

ARTICLE V: STORMWATER MANAGEMENT AND DRAINAGE SYSTEMS

Section 501: Purpose

An adequate drainage system including necessary ditches, pipes, culverts, drains, inlets, bridges, detention ponds, etc. shall be provided for the proper drainage of all surface water. All persons, businesses or developers proposing development or construction in the City of Cornelia shall prepare a Stormwater Management Plan for review and approval. The plan shall detail how post-development stormwater runoff will be controlled and managed and how the proposed project will meet the requirements as set forth herein. No final subdivision plat shall be approved and no building permit shall be issued until and unless the Stormwater Management Plan, including engineering plans and specifications and hydrology report, have been reviewed and approved by the Municipal Planning Board and the necessary stormwater system infrastructure has been installed.

The following shall be exempted from these requirements:

1. Additions or modifications to existing detached single-family dwellings.
2. Construction of a detached single family dwelling which is not part of a larger development.

The Georgia Department of Transportation *Standard Specifications for Construction of Roads and Bridges and Details* shall be used for all construction of all stormwater management structures and appurtenances.

Soil erosion and sediment control practices and BMP's shall comply with the City of Cornelia ordinances, the Georgia Department of Natural Resources Environmental Protection Division regulations, The Georgia Erosion and Sedimentation Act of 1975 as amended, and the latest edition of the *Manual for Erosion and Sediment Control of Georgia* as published by the Georgia Soil and Water Conservation Commission.

Section 502: Hydrology Study

Each new development will be required to perform a hydrology study. The study shall include a discussion of existing downstream conditions and impacts of the proposed development to downstream properties, measures taken to address increased post-construction runoff, concentrated discharges, etc. Stormwater detention facilities that will provide storage and controlled release of runoff shall be required for any development activity that will increase the peak rate of discharge. Hydrologic and hydraulic calculations are required for pre- and post-construction conditions and the calculation and corresponding hydrology study shall be prepared and sealed by a professional engineer registered in the State of Georgia. The hydrology study shall include, at a minimum, the following information:

1. A narrative site description

2. A summary showing pre- and post-developed conditions and allowable release rate, including any bypass or offsite sub-basins, for 2-, 5-, 10-, 25-, 50- and 100-year storm events. Output is required for each design storm.
3. A detailed explanation of the methodology used for hydrologic and hydraulic calculations. The minimum time of concentration shall be 5 minutes.
4. Exhibits shall be included that show the following:
 - A. Topographic drainage area maps for pre- and post-development conditions.
 - B. Sub-basin delineations with acreage, soil types and cover.
 - C. Vicinity Map
 - D. Maps showing the existing and proposed stormwater management facilities on a topographic map with existing and proposed contours showing at 20-foot intervals.
 - E. All perennial and intermittent streams and other surface water features.
 - F. Directions of flow.

Section 503: Drainage Design Criteria

This section provides minimum and maximum values, and methodologies accepted by the City of Cornelia in the preparation of plans for stormwater management and drainage systems. The latest edition of the *Manual for Erosion and Sediment Control of Georgia* shall be consulted for the proper design procedures in meeting the standards of this section.

1. Sizing and location of all existing and proposed storm sewers shall be the responsibility of a professional engineer registered in the State of Georgia. They shall be shown on a topographic map with two foot contour intervals. Existing and proposed contours shall be shown. Profiles of the storm sewers shall be shown on plan and profile sheets labeled with structure numbers, pipe length and materials, invert elevations, and hydraulic grade line (HGL).
2. Storm drainage pipes shall be sloped so as to maintain a minimum velocity of 3 feet/second (fps) during the 2-year storm event so that sediment will not collect. The slopes shall be designed and the storm sewers constructed such that there is no standing water in any pipe or drainage structure that would promote mosquitos breeding.
3. The Rational Method can be used to estimate stormwater runoff peak flows for the design of gutter flows, drainage inlets, storm drain pipes, culverts and small ditches draining small, highly impervious areas less than or equal to 25 acres. The Rational Method cannot be used for storage design or any other application where a more detailed routing procedure is required because The Rational Method can significantly underpredict detention volumes; however, The Modified Rational Method can be used for detention design for drainage areas up to 5 acres. The Rational Method should not be used for calculating peak flows downstream of bridges, culverts or storm sewers that may act as restrictions and impact the peak rate of discharge. The SCS Method or USGS Regression Method may be used for estimating stormwater peak runoff rates and the generation of hydrographs for routing of stormwater flows in areas draining

more than 25 acres. The Simplified SCS Method can be used for drainage areas up to 2,000 acres.

4. The 25-year storm event shall be used in sizing storm drains that serve public streets and rights-of-way. Storm sewers and culverts conveying water under public streets shall be sized to carry runoff from the 100-year storm event without overtopping the road. All other storm-sewer systems shall be sized for the 50-year storm event.
5. Storm sewers and cross drain pipes shall not be less than 18 inches in diameter. No storm drain can be designed or installed under proposed acceleration/deceleration lanes. The Administrative Officer or his designee, upon recommendation by the City Engineer, may modify or waive these requirement if unusual circumstances exist such as topography.
6. Storm drainage shall be collected in storm sewers at or near the perimeter of the property on the upstream end and piped to an existing storm drainage system. This extension requirement can be waived for collection of storm water upstream of roadways where topographic conditions warrant placing the inlet at the toe of the roadway fill.
7. Maximum continuous length of pipe shall be 300 feet for pipes less than 42 inches in diameter.
8. All storm drainage pipes shall extend to the detention facility.
9. Drainage Easements shall be at least 20 ft wide along all storm drain systems and around all detention ponds.
10. Exit velocities from storm-drain pipes shall not exceed 10 fps during the 25-year storm event without the design of additional energy dissipaters (not including required rip-rap). Energy dissipation devices, such as splash pads, stilling basins, etc., shall be designed in accordance with sound engineering practices. Rip-rap shall be designed in accordance with the *Manual for Erosion and Sediment Control in Georgia*.
11. It is the developer's and/or the contractor's responsibility to ensure that all structures built on individual lots or sites have positive drainage and are built at an elevation to adequately avoid being flooded by the 100-year storm and that runoff from their project does not adversely affect downstream or upstream property. The City is not responsible for damages resulting from improper design or inadequate runoff control.
12. Maximum velocity of runoff in swales lined with vegetation shall be 5.0 feet/second during the 25-year storm event. Swales with runoff velocities in excess of 5.0 fps shall be lined with stone, concrete, or approved synthetic matting.

Section 504: Storm Sewers

1. Georgia DOT Standard 1030D shall be used in determining class concrete or gauge of pipe under fill, method of backfilling and pipe installation.
2. Only reinforced concrete pipe shall be used within street rights-of-way for arterial roads, and major and minor collectors. Concrete pipe shall not be used on grades

exceeding 10%.

3. Metal pipe may be used within the rights-of-way of local streets and for driveway culverts. Metal pipe shall either be corrugated steel (AASHTO M-36) with aluminized Type II or bituminous coating, or corrugated aluminum alloy pipe (AASHTO M-196).
4. Corrugated high density polyethylene (HDPE) pipe, smooth lined type “S”, may only be used for residential driveway applications and must be manufactured and installed in strict compliance with Georgia DOT Standard 1030-P HDPE. HDPE pipes shall not exceed 36 inches in diameter.
5. Where a wet weather drainage ditch exists between the proposed road and 20 feet into the lot, the design professional shall size the driveway culvert as if the driveway was at the lowest point on that lot. The construction plans shall show the minimum driveway pipe size required. Driveway culverts may be reinforced concrete, metal or HDPE as specified herein. The inlet and outlet end of all driveway culverts shall have either flared end sections or concrete headwalls that meet the standards of Georgia Department of Transportation 1120 or 1125.
6. Pipe installation shall conform to GDOT *Standard Specifications for Construction of Roads and Bridges*. Before any traffic over a storm drain is allowed, the developer shall provide an adequate depth and width of compacted backfill to protect the structure from damage or displacement. Any debris or silt that constricts the flow through a pipe shall be removed by the developer as often as necessary to maintain drainage. All pipe structures shall be cleaned before the work is conditionally approved. Any damage or displacement that may occur due to traffic or erosion shall be repaired or corrected at the developer's expense.
7. Minimum Clearances Are:
 - a. Eighteen (18) inches between the bottom of the base or sub-base, if used, and the exterior crown of the culvert. In all cases, at least 24 inches of cover shall be provided.
 - b. A minimum of one (1) foot clearance between existing and proposed underground utilities and exterior crown of culverts.
8. Trench construction for storm drainage pipe shall be in accordance with GDOT Standard 1030D and current manufacturer's specifications. A typical detail shall be provided on the construction drawings.
9. The storm sewer bedding shall be designed according to the latest manufacturer's specifications and GDOT Standards and a typical detail shall be provided on the construction drawings.
10. All pipe joint connections and connections to manholes shall be made according to the latest manufacturer's specifications and GDOT Standards. At a minimum, all connections to manholes shall be grouted with cement.
11. Storm Sewer Trench Backfill Compaction Testing — Frequency of testing shall be

determined by project conditions. The minimum test requirements are once per road cut or once per one hundred fifty (150) feet if the trench line lies within the roadway as is in the case of a storm sewer running parallel to and under the pavement or at the discretion of the Administrative Officer or his authorized representative. Any areas failing the compaction tests shall be reworked as necessary to achieve compaction.

Section 505: Drainage Structures

The design professional shall check the hydraulic capacity of each drainage structure designed as an inlet point in the drainage system. The actual storm water flows shall be compared with the structures flow capacity to ensure the capacity is not exceeded. Calculations shall be included in the hydrology study.

1. Catch basins shall be designed by the design professional to GDOT Standards 1033D and/or 1034D. Alternate catch basins complying with the standards of the Georgia DOT are subject to approval by the City.
2. Catch basins shall be located outside of intersection radii unless unusual circumstances cause undue hardship, in which case the City may waive this requirement.
3. Inlet Spacing shall be limited to a maximum distance as follows:
 - 500' on grades up to 7%
 - 400' on grades from 7% to 10%
 - 250' on grades over 10%
4. Maximum gutter spread shall be one half of the travel lane, as measured from the face of curb, for the 25-year storm event. The inlets shall be spaced in order to intercept a minimum of 85% of the flow during the 25-year storm event without exceeding the above gutter spread.
5. The inlet and outlet end of all storm drain pipes including driveway pipe shall have either flared-end sections or concrete headwalls, which meet GDOT Standards 1120 or 1125.
6. Drop inlets shall be designed to GDOT Standards 1019A. Weir drop inlets shall be provided in landscape areas. Grated drop inlets shall be provided in paved areas.
7. Junction boxes or manholes having access to the pipe shall be constructed to meet the requirements of GDOT Standard 9031U or 1011A. Manholes shall be provided with eccentric cone sections.
8. Detention pond riser structures shall be designed to GDOT standards. These structures shall be checked for flotation.
9. Cul-de-sacs on downhill street grades shall require catch basins throat design and cul-de-sac grading detail.
10. Provide a minimum 0.2 feet drop between inverts across structures.

Section 506: Open Channels

1. All open channels shall be profiled at the same scale as the storm drain conduits. The stormwater management plan shall include a typical section of the channel, provided for each reach if the cross-section changes. A maximum slope of 3% along the centerline of the channel is permitted. Exit velocities from storm drain pipe for the 100-year storm shall not exceed 3 fps for vegetative channel lining, or 5 fps when rocks or cobbles are used for channel lining. No other materials may be used for channel lining.

Section 507: Storm Detention Facilities

All development plans, except those that are exempt, will require a hydrology study certified by a professional engineer registered in the State of Georgia qualified to do work in the field of hydrology. Permanent detention facilities are required for every development project that has a one (1) cfs increase in post-development discharge for the 25-year storm.

1. Detention ponds shall be designed for the 2, 5, 10, 25, 50, and 100-year storm events. The SCS Method is the only acceptable method that can be used for developing hydrographs to be used for detention pond routing.
2. An emergency overflow device for a detention pond shall be designed to pass the 100-year peak developed inflow without overtopping the dam in the event the primary outlet control structure becomes obstructed. There shall be at least 2 ft of free board between the 100-year elevation in the emergency spillway and the top of the berm.
3. Pond discharge locations shall be in defined drainage ditches or piped systems. The developer's engineer shall include in the hydrology study a discussion of existing conditions downstream of the detention pond and an explanation of how downstream property owners will not be adversely affected by the "concentrated" runoff. If there is an existing storm drainage system within 150 feet of the discharge point of the outlet pipe for the pond, then the developer shall extend the outlet pipe and tie-in to the existing system.
4. The steepest fill slopes shall be 3:1, and cut slopes shall be no steeper than 3:1. Vegetated embankments shall be less than 20 feet in height. Riprap-protected embankments shall be no steeper than 2.5:1. Geotechnical slope stability analysis is recommended for embankments greater than 10 feet in height and is mandatory for embankment slopes steeper than those given above. All embankments must be designed to State of Georgia Rules for Dam Safety (Chapter 391-3-8) and are subject to the provisions of the Georgia EPD Safe Sam Program. The maximum depth shall not exceed 10 ft. Outlet pipes shall be RCP installed with a concrete cradle.
5. A 10 feet wide access road that runs on top of the dam shall be required around the circumference of the pond except where topography prohibits this and the exception is approved by the Administrative Officer.

6. A high-quality fence made of durable materials including wood, iron or other metal shall be required around all detention facilities. Metal fences prone to rust or deterioration, such as chain link fence, are acceptable if coated with black Teflon or similar material to protect it from deterioration. The fence must also comply with the following standards:
 - A. The fence shall be at least 6 feet high.
 - B. Fence posts shall be set in concrete 10 feet on center.
 - C. There shall be a minimum 12 feet wide gate located for access.
 - D. The fence shall not be installed across the slope of the dam or berm. But installed completely around the pond and containing the dike and access road entrance.
7. The Owner of the property on which the detention facility is located shall be responsible for properly operating, maintaining and cleaning-out all storm water detention facilities.

Section 508: Erosion and Sediment Control Plans

Plans for all sites must include the following information to meet Federal, State and local requirements:

1. Graphic scale and North arrow
2. Vicinity map — Small map showing site relative to surrounding area, including designation of specific phase, if necessary.
3. Existing and planned contours shall be shown with contour lines drawn at two-foot intervals.
4. Adjacent areas — Neighboring areas, such as streams, lakes residential areas, etc., which might be affected, should be shown on plans.
5. Location of erosion and sediment practices, using uniform coding symbols from the *Manual for Erosion and Sediment Control* in Georgia, Chapter 5, with legend.
6. Delineate all State waters located on or within 200 feet of the project site.
7. Delineate contributing drainage areas, both on and off-site.
8. Delineate undisturbed stream buffers along perennial streams, lakes and water supply reservoirs and any variances that have been obtained. The minimum undisturbed buffer shall be 25-feet; however greater undisturbed buffers may be required in the City's Zoning Ordinance.
9. Include soil series and their delineation.
10. Narrative, or notes and other information should also be included and located on the site plan under general notes or under erosion and sediment control notes. Specific

notes must include the following:

- Description of existing land use at project site and description of proposed project. Include land lot and district of the site location.
 - Name, address and phone number of developer/owner
 - Name and phone number of 24-hour local contact who is responsible for erosion and sediment controls
 - Signature/seal of qualified plan preparer
 - Size of project or phase under construction, in acres
11. Activity schedule — Show anticipated starting and completion dates for project events, including vegetation and mulching. Include the statement, in bold letters that: "The escape of sediment from the site shall be prevented by the installation of erosion control measures and practices prior to, or concurrent with, land-disturbing activities."
 12. Include specific design information and calculations for all structural measures on site, such as temporary sediment basins, retrofitted detention ponds and swales.
 13. Show storm drain pipe and weir velocities and demonstrate how receiving area will accommodate discharges without erosion.
 14. Vegetative plan — For all temporary and permanent vegetative practices. Include species, planting and seeding dates, fertilizer, lime and mulching rates. Vegetative plan shall be site specific for the appropriate time of year that seeding will take place and for the appropriate geographic region of Georgia.
 15. Detailed drawings — For all structural practices, specifications must, at a minimum, meet guidelines set forth in the *Manual for Erosion and Sediment Control in Georgia*.
 16. Maintenance statement — include on the plans the statement: "Erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source."
 17. If an existing or new detention pond is to be used for sediment control or stormwater detention during construction, the developer is required to dredge clean and grass the pond upon completion of the construction project.

Section 509: Subdrainage

Subdrainage will be installed to control the surplus ground water by intercepting sidehill seepage or by lowering or regulating the ground water level where such conditions exist.

Section 510: Bridges

Bridges shall be designed for a 100-year storm event and in accordance with the GDOT *Standard Specifications for Construction of Roads and Bridges*.

Section 511: Lake(s)

If it is proposed to make a new or existing lake a part of a subdivision, the developer shall be required to submit a breach analysis for affected property within the boundaries of the development and show the dam breach zone on the plans. The developer should coordinate with Georgia EPD Safe Dams Program to determine the required design criteria and regulatory requirements.

Section 512: Field Changes

Minor changes in construction plans caused by field conditions shall be made at the direction of the Administrative Officer with costs of such changes paid for by the developer. All changes are to be documented as revisions to the approved development plans and correctly shown on the as-built plans. Discrepancies between as-built survey and approved development plans may result in delays in approving final plats.

Section 513: As-Builts

Subdivision As-builts shall include the full set of construction plans with the infrastructure shown as it was actually constructed. The plans shall show the storm sewer system in plan and profile, drainage structure invert elevations, pipe grades, lengths, size of pipes, detention pond outlet works, etc. The detention pond grading plan shall be shown with a certification that the pond configuration and outlet works were built according to the approved design. The as-builts shall be submitted before approval of the final plat. A reproducible copy of the final plan and two (2) sets of as-builts shall be submitted. A digital copy of the as-built plans shall also be submitted in a format and coordinate system compatible with City of Cornelia's Geographic Information System.

END OF ARTICLE V