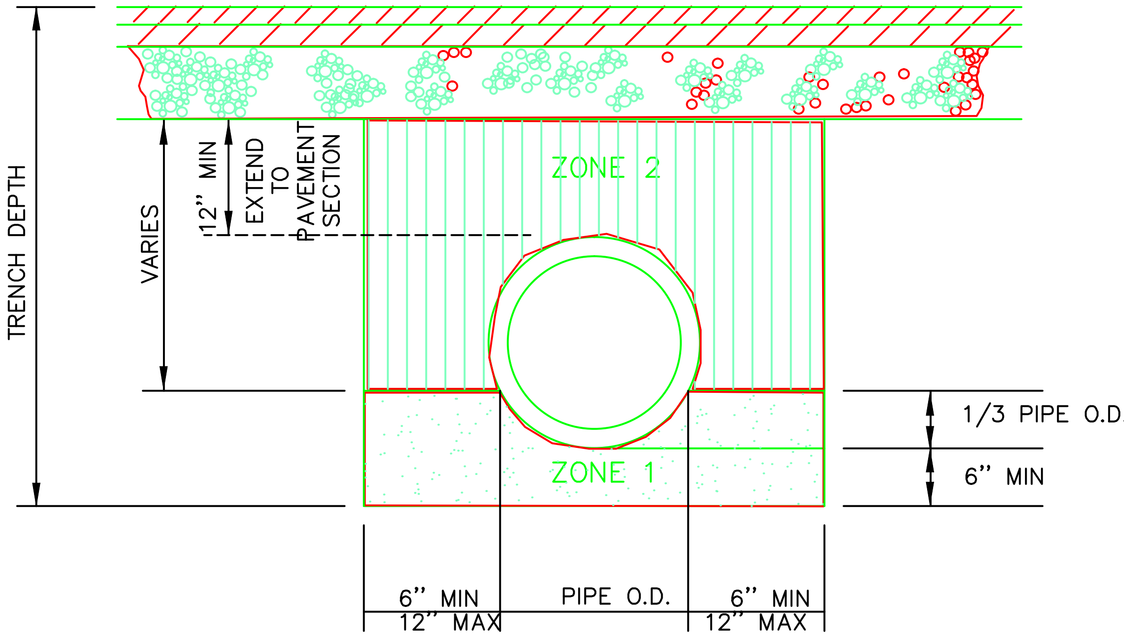
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

RIP RAP
END TREATMENT

DWG NO. ET4

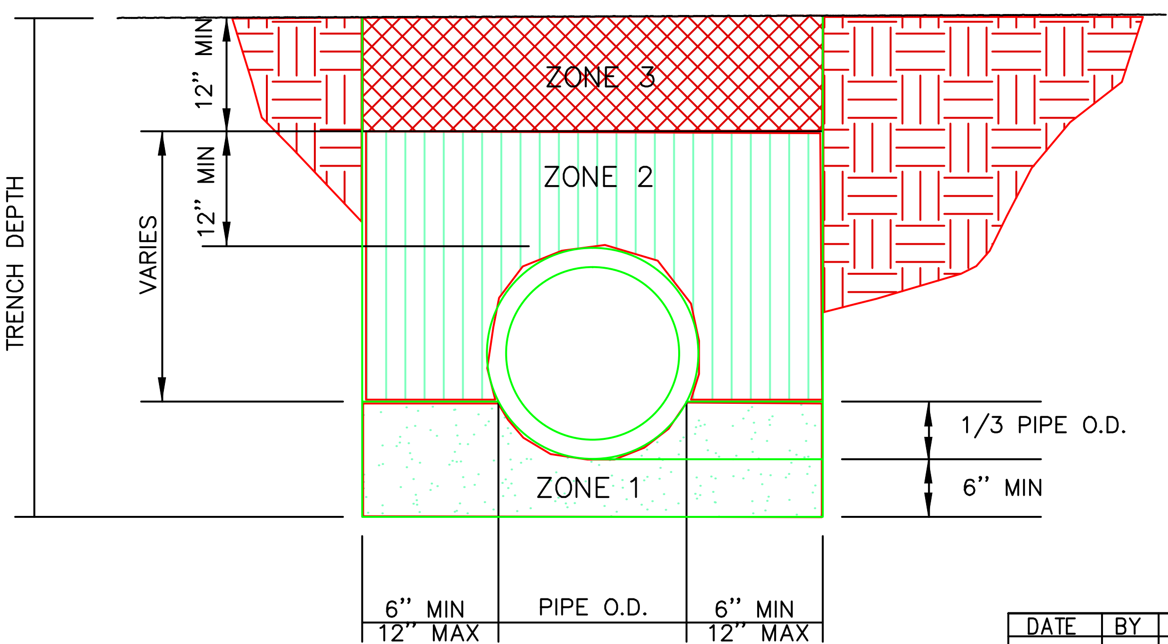
DETAIL MODIFIED FROM USDA/NRCS



STORM SEWER TRENCH IN PAVED AREAS

ZONE 2 – COMPACTED KTC NO. 9 STONE
(FOR PIPING UNDER
AND WITHIN 3' OF PAVED AREAS.)

ZONE 1 – PIPE BEDDING MATERIAL, KTC NO. 9 STONE



STORM SEWER TRENCH IN NON–PAVED AREAS

ZONE 3 – COMPACTED SOIL BACKFILL
(COMPACT SOIL IN 6" LIFTS)

ZONE 2 – COMPACTED SELECT MATERIAL KTC #9 OR EQ.

ZONE 1 – PIPE BEDDING MATERIAL, KTC NO. 9 STONE

NOT TO SCALE

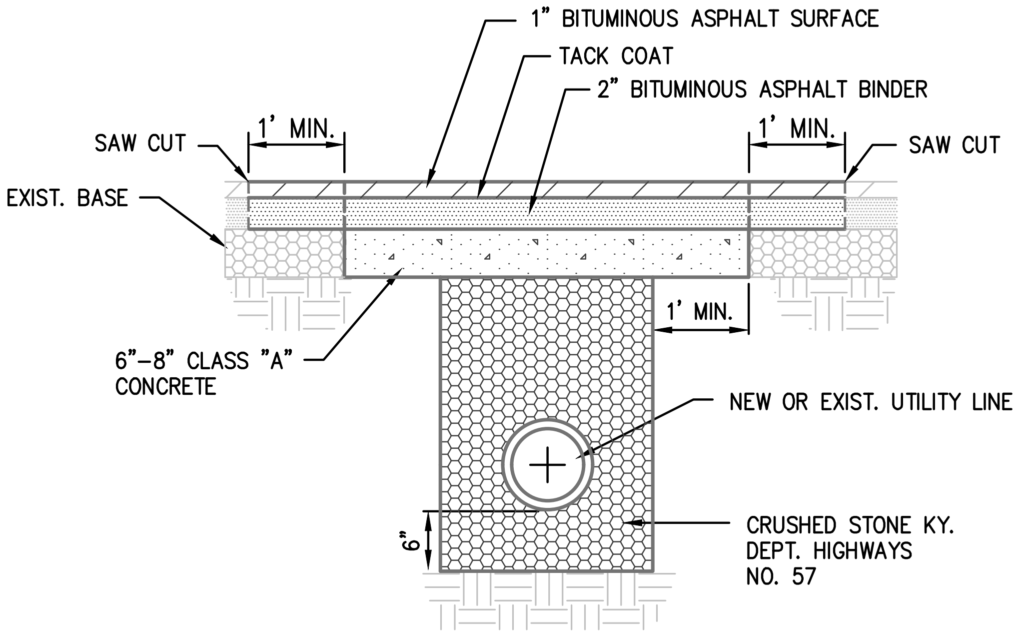
DETAIL MODIFIED FROM KYTC

DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

STORM SEWER
UTILITY TRENCH

DWG NO. ST1



* SURFACE: 1" . . . COMPACTED ASPHALT CONCRETE SURFACE, CLASS I, OR EQUIVALENT 0.1 GALLON PER SQUARE YARD SS–1H TACK COAT.

* BASE: 2" . . . COMPACTED ASPHALT BINDER, CLASS I OR EQUIVALENT.

DATE	BY	REVISION

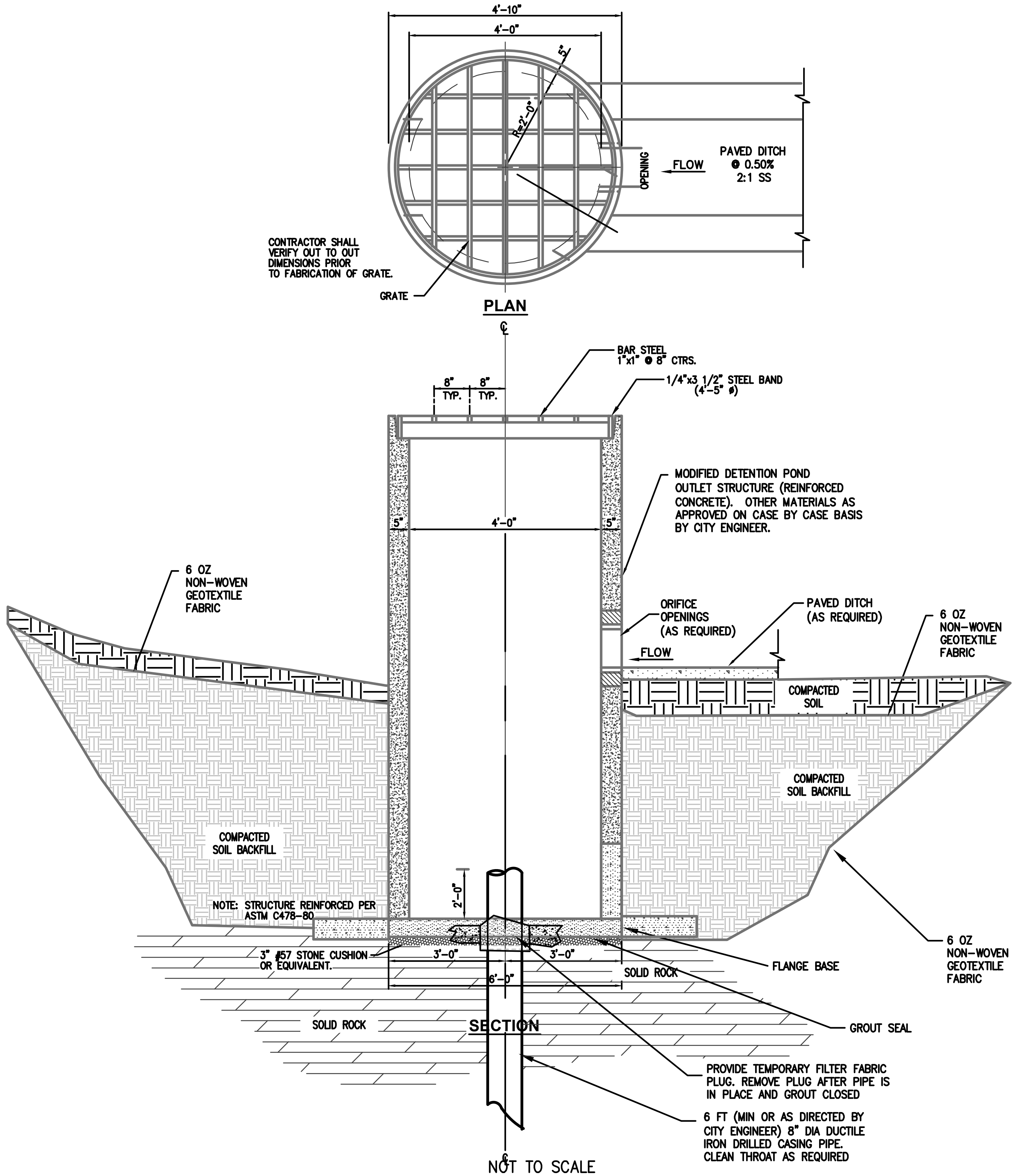
CITY OF SOMERSET
SOMERSET, KENTUCKY

UTILITY TRENCH
RESTORATION

DWG NO. UT1

NOT TO SCALE

DETAIL BY BTM ENGINEERING



NOT TO SCALE

NOTE: CONTRACTOR/DEVELOPER SHALL BE RESPONSIBLE FOR PERMITTING OF CLASS V INJECTION WELL.

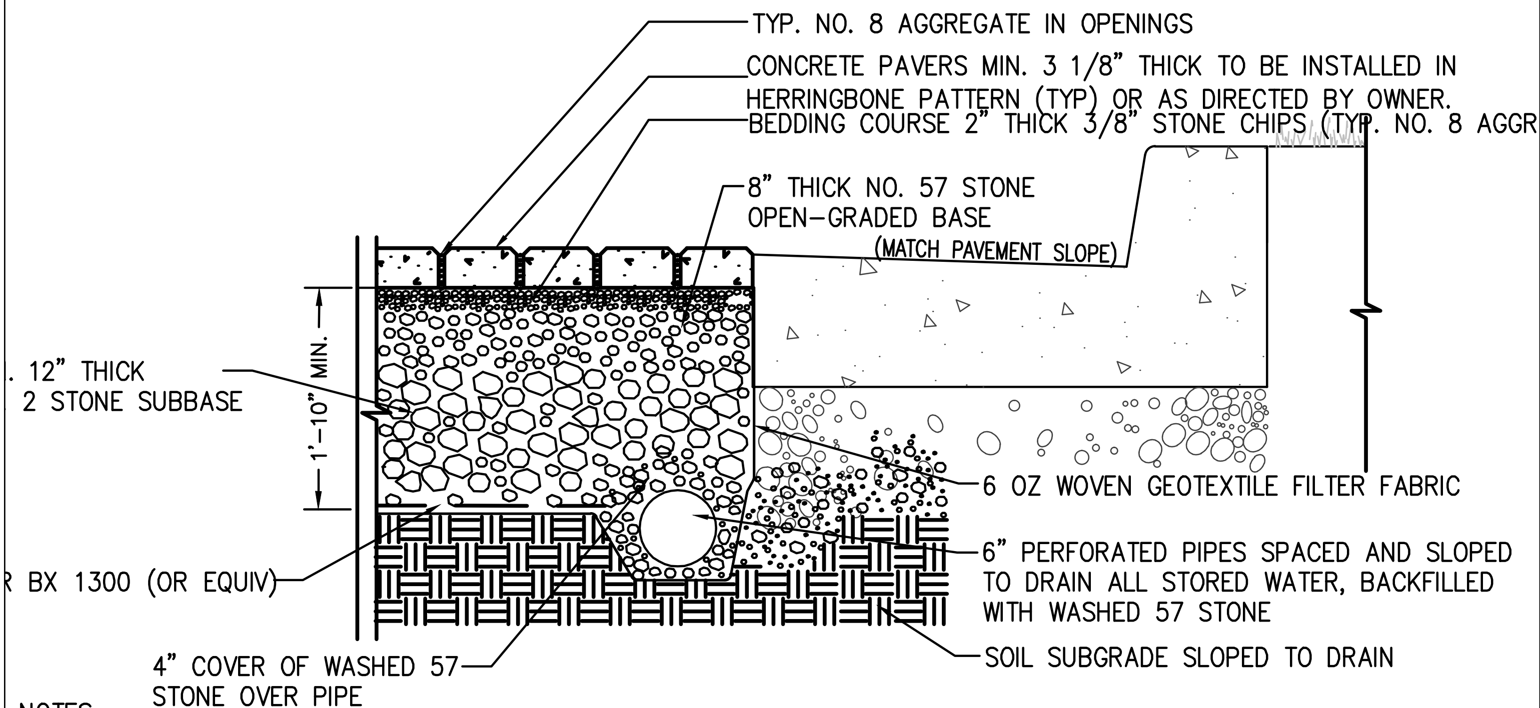
DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

TYPICAL DETENTION POND TO SINKHOLE (DRY WELL)

DETAIL BY BTM ENGINEERING

DWG NO. DW1



NOTES:

1. 6 oz WOVEN GEOTEXTILE FILTER FABRIC TO BE PLACED BETWEEN THE PAVERS AND THE BEDDING COURSE AND #2 STONE AND COMPACTED SUBGRADE FOR SEPARATION.

2. AT CONCRETE CURB AND GUTTER THE CONTRACTOR SHALL WRAP THE #2 STONE UP WITH WOVEN GEOTEXTILE FILTER FABRIC TO SEPARATE DGA FROM PERMEABLE PAVEMENT DESIGN.

3. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. REFER TO SPECIFICATIONS AND ICPI HANDBOOK.

4. PRIOR TO PLACEMENT OF PERMEABLE PAVERS MASS GRADING ACTIVITIES AND SOIL DISTURBING ACTIVITIES SHALL HAVE BEEN COMPLETED, CONDUITS SHALL BE INSTALLED, STORM SEWERS AND SANITARY SEWERS INSTALLED, AND CONSTRUCTION TRAFFIC SHALL BE LIMITED. CARE SHALL BE TAKEN TO LIMIT THE TRACKING OF SOILS ONTO THE PAVER AREA. ANY AREA THAT HAS BEEN COMPROMISED PER THE OWNERS'S REPRESENTATIVE, ENGINEER, OR ARCHITECT SHALL BE REMOVED, THE STONE CLEANED AND/OR REPLACED AND THE PAVERS RESET AT NO ADDITIONAL COST TO THE OWNER, ENGINEER, OR ARCHITECT.

5. COMPACT STONE IN MAXIMUM 8" LOOSE LIFTS TO EQUIVALENT 95% DENSITY.

DATE	BY	REVISION

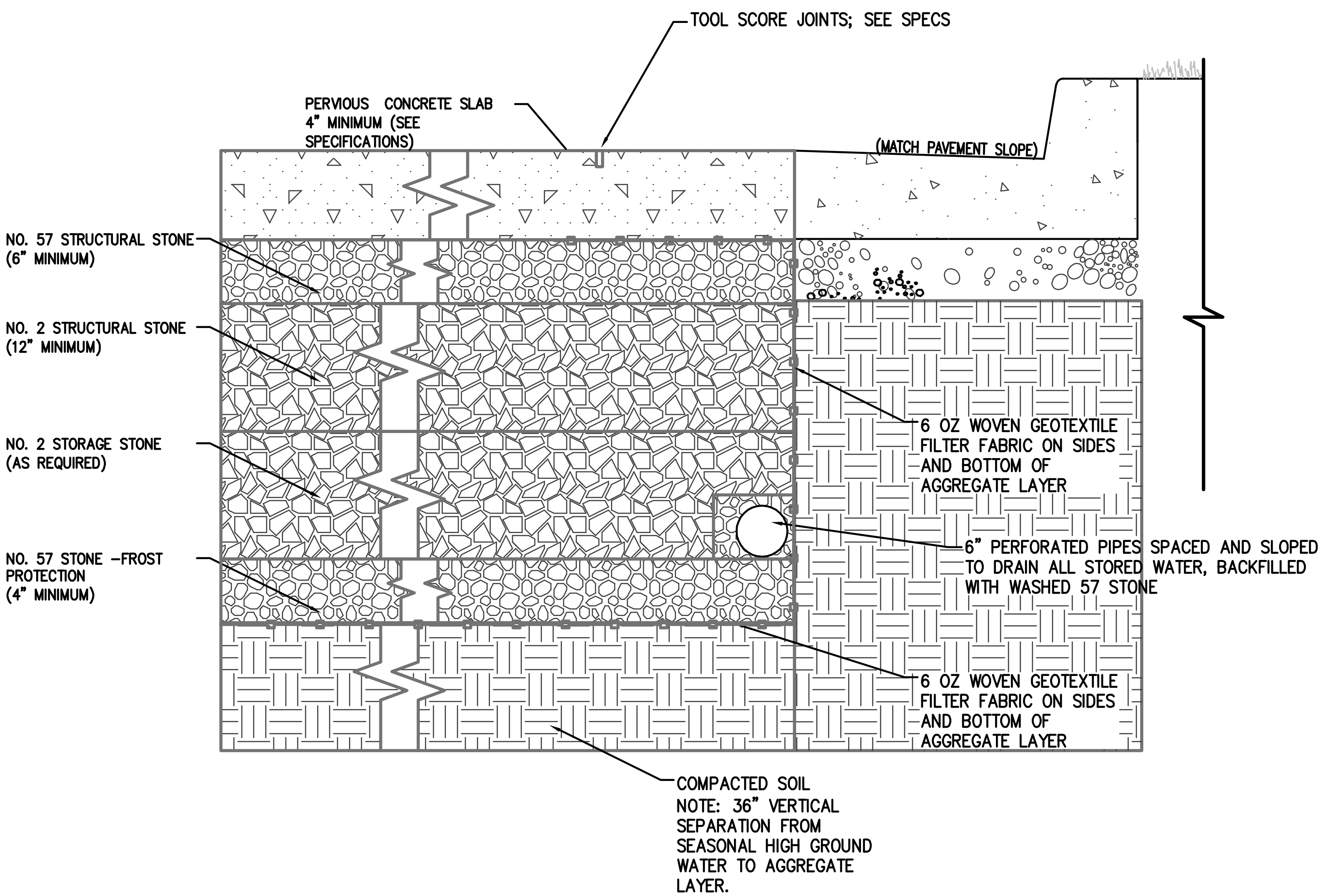
CITY OF SOMERSET
SOMERSET, KENTUCKY

VEHICULAR PERMEABLE
PAVER BLOCK DETAIL

NOT TO SCALE

DWG NO. VPP1

DETAIL MODIFIED FROM ICPI



DATE	BY	REVISION

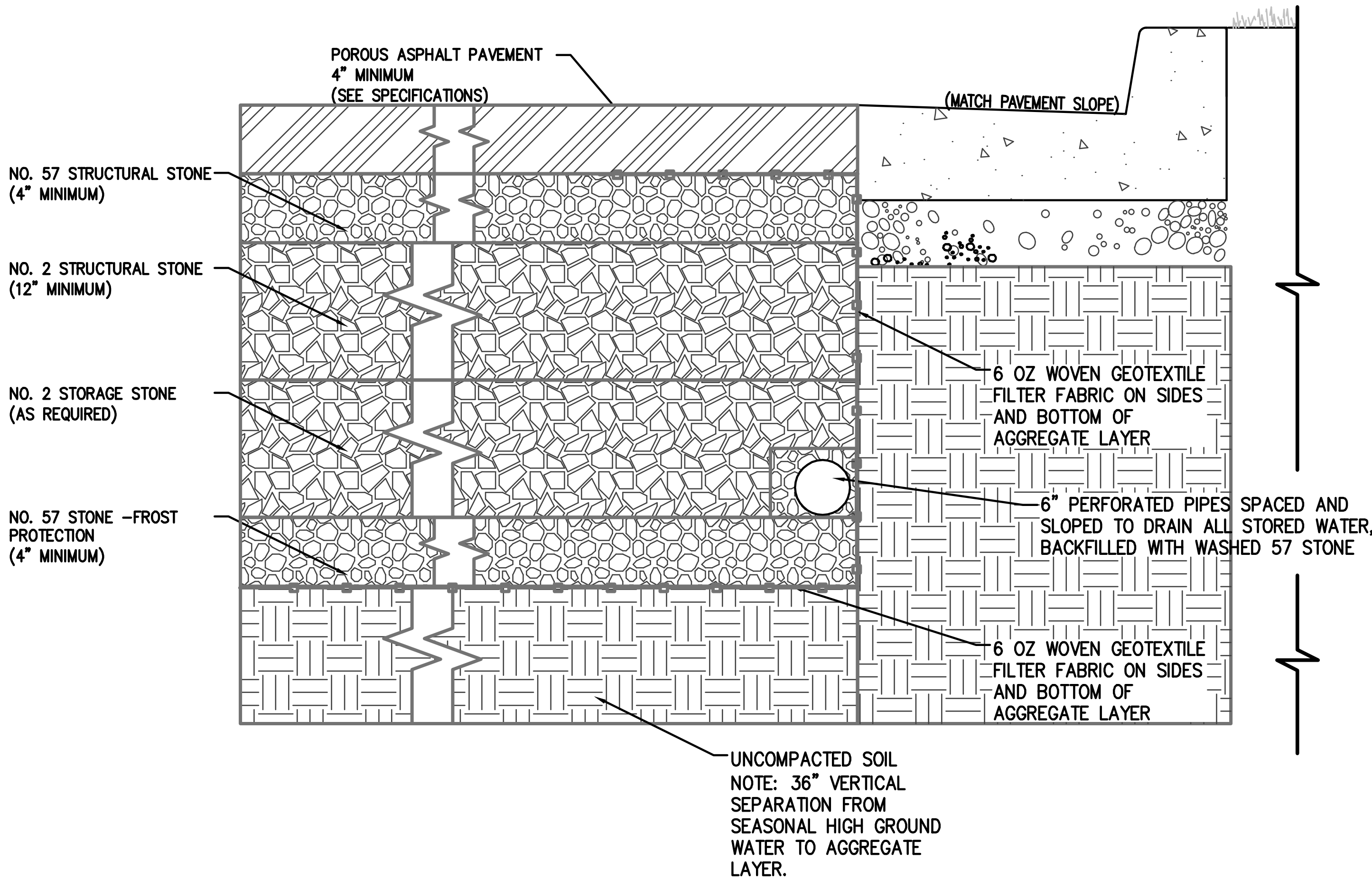
CITY OF SOMERSET
SOMERSET, KENTUCKY

VEHICULAR PERVIOUS
CONCRETE DETAIL

NOT TO SCALE

DWG NO. VPP2

DETAIL BY MODIFIED FROM ACPA DETAILS



DATE	BY	REVISION

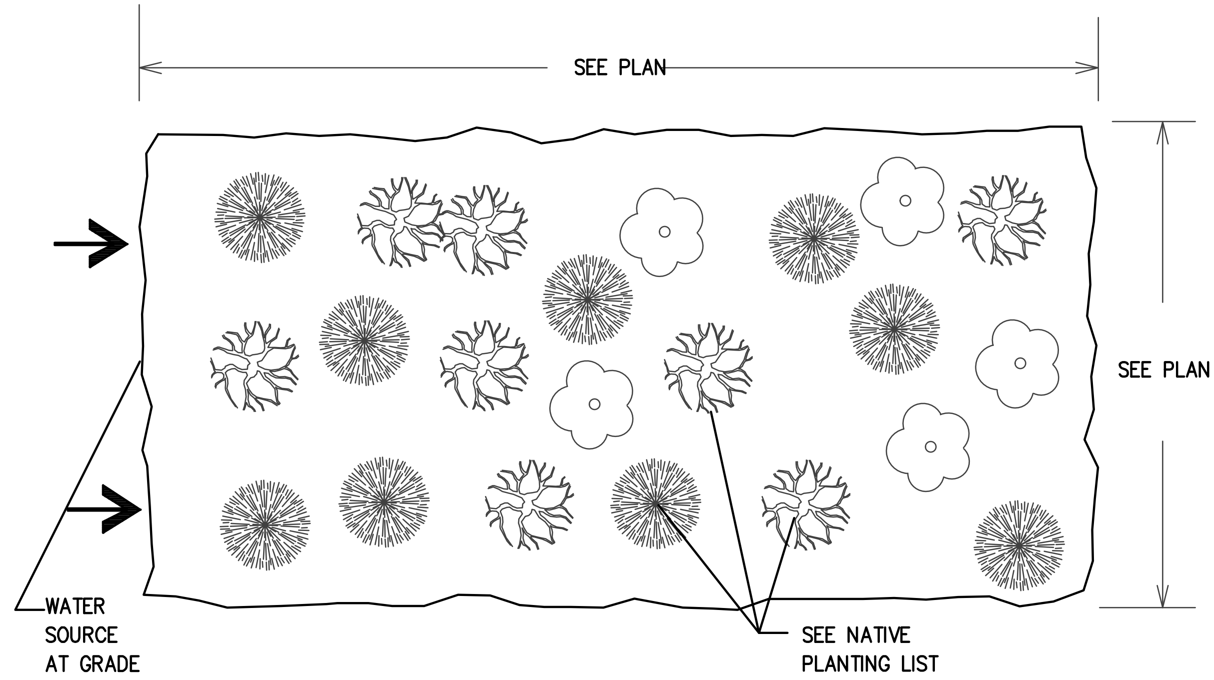
CITY OF SOMERSET
SOMERSET, KENTUCKY

VEHICULAR POROUS
ASPHALT DETAIL

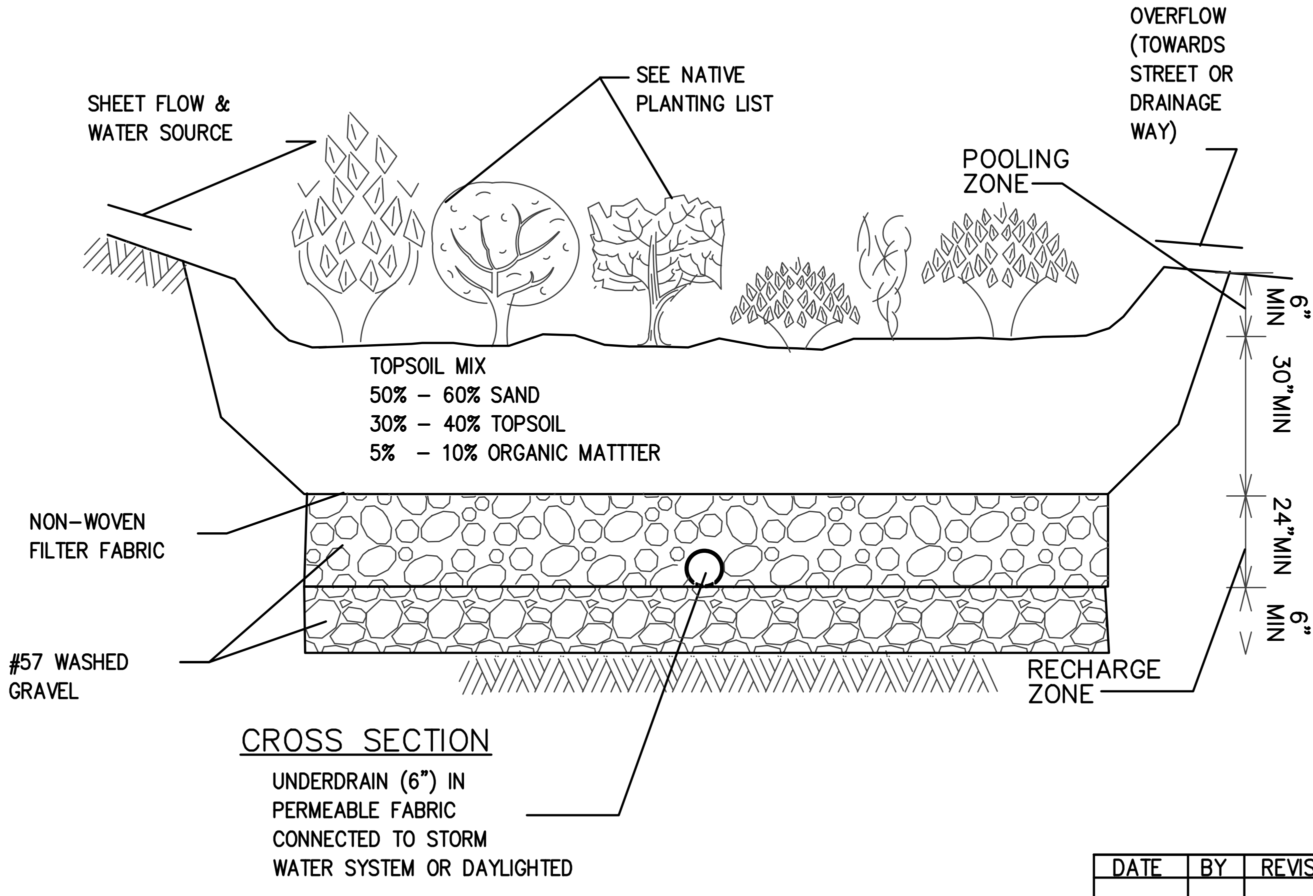
NOT TO SCALE

DWG NO. VPP3

DETAIL BY MODIFIED FROM NAPA DETAILS



PLAN VIEW



CROSS SECTION

DATE	BY	REVISION

CITY OF SOMERSET
SOMERSET, KENTUCKY

RAIN GARDEN DETAIL

NOT TO SCALE

DWG NO. RG1

DETAIL MODIFIED FROM GLENVIEW, ILL. STANDARD DRAWINGS.

ORDINANCE NUMBER 14-01

AN ORDINANCE TO THE CITY OF SOMERSET, KENTUCKY, FULLY REPEALING ORDINANCES 482, 83-2, AND 98-10; ADOPTING THE FOLLOWING AS THE CITY'S "*EXCAVATION, EROSION, FILLING, AND SEDIMENT CONTROL ORDINANCE*"; AND FURTHER DECLARING THAT THIS ORDINANCE SHALL STAND ALONE AND BE CONSIDERED SEPARATE AND APART FROM THE CITY'S PLANNING AND ZONING ORDINANCE(S), AND THE CITY'S STORMWATER MANAGEMENT ORDINANCE;

WHEREAS, THE PRESENT ORDINANCE REFLECTS CURRENT AMENDMENTS AND REGULATIONS IN EFFECT AND FOUND WITHIN KRS, KAR, AND ALL OTHER APPLICABLE STATE AND/OR FEDERAL LAW, AND THEREFORE BRINGS THE CITY'S EXCAVATION, EROSION, FILLING, AND SEDIMENT CONTROL PRACTICES INTO COMPLIANCE WITH ACCEPTED STANDARDS AND MANDATES;

NOW THEREFORE, BE IT ORDAINED BY THE CITY OF SOMERSET, KENTUCKY THAT THE FOLLOWING IS HEREBY ADOPTED AS THE CITY'S "*EXCAVATION, EROSION, FILLING, AND SEDIMENT CONTROL ORDINANCE*" AS FOLLOWS:

I. INTENT

The intent of this Ordinance is to protect property, prevent damage to the environment, and promote the public welfare in the city, by guiding, regulating, and controlling excavation, filling, grading, and other similar activities which disturb or break topsoil, or result in the movement of soil from its natural placement. During excavation, filling, grading, and construction activity, soils are the most vulnerable to erosion by wind and water. This eroded soil not only endangers water resources by reducing water quality, it causes the siltation of aquatic habitat for fish and other desirable species. Eroded soil further necessitates the repair and cleaning of storm sewers, ditches, and other facilities in the City's stormwater system, as well as water drainage systems which occur naturally. The regulations contained in this Ordinance are intended to prevent improper excavation, filling, and grading, and further to prevent unnecessary soil erosion. This Ordinance shall provide procedures for application and approval of permits for excavation, filling, grading, and construction activity within the City's jurisdictional limits, specifically setting forth the process for application, review, and approval of such activities which shall be set forth in specific "Excavation, Filling, Grading and Sediment Control Plans" prior to any soil disturbance.

II. DEFINITIONS

For the purposes of this Ordinance, the following words are defined:

a. *City Engineer.* The City Engineer of Somerset, Kentucky, and the employees and/or the designees of the City Engineer.

b. *Erosion.* The process by which the ground surface is worn away by the action of wind or water.

c. *Excavation* or *cut.* Any act by which soil or rock is cut into, dug, quarried, uncovered, removed, displaced or relocated, including the conditions resulting from such activities.

d. *Fill.* A deposit of soil, rock or other non-deteriorating material used by man to replace or supplement the original soil or sub-soil.

e. *Floodplain.* That land adjacent to a stream, channel, or body of water, which has been or may be hereafter covered by flood water during the base flood. *Floodplain* shall include those lands within the Special Flood Hazard Areas shown on the Federal Emergency Management Agency Flood Insurance Rate Map, as well as other land that is anticipated to be covered with water during the one hundred (100) year, one (1) hour storm, based on a fully developed watershed and calculated using the procedures of the City's *Stormwater Manuals*.

f. *Grading.* Any stripping, excavating, filling, stockpiling of soil, or any combination thereof, including the land in its excavated or filled condition.

g. *Natural features.* Shall include, but not be limited to, lakes, ponds, springs, wetlands, existing water courses, soils and rocks.

h. *Natural ground cover.* Shall include, but not be limited to, vegetation/vegetative cover (such as grasses, shrubs, legumes and the like), and tree stands having trees five (5) inches or greater in diameter, or fifteen (15) feet or greater in height.

i. *Natural ground surface.* Any ground surface in its original state before any grading, excavation or filling. Where there is any question of the location of the *natural ground surface*, the City Engineer shall make such determination.

j. *Post-development floodplain.* The portion of land adjacent to a stream or other watercourse which is anticipated to be covered with water during the one hundred (100) year, one (1) hour storm, based on a fully developed watershed and calculated using the procedures set forth in the City's *Stormwater Manuals* or other established and adopted authority.

k. *Sediment.* Any solid material which is a product of erosion, whether mineral or organic, and that is in suspension, is being transported, or has been moved from its site of origin, whether by air, water or gravity.

l. *Slope.* Any inclined, exposed surface of a fill, excavation or natural terrain.

m. *Soil.* All earth material of whatever origin that overlies bedrock, and may include the decomposed zone of bedrock which can be readily excavated by mechanical equipment.

n. *Stormwater Manuals.* Whenever the term "Stormwater Manuals" is used in this Ordinance, it shall mean the City's most current Stormwater Manual(s), including, but not limited to, the City's most current **"Regulations and Specifications Pertaining to Roadway and Drainage Design"** Manual, provided by the City Engineer and adopted by the Mayor under his/her administrative authority, said manual incorporated in full into this Ordinance by reference. The referred to manual(s) provide standards for the design, review, construction and inspection of stormwater facilities. From time to time the City may revise, modify or amend the manuals referred to in this Ordinance as the "*Stormwater Manual(s)*". Therefore, the most current, recent version of the City's Stormwater Manuals should be used anytime this Ordinance is applicable. Said Manuals should be obtained directly from the City of Somerset only to ensure the most current version is being followed.

o. *Stream.* Any river, creek or channel in which water flows for substantial periods of the year, and which has a drainage area of at least one hundred (100) acres.

p. *Stripping.* Any activity which removes or significantly disturbs the vegetative surface cover, including clearing and grubbing operations.

q. *Watercourse.* Any body of water, including but not limited to, lakes, ponds or streams, whether perennial or intermittent.

III. SCOPE OF COVERAGE

No grading, stripping, excavating, filling or other disturbance of the natural ground cover or natural features shall take place prior to the submission and approval of an "Excavation, Filling, Grading and Sediment Control Plan". Said plans shall be prepared in conformance with this Ordinance and the City's most current Stormwater Manuals, unless otherwise exempted herein (see Section A. below). If the activity subject to this Ordinance is to be conducted in stages, each stage may proceed only if the planned measures for each proceeding stage have been completed in conformance with the submitted overall plan.

IV. RESPONSIBILITY OF PROPERTY OWNERS; RESPONSIBILITY OF PERSONS AND/OR ENTITY HAVING CARE, CUSTODY OR CONTROL OF PROPERTY

No person, company, or other legal entity owning, leasing, occupying, or having care, custody or control of a parcel of property found within the City limits shall knowingly, intentionally, or negligently violate this Ordinance, nor shall they keep and/or maintain property in a manner that violates the provisions of this Ordinance or that causes substantial diminution in the value of other properties found in the neighboring area of the subject property.

The owner(s) and/or other persons having care, custody, or control of any tract of land lying within the City of Somerset upon which activity covered under this Ordinance is, will be, or has taken place, shall be required under this Ordinance to ensure that activity occurring on said property is in compliance with the City's applicable manuals and this Ordinance, and further that the property is properly excavated, filled, graded, and if necessary reseeded for replacement or replenishment of vegetative growth to prevent unnecessary erosion.

V. PROHIBITION OF DISPOSAL AND/OR FILLING WITHOUT A PROPER PERMIT

It is hereby prohibited for any person or entity owning a parcel of land, or any other person(s) having care, custody or control of a parcel of property subject to this Ordinance, or his/her/their agents, employees, or assigns, to conduct or condone the following activities: dumping, burying, covering over, plowing under, casting, throwing, sweeping, sifting, or any other type of disposal or movement of material which contains, or may contain, substances, including but limited to, ashes, debris, garbage, refuse, or any other type of waste, whether liquid or solid, without obtaining the proper permit to do so from the City of Somerset, and any other authority which must provide approval for such activity.

Said prohibited activities specifically includes the practice of using "construction fill" which contains liquids and/or solids of any of the substances listed above, or any other prohibited type of fill per this Ordinance, other local law, and/or state and federal law. It shall also be prohibited under this Ordinance to allow disposal or depositing of any of the aforementioned items, whether knowingly, intentionally, or negligently, due to said items being carried, disposed of, or deposited in any manner by sun, wind, rain, snow, or any other type of naturally occurring activity.

This Ordinance applies to any parcel of property found within the jurisdictional limits of the City of Somerset, including but not limited to, private property, property which is considered in, or upon, any public place, property which is considered in, or upon, any public waterway, property which is considered in, or upon, any drainage system (whether naturally occurring or man-made), property which is considered in, or upon, any sewer system and/or any other type of receiving basin (whether naturally occurring or man-made).

VI. EXCEPTIONS TO THE PERMIT AND PLAN REQUIREMENTS.

A. Certain activities are exempted from the permit and plan approval process which normally would be required under this Ordinance. Any such exemptions only apply to permits and/or plans required by the City of Somerset under this Ordinance and do not exempt the requirements of any other permits and/or plans required to be approved under other City Ordinances, other local law, and/or state/federal law. The following activities are hereby exempt from the required permit process and/or from the required "Excavation, Filling, Grading and Sediment Control Plan" submissions:

a. Any emergency activity which is immediately necessary for the protection of life, property or natural resources.

b. Agricultural practices such as: plowing, cultivation, construction of agricultural structures, and nursery operations such as removal and/or transplanting of trees.

c. Excavation for the installation of lateral sewer lines, telephone lines, electric lines, gas lines or other similar public service facilities, if said excavation is being performed by a person licensed by the proper authority to conduct such activity.

d. Excavation at cemeteries for human or animal burial.

e. Excavation or fill on private property, but only when authorized by any required building permit(s), and only when the disturbed material or fill is handled in such a manner as to conform to the provisions of this Ordinance, provided that all of the following are met (the City Engineer and/or his/her designee shall have full authority to make any determinations needed as to whether the following are met or not):

1. The excavation and fill is less than four (4) feet in vertical depth at its deepest point, as measured from the natural ground;

2. Said excavation and fill does not result in a total quantity of more than one hundred (100) cubic yards of material being removed from, deposited on, or disturbed on any lot, parcel or combination thereof;
3. Said excavation and fill does not impair existing surface drainage, constitute a potential erosion hazard, or act as a source of sedimentation to any adjacent land or watercourse;
4. Said excavation and fill has no final slopes steeper than one (1) foot vertical in three (3) feet horizontal;
5. Said excavation and fill has proper vegetative cover reestablished as soon as possible on all disturbed areas; and
6. Said excavation and fill has no fill placed on a surface having a slope steeper than five (5) feet horizontal to one (1) foot vertical.

f. Grading as a maintenance measure or for landscaping purposes, but only when authorized by any required building permit(s), and only when the disturbed material or fill is handled in such a manner as to conform to the provisions of this Ordinance, provided that all of the following are met (the City Engineer and/or his/her designee shall have full authority to make any determinations needed as to whether the following are met or not):
1. The aggregate area(s) affected or stripped at any one time does not exceed ten thousand (10,000) square feet, and is not within a floodplain or a natural watercourse;
2. The grade change does not exceed eighteen (18) inches at any point, and does not alter the drainage pattern;
3. Proper vegetative cover is reestablished as soon as possible on all disturbed areas; and
4. The grading does not involve a quantity of material in excess of one hundred (100) cubic yards.

g. Finished grading and excavation which is below finished grade for the uses set forth below, but only when authorized by a valid building permit, and only when the disturbed material or fill is handled in such a manner as to conform to the provisions of this Ordinance. The following are considered low density residential projects for purposes of this section of the Ordinance:
1. Basements and footings of a residential structure of no more than four units;
2. Retaining walls;
3. Swimming pools;
4. An accessory structure related to a residential structure of no more than four units.

VII. EXCAVATION, FILLING, GRADING AND SEDIMENT CONTROL PLANS.

The following guidelines shall be followed for any and all activity to which this Ordinance applies, unless specifically exempted by Subsection (A) of Ordinance Section VI set forth above.

1. *Authorization to prepare plans.*

All plans required under this Ordinance must be prepared by a licensed professional engineer, or a licensed landscape architect. All hydrologic, hydraulic, structural and geotechnical design must be prepared by a licensed professional engineer. All Excavation, Filling, Grading and Sediment Control Plans shall be prepared in accordance with this Ordinance and with the City's most current *Stormwater Manuals*.

2. *Submission of the plan, posting of the surety, and issuance of a grading permit.*

All plans required under this Ordinance shall be submitted to the City Engineer, who shall conduct an administrative review of the plan to verify that all items have been submitted as required by this

Ordinance and the City's most current *Stormwater Manuals*. It shall be the responsibility of the design engineer, or the landscape architect, as appropriate, to ensure the accuracy and completeness of all drawings, reports and calculations, and to ensure construction feasibility of the design. Within ten (10) working days of receipt of the required control plans, the City Engineer shall notify, in writing, the engineer or the landscape architect, as appropriate, of any omissions; shall determine the amount of the irrevocable letter of credit; and thereafter shall authorize the Building Inspector to issue the proper permit for soil disturbance. Provided all other permit requirements under the City's Building Code, the state building code, and all other applicable law, the Building Inspector shall issue the soil disturbance permit upon notification by the City Engineer.

3. *Contents of any required Excavation, Erosion, Fill, and Sediment Control Plan(s).*
All plans required under this Ordinance shall conform to the requirements of the City's most current *Stormwater Manuals*, but at the minimum shall contain the following:

a. *Written description.*
The plans shall contain a written description of the site, and the measures which will be used to control the erosion and sediment on the site, which shall include:

i. A statement of the purpose of the project, the location and size of the site, and the area to be disturbed;

ii. A discussion of the topography, land cover conditions, soils, percent and location of impervious areas, and the drainage patterns both before and after the soil disturbance;

iii. A schedule of the work to be conducted, including the beginning and the completion dates of the soil disturbance, staging and sequencing of activities, including re-vegetation and winter shutdown, if appropriate;

iv. A list of the best management practices that will be used, and their location on the site; and

v. An operation and maintenance plan indicating the schedule for inspection and the maintenance and repair of the best management practices during construction.

b. *Site plan.*
The site plan shall be prepared at a scale of one (1) inch equals fifty (50) feet, and shall contain the following information:

i. The site boundaries, the pre-construction topography at two (2) foot intervals, drainage ways, utilities, and the location of the site disturbance;

ii. The finished grades, topography, building locations, paved areas, construction entrances, other access locations, soil stockpile areas, and equipment storage areas;

iii. Planned best management practices overlaid with other site features; and

iv. Areas planned for no disturbance.

c. *Other information.*
The project engineer shall submit all hydrologic, hydraulic, structural and geotechnical design calculations, drawings and specifications.

4. *Certifications.*
The following certifications shall be submitted with the required plans.

a. For all plans, a signed and witnessed certification by the property owner which shall state:
"I certify that I am the owner of the property shown hereon, do agree with all graphic and textural representations shown herein, and that no grading, stripping, excavating, filling or other

disturbance of the natural ground cover will be conducted except in conformance with this submitted plan."

b. For plans prepared by a licensed professional engineer, a signed and witnessed certification which shall state:

"I certify that this plan was prepared by me or under my direction; that the engineering design was prepared in accordance with the Erosion and Sediment Control Ordinance and with the City's *Stormwater Manuals*; and, to the best of my knowledge and belief, the information shown herein is accurate."

c. For plans prepared by a licensed landscape architect, a signed and witnessed certification which shall state:

"I certify that this plan was prepared by me or under my direction; this plan was prepared in accordance with the Erosion and Sediment Control Ordinance and with the City's *Stormwater Manual*; that no hydrologic, hydraulic, structural or geotechnical design is required for this plan; and, to the best of my knowledge and belief, the information shown herein is accurate."

5. *Submission of an irrevocable letter of credit for erosion and sediment control required.*

The City Engineer shall not authorize the issuance of any permit under this Ordinance until the permit applicant has posted an irrevocable letter of credit, in an amount determined by the City Engineer as being sufficient to ensure the provision of the following on the site:

a. Re-grading of the site as might be necessary to correct any slopes which do not meet the standards of this article;
b. Installation of erosion and sediment control measures to protect adjoining or on-site streams and waterways;
c. Seeding and mulching of the site as would be needed to stabilize the soil;
d. Conversion of any temporary basins to properly operating permanent stormwater best management practices.

6. *Extensions of time.*

Every permit issued under this Ordinance shall expire six (6) months from the date of issuance, unless work has commenced in accordance with the plan. If work authorized by the permit is not completed within the terms of the permit, or is not commenced within six (6) months, the permit holder may, in writing and prior to the expiration of the permit, request the Building Inspector grant an extension to the permit. The Building Inspector may grant the extension, upon a showing by the permit holder that all of the following are met (the City Engineer and/or his/her designee shall have full authority to make any determinations needed as to whether the following are met or not):

a. There was justification for the delay in commencing or completing the work;
b. The delay will not create a new erosion hazard or permit an existing hazard to continue;
c. A new completion date has been established; and
d. The extension and re-issuance of the permit is approved by the City Engineer.

VIII. BEST MANAGEMENT PRACTICES (BMP'S) TO BE USED FOR REQUIRED PLANS.

All plans required under this Ordinance shall utilize the Best Management Practices (BMP's) set forth in the City's most current *Stormwater Manuals,* and the City's most current Stormwater Management Ordinance(s). This requirement for BMP's is to minimize improper filling and erosion, and further properly control sedimentation.

IX.	SPECIAL REQUIREMENTS FOR LOW DENSITY RESIDENTIAL PROJECTS.

The following are special requirements for any and all low density residential projects:

a. Construction of, or an addition to, a residential structure of four (4) units or less, including an accessory structure for such a residential structure, shall not require the submission of a separate erosion and sediment control plan as a condition to the issuance of a building permit.

b. However, the following shall be required during construction.

i. *Installation of a silt fence or other sediment control.* In order to prevent sediment from washing into streets, catch basins, storm sewers, grassed open channels and adjacent properties, sediment controls shall be installed. Such controls shall include silt fences, diversion ditches, earthen berms, grass strips at least ten (10) feet wide, or other controls as specified in the City's *Stormwater Manuals*. Disturbed areas that drain directly to a sediment pond or a sediment trap by means of a temporary diversion ditch do not require additional sediment controls.

ii. *Seeding and mulching.* All disturbed areas shall be seeded and mulched within fourteen (14) days after final grading of the property.

iii. *Temporary gravel pad.* A temporary gravel pad, thirty (30) feet wide, shall be installed from the edge of the street at least twenty (20) feet into the property, to provide a temporary construction entrance.

X.	VIOLATIONS AND PENALTIES.

1. *Violations.* Whenever the City Engineer finds that a person has violated a prohibition or has failed to meet a requirement of this Ordinance, the City Engineer may order compliance by sending a written notice of violation to the property owner. All violations shall be corrected within the time period specified in the notice, but in no case shall such time period be less than twenty-four (24) hours. The notice of violation shall be mailed to the property owner at the last known address listed on the current tax assessment roll, or by personally serving, or by causing to be personally served, the property owner with a written notice of violation. If the violation is not corrected as specified, the City Engineer may, without limitation:

a. Order such work as is necessary to leave the site in a safe condition and to achieve compliance with this Ordinance and the City's *Stormwater Manuals*;
b. Order the stoppage of work which is determined to have created, or to have contributed to, any dangerous conditions;
c. Call the letter of credit that was posted for the site and initiate corrective action by work forces under control of the City Engineer, with the cost of such work being recoverable from the letter of credit.

2. *Penalties.* The City may commence appropriate civil legal action and/or seek equitable relief, including injunctive relief, against any person and/or entity who fails to abate a violation and/or to restore an affected property prior to the deadline established in the notice of violation. Any person who conducts any activities that are in violation of this Ordinance, or who violates, neglects, omits or refuses to comply with any provision of this Ordinance shall, upon a finding by a Court of Competent Jurisdiction, be liable of violation of this Ordinance and the City shall be awarded a fine of not less than two hundred dollars ($200.00), nor more than one thousand dollars ($1,000.00), for each offense committed. The time of violation shall be measured from the time the written notice to correct the violation is issued to the owner as set forth in this Ordinance above. Each day a violation is maintained shall constitute a separate offense. Any recoverable cost of corrective action, including but not limited to court costs and attorney fees, may

be awarded by a Court in addition to the above stated fines imposed for violation of this Ordinance. The imposition of penalties shall not exempt the violator from compliance with the provisions of this Ordinance.

XI. SEVERABILITY.

If any part of this Ordinance, including but not limited to, any Subsection, Paragraph, Sentence, Clause, Phrase, or any other portion of this Ordinance, is declared illegal or unconstitutional, or otherwise invalid by a Court of competent jurisdiction, such declaration shall not affect the remaining portions thereof.

XII.

This Ordinance shall take effect after its passage and publication as required by law.

FIRST READING: Jan 13, 2014 SECOND READING: Jan 27, 2014

APPROVED: ______________________
EDWARD R. GIRDLER, MAYOR

ATTEST: ______________________
DAVID GODSEY, CITY CLERK

ORDINANCE NUMBER 14- 02

AN ORDINANCE TO THE CITY OF SOMERSET, KENTUCKY, FULLY REPEALING THE CITY'S PREVIOUS AMENDMENTS MADE TO 00-18, SPECIFICALLY THE AMENDMENTS SET FORTH IN ORDINANCE NUMBER 05-02 AND COMMONLY REFFERED TO AS THE CITY'S "STORMWATER MANAGEMENT ORDINANCE", AND ADOPTING IN ITS PLACE THE CITY'S NEW STORMWATER ORDINANCE AS CONTAINED HEREIN; THIS ORDINANCE SHALL STAND ALONE AND HEREAFTER NOT BE CONSIDERED PART OF THE CITY'S PLANNING AND ZONING ORDINANCE;

WHEREAS, THE PRESENT ORDINANCE REFLECTS AMENDMENTS AND ADDITIONS TO REGULATIONS NOW IN EFFECT AND FOUND WITHIN KRS, KAR, AND ALL OTHER APPLICABLE STATE AND/OR FEDERAL LAW, AND THEREFORE BRINGS THE CITY'S STORM WATER MANAGEMENT PRACTICES INTO COMPLIANCE;

NOW THEREFORE, BE IT ORDAINED BY THE CITY OF SOMERSET, KENTUCKY:

SECTION I.

THAT THE FOLLOWING IS HEREBY ADOPTED BY THE CITY OF SOMERSET AS THE CITY'S OFFICIAL "STORMWATER MANAGEMENT ORDINANCE", AND THEREFORE SHALL REPLACE IN FULL THE FORMER STORM WATER ORDINANCE OF THE CITY SET FORTH IN ORDINANCE NUMBER 05-02, WHICH AMENDED ORDINANCE NUMBER 00-18, AND WHICH WAS KNOWN AS THE STORM WATER MANAGEMENT ORDINANCE, AND THAT THE PRESENT ORDINANCE SHALL APPLY TO ANY AREA LOCATED WITHIN THE CITY'S CORPORATE LIMITS AND/OR WITHIN THE CITY'S STORM WATER MANAGEMENT & ENFORCEMENT JURISDICTION AS MAY BE SET BY THE COMMONWEALTH OF KENTUCKY AND/OR PROPER FEDERAL AUTHORITY;

SECTION II.

THAT THE CITY'S "STORM WATER MANAGEMENT ORDINANCE" IS HEREBY ADOPTED AS FOLLOWS:

CHAPTER 1 - GENERAL PROVISIONS

1.1 DEFINITIONS:

For the purposes of this Ordinance, the following terms, phrases, words, and their derivatives shall have the meaning stated below unless expressly stated otherwise:

APPLICANT: The individual or entity who submits an application to the City of Somerset for an EPSC Permit pursuant to this ordinance.

APPROVING AGENCY: The City of Somerset.

AS-BUILTS: Construction drawings or plans that have been updated to show actual constructed locations of roadways, storm and sanitary sewers, culverts, catch basins, manholes, headwalls, swales and other infrastructure improvements. As-built information may include, but is not limited to, pipe size and material, horizontal and vertical locations of pipelines, rim and invert elevations of manhole and catch basin structures, angles and offsets, and roadway and pipe slopes.

BEDROCK: In place solid rock.

BENCH: A relatively level step excavated into earth material on which fill is to be placed.

BEST MANAGEMENT PRACTICES (BMP): A technique or series of techniques, structural or nonstructural, which are proven to be effective in reducing pollutants in storm water, controlling runoff, erosion and sedimentation and mitigate flooding.

BORROW: Earth material acquired from an off-site location for use in grading on a site.

CLEARING AND GRUBBING: The cutting and removal of trees, shrubs, bushes, windfalls and other vegetation including removal of stumps, roots, and other remains in the designated areas.

COMMUNITY WATERS: Any and all rivers, streams, creeks, branches, lakes, reservoirs,

CONTRACTOR: A person who contracts with the permittee, landowner, developer, or another contractor (i.e. subcontractor) to undertake any or all the land disturbance activities covered by this Ordinance.

CO-PERMITTEE: Any person, other than the permittee, including, but not limited to, a developer or contractor, who has or represents financial or operational control over the land disturbing activity.

DETENTION FACILITY: A temporary or permanent natural or man-made structure that provides for the temporary storage of storm water runoff which is designed so as not to create a permanent pool of water.

DEVELOPER: Any person, firm, corporation, sole proprietorship, partnership, state agency, or political subdivision thereof engaged in a land disturbance activity and/or in the development or re-development of property.

DRAINAGE AREA: Any area-contributing runoff to a single point measured in a horizontal plane, which is enclosed by a ridgeline.

ENFORCEMENT AGENCY: The City of Somerset.

ENGINEER: A professional engineer licensed in the Commonwealth of Kentucky to practice in the field of civil works.

EROSION: The wearing away of the ground surface as a result of the movement of wind, water, ice, and/or land disturbance activities.

EROSION PREVENTION AND SEDIMENT CONTROL (EPSC): The prevention of soil erosion and control of solid material during land disturbing activity to prevent its transport out of the disturbed area by means of air, water, gravity, or ice.

EPSC DESIGN MANUAL AND STANDARDS: A compilation of rules, design criteria, guidelines, and standards which are proven methods of controlling construction related surface runoff, erosion and sedimentation. The City of Somerset's "Regulations & Specifications Pertaining to Roadway and Drainage Design" manual, as adopted and approved by the Executive Authority of the City, shall serve as the City's EPSC Design Manual and Standards.

EPSC PERMIT: A permit required by this Ordinance for land disturbance activities.

EPSC PLAN: A detailed plan which includes a set of best management practices or equivalent measures designed to control surface runoff and erosion and to retain sediment on a specific development site or parcel of land during the period in which pre-construction and construction related land disturbances, fills, and soil storage occur, and before final improvements are completed, all in accordance with this Ordinance.

EROSION CONTROL INSPECTOR: Any person designated as such by, and acting under the Authority of, the City of Somerset pursuant to this Ordinance.

EXISTING GRADE: The grade prior to grading.

EXTENDED DETENTION: A storm water design feature that provides gradual release of a volume of water in order to increase settling of pollutants and protect downstream channels from frequent storm events.

FINISH FRADE: The final grade of the site which conforms to the approved plan.

FLOODPLAIN: The one hundred (100) year floodplain which is that area adjoining a watercourse which could be inundated by a flood that has a one (1) percent chance of being equaled or exceeded in any given year and is delineated on the Federal Emergency Management Agency Floodway Maps.

FLOW ATTENUATION: Prolonging the flow time of runoff to reduce the peak discharge.

GENERAL PERMIT: A Kentucky Pollutant Discharge Elimination System (KPDES) Storm Water General Permit for storm water discharges related to construction activities that disturb one (1) acre or more. Coverage under this general storm water permit is obtained by filing a Notice of Intent (NOI) with the Kentucky Division of Water.

GRADE: The vertical location of the ground surface.

HAZARDOUS MATERIALS: Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, biological or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

ILLEGAL DISCHARGE: Any direct or indirect non-storm water substance, including silt or sediment, or hazardous material disposed, deposited, spilled, poured, injected, seeped, dumped, leaked, or placed by any means, intentionally or unintentionally, into the MS4, community waters, waters of the Commonwealth, or any area draining directly or indirectly into the MS4, except as exempted in this Ordinance.

ILLICIT CONNECTION: Any drain or conveyance, whether on the surface or subsurface, which allows an illegal discharge to enter the MS4. Included are conveyances which allow any non-storm water discharge including sewage, process wastewater, and wash water to enter the storm drain system and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had previously allowed, permitted, or approved.

INFILTRATION: The passage or movement of water into the soil surface.

INSPECTOR: Any person designated by the Enforcement Agency, the City of Somerset. (Also see Erosion Control Inspector.)

ISSUING AUTHORITY: The City of Somerset.

KPDES: Kentucky Pollutant Discharge Elimination System.

LAND DISTURBANCE ACTIVITY: Any land change that may result in soil erosion from wind, water and/or ice and the movement of sediments into or upon waters, lands, or rights-of-way within the City of Somerset, including but not limited to building demolition, clearing and grubbing, grading, excavating, transporting and filling of land.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4): The City of Somerset's conveyance, or system of conveyances, including roads with drainage systems, municipal and county streets, catch basins, curbs, gutters, ditches, man-made channels, and storm drains designed or used for collecting or conveying storm water. Sanitary and combined sewers are not included in the definition of the municipal separate storm sewer system.

NON-STORM WATER DISCHARGE: Any discharge to the MS4, community waters or waters of the Commonwealth that is not composed solely of storm water except as permitted by this Ordinance.

OUTFALL: The point of discharge to any watercourse from a public or private storm water drainage system.

PERMITTEE: The applicant in whose name a valid EPSC Permit is duly issued pursuant to this Ordinance.

POLLUTANT: Anything, which causes or contributes to pollution, including, but not limited to, paints, varnishes, and solvents; oil and other automotive fluids; silt and sediments; floatables, pesticides, herbicides, and fertilizers; hazardous substances; sewage, animal wastes, fecal coliform and pathogens;

dissolved and particulate metals; non-hazardous liquids; and yard wastes, refuse, construction debris, rubbish, garbage, litter, or other discarded or abandoned objects and accumulations.

PREMISES: The area of land, site, grounds, or property on which the illegal discharge emanates.

REDEVELOPMENT: Any construction, alteration, or improvement involving land disturbance performed on sites where existing land use is commercial, industrial, institutional, or multifamily residential.

REGULATIONS & SPECIFICATIONS PERTAINING TO ROADWAY AND DRAINAGE DESIGN MANUAL: A ESPC manual as adopted and approved by the Executive Authority of the City. (Also see EPSC Design Manual and Standards.)

RETENTION FACILITY: A temporary or permanent natural or manmade structure that provides for the storage of storm water runoff by means of a permanent pool of water.

RETROFITTING: The construction of a structural BMP in a previously developed area or the modification of an existing structural BMP, to improve water quality and reduce flow rate and volume over current conditions.

ROUGH GRADE: The stage at which the grade approximately conforms to the approved plan.

RUNOFF: Rainfall, snowmelt, or irrigation water flowing over the ground surface.

SEDIMENT: Soils or other surficial materials transported or deposited by the action of wind, water, ice, or gravity as a product of erosion.

SEDIMENTATION: The process or action of depositing sediment that is determined to have been caused by erosion.

SITE: The entire area of land on which the land disturbance activity is proposed in the EPSC permit application.

SITE PLAN: A plan or set of plans showing the details of any land disturbance activity of a site including but not limited to the construction of: structures, open and enclosed drainage facilities, storm water management facilities, parking lots, driveways, curbs, pavements, sidewalks, bike paths, recreational facilities, ground covers, plantings, and landscaping.

SITE WASTE: Waste from the construction site such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary wastes.

SLOPE: The incline of a ground surface expressed as a ratio of horizontal distance to vertical

SOIL: Naturally occurring surficial deposits overlying bedrock.

STRIPPING: Any activity which removes or significantly disturbs the vegetative surface cover including clearing, grubbing or stumps and root mat, and topsoil removal.

STORMWATER BMP PLAN: A storm water plan that determines the best management practices for a site. (Also see Best Management Practices.)

STORMWATER DESIGN STANDARDS: The City of Somerset's storm water design standards which the City designates as the official guide for storm water design principles, methods and practices. (Also see EPSC Design Manual and Standards; Regulations & Specifications Pertaining to Roadway and Drainage Design Manual.)

STORMWATER MANAGEMENT:

(a) Quantitative control: A system of vegetative and structural measures that control the increased volume and rate of surface runoff caused by man-made changes to the land; and

(b) Qualitative control: A system of vegetative, structural, and other measures that reduce or eliminate pollutants that might otherwise be carried by surface runoff.

TOPSOIL: The upper layer of soil.

UTILITY: The owner/operator of any underground facility including an underground line, facility, system, and its appurtenances used to produce, store, convey, transmit, or distribute communications, data, electricity, power, heat, gas, oil, petroleum products, potable water, storm water, steam, sewage and other similar substances.

WATERCOURSE: Any natural or improved stream, river, creek, ditch, channel, canal, conduit, gutter, culvert, drain, gully, swale, or wash in which waters flow either continuously or intermittently.

WATERSHED: A region draining to a specific river, river system, or body of water.

WATERS OF THE COMMONWEALTH: Any surface watercourses and water bodies including all natural waterways and definite channels and depressions in the earth that may carry water, even though such waterways may only carry water during rains and storms and may not carry storm water at and during all times and seasons.

WETLANDS: A lowland area such as a marsh, that is saturated with moisture, as defined in Sec. 404, Federal Water Pollution Control Act Amendments of 1987.

1.2 AUTHORITY AND OTHER LAWS

A. This Ordinance is adopted by the Somerset City Council, Kentucky under authority of Chapter 100 of the Kentucky Revised Statutes, and shall be administered by the City of Somerset, by and through the Executive Authority of the City, and/or his/her designee. The City may be referred to as the "Approving Agency", "Issuing Authority" and "Enforcement Agency" in this Ordinance.

B. This Ordinance is adopted pursuant to the powers granted and limitations imposed by the Federal Clean Water Act, and in particular those parts that authorize local governments to require any state or federal department or agency to comply with all local water pollution control requirements.

C. This Ordinance shall be construed to insure consistency with requirements of the Clean Water Act, the Kentucky Pollutant Discharge Elimination System (KPDES), and acts amendatory thereof or any other applicable regulations.

D. The standards and requirements set forth herein and promulgated pursuant to this Ordinance are minimum standards. This Ordinance does not intend nor imply that compliance by any person, company, developer, or any other entity will ensure that there will be no contamination, pollution, or discharge of pollutants into the MS4, community waters or waters of the Commonwealth.

E. In their interpretation and other application, the provisions of this Ordinance shall be held to be minimum requirements. Whenever the requirements of this Ordinance are at variance with the requirements of any other city, state and/or federal law, including, but not limited to, said agencies' adopted rules, regulations, ordinances, or resolutions, the most restrictive or that imposing the higher standards shall govern.

1.3 PURPOSE

The requirements set forth in this Ordinance are intended to protect the general health, safety, and welfare of the citizens of the City of Somerset, Pulaski County, and the surrounding area known as Lake Cumberland, in the following manner:

A. To protect and enhance the water quality of watercourses and water bodies in a manner pursuant to and consistent with the Federal Clean Water Act by addressing storm water runoff from new development projects and existing developments that discharge into the municipal separate storm sewer system (MS4), community waters and waters of the Commonwealth;

B. To comply with all applicable state and federal requirements for clean water, including limitations on the discharge of pollutants as set forth by the Kentucky Pollutant Discharge Elimination System (KPDES); and all applicable provisions of the Federal National Pollution Discharge Elimination System's storm water general permit for Phase II communities.

C. To establish legal authority to carry out all inspection, surveillance and monitoring, and enforcement procedures necessary to ensure compliance with this Ordinance

CHAPTER 2- ILLICIT DISCHARGE CONTROL

2.1 PURPOSE

In addition to this Ordinance's general purposes as set forth in Chapter 1, the requirements set forth in this Chapter are intended to:

A. Prohibit illicit discharges and connections to the MS4;

B. Regulate the contribution of pollutants to storm water discharges to the MS4 by any user.

2.2 PROHIBITION OF DISCHARGES

A. No person, company, developer or any other entity shall discharge or cause to be discharged into the MS4, community waters or waters of the Commonwealth any hazardous materials, including but not limited to pollutants or waters containing any pollutants that cause or contribute to a violation of applicable water quality standards, other than storm water. The commencement, conduct or continuance of any illegal discharge is prohibited.

B. The construction, use, maintenance or continued existence of illicit connections to the storm drain system is prohibited. This prohibition includes without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practice applicable at the time of connection.

C. No person shall throw, deposit, leave, maintain, keep, or permit to be thrown, deposited, left, or maintained, in or upon a public or private property, driveway, parking area, street, alley, sidewalk, component of the MS4, community waters or waters of the Commonwealth, any refuse, rubbish, garbage, litter, or other discarded or abandoned objects, articles, and accumulations, so that the same may cause or contribute to pollution. Wastes deposited in streets in proper waste receptacles for the purposes of collection are exempted from this prohibition.

2.3 PERMITTED DISCHARGES

A. A discharge or flow of fire protection water that does not contain oil or hazardous substances or materials that the any regulatory Fire Code requires to be contained and treated prior to discharge;

B. A discharge or flow from lawn watering, or landscape irrigation;

C. A discharge or flow from a diverted stream flow or natural spring;

D. Uncontaminated discharge or flow from a foundation drain, crawl space pump or footing drain;

E. A discharge or flow from air conditioning condensation;

F. A discharge or flow from individual residential car washing;

G. A discharge or flow from a riparian habitat or wetland;

H. Dechlorinated drainage from a private residential swimming pool containing no harmful quantities of chlorine or other chemicals;

I. A discharge or flow from any other water source not containing pollutants; and

J. Upon verbal notification to the Enforcement Agency and prior to time of the test, a discharge or flow from dye testing.

NOTE: No discharge or flow stated under Article 2.3 will be permitted if it has been determined by the Enforcement Agency to be a source of a pollutant or pollutants to the MS4, community waters or waters of the Commonwealth. Written notice of such determination shall be provided by the Enforcement Agency to the discharger.

2.4 OTHER DISCHARGES

The prohibition of discharges or flows shall not apply to any non-storm water discharges permitted under a NPDES permit, waiver, or waste discharge order issued to the discharger and administered by the Kentucky Division of Water under the authority of the Environmental

Protection Agency, provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the storm drain system.

2.5 STORM WATER DISCHARGE PERMIT

Any person, company, developer or any other entity subject to a construction activity NPDES storm water discharge permit or Erosion Protection and Sediment Control (EPSC) Permit shall comply with all provisions of such permits. Proof of compliance with such permits may be required in a form acceptable to the Enforcement Agency.

2.6 RULES AND REGULATIONS

A. Elimination of Illegal Discharges:
Notwithstanding the requirements of this Chapter herein, the Enforcement Agency may require by written notice that a person responsible for an illegal discharge immediately, or by a specified date, discontinue the discharge and, if necessary, take measures to eliminate the source of the discharge to prevent the occurrence of future illegal discharges.

B. Remediation:
Whenever the Enforcement Agency finds that a discharge of pollutants is taking place or has occurred which will result in or has resulted in pollution of storm water entering the MS4, community waters, or waters of the Commonwealth, the Enforcement Agency may require by written notice to the owner of the premises and/or the responsible person that the pollution be remediated and the affected property restored within a specified time.

C. Monitoring and Analyses:
The Enforcement Agency may require by written notice of requirement that any person engaged in any activity and/or owning or operating any facility which may cause or contribute to storm water pollution, illegal discharges, and/or non-storm water discharges to the MS4, community waters, or waters of the Commonwealth system, to undertake at said person's expense such monitoring and analyses by a state certified laboratory and furnish such reports to the Enforcement Agency as deemed necessary to determine compliance with this ordinance.

D. Notification of Spills:
Notwithstanding other requirements of local, state and federal law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of pollutants or hazardous materials which are resulting or may result in illegal discharges to the MS4, community waters or waters of the Commonwealth from said facility, said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of a hazardous material said person shall immediately notify emergency response officials of the occurrence via emergency dispatch services (911). In the event of a release of non-hazardous materials, said person shall notify the Enforcement Agency in person or by phone or facsimile no later than 5:00 p.m. of the next business day. Notifications shall be confirmed by written notice addressed and mailed to the Enforcement Agency within three business days of the notice.

2.7 INSPECTION AND MONITORING

A. Inspection:
Whenever the Enforcement Agency has cause to believe that there exists, or potentially exists, any condition which constitutes a violation of this Ordinance, the Enforcement Agency may enter the suspect property, MS4, community waters and waters of the Commonwealth at all reasonable times for inspection. If it is determined an illegal discharge emanates from private premises, the owner or operator of the premises will be notified in accordance with the provisions of this Ordinance. Copies of records of storm water compliance shall be provided to the Enforcement Agency.

B. Sampling Devices and Testing:
During any inspection as provided herein, the Enforcement Agency may take any samples and perform any testing deemed necessary to aid in the pursuit of the inquiry or to record site activities. The cost of all testing may be passed on to the owner or operator of the premises where the illegal discharge emanates.

2.8 ENFORCEMENT

A. Notice of Violation:

Whenever the Enforcement Agency finds that a person, company, developer or any other entity has violated a prohibition or failed to meet a requirement of this Ordinance, the Enforcement Agency may order compliance by a written "Notice of Violation" to the responsible entity. Such notice may include, but is not limited to, the following information:

(1) The performance of monitoring, analyses by a state certified laboratory, and reporting;

(2) The elimination of illicit connections or discharges; that violating discharges, practices, or operations shall cease and desist;

(3) The abatement or remediation of storm water pollution or contamination hazards and the restoration of any affected property;

(4) Payment of a fine to cover administrative and remediation costs of the Enforcement Agency; and

(5) The implementation of source control or treatment best management practices.

NOTE: If abatement of a violation and/or restoration of affected property is required, the Notice of Violation shall set forth a deadline within which such remediation or restoration must be completed. Said Notice shall further advice that should the violator fail to remediate or restore within the established deadline, the work will be done by the Enforcement Agency and/or their designee, and that the expense thereof shall be charged to the violator.

B. Abatement by City of Somerset

If the violation has not been corrected pursuant to the requirements set forth in the Notice of Violation, then the Enforcement Agency and/or their designee shall enter upon the subject private premises and is hereby authorized to take any and all measures necessary to abate the violation and/or restore the property. It shall be unlawful for any person, owner, agent, or person in possession of any premises to refuse to allow the Enforcement Agency or their designee to enter upon the premises pursuant to this Ordinance.

C. Charging Cost of Abatement/Liens

Within 30 days after abatement of the nuisance by the Enforcement Agency, the City shall notify the property owner of the premises of the cost of abatement, including administrative costs. If the amount due is not paid within 10 days, the City Clerk shall enter the amount due on the tax roll and collect the cost as a special assessment against the property and said cost shall also constitute a lien on the property.

D. Urgency Abatement

The Enforcement Agency is authorized to require immediate abatement of any violation of this Ordinance that constitutes an immediate threat to the health, safety or well-being of the public *without issuing a Notice of Violation* as set forth above. If any such violation is not abated immediately as directed, the City of Somerset and/or their designee is authorized to enter onto private property and to take any and all measures required to remediate the violation. Any expense related to such remediation undertaken by the City shall be fully reimbursed by the property owner and/or responsible party.

E. Violations

It shall be unlawful for any person to violate, or fail to comply with, any provision of this Ordinance. A violation of, or failure to comply with, any of the requirements of this Ordinance shall constitute a Misdemeanor, and upon conviction by a court of competent jurisdiction, shall be punishable by a fine of not less than one hundred fifty dollars ($150.00) but not more than ten thousand dollars ($10,000.00), or by imprisonment for not more than ninety (90) days, or both, for each separate offense. Each day a violation of any part of this Ordinance exists constitutes a separate offense.

F. Acts Potentially Resulting in a Violation of the Federal Clean Water Act

Any person who violates any provision of this Ordinance, or any provision of any permit issued by the City of Somerset, may also be in violation of the Clean Water Act and may be subject to the sanctions of those acts including civil and criminal penalties. Any enforcement action authorized under this Ordinance shall also include written notice to the violator of such potential liability.

CHAPTER 3 - EROSION PROTECTION AND SEDIMENT CONTROL (EPSC)

3.1 PURPOSE

In addition to this Ordinance's general purposes as set forth in Chapter 1, the requirements set forth in this Chapter are intended to:

A. Control or eliminate soil erosion and sedimentation from construction site storm water runoff related to land disturbing activities within the City's jurisdictional limits; and

B. Control or eliminate waste from construction site operators that may cause adverse impacts to water quality.

3.2 LAND DISTURBANCE ACTIVITY

Land Disturbance Activity includes, but is not limited to, the following:

A. Any activity disturbing one (1) or more acres of soil is subject to the provisions of this Ordinance and such activity shall not take place without an authorized EPSC Permit issued by the City of Somerset, or other proper state and/or federal authority.

B. Land disturbance activities that disturb less than one (1) acre on individual lots or parcels which are determined by the City of Somerset to be part of a larger common plan of development are also subject to the provisions of this Ordinance. If an individual lot or parcel owner is different than the Permittee of the larger common plan of development, the individual lot or parcel owner is responsible for complying with the provisions of this Ordinance and is required to obtain an EPSC Permit. The Permittee of the larger plan of development is also responsible for EPSC measures for land disturbance activity on each of the individual lots and/or parcels until the City determines that 80% build-out of the development has been reached.

C. Unless determined to be a problem by the Enforcement Agency, the following activities are exempt from obtaining an EPSC permit and are further exempt from the provisions of this Ordinance:

(1) Emergencies posing an immediate danger to life or property, substantial flood or fire hazards, or natural resources;

(2) Underground utility repairs in paved areas, home gardens, minor repairs, maintenance work, installation of fence, sign, telephone, and electric poles and other kinds of posts or poles;

(3) Agricultural operations required to adopt and implement an individual agriculture water quality plan pursuant to the requirements set forth in the Kentucky Agriculture Water Quality Act (KRS 224); and

(4) Usual and customary site investigations, such as geotechnical explorations, clearing for surveying work, monitoring wells and archaeological explorations, responsible for EPSC measures for land disturbance activity on the individual lot or parcel until the City determines that 80% build-out of the development has been reached.

(5) Building improvements on existing residential dwellings (garages, additions, porches, etc.)

D. The City may exempt, on a project-by-project basis, other minor land disturbance activities not specifically identified in the exemptions above.

3.3 EPSC REQUIREMENTS

NOTE: Complying with the provisions of this Ordinance and issued EPSC Permit does not exempt the Permittee from obtaining coverage from the Kentucky Division of Water (KDOW) under the KPDES Storm Water General Permit for storm discharges related to construction activities that disturb one (1) acre of more. The Permittee is still required to obtain coverage under the KPDES Storm Water General Permit and shall provide a copy of the Notice of Intent filed with KDOW to the Approving Agency.

A. Plan Requirements

Sites where land disturbance activities are proposed will require an EPSC Plan prepared by an Engineer licensed to practice in the Commonwealth. The EPSC Plan is a site specific document and shall include erosion prevention measures, sediment control measures, and other site management practices necessary to prevent the discharge of sediment and other pollutants into waters of the Commonwealth. The owner/developer/contractor shall perform all clearing, grading, drainage, construction and development in strict accordance with the approved EPSC Plan and this Ordinance.

The EPSC Plan shall include the following information in the order listed:

1. The name, address, and telephone number of the owner and/or developer of the property where the land disturbance activity is proposed;

2. Site Description – At a minimum the following information shall be described:
   a. Function of the project,
   b. A chronological construction schedule and time frame, at a minimum, for the following construction activities:
      i. Clearing and grubbing,
      ii. Construction of erosion control devices,
      iii. Installation of permanent and temporary stabilization measures,
      iv. Excavation and filling operations
      v. Building, parking lot and site construction,
      vi. Establishment of final grade, landscaping, or stabilization, and
      vii. Removal of temporary erosion control devices.
   c. Total acreage of the site and estimated acreage to be disturbed by construction related activities, and
   d. Description of the current water quality classification of the receiving water(s).

3. Site Map of sufficient scale to depict the following:
   a. Property boundary of the project,
   b. Proposed drainage patterns and slopes after grading located on topography with a minimum of two (2) feet intervals,
   c. Identify all disturbed areas including fill and borrow areas,
   d. Locations and types of sediment control measures, erosion control measures, planned stabilization measures, and other site management practices,
   e. Location of surface waters, wetlands, riparian zones, 100 year floodplain, and karst features (ie sinkholes, springs),
   f. Location of storm drainage system, including quantities of flow and site conditions around all points of surface water discharge from the site,
   g. Location(s) of discharge point(s),
   h. Locations of equipment storage areas and material(s) storage areas,
   i. Location of concrete washout areas and waste management areas, and
   j. Indication of scale used.

4. Description and location of any discharges associated with industrial activity other than construction.

5. Clear documentation of all erosion prevention measures, sediment control measures, and other site management measures utilized to reduce pollutants from stormwater discharges associated with the construction site and maintain compliance with the permit. Any BMPs may be selected provided that they are proven to be equally or more effective than the equivalent best management practices as contained in the Kentucky Erosion Prevention and Sediment Control Manual and Field Guide.

6. Maintenance of all erosion and sediment control measures:
   a. A maintenance schedule shall be provided which maintains all erosion and sediment control measures in an effective, operating condition, and
   b. All erosion and sediment control measures identified during inspections, as not functioning properly shall be repaired before the next storm event.

7. Identify appropriate pollution prevention measures for eligible non-stormwater components authorized by the current KPDES general permit for construction activities, when combined with stormwater discharges associated with construction activity.

8. Permitee conducted inspections:
   a. The Permittee shall provide to the City regular inspection reports of the site at the intervals as required by the City. Such intervals shall include, but is not limited to, the following:
      1. Within 24 hours after any storm event of 0.5 inches or greater.
      2. Once every calendar month in areas that have received temporary or final stabilization.
      3. Construction entrances and exits shall be inspected *daily* and the permittee shall take necessary steps to remove mud and dirt from public roadways as needed. Bulk clearing of sediment shall not include flushing the area with water. Cleared sediment must be redistributed or disposed of in a manner that is in compliance with all applicable statutes and rules.

   b. Inspections shall be performed by City approved Erosion Control Inspectors and said inspections shall include at a minimum:
      i. A visual inspection to determine if stormwater measures are properly installed, properly maintained, and performing as designed; and
      ii. If excessive pollutants are entering the drainage system.

   c. Inspection reports shall include at a minimum:
      i. Date of inspection,
      ii. Name of inspector and company represented,
      iii. Pertinent weather information including current conditions and conditions since the last inspection,
      iv. Location(s) of any pollutant discharges,
      v. Locations of any stormwater management measures that require maintenance,
      vi. Locations of any stormwater management measures that were inadequate or failed,
      vii. Locations requiring any additional stormwater management measures,
      viii. Identify any actions taken in response to inspection findings,

ix. Identify any incidents of non-compliance with the EPSC,
x. Signed and certified in accordance with the signatory requirements in 401 KAR 5:065.

d. A copy of each inspection report shall be kept at the job site at all times and a copy shall be filed with the City of Somerset.

9. It shall be noted in the EPSC Plan that revisions shall be made whenever erosion prevention measures, sediment control measures, or other site management practices are significantly modified in response to the project.

10. Signature Requirements and Availability:
   a. The EPSC Plan shall be signed and certified in accordance with the signatory requirements in 401 KAR 5:065.
   b. A current copy of the EPSC Plan shall be readily available at the construction site from the date of project Notice of Initiation (NOI) to the date of Notice of Termination (NOT).

11. All other requirements of an EPSC Plan as defined in the current KPDES general permit for construction activities.

B. Design requirements.

1. The design, testing, installation, and maintenance of erosion prevention and sediment control operations and facilities, as well as site waste management, shall adhere to the criteria, standards, and specifications as set forth in the City's "Regulations & Specifications Pertaining to Roadway and Drainage Design" manual which shall be adopted through the executive authority's approval as administrative regulations. Upon approval of the Executive Authority of the City, the manual may be updated and revised as needed on a periodic basis and the City shall ensure that a current manual be made available to the public for review at all times.

C. Requirements for Individual lots when less than 1 acre is disturbed, and the lot/parcel is *not part of a Common Plan of Development* as described above and elsewhere in this Ordinance.

1. Although no EPSC permit is required for individual lots disturbing less than one (1) acre which are not part of a larger common plan of development, a formal storm water review will be required prior to the issuance of a Building Permit by any agency authorized to issue such permits in the Commonwealth. All storm water management measures necessary to comply with this Ordinance Section must be implemented prior to a Building Permit being issued.

2. The following information must be submitted to the City of Somerset for review and approval prior to the issuance of a Building Permit for an individual lot as described above:
   a. A site location plan showing the individual lot and all adjacent lot dimensions, elevations, drainage patterns, and swales.
   b. An erosion and sediment control plan which at a minimum includes the following measures:

i. Installation and maintenance of a stable construction site entrance/exit.
ii. Installation and maintenance of appropriate perimeter sediment control measures prior to land disturbance.
iii. Sediment discharge and tracking from a lot must be minimized throughout the land disturbing activities until permanent stabilization has been achieved.
    1. Sediment that is either tracked or washed onto roads must be cleaned. Bulk clearing of sediment shall not include flushing the area with water. Cleared sediment must be redistributed or disposed of in a manner that is in compliance with all applicable statutes and rules.
    2. Adjacent lots disturbed by an individual lot operator must be repaired and stabilized with temporary or permanent surface stabilization.
iv. Self-monitoring program, including a plan and procedures.
v. Certification of Compliance stating that the individual lot plan is consistent with the storm water management criteria identified within this Ordinance.

3. The individual lot operator is responsible for the installation and maintenance of all erosion and sediment control measures until the site is stabilized.

3.4 EPSC PERMIT SUBMITTAL REQUIREMENTS:

A. Land disturbance activities subject to the provisions of this Chapter shall not take place without an authorized EPSC Permit.

B. Required submittal information may include, but is not limited to, the following:

1 Land disturbance activities < 1 acre and not part of a common plan of development
-Completed Plot Plan
-Plan Review Fee

2 Land disturbance activities > 1 acre or < 1 acre and part of a common plan of Development
-Permit Application
-EPSC Plan
-Plan Review Fee

C. Plan Review Fees for the review of storm water related plans shall be set forth in the City's "Regulations & Specifications Pertaining to Roadway and Drainage Design" manual as adopted and approved by the Executive Authority of the City.

D. Applications submitted under this Chapter shall contain the information required by the City and shall be made on any form for which the City provides for such purposes. The Application Form shall be set forth in the City's "Regulations & Specifications Pertaining to Roadway and Drainage Design" manual as adopted and approved by the Executive Authority of the City.

3.5 EPSC PERMIT REVIEW AND APPROVAL PROCESS

The Approving Agency will review each application for an EPSC Permit to determine its conformance with the provisions of this Ordinance. Within 30 calendar days after receiving a complete application, EPSC plan, and permit review fee, the Approving Agency shall, in writing:

A. Approve the application and EPSC plan and issue the EPSC Permit;

B. Approve the application and EPSC plan subject to such reasonable conditions as may be necessary to secure substantially the objectives of these Regulations, and issue the EPSC Permit subjected to these conditions; or

C. Disapprove the permit application and EPSC plan, indicating the reason(s) and procedure for submitting a revised application and/or submission.

NOTE: The 30-day review period shall begin anew for re-submittals that were previously submitted and determined to be incomplete or disapproved.

3.6 STORM WATER BMP PLAN REVIEW REQUIREMENTS

On development or redevelopment projects where the Approving Agency has determined storm water BMP's are required, the developer shall submit plans of the proposed BMPs prepared by an Engineer licensed to practice in the Commonwealth. The plans shall be drawn to an appropriate scale and shall include plan and profile views, sections, details, notes and other information necessary for the installation of the BMP.

3.7 STORM WATER BMP PLAN REVIEW AND APPROVAL PROCESS

The Approving Agency will review the storm water BMP plan to determine its conformance with the provisions of this Ordinance. Within 30 calendar days after receiving the plans and plan review fee, the Approving Agency shall, in writing:

A. Approve the plans; or

B. Approve the plans subject to such reasonable conditions as may be necessary to secure substantially the objectives of this Ordinance, and approve the plans subject to these conditions; or

C. Disapprove the plans, indicating the reason(s) and procedure for submitting a revised plan.

NOTE: The 30-day review period shall begin anew for re-submittals that were previously submitted and determined to be incomplete, or previously submitted and disapproved.

3.8 AS-BUILT DRAWING REQUIREMENTS

A. Prior to issuance of a certificate of occupancy, recording of the final plat or final release of any bonds or other fiscal security, the project developer and/or contractor shall submit to the Approving Agency and the Agency must approve the as-built condition (including: invert elevations, size, shape and location) of critical storm water management features.

B. The volume, slopes, configuration, condition and topographic information of all storm water management practices shall be certified by a licensed professional engineer. This information shall be provided to the Approving Agency, in the form of an as-built drawing in electronic form acceptable to the Approving Agency. The as-built certification shall indicate if final conditions are consistent with, or exceed, the EPSC permit provisions.

This section provides a set of guidelines and standards to ensure all as-built submittals in digital format are compatible with the GIS system of the Approving Agency. The goal of these requirements is not to burden the engineering, development and design community, but to standardize submittals to ensure quality and compatibility. The standards required include, but are not limited to, the following:

1 The media will be legibly labeled with project name and phase; submittal number, file creation date; and contact information (name and phone number).

2 As-built drawings shall be submitted in an electronic format of either AutoCAD DWG or MicroStation format.

3 Submittals shall be spatially referenced to NAD 83, Kentucky Stateplane Coordinate System, South Zone, U.S. Survey feet and tied to Grant corners, USGS or HARN monumentation as available.

4 Elevations shall be referenced to the NAVD88 vertical datum.

5 Drawing elements shall reside in the primary drawing file and not include cells, nodes, blocks or reference files (x-refs).

6 All features included in the CAD drawing must be drawn on their own layer and defined in the attribute table by a field named "LAYER" (i.e. manholes should be attributed as MH in the field "LAYER").

7 Metadata, or data documentation, should be included with each submittal. The metadata should include information outlining the naming convention of each drawing file included in the submittal, a description of each layer in the drawing including names and descriptions of each submitted file, the projection used to define the coordinate information used in the digital submittal, a reference to the record number for the plans, date of study/revision date, and any other notes pertinent to submittal.

C. If it is determined that the information provided in the as-built drawings or certification of the site improvements and storm water facilities do not meet or exceed the Storm Water Management Program for the City of Somerset, the Approving Agency reserves the right to withhold any bond, fiscal security or certification of occupancy, until such time the deficiency is corrected.

1 If it is determined that information provided in the as-built drawing, certification, inspection or survey of the site do not meet or exceed the EPSC permit provisions, other enforcement mechanisms, as identified within this ordinance, may be applied to the permittee or the person certifying the as-built information.

2 If upon inspection by the Approving Agency it is determined that there is an item that must be addressed to receive acceptance of site conditions, then the permittee shall be required to continue inspections and maintenance as described in the EPSC permit.

3.8 INSPECTIONS

A. The City of Somerset or their designee shall make periodic inspections of land disturbing activities subject to this Ordinance at various stages of construction in order to ensure compliance with the approved EPSC Plan and verify that selected control measures are adequate.

B. The Permittee shall be self-policing and shall correct or remedy any EPSC measures that are not effective or functioning properly at all times during the various phases of construction.

C. The Permittee shall provide inspections, at a minimum, at the following stages:

1. Completion of perimeter erosion and sediment controls

2. Completion of cleaning and grading.

3. Installation of temporary erosion controls.

4. Completion of final grading and ground stabilization.

D. The City of Somerset may increase or decrease the number of required inspections as deemed necessary to ensure an effective EPSC Plan and shall have the right to enter the property of the Permittee without notice pursuant to this Ordinance.

3.9 ENFORCEMENT

A. The City of Somerset shall enforce the regulations contained in this Ordinance. Therefore the City and/or their designee may issue a *stop-work order* for an entire project, or any specified part thereof, if any of the following conditions are determined to exist by the City and/or their designee:

1. Any land disturbance activity regulated under this Ordinance is being undertaken without an EPSC Permit.

2. The EPSC Plan is not being fully implemented.

3. Any of the conditions of the EPSC Permit are not being met.

4. EPSC Plan is determined to be ineffective.

B. For the purposes of this section, a stop-work order is validly posted by:
1. Posting a copy of the stop-work order on the site of the land disturbing activity in reasonable proximity to a location where the land disturbing activity is taking place; and
2. If an EPSC permit has been issued for a site, providing a copy of the stop-work order by mailing said copy first class mail, postage pre-paid, to the address listed by the Permittee on the EPSC permit; or
3. In the case of work for which there is no authorized EPSC permit, a copy of the order shall be mailed to the person listed as the landowner of the property by the Pulaski County PVA Officer or other authorized official.

C. If the work is being performed by a person or entity that has obtained an EPSC Permit and the Permittee does not cease the activity or comply with the EPSC Plan or EPSC Permit conditions within five (5) days of posting the stop-work order, the City may revoke the EPSC Permit.

D. If the landowner or developer where no EPSC permit has been issued does not cease the land disturbance activity for which a stop-work order has been issued, the City Attorney shall be authorized to obtain injunctive relief through a Court of competent jurisdiction.

E. The City may retract the revocation of an EPSC Permit if the land disturbance activity and site is brought into compliance with these Regulations to the City's satisfaction.

F. If the public health, safety or nuisance is at stake, time is of the essence to perform any remedial clean-up work or other work to bring the site into compliance with the regulations contained in this Ordinance. The City may begin remedial work immediately without notice of intent in such situations and thereafter bill the cost of such work to the Permittee, or the landowner in violation. This type of work may include, but is not limited to, the cleaning of mud, silt, sediment, and other debris from public streets and drainage systems.

G. Any Permittee, person, firm, corporation, or agency acting as principal, agent, employee or otherwise, who fails to comply with the provisions of this Ordinance shall be guilty of a Misdemeanor and upon conviction by a Court of competent jurisdiction, shall be punishable by a fine of not less than one hundred fifty dollars ($150.00) and not more than ten thousand dollars ($10,000.00), or by imprisonment for not more than ninety (90) days, or both, for each separate offense. Each day a violation of any part of this Ordinance exists shall constitute a separate offense.

H. If the Permittee, landowner, or developer fails to pay the amount due for the remedial clean-up work, or any other work to bring the site into compliance with this Ordinance, the City Clerk shall enter the amount due on the tax roll and collect said amount as a special assessment against the property where the land disturbance activity and subsequent violation occurred.

CHAPTER 4- POST-CONSTRUCTION STORM WATER MANAGEMENT

4.1 PURPOSE

In addition to the general purposes set forth in Chapter 1 of this Ordinance, the requirements set forth in this Chapter are intended to:

A. Develop and implement strategies which include a combination of structural and/or non-structural best management practices (BMPs) that prevent or minimize water quality impacts from developments in the City of Somerset's jurisdictional limits; and

B. To ensure adequate long-term operation and maintenance of BMPs.

C. To aid in the maintenance of storm water runoff characteristics, reduction of stream bank and channel erosion, reduction of siltation and sedimentation in the community waters and waters of the Commonwealth, and lowering the discharge of pollutants from impervious areas.

4.2 APPLICATION

This Chapter applies to the development or redevelopment of land for residential, commercial, industrial, or institutional use. It does not apply to agricultural land management practices *with the exception of illicit discharge regulations as set forth in this Ordinance and all other applicable law.*

4.3 IMPLEMENTATION OF BMPs

A. The City is responsible for the implementation and enforcement of this Ordinance pursuant to KRS Chapter 83A and all other applicable law.

B. The City, by and through the Executive Authority or his/her designee, may perform the following functions in order to implement and enforce this Ordinance:

1. Adopt, and update as needed, a manual which shall be known as the City's "Regulations & Specifications Pertaining to Roadway and Drainage Design" for use with both development, and redevelopment, projects and which addresses quantitative controls for increased volume and rate of surface runoff as well as qualitative controls that reduce or eliminate pollutants carried by runoff . The manual shall also include, but is not limited to, regulations pertaining to the following:

   a. Policies, procedures, standards, and criteria relating to storm water runoff quality and quantity;

   b. Establish design criteria and standards for construction site waste control, erosion protection, and sediment control related to land disturbance activities;

   c. Provide erosion protection and sediment control training for City officers, and/or employees, as needed to implement and enforce this Ordinance; and

C. The City, by and through the Executive Authority, may enter into agreements with a landowner for long-term operation and maintenance of Best Management Practices (BMPs) if it is found to be in the City's best interests to do so. All such agreements must be prepared by the City Attorney, or other attorney licensed to practice in the Commonwealth, and signed by the proper authorities.

4.4 STORM WATER MANAGEMENT REQUIREMENTS

A. This Ordinance requires the design and implementation of structural and non-structural BMPs for new and redevelopment projects. Said designs shall be based on the Water Quality Standard established by the City as set forth in the "Regulations & Specifications Pertaining to Roadway and Drainage Design" manual described above, and shall include designs that provide effective treatment of runoff in post-developed condition. Designs and supporting performance analyses must be submitted to the City with the construction plans for new or redevelopment projects. Redevelopment projects are required to meet 20% of the local water quality standard.

B. The design of structural BMPs shall be performed by an Engineer licensed to practice in the Commonwealth in the field of civil works.

C. The storm water BMPs shall become a part of the development's site plan and may include the BMPs identified more specifically in Section 4.5 below.

4.5 STORMWATER BEST MANAGEMENT PRACTICES (BMPs)

Stormwater BMPs shall be utilized to address runoff volume and rate, and remove pollutants. These BMPs may include detention facilities, extended detention basins, retention facilities, hydrodynamic separators, first flush basins, infiltration trenches, grass swales, filter strips, stormwater wetlands, natural filtration areas, sand filters, pervious pavements, and rain-gardens. The Water Quality Standard requires, in combination or alone, management measures that are designed, built, and maintained to treat, filter, flocculate, infiltrate, screen, evapo-transpire, harvest and reuse stormwater runoff, or otherwise manage the stormwater runoff quality. Additional information on these practices can be obtained at http://cfpub.epa.gov/npdes/stormwater/menuofbmps/.

4.6 STREAM CORRIDOR PROTECTION

Stream corridor protection BMPs shall be utilized to protect designated streams and waterways through conservation methods. These methods may include buffer strips, greenways, vegetated channels, stream bank stabilization and restoration.

4.7 IMPERVIOUS AREA RUNOFF CONTROLS

Impervious area runoff controls shall be utilized to address high levels of runoff quantity and quality associated with high-density developments. These controls may include preservation of open space, minimizing impervious surfaces, porous pavement, utilization of grass swales instead of curb and gutter, reduced pavement widths and similar measures.

4.8 OUTLET CONROLS

Discharge control BMPs shall be utilized to provide flow attenuation for post-development runoff. These BMPs may include detention facilities, extended detention basins, retention facilities and artificial wetlands.

4.9 RETROFIT IMPROVEMENTS

If a new development or redevelopment project contributes runoff to downstream receiving waters that are impaired or infrastructure that does not have sufficient capacity, the Issuing Authority may, at its discretion, require stormwater management controls greater than the minimum required by this chapter. Drainage calculations shall be provided by the developer's Engineer to demonstrate the integration with the downstream hydraulic system.

4.10 STORMWATER IMPROVEMENT FEE

The Approving Agency, at its discretion, may require the developer of a new development or redevelopment project to pay a storm water improvement fee in lieu of the installation of storm water BMP improvements.

4.11 STORMWATER BMP PLAN

Requirements related to a storm water BMP Plan are set forth in the City's "Regulations & Specifications Pertaining to Roadway and Drainage Design" manual.

4.12 MAINTENANCE REQUIREMENTS

A. Any stormwater management facility or BMP which services individual property owners shall be privately owned and maintained consistent with provisions of this chapter.

B. Any stormwater management facility or BMP which services an individual residential subdivision in which the facility or BMP is within designated open areas or serves as an amenity with an established homeowners association shall be privately owned and maintained consistent with provisions of this chapter.

C. Any stormwater management facility or BMP which services commercial and industrial development shall be privately owned and maintained.

D. All regional stormwater management control facilities proposed by the owners, if approved and accepted by the city for dedication as a public regional facility, shall be publicly owned and/or maintained. All other stormwater management control facilities and BMPs shall be privately owned and/or maintained unless accepted for maintenance by the city.

E. The city may require dedication of privately owned stormwater facilities, which discharge to the city storm water system.

F. When a stormwater quality BMP serves more than one (1) parcel, a home or property owners' association with a binding contract for the purpose of operation and maintenance is required. The owners association shall be responsible for operation and maintenance as directed by this chapter.

4.13 OPERATION AND MAINTENANCE AGREEMENTS

The city shall require all new development and redevelopment to establish and enter into a long-term operation and maintenance agreement and maintenance plan with approved management practices for all stormwater quality BMPs.

A. Operation and maintenance agreements shall be:

1. In the format requested by the City of Somerset;
2. Noted on the final plat with the appropriate notation of the particular lot(s);
3. Included with property ownership title documents and shall be binding on the owner, its administrators, executors, assigns, heirs, and any other successors in interest;
4. Allow the MS4 or its designee, to conduct inspections of the management practices being performed;
5. Allow the MS4 or its designee to perform necessary maintenance or corrective actions form BMPs neglected by the property owner; and

6. Allow the MS4 to recover costs from the property owner/operator when the owner/operator has not performed the necessary maintenance.

B. The maintenance plan shall:

1. Be developed to ensure that the stormwater quality BMP(s) is (are) kept functional;

2. Specify schedules for inspections and techniques for operation and maintenance including vegetation clearing or mowing and removing accumulated trash, debris, sediment, pollutants and other forms of pollution.

C. Stormwater detention and retention maintenance.
Care must be taken to ensure that any required facilities do not become nuisances or health hazards. Detention and retention facilities should be designed to require minimal maintenance, and maintenance expectations must be clearly stated in the long-term operation and maintenance agreement.

4.14 ENFORCEMENT

A. An Administrative Official, designated by the City of Somerset, shall enforce the regulations found in this Ordinance. When the City determines, by and through said Administrative Official, that a person, company, developer, or any other entity has violated a prohibition, or has failed to meet a requirement of this Chapter, the Administrative Official may order compliance by written citation to the Responsible party.

B. A citation may be posted for the project if any of the following conditions exist:

- Structural and/or non-structural BMPs are not being installed or maintained per manufacturer's specifications and/or City of Somerset;
- Construction is not in compliance with the approved Stormwater BMP Plan; or
- Any of the conditions of this Ordinance are not being met.

C. If abatement of a violation and/or restoration of affected BMP is required, the citation shall set forth a deadline within which such remediation or restoration must be completed. Said notice shall further advise that, should the responsible party fail to remediate within the established deadline, the work will be done by the City of Somerset and the expense thereof shall be charged to the responsible party.

D. For violations where no Operation and Maintenance Agreement has been recorded, the City of Somerset will notify the property owner or Responsible Party and cooperate for resolution prior to enforcement. Should the Responsible Party not provide stormwater structure maintenance, or demonstrates a history of non-compliance of the same nature, the City of Somerset may request the City Attorney to seek injunctive relief from a Court of competent jurisdiction.

E. If the violation has not been corrected pursuant to the requirements set forth in the Citation within 10 days of the decision of the City, by and through the above referred to Administrative Official, then the City shall enter the site in violation and is authorized to take any and all measures necessary to abate the violation and/or restore the property. It shall be unlawful for any person, owner, agent, or person in possession of any premises to refuse to allow the City and/or their designee to enter upon the premises for the purposes set forth above.

F. Within 30 days after abatement of the violation by the City of Somerset, the City shall notify the property owner of the premises of the cost of abatement, including administrative costs. If the amount due is not paid within 10 days, the City Clerk shall enter the amount due on the tax roll and collect as a special assessment against the property which shall constitute a lien.

G. The City of Somerset is authorized to require immediate abatement of any violation of this Ordinance that constitutes an immediate threat to the health, safety, or well-being of the public. If any such violation is not abated immediately as directed, the City of Somerset is authorized to enter onto private property and to take any and all measures required to remediate the violation. Any expense related to such remediation undertaken by the City shall be fully reimbursed by the property owner and/or Responsible Party.

H. It shall be unlawful for any person to violate any provision, or fail to comply with any of the provisions, of this Ordinance. A violation of, or failure to comply with, any of the requirements in this Ordinance shall constitute a Misdemeanor and upon conviction by a Court of competent jurisdiction thereof shall be punishable by a fine of not less than one hundred and fifty dollars ($150.00) and not more than ten thousand dollars ($10,000.00), or by imprisonment for not more than ninety (90) days, or both, for each separate offense. Each day a violation of any part of this Chapter exists shall constitute a separate offense.

SECTION III.

1. SEVERABILITY.

IF ANY SECTION OF THIS ORDINANCE, INCLUDING BUT NOT LIMITED TO, ANY SECTION, SUBSECTION, PARAGRAPH, SENTENCE, CLAUSE, PHRASE, OR ANY OTHER PORTION OF THIS ORDINANCE, IS DECLARED ILLEGAL OR UNCONSTITUTIONAL, OR OTHERWISE INVALID BY A COURT OF COMPETENT JURISDICTION, SUCH DECLARATION SHALL NOT AFFECT THE REMAINING PORTIONS HEREOF.

2. EFFECTIVE DATE OF ORDINANCE PROVISIONS.

THIS ORDINANCE SHALL TAKE EFFECT AFTER ITS PASSAGE AND PUBLICATION AS REQUIRED BY LAW.

FIRST READING: March 24, 2014 SECOND READING: April 14, 2014

APPROVED: ______________________
EDWARD R. GIRDLER, MAYOR

ATTEST: ______________________
DAVID GODSEY, CITY CLERK

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