ENVIRONMENTAL RESOURCE PERMIT APPLICANT'S HANDBOOK VOLUME II

FOR USE WITHIN THE GEOGRAPHIC LIMITS OF THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT

EFFECTIVE JUNE 28, 2024

Volume II (including Appendices A, B, C, and D) is incorporated by reference in Subsection 40E-4.091(1)(a) and Rule 62-330.010, F.A.C.

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Contents

PART I – INTRODUCTION, ORGANIZATION, APPLICABILITY

1.0 Introduction

This Applicant's Handbook Volume II (AH Vol. II) accompanies Chapter 62-330, Fla. Admin. Code (F.A.C.), and the "Environmental Resource Permit AH Vol. I (General and Environmental)" (AH Vol. I). AH Vol. I is applicable to all environmental resource permit (ERP) applications, and provides background information on the ERP program, including:

(a) Points of contact.

(b) A summary of the statutes and rules that are used to authorize and implement the ERP program.

(c) A summary of the types of permits, permit thresholds, and exemptions.

(d) Procedures used to review exemptions and permits.

(e) Conditions for issuance of an ERP, including the environmental criteria used for activities located in wetlands and other surface waters (OSWs).

(f) Erosion and sediment control practices to prevent water quality violations.

(g) Operation and maintenance requirements.

This Volume is designed to be applicable only to those ERP applications that involve the design of a stormwater management (SWM) system that requires an ERP as provided in Chapter 62-330, F.A.C., or Section 403.814(12), Fla. Stat. (F.S.). This volume also contains South Florida Water Management District's (District) specific appendices for regionally specific criteria such as exfiltration trench systems, soil storage values, and above ground impoundments (AGIs).

Projects that qualify for a general permit in Section 403.814(12), F.S., are not regulated under Chapter 62-330, F.A.C. However, AH Vol. II contains design and performance standards that are relevant to the design of projects that qualify for that general permit.

This Volume provides specific, detailed stormwater quality and quantity design and performance criteria for SWM systems regulated by the District through the ERP program authorized under Part IV of Chapter 373, F.S. This Volume explains, and provides more detail on, the rule criteria for stormwater quality and quantity contained in Chapter 62-330, F.A.C. In cases where conflicting or ambiguous interpretations of the information in this Volume results in uncertainty, the final determination of appropriate procedures to be followed will be made using Chapters 120 and 373, F.S., applicable F.A.C. rule chapters, and best professional judgment of Agency staff.

Both AH Vols. I and II are adopted by reference in Chapter 62-330, F.A.C. AH Vol. II is also incorporated in Rule 40E-4.091, F.A.C. Both AH Vols. I and II are rules of the Florida Department of Environmental Projection ("Department") and the District. The term "Agency," where used in this Volume, shall apply to the Department, the District, or a delegated local government, as applicable, in accordance with the division of responsibilities specified in the Operating Agreements incorporated by reference in Subsection 62-330.010(5) and Rule 40E-4.091, F.A.C., except where a specific Agency is otherwise identified. Volume II applies whether an ERP application is processed and acted on by the Department, the District, or a delegated local government. AH Vols. I and II are written to provide more detail and clarity to the public in understanding the statutory and rule provisions that implement the ERP program.

1.1 Criteria Objectives

The criteria contained herein were established with the primary goal of meeting water resource objectives as set forth in Part IV of Chapter 373, F.S. Performance criteria are used where possible. Other methods of meeting overall objectives of the District and which meet the conditions for issuance set forth in Rules 62-330.301 and 62-330.302, F.A.C., will be considered. Compliance with the criteria herein constitutes a presumption that the project proposal is in conformance with the conditions for issuance set forth in Rules 62-330.301 and 62-330.302, F.A.C. Pursuant to Section 373.4131, F.S., if a SWM system is designed in accordance with the criteria in this Volume or if a system is constructed, operated, and maintained for stormwater treatment in accordance with a valid Environmental Resource Permit or exemption under Part IV of Chapter 373, the discharges from the system are presumed not to violate applicable state water quality standards.

An applicant may propose alternative designs to those provided in this Volume for consideration by the Agency. However, reasonable assurance in the form of plans, test results, or other information must be provided by the applicant to demonstrate that the alternative design meets the conditions for issuance (Rules 62-330.301 and 62-330.302, F.A.C.)

1.2 District-Specific Thresholds

Within Miami-Dade County, an ERP is not required for the construction, alteration, or operation of a SWM system in uplands provided that the system meets all the conditions below:

(a) The project area is less than 40 acres with positive stormwater outfall, or the project area is less than 320 acres with less than 160 acres of impervious area, and no positive stormwater outfall.

(b) The design plans and calculations are signed and sealed by a registered professional.

(c) The system meets the criteria specified in Rules 62-330.301 and 62-330.302, F.A.C.; and

(d) The system is not located in natural water bodies, wetlands, waters of the state, or an Outstanding Florida Water as listed in Rule 62-302.700, F.A.C.

1.3 District-Specific Exemptions

There are no exemptions specific to the District's geographical area. All applicable exemptions can be found in Rules 62-330.051-.0511, F.A.C.

PART II – GENERAL CRITERIA

2.0 General Criteria for all SWM Systems

This Volume applies to the design of SWM systems that require a permit under Chapter 62-330, F.A.C., or a general permit as provided under Section 403.814(12), F.S. Additional special basin criteria within the District can be found in Chapter 40E-41, F.A.C (for Western C-9 Basin, Kissimmee River Basin, C-51 Basin, and the Water Preserve Area Basins of Palm Beach and Broward Counties), Chapter 40E-61, F.A.C (for the Northern Everglades Basins), and Chapter 40E-63, F.A.C (for the Everglades Agricultural Area Basin and C-139 Basin).

2.1 Definitions

The definitions set forth in AH Vol. I, Section 2.0(a) are applicable to AH Vol. II.

2.1.1 "Above Ground Impoundment (AGI)" – a type of dam, as defined by AH Vol. I, that stores runoff above the average surrounding natural ground. Refer to Appendix B of this Volume.

2.1.2 "Control device" – Element of a discharge structure which allows the gradual release of water under controlled conditions. It is sometimes referred to as the bleed- down mechanism, or "bleeder."

2.1.3 "Control elevation" – The lowest elevation at which water can be released through the control device.

2.1.4 "CSM" – Cubic feet per second per square mile of contributing drainage area (cfs/mi^2).

2.1.5 "Detention volume" – The volume of open surface storage behind the discharge structure between the overflow elevation and control elevation.

2.1.6 "District" – The South Florida Water Management District.

2.1.7 "Elevation" – Height in feet above mean sea level according to the National Geodetic Vertical Datum of 1929 (NGVD) or the North American Vertical Datum of 1988 (NAVD).

2.1.8 "Exfiltration trench" – A subsurface retention system consisting of a conduit such as perforated pipe surrounded by natural or artificial aggregate which temporarily stores and infiltrates stormwater runoff.

2.1.9 "Historic discharge" – The peak rate at which runoff leaves a parcel of land by gravity in an undisturbed/natural state, the pre-development rate of discharge, or the legally allowable discharge in effect at the time of permit application.

2.1.10 "Mean annual higher high tide" – The arithmetic mean of the higher high-water elevations observed at a location or tidal station over the National Tidal Datum Epoch. Only the higher high water of each pair of high waters of the tidal day is included in the mean.

2.1.11 "Overflow elevation" – Design elevation of a discharge structure at which, or below which, water is contained behind the structure, except for that which leaks out, or bleeds out, through a control device down to the control elevation.

2.1.12 "Regulated activity" – The construction, alteration, operation, maintenance, abandonment, or removal of a SWM system, including dredging and filling, regulated pursuant to Part IV, Chapter 373, F.S.

2.1.13 "Retention/detention area (dry)" – Water storage area with bottom elevation at least 1.0-feet above the control elevation of the area. Sumps, mosquito control swales, and other minor features may be at a lower elevation.

2.1.14 "Retention/detention area (wet)" – A water storage area with bottom elevation lower than 1.0-feet above the control elevation of the area.

2.1.15 "Tailwater" – The receiving water elevation (or pressure) at the final discharge point of the SWM system.

2.1.16 "Water management areas" – Areas to be utilized for the conveyance, treatment, or storage of stormwater.

2.1.17 "Wet detention systems" – Permanently wet ponds which are designed to slowly release collected stormwater runoff through an outlet structure.

2.2 Professional Certification

All construction plans and supporting calculations submitted to the Agency for SWM systems that require the services of a registered professional must be signed, sealed, and dated by a registered professional.

2.3 Water and Wastewater Service and Concurrent Processing

(a) Potable water, irrigation, and wastewater facilities must be identified. An applicant for an ERP must provide documentation on how these services are to be provided. If wastewater disposal is accomplished on-site, additional information shall be requested regarding separation of waste and SWM systems.

(b) For ERPs, if on-site consumptive water use withdrawals are also proposed for which a District water use permit is required, the ERP and water use permits must be processed simultaneously. These requirements are dependent upon site specific water resource limitations. It is recommended that the applicant contact Agency staff prior to filing an application to determine whether the proposed project necessitates simultaneous environmental resource and water use permitting.

2.4 Retrofits of Existing SWM Systems

(a) A stormwater retrofit project is typically proposed by a county, municipality, state agency, or water management district to provide new or additional treatment or attenuation capacity, or improved flood control to an existing SWM system or systems. Stormwater retrofit projects shall not be proposed or implemented for the purpose of providing the water quality treatment or flood control needed to serve new development or redevelopment.

Example components of stormwater retrofit projects are:

1. Construction or alteration that will add additional treatment or attenuation capacity and capability to an existing SWM system.

2. Modification, reconstruction, or relocation of an existing SWM system or stormwater discharge facility.

3. Stabilization of eroding banks through measures such as adding attenuation capacity to reduce flow velocities, planting of sod or other vegetation, and installation of rip-rap boulders.

4. Excavation or dredging of sediments or other pollutants that have accumulated as a result of stormwater runoff and stormwater discharges.

(b) Stormwater Quality Retrofits

1. The applicant for a stormwater quality retrofit project must provide reasonable assurance that the retrofit project itself will, at a minimum, provide additional water quality treatment such that there is a net reduction of the stormwater pollutant loading into receiving waters. Examples are:

   a. Addition of treatment capacity to an existing SWM system such that it reduces loadings of stormwater pollutants of concern to receiving waters.

   b. Adding treatment or attenuation capability to an existing developed area when either the existing SWM system or the developed area has substandard treatment and attenuation capabilities, compared to what would be required for a new system requiring a permit under Part IV of Chapter 373, F.S.; or

   c. Removing pollutants generated by, or resulting from, previous stormwater discharges.

2. If the applicant has conducted, and the Agency has approved, an analysis that provides reasonable assurance that the proposed stormwater quality retrofit will provide the intended pollutant load reduction from the existing system or systems, the project will be presumed to comply with the requirements in AH Vol. I and Part IV of this Volume.

3. The pollutants of concern will be determined on a case-by-case basis during the permit application review based upon factors such as the type and intensity of land use, existing water quality data within the area subject to the retrofit, and the degree of impairment or water quality violations in the receiving waters.

(c) Stormwater Quantity (Flood Control) Retrofits

The applicant for a stormwater quantity retrofit project must provide reasonable assurance that the retrofit project will reduce existing flooding problems in such a way that it does not cause any of the following:

1. A net reduction in water quality treatment provided by the existing SWM system or systems; and

2. Increased discharges of untreated stormwater entering adjacent or receiving waters.

If the applicant has conducted, and the Agency has approved, an analysis that provides reasonable assurance that the stormwater quantity retrofit project will comply with the above, the project will be presumed to comply with the requirements in Part III of this Volume.

(d) The applicant for any stormwater retrofit project must design, construct, operate, and maintain the project so that it:

1. Will not cause or contribute to a water quality violation.

2. Does not reduce stormwater treatment capacity or increase discharges of untreated stormwater. Where existing ambient water quality does not meet water quality standards, the applicant must demonstrate that the proposed activities will not cause or contribute to a water quality violation. If the proposed activities will contribute to the existing violation, measures shall be proposed that will provide a net improvement of the water quality in the receiving waters for those parameters that do not meet standards.

3. Does not cause any adverse water quality impacts in receiving waters; or

4. Will not cause or contribute to increased flooding of adjacent lands or cause new adverse water quantity impacts to receiving waters.

2.5 Flexibility for State Transportation Projects and Facilities

With regard to state linear transportation projects and facilities, the Agencies shall be governed by subsection 373.413(6), F.S. (2012).

PART III – STORMWATER QUANTITY/FLOOD CONTROL

3.0 General

This Volume refers to flood and drought frequency impacts interchangeably with rainfall frequency. Additional calculations may be required to identify other combinations of site conditions and rainfall frequencies which might result in impacts of the specified frequency. Examples include designs affected by spring tides, fluctuating tides, and fluctuating receiving water stages.

3.1 Discharge Rate

Off-site discharge rate is limited to rates not causing adverse impacts to existing off-site properties, and:

(a) Historic (pre-development) discharge rates; or

(b) Rates determined in previous Agency permit actions; or

(c) Rates specified in District criteria (see Appendix A to this Volume); or

(d) Minimum bleeder criteria (see Subsection 5.1(b) of this Volume).

3.2 Design Storm

Unless otherwise specified by previous Agency permits, criteria, or Appendix A to this Volume, a 25-year, 3-day storm event shall be used in computing off-site discharge rates. Applicants are advised that local drainage districts or local governments may require more stringent design storm criteria. An applicant who demonstrates its project is subject to unusual site-specific conditions may, as a part of the permit application process, request an alternate discharge rate.

3.2.1 Methodologies

An acceptable historic peak discharge analysis typically consists of generating pre-development and post-development runoff hydrographs, routing the post-development hydrograph through a detention basin, and sizing an overflow structure to control post-development discharges at or below pre-development rates. Acceptable design techniques also include the use of grassed waterways and any other storage capability that the particular system may have.

Historic peak discharge computations shall consider the following:

(a) Duration, frequency, and intensity of rainfall.

(b) Antecedent moisture conditions.

(c) Upper soil zone and surface storage.

(d) Time of concentration.

(e) Tailwater conditions.

(f) Changes in land use or land cover; and

(g) Any other changes in topographic and hydrologic characteristics.

Large systems shall be divided into sub-basins according to artificial or natural drainage divides to allow for more accurate hydrologic simulations.

Historic peak discharge calculations must make proper use of the SCS Peak Rate Factor or K' Factor. The Peak Rate Factor reflects the effect of watershed storage on the hydrograph shape and directly and significantly impacts the peak discharge value. As such, K' must be based on the true watershed storage of runoff, and not on the slope of the landscape which is more accurately accounted for in the time of concentration. However, the average slope of natural watersheds is highly interrelated with the surface storage potential. Land development will generally result in a reduction of natural storage. As a result, the K' value should either increase or remain constant, but never decrease. In most cases, post-development conditions will include detention storage areas; this storage should be accounted for by routing the hydrograph based on a defined stage-storage-discharge relationship and should therefore not be considered in determining K'. However, in some cases where surface storage is maintained, K' may be reduced to same value used in the pre-development condition.

3.2.2 Aggregate Discharge

Where multiple off-site discharges are designed to occur, if the combined discharges meet all other requirements of Chapter 62-330, F.A.C., and discharge to the same receiving waterbody, the Agency will allow the total post-development peak discharge not to exceed the applicable combined discharges from Section 3.2 of this Volume rather than for each individual discharge.

3.2.3 Upper Soil Zone Storage and Surface Storage

In most instances, the upper soil zone storage and surface storage capacities will have an effect on the pre-development and post-development peak discharges and shall be considered in these computations. Any generally accepted and well-documented method may be used to develop the upper soil zone storage and surface storage values.

(a) The soil zone storage at the beginning of a storm shall be estimated by using reasonable and appropriate parameters consistent with generally accepted engineering and scientific principles to reflect drainage

practices, average wet season water table elevation, the antecedent moisture condition (generally AMC II), and any underlying soil characteristics that would limit or prevent percolation of storm water into the entire soil column. The soil storage used in the computation shall not exceed the difference between the maximum soil water capacity and the field capacity (for example, gravitational water) for the soil columns above any impervious layer or seasonal groundwater table. Refer to Subsection 5.6.4.2 and Appendix D of this Volume for additional soil storage criteria.

(b) Surface storage, including that available in wetlands and low-lying areas, shall be considered as depression storage. Depression storage shall be analyzed for its effect on peak discharge and the time of concentration. Depression storage can also be considered in post-development storage routing which requires development of stage-storage relationships. If depression storage is considered, then both pre-development and post-development storage routing must be considered.

3.3 Flood Protection of Building Floors

Building floors shall be at or above the 100-year flood elevations, as determined from the most appropriate information, including Federal Flood Insurance Rate Maps. Both tidal flooding and the 100-year, 3-day storm event shall be considered in determining elevations.

Lower floor elevations will be considered for agricultural buildings which are non-residential and are not routinely accessed by the public. For example, agricultural structures such as barns or equipment sheds normally qualify for a lower finished floor elevation. Applicants are cautioned that potential water quality impacts caused by flooding of contents housed in a structure will be considered in allowing a reduced finished-floor elevation.

3.4 Flood Protection of Roads and Parking Lots

Many local governments have criteria for the protection of roads and parking lots from flooding.

(a) In cases where criteria are not specified by the local government with jurisdiction, the following design criteria for drainage and flood protection shall be used:

1. Road crown:

   a. Frequency: 5-year

   b. Duration: 1-day (road centerlines)

   c. At least 2.0 feet higher than the control elevation, in order to protect the road subgrade.

2. Parking lots:

   a. Frequency: 5-year

   b. Duration: 1-day (low grate elevation)

3. Parking lots served by exfiltration trench systems:

   a. Frequency: 5-year

   b. Duration: 1-hour

(b) If the local government with jurisdiction has set flood protection criteria for roads and parking lots within commercial projects, the District Agency will not require the applicant to meet District road and parking lot flood protection criteria. This shall only be allowed for commercial projects which are to remain single-owner projects. Such criteria may provide lesser degrees of flood protection than required under Agency criteria. Projects which are not permitted pursuant to Agency criteria will be special conditioned, as notice to the permittee and local government, that a substandard design has been permitted. The applicant shall, however, meet Agency criteria for water quality, off-site discharge, and building floor elevations.

3.5 Flood Plain Encroachment

No net encroachment into the floodplain, between the average wet season water table and that encompassed by the 100-year event, which will adversely affect the existing rights of others, will be allowed.

3.6 Historic Basin Storage

Provision must be made to replace or otherwise mitigate the loss of historic basin storage provided by the project site.

3.7 Offsite Lands

Onsite works such as swales and dikes shall be used to allow the passage of drainage from offsite areas to downstream areas. Diking of project development areas or other equivalent methods shall be used to contain water at or above stages identified in the project discharge computations.

3.8 Minimum Drainage

(a) Residential projects shall have systems with the calculated ability to discharge by surface flow or subsurface percolation at least 0.375 inches per day during or subsequent to the storm of the allowable discharge frequency and duration, so that lowering of the water surface elevations within the SWM system to the maximum depth compatible with the environmental protection or other constraints as described in Section 3.9, will occur in 12 days or less.

(b) Commercial and industrial projects to be subdivided for sale, where the initial permittee will not build the entire system, are required to have installed by the initial permittee, as a minimum:

1. The required water quality treatment system for a minimum of 20% of the load reduction as required by AH Vol. I in a retention Best Management Practice (BMP). The individual sites must provide the remainder, which may be in exfiltration trench.

   a. The master SWM system must be in a legally defined common area.

   b. The master SWM system cannot utilize exfiltration trench.

2. A stormwater collection and conveyance system to interconnect the retention/detention system with the outfall, with access points to the SWM system available to each individual lot or tract. The SWM system shall be sized to limit discharge under design conditions to the allowable discharge.

3. Projects permitted in such manner will require deed restrictions which identify to lot or tract purchasers:

   a. The amount of additional on-site SWM system necessary to provide flood protection for specific design events,

   b. Any additional retention/detention required for water quality purposes, and

   c. The assumed percent impervious, or impervious area used in design calculations.

3.9 Over Drainage and Water Conservation

SWM systems shall be designed to:

(a) Maintain existing water table elevations in existing wellfield cones of depression.

(b) Preserve site environmental values (see Section 10.0 of AH Vol. I).

(c) Not waste freshwater.

(d) Not lower water tables which would adversely affect the existing rights of others; and

(e) Preserve site ground water recharge characteristics.

3.10 Detention and Control Elevations

Detention and control elevations shall be set to accomplish the requirements of Section 3.9 of this Volume and are subject to the following criteria:

(a) Wetland protection elevations.

(b) Consistency with surrounding land and project control elevations and water tables.

(c) Possible restrictions by other agencies to include tree protection and landscape ordinances.

(d) Consistency with water use permits; and

(e) A maximum depth of 6.0 feet below natural ground.

3.11 Lake-Wetland Separation

Lakes which potentially may adversely affect wetland areas shall be separated from the wetland preservation, creation, or restoration areas by a minimum distance as determined by the following criteria:

(a) A separation distance (shortest distance between the wetland jurisdictional line and the edge of water in the proposed waterbody at the proposed control elevation) producing a gradient less than or equal to 0.005 ft/ft (vertical/horizontal) using the difference in the elevation of the jurisdictional boundary of the wetland and the basin control elevation to calculate the driving head. Staff will consider elevations differing from the jurisdictional boundary of the wetland to calculate the driving head. The applicant will be required to submit monitoring data or other relevant hydrologic data from the site to substantiate the reason for using a different starting elevation. Existing conditions alone will not be considered sufficient reason to use a different elevation if there is evidence that activities on or adjacent to the project site may be responsible for lowering water tables which may be currently having an adverse impact on the subject wetlands. In these cases, preservation of the wetlands cannot be assured by simply maintaining the existing conditions.

(b) If the gradient resulting from any separation distance and the driving head as defined above is between 0.005 ft/ft and 0.015 ft/ft, then calculations will be required which demonstrate that the drawdown in the adjacent wetland(s) will be of a magnitude which will not result in adverse impacts on the wetland. A drawdown of more than 12 vertical inches in a 90-day period with no recharge shall be presumed to be an adverse impact.

(c) If the gradient is equal to or greater than 0.015 ft/ft, then construction of an impermeable barrier or other equivalent action must be taken to mitigate for the impact of the proposed excavation between the wetland and the excavation.

(d) The Agency will review modeling results which demonstrate that a gradient equal to or greater than 0.015 ft/ft will not have an adverse impact on the adjacent wetland. Model input data shall be derived from a detailed soil profile constructed

from a minimum of three separate sampling locations with permeability testing results on selected samples. Two-dimensional modeling may be necessary to represent the site geometry.

3.12 Water Supply Sources

An evaluation of the impact of the proposed SWM system on sources of water supply must be submitted with the ERP application. Cumulative impacts which may result from the construction and operation of the proposed SWM system must be evaluated in conjunction with the cumulative withdrawals of existing legal uses of water.

PART IV – STORMWATER QUALITY

4.0 State Standards

Projects shall be designed and operated so that off-site discharges will meet State water quality standards.

4.0.1 How Standards are Applied

The quality of stormwater discharged to receiving waters is presumed to meet the surface water standards in Chapters 62-4 and 62-302, F.A.C., and the groundwater standards in Chapters 62-520 and 62-550, F.A.C., if the SWM system is permitted, constructed, operated, and maintained in accordance with Chapter 62-330, F.A.C., AH Vol. I, and Parts III, IV, and V of this Volume. However, this presumption is rebuttable. If off-site runoff is not prevented from combining with on-site runoff prior to treatment, then treatment must be provided for the combined off-site and project runoff.

4.0.2 Erosion and Sediment Control Criteria for SWM Systems

Land clearing activities, including the construction of SWM systems, shall be designed, constructed, and maintained at all times so that erosion and sedimentation from the SWM system, including the areas served by the SWM system, do not cause violations of applicable state water quality standards in receiving waters. Further, because sedimentation of offsite lands can lead to public safety concerns, erosion and sediment controls shall be designed and implemented to retain sediment on-site as required by subsection 62-40.432(2), F.A.C. In particular, the erosion and sediment control requirements described in Part IV of AH Vol. I shall be followed during construction of the SWM system.

4.1 Retention/Detention Criteria

4.1.1 Land Use and Coverage Criteria

(a) Commercial or industrial zoned projects shall provide a minimum of 20% of the load reduction required by AH Vol. I in a retention BMP or a separate containment system designed to prevent discharge.

(b) Projects having greater than 40% impervious area, and which discharge directly to the following receiving waters shall provide a minimum of 20% of the load reduction as required by AH Vol. I in a retention BMP as part of the required retention/detention. Receiving waters being addressed are:

1. Lake Okeechobee and the Kissimmee River.

2. Waterbodies designated as Class I or Class II waters by the Department.

3. Canals back-pumped to Lake Okeechobee or to the Conservation areas or proposed for back-pumping.

4. Other areas, such as the Savannas in St. Lucie and Martin Counties; the Six Mile Cypress Strand; the Big Cypress National Preserve area in Collier County; lands acquired by the District pursuant to Section 373.59, F.S. Water Management Lands Trust Fund (Save Our Rivers); and mitigation bank lands.

5. Outstanding Florida Waters as defined in Chapter 62-302, F.A.C.; and Aquatic Preserves as created and provided for in Chapter 258, F.S.; and

6. Waterbodies within a District-permitted public water supply wellfield cone-of-depression which are not separated from the aquifer by strata at least 10 feet thick and having an average saturated hydraulic conductivity of less than 0.10 foot per day, where the cone-of-depression is defined by one of the following:

   a. In those areas of the District where no local wellfield protection ordinance has been adopted by the local governing body, the one-foot drawdown line as expressed in the water table aquifer under conditions of no rainfall and 100 days of pumpage at the permitted average daily pumpage rate (where significant canal recharge is indicated, canal recharge representative of a 1 in 100-year drought will be considered).

   b. Chapter 27, Article XIII, Wellfield Protection Ordinance, Broward County Code of Ordinances, last amended September 28, 1999, in Rule 40E-4.091, F.A.C. Copies are available at no cost by contacting the South Florida Water Management District Clerk's Office, 3301 Gun Club Road, West Palm Beach, FL 33406 (800) 432-2045, or (561) 686-8800.

   c. Dade County Wellfield Protection Ordinance contour showing maximum limits (Section 24-43 Protection of Public Potable Water Supply Wells; Chapter 24 Environmental Protection; Code of Metropolitan Dade County, Florida; Codified through Ordinance No. 11-01, enacted January 20, 2011 (Supp. No. 68)) incorporated by reference in Rule 40E-4.091, F.A.C. Copies are available at no cost by contacting the South Florida Water Management District Clerk's Office, 3301 Gun Club Road, West Palm Beach, FL 33406 (800) 432-2045, or (561) 686-8800.

(c) In cases of widening existing urban public highway projects, the District shall reduce the water quality requirements if the applicant provides documentation which demonstrates that all reasonable design alternatives have been considered, and which provides evidence that the alternatives are all cost prohibitive.

(d) Pursuant to Subsection 62-555.312(3), F.A.C., stormwater retention and detention systems are classified as moderate sanitary hazards with respect to public and private drinking water wells. Stormwater treatment facilities shall not

be constructed within 100 feet of a public drinking water well and shall not be constructed within 75 feet of a private drinking water well.

4.2 Incorporation of Natural Areas and Existing Waterbodies

Natural areas and existing waterbodies may be used for retention/detention purposes when not in conflict with environmental (see Subsection 10.2.2.4 of AH Vol. I), water quality, (see Subsections 10.2.4 through 10.2.4.5 of AH Vol. I), or public use considerations. Candidate areas for such purposes include:

(a) Previously degraded areas. For the purpose of this section, impaired waterbodies as defined by the Department are not considered previously degraded areas.

(b) Man-made areas such as borrow pits.

(c) Extensive areas which have the ability to absorb impacts easily; and

(d) Areas incorporated into a system with mitigation features.

4.3 Underground Exfiltration Trench Systems

(a) Systems shall be designed for the water quality requirements set forth in AH Vol. I, exfiltrated over one hour for retention purposes, prior to overflow, and based on test data for the site. (Note: such systems will not be acceptable on projects to be operated by entities other than single owners or entities with full-time maintenance staff.)

(b) A safety factor of 2.0 or more shall be applied to the design to allow for geological uncertainties.

(c) A dry system is one with the pipe invert at or above the average wet seawater table.

(d) Exfiltration trench systems will not be acceptable on projects to be operated by entities other than single owners or entities with full-time maintenance staff.

(e) Refer to Appendix C of this Volume for additional design details.

4.4 Sewage Treatment Percolation Ponds

Above-ground percolation pond dikes shall not be within 200 feet of SWM lakes or 100 feet of dry retention/detention areas, or the applicant must provide reasonable assurance that effluent will not migrate into the SWM lakes or detention areas. Reasonable assurance may be provided by:

(a) Documentation of volume and rate of application of effluent to the percolation ponds; and

(b) Submittal of net flow analyses.

4.5 Criteria for Creation of Waterbodies

The creation of waterbodies shall meet both of the following criteria:

(a) Entrapped salt water, resulting from inland migration of salt water or penetration of the freshwater/saltwater interface, will not adversely impact existing legal water users; and

(b) Excavation of the water body shall not penetrate a water-bearing formation exhibiting poorer water quality for example, in terms of chloride concentrations.

4.6 Impervious Areas

Runoff shall be discharged from impervious surfaces through retention areas, detention devices, filtering and cleansing devices, or subjected to some other type of BMP prior to discharge from the project site. For projects which include substantial paved areas, such as shopping centers, large highway intersections with frequent stopped traffic, and high-density developments, provisions shall be made for the removal of oil, grease, and sediment from storm water discharges.

4.7 Stagnant Water Conditions

Configurations which create stagnant water conditions such as hydraulically dead-end canals are to be avoided, regardless of the type of development.

4.8 Water Quality Monitoring

All new SWM systems will be evaluated based on the ability of the system to prevent degradation of receiving waters and the ability to conform to State water quality standards.

4.8.1 Applicability

(a) There are areas within the District where water quality considerations are extremely important, because of the sensitivity of the area. These areas include:

1. Lake Okeechobee and the Kissimmee River.

2. Waterbodies designated as Class I or Class II waters by the Department.

3. Canals back-pumped to Lake Okeechobee or to the Conservation areas or proposed for back-pumping.

4. Sensitive areas, such as the Savannas in St. Lucie and Martin Counties, the Six Mile Cypress Strand and Estero Bay Aquatic Preserve in Lee County, and the Big Cypress National Preserve area in Collier County.

5. Outstanding Florida Waters as defined in Chapter 62-302, F.A.C.

(b) New developments which propose to discharge stormwater to the areas listed in Subsection 4.8.1(a) of this Volume will be given more detailed evaluation by the Agency Staff. In addition, new projects entailing a more intensified land use, such as industrial parks, and proposing to discharge to a sensitive receiving water, directly or indirectly, shall be required to institute a water quality monitoring program if the applicant is unable to provide adequate assurances that degradation of the receiving body water quality will not occur. Such assurances include, for example:

1. Routing drainage of areas where polluting materials would be located away from the SWM system; or

2. Separate containment systems designed to prevent discharge.

(c) The following listing of land use intensity is in ascending order:

1. Wetlands (including transition zones adjacent thereto)

2. Forested lands

3. Rangeland

4. Agricultural

5. Urban and built-up land

(d) Monitoring is required for sites with high pollutant generating potential, such as industrial sites, and Class I and II solid waste disposal sites.

(e) There are two reasons for requiring water quality monitoring by permittees, as follows:

1. Such data can be used to determine if the pollution abatement practices incorporated into the design for the drainage SWM system are functioning properly.

2. In some cases, there may be a real and immediate concern regarding degradation of quality in the receiving waters, regardless of the apparent pollutant removal efficiency of the drainage system.

(f) Applicants are advised that permits issued for projects not requiring monitoring at this time will normally include a statement to the effect that water quality monitoring may be required in the future. This should not be construed as an indication that the Agency is contemplating the implementation of a program of intensive water quality monitoring by all permittees. If water quality problems develop in specific areas, however, permittees will be put on notice in this manner that they may have to determine the quality of the water which they are discharging.

4.8.2 Permit Conditions

The following will be stated in the permit:

(a) The reason for the monitoring requirement.

(b) The monitoring and reporting schedules.

Reporting will include final laboratory results consisting of the following, at a minimum:

1. Sample date,
2. Sample location with D for discharge or N for no discharge,
3. Water discharge rates (cfs),
4. Concentration values of indicated elements or compounds, and
5. Date and time of analysis.

(c) As a general rule, monitoring required of permittees will be confined to points within their boundaries. If additional sampling is needed in order to assess off-site impacts of the projects, the responsible party will be named in the permit. The determination of the responsible party will be based upon the accessibility of the monitoring site to the permittee.

(d) The specific parameters of interest, such as those listed in Chapter 62-302, F.A.C.

4.8.3 Monitoring Program

Each monitoring program will be designed by the applicant for the specific land use or individual project in question and will include the following, at a minimum:

(a) Applicable surface and ground water sampling locations.

(b) The Florida Department of Health certified laboratory to be used for all water quality analyses.

4.9 Solid Waste Facilities

(a) SWM systems for Class I and II solid waste facilities, as defined by Chapter 62-701, F.A.C., shall be so designed, constructed, and operated as to maintain the integrity of the landfill at all times (during construction, operation, closure, and post closure). The applicant must provide assurances that:

1. All flows will be conveyed at non-erosive velocities; and

2. The project is designed to minimize erosion.

(b) Design features in support of this requirement include features such as:

1. Slopes adequate to promote runoff but not affect slope stability.

2. Intermediate benches or swales which reduce runoff velocities and limit erosion.

3. Vegetation of closed portion of landfill.

(c) Class I and II landfill projects shall provide adequate assurance that leachate will not enter the SWM system. This assurance may be provided through affirmative demonstration that the requirement of Chapter 62-701, F.A.C., for design and emplacement of liners, leachate collection systems, and treatment and disposal of leachate will be met.

(d) Borrow pits shall not be included in the SWM system unless the applicant can affirmatively demonstrate that leachate will not enter the borrow pit, and that the water quality standards in Chapters 62-4 and 62-302, F.A.C.), will be met.

(e) Dewatering operations at active, unlined landfills will not be permitted.

(f) For Class I and II landfills, the Agency shall require additional BMPs such as:

1. Detention in excess of the quantities stated in Subsection 4.1.1 of this Volume.

2. Dry detention areas.

3. Dry conveyance swales with adequate dimensions to permit maintenance.

4. Filter mechanisms for additional water quality enhancement prior to discharge.

5. Skimmers in front of discharge structures to restrict discharge of floatable materials.

6. Screw gates on water control structures capable of restricting discharge of poor-quality surface water; or

7. Vegetation of appropriate portions of the SWM system, such as conveyance swales.

(g) To provide information for assessing the need for BMPs at a specific site, Agency staff will require a hydrogeologic investigation that shall, at a minimum, provide information on:

1. The hydrogeologic properties of the formations underlying the landfill, including aquifer and characteristics, groundwater elevations, and direction and rate of groundwater flow.

2. Location of existing wells within one-half mile of the site perimeter.

3. Locations and specifications of existing or proposed monitor wells.

4. The location and chemical composition of any known leachate plumes.

(h) Applicants should consult with Agency staff prior to or at pre-application meetings to determine the specific requirements which will apply for a particular project.

PART V – SWM SYSTEM DESIGN AND CONSTRUCTION CRITERIA

5.0 Discharge Structures

(a) All design discharges shall be made through structural discharge facilities. Earth berms shall be used only to disperse or collect sheet flows from or to ditches, swales, or other flow conveyance mechanisms served by discharge structures.

(b) Discharge structures shall be fixed so that discharge cannot be made below the control elevation, except that emergency devices may be installed with secure locking devices. Use of emergency devices must be coordinated with Agency staff prior to opening or as soon as possible thereafter. The Agency's Executive Director or secretary is authorized to specify the use of emergency devices pursuant to Rule 40E-0.107, F.A.C.

(c) Discharge structures must be non-operable unless approved otherwise.

(d) It is recommended that discharge structures include gratings for safety and maintenance purposes. The use of trash collection screens is desirable.

(e) Discharge structures shall include a baffle system to encourage discharge from the center of the water column rather than the top or bottom. Discharge structures from areas with greater than 50% impervious area or from systems with inlets in paved areas shall include a baffle, skimmer, or other mechanism suitable for preventing oil and grease from discharging to or from retention/detention areas. Designs must assure sufficient clearance between the skimmer and concrete structure or pond bottom to ensure that the hydraulic capacity of the structure is not affected.

(f) Direct discharges, such as through culverts, storm drain, and weir structures, will be allowed to receiving waters, which by virtue of their large capacity or configuration are easily able to absorb concentrated discharges. Such receiving waters include existing storm sewer systems and man-made ditches, canals, and lakes.

(g) Indirect discharges, such as overflow and spreader swales, are required where the receiving water or its adjacent supporting ecosystem might be degraded by a direct discharge. The discharge structure would therefore discharge, for example, into the overflow or spreader swale, which in turn would release the water to the actual receiving water. Such receiving waters include, for example, natural streams, lakes, wetlands and land naturally receiving overland sheet flow. Spreader swales shall be of a length sufficient to reduce discharge velocities to the receiving waters to historic rates or rates less than two feet per second.

(h) Pumped systems will only be allowed for single owner or governmental agency operation entities unless perpetual operation ability can be assured.

5.1 Control Devices/Bleed-down Mechanisms for Detention Systems

(a) Agency criteria require that gravity control devices shall be sized as follows:

1. Maximum discharge: 13.5 CSM.

2. Minimum cross-sectional area: 6.0 square inches, and

3. Minimum dimensions:

   a. Triangular or trapezoidal geometry: 2.0 inches and 20 degrees.

   b. Circular geometry: 3.0-inch diameter.

   c. Square or rectangular geometry: 2.0 inches.

(b) Systems which are limited by a discharge structure with an orifice no larger than the minimum dimensions described herein shall be presumed to meet the discharge quantity criteria except for projects which are required to have zero discharge. Applicants are advised that local drainage districts or local governments may have more stringent gravity control device criteria.

(c) Gravity control devices shall be of a "V" or circular shaped configuration whenever possible, to increase detention time during minor events.

(d) Pumped control devices, if permitted:

1. Maximum discharge: 13.5 CSM.

5.2 Retention System

5.2.1 Description

Stormwater retention works best using a variety of retention systems throughout the project site. Examples of retention systems include:

(a) Man-made or natural depressional areas where the basin bottom is graded flat and vegetation is established to promote infiltration and stabilize the basin slopes.

(b) Shallow landscaped areas designed to store stormwater; and

(c) Vegetated swales with swale blocks or raised inlets.

Soil permeability and water table conditions must be such that the retention system can percolate the desired runoff volume within a specified time following a storm event. After drawdown has been completed, the basin shall not hold any water; thus, the system is normally "dry." Unlike detention basins, the treatment volume for retention systems is not discharged to surface waters.

Besides pollution control, retention systems can be utilized to promote the recharge of ground water to prevent saltwater intrusion in coastal areas or to maintain groundwater levels in aquifer recharge areas.

5.2.2 Retention Basin Construction

Since SWM systems are often exposed to poor quality surface runoff during construction and fine particles of clay, silt, and organics at the bottom of a retention basin create a poor infiltrating surface, retention basin construction methods and the overall sequence of site construction must retain the effectiveness of retention basins and assure that the basin is not rendered inoperable prior to completion of site development.

5.2.3 Dry Retention/Detention Areas (Not Applicable to Natural or Mitigation Wetland Areas)

(a) Dry retention/detention areas shall recover the retained/detained volume within 72 hours.

(b) Mosquito control ditches or other appropriate features for such purpose, shall be incorporated into the design of dry retention/detention areas.

(c) The design of dry retention/detention areas shall incorporate considerations for regular maintenance and vegetation harvesting procedures.

5.3 Wet Detention Design and Performance Criteria

5.3.1 Pond Configuration

The flow path of water from the inlets to the outlet of the pond must be maximized to promote good mixing with no dead spots, minimize short circuiting, and maximize pollutant removal efficiency and mixing.

If short flow paths are unavoidable, the effective flow path can 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.

5.3.2 Wet Retention/Detention Area Dimensional Criteria

Unless otherwise noted, all dimensions are measured at or from the control elevation.

(a) Area: 0.50-acre minimum.

(b) Width: 100-feet minimum for linear areas in excess of 200-feet length. Irregular shaped areas may have narrower reaches but shall average at least 100 feet.

(c) Depth: Minimum depth necessary to meet the permanent pool volume requirements of AH Vol. I.

(d) Littoral Zone:

1. Area: Shall be the lesser of 20% of the wet retention/detention area or 2.5% of the total of the retention/detention area (including side slopes) plus the basin contributing area. If the applicant seeks to use littoral zones as a water quality BMP, as described in AH Vol. I, the area of littoral zone shall be no less than 20% of the wet retention/detention area.

2. Depth: Shallow, littoral zones are desirable for water quality enhancement purposes. Such areas are defined for purposes of this criteria as the portion of wet retention/detention bodies shallower than 6.0 feet as measured from below the control elevation.

3. Plantings: Shall consist of aquatic plants native to Florida and appropriate for the conditions in the wet retention/detention area.

(e) Side slopes:

1. For purposes of public safety, water quality enhancement and maintenance, all wet retention-/detention areas shall be designed with side slopes no steeper than 4:1 (horizontal:vertical) from top of bank out to a minimum depth of 2.0 feet below the control elevation, or an equivalent substitute.

2. Constructed side slopes steeper than 3.5:1 shall be considered a substantial deviation during the consideration of operation permit issuance.

3. Side slopes shall be topsoiled and stabilized through seeding or planting from 2.0 feet below to 1.0 feet above the control elevation to promote vegetative growth.

4. Side slope vegetation growth survival shall be a consideration of operation permit issuance.

5. Side slope dimensional criteria for AGIs are set forth in Appendix B.

(f) Side Slope Criteria for Areas Adjacent to Golf Course Tee Areas, Bunkers, and Greens:

1. The design and final constructed side slopes adjacent to tee areas, bunkers, and greens contiguous to golf course wet retention/detention areas shall be no steeper than 2:1 for the area above the permitted control elevation.

2. For purposes of this rule, the tee area is limited to an area specifically constructed and designated as the location from which a golfer makes his/her first shot toward a designated hole. The green is the area of shortest grass around the hole. Bunkers (sand traps) consist of a prepared area of ground, often a hollow, from which turf or soil has been removed and replaced with sand-like material.

3. For those portions of the wet retention/detention areas adjacent to tee areas, bunkers, and greens with final constructed side slopes steeper than 3.5:1, the final constructed side slopes below the control elevation shall not be steeper than 8:1 to a depth of 2.0 feet below the control elevation or equivalent substitute.

4. Side slopes shall be topsoiled and stabilized through seeding or planting from 2.0 feet below to 1.0 feet above the control elevation.

5. Side slope vegetation growth survival shall be a consideration of operation permit issuance.

(g) Bulkheads: Shall be allowed for no more than 40% of the shoreline length but compensating littoral zone must be provided based on appropriate maximum allowable side slope including local government requirements.

5.4 Maintenance Access and Easements

Minimum perimeter maintenance and operation easements of 20.0 feet width at slopes no steeper than 4:1 shall be provided beyond the control elevation water line. These easements shall be legally reserved to the operation entity and for that purpose by dedication on the plat, deed restrictions, easements, or other equivalent documents, so that subsequent owners or others may not remove such areas from their intended use. Water management areas, including 20.0-foot-wide maintenance easements at a minimum, shall be connected to a public road or other location from which operation and maintenance access is legally and physically available.

5.5 Exfiltration Trench Systems

5.5.1 Description

In an exfiltration trench system, stormwater shall pass through a perforated pipe and infiltrate through the trench walls and bottom into the shallow groundwater aquifer thereby increasing the storage available in the trench and promoting infiltration by making delivery of the runoff more effective and evenly distributed over the length of the system.

When an exfiltration trench is utilized, soil permeability and water table conditions must be such that the trench system can percolate the required stormwater runoff treatment volume within a specified time following a storm event. The trench system shall be returned to a normally "dry" condition when

drawdown of the treatment volume is completed. Like retention basins, the treatment volume in exfiltration trench systems shall not be discharged to surface waters.

Besides pollution control, exfiltration trench systems can be utilized to promote the recharge of ground water and to prevent saltwater intrusion in coastal areas, or to maintain groundwater levels in aquifer recharge areas.

5.5.2 Construction

During construction, measures must be taken to limit the parent soil and debris entering the trench. The use of an aggregate with minimal fines is recommended.

Exfiltration trench systems must conform with the following requirements:

(a) Minimum pipe diameter: 12.0-inch diameter.

(b) Minimum trench width: 3.0 feet.

(c) Rock in trench must be enclosed in filter material, at least on the top and sides; and

(d) Inlets must have maintenance sumps.

Refer to Appendix C of this Volume for additional design details.

5.6 Required Design Information and Assumptions

5.6.1 Antecedent Conditions

Antecedent conditions shall be average wet season elevations for water table or other water surfaces.

5.6.2 Rainfall

Distributions and intensities should be consistent with–these Reference Sources:

(a) Isohyetal Maps from SFWMD Technical Memorandum, Frequency Analysis of One and Three Day Rainfall Maxima for Central and Southern Florida, Paul Trimble, October 1990, (SFWMD.gov/VolumeIIMaps);

(b) The following distribution table:

Time (hours)	Cumulative Percentage of Peak One Day Rainfall	
0	0.0	
24	14.6	
48	35.9	
58	57.2	100% One Day Rainfall
59	62.8	
59.5	67.8	
59.75	82.8	
60	101.5	
60.5	108.8	
61	112.6	
62	117.7	
72	135.9	

(c) Actual gage data analyzed by accepted statistical methods.

(d) U.S. Department of Agriculture, Soil Conservation Service, "Rainfall Frequency Atlas of Alabama, Florida, Georgia and South Carolina for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 years" (1978), incorporated by reference in Rule 40E-4.091, F.A.C.

(e) Florida Department of Transportation "Drainage Manual, Appendix B: IDF Curves, Precipitation Data, Rainfall Distributions" (August 2001) incorporated by reference in Rule 40E-4.091, F.A.C.; and

(f) National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Volume 9 Version 2.0: Southeastern States (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi), incorporated by reference in Rule 40E-4.091, F.A.C., and the NOAA Atlas 14 Precipitation Frequency Data Server.

Copies of the materials incorporated by reference above are available at no cost by contacting the South Florida Water Management District Clerk's Office, 3301 Gun Club Road, West Palm Beach, FL 33406, (800) 432-2045, or (561) 686-8800.

5.6.3 Evapotranspiration (ET)

Amounts can be estimated as follows:

(a) Groundwater depth 0.0 to 1.0 feet: 0.3 inches ET/day

(b) Groundwater depth 1.0 to 2.5 feet: 0.2 inches ET/day

(c) Groundwater depth 2.5 to 4.0 feet: 0.1 inches ET/day

(d) Groundwater depth below 4.0 feet: 0.0 inches ET/day

5.6.4 Storage

5.6.4.1 Open Surface

If open surface storage is to be considered in the review, the applicant shall submit stage-storage computations. If open-surface storage plus discharge is to be considered, the stage-discharge computations shall also be submitted. Actual rather than allowable discharges shall be used in routing. For more extreme storm events, such as 100-year frequency, discharge should be ignored because the high tailwater stage in the receiving water effectively prevents any but a negligible discharge. In such cases, a mass accounting of on-site water will suffice, if the applicant can demonstrate that no adverse impacts will occur to adjacent areas.

5.6.4.2 Ground

(a) The Soil Conservation Service has estimated soil storage capability for the soils found within the District in their average natural state. Refer to Appendix D for a table of soil storage and resulting curve numbers (CNs).

(b) For the same soils that have been compacted intentionally or incidental to earthwork operations, the cumulative storage shall be reduced 25%. An applicant may submit site-specific soil storage capability data.

(c) Groundwater storage beneath impervious surfaces generally appears impractical to any great degree because of the trapped air which water cannot displace. It further appears impractical below a depth of 4.0 feet, except in high, sandy, coastal ridge areas, because of the relationship between infiltration rates and runoff rates in most parts of south Florida.

5.6.5 Infiltration and Percolation

5.6.5.1 Subsurface

Subsurface exfiltration will be reviewed only on the basis of representative or actual test data submitted by the applicant. Test parameters such as elevation, location, and soils shall be consistent with those of the designed system. The Dade County Department of Environmental Resource Management and Florida Department of Transportation are suggested as reference sources to applicants for test procedures and design and maintenance performance of subsurface exfiltration systems.

5.6.6 Runoff

The usual methods of computation are as follows:

(a) Rainfall minus losses and storage.

(b) U.S. Department of Agriculture, Natural Resources Conservation Service, "National Engineering Handbook, Section 4, Part 630, Chapter 10 – 2004. Peak factors" used for natural systems shall not exceed "257" unless project-specific site conditions warrant use of a larger peak factor.

(c) Rational method, for water quality retention/detention purposes.

Copies of the material referenced in Section 5.6.6(b) of this Volume are available at no cost by contacting the South Florida Water Management District Clerk's Office, 3301 Gun Club Road, West Palm Beach, FL 33406, (800) 432-2045, or (561) 686-8800.

5.6.1 Receiving Water Stage

(a) Tailwater for Water Quantity Design

SWM systems must consider tailwater conditions. Receiving water stage can affect the amount of flow that will discharge from the project to the receiving water. This stage may be such that tailwater exists in portions of the project system, reducing the effective flow or storage area.

The stage in the receiving water shall be considered to be the maximum stage which would exist in the receiving water from a storm equal to the project design storm. Lower stages may be used if the applicant can show that the flow from their project will reach the receiving water prior to the time of maximum stage in the receiving water.

(b) Regulated Systems

Applicants are advised that design and maintained stage elevations are available either from the respective local jurisdiction or the Agency. Stages for the Agency's system for frequencies other than the design will be estimated by the Agency upon request from the applicant.

(c) Non-regulated Systems

It is recommended that the applicant compute receiving water stages for such systems from the best available data and submit the results to the Agency for review and concurrence before utilizing such results in further computations.

(d) Any System

Variable tailwater stages shall be considered if they have a significant influence on the design.

5.6.2 Runoff Coefficient and CN for SWM Ponds

SWM ponds, including dry retention ponds, detention ponds with filtration, dry detention ponds with underdrains, and wet detention ponds shall be considered as impervious area for calculating composite runoff coefficients (C) and composite CNs.

5.7 Inspection and Maintenance

Inspection and maintenance standards are described in Sections 12.4 and 12.5 of AH Vol. I and Rule 62-330.311, F.A.C. See Appendix B for inspection and reporting requirements for AGIs.

APPENDICES

APPENDIX A: SFWMD - ALLOWABLE DISCHARGE FORMULAS

Canal	Allowable Runoff	Design Frequency
C-1	$Q = \left(\frac{112}{\sqrt{A}} + 31\right) A$	10 year
C-2	Essentially unlimited inflow by gravity connections southeast of Sunset Drive 54 CSM northwest of Sunset Dr.	200 year +
C-4	Essentially unlimited inflow by gravity connections east of SW 87th Av.	200 year +
C-6	Essentially unlimited inflow by gravity connections east of FEC Railroad	200 year +
C-7	Essentially unlimited inflow by gravity connection	100 year +
C-8	Essentially unlimited inflow by gravity connection	200 year +
C-9	Essentially unlimited inflow by gravity connection east of Red Road 20 CSM pumped Unlimited gravity with development limitations west of Red Road or Flamingo Blvd.	100 year +
C-10	----------	200 year +
C-11	20 CSM west of 13A 40 CSM east of 13A	----------
C-12	90.6 CSM	25 year
C-13	75.9 CSM	25 year
C-14	69.2 CSM	25 year
C-15	70.0 CSM	25 year
C-16	62.6 CSM	25 year
C-17	62.7 CSM	25 year
C-18	41.6 CSM	25 year
C-19	57.8 CSM	----------

Canal	Allowable Runoff	Design Frequency
C-23	31.5 CSM	10 year
C-24	30.25 CSM	10 year
C-25	$Q = \left(\frac{47}{\sqrt{A}} + 28\right) A$	10 year
C-38	31.1 CSM (subject to restrictions of Basin Rule)	10 year
C-40, 41, 41A	35.4 CSM	10 year
Hillsboro Canal (east of S-39	35 CSM	25 year
North New River (east of S-34)	70.8 CSM	25 year
EAA (all canals)	20 CSM	5 year
L-28	11.8 CSM	----------
C-51	35 CSM east of Turnpike 27 CSM west of Turnpike (subject to restrictions of Basin Rule)	10 year
C-100, 100A, 100B, 100C, 100D:	$Q = \left(\frac{104}{\sqrt{A}} + 43\right) A$	10 year
C-102	$Q = \left(\frac{119}{\sqrt{A}} + 25\right) A$	10 year
C-103N, C103-S	$Q = \left(\frac{107}{\sqrt{A}} + 39\right) A$	10 year
C-110	$Q = \left(\frac{137}{\sqrt{A}} + 9\right) A$	10 year
C-111	$Q = \left(\frac{117}{\sqrt{A}} + 29\right) A$	10 year
C-113	$Q = \left(\frac{104}{\sqrt{A}} + 3\right) A$	10 year

Definitions:

- Q = Allowable runoff in cfs (cubic feet per second)
- A = Drainage area in square miles (mi^2)
- Drainage Basin Map (SFWMD.gov/VolumeIIMaps)

APPENDIX B: AGIs

1.0 INTRODUCTION

1.1 Purpose

This Appendix to AH Vol. II for use within the geographic limits of the District has been prepared to elaborate on the criteria and standards applicable to AGIs in accordance with the definition and requirements for "dams" in Part IV of Chapter 373, F.S. The content herein is not intended to be all inclusive of all possible situations but is intended to provide guidelines and basic performance criteria wherever possible on design criteria for the situations commonly encountered for most typical south Florida situations. Because dam performance is a function of construction, operation, and maintenance as well as design, information on those subjects is included. The basic responsibility for dam performance remains vested in the owner or permittee through appropriate representation by his registered professional in accordance with State laws.

This Appendix does not supersede or replace the requirements of Subsection 8.4.5 and Appendix L of AH Vol. I.

1.2 Classification

Upon request or application receipt, District staff will classify impoundments or dams as "Major" or "Minor" for application review purposes in accordance with the following provisions:

1.2.1 Major Impoundments

(a) Impoundments located where the downstream hazard potential is defined as either Significant or a High Hazard Potential in accordance with Appendix L of AH Vol. I.

(b) Maximum average water depths above surrounding ground levels would exceed 4.0 feet.

1.2.2 Minor Impoundments

(a) Impoundments generally located in rural areas where the downstream hazard potential is defined as Low Hazard Potential in accordance with Appendix L of AH Vol. I.

(b) Maximum water depths above surrounding ground levels would generally be limited to 4.0 feet, except where dam break analysis influence lines (6.0-inch depth and 2.0 feet per second [ft/s]) are limited to the land of the permittee and others, including the public, are not involved. It may be necessary that the permittee's land be legally

restricted by such means as a unity of title to insure perpetual single ownership.

1.3 Certification Responsibility

1.3.1 Major impoundments are considered to be individually engineered structures involving the disciplines of geotechnical, soils, foundation, and/or structural engineering and are therefore required to be certified in accordance with State law by registered professionals.

1.3.2 Minor impoundments are considered to be general site improvements and may therefore be certified in accordance with State law as part of the overall SWM system by registered professionals.

1.4 Information Submittals

1.4.1 Major impoundments require the submittal of all design, construction, operation, and maintenance information necessary for complete review of the impoundment. Information to be submitted in addition to design calculations includes:

(a) Proposed construction schedule.

(b) Safe filling and draining schedules.

(c) Design of seepage and water level monitoring programs.

(d) Operation and maintenance manual.

(e) Influence lines for dam break analysis (6.0-inch depth and 2.0 ft/s); and

(f) Emergency response and evacuation plan (if appropriate).

Review by the District will be done for purposes of confirming that reasonable assurances are offered that the intent of District policies and general engineering principles will be met. The review is not intended to supplant the registered professional's initiative, judgment, expertise, experience, and/or responsibility. When necessary, the District may retain outside expertise to participate in the review.

1.4.2 Minor impoundments require only the submittal of the usual ERP information. It is understood that the registered professional may perform calculations, tests, etc. for their own purposes or to meet State law and which may not be submitted.

2.0 DESIGN GUIDELINES

2.1 Major Impoundments

2.1.1 Structural Stability

All elements and appurtenant works for impoundments shall be designed for all possible conditions up to and including maximum water depths and in accordance with generally accepted engineering principles for such works, which include consideration of site preparation, construction materials, geological conditions, storm conditions, settlement, erosion, operation and maintenance, and vandalism. More specific guidelines are as follows:

2.1.1.1 Dikes

(a) Dikes shall be designed based on field test data of subsurface conditions and actual procedures and materials to be used in construction.

(b) Seepage and piping shall be considered, and cutoff walls and toe drains included where necessary.

(c) Dimensions shall be such as to allow maintenance by normal equipment.

(d) Recommended side slopes for vegetated earth should be no steeper than 2.5:1 for external slopes and 3:1 for internal slopes.

(e) Top widths should be of sufficient width to allow safe vehicular access and no less than 12.0 feet.

(f) Dike toes should be continually accessible by vehicle by relatively level berms of at least 10.0 feet width.

(g) Dikes and toe berms should be widened at strategic points for vehicular turnaround or where necessary to load stockpiled material to be used for dike repair.

2.1.1.2 Structures

(a) Discharge and other structures should be located to be accessible from the top of the dike during storm conditions for emergency operation and maintenance if necessary.

(b) They should be of permanent, low-maintenance materials, preferably reinforced concrete.

(c) The location and design should be such that dike integrity is maintained.

(d) Trash racks, seepage rings, and vandalism protection should be included.

(e) A preferable design would consist of an inlet box which does not interfere with normal dike side slopes and a conduit under the dike to an outfall end wall.

(f) Erosion protection, energy dissipators, etc. would be necessary at strategic points including the outfall.

2.1.2 Hydraulics

Unless more stringent criteria should apply because of other jurisdictional standards or unusual risks, the minimum District standards are as follows:

2.1.2.1 Maximum Water Depth

(a) As determined by routing a 3-day precipitation (distributed according to Section 5.6.2 of this Volume) through the inflow and outflow structures with rainfall on the reservoir.

(b) Three-day precipitation amounts may vary between 36 and 56 inches depending on site-specific conditions and risk management considerations. District staff will advise on request.

2.1.2.2 Design Water Depth

As determined by routing the project allowable discharge design event through the inflow and outflow structures with rainfall on the reservoir. The 25-year, 3-day event should typically be used as a minimum.

2.1.2.3 Minimum Freeboard Above Maximum Water Depth

3.0 feet minimum or that required to prevent overtopping or failure due to hurricane force winds as derived from the South Florida Building Code.

2.1.2.4 Discharge Structure

(a) AH Vol. II allowable discharge for reservoir at maximum water depth with 100-year tailwater flood elevation, or

(b) AH Vol. II allowable discharge for reservoir at design water depth and non-limiting tailwater, unless more accurate site specific tailwater elevations are applicable and substantiated by the applicant.

2.1.2.5 Return Overflow

Impoundments must contain an outflow discharge structure which returns water to the area from which inflow occurs.

Pumped Impoundments: A separate structure will be to allow return flow under the conditions of maximum or design water depths in the reservoir with pumps continuing to operate.

Gravity Filled Impoundments: This structure will actually be the inflow structure since reservoir and project stages will be the same.

2.1.2.6 Emergency Discharge Gates

Discharge structures should include emergency gates which can only be opened with District permission.

Return overflow structures must include emergency gates to be operated at the discretion of the permittee or at the direction of the District.

2.1.2.7 Pumps

The pumps used to fill an impoundment serving multiple owners, when allowed, should be multiple pumps of the same sizes to allow interchange of parts.

Electric pumps should have standby fuel-operated power systems.

2.1.2.8 Seepage Collection System

A safety factor of 3.0 shall be utilized for hydraulic conveyance design purposes.

2.1.3 Floodplain Encroachment and Setbacks

(a) Impoundments shall not be located within floodplains or shall otherwise provide compensation and setbacks as provided in Section 3.5 of this Volume.

(b) Impoundments located in flat areas of diffused flow shall have the toe of dikes set back at least 50.0 feet from property lines to allow historic sheet flow to move around the impoundments.

1. Greater dimensions or swale construction may be required if steep slopes, very large contributing areas, etc. would cause that dimension to be inadequate.

2. Smaller dimensions may be allowed if the applicant can demonstrate smaller dimensions will suffice.

2.1.4 Environmental and Water Quality

The provisions of AH Vols. I and II apply. Since many impoundments are utilized for wetland management and/or mitigation, it may be necessary to set control elevations and emergency gate bottoms above natural ground levels in order to prevent wetland over drainage.

2.1.5 Emergency Repair Material

Appropriate amounts of type, quantity, and location of emergency repair materials shall be included in design plans.

2.2 Minor Impoundments

2.2.1 Structural

The same general comments apply as for Major impoundments with specific guidelines as follows:

2.2.1.1 Dikes

(a) Designs shall be in accordance with commonly accepted engineering principles and State laws.

(b) External dikes (permittee's property line): dimensional and access criteria for Major impoundments to the degree necessary to meet the intent of Subsection 1.2.1 of this Appendix.

(c) Internal dikes: Side slopes shall be no steeper than 2:1 and top widths no less than 5.0 feet.

2.2.1.2 Structures

Discharge and other structures should be as for Major impoundments.

2.2.2 Hydraulics

The same general comments apply as for Major impoundments with specific standards as follows:

2.2.2.1 Maximum Water Depth

The maximum water depth equals the design water depth as described for Major impoundments.

2.2.2.2 Minimum Freeboard Above Maximum Water Depth

Equal to the maximum water depth dimensions but not less than 2.0 feet, no more than 3.0 feet.

2.2.2.3 Discharge Structure

AH Vol. II allowable discharge for reservoirs at design water depth and non-limiting tailwater unless more accurate site specific tailwater elevations are applicable and substantiated by the applicant.

2.2.2.4 Return Overflow

Same as for Major impoundments.

2.2.2.5 Emergency Discharge Gates

Same as for Major impoundments except installation is optional.

2.2.2.6 Pumps

Same as for Major impoundments.

2.2.2.7 Seepage Collection Systems

Optional

2.2.3 Floodplain Encroachment and Setbacks

Same as for Major impoundments.

2.2.4 Environmental and Water Quality

Same as for Major impoundments.

2.2.5 Emergency Repair Material

Optional

3.0 CONSTRUCTION

Construction certification is a requirement of all permits for both Major and Minor impoundments, and it is therefore the responsibility of the registered professional to satisfy themselves and the State laws as to construction compliance with design. Changes to permitted design would require the need for record drawings to satisfy certification. Major changes, including changes to permit authorization or special or limiting conditions, would require a permit modification prior to implementation. The District expects continual construction observation to be the minimum requirement necessary to evidence ability to perform certification on Major impoundments. Certification must indicate that construction has been satisfactorily completed so that routine operation and maintenance may commence.

4.0 OPERATION AND MAINTENANCE

4.1 Reporting

Inspection of impoundment conditions, repairs, etc. will be a continuing process required by permit special condition. Inspection reports are to be retained by the permittee and copies made available to the District upon request. It is the basic responsibility of the permittee to initiate interim reporting and/or more detailed reporting to the District as conditions change, emergencies or problems arise, etc. It is expected that Major impoundments will be reported in accordance with the operation and maintenance manual and emergency response and evacuation plan adopted at the time of permit issuance, with updates as necessary.

4.2 Primary Subjects of Interest

4.2.1 Major impoundments

4.2.1.1 Dikes and Seepage Collection System

(a) Vegetation conditions

(b) Erosion.

(c) Evidence of boils, piping, unusual seepage.

(d) Slope stability, surface cracking.

(e) Settlement.

(f) Travel way conditions.

(g) High and low water marks.

(h) Presence of aquatic vegetation in supposed dry areas.

(i) Monitoring system condition and monitoring data.

(j) Adequacy and condition of emergency repair material.

(k) Short- and long-term repair and modification recommendations.

4.2.1.2 Structures and Pumps

(a) Materials conditions.

(b) Operational conditions.

(c) Evidence of vandalism.

(d) Settlement and erosion.

(e) Freedom from trash problems.

(f) Short and long-term repair and modification recommendations.

4.2.1.3 Impoundment Area

(a) Vegetation changes

(b) Evidence of encroachment and misuse of land

4.2.1.4 Emergency Response Plan

(a) Land use changes in area of influence.

(b) Topographic changes causing change in area of influence.

(c) Changes in participants, addresses, phone numbers, etc. involved in emergency response plan.

(d) Evidence of contact update with involved emergency management officials

4.2.2 Minor Impoundments

4.2.2.1 Dikes

(a) Vegetation conditions

(b) Erosion, settlement, cracking, stability

(c) Short term repair and modification recommendations

4.2.2.2 Structures and Pumps

(a) Structural conditions

(b) Operational conditions

(c) Short term repair and modification recommendations

4.2.2.3 Impoundment Area

(a) Vegetation changes

(b) Evidence of encroachment and misuse of land

4.3 Typical Special Condition

4.3.1 Upon completion of construction, and on an annual basis (in March of each year), the permittee shall have an inspection performed to assess the structural adequacy of all above-ground dikes, control structures, levees, and berms behind which water is to be contained and where failure could impact off-site areas. A registered professional shall perform each inspection and prepare each report. These reports shall be signed and sealed by the registered professional performing the inspection, kept on file by the permittee and made available to District staff upon request. If deficiencies are found that will affect the performance of the impoundment, a report which is signed and sealed by the registered professional performing the inspection shall be submitted to the District which includes, but is not limited to, the proposed technique and schedule for repair of any deficiencies noted.

5.0 REFERENCES

Agencies with impoundment experience and publications:

(a) U.S. Army Corps of Engineers

(b) U.S. Department of Interior, Bureau of Reclamation

(c) U S Department of Agriculture, Soil Conservation Service

APPENDIX C: Exfiltration System Trench Design

1.0 Introduction

Sections 4.3 and 5.5 of this Volume address the criteria for exfiltration trenches. This Appendix provides the design methodology.

2.0 Design of Trenches

The currently accepted equation for the design of exfiltration trenches within the District is as follows, while an acceptable typical section is provided in Figure D-1 along with the description of the appropriate parameters.

$$L = \frac{FS(V_{wq})}{K(H_2W + 2H_2D_u - D_u^2 + 2H_2D_s) + (1.39 \times 10^{-4})WD_u}$$

where:

L = trench length (ft)

FS = factor of safety; no less than 2.0

V_{wq} = volume of water quality (WQ) treatment provided by trench in one hour (ac-in/hr)

K = hydraulic conductivity (cfs/ft^2-ft head)

H_2 = head on saturated surface (ft) = EL_{inv} – CE

where:

EL_{inv} = invert elevation of lowest weir/bleeder allowing discharge from trench (ft NGVD or ft NAVD)

CE = control elevation (ft NGVD or ft NAVD)

W = trench width (ft)

D_u = unsaturated trench depth (ft) = EL_{top} – CE

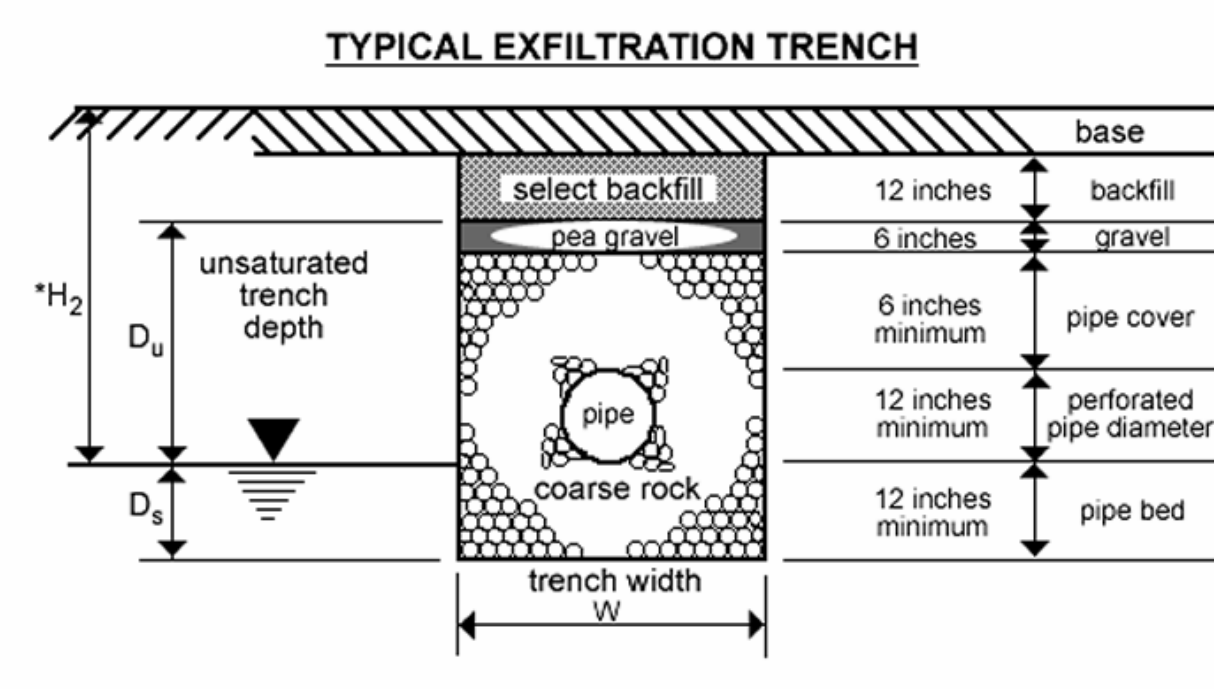
where:

EL_{top} = top elevation of trench (ft NGVD or ft NAVD)

D_s = saturated trench depth (ft) = CE - EI_{cott}

where:

EL_{bot} = bottom elevation of trench (ft NGVD or ft NAVD)



Following is a derivation of the formula for clarity:

1. Volume of Runoff:

$$Q = \left(V\frac{ac \cdot ft}{hr}\right)\left(43560\ \frac{ft^2}{ac}\right)\left(\frac{ft}{12\ in}\right) = 3630V \qquad (EQ.1)$$

where:

Q = volume of runoff in one hour (ft^3/hr)

V = total volume exfiltrated in one hour = FS(V_{wq})

2. Volume of Storage In Trench (based on 50% voids):

$$V_{stor} = 0.50WD_uL \qquad (EQ.2)$$

where:

V_{stor} = volume physically stored in trench in one hour (ft^3/hr)

3. Volume Exfiltrated:

$$V_{bot} = \left(K\frac{ft^3}{s \cdot ft^2 \cdot ft\ head}\right)(H_2 ft)(W ft)(L ft)\left(3600\frac{s}{hr}\right)$$

$$V_{bot} = 3600KH_2WL \qquad (EQ.3)$$

where:

V_{bot} = volume exfiltrated through trench bottom in one hour (ft^3/hr)

and:

$$V_{side} = 3600KL(S_1H_1 + S_2H_2) \qquad (EQ.4)$$

where:

V_{side} = volume exfiltrated through trench side in one hour (ft^3/hr)

$$S_1 = (D_u ft)(L ft)$$

$$S_2 = (D_s ft)(L ft)$$

$$H_1 = (H_2 ft\ head) - (0.50 D_u ft)$$

then:

$$V_{side} = KD_uL[(H_2 - 0.50D_u) + KD_sLH_2]$$

$$V_{side} = \left(3600\frac{s}{hr}\right)\left(K\frac{ft^3}{s \cdot ft^2 \cdot ft\ head}\right)(L ft)[(H_2 ft)(D_u ft) - (0.50D_u^2 ft^2) + (H_2 ft)(D_s ft)]$$

$$V_{side} = 3600KL(H_sD_u - 0.50D_u^2 + H_sD_s) \qquad (EQ.5)$$

Setting the volume of runoff equal to the volume exfiltrated (EQ.1 = EQ.2 + EQ.3 + EQ.5 + EQ. 5):

$$Q = V_{stor} + V_{bot} + 2V_{side}$$
$$3630V = 0.50WD_uL + 3600KH_2WL + 2[3600KL(H_2D_u - 0.50D_u^2 + H_2D_s)]$$

Solving for L:

$$L = \frac{1.00834V}{K(H_2W + 2H_2D_u - D_u^2 + 2H_2D_s) + (1.39 \times 10^{-4})WD_u} \qquad (EQ.6)$$

However, considering the effect on the answer and normal variations in estimation, the equation can be simplified:

$$L = \frac{FS(V_{wq})}{K(H_2W + 2H_2D_u - D_u^2 + 2H_2D_s) + (1.39 \times 10^{-4})WD_u} \qquad (EQ.7)$$

For those situations when either:

(1) the saturated depth of the trench is greater than the non-saturated depth of the trench; or

(2) the trench width is greater than two times the total trench depth,

The proportional assumptions for flow through the trench bottom are probably not valid. A conservative design formula for use in these cases would be:

$$L = \frac{FS(V_{wq})}{K(2H_2D_u - D_u^2 + 2H_2D_s) + (1.39 \times 10^{-4})WD_u} \qquad (EQ.8)$$

As with any design method, a good amount of engineering judgment must be applied for use on site-specific cases.

***NOTE:** The formulas derived to calculate exfiltration trench length are based on a 1.0-hour time of exfiltration. This is representative of the majority of rainfall events being of small magnitude and short duration. Larger-magnitude and longer-duration storm events can affect the design by significantly changing the water table conditions assumed in the equation. In those situations, the design professional must consider the effects that groundwater mounding will have on the elevation of the water table and adjust the variables in the equations accordingly.

APPENDIX D: Soil Storage Values

1.0 Soil Storage

One of the requirements for dry retention/detention flood protection areas is that each area shall have a "mechanism" for returning the water level to control elevation. In such situations, the term "mechanism" is normally interpreted to mean something designed, fabricated, and installed in or on the site. As a result, almost every such project will have some "artificial" mechanism – a V-notch weir, exfiltration trench, key/mosquito ditch, sump, etc. – to provide the required drawdown.

Such devices may not always be necessary. If it can be shown that the soil itself allows the water table to subside in an acceptable length of time, then no "artificial" mechanism needs to be installed. The burden of proof is on the applicant, and District staff will not approve, or recommend for approval, a dry system which does not provide such mechanisms, be they natural or fabricated.

The moisture storage capability (S) of the soil profile has been estimated by the United States Department of Agriculture – Natural Resource Conservation Service (USDA – NRCS; fka Soil Conservation Service (SCS)) for the soils found within the District's boundaries. The total amount of water that can be stored in the soil profile expressed as a function of the depth to the water table* for these soils is:

Coastal[1]				
Depth to Water Table (ft.)	Uncomp. S (In.)	Uncomp. CN	Comp. S (in.)	Comp. CN
1	0.60	94	0.45	96
2	2.50	80	1.88	84
3	6.60	60	4.95	67
4	10.90	48	8.18	55

Flatwoods[2]				
Depth to Water Table (ft.)	Uncomp. S (In.)	Uncomp. CN	Comp. S (in.)	Comp. CN
1	0.60	94	0.45	96
2	2.50	80	1.88	84
3	5.40	65	4.05	71
4	9.00	53	6.75	60

Depressional[3]				
Depth to Water Table (ft.)	Uncomp. S (In.)	Uncomp. CN	Comp. S (in.)	Comp. CN
1	0.60	94	0.45	96
2	2.10	83	1.58	86
3	4.40	69	3.30	75
4	6.80	60	5.10	66

*Typically, the Seasonal High-Water Table. Consult with District staff regarding site-specific situations and questions.

(1)Sandy soils 0 – 40 inches thick with water tables dropping below 40" - St. Lucie series is representative.

(2)Water tables 15 inches – 40 inches: Immokalee series is representative.

(3)Water tables above ground – 15 inches: Riviera and Pompano series are representative.

The compacted values represent the cumulative water storage values reduced by 25% to account for the reduction in void spaces due to the compaction which occurs incidental to earthwork operations.