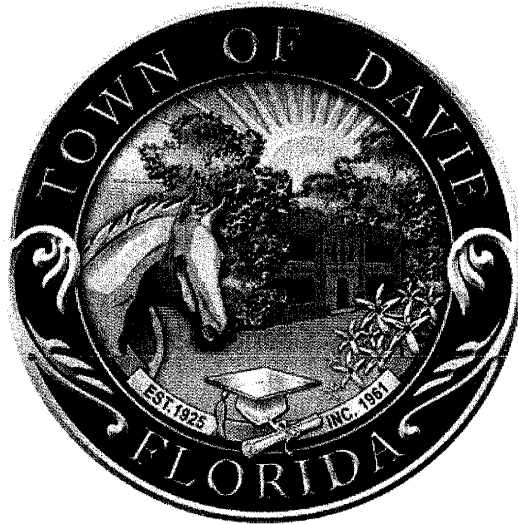


SECTION II
STORM WATER MANAGEMENT



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STORM WATER MANAGEMENT:

All stormwater drainage systems constructed within the limits of Town of Davie (TOD) must comply with the criteria of South Florida Water Management District (SFWMD), Central Broward Water Control District (CBWCD), Tindall Hammock Irrigation and Soil Conservation District (where applicable), and the TOD Land Development Code.

The Tindall Hammock Irrigation and Soil Conservation District's governance within the Town's limits consists of a small area bounded by State Road 441 to the east, State Road 84 to the north, SW 36th Street to the south and Davie Road and College Avenue to the west. The remaining area within the Town of Davie limits falls under the jurisdiction of Central Broward Water Control District.

The storm water conveyance system within the Town of Davie is made up of primary, secondary and tertiary canals including the C-11 canal operated by the SFWMD. The conveyance system is eventually pumped west to the Everglades and east to the Atlantic Ocean.

2.1 Stormwater Systems:

2.1.1 Water Quality:

- A. Per SFWMD criteria, all projects shall provide onsite retention for a volume equivalent to the first inch of runoff from the developed project, or the total runoff of 2.5 inches times the percentage of imperviousness, which ever is the greater. In addition, commercial/industrial developments must also provide dry retention or exfiltration trench system for one-half (1/2) inch of runoff from the total project area.
- B. Environmental licensing standards are required to be met. SFWMD, Army Corp of Engineers and Florida Department of Environmental Department (FDEP) are appropriate regulatory agencies.
- C. The Town of Davie desires that baffles and other measures be utilized per appropriate regulatory agencies to improve water quality in the conveyance system within the Town limits.

2.1.2 Dry Retention/Detention:

- A. Dry Retention/Detention areas are required to have sodded side slopes of a maximum 4:1 horizontal to vertical ratio. The bottom of the Dry Retention/Detention areas must have an elevation of at least one (1) foot above

the water control elevation. SFWMD defines the water control elevation as the lowest elevation at which water can be released through the discharge structure.

- B. Bleed down calculations shall be provided to CBWCD showing that the Dry Retention/Detention area is capable of recapturing its volume capacity within a 72-hour period after the storm event.
- C. Per SFWMD criteria all developments must be bounded by a perimeter berm set at (or above) the 25-year 3-day routed storm stage (please refer to the detail section in this manual for a typical berm detail). The only offsite discharge prior to the 25-year 3-day storm event shall be via a three (3) inch bleeder or based on the SFWMD-Allowable Discharge Formulas, which can be found in the SFWMD Environmental Resource Permit Information Manual, Volume IV.
- D. Positive discharge may be required by Central Broward Water Control District CBWCD.
- E. Retention/Detention easements must be dedicated to CBWCD.

2.1.3 *Canal, Ditches and Swales:*

- A. All canals and ditches shall have a five (5) foot minimum bottom width unless approved otherwise by the Drainage District and the Town Engineering Standards.
- B. All canals shall have a bank slope of 4:1, unless permitted otherwise, with a blanket easement from TOB to TOB, and a canal maintenance easement (CME) of 20 feet dedicated to the local drainage district. The maximum allowable, horizontal to vertical slope ratio within the CME shall be 20:1.
- C. All swale areas within the Town limits shall be sodded in species normally grown as permanent lawns in Broward County. These areas shall be maintained, kept in good repair and kept free from obstructions which may be hazardous to the welfare of the general public.
- D. Dry retention/detention may be seeded at the bottom area.
- E. Maximum channel slopes should not exceed 2.0% for seed and grass areas. In no case, maximum channel slope for sodded areas should not exceed 5.0%.

2.1.4 *Water Bodies:*

- A. Lakes shall have a 4:1 or 5:1 side slope to the "Deep Cut Line" which is considered to be 3 feet below the water control elevation. From the "Deep Cut

Line” to a minimum depth of 10’ below the water control elevation, the slope shall be a maximum of 2:1 horizontal to vertical ratio.

- B. Lakes must have a water surface area of at least 0.50 acres and a minimum width of 100 feet to be considered as part of the stormwater system.
- C. All lakes shall have a bank slope of 4:1, with a littoral shelf, or 5:1 without, and a lake maintenance easement (LME) of 20 feet and a maximum horizontal to vertical side slope of 20:1. The entire area of the water body, defined from TOB to TOB, along with the LME shall be dedicated to the local drainage districts as easements. Typical lake cross section can be found in Section V, Drainage Details.
- D. All water bodies adjacent to trafficways must be provided with guardrails. Materials and installation shall be in conformance with current FDOT Design standards.

2.1.5 *Soils and Ground Storage*

- A. For design purposes, the storage capacity of the soils has been estimated by the Soil Conservation Service for the normal sandy soils found within the South Florida Water Management District boundaries.
- B. The amount of water which can be stored within the soil profile is a function of the depth to water table. For more information on this subject please refer to the SFWMD Environmental Resource Permit Information Manual (Volume IV), Surface Water Management Design Aids Section, page E-1.
- C. In order to determine the percolation characteristics of soils when designing an exfiltration trench system, a “Usual Open – Hole Test” must be performed by a geotechnical engineer, as prescribed by the SFWMD Environmental Resource Permit Information Manual (Volume IV). After the test has been performed, the resulting hydraulic conductivity (K) values shall be used in determining the amount of exfiltration trench needed for the corresponding water quality volume.
- D. A certified geotechnical report with the K value and other testing needs to be submitted by a professional engineer licensed in the State of Florida to the Town of Davie engineering staff. This report should include applicable safety factors based on industry standards.
- E. An application for a “Letter of Map Revision” for projects (Flood Management) shall be submitted as applicable. Please coordinate with the Engineering staff at the Town of Davie for more information.

2.1.6 Exfiltration Trench systems:

- A. The design parameters of exfiltration trench systems shall be in conformance with SFWMD criteria.
- B. The system shall consist of a minimum 15 inch pipe with 3/8 inch perforations arranged 360 degrees around the pipe.
- C. The perforated pipe shall be surrounded by a washed rock medium, at least 5' in width, and wrapped in geotextile fabric.
- D. The amount of exfiltration trench required for each development shall be determined by the SFWMD Volume IV trench design formula which is based on the geometric parameters of the proposed trench and the local soil percolation qualities. Geotechnical report is required to be submitted to confirm the local soil conditions.
- E. The perforated pipe shall terminate at least 5 feet from any drainage structure, with the remaining 5 feet being non-perforated pipe.
- F. Exfiltration trench systems shall be accessible and terminate with accessible structures (inlet or manholes) at the ends of the pipe.

2.1.7 Perimeter Berms:

- A. Per CBWCD/SFWMD criteria perimeter berm shall be set at the proposed development 25-year 3-day storm stage elevation.
- B. The berm must be at least 0.50 feet above the surrounding grades and shall have maximum side slopes of 3:1 or 4:1 when adjacent to a dry retention/detention area. Additionally, berm must have flat top area of at least 2 feet in width. Typical perimeter berm detail can be found in Section V, Drainage Details.

2.1.8 Hydraulic and Pipe Design Standards:

- A. The minimum size storm water pipe diameter within the Town of Davie and Broward County's public right-of ways shall be 15".
- B. The minimum size storm water pipe diameter within FDOT right-of-ways shall be 18".
- C. Driveway crossings shall have a minimum culvert diameter of 15".

- D. Hydraulic Line Calculations for any proposed storm sewer systems must be submitted for review at the local drainage district and the Town of Davie engineering department.
- E. The Hydraulic Grade Line (HGL) computed in the calculation must be 1.0' foot below the rim elevation during the 10 year storm event for arterial streets, and 0.50' below the rim elevation during the 5 year intensity storm even for local streets.
- F. When performing hydraulic calculations, the tail water elevation must correspond to the 3-year 1 day storm event at the end of the 12th hour. Additionally, the modeling must account for energy losses due to friction, and the velocity shall range between 2 feet per second (fps) and 10 fps.

2.1.9 Drainage Structures:

- A. All drainage structures shall be precast concrete as manufactured by U.S. Precast Corporation, or approved equal. The minimum slab and wall thickness shall be a minimum of an 8 inch with No. 4 reinforcing bars spaced 12" apart.
- B. All structure grades shall be of metal material as manufactured by U. S. Foundry, or approved equal.
- C. All drainage pipes constructed within public road right-of-way must be of Reinforced Concrete Pipe (RCP) conforming to ASTM L70-79 specifications.
- D. All installed storm sewer pipes shall have a minimum protective cover of 18 inch.
- E. Rip Rap headwalls shall be constructed of sand/cement encased in permeable burlap, cloth or paper bags, with a minimum compressive strength of 2000 psi, per FDOT standards.
- F. Catch basins and drainage collection structures shall be designed without an open sump. Reference section 2.1.1.C for additional information in regard to improved water quality.
- G. Prior to discharge to any body of water or any exfiltration trench, a pollution retardant baffle (PRB) shall be installed. All pollution retardant baffles shall be sealed and water tight.
- H. PRB Material Specifications are as follows:
 - 1. Aluminum sheet of same thickness (gauge) as pipe shall be welded to close opening at the top.

2. The bottom elevation of the pollution retardant baffle must be at least 2' below control elevation.
3. Neoprene adhesive backed gasket, or approved equal (1" x 2") shall be installed on the sides and top of all baffles.
4. Pollution retardant baffle to be fastened in place with 3/8"x4" stainless steel "red heads", or approved equal.
5. All exfiltration trenches shall have a pollution retardant baffle at each connection point to a structure (see exfiltration trench detail).
6. Fiberglass baffles are not permitted.
7. Mounting brackets may be added to flat bars to ease installation in round structures. Spacing to match holes in flat bars.

2.1.10 Stormwater Pollution Prevention Measures – NPDES

- A. Prior to clearing and grubbing activity, the contractor shall install erosion and sedimentation control measures in accordance with Florida Department of Environmental Protection (FDEP) and the Town of Davie Code of Ordinances.
- B. As construction progresses, the contractor shall periodically check the sedimentation controls and repair them as necessary to keep them in good functioning order.
- C. The contractor shall protect inlets and other site appurtenances from sedimentation using protection as detailed in FDEP Erosion and Sedimentation.
- D. The contractor shall conduct ground stabilizing measures (paving, grassing, mulching and sodding) as soon as practicable following final completion of construction and completed stabilization of potential erosion area, the contractor shall remove sedimentation control measures and clean and repair any areas affected by the construction activities.
- E. A forty (40) feet wide and fifty (50) feet long construction entrance shall be provided prior to construction activity.

2.1.11 Roof Drainage:

All roof drainage outlets shall be shown on the construction plans. The plans must give evidence that stormwater runoff from the building structure will be

directed to the pond, inlet, or structure intended to receive the stormwater runoff in accordance with stormwater management calculations.

2.1.12 *Acceptable Structures:*

All drainage structures within public right-of-way or easements shall be standard Florida Department of Transportation (FDOT) inlets, manholes and junction box types unless special requirements require a unique structure design. Such instances will be reviewed on a case-by-case basis.

A. Placement and Spacing of drainage structures:

- a. Manholes: Stormwater manholes shall in no instance be spaced no further than as given in the table below:

Maximum Spacing for Stormwater Manholes

<u>Pipe Size</u>	<u>Max. Spacing (ft.)</u>
≤ 18"	300
24"-36"	400
≥ 42"	500

- b. Inlets: Inlets are to be spaced so to provide adequate stormwater runoff evacuation to prevent unacceptable stormwater spreading into the traveled lanes.
1. The maximum distance for flow in a curb and gutter to the first point of removal for any roadway shall be 300 ft.
 2. All low point (sump) location inlets shall be designed to intercept 100% of the design flow including by-pass flow from upstream inlets.
 3. All intermediary inlets (not at low points) shall be designed to intercept at least 80% of the design flow.
 4. All roadway inlet structures and ditch bottom inlets within the R/W that are subject to vehicular collision shall be set flush with finished grade. This is not meant to preclude the installation of weir-type control structures but to limit fixed protruding concrete structures from serving as hazards to motorists.

2.1.13 Inspections and Shop Drawings:

- A. The Contractor shall notify the Town and Engineer of Record at least 48 hours prior to construction and/or inspection of the storm drainage system and paving.
- B. Prior to the issuance of the engineering permit, and prior to installation, shop drawings must be submitted to the Engineer of Record and the Town Engineer for review and approval of all storm drainage pipe structures and associated components.

2.2 Minimum Elevation Criteria:

2.2.1 Finished Floor Elevations:

- A. The finish floor elevation of all developments must conform to the CBWCD/SFWMD criteria. These elevations shall be set at the greater of the values indicated in the CBWCD Design Manual, the 100-year 3-day routed stage, the FEMA Base Flood Elevation (BFE) map, Broward County 100-elevation map or a minimum of 18 inches above the adjacent crown of roadway whichever is greater. Additionally, the Developer shall also examine the surrounding drainage situation around the property to be developed and assess any flooding risks.

2.2.2 Minimum Roadway/Parking Lot Elevations:

- B. All roadways must have a minimum crown of roadway elevation set above the values determined by the 10-year 1-day routing calculations.

2.3 Grading Criteria:

Per the Americans with Disability Act (ADA), the maximum cross slope of sidewalks/roadways/parking within an ADA dedicated path is 2.00 % while the maximum longitudinal slope shall be 5.00%. All provisions for handicap parking and access shall be in accordance with Chapter 553 Florida Statutes "accessibility by "Handicap Persons", the latest edition of "Accessibility Requirements Manual" by the Department of Community Affairs, Florida Building Codes and Standards, Chapter 11 and the American Disabilities Act (ADA).

2.3.1 Residential Development:

- A. All residential areas shall be graded such that all storm water runoff is directed away from any habitable structures while not adversely affecting the surrounding properties. Developer, builder, or property owner shall not create adverse drainage impacts to adjacent properties.

- B. For large residential developments, an overall master drainage and grading plan must be provided, incorporating all the proposed residential lots.

2.3.2 *Commercial Development:*

- A. All commercial areas shall be graded such that all storm water runoff is directed away from any structures while not adversely affecting the surrounding properties. Additionally, an ADA compliant path must be provided to all commercial vertical structures.

2.3.3 *Roadway/ Parking Lots:*

- A. All of the Town of Davie classified roadways shall be crowned.
- B. The minimum longitudinal roadway slope shall be 0.40 %, while the minimum cross slope shall be 2.00%. The maximum grade limits for roadways will vary depending on the geometrical configuration and accessibility of vehicles.
- C. Parking lots shall be graded as to provide adequate drainage and safe vehicle operation. Parking service islands should be designed as a typical roadway section where possible. Cross slopes shall be a minimum of 1:0%. Longitudinal slopes shall be a minimum of 0.4%.

2.3.4 *Stormwater Facilities:*

- A. All stormwater facilities, including wet/dry retentions/detentions and roadway swales, shall have maximum side slopes of 4:1 horizontal to vertical ratio.
- B. Steeper slopes may be allowed by obtaining an approved variance request from the local drainage district and the Town of Davie Engineering Department. Should a steeper slope greater than 4:1 be approved by variance, appropriate fencing, retaining wall, handrail or guardrail may be required.
- C. Construction within the Town of Davie requires compliance with the requirements of the Town of Davie and the National Pollution Discharge Elimination System (NPDES) including submittal of the Notice of Intent (NOI) and Notice of Termination (NOT) forms. Please reference the EPA website at www.epa.gov/npdes.
- D. Erosion projection and earth stabilization is mandatory for all sites. The velocities generated by stormwater runoff shall not erode, washout or otherwise affect the intended performance of the drainage system during the design storm event of the facility. Erosion and sediment control shall also be enforced during construction by implementation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP shall comply with FDEP Florida Erosion and

Sedimentation Control Manual. A SWPPP will be required for all commercial developments and for all residential developments greater than 1 acre in size.

- E. All new proposed structural buildings within the Town of Davie shall evaluate and be held to the Green Building Initiative Standards/Requirements outlined in the Town of Davie Code of Ordinances.