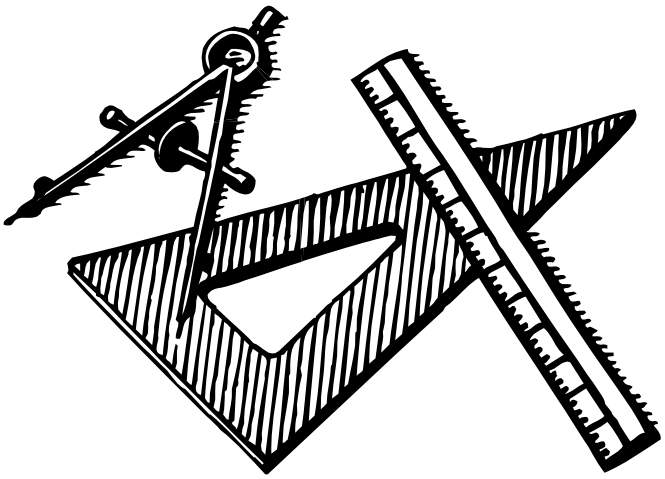


City of Greenville

Standard Design Manual

Prepared by:

CITY OF GREENVILLE
ENGINEERING DEPARTMENT

Table of Contents

SUBDIVISION PLANNING

Section I: SUBMISSION REQUIREMENTS

1.1 Plats

The Director of Community Development may require the Developer to provide prints or reproducible of the plat in a reasonable, but sufficient quantity necessary for approvals, for forwarding to the tax assessor and for permanent public record other than that of the recording official.

1.2 Civil Construction Drawings

1.2.1 Commercial Construction

a. The Developer shall deliver three (3) blue or black line copies of the construction drawing.
Drawing required:
Plat – A copy of the proposed plat showing all easements, adjoining properties and street right-of-ways.
Site Plan – Showing all buildings, parking, lighting, detention ponds, swimming pools and any other additional features.
Water – Off-site and on-site water mains, valves and fire hydrants required to supply the development with the need water and fire protection per current building codes. Plan and Profiles
Sewer - Off-site and on-site sewer mains, manholes and cleanouts to connect the development to the Cities sewer system. (This may include private or public lift station.) Plan and Profiles
Storm Sewer – Show all flow calculations to all inlets, flumes, channels and pipe. Plan and Profiles
Storm Water Detention – If required by the City Engineer
Streets - Off-site and on-site streets and drives. Plan and Profiles
Drainage Map – Show all drainage calculations.
General Notes and City Standard Details – These can be downloaded electronically from the Cities website at www.ci.greenville.tx.us

b. The Director of Planning shall mark the delivery date on all copies and accompanying data.
c. All necessary off-site easements or dedications required for city maintained facilities, not shown on the plat, must be conveyed solely to the City of Greenville, Texas, with proper signatures affixed. The original of the documents, and filing fees as determined by the Engineering Department, shall be returned to the Engineering Department prior to approval and release of the engineering plans.

1.2.2 Residential Construction

a. The Developer shall deliver three (3) blue or black line copies of the construction drawing.
Drawing required:
Plat – A copy of the proposed plat showing all easements, adjoining properties and street right-of-ways.
Utility Plan – Show a plan view of all utilities including sizes and the connections to the cities existing utilities.
Water – Off-site and on-site water mains, valves and fire hydrants required to supply the development with the needed water and fire protection per current building codes. Plan and Profiles
Sewer - Off-site and on-site sewer mains, manholes and cleanouts to connect the development to the Cities sewer system. (This may include private or public lift station.) Plan and Profiles
Storm Sewer – Show all flow calculations to all inlets, flumes, channels and pipe. Plan and Profiles
Storm Water Detention – If required by the City Engineer
Streets - Off-site and on-site streets and drives. Plan and Profiles
Grading Plan – Show grading for all lots, channels and any additional features.(Retaining walls, etc.)
Drainage Map – Show all drainage calculations.
General Notes and City Standard Details – These can be downloaded electronically from the Cities website at www.ci.greenville.tx.us

b. All necessary off-site easements or dedications required for city maintained facilities, not shown on the plat, must be conveyed solely to the City of Greenville, Texas, with proper signatures affixed. The original of the documents, and filing fees as determined by the Engineering Department, shall be returned to the Engineering Department prior to approval and release of the engineering plans.

Section II: STANDARDS

2.1 General Provisions

2.1.1 *No Preliminary or final plat shall be approved by the Commission, and no completed improvements shall be accepted by the City Engineer unless they conform to the standards and specifications contained in this Manual.*

2.1.2 *All subdivisions shall conform to the City of Greenville comprehensive plan and the parts thereof.*

City of Greenville Comprehensive Plan is available at www.ci.greenville.tx.us

2.1.3 *If a tract is subdivided into parcels larger than conventional building lots, such parcels shall be arranged to allow the opening of future streets.*

2.1.4 *No plat submitted to the Planning and Zoning Commission under the provisions of this Manual shall create or have the effect of leaving a reserve strip of land controlling access to land dedicated or intended to be dedicated to the public use.*

2.1.5 *No land shall be subdivided which the Planning and Zoning Commission determines to be unsuitable for its intended use for reasons of flooding, inadequate drainage, soil and rock formations with severe limitations for development, susceptibility to mudslides or earth slides , severe erosion potential, unfavorable topography, inadequate water supply or sewage disposal capabilities, or any other feature harmful to the health, safety or welfare of the future residents or property owners of the proposed subdivision or the community at large.*

2.1.6 *A copy of the City Zoning Map can be picked up at the Community Development Department at 2315 Johnson Street during regular business hours.*

2.2 Minimum Layout Requirements

2.2.1 Lots

a. Lots shall conform to the minimum requirements of the zoning classification district(s) in which the subdivision is located.
b. The size, shape and orientation of lots shall be appropriate for the location and for the type of development contemplated.
c. Depth and width of properties reserved or laid out for commercial and industrial purposes shall be adequate to provide for the off-street service and parking facilities required by the type of use and development contemplated.
d. Corner lots for residential use shall be platted wider than interior lots, if necessary, to permit appropriate building setbacks on both streets.
e. The subdivisions of land shall be such as to provide, by means of a public street, each lot with satisfactory access to an existing street.
f. Each lot shall front upon a public street or an officially approved public access.
g. Side lot lines should be substantially at right angles to straight lines and radial to curved street lines.
h. Double frontage lots
1. Double frontage lots are discouraged, and shall not be allowed except that under special circumstances, double frontage lots may back up to Major Thoroughfares and collector streets when approved by the Commission.
2. If approved by the Commission, the lots shall have no access to such Major Thoroughfare or collector street and a statement to that effect shall be placed on the plat and each lot shall have the word "front" shown on the plat designating which side of the lot is the front.
i. Extra width and depth
1. Where a lot in a residential area backs up to a railroad right-of-way, a high pressure gasoline, oil or gas line, an arterial street, an industrial area, or other land use which has depreciation effect on the residential use of property, and where no marginal access street or other street is provided at the rear of such lot, additional depth shall be required by the Commission.
2. Where a lot sides to any of the above, additional width may be required by the Commission.
j. If a subdivision falls within an area zoned for Planned Unit Development as provided in the Zoning Ordinance, variations from the above requirements may be allowed by the Commission when such plat meets the requirements of the Planned Unit Development zoning regulations.

2.2.2 Street Layout and Comprehensive Plan

a. Adequate streets shall be provided by the Developer and the arrangement, character, extent, width, grade and location of such streets shall conform to the major thoroughfare plan of the Greenville comprehensive plan and shall be considered in their relationship to existing and/or planned streets, to topographical conditions, to public safety and convenience, and to the proposed uses of land to be served by such streets.

b. Street layout shall be designed for the most advantageous development of the entire neighborhood.

c. All thoroughfares shall be sufficiently related to traffic generators such as business districts and shopping centers, industries, public institutions, population densities, and to the pattern of existing and proposed land uses.

d. Where a subdivision embraces a street as shown on the major thoroughfare plan of the city, such street shall be platted in the location and of the category indicated by the Plan.

e. See Street Design Section 3 of this Manual.

2.2.3 Adjoining Street System

a. Where necessary to the neighborhood pattern, existing streets in adjoining areas shall be continued

b. Adjoining streets shall be at least as wide as and in alignment with existing streets.

2.2.4 Minor Streets

Minor streets shall be designed to discourage their use by through traffic, permit efficient drainage and utility systems, and to require the minimum number of streets necessary to insure safe and convenient access to property.

2.2.5 Street Intersections

a. Intersections of major streets shall be at least eight hundred (800) feet apart.

b. Street intersections shall be as nearly at right angles (90 degrees) as practical, giving due regard to terrain and topography.

c. Four-way intersections shall be avoided and three-way or T-intersections shall be used on minor streets wherever practicable.

d. The minimum curb radius at the intersection of two (2) local streets shall be at least twenty (20) feet, and minimum curb radius at an intersection involving a collector street shall be at least twenty-five (25) feet.

e. Alley intersections and abrupt changes in alignment within a block shall have the corners cut off in accordance with standard engineering practice to permit safe vehicular movement.

f. Street jogs at intersections having center line offsets of less than 175 feet shall not be platted.

2.2.6 Cul-de-sacs

a. Cul-de-sacs shall not exceed 750 feet in length.

b. The use of cul-de-sacs, curvilinear streets or U-shaped streets shall be encouraged where their use will provide a more desirable layout.

2.2.7 Marginal street access

a. Where a subdivision has frontage on an arterial street, there shall be provided a marginal access street on the subdivision side of the arterial street, unless the adjacent lots back up to or side up to the arterial street, or unless the City Engineer determines that such marginal access streets are not desirable for adequate protection of the lots and for separation of through and local traffic.

b. A marginal access street shall be provided unless access to the lots abutting the arterial street is prohibited by a notation on the plat.

c. Direct vehicular access from single family, garden home, town house or duplex lots onto major collector or arterial streets shall be prohibited.

d. No driveway cuts shall be located closer than twenty-five (25) feet from an intersection, measured from the ends of the curb return radius.

2.2.8 Rights-of-way

a. If a street right-of-way forms a part of the subdivision boundary, the pavement widths and street rights-of-way shall conform to the regulations referenced in the Greenville comprehensive plan and this Manual.

b. In platting the subdivision, the Developer shall provide additional right-of-way required for existing or future streets, with appropriate right-of-way widths and adjacent easements as designated by the Thoroughfare Standards of the Greenville comprehensive plan or current city standard specifications.

c. Rights-of-way size shall be as specified in Table A, Section 3.1 Design Specifications.

2.2.9 Blocks

Block lengths shall not exceed 2000 feet between street lines except where topographic features or subdivisions containing one-half acre or larger justify or require a variation from the requirement. The approval of the Planning and Zoning Commission shall be required for all such variations.

2.3 Required Improvements and Easements

2.3.1 *All construction of improvements required under provisions of this Manual shall be performed in accordance with current City Standards and Specifications.*

2.3.2 Monuments

a. Permanent survey reference monuments shall be located at the northeast corner of each block.
b. Where, due to topographic condition, permanent structures, or other conditions, the view is obstructed between any two adjacent monuments, intermediate monuments shall be so set as to assure a clear view between adjacent monuments.
c. All monuments shall be shown on the plat.
d. Monuments shall be provided by the Developer as stated above.
e. Standard 3/8 inch re-bar iron pins, 14 inches in length, constitute the standard monument, to be delivered flush and driven to a point four (4) inches below grade. That portion of the pin which lies below grade shall be encased in concrete.

2.3.3 Street Signs

a. All necessary signs including street name signs and regulatory signs shall be installed by the City at all intersections within or abutting the subdivision.
b. Signs shall be of the standard type used by the City.
c. No signs will be placed in undeveloped portions of the subdivision.
d. The Developer shall pay for materials and installation of the signs.
e. The cost per street name sign shall be paid prior to recording of the final plat.
f. The Public Works Department shall determine the cost of the signs.

2.3.4 Sidewalks

a. Where street construction is required under the provisions of this Manual, sidewalks shall be installed as shown in Table F, Section 6.1 Sidewalk Location and Design.
b. All sidewalks shall be constructed in accordance with city standards and specifications and shall be inspected, approved, and accepted by the City Engineer.
c. Pedestrian Access
1. The Planning and Zoning Commission may require, in order to facilitate access from the roads and streets to schools, parks, playgrounds or other nearby roads, perpetual unobstructed easements of up to fifteen (15) feet in width.
2. Easements so required shall be shown on the plat, or, in the case of a minor subdivision, on the sketch plan or other such document required by the Director of Planning.
d. Exceptions
1. Exceptions to the required sidewalks may be recommended by the Director of Community Development.
2. If the Director of Community Development recommends an exception under this section the exception recommended shall be submitted to City Council for approval or denial.

2.3.5 Utility Easements

a. The Developer shall dedicate to the city easements or rights-of-way where required by the City Engineer for on-site service, future development, or as designated by the comprehensive plan.
b. All lots shall have adequate utility easement provisions reserved for the use of all public utility lines, conduits and equipment.
c. Easements shall be continuous to serve all lots in the block.
d. Such easements shall parallel as closely as possible the street frontage of such block.
e. Where such easement forms the boundary of a subdivision and is adjacent to unplatted property, width shall be provided on-site, or by an off-site easement.
f. Such on-site easements shall be considered a part of the lot area for purposes of minimum lot size requirements of the subdivision ordinances.
g. Normal curb exposure shall be required where utility easements intersect streets.
h. Where utility easements are not themselves straight within each block, or if the same do not connect on a straight course with the utility easements of adjoining blocks, then an additional easement shall be provided where necessary for the placing of guy wires or transformers on lot division lines.

i. The Developer shall furnish all easements and rights-of-way necessary for the construction of utility services to the subdivision.

j. Utility easements shall be kept clear of all obstructions, such as but not limited to, fences, buildings, shrubs and other vegetation, or other improvements which in any way endanger or interfere with the construction, maintenance, or operation of any utility system.

2.3.6 Utility Main lines

a. All utility main lines that pass across, down or under a street shall be installed before the subgrade work is begun.

b. When it is necessary that a utility line pass under existing street pavement, they shall be installed by boring and/or encasing to a point at least three (3) feet beyond the edge of the pavement and at a depth below the sub-grade of the street.

c. Access for crews using motorized equipment shall be a prime consideration in evaluating the suitability of easement provision.

2.3.7 Streets

a. The developer shall be responsible for the construction or improvement of all internal streets within his development according to current City of Greenville standard specifications.

b. Construction or improvement of the street shall not be required until the time of development of the property.

c. The estimate of the cost of said improvements shall be prepared by the engineer for the Developer and approved as to adequacy by the City Engineer.

d. Pavement width shall be as specified in Table A, Section 3.1 Design Specifications.

(Ord. 96-088 adopted 5-28-96, Sec. 1)

2.3.8 Fire Lanes

Where adequate space and access for fire control purposes may not otherwise be provided, easements for fire lanes shall be paved to a minimum width required by the City Fire Marshal, and shall be maintained by the property owner.

2.3.9 Water Installations

a. Water Distribution See Section 7 Water Design

1. Water systems shall have a sufficient number of outlets and shall be of sufficient size to furnish an adequate domestic water supply and fire protection to all lots per the latest approved building code.

2. All water systems shall comply with current City standard specifications.

3. Water mains shall be a minimum of 6 inch In residential and 8 inch non residential nominal internal diameter, and their construction and material shall conform to current city standard specifications. Actual size to be determined to meet current building and fire codes by a Licensed Texas Professional Engineer.

4. Dead-end lines should be extended to, and then through, the property sought to be subdivided.

5. All dead-end water lines shall be valved and provided with a blow-off mechanism for their flushing, and constructed according to current city standard specifications.

b. Fire Protection

1. The Developer shall at his expense install fire hydrants servicing the subdivision in accordance with current City standard specifications.

2. Provisions of the National Fire code as amended and adopted by the city shall be applicable to all subdivisions proposed.

2.3.10 Sewers

See Section 8 Sewer Design

a. All subdivisions shall be provided with a sewage disposal system installed by the Developer as approved by the City Engineer and satisfying current city standard specifications. Relocation of existing sewers shall meet the same standards as are set forth herein.

b. Dead-end lines shall extend to, and then through, the project

c. Connection with the sanitary sewer system shall be required, except as herein otherwise indicated.

d. Septic tank shall not be installed on lots less than two (2) acres in area, with no reasonable access to the City sewer system and only with prior approval of the Director of Community Development.

e. If a sanitary sewage disposal system is to be installed, the plans for such system must be permitted by the Texas State Health Department and approved by the City Engineer prior to formal filing of the plat before the Commission.

f. No lift station, sanitary sewer siphon, or force main shall be constructed as a part of the sewer line unless the Developer agrees in writing that he will construct at his expense such elements in accordance with the standards provided by the City Engineer.

g. All sewer and water lines constructed or installed pursuant to the provisions of this Manual shall, when completed and accepted by the City Engineer or his authorized representative, become the property of the city, free and clear of all encumbrances.

h. Each and every contract entered into between a Developer and a contractor for the installation of sewer or water lines pursuant to the provisions of this Manual shall recite the provisions stated in the preceding subsection.

i. No sewer or water lines shall be installed or constructed except within a public street or alley, or within an easement granted to the city or dedicated to the public by appropriate instrument, approved by the City Attorney, and filed for record with the County Clerk of Hunt County.

2.3.11 Drainage

a. Drainage easements shall be kept clear of all obstructions, such as but not limited to, fences, buildings, trees and shrubs, or other structures or improvements which in any way endanger or interfere with the construction, maintenance, or operation of any drainage system.

b. Lots in any proposed subdivision shall not be approved until drainage facilities adequate to prevent flooding have been installed or necessary arrangements made for such installation as required under this Manual.

c. On any lot designated by the City Engineer as requiring completion or partial completion of drainage improvements prior to building construction, no Building Permits shall be issued prior to a release authorized by the City Engineer.

d. Off-site drainage

1. The owner or Developer of property to be developed shall be responsible for all storm drainage flowing on his property. This responsibility includes the drainage directed to that property by prior development as well as drainage naturally flowing through the property by reason of topography.

2. Adequate consideration shall be given by the owner in the development of property to determine how the discharge leaving the proposed development will affect downstream property.

3. On lots or tracts where storm water runoff has been collected or concentrated, it shall not be permitted to drain onto adjacent property except in existing creeks, channels or storm sewers, unless proper drainage easements or notarized letters of permission from the affected property owner are provided.

4. The Developer shall pay for the cost of all drainage improvements required for the development of his subdivision, including any necessary offsite channels or storm sewers and acquisition of the required easements with the following exceptions:

(i) If the owner is unable to acquire the necessary off-site easements, he shall provide the city with documentation of his efforts, including evidence of a reasonable offer made to the affected property owner. Upon such a written request for assistance, the city shall acquire these easements either through negotiations or through condemnation. In either case, the cost of these easements shall be paid by the developer.

(ii) In areas where the proposed offsite improvements are to be made within existing city right-of-way, an estimate of these offsite costs shall be prepared and submitted along with the plans. Subject to Council approval, cost for such offsite improvements shall be prorated to the extent that the developer pays for a percentage of the offsite cost based on the increase of the discharge originating within the limits of his addition.

5. Where it is anticipated that additional runoff incident to the development of the subdivision will overload an existing downstream drainage facility, whether natural or man-made, and result in hazardous conditions, the Planning Commission may withhold approval of the subdivision until appropriate provision has been made to accommodate the problem, and plans shall be provided which include all necessary off-site improvements including storm sewer systems, channel grading, driveway adjustments, culvert improvements, easements, etc.

e. The Developer shall, at his expense, provide complete final plans and specifications for drainage facilities.

1. The plans and specifications shall be prepared by a Texas registered professional engineer qualified to do such work, and shall be in accordance with current city standard specifications.

2. The plans and specifications shall be submitted to the City Engineer for review and shall receive his approval prior to formal filing of a final plat to the Commission.

2.3.12 Bridges

a. Where bridges are needed to serve streets, the total cost of the bridge shall be paid by the Developer.

2.4 DRIVEWAY STANDARDS

2.4.1 Driveway

The City Engineer may vary the Driveway Standard where the strict application of this section would not be in the public interest and would cause undue hardship. Any variance of the driveway standards should be consistent with the general purpose and intent of this section. (Ord. 97-189, adopted 11-11-97, Sec. 2)

CONSTRUCTION DESIGN

Section III: Streets

3.0 Classifications and Definitions

Thoroughfare "A" (Class A)
"Principal arterial (Thoroughfare "A")" is the higher of two principal arterial classifications, the purpose of which is to move high volumes of traffic speedily across and between large sub-areas of the city or into the county. Streets under this classification also serve a select number of regional activity centers. Access to the network is normally limited to arterial intersections. Direct land service is prohibited or minimal, and then only to major activity centers of regional impact. Principal arterial (Thoroughfare "A:) provide the speediest movement of longer distance trips. The level of transit service is high.

Thoroughfare "B" (Class B)
Principal arterial (Thoroughfare "B")" is the lower of two principal arterial classifications, the purpose of which is also to move high volumes of traffic speedily across and between sub-areas of the city or region, but with volumes and speeds below those of the principal arterial (Parkway classification). Access is generally limited to intersections with other arterial and collectors. Direct land access is minimal and controlled, but less restrictive as compared to principal arterial (Thoroughfare "A"). The level of transit service is high; bicycle and pedestrian activities are low.

COLLECTORS

Commercial (Class C)
"Minor arterial" streets provide for movement within sub-areas of the city, largely defined by principal arterial streets. They serve through-traffic and provide direct access for commercial, industrial, office and multifamily development but, generally, not for residential properties. Since minor arterial serve a more localized area, transit, bicycle and pedestrian activities are moderate.

Residential (Class D)
"Residential Collector" streets connect local traffic within a development or neighborhood of the city to arterial streets. Service to adjacent land uses is subordinate to traffic movement. Access to abutting properties and parking is controlled by driveway spacing and pavement markings. Typically, collector streets are not continuous for any great length, nor do they form a connected network by themselves. Since collector streets connect neighborhoods to commercial areas, and both to the arterial network, transit services are low while bicycle and pedestrian activities range from moderate to high. Parking is sometimes allowed.

Minor or Local (Class E)
"Collector" streets connect local traffic within a development or neighborhood of the city to arterial streets. Service to adjacent land uses is subordinate to traffic movement. Access to abutting properties and parking is controlled by driveway spacing and pavement markings. Typically, collector streets are not continuous for any great length, nor do they form a connected network by themselves. Since collector streets connect neighborhoods to commercial areas, and both to the arterial network, transit services are low while bicycle and pedestrian activities range from moderate to high. Parking is sometimes allowed.

MARGINAL ACCESS

Residential Local Access (Class F)
"Local access" streets serve to distribute traffic from collectors and provide direct access for abutting properties. They are intended to serve neighborhoods as a whole, in contrast to serving the access needs of abutting properties. Through trips are discouraged and parking is allowed. Transit use is very low while the neighborhood focus provides for high levels of bicycle and pedestrian activity.

Non-Residential (Class G)
"Marginal Access" streets are a special category of local access streets without outlets that connect single streets or adjoining streets. Typically, they serve non-residential areas with limited use. There is no transit use. Parking may be limited and in street widths reduced in some cases.

Residential Cul-d-sac (Class H)
"Cul-de-sacs" are a second special category of local access streets that provide an outlet at one end only, and are constructed with a turnaround at the other. Typically, they serve twenty-five or fewer lots. They provide for combined bicycle and pedestrian movements. There is no transit use.

3.1 Design Specifications

City of Greenville street definitions - See Table A

TABLE A Street Standards

TYPE	*CLASS*	*R.O.W.*	*PAVEMENT WIDTH*	*Typ. No. Lanes*
Thoroughfare "A"	*A*	*110*	*49' Back to Back*	*4*
Thoroughfare "B"	*B*	*90*	*49' Back to Back*	*4*
Commercial (Collector)	*C*	*70*	*49' Back to Back*	*3*
Residential (Collector)	*D*	*60*	*41' Back to Back'*	*2*
Minor or Local	*E*	*50*	*31' Back to Back*	*2*
Residential (Marginal Access)	*F*	*50*	*31' Back to Back*	*2*
Non-Residential (Marginal Access)	*G*	*60*	*41' Back to Back*	*2*
Residential Cul-d-sac	*H*	**60*	***33' Back to Back*	*2*

- ** 120' Diameter in turnaround*
- *** 100' Diameter in turnaround*

The City of Greenville reserves the right to require an upgrade in street class to accommodate future growth.

Typical street sections shall be based upon projected traffic volume, existing soil conditions, and drainage condition and requirements. The street sections shall be based on a twenty (20) year life and the following loading shall be used as a minimum design standard:

(A) Residential lane and alleys 20,000 18 Kip Axle Repetitions.
(B) Minor or Local (33 feet B-B) 20,000 18 Kip Axle Repetitions.
(C) Collector Residential (41 feet B-B) 100,000 18 Kip Axle Repetitions.
(D) Collector Commercial (49 feet B-B) 100,000 18 Kip Axle Repetitions.
(E)"B" Thoroughfare (49 feet B-B) 400,000 18 Kip Axle Repetitions.
(F) Reserved.
(G) "A" Major Thoroughfare (49 feet B-B) 500,000 18 Kip Axle Repetitions.

3.1.1 Minimum Horizontal Design Radius

Minimum centerline radius is defined by the design speed of the respective street. The design speed of each street in the City of Greenville, as defined by the City's Comprehensive Plan, can be determined from Table B.

TABLE B Design Speed

Street Class	*Design Speed (mph)*
H,G,F	*30*
E	*35*
D	*40*
B,C	*45*
A	*55*

TABLE C Minimum Design Radius

Design Speed (mph)	*Design Radius (ft)*
30	*450*
35	*600*
40	*850*
45	*1050*
55	*1700*

Exception: Class G and H residential streets shall be 250 feet for curves. This does not apply to turns approximating 90°. Maximum length of a horizontal curve on a Class E,F,G or H street shall not exceed 1.6 times the centerline radius of 250 foot or greater.

3.1.2 Intersection Design

a. Street intersections shall be radial or perpendicular, within a five (5) degree tolerance, at the intersection or right-of-way lines.
b. The radius shall be thirty (30) feet at the intersection of a secondary and a major, or major and major streets.
c. At all other intersecting streets, the radius shall be twenty (20) feet.
d. Intersections of major streets shall be at least eight hundred (800) feet apart.
e. Street intersections shall be as nearly at right angles (90 degrees) as practical, giving due regard to terrain and topography.
f. Four-way intersections shall be avoided and three-way or T-intersections shall be used on minor streets wherever practicable.
g. The minimum curb radius at the intersection of two (2) local streets shall be at least twenty (20) feet, and minimum curb radius at an intersection involving a collector street shall be at least twenty-five (25) feet.
h. Alley intersections and abrupt changes in alignment within a block shall have the corners cut off in accordance with standard engineering practice to permit safe vehicular movement.

i. Street jogs at intersections having center line offsets of less than 175 feet shall not be platted.

Note: At intersections, the curb radius may encroach on the right-of-way so as to not provide sufficient room for sidewalks, utilities, etc. Therefore, right-of-way must be dedicated at the intersection of all streets to allow a minimum of nine and one half (9 ½) feet maintained from back of the curb along the street radius.

3.1.3 Residential Frontage

Residential houses shall not front Class A, B, C, or D streets unless parallel access roads are provided. Minimum distances between adjacent curbs of a thoroughfare and the access road shall be twenty (20) feet. Frontage road right-of-way shall be in addition to the thoroughfare right-of-way.

3.1.4 Ending Residential Streets

A street ending at the edge of a subdivision that does not have access to an existing street or ends to a future subdivisions must have a temporary turn around. The turn around shall have a standard sub-grade and can have a rock surface. If the turn around lies outside of the existing subdivision it must have an executed easement by the time of Final Plat approval.

3.1.5 Utility Placements

All new streets will have a dedicated utility layout to determine the placement of the utility line whether above or below ground.
The typical placement of Sewer, Water and Storm Sewer will be inside the right-of-way and Telephone, Electric, Gas and Cable will be placed in the utility easement or as shown below. (See Figure 2, 3, & 4)

3.1.6 Median and Decorative Areas

The City of Greenville will determine in the plat review whether a dedication of decorative areas will be accepted by the City or a home owners association must be formed to upkeep the areas requested.

a. *A median shall be a minimum of four (4) feet and a maximum of ten (10) feet wide, back of curb to back of curb.. The width of the median must be added to the dedicated right-of-way.*
b. *A median shall be no closer than two (2) feet from the intersection of the right-of-way line of any adjacent streets. (See Figure 1)*

FIGURE 1

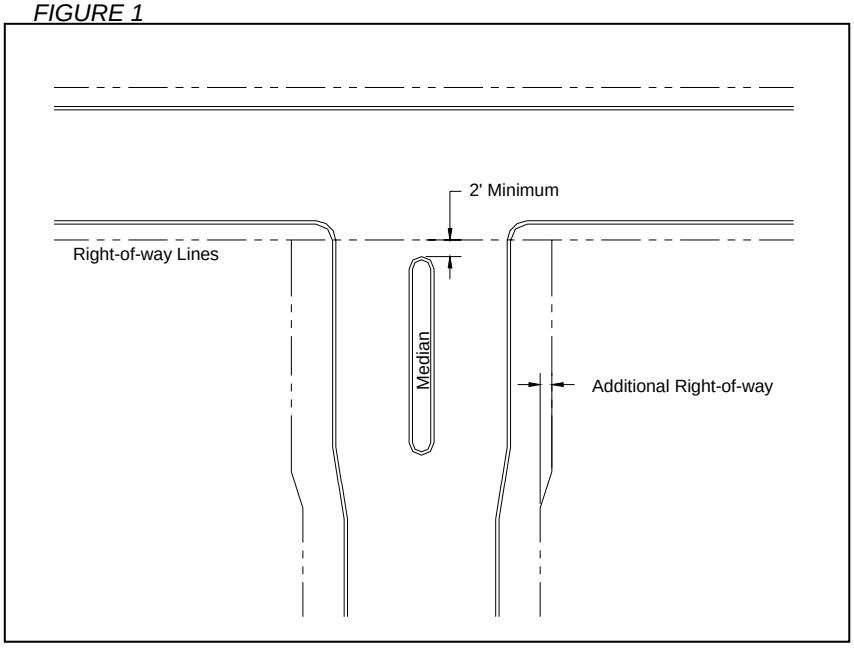


FIGURE 2 Utility Layout 1

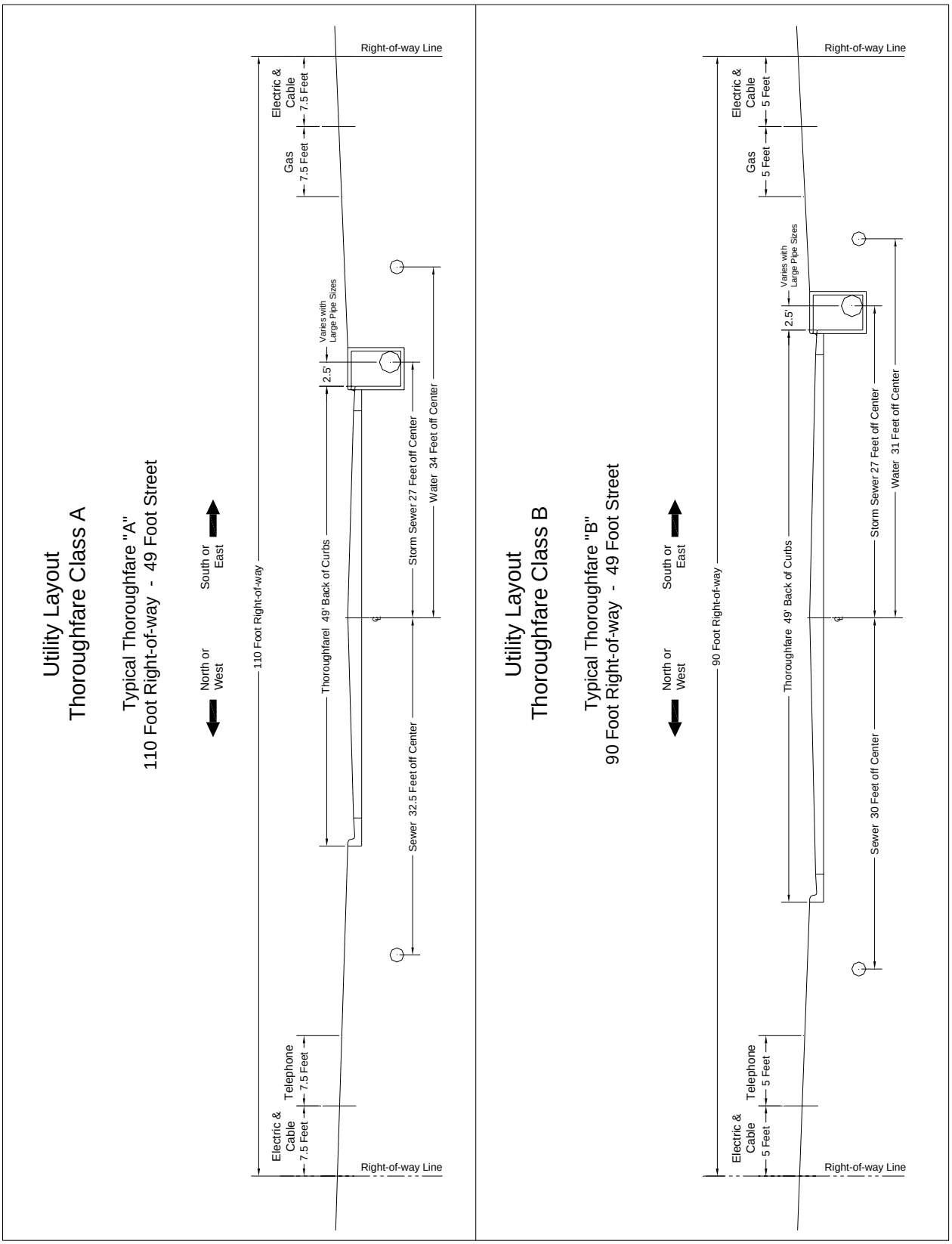


FIGURE 3 Utility Layout 2

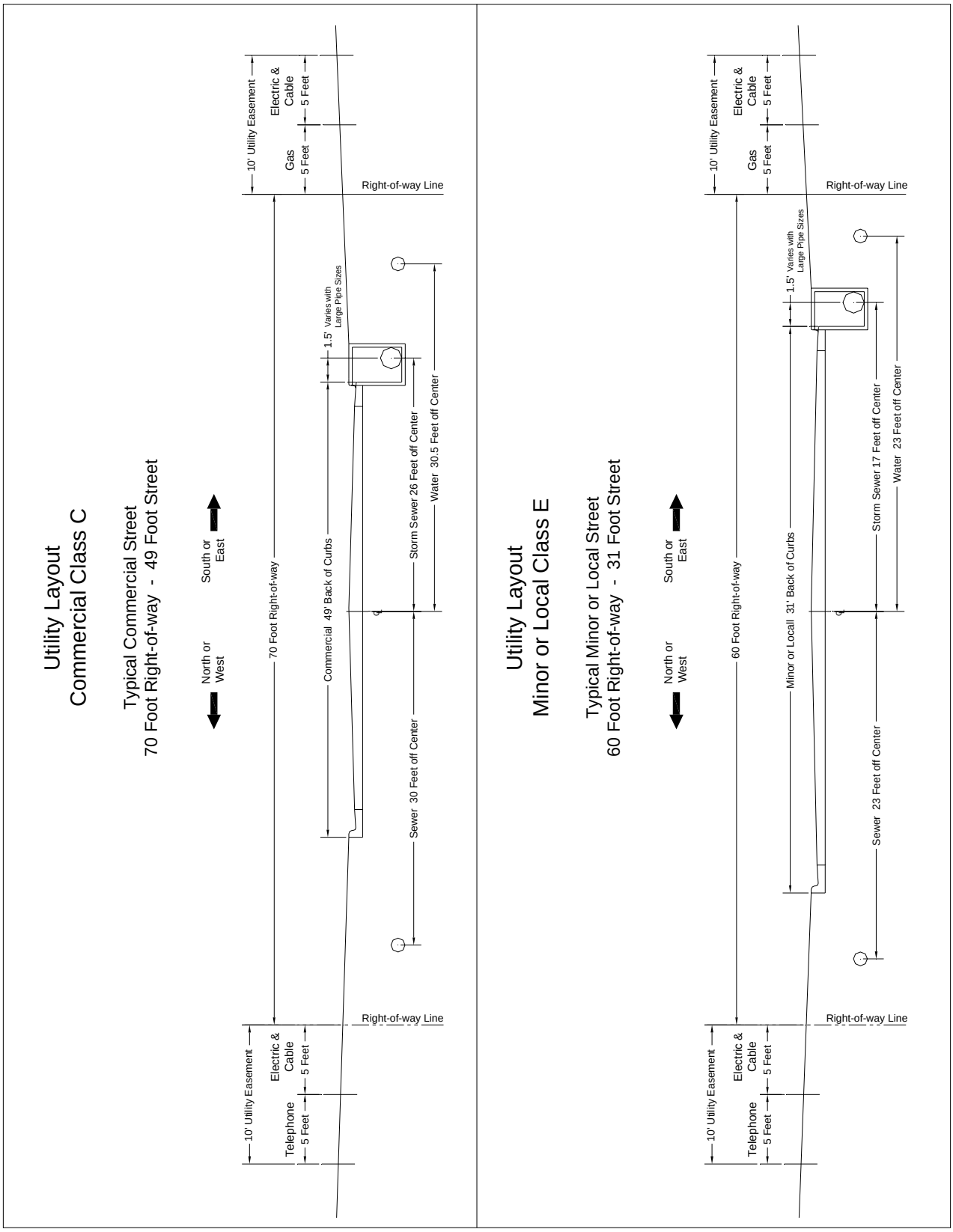
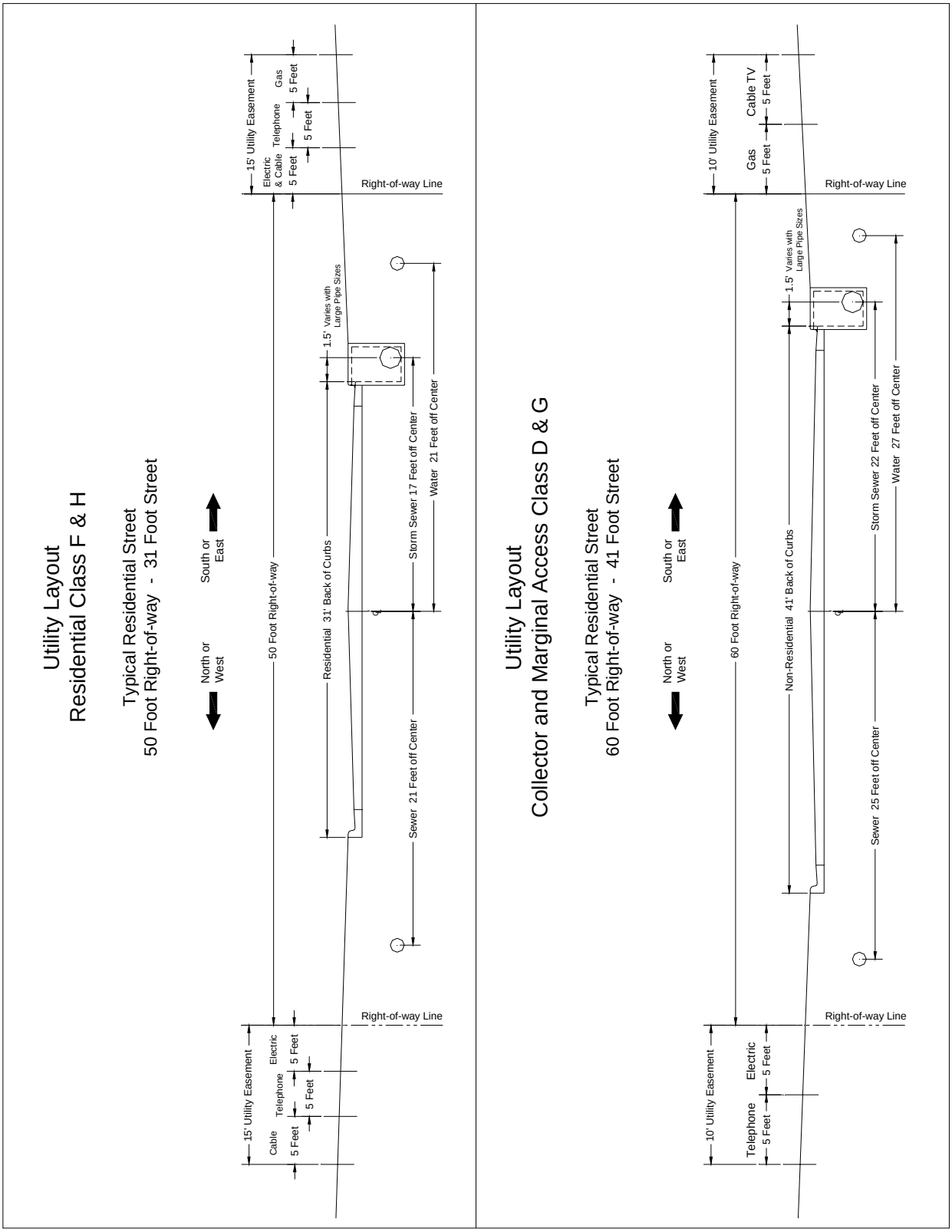


FIGURE 4 Utility Layout 3



Section IV: Alleys and Service Roads

4.0 Alley Definition

Alleys are minor traveled ways which are used primarily for vehicular service access to the back or the side of properties otherwise abutting on a street.

4.1 Alley Width

Alleys shall be a minimum of ten (10) feet and a maximum of twenty (20) feet wide. For detailed construction information for alleys refer to Engineering Drawing 25005 (www.ci.greenville.tx.us)

4.2 Alley Intersections

Alleys shall not intersect any thoroughfare (Class A & B). Alleys which run parallel to a common right-of-way line with a major thoroughfare shall turn away from the major street not less than one subdivision lot width or a minimum of fifty (50) feet from the cross street intersection as indicated in Figure 1. All alley intersections with streets shall be perpendicular or radial, within a five (5) degree tolerance, at the intersection of the right-of-way lines. Alley offsets along residential streets shall be less then fifteen (15) feet or greater than seventy-five (75) feet measured from the alley right-of-way to alley right-of-way.

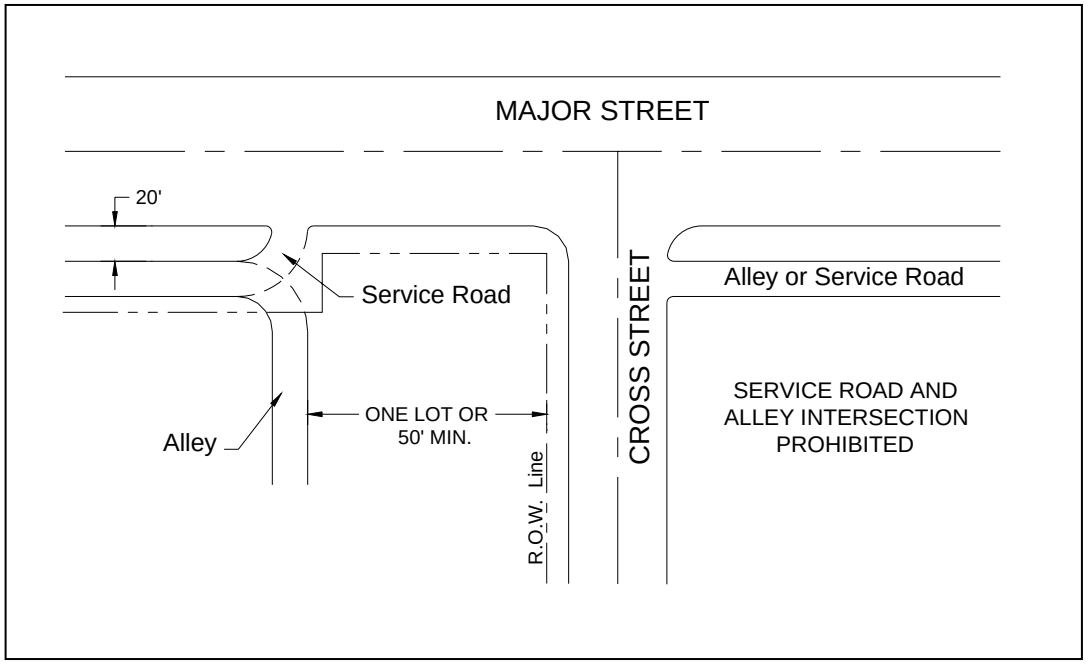
4.3 Alley Radius

Alley radii at street intersections shall not be less than fifteen (15) feet.

4.4 Service Road Intersection

Major thoroughfare service roads shall turn into the thoroughfare at a point not less than one subdivision lot width from the cross street intersection as indicated in Figure 5.

FIGURE 5 Parallel Service Road/Alley Minimum Intersection at a Major Road



Section V: Driveway Design

5.0 Definition of Driveway Types

a. *A **"residential**" driveway provides access to a single-family residence, to a duplex or a multi-family building containing five (5) or fewer units. These drives shall intersect Class E, F, G and H streets only. All access to residential property abutting all other streets shall be off an alley or service road.*
b. *A **"commercial**" driveway provides access to a office, retail, institutional building or multi-family building having more than five (5) units. It is anticipated that such buildings will have incidental truck services. Commercial drives shall access Major or Secondary Thoroughfares Class A, B and C only.*
c. *An **"Industrial**" driveway serves truck movements to and from loading areas of an industrial facility, warehouse or truck terminal. A centralized retail development, such as a community or regional shopping center, may have one or more driveways specially designed, signed and located to provide access for trucks and such driveways shall be considered industrial driveways. Industrial plant driveways whose principle function is to serve administrative or employee parking lots shall be considered commercial driveways. Industrial drives shall access Major or Secondary Thoroughfares Class A, B and C only.*

***NOTE:** Two-way driveways shall always be designed to intersect the street at a ninety (90) degree angle. One-way driveways may be designed to intersect a street at a forty-five (45) degree angle.*

5..1 Applicability

The standards contained in this Section shall apply to all driveways designed and intended to serve as access from a roadway to a lot or parcel of land used for any development or purpose other than a single-family detached dwelling, a patio home dwelling, a two-family dwelling, or one (1) single-family attached dwelling. The City Engineer shall approve the location, size, and construction of all driveways intended to serve as access from a roadway to a lot or parcel of land which is used or intended to be used as a building site for a single-family detached dwelling, a patio home dwelling, a two-family dwelling, or one (1) single-family attached dwelling.

5.2 Driveway Width and Radius

The design requirements for one-way and two-way driveways shall be as follows for access to thoroughfares, Industrial, collector, and residential streets. The minimum and maximum widths specified for driveways shall determine the distance from pavement edge to pavement edge. The minimum and maximum curb return radius specified shall control the arc of the curb from the driveway to the street. The minimum throat length specified shall determine the minimum distance from the edge of the street pavement to the first traffic conflict point on the driveway. The minimum spacing specified shall determine the minimum distance between driveways on the same lot or tract, measured from edge of pavement to edge of pavement. (See Table D)

TABLE D Driveway Design

	Street Classification		*One-Way*	*Two-Way*
	Thoroughfare Class A, B			
Width (Min.-Max)			*20 - 25*	*30 - 45*
Curb return radius (Min.-Max)			*20 - 30*	*20 - 30*
Throat length (Min)			*20*	*20*
Spacing (Min)			*100*	*100*
	Industrial Class C, D			
Width (Min.-Max)			*20 - 25*	*30 - 45*
Curb return radius (Min.-Max)			*20 - 30*	*20 - 30*
Throat length (Min)			*20*	*20*
Spacing (Min)			*50*	*50*
	Collector Class E			
Width (Min.-Max)			*15 - 25*	*25 - 40*
Curb return radius (Min.-Max)			*10 - 25*	*10 - 25*
Throat length (Min)			*-*	*-*

Spacing (Min)			*50*	*50*
	Residential Class F, G, H			
Width (Min.-Max)			*10 - 15*	
Curb return radius (Min.-Max)			*5 - 10*	
Throat length (Min)			*-*	
Spacing (Min)			*-*	

NOTE: *Driveway radii shall always be designed to become tangent to the street curb line at the intersection with the street.*

a. If a curb drain inlet is present, there shall be a minimum distance of ten (10) feet between the inlet and the pavement edge of any driveway.

b. All driveways shall be constructed within the street frontage of the subject property, as determined by extending the side property lines to the curb line. Neither the driveway nor the curb returns shall overlap adjacent property frontage without written approval from the adjacent property owner.

c. Common driveways may be approved, provided that a permanent written access easement is obtained.

d. Driveways may not exceed seventy (70) percent of roadway frontage.

e Driveways shall be located no closer to the corner of intersecting rights-of-way than sixty (60) percent of parcel frontage or one hundred (100) feet, whichever is less. Driveways shall not be constructed within the curb return of a street. (Ord. 97-189, adopted 11-11-97, Sec. 2)

f. All driveways on undivided thoroughfares should be designed to align with opposing driveways or be offset by a minimum distance of one hundred twenty (120) feet, measured from pavement edge to pavement edge. All driveways on divided streets should be designed to align with median breaks or be offset by a minimum of one hundred (100) feet, measured from the nose of the median to the nearest edge of the driveway. All driveways on collector streets should be designed to align with opposing driveways or be offset by a minimum of eighty (80) feet, measured from pavement edge to pavement edge. (Ord. 97-189, adopted 11-11-97, Sec. 2)

g. Existing driveways may be required to conform with the standards of this Section, including driveway closure and curb construction where appropriate, as a condition of the approval of any zoning, rezoning, specific use permit or planned development.

5.3 Driveway Spacing and Location in Relation to Other Drives

a. Residential
Driveway approaches on a tract of land devoted to one use shall not occupy more than seventy (70) percent of the frontage abutting the roadway. No more than two (2) driveway approaches shall be permitted on any parcel of property on each street.

b. Commercial
The spacing and location of driveways shall be related to both existing adjacent driveways and those shown on approved development plans. The spacing between driveways shall depend on the speed limit of the Major or Secondary thoroughfare as shown in Table E. Driveways shall not be permitted in the transition area of any deceleration lane or right turn lane.

Note: *Spacing between driveways will be measured along the property line from edge of one driveway to the closet edge of the next driveway and not from centerline to centerline.*

Table E Driveway Spacing

Street Class	*Design Speed (MPH)*	*Minimum Driveway Spacing (FT)*
H, G, F	*30*	*30*
E	*35*	*50*
D	*40*	*N/A*
B, C	*45*	*60*
A	*55*	*100*

5.4 Driveway Spacing in Relation to a Cross Street

a. Driveways that intersect at ninety (90) degrees to a residential street (Class F, G or H) shall be located a minimum of five (5) feet from the end of the street radius to the end of the driveway radius. (See Figure 6A)

b. Driveways that intersect at ninety (90) degrees to a secondary street (Class C, D or E) shall be located a minimum of thirty (30) feet from the end of the street radius to the end of the driveway radius. . (See Figure 6B)

FIGURE 6A Drive Spacing to Cross Streets

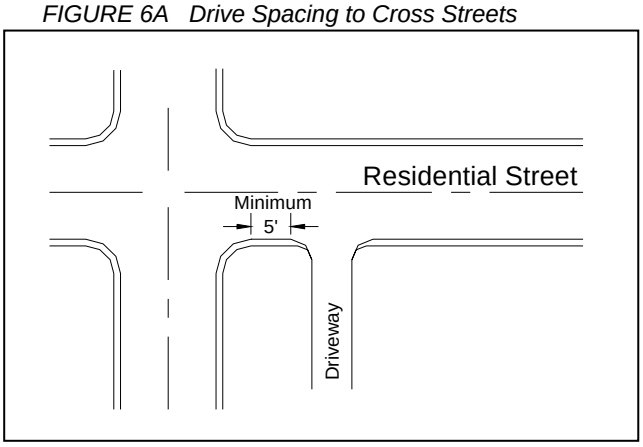
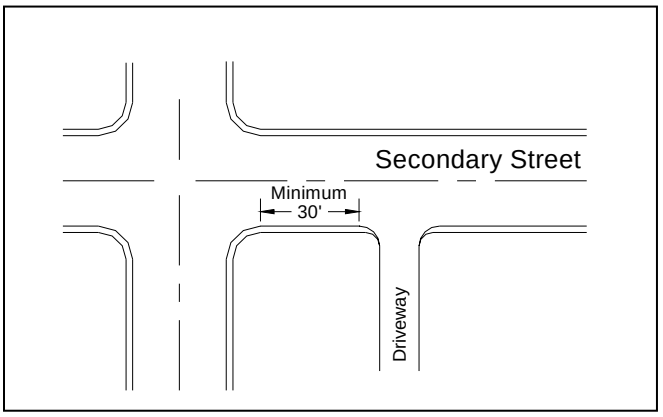


FIGURE 6B



c. Driveways that intersect at ninety (90) degrees to a major street (Class A or B) shall be located a minimum of one hundred (100) feet from the end of the street radius to the end of the driveway radius. If the property length, along the street, is such that both the drive and it's curb radius cannot be totally within the proposed development, the drive can be situated so as to be a joint access drive.

d. Driveways that intersect at forty-five (45) degrees to a secondary street (Class C, D or E) shall be located a minimum of thirty-five (35) feet from the end of the street radius to the end of the driveway radius.

e. Driveways that intersect at forty-five (45) degrees to a major street (Class A or B) shall be located a minimum of one hundred (100) feet from the end of the street radius to the end of the driveway radius. If the property length, along the street, is such that both the drive and it's curb radius cannot be totally within the proposed development, the drive can be situated so as to be a joint access drive.

5.5 Variance

The City Engineer may vary the Driveway Standard where the strict application of this section would not be in the public interest and would cause undue hardship. Any variance of the driveway standards should be consistent with the general purpose and intent of this section. (Ord. 97-189, adopted 11-11-97, Sec. 2)

Section VI: Sidewalk Location and Design

6.0 Definition of Sidewalk

A sidewalk is defined as a paved area in a street right-of-way between the curb lines or edge of pavement of the street and the adjacent property lines for the use of pedestrians. The maximum grade of the sidewalk shall be one half (1/2) inch per foot, the maximum crossfall of the sidewalk shall be one fourth (1/4) of an inch per foot. These sidewalks shall conform to the following standards:

> ***Note: All sidewalks, ramps, building accesses and parking must comply with all State and local standards including but not limited to Texas Accessibility Standards and the American Disabilities Act.***

6.1 Requirements

a. Zoning Classification Requiring Sidewalks
Concrete sidewalks designed and located according to the City standards shall be constructed along all streets in all zoning classifications, except agriculture zoning. Sidewalks shall be built at the time of site development. Should it be impractical to install the sidewalks at that time, funds for the sidewalk construction shall be placed in escrow with the City for use when the City determines the sidewalks are needed. Payment of escrow must be made prior to site plan or Final Plat approval is made. (Reference Engineering Drawing 25002 – Typical Sidewalk Installation) (www.ci.greenville.tx.us)

TABLE F Required Sidewalk Sizes

Residential				*Non-Residential*
Street Type	*Zoning*			
	SF-1, SF-2, SF-3	*SF-A, 2F, MF-2*	*MHP, MF-1*	*All Other Zones*
Minor or Local	*4' Wide*	*4' Wide*	*5' Wide*	*6' Wide*
Marginal Access	*4' Wide*	*4' Wide*	*5' Wide*	*6' Wide*
Collector	*4' Wide*	*4' Wide*	*5' Wide*	*6' Wide*
Arterial	*4' Wide*	*4' Wide*	*5' Wide*	*6' Wide*

NOTE: *The developer is required to construct the sidewalks on both sides of the street at the time the street is constructed.*

b. Residential Areas (Single Family and Duplex)
A concrete sidewalk, four (4) foot in width, shall be located within the street right-of-way, two and one half (2 ½) feet from the right-of-way line, unless pre-existing physical encroachments, (Utility infrastructure, trees, etc.) dictate otherwise. (Reference Engineering Drawing 25002 – Typical Sidewalk Installation) (www.ci.greenville.tx.us)

c. Non-residential Areas and Apartment Complexes
A concrete sidewalk, five (5) foot in width, shall be located within the street right-of-way, not more than two and one half (2 ½) feet from the right-of-way line. If other materials are placed in the right-of-way between the sidewalk and the curb, the material must meet City specifications and be of a color and texture distinctly deferent from the sidewalk and specified on the site plan. (Reference Engineering Drawing 25002 – Typical Sidewalk Installation)

d. Special Provision Sidewalk
If it should be necessary to construct the sidewalk adjacent to the curb line, the walk shall be five (5) feet in width. At no time shall the walk be less than five (5) feet in width.

e. Outside the Right-of-way
If the sidewalk is to be placed outside of the street right-of-way, it must be placed in a sidewalk easement dedicated to the City or it will be private and the maintenance becomes the responsibility of the property owner.

f. Waiver
The sidewalks required in non-residential areas may be waived by the Planning and Zoning Commission either temporarily or permanently at the time of Final Plat approval. The Waiver may be granted based on site conditions and/or location of the tract.

g. Barrier Free Ramps

Curbs and sidewalks constructed at intersections of all streets and thoroughfares must comply with the Americans with Disabilities Act and the Texas Accessibility Standards and must be constructed in a manner to be easily and safely negotiated by handicapped persons.

Section VII: Water Design

7.0 Definitions

Transmission Lines *- Major lines, usually twelve (12) inch or larger, feeding water to and from water towers and to sections of the City. These lines are not to be tapped for services and are used for moving water into mains in areas to be tapped.*
Mains *- Lines connected to transmission lines to bring water into smaller areas for servicing the City. These lines are usually looped to have water coming from two (2) directions.*
Sub-Mains *- Lines that run from mains into small areas where they end into a service. These lines are used in cul-d-sac's and other areas that end a line without a loop to another line.*

7.1 Mains

In general, water mains are to be placed on the South or East side of a street between the storm drain and the right-of-way line or otherwise shown in figures 2, 3 and 4, or as directed by the Design and Review Division.

a. *All water lines shall be Blue PVC (SDR 18-AWWA C-900-75) John Mansville or an approved equal.*
b. *All water mains shall have a minimum cover of forty-eight (48) inches below finished pavement grade, or sixty (60) inches below existing or finished grade in unpaved areas, or as required to clear other utilities.*
c. *For mains less than one thousand (1000) feet in length, in residential areas and not supplying more than one (1) fire hydrant, a minimum of a six (6) inch pipe is required.*
d. *Dead end sub-mains shall not exceed six hundred (600) feet in length and a must end into a service meter at the end of the main or a fire hydrant.*
e. *For mains over one thousand (1000) feet in length, in residential areas and supplying more than one (1) fire hydrant, a minimum of an eight (8) inch pipe is required. Pipe shall be sized to meet fire hydrant flow requirements.*
f. *For mains over seven hundred and fifty (750) feet in commercial or manufacturing areas, a twelve (12) inch pipe is required.*
g. *Profile elevations are required on all water mains.*
h. *Valves twelve (12) inch and under shall be placed on or near street right-of-way intersections not over eight hundred (800) feet apart in residential or multi-family areas and not over six hundred (600) feet in other areas, and in such a manner as to preferably require two (2), but not more than three (3) valves to shut down a City block or as may be required to prevent shutting off more than one fire hydrant. On cross feed mains without services, a maximum of four (4) valves shall be used to shut down each block. Valves shall be placed at or near the ends of mains in such a manner that a shutdown can be made for future main extension without causing loss of service on the existing main. The locations of valves twelve (12) inches and larger shall be approved by the City Engineering Department.*
i. *Valves twelve (12) inches and under shall be Resilient Seat Gate Valves (RSGV).*
j. *At all tees six (6) inches and above require three (3) valves and all crosses require four (4) valves.*
k. *Mega-lug fittings shall be used on all tie-ins. Thrust blocking shall be used per standard construction drawing 26001(www.ci.greenville.tx.us)*
l. *Ductile iron fittings are to be wrapped in four (4) mil plastic.*
m. *Detector tape shall be used over all PVC mains.*
n. *Embedment shall be North Central Texas Council of Governments (NCTCOG), Class "B-3"*

7.2 Testing

a. *Sterilization*
b. *Hydro-static*

7.3 Services

a. *Water services shall be copper pipe, Type K, and shall include corporation stop, curb stop and meter box at the property line.*
b. *Curb stop and corporation stops shall be straight through 360° operation. (Mueller #300 Mod. B-20283-3 or equivalent.*
c. *Standard meter layout per City standard drawing 26002.*
d. *All meter boxes shall be located in non-traffic areas protected by six (6) inch curb or bollards.*

7.4 Fire Hydrants

A sufficient number of fire hydrants shall be installed to provide hose stem protection for every point on the exterior wall of the building with the lengths of hose normally attached to the hydrants. There shall be sufficient hydrants to concentrate the required fire flow around any building with no hose line exceeding the distances hereinafter established and with an adequate flow available from the water system to meet this required flow. In addition, the following guidelines shall be met or exceeded:

a. ***Single Family and Duplex Residential*** *– As the property is developed, fire hydrants shall be located at all intersecting streets and at intermediate locations between intersections at a maximum spacing of five hundred (500) feet between fire hydrants as measured along the route that fire hose is laid by a fire vehicle.*
b. ***Multi-Family Residential*** *- As the property is developed, fire hydrants shall be located at all intersecting streets and at intermediate locations between intersections at a maximum spacing of four hundred (400) feet as measured along the length of the centerline of the roadway, and the front of any structure at the grade shall be no further than five hundred (500) feet from a minimum of two (2) fire hydrants as measured along the route that a fire hose is laid by a fire vehicle.*
c. ***Other Zones*** *- As the property is developed, fire hydrants shall be located at all intersecting streets and at intermediate locations between intersections at a maximum spacing of three hundred (300) feet as measured along the length of the centerline of the roadway, and the front of any structure at the grade shall be no further than three hundred (300) feet from a minimum of two (2) fire hydrants as measured along the route that a fire hose is laid by a fire vehicle.*
d. *Fire hydrants shall be installed along all fire lane areas as follows:*
    1. *Within one hundred and fifty (150) feet of the main entrance to a building.*
    2. *At the maximum intermediate spacing, in non-residential areas, of three (300) feet as measured along the length of the fire lane.*
    3. *At the maximum intermediate spacing, in Apartment, Townhouse or Cluster Residential areas, of three (300) feet as measured along the length of the fire lane.*
e. *Fire hydrants shall be located four (4) feet from the back of curb when possible. If four (4) feet is not practical a hydrant shall not be less than two (2) or more than six (6) feet behind the back of curb.*
f. *Generally, no fire hydrant shall be located closer than fifty (50) feet to a non-residential building or structure unless approved by the Engineering department and the Fire Department.*
g. *In instances where access between the fire hydrant and the building, which it is intended to serve, may be blocked by barriers, extra fire hydrants shall be provided to improve fire protection. Railroads, divided thoroughfares, blocks which are subject to buildings restricting movement, and other manmade or natural obstacles are considered as barriers.*
h. *All required fire hydrants shall be of the national standard three (3) way breakaway type no less than five and one-fourth (5 1./4) inches in size and shall conform to the provisions of the latest A.W.W.A. specifications C-502 and shall be placed upon water mains of no less than six (6) inches in size.*
i. *Valves shall be placed on all fire hydrant leads.*
j. *Anchor fitting shall be used to attach fire hydrants.*
k. *Fire hydrants shall be painted per City of Greenville standards and specifications and located in a protected area with a six (6) inch curb or bollards.*
l. *Steamer nozzles of fire hydrants shall be eighteen (18) inches above the top of curb of finished grade and shall face the center of the fire lane or street.*
m. *Fire hydrants, when placed at intersections or access drives to parking lots, when practical, shall be placed so that no part of the fire truck will block the intersection or parking lot access when connections to the fire hydrant are made.*

NOTE: Fire hydrants, required by the article, and located on private property, shall be accessible to the Fire Department at all times.

NOTE: The Fire Marshall shall approve final locations of fire hydrants to assure compliance with all fire codes and flow issues per the latest approve standards.

Section VIII: Sewer Design

8.0 Definitions

Trunk Lines *- Lines running through a basin, generally without service taps, to collect and carry sewage from main lines to the wastewater treatment plant.*
Mains *- Lines through neighborhoods carrying sewage from homes and businesses to the trunk lines.*
Manholes *- Structured entrances into the sewer system for maintenance access.*
Main Line Cleanout *- Cleanout on the end of a main line.*
Service Cleanout *- Cleanout on a service line usually at or near the property line.*
Laterals *- Service lines from the main to the property line.*

8.1 Mains

In general, sewer mains are to be placed on the North or West side of a street as shown in figures 2, 3 and 4, of section 1 of this manual, or as directed by the City Engineering Division.

a. *Sanitary sewer pipe shall be Green PVC (SDR 35-ASTM D 3034-73) John Mansville or approved equal, using twenty (20) feet joints on twelve (12) inch diameter and below and thirteen (13) feet joints on fifteen (15) inch diameter and above.*
b. *Embedment shall be per North Central Texas Council of Government (NCTCOG) specifications Class B-2. (See* ***Standard Drawings for Public Works Construction****) Available at www.ci.greenville.tx.us*
c. *No sanitary sewer line shall be less than six (6) inches, with the exception of services laterals and some force mains.*
d. *Minimum cover shall be three and one half (3 ½) feet. In general, the minimum depth for sewer to serve a given property with a four (4) inch lateral shall be three (3) feet plus 2% times the length of the building lateral (the distance from the sewer to the corner of the building). Thus for a house one hundred and thirty-five (135) feet from the sewer, the depth would be three (3) feet plus 2% x 135 feet = 3.0 plus 2.7 = 5.7 feet. The depth of the flow line of the sewer should be at least 5.7 feet below the elevation of the ground at the point where the service enters the house. Profiles of the ground line twenty (20) feet past the building line will be required to verify that the criteria is met.*
e. *No sanitary sewer in alleys unless approved by the Engineering Department.*
f. *Bores and Encasements:*
    1. *All bores under street, highways and creeks will require smooth steel encasement large enough to accommodate one size large pipe than is required.*
    2. *Main lines under creeks where less than three (3) feet of cover is not possible a concrete cap is required.*
    3. *Racci brand type skids are required on pipe inside the encasement.*
    4. *Bores under highways require TXDot permits.*
g. *Curved Sewer Lines*
    1. *No vertical curves will be allowed.*
    2. *Horizontal curvature may be by joint deflection or pipe flexure but not both. The designing Engineer must specify on the plans the method of deflection allowed and the allowable radius or joint deflection for each pipe size.*
    3. *When pipe flexure is used, the minimum radius of curvature shall be equal to that recommended by the pipe manufacturer or 300 X D, where "D" is the average outside diameter of the pipe in inches, whichever is greater. The designing Engineer shall note on the plans that, when using pipe flexure, all joints are to remain fully seated.*
    4. *If joint deflection will be used to provide horizontal curvature, the allowable deflection shall be five (5) degrees or 80% of the Manufacturer's recommended maximum joint deflection, or 80% of the National Reference Standard maximum recommended joint deflection, whichever is less. When joint deflection is used the designing Engineer must specify the size of mandrel to be used for deflection testing. The mandrel shall be sized to verify that the maximum joint deflection has not been exceeded.*
    5. *Horizontal curves shall match changes in the street direction as near as possible, but will not be allowed across residential single family and duplex lots.*
    6. *Slopes on curved sewers shall be a minimum of 3% greater than the corresponding minimum slope of the sewers in a straight line.*

7. *Manholes on curved sewers shall be located at the P.C. and P.T. of the curve and a maximum spacing of three hundred (300) feet along the curve.*

h. *The minimum acceptable "n" factor for use in design of sanitary sewers shall be 0.013. Pipes should be placed on such a grade that the velocity when flowing full is not less than two (2) feet of more than ten (10) feet per second. Minimum grades based on n=0.013 shall be as follows in Table G:*

TABLE G Slopes

Size of Pipe in Inches I.D.	***Minimum Slope in Percent***	***Maximum Slope in Percent***
6	*0.50*	*12.35*
8	*0.33*	*8.40*
10	*0.25*	*6.23*
12	*0.20*	*4.88*
15	*0.15*	*3.62*
18	*0.11*	*2.83*
21	*0.09*	*2.30*
24	*0.09*	*1.93*
27	*0.06*	*1.65*
30	*0.055*	*1.43*
33	*0.05*	*1.26*
36	*0.045*	*1.12*
39	*0.04*	*1.01*

- *For lines larger than thirty-nine (39) inches in diameter, the slope shall be determined using Manning's equation to maintain a minimum velocity of two (2) feet per second when flowing full and a maximum velocity of ten (10) feet per second when flowing full.*

$$V = \frac{1.49}{n} \times R^{2/3} \sqrt{S}$$

Where *V = velocity (ft/sec)*
n = Manning's Roughness Coefficient (0.013)
R = Hydraulic Radius (ft)
S = Slope (ft/ft)

Note: All grades to be shown to the nearest .01 foot.

8.2 Manholes and Cleanouts

a. *Manholes shall be placed at all four (4) way and three (3) way sewer main intersections, changes in grade and direction, and at a maximum spacing of five hundred (500) feet.*
b. *The diameter of a manhole constructed over the center of a sewer should vary with the size of sewer main. For twelve (12) inches and below a four (4) foot manhole is required, for fifteen (15) through thirty (30) inches, a five (5) foot manhole is required. All mains thirty-three (33) inches and above require a six (6) foot manhole.*
c. *All manhole lids must be three hundred (300) lb., twenty-four (24) inch with pick bar.*
d. *All manholes are to be coated with two (2) coats bitumastic super service, black or approved equal.*
e. *When possible all manhole rim elevations shall be above the one hundred (100) year flood plain. In instances where manhole cannot be raised the Flood Plain, sealed manholes "Type S" shall be used to prevent the entrance of storm water. Where more than three manholes in sequence are to be bolted and gasketed, every third manhole shall be vented above the one hundred (100) year Flood Plain elevation. The designing Engineer shall provide the elevation of the 100-year Flood. Sealed manholes shall also be used in all areas subject to carrying drainage flow or in drainage ways.*
f. *Where unequal size pipes enter a manhole, the crown of the pipes should be set at the same elevation.*
g. *In order to provide access for sewer lines for cleaning, manholes and cleanouts shall be located so that two hundred and fifty (250) feet of sewer rod can reach any point in the line. This means that spacing between a manhole and an upstream cleanout shall be limited to four hundred (400) feet. Cleanouts may be located at the end of the line only.*
h. *Cleanouts shall be placed on the end of all lines, unless the developer plans on future development and then a manhole is acceptable.*
i. *Drop manholes are required when the inflow elevation is more than eighteen (18) inches above the outflow elevation. All drops shall be located inside the manhole.*

j. Manholes are required on each end of a line that is installed by a method other than open cut and at each end of an aerial crossing.

8.3 Laterals

a. For single family dwellings, the lateral size shall be four (4) inches minimum, for multiple units, apartments, local retail and commercial the lateral shall be six (6) inches minimum, and for manufacturing and industrial the size should be eight (8) inches or larger as required. Subdivision sewer taps usually come out ten (10) feet downstream from the center of the lot and shall have ten (10) feet of separation from the water service. Manholes are required on six (6) inch and larger laterals where they connect to the main line.

b. .Sewer taps and laterals shall be made at the main using PVC (SDR 35) and a wye connection (not a tee or tee-wye connection).

8.4 Lift Stations

8.4 Testing

a. Manhole Vacuum test
b. Main line Low pressure test
c. Mandrel
d. Post construction Video

Section IX: Flood Plain Regulations

9.0 Flood Plain Areas

Not all streams inside the Corporate Limits and ETJ have been studied by the U.S. Corps of Engineers and FEMA. The City's Flood Plain Administrator may require a study to be performed on any stream adjacent to a new development. This study should determine the boundary and B.F.E. of the 100 year Floodplain. The Public Works Administrative Office and the Community Development Office located at 2315 Johnson Street maintain copies of the local Flood Insurance Rate Maps (FIRM) published by the Federal Emergency Management Agency (FEMA) for viewing. To purchase copies of the maps contact FEMA's Map Service Center at (800) 358-9616.

9.1 Flood Insurance

For questions about flood insurance, call the National Flood Insurance Program at (800) 638-6620.

9.2 Construction in the Flood Plain

Building on land within the boundary of the 100-year flood plain is generally not permitted without a Flood Plain Development Permit signed by the City's Flood Plain Administrator. The City's Flood Plain Administrator is Massoud Ebrahim, P.E. He can be reached at (903) 457-3135. Any construction or grading activity within the flood way is prohibited!

a. ***Review***

Review the Flood Plain Regulations located in Section 11.800 of the Code of Ordinances. Contact Massoud Ebrahim, P.E., Flood Plain Administrator at (903) 457-3135 if you have questions about specific requirements listed in this Section. For the requirements to develop a new subdivision on land located within a flood hazard area, review Article VII of the Subdivision Ordinance located in Chapter 13 of the Code of Ordinances.

b. ***Application***

After reviewing the Flood Plain Regulations, prepare all the information required for a Flood Plain Development Permit Application including the following information:

- *Plans drawn to scale showing the location, dimensions, and elevation of proposed landscape alterations, existing and proposed structures, and the location or the foregoing in relation to the flood hazard areas*
- *The elevation (in relation to mean sea level) of the lowest floor (including basement) of all new and substantially improved structures*
- *The elevation (in relation to mean sea level) to which any non-residential structure shall be flood proofed*
- *A certificate from a Registered Professional Engineer or Architect that any non-residential flood proofed structure shall meet the flood proofing criteria of Section 11.818b of the City's Flood Plain Damage Prevention Regulations*
- *A description of the extent to which any water course of natural drainage will be altered or relocated as a result of the proposed development*

Submit all the required application materials to the City Engineer at 2315 Johnson Street. Provide copies of all application materials to the Director of Community Development.

c. ***Application Review***

The Flood Plain Administrator will evaluate each flood plain development permit application using the ten (10) criteria outlined in Section 11.815 of the Code of Ordinances:

- *The danger to life and property due to flooding or erosion damage*
- *The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner*
- *The danger that material may be swept onto other lands to the injury of others*
- *The compatibility of the proposed use with existing and anticipated development*
- *The safety of access to the property in times of flood for ordinary and emergency vehicles*
- *The cost of providing governmental assistance during and after flood conditions including maintenance and repair of streets and bridges, and public utilities and facilities, such and sewer, gas, electrical, and water systems*
- *The expected heights, velocity, duration, rate of raise and sediment transport of the floodwaters in the effects of wave action, if applicable, expected at the site*
- *The necessity to the facility of a water front location, where applicable*
- *The availability of alternative locations, not subject to flooding or erosion damage, for the proposed land use, and*
- *The relationship of the proposed use to the Comprehensive Plan for that area*

After reviewing the application, the Floodplain Administrator will either approve or deny the application.

d. ***Appeal***

Any person aggrieved by the requirement, decision or determination of the Floodplain Administrator may appeal such to the Zoning Board of Adjustment. Any request for appeal must be filed in writing with the Floodplain Administrator within ten (10) days of the date of the decision or determination is issued by the Floodplain Administrator, in accordance with the appeal criteria outlined in Section 11.816 of the Code of Ordinances.

A person may also request a variance from the Flood Damage Prevention Regulations located in Section 11.800 of the Code of Ordinances. These variance requests are also considered by the Zoning Board of Adjustment. The criteria for the issuance of floodplain variances are outlined in Section 11.816(i) through 11.816(o) of the Code of Ordinances. Decisions of the Board of Adjustment may be appealed to a court with jurisdiction over such matters.

Section X: Drainage Design

10.0 Detention

Detention Design Standards

a. Ponds will provide for temporary storage of storm water runoff and shall be designed with capacity to detain the post-development runoff for a minimum 10 year storm event. Runoff should be released at a controlled rate which shall not exceed the pre-developed peak runoff rate of the site or the capacities of the existing drainage systems, whichever is less.

Ponds may be required to accommodate a 25, 50, or 100 year storm event if the City Engineer determines that additional runoff incidental to the development of the subdivision will overload existing downstream drainage facilities, whether natural or man-made, and result in hazardous conditions.

b. A barrier-type fence, at least 6 foot in height, is required to prevent access to detention pond facilities that have interior slopes greater than 3H:1V. Where a fence is required, a gate, a minimum of 12 feet in width, is required to allow access for maintenance equipment.

c. A 10 foot maintenance access strip on top or along the side of the berm is required around the perimeter of the detention pond facility. This 10 foot strip shall not have a post-construction slope greater than 15%. A permanent maintenance equipment access ramp is also required with a slope not exceeding 4:1. The minimum ramp width is ten feet.

Maintenance

a. Corrective maintenance is required if a pond does not drain completely within sixty (60) hours of the cessation of storm water inflow. No standing water is allowed.

b. Silt shall be removed and the pond returned to the original lines and grades when standing water conditions occur or the basin storage volume is reduced by more than 10%.

c. To limit erosion, no unvegetated area shall exceed 10 ft^2 in extent.

d. Accumulated paper, trash, and debris shall be removed every 6 months or as necessary.

e. Ponds shall be mowed at least twice annually between the months of June and September.

f. Structural integrity of ponds shall be maintained at all times.

(Ord. 94-137 adopted 7-26-94, Sec. 1)

A person who violates this subsection is guilty of a separate offense for each day or part of day the violation is committed, continues, or permitted. Each offense upon conviction, is punishable by a fine not to exceed $500.00.

Calculations of runoff shall be based on a fully developed drainage area or watershed.

Values for the runoff coefficient to be used in determination of storm water runoff shall be as indicated below:

Land Use	*Runoff Coefficient C*
Parks and Permanent Open Space	*0.40*
Single Family Residence	*0.60*
Multi-Family Residence	*0.75*
Business or Industrial	*0.95*
Central Business District	*1.00*

c. Design storm frequencies to be used in the design of drainage facilities shall be as indicated below:

Type of Facility	*Minimum Design Frequency Q*
Storm sewers (including major laterals, laterals and sub laterals)	*10 Year*
Large drainage outfalls	*25 Year*
Highway Culverts and Bridges	*50 Year*
Primary Drainage Channels (Major creeks, such as Long Branch	*100 Year*

10.1 STORM DRAINAGE DESIGN

Storm Drainage Design

a. Computation of runoff shall be based upon a fully developed drainage area or watershed.
b. The Rational Method (Q=ClA) shall be typically used, as applicable.
c. Where the City Engineer deems that the size of the watershed warrants, unit hydrograph techniques, utilizing a design approved by the City Engineer, shall be used.
d. Storm drainage shall be designed for ultimate development of the watershed, and therefore, runoff coefficients used shall consider these fully developed conditions.
e. The comprehensive plan, official zoning map, and other land use plans shall be used to determine the ultimate development
f. Values for the runoff coefficient to be used in the determination of storm water runoff shall be as indicated above.
g. Design Storm frequencies to be used in the design of drainage facilities shall be as indicated above.

Drainage Ditches

a. Lined drainage ditches in lieu of enclosed storm sewers may be installed when the City Engineer, on the basis of competent engineering evidence submitted to him in accordance with criteria and guidelines previously mentioned, concludes that the installations of enclosed storm sewers as herein established is not required for the protection of health, safety, and general welfare.
b. Construction and installation of such open drainage ditch, along with any improvements required upon natural drainage ways, shall be totally at the Developer's expense and shall conform with city standard specifications.

Drainage and Storm Sewers

a. Drainage structures shall be constructed in such locations and of such size dimensions to adequately serve the subdivision and associated drainage area. Drainage provision shall ensure the health and safety of the public and property in times of flood and such facilities shall not cause excessive increases in the flood heights or velocities, particularly to adjacent and downstream properties. When calculations indicate that curb capacities are exceeded at a point, no further allowance shall be made for flow beyond that point, and inlets shall be used to intercept flow at that point.
b. In new subdivisions, the developer shall provide all the necessary easements and rights-of-way required for drainage structures, including storm sewer and open or paved channels. The applicant may be required by the City Engineer to carry away by pipe or open ditch any spring or surface water that exists either prior to, or as a result of, the subdivision. Such drainage facilities shall be located in the street right-of-way where feasible, or in perpetual unobstructed easements of appropriate width, and shall be constructed in accordance with the then current construction standards and specifications of the City of Greenville.
c. Storm sewers and curb inlets:
1. Storm sewers shall be provided and curb inlets located so as to properly drain all streets and intersections.
2. Permissible spread of water:
A. Commercial collector and thoroughfare streets widths above forty-one feet (41') B-B (back-to-back). The flow of water in gutters of these collector streets widths above forty-one feet (41') B-B (back-to-back) shall be limited so that two (2) standard lanes will remain clear during the peak runoff from the design storm. Inlets shall be located at low points or wherever the flow exceeds the two (2) standard lane requirements. Gutter depression at the inlet is discouraged, but shall not exceed five inches (5") in any case. The design storm will have a ten (10) year return frequency. Example: Street width forty-one feet (41') to forty-nine (49')-- two (2) twelve foot (12') traffic lanes to remain clear.
B. Residential collector streets (41' B-B). The flow of water in gutters of a residential collector street shall be limited so that one (1) standard lane will remain clear during the peak runoff from the design storm. Inlets shall be located at low points or wherever the flow exceeds the one (1) standard lane requirement. Gutter depression at the inlet is discouraged, but shall not exceed five inches (5") in any case. The design storm will have a ten (10) year return frequency. Example: Street width forty-one (41')-- one (1) twelve foot (12') traffic lane to remain clear.
C. Residential street (28 feet B-B). The flow of water in gutters of a residential street shall be limited to a flow at the curb of six inches (6") or wherever the street is just covered, whichever is the least depth. The inlets shall be located at low points, or wherever the gutter flow exceeds the permissible spread of water. In no case shall the gutter depression at the inlet exceed five inches (5"). The design storm will have a ten (10) year return frequency.
D. The permissible water spreads are based upon the design storm frequency (10-year), but consideration must be given to street conveyance of the major storm (100-year) and possible flooding. All streets shall be capable of conveying a major storm without water encroaching into adjacent buildings. Therefore, the maximum spread limit in streets for a major storm shall be the building lines. This requirement of utilizing the street to convey the major storm runoff may require increasing the capacity of the enclosed drainage system.
E. Drainage System Requirements:
The complete drainage system is composed of the initial system, consisting of inlets, storm drains, and associated appurtenances to convey the initial storm run off (10-year); and the major system or the major runoff (100-year), which consists of swales, creeks, channels, flood ways and emergency overflows to prevent water encroachment into residential and commercial facilities.

(1) Initial storm systems are required when water spread limits are exceeded.
(2) Channels:
(a) Channels are to be concrete lined at least to the 10-year frequency channel flow level with additional height to carry the 25-year flow.
(b) 100-year flow is to be contained within the building lines.

F. Additional Storm Drainage Criteria:
(1) Utilization of detention ponds may be required, when the City Engineer concludes that such installation is necessary. All detention ponds shall conform to the requirements of ~~Section 3-3.11(I)~~ of this ordinance.
(2) The City's major drainage flood plains that are still functioning in a natural or semi-natural state will require special and other preservation considerations.
(3) Minimum velocity with the pipe flowing full shall be three (3) feet per second.
(4) The minimum storm drain pipe diameter shall be fifteen (15) inches.
(5) Pipe diameters shall not normally decrease downstream.
(6) Pipe crowns at change in sizes should be set at the same elevation.
(7) Vertical curves in the conduit will not be permitted, and horizontal curves will be permitted only with the approval of the City Engineer.

10.2 Storm Pipe

a. Storm sewer pipe to be RCP. No HDPE or corrugated pipe.
b. Storm sewer pipe should be located per utility location drawings in Section VI: Streets.
c. No storm pipe is to be located under pavement (except crossings). Any storm sewer located under pavement must be box type and approved by the City Engineer.
d. All Horizontal and vertical changes in pipe direction and pipe intersections/connections must be made at a manhole, inlet or junction box.
e. No radius is to be made with storm pipe, pipe is to be laid in straight section unless otherwise approved by the City Engineer.

10.3 Channels

a. Grass Channel – If approved by the City Engineer
1. *Grass channels with less than 1% grade must have a concrete pilot channel. (3500 psi concrete, #3 bars on 18" centers both ways)*
2. *Maximum slope on a grass channel to be 3:1 and will be required to be sodded to prevent erosion.*
3. *All channels will be designed with consideration for future maintenance. (With the width of easements sufficient for maintenance with a backhoe or other machinery if necessary.)*
4. *All public channels must have access to enter and maintain from a public right-of-way.*
5. *All channels are to be shown on the construction drawings with a plan and profile and cross-sections.*

c. Concrete Lined
1. *Concrete channel shall be constructed with 3500 psi concrete, #3 bars on 18" centers both ways. And require a plan and profile and cross sections in the construction plans.*
2. *Concrete channels must have a minimum of .5% grade.*
3. *All channels will be designed with consideration for future maintenance. (With the width of easements sufficient for maintenance with a backhoe or other machinery if necessary.*
3. *All public channels must have access to inter and maintain from a public right-of-way.*
4. *All channels are to be shown on the construction drawings with a plan and profile and cross-sections.*

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	Community Development	***(903) 457-3160***
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	Terry Jackson	*Executive Secretary*
	Steve Methven	*Building Official*
	Dale Bissell	*Building Inspector*
	Cathleen Cosper	*Sanitarian*
	Wendell Allen	*Code Enforcement Officer*
	Building Inspection Request Line	***(903) 453-0402***
	Public Works	***(903) 457-3135***
	Massoud Ebrahim, P.E.	*Director/Flood Plain Admn.*
	ENGINEERING	***(903) 457-3160***
	David Herbert	*Superintendent of Engineering*
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	Kenny Ward	*Fire Chief*
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