



**Chambers County
Texas
Public Infrastructure
Design Standards**

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Article I General Procedures And Requirements

A. General

These Standards describe the general requirements for the preparation of Subdivision Plats, Engineering Construction Documents, and the criteria to be utilized by the Engineer and Surveyor in the analysis and design of infrastructure that is intended for, or to be dedicated for public use. The standards herein reflect minimum professional engineering requirements for all infrastructures throughout the jurisdiction of Chambers County. For infrastructures located within an incorporated community or the Extra Territorial Jurisdiction thereof that is intended to be dedicated to the public or Chambers County these standards shall also apply. No offer of acceptance of any proposed facility by the County will be approved unless the facility meets the standards herein, or has been approved as an exception to these standards by the Commissioner's Court.

1. These standards shall apply to all facilities that are to be dedicated or maintained by Chambers County;
2. No private system connections to utilities, drainage or flood control facilities of the County or Trinity Bay Conservation District will be allowed unless such facilities have been approved by the County Engineer and the Trinity Bay Conservation District.
3. Definitions for the terms and words used in these Standards are adopted in the Chambers County Subdivision Regulations and are incorporated herein as if included in their entirety.
4. The developer of a subdivision is responsible for all costs of design, construction, inspection and fees required for the review and approval of all plans and specifications for facilities intended to be dedicated to the public or used by purchasers or lessees of the lots or tracts being subdivided. Reimbursement cost participation by Chambers County and/or the Trinity Bay Conservation District shall be provided only for oversized facilities required of the developer to comply with the relevant Master Plans of such facilities. Such reimbursement shall be made in accordance with the policies in effect at the time of processing of the Preliminary Subdivision plat

B. Scope of Design Standards

Chambers County consists of several public agencies with jurisdiction over the development of public and private property. The boundaries and authority of these agencies varies according to state law. The developer undertaking to plan, design and construct any facilities that are for the use of the public, potential purchasers, or which rely upon the public infrastructure for public services must meet all the requirements of each agency. The Office of the County Engineer is the Chief Development Official of the county and all review of proposed improvements begins with that office.

C. Regulatory Agencies

The agencies that have jurisdiction over land development in Chambers County includes, but is not limited to the following:

Table 1

Chambers County Engineer	Subdivisions, Master Plans, Engineering design and documents for streets, and for drainage in the western part of the county.
Trinity Bay Conversation	Water, sanitary sewer, and drainage in the eastern part of the county.
Trinity River Authority	Development, construction and operation of the Trinity River from its source to the mouth in Trinity Bay.
U.S. Army Corps of Engineers, Galveston District	Wetlands, filling of wetlands, and modification to waters of the United States.
Chambers County Health Department	Design and inspection of on-site sanitary waste disposal systems.
Chambers County Fire Marshal	Fire code review, approval, and inspection for commercial sites, buildings, structures, and facilities. Approval of access to private communities for emergency services.
Texas Department of Transportation	Access to state highways for driveway permits and drainage approval for discharges into TxDOT roadside ditches.

D. Development Review and Advisory Committee

1. The Development Review and Advisory Committee is available to consult with Owners and agents of developers who wish to obtain information and guidance on the standards and procedures to be applied to their property. The Committee meets on an appointment basis.
2. An appointment may be obtained by calling the Chambers County Engineer's Office at the number located on the county web site at <http://www.co.chambers.tx.us/index.html>

E. Utility Design Requirements

1. Utility Capacity Allocation
 - a. The supply and commitment to provide water, sanitary sewer and storm drainage services are subject to the reservation of capacity in the systems and the payment of Fees by the developer or subdivider. The purpose of these fees is solely to provide adequate service to accommodate new development for expansion of existing facilities and the design and construction of new facilities.

- b. Chambers County and the Trinity Bay Conservation District ("District") share responsibility for these systems. Those responsibilities are divided as follows:
 - 1) For Drainage and Storm Water Management within the county east of the Trinity River extending from the Liberty County line on the north to the Galveston County Line on the south, the Trinity Bay Conservation District provides services, approves plans, inspects construction and maintains the completed, dedicated facilities;
 - 2) Payment of the current Reservation Fee is to the District is required in accordance with the policy currently in effect; and
 - 3) For drainage and storm water management within the county west of the Trinity River, within the Extra Territorial Jurisdiction of Bay town; Beach City, and Mont Belvieu, and within these cities where connections are proposed to facilities owned and maintained by Chambers County, the County Engineer approves plans, inspects construction and maintains the completed, dedicated facilities.
 - c. The Commissioners Court and District Board may officially accept facilities upon expiration of the two year maintenance warranty period, provided all inspections and tests have been passed.
 - d. Utility Capacity Reservation Letters must be obtained, paid for, and submitted to the County Engineer with all Final Plats prior to approval by the Commissioner's Court.
2. Capacity Reservation Determinations
- a. Domestic Potable Water and Fire Protection Water: - Water service will be provided by public systems where reasonably available, defined as within 1/2 mile of any subdivision containing 10 or more lots, or within 500 feet of any subdivision containing between four lots and 10 lots. The agency providing water services shall define the requirements for each subdivision and Fees shall be established in accordance with the adopted regulations, ordinances or resolutions of these providers.
 - b. Individual wells will be permitted only in accordance with the regulations of the Chambers County Health Department. The lack of public water to any subdivision in sufficient quantities and pressures to provide fire protection shall be sufficient grounds for the Commissioner's Court to disapprove a Final Plat. The subdivider may design and install either connections to a suitable public system or create a private central water system to insure adequate fire protection. Where connection to the public system requires off-site extension of water lines the developer shall be entitled to reimbursement for the expense of the extension.

Article II Water System Requirements

A. General

1. Water system design requirements are established based upon land uses as specified in this section.
2. Type A Development shall include all residential development with densities less than 12 units per acre;
3. Type B Development shall include all residential development in excess of 12 units per acre and all commercial, retail and industrial development.

B. Limit of Public System

1. The Public Water System shall not extend beyond the water meter. All construction to the meter shall conform to these Standards. All construction beyond the meter shall conform to the adopted Plumbing Code and the specifications of the Texas Department of Health and the Texas Board of Insurance.

C. Water Main Sizing and Materials

1. Minimum Sizes
 - a. Water mains in Type A Development shall have minimum sizes as follows:
 - 1) Two-inch (2") mains may serve a maximum of two (2) domestic, residential connections. Two-inch (2") mains shall not exceed two hundred feet (200') in length and shall be installed with a blow off at the end of the line. All two-inch (2") mains shall be specifically approved by the water service provider;
 - 2) Four-inch (4") mains may serve a maximum of twenty (20) lots when supported on both ends by a larger main. A dead end four-inch (4") main may support a maximum of ten (10) lots; shall not exceed four hundred feet (400') in length, and shall be terminated with a blow off. Fire hydrants shall not be located on a four-inch (4") main;
 - 3) Six-inch (6") mains shall be a maximum of one thousand five hundred feet (1,500") in length when supported on both ends by eight-inch (8") mains or larger and shall have no more than two intermediate fire hydrants. Dead end six-inch (6") mains shall not be more than six hundred feet (600') in length and shall terminate at a fire hydrant; and
 - 4) Eight-inch (8") mains are required for mains over one thousand five hundred feet (1,500') in length, or when three (3) or more intermediate fire hydrants are required. Eight-inch (8") mains shall not be dead end.
 - b. Water mains in Type B Development shall have minimum sizes as follows:

- 1) Minimum size of mains shall be eight-inch (8"). Maximum length of a dead end eight-inch main shall be three hundred fifty feet (350'). A dead end main shall be terminated with a fire hydrant;
- 2) Twelve-inch and larger mains shall be required at locations established by the water system operator in accordance with its adopted Master Plan; and
- 3) Six-inch (6") fire hydrant leads shall not exceed two hundred feet (200') in length.

2. Construction Materials

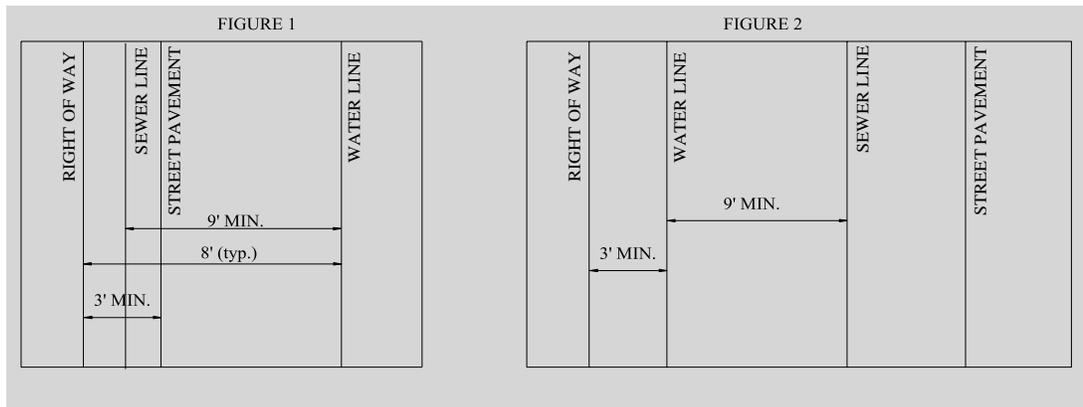
Water mains shall be constructed of the following materials:

- a. Polyvinyl Chloride (PVC) Pressure Pipe, four-inch (4") through twelve-inch (12") shall conform to the requirements of [AWWA C900-97: Polyvinyl Chloride PVC Pressure Pipe and Fabricated Fitting 4in.-12in. \(100 mm-300 mm\), for Water Dist.](#), (or most current revision) Class 150 DR 18. Pipe shall be designed and constructed in conformance with the minimum requirements of [AWWA PVC Pipe-Design and Installation \(M23\)](#);
- b. Ductile-Iron (DIP), twelve-inch (12") through fifty-four inch (54"), shall conform to the requirements of [C151/A21.51-02: ANSI Standard for Ductile-Iron Pipe. Centrifugally Cast. for Water.](#) Under special conditions the Water Service Provider may require thickness design in conformance with the minimum requirements of [C150/A21.50-02: ANSI Standard for Thickness Design of Ductile- Iron Pipe.](#) Pipe shall be installed in conformance with the minimum requirements of [AWWA C600-99: Installation of Ductile-Iron Water Mains and Their Appurtenances](#), or most current revision. Ductile Iron Pipe shall be furnished with bituminous or cement mortar lining, [AWWA C104/A21.4-95: ANSI Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water](#);
- c. Steel Water Pipe, four-inch (4") and larger shall conform to the requirements of [AWWA C200-97: Steel Water Pipe-6 In. \(150mm\) and Larger](#). Steel pipe minimum wall thickness shall conform to the thickness shown on the Chambers County Construction Details. All steel pipe shall have a coal tar coating in accordance with [AWWA C203-02: Coal-Tar Protective Coatings & Linings for Steel Water Pipelines Enamel & Tape Hot-App.\(Incl. add.C203a-99\)](#).;
- d. Other pipe materials may be used for construction of water mains when specifically approved by the Water Service Provider. Private water service lines between the meter and the building(s) shall be of the same material as the lines connecting to the public system;
- e. Bedding and backfilling shall conform to Construction Details in these Standards;
- f. Water mains and appurtenances in ten-inch (10") and fourteen-inch (14") diameters are not allowed;

- g. All public water mains shall be installed within a public utility easement or public right of way. Backflow Preventers shall be installed in easements not less than ten-feet (10") by ten-feet (10') and shall be in approved vaults if used for fire protection; and
- h. Construction of water mains shall be in accordance with approved construction plans and Construction Details in these Standards.

D. Location of Water Mains

- 1. Water mains shall be centered on a line eight-feet (8') inside the right- of-way line when within a street or highway and centered to one side of a utility easement to provide at least nine-feet (9') of horizontal clearance from any sanitary sewer line. (See Fig. 1)



(Location of main depends upon which side of street service is located. In all cases water main shall be located closest to R-O-W with sanitary sewer closest to street pavement).

- 2. Water mains shall be placed along a uniform alignment with the right-of-way. When necessary, the water main may be deflected at a fire hydrant location to accommodate proper installation of the fire hydrant. At all locations where a water main changes alignment the location of the water main shall be clearly shown on the construction plans. A minimum distance of three-feet (3') shall be maintained from the right of way line to the outside edge of the water line. (See Fig. 2)
- 3. When necessary, water mains may be located within the esplanade section of boulevard streets. Mains should be located as near the centerline as possible to avoid conflicts with future pavement widening.
- 4. Along streets with open drainage, all twelve-inch (12") and smaller water mains may be located five feet (5') from the right-of-way line and sixteen inch (16") and larger water mains are to be located as directed by the County Engineer.
- 5. Water mains may be located in the center of a ten-foot (10') utility easement if the easement adjoins a public right-of-way.
- 6. Location of a water main in an easement not adjoining a public right-of way is prohibited unless specifically approved by the County Engineer.

E. Clearance of Water Lines from Other Utilities

1. Conflict Clearances

When a water main is placed parallel to another utility line at or near the same grade, it shall have a minimum of four-feet (4') of horizontal separation. When the other utility is a sanitary sewer, a minimum of nine-feet (9') separation must be provided. In the event that a minimum of nine-feet (9') cannot be maintained, the sanitary sewer must be constructed of pressure pipe with watertight joints as used in water main construction and the clearances must be as defined in the following section or as specifically approved by the County Engineer and Water Service Provider. When a water main crosses a utility other than the sanitary sewer, a minimum of six inches (6") of clearance must be maintained and the water main shall have one joint of pipe, a minimum of eighteen feet (18') long centered on the other utility.

2. Crossing Clearances

For water mains crossing an existing or proposed sanitary sewer or force main, the following clearances shall be provided. The minimum clearances will be approved only when justified and field conditions so dictate. All crossings of sanitary sewer lines by any water main shall be in strict conformance with the current Rules and Regulations of the Texas Commission on Environmental Quality (TCEQ).

3. Separation Clearances

When water mains and sanitary sewers are installed they shall be installed no closer than nine-feet (9') in all directions and parallel lines must be installed in separate trenches, except as follows:

- a. Where a sanitary sewer parallels the water main the sanitary sewer shall be constructed of ductile iron or cast iron pipe meeting AWWA specifications having a minimum working pressure rating of one hundred fifty pounds per square inch (150 psi) or greater and equipped with pressure type joints. The water main and sanitary sewer shall be separated by a minimum vertical distance of two-feet (2') and a minimum horizontal distance of four-feet (4') measured between the nearest outside diameters of the pipes, and the water main shall be installed above the sewer line; and
- b. Where a sanitary sewer crosses the water main, and that portion of the sewer within nine-feet (9') of the water main is constructed as described above, the water line may be placed no closer than six-inches (6") from the sewer. The separation distance must be measured between the nearest outside pipe diameters. The water line shall be located at a higher elevation than the sewer and whenever possible one joint, a minimum of eighteen feet (18') long, must centered on the existing line.

4. Separation Distances

Where water lines are installed in an area where sanitary sewers exist, every effort must be made to maintain nine-foot (9') separation between the outside diameters of the two lines. Where this separation

cannot be achieved because of local conditions the following shall be required:

- a. Where a new water line is to cross or be installed in parallel with an existing sanitary sewer, and the sewer is constructed as described in 3(A), above, the separation distances specified in that section shall apply;
 - b. Where a new water line is to be installed in parallel with an existing clay, truss, or concrete gravity sewer showing no evidence of leakage and the water line is installed above the sewer a minimum of two-feet (2') vertically and four-feet (4') horizontally, the sanitary sewer need not be disturbed. Should excavation for the water line produce evidence that the sewer is leaking, the sewer must be repaired. Any existing sewer that is made of bituminous coated cellulose fiber, commonly referred to as "Orangeburg Pipe" must be replaced with approved materials regardless of its condition;
 - c. Where a new water main is to cross an existing clay, truss, or concrete gravity sewer showing no leakage, the sewer need not be disturbed if the water line is to be installed at least twenty-four inches (24") above the existing sewer. A full joint of the water line, at least eighteen feet (18') in length should be centered over the sewer crossing to provide maximum protection against contamination;
 - d. Existing clay, truss, or concrete sewer pipe which shows no evidence of leakage and because of physical limitations must remain at a higher elevation than a proposed intersecting water line, or closer than two-feet (2'), may remain undisturbed if the water line is inserted in a joint of pressure type encasement pipe at least eighteen-feet (18') long and two(2) nominal sizes larger than the water line. The encasement pipe should be centered on the sewer crossing and both ends sealed with cement grout. As an option to this procedure, that portion of the sewer line within nine- feet (9') of the crossing may be replaced with cast iron or ductile iron pipe with watertight joints as described in Section 3(A) above; and
 - e. Unless sanitary sewer manholes and the connecting sewer can be made completely watertight and tested for no leakage, they must be installed so as to provide a minimum of nine-feet (9') of horizontal clearance from an existing or proposed water line. Encasement of the water line in a carrier pipe as described subsection (d) above may be approved in special cases if the plans have the approval of the Texas Department of Health and the Water Service Provider.
5. Depth of Cover
- a. Minimum depth of cover for water mains shall be as follows:

- 1) Twelve-inch (12") and smaller mains shall have a minimum cover of four feet (4') from the top of curb. For open ditch roadway sections, twelve-inch (12") and smaller mains shall be installed at least three feet (3') below the ultimate flow line of the ditch or six-feet (6') below natural ground, at the right of way line, whichever is deeper;
- 2) Sixteen-inch (16") and larger mains shall have a minimum cover of five-feet (5') from the top of curb. For open ditch roadway sections, sixteen-inch (16") and larger mains shall be installed at least three feet (3') below the ultimate flow line of the ditch or seven-feet (7') below natural ground, at the right of way line, whichever is deeper; and
- 3) Changes in grade to clear other utilities or underground features may be made by deflecting pipe joints. The maximum designed deflection shall be one-half (1/2) of manufacturers allowable deflection. If a depth greater than eight-feet (8') to the top is required, a welded steel section will be used. The standard depth of cover maintained on the water main and the grade change shall be made using the welded steel section. The installation of fittings for vertical deflections of changes in grade shall not be allowed except with specific approval of the County Engineer and/or the Water Service Provider.

F. Valves

All water valves shall conform to AWWA standards and shall be designed as follows:

1. Two-inch (2") through twelve-inch (12") valves shall be resilient seated gate valves, AWWA [C509-01: Resilient-Seated Gate Valves for Water Supply Service](#), counter-clockwise opening with MJ or push-on joints. Valves shall have a complete coating on all iron parts in the valve interior to eliminate corrosion;
2. Sixteen-inch (16") and larger valves may be butterfly valves, [AWWA C504-00: Rubber-Seated Butterfly Valves](#), with complete interior coating to avoid corrosion of all iron parts, as approved by the Water Service Provider. All butterfly valves shall be installed in a vault of adequate size and construction as approved by the Water Service Provider;
3. Cast iron valve boxes are required on all gate valves less than or equal to sixteen-inch (16") as noted below. Valve vaults are required on all valves larger than sixteen-inches (16") in size;
4. All valves shall be sized equal to the size of the main on which it is installed; and
5. Valves shall be approved by the Water Service Provider and shall be listed on the Approved Products List of the Provider.

G. Spacing

Valves shall be set at maximum distances along the mains as follows:

Table 2

Main Size	Max. Spacing
4" through and including 12"	1,500 feet
16" and larger	2,000 feet
All main intersections shall have a minimum of (1) less valve than the number of mains at the intersection.	

H. Locations

Valves shall be located as follows:

1. Valves on all mains shall be located within the street right-of-way. Valves shall not be placed under, or within two-feet (2') of ultimate pavement, except as specifically approved by both the County Engineer and the Water Service Provider;
2. Valves (excluding Tapping Sleeves and Valves) are normally located on the projection of intersecting street right-of-way lines or at the curb return adjoining a paved street across the main;
3. All fire hydrants shall be isolated from the service main with a valve located in the fire hydrant lead;
4. Intermediate valves not located on the projection of intersecting street right-of-way lines may be located at lot line projections of five-feet (5') from fire hydrants; and
5. Valves shall be placed at the end of all mains that are to be extended in the future, and the main shall extend a minimum of twenty-feet (20') beyond the valve.

I. Fire Hydrants

1. Fire hydrants shall have three-way nozzle arrangements, five and one-quarter inch (5-1/4") compression type main valve, mechanical joint boot, and conform to the requirements of [AWA C502](#). The pumper nozzle shall be the National Standard Thread and the hose nozzles shall be two and one-half inch (2-1/2") threads. Fire hydrant shall be listed on the Approved Products List (example: Mueller, Centurion or American Darling) provided by the Water Service Provider.
2. Spacing – Fire hydrants shall be spaced along all mains six inch and larger as follows:
 - a. Type A development – Five Hundred Foot (500') spacing and at all street intersections; and
 - b. Type B development – Five Hundred Foot (500') spacing and at all street intersections, in addition to the spacing and fire hydrant requirements specified in the Chambers County Fire Code.

3. Fire Hydrants shall be located as follows:
 - a. Fire hydrants shall be located three-feet (3') behind the back of curb or projected future curb and be set at the point of curvature (PC) of the intersection curb radius. A parallel tee may be used for a fire hydrant lead at the water main when specifically approved by the Water Service Provider;
 - b. On all state highways and open ditch roadways fire hydrants and/or flushing valves shall be set within three feet (3') of the edge of the right-of-way line. Crossing of state rights of ways must be approved by TxDOT and locations of all facilities must be in conformance with state requirements. All state approvals shall be obtained before plans and specifications will be approved by the County Engineer or Water Service Provider;
 - c. Fire hydrants located between right-of-way intersections should be set at a lot line; however, this location may be adjusted five-feet (5') either way to miss driveways or other obstructions. In such case the fire hydrant should not be closer than three-feet (3') from curbed driveways or five-feet (5') from non-curbed driveways;
 - d. Fire hydrants may be located in the esplanade section of boulevards only when existing buildings or other physical obstructions prevent locating them as above. Location of fire hydrants in esplanades will be subject to the specific approval of the County Engineer;
 - e. Fire hydrants shall be located to be accessible from all sides for a distance of seven-feet (7') and in a protected but visible area; and
 - f. Fire hydrant elevation shall be measured from the center of the stem or nozzle to either the top of curb or natural ground, whichever is applicable, and shall be a maximum of thirty-six inches (36") from the ground or curb with a minimum of eighteen- inches (18') from the ground or curb.
4. Depth of Bury

The depth of bury for all fire hydrants shall be established such that the bury line on the fire hydrant is installed at the ground line at each location or at the finished ground after pavement construction is completed. The depth of bury for fire hydrants shall be shown on the construction plans. Minimum cover for fire hydrant leads shall be four - feet (4').
5. Fire hydrants shall not be installed within nine-feet (9') of a sanitary sewer system under any conditions.
6. Fire hydrants shall color coded according to the flow available at the hydrant, subject to approval by the County Fire Marshal:

Table 3

Light Blue	1500 gpm or greater
Green	1000 to 1499 gpm
Orange	500 to 999 gpm
Red	Less than 500 gpm

Blue pavement reflectors shall be installed by the developer on roadways

and streets near the center strip of the roadway, on the side of the stripe which the hydrant is located.

J. Fittings and Appurtenances.

1. Fittings shall be Ductile Iron Compact Fittings Three-Inch (3"), Twelve-Inch(12"), [AWWA C153/A21.53-00: ANSI Standard for Ductile-Iron Compact Fittings for Water Service](#), conforming to the minimum requirements of AWWA [C110/A21.10-98: ANSI Standard for Ductile-Iron and Gray-Iron Fittings 3 In.-48 In. \(76 mm-1 219 mm\) for Water](#). Fittings shall be furnished with bituminous or cement mortar lined in accordance with [AWWA C104/A21.4-95: ANSI Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water](#).
2. All fittings shall be identified and described on the construction plans.
3. Fittings are not permitted in fire hydrant leads except as specifically approved by the County Fire Marshal.
4. All water main fittings shall have push-on or mechanical joints.
5. All plugs shall be provided with retention clamps.

Polyethylene tube encasement shall conform to the requirements of [AWWA C105/A21.5-99: ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems](#). Soils within the project area shall be tested in accordance with Appendix "A" of AWWA C105 to adequately determine the requirements for encasement.

6. Concrete thrust blocking conforming to the Construction Details herein shall be required on all bends, tees, plugs, fire hydrants, and combinations thereof.

K. Steel Water Pipe

1. Welded steel pipe is required for all water mains with cover of less than four-feet (4') or greater than eight-feet (8'), and for offset assemblies. Refer to the Standard Details for offset assembly specifications.
2. All transitions from steel pipe to approved water main materials shall be constructed using electrically isolated flange joints.
3. Welded steel pipe shall be constructed in conformance with the Standard Details herein.

L. Crossings

Installation of a water main across a proposed or existing highway, county road, public street, railroad, pipeline or drainage way shall be at 90 degrees to the roadway whenever possible. All such crossings shall be specifically approved by the County Engineer and shall be clearly shown on the Construction Plans and As-Built Plans. As-Built Plans shall show location, flow line, line size and joint lengths for all crossings. All encasements, of required, shall also be shown accurately. Crossing of state rights of ways must be approved by TxDOT and locations of all facilities must be in conformance with state requirements. All state approvals shall be obtained before plans and specifications will be approved by the County Engineer or Water Service Provider.

M. Water Services to Properties

1. Water Service to Type A Development:

- a. Water service from the main to the curb stop shall be installed using approved materials from the products list supplied by the Water Service Provider. All service saddles for water construction must be brass size on size;
- b. Curb stops shall be of cast brass or bronze construction, provided with compression-style fittings at both ends for CTS tubing, Ford "Pack Joint", A.Y. McDonald "Mac-Pak" or approved equal. Couplings with set screws or grip rings will not be acceptable. Curb stops shall be Mueller Co. 300 Ball Curb Valve, Model B-25209, Ford Meter Box B44-G style Ball Valve Curb Stop, A.Y. McDonald #6100T-22 or approved equal. Standard Tee Head Stops in body shall permit a 90-degree (one fourth) turn;
- c. Water service lines shall be placed at a minimum depth of thirty-six inches (36") below final paving elevation;
- d. Water meters shall be five-eighths-inch (5/8") to two-inch (2") displacement type, magnetic drive, cold water meters. Meters shall be purchased from the Water Service Provider at the time building construction commences on the property. (Following Building Permit Approval as required);
- e. Meter boxes shall be located just within the public right-of-way along the projection of the lot line. Location of meters on open ditch streets shall be specifically approved by the Water Service Provider; and
- f. Water Service Provider maintenance shall end at the meter and curb stop.

2. Water Service to Type B Development:

- a. Detector check valves shall be required on fire lines;
- b. The location of the service line tee, valve, valve box and temporary plug shall be designated on the construction plans in the appropriate location to serve the future meter;

- c. All apartments, manufactured rental home communities, or townhomes proposed in a private street development shall have one or two master meters sized adequately to serve the entire development. Exceptions to this policy may be granted by the Water Service provider on an unusual situation. Meters shall be installed in compliance with the Standard Details; and
- d. Water Service Provider maintenance shall end at the meter and check valve vaults. Vaults shall meet the requirements in the Standard Details and shall be maintained by the Water Service Provider.

N. Overall System Layout

Layout and size of all water mains shall be consistent with the overall layout and Master Plan of the Water Service Provider serving the area. Layouts and sizes shall be approved by Water Service Provider and the County Engineer when any lines, mains, or appurtenances are located within any right of way or public easement. Layouts of systems inside the ETJ of any city shall be approved by the City in addition to the Water Service Provider and County Engineer.

O. Standards

1. Provide a source of fresh water at each end or at multiple points in a subdivision. Provide adequate circulation and place valves and fire hydrants so that flushing will be effective in all mains.
2. Avoid dead ends. All dead ends shall be isolated with a line valve, be as short as possible, and be equipped with a fire hydrant or blow off valve at the end of the main.
3. In unavoidable permanent dead end situations reduce the sizes of pipe successively. Carry a six inch (6") pipe to the last fire hydrant.
4. Where a water main is stubbed out for future extensions place a valve to isolate the dead-end until it is extended. Provide a standard two inch (2") blow off at the end of the line.

P. Miscellaneous Requirements

1. All tapping sleeves shall be stainless steel, including bolts, screws and clamps.
2. Bore and Jack sections shall be clearly shown on the plans by location and footage. Bore and Jack locations and schedules shall be approved by the County Engineer. The following criteria is generally used as a basis for setting bore and jack sections:
 - a. Public Streets -All paved public streets are to be bored and jacked regardless of surface. Bore and Jack length shall be computed as roadway width at proposed bore plus five feet (5') to either side. All state roadways shall have crossings and bore and jack operations approved by TxDOT prior to approval of the County Engineer;

- b. Driveways --Whenever it is cost effective concrete driveways in good condition shall be bored and jacked. Bore and jack length shall be computed as driveway width at bore plus one foot (1') to either side. Where driveways cross culvert pipe sections along open ditch streets and the proposed water main is in close proximity and parallel to the culvert pipe, the length of bore shall be the same as the length of culvert pipe;
 - c. Sidewalks -When the water line crosses under a sidewalk four feet (4') or more in width and in good condition, the sidewalk shall be either bored and jacked or the sidewalk shall be removed and replaced, whichever is cost effective. Bore and jack length shall be at least the width of the sidewalk. The proposed type of construction shall be noted on the plans;
 - d. Trees -All hardwood trees six inches (6") in caliper or greater within ten feet (10') of a water main shall be noted on the plans. The water line should be bored and jacked within the drip line of any hardwood tree larger than twelve inches (12") in caliper; and
 - e. Bore Pits -Bore pits shall be at least three feet (3') from the back of curb on local streets and five feet (5') from back of curb on a major roadway. Bore pits in highway, railroad, or county or state roads shall conform to these requirements and to the requirements of any Crossing Permit or Use Agreement. All bore pits shall be shored in accordance with OSHA requirements when the depth exceeds four feet (4') below natural grade. Bore pits shall be backfilled or covered each night and proper flashers shall be installed. Bore Pits shall be shown on the plans.
3. Open Cuts- Where water main construction requires open cuts the plans shall call for steel plate covers to be installed and maintained over the cut when the contractor is not actively working in the cut. Street cuts shall be "saw cut".
 4. Work areas adjacent to the areas of installations shall be restored to original condition after construction. Areas shall be sodded with St. Augustine or Bermuda grass sod and daily watering shall be applied for seven (7) calendar days after sod is installed.
 5. Traffic Control Plans -Traffic Control Plan shall be prepared as part of the construction plans to provide proper barrier and signage adjacent to open cuts and bore pit locations. TxDOT Traffic Control standards, signed and sealed by a Registered Professional Engineer shall be employed for the Traffic Control Plans.
 6. All excavation operations shall meet the minimum standards of 29 CFR 1926.650, .651, and .652 Subpart P, OSHA, 2003, regarding standards and practices for excavation of construction sites.
 7. Contractor shall obtain and pay for all construction permits and licenses. All required permits shall be posted at the job site or accessible to inspectors during normal working hours.

Article III Sanitary Sewer System Requirements

A. General

All properties subject to the provisions of these regulations in Chambers County shall be connected to an approved public or private sanitary sewer system prior to occupancy for any agricultural, residential, commercial or industrial purpose. Developers and subdividers shall plan, design and construct sanitary sewer services to all lots as a fundamental requirement of plat approval.

1. Sanitary sewers within the Chambers County jurisdiction shall allow for orderly expansion of the system and shall conform to the comprehensive water and sewer plan for Chambers County and/or the Water Service Provider.
2. Sewers shall be sized based on the minimum requirements set out in this standard and the standard wastewater flow rates as established by the Water Service Provider.
3. All sewers shall conform to the minimum requirements of the Texas Department of Health; "Design Criteria for Sewerage Systems" and all local requirements herein.
4. Sewers shall be separated from waterlines by minimum of nine feet (9'). Where the minimum separation is not maintained, refer to Article II E, for allowable clearances. Sewers crossing utilities other than water shall minimum of six inches (6").
5. Public sanitary sewer, as maintained by the Water Service Provider shall be defined as all sewers, including stack and service leads, that serve more than one sewer connection, that are located in public easements or street right-of way, and that are installed in accordance with these standards.
6. All design shall conform to these Standard Details.

B. Public Sewer System Design and Materials

1. Minimum Design Criteria

Minimum design criteria for determining the size of a sewer shall be as follows:

- a. Wastewater flows shall be based on the current, approved utility phasing plan for the area. The average day flow for the design of sanitary sewers shall be based on a minimum set by the plan in gallons per day per single family connection for residential areas. Commercial, industrial and office developments shall be designed for an average daily flow that can be anticipated from the contributing area;
- b. The peak design flow for sewers shall be four (4) times the average daily flow of the fully developed service area. Sewers larger than eighteen-inch (18") may be sized using a peaking factor of less than four (4) with approval of the Water Service Provider. The

minimum allowable values for the design peak factor are presented in Appendix B of these standards; and

- c. Minimum size public sewer shall be eight-inch(8").
2. Service leads to buildings shall be PVC Schedule 40 or SDR 26. Each lot shall have individual service. Service in new areas shall be brought up with a riser two feet (2') above ground. Minimum size sewer service lead shall be four inch (4") and shall not serve more than one (1) residential service; and
 - a. Commercial sewer service lead shall be six-inch (6") pipe or larger and shall not serve more than one (1) commercial connection. Specific approval shall be required for lines less than six inches (6").
3. Cement Stabilized Sand for Bedding and Backfill:
 - a. Portland Cement, Type I, [ASTMC150-02AE1](#);
 - b. Clean, durable, with less than 0.5 percent clay lumps, ([ASTM C142-97](#)); with less than 0.5 percent lightweight pieces, ([ASTM C123-03](#)); with organic impurities, ([ASTM C40-04](#)); NOT showing a color darker than standard color; and plasticity index of less than six (6) when tested in accordance with [ASTMD4318-00](#);
 - c. Compact to ninety-five percent (95%) Standard Proctor Density ([ASTM D2922-01](#) and [ASTM D3017 -01](#)) in lifts not greater than eight inches (8") thick. Actual testing may be required as deemed necessary by the Water Service Provider; and
 - d. The cement-sand mixture shall consist of at least one and one half (1-1/2) sacks of cement per cubic yard of sand. The cement-sand mixture shall have a minimum unconfined compressive strength of one hundred pounds per square inch (100psi) in forty-eight (48) hours, when compacted to ninety-five percent (95%) of Standard Proctor Density ([ASTM D2922-01](#) AND [ASTM D3017-01](#)), without additional moisture control cured and tested in accordance with [ASTM C31/C31 M-03a](#).
4. Location of Sanitary Sewers
Street Right-of-Way. - Sanitary sewer with a maximum depth of ten feet (10'), measured from finished grade, shall be placed within the right-of-way at least seven feet (7') from the right-of-way line, except as provided herein. All sewers that are deeper than ten feet (10') shall be centered in an exclusive easement parallel to and adjoining the right-of-way.
5. Allowable Depths
 - a. Sewers shall be designed to meet or exceed the pipe manufacturer's recommendations for depth. The Approved list of specific material and guidelines for sewers is available from the Water Service Provider.
 - b. Minimum depth of a sewer shall be four feet (4') below finished grade or top of curb, which ever is lower.

- c. Sewer bedding will be cement stabilized sand, bank sand, or approved granular material. Bedding shall be compacted to ninety-five percent (95%) Standard Proctor Density prior to backfilling the trench. In water bearing sand washed shell or other approved granular material will be required. Trevira wrap will be required for water bearing soil as shown in the Standard Details. When water bearing sands are encountered the Water Service Provider shall be notified immediately.
- d. A mandrel test shall be performed prior to acceptance of all Installed PVC pipe. The initial Mandrel test shall be performed thirty (30) days after the trench has been backfilled. The mandrel must move freely inside the pipe and will be pulled by the hand from the upstream end of the pipe to the downstream end. A second mandrel test, after settlement has occurred, may be required by the Water System Provider to determine long term deflections. Deflections in PVC pipe shall not exceed five percent (5%).

6. Hydraulic Requirements

- a. Design velocity in a gravity sewer flowing full shall be a minimum of two feet (2') per second. Where sewers are anticipated to flow less than one-half full consideration should be given to increasing the slope of sewer to provide two feet (2') per second velocity in the pipe for the anticipated flow rate.
- b. Minimum acceptable slopes in sewers shall be as shown in Table 4

Table 4

Size of Pipe (Inches)	Fall in Feet Per 100 feet of Length
6	0.50
8	0.40
10	0.25
12	0.20
15	0.15
18	0.11
21	0.09
24	0.08

- c. Sewers are to be designed so that crowns of the pipes are matched at manholes. The upstream sewer may be designed so that the flow line of the upstream sewer is higher than the flow line of the downstream sewer. When the flow line of the upstream sewer is raised more than three feet (3') above the flow line of the downstream sewer; a drop manhole connection is required, except as specifically approved by the Water Service Provider.
- d. Sanitary sewer service leads shall be laid at seven-tenths percent (0.7%) slope.

6. Alignment

- a. Sewers should be laid in a straight alignment where possible. Curved sewers may be allowed with specific approval of the Water Service Provider.
- b. Sewers less than eighteen-inches (18") in diameter may be curved by deflecting the pipe at the joint. Deflection shall not exceed one-half (1/2) of the pipe manufacturer's recommendations for joint deflection. Eighteen-inch (18") and larger sewers may also be curved using manufactured bends with a maximum deflection of eleven and one-quarter degrees (11-1/4°). Deflected pipe joints and bends shall be shown and specifically located on the construction drawings. Television inspection of completed installations shall be required by the Water Service Provider.

7. Test Procedures for Gravity Pipe Lines

a. In General

- 1) Gravity mains less than 36 inches in diameter will be air tested. Gravity mains 36 inches in diameter and larger may be tested with air at each joint.
- 2) All gravity mains shall be tested for deflections.

b. Air Leakage test

- 1) After backfilling and removing debris from each section of sewer line, conduct a line acceptance test under observation of an inspector. Where applicable and/or directed by the inspector the contractor will test the sanitary sewer lines in strict accordance with the following leakage test using low-pressure air. If the test results indicate an unacceptable installation, locate the source of leakage, correct the defect, and retest until the installation is proven satisfactory.
- 2) Inspections shall be scheduled at least 24 hours in advance. Failure of an inspection by the contractor shall result in a fee equal to the hourly rates and travel invested by the water service provider and shall be paid prior to acceptance of the system.
- 3) Minimum Requirements for Equipment
 - i. Control Panel;
 - ii. Low-pressure air supply connected to control panel;
 - iii. Pneumatic plugs of acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing; and
 - iv. Air hose from control panel to:
 - a) Air supply;
 - b) Pneumatic plugs;
 - c) Sealed line for pressurizing; and

d) Sealed line for monitoring internal pressure.

4) Testing Pneumatic Plugs

Test plugs before using in actual test installation. Place one length of pipe on ground and seal at both ends with pneumatic plugs to be checked. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5.0 psig. The plugs are acceptable if they remain in place under the test pressure without external aids.

5) Compensating for Ground Water Pressure

- i. When ground water exists, install a capped pipe nipple at the same time the sewer line is placed. Use a one-half inch ($\frac{1}{2}$ ") capped nipple approximately 10 inches long. Make the installation through the manhole wall on top of the sewer line where the line enters the manhole.
- ii. Immediately before performing the line acceptance test, remove the pipe cap, clear the pipe nipple with air pressure, and connect a clear plastic tube to pipe nipple. Support the tube vertically and allow water to rise in the tube. After the water stops rising, measure the height in feet of water over the invert of the pipe. Divide this height by 2.3 feet/psi to determine the ground water pressure to be used in line testing.

6) Line Testing

- i. After pneumatic plugs have been checked, place plugs in line at manhole and inflate plugs to 25 psig. Introduce low-pressure air into the sealed line until the internal air pressure reaches 4.0 psig greater than the ground water pressure. Allow at least two minutes for air pressure to stabilize. If at least 3.5 psig over groundwater pressure is maintained disconnect the air hose from the control panel to the air supply and measure the time of the pressure drop between 3.5 psig and 2.5 psig above ground water pressure.
- ii. Time required for pressure to decrease from 3.5 to 2.5 psig (greater than average groundwater back pressure over pipe) to be not less than time shown for given diameter in following table. Times shown are based on loss of air not to exceed 0.0015 cubic feet per minute per square foot of internal pipe surface tested at an average pressure of 3.0 psig greater than groundwater back pressure.
- iii. Since a K value or less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as follows:

Table 5

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Longer Length (seconds)
6	340	398	0.855(L)
8	454	298	1.520(L)
10	567	239	2.374(L)
12	680	199	3.419(L)
15	850	159	5.342(L)
18	1020	133	7.693(L)
21	1190	114	10.471(L)
24	1360	100	13.676(L)
27	1530	88	17.309(L)
30	1700	80	21.369(L)
33	1870	72	25.856(L)

iv. Lines with 27 inch average inside diameter and larger may be air tested at each joint. If the joint test is used, a visual inspection of the joint shall be performed immediately after testing. The pipe is to be pressurized to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Once the pressure has stabilized, the minimum time allowable for the pressure to drop from 3.5 psig shall be 10 seconds.

6) Retest

iv. Sanitary sewers failing to meet requirements of low pressure air test are to be tested again after contractor has located and remedied defects causing failure. No sanitary sewers to be accepted until limits of test procedures are satisfied.

v. Inspections shall be scheduled at least 24 hours in advance. Failure of an inspection by the contractor shall result in a fee equal to the hourly rates and travel invested by the water service provider and shall be paid prior to acceptance of the system.

7) Deflection Test

i. Deflection tests shall be performed on all flexible pipes. For pipelines with inside diameters less than twenty-seven inches (27"), a rigid mandrel shall be used to measure deflection. Other methods shall provide a precision of to +/- 0.2% deflection. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of 5%. If a pipe should fail to pass the deflection test, the problem shall be corrected and a second test shall be conducted after the final backfill has been in place an additional 30 days. The tests shall be performed without mechanical pulling devices.

i. Inspections shall be scheduled at least 24 hours in advance. Failure of an inspection by the contractor shall result in a fee equal to the hourly rates and travel invested by the water

service provider and shall be paid prior to acceptance of the system.

- i. Mandrel Sizing: The rigid mandrel shall have an outside diameter (O.D.) equal to 95% of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thickness for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe. All dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.
- iv. Mandrel Design: The rigid mandrel shall be constructed of a metal or a rigid plastic material that can withstand 200 psig without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 75% of the inside diameter of the pipe. A proving ring shall be provided and used for each size mandrel in use.

8) Television Inspection of Gravity Sanitary Sewers

- ii. Inspect newly-constructed and rehabilitated sewers, point repairs, service connections, and reconnects by closed-circuit color television inspection. Include a view of the beginning and ending manholes. This view shall consist of a pan of manhole walls, bench, and inverts.
- iii. Provide VHS format video tapes at T-120 lengths at standard play or suitable CD's in MPEG format compatible with Windows operating system. Use color television equipment inspection equipment that has an accurate footage counter that displays on the monitor and records the distance of the camera from the center line of the starting manhole with an accuracy of +/- 1 %.
- iv. Perform closed-circuit color television inspection on one manhole section at a time. Adjust camera height on skids so that the camera lens is centered (1/2 I.D. or higher) in the pipe being televised. If Skids must be lowered to pass protruding service connections, so note on inspection report.
- v. Permanently label each CD/tape with the following information before submittal:
 - a) Job Number;
 - b) Location manhole numbers, size, and length of line;
 - c) Date televised;
 - d) Name of contractor; and
 - e) Signature of the job foreman or individual who performed the test.

- vi. Recorded media shall become property of Water Service Provider.
- 9) Final Acceptance
- ii. No pipeline installation shall be accepted until all leaks have been repaired, whether or not the leakage is within the maximum allowable limits.
 - iii. The Project Engineer shall certify to the water system provider that all required tests have been successfully completed before the pipeline is accepted.
- 10) Appurtenances
- ii. Manholes
 - a) Manholes should be placed at points of changes in alignment (except along a curved sewer), grade or size or sewers, at the intersection of sewers and at the end of all sewers. Clean-outs will not be permitted on public lines.
 - b) Manholes should be spaced at a maximum distance of four hundred feet (400') apart.
 - c) Manholes at the end of sewers in rear lot easements should be placed in street right-of-way.
 - d) Sewers laid in easements shall have a manhole in each street crossing.
 - e) Manholes must be located to eliminate the inflow of storm water into the sanitary sewer. The top of manhole rim elevation shall be shown on the plans for all sanitary manholes except in the paved area. All manholes shall be furnished with approved inflow protectors.
 - f) Manholes shall be constructed in accordance with the Standard Details.
 - g) A Drop manhole should be constructed for any sewer twelve inches (12") in diameter or less that enters a manhole of greater than thirty -six inches (36") above the invert of the manhole. Sewers larger than twelve inches (12") shall be designed to accommodate a drop at the manhole using standard pipe fittings.
 - h) Steps in manholes will not be permitted.
 - i) Fiberglass manholes with precast, gasketed, concrete bottoms may be permitted for manholes that are less than eight feet (8') deep and are located within an easement. Fiberglass manholes are not allowed in street right-of-way.

- j) Manhole covers shall be cast iron, traffic bearing type ring and cover with the words "Sanitary Sewer" cast into the cover with the name of the Water Service Provider (see Standard Details).
- k) All manhole adjustments shall be made with precast concrete rings.
- l) Coat entire interior of manhole with Koppers Super Black or approved equal protective coating, minimum thickness is twenty five (25) mils.

iii. Stacks

Stacks shall be constructed for connections to sewers that are more than eight feet (8') below finished grade. Stacks shall be provided during the initial construction of the sewer.

iii. Lift Stations

Lift stations shall be designed in conformance with the "Texas Department of Health Design Criteria for Sewer Systems" and the Standard Details herein. Lift stations should be considered only when a gravity system cannot be achieved. All lift stations shall be specifically approved by the Water Service Provider. The Design Engineer shall provide design requirements and pertinent data with construction plans for review. A preliminary design meeting with the Water Service Provider is recommended. Lift stations, if permitted, shall be designed as follows:

- a) Pumps shall be sized to operate at optimum efficiency. Minimum acceptable efficiency at the operating point will be sixty percent (60%), unless specifically approved by the Water Service Provider.
- b) Operation and maintenance procedures shall comply with manufacturer's recommendations.
- c) Wet well working volume should be sized to allow for the recommended pump cycle time of six (6) minutes for each pump.
- d) Controls and equipment shall be approved by the Water Service Provider. Pumps shall be manufactured by Hydromatic, Flygt, Gorman-Rupp., or equal. Pump controls shall be manufactured by E. G. Controls, Consolidated Electric, or equals (refer to the Water Service Provider Approved Products list).
- e) Emergency operations should be considered. Provide fittings and blind flange that will be readily accessible for emergency bypass pumping.

iv. Service Connections

- a) Sewer service leads shall not exceed one hundred feet (100') in length. Near side double sewer service leads shall not exceed five feet (5') in length and shall be located within a public right-of-way or easement.
 - b) Single-Family residential Lots
Far side and near side service connections shall be installed at the time of construction of the sewer line. SDR 28 or SDR 35 PVC pipe is to be used for each residential individual service.
 - c) Multi-Family residential Lots
Service connections shall not be made at top of sewer main pipe in manhole. Long service connections should be installed at the time of construction of the sewer. SDR 28 or SDR 35 PVC pipe is to be used for each service line.
- v. Service Connections At Manholes
- a) Service connections should not be made at manhole when an alternative is possible. When a service connection stub-out is not provided, an opening shall be neatly cut out of the manhole at the required elevation. The service connection shall be extended into the manhole six inches (6") as shown in the Standard Details.
 - b) Service connections at concrete manholes shall be grouted in place using nonshrink grout, Fosroc, Preco-Patch, or equal. For equals, refer to the Water Service Provider Approved Products List. When a hole for a service connection in a brick manhole exceeds eighteen inches (18"), the manhole shall be rebuilt above the disturbed area.
 - c) Service connections at fiberglass manholes shall be drilled uniformly through the manhole wall. A neoprene gasket shall be installed around the pipe to provide a water-tight seal through the wall. Where required, fiberglass mat and resin shall be used in accordance with the manufacturer's recommendations to repair wall openings.
 - d) Service connections entering a manhole three feet (3') or more above the flow line of the manhole shall include a drop pipe with fittings outside the manhole. The drop shall be installed adjoining and anchored to the wall of the manhole, unless specifically approved otherwise.
 - e) Provide adequate markings onsite and accurate as-built locations, so that the service connection stub-out can be recovered at the time that the connection to the service is made.

- f) All connections to the public sewer system shall be approved by the Water Service Provider prior to construction. Actual connections to the public sewer system shall be inspected by a representative of the Water Service Provider.
- g) Service connections that are installed after initial construction of a sewer shall be constructed using PVC saddle with gasket and stainless steel straps as approved by the Water Service Provider.

C. On Site Treatment Facilities

1. On-site sewage facilities are allowed only where no public sewer is not available. and only for properties that are not in a subdivision that contains 5 or more lots, inclusive of all phases of development under the same Ownership or control. On-site sewage facilities are intended to permit the development of individual properties in a strictly rural setting where the creation of a public or private secondary treatment system would result in hardship to the individual.
2. Applicability
Septic systems On-site sewage facilities must be approved by the County Engineer and County Health Department Environmental Health Department in accordance with the requirements of the Texas Department of Health Texas Commission on Environmental Quality (TCEQ) and local requirements.
3. Grinder Pumps
 - a. When a gravity sewer line is not available, a grinder pump system may be installed.
 - b. Grinder pumps shall be Hydromatic, Meyers, Flygt or approved equal (refer to the Water Service Provider Approved Products list).
 - c. A residence may use a single pump. Commercial installations require a minimum of two pumps. System must be approved by the Water Service Provider.

Cl. Specifications for Construction of Low Pressure sewer Lines

1. General
Construction of low pressure sewer lines includes all preparation of site, clearing, grubbing, excavation, street surface removal, boring, dewatering, sheeting, bracing, laying and joining of pipe, placement and splicing of tracer wire, bedding, backfilling, installation of fittings, testing, and clean up of the site. The work includes furnishing of all materials, equipment, tools, labor and all other incidentals to complete the construction.
2. Sequence of Work

- a. The contractor shall pursue the job in an orderly fashion. All appurtenances shall be constructed as soon as the pipe line they serve is constructed to their location;

The construction of appurtenances may be postponed upon approval of the Utility Service Provider and determination that the circumstances were beyond the control of the contractor. A sufficient space, as determined by the Utility Service Provider, shall be provided for proper installation at a later time;

- b. When the construction progresses to the point of a proposed lateral, the contractor shall construct those laterals and the collection lines that they serve in sequential order. All isolation valves shall be left closed after the line segments they serve have been completed and tested. This shall be done so that the contractor may complete the pump unit installations at one time and activate the services; and
- c. At least ten (10) days prior to construction, the contractor shall submit to the Utility Service Provider, in writing, a Construction Plan detailing the sequence in which each line segment will be constructed. The contractor shall alter this plan at the request of the Utility Service Provider. The contractor shall not deviate from this plan without the approval of the Utility Service Provider.

3. Site of Work

The Owner will furnish the site, easements, or any right of way considered necessary by the Utility Service Provider. If the contractor needs more working area, he shall make his own arrangements and indemnify the Owner from any damages or claims.

4. Protection of the Public

- a. The contractor shall make any provisions necessary to protect the public from inconveniences and dangers caused by the construction. Storage and stringing of the material and equipment and excavation shall be done in a manner to cause minimum obstruction and inconvenience to the traffic and the property Owners along or adjacent to the construction site. Fire hydrants, water meters, water valves, gas valves, manholes, catch basins, and boxes for telephone, signal, and alarms shall not be obstructed or covered.
- b. The Owner reserves the right to remedy any neglect on the part of the contractor in regards to public conveniences and safety which may come to its attention. After twenty-four (24) hours notice in writing to the contractor, save in cases of emergency, when the Owner shall have the right to remedy any neglect without notice, and, in either case, the cost of such work done by the Owner shall be deducted from monies due or become due to the contractor.

5. Handling of Traffic

The contractor shall make any provision necessary to handle, direct, and divert the traffic. At no time shall a street be closed due to the contractor's construction.

6. Barricades, Lights and Watchmen

a. Where the work is carried on, in or adjacent to any street, alley, or public place, the contractor shall, at his own expense, furnish and erect such barricades, fences, lights and danger signals; shall provide such watchmen and shall take such precautionary measures for the protection of persons, property, and of the work, as necessary in the opinion of the County Engineer:

- 1) Barricades shall be recently painted in a color that will be visible at night;
- 2) From sunset to sunrise the contractor shall furnish and maintain adequate lights at each barricade;
- 3) A sufficient number of barricades shall be erected to keep vehicles from being driven on or into any work under construction; and
- 4) The contractor shall furnish watchmen in sufficient numbers to protect the work.

b. The contractor shall be held responsible for all damage to the work due to failure of barricades, signs, lights and watchmen to protect it, and whenever evidence is found of such damage, the County Engineer may order the damaged portion immediately removed and replaced by the contractor at the contractor's cost and expense. The contractor's responsibility for the maintenance of barricades, signs and lights, and for providing watchmen, shall not cease until the project has been accepted by the Owner.

c. Barricades, signs and handling of traffic shall be in accordance with the Texas Manual on Uniform Traffic Control Devices and as directed by the County Engineer, all in accordance with these specifications. A copy of the manual is available for review without charge at the County Engineer's office.

7. Protection of Utilities

a. The plans note the existence of existing utilities. The contractor shall inspect the route of the construction during the bidding period to check the location of such utilities, possibility of any conflict, and addition of new utilities. When a conflict exists the alignment of the proposed sewer line may be adjusted with prior approval from the Utility Service Provider and marked "Revised as Built" at the completion of the project.

- b. The contractor shall be responsible for making any provisions necessary to protect all utilities, services, and appurtenances. He shall locate and give the Owner-operator of each utility that utility's required advance notice prior to construction. The contractor and/or utility Owner shall be responsible for repairing damaged utilities. If the contractor is required to repair a utility, it shall be done without delay and at no additional expense to the project Owner or Utility Service Provider.
8. Protection of Existing Structures on Easements
- The contractor shall make every attempt to adjust the alignment of the sewer line around all existing structures, fencing, or other obstructions which exist in the easement. See the construction notes regarding fences. If it is not possible to navigate the line around the obstruction, the Utility Service Provider shall be notified immediately.
9. Protection of Private Property
- The contractor shall not enter upon private property for any purpose without having previously obtained permission from the Owner. The contractor shall be responsible for the preservation of, and shall use every precaution to prevent damage to all trees, shrubbery, plants, lawns, fences, culverts, bridges, pavement, driveways, sidewalks, buildings, service lines, or any other structure in or adjacent to private property. In case of a complaint from a private property Owner, the contractor shall take immediate action to satisfy the property Owner.
10. Preparation of the Site and the Route
- The contractor shall make all preparation necessary before excavation starts. The construction site, and/or the route which the pipe will be laid in, shall be cleared and grubbed before pipe laying. All stumps, brush, logs, rubbish and other objectionable material shall be removed and disposed of in a manner approved by the Utility Service Provider. Burning and/or hauling of the material shall be executed in compliance with ordinances of the District, County, or any other governmental body. If work is proceeding through a utility easement, care shall be taken to clear all the proposed easement as specified above.
11. Protection of Street and Drainage
- The contractor shall make all attempts to keep streets and drainage open. Streets should be kept as clean as possible and mud scraped off as often as required. Drainage ditches shall be kept open and if filled by the contractor they shall be reopened before the crew leaves the site at the end of a working day.
12. Materials
- Main Line Sewer Pipe shall be Polyvinyl Chloride (PVC) Pipe, SDR 21, push-on type with factory premolded gasketed joints and made from Class 12454-B virgin compounds as defined in [ASTM D-1784](#). All fittings shall be PVC schedule 40 solvent weld joints. Pipe and fittings shall conform to the following ASTM standards: [D-1784](#), [D-2672](#), [D-2241](#), [D-3139](#), [D-1785](#) and [D-2466](#). Main Line Sewer Pipe installed

by directional drilling shall be High Density Polyethylene (HDPE) Pipe, DR 17, meeting the requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM [D-1248](#). All HDPE fittings shall conform to ASTM [D-1248](#), [D-2837](#), [D-1693](#) and meet the requirements for Type II or III, Class B or C, Grades p23 or p34, Category 5. Fittings shall be manufactured by the same manufacturer as the pipe.

13. Excavation and Backfill

Excavation for the sewer line will be by open trench method as necessary to install the low pressure force main to the minimum cover shown on the plans, except road crossings. All road crossings shall be bored. Backfill shall be in accordance with the details in the plans. The backfill material shall be select native material free of large clumps of dirt. Care shall be taken to ensure that the entire area around pipe is backfilled. A mound shall be left approximately 3 inches above natural ground for settlement, as shown in the details.

14. Laying of Pipe

- a. Proper implements, tools, and equipment should be used for placement of the pipe in the trench to prevent damage. Under no circumstances should the pipe or accessories be dropped into the trench. Jointing of pipes shall be in strict accordance with manufacturer's printed instructions.
- b. PVC Pipe shall be installed in accordance with ASTM [D-2774](#). Pipe bells should be laid on the upstream end. All foreign matter or dirt should be removed from the pipe interior. Pipe joints should be assembled with care. Whenever pipe laying is interrupted, the open ends of installed valves and air release valves shall be installed as soon as the line they serve is constructed to their proposed location.
- c. If a piece of pipe is installed and is determined to be defective or collapses, the contractor shall replace that section of pipe, at no additional cost to the Owner, including surface restoration.

15. Locating Intersecting Pipes

The contractor shall make attempts to locate intersection lines ahead of pipe laying. He shall locate and excavate in advance any sewer lines which will be tied into the system being constructed. Any pipe line or gas line, as well as underground power lines and telephone cables, shall be located and the Owner shall be given proper notification prior to construction in area of lines.

16. Dewatering

Under no circumstances shall the surface water be allowed to flow in the trench. When ground water exists in the trench, the contractor shall make attempts to drain it away from pipe laying area or pump it out of the trench. If quicksand or water conditions appear in the trench bottom, the contractor shall undercut the trench and replace it with granular material at no extra cost to the Owner, and with the Utility Service Provider's approval.

17. Pipe Handling

The contractor shall unload, store, and place pipe according to the specification of the pipe manufacturer. Care shall be taken not to damage the pipe by impaction or point loading. The pipe shall be kept in the shipping bundle until the day that it will be installed.

18. Joints

PVC Pipe bell and spigot joints shall be factory pre-molded, compression type joints of elastomeric material. The integral bell gasketed joint shall be so designed so that when assembled, the elastomeric gasket inside the bell is compressed radially on the pipe spigot to form a positive seal. The joint shall be so designed to avoid displacement of the gasket when installed in accordance with the manufacturer's recommendation. The joints shall conform to [ASTM D-3212](#) specification standards.

19. Street Surfaces

In all streets the surface of the trenches after being refilled, dried and settled, shall be restored in the most workmanlike manner without needless delay and shall in every respect be equal in quality, character, material and workmanship to the original street or better. The expense of restoring the streets must be included in the price bid per linear foot for mains, unless otherwise provided. Backfill in and along streets shall be as per the details in the plans.

20. Crossing of Driveways & Parking Areas

- a. The contractor shall bore all Portland Cement concrete driveways; however, should the contractor damage any portions of a driveway, he shall restore those driveways and their culverts to their original condition or better as soon as possible. For any disturbed concrete driveways, the disturbed areas shall be backfilled to within 2 inches of the existing concrete with 1½ sack per cubic yard stabilized sand and then with reinforced concrete with a $f'c = 3000$ psi.
- b. Driveways and parking areas paved in asphaltic concrete or rock may be trenched across, provided these sections of trench are immediately backfilled (within 4 hours of opening the trench) in such a manner as to allow traffic to resume use of said driveway or parking area. Final repair of asphalt driveways shall be replaced similarly to asphalt streets, as shown in the details in the plans.
 - 1) Contractor shall inform citizens which will be affected by this work at least 24 hours prior to the start of the work.

21. Utility Crossings

- a. The plans note the existence of major pipe lines and utility lines in the route of construction. Exact locations are not in the plans. The Owner and the Utility Service Provider assume no responsibility for inaccuracies, additions, omissions, or revisions.

- b. It is the responsibility of the contractor to locate all utilities and/or pipelines to be crossed, contact the Owner of the utility or pipe line, and make arrangements for crossing such lines. A minimum of 24" shall be maintained between the proposed Sanitary Sewer Collection Line and the utility or pipe line; however, an absolute minimum of 24" shall be maintained between the sewer main line and the surface when crossing other lines. It is best to locate such lines a few hundred feet ahead of the pipe laying operation in order to make revisions in grade or alignment, if they are necessary and approved by the Utility Service Provider.

22. Excess Soils

Excess soils shall be disposed of by the contractor in accordance with all local, state, and federal laws. The contractor shall make his own arrangements, at his own cost, to dispose of the excess soils in a manner approved by the Utility Service Provider. If, in the opinion of the Utility Service Provider, the excess solid constitute a hazard or a nuisance, the contractor shall dispose of those soils immediately.

23. Plugging Ends

Before leaving the work for the night, or at any time, the end of the pipe shall be securely closed with a water tight plug at the entire cost and expense of the contractor.

24. Fittings

- a. All fittings shall be SCH 40 PVC solvent weld type. Fittings shall be of equal or greater pressure rating as the pipe on which they are used. Schedule 80 PVC flanges with stainless steel bolts shall be used at gate valve connections.
- b. A SCH 40 PVC solvent weld type 'Tee', with the run diameter matching the size of the main and a branch diameter of 1½ " shall be placed in line and in the proper orientation such as to serve as a service tap for each residence or business along the route. Install a corporation stop, as specified in section 34(c) herein, on the service branch of the 'Tee'. Corporation stop shall have a threaded plug installed in the open end and shall be left in the closed position for testing of the main line. Corporation stop shall be opened at time of service line construction.

25. Hydrostatic Test

- a. The contractor shall provide all necessary equipment and shall perform all work required in connection with the tests.
- b. All pressure pipe installations shall be tested for leakage.
The test pressure shall be 1.5 times the maximum force main design pressure or 125 psig, whichever is greater.
- c. The test shall be held for a period of one (1) hours.
- d. The new system shall be tested in sections between valves, but not to exceed 1,000 feet unless approved by the Utility Service Provider.

- e. Each test section shall be slowly filled with water, care taken to expel all air from the pipe. If necessary, the pipes shall be tapped at high points to vent the air. There will be no extra charge to the Owner for venting.
- f. At the end of the test period, the amount of leakage shall be determined by the quantity of water that must be supplied into the pipe, or any valved section thereof, to maintain pressure within five (5) psi of the specified test pressure, after the air in the pipe has been expelled. The maximum allowable leakage shall be calculated using the following formula:

$L = SDP^{0.5}/133,200$	
Where	
L=	leakage in gal/hr
S=	length of pipe in ft
D=	inside diameter of pipe in inches
P=	pressure in pounds per square inch

- g. If the quantity of leakage exceeds the maximum amount calculated, the failed section will be rejected and not accepted until it meets the above requirements.
- h. No more than 5,000 feet of sewer line may be installed without being tested unless approved by the Utility Service Provider. This amount includes all installed pipe not yet tested and not necessarily consecutive lines.

26. Clean Up

The contractor shall remove from the site of work, and from public and private property, all jobs related temporary structures, rubbish, waste material; including all excess excavated materials and all trees removed. Final clean up shall mean that the work area, with the exception of the trenched line route, shall be returned to its original condition, in the opinion of the Utility Service Provider. Any area which has rutting or ponding resulting from the contractor's work shall be restored to its original condition by the contractor at no extra cost to the Owner.

27. Agency Requirements to be Met-

All water and sewer lines installed shall meet the requirements of the Texas Emissions Environmental Quality Commission (TEEQC). Sewer lines shall comply with the requirements of design criteria for sewerage systems as established by the TEEQC. In particular, all sanitary sewer installations shall be in accordance with the 30 TAC Chapter 317 Appendix E "Separation Distances":

a. Water line/new sewer line separation

When new sanitary sewers are installed, they shall be installed no closer to waterlines than nine feet in all directions. Sewers that parallel waterlines must be installed in separate trenches. Where the nine-foot separation distance cannot be achieved, the following guidelines will apply:

- i) Where a sanitary sewer parallels a waterline, the sewer shall be constructed of cast iron, ductile iron, or PVC meeting ASTM specifications with a pressure rating for both the pipe and joints of 150 psi. The vertical separation shall be a minimum of two feet between outside diameters and the horizontal separation shall be a minimum of four feet between outside diameters. The sewer shall be located below the waterline;
- ii) Where a sanitary sewer crosses a waterline and the sewer is constructed of cast iron, ductile iron, or PVC with a minimum pressure rating of 150 psi, an absolute minimum distance of six inches between outside diameters shall be maintained. In addition, the sewer shall be located below the waterline where possible and one length of the sewer pipe must be centered on the waterline;
- iii) Where a sewer crosses under a waterline and the sewer is constructed of ABS truss pipe, similar semi-rigid plastic composite pipe, clay pipe, or concrete pipe with gasketed joints, a minimum two-foot separation distance shall be maintained. The initial backfill shall be cement stabilized sand (two or more bags of cement per cubic yard of sand) for all sections of sewer within nine feet of the waterline. This initial backfill shall be from one quarter diameter below the centerline of the pipe to one pipe diameter (but not less than 12 inches) above the top of the pipe; and
- iv) Where a sewer crosses over a waterline, all portions of the sewer within nine feet of the waterline shall be constructed of cast iron, ductile iron, or PVC pipe with a pressure rating of at least 150 psi using appropriate adapters. In lieu of this procedure the new conveyance may be encased in a joint of 150 psi

pressure class pipe at least 18 feet long and two nominal sizes larger than the new conveyance. The space around the carrier pipe shall be supported at five feet intervals with spacers or be filled to the spring line with washed sand. The encasement pipe should be centered on the crossing and both ends sealed with cement grout or manufactured seal.

h. Water Line/Manhole Separation

Unless sanitary sewer manholes and the connecting sewer can be made watertight and tested for no leakage, they must be installed so as to provide a minimum of nine feet of horizontal clearance from an existing or proposed waterline. Where the nine-foot separation distance cannot be achieved, a carrier pipe as described in paragraph (a)(iv) of this section may be used where appropriate.

28. Measurement And Payment

- a. Pipe will be measured by the linear foot of pipe complete in place. Such Measurement will be along the centerline between the ends of the pipe barrel, as installed. Unit price shall include all materials, fittings, labor, excavation, backfilling, testing, road and driveway repairs, and other incidentals necessary for a complete installation.
- b. Payment shall be made for line work based on the following percentages. No payment shall be made for pipe constructed that has not been backfilled and tested. After backfilling and successful testing of a line segment, it shall qualify as 80% complete with regard to unit price and progress payments. When final cleanup is complete from a line segment, it shall be considered 100% complete with regard to unit price and progress payments. These amounts are subject to the normal retainages called for in the agreement.

29. Valves

a. General

The contactor shall furnish all equipment, materials, fittings, and appurtenances and perform all necessary operations required for a complete installation of each valve in its specified location. This shall include all housings, valve boxes, and manholes indicated in the plans and specifications.

b. Gate Valves

Gate valves shall strictly conform to the requirements of the latest revisions of the [American Water Works Association Standard Specification C509-01](#) in addition to changes and additions specifically stated in these specifications. Gate valves for this project shall be American Valve & Hydrant Model AFC-500 FLG x FLG or prior approved equivalent. The gate valve shall be designed to withstand a minimum of 400 psi while in the open position and a minimum of 200 psi in the closed position.

c. Valve Construction shall be as follows:

- 1) All gate valves shall be of the non-rising stem type and shall be resilient seated;
- 2) All gate valves shall include a valve box as indicated in the plans;
- 3) The valve body and the bonnet shall be cast from a high grade gray cast iron conforming to the latest revision of [ASTM A126- 04 Class B](#). The valve stem, stem nuts, and stem collars shall be forged from manganese bronze;
- 4) The minimum number of turns required to fully open a gate valve shall be a minimum of 4 turns per inch of nominal diameter for each gate valve; and
- 5) All ferrous surfaces, both inside and out, shall be coated with a fusion bonded epoxy conforming to the latest revision of [AWWA C550](#).

d. Air Release Valve

- 1) The contractor shall furnish all equipment, appurtenances, and labor necessary for the installation of a complete air release valve, including all necessary fittings and manhole in accordance with the plans and specifications.
- 2) The body shall be cast from a high grade cast iron conforming to ASTM [A-126](#) Class B. Nuts and bolts shall be stainless steel. Each assembly will include an inlet valve, air release valve, blow off valve, and a valve box. The assembly shall be installed accordance with the plans. The locations of each valve shall be as shown in the plans. The actual location is to field verified by the Utility Service Provider or his representative.
- 3) The air release valve shall be an [APCO 2" Model 400 SARV](#) or prior approved equivalent.

e. Ball Valves

Ball valves shall be Apollo 1½" brass full port hydro-ball valve Model 7B-106-31 or prior approved equipment.

f. Flushing Connection

The end flushing connection shall be constructed as shown in the details in the plans. The ball valve used in this assembly shall comply with this specification.

31. Service Connections

a. General

- 1) Construction of low pressure sewer services includes all preparation of site, clearing, grubbing, excavation, street surface removal, boring, dewatering, sheeting, bracing, laying and joining of pipe, placement and splicing of tracer wire, bedding, backfilling, installation of fittings, installation of septic tanks and/or pump basins, rerouting of gravity lines, and pump package installation, testing, and start up, and clean up of the

site. The work includes furnishing of all materials, equipment, tools, labor and all other incidentals to complete the construction.

- 2) At least ten (10) days prior to construction, the contractor shall submit to the Utility Service Provider a Construction Plan detailing the sequential order for the construction of each section of service connections. The contractor shall alter this plan at the request of the Utility Service Provider. The contractor shall not deviate from this plan without the approval of the Utility Service Provider.

b. Pump and Pump Station Installation

All pump and pump stations shall be installed according to the details and the manufacturer's recommendations.

c. Pressure Service Lines

- 1) The service line shall consist of 1 ½" PVC SDR 21 solvent weld jointed piping to the main line service 'Tee' in the easement. A 1 ½" x 1 ¼" reducing male adapter will be required at the pump station. Fittings shall be Schedule 40 PVC solvent weld type fittings. All pipe and fittings shall be made from Class 12454-B virgin compounds as defined in [ASTM D-1784](#). In addition, all PVC materials shall conform to the following [ASTM Standards: D-2672, D-2241, D-3139, D-1785 and D-2466](#). The service line may also consist of 1 ½" HDPE SDR 11.
- 2) Connections of the service line to the proposed sanitary sewer main shall be made by removal of the treaded plug in the corporation stop installed at time of main line installation and in accordance with the details. Corporation stop shall be opened at time of service line construction. This includes all necessary appurtenances required to make the connection.
- 3) Construction of low pressure sewer lines includes all preparation of site, clearing, grubbing, excavation, laying and joining of pipe, bedding, backfilling, installation of fittings, and clean up of the site. The work includes furnishings of all materials, equipment, tools, labor and all other incidentals to complete the construction. All PVC Pipe and fitting installation shall conform to [ASTM D-2774](#).
- 4) Proper implements, tools, and equipment should be used for placement of the pipe in the trench to prevent damage. Under no circumstances should the pipe or accessories be dropped into the trench. Jointing of pipes shall be in strict accordance with manufacturer's printed instructions.
- 5) Pipe joints should be assembled with care. Whenever pipe laying is interrupted, the open ends of installed pipe should be closed to prevent entrance of trench water, mud, or foreign matter. All pipe shall be laid, generally, in straight segments. Alignment changes requiring fittings shall be made using 45°

bends (90° bends may only be used where 45° bends are not practical and with the approval of the Utility Service Provider or his representative.

32. Existing Service Lines

It is the responsibility of the contractor to connect all existing sanitary sewer service lines to the proposed grinder pump basin in accordance with all county plumbing codes and all accepted standards of plumbing construction. This does not include roof gutter drains or yard drains. Where necessary, the contractor shall construct such gravity sanitary sewer lines to connect all household sewer lines and ant sewer lines serving existing facilities located away from the main house, to the new basin. The proposed gravity service lines shall be of the same size as the existing lines. This shall consist of 4" PVC SDR 35 pipe, 3" PVC SCH 40 pipe, 2" PVC SCH 40 pipe, and 1 ½" PVC SCH 40 pipe. The lines shall be laid at a minimum slope of 0.01 feet/feet. If the use of this slope causes the service line to be less than 30" from the bottom of the basin, the contractor shall consult with the Utility Service Provider for directions. In general, all turns shall be made using 45° bends. Where 45° bends cannot be used, 90° bends may be used, with the approval of the County Engineer or his representative. Where practical, tees may be used to collect multiple lines at the basin. Gravity sanitary sewer pipe shall conform to ASTM [D-3034](#) with a cell class of 12454-B and shall be installed according to ASTM [D-2321](#).

33. Existing Septic Tanks

All existing septic tanks will be abandoned. It is the contractor's responsibility to have the sewage of the existing septic tanks pumped out in accordance with any county or state regulations. All influent and effluent lines shall be plugged. The contractor shall then backfill the existing septic tanks according to Item 35. The contractor shall restore all private property to its original condition.

34. Valves

a. General

The contractor shall furnish all equipment, materials, fittings and appurtenances and perform all necessary operations required for a complete installation of each valve in its specified location. This shall include all housings and valve boxes indicated in the plans and specifications.

b. Ball Valves

Ball valves shall be Apollo 1 ½" NPT brass full port hydro-ball valve Model 7B-107-31, or prior approved equivalent. Ball valves installed on the service line shall include a housing consisting of a DFW Plastics Model D-109 6" Economy Valve Box and a 6" PVC SCH 40 section of pipe installed as shown in the details.

c. Corporation Stops

Corporation Stops shall be installed on each service 'Tee' on the main line. Corporation stops shall be Hays Model 4480 1 ½" NPT full port corporation stops. The installation shall include all materials, appurtenances, and labor necessary to join the service line to the corporation stop. Any other corporation stop shall require prior approval.

d. Check Valves

An extra check valve will be provided with each pump, with the exception of the spares, by the pump manufacturer and will be installed by the CONTRACTOR, as shown on the Plans.

35. Excavation and Backfill

- a. Excavation for the sewer line will be by open trench method as necessary to install the low pressure force main to the minimum cover shown on the plans. The trench shall be excavated using a trencher such as a ditch witch or a hand tool. The excavation for the pump stations shall be made using a small excavator such as a bobcat with an appropriately sized auger. A small backhoe may be used for the excavation and placement of septic tanks.
- b. Backfill shall be in accordance with the details in the plans. The backfill material shall be select native material free of large clumps of dirt. Care shall be taken to ensure that the entire area around the pipe is backfilled. Excess backfill shall be mounded above the trench to allow for settlement as shown in the details. The contractor shall not be responsible for settlement in the trench due to uniform consolidation; however, any cavities in the trench shall be backfilled and compacted by the contractor.

36. Site of Work

The Owner will furnish the site, easements, or any right of way considered necessary by the Utility Service Provider.

37. Protection of the Public

- a. The contractor shall make any provisions necessary to protect the public from inconveniences and dangers caused by the construction. Storage and stringing of the material and equipment and excavation shall be done in a manner to cause minimum obstruction and inconvenience to the property owners. Fire hydrants, water meters, water valves, gas valves, manholes, and boxes for telephone shall not be obstructed or covered.
- b. The Owner reserves the right to remedy any neglect on the part of the contractor in regards to public conveniences and safety which may come to its attention. After twenty-four (24) hours notice in writing to the contractor, save in cases of emergency, when the Owner shall have the right to remedy any neglect without notice, and in either case, the cost of such work done by the Owner shall be deducted from monies due or to become due to the contractor.

38. Protection of Existing Structures

The contractor shall make every attempt to adjust the alignment of the sewer line around all obstructions. See the construction notes regarding fences. If it is not possible to navigate the line around the obstruction, the Utility Service Provider shall be notified immediately.

39. Protection of Private Property

The contractor shall be responsible for the preservation of, and shall use every precaution to prevent damage to all trees, shrubbery, plants, lawns, fences, culverts, pavement, driveways, sidewalks, buildings, and service lines in or adjacent to private property. The contractor shall, where practical, remove existing shrubbery and the like and preserve until such time that shrubbery shall be replanted in its original location. The contractor shall restore all private property to its original condition. The contractor shall not be required to sod or seed the area disturbed by the trench; however, any disturbed areas outside of the trench shall be broadcast seeded.

40. Pipe Handling

The contractor shall unload, store, and place pipe according to the specification of the pipe manufacturer. Care shall be taken not to damage the pipe by impaction or point loading. The pipe shall be kept in the shipping bundle until the day that it will be installed.

41. Crossing of Driveways, Parking Areas, and Sidewalks

Should the Contractor be required to cross driveways, parking areas or sidewalks with service lines, he shall do so in accordance with Technical Specification D-20 of this Chapter of this manual, as when constructing main sewer collection lines.

42. Excess Excavation

Excess excavation shall be disposed of by the contractor in accordance with all local, state, and federal laws. The contractor shall make his own arrangements, at his own cost, to dispose of the excess excavation in a manner approved by the Utility Service Provider. If, in the opinion of the Utility Service Provider, the excess soils constitute a hazard or a nuisance, the contractor shall dispose of those soils immediately.

43. Plugging Ends

Before leaving the work for the night, or at any time, the end of the pipe line shall be securely closed with a water tight plug at the entire cost and expense of the contractor.

44. Clean up

The contractor shall remove from the site of work, and from public and private property, all job related rubbish and waste material including all excess excavated materials.

45. Measurement and Payment

Pipe for the proposed service line and for collection the existing service lines will be measured and paid by the linear foot of pipe complete in place. Such measurement will be along the centerline between the ends of the pipe barrel, as installed. Unit price shall include all materials, fittings, labor, excavation, backfilling, testing, road and driveway repairs, and other incidentals necessary for a complete installation. Service taps shall be paid for each tap. All plumbing connections for pressure and gravity piping shall be paid for each connection.

46. Electrical Connections

General

Contractor shall provide all labor, materials, tools, equipment and consumables to supply electrical service to the proposed pump system in accordance with the National Electrical Code, manufacturer's recommendation and accepted industry standards of installation. All work shall be performed by a qualified electrician, licensed to perform electrical construction work in areas subject to inspection under the guidelines of the National Electrical Code. All final electrical installations will be inspected by the engineer/Owner to insure compliance to this specification and the National Electrical Code.

47. Electrical Service

- a. The contractor shall provide 20 AMP 120V 1 ϕ electrical service to 0 each pump unit. The contractor shall provide a 2 pole 20 AMP NEMA 3R standard circuit breaker mounted in the existing distribution box at each location. Contractor shall extend 20 AMP 120V service wires in conduit and/or direct bury from the new pump dedicated circuit breaker to a master disconnect switch in a weather proof enclosure mounted on the wall adjacent to the system control panel. The contractor shall extend 20 AMP 120V service wires in conduit from the master disconnect switch to the system control panel furnished with the pump equipment package. The contractor will be responsible to mount the system control panel supplied with the equipment package. From the system control panel, the contractor shall install conduit to a point below grade and extend 10/3 and 14/8 with Ground Type TC direct bury rated cable from the control panel to the pump unit. The contractor shall make all final connections at the pump unit and the system control panel in accordance with the manufacturer's recommendation. A drip loop shall be made inside the septic tank or pump basin. All exposed wires shall be installed in conduit as shown in the drawings.
- b. Under no circumstance will the contractor be allowed to double lug any conductors in the meter box or service panel.

48. Grounding

The contractor shall provide all necessary grounding conductors to insure a complete continuous electrical AC safety ground from the

equipment to the existing house grounding system, in accordance with the National Electrical Code.

49. Payment

Power and control cable shall be measure and paid by the linear foot installed complete in place. This includes all riser sections, drop sections, and conduit. Electrical connections shall be paid for each connection, including, electrical breaker, and the other incidentals necessary for a complete installation.

50. Centrifugal Pump

General

Contactors shall furnish all labor, materials, equipment and incidentals required to provide submersible centrifugal sewage grinder pump station(s) as specified herein, each consisting of a basin, grinder pumps and all necessary appurtenances to form a complete package system.

51. Operating Conditions

Each pump shall be rated 2 H.P., 230V single phase, 60 hertz, 3450 R.P.M. The unit shall produce 45 U.S. GPM at 85 feet TDH.

52. Construction

- a. Each pump shall be of the sealed submersible grinder type model Hydromatic HPG200M2-2 or Engineer-approved equal. The pump volute, motor and seal housing shall be high quality gray cast iron, ASTM [A-48, Class 30](#). All external mating parts shall be machined and Buna-N Rubber O-ring sealed on a beveled edge. Gaskets shall not be acceptable. All fasteners exposed to the pumped liquid shall be 316 series stainless steel.
- b. The Pump Basin shall be a 24" x 48" heavy duty non-tapered fiberglass basin with anti-flotation ring and a bolt on fiberglass lid.

53. Electrical Power Cord

- a. Electric power cord shall be SOW/SOW-A water resistant 600V, 60° C, U.L. And C.S.A. approved. The single cord shall incorporate and shall be a minimum of seven (7) 12 gauge, both power and sensor conductors.
- b. The pump shall be protected with compression fitting and epoxy potted area at the power cord entry to the pump. A separation between the junction box areas of the pump and the motor by a stator lead sealing gland or terminal board shall not be acceptable.
 - 1) The power cable entry into the cord cap assembly shall be made with a compression fitting. Each strand shall be individually separated. This area of the cord cap shall then be filled with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary attraction.

- 2) The power cord leads shall then be connected to the motor leads with extra heavy connectors having brass inserts with screwed wire to wire connection, rather than a terminal board that allows for possible leaks.
- 3) The cord cap assembly where bolted to the connection box assembly shall be sealed with a Buna N Rubber O-Ring on a beveled edge to assure proper sealing.

54. Motor

- a. The stator, rotor and bearings shall be mounted in a sealed, dielectric oil filled, submersible-motor housing. The stator windings shall have Class F insulation, (155° C or 311° F). Three (3) phase motors shall be NEMA design B, and single phase motors shall be NEMA design L.
- b. The pump and motor shall be specifically designed so that they may be operated partially dry or completely submerged in the liquid being pumped.
- c. Stators shall be securely held in place with threaded fasteners so they may be easily removed in the field, and must be capable of being repaired or rewound by a local motor service station. No special tools shall be required for pump and motor disassembly.
- d. The pump shall be equipped with heat sensors.

55. Bearing and Shaft

- a. An upper single row ball radial bearing and lower single row ball thrust bearing shall be provided. Bearings shall be permanently lubricated by the dielectric oil which fills the motor housing.
- b. The shaft shall be machined from solid Series 400 stainless steel and be designed with large diameters and minimum overhand to reduce shaft deflection and prolong bearing and seal life.

56. Seal

The rotor and stator in the motor housing shall be separated and protected from the pumped liquid by a type 21 carbon ceramic mechanical seal. The seal housing shall be equipped with a moisture sensing probe installed between the seals, and the sensing of moisture in the seal chamber shall be automatic, continuous, and not require the pump be stopped or removed from the wet well.

57. Impeller

The impellers shall be designed for rough duty service and shall be of a five vane, semi-open design with hydrodynamic sealing vanes on the rear shroud. The impeller shall be constructed of engineered thermo-plastic, with a permanently molded, hexagonally locked bronze insert. The impellers shall be of a non-overloading design and be factory or field trimmable to meet specific performance conditions. Wear or field trimming shall not deter the factory balance.

58. Self-Adjusting Grinder Cutters

- a. The combination centrifugal pump impeller and grinder unit shall be attached to the common motor and pump shaft. The grinder unit shall be on the suction side of the pump impeller and discharge directly into the impeller inlet leaving no exposed shaft to permit packing of ground solids. The grinder shall consist of two stages. The cutting action of the second stage shall be perpendicular to the plane of the first cut for better control of the particle size and require no external adjustment. The grinder shall be capable of grinding all materials found in normal domestic sewage, including plastics, rubber, sanitary napkins, disposable diapers, and wooden articles into a finely ground slurry with particle dimensions no greater than 1/4". Both stationary and rotating cutters shall be made of 440C stainless steel hardened to Rockwell 55-60C and ground to close tolerance.
- b. The upper (axial) cutter and stationary cutter shall be reversible to provide new cutting edges for double life from each cutting part. The lower (radial) cutter shall macerate the solids against the I. D. of the cutter ring and extrude them through the slots of the cutter ring. The upper (axial) cutter shall cut off the extrusions as they emerge from the slots of the stationary cutter ring to eliminate any roping effect which may occur in pumps with a single stage cutter design.

59. Painting

The pump shall be painted after assembly; with any alkyd air dried lead free enamel with a minimum mil thickness of 3 to 4 mils.

60. Testing

- a. Commercial testing shall be required and include the following:
 - 1) The pump shall be visually inspected to confirm that it is built in accordance with the specification as to HP, voltage, phase and hertz;
 - 2) The motor and seal housing chambers shall be hi-potted to test for moisture content and/or insulation defects;
 - 3) Pump shall be allowed to run dry to check for proper rotation; and
 - 4) Discharge piping shall be attached; the pump submerged in water and amp readings taken in each leg to check for an imbalanced stator winding. If there is a significant difference in readings, the stator windings shall be checked with a bridge to determine if an unbalanced resistance exists. If so, the stator will be replaced.

61. Warranty

- a. The pump unit or any part thereof shall be warranted against defects in material or workmanship for a period of twelve (12) months from date of installation or eighteen (18) months after receipt of shipment, whichever occurs first, and shall be replaced at

no charge with a new or remanufactured part, F.O.B., factory or authorized warranty service station. The warranty shall not assume responsibility for removal, reinstallation or freight, nor shall it assume responsibility of incidental damages resulting from the failure of the pump to perform. The warranty shall not apply to damage resulting from accident, alteration, design, misuse or abuse.

b. Shop Drawings

After receipt of notice to proceed, the manufacturer shall furnish the County Engineer an minimum of six (6) sets of shop drawings detailing the equipment to be furnished including dimensional data and materials of construction. The County Engineer shall promptly review this data, and return two (2) copies to the manufacturer as approved, or approved as noted. Upon receipt of accepted shop drawings, the manufacturer shall proceed immediately with fabrication of the equipment.

62. Pump Station Equipment

a. Operating Conditions

2 HP, 230V, 1 phase centrifugal grinder pump: The station shall include 4 stainless steel feet with bolts for the pump.

b. Basin

The pump basin shall be 24" x 48", fiberglass, with anti float ring and bolt on fiberglass lid. The basin shall be field modifiable and will include three Adapta Flex hubs (1 1/4", 2", 4") to be installed by the installation contractor.

c. Control/Panel

Each Pump station control panel shall be U. L. listed and shall include a NEMA 4x Non Metallic enclosure. It shall include circuit breakers(s) and all necessary components to accomplish proper pump and control operation including the following alarm capabilities:

- 1) When liquid level in sewage wet-well rises above the alarm level a visual alarm will be activated;
- 2) Visual alarm remains illuminated until sewage in wet-well returns to normal operating level; and
- 3) Alarm for seal failure
 - i The visual alarm shall be a red fluted lens mounted to the top of the enclosure in such a manner as to maintain rain proof integrity.

d. Simplex Piping Kit

Piping PVC Schedule 80 kit consisting of 1 each: 1 1/4" swing check valve, 1 1/4" ball valve, 1 1/4" el, 1 1/4" x 12" nipple, 5' section of 1 1/4"

pipe, 1 ¼" union, 1 ¼" adaptaflex coupling and a 4" adaptaflex coupling.

e. Corrosion Protection

All materials exposed to wastewater shall have inherent corrosion protection: i.e. cast iron, fiberglass, stainless steel, PVC.

f. Additional Check Valve

The manufacturer is to supply one additional check valve, loose, with each pump station.

63. Duplex Lift Station Equipment

The following equipment and materials are additions or changes required for the duplex lift stations:

- a. 2-Hydromatic HPG200M2-2 Grinder pumps;
- b. 8 Stainless Steel feet with bolts;
- c. The control panel shall include an alternating relay;
- d. The tank shall be 36" x60" instead of 24" x48";
- e. The piping PVC schedule 80 kit shall include 2 each of the items listed above as well as 1 each 1 ¼" x 2" x 1 ¼" tee, 2' x 24"2" nipple, 2" adaptaflex coupling; and
- f. 1 additional 30' float switch.

64. Manuals

The manufacturer shall supply four (4) copies of Operation and Maintenance Manuals to the Owner and one copy (1) of the same to the Utility Service Provider.

Article IV Drainage Design Requirements

A. General

1. All drainage plans and construction shall must meet or exceed the requirements of Chambers County, Trinity Bay Conservation District, Trinity River Authority and U.S. Army Corps of Engineers when proposed outfall occurs within their jurisdiction.
2. Public storm sewers are defined as sewers and appurtenances that provide drainage for a public right-of-way or more than one private tract, and are located in public right-of-way or easement. Private storm sewers provide internal drainage for a reserve or other tract. Private storm sewer connections to public storm sewers shall occur at a manhole or at the back of inlet as approved by the County Engineer or TBCD. All construction and design shall conform to the Standard Details.
3. All storm sewers shall meet or exceed the requirements of the "Drainage Criteria Manual for Chambers County, Texas" and the requirements of the Water Service Provider, as applicable.
4. All storm water systems shall be designed, and be equipped with appropriate treatment facilities, to meet the Chambers County Texas Pollution Discharge Elimination System, Phase II Standards (CCTPDES).

Article V Paving Design

A. General

1. All paving plans and construction plans shall be approved by the County engineer for all streets, thoroughfares, highways, sidewalks, bridges and trails within Chambers County.
2. All roadways that intersect with or connect to State roads are required to meet the standards of TxDOT and all drainage associated with roadways that outfall into TxDOT facilities must be specifically designed and approved by TxDOT prior to approval of plans by the County Engineer. Contact [TxDOT Beaumont District](#) for permits and guidance.
3. All streets shall be constructed in accordance with the Standard Details and in conformance with the design determination of a Registered Professional Engineer.
4. Street design should conform to all applicable planning tools, such as the Chambers County Subdivision Regulations, The Texas Manual on Uniform Traffic Control Devices, major thoroughfare plans, Chambers County Comprehensive Plan, etc. Other considerations for design should include street function, street capacity, Service Levels, traffic safety, sight distance, pedestrian safety and utility locations. These additional considerations may affect the minimum requirements set forth herein. Refer to the Chambers County Major Thoroughfare Plan.