

Whitfield-Dalton Stormwater Local Design Manual

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1. FORWARD

This Stormwater Local Design Manual (LDM) is meant to serve as a comprehensive guide to implementing stormwater management systems in Whitfield County, City of Dalton, City of Tunnel Hill, and the City of Varnell. Additionally, the LDM is designed to supplement the Georgia Stormwater Management Manual (GSMM) 2016 Edition, which shall serve as the technical reference manual for design and specification of individual components within the system.

1.1. Meeting the Stormwater Management Requirements

The following outlines the process for developing a stormwater management plan as required for issuance and maintenance of site development permit in Whitfield County, City of Dalton, City of Tunnel Hill, and the City of Varnell.

Pre-Design Phase

- Step 1. Check for new special district requirements with County Engineer
- Step 2. Check for concept plan submittal requirements
- Step 3. Prepare concept plan (if required)
- Step 4. Submit concept plan to County Engineer and schedule concept plan meeting (if required)
- Step 5. Meet with County Engineer to discuss concept plan (if required)

Design Phase

- Step 6. Prepare stormwater management plan
- Step 7. Submit stormwater management plan to County Engineer for approval
- Step 8. Execute stormwater inspection and maintenance agreement for all private on-site stormwater management facilities
- Step 9. Apply for Stormwater Management Permit.

Construction Phase

- Step 10. After receiving approval from County Engineer begin construction
- Step 11. Coordinate construction with County Engineer inspection staff during construction

Post-Construction Phase

- Step 12. After construction prepare As-Built Survey and As-Built Design Certification
- Step 13. Adjust stormwater structures if necessary
- Step 14. Secure Certificate of Occupancy / Final Plat

2. GENERAL LEVEL OF SERVICE STANDARDS

2.1. Detention Requirements

2.1.1. Discharge Rates from New Development Projects

Development plans including site grading and drainage plans should be developed to minimize disruption of natural drainage patterns on properties as well as to minimize impacts to downstream drainage infrastructure and structures. Whenever a Hydrologic & Hydraulic Report (as defined in Section 8 of this document) indicates a potentially adverse impact resulting from development of a property on a downstream property, that project shall incorporate stormwater detention facilities to reduce the discharge rate. The meaning of adverse impact shall apply to situations where the post development discharge rates, up to and including the 100-year storm event, exceed those determined for the pre-developed conditions. Additionally, no increases in stormwater runoff rates shall be allowed at any discharge point from the site unless approved by the County Engineer.

The baseline or pre-developed conditions shall be on an analysis of the existing conditions taking into account existing land use, stormwater management controls and other factors that can affect the hydrologic responsiveness of the site. Proposed developments shall be analyzed for the following storm events:

- 1-year 24-hour Design Storm
- 2-year 24-hour Design Storm
- 5-year 24-hour Design Storm
- 10-year 24-hour Design Storm
- 25-year 24-hour Design Storm
- 50-year 24-hour Design Storm
- 100-year 24-hour Design Storm

If the total area of the site (i.e. total property area) and the drainage area to each stormwater management facility is less than one acre, then a rainfall intensity based analysis (i.e. rational method) may be performed. However, if detention facilities are to be designed and constructed in series, the 24-hour storm criteria will apply regardless of the drainage area.

Where downstream conditions indicate that the conveyance and/or storage capacity of existing infrastructure could be impacted by the post development conditions, or where existing structures could be impacted by the post developed conditions, a more stringent standard may be required. For example, if the project site drains into an existing detention pond within the study area then the designer will be required to demonstrate that the discharge rates from the proposed development will still allow the detention pond to operate at a level commiserate with the site in an undeveloped state.

Detention facilities should be designed upon the basis of known or projected developments (proposed by the developer) for the contributing drainage basin. Although, the developer is only required to construct the facility with sufficient volume to provide detention for the proposed development, a design shall be provided to the County Engineer demonstrating the ultimate configuration of the facility at full build-out. Additionally, the proposed site plan

should have sufficient land around the facility reserved to construct the ultimate configuration without significant demolition.

2.1.2. Discharge Rates from Redevelopment Projects

Development plans including site grading and drainage plans should be developed to minimize disruption of natural drainage patterns on properties as well as to minimize impacts to downstream drainage infrastructure and structures. Whenever a Hydrologic & Hydraulic Report (as defined in Section 8 of the LDM) indicates a potentially adverse impact resulting from development of a property on a downstream property, that project shall incorporate stormwater detention facilities to reduce the discharge rate. The meaning of adverse impact shall apply to situations where the post development discharge rates, up to and including the 100-year storm event, exceed those determined for the pre-developed conditions. Additionally, no increases in stormwater runoff rates shall be allowed at any discharge point from the site unless approved by the County Engineer.

The baseline or pre-developed conditions shall be based on an analysis of the existing conditions taking into account existing land use, stormwater management controls and other factors that can affect the hydrologic responsiveness of the site. Proposed developments shall be analyzed for the following storm events:

- 1-year 24-hour Design Storm
- 2-year 24-hour Design Storm
- 5-year 24-hour Design Storm
- 10-year 24-hour Design Storm
- 25-year 24-hour Design Storm
- 50-year 24-hour Design Storm
- 100-year 24-hour Design Storm

If the total area of the site (i.e. total property area) and the drainage area to each stormwater management facility is less than one acre, then a rainfall intensity based analysis (i.e. rational method) may be performed. However, if detention facilities are to be designed and constructed in series, the 24-hour storm criteria will apply regardless of the drainage area.

Where downstream conditions indicate that the conveyance and/or storage capacity of existing infrastructure could be impacted by the post development conditions, or where existing structures could be impacted by the post developed conditions, a more stringent standard may be required. For example, if the project site drains into an existing detention pond within the study area then the designer will be required to demonstrate that the discharge rates from the proposed development will still allow the detention pond to operate at a level commiserate with the site in an undeveloped state.

Detention facilities should be designed upon the basis of known or projected developments (proposed by the developer) for the contributing drainage basin. Although, the developer is only required to construct the facility with sufficient volume to provide detention for the proposed development, a design shall be provided to the County Engineer demonstrating the ultimate configuration of the facility at full build-out. Additionally, the proposed site plan should have sufficient land around the facility reserved to construct the ultimate configuration without

significant demolition.

2.2. Conveyance Systems

The following subsections outline the specifications for the design of stormwater conveyance systems. In no case, shall a drainage system be designed to directly or indirectly discharge stormwater runoff into a sanitary sewer line or system.

2.2.1. Bridges

All bridges shall be designed to accommodate the 100-year 24-hour design storm with the established 100-year flood elevation 1-foot below the low cord of the bridge (i.e. the lowest part of the bridge deck structure or girders whichever is lower).

2.2.2. Culverts & Pipe Systems

The level of service provided by culverts and pipe systems in Whitfield County, City of Dalton, City of Tunnel Hill and the City of Varnell is dependent on a number of different factors. These include the type of road that the system will service, the potential for upstream flooding, floodplain impacts and other service issues. Generally, the level of service to be provided by culverts is outlined in the table below:

Roadway Classification / Use	Design Storm
Emergency Access Routes (To be Determined by County Engineer)	100-Year
Collector Roadways	50-Year
Local Roads	25-Year
Roads with No Other Outlet	100-Year
Parking Lots / Material Storage Areas / Landscape Areas	10-Year

The level of service standards outlined above are considered minimum standards, where warranted the level of service may be increased at the discretion of the designer. For determining the maximum allowable head at any structure, the hydraulic grade line (HGL) should be designed to no less than six inches below the elevation of the inlet (catch basins, yard inlets, drop inlets, hooded grate inlets, etc.). The HGL should be designed to no less than six inches below the rim elevation for all junction boxes. Other inlets such as headwalls, flared end sections, etc. should be designed based on the guidance outlined in Section 2.2.4 of the LDM.

Culverts with contributing drainage areas greater than 25 acres shall be designed to the 24-hour storm. For example, if a culvert is to be designed to convey stormwater runoff from a 25-acre drainage basin under a neighborhood road, the design storm shall be a 25-year 24-hour storm. If a culvert is designed to connect to an existing system of a differing design level of service, then the system with the greater design requirement will be used to size the proposed system.

All pipes should be designed to maintain a minimum velocity of 3 feet per second during the 2-year design storm to promote sediment removal.

2.2.3. Inlets (Catch Basins, Yard Inlets, Drop Inlets, Hooded Grate Inlets and Flumes)

Inlets collecting stormwater runoff from street surfaces and area inlets shall be sized to capture the storm event specified for the pipe system to which it drains and a maximum flooding depth as determined by the following table:

Roadway Classification / Use	Design Storm	Flooding Depth
Emergency Access Routes	100-Year	8.0 ft Maximum Gutter Spread
Collector Roads	50-Year	8.0 ft Maximum Gutter Spread
Local Roads	25-Year	8.0 ft Lane Width Open
Roads with No Other Outlet	100-Year	8.0 ft Lane Width Open
Parking Lots (with a check of the 100-year storm flooding depth and maximum 1-foot depth)	10-Year	Maximum 0.5 ft Depth
Detention Areas utilized for other purposes with general public access (i.e. parking lot detention, etc.) with flood warning sign	100-Year	Maximum 1.5 ft Depth
Material Storage Areas / Landscape Areas with flood warning sign if area is utilized by the public (with a check of the 100-year storm flooding depth)	10-Year	Maximum 2.0 ft Depth

Inlets and grading adjacent to habitable structures shall be designed to prevent stormwater runoff from entering the structure during the 100-year design storm.

In no case shall inlets located on public streets be spaced in excess of the following table:

Road Grade	Maximum Distance Between Inlets
0.00% to 7.00%	400-feet
7.01% to 10.00%	300-feet
10.01% and Greater	250-feet

2.2.4. Inlets (Headwalls, Flared End Sections, etc.)

Inlets that utilize the opening of the pipe as the inlet (i.e. headwalls, flared end sections, etc.) shall be sized to capture the storm event specified for the pipe system to which it drains. The HGL should be designed to be no less than six inches below the edge of pavement or the point at which water would bypass the inlet (i.e. bypass to another inlet, etc.) whichever is less. Additionally, the headwater conditions induced by the inlet should not cause an impact on any upstream drainage structures such that the upstream structure will realize a loss in performance. In simpler terms, the headwater from an inlet should not back water into another culvert or drainage system. This requirement can be waived by the County Engineer in situations where it would be infeasible to design the culverts due to proximity of the culverts or extremely shallow grades between the culverts.

2.2.5. Roadside Ditches

Roads constructed without curb and gutter shall incorporate ditches that are designed to the specific design storms. The level of service provided by the ditches shall match the level of service provided by a comparable pipe system as outlined in Section 2.2.2 of the LDM above. The level of service standards are considered minimum standards, where warranted the level of service may be increased at the discretion of the designer.

Culverts with contributing drainage areas greater than 25 acres shall be designed to the 24-hour storm. For example, if a culvert is to be designed to convey stormwater runoff from a 25-acre drainage basin under a neighborhood road, the design storm shall be a 25-year 24-hour storm.

2.2.6. Drainage Channels

For drainage channels designed to convey stormwater runoff either from or to a culvert, the channel should be sized to accommodate the same storm event specified for the pipe system at a minimum. Channels designed to convey stormwater runoff to detention ponds shall be sized to accommodate the 100-year design storm.

2.2.7. Groundwater Dewatering

Sub-drainage will be installed to control the surplus groundwater by intercepting seepage or by lowering or regulating the groundwater level where such conditions exist.

2.2.8. Flood Elevation Impacts

It is the policy of Whitfield County, City of Dalton, City of Tunnel Hill and the City of Varnell that raising the elevation of flooding on an adjacent property shall not be acceptable. As such, the level of service standards outlined in Section 2.2 of the LDM shall be considered minimum standards. Where flood elevations on an adjacent property will be increased due to development and / or construction of a drainage system, the level of service may be increased by the County Engineer to result in no impact to the adjacent property. This requirement may be waived at the County Engineer's discretion if the adjacent property owner provides a permanent drainage easement between the two property owners. The easement shall provide that the owner of the impacted property acknowledges that an increase in flood elevations will occur on their property as a result of the proposed development. Additionally, the easement shall include at a minimum a map showing the extent of the pre-development and post-development 100-year floodplains. Finally, the easement must be recorded with the County as an attachment to the affected property's land deed and shall be binding on all future property owners.

2.3. Stormwater Quality Treatment

2.3.1. Stormwater Quality in New Development

Stormwater management systems for new development shall be designed to treat or retain the runoff from 85% of the storms that occur in an average year, and reduce average annual post-development total suspended solids loadings by 80%. Averaged from rainfall events across the state of Georgia, this equates to treating storm events of 1.2 inches or less, as well as the first 1.2 inches of runoff for all larger storm events.

The County Engineer will waive the water quality treatment requirement if 100% of the 1.0 inch

runoff reduction volume (RRv) is achieved. If the entire 1.0-inch runoff reduction standard cannot be achieved, the remaining runoff from the 1.2-inch rainfall event must be treated by BMPs to remove at least 80% of the calculated average annual post-development TSS loading from the site.

This standard is quantified and expressed in terms of engineering design criteria through specification of the water quality volume (WQv), which is equal to the runoff generated on a site from 1.2 inches of rainfall. The WQV must be treated to the 80% TSS removal performance goal. This standard assumes that BMPs will be designed, constructed and maintained according to the criteria in the GSMM. Stormwater discharges from land uses or activities with higher or special potential pollutant loadings may require the use of specific structural practices and pollution prevention practices. A detailed overview of BMPs is provided in Chapter 4 of the GSMM.

For further discussion on this standard, see Section 2.2.4.1 of the GSMM.

The County encourages the designer to implement specific stormwater credits for reducing the water quality treatment requirements on site. These credits can be found in Section 2.3.3 of the GSMM. However, the County recognizes that water quality treatment of stormwater runoff from certain areas of a site is not feasible. As such, the following areas are exempt from water quality treatment.

- Portions of the site that lie within State mandated undisturbed buffers.
- Portions of the site that lie within 50 feet of the property line and drain away from the site assuming that no impervious surfaces (including compacted gravel / rock) lie within the 50 foot zone except retaining walls.
- Impervious surfaces associated with the driveway for the first 50 feet as measured from the edge of pavement of the public street to which it connects.
- Portions of the site which will remain undisturbed and which does not drain to a water quality or detention facility / BMP. These undisturbed areas must contain at least 10,000 square feet of contiguous area. Additionally, these areas must not be used for any purposes during construction and must be protected from such activities by construction fencing or other means to prevent construction personnel ingress.

Additional, water quality requirements may be specified for hotspot land uses and activities.

2.3.2. Stormwater Quality in Redevelopment

Stormwater management systems for redevelopment shall be designed to treat or retain the runoff from the disturbed area of the site from 85% of the storms that occur in an average year, and reduce average annual post-development total suspended solids loadings by 80%. Averaged from rainfall events across the state of Georgia, this equates to treating storm events of 1.2 inches or less, as well as the first 1.2 inches of runoff for all larger storm events.

The County Engineer will waive the water quality treatment requirement if 100% of the 1.0 inch runoff reduction volume (RRv) is achieved. If the entire 1.0-inch runoff reduction standard cannot be achieved, the remaining runoff from the 1.2-inch rainfall event must be treated by BMPs to remove at least 80% of the calculated average annual post-development TSS loading from the site.

This standard is quantified and expressed in terms of engineering design criteria through specification of the water quality volume (WQv), which is equal to the runoff generated on a site from 1.2 inches of rainfall. The WQV must be treated to the 80% TSS removal performance goal. This standard assumes that BMPs will be designed, constructed and maintained

according to the criteria in the GSMM. Stormwater discharges from land uses or activities with higher or special potential pollutant loadings may require the use of specific structural practices and pollution prevention practices. A detailed overview of BMPs is provided in Chapter 4 of the GSMM.

For further discussion on this standard, see Section 2.2.4.1 of the GSMM.

The County encourages the designer to implement specific stormwater credits for reducing the water quality treatment requirements on site. These credits can be found in Section 2.3.3 of the GSMM. However, the County recognizes that water quality treatment of stormwater runoff from certain areas of a site is not feasible. As such, the following areas are exempt from water quality treatment.

- Portions of the site that lie within 50 feet of the property line and drain away from the site assuming that no impervious surfaces (including compacted gravel / rock) lie within the 50 foot zone except retaining walls.
- Impervious surfaces associated with any new driveway (maximum width of each driveway allowed for exemption is 50 ft) for the first 50 feet as measured from the edge of pavement of the public street to which it connects.

Additional, water quality requirements may be specified for hotspot land uses and activities.

2.3.3. Stormwater Quality Requirements for Hotspot Land Uses

Stormwater hotspots are land uses that often produce higher concentrations of certain pollutants, such as hydrocarbons or heavy metals, than are normally found in urban stormwater runoff. For the purposes of stormwater regulation, the following land uses / activities are defined as hotspots:

- | | |
|---|---------------------------------------|
| • Gas / Fueling Stations | • Outdoor Material Storage Areas |
| • Landfills | • Loading and Transfer Areas |
| • Vehicle Washing / Steam Cleaning | • Vehicle Maintenance Areas |
| • Auto Recycling Facilities | • Construction Sites |
| (Stormwater Permitted Sites Only) | |
| • Large Parking Lots with Greater than 200 Car Parking Spaces or 20 Semi-truck parking Spaces | • Industrial Sites (NPDES Industrial) |

For the purposes of this regulation, activities that are required to be compliant with National Pollutant Discharge Elimination System (NPDES) Permits issued by the Georgia Environmental Protection Division (EPD) will be considered compliant with the water quality requirements of this section if the requirements for the EPD permit are fully met unless noted below. These activities typically include construction site activities and certain industrial activities. Those sites which do not meet these exemption criteria will be required to implement additional requirements.

Gas / fueling stations are required to construct and maintain oil / water separators (or equivalent pre-treatment device approved by County Engineer) to collect and treat stormwater runoff from those areas where gas / fuel will be dispensed or loaded to underground and / or above ground storage tanks.

Large Parking Lots with Greater than 200 Car Parking Spaces or 20 Semi-truck parking spaces are required to construct and maintain oil / water separators to collect and treat stormwater runoff from those areas where vehicles will be parked.

Vehicle maintenance areas are required to construct and maintain oil / water separators to collect and treat stormwater runoff from those areas where vehicle maintenance will occur and vehicles will be parked awaiting maintenance.

Vehicle washing / steam cleaning areas are required to construct and maintain oil / water / grit separators to collect and treat stormwater runoff from those areas where washing will occur. Sand filters may be utilized in lieu of oil / water / grit separators with prior approval from the County Engineer.

Auto recycling facilities are required to construct and maintain oil / water separators to collect and treat stormwater runoff from those areas where vehicles will be stored as well as areas where active recycling is occurring.

Outdoor material storage areas are required to construct and maintain sedimentation basins meeting the minimum standards outlined in the Georgia Manual for Sedimentation and Erosion (current edition) to collect and treat stormwater runoff from those areas where materials will be stored.

Loading and transfer areas other than truck docks which shall be considered exempt will be evaluated on a case by case basis. Generally, where the primary concern will be solids transport to nearby streams and drainage structures, the area will be required to construct and maintain sedimentation basins meeting the minimum standards outlined in the Georgia Manual for Sedimentation and Erosion (the Green Book, current edition). If the primary concern will be hydrocarbons and other floatable contaminants, the area will be required to construct and maintain oil / water separators to collect and treat stormwater runoff.

All oil / water separators should be designed to the following criteria:

- Sized to treat the Water Quality Volume.
- Designed as an off-line system.
- Designed to pre-treat stormwater runoff before entering other Water Quality BMPs.

2.4. Channel Protection

2.4.1. Channel Protection for New Development Projects

Channel protection shall be provided for each discharge point from the site unless meeting the exemption criteria outlined below. Channel protection shall be accomplished by providing for 24-hour extended detention of the 1-year 24-hour storm event.

Channel protection shall not be required if one of the following criteria is applicable to an outfall point on the site:

- Point discharges that do not exceed two cubic feet per second for the 1-year 24-hour storm in a post developed condition.
- Sheet flow discharges that do not have more than 100 feet of contributing drainage area assuming that no impervious surfaces are within the contributing drainage area.
- Point or sheet flow discharges from drainage areas consisting entirely of undisturbed lands on the site.
- Point discharges which drain directly to a piped drainage system and which the County Engineer has determined that the outfall of the system will not experience significant channel erosion as a result of not providing channel protection via extended detention of the 1year 24-hour storm.
- Point discharges which drain directly to streams, rivers, wetlands, lakes or other scenarios where reduction of the 1-year 24-hour storm will in the opinion of the County Engineer result in no impact to downstream channel integrity.

2.4.2. Channel Protection for Redevelopment Projects

Channel protection shall be provided for each discharge point from the disturbed portion site unless meeting the exemption criteria outlined below. Channel protection shall be accomplished by providing for 24-hour extended detention of the runoff from the disturbed portion of the site for the 1-year 24-hour storm event.

Channel protection shall not be required if one of the following criteria is applicable to an outfall point on the site:

- Point discharges that do not exceed two cubic feet per second for the 1-year 24-hour storm.
- Sheet flow discharges that do not have more than 100 feet of contributing drainage area assuming that no impervious surfaces are within the contributing drainage area.
- Point discharges which drain directly to a piped drainage system and which the County Engineer has determined that the outfall of the system will not experience significant channel erosion as a result of not providing channel protection via extended detention of the 1year 24-hour storm.
- Point discharges which drain directly to streams, rivers, wetlands, lakes or other scenarios where reduction of the 1-year 24-hour storm will in the opinion of the County Engineer result in no impact to downstream channel integrity.

2.5. Energy Dissipation

Energy dissipation shall be employed whenever the velocity of flows leaving a new stormwater facility exceeds the erosion velocity of the downstream area.

3. APPROVED CONSTRUCTION MATERIALS & BMPs

3.1. Conveyance Structures

3.1.1. Pipes Within the Whitfield County Right of Way (including City of Tunnel Hill and City of Varnell)

All pipes located under roadways and within the public right-of-way of Whitfield County, and that are accepted by the County Engineer for long-term maintenance, shall be constructed of reinforced concrete pipe (RCP) meeting Georgia Department of Transportation Standards.

All pipes must have a minimum of 12 inches of cover from the exterior crown of the pipe, and in accordance with manufacturer's specifications. Pipes under pavement must have a minimum of 12-inches of cover from the exterior crown of the pipe to the bottom of the roadway base. Pipes must have at least 6-inches of clearance between the exterior of the pipe and all underground utilities.

In situations where the County Engineer has reason to suspect that a pipe system may have not been installed properly, the County Engineer may require at his discretion, video inspections of pipe systems to be provided at the Owner's expense prior to acceptance of the system.

3.1.2. Pipes Within the City of Dalton Right of Way

All pipes located under roadways and within the public right-of-way of the City of Dalton, and that are accepted by the City of Dalton for long-term maintenance, shall be constructed of reinforced concrete pipe (RCP – Class 3) meeting Georgia Department of Transportation Standards. All pipes must have a minimum of 12 inches of cover from the exterior crown of the pipe, and in accordance with manufacturer's specifications. Pipes under pavement must have a minimum of 12 inches of cover from the exterior crown of the pipe to the bottom of the roadway base.

In situations where the City of Dalton or the County Engineer have reason to suspect that a pipe system may have not been installed properly, the City of Dalton may require at their discretion, video inspections of pipe systems to be provided at the Owner's expense prior to acceptance of the system.

3.1.3. Other Pipe Systems in Whitfield County (including City of Tunnel Hill and City of Varnell)

Pipe systems not within the public right-of-way of Whitfield County, City of Tunnel Hill and City of Varnell shall be constructed of RCP, HDPE, or CMP meeting Georgia Department of Transportation Standards and approved by Whitfield County Engineer. Minimum bedding standards for HDPE pipe and CMP shall be such that stone bedding (i.e. No. 57 stone) shall be placed to half of the pipe diameter for all depths greater than four feet and / or in accordance with manufacturer's specifications, whichever is greater.

All pipes must have a minimum of 12 inches of cover from the exterior crown of the pipe, and in accordance with manufacturer's specifications. Pipes under pavement must have a minimum of 12 inches of cover from the exterior crown of the pipe to the bottom of the

roadway base. The minimum cover for pipes which run along individual lot property lines in residential developments shall be increased to three feet to account for the potential for damage due to residential fence construction.

All CMP shall be galvanized or aluminum coated (Type 2) steel pipe. Galvanized steel pipe must be galvanized with a minimum of four ounces of galvanization per square foot, and have three inch by one inch corrugation for pipe sizes of 36 inches in diameter and larger, and be 14 gauge or heavier construction. Aluminum coated (Type 2) must use steel sheet for corrugated steel pipe that meets AASHTO M 274M requirements. Those areas where a high ground water table exists and/or soil corrosivity and resistivity do not meet manufacturer's recommendations for a 50-year service life, only RCP may be utilized. The County Engineer may, at its discretion, require soil tests to be provided at the Owner's expense to determine corrosivity and resistivity of the soils as well as the presence and depth of the groundwater table. All soil tests performed by the Owner must be performed in strict conformance with pipe manufacturer's specifications.

Maximum deflection of installed pipe systems shall be in accordance with manufacturer's specifications.

3.1.4. Other Pipe Systems in the City of Dalton

Pipe systems not within the public right-of-way of the City of Dalton but in the City Limits of Dalton shall be constructed of RCP, HDPE, or CMP meeting Georgia Department of Transportation Standards and approved by Whitfield County Engineer. Non-RCP pipe will be allowed if all of the following conditions are met: (1) Pipe is not located within private street right-of-way, (2) pipe does not directly connect to the City of Dalton's MS4 system, and (3) pipe does not receive stormwater drainage from City of Dalton right-of-way. Exceptions may be granted upon submittal of a site specific request and approval by City of Dalton prior to construction. Minimum bedding standards for HDPE pipe and CMP shall be such that stone bedding (i.e. No. 57 stone) shall be placed to half of the pipe diameter for all depths greater than four feet and / or in accordance with manufacturer's specifications, whichever is greater.

All pipes must have a minimum of 12 inches of cover from the exterior crown of the pipe, and in accordance with manufacturer's specifications. Pipes under pavement must have a minimum of 12 inches of cover from the exterior crown of the pipe to the bottom of the roadway base. The minimum cover for pipes which run along individual lot property lines in residential developments shall be increased to three feet to account for the potential for damage due to residential fence construction.

All CMP shall be galvanized or aluminum coated (Type 2) steel pipe. Galvanized steel pipe must be galvanized with a minimum of four ounces of galvanization per square foot, and have three inch by one inch corrugation for pipe sizes of 36 inches in diameter and larger, and be 14 gauge or heavier construction. Aluminum coated (Type 2) must use steel sheet for corrugated steel pipe that meets AASHTO M 274M requirements. Those areas where a high ground water table exists and/or soil corrosivity and resistivity do not meet manufacturer's recommendations for a 50-year service life, only RCP may be utilized. The County Engineer may, at its discretion, require soil tests to be provided at the Owner's expense to determine corrosivity and

resistivity of the soils as well as the presence and depth of the groundwater table. All soil tests performed by the Owner must be performed in strict conformance with pipe manufacturer's specifications.

Maximum deflection of installed pipe systems shall be in accordance with manufacturer's specifications.

3.1.5. Channels

All channels must be protected from erosion through the use of rip-rap, concrete, erosion control matting or similar method acceptable to the County Engineer. All channel side slopes shall have a 3-foot horizontal to 1-foot vertical (3:1) slope or less.

3.1.6. Inlets

All inlets shall be constructed of materials and methods approved by the Georgia Department of Transportation and / or designs pre-approved by Whitfield County Engineer. Inlet covers (where appropriate) shall be designed and manufactured in accordance with local construction standards related to storm drain stenciling and pollution prevention education. The Owner and / or designer shall consult Whitfield County Engineer regarding specific requirements for storm drain covers and inlets.

Headwalls or flared end sections shall be required on inlet and outlet ends of any pipe.

3.1.7 Structures

All pipe or other penetrations into manholes, structures, or junctions shall be permanently sealed watertight. Fill all spaces between pipe or other connections and manholes, junctions, or structures completely with non-shrink cementitious concrete grout placed on inside and outside of manhole or structure, completely filling all voids.

All inlets (catch basins, yard inlets, and hooded grate inlets), junction boxes and outlet control structures shall have manhole steps easily accessible for inspection and maintenance. Manhole access location must provide reasonable access to manhole steps. Step spacing shall be limited to a maximum of 16 inches and steps must meet OSHA Standards. Steps must be aligned to allow safe and easy access from access point to lowest invert of structure.

3.2. Detention Ponds

All detention facilities constructed in accordance with the requirements of this manual shall be constructed on subdivided parcels deeded to the property owner or the homeowners association. No detention facility for residential subdivisions shall be constructed in whole or part on a parcel or lot intended for sale to a future resident.

3.2.1. Dry Earthen Detention Ponds

Dry detention ponds shall be designed to provide for positive drainage on the pond floor to the outlet of the pond with a minimum of a 2% slope. Side slopes for the dam shall be designed to

have a maximum of 3-feet horizontal to 1-foot vertical (3:1) slopes.

A six foot chain link fence will be required for above ground stormwater detention facilities that exceed six feet in depth measured from the outlet invert to the top of the berm. In the front yard, the fence height may be reduced to four feet. The fence shall include a double drive-thru gate of sufficient size to permit entrance of equipment necessary to allow periodic maintenance activities. A chain link fence will not be required when the site in which the pond is to be constructed is zoned non-residential and is more than 1,000 feet from properties zoned residential or publicly owned property (excluding right-of-way).

Acceptable backfill and fill materials shall consist of suitable soils for dam construction as determined by the County Engineer; free of rock or gravel larger than one inch in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Backfill and fill materials should be placed in layers not more than eight inches in loose depth for material compacted by heavy compaction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers. Each layer should be uniformly moistened or aerated before compaction to within three percent of optimum moisture content. Layers should not be placed on surfaces that are muddy, frozen, or contain frost or ice. All backfill and fill materials should be placed evenly to required elevations, and uniformly along the full length of the embankment. Additionally, soils should be compacted to at least 95% maximum dry unit weight according to ASTM D 698.

3.2.2. Dry Underground Detention Ponds

No underground detention pond shall be constructed on residential development projects. Underground detention ponds may be considered on non-residential development projects after the designer has shown that construction of an aboveground detention pond is infeasible to the satisfaction of the County Engineer. If allowed, all structures which are designed to store water shall be constructed of reinforced concrete or HDPE. Additionally, the structures should be designed such that vehicular traffic meeting an H-20 loading standard could traverse the area over the detention pond once backfilled or completed without resulting in structural failure of the pond. When designing the pond, the designer should design the structure such that routine maintenance can be accommodated without unreasonable demands being placed on future property owners.

3.2.3. Wet Detention Ponds

Wet detention ponds may be constructed if the facilities are designed to the criteria outlined in Section 4.25 of the GSMM (Volume 2). However, the designer will be required to submit a water balance simulation as part of the Hydrologic and Hydraulic Report Submittal.

3.2.4 Trash Racks

A trash rack is a device designed to catch trash and debris and prevent the clogging of outlet structures. Trash racks shall be installed at the intake to the outlet control structure of the stormwater management facility to ensure proper functioning of the facility outlets in accordance with the following:

- The trash rack shall have parallel bars, with no greater than six-inch spacing between the bars.

- The trash rack shall be constructed and installed to be rigid, durable and corrosion-resistant, and shall be designed to withstand a perpendicular live loading of 300 pounds per square foot.
- The trash rack should be removable (no specialty tools required) for maintenance and adequately secured to the outlet structure for safety.

An overflow grate is intended to protect the opening in the top of a stormwater management facility outlet structure. It is designed to prevent obstruction of the overflow structure. If an outlet structure has an overflow grate, such grate shall meet the following requirements:

- The overflow grate shall be secured to the outlet structure but removable for emergencies and maintenance.
- The overflow grate spacing shall be no less than two inches across the smallest dimension.
- The overflow grate shall be constructed and installed to be rigid, durable and corrosion-resistant, and shall be designed to withstand a perpendicular live loading of 300 pounds per square foot.

3.3. Water Quality Best Management Practices

Generally, Whitfield County, City of Dalton, City of Tunnel Hill and the City of Varnell will accept all BMPs listed within the GSMM (Volume II, Chapter 4) with the accepted removal efficiencies listed in Table 4.1.3-1 and runoff reduction rates listed in Table 4.1.3-2 of the GSMM.

3.3.1. Proprietary Structural Controls

The County Engineer may at their discretion allow proprietary structural controls. Prior to specification of such a device, the designer shall consult the County Engineer to determine if the control will be acceptable. Sufficient evidence through testing reports must be submitted to the County Engineer meeting the water quality requirements of removing at least 80% of the calculated average annual post-development TSS loading.

3.4 Drainage Pipe Easements

All drainage pipe easements are to be the diameter of the pipe plus the width required for trench and slopes to safely maintain or replace drainage structures at a future date. At minimum this easement must be 20- feet and under no circumstance may the easement be within the influence zone of a structural foundation. Additional building set-backs shall be added to the plan as necessary to ensure that structures are not constructed within the easements. This easement width is to account for the required trench and slopes to safely maintain or replace drainage structures at a future date.

4. APPROVED HYDROLOGIC & HYDRAULIC METHODS

4.1. Hydrologic Methods

4.1.1. Rational Method

The rational method may be used to develop peak runoff flows for culverts with contributing drainage areas less than 25 acres in size and for detention ponds with contributing drainage areas less than one acre in size. All computations shall be in accordance with Section 2.1.4 of the GSMM (Volume 2). Rainfall intensities shall be derived from National Oceanic and Atmospheric Administration (NOAA) Atlas14 publication, Volume 9, Version 2, Dalton Station.

As specified above, the rational method may be used to size detention facilities. If the rational method is utilized, the DeKalb Method or the Baumgardner / Morris Method (Terramodel) must be utilized to develop runoff hydrographs. Triangular rational method runoff hydrographs may not be utilized in the design of detention facilities.

4.1.2. SCS Method

In most cases, the Soil Conservation Service (SCS) method must be utilized to size detention ponds with contributing drainage areas greater than one acre and culverts with contributing drainage areas greater than 25 acres. All computations shall be in accordance with Section 3.1.5 of the GSMM (Volume 2). Rainfall depths shall be derived from National Oceanic and Atmospheric Administration (NOAA) Atlas14 publication, Volume 9, Version 2, Dalton Station. The following table also provides the rainfall depths for use in Whitfield County Engineer:

Design Storm	Rainfall Depth
1-Year 24-Hour	3.22"
2-Year 24-Hour	3.72"
5-Year 24-Hour	4.54"
10-Year 24-Hour	5.22"
25-Year 24-Hour	6.16"
50-Year 24-Hour	6.89"
100-Year 24-Hour	7.26"

4.2. Hydraulic Methods

All hydraulic calculations shall be made in accordance with Chapter 4 of the GSMM (Volume 2).

4.3. Channel Protection Design

Outlets to provide for meeting channel protection criteria shall be designed to meet the standards outlined in Section 2.2.4.2 and Section 3.3.5 of the GSMM (Volume 2).

5. SPECIAL DISTRICTS

The County Engineer may establish special design criteria for select areas based on the findings of watershed assessments, hydrologic and hydraulic reports, and known flooding issues. The designer is encouraged to consult with the County Engineer to determine if any special districts exist within Whitfield County.

5.1. Conasauga River Special District

The Conasauga River Special District incorporates all properties discharging directly into the Conasauga River. Those properties that fall within the special district shall not be required to meet the detention requirements outlined in Section 2.1 of the LDM. Additionally, extended detention of the 1-year 24-hour storm as outlined in Section 2.4 of the LDM will not be required. All other requirements outlined in this manual will remain applicable to the properties.

Those properties lying adjacent to properties in the special district as defined that are able to secure an agreement that is acceptable to the adjacent property owner and Whitfield County will also be considered to lie in the Conasauga River Special District. The agreement should stipulate that the adjacent property owner (i.e. downstream property owner) is aware that stormwater discharges onto their property will increase as a result of the lack of controls and that flooding may be increased on their property. The agreement should also include a release of liability for resultant damages from increased stormwater discharge rates from the upstream property owner and Whitfield County.

5.2. Coahulla Creek Special District

The Coahulla Creek Special District incorporates all properties discharging directly into Coahulla Creek and which lie downstream of the confluence of Coahulla Creek and Mill Creek. Those properties that fall within the special district shall not be required to meet the detention requirements outlined in Section 2.1 of the LDM. Additionally, extended detention of the 1-year 24-hour storm as outlined in Section 2.4 of the LDM will not be required. All other requirements outlined in this manual will remain applicable to the properties.

Those properties lying adjacent to properties in the special district as defined above and lying below the confluence of Coahulla Creek and Mill Creek that are able to secure an agreement that is acceptable to the adjacent property owner and the Whitfield County will also be considered to lie in the Coahulla Creek Special District. The agreement should stipulate that the adjacent property owner (i.e. downstream property owner) is aware that stormwater discharges onto their property will increase as a result of the lack of controls and that flooding may be increased on their property. The agreement should also include a release of liability for resultant damages from increased stormwater discharge rates from the upstream property owner and Whitfield County.

6. REQUIREMENTS FOR WAIVER REQUEST

The County Engineer does not intend to waive from the requirements outlined in this manual. However, the County Engineer recognizes that situations exist such that strict adherence to the requirements may result in degradation of upstream or downstream areas from a development project. As such, the County Engineer may from time to time allow a variance from the procedures and requirements outlined in this manual. The following documents the minimum criteria that will apply to all variance requests.

6.1. Waiver Narrative

A brief narrative should be provided with each waiver request describing the project, location and provide a location map such that the project location can be identified by County Engineer. Additionally, a narrative should be provided outlining the standards for which the applicant is seeking a waiver as well as a description of the impacts that will result from a granting of the waiver.

6.2. Existing Conditions Hydrologic Analysis

The existing conditions hydrologic analysis should provide the reader with a comprehensive evaluation of the site conditions prior to development of the project. The designer should provide the following information with this element of the waiver request:

6.2.1. Existing Conditions Narrative

A written description of the existing conditions found at the site should be provided. Additionally, the narrative should describe the methodologies, assumptions and other pertinent discussions of how the existing conditions were analyzed by the designer.

6.2.2. Existing Conditions Map

An existing conditions map should be provided with the report including but not limited to following:

- Topography (2-ft. or less contour interval) of existing site conditions.
- Perennial / intermittent streams, wetlands, lakes and other surface water features.
- Drainage basin delineations showing the location of each drainage sub-basin.
- Drainage basin delineations for each contributing drainage basin upstream of the project site on an appropriate map (USGS Quadrangle, etc.).
- Existing stormwater conveyances and structural control facilities.
- Direction of flow and discharge points from the site including sheet flow areas.
- Any area of significant depression storage.
- Federal, state and local buffers.

The map should provide a clear understanding of the various drainage patterns located throughout the site as well as drainage onto the site from upstream areas. Additionally, the map should provide a clear view of the natural features of the site that may impact development.

6.2.3. Existing Conditions Tables

A set of tables should be included in the report that will allow the reader to understand how various parameters utilized in modeling the existing conditions were developed. Additionally, tables should be included documenting the results of the modeling.

- A table listing the acreage, soil types and land cover characteristics for each sub-basin.
- A table listing the total acreage, composite curve number and time of concentration for each sub-basin.
- A table listing the peak runoff rates and total runoff volumes from each sub-basin.
- A table listing the peak runoff rates and total runoff volumes for each drainage area upstream of the project site.
- A table listing the peak runoff rates and maximum water surface elevations for all detention facilities studied as part of the existing conditions analysis.

6.2.4. Existing Conditions Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected.

6.3. Downstream Analysis

The downstream analysis should provide the reader with a comprehensive picture of the downstream areas and their capacity to accommodate stormwater runoff from the proposed development.

6.3.1. Maps

- Drainage basin delineations showing the point at which the contributing area of the project represents 10% of the total drainage basin area as defined in Section 3.1.9.2 of the GSMM.
- Identify culverts, channels and other structural stormwater controls that the stormwater runoff must pass through prior to the 10% point identified previously.

6.3.2. Narratives

Provide a narrative with associated calculations demonstrating the downstream analysis at various points showing existing conditions, future conditions without detention or other on-site stormwater controls, future conditions with appropriate detention or other on-site stormwater controls, and future conditions with controls that would be put in place if the waiver were granted.

6.3.3. Downstream Analysis Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected.

6.4. Post-Development Hydrologic Analysis

The proposed conditions hydrologic analysis should provide the reader with a comprehensive evaluation of the site conditions following development of the project. The designer should

provide the following information with this element of the report:

6.4.1. Proposed Conditions Narrative

A written description of the proposed conditions to be found at the site after construction assuming the waiver is granted should be provided. Additionally, the narrative should describe the methodologies, assumptions and other pertinent discussions of how the proposed conditions were analyzed by the designer.

6.4.2. Proposed Conditions Map

A proposed conditions map should be provided with the report including but not limited to following:

- Topography (2-ft or less contour interval) of proposed site conditions.
- Perennial/intermittent streams, wetlands, lakes and other surface water features.
- Drainage basin delineations showing the location of each drainage sub-basin.
- Proposed stormwater conveyances and structural control facilities.
- Direction of flow and discharge points from the site including sheet flow areas.
- Location and boundaries of proposed natural feature protection areas.

The map should provide a clear understanding of the various drainage patterns located throughout the site as well as drainage onto the site from upstream areas. Additionally, the map should provide a clear view of the natural features of the site that will be impacted by development as well as features that will not be impacted.

6.4.3. Proposed Conditions Tables

A set of tables should be included in the report that will allow the reader to understand how various parameters utilized in modeling the proposed conditions were developed. Additionally, tables should be included documenting the results of the modeling.

- A table listing the acreage, soil types and land cover characteristics for each sub-basin.
- A table listing the total acreage, composite curve number and time of concentration for each sub-basin.
- A table listing the peak runoff rates and total runoff volumes from each sub-basin.
- A table listing the peak runoff rates and total runoff volumes for each drainage area upstream of the project site.
- A table listing the peak runoff rates and maximum water surface elevations for all detention facilities studied as part of the proposed conditions analysis.

6.4.4. Proposed Conditions Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected.

7. STORMWATER CONCEPT REQUIREMENTS

The County Engineer recognizes that some sites will require a substantial investment in time and effort to develop a comprehensive stormwater management plan that will address the requirements contained within this manual. As such, some developments are required to conduct a concept conference with the County Engineer prior to submittal of the land disturbance application. A concept conference can be held either in the form in person or via phone. This requirement is aimed at reducing the amount of effort required to develop the final plan and permit the project. Concept conferences are required to be held for all developments that meet one or more of the following criteria:

- Any residential subdivision with greater than 50 lots, unless such development contains 2-acre or greater lots.
- Any non-residential development with a disturbed area of 10 acres or greater.
- Any non-residential development regardless of size which has an impervious surface coverage that covers 50% or more of the property excluding those lands contained within undisturbed buffers including but not limited to floodplains, stream buffers and undisturbed buffers between dissimilar zonings.
- Any non-residential development regardless of size which is defined as a hot spot land use.

Prior to holding the concept conference the designer should consider submitting any pertinent design documents such as conceptual plans, maps or calculations in order to illustrate the proposed development.

8. HYDROLOGIC & HYDRAULIC REPORT REQUIREMENTS

All development projects must submit a hydrologic and hydraulic report outlining the impacts of the site on the stormwater system. At a minimum, this report must include the following sections:

- Certification by Registered Professional
- Project Narrative
- Existing Conditions Hydrologic Analysis
- Post-Development Hydrologic Analysis
- Stormwater Management System Design
- Downstream Analysis
- Erosion & Sedimentation Control Plan
- Planting Plan (if applicable)
- Operations & Maintenance Plan

The following subsections outline the requirements for each of the elements outlined above.

8.1. Professional Certification

Each report should begin with the following statement and be signed and sealed by the professional who prepared the report and analysis:

“I, (Name of Professional), a Registered (Professional Engineer / Land Surveyor) in the State of Georgia, hereby certify that the grading and drainage plans for the project known as (Project Name), lying in Land Lot (XXX), of the (XX) District, Whitfield County, Georgia, have been prepared under my supervision, and, state that in my opinion, the construction of said project will not produce storm drainage conditions that will cause damage or adversely affect the surrounding properties for the storm events specified in Whitfield-Dalton Stormwater Local Design Manual. This (day) day of (Month), (Year).”

8.2. Project Narrative

A brief narrative should be provided with the report outlining the project goals, location and provide a location map such that the project location can be identified by County Engineer.

8.3. Existing Conditions Hydrologic Analysis

The existing conditions hydrologic analysis should provide the reader with a comprehensive evaluation of the site conditions prior to development of the project. The designer should provide the following information with this element of the report:

8.3.1. Existing Conditions Narrative

A written description of the existing conditions found at the site should be provided. Additionally, the narrative should describe the methodologies, assumptions and other pertinent discussions of how the existing conditions were analyzed by the designer.

8.3.2. Existing Conditions Map

An existing conditions map should be provided with the report including but not limited to following:

- Topography (2-ft. or less contour interval) of existing site conditions.
- Perennial / intermittent streams, wetlands, lakes and other surface water features.
- Drainage basin delineations showing the location of each drainage sub-basin.
- Drainage basin delineations for each contributing drainage basin upstream of the project site on an appropriate map (USGS Quadrangle, etc.).
- Existing stormwater conveyances and structural control facilities.
- Direction of flow and discharge points from the site including sheet flow areas.
- Any area of significant depression storage.
- Federal, state and local buffers.

The map should provide a clear understanding of the various drainage patterns located throughout the site as well as drainage onto the site from upstream areas. Additionally, the map should provide a clear view of the natural features of the site that may impact development.

8.3.3. Existing Conditions Tables

A set of tables should be included in the report that will allow the reader to understand how various parameters utilized in modeling the existing conditions were developed. Additionally, tables should be included documenting the results of the modeling.

- A table listing the acreage, soil types and land cover characteristics for each sub-basin.
- A table listing the total acreage, composite curve number and time of concentration for each sub-basin.
- A table listing the peak runoff rates and total runoff volumes from each sub-basin.
- A table listing the peak runoff rates and total runoff volumes for each drainage area upstream of the project site.
- A table listing the peak runoff rates and maximum water surface elevations for all detention facilities studied as part of the existing conditions analysis.

8.3.4. Existing Conditions Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected.

8.4. Post-Development Hydrologic Analysis

The proposed conditions hydrologic analysis should provide the reader with a comprehensive evaluation of the site conditions following development of the project. The designer should provide the following information with this element of the report:

8.4.1. Proposed Conditions Narrative

A written description of the proposed conditions to be found at the site after construction should be provided. Additionally, the narrative should describe the methodologies, assumptions and

other pertinent discussions of how the proposed conditions were analyzed by the designer.

8.4.2. Proposed Conditions Map

A proposed conditions map should be provided with the report including but not limited to following:

- Topography (2-ft or less contour interval) of proposed site conditions.
- Perennial/intermittent streams, wetlands, lakes and other surface water features.
- Drainage basin delineations showing the location of each drainage sub-basin.
- Proposed stormwater conveyances and structural control facilities.
- Direction of flow and discharge points from the site including sheet flow areas.
- Location and boundaries of proposed natural feature protection areas.

The map should provide a clear understanding of the various drainage patterns located throughout the site as well as drainage onto the site from upstream areas. Additionally, the map should provide a clear view of the natural features of the site that will be impacted development as well as features that will not be impacted.

8.4.3. Proposed Conditions Tables

A set of tables should be included in the report that will allow the reader to understand how various parameters utilized in modeling the proposed conditions were developed. Additionally, tables should be included documenting the results of the modeling.

- A table listing the acreage, soil types and land cover characteristics for each sub-basin.
- A table listing the total acreage, composite curve number and time of concentration for each sub-basin.
- A table listing the peak runoff rates and total runoff volumes from each sub-basin.
- A table listing the peak runoff rates and total runoff volumes for each drainage area upstream of the project site.
- A table listing the peak runoff rates and maximum water surface elevations for all detention facilities studied as part of the proposed conditions analysis.

8.4.4. Proposed Conditions Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected.

8.5. Stormwater Management System Design

The stormwater management system design should provide the reader with a comprehensive description of the proposed stormwater management system components on site. The designer should provide the following information with this element of the report:

8.5.1. Stormwater Management System Map

The stormwater management system map should document the various structural components of how stormwater runoff will be moved around the site.

- Location of all non-structural stormwater controls
- Location of all existing stormwater controls to remain after development
- Location of all proposed stormwater controls
- Location of all proposed impoundment type controls (i.e. detention ponds, stormwater ponds, stormwater wetlands, etc.)
- Location of all conveyance structures
- All impoundment type controls should be labeled with the following information:
 - Maximum water surface elevation
 - Depth and storage volumes for the design storm
 - Depth and storage volumes maximum water surface if the design storm event is exceeded (i.e. top of dam)
- All inlets to conveyance structures should be labeled with the following information:
 - Maximum design water surface
 - Maximum potential water surface
- All pipes should be labeled with:
 - Length
 - Material
 - Slope
- All pipes should be profiled and labeled with:
 - Length
 - Material
 - Slope
 - Hydraulic grade line
- Map showing all contributing drainage areas/sub-basin delineations

8.5.2. Narratives

- Narrative describing that appropriate and effective structural stormwater controls have been selected.
- Design calculations and elevations for all existing and proposed stormwater conveyance elements including stormwater drains, pipes culverts catch basins, channels, swales and areas of overland flow.
- Design calculations and elevations for all structural water quality BMPs to be utilized for water quality improvement.
- Design calculations showing that the design meets the requirements of the water quality improvements as outlined in the ordinance and local design manual. The County Engineer encourages the designer to utilize the site design tool provided by the North Georgia Water Planning District to meet this requirement. The tool can be acquired from the following website: <http://www.northgeorgiawater.com/>.

8.6. Downstream Analysis

The downstream analysis should provide the reader with a comprehensive picture of the downstream areas and their capacity to accommodate stormwater runoff from the proposed development.

8.6.1. Maps

- Drainage basin delineations showing the point at which the contributing area of the project represents 10% of the total drainage basin area as defined in Section 3.1.9.2 of the GSMM.
- Identify culverts, channels and other structural stormwater controls that the stormwater runoff must pass through prior to the 10% point identified previously.

8.6.2. Narratives

Provide a narrative with associated calculations demonstrating the downstream analysis at various points showing existing conditions, future conditions without detention or other on-site stormwater controls and future conditions with detention or other on-site stormwater controls.

8.7. Erosion & Sedimentation Control Plan

The erosion and sedimentation control plan should be included in the report demonstrating the plan to effectively mitigate stormwater impacts during construction. The following elements should be included in this section of the report.

- All elements specified in the Georgia Erosion and Sediment Control Act and local ordinances and regulations.
- Sequence/phasing of construction and temporary stabilization measures.
- Temporary structures that will be converted into permanent stormwater controls.

8.8. Planting Plan

If the design of the stormwater management system includes best management practices that utilize vegetation as part of the treatment process, please include a copy of the planting plan outlining the types, numbers, and locations of the various plantings required by the design.

8.9. Operations & Maintenance Plan

A narrative of what maintenance tasks will be required for the stormwater controls specified for the site as well as the responsible parties. Additionally, the report will need to identify access and safety issues for the site. The designer is directed to specific maintenance requirements for best management practices outlined in Section 4 of the GSMM (Vol. 2), Appendix E: Operations and Maintenance Guidance Document (Vol. 2) and Volume 3 of the GSMM.