V. Drainage

A. General

The techniques utilized for providing drainage should result in proper stormwater conveyance and treatment for developments, and in safe vehicle operation on or off the roadway. Proper drainage of pavement, shoulders, medians and roadside clear zones is important to maintain safe streets and highways.

All components of drainage design and construction shall be in strict accordance with the Land Development Regulations (Section V-6 Stormwater Management). The City will not accept for maintenance any road or street, or will not approve any development for which

adequate provision for drainage is not assured. All stormwater collection and treatment systems shall be in accordance with all Florida Department of Environmental Protection and U.S. Environmental Protection Agency requirements. Runoff from any new road, street or development shall not cause a violation of the rights of any downstream property owners, nor shall the runoff overtax the capacity of existing downstream structures or result in flood conditions at any point. Finally, no additional excavation or work pertaining to runoff shall be left for the City to perform. During construction, the contractor/owner/permit holder shall insure that all proper stormwater controls are in place and properly maintained so that site erosion is contained. Prior to the acceptance of the stormwater system all components shall be in proper working order (as designed by the Engineer of record) and free of debris and silt.

B. Drainage Pipe and Drainage Structures

Drainage pipes shall be either concrete or corrugated metal meeting the requirements specified for each in the Florida Department of Transportation Standard Specifications. Concrete pipe shall be used under all roadway surfaces. Other types of pipe may be used in areas outside the roadway surface upon approval of the City Manager or his designee.

1. Materials

a. Concrete

All materials used for concrete drainage structures shall conform to recommendations of the American Concrete Institute (ACI S211.1-81). All concrete, unless noted otherwise, shall develop a 28-day compressive strength of 3000 psi. If any concrete should fail to meet the requirements, the structure shall be removed as necessary to remove the defective concrete and shall then be rebuilt.

b. Form

Construct all forms accurately to the dimensions and lines shown, and brace so as not to yield. All forms for contact with concrete that will be exposed to view after completion shall have a smooth, dense surface (i.e. such as tempered masonite) without any holes or

imperfections. The alignment of the forms shall be checked frequently during the placing of concrete. If any movement occurs, stop the placing of concrete until the proper alignment is restored.

c. Reinforcement

Bars shall be of intermediate grade steel in accordance with ASTM Designation A615-76. Welded wire mesh shall conform to ASTM A185 for smooth wire and ASTM A497 for deformed wire.

(1) All reinforcement shall be fabricated and placed in accordance with ACI 318-83. Welded wire meshes shall be lapped six inches at all edges.
(2) The City Manager or his/her designee shall be notified at least 24 hours before the pouring of any concrete is to be started.

d. Placing, Curing and Finishing

The mixing, placing, curing and finishing of concrete shall comply with ACI 304-73 and ACI 318-83. All exposed concrete shall be given a hard steel-troweled finish with no trowel marks remaining. No cement shall be dusted on the surface. All concrete shall be cured by coating with an approved curing membrane, or by keeping it wet for at least six days after pouring. After the forms are stripped, all exposed concrete surfaces shall be painted as needed and rubbed to a uniform finish.

e. Masonry

Bricks for accessories shall be hard common clay brick. Mortar shall be one part Portland Cement and three parts masonry sand added to lime putty or mortar mix in the amount of fifty (50) percent of the volume of cement. Special commercial mortar mixes may be used if approved by the Engineer. All masonry materials shall conform to the latest applicable ASTM specifications.

(1) Set all masonry units in full beds of mortar, with full joints and strike all joints flush.

(2) Masonry reinforcements shall be galvanized Dur-O-Wal, or be approved equal, and shall be installed at every other bed joint.

(3) Catch Basin, Drop Inlet and Junction box Castings: All storm sewer castings shall be heavy-duty traffic units. The units shall be as manufactured by the Vulcan Foundry, Denham Springs, Louisiana; Neenah Foundry Company, Neenah, Wisconsin; McKinley Iron Works, Fort Worth, Texas; or approved equal.

f. Catch Basins, Drop Inlet, Junction Box, Box Culvert and Headwall Construction

Concrete bases shall be poured in place on undisturbed dry subgrades to the dimensions shown on the plans. Alternately the bases may be precast into the structure.

Cast-iron steps shall be installed as the structure is built. The castings shall be set accurately to grade.

All piping entering a structure shall terminated at the interior wall of the structure and not extend into the structure. All such pipe shall be grouted at the inside of the structure as well as the outside of the structure.

g. Concrete Pipe (RCP)

Concrete pipe will be used on stormwater drainage projects and shall conform to requirements of C-76 for Class III reinforced concrete pipe with flexible water tight gaskets. In right-of-way areas, where the pipe terminates, mitered ends are required. All pipe placed within the right-of-ways to be dedicated to the city shall have each joint connection wrapped in filter fabric.

h. Corrugated Steel Pipe (CMP)

Corrugated steel pipe may only be used for driveway applications, and shall be manufactured in accordance with AASHTO M-36 and shall be Bituminous Coated (per AASHTO M-190).

i. Filter Fabric

Engineering fabric used in trench drain and retaining wall systems shall be installed according to the manufacturer's recommendations. Material used in this system shall comply with the following minimum physical properties:

PROPERTIES	STANDARD
Grab Tensile Strength ASTM D1682 (lbs)	125 Minimum
Elongation at Failure ASTM D1682 (%)	50% Minimum
Burst Strength ASTM D3786 (psc)	250 Minimum
Coefficient of Normal Permeability (cm/sec)	1 x 10 Minimum
Equivalent Opening Size (EOS) Sieve No.	50
No Smaller than U. S. Standard Sieve No.	100

PROPERTIES	STANDARD
Puncture Strength ASTM D751 (Modified) (lbs.)	50 Minimum
U.V. Stability Fadometer Exposure Hrs. 90% of Grab Tensile ASTM D1682 after Exposure	300 Minimum

2. Laying Storm Pipe

a. General

Before lowering pipe into trenches, the bottom of the ditch shall be graded so that when the pipe rests in the ditch it will have a bearing for its entire length. The bottom of the trench shall be carefully examined for defects. After placing pipe in ditch, the ends shall be wiped free from all dirt, sand, and foreign material and the inside of the pipe shall be thoroughly cleaned. The joints shall then be made in accordance with the recommendations of the pipe manufacturer.

All pipe shall be handled and installed in strict accordance with the manufacturer's printed instructions.

b. Direction of Laying

The laying of pipe in finished trenches shall be commenced at the lowest point, with the spigot ends pointing in the direction of flow. All pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered so that when laid they will form a sewer with uniform invert in a straight line.

c. Protecting Underground Surface Structures

Temporary support, adequate protection and maintenance of all underground and surface utility structures, drain sewers, and other obstructions encountered in the progress of the work shall be furnished by the Contractor.

d. Unsuitable Conditions

No pipe shall be laid in water, or when the trench conditions or weather is unsuitable for such work.
Stormwater discharge facilities shall incorporate a scupper or oil skimmer. Support structure shall be u-channel galvanized #2 posts, wood materials shall be marine pressure treated and attached with 5/8" stainless steel hardware. See Figure II-15 and II-16.

3. Driveways

All driveways for development shall comply with the policy and procedures established by the City of Milton. Drives shall generally comply with Figure II-10 and section II.F.3 of this regulation.