

CITY OF CLEARWATER
PUBLIC WORKS ADMINISTRATION
STORMWATER MANAGEMENT

STORM DRAINAGE DESIGN CRITERIA

INTRODUCTION

This manual is a guide to assist Engineers in the design of stormwater systems in the City of Clearwater. In general these standards are a combination of requirements set by the Southwest Florida Water Management District, and requirements set by the City of Clearwater, Public Works Administration. This manual does not propose to itemize the requirements of the Southwest Florida Water Management District, but to highlight and detail the requirements of the City of Clearwater. Where design standards of applicable regulatory agency's vary, the more restrictive or higher standard will apply. The Designer is required to be familiar with the current design requirements of the Southwest Florida Water Management District. The appropriate Southwest Florida Water Management District storm water permit and other applicable regulatory agency permits will be required prior to any final construction permit approval by the City of Clearwater.

The Designers attention is called to the City of Clearwater requirement that all development and redevelopment will require provisions for storm water management. In particular, redevelopment will be required to provide storm water management facilities in accordance with the regulations herein.

For the purpose of administering these stormwater management regulations, redevelopment is defined as the alteration of buildings, parking, or other landform features of a property, which necessitates the Community Development Code review process. Redevelopment of property for which no stormwater management facilities exists will be required to provide such facilities in accordance with the methodology contained herein, notwithstanding that the circumstances of the redevelopment may not result in an increase of stormwater runoff.

STORMWATER MANAGEMENT

DESIGN CRITERIA

1. GENERAL

All construction shall comply with the City of Clearwater Contract Specifications and Standards. All stormwater facility designs must be designed and certified by a Florida Registered Engineer.

Record drawings shall be submitted and certified by a Florida Registered Engineer before final acceptance of project.

Design Frequency

- (a) - 10 Year - storm systems, culverts
- (b) - 25 Year - channels and detention areas with outfalls
- (c) - 50 Year - detention areas without outfalls
- (d) - 100 Year - detention areas without outfalls which when capacity is exceeded overflow onto private property

Runoff Coefficients

Ponds, lakes and detention area (wet or dry)	1.00
Buildings, paved areas, and other impervious areas	.95
Turfblock	.45
Green or pervious areas	.20

Design coefficients shall be obtained by using the above coefficients on a weighted run off method for both pre-development and post-development.

2. STORM DRAINAGE

Detention areas must be built before storm sewers are installed. Slopes shall not be steeper than four to one (4:1) and shall be protected from erosion by sod.

Time of Concentration

Time of concentration to first inlet on a system shall be determined by using velocity of runoff chart (Chart attached). A minimum time of 15 minutes to first inlet shall be used.

3. STORM SEWERS, INLETS, AND STREET DESIGN PERTAINING TO WATER FLOW

Unless specifically approved by the City Engineer, reinforced concrete pipe shall be used in all easements and street rights-of-way. Minimum size shall be 15" diameter. Design frequency - 10-year storm. Mannings Roughness coefficient for storm pipe:

STORMWATER MANAGEMENT

(a) <u>RCP</u>	<u>N</u>
15" - 30" inclusive	.013
36" - 48" inclusive	.012
54" – up	.011
(b) <u>CMP</u> or <u>Aluminum</u>	.023
Asphalt coated	.018
(c) <u>PVC Storm Drain Pipe</u>	.009

The slopes for culverts used as storm sewers shall produce a velocity within the following limits:

	<u>Maximum</u>	<u>Minimum</u>
<u>CMP</u>	10 f.p.s.	2 f.p.s.
<u>RCP</u>	12 f.p.s.	2 f.p.s.

Standard hydraulic gradient elevation shall be minimum of 1.0 foot below throat of inlet or manhole.

Minimum Culvert Size:

- (a) - Pipe - 15"
- (b) - Box Culvert - 3' x 3'

Maximum length of pipe without access structure:

- (a) - (15" - 18") Pipe - 350 ft.
- (b) - (24" - 36") Pipe - 400 ft.
- (c) - (42" & cover & all box culverts) - 500 ft.

4. INLETS AND MANHOLES

Vertical throat opening for inlets shall be 5".

Inlets and manholes will be designed so as not to have standing water when not functioning.

All inlets to have manhole lids in accordance with City standards.

Inlets are not to be placed in curb return.

Pipes are to be cut flush with inside wall of inlet.

Subdrain shall enter structure a minimum of one foot above invert and 2'-6" below top of structure.

When pipe diameter exceeds 30", inlets shall not be used as junction boxes, limit 3 pipes per inlet.

For design purposes inlet capacity should be assumed as follows:

	Grate Inlet *	-	4 CFS
	(No Wing Type *	-	4 CFS
5" Throat	(Single Wing Type	-	6 CFS
	(Double Wing Type	-	8 CFS

* - Subject to City Engineer's approval only.

Standard inlet wings shall be a minimum of four feet in length as per City Standards.

STORMWATER MANAGEMENT

5. STREET DESIGN

Generally gutter water should not be carried for distances exceeding 600 feet.

Except as where impractical, channeling water across intersections will not be allowed.

			Inlet Spacing
Normal Grades	-	.5% up to 2%	- 600 ft.
Steep Grades	-	greater than 2%	- 400 ft.

Where grades exceed 2%, a 6' wing will be required on the inlet. Grades less than 0.5% are subject to City Engineer's approval only. A minimum of 0.5% grade shall be required for asphalt drives and parking lots. Right-of-way shoulders shall be sodded three feet behind curb and remainder, graded, seeded, and mulched. Mulch to be dry or green per F.D.O.T. current standard.

6. HEADWALLS

All inlet and outlet pipes shall be provided with a headwall, mitered end section, or flared end section. Headwalls shall be reinforced concrete. Pinned Sand/Cement bag structures built in accordance with City of Clearwater specifications may be permitted only for temporary use. All outlets shall have an appropriate apron to prevent erosion.

7. CHANNELS AND SWALES

Roughness Coefficient - for a channel with maintained vegetation is .030 to .035.

Normal channel depth shall not be within 10% of critical depth. When velocities exceed maximum allowable values energy dissipators shall be provided. Plans shall include undeveloped areas, pre-development drainage, and pre-development discharge at key design points such as channels, existing ponds, sloughs, etc. Also post-development calculations for storm runoff and proper detention shall be determined.

Type of Soil in Flow Line	Maximum Allowable Velocity (f.p.s.)
Fine Sand	1.5
Sandy Loam	1.8
Silt Loam	2.0
Firm Loam	2.5
Fine Gravel	2.5
Stiff Clay	3.8
Coarse Gravel	4.0
Hardpan	6.0

Major channels (Q greater than 30 CFS) shall have a five-foot bottom width. Drainage swales normally will not be permitted along rear lot lines.

Swales shall be vegetated and designed for a 50-year storm.

STORMWATER MANAGEMENT

8. STORM WATER DETENTION

This policy is to insure that runoff will not be increased beyond its present state by development. It is also intended to protect the quality of receiving waters in the City from additional pollution resulting from new development. The design frequency shall be a 25-year storm based on rainfall intensity graph for the Clearwater area. The duration may be obtained from the Rational method for areas up to 10 acres. Design variations may be considered for areas less than one acre. The runoff coefficient differential DELTA C is obtained by subtracting pre-development coefficient from post-development coefficient.

For projects greater than 10 acres, systems design must incorporate the U.S. Department of Agriculture Soil Conservation Service Modified Unit Hydrograph, or equivalent as determined by the City Engineer, in conjunction with a SCS Type II Florida Modified rainfall distribution curve.

In the case of redevelopment of land upon which no stormwater attenuation or water quality feature exists, or upon which the existence of such features do not meet the standards applicable at the time of redevelopment, the redeveloper will be required to provide facilities in a manner similar to an original developer and in proportion to the extent to which the site plan of the property is affected or disturbed by the redevelopment. In the methodology for calculating stormflow from property undergoing redevelopment, the pre-development volume of runoff will be calculated by the use of a Weighted Runoff Coefficient taken from the following table:

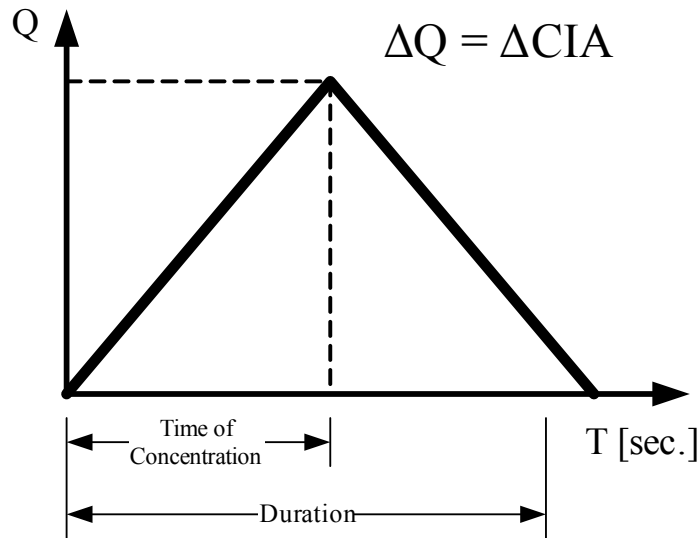
PROPERTY DESCRIPTION*	WEIGHTED COEFFICIENT OF RUNOFF**
Undergoing redevelopment and not contributing to an existing flooding problem ***	1/2 Actual
Undergoing redevelopment and contributing to an existing flooding problem	.20
Undergoing redevelopment and contributing to an existing flooding problem for which an attenuating stormwater management project is under construction	1/2 Actual
* City Engineer shall be the determining authority of the Property Description ** In no case shall the coefficient be less than .20 ** To be applied only to area of property undergoing alteration *** Situation wherein property damage occurs in a 25 year - 24 hour storm	

The City of Clearwater standards relative to the provision of water-quality features are, by this reference, the same as the Southwest Florida Water Management District's, excepting that where SWFWMD may rule that no water quality features are required, the City's standard shall require the provision of treatment of 1/2 inch of rainfall as applied over the entire area of a development project and 1/2 inch as applied over the portion of the site plan undergoing alteration in the case of redevelopment.

The design hydrograph is an isosceles triangle with a time of concentration equal to one half of the duration. Detention design shall incorporate a minimum time of concentration of one hour & 25-year storm intensity. The outfall shall be restricted to accommodate the pre-development flow with

STORMWATER MANAGEMENT

appropriate overflow facilities for larger volumes. Detention ponds will require 0.5' of freeboard.



Volume of detention may be established by multiplying time of concentration times DELTA Q providing the outlet control structure (weir, pipe, etc.) is designed to restrict other than pre-development Q. An outfall design allowing less than the pre-developed Q to pass is acceptable if storage is provided.

Discharge to Lake or Wetland

In situations where the pre-developed Q abuts a lake or wetland, the developer may store additional runoff above that required for water quality treatment in the wetland provided that the following conditions are met:

Wetland with positive outfall has the capacity to store a 25-year design storm.

Wetland with no outfall has the capacity to store a 50-year design storm.

Wetland has sufficient capacity to absorb additional runoff.

All areas on or off site contributing to a wetland shall be included in the design. Runoff discharging directly to the wetland shall be transmitted via grassed swales. Runoff from lots abutting a wetland shall be collected in an interceptor swale designed to drain dry in less than 24 hours.

The maximum design high water elevation of the wetland shall be one foot below the lowest floor elevation around the wetland or one foot below the flow line of the nearest adjacent road, whichever is lower. The design wetland elevation shall be determined by the inflow and outflow hydrograph method.

The impact to the wetland system will be taken into consideration when reviewing these applications. Those areas directly outfalling into tidal salt-water basins will be reviewed for water quality impacts only.

STORMWATER MANAGEMENT

Dry Detention Systems

Dry detention systems are those that under non-storm conditions are dry, i.e., has a grassed bottom and side slopes that can be mowed. These systems shall be designed with no steeper than 4:1 side slopes, preferably no deeper than three feet deep and drain dry within 24 hours or less. The side slopes and bottom shall be sodded. Drawdown may be accomplished by the use of underdrain according to City specifications or by percolation if the soil conditions permit. At least one soil boring showing soil profile and the seasonal high water table shall be provided with the site plan. The soil boring shall be located at the center of the proposed detention area.

Wet Detention Systems

Wet detention/retention systems are those that under non-storm conditions are designed to have a standing pool of water. The design shall be in accordance with City Details. All wet systems shall incorporate a vegetated littoral shelf over 35% of the areal cover of the pond under normal conditions. Drawdown may include an underdrain system, natural percolation or slow bleed down system. Underground vaults are not allowed as water quality facilities and are permissible for water quantity storage only as specifically allowed by the City Engineer.

Detention Pond Walls

The use of vertical walls on the sides of detention ponds or side slopes steeper than 4:1 are discouraged and will not be permitted except as may be specifically approved due to reason of undue hardship to the developer. In no circumstance will vertical walls on detention ponds be permitted adjacent to rights-of-ways, along the boundaries of adjacent parcels of land, on more than two sides of a detention pond, or any side of a pond serving only as a water quality facility.

9. SUBMITTALS

In addition to submitting complete plans and specifications, the Engineer shall also submit the following:

- A. Drainage calculations or computations including hydro-graphs for any detention areas, retention ponds, complete with cross sections.
- B. A scale map or plat showing each subdivision drainage basin, as an aid for review of the proposed work. A minimum of 50 feet of topographical survey shall be required adjacent to the perimeter of the proposed site.
- C. Profile of hydraulic gradient for storm pipe system.
- D. All pertinent information of adjoining properties affected by stormwater from site such as finish floor elevations of buildings, streets, channel or receiving waters to the final outfall. All adjacent property draining onto the proposed site is to be shown on the site plan.

Before project is accepted by the Public Works Administration, a Registered Engineer must submit written verification that the project was constructed in accordance with approved construction plans.

STORMWATER MANAGEMENT

10. ATTACHMENTS

Rainfall - Intensity/Duration - Clearwater. This Rainfall Intensity Graph shall be used for 10, 25, and 50-year storms.

Velocity of Runoff - for use in determining intensity for above grade runoff.