RESOLUTION 2021___

A RESOLUTION APPROVING AN AMENDMENT TO THE BRYAN COUNTY ENGINEERING DESIGN MANUAL

WHEREAS, the Bryan County Board of Commissioners adopted the Bryan County Engineering Design Manual ("EDM") on January 12, 2021; and

WHEREAS, the purpose of the Engineering Design Manual is to establish technical standards and minimum guidelines for the design and construction of infrastructure improvements, to include drainage, roadways, and water and sewerage systems; and

WHEREAS, since the adoption of the EDM, Bryan County has reviewed the Engineering Design Manual and made certain recommendations to amend requirements for roadways; and

WHEREAS, the County has held public hearings on June 15, 2021 and July 13, 2021 to solicit public comments on the proposed amendments; and

NOW THEREFORE BE IT RESOLVED, that Bryan County does hereby approve and adopt the amended Bryan County Engineering Design Manual.

Adopted this 13th day of July 2021.

(SEAL)

BRYAN COUNTY BOARD OF COMMISSIONERS

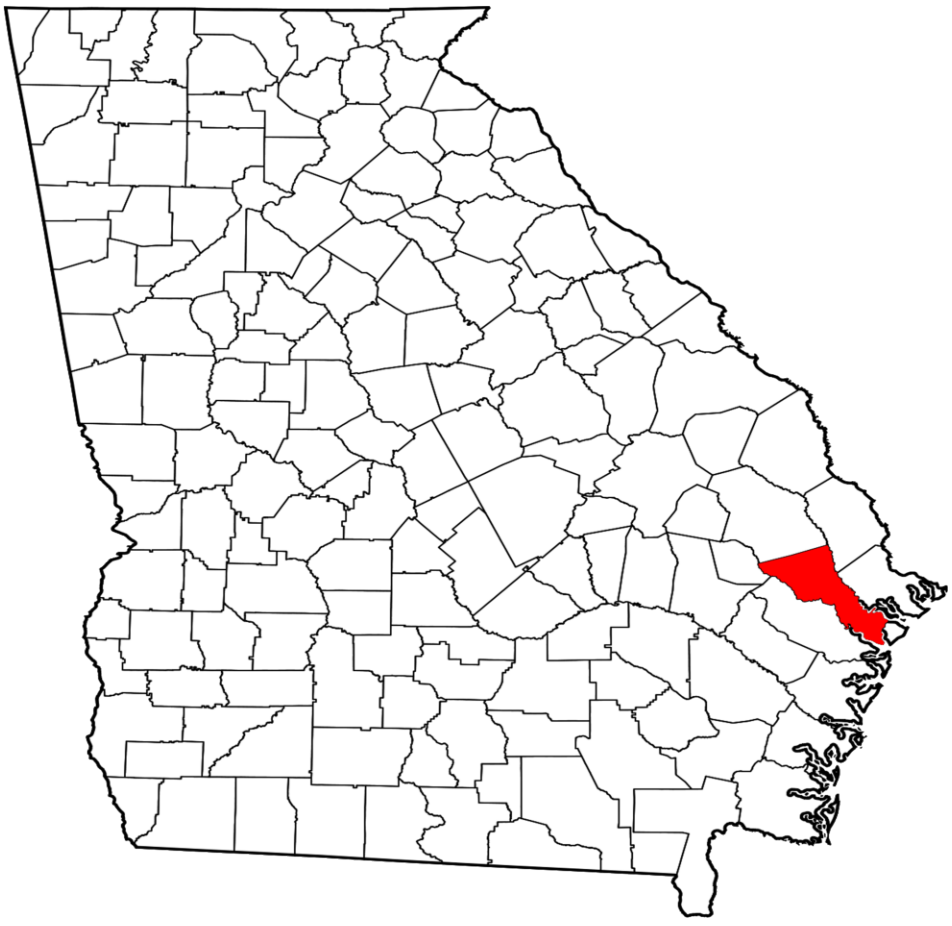
By: Carter Infinger
Carter Infinger Chairman

Attest: Charlene Butler
Charlene Butler, Deputy County Clerk

Bryan County
Board of Commissioners

BRYAN COUNTY ENGINEERING DESIGN MANUAL (EDM)

July 13, 2021



BRYAN COUNTY
ENGINEERING DESIGN MANUAL

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ARTICLE 1
GENERAL

All submissions to the Engineering Department shall bear the signature and date across the seal of the Georgia Professional Engineer who prepared the plans, reports, design calculations, or other required supporting documentation pertinent to the Construction Plans submitted with all land development applications.

All construction within the County Right-of-Way (ROW) shall require a permit and/or approval from the Department of Engineering.

Supplemental detail sheets are provided herein for specifics on construction. Unless otherwise noted, all construction details shall be in accordance with the Bryan County standard details as provided.

Construction plans shall include all elements as required by the Unified Development Ordinance (UDO) including but not limited to water supply and distribution, sanitary sewer collection and treatment, traffic and pedestrian circulation, subdivision/site access, roadways and grading, stormwater management and drainage systems, traffic control, and utilities.

All utilities shall be installed underground and within their respective designated ROW corridors.

Easements dedicated to the County for operation and maintenance of any water, sewer, or storm drainage infrastructure shall be a minimum of twenty (20) feet wide. The Engineering Director may require additional easements or ROW should it be deemed necessary based on the size and/or depth of the proposed facility.

Maintenance easements dedicated to the County for water and/or sewer utilities shall be kept clear and maintained by the property owner and/or entity providing the easement.

ARTICLE 2
DRAINAGE

Section 200: Purpose and Applicability

The Department of Engineering has adopted the Georgia Stormwater Management Manual (GSMM)[1] as the basis for the design and review of stormwater management facilities and practices in Bryan County. The purpose of this addendum is to augment and clarify the guidelines set out in the GSMM for the specific management of stormwater runoff within unincorporated Bryan County, Georgia (excluding the cities of Pembroke and Richmond Hill). Article IX Environmental Management, of the Bryan County Unified Development Ordinance (UDO)[2] provides the Department with the authority to manage stormwater based on the scope of responsibilities it defines. All land development taking place in Bryan County shall reference and adhere to the design guidelines. At a minimum, the following documents shall be used for guidance and design criteria:

- **Article IX of the Bryan County UDO**
- **Georgia Stormwater Management Manual (GSMM)** Volume I, Chapter 4 for guidance on implementing stormwater management requirements during development. Volume II provides specific guidance for unified stormwater sizing criteria and for methods of estimating stormwater runoff.
- **Georgia Coastal Stormwater Supplement (CSS)**
- **Bryan County Addendum** (this document) to the GSMM provides county-specific clarification and is organized into the following sections:
  - *Section 1: Purpose and Applicability* - provides guidance on the application and exemption of these regulations to new development, redevelopment projects, and existing stormwater management facilities.
  - *Section 2: Stormwater Conveyance (Drain Pipe) Design* - provides guidance on the design of stormwater conveyance facilities such as Gutter Flow and Inlets, Storm Drain Pipes, Culverts, and Small Ditches.
  - *Section 3: Stormwater Detention Facilities and Practices* - describes the criteria for requiring stormwater detention, provides guidance on the design of stormwater detention facilities and practices, and other miscellaneous requirements.
  - *Section 4: Stormwater Plan Review Process and Requirements* - delineates the process for the design and review of stormwater management facilities for new and redevelopments, including the pre- and post-construction requirements necessary to obtain development permits, and establishes

1 The Georgia Stormwater Management Manual (GSMM) can be downloaded from www.georgiastormwater.com

2 The ordinance can be viewed on the Bryan County Website

maintenance responsibilities for existing and new stormwater management facilities.

- *Section 5: Supplemental Stormwater Documents* - Stormwater Management/BMP Facilities Covenant

Applicability

All land development activities in Bryan County including planned construction of commercial, industrial, residential, parks or recreational type developments shall be governed by Article IX of the Bryan County UDO. Land development activities meeting any of the following criteria will be required to comply, at a minimum, with the documents as listed above in Section 200:

1. Any major residential subdivision;
2. Any minor residential subdivision that involves the extension of an existing public road for any distance or the creation of a new public road;
3. Any new commercial/industrial development and/or redevelopment that includes the creation of 5,000 square feet or more of impervious cover, or that involves other land development activities disturbing (one) 1 acre or more;
4. Any developments that construct improvements in phases and that meet criterion No.1 above when considering the cumulative runoff increase due to all phases.
5. Those developments, regardless of size, that are considered to be "hot spots" due to a particularly unique and/or intense use which may have detrimental impacts to water quality and/or runoff volumes. Hot spots shall include but are not limited to the following:
    - Gas/fueling stations
    - Parking lots with over 200 spaces
    - Vehicle maintenance/storage/washing facilities
    - Auto/truck/heavy equipment salvaging/recycling yards
    - NPDES Industrial Permit facilities

General

1. A certificate from the Applicant's Engineer in accordance with Section 114-902(b).
2. Inter-basin transfer of stormwater between drainage basins and/or wetlands is prohibited.
3. Drainage plans shall be designed to eliminate overland sheet flow across lot lines. Where rear lot drainage facilities are required, a minimum twenty (20) foot drainage easement shall be provided for access and maintenance of the facilities.
4. Minimum lot slope grades across grass lawn areas shall be 1.5%.
5. All swale banks shall be constructed in such a manner that the side slopes will not erode and can be maintained with riding grass cutting equipment. The type of soil encountered or used for stabilization shall be considered in selecting the proper slope. Side slopes flatter than 3:1 shall be required shall unfavorable soil conditions warrant.
6. Stormwater discharge points located one hundred (100) feet or less from an adjacent property

line which do not discharge directly into an acceptable receiving facility, such as a natural water body or established drainage channel, shall require authorization/easement from the adjacent property owner(s).

7. Permits shall be provided as necessary from all outside agencies having jurisdiction over point discharge locations.
8. No subdivision will be permitted which alters the surface water elevation of any waterbody or wetland in such a way as to adversely affect the natural drainage from any upstream or downstream areas of the drainage basin.
9. All County owned and maintained drainage systems shall be designed to operate under free flow conditions up to the 25 year design storm. Submerged systems during normal dry static conditions are prohibited. Retention systems shall be required to return to normal water surface elevations within 24 hours of any design storm event that creates a tailwater condition in the drainage collection system.

Exemptions

The following activities are exempt from the requirements of this Manual:

1. Additions or modifications to existing single-family detached or duplex residential structures if they do not disturb over 5,000 square feet of land area;
2. Developments that do not disturb over 5,000 square feet of = land area;
3. Individual single-family residential lots that are not part of a subdivision or phased development project;
4. Agricultural or silvicultural land management activities within areas zoned for these activities; and,
5. Repairs to any stormwater management facility or practice deemed necessary by the Department of Engineering.

Notwithstanding the foregoing, the maintenance obligations established in Section 203 shall not be subject to this exemption.

Section 201: Stormwater Conveyance Design

Runoff Computation

Unless otherwise noted in this Addendum, computing runoff and generating hydrographs must be done by one of the methods outlined in the GSMM. Table 2-1 summarizes the hydrologic calculation methods that will be accepted by the Director of the Engineering Department and the section reference from the GSMM that explains each. The table also provides guidelines for using the appropriate method based on the size of the drainage area. Additional information relating to the design of conveyance structures can be found in Section 4.1 of the GSMM. The Rational Formula can be used to design conveyance systems. One of the other methods listed must be used for designing the stormwater detention facilities described in Sections 202.

TABLE 2-1

Methods for Runoff Computation

Computation Task	GSMM Chapter	Rational Formula	SCS	USGS Equation	Water Quality Volume
Size Limitations for Each Method		*25 acres*	*25 to 2,000 acres*	*2,000 acres to 25 square miles*	*Based on Structural Control*
Water Quality Volume	1.3				**X**
Channel Protection Volume	1.3		**X**		
Overbank Flood Protection	1.3		**X**	**X**	
Extreme Flood Protection	1.3		**X**	**X**	
Storage Facilities	2.2		**X**	**X**	
Outlet Structures	2.3		**X**	**X**	
Gutter Flow and Inlets	4.2	**X**			
Storm Drain Pipes	4.2	**X**	**X**	**X**	
Culverts	4.3	**X**	**X**	**X**	
Small Ditches	4.4	**X**	**X**	**X**	
Open Channels	4.4		**X**	**X**	
Energy Dissipation	4.5		**X**	**X**	

Source: Georgia Stormwater Management Manual, Volume II, p. 3.1-2.

Storm Drain Pipe Design

All storm drainage pipe and drainage structures shall be designed to meet the following criteria:

- Street catch basins, inlets, cross drains and longitudinal piping shall be designed for the 25-year storm and shall be installed in accordance with manufacturer's recommendations at required minimum cover depths.
- All drainage pipes shall be aminimum size of 15 inches in diameter.
- Unless otherwise noted all storm drainage structures and piping shall be constructed and installed in accordance with Georgia DOT latest standards.
- Inlet and outlet flared end sections (FES) are required for all pipes up to 36 inches in diameter. Headwalls are required for all pipes greater than 36 inches in diameter.
- The 100-year storm frequency shall be used on live streams, cross drains serving basins of 20 acres or larger and any other drainage system receiving and/or transferring offsite drainage flow.
- Velocities for all pipes shall be a minimum of two (2) feet per second and outlet velocities, if practical, shall not exceed four (4) feet per second when flowing full. Should outlet velocities exceed five (5) feet per second, or are greater than downstream erosion velocities then energy dissipation devices and/or channel protection must be provided.

- The downstream end of all storm drain pipe shall be located at a minimum of fifty (50) feet past the building line for pipe sizes up to and including thirty-six (36) inches in diameter, unless the storm drainage is on a live stream.
- For all pipe design, the designer shall check the 100-year hydraulic grade line to determine that no inlet structures are flooded and that the collection capacity of any structure has not been compromised by the 100-year hydraulic grade line.
- Pipes located as driveway cross drains shall be a minimum of fifteen (15) inches in diameter. Installation shall be approved by the Public Works Director.
- Pipes of dissimilar sizes shall be vertically aligned with their energy grade lines or have crowns set at matching elevations when converging at a drainage structure.
- All pipe joints, in addition to the required rubber gaskets, shall be covered with approved geotextile material of sufficient width to be secured to the top of the pipe and completely encircle the joint with a fifty (50%) percent overlap.
- Maximum lengths of pipe runs shall not exceed three hundred (300) feet. All drainage pipes shall begin and end in either inlets, manholes, or end treatments.

The type of pipe required for all storm drainage lines located within any County Right-of-Way (ROW) shall be a minimum Class III reinforced concrete pipe (RCP) unless cover and/or insitu materials require otherwise. High density polyethylene pipe (HDPE) and polyvinyl chloride pipe (PVC) shall be allowed within privately owned and maintained drainage facilities outside of paved areas and only where cover depths are less than ten (10) feet. The construction standards and design criteria for each type of pipe shall be in accordance with accepted GDOT standards and manufacturers recommendations, whichever is more restrictive. RCP will be also be required when the storm drain pipe will be placed in a live stream and a more economical solution is not a viable alternative as determined by the Director of the Engineering Department.

The storm drain pipe designs and related plans and specifications shall be prepared by a Professional Engineer registered in the State of Georgia. The computations must be dated, project identified, signed and sealed by the designer. The designer's seal and signature shall be on all residential and commercial subdivision plans that involve new public improvements.

Plans, specifications and computations must be in detail sufficient to enable an engineer to fully check and verify the results and computations. The plans used for construction must contain basic design data, a project narrative, schedule of construction, and the designer's seal, signature and address. After construction and before acceptance for occupancy or final plat approval, the engineer must certify with their seal and signature that the "as-built" conditions of the storm drains will meet the requirements of this manual.

Swales

All drainage swales shall be designed to meet the following criteria:

- Maximum allowable flow velocity shall be five (5) feet per second.
- Side slopes shall be 3:1 or flatter.

Section 202: Stormwater Management Facilities/Practices

Stormwater management typically relies on a system of natural and constructed facilities (practices) for the storage, treatment, and conveyance of runoff. The necessary maintenance and inspection of these systems are primarily the responsibility of individual property owners or associations, though the County recognizes its role in facilitating these activities and addressing regional stormwater planning needs.

Bryan County encourages the use of better site design practices that preserve the natural drainage system and on-site, non-structural stormwater management practices whenever practical. These practices decrease the quantity and increase the quality of stormwater discharged to lakes and streams during rain events. Bryan County also encourages the protection and enhancement of existing wetlands and floodplains, which are protected from dredging and filling by 33 CFR Part 330 of the Federal Register and Section 404 of the Clean Water Act.

Stormwater Design Requirements / Unified Sizing Criteria

The GSMM has developed a set of Unified Stormwater Sizing Criteria that serves as the basis of designing stormwater facilities in Bryan County. These criteria provide an integrated approach for meeting the stormwater runoff quality and quantity management requirements for those applicable developments identified in Section 200. The purpose of the Unified Stormwater Sizing Criteria is to design a stormwater management system to:

- Remove stormwater runoff pollutants and improve water quality;
- Prevent downstream streambank and channel erosion;
- Reduce downstream overbank flooding; and
- Reduce the runoff from and safely pass extreme storm events.

Stormwater detention facilities in Bryan County must be designed to meet the criteria in Table 2-2 using the appropriate runoff calculation methods described in Table 2-1 of Section 201. Additional discussion of these criteria can be found in the GSMM, Volume II, Section 3.1.

TABLE 2-2

Summary of the Statewide Stormwater Sizing Criteria for Stormwater Control and Mitigation

Sizing Criteria	Description
Water Quality	Treat 85% of the runoff from the storms that occur in an average year and reduce average annual post-development total suspended solids loadings by 80%. For Georgia, these conditions equate to providing water quality treatment for the runoff resulting from the initial 1.2 inches of rainfall for every storm.
Channel Protection	Provide extended detention so that the 1-year, 24-hour storm event is released over a period of 24 hours to reduce bank full flows and protect downstream channels from erosive velocities and unstable conditions.
Overbank Flood Protection	Provide peak discharge control of the 25-year storm event such that the post-development peak rate does not exceed the predevelopment rate to reduce overbank flooding.
Extreme Flood Protection	Control and safely convey the flood produced by the 100-year, 24-hour storm event. Conduct a downstream hydrologic analysis to determine whether there are any additional impacts in terms of peak flow increase or downstream flooding. This analysis shall be conducted at the outlets of the site, and at each downstream tributary junction until the area of the portion of the site draining into the system is less than or equal to10% of the total drainage area above that point. The comparison shall be conducted for the 100-year flood resulting from full build-out conditions in the watershed.

Notes: Source: Georgia Stormwater Management Manual, Volume 11, p. 1.3-1.

Water Quality Performance Criteria

Total suspended solids (TSS) is a key pollutant associated with sediment runoff. It also serves as a "carrier" of other pollutants such as organics, nutrients, and metals. Thus, TSS, a measure of suspended matter, including soils and sediments, will serve as the watershed improvement guideline for managing pollutants.

Stormwater management systems (which can include both structural stormwater controls and better site design practices) must be designed to remove 80% of the average annual post-development TSS load and be able to meet any other additional watershed- or site-specific water quality requirements. All stormwater detention facilities shall be designed to control the peak flow rates associated with storms having 1-, 10-, 25-, 50-, and 100- year storm frequencies.

Bryan County will require that all sites utilizing dry detention structures discharge at 90% of the pre-developed rate of release. Sites using wet or regional detention structures will be allowed to release runoff at 100% of the pre-developed rate of release. It is presumed that a stormwater management system complies with this performance standard if:

- It is sized to capture and treat the prescribed water quality treatment volume, which is defined as the runoff volume resulting from the first 1.2 inches of rainfall of every storm. Appropriate structural stormwater controls are selected, designed, constructed, and maintained according to the specific criteria in the GSMM, and

- Runoff from hotspot land uses and activities is adequately treated and addressed through the use of appropriate structural stormwater controls and pollution prevention practices.

Criteria for Requiring Stormwater Management

Whenever a Stormwater Management Report (Section 203) indicates that adverse stormwater runoff impact is expected from the development of a property, that project shall be required to provide a stormwater management facility or facilities so that the Unified Sizing Criteria are met. The following criteria shall be evaluated by the engineer preparing the Stormwater Management Report and used in determining whether stormwater management facilities should be required for any portion of any site:

- Existing land uses downstream.
- Anticipated future land uses downstream.
- Magnitude of increase in peak flows due to development.
- Presence of existing drainage problems.
- Capacity of existing and anticipated drainage systems.
- Creation of concentrated flows where none had occurred previously.
- Existing flows generated off-site that pass through the project site. And,
- The nature of the receiving watercourse.

Stormwater Management Not Required

Stormwater management facilities shall be required for all development activities not meeting the Unified Sizing Criteria described in Section 202, unless the engineer provides certified documentation supporting the conclusion that one of the following is true and correct as applicable:

- The uncontrolled, post-development runoff for each individual sub-basin will leave the project site as sheet flow and will not have an adverse impact upon downstream properties due to dispersal of stormwater.
- The uncontrolled flow will pass through downstream properties in drainage easements obtained by the developer to existing stormwater management facilities that have been designed to manage the upstream property's runoff, and the flow is shown not to produce adverse impacts to the downstream properties.

Should the Professional Engineer conclude that stormwater management facilities may not be necessary because of anticipated compliance with the foregoing items, then rigid compliance with all of the following criteria is mandatory:

- A Stormwater Management Report (Section 203) shall always be required whether or not stormwater management facilities are required.
- If the applicant proposes to show that the detention requirements may be eliminated for all or a portion of a project, then a pre-submittal conference with

the Department of Engineering is recommended prior to preparation and submittal of construction plans for the project.

At the pre-submittal conference with the staff, the engineer shall be prepared to discuss the downstream analysis findings as follows:

a) The affected stream must be analyzed for a distance downstream to a point where the proposed development represents less than (10%) percent of the total watershed. This analysis shall be referred to hereafter as the "10% rule." The analysis must include all culverts, obstructions, existing and potential erosion problems, existing structures, proposed structures, proposed improvements and any other pre-developed or post-developed modifications to natural conditions;

b) If the existing downstream conditions are overburdened within the "10 % downstream point" by the pre-development flows in the stream, then stormwater management shall be required unless the developer elects to eliminate the downstream overburdened conditions at their expense when the development occurs.

c) If the 10% percent rule described above is to be used to show that the stormwater management requirements may not apply, then the following must be included in the Stormwater Management Report:

- The 10% study point has to be at the downstream property line and,
- The 10% study will compare peak developed flows originating on the site against peak flows for the 1-, 10-,25-, 50-, and 100-year storm events of the major stream at the downstream property line. Comparison of the peak flows shall include the timing of the peak flows.

Structural BMP Specifications

Table 2-3 provides an overview of the structural BMPs that can be used for stormwater detention in Bryan County. For specific design criteria and examples refer to Volume II, Section 3 of the GSMM. These BMPs are for general application and can be designed for use in a variety of situations.

Other structural controls, including proprietary hydrodynamic separation systems and others listed in the GSMM as "limited application structural controls," are recommended for limited use with particular land uses and densities or as one part of a larger stormwater management design and will only be accepted by the Director of the Engineering where appropriate.

TABLE 2-3

General Application Structural Best Management Practices

Structural Control	Examples	Description
Stormwater Ponds	Wet Pond Wet Extended Detention Pond Micropool Extended Detention Pond Multiple Pond Systems	Stormwater ponds are constructed stormwater detention basins that have a permanent pool of water. Runoff from rain events is detained arid treated in the pool.
Stormwater Wetlands	Shallow Wetland Extended Detention Shallow Wetland Pond / Wetland Systems Pocket Wetland	Stormwater wetlands are constructed wetland systems used for stormwater management. Stormwater wetlands consist of a combination of shallow marsh areas, open water and semi-wet areas above the permanent water surface.
Bioretention Areas	Bioretention facilities (rain gardens) Stormwater planters	Bioretention areas are shallow stormwater basins or landscaped areas that utilize engineered soils and vegetation to capture and treat stormwater runoff. Runoff may be returned to the conveyance system, or allowed to partially exfiltrate into the soil.
Sand Filters	Surface Sand Filter Perimeter Sand Filter	Sand filters are multi-chamber structures designed to treat stormwater runoff through filtration, using a sand bed as its primary filter media. Filtered runoff may be returned to the conveyance system, or allowed to partially exfiltrate into the soil.
Infiltration Trenches		An infiltration trench is an excavated trench filled with stone aggregate used to capture and allow infiltration of stormwater runoff into the surrounding soils from the bottom and sides of the trench.
Enhanced Swales	Dry Swale Wet Swale / Wetland Channel	Enhanced swales are vegetated open channels that are explicitly designed and constructed to capture and treat stormwater runoff within dry or wet cells formed by check dams or other means.

Source: Georgia Stormwater Management Manual, Volume II, p. 3.1-2.

Miscellaneous Requirements for Stormwater Facilities and Practices

Oil/Grit Separator Requirement for Hot Spot Land Uses

While these devices are for the most part ineffective as a stand-alone treatment of stormwater runoff quality for large areas, the use of oil/ grit separators is effective for addressing pollutants of concern such as hydrocarbons from hotspot land uses. These land uses can generally refer to service stations, convenience stores, and other developments with commercial fueling facilities. Hydrocarbons in urban runoff can reach water bodies and negatively impact aquatic ecosystems. As a result, Bryan County requires that all proposed service stations, convenience stores, and other developments with commercial fueling facilities shall provide an oil/grit separator for water quality. Additional information on design considerations related to oil/grit separators can be found in Volume II, Section 3.1 of the GSMM.

Stormwater Management Drainage Easements

All easements dedicated to the County for the purpose of access and maintenance of drainage facilities shall be a minimum of twenty (20) feet wide for pipes up to 36 inches in diameter and thirty (30) feet wide for pipes up to sixty (60) inches in diameter. The Engineering Director may require the dedication of additional width should it be deemed necessary based on the size and/or depth of the proposed facility.

Drainage easements suitable for the construction and maintenance of the drainage system shall be provided. A minimum of twenty (20) feet in width will be required for any drainage easement along a drainage pipe, ditch, stream or other area that is designated for stormwater to flow. No obstruction shall be built, constructed or planted that would inhibit proper function of the drainage system. All stormwater management facilities shall be accessible from a road (public or private) right-of-way by a minimum twenty (20)-foot access easement, and there shall be an easement for the detention facility including twenty (20) feet extending horizontally beyond the 100-year high water elevation of the facility. A level berm with a minimum width of ten (10) shall be provided around the entire perimeter of the facility and located within the easement. No fences or planting of shrubbery shall be allowed on access easements. Fences and/or shrubbery may be placed within a piped drainage easement, if an indemnification agreement is provided to Bryan County.

Stormwater Management Pond Fencing

When a stormwater management retention pond is over four (4) feet deep and in a location that constitutes a potential safety hazard, access shall be restricted by a permanent fence or barrier and warning signs. Fences shall be five (5) feet high chain link or other approved material with a ten (10) foot wide gate. Fences shall be located on the outside edge of the twenty (20) foot perimeter easement when possible (section 3.5.2).

Silt Gauge

A silt gauge will be installed on all detention ponds consisting of a durable weather- resistant post. The post will be embedded a minimum of 2 feet and extend a minimum of 5 feet above ground. Numbers and adjacent tick marks must be on the post beginning 1 foot above the ground elevation and thereafter a number tick mark for each corresponding foot. Numbers and tick marks must be clear, readable, weather resistant, and durable. A comparable alternative may be used upon approval by the Department of Engineering.

Section 203: Stormwater Management Review Requirements

This section provides guidance on the process for the design and review of proposed stormwater management facilities for new and redevelopments in Bryan County, including the pre- and post-construction requirements necessary to obtain development permits. This section also establishes obligations for maintenance of existing and new stormwater maintenance facilities.

Pre-Construction Requirements

Stormwater Management Report

For every project, a Stormwater Management Report shall be prepared and sealed by a Professional Engineer currently registered in the State of Georgia. The purpose of this report shall be to formulate a plan to manage stormwater, so that stormwater runoff hazards are not created, existing runoff-related problems are not exacerbated, and stormwater quality is not adversely affected, either upstream or downstream from or within the boundaries of the property being developed. Nevertheless, a Stormwater Management Report shall be prepared regardless of whether the project requires stormwater management.

The Stormwater Management Report shall address the following issues and analyze compliance with the water quantity and water quality performance indicators noted in Section 200:

A) A narrative description of the project along with the methodology utilized for managing the stormwater runoff;

B) Geotechnical investigations including soil maps, borings, site specific recommendations, and any additional information necessary for the proposed stormwater management design;

C) Site plan that depicts all streams, lakes, wetlands and other bodies of water. Additionally, if required, the plan shall depict relevant boundaries of the 100-year floodplain for ultimate build-out conditions, and/or provide the flood elevations for the proposed development as necessary.

D) Hydrologic computations, including drainage area maps depicting pre development and post development runoff flow paths and land use, including the locations and quantities of stormwater runoff entering and exiting the site for both pre-developed and post-developed conditions. Analysis of the off-site properties shall anticipate future development in addition to addressing existing conditions.

E) Drainage area delineation maps and other exhibits at a satisfactory scale and sufficient in quantity and scope to define the boundaries of the site relative to any applicable water courses, drainage divides, Tc paths, drainage structures and other pertinent features.

F) Hydraulic computations;

G) Structural computations;

H) Unified sizing criteria volume computations according to the Bryan County Addendum to the Georgia Design Manual;

I) Analysis of downstream conditions at each and every point or area along the project site boundaries at which runoff will exit the property. Analysis points for runoff from the site shall be clearly labeled. The report shall be provided with a comparative table showing runoff in CFS for each analysis point in the pre- and post- conditions.

J) Analysis of the portion of the drainage way “immediately” downstream from the project. In determining downstream effects from stormwater discharge control structures and the development, hydrologic-hydraulic engineering studies, using the 100-year flood for ultimate build-out conditions, shall extend to a point where the proposed development represents less than (10%) percent of the total watershed (the 10% rule). If the discharge calculations indicate that adjacent properties, between the exit of the proposed development and the "10% downstream point" might be adversely impacted by the proposed development, then the Engineer will provide a summary of recommendations.

The Stormwater Management Report shall describe in detail the proposed stormwater management plan. Plans, specifications and computations must be complete and in detail sufficient to enable the County to fully check and verify the results and computations. The plans used for construction must contain design data, a project narrative, schedule of construction, name and address or person responsible for construction and the Engineer's seal, signature and address on the engineering drawings required for the project construction.

This section of the report shall include the following items:

- Description of the overall stormwater management strategy,
- Topographic maps showing all on-site and off-site contributing drainage areas,
- Basis for determining runoff coefficients and times of concentration,
- Inflow and outflow hydrographs with peak flows for the 1-, 10-, 25- and 100-year storm frequencies,
- Hydraulic performance properties for all stormwater management facilities (e.g., stage/storage/discharge curves, infiltration capacities, overflow relationships),
- Details and calculations for all outlet control structures, including buoyancy calculations and emergency spillways,
- Configuration of the stormwater management system, including outflow and overflow control devices, shall be clearly described in the Report with cross-sections depicted on all construction drawings,
- Graded access easements, (maximum 3:1 slope) around all stormwater management ponds in areas inaccessible to vehicular traffic,
- Temporary sediment basins are required for all detention sites and major drainage exits. The detention facility shall be designed to provide temporary sediment control unless a live stream exists.
- Underground detention facilities with details that provide:
  - The location and type of access protection for the detention facility.
  - Safety requirements as specified by Bryan County for the site.
- Outline of the maintenance procedure to be filed with Bryan County for all components of the stormwater management report, and

- Summary of the proposed stormwater management approach and the expected performance.

Construction drawings submitted for stormwater management plan approval shall include the following:

- A vicinity map;
- Topography survey showing existing and proposed terrain, including the area to be included in the downstream analyses;
- Any proposed improvements including location of buildings or other structures, impervious surfaces, storm drainage facilities, and all grading;
- The location of existing and proposed structures and utilities;
- Any easements and rights-of-way;
- The delineation, if applicable, of the 100-year administrative floodplain and any on site wetlands;
- Structural and construction details for all components of the proposed drainage system or systems, and stormwater management facilities;
- All necessary construction specifications;
- A sequence of construction;
- Data for total site area, disturbed area, new impervious area, and total impervious area;
- A table showing the unified sizing criteria volumes required in the County Addendum to the Design Manual;
- A table of materials to be used for stormwater management facility planting;
- All soil boring logs and locations;
- A maintenance schedule;
- Certification by the owner/ developer that all stormwater management construction will be done according to this plan; and
- An as-built certification signature block to be executed after project completion.

Post-Construction Requirements

As-Built Certification of Stormwater Management Facilities

After construction and before acceptance for occupation or otherwise, the designer shall submit a certified field run topographic map of all areas including the stormwater management facilities, a revised Stormwater Management Report (if needed), and a long-term inspection and maintenance covenant signed by the property owner or organization. The designer shall certify that the as-built conditions regarding storage and outflow meet Bryan County requirements.

Inspection and Maintenance Covenant

Prior to the issuance of any new permit of occupancy, the developer must execute an inspection and maintenance agreement, and/ or a conservation easement, if applicable, that shall be binding on all subsequent owners of the site. A copy of this covenant is provided in Section 204. The inspection and maintenance agreement shall identify by name or official title the person(s) responsible for carrying out the inspection and maintenance. Responsibility for the operation and maintenance of the stormwater management facility or practice shall remain with the property owner and shall pass to any successor owner. If portions of the land are sold or otherwise transferred, legally binding arrangements shall be made to pass the inspection and maintenance responsibility to the appropriate successors in title. These arrangements shall designate for each portion of the site, the person to be permanently responsible for its inspection and maintenance.

As part of the inspection and maintenance agreement, a schedule shall be developed for routine inspection and maintenance to ensure proper function of the stormwater management facility or practice. The agreement shall also include plans for annual inspections to ensure proper performance of the facility between scheduled maintenance events and shall also include remedies for the default thereof.

Maintenance by Private Parties

On all industrial/commercial sites where stormwater management facilities exist, the maintenance of new and existing stormwater management facilities is the responsibility of the owner or operator of the property. Bryan County Department of Engineering personnel will perform periodic inspections as required of existing and new private stormwater management facilities to determine whether they are maintained properly. Deficiencies will be noted to the owner or operator in writing. It shall be the responsibility of the owner or operator to repair deficiencies in a timely manner. Failure on the part of the owner or operator to repair deficient stormwater management facilities will be a violation of the Bryan County Stormwater Ordinance. Stormwater management facilities of any kind, either in whole or in part, are not allowed on private residential properties.

Maintenance by Property or Homeowners Associations

When any subdivision or industrial/commercial park, whether new or existing, has a legally created property or homeowners association, the association will be responsible for maintenance of all drainage easements and all stormwater facilities within the entire development. The association may be required to apply larvicides, stock mosquito fish or take other measures, as required by the Department of Engineering, to protect the health, safety and welfare of the public. Any emergency maintenance required by Bryan County will be done by the Department of Public Works, or subcontracted and the charge will be assessed to the association. Bryan County Department of Engineering personnel may perform periodic inspections of existing and new private stormwater management facilities to determine whether they are maintained properly. Deficiencies will be noted to the association in writing. It shall be the responsibility of the association to repair deficiencies in a timely manner. Failure on the part of the association to repair deficient stormwater management facilities will be a violation of the Bryan County Stormwater Ordinance.

Commercial & Industrial Spill Prevention

All proposed commercial and industrial facilities that store designated hazardous waste materials or are deemed as a hot spot as defined in Section 1.1 for any purpose are required to submit a spill prevention and containment plan for the proposed facility. This plan must be submitted to the Director of the Engineering and Emergency Management Director prior to the approval of the Final Plat. All chemical/raw material storage and handling must occur under a covered portion of the facility. Proposed storage areas must contain signs with phone numbers at Bryan County and the State EPD for reporting spills.

Spill prevention and containment plans must address the following issues, at a minimum:

a) Description of the types and quantities of designated hazardous waste materials to be stored at the proposed facility.

b) Measures that will be taken to prevent spills.

   i) Chemical/raw material storage methods.

   ii) Loading/ unloading instructions.

c) Spill containment measures.

   i) Methods for spill capture and location of materials and equipment to implement these methods

   ii) Provide graded berm around large storage areas for containment of spills. The storage inside the berm shall be at least 110% of the volume of the largest tank in the containment area. The containment area should be lined to prevent infiltration of the spillage in the ground.

d) Document plan for collection of spilled materials and procedures to prevent the spill from entering the storm sewer system.

Commercial & Industrial Spill Notification and Containment

Notwithstanding other requirements of law, as soon as any person responsible for a facility, activity or operation, or responsible for emergency response for a facility, activity or operation has information of any known or suspected release of pollutants or non-stormwater discharges from that facility or operation which are resulting or may result in illicit discharges or pollutants discharging into stormwater, Bryan County separate storm sewer system, State Waters, or Waters of the U.S., said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release so as to minimize the effects of the discharge.

The person responsible for a facility, activity or operation, or responsible for emergency response for a facility shall:

- Notify the Emergency Management Director in person or by phone, facsimile or in person no later than 24 hours after the incident, the nature, quantity and time of occurrence of the discharge. Notifications in person or by phone shall be confirmed by written notice addressed and mailed to the Department within three business days of the phone or in person notice.

- The owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years. Said person shall also take immediate steps to ensure no recurrence of the discharge or spill.
- In the event of such a release of hazardous materials, emergency response agencies and/ or other appropriate agencies shall be immediately notified.

Section 204: Supplemental Stormwater Documents

STORMWATER MANAGEMENT/BMP
FACILITIES COVENANT
Bryan County, Georgia
Department of Engineering

THIS Covenant made and entered into this _____ day of _____, 20___ by and between (Insert Full Name of Owner)
_____hereinafter called the "Landowner", and Bryan County, Georgia hereinafter called the "County".

WHEREAS, the Landowner is the owner of certain real property described as (Bryan County Tax Map/Parcel Identification Number)_____as recorded by deed in the land records of Bryan County, Georgia at Deed Book _____Page, hereinafter called the "Property";
and

WHEREAS, the Landowner is proceeding to, or has, made improvements on the Property; and

WHEREAS, the Site Plan/Subdivision Plan known as _____ (Name of Plan/Development) hereinafter called the "Plan", which is expressly incorporated herein by reference, as approved, or to be approved, by the County, provides for detention of stormwater within the confines of the Property; and

WHEREAS, the County requires that onsite stormwater management/BMP facilities as shown on the Plan be constructed and adequately maintained by the Landowner, its successors and assigns, including any homeowners association;

WHEREAS, Chapter Seven of the Georgia Stormwater Management Manual addresses issues relating to the operation and/ or maintenance of stormwater systems; and

WHEREAS, the Landowner, its successors and assigns, understands that the execution and adherence to the provisions of this Covenant is a condition precedent to the County's permitting, and/ or approving the final plat for the Property and subdivision located thereon;

NOW THEREFORE, in consideration of the foregoing premises and mutual covenants the parties hereby agree as follows:

1. The on-site stormwater management/BMP facilities shall be constructed, operated, and maintained by the Landowner, its successors and assigns, in accordance with the plans and specifications identified in the Plan, as well as in accordance with State and federal law, the Georgia Stormwater Management Manual, and any and all applicable County ordinances.

2. The Landowner, its successors and assigns, including any homeowners association, shall adequately maintain the stormwater facilities and improvements on the Property. Adequate Maintenance required by this Covenant shall include, but is not limited to, scheduled and corrective maintenance of all facilities and improvements intended to manage and/ or control stormwater on the Property, with such facilities and improvements to expressly include, but not be limited to pipes, channels structures, vegetation, berms, outlet structures, pond areas, access roads, or any other improvement relating to stormwater on the Property, but excluding any such improvements located on, under, or within any publicly owned rights of way (the "Stormwater Facilities and Improvements"). Adequate maintenance is herein defined as keeping such Stormwater Facilities and Improvements in good working condition such that they satisfactorily perform their intended design functions.

3. The Landowner, its successors and assigns, shall inspect the Stormwater Facilities and Improvements and submit an inspection report to the County on an annual basis. The purpose of the inspection is to assure safe and proper functioning of the Stormwater Facilities and Improvements located on the Property. Each annual inspection shall include a full and complete inspection of all Stormwater Facilities and Improvements located on the Property. Any and all deficiencies identified during such inspections shall be noted in the inspection report submitted to the County. The inspection report shall also include a detailed plan for any and all repairs to the Stormwater Facilities and Improvements necessary to correct any deficiencies identified during the inspection, with the repair plan to be prepared by a professional engineer, or some other duly qualified professional, licensed in the State of Georgia.

4. The Landowner, its successors and assigns, hereby grants permission to the County, its authorized agents and employees, to enter upon the Property and to inspect the Stormwater Facilities and Improvements as deemed necessary by the County for purposes of protecting the public health, safety or welfare, for purposes of investigating or inspecting any reported or suspected deficiencies in the Stormwater Facilities and Improvements on the Property, for purposes of responding to or investigating

citizens' complaints relating to the management or control of stormwater on the Property, or for any other purpose deemed necessary by the County. The County shall provide the Landowner, its successors and assigns, with a copy of the any inspection findings, as well as a directive to commence with any required repairs. To the extent that the County does not agree with or to the contemplated repairs proposed by the Landowner, the County may submit an alternate repair plan to the Landowner.

5. In the event the Landowner, it successors and assigns, fails to maintain the Stormwater Facilities and Improvements on the Property in good working condition acceptable to the County, or fails to make repairs as specified in the inspection report within a reasonable time frame as established by the County, with such timeframe not to be shorter than thirty (30) days, the County may enter upon the Property and take any and all action necessary to correct deficiencies identified in the inspection report. The Landowner, its successors and assigns, shall be responsible for any and all fees and expenses incurred by the County in taking such corrective action. This provision shall not be construed to allow the County to erect any structure of a permanent nature on the land of the Landowner outside the easement for the stormwater management/ BMP facilities. It is expressly understood and agreed that this Covenant imposes no obligation or responsibility on the County to routinely maintain or repair any Stormwater Facilities and Improvements located on the property.

6. The Landowner, its successors and assigns, will perform all work necessary to keep the Stormwater Facilities and Improvements in good working condition as required by the approved Plan, as well as by State and federal law, the Georgia Stormwater Management Manual, and any and all applicable County ordinances.

7. In the event that the County performs or undertakes work of any kind pursuant to this Covenant or expends any funds or resources in performance of said work for labor, use of equipment, supplies, material, and the like, the Landowner, its successors and assigns, shall reimburse the County upon demand, within thirty (30) days of receipt of same.

8. This Covenant shall impose no liability on the County with respect to the maintenance or repair of any Stormwater Facilities and Improvements on the Property, nor does the County assume any obligation or duty to undertake or perform any action allowed for, or permitted by this

Covenant. The Landowner, its successors and assigns, further agrees to indemnify and hold the County harmless from any liability arising out of the management, operation, maintenance, or failure of any Stormwater Facilities and Improvements subject to this Covenant.

9. Notwithstanding any right extended to the County pursuant to this Covenant, it is expressly recognized and acknowledged that the County retains all prosecutorial rights and remedies available to it, including the enforcement of any and all applicable County ordinances, against the Landowner, its successors and assigns, relating to the operation, maintenance, and/ or repair of Stormwater Facilities and Improvements located on the Property.

10. This Covenant shall be recorded among the land records of Bryan County, Georgia, and shall constitute a covenant running with the land, and shall be binding on the Landowner, its administrators, executors, assigns, heirs and any other successors in interests, including any homeowners association.

WITNESS the following signatures and seals

_____
Company/Corporation/Partnership Name

By: _____
(Signature)

_____
(Type/Print Name)

_____
(Type/Print Title)

STATE OF GEORGIA

COUNTY OF _____

The foregoing Instrument was acknowledged before me this ____day of _____, 20___ by

_____
NOTARY PUBLIC

My Commission Expires:
_____

(SEAL)

ARTICLE 3
ROADWAYS

Section 300: General

The Department of Engineering has adopted the Georgia Department of Transportation (GDOT) Design Policy Manual and latest addendums thereto as the basis for the design, review and construction of transportation facilities in Bryan County. In addition, all other current design manuals and/or policies issued by GDOT shall be utilized as required for specific transportation elements not addressed in the GDOT Design Manual. Similarly, all construction related activities are governed by the GDOT Construction Manual. The purpose of this addendum is to augment these policies and guidelines set out in these documents with specific criteria related to the design and construction of transportation facilities within unincorporated Bryan County, Georgia (excluding the cities of Pembroke and Richmond Hill, and GDOT ROW). Article X Roads, of the Bryan County Unified Development Ordinance (UDO) provides the Department with the authority to manage transportation systems and road construction based on the scope of responsibilities it defines. All land development taking place in Bryan County, at a minimum, shall reference and adhere to the design guidelines and policies for guidance and design criteria, of the following documents and latest addenda thereof:

- **Article X of the Bryan County UDO**
- **Bryan County Engineering Design Manual**
- **GDOT Design Manual**
- **GDOT Construction Manual**
- **FHWA Manual on Uniform Traffic Control Devices**
- **Highway Capacity Manual (HCM)**
- **ITE Trip Generation Manual**
- **AASHTO Policy on Geometric Design of Highways and Streets**

All Bryan County road names, locations, and classifications are shown on the Official Bryan County Road Classification Map which is updated on a yearly basis or as necessary. New roads shall typically be classified by the number of vehicle trips per day measured as average annual daily traffic (AADT) as follows:

- Arterials – greater than 1500
- Collectors – 400 to 1500
- Local – less than 400

In addition to the above, the Engineering Director may also take into account and evaluate other elements that may affect the road classification such as the road design, surrounding roadway networks and

connections thereto, adjacent land uses serviced by the road, etc.

All new roadway design shall be accompanied by a Geotechnical Report for the site which shall include at a minimum, depths to seasonal high groundwater, classification of insitu soils, remediation techniques if necessary due to unsuitable soil conditions, and boring/auger data along the proposed road centerline at 300 foot intervals.

Where curb and gutter is a part of the Road design, the maximum linear gutter line distance stormwater can traverse shall be three hundred (300) feet.

The minimum required separation from the pavement base material and seasonal high water table shall be two feet. Any deviations from this standard shall require remediation via the installation of underdrain in accordance with Section 307 of the EDM.

All new utility installations within the County ROW shall be underground.

All traffic control signage and pavement markings shall be in accordance with the latest edition of the MUTCD. All pavement markings and striping shall be thermoplastic with high reflectivity glass beads. Minimum striping width shall be five (5) inches.

Section 301: Pavement Sections

The Geotechnical Report shall be submitted for all roadways with test borings being taken at a rate of no greater than every 300 feet along the design centerline. The testing locations may be reduced if in the opinion of the geotechnical engineering the soils conditions so warrant. The report shall provide data on all insitu materials and their acceptability for use as roadway sub-base material along with recommendations for remediation, if necessary. In addition, the geotechnical engineer shall provide depths from existing grades to seasonal high groundwater and current groundwater conditions at the time of the borings in order to provide a full evaluation and analysis of the site hydrology. The report shall take into account the interrelated characteristics of all surface water runoff and groundwater conditions, and include considerations and recommendations for the design of all water control systems necessary to attenuate surface runoff from the roadways and to remediate any groundwater conditions that impact the integrity of the roadway sub-base should the design not meet the two (2) feet minimum separation as required in Section 300.

Roadway sub-base shall be a minimum of twenty-four (24) inches of granular material compacted to ninety-eight percent (98%) modified proctor density. The Geotechnical Report shall include necessary gradation analysis and proctor tests for all insitu and imported select fill to be used as roadway sub-base material. Satisfactory laboratory and testing reports for all sub-base materials shall be submitted for review and approval prior to proof rolling. Testing locations shall be in close proximity of the boring locations and shall occur at a rate of no greater than every 300 feet along the roadway centerline. All roads shall be proof rolled and witnessed by a representative of the Engineering Department prior to the rock base material being placed. All unsuitable material shall be removed and replaced with acceptable material and retested.

The Geotechnical Report shall include necessary gradation analysis and proctor tests for all roadway base material. The roadway base shall be compacted to ninety-eight percent (98%) modified proctor density. Satisfactory laboratory and testing reports for all base materials shall be submitted for review and

approval prior to proof rolling. Testing locations shall be in close proximity of the boring locations and shall occur at a rate of no greater than every 300 feet along the roadway centerline. All roads shall be proof rolled and witnessed by a representative of the Engineering Department prior to the installation of asphalt. All unsuitable material shall be removed and replaced with acceptable material and retested.

Minimum roadway base section design shall be based on road classification as follows, unless the Geotechnical Report recommends a more substantial design:

- Arterial roads shall consist of six (6) inches Graded Aggregate Base, two (2) inches 19 mm Superpave, and two (2) inches 12.5 mm Superpave.

- Collector roads shall consist of eight (8) inches Graded Aggregate Base, and two (2) inches 12.5 mm Superpave.

- Local roads shall consist of six (6) inches Graded Aggregate Base, and two (2) inches 12.5 mm Superpave.

Roadway surface course shall be based on road classification as follows:

- Arterial and collector roads shall consist of two (2) inches 12.5 mm Superpave.

- Local roads shall consist of one and one-half (1.5) inches 9.5 mm Superpave.

Section 302: Local Road Design

Minimum centerline pavement grade with curb and gutter shall be 0.50%
Maximum centerline pavement grade shall be 4.0%.
Minimum roadway cross slope shall be 2.00%
Maximum Road design speed - thirty (30) MPH
Minimum sight distance - two hundred (200) feet
Minimum centerline radius of curve - one hundred (100) feet

Section 303: Dirt Road Standards

(1) Materials:

Soil shall be Class II-B-3 or better as defined in Georgia Department of Transportation Standard Specifications Construction of Roads and Bridges, Section 810.01. Where insitu material does not meet this standard the soil shall be augmented and stabilized with graded aggregate or sand.

(2) Compaction:

The entire surface of the in place material shall be plowed, harrowed and mixed to a depth of eight (8) inches, brought to grade and compacted. A proof roll test with a fully loaded tandem dump truck shall be required to verify the stability of the road. Any areas deemed inadequate shall be removed, replaced, and retested.

(3) Access Easement:

The minimum width of a dirt road access easement shall be thirty (30). The Engineering Director may require an increased width as per Section 114-406(b)(2) of the UDO.

(4) Crown:

The Road shall slope form the centerline to the edge at 2%.

(5) Drainage:

The Road shall have adequate drainage provided by means of roadside swales or ditches with maximum side slopes of 3:1 (H:V). Pipe crossings shall be provided at all low points along the road centerline using a minimum fifteen (15) inch diameter reinforced concrete pipe constructed perpendicular to the road and set on grade with the adjacent ditch inverts. There shall be a minimum cover of twelve (12) inches across the top of the pipe.

(6) Design Criteria:

The road shall be a minimum of twenty (20) feet wide. Horizontal and vertical alignments shall be in accordance with applicable GDOT and AASHTO design standards.

Section 304: Rock Road Standards

(1) Materials:

Roads shall be constructed with eight (8) inches of graded aggregate base (GAB) or recycled concrete in conformance with current GDOT Standard Specifications for Road and Bridge Construction, Section 815. A waiver may be requested for the installation of a reduced rock section or the elimination of rock section in its entirety. The request shall be accompanied by a soils report prepared by a geotechnical engineer licensed in Georgia which substantiates the requested waiver. The report shall certify the adequacy of the insitu soil(s) and/or reduced rock section to function in the same capacity as that of the required section.

(2) Compaction:

The entire surface of the in place material shall be brought to grade and compacted. A proof roll test with a fully loaded tandem dump truck shall be required to verify the stability of the road. Any areas deemed inadequate shall be removed, replaced, and retested.

(3) Right-of-Way (ROW):

The minimum ROW shall be fifty (50) feet unless drainage improvements allow for a reduced width. In no case shall the provided ROW be less than forty (40) feet.

(4) Crown:

The Road shall slope form the centerline to the edge at 2%.

(5) Drainage:

The Road shall have adequate drainage provided by means of roadside swales or ditches with maximum side slopes of 3:1 (H:V). Pipe crossings shall be provided at all low points along the road centerline using a minimum fifteen (15) inch diameter reinforced concrete pipe constructed perpendicular to the road and set on grade with the adjacent ditch inverts. There shall be a minimum cover of twelve (12) inches across the top of the pipe.

(6) Design Criteria:

The road shall be a minimum of twenty (20) feet wide. Horizontal and vertical alignments shall be in accordance with applicable GDOT and AASHTO design standards.

Section 305: Curb and Gutter

Curb and gutter shall be constructed with Portland Cement Concrete having a twenty-eight (28) day strength of three thousand five hundred (3,500) psi. Slip form or machine curb and gutter shall have expansion material minimum of one-half (½) inch thick with a maximum spacing of one hundred (100) feet and abut a solid structure where one (1) day's pour abuts a previous day's pour. Construction joints

shall be sawed or tooled at a maximum spacing of ten (10) linear feet.

Residential curb and gutter shall have a minimum gutter thickness of six (6) inches.

Industrial/commercial curb and gutter shall have a minimum gutter thickness of eight (8) inches and shall be thicker as required by its location, soil conditions and traffic load.

Section 306: Roads

(1) Sight Distance:

No fence, wall, tree, terrace, building, sign, shrubbery, hedge, other planting or structure or object capable of obstructing driver vision will be allowed at intersections.

(2) Clear Right-of-way:

Except as otherwise provided herein, it shall be required that the right-of-way be cleared, all surface improvements removed from the right-of-way, and all sub-surface improvements parallel to the pavement be re-located from under the pavement. All areas disturbed during construction and shoulders and slopes shall be seeded to obtain permanent vegetation for controlling erosion.

(3) Roadside Parking:

All Roads shall be considered to provide Road-side parking unless plans clearly state that Road-side parking will be prohibited. Where Road-side parking is prohibited, the Applicant shall provide for **"No Parking"** signage as part of the design. Where Road-side parking is provided, a nine (9) foot wide paved surface will be provided for each lane.

(4) Horizontal Curves:

On Collector Roads, the minimum centerline radius of curvature shall not be less than three hundred fifty (350) feet. On Local Roads, the minimum centerline radius of curvature shall not be less than one hundred (100) feet.

(5) Vertical Curves:

All points of vertical inflection along the roadway centerline with a total grade break of 1.5% or greater shall have a vertical curve inserted.

(6) Reserved Strips Prohibited:

A Road intended to be dedicated to the County shall not be located so that a narrow buffer strip is maintained between the right-of-way of such Road and adjacent property in such a manner as to deny access to another adjacent property.

(7) Access to Arterial Roads:

No residential Road, driveway, or other access point shall enter an Arterial Road at a point nearer than five hundred (500') feet from an existing highway, Road, driveway, or other access point; except, where an Existing Lot of Record would be rendered unusable by the strict application of this provision.

(8) Cul-de-Sacs:

Maximum allowable length for a dead end residential cul-de-sac is 1200 feet.

(9) Residential Subdivision:

Except as otherwise provided herein, Roads within Subdivisions shall have a standard Road width of twenty-seven (27) feet back to back with curb and gutter and a shoulder width of six and one-half (6.5) feet. When Roadside swales or ditches are permitted, the Road width shall be twenty-four (24) feet wide with a six and one-half (6.5) foot shoulder or greater. Where roadside parking is required, the paved Road width will be increased nine (9) feet for each lane.

(10) Phased Construction:

All roads classified as collectors and arterials shall be constructed in a two (2) phased approach which requires the installation of the two (2) inch surface course to occur no earlier than at least seventy-five percent (75%) of the lots accessing the road have been constructed, or three (3) years from the time of acceptance of the roadway base section, whichever comes first. These roads shall follow the bonding procedures in accordance with UDO Section 114-366(o).

Local roads may be constructed in their entirety and shall follow the standard three (3) year maintenance bond requirements in accordance with UDO Section 114-366(o)(6) and (7).

Section 307: Underdrains

In cases where the 2' seasonal high ground water separation to the bottom of the road base cannot be met, a waiver request may be submitted for consideration. All waiver requests shall be attached to the Preliminary Plat Approval Application as a separate package. The written request shall be accompanied by the Geotechnical Report for the site along with a layout plan of the proposed development which indicates the boring locations as referenced in the report. The Geotechnical Report shall include recommendations for groundwater management on site based on specific site soil conditions and characteristics. All areas which do not meet the 2' seasonal high separation requirement shall be clearly identified on the plan along with the depths to seasonal high groundwater from existing grade. The Engineer of Record shall provide the remediation technique(s) including, but not limited to, subgrade drains, to be considered to prevent the roadway subbase from being permanently inundated with groundwater. The Engineer shall also provide all site specific supporting soil data, hydrological analysis, and engineering design necessary to justify the requested waiver(s).

Construction plans shall include all necessary details associated with the remediation technique(s). Should subgrade drains be incorporated into the design, the pipe diameters shall be as required by the Geotechnical Engineers' recommendation, but in no case less than six (6) inches in diameter. Subgrade drain inverts

shall not be less than the project's static pond elevation or immediate downstream outfalls. Minimum gradient for all subgrade drain pipes shall be 0.15% and shall be constructed in accordance with the attached details.

Proper construction techniques and installation in accordance with the approved design is critical for the long term functionality of the design, especially the subgrade drains therefore, the final approval process shall include a certification from the Design Engineer for the installation of all subgrade drains and any other appurtenances associated with the approved remediation techniques. The document shall certify that either the design engineer and/or his or her duly authorized representative have witnessed the satisfactory installation of all piping and structures in conjunction with the approved remediation techniques. The Certification shall be accompanied by approved shop drawings, material certifications, daily inspection reports, photographs, and any other associated documentation. Final Plat approval shall be provided only after all documentation has been submitted and the County is satisfied that all improvements have been installed in accordance with the approved design.

- Use of road underdrain systems in conjunction with excessive or inordinate cutting (excavation) of road grade is prohibited. Excavation for road construction must be minimized to limit the magnitude of the underdrain system required, such that the total length of roadway within a project requiring underdrains shall be not more than fifteen (15) percent of the total length of all roadways within the overall project.

- The project's professional geotechnical engineer, who must be licensed in Georgia, shall provide the following design certification for all roads within the development that propose to use subgrade drainage to lower the groundwater level:

    - *"This is to certify that the underdrain design for _____ road(s), extending from station _____ to station _____, has been designed such that the separation between the bottom of the roadway base and the artificially induced wet season groundwater table is no less than two (2) feet for the entire width of pavement."*

- The installation of all subgrade drains shall be inspected by the project's professional geotechnical engineer, who must be licensed in the state of Georgia, and who shall then certify, in writing, that the underdrain installation has been constructed according to the approved plans.

- Prior to acceptance of the roadway by the County, the project's professional geotechnical engineer shall certify, in writing, that the underdrain system has been installed in accordance with approved plans and is functioning as designed.

- The project engineer must demonstrate through calculations and design considerations that the project's stormwater facilities shall be designed to accommodate expected flow contributed by the underdrain system.

- Use of underdrain systems are prohibited in areas designated as groundwater recharge areas by the United States Geological Survey (USGS).

- Underdrain systems may be permitted within a zone of influence of jurisdictional wetlands only if it is demonstrated by the applicant, providing competent substantial evidence and sound engineering

techniques and data, that the use of an underdrain system will not create negative impacts to wetlands.

- No trees are permitted to be planted within the right-of-way or within twenty feet (20') of an underdrain system without the installation of root guards.

- A minimum of six-inch (6") pipe is required for all underdrains.

- Cleanouts must be installed at the upper end of each subgrade drainage pipe branch, and intermediate riser cleanouts place at intervals of 100 linear feet, and at sharp angles or directional changes greater than 10 degrees. Cleanout risers shall be the small diameter as the subgrade drainage pipe.

- Underdrains shall not significantly affect water table conditions on adjacent property. The project's professional geotechnical engineer or hydrologist must demonstrate, utilizing sound and generally acceptable engineering practices and scientifically reliable data, that lowering the seasonal high groundwater table will not adversely impact adjacent properties or surface waters. The Engineering Director shall have the authority to require the developer to implement specific measures deemed necessary to avoid or correct any adverse impact of drainage facilities upon adjacent properties.

- A soil investigation report prepared by a professional geotechnical engineer, licensed in the state of Georgia, shall be submitted with the site development permit application and shall include, at a minimum, test borings to a minimum of depth of 4-feet below proposed edge of pavement elevation and a maximum spacing of 300 linear feet along proposed roadway centerlines. The soil investigation report must present the existing seasonal high groundwater water table and estimated water table during periods of normal rainfall without drainage improvements that may lower the groundwater.

- The planned use of underdrain systems to provide minimum separation between the seasonal high groundwater table and the bottom of roadway base on subdivisions proposed for development utilizing on-site sewage treatment systems (i.e., septic tanks and absorption fields) shall be prohibited except under the following circumstances:

    a. Lots within the area proposed for underdrains shall be a minimum of one-half (½) acre.

    b. The minimum distance between the roadway underdrain and the closest edge of a drain field shall be not less than seventy-five (75) feet.

- The use of limestone, recycled crushed concrete, or other alternative base material for roadways using subgrade drainage systems to lower the groundwater table shall be prohibited. Only granite graded aggregate base (GAB) shall be allowed.

- As part of waiver request to utilize subgrade drainage, the Project engineer must provide design considerations demonstrating how the subgrade drainage system will react during a 1.2-inch (85^{th} percentile) storm event. If the roadway subbase becomes inundated during these storm events, the project engineer must provide calculations presenting the anticipated drawdown time required for the system to return to norm, and the subgrade system to return groundwater levels to a minimum of 2-ft below roadway base. This drawdown time shall not exceed 72-hours.

Section 308: Property Access

(1) Road Encroachment Permits for all driveways, curb cuts, utilities, and roadside culverts are required prior to the start of construction.

(2) Installation of new driveways on curb and gutter roads must conform with the driveway curb cut design criteria as applicable in Section 309 herein.

Section 309: Curb-Cut Location and Design

Where the lowering or cutting away of curbs, or the placement of driveway pipe and/or asphalt on non-curb sections is required for the purpose of ingress and egress to a Lot or Subdivision, such work shall be subject to the following provisions: The Engineering Director may require submission and review of an access plan. Access to each parcel in PD developments and commercial/ industrial properties shall be reviewed during Construction Plan review.

(1) Residential Curb Cuts:

(a) No more than two (2) combined entrances and exits shall be allowed for any Lot, having a frontage less than two hundred (200) feet on any one Local Road. Additional entrances or exists for Lots having a frontage in excess of two hundred (200) feet may be permitted at the rate of one (1) entrance/exit for each additional one hundred (100) feet of frontage.

(b) For Local Road intersections (corner Lots), no curb cuts shall be located within twenty-five (25) feet of the intersection of two (2) curb lines or such lines extended, or within fifteen (15) feet of the end of curb radius, whichever is more restrictive. On Collector Roads, no driveway shall be within seventy (70) feet of the intersection of two curb lines or curb lines extended or fifty-five (55) feet of the intersection of the two (2) right-of-way lines, or within fifty (50) feet of the end of curb radius.

(c) The distance between any two curb cuts on the same side of the roads shall not be less than ten (10') feet on Local Roads and twenty-five (25') feet on Collector Roads. Said distance shall be measured between the points of tangency of the curb return radii. Where the posted speed limit on any road is 50 MPH or greater, the minimum distance shall be 350 feet or the greatest obtainable distance from existing drives.

(d) The width of the driveway shall not exceed twenty (20) feet at the right-of-way line and twenty four (24) feet at the edge of the pavement.

(e) Curb cuts for abandoned sites, or where access is obstructed due to parking lots, buildings, or other permitted structures, the old driveway shall be removed, the sidewalk (if existing) shall be replaced, the curb and gutter shall be replaced, fill dirt backfilled to its natural state and grassed; where it is a piped drive to a dirt or paved road, said pipe shall be removed, asphalt removed, and the shoulders and ditch regraded to its previous state.

(2) Commercial & Multi-Family Curb Cuts:

Commercial and Multi-family curb cuts shall be installed by the property owner in accordance with the approved plans by the Engineering Director.

(a) No more than two (2) combined entrances and exits shall be allowed for any parcel where the frontage is less than three hundred (300) feet on any one (1) Road. On parcels with less than one hundred-fifty (150) feet of frontage, only one (1) combined entrance and exit shall be allowed (two one-way driveways shall be allowed in lieu of the one two-way). Additional entrances or exits for parcels of property having frontage in excess of three hundred (300) feet may be permitted at the rate of one entrance/exit for each additional one hundred-fifty (150) feet of frontage.

(b) For Local Road intersections (corner lots), no curb cuts shall be located within twenty-five (25) feet of the intersection of two (2) curb lines or such lines extended, or within fifteen (15) feet of the intersection of (2) two right-of-way lines or such lines extended, or within fifteen &15) feet of the end of curb radius, whichever is more restrictive. On Collector Roads, no driveway shall be within seventy (70) feet of the intersection of two curb lines or curb line extended or fifty-five (55) feet of the intersection of the two (2) right-of-way lines, or within fifty (50) feet of the end of curb radius.

(c) The distance between any two (2) curb cuts on the same side of a Road shall be not less than twenty-five (25) feet on Local Roads and twenty-five (25) feet on Collector Roads. Said distance shall be measured between the points of tangency of the curb return radii.

(d) All driveways shall be constructed so as to be at least twelve and one-half (12.5) feet radius for multi-family and at least twenty-five (25) feet radius for commercial development.

(e) Maximum width of any driveway shall not exceed thirty-five (35) feet measured at the end of the radii, minimum of twelve and one-half (12.5) feet radius.

(f) Curb cuts for abandoned sites, or where access is obstructed due to parking lots, buildings, or other permitted structures, the old driveway shall be removed, then sidewalk (if existing) shall be replaced, the curb and gutter shall be replaced, fill dirt backfilled to its natural state and grassed; where it is a piped driveway to a dirt or paved road, said pipe shall be removed, asphalt removed and the shoulders and ditch regraded to its previous state.

Section 310: Traffic Control Plan

An Applicant shall furnish a traffic control plan for all subdivisions involving public or private right-of-ways for review and approval. This requirement applies to all subdivisions which increase the traffic count and/or have an impact on traffic routing. Traffic counts shall be determined in conformance with the most current edition of the Institute of Transportation Engineer's Trip Generation Manual (ITE Manual).

The traffic control plan shall indicate all traffic control/warning signs and devices required for the safe and orderly flow of traffic. This plan shall include, but not be limited to, signs such as: NO PARKING, STOP,

DEAD END, SPEED LIMIT, SLOW-CHILDREN PLAYING, YIELD PEDESTRIAN CROSSING, ROAD NAME, and pavement striping.

An Applicant shall also be responsible for any changes or additions required in the road from which access to the subdivision is authorized. The Engineering Director may require additional information and traffic engineering studies to determine impact on the neighboring road system by the proposed subdivision. The improvements to the neighboring road system that may be required include turn lanes, passing lanes, acceleration lanes, deceleration lanes, by-pass lanes, signs, pavement markings, etc.

All traffic control signs, devices, and striping shall conform to the Manual for Uniform Traffic Control Devices (MUTCD) latest edition. All traffic control and warning signs shall be of engineering grade highest available reflectorized quality, made on extruded aluminum sign blanks and mounted on galvanized u-channel posts. All incidental hardware for signage shall meet or exceed specifications of the Georgia Department of Transportation.

ARTICLE 4
WATER SYSTEMS

Section 400. Water Supply.

(1) The electrical supply for all water systems shall be protected with lighting arrestors.

(2) All water systems serving twenty (20) lots or more shall provide a master water meter at the well site and a back-up emergency generator.

(3) All water systems shall be provided with a back-up well and pump in accordance with EPD requirements.

(4) All electrical control systems for water systems shall provide surge and phase protection with automatic restart in the control cabinet and shall provide for the connection of an emergency standby generator. Where emergency standby power provisions are provided, a warning label shall be provided stating the phase, voltage, delta or wye service and any other information necessary for safety and emergency service by others.

(5) All water systems shall supply at least the maximum instantaneous demand plus 500 gallons per minute with a residual pressure at the end of the system of 20 psi.

Section 401. Water Distribution.

(1) General

(a) Manholes, pits, or vaults containing valves, blow-offs, meters, pressure reducing valves, or other appurtenances in the distribution system shall drain to the surface of the ground where they are not subject to flooding by surface water, or to absorptions pits underground. Under no circumstances are such to be connected to storm or sanitary sewer systems.

(b) Water mains shall be laid at least ten feet (10') horizontally from any existing or proposed sewer.

(c) Where water mains and sewer cannot be laid to the above standard, the mains shall be laid to conform to the Georgia Environmental Protection Division's Rules and Regulations and as a minimum shall comply with the Recommended Standards for Water Works as promulgated in the "Ten State Standards".

(d) All water mains shall have a minimum diameter of eight (8) inches and provide a minimum fire flow of 500 gpm.

(e) All water distribution systems shall have 3 way type fire hydrants a minimum of 500 feet apart and shall be no more than 500 feet from each house. No portion of a multi-family, commercial, or industrial building may be more than 500 feet from a hydrant as measured by an approved route around the exterior of the facility or building. This distance may be increased for buildings equipped throughout with an approved automatic sprinkler system installed in accordance with IFC Section 903.3.1.1 or 903.3.1.2. Dead end streets and cul-de-sacs shall have a fire hydrant installed so that the primary entrance to the most distance building is not greater than 300 feet.

(f) Dead end water mains that exceed 300 feet and 600 feet in length shall be a minimum of eight (8) inches in diameter and ten (10) inches in diameter, respectively; except where plans for a future development allow for the main to be tied into an existing system, and a Performance Bond is submitted for the proposed improvement.

(g) New water mains installed in conjunction with a subdivision shall extend to the farthest lot line owned by the developer, or in the case of a phased development, to the farthest lot line of that phase of development. If mains terminate 300 feet or less from an existing water main, the developer shall be required to connect to the existing water main in order to loop the system.

(2) Underwater Crossings:

(a) A minimum cover of two (2) feet shall be provided over the pipe. When crossing water courses which are greater than fifteen (15) feet in width, the following shall be provided:

(i) The pipe shall be of special construction, having flexible watertight joints. Pipe shall be wrapped with a protective covering to be specified by the Engineering Director.

(ii) Valves shall be provided at both ends of the water crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding. The valves shall be installed in a manhole or vault.

(iii) Permanent taps shall be made on each side of the valve on the source side to allow insertion of a small meter to determine leakage and for sampling purposes.

(3) Above-water Crossings:

The pipe shall be adequately supported and anchored, protected from damage, freezing, accessible for repair and with expansion and contractions joints.

(4) Dead Ends:

Dead ends shall be minimized by looping of all mains whenever practical. Where dead ends occur, they shall be provided with a fire hydrant within five hundred (500) feet of all residences if flow and pressure are sufficient, or with an approved flushing hydrant or blow-off for flushing purposes. Flushing devices should be sized to provide flows which will give a velocity of at least two and one-half (2.5) feet per second in the water main being flushed. The water system shall be extended to the county right-of-way with a minimum eight (8) inch main and terminated with a valve and end cap the size of the main.

(5) Distribution System Design:

All water mains, including those not designed to provide fire protection, shall be sized after a hydraulic analysis based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of 20 PSIG at ground level at all points in the distribution system under all conditions of flow.

(6) Fire Hydrant Service:

The minimum size of the pipe between the fire hydrants and the water main serving fire hydrants shall be a minimum of six (6) inches in diameter. Hydrants branch water mains must be equipped with a six (6) inch valve as shown in detail.

(7) Air Release Valves:

Air release valves or hydrants shall be required at all high points in the water distribution system. Automatic air release valves shall not be used in situations where flooding of the manhole or chamber may occur.

Section 402. Service Connections.

Any time a water system is installed in a Subdivision, water services shall be provided to each lot and shall be marked with a metal stake. Service connections shall consist of a tap to the water main, corporation stop, one (1) inch pipe size polyethylene or polybutylene tubing, and one (1) inch curb stop. Taps to mains shall be at a 45° angle. Service lines shall have a minimum of twenty-four (24) inch cover and the cover shall reduce to twelve (12) inch at the point of connection to the meter. Each dwelling service shall be marked with a 3/4" - 1" PVC pipe taped to the curb stop and extending a minimum of eighteen (18) inches above ground. Measurements to the service lines must appear in the record drawings. Curb stops shall not be left protruding from the ground, but must be terminated at the end of the PVC pipe. Where marked with a “W” engraved 1/4" into the curb to locate the water service lateral. Any new construction located within 200 feet of the water distribution system shall be required to connect to the system.

Section 403. System Structures Location.

(1) Water lines shall be designed to minimize pavement crossings to the greatest degree practical.

(2) Valve boxes, manholes, and other appurtenances shall not be located in the paved portion of the right-of-way.

(3) Fire Hydrants, valve boxes, manholes and other structures shall be located at adjoining property lines, if possible.

(4) Water services shall be shown on the Construction Plans and referenced to structures or other identifiable objects of permanence.

(5) Depth of the water lines and services shall have a minimum depth of bury of thirty-six (36) inches and shall have a minimum of twenty-four (24) inches of cover at the invert of Roadside swales and ditches. Where this cannot be obtained, the line shall be ductile iron pipe or encased in concrete the width of the swale or ditch.

Section 404. Water Materials.

All water systems shall meet the following material specifications.

Lead Content: Any pipe, valve, meter, appurtenance, solder or flux used shall be lead free. "Lead free" is defined in accordance with The Reduction of Lead in Drinking Water Act (Lead Reduction Act), which amends Section 1417 of the Safe Drinking Water Act. The Lead Reduction Act changes the definition of lead-free from 8.0 percent to 0.25 percent. The Lead Reduction Act took effect on January 4, 2014, and requires pipes, pipe fittings, plumbing fittings, and fixtures to be "lead free."

(1) Pipe:

All pipe shall be marked as to Type, Class or nominal thickness, weight, manufacturer, and date of production. Pipe not properly marked shall be unacceptable and removed from the job.

(a) Ductile Iron Pipe (DIP): DIP shall conform to the requirements of ANSI Specification A21.51 (AWWA C-151) latest revision. The pipe shall be designed for the actual cover installed over the pipe. Joints shall be "push-on" which conform to the requirements of ANSI Specifications A21.11. Ductile iron fittings shall conform to the requirements of ANSI Specifications A21.10. Joints for fittings shall be mechanical joints conforming to the requirements of ANSI Specifications A21.11. All ductile iron pipe and fittings shall have a cement-mortar lining of 45 mils thickness minimum conforming to the requirements of ANSI

Specifications A21.4. Ductile iron fittings are required regardless of the type of pipe on three (3) inch size and larger. All fittings shall be American made.

(b) Poly Vinyl Chloride (PVC): PVC pipe and joints shall conform to all requirements of the AWWA/ASTM Specifications D-2241 and shall be C-900. Joints shall be "push-on" type utilizing synthetic rubber ring gaskets conforming to the requirements of AWWA/ASTM Specifications D-1869. Pipe shall bear the National Sanitation Foundation (NSF) seal of approval. PVC fittings may be used only on pipe smaller than three (3) inches in size.

(c) Polyethylene Pipe: Polyethylene pipe (service connection pipes) shall conform to the requirement of AWWA/ASTM D-2239 - SDR 11.5 and shall be IPS PE 3408 pipe. The pipe shall be designed for 100 psi and shall bear the National Sanitation Foundation (NSF) seal of approval. The joints shall be "push-on" type utilizing synthetic rubber ring gasket conforming to the requirements of AWWA/ASTM Specification D-1869.

(2) Valves

Gate valves shall be used for all sizes two inches (2) through twelve (12) inches in the main distribution line. Butterfly valves shall be used where the diameter exceeds twelve (12) inches or if determined necessary by the County Engineer. All valves shall open counter clockwise. All butterfly valves shall have a 450 foot lbs. Actuator minimum. All valves shall have a cast iron screw type valve box and a four (4) inch thick concrete collar. All valves are to be designed for a minimum working pressure of not less than 150 psi.

(a) Butterfly valves shall be the resilient seated type which meet the requirements of AWWA/ASTM Specification C-504.

(b) Main line gate valves shall be the resilient seated iron body type which meet the requirements of AWWA/ASTM Specification C-509. Unless otherwise specified, gate valves shall be designed for a working pressure of not less than 150 PSI.

(c) Ball valves shall be used in lieu of two (2) inch gate valves only as a meter stop at the meter location.

(3) Marking Tape

All PVC water mains and service lateral installations shall include the installations of a continuous magnetically detectable tape buried directly over the pipe at a depth of twelve (12) inches below the finish grade. The tape shall be at least two (2) inches wide, and be boldly labeled every eighteen to thirty-two (18 - 32) inches as follows: **"CAUTION WATER LINE BURIED BELOW"**. The tape shall be designed to last as long as the pipe it is installed over, even in adverse soils.

(4) Tracer Wire

Tracer Wire will be installed on all water mains and service laterals from the main to the meter with direct burial connectors, and provide continuous electrified conductivity. Area markers shall be at least every 500 feet with tracer wire attached, unless a manhole, valve with box, or hydrant is available.

Section 405. Fire Hydrants.

Fire hydrants shall be as specified by the Emergency Services Director.

Section 406. Hydrostatic Tests.

Hydrostatic tests shall consist of two (2) parts; pressure test and leakage test at which a representative of the Engineering Department shall be present. These tests shall be supervised by the Applicant's Engineer.

(1) Pressure Test:

Prior to any pressure testing, the Contractor must clean out and flush the line of dirt and foreign material. After the water mains and lines have been laid or erected and the necessary anchors installed, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure not less than fifty (50%) percent above the normal operating pressure, but not less than 150 PSI and not greater than the pressure rating of the pipe.

Test pressure shall be based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.

All valves shall be completely opened and closed several times during the test period.

If permanent automatic air release valves are not located at all high points, brass corporation stops shall be installed and shall remain as part of the work. All air shall be vented from the main prior to testing. Test duration shall be a minimum of two (2) hours.

(2) Leakage Test:

After the water system pressure test has been completed satisfactorily, the leakage test shall be conducted in conformance with AWWA C600.

The duration of each test shall be two (2) hours at a pressure of 150 PSI. All visible leaks shall be corrected regardless of the amount of leakage.

No installations shall be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$L = SD\sqrt{P}/ 133,200$; where:

L = Allowable leakage in gallons per hour
S = Length of pipeline tested in feet
D = Diameter of pipe in inches
P = Average test pressure in PSIG

(3) Sterilization:

All new, cleaned, repaired or affected water mains shall be disinfected in accordance with AWWA C601. These results must be submitted with the Engineer's certification letter.

ARTICLE 5
SEWERAGE SYSTEMS

Section 500. General.

(1) Sewerage systems providing service to two (2) or more units are not allowed.

(2) Land disposal of any treated to partially treated wastewater by means of an absorption field, low pressure system, drip irrigation, overland flow, spray irrigation or constructed wetland shall be approved by the EPD. Such systems shall conform to the State of Georgia regulations for land application, and shall include a preliminary site assessment, groundwater monitoring, redundant application area or sufficient storage for a five (5) day period.

(3) All sewerage systems shall have an Operation and Maintenance Manual prepared by Applicant's Engineer.

(4) Sewer mains shall be designed to minimize pavement crossings to the greatest degree practical.

(5) Manholes shall not be located in the paved portion of the right-of-way and shall be located in relation to adjacent property lines as possible.

(6) Horizontal separation between water and sewer shall be in accordance with EPD-DNR.

(7) Maintenance of all sewer laterals up to their connection point on the sewer main shall be the responsibility of the property owner.

(8) Sewer lines shall be tested with a "Go-No-Go" mandrel, with a maximum allowable five (5%) percent deflection. A representative from the County's Engineering Department must be present at all tests.

(9) Sewer laterals shall be installed to the property line of each lot and its location shall be shown on the construction plans for the subdivision. Each Unit shall be marked with a three (3) feet steel rod driven flush with the ground. Measurements to the sewer lateral must appear in the Construction Plans.

(10) The sewer lateral shall have a minimum depth of bury of thirty-six (36) inches and shall have a minimum of twenty-four (24) inches of cover at the invert of Roadside swales and ditches. Where this cannot be obtained, the lateral will be encased in concrete the width of the swale or ditch.

(11) Lateral connections to manholes or other drainage structures are not allowed.

Section 501. Testing.

The Contractor shall perform the following tests:

(1) Pipe Deflection:

After backfilling trenches, all PVC sewer pipe shall be tested for initial diametric deflection by the use of a five (5%) percent mandrel which is acceptable to the Engineering Director. The initial diametric deflection shall not exceed five (5%) percent.

(2) Soil Compaction:

All trenches determined by the Engineering Director not to meet the compaction requirements stated previously for Roads shall be tested for conformance by a testing laboratory approved by the Engineering Director at the locations and depths requested by the Engineering Director.

(3) Pressure Test:

All force mains shall successfully pass a pressure test of one and one-half (½) times working pressure, but in no case less than 100 psig.

The formula for allowable pressure loss will determine if a force main is acceptable. No installations shall be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$L = SD\sqrt{P}/ 133, 200$; where:

L = Allowable leakage in gallons per hour
S = Length of pipeline tested in feet
D = Nominal diameter of pipe in inches
P = Average test pressure in PSIG

Section 502. Design.

(1) Match crowns of all lines when different size lines enter a manhole.

(2) Service laterals shall be connected to the sewer main. Under special conditions and with prior approval, service laterals may be connected to manholes with the crown of the sewer lateral matching the crown of the sewer main. A concrete slide from the incoming pipe

invert to the MH invert must be constructed.

(3) Service laterals longer than one hundred fifty (150) feet shall be six (6) inches in diameter and shall not exceed two hundred (200) feet in length. Service laterals less than one hundred fifty (150) feet may be four (4) inches in diameter on single Unit or where approved by the Engineering Director. Lateral is defined as the pipe laid from the sewer main to the property line of the Unit. Sewer lateral shall be marked with a one-half (½) inch iron rod eighteen (18) inches in length driven flush with the finish grade at the end of the lateral.

(4) Connection of mains to existing manholes shall be made in the presence of the representative of the County's Engineering Department. The Contractor shall notify the County's Engineering and Department forty-eight (48) hours before starting on the connection. All connections made to precast reinforced concrete manholes shall be cored and have installed a flexible manhole sleeve.

(5) Pipe Protection: Sewer pipe which, when completed, will have less than three (3) feet of cover shall be constructed of ductile iron pipe.

(6) Manhole tops should be above the ten (10) year flood elevation. Manhole tops in pavement lower than the ten (10) year flood elevation shall have a watertight ring and cover. Manholes constructed in public right-of-ways or easements shall have top a maximum of six (6) inches above grade.

(7) All sewers shall be so designed and constructed to have the following minimum slopes and where possible greater slopes are desirable:

Sewer Size	Minimum Slope in Feet per 100 Feet
8 inch	0.40
10 inch	0.28
12 inch	0.22

(8) All dead-end sewers (8" diameter) shall be laid at a minimum slope of 0.70 feet per one-hundred (100) feet.

(9) No more than one (1) building unit shall be connected to each lateral.

Section 503. Underwater Force Main Crossings.

A minimum cover of two (2) feet shall be provided over the force main. When crossing water

courses which are greater than fifteen (15) feet in width, the following shall be provided:

(1) The pipe shall be of special construction, having flexible watertight joints. Pipe shall be wrapped with a protective covering to be specified by the County Engineer.

(2) Valves shall be provided at both ends of the water crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding. The valves shall be installed in a manhole or vault.

(3) Permanent taps shall be made on each side of the valve on the source side to allow insertion of a small meter to determine leakage and for sampling purposes.

Section 504. Sewer Material.

(1) Pipe:

Pipe Size and Type Selection

(a) On depths of 1 to 3 feet, use DIP.

(b) On depths of 3 to 12 feet and greater, use PVC SDR-18, PVC SDR-26 (ASTM D-3034), or DIP at Applicant's Engineer's option.
(c) Any pipe above 16" diameter shall be DIP, regardless of depth.
(d) Pipe enclosed in casing shall be DIP only.

(2) Pipe Material Specifications:

All pipe shall be marked as to the type, class or nominal thickness, weight, manufacturer, and date of production. Pipe not properly marked shall be unacceptable and removed from the job.

(a) Ductile Iron Pipe (DIP): DIP shall conform to the requirements of ANSI Specifications A21.51. The pipe shall be designed for the actual cover installed. Joints shall be "push-on" which conform to the requirements of ANSI Specifications A21.11. Ductile iron fittings shall conform to the requirements of ANSI Specifications A21.10. Joints for fittings shall be mechanical joints conforming to the requirements of ANSI Specifications A21.11. All ductile iron pipe and fittings shall have a cement-mortar lining of 45 mils thickness minimum conforming to the requirements of ANSI Specifications A21.4. Ductile iron fittings must be used on pipe sized 3 inches or larger.

(b) Poly Vinyl Chloride (PVC): PVC pressure sewer pipe shall conform to the

requirements of ASTM Specifications D-2241, Class 160 - SDR 26. Joints shall be mechanical joint type utilizing synthetic rubber ring gaskets conforming to the requirements of ASTM Specifications D1869 and shall be ductile iron.

PVC gravity sewer pipe and fittings shall conform to the requirements of ASTM Specifications D3034 - SDR 35 for pipe 4" - 15" and ASTM Specifications F-679 for pipe 18" - 24". Pipe shall be designed for a maximum long term deflection that shall not exceed five (5%) percent. PVC fittings may be used on pipe smaller than three (3) inches in size.

(c) Magnetically Detectable Tape: All PVC sewer mains and lateral installations shall include the installation of a continuous electronically or magnetically detectable tape buried directly over the pipe at a depth of twelve (12) inches below the finished grade. The tape shall be at least two (2) inches wide, and be boldly labeled every eighteen to thirty-two (18" - 32") inches as follows: **"CAUTION SEWER LINE BURIED BELOW"**. Tape marking sanitary sewer lines shall be green striped; force mains, reclaimed water mains, and effluent lines shall be brown striped. The tape shall be designed to last as long as the pipe it is installed over, even in adverse soils.

(d) Tracer wire shall be installed on all plastic pipes, laterals, services and appurtenances. The wire shall be installed in such a manner as to be able to properly trace all pipelines and services without loss or deterioration of signal or without the transmitted signal migrating of the tracer wire being tested.

(3) General Information

(a) All materials used in the construction of sewers shall be new and unused when delivered on-site and shall be suitable for installation and operation under the conditions for which they are to be used.

(b) Casing pipes shall be installed at:

(i) Railroad crossings, as directed by the Railroad;
(i) State highway crossings, as directed by the Georgia Department of Transportation, or;
(ii) As designated by the Engineering Director.

(c) No sewer line of any type shall be allowed to pass through any storm drainage structure.

Section 505. Manhole Construction.

(1) Sections: Manhole sections shall be precast reinforced concrete sections with tongue and

groove joints and shall conform to ASTM Specification C478, latest revision. The number of manhole joints shall be minimized. Riser sections for manholes shall be made as long as practical to accomplish this requirement.

Alternative 1:

Concrete use in their manufacture shall conform to the requirements of ASTM C-150 (Type II) and shall be manufactured with 100% calcareous aggregate (limestone) conforming to the requirements of ASTM C-33 with a concrete alkalinity of not less than 0.80 and shall have a twenty-eight (28) day compressive strength to not less than 5,000 pounds per square inch and the absorption shall not exceed four (4%) percent. The minimum wall thickness of the manhole riser section shall be:

4' Diameter Manhole	4" Minimum Wall Thickness
5' Diameter Manhole	5" Minimum Wall Thickness
6' Diameter Manhole	6" Minimum Wall Thickness

Cone sections shall be eccentric and have a minimum wall thickness of eight (8) inches at the top and shall have a side thickness to match the section with which it is associated.

Base riser sections shall be monolithically cast and have minimum bottom thickness of:

4' Diameter Manhole	6" Minimum Bottom Thickness
5' Diameter Manhole	8" Minimum Bottom Thickness
6' Diameter Manhole	8" Minimum Bottom Thickness

Alternative 2:

Concrete used in their manufacture shall be made with granitic stone only and shall have a twenty-eight (28) day compressive strength to not less than 5,000 pounds per square inch. Alkalinity shall be adjusted to provide a Life Factor, Az = calcium carbonate equivalent times cover over reinforcement, no less than 0.35. Calcium chloride or admixtures of calcium chloride shall not be used. Manhole interior and exterior walls shall be coated with 1/8 inch of Coal Tar Epoxy, Koppers 300 M, or equal. The minimum wall thickness of the manhole riser section shall be:

4' Diameter Manhole	5" Minimum Wall Thickness
5' Diameter Manhole	6" Minimum Wall Thickness
6' Diameter Manhole	7" Minimum Wall Thickness

Cone sections shall be eccentric and have a minimum wall thickness of eight (8) inches at the top and shall have a side thickness to match the section with which it is associated.

Base riser sections shall be monolithically cast and have minimum bottom thickness of:

4' Diameter Manhole	6" Minimum Bottom Thickness
5' Diameter Manhole	8" Minimum Bottom Thickness
6' Diameter Manhole	8" Minimum Bottom Thickness

(2) Openings:

Suitable openings for inlet and outlet sewer pipe shall be cast into the base sections and into riser sections for drop connections. These openings shall be circular, accurately made, and located as required for each manhole. Base riser sections shall be set on compacted pipe embedment material twelve (12) inches in thickness.

(3) Joint Sealant:

A flexible plastic joint sealant shall be applied to manhole section joints. The sealant shall be a factory extruded formulation of one hundred (100%) percent solids with top-quality partially vulcanized butyl rubber which provides shape retention in combination with adhesion and cohesion. The sealant shall conform to the requirements of Federal Specifications SS-S-210A. It shall be applied to clean, dry surfaces only. After manhole sections are jointed, the inside of the joint shall be covered with a smooth tapered coat of non-shrink grout to thickness of one-half (½) inch at the joint. The outside of the joint shall be covered with a six (6)inch wide strip of polyethylene backed flat butyl rubber sheet no less than 1/16 inch thick and shall over lap at the ends a minimum of six (6) inches.

(4) Flexible Manhole Sleeves:

Flexible manhole sleeves of flexible manhole entrance joints shall be installed on all pipe entering and leaving manholes. Flexible manhole sleeves shall be installed on all pipe twenty-one (21") inches in size and smaller. Flexible manhole sleeves shall be Type I or Type II. Type I sleeves shall be of a high quality synthetic rubber terminating in a substantial serrated flange of the same material. The flange shall be cast into the wall of the manhole base or section to form a tight water-stop. Minimum thickness of the sleeve material shall be 3/8 inch. Sleeve material shall comply with the requirements of ASTM Specification C 923. Sleeves shall be secured to the sewer pipe to make a watertight union with stainless steel strap clamps, draw bolts, and nuts. Type II sleeves shall be high quality synthetic rubber having a minimum thickness of 3/8 inch which complies with the requirements of ASTM Specification C923. Manhole openings shall be accurately core drilled. The sleeve shall be secured to the manhole by a stainless steel band with self-locking toggle to make a watertight union. The sleeve shall be secured to the sewer pipe to make a watertight union with stainless steel clamps, draw bolt, and nuts.

Manholes sections shall be scored or stamped with the date of castings and the date shall appear on the inside of the cone section.

(5) Manhole Inverts:

Manhole inverts shall be constructed of cement grout and shall have the same cross-section as the invert of the sewer which they connect. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit. Inverts shall be "U" design with top of the "U" even with the crown of the pipe. Invert piping shall not extend inside the manhole any further than two (2) inches. Slope of inside of invert bench shall be a minimum of two (2) inches higher than the crown of the pipe. When dissimilar pipe sizes occur, the elevation of the crown of the pipe shall be the same.

(6) Manhole Frame & Covers:

After the manhole has been set in the final position, the cast iron frame for the cover shall be carefully set at the required elevation and properly bonded to the masonry with cement grout. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be titled so as to conform to the exact slope, crown and grade of the existing pavement adjacent thereto.

Manhole frame and covers shall be "American Made" and constructed of cast iron conforming to the minimum requirements of ASTM Specification A48, Class 35. There shall be a clear opening of 23 3/4" inches through the frame. All casting shall be made accurately to the required dimensions and shall be sound, smooth, clean and free from blisters and other defects. The contact surfaces between the cover and its corresponding supporting ring in the frame shall be machined so that the cover will rest on the ring for the full perimeter of the contact surface. Castings shall be thoroughly cleaned by shot blasting and shall remain unpainted. There shall be no holes or perforations in the cover.

(7) Leveling & Final Grade:

Leveling and final grading of manhole frames and covers shall be accomplished by using a maximum of two (2) concrete grade rings. Concrete grade rings shall not exceed four (4) inches in thickness. Grade rings shall be laid in a full bed of non-shrink grout and covered after laying with a smooth coating of non-shrink grout or hydraulic cement a minimum of one-half (½) inch thick.

(8) Manhole Steps:

All manhole steps shall comply with the current requirements of OSHA.

(9) Lifting Loop or Holes:

Lifting loops shall be ASTM A416 steel strand and shall not penetrate through the walls of the section. When holes are employed for lifting, the holes shall conform to the

recommended design in accordance with OSHA Standard 1926.704. Lifting holes shall be sealed using a butyl rubber plug driven to resistance and covered with a coal tar epoxy, Koppers 300M, or equal.

(10) General:

(a) All manholes over twelve (12) feet deep shall be reviewed during design by the Engineering Director. Manholes in excess of twenty (20) feet deep are not allowed.

(b) Where the difference in the invert elevation of two (2) or more sewers intersecting in one (1) manhole is two (2) feet or more, a drop manhole shall be constructed. Drops shall be made outside of the manhole and made of ductile iron and supported by Class B concrete.

(c) Where different size pipes intersect, the crowns of the pipes shall be set at the same elevation. Inverts shall be constructed to provide for a smooth transition.

(d) Where work requires special stream, railroad, highway, or other extraordinary conditions, or where alternate types of construction are required not covered by these Engineering Standards, the materials and construction method shall be submitted for approval to the County Engineer.

(e) All manholes shall be eccentric design unless approved by the Engineering Director.

(f) Minimum depth from invert top of casting of end manhole shall be four (4) feet.

(g) Transition top sections shall provide an eccentric transition from sixty (60) inches and larger manholes to forty-eight (48) inches in diameter risers and cone top sections. Transition top sections shall not be used in areas subject to vehicle traffic.

(h) All manholes constructed in an area of vehicle traffic shall be designed for the maximum load expected and shall be designed for a minimum HS-20 traffic loadings as defined by ASTM C890.

Section 506. Sewage Air and Vacuum Release Valves.

Sewage air and vacuum release valves shall be installed at all high points in the force main and shall be laid to grade.

Valves shall automatically exhaust large quantities of air and gases while the pipeline or system is being filled and allow air to re-enter during draining or whenever a negative pressure exists. Applicant's Engineer shall submit design consideration for selection of valves based on operation

of the system and proper sizing the orifice diameter.

Valves shall be housed in manholes or vaults, or above ground as approved by the County Engineer.

Section 507. Lift Station Construction.

This section of the Engineering Standards is provided for the purpose of outlining items required in a majority of lift stations, but is not intended to cover all special conditions of Applicant's Engineer's special requirements.

General:

Site dimensions shall be sufficient to provide a space for the wet well, electrical control panel, hose bib, yard lighting, and service manhole.
The Site shall be fenced.
The entire site shall be covered with MIRAFIX 600X filter fabric covered with four (4) inches of clean stone. This covering should extend one (1) foot outside the fenced area. Stone shall be No. 57.

A Power pole should be located in such a manner so the electric meter can be easily read from outside the fenced area and the service pole used for yard lighting.

All power lines within the site shall be underground. No overhead power line will be allowed to cross the site.

The lift station site shall be serviced by an all-weather road with the top of road above the one hundred (100) year flood elevation. The road and site drainage shall be approved by the Engineering Director.

A yard hydrant shall be supplied with locking capability and with approved vacuum breaker installed on outlet. The Applicant must provide a gate valve and valve box in the water line and a reduced pressure backflow preventer valve prior to the yard hydrant at the supply main. The yard hydrant shall be of sufficient size to provide adequate volume and pressure to facilitate washing down of pumps and maintenance of the wet well.

A service manhole must be located in the fenced area of each pump station for by-pass pumping.

Section 508. Design Considerations.

Applicant's Engineer should submit the following design considerations:

(1) Station service area ultimate loading.

(2) Floatation calculation (weight of station without pumps vs uplift).

(3) Cycle time calculation maximum ten (10) cycles/hour.

Section 509. Pumps and Motors (Submersible Stations).

(1) Pumps shall be designed to handle peak flow with the largest pump out of service. Minimum design peaking factor shall be 2.5.

(2) Motors shall be non-overloading over entire pumping range and have a 1.10 service factor.

(3) No "add-a-phase" systems shall be allowed.

(4) Unbalanced voltages on motors under load shall not exceed one (1%) percent when measured at the motor disconnect terminals. Voltage measurements shall be read with an accurate digital volt meter; and readings shall be recorded as part of the final inspection. Systems will not be accepted until unbalance has been corrected. Applicant's Engineer shall supply certification that the station has passed this requirement.

(5) Lift stations shall be equipped with emergency stand-by power connections and piping connections for by-pass pumping.

(6) Pumps shall be capable of obtaining a self-cleansing velocity of 2.5 fps.

Section 510. Testing.

(1) Start-up service shall be provided by the manufacturer's representative prior to acceptance of the pump station. Simplex and duplex draw-down test shall be performed by Applicant's Engineer prior to final acceptance of the pump station. Specifications to include completion of pump station start-up procedures in the presence of a representative of the County's Engineering and Inspections Department and the pump supplier.

Applicant's Engineer shall provide a certification that the work has been completed in accordance with the approved plans and specifications.