

Appendix "C"

STORM WATER MANAGEMENT

DESIGN STANDARDS

LAKE COUNTY, FLORIDA

Table of Contents

Part I.	Definitions	1
Part II.	General	7
	A. Pollution Abatement	8
	B. Recharge Where Possible	9
	C. Protection From Flooding	9
	D. Erosion Control	10
Part III.	Disposition of Storm Water Runoff	10
Part IV.	Development Within Flood Prone Areas (100-Year Flood)	11
Part V.	Design Criteria	11
	A. Methods of Computing Runoff Volume and Peak Rate Discharge	11
	B. Design Storm (Minimum)	12
	C. Storm Distribution	13
	D. Detention/Retention Pond Criteria	13
	E. Open Channels or Retention/Detention Ponds	22
Part VI.	Hydraulic Design Criteria	24
	A. Roadway (Pavement) Design	24
	B. Storm Sewer Design	27
	C. Culvert Design	28
Part VII.	Storm Water Management Plan Requirements	30
	A. Storm Water Management Map	30
	B. Subsoil Investigation	31
	C. Storm Water Calculations	31
Part VIII.	Proof Legal/Operation Entity Eligibility	33
	A. Homeowners, Property Owners, or Master Associations	34
	B. Condominium Association	34
	C. Association Requirements	34

STORM WATER MANAGEMENT DESIGN STANDARDS

LAKE COUNTY, FLORIDA

PART I. DEFINITIONS

For the purpose of these design standards, the following terms, phrases, and definitions shall apply. Words used in the singular shall include the plural, and the plural, the singular. Words used in the present tense shall include the future tense. The word "shall" is mandatory and not discretionary. The word "may" is permissive. Words not defined herein shall be construed to have the meaning given by common and ordinary use as defined by the latest edition of Webster's Dictionary.

Applicant shall mean any person applying for or who has been granted a permit to proceed with a project.

Aquifer shall mean an underground formation, group of formations, or part of a formation that is permeable enough to transmit, store, or yield usable quantities of water.

As-built plans shall mean the final plans amended to include all locations, dimensions, elevations, capacities, capabilities, as actually constructed and installed.

Canal shall mean an artificial waterway for transportation, irrigation, or stormwater conveyance.

County shall mean Lake County, Florida.

Clearing shall mean the removal of trees and brush from a part of the land, but shall not include mowing.

Compensating storage shall mean equivalent floodplain storage provided to counterbalance floodplain filling.

Construction shall mean the building, assembling, expansion, modification or alteration of the existing contours of the site, the erection of buildings or other structures, or any part thereof, or land clearing.

Detention shall mean the collection and temporary storage of storm water in such manner as to provide for treatment through physical, chemical, or biological processes or attenuation of the peak rate of flow.

Development shall mean the alteration, construction, installation, demolition or removal of a structure, impervious surface or drainage facility; or clearing, scraping, grubbing, killing or otherwise removing the vegetation from a site; or adding, removing, exposing, excavating, leveling, grading, digging, burrowing, dumping, piling, dredging or otherwise significantly disturbing the soil, mud, sand or rock of a site.

Directly connected impervious areas are those impervious areas which are connected to the surface water management system by a drainage improvement such as a ditch, storm sewer, paved channel, or other man-made conveyance.

Director shall mean the Director of the Lake County Division of Pollution Control, or a designee.

Discharge shall mean the outflow of water from a project, site, aquifer, drainage basin or facility.

Ditch shall mean an artificial waterway for irrigation or stormwater conveyance.

Division shall mean the Lake County Division of Pollution Control.

Drainage facility shall mean any component of the storm water management system.

Drainage system shall mean all facilities used for the movement of storm water through and from a drainage area including, but not limited to, any and all of the following conduits and appurtenant features: canals, channels, ditches, flumes, culverts, streets, etc. It also includes all watercourses, waterbodies and wetlands.

Dry detention shall mean detention provided by a pond or basin that normally has a dry bottom except during, and up to 14 days after, a rainfall event.

Easement shall mean a grant by a property owner for the use of a specified portion of land for a specified purpose.

Erosion shall mean the wearing or washing away of soil by the action of water.

Extended dry detention shall mean detention provided by a pond or basin that normally has a dry bottom that drains the runoff volume captured for water quality management over a time period exceeding 12 hours and drains completely between storms.

100-year flood shall mean the flood flow or stage of the magnitude which has a one percent (1%) chance of being equalled or exceeded during any one given year.

100-year floodplain shall mean that area inundated as a result of runoff from a 100-year flood.

Floodplain or Flood Prone Area shall mean that area inundated as a result of runoff from a storm with a defined probability of occurrence in any year (e.g., the one percent probability of occurrence floodplain is the 100-year floodplain).

Floodway shall mean the permanent channel of a stream or other watercourse, plus any adjacent floodplain areas that must be kept free of any encroachment in order to discharge the 100-year flood without cumulatively increasing the water surface elevation more than a designated amount, not to exceed one foot except as otherwise established by the Water Management District or established by a Flood Insurance Rate Study conducted by the Federal Emergency Management Agency (FEMA).

NOTE: The one foot increase cited above is used in the determination of the floodway itself and is not meant to allow subsequent increases in the 100-year flood elevation, once the limits of the floodway have been so set. That is, in order to determine that portion of the floodplain which will be designated as the floodway, one begins at the outer limits of the floodplain and assumes full development inward, toward the river or stream channel, on both sides of the flood hazard area, until the point is reached where development will cause the 100-year flood elevation to rise by one foot. The area remaining between this boundary and the channel is the floodway, and because any further development here would necessarily increase the 100-year flood elevation by more than one foot, no such development can be permitted.

Geotechnical Engineer shall mean a licensed Professional Engineer in

the State of Florida whose expertise or experience is in the field of geotechnical engineering.

Groundwater shall mean water below the surface of the ground whether or not flowing through known or defined channels.

Hydrograph shall mean a graph of discharge versus time for a selected point in the drainage system.

Impervious surface shall mean a surface which has been compacted or covered with a layer of material so that it is highly resistant to infiltration by water. It includes semipervious surfaces such as compacted clay, as well as most conventionally surfaced streets, roofs, sidewalks, parking lots, and other similar surfaces.

Intensity shall mean the depth of accumulated rainfall per unit of time.

Land-locked area shall mean an area which does not discharge runoff from the ten (10) year, twenty-four (24) hour storm event.

Landscape architect shall mean a qualified person registered and currently licensed to practice landscape architecture in the State of Florida pursuant to Chapter 481, Florida Statutes, whose expertise and experience allows for the preparation of storm water design, calculations, and drawings as set out in the applicable sections of this Ordinance.

Local roads shall mean roadways which do not provide the sole ingress or egress from a dwelling, building, or work.

Maintenance shall mean the action taken to restore or preserve the functional design of the as-built plans of any facility or system.

Open channel shall mean a canal, ditch, or swale used to safely convey storm water runoff.

Owner shall mean the person in whom is vested the fee, ownership, dominion, or title of property, (i.e., the proprietor). This term may also include a tenant, if chargeable under his lease for the maintenance of the property, and any agent of the owner or tenant including a developer.

Parcel or parcel of land shall mean a contiguous quantity of land in possession of, owned by, or recorded as property of the same claimant person in the Public Records of Lake County, Florida, as of the effective

date of this Ordinance or as may be subsequently recorded pursuant to the Lake County Subdivision Regulations.

Peak rate of flow shall mean the maximum rate of discharge resulting from a given storm event.

Person shall mean any and all persons, natural or artificial, and includes any individual, firm, corporation, governmental agency, business trust, estate, trust, partnership, association, two or more persons having a joint or common interest, or any other legal entity.

Positive outlet shall mean a gravity discharge from a basin via overland flow, artificial waterway, natural waterway, or pipe.

Post-development shall refer to the average conditions as of the completion of the development for which a permit has been applied.

Pre-development shall mean the hydrologic condition of the project site immediately before development or construction begins.

Professional Engineer shall mean the State of Florida Registered Professional Engineer of record for the project under consideration.

Professional Geologist shall mean the State of Florida Registered Professional Geologist of record for the project under consideration whose expertise and experience allows for the performance of the tests and preparation of evaluations and reports as set out in the applicable sections of this Ordinance.

Project Engineer shall have the same meaning as Professional Engineer.

Rate shall mean volume per unit of time.

Receiving waters or receiving waterbodies shall mean any waterbodies, watercourses, and wetlands into which surface waters flow.

Recharge shall mean the inflow of water into an aquifer which meets state aquifer and water quality requirements contained in Chapters 17-3 and 17-4, Florida Administrative Code.

Retention or to retain shall mean the prevention of, or to prevent, the discharge, directly or indirectly, of a given volume of storm water runoff into surface waters by complete onsite storage.

Riverine flood hazard area shall mean a floodplain area associated with stormwater, rather than tidal, flooding.

Sediment shall mean solid material, whether mineral or organic, that is in suspension, is being transported, or has been moved from its site of origin by water.

Sedimentation control device shall mean any structure or area which is designed to hold runoff water until suspended sediments have settled.

Site shall mean any tract, lot, or parcel of land or combination of tracts, lots, or parcels of land which is in one ownership, or contiguous and in diverse ownership where development is to be performed as part of a unit, subdivision, or project.

Storm event shall mean the storm of a specific duration, intensity, and frequency.

Storm water or runoff shall refer to the flow of water which results from, and which occurs during and immediately following, a rainfall event.

Storm water management permit shall refer to the approved detailed analysis, design, and drawings of the storm water management system required for all construction.

Storm water management system/facilities shall refer to the designed/ constructed features of the property which collect, convey, channel, store, inhibit, or divert the movement of storm water.

Swale shall mean an artificial waterway which:

- (a) Has a top width-to-depth ratio of the cross-section equal to or greater than 6:1, or side slopes equal to or greater than 3 feet horizontal to 1 foot vertical;
- (b) Contains contiguous areas of standing or flowing water only following a rainfall event;
- (c) Is planted with or has stabilized vegetation suitable for soil stabilization, stormwater treatment, and nutrient uptake; and
- (d) Is designed to take into account the soil erodibility, soil

percolation, slope, slope length, and contributing area so as to prevent erosion and reduce the pollutant concentration of any discharge.

Tailwater shall mean the water into which a spillway or outfall discharges.

Waterbody shall mean any natural or artificial pond, lake, reservoir, or other area which ordinarily or intermittently contains water and which has a discernible shoreline.

Watercourse shall mean any natural or artificial stream, creek, channel, ditch, canal, waterway, gully, ravine, or wash in which water flows either continuously or intermittently, and which has a definite channel, bed, or banks.

Water Management District shall mean the St. Johns River Water Management District and the Southwest Florida Water Management District.

Wet detention shall mean a detention basin that contains a permanent pool of water that will retain runoff for a minimum period of 14 days for an average rainfall summer, and which has a littoral zone over a substantial portion of the pond surface area.

Wetlands shall mean those areas defined in the Lake County Wetlands Protection Ordinance that are inundated or saturated by surface or ground water with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Works shall mean all artificial structures, including, but not limited to, canals, ditches, swales, conduits, channels, culverts, pipes, and other construction that connects to, draws water from, drains water into, or is placed in or across the waters in the state (Section 373.403(5), Florida Statutes).

PART II. GENERAL

A storm water management system shall be designed and installed for the development that will contain features to provide for pollution abatement; recharge, where possible; and protection from flooding. The intent of

these design standards is to encourage environmentally sound storm water management practices; they should go beyond simply providing drainage facilities. Emphasis should be placed on the use of upland facilities for storm water control and groundwater recharge. Developments that sacrifice recharge and upland controls in order to maximize numbers of lots will not be allowed. The County's storm water management perspective includes the control of both water quantity and water quality.

A. Pollution Abatement.

Pollution abatement will be accomplished by:

- (1) Retention with percolation, or detention with filtration, of the greater of one-half inch of runoff from developed sites which consist of less than 50% impervious surface with drainage area less than 100 acres or runoff from the first one inch of rainfall (systems using detention with filtration will be limited to tributary areas of less than 10 acres);
- (2) Detention without filtration (wet detention) of the first inch of runoff or 2.5-inches times the impervious area, whichever is greater;
- (3) Providing an additional level of treatment equal to 50 percent more than described above and shall provide off-line retention or detention of the greater of one-half inch of runoff from developed sites which consist of less than 50% impervious surface with drainage area less than 100 acres or runoff from the first one inch of rainfall for any areas that discharge to Class I, Class II, or Outstanding Florida Waters (OFW).
- (4) Providing for the same level of treatment as required above for Class I Waters for any areas that discharge to stream-to-sinkhole or to drainage wells which are directly connected to the Florida Aquifer.
- (5) Monitoring may be required by the County in any drainage system in order to provide assurance that the storm water management facilities are functioning as designed and are not having adverse impacts on water quantity or quality of receiving waterbodies or water courses.

The County highly discourages the use of detention with filtration

pollution abatement systems due to their high failure rate and costly maintenance. These systems shall be allowed only if a detention without filtration system cannot be used.

B. Recharge Where Possible.

Lake County strongly endorses the practice of recharge, especially in upland areas to promote the long term protection of the quantity and quality of potable water supplies in the Floridan aquifer. Recharge in designated areas where the soils are compatible (Hydrologic Soils Group A as described by the USDA Soil Conservation Service) will be accomplished by providing for retention of 3 inches runoff from all directly connected impervious areas within a project site. As an alternative, applicants may demonstrate that the post-development recharge capacity is equal to or greater than the pre-development recharge capacity.

C. Protection From Flooding.

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

- (1) Areas contributory to land-locked areas with no positive outlet shall provide extended dry detention or retention of the difference in pre- and post-development storm water runoff volume from the 25-year, 96-hour storm event.
- (2) Areas that are not contributory to land-locked areas shall have their post-developed peak rate of discharge less than or equal to the pre-developed peak rate of discharge during a 2-, 10-, and 25-year frequency, 24-hour duration storm event for each contributing sub-basin within the site. For areas tributary to small depressional areas, upstream infiltration is encouraged. Use of these depressional areas often causes groundwater mounding at the depression. If these depressions are used for stormwater management, applicants shall demonstrate that groundwater mounding effects will not adversely affect the quantity or quality of ground and surface waters for build-out conditions.
- (3) For projects utilizing pump discharges in the Oklawaha River Basin, as defined by the St. Johns River Water Management District (SJRWMD), the total post-development runoff volumes

shall not exceed pre-development runoff volumes for the 4-day period beginning the third day of the 2-, 10-, and 25-year, 24-hour storm event.

- (4) All proposed commercial, industrial, and residential structures are to be flood free during a 100-year frequency, 24-hour duration storm event.
- (5) All defined evacuation routes or roads which provide the sole ingress or egress to buildings or houses shall be designed and constructed to be passable (less than 6 inches of flooding) for the 100-year frequency, 24-hour duration storm event.

D. Erosion Control.

No grading, cutting, or filling shall be commenced until erosion and sedimentation control devices have been installed between the disturbed area and waterbodies, watercourses, and wetlands. Vegetated buffer strips shall be created or, where practicable, retained in their natural state along the banks of all watercourses, waterbodies, or wetlands. The width of the buffer shall be a minimum of 50 feet to prevent erosion, trap the sediment in overland runoff, provide access to the waterbody, and allow for periodic flooding without damage to structures.

PART III. DISPOSITION OF STORM WATER RUNOFF

All developments will treat the required pollution abatement volume prior to discharge to receiving waters. When pollution abatement volumes and detention volumes to reduce the peak rate of discharge are incorporated into one facility, the volume of water impounded to reduce peak discharges in excess of the pollution abatement volume must be discharged by a positive, non-filtering system.

Off-site easements (public rights-of-way or waters of the state) for storm water management facilities will be required when either of the following conditions exist:

- A. The discharge is into any man-made facility for which the County does not have either a drainage easement or right-of-way.
- B. 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, and where no adverse impact outside the easement occur.

In a situation where an easement already exists, engineering devices (such as skimmers) which are used to minimize the transport of floating debris, oil, and grease remaining in the detention volumes to reduce peak discharges will be incorporated into the design of the outlet control structure. The design of the system will make adequate provision to minimize erosion.

PART IV. DEVELOPMENT WITHIN FLOOD PRONE AREAS (100-YEAR FLOOD)

All development within flood prone areas as delineated on the official National Flood Insurance Program, Flood Insurance Rate Maps, or the latest and best information available, or as determined by the Director shall comply with the following requirements:

- A. Establish, to the satisfaction of the County, the elevation of the 100-year flood.
- B. Set the minimum finished floor elevation at 18 inches, or above, the elevation of the 100-year flood.
- C. Provide compensating storage for all flood water displaced by development below the elevation of the 100-year flood. Compensating storage is to be accomplished between the seasonal high water elevation and the estimated 100-year flood elevation.

All developments within riverine flood hazard areas shall be designed to maintain the flood carrying capacity of the floodway such that the base flood elevations are not increased, either upstream or downstream.

PART V. DESIGN CRITERIA

- A. Methods of Computing Runoff Volume and Peak Rate Discharge.

The design method used to establish runoff volume and peak rates of discharge shall be by acceptable engineering techniques. In order to provide for a reasonable measure of consistency, the following methods of computation are encouraged:

- (1) Basins or sub-basins 0 to 40 acres - Hydrograph developed by SCS methods, the Santa Barbara Urban Hydrograph method, the USEPA SWMM (Kinematic Wave) method, or other methods acceptable to the Director.
- (2) Developments of over 40 acres—SWMM (USEPA), TR—20 (USDA Soil Conservation Service), HEC I (US Army Corps of Engineers), or other methods acceptable to the Director.
- (3) Storm Sewers - Rational Formula or SWMM (USEPA), or other methods acceptable to the Director.

B. Design Storm (Minimum).

FACILITY	FREQUENCY DURATION
Bridges	50 Year 24 Hours
Principal arterial bridges and evacuation routes	100 Year 24 Hours
Canals, ditches, swales or culverts for drainage external to the development	25 Year 24 Hours
Canals, ditches, swales or culverts for drainage internal to the development	10 Year 24 Hours
Detention and retention basins contributory to land-locked areas with no positive outlet	25 Year 96 Hours
Major Detention/Retention Structures with a positive outlet. The Probable Maximum Precipitation (PMP) as required by the SJRWMD shall be evaluated	PMP 24 Hours
Minor Detention/Retention Structures with a positive outlet	25 Year 24 Hours

Houses/Buildings First floor elevation must be 18" or above the 100-Year Flood Elevation

100 Year 24 Hours

Major (Hazard Classification B&C)/Minor (Hazard Classification A) Detention/Retention Structures are based on A, B, C, Hazard Classification for Dams and Impoundments as defined by the SJRWMD's Applicant's Handbook 10.5.6.

Storm sewers shall be designed for the 10-year storm. If SWMM methodology is used, the duration of the storm shall be 24 hours and the rainfall time increment shall be six (6) minutes. If Rational Formula methodology is used, rainfall intensities are to be obtained from the Florida Department of Transportation Rainfall Curves for Zone 7, and time of concentration 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.)

The design frequency for major drainage systems may be increased if deemed necessary by the Director to protect upstream or downstream properties or to comply with other regulations.

C. Storm Distribution.

Rainfall distribution for storm water management systems is to be in accordance with Soil Conservation Service Type III Rainfall Distribution. This is also referred to as the SCS Type II Florida Modified contained in the SJRWMD applicant's handbook.

D. Detention/Retention Pond Criteria.

(1) Design Criteria for Pollution Abatement Utilizing Retention with Percolation.

The design of ponds for the required retention with percolation may be designed as a separate facility, or pollution abatement may be combined into the design of the detention pond required to reduce the peak rate of flow from the developed site to the peak rate of flow prior to the development of the site. All retention ponds will be designed as dry bottom ponds. The volume of storm water impounded for pollution abatement will

be recovered within a 72-hour time period. The bottom of a required retention pond shall be a minimum of 3-feet above the seasonal high water table. Final design infiltration rates will be determined by a Geotechnical Engineer or Professional Geologist. All necessary calculations to support the above shall be submitted to the County.

(2) Design Criteria for Pollution Abatement Utilizing Detention Ponds without Filtration (Wet Detention).

The design of ponds for the required detention without filtration may be designed as a separate facility, or pollution abatement may be combined into the design of the detention pond required to reduce the peak rate of flow from the developed site to the peak rate of flow prior to the development of the site.

- a. The maximum depth of the pond shall not exceed 12 feet, and as shown in the table below, the percent area of the pond shall be limited by the depth of the pond, i.e., the depth to area relationship of the detention pond without filtration shall be as follows:

PERCENT AREA OF POND	POND'S DEPTH (FT)
< 10	> 8
50 - 70	4 - 8
25 - 50	0 - 4

- b. The pond's water storage volume below the outlet structure's control elevation, or the low season water table, shall provide a minimum residence time of 14 days.
- c. The pond shall be designed with a littoral shelf in accordance with the following:
1. The littoral zone shall be gently sloped 6:1 (horizontal:vertical) or flatter. At least 25 percent of the wet detention system surface area shall

consist of a littoral zone. The percentage of littoral zone is based on the ratio of vegetated littoral zone to surface area of the pond at the control elevation. Above the outlet structure's control elevation, the steepest side slopes shall be 4:1 (horizontal:vertical)

2. The pollution abatement volume should not cause the pond level to rise more than 18 inches above the control elevation unless it is demonstrated that the littoral zone vegetation can survive at greater depths.
 3. Eighty percent coverage of the littoral zone by suitable aquatic plants is required within the first twenty-four months of completion of the system.
 4. To meet the 80% coverage requirement, planting of the littoral zone is recommended. As an alternative, portions of the littoral zone may be established by placement of wetland top soils (at least a four inch depth) containing a seed source of desirable native plants. When utilizing this alternative, the littoral zone must be stabilized by mulching or other means and at least the portion of the littoral zone within 25 feet of the inlet and outlet structures must be planted.
- d. In lieu of the requirements in Part V.D.(2)c. above, the applicant may provide either of the following:
1. At least fifty percent additional permanent pool volume over that specified in paragraph (b), above; or
 2. Pre-treatment of the stormwater pursuant to paragraph A.(1) and A.(2) of the Pollution Abatement Section.
- e. Be designed so the flow path through the pond has an average length to width ratio of at least 2:1. The alignment and location of inlets and outlets should be designed to maximize flow paths in the pond. If short

flow paths are unavoidable, the effective flow path should be increased by adding diversion barriers such as islands, peninsulas, or baffles to the pond. Inlet structures shall be designed to dissipate the energy of water entering the pond.

- f. Be designed so that bleed down structure invert elevations are at or above the estimated post-development wet season water table elevation.
- g. Provide for permanent maintenance easements or other acceptable legal instruments to allow for access to and maintenance of the system, including the pond, littoral zone, inlets, and outlets.
- h. Outlet structures shall be designed with a V-notch weir, or an orifice, for release of the pollution abatement volume such that no more than half of this volume is discharged in the first 60 hours following a storm event. Outlet structures shall be designed to skim floating debris, oil, and grease from an elevation 6 inches below the control elevation of the outlet structure to an elevation 6 inches above the design highwater level of the pond.

(3) Design Criteria for Pollution Abatement Utilizing Detention Ponds with Filtration.

The design of ponds for the required detention with filtration may be designed as a separate facility, or pollution abatement may be combined into the design of the detention pond required to reduce the peak rate of flow from the developed site to the peak rate of flow prior to the development of the site. All detention ponds with filtration will be designed as dry bottom ponds unless specifically approved otherwise by the County.

There will be a minimum of 2-feet of filter media required for filtering the pollution abatement volume. The volume of storm water impounded for pollution abatement will be recovered through the filter media within a 72-hour time period. The bottom of a required detention pond with filtration shall be a minimum of 3 feet above the estimated seasonal high water

table. Where this is not possible due to a high water table, the County encourages the use of detention ponds without filtration. Only if a detention pond without filtration cannot be used may the Director allow underdrains to be installed with a minimum invert elevation of one foot below the pond bottom. When placed in the side slope, the underdrain shall be installed along the entire perimeter of the pond unless a Geotechnical Engineer can show to the satisfaction of the County that a lesser amount of underdrain can adequately control the high water table and the drawdown of the pond. For detention ponds with filtration that are designed to continuously contain water below the underdrain, a minimum of 6 feet of depth below the design low water or "normal" water level shall be designed into the facility.

Final design seepage rates will be determined by a Geotechnical Engineer or Professional Geologist. All necessary calculations to support the above shall be submitted to the County.

a. Filtration systems shall:

1. Provide the capacity for the specified pollution abatement volume of stormwater within 72 hours following a storm event.
2. Have pore spaces large enough to provide sufficient flow capacity so that the permeability of the filter is equal to or greater than the surrounding soil. The design shall ensure that the particles within the filter do not move. When sand or other fine textured aggregate other than natural soil is used for filtration, the filter material should be of quality sufficient to satisfy the following requirement:
 - i. Filter material should be washed (less than 1 percent silt, clay and organic matter); and
 - ii. Filter material should have a uniformity coefficient of 1.5 or greater but not more than 4.0; and
 - iii. Filter material should have an effective grain

size of 0.20 to 0.55 millimeters in diameter. These criteria are not intended to preclude the use of multilayered filters nor the use of materials to increase ion exchange, precipitation or the pollutant absorption capacity of the filter.

3. Include, at a minimum, capped and sealed inspection and cleanout ports which extend to the surface of the ground at the following locations for each drainage pipe:
 - i. The terminus;
 - ii. Every 400 feet; and
 - iii. At any change in direction greater than 45 degrees.
4. Utilize filter fabric or other means to prevent the filter material from moving or being washed out through the underdrain pipe.
5. Be designed with a safety factor of at least two unless the engineer affirmatively demonstrates based on plans, test results, calculations or other information that a lower safety factor is appropriate for the specific site conditions. Examples of how to apply this factor include but are not limited to the following:
 - i. Reducing the design percolation rate by half,
 - ii. Doubling the length of the filtration system, or
 - iii. Designing for the required drawdown within 36 hours instead of 72 hours.
6. Be designed so that the invert elevation of the perforated pipe is above the seasonal high water table elevation or separated by structural means from the hydraulic contribution of the surrounding water table unless the Project Engineer demonstrates based on plans, test results,

calculations or other information that an alternative design is appropriate for the specific site conditions.

b. Underdrain stormwater systems shall:

1. Provide the capacity for the specified pollution abatement volume of stormwater within 72 hours following a storm event. The storage volume must be provided by a decrease of stored water caused only by percolation through soil with subsequent transport through the underdrain pipes, evaporation or evapotranspiration.
2. Provide at least two feet of indigenous soil between the bottom of the stormwater holding area and the top of the underdrain pipe(s);
3. Be designed with a safety factor of at least two. Examples of how to apply this factor include but are not limited to reducing the design percolation rate by half or designing for the required drawdown within 36 hours instead of 72 hours.
4. Contain areas of standing water only following a rainfall;
5. Be stabilized with pervious material or permanent vegetative cover;
6. Include, at a minimum, a capped and sealed inspection and cleanout ports which extend to the surface of the ground at the following locations of each drainage lateral:
 - i. The terminus;
 - ii. Every 400 feet; and
 - iii. At any change in direction greater than 45 degrees.
7. Utilize filter fabric or other means used to prevent

the soil from moving and being washed out through the underdrain pipe.

(4) Design Criteria of Detention Facilities to Protect from Flooding.

If the site has multiple drainage basins, each developed drainage basin in the site shall limit its peak rate of discharge, or its volume of runoff, to that discharge rate or volume generated from that site's drainage basin prior to development. Supporting calculations shall be submitted and will contain, as a minimum, a runoff hydrograph for the undeveloped and developed site, stage-storage calculations for the detention facility, stage-discharge calculations for the outlet structure, and a runoff hydrograph after routing through the proposed detention facility. All routing calculations shall account for tailwater conditions of the receiving facility, and shall be submitted to the County.

Credit for seepage through the pond bottom to further reduce the peak rate of discharge, or runoff volume, will not be allowed unless accompanied by supporting documentation prepared by a Geotechnical Engineer or Professional Geologist.

A minimum of eighty percent (80%) of the total volume of water required to attenuate the peak discharge from the facility in excess of the pollution abatement volume must be recovered within 10 days after the passage of the design storm. The remaining twenty percent (20%) must be recovered within an additional 4 days. All storage recovery from detention facilities in excess of the pollution abatement volume will be accomplished by a positive, non-filtering discharge structure only. The use of underdrains is prohibited to accomplish the non-pollution abatement volume recovery.

The primary outlet structure shall be designed to skim floating debris, oil, and grease from an elevation 6 inches below the surface of the pollution abatement volume to an elevation 6 inches above the design highwater level of the pond.

(5) Design Criteria for Recharge Facilities.

Recharge facilities shall be required on lands where Hydrologic

Group A soils are present, as indicated in the Soil Survey of Lake County, Florida, and the Soil Survey of the Ocala National Forest, Florida, prepared by the USDA Soil Conservation Service.

The applicant can apply for an exception to this criteria only by submitting a detailed soils report, prepared by a Geotechnical Engineer or Professional Geologist, to the County for review prior to the development of final detailed storm water management plans for the site. The report shall contain a recommendation as to whether or not recharge is feasible on the proposed site. The County, after review of the report and recommendation of the Geotechnical Engineer, shall make a final written decision regarding whether or not recharge will be required.

If recharge is required by the County due to the presence of onsite Hydrologic Soils Group A soils, retention of 3 inches of runoff from all directly connected impervious areas within the developed site will be required. As an alternative, applicants may demonstrate that the post-development recharge capacity is equal to or greater than the pre-development recharge capacity.

Infiltration rates utilized in the design of the recharge facility will be determined by a Geotechnical Engineer or Professional Geologist registered in the State of Florida. All necessary calculations to support the above shall be submitted to the County.

(6) Design Criteria for Offsite Areas.

Offsite areas which discharge to or across a site proposed for development must be accommodated in the storm water management plans for the development. The storm water management system for the development must be capable of transporting existing offsite flows through or around the development without increasing stages or flows upstream or downstream of the development. The estimation of the offsite flows must be done separately from the estimation of onsite pre- and post-development flows (i.e., separate offsite and onsite hydrographs must be computed due to the typically significant differences in land use characteristics).

It is strongly recommended that the Project Engineer meet with the Division staff prior to generating final detailed design calculations in order to establish offsite design requirements for a particular project.

E. Open Channels or Retention/Detention Ponds.

(1) Rights-of-Way/Easements.

Outfall ditches and canals shall have sufficient right-of-way/easements for the facility plus an unobstructed maintenance berm on one or both sides. Said right-of-way/easement shall be contiguous to a public right-of-way/easement and shall allow for suitable access by maintenance equipment. Where the rights-of-way/easement is provided for access only, the minimum width shall be 20 feet. Maintenance berms shall be sloped no steeper than 1/4-inch per foot. Ponds shall have a sufficient right-of-way/easement to allow for installation plus an unobstructed maintenance berm all around the perimeter of the pond.

(2) The minimum requirement for maintenance berms is as follows:

DITCH OR CANAL TOP OF BANK WIDTH	MINIMUM MAINTENANCE BERM REQUIRED
Less than 16 feet	20 feet one side
16 feet to 32 feet	20 feet both sides
32 feet to 55 feet 30 feet on the other side	20 feet one side and
Over 55 feet	30 feet both sides
PONDS	MINIMUM MAINTENANCE BERM REQUIRED
With fencing perimeter	20 feet all around

Without fencing

10 feet

(3) Areas adjacent to open channels and ponds shall be graded to preclude the entrance of storm water except at planned locations. Where retention/detention areas are located on the project periphery, the developer may be required to provide additional landscaping or screening to adequately protect abutting properties.

(4) Maximum Side Slopes:

OPEN CHANNELS	MAXIMUM SIDES SLOPES HORIZONTAL:VERTICAL
Less than four (4) feet deep	4:1
Ponds	4:1

(5) Minimum Bottom Width:

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

(6) Erosion Protection:

OPEN CHANNELS - GRADE	PROTECTION REQUIRED
Less than one (1) percent	Grassing and Mulch
One (1) to three (3) percent	Sodding
Greater than three (3) percent	Paving (with exception of swales on local roads which must be sodded).
PONDS	PROTECTION REQUIRED
Side slopes and berms	Sod
Bottom	Grass and Mulch

A dense stand of grass is required to be established within all dedicated rights-of-way and easements.

(7) Fencing:

Fenced storm water facilities are discouraged within the County and shall only be allowed if approved by the Director. Storm water facilities require fencing due to steep side slopes which potentially endanger human life. Steep slopes and, therefore, fences are discouraged. If a fence is the only option, then it must be designed as per the following:

6-foot-high chainlink fence, or better, (i.e., brick wall) along right-of-way around entire perimeter including maintenance berms with an access for maintenance vehicles.

(8) Freeboard - Open Channels and Ponds:

One-foot minimum above design storm high water elevation.

(9) Open Channels:

With the exception of roadside swales and natural watercourses, open channels shall not be permitted within 100 feet of residential lots or school sites, unless the open channel is fenced, or approved by the Director.

(10) Berms Constructed on Fill:

Where fill berms are proposed, calculations supporting the stability of the fill berms are to be submitted by a Geotechnical Engineer. The applicant shall design all raised bermed storm water ponds according to SJRWMD criteria (reference Section 17.0 of the SJRWMD Management and Storage of Surface Water Applicant's Handbook).

PART VI. HYDRAULIC DESIGN CRITERIA

A. Roadway (Pavement) Design.

(1) General.

Good pavement drainage design consists of the proper selection of grades, cross slopes, curb types, inlet locations, etc., to remove the design storm rainfall from the pavement in a cost-effective manner while preserving the safety, traffic capacity, and integrity of the highway and street system. These factors are generally considered to be satisfactory, provided that excessive spreads of the water are removed from the vehicular traveled way and that siltation at pavement low points is not allowed to occur. The guidelines included herein will accomplish these objectives.

(2) Minimum Groundwater and High Water Clearances.

All streets should be designed to provide a minimum clearance of 1 foot between the bottom of the base and the seasonal high ground water table as established by a Geotechnical Engineer or Professional Geologist, or the artificial water table induced by a road underdrain system. Swales will be permitted only when the seasonal high ground water table, as established by a Geotechnical Engineer or Professional Geologist, is a minimum of 2 feet below the invert of the swale. Swales shall be constructed to allow positive drainage from the pavement to the invert of the swale (i.e., no ponding of water at the edge of pavement).

(3) Curbs and Gutters - Types.

All roadway drainage not considered suitable for swale and/or ditch type drainage shall be designed as one of the following:

- a. Miami Curb and Gutter Section; or
- b. Standard Curb and Gutter Section.

(4) Design Storm Frequency.

The design storm frequency to be utilized for the design of pavement drainage shall be as follows:

Arterial streets	10-year, Hydraulic Gradient Line 1.0 feet below the gutter
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Collector and local streets

10-year, Hydraulic Gradient Line 0.5 feet below the gutter line

(5) Runoff Determination.

The peak rates of runoff for which the pavement drainage system must be designed, shall be determined by the Rational Method or hydrograph methodology. The time of concentration, individual drainage areas, and rainfall intensity amounts shall be submitted as part of the drainage plans. Minimum time of concentration shall be according to Florida Department of Transportation (FDOT) acceptable methods.

(6) Stormwater Spread into Traveled Lanes.

Inlets shall be spaced at all low points, intersections, and along continuous grades to prevent the spread of water from exceeding tolerable limits. The acceptable limits for arterial and collector roadways are defined as approximately one-half the traveled lane width. Acceptable limits for local subdivision roadways are defined as below the crown of the local road.

(7) Maximum Inlet Interception Rates.

FDOT single type curb inlets shall be located such that a maximum of 5 cubic feet per second (cfs) is intercepted. FDOT full curb inlets shall be located such that a maximum of 9 cfs is intercepted. Bypass flow is limited to a maximum of 1 cfs. Off-site flows from impervious areas more than 0.5-acre shall be intercepted prior to the right-of-way line.

(8) Inlet Types.

Inlet types to be used shall be the latest version of the FDOT, or others approved by the Director.

(9) Low Point Inlets.

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

above. On arterial roadways, in order to prevent siltation and to provide for a safety factor against the clogging of single inlets in a sump location, it is required to construct multiple inlets at all sump locations. Preferably, three inlets should be constructed on each side of the roadway, one at the low point and one on each side at a point 0.2 feet higher than the low point.

B. Storm Sewer Design.

(1) Easements.

A 20-foot easement centered on the storm sewer shall be conveyed to the County when the storm sewer is not located within dedicated rights-of-way. Easements shall be contiguous to public rights-of-way and shall allow for suitable access by maintenance equipment.

(2) Design Discharges.

Storm sewer system design is to be based upon a 10-year frequency event as referenced in Design Storm Section B of the Design Criteria. The system shall be designed to handle the flows from the contributory area within the proposed subdivision. Then, the system shall be analyzed a second time to insure that any offsite flows can also be accommodated. This second analysis shall consider the relative timing of the onsite and offsite flows in determining the adequacy of the designed system.

(3) Minimum Pipe Size.

The minimum size of pipe to be used in storm sewer systems is 18 inches.

(4) Pipe Grade.

All storm sewers shall be designed and constructed to produce a minimum velocity of 2.0 feet per second (fps) when flowing full. No storm sewer system or portion thereof shall be designed to produce velocities in excess of 10 fps for reinforced concrete pipe, and 10 fps for metal pipe, providing that the outlet ends have sufficient energy dissipators and

erosion protection.

(5) **Maximum Lengths of Pipe.**

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

PIPE SIZE MAXIMUM	STRUCTURE ACCESS SPACING
18 inches	300 feet
24 to 36 inches	400 feet
42 inches and larger	500 feet

(6) **Design Tailwater.**

All storm sewer systems shall be designed taking into consideration the tailwater of the receiving facility or waterbody. The tailwater elevation used shall be based on the design storm frequency.

(7) **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 in the individual manholes, catch basins, and junctions within the system.

(8) **Allowable Materials.**

Allowable material for storm sewers and structures shall be in accordance with Florida Department of Transportation standards and specifications, others approved by the Director, and all other applicable Lake County Codes.

C. Culvert Design.

(1) **Minimum Pipe Size.**

The minimum size of pipes to be used for culvert installations under roadways shall be 18 inches. The minimum size of pipes

to be used for driveway crossings shall be 15 inches.

(2) Maximum Pipe Grade.

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

(3) Maximum Lengths of Structure.

The maximum length of culvert conveyance structure without access shall be as allowed in the Hydraulic Design Criteria, Item B.5.

(4) Design Tailwater.

All culvert installations shall be designed taking into consideration the tailwater of the receiving facility or waterbody. The tailwater elevation used shall be based on the design storm frequency.

(5) Allowable Headwater.

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

(6) Design Procedure.

The determination of the required size of a culvert installation can be accomplished by mathematical analysis or by the use of design nomographs.

(7) Headwalls Requirement.

Headwalls shall be required at all storm sewer or culvert inlets or outlets to and from open channels or lakes.

PART VII. STORM WATER MANAGEMENT PLAN REQUIREMENTS

A. Storm Water Management Map.

The Project Engineer or Landscape Architect shall include in the construction plans a master storm water management map showing all existing and proposed features. The map is to be prepared on a 24-inch by 36-inch sheet on a scale not to exceed 1" = 400'. Listed below are the features that are to be included on the map.

- (1) Hydrologic boundaries, including all areas flowing to the proposed project.
- (2) Project's boundaries and area.
- (3) Sufficient topographical information with elevations to verify the location of all ridges, streams, etc. (one-foot contour intervals within the project's boundaries and for proposed off-site improvements).
- (4) High water data or critical flood elevations on existing structures upstream of, within, and downstream of the project.
- (5) Notes indicating sources of high water data and critical flood elevations.
- (6) Notes pertaining to existing standing water, areas of heavy seepage, springs, wetlands, streams, hydrologically sensitive areas, etc.
- (7) Existing storm water management features (ditches, roadways, ponds, etc.). Existing storm water management features are to be shown a minimum of 1,000 feet downstream of the proposed development unless the ultimate outfall system is a lesser distance.
- (8) Subdivision layouts with horizontal and vertical controls.
- (9) Storm water management features, including locations of inlets, swales, ponding areas, and all works, etc.
- (10) Delineation and area of pre-development and post-development

sub-basins.

- (11) Delineate retention/detention areas and ingress/egress areas for facilities maintenance.
- (12) General type of soils by sub-basin (obtain from soil survey of Lake County), and location of soil borings.
- (13) 10-, 25- and 100-year flood elevations for any areas in or within 100 feet of the property. The source of these elevations shall also be shown on the plans.
- (14) Description of current ground cover, land use, and imperviousness by sub-basin.

B. Subsoil Investigation.

A subsoil report shall be prepared by a Geotechnical Engineer or Professional Geologist experienced in the preparation of this type of report. The contents of the subsoil report will be in accordance with Design Criteria, Item D, and as a minimum shall include, but not be limited to, soil borings which indicate American Association of State Highway and Transportation Officials (AASHTO) soil classifications, gradation, determination of existing (24-hour test) and wet season water table, field determined vertical and horizontal soils permeability rates, soils porosity values, and the depth of the relative impermeable soil layer for determining the duration of the vertical infiltration. A minimum of two borings will be taken per retention/detention area. Soil boring locations shall be included in the report.

C. Storm Water Calculations.

Storm water calculations, sealed by a Professional Engineer or Landscape Architect, for all storm water works, including design high water elevations for all applicable storm events shall include the following:

- (1) Pre- and post-development storm water flows and stages for the site and retention/detention ponds including, but not limited to, the following:
 - a. Pre-development hydrograph, post-development runoff

hydrograph to the storm water pond, and the routed post-development hydrograph discharged from the storm water pond.

- b. Pre-development and post-development runoff volumes.
 - c. Stage-area-storage calculations for the storm water pond.
 - d. Stage-discharge calculations for the outfall control structure, including tailwater assumptions..
 - e. Treatment volume and recovery calculations for the storm water pond and associated swales or works.
 - f. Soil storage or curve number calculations per sub-basin, including impervious calculations.
 - g. Time of concentration calculations per sub-basin.
 - h. 100-year floodplain compensating calculations, if applicable.
 - i. Recharge demonstration where required for SCS Hydrologic Group A Soils.
- (2) Storm sewer, culvert, and open channel tabulations including, but not limited to, the following:
- a. Location and type of structures.
 - b. Length of facility and dimensions including diameter, height, and/or width for pipes. Cross-sections for open channels.
 - c. Sub-basin areas tributary to each structure.
 - d. Runoff coefficient or curve number per sub-basin.
 - e. Time of concentration to the inlet of each structure.
 - f. Each storm water flow to and from the storm water structure or junction point.

- g. Hydraulic gradient for the applicable storm event, including losses through structures with friction and local loss coefficients.
 - h. Estimated receiving water elevation with sources of information, if available.
 - i. Velocities for all facilities and details for provisions to control erosion.
- (3) Construction plans including, but not limited to, the following:
- a. Overall project plan of roads, lots, and retention or detention facilities.
 - b. Cross-section of retention/detention facilities.
 - c. Typical swale, ditch, or canal sections.
 - d. Drainage rights-of-way.
 - e. Road plan and profile with groundwater elevation shown in profile.
 - f. An erosion control plan.
 - g. Overall project grading plan (at 1-foot contours) and individual lot grading plans.
 - h. Density of the project.

PART VIII. PROOF LEGAL/OPERATION ENTITY ELIGIBILITY

To satisfy this requirement, the Permittee must provide written documentation. If the entity is a governmental unit, the Permittee must supply written proof in the appropriate form, by either letter or resolution, that the governmental entity will accept the operation and maintenance of all of the storm water management system, including lakes, easements, etc., prior to staff report approval (see also Section 14 of the Lake County Stormwater Management Ordinance).

A. Homeowners, Property Owners, or Master Associations.

If a homeowners, property owners, or master association is proposed, the Permittee must submit the Articles of Incorporation for the association, and Declaration of Protective Covenants or Deed Restrictions, as well as a reference map if referred to in documents. After these are approved, the Permittee must furnish the Certificate of Incorporation and the recording information (Official Book and page number) for the Declaration.

B. Condominium Association.

If a condominium association is proposed, the Permittee must supply the Articles of Incorporation for the condominium association, and Declaration of Condominium. After the documents are approved, it will be necessary for the Permittee to forward a copy of the letter from the Department of Business Regulation, Bureau of Condominiums stating that the documents are proper for filing.

C. Association Requirements.

The association, be it either a non-profit association or a condominium association, must comply with the applicable provisions of Florida laws, specifically Chapters 617 or 718, Florida Statutes.

(1) General Powers.

The association must have the following general powers which are reflected in the Articles of Incorporation:

- a. Own and convey property
- b. Operate and maintain common property; specifically the storm water management system as permitted by Lake County and the Water Management District, if required; including all lakes, retention areas, culverts, and related appurtenances.
- c. Establish rules and regulation.
- d. Assess members and enforce said assessments.

- e. Sue and be sued.
- f. Contract for services (if the association contemplates employing a maintenance company) to provide the services for operation and maintenance.
- g. The association must have as members all the homeowners, lot owners, property owners, or unit owners.
- h. The association shall exist in perpetuity; however, if the association is dissolved, the Articles of Incorporation must provide that the property consisting of the storm water management system shall be conveyed to an appropriate agency of local government. If it is not accepted, then the storm water management system must be dedicated to a similar non-profit corporation.
- i. All other powers necessary for the purposes for which the association is organized.

(2) Required Association Stipulations.

The Declaration of Protective Covenants, Deed Restrictions, or Declaration of Condominium must set forth the following:

- a. That it is the responsibility of the association to operate and maintain the storm water management system.
- b. The storm water management system is owned by the association or described therein as common property.
- c. That there be a method of assessing and collecting the assessment for operation and maintenance of the storm water management system.
- d. That any amendment which would affect the storm water management system, including the water management portions of the common areas, must have the prior approval of Lake County and the Water Management District, if required.
- e. That the Declaration of Covenants be in effect for at

least 25 years with automatic renewal periods thereafter.

(3) Phased Projects.

- a. If a property owner's association is proposed for a project which will be constructed in phases, and subsequent phases will utilize the storm water management system for the initial phase or phases, the association should be created with the ability to accept future phases into the association.
- b. If the development scheme contemplates independent associations for different phases, a master association should be formed to include all of the various associations with the master association having the responsibility to operate and maintain the storm water management system for the entire project.

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