

2. ENGINEERING CRITERIA

2.01 GENERAL

The following regulations and criteria will be utilized by the District in the review of plans, plats, as-builts, or other submittals.

2.01.1 DEFINITIONS

Definition and terms that are not defined below shall be given their ordinary and customary meaning or usage of the trade or will be defined using published, generally accepted dictionaries, together with any rules and statutes of the Agencies that have additional authority over the regulated activities.

“Aquatic plant” or “aquatic vegetation” means a plant, including the roots, which typically floats on water or requires water for its entire structural support, or which will desiccate outside of water.

“As-Built Drawings” means plans that accurately represent the constructed condition of the permitted facility that is certified by a Florida registered Professional Surveyor and Mapper.

“Detention” means the collection and temporary storage of stormwater in an impoundment in such a manner as to provide for treatment through physical, chemical, and biological processes with subsequent gradual release of the stormwater.

“Discharge” means to allow or cause water to flow.

“Exotic species” means a plant species introduced to Florida, purposefully or accidentally, from a natural range outside of Florida, including naturalized exotic species (an exotic plant that sustains itself outside cultivation) and invasive exotic species (an exotic plant that not only has naturalized, but is expanding on its own in Florida native plant communities). Exotic plant species are defined by the “Florida Exotic Pest Plant Council” (EPPC), and include cattails, melaleuca, Brazilian pepper, Australian pine, laurel fig (ficus) and other nuisance species that are not native to Florida, exhibit rapid growth, out compete native vegetation, and can clog lakes and canals (Exhibit “U”). Additional information on Florida’s exotic plant species is available at: <http://www.fleppc.org/>.

“Filling” or “fill” means the deposition or to deposit, by any means, of materials in a lake, pond, wetland, canal, other waterway, detention, or retention area.

“NAVD 88” means North American Vertical Datum of 1988.

“NGVD 29” means National Geodetic Vertical Datum of 1929.

“Nuisance species” means any species of flora or fauna whose noxious characteristics or presence in sufficient number, biomass, or areal extent that prevents, or interferes with, uses or management of resources, and which are native or naturalized in the area where it occurs.

“Positive outfall” means discharge via a device or devices designed to convey discharges of stormwater from the applicant’s property across downstream properties and ultimately into a District canal by means of a system consisting of one or a combination of pipes, culverts, canals, swales, or ditches in a concentrated and not diffuse manner.

“Pre-development” means the land use immediately previous to submittal of an application for paving and drainage approval if no District water management works permit was issued for the property, or the land use and storm water management design described in the latest District approved water management works permit for the property.

“Record drawing” means plans certified by a registered professional that accurately represent the constructed condition of an activity, including identifying any substantial deviations from the permitted design that are based on the As-built drawings submitted by the contractor and certified by a Florida registered Professional Surveyor and Mapper..

“Registered Professional” means a professional registered or licensed by and in the State of Florida and practicing under Chapter 471, 472, 481, or 492, F.S.

“Retention” means a system designed to prevent the discharge of a given volume of stormwater runoff into surface waters in the state by complete on-site storage. Examples are systems such as excavated or natural depression storage areas, pervious pavement with subgrade, or above ground storage areas.

“Structural slab-on-ground” means a slab that is cast directly on the ground and is a required part of a load path which transmits vertical or lateral loads to the ground and must conform to applicable structural building codes. Non-structural slabs-on-ground serve only as an architectural wearing surface and are not subject to structural building code requirements and are not subject to the six inches (6”) above berm elevation requirement.

“Substantial Damage” means damage of any origin sustained by a structure (i.e., a building, storm sewer, culvert, or bridge) whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before damage occurred.

“Substantial Improvement” means any repair, reconstruction, rehabilitation, alteration, addition or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the improvement or repair is started. The term does not, however, include any project for improvement of a building required to correct existing health, sanitary or safety code violations identified by the building official having jurisdiction and that is the minimum necessary to assure safe living conditions.

“Swale” means a a manmade trench that: (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 vegetation suitable for soil stabilization, stormwater treatment, and nutrient uptake; (d) is designed to take into account the soil erodibility, soil percolation, slope, slope length, and drainage area so as to prevent erosion and reduce pollutant concentration of any discharge; and (e) has a channel invert no lower than one (1) foot above the water control elevation.

2.01.2 VERTICAL DATUM

Elevation data in engineering documents and construction drawings submitted to the District shall be based on the NAVD 88 datum. Requests for modifications to permits issued prior to the updated FEMA Flood Insurance Rate Maps that took effect on August 18, 2014 shall include on the paving, drainage and grading drawings the site-specific conversion factor between NGVD 29 and NAVD 88 data for historical record keeping purposes.

2.02 FINISHED FLOOR, 100 YEAR ELEVATIONS

All habitable structures shall be set at or above the higher of:

- 2.02.1 Federal Emergency Management Act (FEMA) Flood Studies
- 2.02.2 Broward County 100 Year Flood Studies
- 2.02.3 Eighteen inches (18”) above the nearest crown of road
- 2.02.4 Stage storage calculations for the 100-year, 3-day rainfall with zero discharge
- 2.02.5 Florida Building Code in accordance with the American Society of Civil Engineers Standard 24 – Flood Resistant Design and Construction (ASCE 24), latest edition

Nonresidential structures shall be set at or above the higher of Criterion 2.02.1, 2.02.2, and 2.02.4 enumerated herein and six inches (6") above the nearest crown of road of the adjacent roadway, whichever is higher.

Applicants shall verify that structural slabs-on-ground elevations are at least six inches (6") above the proposed berm elevation.

2.03 ROAD FLOOD CRITERIA

All roadways (public and private) and parking lots (public and private) shall have a minimum crown elevation (normal or inverted) set at the higher elevation of:

2.03.1 10-year flood criteria map of Broward County

2.03.2 Peak stage storage calculations for the 10-year, 1-day rainfall

The minimum crown elevation for inverted road sections shall refer to the center of the roadway and the minimum crown elevation for parking lots shall refer to the centerline of each drive aisle.

Rims of drainage structures may be set no more than six inches (6") below the edge of the roadway, parking lot or drive aisle provided the structure is located outside of the limits of the driving surface (e.g., inside a green area adjacent to the driving surface).

2.04 EXCAVATIONS

All lake, pond, canal, or other excavations shall be in accordance with South Florida Water Management District (SFWMD) Environmental Resource Permit (ERP) rules for Storage Areas.

2.04.1 Canal shall be defined as a surface water body intended primarily to convey flows and which has a very limited storage capacity for flood attenuation or water quality control (wet detention). A surface water body that provides flood or water quality detention storage shall be considered a lake, wetland, or pond.

2.04.2 Canal excavation shall have a side slope that provides stability against erosion from the top of bank (elevation 5.0 feet NGVD 29 [3.4 feet NAVD 88] minimum) to 3.0 feet below the water control elevation. Canal side slopes shall be no steeper than 4:1 (horizontal:vertical) from top of bank to 3.0 feet below the water control elevation. Below this point, side slopes shall be as the material permits, but no steeper than 2:1 unless a steeper slope can be justified based on supporting engineering and geotechnical information. Canals shall be excavated

to provide a minimum of ten feet (10') of depth below the water control elevation.

2.04.2.1 Existing District canals adjacent to properties applying for a stormwater management permit or plat approval shall be brought to the design standards of the District, including provision of a 20-foot Canal Maintenance Easement, and removal of all trees, shrubbery, and exotic species from canal water, banks, slopes, and maintenance easements.

2.04.3 Lake, wetland, or pond excavations shall have a side slope that provides stability against erosion. All shorelines shall be planted with aquatic vegetation in littoral zones around the perimeter of the lake, wetland, or pond excavation to create an average minimum littoral zone width of twenty feet (20') located within the vertical limits established in 2.04.5.2. As an alternative to planting the entire shoreline, an equivalent area of aquatic vegetation may be concentrated along common areas or the center of the lake or pond. Exhibit "T" provides a list of suggested species and planting depths. For shorelines planted with aquatic vegetation, side slopes shall be no steeper than 4:1 (horizontal to vertical) from the top of bank (minimum elevation of 5.0 feet NGVD 29 [3.4 feet NAVD 88] west of SW 100th Avenue, 4.0 feet NGVD 29 [2.4 feet NAVD 88] from SW 100th Avenue to the Florida Turnpike, 3.0 feet NGVD 29 [1.4 feet NAVD 88] east of the Florida Turnpike) to a depth of 2 feet below the water control elevation; thereafter, a flat slope shall be provided from the toe of the slope (2 foot deep) and extending 12 feet into the lake. Beyond that point, side slopes shall be as the material permits, but no steeper than 2:1 unless a steeper slope can be justified based on supporting engineering and geotechnical information.

For shorelines not planted with aquatic vegetation, side slopes shall be no steeper than 5:1 (horizontal to vertical) from the top of bank (minimum elevation of 5.0 feet NGVD 29 [3.4 feet NAVD 88] west of SW 100th Avenue, 4.0 feet NGVD 29 [2.4 feet NAVD 88] from SW 100th Avenue to the Florida Turnpike, 3.0 feet NGVD 29 [1.4 feet NAVD 88] east of the Florida Turnpike) NGVD 29 to a depth of 3 feet below the water control elevation. Beyond that point, side slopes shall be as the material permits, but no steeper than 2:1 unless a steeper slope can be justified based on supporting engineering and geotechnical information.

Lake or pond excavation shall have a minimum depth of ten feet (10') below the water control elevation and a maximum depth as governed by SFWMD Environmental Resource Permit (ERP) Applicant's

Handbook Volume II or a bottom elevation of (-) 40.0 feet NGVD 29 [(-) 41.6 feet NAVD 88], whichever is less.

2.04.4 Dry retention or detention areas shall have a side slope of 4:1 (horizontal to vertical) and shall be excavated no deeper than one foot (1') above the control elevation. Control elevation in the District is defined as elevation 4.00' NGVD 29 [2.4' NAVD 88] west of SW 100th Avenue (Palm Avenue/Nob Hill Road), 3.00' NGVD 29 [1.4' NAVD 88] from SW 100th Avenue to the Florida Turnpike, and 2.00' NGVD 29 [0.4' NAVD 88] east of the Florida Turnpike. The bottom of dry retention or detention areas shall be sodded.

2.04.4.1 Dry retention or detention areas shall be de-mucked and filled with permeable material that will allow the stored water to infiltrate into the ground water.

2.04.4.2 Retaining walls shall not be allowed within retention or detention areas except for retention or detention areas abutting retaining wall berms which shall be designed in accordance with the detail in Exhibit "I".

2.04.5 All side slopes of excavations shall be stabilized with a suitable vegetative cover in conformance with these criteria.

2.04.5.1 Except for littoral zones to be planted with aquatic vegetation, canal, lake, and pond side slopes shall be sodded (not seeded) from the top of bank to the water surface control elevation.

2.04.5.2 Lake, wetland, and pond side slopes shall be planted with aquatic vegetation from up to one foot (1) above to a depth of 1 foot (1') to 2 feet (2') below the water control elevation as recommended by the applicant's biologist, landscape architect or environmental engineer. The area planted shall have hydric soils suitable for wetland plants. A minimum hydric top soil (i.e., muck) depth of 0.5 feet shall be provided.

Wetland plantings adjacent to residential homes shall not exceed 4-feet in height for mature plants as measured from the control water elevation. Plantings of trees adjacent to residential homes and within District easements shall be subject to approval by the Board.

2.04.5.3 Exotic plant species as defined by the "Florida Exotic Pest Plant Council" (EPPC), such as cattails, melaleuca, Brazilian

pepper, Australian pine, laurel fig (ficus) and others, shall not be planted on canals, lakes, wetlands, ponds, or District property and Right-of-way. These plants are considered nuisance species because they are not native to Florida, exhibit rapid growth, outcompete native vegetation, and can clog lakes and canals. Exhibit "U" provides a copy of the EPPC list.

2.04.5.4 Permanent signs shall be visibly posted on lake and pond side slopes planted with suitable aquatic vegetation to prevent removal or spraying with harmful chemicals. The sign panel must be visible above the expected mature height of aquatic plantings. Exhibit "Y" provides a typical detail for the required signage. The location and spacing of the signs shall be determined by the District.

2.04.5.5 Restoration and repair of lake, wetland, and pond side slopes shall require plans, specifications, and supporting documentation submitted to the District Manager for review and approval. The District Manager may require any such plans to be signed and sealed by a Florida Professional Registered Engineer.

Restoration and repair of side slopes shall utilize gradual slopes and erosion control blankets made of natural fibers, and the slopes sodded as per section 2.04.5.1. For more severe erosion, stabilization shall be accomplished using a combination of filter fabric and interlocking concrete blocks sodded above the water line.

The use of seawalls, bulkheads, and retaining walls is discouraged. However, if a seawall, bulkhead, or retaining wall is proposed, the top of such wall shall be constructed no higher than 1 foot above the lake control elevation and shall be aesthetically consistent with the established pattern of existing seawalls, bulkheads, and retaining walls within the lake. Plans for seawalls, bulkheads, and retaining walls shall be signed and sealed by a Florida Professional Registered Engineer.

2.04.6 All lake, wetland, pond, canal or other waterway shall have a stabilized maintenance easement twenty feet in width, measured from the top of bank, with a maximum gradient of 20:1. This twenty feet (20') shall be considered a setback for any buildings, structures, or water bodies and shall be suitable for vehicular traffic. For the purpose of this

paragraph, structure is defined as any installed, or erected object on or in the ground.

2.04.7 Where a conservation easement is in place with Broward County and/or South Florida Water Management District the 20-foot Lake Maintenance Easement (LME) may be reduced to a 10-foot LME to allow for foot traffic only. However, the 20-foot setback to any building shall still apply. In addition, proper easements for maintenance and access shall be provided for any drainage structures or culverts.

2.04.8 All lake, pond, canal, or other waterway maintenance areas shall be cleared of all trees and shrubbery and no new trees or shrubbery shall be planted. Lake maintenance easement areas that are reduced to 10 (10) feet adjacent to conservation easements may be planted with appropriate ground cover plants such as sedges and rushes in lieu of sodding.

2.04.9 All lakes, ponds, or other waterways shall be provided with a concrete boat ramp from the top of bank to two feet below control elevation. The ramp shall be twelve feet (12') in width. A stabilized easement twenty feet (20') in width shall be provided from the nearest roadway to the ramp.

2.04.10 No natural or artificial lake, pond, wetland, canal, other waterway, detention, or retention area— collectively referred to herein as a water body— shall be partially filled unless the remaining portion of the water body is hydraulically connected to a proposed water body and the storage volume of the proposed water body is greater than the volume of the existing water body to be filled. Otherwise, no water body shall be filled unless a variance is granted by the Board of Commissioners of the Central Broward Water Control District. This section does not apply to the filling of water bodies having a bottom elevation higher than the elevation depicted in the Broward County Water Table Map for Average Wet Season, or the construction of culverts within the secondary system as covered under Section 2.12, Culverts.

2.04.10.1 Any water body to be filled, excluding the construction of culverts within the secondary system as covered under Section 2.12 shall be accompanied by the following.

A. Survey and engineering data to include:

- a. area at top of bank, water control elevation, and bottom of water body to be filled
- b. maximum/minimum depth from top of bank to bottom of water body
- c. cross sections (top-of-bank to top-of-bank) every 100' of perimeter at top of bank
- d. volume of fill to be placed from the District water control elevation to the 100-year flood stage at the top of bank
- e. volume of fill to be placed from the District water control elevation to the bottom of the water body
- f. volume of material to be dredged above and below the District water control elevation

B. Biological report showing no adverse impacts to aquatic life as a result of the proposed work. This section does not apply to the filling of dry detention or dry retention areas. The report must include:

- a. the methodology and data sources used to assess aquatic life (both flora and fauna) present, or could potentially be present, at the subject site(s).
- b. an assessment of flora and fauna present, or could potentially be present, at the subject site(s).
- c. a determination with respect to whether the proposed work will adversely affect aquatic life at the subject site(s).
- d. If the determination concludes that the proposed work could adversely affect aquatic life, then it must include the proposed measures necessary to mitigate the impacts resulting from the proposed work at each site.

2.04.11 A variance in accordance with Section 7, Variance and Appeals, shall be required for underground or vault storage systems proposed for flood control or floodplain compensation storage. The District will only consider these requests when a hardship is proven and when open storage systems (lakes and retention areas) are not feasible to meet the criteria of the District.

2.04.11.1 Underground storage systems shall provide for diversion of the first flush into isolated chambers with observation ports and full maintenance access with the intent of capturing at least 90% of sediments. These chambers shall be accessible for periodic cleaning using readily available equipment.

- 2.04.11.2** Prior to installation of the underground system, soils with poor percolation capacity, such as muck, shall be removed and replaced with permeable soils that will allow stored water to infiltrate into the ground.
- 2.04.11.3** Underground storage shall amount to 150% of the required storage for vault storage and 200% of the required storage for seepage systems as determined by routing calculations. For underground storage in seepage systems, the SFWMD ERP Exfiltration Trench formula parameter " V_{add} " shall equal the flood control or floodplain compensation volume and the Factor of Safety, FS, shall be 2.0 (i.e., $V_{add} \times FS = 200\%$ of required storage volume). Refer to the SFWMD ERP Information Manual, Part III – References and Design Aids, Appendix G, Exfiltration Trenches, Equation 7 and 8.
- 2.04.11.4** A 3-year letter of credit or 3-year bond for 110% of the value of the underground system shall be provided as a condition of approval of the variance and stormwater management permit.
- 2.04.11.5** The stormwater management permit shall be renewed **annually** in accordance with Section 1.06, Renewals, as a condition for final release of the 3-year bond or letter of credit.
- 2.04.11.6** **Minimum operation, inspection and maintenance procedures or schedules shall be provided to CBWCD for review and approval prior to approval of the as-built drawings.**

2.05 WATER QUALITY RETENTION VOLUME

All projects shall provide on-site retention for one inch of run off from the total project area, or $2^{1/2}$ times SFWMD ERP percent impervious, whichever is greater. Additionally, commercial or industrial sites shall provide dry retention for

one half inch (1/2") of run off from the total project area. The designer shall allow for SFWMD ERP criteria as a minimum. In addition, the District shall require dry pretreatment for the first one half inch (1/2") runoff for roadway projects and other projects where the impervious area exceeds 60% of the total area.

All retention areas (dry and wet) must be capable of percolating the water quality design storage volume within 72 hours. One "open hole test" in accordance with SFWMD ERP Applicant's Handbook Volume II, shall be performed for each 500 feet or fraction thereof of retention area perimeter to determine the hydraulic conductivity of the soil. Copies of test results along with hydraulic calculations (Exhibit "X") shall be submitted to the District along with the permit application.

Projects located upstream of a secondary canal where the canal flow or elevation is controlled by a District operated control structure are exempt from the water quality retention requirement described in 2.05 except that dry pretreatment shall be provided on-site for commercial and industrial projects, roadway projects, and other projects where the impervious area exceeds 60% of the total area.

2.06 ADJACENT PROPERTY

In addition to the grant of easement required in Section 1.04 of this criteria, applicants shall be required to design and/or construct the drainage system so as not to preclude existing upstream drainage from reaching a District facility.

2.06.1 No developed property shall shed water on adjacent land. The applicant shall erect either a wall or berm, or combination thereof, to retain the runoff from the twenty-five year, three-day storm event.

2.06.2 Perimeter berms shall be designed in accordance with Exhibit "I". Retaining walls and foundations shall be located sufficiently away from the applicant's property line to permit construction of the wall without encroaching into adjacent property, unless the applicant secures a written letter of no objection from the affected property owner to construct the wall prior to construction commencement.

2.06.3 Perimeter berm elevations shall be 6 inches (6") below structural slab elevations.

2.07 DISCHARGE CRITERIA

The maximum allowable discharge into the District's canals is outlined in SFWMD ERP Applicant's Handbook Volume II, and is repeated herein. In the west C-11 basin (west of SW 100th and/or Palm Avenue) maximum discharge is three quarters of one inch (3/4") per day, or 20 CSM (cubic feet per second per square mile). In the east C-11, maximum discharge is one and one half inches per day, or 40 CSM. Maximum allowable discharge is computed on the twenty-five year, three-day event.

Projects located upstream of a secondary canal where the canal flow or elevation is controlled by a District operated control structure are exempt from the maximum discharge requirement.

- 2.07.1** Project discharge shall be the sum of individual discharge values determined for the project. In determining allowable discharge, the capacity of all elements in the control structure (notches, orifices, etc.) shall be considered.
- 2.07.2** Discharge shall be evaluated at the control elevations established herein.
- 2.07.3** Minimum allowable orifice size shall be the equivalent of a 3-inch diameter for circular orifices, or the equivalent for other geometries.
- 2.07.4** All properties shall provide for a positive outfall with the capacity to discharge the allowable discharge.

2.08 RUNOFF

Ground storage capacity may be taken into account in determining total runoff volume. Storage capacity of soils are described in the SFWMD ERP Applicant's Handbook Volume II and should be used. For the purpose of determining soil storage, the wet season water table shall be the control elevations established by the District; 4.00' NGVD 29 [2.4' NAVD 88] west of SW 100th Avenue (Palm Avenue/Nob Hill Road), 3.00' NGVD 29 [1.4' NAVD 88] from SW 100th Avenue to the Florida Turnpike, and 2.00' NGVD 29 [0.4' NAVD 88] east of the Florida Turnpike.

2.08.1 ROOF RUNOFF

Roof runoff from roofs of 2500 square feet or more, and from zero lot line housing, shall be specifically addressed on the plans as it relates to erosion and protection of adjacent property. Details shall be provided which indicate points at which runoff will be collected and the method utilized to control it.

Drainage easements in accordance with Section 3.04 of these criteria shall be required.

2.09 GRADING

Grade slopes shall be away from structures to be protected and toward drainage facilities. A grading plan shall be prepared and submitted to the District; said plan shall clearly indicate that no runoff from the applicants project shall discharge or flow onto adjacent property (refer also to 2.06 this criteria).

2.09.1 Roadways and roadway swale sections shall have a minimum gradient of three tenths of one percent (0.3%) or .003 foot per foot. A maximum run of three hundred feet (300') between high point and low point shall be permitted. No roadway swale shall be permitted which has an elevation less than one foot above the District's Control Elevation.

2.09.2 In addition to a longitudinal gradient herein specified, all roadways and parking lots shall have a minimum cross pitch (transverse gradient) of one eighth of an inch per foot (1/8" per foot) or one percent (1.0%), and a maximum gradient of five percent (5.0%).

2.10 DRAINAGE SYSTEMS

All roadways and parking lots shall have a drainage system designed to convey the rainfall from a three-year rainfall. The rational formula, $Q = CIA$, shall be used for design. The rainfall intensity (I) shall be obtained from the Florida Department of Transportation (FDOT) Zone 10 rainfall curves. A breakdown of this curve is included herein. The minimum time of concentration shall be ten (10) minutes. Design of the drainage system shall be such that no hydraulic gradient (energy line) is above the frame and/or grate of any drainage structure in the system.

2.10.1 Minimum drain pipe diameter in the District:

- "Building Storm Drains" and "Building Storm Sewers" (as defined in the Florida Building Code) downstream to first yard drain, catch basin, or manhole: size according to the

Florida Building Code – Plumbing – Storm Drainage chapter, latest edition

- Pipes that: convey runoff from greater than 0.25 acres of contributory drainage area, or; form part of a storm sewer main trunk line that discharges into a stormwater detention or retention facility, or outfall: 15” minimum
- Perforated or slotted pipe in exfiltration trenches, excluding under drain systems in detention/retention areas: 15” minimum
- Lake interconnecting pipes: 48” minimum

2.10.1.1 The maximum pipe spacing between structures shall be as follows:

<u>Diameter (inches)</u>	<u>Spacing (feet)</u>
Up to 18”	300’
24” to 36”	400’
42” and up	500’

2.10.2 The following drainage pipe materials are permitted which shall utilize the following roughness coefficients “N.” Pipes under roadways in public rights-of-way shall be reinforced concrete pipe unless other pipe materials are allowed by the entity that owns the right-of-way.

<u>Pipe Material</u>	<u>MANNING “N”</u>
Concrete	.012
CMP	.021
CAMP	.019
P.V.C.	.009
HDPE	.012

2.10.3 Hydraulic design shall utilize a static tail water elevation equal to the stage at the end of hour 12 of stage storage calculations for the 3-year, 1-day rainfall.

2.10.4 Catch basins and drainage collection structures shall be designed with an eighteen inch (18”) vertical sump from the invert elevation (or bottom of baffle) to the bottom of the structure. In addition, a twelve inch (12”) diameter open sump, filled with washed grade rock, no larger than one and one half inches (1^{1/2}”) shall be placed in the base of the structure. Prior to discharge to any body of water or any seepage trench, a pollution retardant baffle shall be installed.

- 2.10.5** All outfalls shall be protected with an appropriately designed headwall of either concrete or rip-rap. In the case of rip-rap, a six inch (6") poured concrete cap is required (Exhibits "H" or "K").
- 2.10.5.1** The top of the headwall shall be set at the crown elevation of roadway for culvert crossings of the secondary canals (Exhibit "K").
- 2.10.5.2** The top of the headwall shall be set no higher than the water control elevation (Exhibit "H").
- At the discretion of the District Manager or Engineer, headwalls of deep outfalls to lakes or ponds may be replaced with a metal pipe attached to a concrete jacket in accordance with FDOT design standards.
- 2.10.6** When routing stormwater to a wet detention treatment facility, inlets to the facility shall be directed to the opposite side of the facility from the discharge structure.
- 2.10.7** Pipes interconnecting lake systems shall be sized to comply with all the provisions of this Section 2, Engineering Criteria. Stage-storage routing shall be performed to demonstrate that interconnected lakes comply with the criteria for all design storm events (3-year, 10-year, 25-year, and 100-year).

2.11 SEEPAGE SYSTEMS

Seepage systems may be used for purposes of water quality retention, but shall not be used for purposes of flood control. The storage and exfiltration capacity of a seepage system shall not be credited to pipe routing calculations. The storage and exfiltration capacity of seepage systems may be credited toward stage-storage routing calculations, provided that the maximum amount of credit shall not exceed the water quality design volume of the seepage system. Excess seepage system capacity beyond the required water quality design volume shall not be credited toward stage-storage routing calculations.

On-site subsurface retention, seepage system, or french drain shall be considered as being a perforated pipe system (fifteen inch (15") minimum diameter) surrounded by three quarter of an inch (3/4") washed rock, and protected on four (4) sides by a pervious geotextile (mirafi, typar).

- 2.11.1** Design and length of seepage systems shall be in accordance with SFWMD ERP Information Manual, Part III – References and Design Aids, Appendix G, Exfiltration Trenches . An applicant may include the parameter " V_{add} " to determine the length of exfiltration

trench required to store any additional volume beyond the required water quality treatment volume only if the applicant receives approval for the use of underground storage in accordance with Section 2.04.11.

- 2.11.2** One standard open hole falling head percolation test shall be taken for each five hundred feet (500') or fraction thereof of seepage system designed, copies of which shall be submitted to the District with hydraulic calculations.
- 2.11.3** Depth to water table shall be from finished grade to the District Control elevation 4.00' NGVD 29 [2.4' NAVD 88] west of SW 100th Avenue (Palm Avenue/Nob Hill Road), 3.00' NGVD 29 [1.4' NAVD 88] from SW 100th Avenue to the Florida Turnpike, and 2.00' NGVD 29 [0.4' NAVD 88] east of the Florida Turnpike.
- 2.11.4** No seepage system shall be considered as dry retention unless the invert of the perforated pipe is at or above the District Control Elevation 4.00' NGVD 29 [2.4' NAVD 88] west of SW 100th Avenue (Palm Avenue/Nob Hill Road), 3.00' NGVD 29 [1.4' NAVD 88] from SW 100th Avenue to the Florida Turnpike, and 2.00' NGVD 29 [0.4' NAVD 88] east of the Florida Turnpike.
- 2.11.5** Maintenance structures shall be placed at the terminal ends of all french drains/seepage systems and debris baffles shall be placed on the drain field side of all drainage inlets.

2.12 CULVERTS

Culverts shall be installed where roadways and driveways cross District canals. The size of new culverts or culvert replacements shall be determined by the District Engineer, but in no case shall be less than required to pass the allowable discharge for the basin or 48 inches in diameter, whichever is higher. The applicant shall provide calculations to demonstrate that the proposed culvert will pass the 100-year peak design flows with a head loss under 0.10 feet including entrance losses; or has the equivalent hydraulic capacity of 110% of the design cross-section of the channel as determined by the District. Additionally, the applicant will be required to excavate the canal to two feet (2') below the proposed culvert invert for a distance of fifty feet (50') upstream and downstream of the crossing. No driveway culvert shall be installed within fifty feet (50') of an existing culvert. As a condition of permitting, the District may require dedication of a roadway easement for adjacent property owners.

- 2.12.1** Notwithstanding the provisions of this section, no additional culverts will be permitted in the District's S-35 canal (Hancock Road), N-27 canal (Boy Scout Road), N-25 canal (SW 37 Avenue), S-22 canal

(SW 106 Avenue), S-24 canal (SW 48 Street), and S-25 canal (Hiatus Road). All future crossings on these canals shall be made by a bridge with a clear span of 15 feet (15') and a minimum bottom of structure elevation of 6.0' NGVD 29 [3.4' NAVD 88]. An applicant may utilize a concrete culvert, box culvert, or arch culvert in lieu of a bridge crossing provided the culvert creates no more than 0.01' of total head loss (including form, entrance and exit losses) and meets the other requirements of this Section. The District may impose additional conditions such as improving the conveyance capacity of existing nearby culverts as mitigation for anticipated head loss resulting from the addition of a culvert in the Canals referenced in this sub-section.

- 2.12.2** No culverts in the secondary canal system shall exceed 100 feet without a variance.
- 2.12.3** All culverts in the secondary canal system shall be made of reinforced concrete.
- 2.12.4** The culvert crown elevation shall be set at the District's water control elevation: 4.00' NGVD 29 [2.4' NAVD 88] west of SW 100 Avenue (Palm Avenue/Nob Hill Road), 3.00' NGVD 29 [1.4' NAVD 88] from SW 100 Avenue to the Florida Turnpike, and 2.00' NGVD 29 [0.4' NAVD 88] east of the Florida Turnpike.
- 2.12.5** A minimum safety factor of 6 inches shall be added to the minimum required culvert size.
- 2.12.6** Culvert replacements and driveway culverts on Secondary Canals that provide access to buildings undergoing substantial improvement shall conform to the design requirements of new culverts.

2.13 UTILITY CROSSINGS

- 2.13.1** Overhead power, telephone, cable, and other utility crossings must have a minimum vertical clearance of twenty five feet (25') between low wire elevation and the elevation of the maintenance berm or natural ground.
- 2.13.2** Over water crossings shall be supported on piling with a minimum spacing between piles of twenty feet (20'). A clear height of six feet (6') from the District control elevation to the underside of any portion of the structure shall be provided.

- 2.13.3** Submarine or subaqueous crossings of any nature shall be laid to a depth of two feet (2') below the depth and cross section of the District's canal's ultimate or design bottom elevation. Additionally, a concrete cover eight inches (8") in thickness shall be placed immediately above the crossing if utilizing a "cut and cover" excavation method. The cover shall be the full width of the canal and shall extend two feet (2') outside the crossing material. If utilizing a horizontal directional drilling installation method, the minimum clearance between the canal bottom and the outside of the pipe shall be 2'. The applicant shall install an object marker with the appropriate message along the centerline of the crossing and within five feet (5) of the top of bank on both sides of the canal. The message shall describe the type of utility crossing (e.g., Gas, Electric, Sewer, Cable, etc.)
- 2.13.4** Notwithstanding the provisions of this section, the utility system owner which owns or will own the utility, shall be required to enter into a hold harmless and indemnification agreement, indemnifying and holding the District harmless from any and all damages as a result of the utility line being constructed in the District's property.

2.14 DOCKS, DECKS, AND OTHER STRUCTURES

- 2.14.1** Docks and Decks may be erected in a drainage, flowage and storage easement, or lake maintenance easement with permission of the District.
- 2.14.1.1** In order to obtain permission the property owner shall be required to enter into an agreement with the District. The agreement is described in Exhibit "S", Dock and Deck Agreement.
- 2.14.2** No structure of any nature (refer to 2.04.6) shall be erected which would encroach into a canal, canal right-of-way, canal easement, or canal maintenance easement.

2.15 SINGLE FAMILY HOMES

Single family home sites not covered under a District approved stormwater management permit shall, at a minimum, comply with the following requirements. Compliance with other provisions of the engineering criteria shall be at the discretion of the District Manager.

- 2.15.1** Prior to initiating any construction activity, including clearing grubbing, or earth moving operations, applicants shall submit two sets of plans and the information in Exhibit "W", Checklist for Single

Family Homes Plan Approval, for review and approval by the District Manager.

- 2.15.2** No developed property shall shed water on adjacent land. The applicant will be required to erect either a wall or berm, or combination thereof, to retain the runoff from the twenty-five year, three-day storm event.
- 2.15.3** At a minimum, thirty percent (30%) of the site shall remain at existing grade to provide for storage of the 25-year, 3-day, rain storm event. Proposed grade shall be one foot above elevation 4.00' NGVD 29 [2.4' NAVD 88] west of SW 100 Avenue (Palm Avenue/Nob Hill Road), 3.00' NGVD 29 [1.4' NAVD 88] from SW 100 Avenue to the Florida Turnpike, and 2.00' NGVD 29 [0.4' NAVD 88] east of the Florida Turnpike. Higher proposed elevations may be allowed provided that ground elevations in the general area are naturally higher and that the proposed grade elevation is no higher than ground elevations of adjacent properties. The surface water management area (30% of the site) shall be designated and recorded with the Broward County Board of County Commissioners, County Records Division, Recording Section, 115 South Andrews Avenue, Room 114, Fort Lauderdale, FL 33301, utilizing the forms provided in Exhibit "Z".
- 2.15.4** If offsite discharges are designed to occur during 25-year and lesser storms, the applicant shall utilize best management practices, in accordance with these engineering criteria, to reduce pollutant discharges.
- 2.15.5** Prior to receiving the Certificate of Occupancy, the applicant shall submit as-built drawings in accordance with the Checklist for Single Family Homes Plan Approval (Exhibit "W") for the review and approval of the District Manager. Applicant shall grant District staff access to the property for the purpose of conducting visual inspections.

2.16 FLOOD PLAIN ENCROACHMENT

No net encroachment into the floodplain shall be allowed that adversely affects the existing rights of others. With regard to runoff storage, the volume of useful storage available to the basin shall not be decreased as a result of proposed development or redevelopment. The area subject to no net encroachment shall extend from the 100-year water surface elevation to 4.00' NGVD 29 [2.4' NAVD 88] west of SW 100 Avenue (Palm Avenue/Nob Hill Road), 3.00' NGVD 29 [1.4' NAVD 88] from SW 100 Avenue to the Florida Turnpike, and 2.00' NGVD 29 [0.4' NAVD 88] east of the Florida Turnpike. Calculations to demonstrate no net

floodplain encroachment shall follow the same guidelines as the SFWMD ERP Applicant's Handbook Volume II. In addition, the applicant shall provide calculations demonstrating that the allowable storage to the basin has not been reduced at the District 100-year flood encroachment elevation. The District 100-year flood encroachment elevation shall be provided by the District Engineer.

A request for a variance from this Section does not require demonstrating a genuine hardship with respect to Sub-Section 7.02.1 of the Criteria. Any variance requested shall be the minimum necessary deviation from the Criteria to afford relief considering the flood heights or flood hazard. In lieu of demonstrating a genuine hardship, the District may require alternative mitigation measures be provided as part of any request for variance. Alternative measures include, but not necessarily limited to, upgrading existing secondary canal culverts, providing additional off-site flood plain storage, or providing a basin-specific capital improvement or maintenance project.

- 2.16.1** Applicants have the option of performing floodplain encroachment calculations using the guidelines of the SFWMD ERP Applicant's Handbook Volume II, or providing a lake size of 25% of the area of the property for properties exceeding 10 acres in size, or 15% of the property for properties of 10 acres or less. In either case, these percentages are the maximum lake area required after the applicant demonstrates to the District Engineer that the site grading has been lowered to the maximum extent practicable. Lake areas shall be measured at the top of bank minimum elevation of 6.00' NGVD 29 [3.40' NAVD 88] west of SW 100 Avenue (Palm Avenue/Nob Hill Road), 5.00' NGVD 29 [2.40' NAVD 88] from SW 100 Avenue to the Florida Turnpike, and 4.00' NGVD 29 [2.4' NAVD 88] east of the Florida Turnpike.
- 2.16.2** Applicants have the option of providing a lake or a retention or detention area, provided that the site storage of the retention or detention area is no less than the site storage provided by the required lake area, as measured from the lake's top of bank elevation to the 100-year water surface elevation of the nearest District canal.
- 2.16.3** Projects located upstream of a secondary canal where the canal flow or elevation is controlled by a District operated control structure shall maintain pre-development flood plain storage volumes on-site, or provide the necessary flood plain storage volume based on a site-specific engineering analysis that complies with District criteria, whichever is greater.

2.17 LANDSCAPING

Stormwater management permit applications shall include a landscape plan identifying proposed vegetation and existing vegetation to remain along with a legend identifying all species. The landscape plan shall show the location of all vegetation in relation to existing or proposed easements, right-of-ways, stormwater management systems, drainage structures, and overall site plan.

Easements dedicated to the District (canal easements, canal maintenance easements, drainage, flowage and storage easements, lake maintenance easements, drainage easements, and ingress/egress easements) shall be cleared of all trees, shrubbery, and exotic plant species, and no new trees or shrubbery shall be planted.

2.17.1 Trees where the lateral extent of the drip line of the canopy at mature height is expected to encroach within ten (10) feet of the near edge of a storm sewer shall not be planted closer than ten (10) feet from the near edge of a storm sewer pipe.

2.18 EXHIBITS

Exhibits referenced in these regulations and criteria form a part thereof and are incorporated by reference. In the case of conflict, the more stringent shall apply. Copies of the exhibits are available at the District's office and on the District's web site centralbrowardwcd.org.