

# APPENDIX A

## REQUIRED IMPROVEMENTS

These standards for the design and construction of streets and utilities are established to ensure that all proposed subdivisions are provided with adequate, safe, and sufficient services.

### **DEFINITIONS:**

1. SPWD - City of Springfield, Public Works Department
2. SED - City of Springfield Engineering Department
3. TDOT - Tennessee Department of Transportation
4. ENGINEER - An engineer certified and registered by the State Board of Architectural and Engineer Examiners pursuant to Section 62-2, Tennessee Code Annotated.
5. TDOT STANDARD SPECIFICATIONS – Standard Specifications for Road and Bridge Construction, Tennessee Department of Transportation, Nashville, Tennessee, March 1, 1995 Edition, and any subsequent revisions, special provisions and additions.
6. AASHTO – American Association of State Highway and Transportation
7. ASTM - American Association for Testing Materials
8. SUBDIVIDER – Developer of the site or owner.

### **STREET AND ROAD CONSTRUCTION**

#### AP 1-1 STREET PLANS

The developer shall provide street construction plans, including drainage calculations, for approval by the City Engineer and Director of Public Works. These plans will show plans and profiles of all streets (vertical and horizontal alignments), typical cross sections, natural and finished grades, vertical curves, horizontal curves, tangents, grades at intersections, angle of intersection, property line radii, street offsets, sidewalk width and position, etc. and shall be stamped and signed by a Registered Tennessee Professional Engineer. Construction plans shall be approved prior to street construction.

#### AP 1-1.1 Centerline

The centerline of proposed streets and roadways may be required, to be marked or flagged in the right-of-way of the existing roadway prior to preliminary approval. All improvements shall be located from the centerline of the right of way.

### AP 1-1.2 Notification

The subdivider shall be required to notify the SPWD and the Engineering Department, in writing, at least 48 hours prior to construction in order that an Inspector may be scheduled to inspect the proposed work.

## AP 1-2 EARTHWORK & EMBANKMENT

The subdivider shall grade or fill horizontally all streets, roads, and alleys to the full width of base construction plus seven feet, which may be located on one side of the roadway. Due to special topographical conditions, deviation from the above will be allowed only with specific approval of the Planning Commission.

### AP 1-2.1 STRIPPING, STOCKPILING, AND PLACING TOPSOIL

All topsoil shall be stripped within the street right-of-way and from any other areas designated by the enforcing officer. Topsoil shall be stored in stockpiles. All organic matter within the right-of-way shall be stripped and disposed of unless directed otherwise by the enforcing officer.

A two-to-three-inch layer of topsoil shall be placed where seeding is required or where required by the enforcing officer.

After the stockpiled topsoil has been placed as specified above, the areas where the topsoil was stockpiled shall be neatly graded and dressed.

Topsoil stockpiles shall be protected with erosion control devices to prevent soil erosion.

### AP 1-2.2 CLEARING & GRUBBING

Before grading is started the entire right-of-way, area shall be cleared and grubbed of all trees, stumps, roots, brush, and other objectionable materials. Do not disturb any trees and other vegetation that are not in conflict with improvements.

### AP 1-2.3 EXCAVATION

Excavation for roadways includes the removal of pavements; root mat; stripping of topsoil; cutting ditches; storing suitable material for incorporation on the job at a later date; widening cuts and shaping slopes necessary for preparation of the roadbed, channels, waterways, intersections, approaches, entrances; disposal of unsuitable and surplus materials; and other incidental work within the limits of construction.

Where the location is on a section of old road, the Developer shall be required to scarify or break the old surface and remove or spread the material there from uniformly over the roadbed as directed.

When required, cut surface ditches on the top of slopes for excavation, or at the foot of slopes of embankments, and at such other points not necessarily confined to the right-of-way, or shown on the approved plans. Surface ditches shall be of such dimensions and grads as necessary to provide proper drainage. Side ditches may be changed from time to time as to slope and depth according to the amount of drainage.

Excavation for roadways shall include the disposal of materials unsuitable for reuse in the embankment (referred to as “unsuitable material”) as directed by the SPWD.

When the material encountered is not suitable for the foundation of the subbase or for finished grade, excavate the unsuitable material below the grade shown on the profile, backfill with suitable material as approved by SPWD and shape to conform to the section of the road surface as shown on the approved plans.

All tree stumps, boulders, and other obstructions shall be removed to a depth of two (2) feet below the subgrade. Solid shall be scarified to the subgrade one (1) foot below subgrade. All areas excavated below subgrade shall be backfilled and compacted with materials approved by the SPWD and shape to conform to the section of road surface as shown on the approved plans.

All construction shall be in accordance with Division II – Part I Earthwork, TDOT STANDARD SPECIFICATIONS unless otherwise directed by the SPWD.

#### AP 1-2.4 EMBANKMENT

Embankment shall consist of the placing and compaction of approved material within the construction area and shall include the preparation of the area upon which the embankment is to be placed.

Construct embankment with approved material and place so as to provide uniform compaction throughout. The embankment shall contain no mud, frozen material, roots, sod or other deleterious matter.

Do not place embankment on frozen ground or areas covered with ice or snow.

The area of original ground surface on which embankments of less than ten feet in depth are to be constructed shall be denuded of all vegetation.

Where existing highways are to be widened and fills extended, denude existing slopes of all vegetation. Where the width of the fill to be added is sufficient to accommodate the compacting equipment, bench the existing sloped in horizontal and vertical planes to obtain the proper width.

Construct embankments of approved material and build in layers not exceeding 8

inches of loose material, except in cases of rock, where layers of 2 feet may be used. Rock over 4 inches in diameter shall not be placed with the top 12 inches of subgrade. Each layer shall be compacted at optimum moisture content and the embankment shall have the required maximum density of 95 percent as compared to the density of the same material when tested in accordance with AASHTO, T-99. Save the best material for finishing and dressing the surface.

Where such areas will support the compacting equipment, compact the original ground to a depth of 8 inches prior to the placing of any fill material. Embankments to be placed over swampy areas may be deposited by end-dumping the original course. This course shall be the minimum depth required to support the equipment. The use of compacting equipment shall not be required on the original course. Upon the completion of the original course, construct the remainder of the embankment in layers and compact in accordance with these specifications.

On embankments constructed on slopes of more than 30 degrees with the horizontal, the slopes shall be benched to a width sufficient to carry the compacting equipment and the fill constructed as hereinbefore specified.

Surplus material and unsuitable material may be disposed of by using the material to widen and flatten sloped embankments where sufficient right-of-way exists.

Shape, compact, slopes and dresses in such a manner as to yield the grades and slopes shown on the approved plans.

All construction shall be in accordance with Division II – Part I Earthwork, TDOT STANDARD SPECIFICATIONS unless otherwise directed by the SPWD.

#### AP 1-2.5 ROCK EXCAVATION

The developer shall use utmost care not to endanger life or property. The contractor must provide the SPWD a Certificate of Insurance in an amount satisfactory to the Director of Public Works and written proof of personnel licensed by the State of Tennessee to perform this work.

The developer shall obtain all permits required for the transportation, handling, storage and use of explosives and drilling equipment. Blasting permits shall be obtained from the appropriate agency and no blasting is to occur without informing the SPED.

All Blasting shall be in accordance with the Underground Utility Damage Prevention Act of the State of Tennessee as well as other state and federal regulations and ordinance relating to explosives. Blasters shall have a State of Tennessee approved license available for examination at all times on the work site.

Cover areas to be blasted with mats or other approved material to stop flying, during explosions. Give sufficient warning to all persons in the vicinity of the work before a charge is exploded.

Employ flagmen to stop or direct traffic as required.

In addition, all rock excavation shall be in accordance to section 203, TDOT STANDARD SPECIFICATIONS.

#### AP 1-2.6 DUST PREVENTION

The developer shall sprinkle the grade with water or apply a dust-allaying material when in accordance with Section 104.09 TDOT STANDARD SPECIFICATIONS, as may be to prevent a dust nuisance to the public or as directed by SPWD.

#### AP 1-2.7 SUBGRADE RESTORATION AND STABILIZATION

All underground utilities, including water, sewer, gas, telephone, or other, shall be installed completely throughout the length and width of all roadways, including individual service connections to each and every lot. All individual service connections shall be stubbed out from the main line to the street right-of-way.

Where the subgrade is required to be cut for the installation of underground utilities, or service connections, the backfill shall be a crushed limestone placed in layers not to exceed eight (8) inches in thickness and shall be compacted by a pneumatic tamper to a density equal that of the original compacted subgrade.

On previously approved subgrade which has been disturbed by installation of utilities, additional testing of the density may be required before any base stone is applied. The finished subgrade shall provide for super-elevation and crown of the roadway where required.

#### AP 1-2.8 TRIMMING OF TREES

Trees may be trimmed to remove branches or roots, which interfere with construction with the approval of SPWD. Do not cut tree roots unnecessarily, but if cutting is required backfill immediately after construction in the area is complete.

#### AP 1-2.9 DISPOSAL

Dispose of all trees, shrubs and other waste materials at an area shown on the plans, or at the Robertson County Transfer Station or an area approved by the SPWD. *Burning of wood waste is not allowed.* However, the Fire Department may consider granting a waiver from the open burning restrictions. The responsibility for obtaining all waivers shall be the Developer's or permit holder's.

## ROADWAY PAVEMENT

### AP 1-3 BASE CONSTRUCTION:

This work shall consist of furnishing and placing one (1) or more courses of crushed lime base materials, pug mill mix, on a prepared subgrade in accordance with Division II, Part II, Base and Subgrade Treatments and Part III, Flexible Surfaces, TDOT STANDARD SPECIFICATIONS and in reasonably close conformity with the lines, grades and typical sections shown in the construction plans or as directed by the SPWD. **Local streets** shall have a compacted base course of a minimum of six (6) inches thick (eight (8) inches for a collector) and a width four (4) feet wider than the final application of asphalt pavement. **Non-residential streets** shall have a compacted base course of a minimum of ten (10) inches thick and a width six (6) feet wider than the final application of asphalt pavement. The type of base stone to be placed on roads and streets shall be a crushed limestone TDOT, Type A, Grading "D" as specified under Section 303, TDOT STANDARD SPECIFICATIONS. See Detail.

- AP 1-3.1 The centerline of the roadway shall coincide with the centerline of the right-of-way dedicated for such road or street.
- AP 1-3.2 The subdivider shall submit all subgrade tests for approval to the City Engineer or Public Works Engineer prior to placing stone in the right-of-way.
- AP 1-3.3 After preparation of the subgrade, the roadbed shall be surfaced with crushed limestone. The crushed stone shall be a TDOT Type "A", grading "D", Pug Mill mix as specified in Sections 303 & 903, TDOT STANDARD SPECIFICATIONS.
- AP 1-3.4 Spreading of the stone shall be done uniformly over the area to be covered in a maximum of three (3) inch lifts and shall not be dumped in piles
- AP 1-3.5 After spreading, the stone shall be rolled until thoroughly compacted. The compacted thickness of the stone shall be no less than the minimum for that particular street classification.
- AP 1-3.6 Upon completion of the base stone, the subdivider shall contact the SPWD and request core samples, proof-rolling, etc. test be performed and receive written approval before commencing and further construction.

### AP 1-4 PRIME COAT

This construction shall consist of an application of bituminous material at a rate of 0.30 gallons per square yard, and a cover material, if required, on a crushed limestone base in accordance with Section 402, TDOT STANDARD SPECIFICATIONS, and in reasonable

close conformity with the lines shown on the plans or as directed by the SPWD.

AP 1-5 BINDER

(Sections AP 1.5, AP 1.6 and AP 1.7 as amended on February 1, 2007)

After a thoroughly compacted base has been established and approved by SPWD, and the prime coat, or tack coat has been applied, a minimum of two (2) inch or otherwise indicated on the plans, compacted thickness, hot mix asphaltic binder, Grading "B-M" shall be applied. The hot mix asphalt binder shall may consist of a portion of recycled asphalt materials, if approved by the Public Works Department, but shall conform to materials, construction methods and equipment as specified in section 307 and other applicable sections, TDOT STANDARD SPECIFICATIONS. The minimum AC content in this mix shall be as specified in the Public Works Department "Annual Street Repair & Maintenance" contract for the year in which the asphalt pavement is be installed.

See Detail

AP 1-5.1 Prior to applying the binder, the base shall be sprinkled with water to create a dustless environment.

AP 1-5.2 A bituminous prime coat shall be applied uniformly over the surface of the base by use of an approved bituminous distributor.

AP 1-5.3 In the event that the bituminous material fails to penetrate the base, crushed stone chips (size 7 and 8) shall be applied at a rate of between eight (8) and twelve (12) pounds per square yard before the roadway will be open for traffic. The stone chips shall be applied in such a manner as to prevent traffic from tracking over fresh bituminous material.

AP 1-5.4 Reference is made to Section 307, latest edition of the TDOT STANDARD SPECIFICATIONS, for accepted materials, equipment and construction requirements.

AP 1-6 TACK COAT

The subdivider shall be responsible for removal and disposal of any foreign material and sweeping of the existing pavement, immediately before paving or resurfacing. A tack coat shall be applied to old or existing pavement surfaces or to a previously installed' asphalt pavement or surface to provide bond for an overlaid course. The tack coat shall be applied at the rate of 0.05 gallon per square yard, using materials, construction methods and installation as specified in TDOT STANDARD SPECIFICATIONS, Section 402 or as directed by SPWD.

AP 1-7 SURFACE LAYER

Upon completion of the application of the tack coat, a minimum of a one and one half (1.5) inches or unless otherwise designated on the plans, compacted thickness, hot mix asphaltic wearing surface, Grading "D" or "E" shall be applied. The hot mix wearing surface shall consist of all virgin materials and shall conform to Section 411 and any other applicable sections of TDOT STANDARD SPECIFICATIONS. The minimum AC content in this mix shall be as specified in the Public Works Department "Annual Street Repair & Maintenance" contract for the year in which the asphalt pavement is be installed.

The final asphalt surface layer shall be placed when:

- AP 1-7.1 Eighty percent (80%) of the residences or buildings for construction within the platted subdivision are completed and certificates of occupancy have been issued by the City, or the City of Springfield Board of Mayor and Aldermen requests that the paving be performed, or eighteen (18) months after the binder layer has been placed.
- AP 1-7.2 The asphaltic concrete pavement shall consist of a binder course as defined in Section 307, Grade B-M, latest edition of the TDOT STANDARD SPECIFICATIONS, for accepted materials, equipment and construction requirements. Recycled asphalt pavement aggregate shall not be allowed and the minimum Asphalt Cement content is 5.2 percent.
- AP 1-7.3 The asphaltic concrete surface pavement shall consist of a surface course as defined in Section 411, Grade D or E, latest edition of the TDOT STANDARD SPECIFICATIONS, for accepted materials, equipment and construction requirements. Minimum Asphalt Cement content is 6.0 percent.
- AP 1-7.4 Reference is made to the latest edition of the Standard Specifications for Road and Bridge Construction, Tennessee Department of Transportation, for accepted materials, equipment and construction requirements.

**Final surface layer shall not be placed without prior written approval of the SPWD.**

AP 1-8 TESTING

- AP 1-8.1 Testing of the sub-grade, crushed limestone stone base and asphaltic concrete installed shall be performed according to the latest procedures adopted by the SPWD.
- AP 1-8.2 It shall be the responsibility of the subdivider to contact the Public Works Department and Engineering Department at least 48 hours prior to construction of each of the following phases of construction:

Earthwork

Placing of the crushed stone base

Placing of the asphalt binder or surface

Bedding and backfilling of culverts.

AP 1-8.3 All testing shall be performed by a laboratory approved by the Tennessee Department of Transportation at the time the road is constructed. The developer shall pay all costs associated with testing requirements. The selection of test points shall be determined by the SPWD.

AP 1-8.4 All testing and certifications on concrete and reinforcement steel shall be performed by a TDOT certified testing personnel and all data supplied to the SPWD before acceptance of the project in accordance with section 501, TDOT STANDARD SPECIFICATIONS.

#### AP 1-9 TESTING PROCEDURES

##### AP 1-9.1 General

All tests to determine quality of materials shall be representative of the actual material to be used on the project. Previous tests of materials are acceptable only if performed within twelve (12) months after the adoption of these regulations.

##### AP 1-9.2 Soil

AP 1-9.2 A Proof-roll with loaded tandem dump truck in presence of the construction inspector. The selection of test points shall be determined by the Public Works Engineer or City Engineer

AP 1-9.2 B One (1) Standard Proctor Compaction Test shall be taken every six-hundred (600) feet. There shall be a minimum of two (2) of these tests taken on all streets.

AP 1-9.2 C One (1) In-place field density test shall be taken every three hundred (300) linear feet of roadway constructed. There shall be a minimum of two (2) of these tests taken on all streets. Minimum density required is 95% within 3% of optimum moisture content according to ASTM D 698.

##### AP 1-9.3 Crushed Stone Base

AP 1-9.3 A One (1) Standard Proctor Compaction Test shall be taken every six-hundred (600) feet. There shall be a minimum of two (2) of these tests taken on all streets.

AP 1-9.3 B One (1) In-place field density test shall be taken every three hundred (300) linear feet of roadway constructed. There shall be a minimum of two (2) of these tests taken on all streets. Minimum density required is 80% of solid volume, as defined in Section 303 of TDOT STANDARD SPECIFICATIONS.

AP 1-9.4 Asphalt

AP 1-9.4 A Submit asphalt mix design for review and approval by the SPWD.

AP 1-9.4 B One core test to determine final compacted thickness and density every three hundred (300) linear feet of roadway constructed for each layer of hot mixed asphalt pavement. There shall be a minimum of two (2) of these tests taken on all streets. Any section of street not meeting the minimum thickness as required by these specifications shall be resurfaced or repaired as deemed necessary by the SPWD.

AP 1-9.4 C Perform at least one (1) extraction test per day or a minimum of one test per 500 tons or portion thereof asphalt mix placed. Asphalt mixes that do not conform with the minimum asphalt content required in these specifications and the approved asphalt mix design shall be rejected. This test shall be performed by a technician currently certified by TDOT as a Certified Asphalt Plant Technician.

**CONCRETE**

AP 2-1 CURBS AND CURBS & GUTTERS

When concrete curbs are installed on both sides of all new streets, the curbs shall be backfilled and the fill shall slope into the storm drainage system. Where access streets to adjoining properties are provided and they provide no frontage for lots, they shall be curbed to the property line. Where a temporary turnaround is provided, curbs shall end at the transition curve. In all cases the curbs shall be of no lower classification than machine formed concrete extruded curbs twelve (12) inches wide at the base and eight (8) inches high and shall be installed and inspected to the specification of the SPWD.

Concrete curb shall be constructed with a TDOT Class "A" concrete mix.

Construction joints shall be at ten (10) foot intervals and expansion joints shall be at no greater than one hundred (100) foot intervals unless directed otherwise by the SPWD. Joint filler shall be  $\frac{3}{4}$  inch preformed asphalt expansion joint material conforming to ASTM D994 or ASTM D1751.

The subdivider will be responsible to provide curing for the concrete using a curing compound spray or plastic cover approved by the SPWD. Further he must prevent any

damage or freezing of the poured concrete using methods approved by SPWD.

Concrete curb and Curb & Gutter shall be constructed in accordance with Section 702, TDOT STANDARD SPECIFICATIONS unless directed otherwise by the SPWD. (See Appendix B)

#### AP 2-2 SIDEWALKS, DRIVEWAYS AND FLAT CONCRETE WORK

Concrete sidewalks shall be installed as required by these regulations or the City of Springfield Planning Commission and shall be installed per the lines, grades and specifications show on the construction plans and typical drawing or as directed by the SPWD.) Sidewalks shall be located in public rights-of-ways adjoining property lines and generally shall be four (4) inches thick, (six (6) thick at driveway crossings), with a minimum of four (4) inch compacted crushed limestone leveling base, and reinforced with welded wire fabric mesh.

Concrete sidewalks shall be constructed with a TDOT Class "A" concrete mix.

Construction joints shall be at five (5) foot intervals and expansion joints shall be at no greater than one hundred (100) foot intervals unless directed otherwise by the SPWD. Joint filler shall be ½ inch performed asphalt expansion joint material conforming to ASTM D994 or ASTM D1751.

The subdivider will be responsible to provide curing for the concrete utilizing a liquid curing compound, or plastic cover or other methods approved by the SPWD. Further care must be taken to prevent any damage or freezing of the poured concrete using methods approved by SPWD

Handicap accessible ramps are required at all intersections and constructed per TDOT Standard Drawing Book and ADA regulations.

In a dead-end street, sidewalks shall end at the transition curve of the cul-de-sac.

Sidewalks may be bonded as with other subdivision improvements

Sidewalks measuring four feet in width are required on at least one side of all new Residential streets and five feet in width on Collector and Commercial streets with the following exceptions:

- AP 2-2.1 Sidewalks are not required in proposed minor subdivisions with existing streets not having sidewalks.
- AP 2-2.2 Residential alleys shall not require sidewalks.
- AP 2-2.3 The developer shall install all required sidewalks within the platted subdivision upon eighty percent (80%) of the residences or buildings for construction within the

platted subdivision having been completed and certificates of occupancy have been issued by the City, or the City of Springfield Board of Mayor and Aldermen requests that the sidewalk construction be done, or eighteen (18) months after the street binder layer has been placed.

Sidewalks, driveways and other flat concrete work shall be constructed in accordance with Section 701, TDOT STANDARD SPECIFICATIONS unless directed otherwise by SPWD.

#### AP 2-3 STREET SIGN AND TRAFFIC CONTROL SIGNS

Street signs and traffic control signs shall be provided by the SPWD and purchased by the subdivider for subdivisions within the City. The installation of these signs shall be coordinated with the SPWD. If the subdivider chooses to use other than City standard street signs they must be approved by the Director of Public Works. Installation and maintenance of such signs prior to acceptance of the street for City of Springfield maintenance shall be the responsibility of the subdivider. It shall be the responsibility of the subdivider to provide street signs as designated by for subdivisions developed within the Planning Region.

### **STORMWATER**

#### AP 3-1 STORMWATER DRAINAGE SYSTEM

Adequate drainage systems shall have the hydraulic capacity to accommodate the maximum expected storm water discharge for a specified tributary drainage area and precipitation duration and intensity.

Adequate drainage systems shall be designed to accomplish the following:

- AP 3-1.1 Account for both offsite and onsite storm water.
- AP 3-1.2 Maintain natural drainage divides.
- AP 3-1.3 Convey storm water to a stream, channel, natural drainage way, or other existing facility.
- AP 3-1.4 Discharge storm water into the natural drainage way by connecting the drainage way at natural elevations, or by discharging the storm water into an existing facility of sufficient capacity to receive it, or by discharging into an approved drainage well.

Determination of the size and capacity of an adequate drainage system shall take into account the future development in the watershed or affected portions thereof. The design must not adversely affect adjacent or neighboring properties.

Concrete curbs or curb and gutter with storm water drainage systems are required on all public ways serving an area with a density of two (2) or more dwelling units.

It is the responsibility of the developer or property owner to pick up or acceptably handle the runoff as it flows onto his property from the watershed above, and conduct it through his property to an adequate outfall at his lower property line or beyond. The outfall must be sufficient to receive the runoff without deterioration of the downstream drainage way.

AP 3-2 MINOR SYSTEMS (SUBDIVISION, STREET WITHOUT MAJOR DRAINAGE WAY OR STREAM CROSSING)

The design of the minor storm drainage system shall be based on a storm frequency of 25 years. This criterion shall be applied to both closed conduit and open channel systems. However, if the 25 year design flow for an open channel system is greater than 100 cubic feet per second (cfs), then the open or closed system shall be capable of passing the 100-year design flow within the drainage easement. **Systems relying on sinkholes or drainage wells for discharge shall be capable of passing the 100-year design flow within the drainage easement.**

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

- AP 3-2.1 Design surface runoff across lots shall not have erosive velocities.
- AP 3-2.2 Quantities of surface runoff greater than 4 cfs that flow through lots shall be collected and conveyed in a system of open channels, closed conduits, or a combination of both.
- AP 3-2.3 Lots should generally be graded in such a manner that surface runoff does not cross more than three lots before it is collected in a system of open channels, closed conduits, or a combination of both.

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

AP 3-3 MAJOR SYSTEMS (DRAINAGE BASINS i.e. BLACK BRANCH, SULPHUR FORK CREEK BASIN, PAWNEE DRIVE BASIN, CARR CREEK, ETC.)

Wherever possible, natural waterways serving the major system should remain undisturbed, with proposed development situated wisely accordingly. However, due to the insufficient capacity of most natural drains, improvements to the channel may be necessary to properly utilize the adjacent property. Improvements to natural open channels that are to function primarily as the major system shall be designed to pass the 100-year design flow without damage to the channel. Man-made channels designed to

function, as the major system (trunk line system) shall be capable of carrying a 100-year design flow. Where man-made channels are necessary, the channels should be located as far away from buildings or structures as possible and preferably in established greenbelts.

The onsite major storm drainage system for most developments is the natural backup system and consists of the less obvious drainage ways. Ideally, this major system should provide drainage relief such that no building will be flooded with a 100-year design flow even if the minor system capacity is exceeded. The 100-year frequency storm shall be used to compute runoff for the design of the onsite major drainage system. This system shall be designed to provide relief for flow in excess of the 25-year design flow.

The following guidelines pertain to design of the onsite major drainage system:

- AP 3-3.1 Areas should be graded in such a manner or buildings located or constructed in such a manner that if the capacity of the minor system is exceeded, no building will be flooded by the design flow.
- AP 3-3.2 Critical areas to consider are sumps, relatively flat areas, and areas where buildings are located below street or parking lots.
- AP 3-3.3 The 100-year frequency storm shall be used to compute runoff for the major drainage system.
- AP 3-3.4 For the first trial, the same time of concentration values shall be used that were used in designing the minor drainage system and the minor system assumed to be completely inoperable. If no building will be flooded based on these assumptions, then the analysis can be considered complete.
- AP 3-3.5 If buildings will be flooded based on the assumptions used in the preceding item, more precise hydrologic and hydraulic computations are required. The minor system, overland relief swales, or surface storage should be designed so that no building will be damaged by flooding.
- AP 3-3.6 In general, the minor storm drainage system should not be oversized as a basis for providing major system capacity. The major drainage system should be in the form of area grading or the location and construction of buildings in such a manner that overland relief swales or surface storage will provide adequate flood protection.

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

construction and drainage plan.

AP 3-4 OPEN CHANNELS

AP 3-4.1 CHANNEL CAPACITY

Open channel capacity shall be determined by Manning's equation. Appropriate Manning's n values as presented shall be utilized for design and are subject to approval from the City of Springfield.

AP 3-4.2 LINED CHANNELS

Open channels may be designed as lined channels. Acceptable lining materials must be placed in accordance with applicable subdivision regulations. Approval of lining materials is subject to review by the City of Springfield.

Channel lining shall be required when the design velocity exceeds the allowable, non-erosive velocity for a given channel reach and no other erosion control measures provide adequate protection. Allowable, non-erosive velocities for various soil types are presented in Table AP 3-4 B

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Table AP 3-4 B

MAXIMUM VELOCITIES FOR  
COMPARING LINING MATERIALS

MATERIAL	MAXIMUM VELOCITY FEET/SECOND
Bare soil	1.50
Silt or fine sand	1.75
Sandy loam	2.00
Silt loam	3.75
Stiff clay	4.0
Sod	5.5
Lapped sod	Use Table AP 3-5 B
Vegetation	10
Rigid	

Higher velocities may be acceptable for rigid linings if appropriate protection is provided.

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AP 3-5 GRASSED CHANNELS

The design of grassed channels shall consider the variable degree of retardance

generated by different types of cover.

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

Table AP 3-5 B

MAXIMUM VELOCITIES FOR VEGETATIVE CHANNEL LININGS

Vegetation Type	Slope Range (%)	Maximum Velocity (feet per second)
Bermuda Grass	0 – 5	6
	5 - 10	5
Kentucky Bluegrass Buffalo Grass	0 – 5	5
	5 - 10	4
Grass Mixture	0 – 5	4
	5 - 10	3
Lespedeza Sericea Alfalfa	0 – 5	2.5
Annuals	0 – 5	2.5
Based on erosive soils.		
Reference: USDA, TP-61 (1947)		

AP 3-6 EASEMENT WIDTH

All open channels shall be located within the right-of-way of a drainage easement. Minimum easement width shall be determined from Table AP-3.6 B.

Table AP-3.6 B

MINIMUM EASEMENT WIDTH FOR OPEN CHANNELS

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

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AP 3-7 STORM DRAINS

AP 3-7.1 CONDUIT CAPACITY

Closed conduits shall be designed for the total flow intercepted by the inlets during the design storm event, but in no case shall they be designed for a storm event less than 25 Year.

AP 3-7.2 PRESSURE FLOW

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

- (1) An elevation greater than one foot below the established ground surface, or
- (2) More than five feet above the crown of the conduit.

AP 3-7.3 EASEMENT WIDTH

Minimum allowable easement width for storm drains shall be determined from Tablet AP-3.7 B., or as required by the City of Springfield.

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Table AP-3.7 B

MINIMUM EASEMENT WIDTH FOR STORM DRAINS

Conduit Size	Easement Width
15 - 18 inches	20 feet
21 - 33 inches	20 feet

36 - 48 inches	30 feet
54 - 72 inches	30 feet

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AP 3-7.4 INLETS

Since curb and gutter inlets shall not be used as components of a major drainage system, the 100-year frequency storm shall not be considered. See detail

AP 3-7.5 CULVERTS

The design flow for culverts shall be based on the following return frequencies:

AP 3-7.5 A 50-year for residential collector and commercial road crossings or as directed by the SPWD.

AP 3-7.5 B 5-year for residential roads and crossings.

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

AP 3-7.6 OUTLET PROTECTION

Concrete headwalls on the outlet end shall be constructed with concrete energy dissipators. The design discharge at the outlet of drainage systems shall not result in velocities that equal or exceed the erosive velocity of the receiving channel, unless energy dissipation and erosion protection measures are placed at the outlet. Energy dissipation and erosion control devices shall have no over fall at the terminal end and shall discharge onto a stable section. The terminal section shall be considered stable if the terminal section design velocity is less than the erosive velocity. Concrete dissipators are required on the outlet end of all headwalls as well as rip-rap, if deemed necessary by the design velocity or as directed by SPWD.

AP 3-7.7 BRIDGES

All bridges with spans of 20 feet or greater shall be designed for the 100-year, 24-hour storm event. The design flow shall consider runoff from the total tributary area and will require stream channel routing, as appropriate.

AP 3-7.8 STORMWATER DETENTION/RETENTION

Storm water detention is mandated for all new subdivision developments unless waived by the Director of Public Works or City Engineer.

AP 3-7.8 A RELEASE RATE

The release rate from any detention facility should approximate that of the developed site prior to the proposed development for the 2, 5, and 10-year through 25-year storms, with emergency overflow capable of handling the 100-year discharge except where waived or altered by the Springfield Department of Public Works. Adequate alternate drainage must be provided to accommodate major storm flows. **Detention systems must be constructed during the first phase of major developments to eliminate damage to adjacent properties during construction.** If siltation has occurred, detention systems must be restored to their design dimensions after construction is complete and certified as part of the as-built submittal.

AP 3-7.8 B DETENTION VOLUME

The required detention volume shall be that volume necessary to attenuate the post-development peak discharge to a level not to exceed the pre-development peak discharge. This volume may be minimized by careful attention to outlet structure design. Generally, a detention control structure is required that is capable of passing the 100-year storm without overtopping berm, however in small or shallow detention ponds other structures may be allowed as directed by the Director of Public Works.

AP 3-7.8 C DRAWDOWN

Detention storage volume shall be drained within 72 hours. This requirement includes that volume above permanent pool in retention systems. Drawdown may be accomplished by a small orifice or notched weir. Other methods may be approved subject to SDPW review.

AP 3-7.8 D MAINTENANCE

Care must be taken to ensure that any required detention facilities do not become nuisances or health hazards. Detention facilities should be designed to require minimal maintenance, and maintenance responsibility must be clearly stated on the plans. Where dual purpose facilities are provided, or where flat grades or poorly draining soils encountered, provisions for adequate low flow drainage may be required. Where the retention/detention facility is planned to be used as a lake or pond with a permanent pool, water budget calculations shall be performed to demonstrate that an adequate pool is expected during dry summer months.

All detention facilities located in residential developments shall be within public storm drainage easements and shall be maintained by the Springfield

Department of Public Works. Detention facilities located in condominium developments, apartment or townhouse complexes, single family PUDs, industrial, commercial, or institutional developments shall be within public storm drainage easements and maintained by the property owner or homeowner's association. ***A maintenance agreement must be executed before the development plan is approved.***

AP 3-8 SINKHOLES AND DRAINAGE WELLS

All drainage systems discharging to sinkholes or drainage wells shall be designed using the 100-year storm for the critical duration of the watershed tributary to the sinkhole or drainage well. A geologic investigation and report is required, along with a demonstration that development will not occur within the area flooded by the 100-year storm and that all state and federal permitting requirements are complied with.

An erosion control plan shall identify the erosion control practices and sediment trapping facilities, which are, appropriate for the site conditions in question. In addition, the appropriate schedule of implementation shall be identified. Particular attention is required for concentrated storm water flows. Either concentrated storm water flows shall be avoided or the conveyance system shall be protected sufficiently to prevent significant erosion. Sediment trapping devices are generally required at all points where storm water leaves a site laden with sediment. The plan shall identify permanent storm water conveyance structures, final stabilized conditions of the site, provision for removing temporary control measures stabilization of the site where temporary measures are removed, and maintenance requirements for any permanent measures.

AP 3-9 STABILIZATION OF DENUDED AREAS AND SOIL STOCKPILES

Permanent or temporary soil stabilization shall be applied to denuded areas within 15 days after final grade is reached on any portion of the site. Soil stabilization shall also be applied within 15 days to denuded areas which may not be at final grade, but will remain dormant (undisturbed) for longer than 60 days.

Soil stabilization refers to measures that protect soil from the erosive forces of raindrop impact and flowing water. Applicable practices include vegetative establishment, mulching, and the early application of gravel base on areas appropriate for the time of year, site conditions, and estimated duration of use.

Soil stockpiles shall be stabilized or protected with sediment trapping measures to prevent soil loss.

AP 3-10 ESTABLISHMENT OF PERMANENT VEGETATION

A permanent vegetative cover shall be established on denuded areas not otherwise permanently stabilized. Permanent vegetation shall not be considered established until a ground cover is achieved which, in the opinion of the SDPW and City Engineer, is mature enough to control soil erosion satisfactorily and to survive severe weather conditions.

AP 3-11 PROTECTION OF ADJACENT PROPERTIES

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

Vegetated buffer strips may be used alone only where runoff in sheet flow is expected. Buffer strips should be at least 20 feet in width. If at any time it is found that a vegetated buffer strip alone is ineffective in stopping sediment movement onto adjacent property, additional perimeter controls shall be provided.

AP 3-12 TIMING AND STABILIZATION OF SEDIMENT TRAPPING MEASURES

Sediment basins and traps, perimeter dikes, sediment barriers and other measures intended to trap sediment onsite shall be constructed as a first step in grading, and be made functional before upslope land disturbance takes place. Earthen structures such as dams, dikes, and diversions shall be seeded and mulched within 15 days of installation.

AP 3-13 SEDIMENT BASINS

Storm water runoff from drainage areas with 5 acres or greater disturbed area shall pass through a sediment basin or other suitable sediment trapping facility.

AP 3-14 CUT AND FILL SLOPES

Cut and fill slopes shall be designed and constructed in a manner, which will minimize erosion. Consideration must be given to the length and steepness of the slope, the soil type, upslope drainage area, groundwater conditions, and other applicable factors. As a minimum, all slopes at 2 to 1 or greater shall be stabilized with rock riprap, or other method approved by the SDPW.

AP 3-15 CONSTRUCTION EXITS

A stabilized stone pad shall be placed at any point where traffic will be leaving a construction site to a public right-of-way, street, alley, sidewalk, or parking lot. Stone pads shall contain TDOT #2 stone, six (6) inches thick and be a minimum of one-hundred (100) feet long.

## AP 3-16 STORM SEWERS & DRAIN SYSTEMS

### AP 3-16.1 Concrete Storm Sewer Pipe

Concrete storm sewer pipe, shall be reinforced concrete pipe. Reinforced concrete pipe shall be Class III unless otherwise stipulated on the plans and shall conform to the specifications of ASTM C-76. Pipe shall have ends sealed inside and outside of pipe with bitumastic joints and shall be accepted on the basis of plant load bearing tests, material tests and inspection of pipe for visual defects and imperfections.

### AP 3-16.2 Mortar

Mortar used in manhole construction shall be one part of Portland cement conforming to ASTM C-150, Type II, and two parts of sand conforming to ASTM C-144, with enough water added to produce mortar of the property consistency for the type of joint.

### AP 3-16.3 Manhole and Inlet Frames and Covers

Manhole frames and covers shall be constructed of gray or ductile iron conforming to ASTM A-48 Class 30 and A-536 Grade 65-45-12. Frames and covers shall have ground bearing surfaces to prevent rocking and rattling under traffic. Manhole covers shall be as shown on the Construction Standards and as indicated on the Plant. *Castings shall be cleaned and painted with bituminous coating.*

### AP 3-16.4 Manhole Steps

Manhole steps shall be a composite of a No. 4 grade 60 deformed steel bar encased in copolymer polypropylene plastic of the "press-fit" design, rubber or aluminum.

### AP 3-16.5 Box or Pipe Culvert Width

Where the use of box culverts is required, they shall be designed at a width to allow future construction of sidewalks if not included in the initial project.

### AP 3-16.6 Installation

Maintain a minimum 10-foot horizontal distance between storm sewer and water mains.

Temporary support, protect and maintain all underground and surface structures and utilities encountered in the process of the work. Where the grade or alignment of the pipe is obstructed by existing utilities, such as conduits, pipes or drains, the obstruction shall be permanently relocated by the Contractor in cooperation with the Owners of said utilities.

Install piping in such a manner as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending moments at joints. Conduct work in strict conformance with the procedures established by the manufacturers of the various types of pipe.

In no case shall the type or size of pipe change between drainage structures.

Lay pipe to a true uniform line and grade from elevations indicated on the drawings with continuous bearing of barrel on cradle or bedding material.

Lay pipe up-grade with the bell and pointing in the upstream direction and the spigot end pointing in the downstream direction. Lay each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to prevent any sudden offsets in the flow line.

Ensure that pipe is well bedded on a solid foundation. Correct any defects due to settlement. Excavate bell holes sufficiently large to insure proper jointing and pipe support. Exercise precautions to include the furnishing and placing of bedding to prevent any pipe from resting directly on rock.

Plug and re-grout lift holes left in the pipe prior to backfilling operations.

As the work progresses, clear the interior of the pipe of all dirt and superfluous materials of every description.

Keep trenches and excavations free of water during construction and until final inspection. Do not lay pipe in water or in a frozen bedding condition. Prevent flotation and re-lay pipe that has floated.

#### AP 3-16.7 Manhole, Junction and Inlet Box Construction

Construct manholes and inlet boxes in accordance with the specifications, the plans and typical drawings. Boxes and manholes maybe poured in place, brick or pre-cast as approved by the SPWD.

Construct appropriate flow channels in the bottom of manholes and inlet boxes as shown in these specifications and on the plans. Flow channel construction shall provide a smooth transition between adjacent sections.

Cast-in-place concrete for manholes and inlet boxes shall be placed monolithically. Concrete shall be allowed to drop freely up to five-feet in height; where greater drops are required, a tremie or other device may be used.

Joints for brickwork shall be completely filled and shall be smooth and free from surplus mortar on the inside of the structure. Brick shall be laid radially with every

sixth course laid as a stretcher course. Brick manholes and inlet boxes shall be parged over the entire inside surface of the walls.

Cut the pipe flush with the inside wall of the structure. Tightly mortar in pipe with quick-setting non-shrink grout.

Firmly anchor manhole steps, where required, to wall according to manufacturer's recommendations. Steps shall project not less than five-inches from the inner surface of the wall. Manhole steps set in vertical alignment shall be not less than 12-inches wide.

Adjust the frame and castings to finished grade by brick or concrete adjusting ring construction.

### AP 3-17 SEEDING, SODDING & MATTING

#### AP 3-17.1 Description of Work

Provide all labor, materials, tools and equipment as required to have topsoil, fertilizer, lime, mulch, seed and/or sod applied on all areas disturbed by construction and all areas called for on the approved plans

#### AP 3-17.2 Protection

Streets, road, adjacent property and other work to remain shall be protected throughout the work by suitable fences or barricades. Concrete surfaced areas shall be planked before loaded vehicles are allowed.

#### AP 3-17.3 Erosion Control Matting

Description: The worked covered by this item consists of preparing the ground surface, seeding as herein specified, and furnishing and installing erosion control mats in drainage ways and as an alternative to sodding for establishment of grass on banks and in swales. Use of erosion control mats in lieu of sodding will require approval by SPWD on a case by case basis.

Materials and Installation: Erosion control mat may be North American Green C125 or equal, or other acceptable material as specified or as approved by SPWD. Wire staples shall be provided consisting of 12-inch lengths of No. 11 gauge wire, bent to form a U, firmly driven into the ground so as to hold the erosion control mat tightly to the soil. Staples shall be spaced not more than three (3) feet apart along the sides of the mat, not more than one (1) foot apart at roll ends, and one (1) foot apart transversely at intervals not to exceed fifty (50) feet or as specified by the manufacturer.

Care and Repair: The Contractor shall care for the areas of erosion control mat installation until acceptance of the work and repair any damage due to traffic, erosion or other causes, before such acceptance.

AP 3-17.4 Grading and Dressing

This work shall consist of dressing all slopes and areas to within reasonable close conformity to the lines and grades indicated on the plans, or as directed by the enforcing officer. Final dressing shall be performed by hand or machine to produce a uniform finish to all parts of the roadway including embankments, ditches, etc. Rock cuts shall be cleaned of all loose fragments; side slopes shall be laid back to a three-to-one (3:1) slope and seeded as described in these specifications.

It shall be the responsibility of the Developer to finish (fine) grade all areas to be seeded or sodded, eliminating all bumps, depressions, sticks, stones and other debris to the satisfaction of SPWD. Developer shall remove all undesirable vegetation and rocks larger than one (1") inch in diameter from area to be seeded. After the topsoil has been spread and compacted to the required depth, no seeding or sodding shall be commenced until the depth of soil has been approved.

The entire right-of-way shall be cleaned of all weeds and brush and all structures, both old and new, shall be cleared of all brush, rubbish, sediment, or other objectionable material.

AP 3-17.5 Hydroseeding

All seeding must be performed by hydroseeding utilizing the materials and equipment specified in section 801 TDOT STANDARD SPECIFICATIONS.

All hydroseeded areas that do not show satisfactory growth within 30 days after hydroseeding shall be scarified and re-hydroseeded as directed until a satisfactory cover is established. The areas shall be considered established when they are reasonable free from weeds, green in appearance, and the specified grass mixture is vigorous and well growing, and no bare spots bigger than 4 square feet are apparent. Full coverage is required in thirty (30) days.

The application rate and type of seed, mulch, lime, fertilizer, etc. shall be in accordance to section 918, TDOT STANDARD SPECIFICATIONS. Unless directed otherwise by the SPWD. Bermuda grass seed shall be used in any of the TDOT seed mixtures.

AP 3-17.6 Sodding

Preparation:

Developer shall remove all undesirable vegetation and rocks larger than one (1") inch in diameter from areas to be sodded. Prior to the time any sod is placed, fertilizer shall be applied as per the manufacturer's recommendations, and the finished soil surface shall be raked until it is smooth, uniform, and a consistent texture.

Scattered bare spots, none of which is larger than one square foot, will be allowed up to a maximum of three (3%) of any lawn area.

New planting shall be protected and maintained until the end of the lawn maintenance period or, if installed after the lawn maintenance period, until installation of the planning is complete. Maintenance period shall include watering, weeding, cultivating.

#### AP 3-17.7 Erosion Control

The establishment of grass on banks and in swales and all other disturbed areas shall be the responsibility of the Developer. Seed with erosion matting or sod shall be used for this purpose as determined by the Developer, except for those areas indicated on the drawings and herein specifically specified to be solid sodded or strip sodded. Sodding shall be done on a smooth, even surface conforming with finished grade requirements after sodding is completed. Sod shall be tamped or rolled immediately after it is laid and shall be even and equally firm at all points on the finished surface. Protection of banks and swales shall be the responsibility of the Developer.

#### AP 3-17.8 Maintenance

Maintenance shall begin immediately after each portion of the lawn is completed until such time that final acceptance is granted. Seeded or sodded areas shall continue in accordance with the following guidelines:

The sod and seeded areas shall be watered as directed by the SPWD for a minimum period of 30 days, mowed, and replanted as necessary, as long as is necessary, to establish a uniform stand of the specified grass and until acceptance.

The subdivider shall not permit any equipment or materials to be placed on any planted area and shall erect suitable barricades and guards to prevent equipment, labor, the public from traveling on or over any area planted with sod.

Lawns shall be protected and maintained by watering

All seeding, sodding and erosion control matting shall be on accordance with section 801 thru 805, TDOT STANDARD SPECIFICATIONS.

AP 3-18 STANDARD DRAWINGS

The attached standard drawing and The TDOT Standard Drawing Book is made a part of this document.

AP 3-19 COMPLIANCE WITH MINIMUM STANDARDS

The above described standards for the design and construction of streets and drainage improvements, contained in Section 4 and Appendix A, shall be in accordance with the Standards of the Springfield Public Works Department (SPWD). If a conflict occurs between "**Appendix A**" and the standards of the SPWD, the latest version of the SPWD standards for design and construction shall govern. If above described standards for design and construction of streets and drainage does not address an item of construction or design, then the TDOT STANDARD SPECIFICATIONS shall govern.