SECTION 12
STORMWATER TECHNICAL REQUIREMENTS

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12.1 REQUIRED FEATURES

A stormwater management system shall be designed and installed for all developments within the jurisdiction of the City of Groveland that will contain features to provide for:

12.1.1 <u>Pollution Abatement</u>

Pollution abatement will be accomplished by retention, or detention with filtration in accordance with St. Johns River Water Management District (SJRWMD) criteria.

12.1.2 <u>Protection from Flooding</u>

Protection from flooding will be accomplished by a design which will provide that:

a. The post-development peak rate of discharge permitted from the site will not exceed the predevelopment peak rate of discharge from the site during a 25-year frequency/24-hour duration storm event.
b. All residential structures are to be flood free and all commercial and industrial structures are to be either flood free or flood-proofed.

12.1.3 <u>No Positive Outfall</u>

When a positive outfall is not available, the site shall be designed to retain 100-year frequency/24-hour duration storm on-site

12.2 DISPOSITION OF RUNOFF

12.2.1 All development will be required to pretreat the required volume of runoff for pollution abatement purposes. Pretreatment of this volume of runoff is defined as retention (no surface discharge) or detention with filtration (surface discharge) prior to release.

12.2.2 Off-site easements for stormwater management facilities will be required when either of the following conditions exists:

12.2.2.1 The discharge is into any man-made facility for which the City does not have either a drainage easement or right-of-way; or

12.2.2.2 The discharge is into a natural system such that the rate or character (i.e., sheetflow vs. concentrated flow) of the flow at the property line has been changed. The easement will be required to a point at which natural conditions are duplicated.

12.3 DEVELOPMENT WITHIN AREAS OF SPECIAL FLOOD HAZARD

12.3.1 All developments within areas of special flood hazard as delineated on the Federal Emergency Management Agency (FEMA) flood insurance rate maps (FIRM) or as determined by the representative of the Public Works Director shall comply with the following requirements:

12.3.1.1 Establish, to the satisfaction of the Public Works Director, the elevation of the base flood (100-year flood). The elevation as approved by the Public Works Director shall be clearly identified on the subdivision lot grading plans. Supporting calculations to determine the Normal High Water Elevation (NHWE) and 100-year flood elevation must be submitted for review and approval by the Public Works Director.

12.3.1.2 Set the minimum finished floor elevation at least one (1) foot above the elevation of the base flood.

12.3.1.3 For commercial or industrial developments, flood proofing may be substituted in lieu of elevating the finished floor.

12.3.1.4 Provide compensating storage for all flood water displaced by development below the elevation of the one-hundred-year flood.

12.4. DRAINAGE DESIGN REQUIREMENTS

12.4.1 Drainage Map

The Engineer of Record shall include in the subdivision construction plans a master drainage map showing all existing and proposed features. The map is to be prepared on a twenty-four (24) inch by thirty-six (36) inch sheet on a scale not to exceed one (1) inch equals two hundred (200) feet. Listed below are the features that are to be included on the drainage map.

12.4.1.1 Drainage bounds, including all offsite areas draining to the proposed subdivision.

12.4.1.2 Sufficient topographical information with elevations to verify the location of all ridges, streams, etc. (one-foot contour intervals).

12.4.1.3 Notes indicating sources of high water data.

12.4.1.4 Drainage features, including location of inlets, swales, ponding areas, and flow arrows.

12.4.1.5 Delineation of drainage sub-areas.

12.4.1.6 Identification of retention/detention areas and ingress/egress areas thereto.

12.4.1.7 General type of soils (obtain from soil survey of Lake County.

12.4.1.8 Flood hazard classification.

12.4.1.9 Description of current ground cover and/or land use.

12.4.1.10 NHWE designation for all surface water bodies.

12.4.1.11 All storm sewer pipes and sizes.

12.4.2 Subsoil Investigation

A subsoil report shall be prepared by a geotechnical engineer. A minimum of two (2) borings will be taken per retention/detention area.

12.4.3 Stormwater Calculations

Stormwater calculations for retention/detention areas, including design high water elevations for the 25-year frequency, 24-hour duration and 100-year frequency/24-hour duration storm events, shall include the following:

12.4.3.1 Storm sewer tabulation including, but not limited to, the following:

a. Location and types of structures.
b. Types and lengths of line.
c. Drainage and sub-area tributary to each structure.
d. Runoff coefficient per sub-area.
e. Time of concentration to structure.
f. Hydraulic gradient for the 10-year storm.
g. Estimated receiving water (tailwater) elevation with sources of information, if available.
h. Diameters of pipe.
i. Outlet and other pipe velocities.

12.4.3.2 Drainage plans including, but not limited to, the following:

a. Cross-section of retention/detention facilities.
b. Typical swale, ditch or canal sections.
c. Drainage right-of-ways.
d. Typical fencing detail.
e. A note on the design plans that an erosion control plan will be approved by the Public Works Director prior to the pre-construction conference.

12.4.3.3 Routing Calculations

Include the following:

a. Identify the location of all storage areas and hydraulic structures on the basin map.

b. A schematic drawing (i.e., nodal diagram) showing the interconnection of the hydrologic/hydraulic network.

c. Stage vs. storage/area/time calculations with references and methodology.

i. Hydrologic parameters required to calculate the hydrograph such as drainage area, time of concentration, run-off coefficient and runoff curve number.

ii. Peak stage, peak outflow, and peak velocity results for the simulated design storm event, including all computer printouts of input and output.

iii. Additional information that the Public Works Director deems necessary.

12.5 GENERAL DESIGN CRITERIA

12.5.1 <u>Methods of Computing Runoff Volume and Peak Rate of Discharge</u>

The design method used to establish runoff volume and peak rate of discharge shall be by current techniques. In order to provide for reasonable measures of consistency, the following methods of computation are encouraged to be used:

12.5.1.1 Basins or sub-basins (for pipe network analysis). The rational formula may be used to determine peak discharges by the formula Q= CIA, where:

Q = Peak Discharge in cubic feet per second (CFS)
I = Intensity of rainfall derived from FDOT rainfall charts and the time of concentration for the basin.
A = Area contributing in acres.
C = Runoff coefficient.

12.5.1.2 Basins or sub-basins (for pond routing). Hydrograph(s) should be developed by the United States Department of Agriculture (U.S.D.A.) Soil Conservation Service's Unit-Hydrograph method or by the modified Santa Barbara Urban Hydrograph method. The current Soil Survey of Lake County, Florida published by the United States Department of Agriculture Soil Conservation Service or site-specific data submitted by a geotechnical engineer shall be referred to for the proper use of soils classification when calculating runoff curve numbers.

12.6 DESIGN STORM

12.6.1 The following minimum design storms shall apply:

Facility	Design Storm
Cross drains, storm sewers	10-year
Roadside swales for drainage internal to the development	10-year
Detention basins	25-year
Retention basins (no positive outfall)	100-year

12.7 STORM DURATION AND RAINFALL INTENSITY

12.7.1 The following guidelines are for use in the design of the stormwater management system. For the rational method, time of concentration (TC) will dictate the rainfall intensity. Rainfall intensities for the rational method are to be obtained from the Florida Department of Transportation Rainfall Curves. TC values are to be obtained from the Federal Highway Administration Kinematic Wave Formula for sheet or overland flows, and from the Manning Equation for concentrated flows (i.e., gutter flow, ditch flow, pipe flow, etc.)

12.7.2 Rainfall distributions for the above are to be in accordance with the St. Johns River Water Management District.

12.8 RETENTION, DETENTION FACILITIES

12.8.1 Pollution Abatement Volume Recovery Rate

The pollution abatement volume recovery rate shall be as required by the St. Johns River Water Management District.

12.8.2 Design Criteria for Detention Facilities to Reduce Peak Rate of Discharge for 25-year Frequency/24-hour Duration Storm

The detention pond will be sized to limit the peak rate of discharge from the developed site to that discharge generated prior to development. Supporting calculations shall be submitted and will contain, as a minimum, runoff hydrographs for the pre-developed site and the post-developed site, and a discharge hydrograph after routing through the proposed detention facility. All routing calculations to be submitted must consider the tailwater of the receiving facility. If the receiving facility is an existing storm sewer, the Hydraulic Gradient Line (HGL) elevation of this receiving facility can be assumed at one-half (1/2) foot below its crown of pipe elevation unless a detailed study of the existing system indicates otherwise.

12.8.2.1 Credit for seepage to further reduce the peak rate of discharge will not be allowed.

12.8.2.2 A minimum of fifty (50) percent of the total volume of water required to attenuate the peak discharge of the facility in excess of the pollution abatement volume must be evacuated within 24-hours. The remaining fifty (50) percent must be evacuated within an additional seventy-two (72) hours.

12.8.2.3 The outflow structure shall be designed to skim floating debris, oil, and grease from an elevation six (6) inches below elevation of inflow into the structure to an elevation of six (6) inches above the design high water level of the pond and shall cover all directions of inflow to the outfall structure. The design of this control system shall make adequate provision to minimize erosion.

12.8.3 Design Criteria Where a Positive Outfall is Not Available

When a positive outfall is not available or discharge into a lake without a positive outfall is proposed, the pond design shall retain the one-hundred (100) year frequency/twenty-four (24) hour duration storm event. The pond shall be designed without using infiltration during the storm event. The pond shall be designed to completely evacuate a one-hundred (100) year frequency/twenty-four (24)-hour duration storm by natural seepage or positive bleed down within fourteen (14) days. Final design seepage rates will be determined by a geotechnical engineer. All necessary calculations to support the above shall be submitted to the Public Works Director.

12.8.4 Design criteria for offsite drainage

Offsite areas which drain to or across a site proposed for development must be accommodated in the stormwater management plans for the development. The stormwater management system for the development must be capable of conveying existing offsite flows through or around the development. The estimation of the offsite flows must be done separately from the estimation of onsite post development flows (i.e., separate offsite and onsite hydrographs must be computed due to the typically significant differences in land use characteristics).

12.9 OPEN DRAINAGE FACILITIES

12.9.1 Right-of-Way and Easement

12.9.1.1 Outfall ditches and canals shall have sufficient right of way for each facility plus an unobstructed maintenance berm on one (1) or both sides.

12.9.1.2 Ponds shall have sufficient area to allow for installation plus an unobstructed maintenance berm around the perimeter of the pond.

12.9.2 Maintenance Berms

The minimum requirement for maintenance berms is as follows:

Ditch or Canal Top Width	Minimum Maintenance Berm Required
Less than 16 feet	20 feet on one side
Greater than 16 feet	20 feet both sides

Ponds

With fencing	20 feet around pond perimeter
Without fencing	5 feet around pond perimeter

12.9.3 Grading

Areas adjacent to open drainage ways and ponds shall be graded to preclude the entrance of stormwater except to planned locations. Parcels or lots adjacent to canals shall not be pitched so that runoff from the site enters the canal directly.

12.9.4 Side Slopes

The maximum side slopes for open drainage facilities shall be as follows:

Open Drainageways	Maximum Side Slopes (Horizontal/Vertical Ratio)
Less than or equal to four (4) feet deep	3:1
Over four (4) feet deep	2:1
Ponds	
With fencing six (6) feet high	Greater than 4:1
Without fencing	4:1

Bottom Width

The minimum bottom width for ponds and open drainage ways shall be four (4) feet.

12.9.5 Tailwater

All stormwater ponds shall be designed taking into consideration the tailwater of the receiving facility. In the case where the detention pond discharges to a canal or other water body, the following sources of information may be utilized to determine and acceptable tailwater for routing flows from the pond:

12.9.5.1 Studies and reports approved by the City with stage-time-discharge data for canal or waterways to be utilized.

12.9.5.2 Where detailed stage-time-discharge information is not available, the Public Works Director may allow the following:

a. The use of FEMA floodplain information.
b. A normal depth based on the cross-sectional data of the receiving body.
c. An average of the elevation of the existing water level and the elevation of the high water mark on the canal or receiving water body.
d. Two (2) feet above the established conservation line.
e. A detailed drainage study.

12.9.6 Erosion Protection

Open drainage facilities shall be protected from erosion as follows:

Side slopes and berms	Sod
Bottom	Grass and mulch

12.9.7 Fencing

Open drainage facilities shall be fenced as follows:

Ponds, if required, six foot black vinyl chain link along right of way around perimeter, including maintenance berms.

Canals: Six-foot black vinyl chain link along canal easements or right of way where lots abut canals.

12.9.8 Berms Constructed of Fill

Where berms are proposed, the design shall be certified by the geotechnical engineer. The geotechnical engineer shall also certify that construction has been completed as designed.

12.10 HYDRAULIC DESIGN CRITERIA

12.10.1 Design Storm Frequency

The design storm frequency to be utilized for the design of pavement drainage shall set the hydraulic gradient line at six (6) inches below gutter for a ten (10) year frequency storm.

12.10.2 Runoff Determination

The peak rates of runoff for which the pavement drainage system must be designed shall be determined by the rational method. The time of concentration, individual drainage areas and rainfall intensity amounts shall be submitted as part of the drainage plans. A separate Rational Runoff Coefficient (C) shall be determined for the specific contributing area to each inlet/catch basin within the proposed storm sewer system. A composite C value shall be computed for each contributing area based on an individual C value of 0.9 for the estimated impervious portion of the actual area and an individual C value of 0.2 for the remaining previous (grassed) portion of the actual area.

12.10.3 Stormwater Spread into Traveled Lane

Inlets shall be located at all low points, intersections and along continuous grades to prevent the spread of water from exceeding tolerable limits. The acceptable tolerable limits for roadways is defined as approximately one-half the traveled lane width.

12.10.4 Maximum Inlet Interception Rates

Bypass flow is limited to a maximum of one (1) cfs. Off-site flows from impervious areas of more than one-half (0.5) acre shall be intercepted prior to the right-of-way line. No part of an inlet structure shall be located within an intersection curb radius or in front of the access to the retention pond.

12.10.5 Low Point Inlets

All inlets at low points (sumps) shall be designed to intercept one hundred (100) percent of the design flow without exceeding the allowable spread of water onto the traveled lanes as defined above.

12.11 STORM SEWER DESIGN

12.11.1 Design Discharges

Storm sewer system design is to be based upon a 10-year frequency event and shall be designed to handle the flows from the contributory area within the proposed subdivision.

12.11.2 Minimum Pipe Size

The minimum size of pipe to be used in storm sewer systems is fifteen (15) inches. Designs shall be based upon six (6)-inch increments in sizes above eighteen (18) inches.

12.11.3 Pipe Grade

All storm sewers shall be designed and constructed to produce a minimum velocity of two and one-half feet per second (fps) when flowing full. No storm sewer system or portion thereof will be designed to produce velocities in excess of twenty (20) fps for reinforced concrete pipe or 10 fps for metal pipe, and these maximums shall only be used when these outlet ends have sufficient erosion protection and/or energy dissipates.

12.11.4 Maximum Lengths of Pipe

The following maximum runs of pipe shall be used when spacing access structures of any type.

Pipe Size (inches)	Maximum (feet)
15	200
18	300
24 to 36	400
42 and larger	500

12.11.5 Design Tailwater

All storm sewer systems shall be designed taking into consideration the tailwater of the receiving facility. In the case where the detention pond is the receiving facility, the design tailwater level can be estimated from the information generated by routing through the pond the hydrograph resulting from a ten (10)-year frequency storm of duration equal to that used in designing the pond. The design tailwater level can be assumed to be the ten (10)-year pond level corresponding to the time at which peak inflow occurs from the storm sewer into the pond. In lieu of the above detailed analysis, a simpler design tailwater estimated can be obtained by averaging the established twenty-five (25)-year design high water elevation for the pond and the pond bottom elevation for “dry bottom” ponds or the normal water elevation for “wet bottom” ponds.

12.11.6 Hydraulic Gradient Line Computations

The hydraulic gradient line for the storm sewer system shall be computed taking into consideration the design tailwater on the system and the energy losses associated with entrance into and exit from the system, friction through the system, and turbulence n the individual manholes/catch-basins/junction boxes within the system. The energy losses associated with the turbulence in the individual manholes are minor for an open channel or gravity storm sewer system and can typically be overcome by adjusting (increasing) the upstream pipe invert elevations in a manhole by a small amount. However, the energy losses associated with the turbulence in the individual manholes can be significant for a pressure or surcharged storm sewer system and must be accounted for in establishing a reasonable hydraulic gradient line.

12.12 CULVERT DESIGN

12.12.1 Minimum Pipe Size

The minimum sizes of pipes to be used for culvert installations under roadways shall be eighteen (18) inches. The minimum size of pipes to be used for driveway crossings shall be fifteen (15) inches. Mitered end sections shall be provided on all pipes.

12.12.2 Maximum Pipe Grade

The maximum slope allowable shall be a slope that produces ten (10) fps velocity within the culvert barrel. Erosion protection and/or energy dissipates may be required to properly control entrance and outlet velocities.

12.12.3 Maximum Length of Culverts

The maximum length of culvert conveyance structure without access shall be as allowed in Paragraph 1.11.3

12.12.4 Design Tailwater

All culvert installations shall be designed taking into consideration the tailwater of the receiving facility.

12.12.5 Allowable Headwater

The allowable headwater for a culvert installation should be set by the designer for an economical installation. When endwalls are used, the headwater should not exceed the top of the endwall at the entrance. If the tope of the endwall is inundated, special protection of the roadway embankment and/or ditch slope may be necessary for erosion protection.

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