Islamorada, Village of Islands

STORMWATER DESIGN CRITERIA TECHNICAL MANUAL

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SECTION 1.0
PURPOSE AND INTENT

Pursuant to Chapter 30, Article VII, Division 8 of the Land Development Regulations (LDRs) of Islamorada, Village of Islands, the purpose and intent of the stormwater management regulations is to provide for the safe management and disposal of stormwater runoff from developed areas, which will minimize or eliminate pollution that may degrade water quality to the canals and nearshore waters, and to provide solutions that are sensitive to ecological and natural resources for projects which are not exempt according to these regulations.

The following Stormwater Design Criteria Technical Manual has been created as a supplementary and illustrative guidance manual for reference. This Technical Manual contains forms and procedures, minimum design standards, details and maintenance requirements for stormwater management in order to provide as much technical assistance as possible to those submitting a stormwater management plan for development and to aid and accompany the Stormwater regulations.

Short Form Applications: The purpose of the Short Form application for a stormwater management plan is to provide ease of use and minimize the costs associated with compliance to the stormwater management regulations to the citizens of the Village.

An example of a filled-out short form has been provided in Appendix C and is intended to provide guidance for the completion of the Short Form Application for a Stormwater Management Plan. This accompanies the short form worksheets in Section 2 of this Manual.

Standard Applications: The Standard Applications refer to all development that requires full compliance with the stormwater management regulations and that cannot be submitted under the Short Form Application. This Manual contains information and an example which is provided in Appendix D for the Standard Application which is applicable for more complex projects requiring detailed plans showing engineering evaluation, drainage calculations, for the design and construction of an appropriate stormwater management system. In addition, this Manual contains examples of how the rules and technical criteria may be used during the course of designing various types of surface water management systems. What is presented does not constitute additional rule criteria, and should not be used in lieu of or in a manner that is inconsistent with adopted stormwater management regulations.

Applicants are cautioned that the examples in this document are not intended for all potential design aspects of surface water management systems. Specific project variables encountered such as topography, existing development, receiving water body location and wetland preservation may dictate more elaborate or detailed analyses.

Additional information and/or permits may be required by other entities such as Monroe County, South Florida Water Management District (SFWMD), Florida Department of Environmental Protection (FDEP) and Florida Department of Transportation (FDOT). All additional permits must be retained prior to the initiation of construction activities and proof of such permits must be submitted to the Village.

SECTION 2.0
STORMWATER MANAGEMENT PLAN
SHORT FORM APPLICATIONS

The following Short Form Application worksheets are being provided for all short form applications, as provided in Section 30-1724, *Applications for Approval*, of the Stormwater Management LDRs. Note that additional information is required per Section 30-1724 for Short Form Applications, such as a site plan and description of the proposed site alterations.

The short form application applies to Category 1 parcels which are those parcels that currently contain greater that fifty (50) percent impervious area and where additional or site modification will cause no increase in impervious area or parcels which development of a property where alteration or improvement that result in less than 1,000 square feet of new impervious area that is not adjacent to a canal or other water body or development of a property where alteration or improvement that result in less than 500 square feet of new impervious area that is adjacent to a canal or other water body as defined in Section 30-1726(a)(1) of the LDRs.

For Category 1 parcels, a stormwater management system shall be designed and installed to contain the pollution abatement volume from the new impervious area. The pollution abatement volume is generally described as the first flush runoff that shall be retained from the new improved area. An example of a completed application and sample worksheet has been provided in Appendix C as a guidance for applying the regulations contained in Section 30-1727(1)a. of the LDRs and the worksheets contained in this section.

Several definitions are used in the worksheets to assist in computing the required stormwater treatment volume for Category 1 parcels. These are defined as follows and apply to different areas of the worksheets.

Site Area: Total area of the lot on which impervious areas are to be added or improved.

Cubic Feet Required: Total volume of runoff from the lot that will require retention. This definition is also used for the Stormwater Treatment Volume.

New Impervious Area: New impervious area that will be added to the subject lot.

STORMWATER RETENTION POND AND SWALE WORKSHEET "SHORT FORM"

LOT: _____ BLOCK: _____ SUBDIVISION: _____

PHYSICAL ADDRESS: _____OWNER NAME: _____

Calculate Treatment Volume Required

Previously Unimproved Site

(A) Rainfall = 0.5"

(B) Site Area _____ ft^2

(C) Cubic Feet Required = $\frac{\text{Site Area x Rainfall}}{12} = \frac{\text{B x A}}{12}$ = _____ft^3

(D) Rainfall = 1.25"

(E) Impervious Area _____ ft^2

(F) Cubic Feet Required = $\frac{\text{Impervious Area x Rainfall}}{12} = \frac{\text{E x D}}{12}$ = _____ft^3

(G) Stormwater Treatment Volume (greater of C or F) = _____ft^3

(H) Stormwater treatment discharge facilities which discharge directly to sensitive receiving waters including Class III Outstanding Florida Waters, or canals or other waterways connecting these with these waters shall provide additional retention pretreatment equal to fifty (50) percent of the total required volume, depending on the arrangement of on-site facilities.

Total Cubic Feet Required = G x 1.5 = _____ft^3

Previously Improved Site

(I) New Impervious Area _____ ft^2

(J) Rainfall = 1.25"

(K) Cubic Feet Required = $\frac{\text{Impervious Area x Rainfall}}{12} = \frac{\text{I x J}}{12}$ = _____ft^3

(L) Stormwater treatment discharge facilities which discharge directly to sensitive receiving waters including Class III Outstanding Florida Waters, or canals or other waterways connecting these with these waters shall provide additional retention pretreatment equal to fifty (50) percent of the total required volume, depending on the arrangement of on-site facilities.

Total Cubic Feet Required = K x 1.5 = _____ft^3

STORMWATER RETENTION POND AND SWALE WORKSHEET "SHORT FORM" (Cont.)

Calculate Swale Length (if applicable)

(M) Cubic Feet Required _____ ft^3

(N) Square Feet Cross Sectional Area _____ ft^2

Note: A swale with 4:1 slopes and 1 foot depth has a 4 ft^2 of Cross Sectional Area.

(O) Swale Length = $\frac{\text{Cubic ft. Required}}{\text{Square Feet Cross Sectional Area}} = \frac{M}{N} =$ _____ft

MUST PROVIDE CROSS SECTIONAL DETAIL OF SWALE, BERM, OR OTHER STORMWATER RETENTION OR DETENTION STRUCTURE

STORMWATER DRY DETENTION POND WORKSHEET "SHORT FORM"

LOT: _____ BLOCK: _____ SUBDIVISION: _____

PHYSICAL ADDRESS: _____OWNER NAME: _____

Calculate Treatment Volume Required

Previously Unimproved Site

(A) Rainfall = 0.75"

(B) Site Area _____ ft^2

(C) Cubic Feet Required = $\frac{\text{Site Area x Rainfall}}{12} = \frac{\text{B x A}}{12}$ = _____ft^3

(D) Rainfall = 1.875"

(E) Impervious Area _____ ft^2

(F) Cubic Feet Required = $\frac{\text{Impervious Area x Rainfall}}{12} = \frac{\text{E x D}}{12}$ = _____ft^3

(G) Stormwater Treatment Volume (greater of C or F) = _____ft^3

(H) Stormwater treatment discharge facilities which discharge directly to sensitive receiving waters including Class III Outstanding Florida Waters, or canals or other waterways connecting these with these waters shall provide additional retention pretreatment equal to fifty (50) percent of the total required volume, depending on the arrangement of on-site facilities.

Total Cubic Feet Required = G x 1.5 = _____ft^3

Previously Improved Site

(I) New Impervious Area _____ ft^2

(J) Rainfall = 1.875"

(K) Cubic Feet Required = $\frac{\text{Impervious Area x Rainfall}}{12} = \frac{\text{I x J}}{12}$ = _____ft^3

(L) Stormwater treatment discharge facilities which discharge directly to sensitive receiving waters including Class III Outstanding Florida Waters, or canals or other waterways connecting these with these waters shall provide additional retention pretreatment equal to fifty (50) percent of the total required volume, depending on the arrangement of on-site facilities.

Total Cubic Feet Required = K x 1.5 = _____ft^3

MUST PROVIDE CROSS SECTIONAL DETAIL OF SWALE, BERM, OR OTHER STORMWATER RETENTION OR DETENTION STRUCTURE

STORMWATER WET DETENTION POND WORKSHEET "SHORT FORM"

LOT: _____ BLOCK: _____ SUBDIVISION: _____

PHYSICAL ADDRESS: _____OWNER NAME: _____

Calculate Treatment Volume Required

Previously Unimproved Site

(A) Rainfall = 1"

(B) Site Area _____ ft^2

(C) Cubic Feet Required = $\frac{\text{Site Area x Rainfall}}{12} = \frac{\text{B x A}}{12}$ = _____ft^3

(D) Rainfall = 2.5"

(E) Impervious Area _____ ft^2

(F) Cubic Feet Required = $\frac{\text{Impervious Area x Rainfall}}{12} = \frac{\text{E x D}}{12}$ = _____ft^3

(G) Stormwater Treatment Volume (greater of C or F) = _____ft^3

(H) Stormwater treatment discharge facilities which discharge directly to sensitive receiving waters including Class III Outstanding Florida Waters, or canals or other waterways connecting these with these waters shall provide additional retention pretreatment equal to fifty (50) percent of the total required volume, depending on the arrangement of on-site facilities.

Total Cubic Feet Required = G x 1.5 = _____ft^3

Previously Improved Site

(I) New Impervious Area _____ ft^2

(J) Rainfall = 2.5"

(K) Cubic Feet Required = $\frac{\text{Impervious Area x Rainfall}}{12} = \frac{\text{I x J}}{12}$ = _____ft^3

(L) Stormwater treatment discharge facilities which discharge directly to sensitive receiving waters including Class III Outstanding Florida Waters, or canals or other waterways connecting these with these waters shall provide additional retention pretreatment equal to fifty (50) percent of the total required volume, depending on the arrangement of on-site facilities.

Total Cubic Feet Required = K x 1.5 = _____ft^3

MUST PROVIDE CROSS SECTIONAL DETAIL OF SWALE, BERM, OR OTHER STORMWATER RETENTION OR DETENTION STRUCTURE

STORMWATER EXFILTRATION TRENCH SYSTEM (DRAINAGE WELL) WORKSHEET "SHORT FORM"

LOT: _____ BLOCK: _____ SUBDIVISION: _____

PHYSICAL ADDRESS: _____OWNER NAME: _____

Calculate Treatment Volume Required

Previously Unimproved Site

(A) Rainfall = 0.5"

(B) Site Area _____ ft^2

(C) Cubic Feet Required = $\frac{\text{Site Area x Rainfall}}{12} = \frac{\text{B x A}}{12}$ = _____ft^3

(D) Rainfall = 1.25"

(E) Impervious Area _____ ft^2

(F) Cubic Feet Required = $\frac{\text{Impervious Area x Rainfall}}{12} = \frac{\text{E x D}}{12}$ = _____ft^3

(G) Stormwater Treatment Volume (greater of C or F) = _____ft^3

(H) Stormwater treatment discharge facilities which discharge directly to sensitive receiving waters including Class III Outstanding Florida Waters, or canals or other waterways connecting these with these waters shall provide additional retention pretreatment equal to fifty (50) percent of the total required volume, depending on the arrangement of on-site facilities.

Total Cubic Feet Required = G x 1.5 = _____ft^3

Previously Improved Site

(I) New Impervious Area _____ ft^2

(J) Rainfall = 1.25"

(K) Cubic Feet Required = $\frac{\text{Impervious Area x Rainfall}}{12} = \frac{\text{I x J}}{12}$ = _____ft^3

(L) Stormwater treatment discharge facilities which discharge directly to sensitive receiving waters including Class III Outstanding Florida Waters, or canals or other waterways connecting these with these waters shall provide additional retention pretreatment equal to fifty (50) percent of the total required volume, depending on the arrangement of on-site facilities.

Total Cubic Feet Required = K x 1.5 = _____ft^3

MUST PROVIDE CROSS SECTIONAL DETAIL OF SWALE, BERM, OR OTHER STORMWATER RETENTION OR DETENTION STRUCTURE

SECTION 3.0
STORMWATER TREATMENT FACILITIES – DESIGN CALCULATIONS AND MAINTENANCE REQUIREMENTS

3.1 Design Method

The following design methodologies apply to the requirements specified in Section 30-1724 of the LDRs. These procedures are applied to Category 2 and Category 3 developments, which require more complex stormwater management systems than Category 1 developments that require the Short Form Applications.

The following formula may be used in order to establish runoff volume and peak rate of discharge, as required by Category Two development:

The Rational Formula shall be used to determine peak pre-discharges by the formula Q = CIA, where

Q = Peak discharge in cubic feet per second (cfs);
C = Runoff coefficient (dimensionless unit);
I = Intensity of rainfall (Appendix A); and,
A = Area contributing in acres.

The detention storage volume of the pond required when using the Rational Formula will be determined by the formula V = CRA, where

V = Volume of pond in acre-feet;
C = Runoff coefficient (dimensionless unit);
R = 25-year, 72-hour rainfall in feet; and,
A = Area contributing in acres.

Hydrographs submitted for Category Three Development may utilize the SCS Unit-Hydrograph or by the modified Santa Barbara Urban Hydrograph method.

SECTION 4.0
STORMWATER TREATMENT TECHNOLOGY ALTERNATIVES

Stormwater treatment facilities are designed to treat the pollution abatement volume or "first flush" of a rainfall event, which contains the majority of the pollutants associated with the runoff. The pollution abatement volume is dependant upon land use of the site as well as the type of stormwater management facility, which is being utilized. Pursuant to the Islamorada, Village of Islands Stormwater Management Master Plan, stormwater treatment technologies for the various future land use categories in the Village are ranked by preference and include the following:

Future Land Use Category	Stormwater Treatment Technology
Airstrip	Combination of vegetated interceptor swales and retention/detention basin(s)
Conservation	Vegetated interceptor swales and buffer areas
Industrial	Sediment removal devices in tandem with exfiltration trenches (drainage wells)
Mariculture	Sediment removal devices in tandem with exfiltration trenches (drainage wells)
Public and Semi-Public Services	Sediment removal devices in tandem with exfiltration trenches (drainage wells)
Mixed Use Residential	Sediment removal devices in tandem with exfiltration trenches (drainage wells)
Mixed Use Non-Residential	Sediment removal devices in tandem with exfiltration trenches (drainage wells)
Recreation and Open Space	Vegetated swales with retention/detention areas in tandem with buffer areas
Residential Conservation	Vegetated interceptor swales and buffer areas
Residential High	Sediment removal devices in tandem with exfiltration trenches (drainage wells)
Residential Low	Vegetated interceptor swales and buffer areas
Residential Medium	Vegetated interceptor swales and buffer areas

Note that the preferred treatment technologies are based on overall general assumptions and that other treatment technologies may be utilized which may be more suitable or may produce a more cost effective and desirable approach to reducing stormwater pollutant loads at the project site.

4.1 Drainage Ponds

The following shall apply to retention/detention ponds:

1. *Design criteria for pollution abatement utilizing retention.* The design of ponds for the required retention volumes may consider separate facilities, or pollution abatement may be combined into the design of the detention pond required to reduce the peak rate of flow from the developed site, to that peak rate of flow prior to the development of the site. All retention ponds shall be designed as dry bottom ponds unless otherwise approved by the Village. A minimum of two feet (2') of filter media is required for filtering the pollution abatement volume. The volume of stormwater impounded for pollution abatement shall be evacuated through the filter media within a seventy-two-hour time period. A positive,

nonfiltering bleed-down device with an operable gate or valve shall be installed as a backup system in the event that the filtration system fails. The gate or valve shall normally be set and locked in the closed position. The bottom of a required retention pond shall be a minimum of one foot (1') above the estimated seasonal, high water table. A qualified engineer shall determine final design recovery rates. All necessary calculations to support the above shall be submitted to the Village.

2. *Design criteria of detention facilities to reduce peak rate of flow:* The detention pond shall be sized to limit the peak rate of discharge rate from the developed site to that discharge generated prior to development. Supporting calculations shall be submitted and shall contain, at a minimum, runoff hydrographs for the pre-developed site and the post-developed site, and a discharge hydrograph after routing through the proposed detention facility. All routing calculations to be submitted must consider the tailwater of the receiving facility. If the receiving facility is an existing storm drain, the hydraulic gradient line elevation (HGL) of this receiving facility can be assumed at one-half foot below its gutter line elevation, unless a detailed study of the existing system indicates otherwise.

    a. Credit for seepage to further reduce the peak rate of discharge will not be allowed, unless accompanied by supporting documentation (infiltration studies, filed permeability tests, seepage studies, etc.) prepared by a qualified engineer.

    b. A maximum design discharge of one half inch (0.5") of the detention volume in twenty-four (24) hours.

    c. All stormwater evacuation from detention facilities in excess of the pollution abatement volume shall be accomplished by a positive, nonfiltering discharge structure only. The use of underdrains to accomplish this required evacuation is prohibited. One foot (1') of the freeboard is required above the design high water of the pond.

    d. The outlet structure shall be designed to skim floating debris, oil and grease from an elevation six inches (6") below the surface of the pollution abatement volume to an elevation six inches (6") above the design high water level of the pond.

3. *Design criteria where a positive outfall is not available:* When a positive outfall is not available or discharge into a water body without a positive outfall is proposed, the pond design shall detain the 72-hour/25 year storm event. The pond shall be designed to evacuate a daily volume equivalent to one inch (1") of runoff from the total area contributing to the pond.

4. *Design criteria for off-site drainage:* Off-street areas which drain to, or across, a site proposed for development must be accommodated in the stormwater management plans for the development. The stormwater management system for the development must be capable of transporting existing off-site flows through, or around, the development. The estimation of the off-site flows must be done separately from the estimation of on-site post-flows (i.e., separate off-site and on-site hydrographs must be computed due to the typically significant difference in land use characteristics). It is strongly recommended that the project engineer meet with the appropriate Village staff prior to generating final detailed design calculations in order to establish off-site design requirements for a particular project.

4.2 Exfiltration Trench System (Drainage Well)

An exfiltration trench system (drainage well) shall be permitted for management of stormwater providing the designs have been completed by a qualified engineer and that the following requirements are met:

1. A Class V Well permit shall be obtained from Florida Department of Environmental Protection (FDEP) and proof of such permit shall be submitted to the Village prior to construction activities.

2. A licensed water well driller shall be contracted to perform well installation activities.

3. The design of the exfiltration trench system (drainage well) shall provide for access for inspection purposes and further shall have provisions to insure that maintenance activity can be performed.

4.3 Vegetated Swales (Interceptor Swales), Vegetated Buffer Areas and Berms

It is the intent of the Village to encourage the use of vegetated swales (interceptor swales), vegetated buffer areas, and berms to minimize pollutant loading to near shore waters, as well as a method of protecting Conservation land use areas. Where appropriate, native vegetation shall be installed within and downstream of the swale and/or system. A list of acceptable native vegetative species is provided within the Village Stormwater Management Master Plan, available in the office of the Director of the Planning and Development Services Department.

SECTION 5.0
DESIGN CRITERIA, PERFORMANCE AND MAINTENANCE

5.1 Retention Pond

Description

A retention pond is a stormwater treatment system which is defined as a storage area designed to collect a defined amount of runoff which allows the runoff to percolate through permeable soils into the shallow aquifer. The treatment volume is not discharged to surface waters. Soil characteristics and water table conditions must be such that the retention system can percolate the desired runoff amount within the specified time period following a rainfall event. Once drawdown is complete, the basin does not hold water therefore the system is normally dry.

Treatment Volume

The pollution abatement volume, or first flush of runoff, should be collected in the retention pond and infiltrated into the surrounding soil. Pollution abatement shall be provided for the first one-half inch (0.5") of runoff over the entire project area, or one and one-quarter inches (1.25") times the impervious area – whichever is greatest. For direct discharges to Class III Outstanding Florida Waters, canals or canals connected to other waterways which are approved, conditionally approved, restricted or conditionally restricted for shellfish harvesting, the stormwater treatment system shall provide for at least an additional fifty (50) percent of the applicable pollution abatement volume specified above.

Recovery Time

The retention pond shall be designed such that the maximum design discharge shall be one half inch (0.5") of the retention volume in twenty-four (24) hours following a rainfall event assuming average antecedent moisture conditions. Antecedent moisture conditions refer to the amount of moisture and storage available in the soil prior to a rainfall event. Antecedent conditions have a significant effect on runoff rates, runoff volumes, infiltrations rates and infiltration volumes. In general, the stormwater is drawn down in a retention pond by natural soil infiltration and dissipation processes into the groundwater table.

Basin Stabilization

The retention pond shall be stabilized with pervious material or permanent vegetative cover to provide proper treatment of the runoff.

Construction

Construction procedures are recommended as follows to avoid degradation of retention basin infiltration capacity during construction:

1. Construct retention pond to a rough grade by underexcavating bottom and sides by approximately one foot (1'). Side slopes should be sodded immediately to prevent erosion and introduction of additional sediment.

2. Once drainage area contributing to the stormwater retention pond is stabilized, interior side slopes and basin bottom should be excavated to final design specifications. Undesirable

material and excess soil should be excavated and removed carefully so that accumulated silts, clays, organics and other fine sediment material has been removed. Note that the excavated material should be disposed of beyond the drainage basin limits.

3. The retention pond bottom should be deep raked and loosened for optimal infiltration once the facility has been excavated to final grade.

Maintenance

The stormwater system should be inspected on a routine basis to assure it is functioning properly and major inspections should be conducted on a semi-annual basis. Additionally, brief inspections should be conducted following rainfall events greater than one inch (1").

Cleanout frequency of infiltration basins will depend on a number of factors including vegetation, storage capacity, infiltration characteristics, volume of inflow, amount of sediment load, type of sediment load and if pretreatment is utilized. Typically, structures should be cleaned out when sediment levels reduce the storage volume by ten (10) percent. An elevation mark should be placed inside the pond indicating such elevation. Rotary tillers or disc harrows with light tractors are recommended for scarifying pond bottoms. After tilling, the basin floor should be level and smooth to ease future sediment removal and minimize amount of material being removed during future cleaning practices.

5.2 Dry Detention Pond

Description

Dry detention ponds are similar to retention systems in that the facilities are normally dry, however, the main difference is that detention systems are designed to discharge the runoff through an outlet structure to adjacent surface waters. Runoff is held for a short period of time and then slowly released to a receiving waterbody typically at a rate no greater than pre-development peak discharge rates. Sedimentation is the primary pollutant removal process in dry retention facilities and only pollutants which are in particulate form are removed by this process. Due to the limited pollutant removal efficiency of dry detention facilities, pollutant removal efficiency is not as great as in retention or wet detention therefore dry detention should be utilized when no other stormwater management system is feasible.

Treatment Volume

The pollution abatement volume, or first flush of runoff, should be detained in the dry retention pond and slowly released through a control structure. Pollution abatement shall be provided for the first three-quarter inch (0.75") of runoff over the project area, or one and seven-eighths inches (1.875") times the impervious area – whichever is greatest. For direct discharges to Class III Outstanding Florida Waters, canals or canals connected to other waterways which are approved, conditionally approved, restricted or conditionally restricted for shellfish harvesting, the stormwater treatment system shall provide for at least an additional fifty (50) percent of the applicable pollution abatement volume specified above.

Recovery Time

An outfall structure should be designed such that the maximum design discharge following a storm event shall be one half inch (0.5") of the detention volume in twenty-four (24) hours.

Inlet Structures

Inlet structures should be designed such that the energy of the water is dissipated when entering the retention pond.

Outlet Structure

The outlet structure shall include a drawdown device which slowly releases the pollution abatement volume in addition to including a device which shall prevent the discharge of accumulated sediment, minimize exit velocities and prevent clogging. Additionally, devices shall be no smaller than six (6) square inches with a two inch (2") minimum cross section dimension or less than a twenty degrees (20°) "V" notch. The control elevation should be set at or above the design tailwater elevation. This allows the detention facility to effectively recover the treatment storage.

Minimum Elevations

To ensure detention basin floor is normally dry and minimize groundwater contributions, the control elevation and basin floor should be set at least one foot (1') above the seasonal high groundwater table. The retention pond floor should be level or uniformly sloped toward the control structure.

Basin Stabilization

The detention pond shall be stabilized with pervious material or permanent vegetative cover.

Basin Configuration

The average length to width ratio for dry detention basins shall be at least 2:1. The inlet and outlet structures must be configured such that the residence time is maximized. This condition minimizes short circuiting and pollutant removal efficiency is maximized. If the ratio cannot be achieved, the effective flow path can be increased with the addition of diversion barriers.

Construction

Construction procedures are recommended as follows during construction:

1. Construct detention pond to a rough grade by underexcavating bottom and sides by approximately one foot (1'). Side slopes should be sodded immediately to prevent erosion and introduction of additional sediment.

2. Once the drainage area contributing to the stormwater detention pond is stabilized, interior side slopes and basin bottom should be excavated to final design specifications. Undesirable material and excess soil should be excavated and removed carefully so that accumulated silts, clays, organics and other fine sediment material has been removed. Note that the excavated material should be disposed of beyond the drainage basin limits.

Note that structural elements must be designed by a Florida registered professional engineer and in accordance with acceptable engineering standards.

Maintenance

The stormwater system should be inspected on a routine basis to assure it is functioning properly and major inspections should be conducted on a semi-annual basis. Additionally, brief inspections should be conducted following rainfall events greater than one inch (1").

Maintenance requirements should include sediment removal when a certain storage elevation is reached. Debris removal can be accomplished with the use of trash racks or other screening devices. Additionally, debris should be removed following each rainfall event. Sediment deposition should also be monitored in the detention facility and the maintenance plan shall specify an elevation at which sediments should be removed. An elevation mark should be place inside the pond indicating such elevation and should be set at no greater than twenty-five (25) percent capacity with ten (10) percent being preferred.

5.3 Wet Detention Pond

Description

A wet detention pond is a permanently wet pond in which runoff is held for a short period of time and then slowly released to a receiving waterbody typically at a rate no greater than pre-development peak discharge rates. Wet detention ponds are typically recommended for sites with moderate or high water table conditions. Wet detention provides for significant removal of dissolved and suspended pollutant loads via the physical, chemical and biological processes which take place within the pond. Wet detention also provides for flood detention, runoff for irrigation and aesthetic value.

Treatment Volume

The pollution abatement volume, or first flush of runoff, should be detained in the wet detention pond and slowly released through a control structure. Pollution abatement shall be provided for the first one inch (1") of runoff over the project area, or two and one-half inches (2.5") times the impervious area – whichever is greatest. For direct discharges to Class III Outstanding Florida Waters, canals or canals connected to other waterways which are approved, conditionally approved, restricted or conditionally restricted for shellfish harvesting, the stormwater treatment system shall provide for at least an additional fifty (50) percent of the applicable pollution abatement volume specified above.

Recovery Time

An outfall structure should be designed such that the maximum design discharge following a storm event is one half inch (0.5") of the detention volume in twenty-four (24) hours.

Inlet Structures

Inlet structures should be designed such that the energy of the water is dissipated when entering the detention pond.

Outlet Structure

The outlet structure shall include a drawdown device which slowly releases the pollution abatement volume in addition to including a device which shall prevent the discharge of accumulated sediment, minimize exit velocities and prevent clogging. The control elevation should be set at or above the design tailwater elevation. This allows the detention facility to effectively recover the treatment storage. Additionally, devices shall be no smaller than six (6) square inches with a two inch (2") minimum cross section dimension or less than a twenty degrees (20°) "V" notch.

Permanent Pool Volume

The permanent pool should be sized for at least a fourteen (14) day residence time during the wet season (June - October). The storage capacity shall be large enough to detain untreated runoff long enough for removal processes such as uptake of nutrients by algae, adsorption of nutrients and heavy metals, biological oxidation of organic materials and sedimentation to occur.

Littoral Zone

The littoral zone is defined as the portion of the wet detention pond which is designed to contain rooted aquatic plants. The littoral area is typically at gently sloping pond sides which extend two (2) to three (3) feet below the normal water level or control elevation of the pond. Littoral zones can also be located at other areas of the pond which have suitable depths.

A specific vegetation establishment plan must be prepared and consider the hydroperiod of the pond and type of plants which are to be established. A layer of muck can also be incorporated into this area to promote establishment of the vegetation. Design criteria for wet detention littoral zones include:

1. Six (6) to one (1) (horizontal:vertical) or flatter slope in the littoral zone and at least thirty (30) percent of the pond surface shall consist of the littoral zone.

2. The treatment volume shall not cause the water level in the pond to rise more than eighteen inches (18") above the established control elevation unless it is demonstrated that the vegetation in the littoral zone can survive at greater depths.

3. Eighty (80) percent coverage of the littoral zone by suitable aquatic plants is required within twenty-four (24) months after construction of the system.

4. As an alternative to the recommended planting to meet the eighty (80) percent coverage requirement, portions of the littoral zone may be established by the introduction of wetland top soils at least four inches (4") in depth containing a seed source of the desired wetland plants. The littoral zone must be stabilized by mulching or other means and at least the portion of the littoral zone within twenty-five feet (25') of the inlet and outlet structures must be planted when using this alternative.

An additional fifty (50) percent of the permanent pool volume is required in lieu of a littoral zone or pretreatment of the stormwater prior to entering the wet detention pond is required.

Side Slopes

The pond shall be designed so that the average pond side slope measured between the control elevation and two feet (2') below the control elevation in no steeper than 4:1 (horizontal:vertical).

Pond Depth

A wet detention pond shall not exceed a maximum depth of twelve feet (12') and a mean depth (pond volume divided by pond area at control elevation) between two (2) to eight (8) feet. Typically, many of the nutrients and metals removed from the water column accumulate in the top inches of the pond bottom sediments. If a pond is deep enough it has a tendency to stratify creating potential for anaerobic conditions at the pond bottom. Therefore, the maximum depth criteria minimizes potential significant thermal stratification and helps maintain aerobic conditions which maximizes sediment uptake and minimizes sediment release of pollutants. Additionally, the mean minimum mean depth criteria minimizes aquatic plant growth that may become excessive if the wet retention pond is too shallow.

Groundwater Table

The control elevation should be established at or above the normal groundwater table elevation on-site to minimize groundwater contributions which may lower treatment efficiencies. The elevation is typically determined by calculating the average of the seasonal high and seasonal low groundwater elevations.

The outfall structure shall provide for discharge of baseflow at the design normal water level and the baseflow rates must be included in drawdown calculations for the outfall structure. Baseflow should also be considered when designing the wet retention pond for permanent pool residence time.

Pre-Treatment

Pre-treatment increases pollutant removal efficiency of the stormwater management system by reducing the pollutant loading which enters the wet detention pond. Pre-treatment facilities include the following:

1. Retention systems which adhere to design performance criteria

2. Swale systems which adhere to design performance criteria

3. Exfiltration trenches adhere to design performance criteria

Alternative pre-treatment methods will be evaluated on a case-by-case basis by the Village.

Basin Stabilization

The detention pond shall be stabilized with pervious material or permanent vegetative cover.

Basin Configuration

The average length to width ratio for wet detention basins shall be at least 2:1. The inlet and outlet structures must be configured such that the residence time is maximized. This condition

minimizes short circuiting and pollutant removal efficiency is maximized. If the ratio cannot be achieved, the effective flow path can be increased with the addition of diversion barriers to the basin.

Construction

Construction procedures are recommended as follows during construction:

1. Construct detention pond to a rough grade by underexcavating bottom and sides by approximately one foot (1'). Side slopes should be sodded immediately to prevent erosion and introduction of additional sediment.

2. Once the drainage area contributing to the stormwater detention pond is stabilized, interior side slopes and basin bottom should be excavated to final design specifications. Undesirable material and excess soil should be excavated and removed carefully so that accumulated silts, clays, organics and other fine sediment material has been removed. Note that the excavated material should be disposed of beyond the drainage basin limits.

Note that structural elements must be designed by a Florida registered professional engineer and in accordance with acceptable engineering standards.

Maintenance

The stormwater system should be inspected on a routine basis to assure it is functioning properly and major inspections should be conducted on a semi-annual basis. Additionally, brief inspections should be conducted following rainfall events greater than one inch (1").

Maintenance requirements should include sediment removal when a certain storage elevation is reached. Debris removal can be accomplished with the use of trash racks or other screening devices. Additionally, debris should be removed following each rainfall event. Sediment deposition should also be monitored in the detention facility and the maintenance plan shall specify an elevation at which sediments should be removed. An elevation mark should be place inside the pond indicating such elevation and should be set at no greater than twenty-five (25) percent capacity with ten (10) percent being preferred.

5.4 Exfiltration Trench System / Drainage Well

Description

An exfiltration trench is a subsurface stormwater management system consisting of a conduit such as perforated pipe which is surrounded by natural or artificial aggregate which temporarily stores and infiltrates runoff. Perforated pipe increases the storage available in the trench and helps promotes infiltration. Typically, this type of system is utilized when space is limited. Like retention basins, the treatment volume is not discharged to surface waters. Exfiltration trenches are also used to promote recharge of groundwater and prevent salt water intrusion in coastal areas.

Typically, the operation life of an exfiltration trench is five (5) to ten (10) years. Sediment accumulation and fines reduce the life of the system and replacement may be the only alternative to restoring the treatment capacity of the system.

Treatment Volume

The pollution abatement volume, or first flush of runoff, should be collected in the exfiltration trench and infiltrated into the surrounding soil. Pollution abatement shall be provided for the first one-half inch (0.5") of runoff over the project area, or one and one-quarter inches (1.25") times the impervious area – whichever is greatest. For direct discharges to Class III Outstanding Florida Waters, canals or canals connected to other waterways which are approved, conditionally approved, restricted or conditionally restricted for shellfish harvesting, the stormwater treatment system shall provide for at least an additional fifty (50) percent of the applicable pollution abatement volume specified above.

Recovery Time

The stormwater system should be designed to provide for the appropriate treatment volume and contain no contiguous areas of standing or free flowing water within seventy-two (72) hours following rainfall events assuming average antecedent moisture conditions. Antecedent moisture conditions refer to the amount of moisture and storage available in the soil prior to a rainfall event. Antecedent conditions have a significant effect on runoff rates, runoff volumes, infiltrations rates and infiltration volumes. In general, the stormwater is drawn down in an exfiltration trench by natural soil infiltration and dissipation processes into the groundwater table.

Safety Factor

The exfiltration trench shall be designed with a safety factor of at least two (2) unless it can be demonstrated that a lower safety factor is appropriate for specific site conditions.

Minimum Dimensions

The exfiltration trench system shall be designed with a minimum twelve inch (12") pipe diameter and a three foot (3') minimum trench width. The perforated pipe should be located within the trench section to minimize sediment accumulation in aggregate void storage and maximize preservation of the storage for treatment.

Filter Fabric

The exfiltration trench should be designed so that aggregate in the trench is enclosed in filter fabric, which prevents migration of fine materials from the adjacent soil that could potentially clog the trench. Additionally, filter fabrics may be utilized directly surrounding the perforated pipe though the pipe may be more prone to clogging and capacity reduction. However, this design can be cleaned relatively simply with high-pressure hoses or vacuum systems whereas without the filter fabric surrounding the pipe, complete replacement is typically necessary when there is clogging.

Inspections and Cleanout Structures

Cleanout structures, otherwise known as sediment removal devices, should be installed at the inlet of the pipe structure. Inspections and cleanout structures aid in observing how quickly the trench recovers following a storm event and how quickly the trench fills with sediment. It also allows access to the perforated pipe.

Construction

Steps should be taken to limit the parent soil and debris from entering the trench which extends the life of the exfiltration system. Diversion berms should be placed around the trench during construction and sediment and erosion control plans should be designed to keep sediment and runoff away from the trench area.

Maintenance

The stormwater system should be inspected on a routine basis to assure it is functioning properly and major inspections should be conducted on a semi-annual basis. Additionally, brief inspections should be conducted following rainfall events greater than one inch (1").

Routine maintenance includes cleaning out the pretreatment devices such as sediment control structures periodically and the periodic cleaning of infiltration trench manually or by vacuum truck when ten (10) percent or more of the available capacity is depleted.

5.5 Vegetated Swales (Interceptor Swales), Vegetated Buffer Areas, and Berms

Description

Vegetated swales are man-made or natural systems, which are shaped or graded to specified dimensions and designed for conveyance and infiltration of stormwater runoff. Swales only hold water during and immediately following a storm event; however, unlike retention systems there are no physical barriers such as berms or check dams to impound the runoff in the swale prior to discharge. Berms are similar in nature swales but are built up mounds of soil and vegetated materials that are typically used on or near the perimeter of a parcel to retain stormwater from exiting the parcel.

Treatment Volume

The pollution abatement volume, or first flush of runoff, should be collected in the stormwater management system and infiltrated into the surrounding soil. Pollution abatement shall be provided for the first one-half inch (0.5") of runoff over the project area, or one and one-quarter inches (1.25") times the percent impervious surface – whichever is greatest. For direct discharges to Class III Outstanding Florida Waters, canals or canals connected to other waterways which are approved, conditionally approved, restricted or conditionally restricted for shellfish harvesting, the stormwater treatment system shall provide for at least an additional fifty (50) percent of the applicable pollution abatement volume specified above.

Recovery Time

The swale shall be designed such that the maximum design discharge shall be one half inch (0.5") of the retention volume in twenty-four (24) hours following a rainfall event (assuming average antecedent moisture conditions).

Dimensional Requirements

Swales shall have side slopes equal to or greater than 4:1 (horizontal:vertical). Berms shall typically be no higher than three feet above natural ground surface and shall have a maximum side slope of 2:1.

The required width of a vegetated buffer can be determined through the infiltration of a desired runoff volume in the vegetative buffer or through overland sheet flow of the runoff through the buffer. Typically, overland flow should be utilized when there is a high groundwater table or poor infiltration rates and infiltration should be utilized when there is a low groundwater table and the soil has good infiltration rates. For both scenarios, a minimum of a fifteen foot (15') buffer width is required.

Stabilization

Swales and berms shall be stabilized with vegetative cover suitable for soil stabilization, stormwater treatment and nutrient uptake. The swale and berm should be designed to take into account soil errodibility, soil percolation, slope, length and drainage area. This allows for the reduction in pollutant loading concentrations and helps to prevent erosion.

Construction

Swales and berms shall be staked for construction. All vegetative debris including trees, stumps and brush shall be removed from the system and disposed of as not to interfere with the proper functioning of the swale or berm.

The soil removed from the swale shall be deposited beyond the drainage basin limits or where it will not interfere with flow of water into the swale system. Topsoil should be saved and spread in the constructed soil if necessary to ensure establishment of vegetative cover. The swale should be over-excavated to allow for replacement of the topsoil without encroaching of the cross section design.

Settlement of soils should be specifically considered when designing berms and proper compaction be performed prior to stabilizing with vegetative cover.

Methods for establishing grass vegetation include:

1. Seeding with straw mulch and tack coat

2. Seeding with straw mulch and jute mesh or erosion netting

3. Sodding

Maintenance

The stormwater system should be inspected on a routine basis to insure it is functioning properly and major inspections should be conducted on a semi-annual basis. Additionally, brief inspections should be conducted following rainfall events greater than one inch (1"). Inspections of the swale or berm for areas of failures should be performed after each rainfall event and make any repairs or replacements when observed and re-seedings in the planting season.

Fertilization and mowing should be done to ensure the vegetation is in healthy condition. Cut vegetation should be removed to prevent decaying organic litter and from adding pollutants to the swale discharge. Vehicular traffic should be prohibited from swales and berms.

Appendix A

Design Support Information

Table 1
Runoff Coefficients (C) for a Design Storm Return Period of Ten Years or Less[1]

Land Use	C
Lawns	0.10
Rooftops and pavement (concrete and asphalt)	0.95
Pervious pavements[2]	0.85
Woodlands and heavily vegetated areas	0.15
Gravel/Rock/Limestone	0.30
Pasture and grass, areas[3]	0.20
Residential	
Low	0.35
Medium	0.45
High	0.60

Sources: Florida Department of Transportation, 1987; Wanielista, 1990

[1] For 25- and 100-year recurrence intervals, multiply coefficient by 1.1 and 1.25, respectively, and the product cannot exceed 1.0.
[2] Coefficients assume good ground cover and conservation treatment
[3] Depends on depth and degree of permeability of underlying strata.

Appendix B

Standard Details

Appendix C

Short Form Example

February 9, 2002

Planning & Development Services Department
Islamorada, Village of Islands
81990 Overseas Hwy, 2nd Floor
PO Box 568
Islamorada, FL 33036

Subject: Short Form Application for Stormwater Management System
Lot 57, Block 2, Subdivision Venetian Shores
123 Conch Blvd.
Islamorada, FL
Owner Name: Ralph Jones

To Whom It May Concern:

Please accept the attached Short Form Application for a Stormwater Management System for 123 Conch Way, Islamorada, Florida for your review and approval. Enclosed with this application are a written description of the site alterations, Stormwater Retention Pond and Swale Worksheet (Short Form), applicable stormwater calculations, and a site sketch of the proposed site alterations and stormwater management system.

The project consists of the addition of a 250 square foot brick paver patio on the north side of the existing building structure. The project site is located adjacent to a canal in the Venetian Shores development; however, there will be no direct discharge from the proposed site alterations to the adjacent canal. The project is designed with a 17-foot vegetative buffer consisting of St. Augustine grass and native vegetation between the proposed patio and canal sea wall. Additionally, a dry retention pond have a volume of approximately 27 cubic feet has been designed to retain the required stormwater runoff from the proposed addition.

Please review the attached information at your earliest convenience. If you have any questions regarding the information provided, please contact me at (305) 555-1212.

Sincerely,

Joe Smith, P.E.

attachments

STORMWATER RETENTION POND AND SWALE WORKSHEET "SHORT FORM"

LOT: 57 BLOCK: 2 SUBDIVISION: Venetian Shores

PHYSICAL ADDRESS: 123 Conch Blvd OWNER NAME: Ralph Jones

Calculate Treatment Volume Required

Previously Unimproved Site

(A) Rainfall = 0.5"

(B) Site Area N/A ft^2

(C) Cubic Feet Required = $\frac{\text{Site Area x Rainfall}}{12} = \frac{\text{B x A}}{12}$ = N/A ft^3

(D) Rainfall = 1.25"

(E) Impervious Area N/A ft^2

(F) Cubic Feet Required = $\frac{\text{Impervious Area x Rainfall}}{12} = \frac{\text{E x D}}{12}$ = N/A ft^3

(G) Stormwater Treatment Volume (greater of J or M)= N/A ft^3

(H) Stormwater treatment discharge facilities which discharge directly to sensitive receiving waters including Class III Outstanding Florida Waters, or canals or other waterways connecting these with these waters shall provide additional retention pretreatment equal to fifty (50) percent of the total required volume, depending on the arrangement of on-site facilities.

Total Cubic Feet Required = G x 1.5 = N/A ft^3

Previously Improved Site

(I) New Impervious Area 250 ft^2

(J) Rainfall = 1.25"

(K) Cubic Feet Required = $\frac{\text{Impervious Area x Rainfall}}{12} = \frac{\text{I x J}}{12}$ = 26.04 ft^3

(L) Stormwater treatment discharge facilities which discharge directly to sensitive receiving waters including Class III Outstanding Florida Waters, or canals or other waterways connecting these with these waters shall provide additional retention pretreatment equal to fifty (50) percent of the total required volume, depending on the arrangement of on-site facilities.

Total Cubic Feet Required = K x 1.5 = N/A ft^3

STORMWATER RETENTION POND AND SWALE WORKSHEET "SHORT FORM" (Cont.)

Calculate Swale Length (if applicable)

(M) Cubic Feet Required N/A ft^3

(N) Square Feet Cross Sectional Area N/A ft^2

Note: A swale with 4:1 slopes and 1 foot depth has a 4 ft^2 of Cross Sectional Area.

(O) Swale Length = $\frac{\text{Cubic ft. Required}}{\text{Square Feet Cross Sectional Area}} = \frac{M}{N} =$ N/A ft

MUST PROVIDE CROSS SECTIONAL DETAIL OF SWALE, BERM, OR OTHER STORMWATER RETENTION OR DETENTION STRUCTURE

Appendix D

Standard Example

February 9, 2002

Planning & Development Services Department
Islamorada, Village of Islands
81990 Overseas Hwy, 2nd Floor
PO Box 568
Islamorada, FL 33036

Subject: Application for Stormwater Management System
Lot 36 - Block 6 - Subdivision Williams Tract
Snapper Street Resort
123 Snapper Street
Islamorada, FL
Owner Name: Mary Williams

To Whom It May Concern:

Please accept the attached Application for a Stormwater Management System for 123 Snapper Street, Islamorada, Florida for your review and approval. Enclosed with this application are a written description of the site alterations, stormwater calculations and stormwater system design, and site design drawings.

Proposed Site Alterations

The project generally consists of redevelopment of the existing Snapper Street Resort Complex with the addition of new parking areas, re-vegetation, façade and interior renovations and stormwater improvements. An additional impervious area of approximately 2,200 square feet is proposed for the site.

Stormwater Management Plan

As indicated on the attached site plan, the stormwater management plan consists of redirecting stormwater from the impervious areas of the site to three retention ponds that are to be constructed on the site. Drainage calculations indicate that the ponds are required to treat 1,234 cubic feet of runoff and have been designed according to the criteria set forth in Chapter 30, Article VII, Division 8, *Stormwater Management*, of the Village Code and the supplementary Stormwater Design Criteria Technical Manual.

Drainage Map

See Drainage Plan

Lot Grading Map
See Drainage Plan

Vegetation Plan
The vegetation plan generally consists of the addition of new native plants around the perimeter of the project area. The Landscape Architect specifically selected the vegetation in general accordance with locally accepted criteria for native vegetation, minimal watering requirements and aesthetic value. The attached Drainage Plan specifies the location and layout of the proposed vegetative areas.

Stormwater System Maintenance and Operation
The owner, Ms. Mary Williams, will conduct the stormwater system maintenance and operation according to the frequencies specified in the Stormwater Design Criteria Technical Manual.

Please review the attached information at your earliest convenience. If you have any questions regarding the information provided, please contact me at (305) 555-1212.

Sincerely,

Joe Smith, P.E.

attachments