ORDINANCE NUMBER 1438 - 11

AN ORDINANCE PROVIDING FOR DRAINAGE SPECIFICATIONS IN THE CITY OF MUSCLE SHOALS, ALABAMA

WHEREAS, the Council of the City of Muscle Shoals, Alabama is desirous of providing for and setting forth the requirements for drainage specifications within the City of the City of Muscle Shoals, Alabama;

BE IT ORDAINED by the Council of the City of Muscle Shoals, Alabama as follows:

City of Muscle Shoals
Drainage Manual

Introduction

The City of Muscle Shoals was founded in 1921 and remained largely undeveloped until the mid 60's when US Highway 43 was constructed through the City. The City has grown up around that Highway, and has grown to a population of more than 15,000 residents. The City has a complicated hydrology and topography. The City's topography is defined by a karst topography that has formed many depressions, both large and small, throughout the City. The large majority of the City drains to these depressions and many of them have been excavated by the City and are now operated and maintained by the City as regional retention/detention facilities. There are still many more of these depressions throughout the City that remain as natural retention areas that are only relieved by evaporation, and infiltration into the groundwater table. Many of these natural retention areas are located on private property that is not under the control of the City and they are not operated or maintained by the City.

General

This Manual represents the application of accepted principles of stormwater drainage engineering and is a working supplement to basic information obtainable from standard drainage handbooks and other publications on drainage. The policy statements of this section provide the underlying principles by which all drainage facilities shall be designed. The application of the policy is facilitated by the technical criteria contained in the remainder of the manual.

Policy

1) Stormwater runoff peak flow rates for the two (2), five (5), ten (10), twenty-five (25) and one-hundred (100) year frequency storms shall not cause increased adverse inundation of any building or structure.

2) Street curbs, gutters, inlets and storm sewers shall be designed to intercept, contain and transport all runoff from the 10 year frequency storm unless a greater frequency storm is required by the City Engineer.

3) In addition to 2) above, the public drainage system shall be designed to convey those flows from greater than the 10 year frequency storm up to and including the 100 - year frequency storm without damaging the system or any existing or proposed structures.

4) When stormwater detention is required by the City, stormwater runoff peak flow rates shall not be increased at any point of discharge for the two (2), five (5), ten (10), and twenty-five (25) year storm frequency events.

5) Situations may arise where stormwater from a developed site is discharged to an existing privately owned natural retention area that is not maintained by the City of Muscle Shoals. In this situation retention must be provided such that the total volume discharged for a 25 year storm is not greater than pre-development volumes. In addition, the 100 year storm should be evaluated to ensure that no existing structures will be adversely affected. In

these areas the infiltration onsite of stormwater is encouraged.

6) Regulation of peak flows to allowable levels, as determined by the provisions of this policy, shall be achieved by storage on-site or off-site. The Detention/Retention Section of this manual provides a guide to acceptable methods.

7) It is understood that this manual will not be applicable to all situations that may arise within proposed developments. When special situations arise they will be evaluated on a case by case basis and exceptions to this manual may be made by the City Engineer when warranted. However, in all cases it must be determined that any alternate designs must, at a minimum, not cause damage to downstream property or structures.

Purpose

Experience has shown that most of the more serious flooding, erosion, and water quality problems are "created." Usually this occurs from conveying more stormwater to a given area than can be carried away effectively. Ever increasing drainage problems emerge unless well conceived, cooperative stormwater drainage and flood control programs are undertaken. The stormwater management goals of the City of Muscle Shoals, AL, are to prevent flooding, and erosion that may result from stormwater runoff from development and redevelopment projects. The City's Drainage Manual (the Manual) provides guidance and direction for meeting these goals.

The purpose of the Manual is to protect existing natural stormwater resources, convey and control stormwater in a safe and responsible manner, and meet water quality goals. The Manual is intended to provide information to the general public on the City's stormwater policies and design practices, as well as assist developers, engineers, and City staff in the preparation, review and approval of the Stormwater Report and Construction Drawings that must accompany private and public development proposals. This document is organized to facilitate specific design and submittal activities related to stormwater management infrastructure. Stormwater management, particularly in the area of stormwater quality management, is an evolving science. As such, the Manual will be updated as necessary to reflect accepted standard practice in stormwater management.

Applicability

Unless otherwise exempted, this Manual shall be used for all public and private projects that change land use, existing stormwater flow patterns, and/or stormwater pollutant discharges as applicable to all premises within the City of Muscle Shoals.

Any new development or redevelopment involving the following shall be subject to the Manual:

a) Construction of commercial, industrial or institutional facilities,
b) Expansion of commercial, industrial or institutional facilities.

c) Redevelopment of commercial, industrial or institutional facilities if the renovation will substantially affect stormwater drainage,
d) Construction of multi-family residential facilities,
e) Expansion of multi-family residential facilities,
f) Redevelopment of multi-family residential facilities if the renovation will substantially affect stormwater drainage,
g) Construction of residential subdivisions,
h) Expansion of residential subdivisions,
i) Redevelopment of residential subdivisions, if the renovation will substantially affect stormwater drainage,
j) Filling or regarding to change the topography of any existing land within the City of Muscle Shoals,
k) Construction, reconstruction, improvement, and/or modification of all private and public transportation facilities which alter existing drainage patterns under this item. Routine maintenance of these facilities or construction of elements that do not impact the existing drainage patterns are excluded,
l) The Manual is not applicable to the expansion, construction, or reconstruction of one single family dwelling or one two-family dwelling on a single parcel unless it is deemed appropriate by the City Building Official,

Definitions

Unless specifically defined in this section, words or phrases used in this chapter shall be interpreted so as to give them the meaning they have in common usage, and to give this chapter its most reasonable application.

2-year frequency storm - A storm event with a fifty (50) percent chance of being equaled or exceeded in a given year. Defined to be 3.78 inches in 24 hours or other such magnitude the City Engineer shall establish based upon scientific and engineering information.

5-year frequency storm - A storm event with a twenty (20) percent chance of being equaled or exceeded in any given year. Defined to be 4.78 inches in 24 hours or other such magnitude the City Engineer shall establish based upon scientific and engineering information.

10-year frequency storm - A storm event with a ten (10) percent chance of being equaled or exceeded in any given year. Defined to be 5.46 inches in 24 hours or other such magnitude the City Engineer shall establish based upon scientific and engineering information.

25-year frequency storm - A storm event with a four (4) percent chance of being equaled or exceeded in any given year. Defined to be 6.21 inches in 24 hours or other such magnitude the City Engineer shall establish based upon scientific and engineering information.

50-year frequency storm - A storm event with a two (2) percent chance of being equaled or exceeded in any given year. Defined to be 6.82 inches in 24 hours or other such magnitude the City Engineer shall establish based upon scientific and engineering information.

100-year frequency storm - A storm event with a one (1) percent chance of being equaled or exceeded in any given year. Defined to be 7.47 inches in 24 hours or other such magnitude the City Engineer shall establish based upon scientific and engineering information.

Blue-Line Stream - Any stream shown on the 7.5 minute USGS Quad Maps.

Buffer Zone - A naturally undisturbed, vegetated and pervious streamside zone that is protected from clearing, grading, filling, paving, building or other destruction of the naturally vegetated state.

Covenants by Property Owner for Permanent Maintenance of Stormwater Facilities - A legal document executed by the Property Owner and recorded with the Colbert County Courthouse guaranteeing perpetual and proper maintenance of stormwater facilities.

Detention - A practice to store stormwater runoff by collection as a temporary pool of water and provide for its gradual (attenuated) release and thereby control peak discharge rates.

Discharge - Dispose, deposit, spill, pour, inject, seep, dump, leak or place by any means, including any direct or indirect entry of any solid or liquid matter into the stormwater system by any means intentional or otherwise.

Disturbed Area - Portion of any site that has been altered from existing conditions, including but not limited to the following: providing access to a site, clearing of vegetation, grading, earth moving, providing utilities and other services such as parking facilities, stormwater management and erosion control systems, potable water and wastewater systems, altering land forms, or construction or demolition of a structure on the land.

Downstream - Downgradient from the lowest point of each subwatershed in a development.

Erosion - The removal of soil particles by the action of water, wind, ice or other geological agents, whether naturally occurring or acting in conjunction with or promoted by development activities or effects.

Floodplain - For a given flood event, that area of land temporarily covered by water.

Hydraulic - Pertaining to, involving, moved or operated by a fluid, especially water, under pressure or under a gravity-driving force.

Hydrologic - Pertaining to the scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Impervious area - Impermeable surfaces, such as pavement or rooftops, which prevent the percolation of water into the soil.

Infiltration - A practice designed to promote the recharge of groundwater by containment and concentration of stormwater in porous soils.

Major storm - A 100-year design storm or a storm that has a probability of one (1) percent chance in any given year.

Major Collector Channel - Drain twenty (20) acres or more

Minor Collector Channel - Drains less than twenty (20) acres

Natural Resources Conservation Service (NRCS) - An organization within the U.S. Department of Agriculture that has published standard drainage procedures in the form of Technical Release No. 55. Formerly known as the Soil Conservation Service (SCS).

Outfall - The terminus of a stormwater system where the contents are released.

Parking area - The off-street facility including parking spaces along with adequate provision for drivers and aisles for maneuvering and giving access, and for entrance and exit, designed to be usable for the parking of vehicles.

Peak flow - The maximum instantaneous rate of flow of water at a particular point resulting from a storm event.

Peak flow attenuation - The reduction of the peak discharge of a storm.

Person - Any individual, firm, corporation, partnership, association, organization or entity, including governmental entities, or any combination thereof.

Retention - A practice designed to store stormwater runoff by collection as a permanent pool of water without release except by means of evaporation, infiltration, or attenuated release when runoff volume exceeds storage capacity of the permanent pool.

Riprap - A combination of large stone, cobbles and boulders used to line channels, stabilize stream banks, and reduce runoff velocities.

Runoff - The water resulting from precipitation that is not absorbed by the soil.

Sanitary sewer - A system of underground conduits that collect and deliver sanitary wastewater to a wastewater treatment plant.

Sanitary wastewater - Wastewater from toilets, sinks and other plumbing fixtures.

Site Development - To physically alter a site. Site development includes, but is not limited to, providing access to a site, clearing of vegetation, grading, earth moving, providing utilities and other services such as parking facilities, stormwater management and erosion control systems, potable water and wastewater systems, altering land forms, or construction or demolition of a structure on the land.

Stormwater - Runoff from rain, snow or other forms of precipitation, resulting in surface runoff and drainage.

Stormwater system - The system of roadside drainage, roadside curbs and gutters, curb inlets, swales, catch basins, manholes, gutters, ditches, pipes, lakes, ponds, sinkholes, channels, creeks, streams, storm drains, and similar conveyances and facilities, both natural and manmade, located within the city which are designated or used for collecting, storing, or conveying stormwater, or through which stormwater is collected, stored or conveyed, whether owned or operated by the city or other person.

Swale - A natural or manmade depression or wide shallow ditch used to route or filter runoff.

Upstream - Upgradient of the lowest point of each subwatershed of a development.

Utility, public or private - Any agency which under public franchise or ownership, or under certification of convenience and necessity, provides the public with electricity, natural gas, steam, communication, rail transportation, water, sewage collection, or other similar service.

Vegetation - Collection of plant life, including trees, shrubs, bushes, and grass

Stormwater Policy

Section 1 Design Criteria

1.1 Street Drainage

No lowering of the standard height of street crown shall be allowed for the purposes of obtaining additional hydraulic capacity.

1.2 Drainage System

1.2.1 Culverts

(1) Construction plans for proposed reinforced concrete box culverts, and related structures may be adaptations of the current Alabama Department of Transportation (ALDOT) Standards.

(2) For culverts in residential streets, runoff from the 100 year frequency flow shall not produce a headwater elevation at the roadway greater than either twelve (12) inches above the roadway crown elevation or any top of upstream curb elevation, whichever is lower.

(3) For culverts in streets other than a residential street, runoff from the 100 year frequency storm shall not produce a headwater elevation at the roadway greater than six (6) inches above the roadway crown elevation or six (6) inches above any top of upstream curb elevation, whichever is lower.

1.2.2 Drainage Facilities

All drainage facilities (including but not limited to headwalls, open channels, storm sewers, area inlets, and detention, retention and water quality controls and their appurtenances) shall comply with the following requirements, unless otherwise noted in this section.

(1) Storm sewer inlets and gutter transitions shall be designed to avoid future driveways and to avoid conflicts with standard water and wastewater service locations. No utilities shall be allowed to cross under a storm sewer inlet.

(2) Drainage channels and detention ponds that are to be maintained by the public (City) shall be contained within dedicated easements. Adequate room for access shall be provided for drainage channels and detention ponds.

(i) Ramps no steeper than five (5) feet horizontal to one (1) foot vertical shall be provided at appropriate locations to allow access to drainage channels and detention ponds.

(ii) The minimum bottom width for any channel with vegetative side slopes shall be eight (8) feet.

(iii) A reinforced concrete trickle channel shall be provided in all newly constructed channels and from detention pond inlets to outlets. The area adjacent to trickle channels shall slope at a minimum of two (2) percent.

(3) Detention ponds shall be designed with adequate area around the perimeter for access and maintenance. Said area shall be a minimum of seven (7) feet wide for ponds with depths of five (5) feet or less (back slopes included) and a minimum of fifteen (15) feet wide for ponds over five (5) feet deep or with back slopes in excess of five (5) feet high. Said area shall not slope more than five (5) percent.

(4) Rip-rap for slope protection or velocity dissipation shall be formed concrete dissipaters or mortared rip-rap.

1.2.3 Storm Drains

(1) Storm drains between lots (crossing blocks) shall be avoided as much as possible. When unavoidable, such mains shall be laid along a straight alignment (absent of curves, jogs and manholes/junction boxes when traversing between lots) with manholes/junction boxes provided at each intersecting street. Storm drains along rear of residential lots (through back yards) shall be avoided. Easements shall be a minimum of fifteen (15) feet in width with an additional two (2) feet of easement for every one (1) foot of depth over eight (8) feet.

(2) All bends, wyes and pipe size changes in storm sewers shall occur at manholes/junction boxes unless otherwise approved by the City Engineer.

(3) Bedding of storm sewer shall be to the top of pipe.

(4) Storm drains shall have a minimum size of 15 inches in diameter.

(5) Junction boxes and manholes shall be reinforced concrete. Junction boxes in lieu of manholes shall be provided where any pipe opening exceeds thirty-six (36) inches and where the distance from the outside surfaces of any two pipes entering a manhole is less than one (1) foot, measured along the inside of the manhole.

1.2.4 Open Channel Sections

(1) Minor collector channels shall be constructed with underground storm sewers. If it can be established by certified engineering data to the satisfaction of the City Engineer that storm sewers are not physically feasible, open ditches may be used, provided that such ditches are lined properly with materials accepted by the City Engineer. These structures shall be of sufficient cross section and slope as to fully contain design flows and facilitate self cleaning. Outfalls shall enter major collector drainage ways and major streams at grade or be designed and constructed with adequate concrete aprons, energy dissipaters or similar features to prevent erosion.

(2) Major collector channels drainage ways, detention ponds and related structures may utilize either existing natural open sections which may be modified, or newly constructed facilities. If modified or newly constructed facilities are utilized, they shall be lined with permanent materials including, but not limited to: concrete or vegetation.

(3) Vegetated channels shall have sufficient grade but with velocities that will not be so great as to create erosion. Side slopes shall not be steeper than three (3) (horizontal) to one (1) (vertical) for channels four (4) feet or less in depth and no steeper than 4 to 1 in all other channels to allow for future growth and to promote slope stability. All slopes shall be hydromulched, sodded or seeded with approved grass, grass mixtures or ground cover suitable to the area and season in which they are applied.

(4) Discharge from storm sewer outfalls shall not cause channel, or stream bank erosion. If the storm drain discharges to an open drainage facility (as determined by the City), the applicant must show acceptable nonerosive conveyance to that drainage facility, appropriate energy dissipation at the outfall and a stable headwall.

(5) No area within the limits of construction of the development shall allow stormwater to become stagnant. Maximum retention or "draw-down" time for detention ponds shall not exceed twenty-four (24) hours from the time of peak storage to the time of complete emptying of the pond, as determined by hydrograph routing or other calculations acceptable to the City. This requirement does not apply to facilities in which retention or "draw-down" time is required to be greater than twenty-four (24) hours.

1.3 Computations

1.3.1 Computations to support all drainage designs shall be submitted to the City Engineer for review. The computations shall be in such form as to allow for timely and consistent review and

also to be made a part of the permanent city record for future reference. Computations shall demonstrate that as a result of the proposed development there will not be any adverse impact to downstream structures adjacent to the drainage for design storms up to the 100 year storm. All computations submitted shall be from a licensed Professional Engineer with expertise in the area of hydraulics and hydrology.

1.4 Development Within FEMA Flood Plains

1.4.1 Development Within Floodplains

(1) Federal Emergency Management Agency.

(i) The Federal Emergency Management Agency (FEMA) maintains Flood Insurance Rate Maps (FIRMs) that depict floodplain and floodway boundaries based on existing conditions of development in the contributing area.

(ii) FEMA revises or amends FIRMs by issuing of a Letter of Map Amendment (LOMA) or Letter of Map Revision (LOMR). FEMA establishes the process and fee schedule for review of LOMA or LOMR requests.

(2) Coordination of City of Muscle Shoals and FEMA Floodplain Delineations.

(i) If a LOMR is to be requested due to land development activities that alter existing conditions, then the following requirements are applicable:

1. The Property Owner must enter into a Letter Agreement with the City assuring that the proposed activities are consistent with existing plans and improvements of the City, that the City will request its consultant to prepare any studies, plans, proposals or applications to FEMA and that the City will incur no cost, expense or liability from the project.

2. The Property Owner must provide all information necessary for city review and submission to its consultation for preparation of the request and pay all costs, fees and expenses associated with the request.

(ii) If a LOMR-F is to be requested, due to land development activities that alter existing conditions, then the following requirements are applicable:

1. The Property Owner must complete an APPLICATION FOR PERMIT TO DEVELOP IN A SPECIAL FLOOD HAZARD AREA and an APPLICATION FOR A BUILDING PERMIT. Both permits require submission of an ELEVATION CERTIFICATE based on construction

drawings and completed by a Registered Land Surveyor or Licensed Engineer.

2. A second ELEVATION CERTIFICATE based on existing construction conditions must be submitted to the city: (1) for slab construction - after the slab form is set but prior to pouring or (2) for crawl space or stem wall construction – after the floor is framed or the form set but prior to erecting any walls to ensure compliance with floor elevation requirements of the Flood Damage Prevention Ordinance. The slab for all equipment servicing the building must also comply with elevation requirements of the ordinance.

3. A third ELEVATION CERTIFICATE based on finished construction must be submitted to the city to ensure compliance with Flood Damage Prevention Ordinance and prior to issuance of a Certificate of Occupancy. At the time the third ELEVATION CERTIFICATE is completed, the application to FEMA for a LOMR-F to remove the structure from the floodplain and avoid paying flood insurance can begin.

1.5 Site Grading Considerations

1.5.1 A comprehensive grading plan shall be included with subdivision or site construction plans.

1.5.2 The grading plan shall be designed to ensure all lots will adequately drain upon completion of the improvements.

1.5.3 Where practical, all lots shall be graded from rear to front at which point the drainage shall be intercepted by the street. Alternate grading schemes may be utilized if it can be demonstrated to the satisfaction of the City Engineer that grading from rear to front would be detrimental to trees or other natural features; or it would not be reasonably adaptable to the existing topography because of excessive cuts and fills, or future lot development (i.e. commercial, industrial or multi-family lots).

1.5.4 All lots shall be graded at a minimum of one (1) percent. Grading of lots with existing slopes of one (1) percent or greater will not be required provided the conditions under 1.5.3 above have been satisfied and it is demonstrated to the satisfaction of the City Engineer that there are no existing or proposed features that will prevent the lots from adequately draining.

1.5.5 Unless otherwise accepted by the City Engineer, surface swales shall be designed and provided along lot lines when more than two lots will be contributing to stormwater runoff at any given point. Side slopes for swales shall not exceed 10:1 (Horizontal: Vertical) unless otherwise accepted by the City Engineer.

1.5.6 Minimum finished floor elevations shall be shown for all lots. Such elevations shall be as required by the City of Muscle Shoals Flood Damage Prevention Ordinance (Ordinance No. 1421-10).

1.5.7 Blue tops shall be set at lot corners and other points to ensure grading is accomplished in accordance with the plan.

1.5.8 Following final grading, all exposed areas shall be permanently stabilized. Earthen areas shall be seeded or sodded and erosion controls shall remain in place until grass growth reaches one and one half (1½) inches, is of a density where it can be reasonably expected to be self-sustaining, and there are no bare areas in excess of ten (10) square feet.

1.6 Erosion Control

1.6.1 Silt fences, sedimentation basins, stabilized construction entrances/exits and similar recognized techniques shall be employed during and after construction to prevent point source sedimentation loading of downstream facilities. Such installations shall be to the satisfaction of the City Engineer. Additional measures may be required during and after construction if, in the opinion of the City Engineer, they are warranted.

1.6.2 All disturbed and exposed areas due to construction shall be permanently stabilized. All such areas shall be dressed with topsoil and vegetated by seeding or sodding as appropriate. Where the City Engineer determines that future maintenance is materially impaired or erosion is a distinct possibility, the developer shall be required to use concrete or similar permanent cover in lieu of vegetation. Erosion control matting (either pre-seeded or seeded after placement) may also be required if the City Engineer determines that such protection of slopes is required to ensure that seeding or soil will not wash off of slopes.

1.6.3 The developer of a proposed development shall submit to the Muscle Shoals Planning Commission with the construction plans four copies of a plan to control erosion on the site of the proposed subdivision. Said plan shall be prepared by the subdivider's engineer according to the best available practices of sediment and erosion control and shall consist of a map(s) and a description of the premises setting forth the proposed (a) improvements to be constructed, (b) changes to be made in the contours of the site, and(c) removal or destruction of the natural topsoil, trees, or other natural vegetation on the said described premises.

1.6.4 The City Engineer shall review said sediment and erosion control plan and submit written comments to the Muscle Shoals Planning Commission prior to presentation of the construction plans for approval. Written comments shall specifically state the acceptability of the plan, non-acceptability, or any necessary changes to insure adequate erosion control. The City Engineer shall also submit written comments to the Muscle Shoals Planning Commission, prior to presentation of a final plat for approval, stating that the sediment and erosion control plan has been carried out in substantial compliance with this section or that the subdivider has failed to comply. Where the City Engineer's comments or other validated evidence indicates that the

subdivider has not carried out the approved sediment and erosion control plan the Muscle Shoals Planning Commission shall not grant final approval of the subdivision.

Section 2 Submittal Requirements and Computation Methods

2.1 Plan Requirements

2.1.1 A site development plan shall be required for any site development except when:

(1) The developed area is used for gardening or agricultural purposes;

(2) The proposed work does not, in the opinion of the Building Department, affect the drainage on the site.

2.1.2 Development plan requires plans showing existing and proposed 1-foot contours as they relate to the roadway, parking lot, drainage facilities, cut and fill slopes, all stormwater pipe size, material and location, identification of all areas of depression, blue-line streams, easements, erosion and sediment control measures, detention pond data including size, location, slope of bottom, outlet, invert, top elevations, spillway size and elevation, and the detention easement and an adequately sized traversable access easement. Also, catch basin location, elevation, slope, swales, ditches, and their stabilization treatment. When this site development plan includes a street to be dedicated to the city, a complete set of roadway plans must be submitted including profiles, grades, and cross sections showing cross slope, and limits of construction. All Development plans that are submitted to the Building Department must meet the following minimum standards:

(1) Must contain the following certification from the design engineer .

(i) The Engineer of Record for this project assumes full responsibility for the design shown hereon and the effects thereof. The City by reviewing this information assumes no responsibility for any unforeseen negative impacts to adjoining or downstream property owners.

(2) Stamp and signature from appropriate design professional;

(3) Constructible plans;

(4) All required hydraulic and hydrologic calculations with reasonable assumptions;

(5) Pre- and post-developed contours;

(6) Erosion and sediment control plan;

(7) Required retaining wall calculations (if any);

(8) Owner's, and if applicable Lessee's, name, address, and phone number;

(9) Vicinity map;

2.1.3 Plans that do not meet these minimum standards will be rejected, and will not be reviewed further until submission standards are met.

2.2 Drainage Report Requirements

2.2.1 Drainage report must be submitted with any proposed project and must address the calculations and requirements set forth in this section. The report must be prepared by a Professional Engineer licensed by the State of Alabama that is proficient in hydraulics and hydrology. The report must address any possible downstream impacts of the proposed development and mitigation of those impacts if required.

2.3 Hydrology Methods

2.3.1 Consideration of peak runoff rates for design conditions is generally adequate for conveyance systems such as storm sewers or open channels. However, if the design includes flood routing, detention ponds, retention ponds, etc. a flood hydrograph is usually required.

2.3.1 Rational Method

(1) The rational method is generally acceptable for the determination of peak flows from watersheds smaller than 50 acres. This method is not acceptable for detention/retention pond sizing, or evaluation.

2.3.2 NRCS Unit Hydrograph Method

(1) The NRCS Unit Hydrograph method is specifically cited for drainage computations, using 24-hour Type II rainfall distribution and AMC II soil conditions. The NRCS method shall be used to compute a peak flow for sizing all stormwater conveyances or to generate a hydrograph for the purposes of detention/retention routing. The NRCS Unit Hydrograph method shall be used for all design calculations, but other methods may be consulted for sizing stormwater conveyances (particularly if conservative values and assumptions are used).

The NRCS was formerly called the Soil Conservation Service (SCS), part of the United States Department of Agriculture. The TR-55 publication (Urban Hydrology for Small Watersheds) is the principal technical reference to be downloaded from NRCS:
http://www.wsi.nrcs.usda.gov/products/w2q/h&h/docs/other/TR55_documentation.pdf

2.3.3 The maximum sheet flow length to be used shall be ≤100 feet.

2.4 Functional Design of Stormwater Drainage Systems

2.4.1 In selecting the design frequency storm, the following criteria (listed in the order of being progressively more restrictive) will be used:

2.4.2 Longitudinal side drains shall be designed for a 10-year frequency flood, providing that no residential or commercial structures are flooded by a 100-year flood.

2.4.3 Roadway cross-drains for all local streets and collector streets shall be designed for a 10-year frequency flood, providing that no structures are flooded by a 100-year flood.

2.5 Design of Open Channels

2.5.1 Manning's equation is the principal means for determining flow capacity and velocity in open channels. Open channels shall be designed according to the "Design of Roadside Channels with Flexible Linings Hydraulic Engineering Circular Number 15, Third Edition (HEC 15). This guide can be downloaded at the following address:
http://www.fhwa.dot.gov/engineering/hydraulics/pubs/05114/index.cfm

2.6 Design of Curb and Grate Inlets

2.6.1 Use of the City of Muscle Shoals standard inlets (see City of Muscle Shoals Construction Specifications) or ALDOT standard inlets is required within all public rights-of-way or drainage easements. Use of standard inlets on private property is encouraged for reasons of structural reliability, ease of maintenance, common availability and standardized installation methods. The designer must locate street inlets to quickly drain stormwater from paved surfaces, keeping streets passable and safe for vehicular traffic. Street inlets must be spaced and located in a manner to carefully balance vehicle safety, drainage system capacity, economics and efficiency. Maximum inlet spacing is generally 300 feet unless proven otherwise by computations. Inlets should be located at uphill corners of each street intersection to prevent sheet flow of stormwater. The basic geometry of stormwater flow along curbs is a thin shallow triangular cross-sectional area. If the section contains curb and gutter, then the stormwater flow is a composite shape formed by both concrete and asphalt surfaces, for which Manning's equation is still applicable. Based upon the longitudinal slope of the gutter and the cross slope of the street, the gutter flow will spread across the street. The spread impacts vehicular traffic in a negative way, causing vehicles to hydroplane or to pull in one direction. Basic references for computing spreads, inlet capacities, and interception rates for curb and grate inlets are FHWA Hydraulic Engineering Circular No. 12, Drainage of Highway Pavements (March 1984), or FHWA Hydraulic Engineering Circular No. 22, Urban Drainage Design Manual (November 1996). Both references can be downloaded in Acrobat format at the FHWA website:
http://www.fhwa.dot.gov/engineering/hydraulics/highwaydrain/index.cfm

2.6.2 Detailed inlet computations are usually not required for local residential streets and alleys, except at sag locations where potentially inadequate inlets could flood nearby houses and buildings. Slow design speeds on local streets usually minimize the impact of spread and

hydroplaning, although local streets do tend to have steeper approach slopes for intersections. Typical considerations for inlet design include:

2.6.3 Place inlets at all sag locations and other depressed areas to ensure positive drainage. Ensure that ponded water does not flood nearby structures, buildings, or houses. Flanking inlets, at an offset distance of 25' or 50', are desirable in sag locations with large flow rates.

2.6.4 Place inlets at street intersections to prevent stormwater from flowing across a street or entrance. This is particularly important wherever a local street intersects a larger street, such as a collector or arterial. Valley gutters across street intersections are not encouraged, unless specifically used for very short streets or cul-de-sacs.

2.6.5 Maintain a minimum curb and gutter longitudinal slope of 0.5% to keep positive drainage. When designing a flat stretch of street, the street designer may incorporate a gently rolling vertical profile to maintain positive drainage (along with placement of additional inlets). The designer is cautioned that the use of long vertical curves is discouraged in areas with minimum slopes.

2.7 Design of Storm Drainage Systems

2.7.1 Manning's equation is typically used to compute non-pressurized flow in pipes and storm drainage systems where inlets and headwalls are closely spaced to allow atmospheric pressure throughout the entire system. Computations for each pipe should be performed systematically (such as in a table) and include the drainage area, design flow, velocity, capacity, diameter or size, slope, length, construction material, upstream and downstream inlets, etc. Computations should also include one or more maps and drawings to show drainage areas, impervious surfaces, slopes, land cover, paths for computing time of concentration, and any offsite areas that contribute flow. Minimum size diameter of storm drainage pipes is 15 inches. For allowable types of pipe see the City of Muscle Shoals Construction Specifications. Computation of the hydraulic grade line (HGL) may be required by the Engineer, particularly if pipes are designed without excess capacity, pipes are placed at steep slopes with high velocities, the outfall is submerged, or if there are excessive deflection angles in the stormwater drainage system. Excessive velocities should be avoided to prevent HGL problems and the potential for erosion. Minimum design velocities should be at least 3 feet per second to ensure that a storm drainage system has some capability for self-cleaning.

2.8 Design of Culverts

2.8.1 A culvert is a single drainage pipe, not part of an enclosed system, which has a pipe or box opening as the inlet condition. Allowable flow within culverts are subject to inlet control, outlet control, or some combination of the two controls. Culvert design is performed using FHWA Hydraulic Design Series No. 5, Hydraulic Design of Highway Culverts (September 1985), which can be downloaded at http://www.fhwa.dot.gov/engineering/hydraulics/library_arc.cfm?pub_number=7&id=13 as an Adobe Acrobat document. Considerations in culvert design include analysis of open channels at both ends of the culvert, potential for storage or channel routing, and design of

energy dissipators and outlet protection. Head loss can be reduced by using headwalls, wingwalls, mitered slopes, and tapered inlets; refer to Hydraulic Design Series No. 5 for more details concerning culvert design. Considerations for determining the allowable headwater are potential for upstream property damage, road overtopping, erosion potential, human safety, and whether wingwalls and headwalls are designed as part of the culvert. Minimum size diameter for culverts is 15 inches.

2.9 Hydraulic Grade Line Computations

2.9.1 Where the hydraulic grade line (HGL) is deemed to be critical by the City Engineer or his representative, the HGL shall be computed. HGL computations must be performed by a registered engineer using principles of hydrology and hydraulics, and basic formulas such as conservation of momentum and energy, continuity of flow, and types of flow classification.

2.10 Analysis of Downstream System

2.10.1 Discharge from a developed site (typically a stormwater detention or retention basin) must be routed to an existing natural or manmade stormwater pipe or channel with adequate capacity. Calculations must be submitted that show the capacity of the receiving stormwater pipe or channel to handle the design storms. The first reason for analysis of the downstream system is to ensure that known flooding problems are not exacerbated. Stormwater detention basins are always designed so that the peak flow discharge is not increased. This means that the immediate downstream receiving channel, if it currently has adequate capacity, will continue to be adequate. However, if the stormwater detention basin causes a longer duration for peak or near-peak flows, then flooding could occur in locations where it did not occur before. The second reason for analysis of the downstream system is to determine any backwater effects on the detention outlet structure and embankment. In most situations, the design engineer assumes inlet control conditions for the detention basin control structure, which must be verified to ensure that the detention basin operates as designed.

2.10.2 If no existing natural or manmade stormwater channel exists downstream the discharge must be returned to a sheet flow condition before it is discharged. The location of the discharge onto the downstream property must be in a similar location as the predevelopment discharge.

Section 3 STORMWATER DETENTION/RETENTION AND MAINTENANCE

3.1 Stormwater Detention and Retention

3.1.1 General

(1) For the purposes of this ordinance, retention refers to storage without access to a positive outlet, and detention refers to temporary storage facilities with a controlled release of the stored water. Retention and detention can be used separately or together in storage basins as site conditions require.

(2) Stormwater detention is typically not required in the following two situations:

(i) The project site discharges stormwater runoff directly into a City of Muscle Shoals retention pond or City of Muscle Shoals pipe system with adequate capacity for the additional stormwater.

(ii) Stormwater detention for a project site is either unwarranted or impractical. The engineer must submit complete hydrologic and hydraulic computations to support this conclusion. Typically this might occur in the very lowest downstream reaches of a major watershed, if it can be proved that undetained stormwater should be discharged quickly to avoid the peak discharge timing for the entire watershed.

(3) All detention computations must use NRCS design methods with Type II 24-hr storm and average antecedent moisture conditions (AMC II)

3.2 Design Criteria for Sizing Detention Structures

3.2.1 All stormwater detention structures must attenuate the post development peak flow rates from the 2-year, 5-year, 10-year and 25-year NRCS 24-hour design storms to discharge at or below predevelopment peak flow rates. The purpose for detention structures is to slow or attenuate the peak flows downstream by controlling the release rate. The post development peak outflow rate is limited to the predevelopment peak outflow rate as the basis of detention design.

3.2.2 The calculations shall include sufficient design information to show that the facility will operate as required. This shall include the existing (or before site development) peak flow discharges, the after site development peak flow discharges, and/or volumes of stormwater runoff based on the proposed site development, as well as all necessary computations used to determine the reduced peak flow rates for the design storms. The capacity of the facility shall be sufficient to control the volume of stormwater runoff resulting from 2-year, 5-year, 10-year, and 25-year frequency 24-hour duration storms. The facility must be designed to pass a 100-year storm without damaging the facility.

3.2.3 Discharge from the stormwater detention pond shall be routed to a ditch, channel, or stormwater facility of adequate capacity. Calculations showing the capacity of the receiving stormwater facility and its capability to convey a 10-year frequency storm shall be provided. The City Engineer has authority to condition the approval upon the compliance with additional requirements, including but not limited to correctly sizing and installing offsite conveyance facilities or other stormwater management solutions required to reduce the adverse impact of the proposed development on other properties or the development.

3.3 Design Standards for Detention/Retention Facilities

3.3.1 A retention basin should be sized so that the volume of the excavated material from the pond is equal to the difference between the pre-development and post-development runoff volume from the development. The volume calculation should be based on a 25 year 24 hour

(1) If there is a stormwater detention facility shown on the design plans, the City requires that the current property owner (as well as any future owners of this property) enter into a permanent maintenance agreement with the City of Muscle Shoals.

3.4.2 Facility Access and Easements

(1) Adequate easements shall be provided for maintenance whether the facility is publicly or privately maintained.

(2) Facility easements: Encompasses the entire stormwater detention basin.

(3) Access easements: Provides access to the facility easement, if the easement is not immediately adjacent to the public right-of-way (minimum 20' wide).

(4) The City of Muscle Shoals is not responsible for damage to any structures, utilities or vegetation located within a facility access easement, whenever such access is deemed necessary by city inspection personnel. The City of Muscle Shoals is not responsible for repair or replacement of structures, utilities and vegetation. A facility access easement is normally intended for heavy equipment access rather than ordinary passenger vehicle access. A city inspector will normally gain access to a detention basin by parking nearby.

3.5 Facility Construction Requirements

3.5.1 All stormwater pipes, structures, ditches, facilities, etc., shall be constructed in accordance with the City of Muscle Shoals Construction Specifications Manual, Latest Edition.

BE IT FURTHER ORDAINED that the provisions of this Ordinance are severable. If any part of this Ordinance is declared or determined to be invalid or unconstitutional, such declaration or determination shall not affect the part that remains.

BE IT FURTHER ORDAINED that a copy of the Drainage Specifications thereto shall be kept and maintained in the Office of the City Clerk.

BE IT FURTHER ORDAINED that this Ordinance, and its provisions, shall become effective on the 21st day of November, 2011 upon publication or posting pursuant to law or as otherwise provided for by law.

ADOPTED AND APPROVED this 14th day of November, 2011.

COUNCIL OF THE CITY OF MUSCLE SHOALS, ALABAMA

By: _____
DAVID H. BRADFORD, Its Mayor

ATTEST:

_____
RICHARD L. WILLIAMS, City Clerk