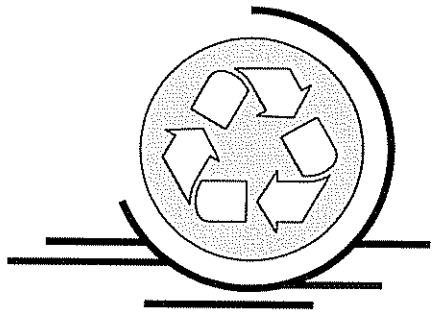
HANCOCK COUNTY UTILITY AUTHORITY STANDARD SPECIFICATIONS



HANCOCK COUNTY UTILITY AUTHORITY
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02221 ..... SELECT BEDDING & FOUNDATION MATERIAL

1.0 SCOPE OF WORK

1.1 This work shall consist of all labor, materials, and equipment required to construct a compacted embedment or foundation for pipeline construction to the lines and dimensions indicated on the plans and as specified and authorized herein.

1.2 SPECIFIED ELSEWHERE. Water Distribution System – Section 02660

2.0 MATERIALS

2.1 SELECT BEDDING MATERIAL. Select bedding material shall consist of clean sand with less than ten percent (10%) passing the No. 200 sieve.

2.2 SELECT FOUNDATION MATERIAL. Select foundation material shall consist of a manufactured mixture of sixty-five percent (65%) crushed limestone (#610 gradation) and thirty-five percent (35%) sand (less than 10% passing the No. 200 sieve).

3.0 CONSTRUCTION REQUIREMENTS

3.1 This work shall conform to the widths and depths as shown on the plans.

4.0 METHOD OF MEASUREMENT

4.1 Select bedding material and select foundation material will be measured by the cubic yard, plan measure. The volume will be determined by the allowable trench width multiplied by the allowable depth (less the area of the pipe) as shown on the plans multiplied by the authorized trench length.

5.0 PAYMENT

5.1 Payment will be made in accordance with Pay Item No.

02221-A Select Bedding Material

$_____ per cubic yard (PM)

02221-B Select Foundation Material

$_____ per cubic yard (PM)

02660 . . . . . WATER DISTRIBUTION SYSTEM

1.0 SCOPE OF WORK

1.1 This work shall consist of all labor, materials, equipment, tools and services required to furnish and install water mains, fittings, hydrants, valves, thrust blocks and related appurtenances at sites and locations as designated in these specifications and in reasonably close conformity with the lines and grades specified in the Drawings.

1.2 Work in this section shall be in accordance with applicable State Requirements and OSHA Safety and Health Standards for Construction.

2.0 MATERIALS

2.1 POLYVINYL CHLORIDE (PVC) WATER PIPE. Polyvinyl Chloride (PVC) Pipe shall conform to AWWA C-900 or AWWA C-905, Class 150, DR 18. Pipe shall be made to cast iron O.D.'s. Each length of pipe shall be stamped with approval of National Sanitation Foundation and Underwriters Laboratories, Inc. for transporting potable water. Pipe couplings or joints shall be an integral part of the pipe barrel, consisting of an expanded bell with a groove to retain a rubber sealing ring conforming to the requirements of AWWA C-111. Pipe shall be furnished in standard lengths (minimum 20 feet) with integrally cast bells or couplings using elastomeric gaskets that meet the requirements of ASTM D-1869 and F-477. All necessary adapters for connection to fittings shall be provided.

2.2 DUCTILE IRON PIPE. Ductile iron pipe shall be designed in accordance with AWWA Specification C150 and manufactured in accordance with AWWA Specification C151. Joints shall conform with AWWA Specification C111 or C115 as applicable and shall be of the push on or mechanical type except where flanged joints are indicated on the plans. Ductile iron pipe 4" in diameter shall be of thickness Class 51 and pipe 6" and greater in diameter shall be of thickness Class 50, except pipe with threaded flanges shall be Class 53.

2.3 FITTINGS

2.3.1 Cast Iron Fittings are not allowed.

2.3.2 Ductile Iron conforming with ANSI A-21.10 (AWWA C-110), 350 p.s.i. rated.

2.3.3 Compact Ductile Iron Fittings conforming with ANSI A-21.53 (AWWA C-153), 350 p.s.i. rated.

2.3.4 All fittings shall be cement mortar lined per ANSI A21.4 (AWWA C-104), or fusion-bonded epoxy lined (AWWA C116). All fittings shall be of the mechanical joint type.

2.4 PIPE JOINT RESTRAINTS

2.4.1 Mechanical Joint Retainer Glands shall be used for all connections of pipe to fittings and shall be made with a suitable restrained joint system, meeting any one of the following specifications:

2.4.2 For Ductile Iron Pipe, a suitable ductile iron retainer gland, designed and recommended by the gland manufacturer, for the type of pipe used. Gland shall be manufactured entirely of 60-42-10 ductile iron conforming to ASTM A536-80. Glands shall attach to the pipe barrel through a plurality of individually activated gripping surfaces (wedges). EBAA Iron "Megalug" series or approved equal for Ductile Iron Pipe.

2.4.3 For PVC Pipe, a heavy ductile iron or fused epoxy coated structural steel (ASTM A36) clamp which employs serrations on its inside surface to firmly grip the outside of the PVC pipe barrel. Clamp shall be specifically designed and recommended for use with the size and thickness class of pipe used. All hardware shall be ductile iron. Uni-flange Series 1300 or approved equal.

2.4.4 For Ductile Pipe only, a ductile iron mechanical joint retainer gland employing cupped-end threaded set screws which conform with the pipe manufacturer's guidelines as to number of set screws and torque to be applied to properly restrain the joint to a rating of not less than 250 p.s.i.

2.4.5 Pipe Joint Restraint (applicable only for pipe joints within specified distances from fittings—see schedule in Drawings): Use two glands similar in design and materials to the joint retainer glands previously specified, one immediately behind the joint bell and one on the pipe spigot, connected by two or more ductile iron rods spanning across the pipe joint. For ductile pipe, it is also permissible to use mechanical joint pipe with restrained retainer gland, or special "lock-ring" pipe joints.

2.5 METALLIC MARKING TAPE. Marking tape shall have a three-inch (3") width and the words "Buried Waterline" should be printed on it along its entire length. Tape shall be Detect tape as manufactured by Allen Systems, Inc., which is handled by the Mavor Kelly Company in New Orleans or approved equal.

2.6 LOCATOR WIRE. Locator wire shall be fourteen (14) gauge solid copper insulated locator wire.

2.7 FIRE HYDRANT

2.7 1 All fire hydrants shall comply with AWWA Specifications C-502 and the following design specifications.

2.7.2 Fire hydrants shall be of the compression type closing with the line pressure. The valve opening shall be 5 1/4 inch. The friction loss though the hydrant shall not exceed 2.5 p.s.i. at 1,000 GPM flowing through the pumper nozzle.

2.7 3 The bonnet section of all hydrants shall be designed so the bearing surfaces and stem threads are sealed in a cone shaped lubricant reservoir and automatically lubricated each time the hydrant is operated.

2.7.4 The hydrant shoe shall have at least two drain outlets. Size of shoe shall be 6 inches and of the mechanical joint type. A retainer gland as specified for water main pipe is required.

2.7.5 Hydrants shall be furnished with two 2 1/2 inch hose nozzles and one 4 1/2 inch pumper nozzle. The type and size of threads shall be National Standard. The distance from the ground line to the center line of the pumper nozzle shall be not less than 17 inches, nor more than 26 inches. The operating nut shall be pentagonal, 1 ½" from point to flat, and shall open in the counter-clockwise direction.

2.7.6 Hydrants shall be furnished with a breakable feature designed to break cleanly 2 inches above the ground line upon contact. This feature shall consist of a two part breakable safety flange with a torque diverting breakable stem coupling. Flangible bolt construction will not be accepted.

2.7.7 The design of the hydrant shall permit easy installation of top extensions and a full 360 rotation of the upper barrel without shutting off the water.

2.7.8 Hydrants shall be M & H 129 or Mueller A-423 model, which have been adopted as the Authority's standard fire hydrants.

2.7.9 Paint shall conform to requirements of AWWA C-502, and shall be red.

2.8 CONCRETE. Concrete shall conform to requirements for Class B concrete, MDOT Standard Specifications.

2.9 REINFORCEMENT. Reinforcement shall be grade 40 or grade 60 billet steel conforming to ASTM A-615.

2.10 WATER SAMPLING STATION. Water Sampling Stations shall be furnished in a heavy-duty non-corroding lockable box with an anchor post; shall have a water evacuation system for freeze control; shall have a separate tap for flow control and shall be model no. EH101 as manufactured by Gil Industries, Inc., Gonzales, FL.

2.11 AUTOMATIC FLUSHING ASSEMBLIES. Automatic Flushing Assemblies shall be provided in lockable, corrosion resistant box, shall be provided with freeze protection apparatus and shall be Eclipse model no. 9600 as manufactured by Kupferle Foundry Company, St. Louis, MO, (314) 231-8738, or an approved equivalent. Automatic flushing assemblies shall be provided with a six (6) inch PVC drain and P-trap connected to the sewer collection system.

2.12 GEOTEXTILE FABRIC. Geotextile fabric shall be non-woven, needles punched, and weigh a minimum of four ounces (4 oz.) per square yard, as manufactured by Terratex Construction Fabrics, "NO4", or approved equal.

2.13 GATE VALVES

2.13.1 Gate valves shall be of the resilient seated wedge type, fusion bonded epoxy coated to AWWA C-550, cast iron body design. They shall comply with AWWA C-509, latest version. Gate valves shall be "Mueller", which has been adopted as the Utility Authority standard value.

2.13.2 All valves shall be rated for zero leakage at working pressure rating. Valves two (2) to sixteen (16) inches shall be rated for 200 psi WWP and hydrostatically tested to 400 psi for structural integrity.

2.13.3 Gate valves shall be equipped with mechanical joint ends, except in conjunction with hydrants, where flanged ends shall be used.

2.13.4 Gate valves shall be of the non-rising stem (NRS) type. NRS thrust collars shall be cast integrally with the stem and machined to size. A stainless steel thrust bearing shall be incorporated, as required, to optimize operating torques.

2.13.5 Operating stems for NRS gate valves shall be equipped with o-ring seals to prevent leakage past stem.

2.13.6 Gates for all valve sizes shall be completely encapsulated with elastomer, including stem bore, be field replaceable, and provide a dual seal on the mating body seat. Valve shall be capable of installation in any position with rated sealing in both directions. Elastomer seats of specially compounded material shall be utilized and capable of sealing under normal conditions. The valve body shall have integral guides engaging integral lugs in the gate in a

tongue and groove manner, supporting the gate throughout the entire open/close travel.

2.13.7 Each valve shall have a two (2) inch square operating nut and shall open to the left.

2.13.8 Retainer glands shall conform with the requirements specified for water main pipe.

2.14 VALVE BOXES

2.14.1 Valve boxes shall be made of good quality cast iron and shall be of the sectional type. The lower section shall be a minimum of five (5) inches in diameter, enlarged to fit around the bonnet of the valve if a two-section box is used, or to fit a circular or oval base section if a three section box is used. The upper section shall be arranged to screw down over the adjoining lower section and shall be provided with cast iron lids or covers marked "WATER".

2.14.2 Valve boxes shall be set in such a manner that the upper section may be raised a minimum of four (4) inches above finished grade.

2.15 WATER METERS

2.15.1 Residential meters (5/8" to 2") shall be produced from an ISO 9001 manufacturing facility and conform to AWWA C700. Meters shall be magnetic driven, positive displacement meters with flat nutating disc type. Each meter must be accompanied by a factory test tag certifying the accuracy of the flows required by AWWA C700.

2.15.2 Commercial meters (2" to 8") shall be produced from an ISO 9001 manufacturing facility and conform to AWWA C702. Meters shall consist of a turbine-type, main line meter for measuring high rates of flow and a bypass meter of an appropriate size for measuring low rates of flow through the bypass meter. Bypass meter shall conform to AWWA C700.

3.0 CONSTRUCTION REQUIREMENTS

3.1 EXCAVATION - GENERAL

3.1.1 Excavation shall include the clearing of the work site, the loosening, loading, removing, transporting and disposing of all materials, wet or dry, above or below ground necessary to be removed to construct all pipes included in this contract to the lines, grades and locations shown on the Drawings. Excavation shall be incidental and included in the cost of other items.

3.1.2 The bottom width and depth of the trench shall be within the limits detailed in the plans. Overdigging is not permitted unless authorized by Engineer.

3.1.3 No burying or burning of trees, stumps, roots, or other debris will be allowed.

3.1.4 Where directed by Engineer or shown on drawings, the Contractor shall remove with care all shrubbery, plants, trees, flowers or other vegetation. These items shall be set aside, watered, and kept alive and reset to pre-construction conditions. The Contractor shall furnish and install, to Engineer's satisfaction, replacement plants which die as a result of construction operations.

3.1.5 In areas where water main will be installed in close proximity to trees designated to remain, the major root systems of the trees shall be protected from damage. Where necessary, contractor shall install water main by tunneling underneath the tree roots.

3.1.6 The Contractor shall, at his own expense, furnish and install all temporary sheeting, shoring, timbering and bracing required to maintain the excavation in a condition to furnish safe working conditions and to permit the safe and efficient installation of all items of contract work. The Contractor shall further, at his own expense, shore up or otherwise protect all fences, buildings, walls, walks, curbs, or other property adjacent to any excavation which might be disturbed during the progress of the work, except for such facilities which are within the allowable trench limits and are designated for removal and restoration.

3.1.7 Temporary supports must be removed by the Contractor at his own expense after or concurrently with the completion of the permanent facility.

3.1.8 The Contractor shall do all ditching, pumping, well pointing and bailing, build all drains, and do all other work necessary to keep the excavation clear of ground water, sewage or storm water during the progress of the work and until the finished work is safe from injury. Where the excavation is wet sand, and suitable construction conditions cannot be obtained by other methods, the Contractor shall install and operate, at his own expense, a pumping system connected with well points, so as to drain the same effectually. All well point holes shall be backfilled with sand after removal. No masonry or pipe shall be laid in water, and water shall not be allowed to rise over masonry until concrete or masonry has set at least 48 hours. All water pumped or drained from the work shall be disposed of in a manner that will not damage adjacent property or other work under construction. Necessary precautions shall be taken to protect all construction against flooding. This work shall be incidental and included in the cost of other items.

3.1.9 Whenever the excavation is carried beyond the lines and grades shown on the drawings, the Contractor shall, at this own expense, refill all such excavated space with such material and in such manner as may be directed by the Engineer.

3.1.10 Unsuitable and surplus excavated material not incorporated in the work shall be disposed of by the Contractor at his own expense.

3.1.11 Contractor shall provide Engineer and Owner with proposed location for disposal of materials and adequate certification that proves the disposal site is permitted to receive the material for disposal. Contractor shall also provide Engineer and Owner with adequate proof that the materials were delivered to the approved site prior to payment.

3.1.12 In the event that any existing gas pipe, water pipes, conduits, sewers, tile drains or poles are blocked or interfered with by the excavation required on this project, the Contractor shall maintain them in continuous operation, and restore them to pre-construction conditions. Gas pipes or electrical power distribution facilities which are disturbed in any way shall be inspected and repaired (if necessary) by the utility owner. This work shall be incidental and included in the cost of other items.

3.1.13 Any culvert pipe joint exposed by excavation shall be wrapped with an approved geotextile filter fabric, three feet in width, before backfilling. This work shall be incidental and included in the cost of other items.

3.2 TRENCH EXCAVATION

3.2.1 The ground shall be excavated in open trenches, of sufficient width and depth to provide ample room within the limits of the excavation, or lines of sheeting and bracing, for the proper construction of the water main.

3.2.2 Mechanical excavation of trenches shall be stopped above the final invert grade elevation so that the pipe may be laid on a firm, undisturbed native earth bed.

3.2.3 The width of the trench at the top of the pipe shall not exceed the outside diameter of the pipe plus two feet. The maximum allowable trench width at the ground surface shall not exceed the outside diameter of the pipe, plus twice the depth of cut. Restoration of disturbed facilities as a pay item will only be allowed within these limits.

3.2.4 The minimum depth of excavation shall be as required for a cover over the completed water main of not less than 30 inches. Where water pipes cross under existing drainageways, provide not less than 24 inches cover under ditches or 12 inches clearance under storm drain pipes.

3.3 BEDDING

3.3.1 When the native bedding material encountered in the trench bottom consists of a material deemed by the Engineer to be unsuitable for pipe bedding, the Contractor shall overdig to a depth as specified in the Drawings and replace with select foundation material. Should overdigging occur where a suitable native soil exists for bedding purposes, the Contractor shall fill the area of over-excavation select foundation material, at his own expense.

3.3.2 Trenches shall be dry when the trench bottom is prepared. A continuous trough shall be pared or excavated to receive the bottom quadrant of the pipe barrel. In addition, bell holes shall be excavated so that after placement, only the barrel of the pipe receives bearing pressure from the trench bottom.

3.3.3 Preparation of the trench bottom and placement of the pipe shall be carefully made so that when in final position, the pipe is true to line and grade.

3.4 LAYING PIPE

3.4.1 Pipe shall be protected during handling against impact shocks and free fall. Pipe shall be clean at all times, and no pipe shall be used in the work that does not conform to the appropriate specifications.

3.4.2 Pipe shall be laid accurately, to the line and grades with fittings and valves at the required locations as designated in the Drawings. Preparatory to making pipe joints, all surfaces of the portions of the pipe to be jointed or of the factory-made jointing material shall be clean and dry. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a workmanlike manner as to obtain the degree of water-tightness required.

3.4.3 If dirt enters the pipe, it shall be removed and the interior pipe surface swabbed with a 1 percent hypochlorite disinfecting solution.

3.4.4 Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing and for as long a period as required. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to offset conditions that might tend to move the pipe off line and grade.

3.4.5 If pipe and fittings are not kept dry during installation, Contractor shall ensure that any water entering the pipe contains an available-chlorine concentration of approximately 25 mg/l by adding calcium hypochlorite granules or tablets to each length of pipe.

3.4.6 Wherever necessary to deflect pipe from a straight line, either in the horizontal or vertical plane, the degree of deflection shall not exceed maximum permissible deflections as recommended by pipe manufacturer.

3.5 BACKFILLING

3.5.1 All trenches and excavation shall be backfilled as soon as the work has developed sufficient strength to resist backfilling loads and forces and the work shall be prosecuted expeditiously after it has commenced.

3.5.2 No pipe shall be backfilled above the top of the pipe until the pipe elevation, alignment and joints have been checked, inspected and approved by the Engineer.

3.5.3 All pipes as soon as laid shall have the space between the pipe and the bottom and the sides of the trench backfilled to the spring line of the pipe with select bedding material. This material shall be thoroughly compacted by hand or mechanical means.

3.5.4 Backfill shall then proceed with the placement of select bedding material in 6 inch layers to one foot above the top of the pipe.

3.5.5 Remaining trench shall be backfilled with native excavated soil in 12" lifts.

3.5.6 Where the native excavated soil does not meet the requirement for select bedding material, the Engineer may authorize the replacement for such unsuitable material with select bedding material. All surplus or unsuitable material not used in backfilling shall be disposed of off-site by Contractor.

3.6 COMPACTION OF PIPE TRENCHES

3.6.1 In areas where pipe trenches are not under or immediately adjacent to existing or proposed structures, roads, driving surfaces, or sidewalks, as determined by Engineer, the backfill material will be compacted to 90% Standard Proctor Density.

3.6.2 In areas where pipe trenches are under or immediately adjacent to existing or proposed structures, roads, driving surfaces, or sidewalks, as determined by Engineer, the backfill material will be compacted to 95% Standard Proctor Density.

3.7 METALLIC MARKING TAPE FOR PVC PIPE. All water lines and service lines must be installed with metallic tape placed directly over and on the center of the facility approximately 12-inch above the pipe for its entire length. Tape must be connected to all facilities or appurtenances. No additional compensation will be allowed for this operation.

3.8 LOCATOR WIRE. All water lines and service lines shall be installed with locator wire placed directly on the center of the pipe for its entire length. Wire shall be tied to an appurtenance at the start of a new main and shall be a continuous piece of wire for its entire length. Contractor shall supply splice kits and other necessary accessories in order to ensure a continuous wire. No additional compensation will be allowed for this operation.

3.9 GENERAL REQUIREMENTS

3.9 1 All connections between pipe and fittings shall be made with an approved restrained joint system. In addition, all pipe joints within a distance which is tabulated in the Drawings from a fitting must also employ an approved restrained joint system. The assembly and installation of each restrained joint system shall be in strict accordance with the manufacturer's printed instructions and in the presence of a representative of the Engineer.

3.9.2 Concrete thrust blocks are to be installed according to the plan dimensions and details, placed between the fittings and undisturbed earth. Thrust blocks are also required at all bends of 11 1/2 degrees or more, unless specifically waived by the Engineer because of unusual conditions at a specific fitting.

3.9.3 For all pipe sizes and types, install only full lengths of pipe adjacent to fittings, except where authorized by Engineer.

3.9.4 Contractor must use care to prevent the entry of ground water or other contaminants into the water pipe, fittings, valves and appurtenances, either before, during, or after construction. Pipe delivered for construction shall be stored so as to minimize the entrance of foreign materials. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped.

3.9.5 Connections to existing distribution system shall be made in a manner approved by the Engineer and shall be scheduled during times with the least inconvenience to customers and shall be accomplished in a timely manner with a minimum interruption of service. Contractor will be required to provide a minimum of 48 hours advance notification to customers where service will be interrupted. Contractor shall also provide advance notification to Owner's water department and fire department.

3.9.6 Where the project requires connection, removal, or any type of contact with existing asbestos cement pipe, Contractor shall comply with all local, state and federal requirements for cutting, handling and disposal of asbestos cement pipe.

3.9.7 Contractor must coordinate the use of domestic water with the Owner. The Owner will allow Contractor to utilize water from the distribution system for the filling of the new water mains and a reasonable amount of water for initial flushing, without compensation. If in the opinion of the Engineer and Owner, the Contractor did not take proper precautions in preventing debris and contaminants from entering the new system during construction or does not follow proper disinfection procedures as described in the latest revision of AWWA C651, the Owner reserves the right to assess charges to the Contractor for any excessive use of domestic water.

3.9.8 The new water mains shall be kept isolated from the active distribution system by physical separation until satisfactory bacteriological testing has been completed and the disinfected water flushed out. Water required to fill the new water mains for hydrostatic pressure testing, disinfection and flushing shall be supplied through a temporary connection between the distribution system and the water main and shall include an appropriate cross-connection control device.

3.9.9 Contractor shall be responsible for the proper handling and disposal of water discharged during flushing operations. All water discharged from the water system shall be disposed of in a manner that will not damage adjacent property, other work under construction, or adversely affect traffic or the general public. No water shall be discharged to the sanitary sewer collection system. Contractor shall advise and coordinate flushing of water mains with the Owner's water department and fire department and shall be performed in a manner that will not result in less than acceptable water pressure in the existing system. In case of fire or emergency, Contractor shall temporarily cease flushing operations.

3.9.10 All water lines and service lines shall be installed with metallic tape placed directly over and on the center of the facility at a depth of one (1) foot over the line for its entire length. Tape must be connected to all facilities or appurtenances. This work shall be incidental and included in cost of other work.

3.9.11 All water mains and services shall be installed with locator wire placed directly on the center of the main for its entire length. Wire shall be tied to an appurtenance at each end of the main or service, and shall be a continuous piece of wire for its entire length. The Contractor shall supply splice kits and other accessories necessary for one continuous locator wire. This work shall be incidental and included in cost of other work.

3.10 PRESSURE TEST. The sections and complete pipe line shall be subjected to pressure tests conforming with AWWA Standard C-600, Section 4, latest revision.

$$L = \frac{SD(12.25)}{133,200}$$

Where:

L = allowable leakage, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of the pipe, in inches

3.11 LEAKAGE TEST

3.11.1 The leakage test shall be conducted concurrently with the pressure test. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.

3.11.2 Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within five (5) psi (0.35 Bar) of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. Leakage shall not be measured as a drop in pressure in a test section over a period of time.

3.11.3 No pipe will be accepted if the leakage is greater than that determined by the following formula:

3.11.4 The test pressure shall be one hundred fifty pounds per square inch (150 psi) at lowest elevation of test section. The duration of the test shall be at least four (4) hours.

3.11.5 When testing against closed metal seating valves, an additional leakage per closed valve of 0.0078 gal/hr/inch of nominal valve size shall be allowed.

3.12 HYDRANT PRESSURE TEST. After the pressure and leakage tests for the main lines have been satisfactorily completed, the Contractor shall remove all hydrant caps (hose nozzle caps and pumper nozzle caps) and grease the nozzle threads. The hydrant caps shall be replaced and the main hydrant valves shall be fully opened. All hydrants shall be required to withstand the same pressure test as described in Subsection 3.10 of the AWWA Standard without leakage.

3.13 DISINFECTION

3.13.1 After the water main has been completed and a satisfactory pressure test has been made, the Contractor shall sterilize the water mains in accordance with AWWA C651. The Contractor shall submit the method and/or individual

who will provide the chlorination service for prior approval by the Engineer or his authorized representative. Mains shall be thoroughly flushed before introduction of the chlorinating materials. All new mains and repaired portions of or extensions to existing mains shall be chlorinated. Granular chlorine shall not be applied in the new main, fittings, services, etc. All chlorinating materials shall be in a liquid or gas form.

3.13.2 Water from the existing distribution system or other source of supply shall be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine. The rate of chlorine mixture flow shall be in such proportion to the rate of water entering the pipe that the chlorine dose applied to the water entering the newly laid pipe shall produce a residual of at least twenty-five (25) PPM after twenty-four (24) hours standing measured at the farthest point from injection. This may be expected with an application of fifty (50) PPM, although some conditions may require more.

3.13.3 If the circumstances are such that Engineer determines that a shorter retention period must be used, the chlorine concentration shall be increased accordingly. For instance, for a contact period of one (1) hour, a one hundred (100) PPM chlorine concentration is required. Under these conditions special care shall be taken to avoid attack in pipe, valves, hydrants and other appurtenances.

3.13.4 In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent.

3.13.5 Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipeline and its extremities until the replacement water throughout its length shall, upon test, be proved comparable in quality to the water served the public from the existing water supply system and approved by the public health authority having jurisdiction. Large volume disposal of treated water may require a permit from the Department of Environmental Quality Office of Pollution Control.

3.13.6 After completion of disinfection of water lines, Contractor shall arrange for at least two (2) microbiological water samples to be collected by a representative of a laboratory certified by the State Department of Health from every dead-end line and every major looped line, as determined by Engineer. Water being collected for testing shall not have a chlorine residual higher than is normally maintained in other parts of the distribution system. No chlorine shall be present which is a result of line disinfection. No coliform bacteria and confluent growth indication shall constitute a satisfactory sample when analyzed by the Mississippi State Department of Health or a laboratory certified by the State of Mississippi. The Contractor shall be responsible for achieving acceptable tests and shall pay all costs involved. The testing and disinfection operations shall be coordinated with the local water utility.

3.13.7 Should the initial treatment fail to result in the condition specified, the original chlorination procedure shall be repeated until satisfactory results are obtained.

3.14 SEPARATION BETWEEN SEWER AND WATER LINES

3.14.1 Horizontal and Vertical Separation. Water mains shall be laid at least 10 feet horizontally and 18 inches vertically from any existing or proposed sanitary sewer or manhole (including force mains). The distance shall be measured edge to edge. Water lines should always be installed above sewer lines and the bottom of the water line should be at least 18 inches from the top of the sewer line.

3.14.2 Special Conditions

3.14.2.1 Where local conditions prevent adequate horizontal and vertical separation, the appropriate reviewing agency may allow the water line to be laid closer to the sewer line if supported by adequate data from the design engineer. Each situation will be reviewed on a case by case basis. In this situation, all three of the following conditions must be met:

3.14.2.2 If the 10 foot horizontal separation between water and sewer lines cannot be maintained then the water line should be ductile iron with water joints located at the maximum distance possible from sewer line joints. PVC pipe may be used if it is protected by a steel casing. Also the water and sewer lines must be in separate trenches with adequate space for maintenance. In some cases, special sewer line construction procedures may be required.

3.14.2.3 Where water lines cross over sewer lines, the pipe segments should be centered to provide maximum spacing of joints of both water and sewer lines. A vertical separation of at least 18 inches should be maintained (water over sewer).

3.14.2.4 Where the 10 foot horizontal and 18 inch vertical separation cannot be maintained, condition 3.14.2.2 must be met and the sewer line shall be constructed according to water main standards.

3.15 SETTING HYDRANTS

3.15.1 Hydrants shall be located as shown on the plans or as directed by the City Engineer or his authorized representative.

3.15.2 Hydrants shall be installed as shown in the detailed drawings and in a manner that will provide complete accessibility and will prevent damage from vehicles or injury to pedestrians. All hydrants shall be perpendicular to ground and shall have their pumper connections at right angles to the curb

line. Thrust block backings shall be constructed in accordance with manufacturer's recommendations, these specifications, per Engineer's direction.

3.15.3 Each hydrant shall be connected to the main with a six (6) inch branch line. All hydrant caps shall be removed and greased with AWWA approved grease. After installation, all hydrants shall be tested for satisfactory operation.

3.15.4 Crushed stone or gravel shall be placed at the base of the hydrant per detail, in order to provide drainage.

3.15.5 Minimum height of hose nozzles shall be eighteen inches (18") above ground surface (or anticipated future ground surface) as shown on the plans.

3.15.6 After installation, and prior to final acceptance, the fire hydrants shall be painted above the ground line in accordance with AWWA Standard C-502. Multiple coats may be required to achieve uniform appearance if the hydrants are supplied by the manufacturer in a different color than specified.

3.15.7 Before ordering hydrants, Contractor shall determine the barrel length required for all hydrants on the project, both new and relocated. New hydrants shall be ordered in barrel lengths as needed to place a hydrant at each designated location on the project.

3.15.8 Where utility lines, storm drainage facilities, or other obstruction require a modification to the barrel height of a hydrant, Contractor may use manufactured hydrant barrel extensions, per Engineer's acceptance. Barrel extensions shall not be measured for separate payment, and should be included in the cost of other items.

3.15.9 Hydrants that are installed or have been taken out of service, shall be completely covered and identified as being "NOT IN SERVICE" until approved for use or removed from the site.

3.16 GATE VALVES AND VALVE BOXES

3.16.1 Valve boxes shall be supplied for all buried valves.

3.16.2 Gate valves shall be installed as detailed in the Drawings and in strict accordance with manufacturer's recommendations.

3.16.3 Valve boxes shall be installed as detailed in the Drawings and in strict accordance with manufacturer's recommendations.

3.16.4 Installation of thrust blocks will be as detailed in the Drawings.

4.0 METHOD OF MEASUREMENT

4.1 Water distribution pipe will be measured as the number of linear feet of pipe of the size and type specified, in place and accepted, field measure.

4.2 Distribution pipe fittings will be measured by the ton (2,000 pounds) of fittings in place and accepted, including glands, bolts, and gaskets computed upon unit weights listed in AWWA C-110. This applies even if the fittings used are compact ductile iron fittings conforming with AWWA C-153.

4.3 Water Sampling Stations and Automatic Flushing Assemblies shall be measured as a unit complete in place and accepted, per each which shall include all components as specified and shown in details herein.

4.4 Fire hydrant assemblies shall be measured as a complete unit, in place and accepted, per each, which shall include all components as specified and shown in details.

4.5 Gate valves of the size and type specified, will be measured in place and accepted, per each.

4.6 Valve boxes shall not be measured for separate payment and should be included in other items.

4.7 Valves installed as part of fire hydrant assembly shall not be measured for payment and should be included in other items.

4.8 Water meters will be measured by the completed unit, installed and accepted, of the size and type specified, per each.

5.0 PAYMENT

5.1 Payment will be made under PAY ITEM NO.

02660-A ____" PVC WATER MAIN

$_____per linear foot

02660-B ____" DUCTILE IRON WATER MAIN

$ _____per linear foot

02660-C DUCTILE IRON FITTINGS

$ _____per ton

02660-D AUTOMATIC FLUSHING ASSEMBLY

$ _____per each

02660-E WATER SAMPLING STATION

$ _____per each

02660-F FIRE HYDRANT ASSEMBLY

$ _____per each

02660-G ____" GATE VALVE

$ _____per each

02660-D ____" RESIDENTIAL WATER METER

$ _____per each

02660-E ____" COMMERCIAL WATER METER

$ _____per each

1.0 SCOPE OF WORK

1.1 This work shall consist of all labor, materials, equipment, tools and services required to furnish and install water service lines and fittings at locations designated in the Drawings or as directed by the Engineer.

1.2 Specified Elsewhere: Water Distribution System - Section 02660

2.0 MATERIALS

2.1 Water service tubing shall be polybutylene plastic conforming to ASTM 2666, or polyethylene plastic conforming to ASTM 2737, NSF approved, dimensions to fit standard CTS fittings, SDR 9, 250 p.s.i.

2.2 Service saddles shall be ductile iron or brass with double stainless steel bands designed for use with C-900 or C-905 PVC pipe, outlet tapped with AWWA taper, 200 psig working pressure, one inch tap size conforming to all applicable parts of ANSI/AWWA C-800; Mueller BR2S Series, Ford 202 BS, or approved equivalent. Service saddles are required for all service line connections.

2.3 Corporation stops, curb valves, wye fittings, and other required service fittings shall conform to AWWA C-800. All connections to service tubing shall be by approved compression type fitting, with stainless steel tubing inserts as recommended by the fitting manufacturer. Curb valves shall employ a one-piece integral plug with full-opening port and tee head, turning on a plastic thrust washer at the top and sealed by an "O"-ring. The valve body shall be a one-piece brass casting with closed bottom. The inlet and/or outlet port shall be sealed by a second "O"-ring. Corporation stops shall be one inch, ground key, taper thread inlet with CTS O.D. outlet, and shall be Mueller No. H-15008, or Ford B43 Series.

2.4 Service wyes shall be Mueller, brass, compression connection for CTS O.D. tubing on all ends, ANSI/AWWA C-800.

2.5 Meter valves shall be Mueller, straight, brass with lockwing, 1" compression connection x ¾ inch for domestic service and 1" compression connection x 1" meter connection for irrigation service.

2.6 Meter boxes shall be plastic structural foam boxes with cast iron covers and cast iron hinged reader lid. Box shall measure not less than 10" X 16"

(at the top) by 12" deep. Where shown on the plans or designated by the Engineer.

3.0 CONSTRUCTION REQUIREMENTS

3.1 Installation of all service line components (service saddle, corporation stop, tubing, and curb valve) shall be in strict accordance with manufacturer's recommendations.

3.2 Excavation, bedding, and backfilling shall be in accordance with the requirements given for water main pipe.

3.3 Water service lines shall be pressure tested and sterilized in conjunction with the associated water main.

3.4 Service lines shall be thoroughly flushed upon placing the associated water main into service.

3.5 Service lines shall be laid deep enough to prevent damage from freezing, or during routine road or street maintenance, but not so deep as to require installing the line at an excessive angle in the meter box.

3.6 The meter should be located in an obvious, well drained location, but not in driveways, under fences or in flower beds. It should be set with the register in an easily readable position, and clear of the ground within the meter box. The top of the meter box should be set approximately 1" above the surrounding ground surface. In all cases, the meter must be set within the meter box with the lid closed.

4.0 METHOD OF MEASUREMENT

4.1 Water services will be measured by the completed unit, as detailed in Drawings, including saddle, corporation stop, service tubing, wye, meter valve(s), and meter box(s), per each.

5.0 PAYMENT

5.1 Payment will be made under PAY ITEM NO.

02661-A SINGLE RESIDENTIAL WATER SERVICE

$_____per each

02661-B DOUBLE RESIDENTIAL WATER SERVICE

$_____per each

02661-C ____" COMMERCIAL WATER SERVICE

$_____per each

02662. . . . . CONNECTION TO EXISTING WATER MAINS

1.0 SCOPE OF WORK

1.1 This work shall consist of all labor, materials, equipment, tools, and services required to make connections between new water piping systems and existing water mains, at locations designated in the Drawings or as directed by the Engineer.

1.2 SPECIFIED ELSEWHERE. Water Distribution System - Section 02660

2.0 MATERIALS

2.1 Tapping sleeves shall be fabricated from heavy Type 304 stainless steel, with a full circumferential seal to the run pipe provided by a rubber gasket resistant to water, salt solutions, mild acids, gases, and sewage. Multiple stainless steel bolts shall ensure uniform sealing. Outlet flange shall conform with ANSI 150 pound drilling, recessed for tapping valve per MSS-SP 60. A 3/4 inch NPT test plug shall be provided. O.D. range of body must match the actual measured O.D. of the pipe being tapped.

2.2 Tapping valves shall conform with the requirements for Gate Valves and Valve Boxes on Water Mains, except that the inlet shall be Class 125 Flange and the outlet, Mechanical Joint. The valve opening shall be oversized to permit a cutter head to pass which is 1/2" smaller than the nominal branch pipe size. Valves shall be furnished complete with cast iron sectional valve box, as specified under Gate Valves and Valve Boxes on Water Mains. A retainer gland as is specified under Item for Water Distribution System is required for the connection of the new pipe to the tapping valve.

3.0 CONSTRUCTION REQUIREMENTS

3.1 It is the intent of these specifications that new segments of water main be constructed and pressure tested prior to connecting them to existing mains, per the requirements of Section 02660.

3.2 After the new pipe segments are in place and accepted, connections will be made to the existing main. All abandoned pipes shall be capped.

3.3 Contractor shall verify size and type of existing water main prior to connection of the new system. Necessary adaptor fittings, glands, or special gaskets shall be furnished as needed to properly connect to the type of existing pipe or fitting encountered.

3.4 Installation of tapping sleeves shall fully conform with manufacturer's recommendations. The pipe barrel to be tapped shall be fully and carefully cleaned. Asbestos cement pipe shall be smoothed with a wire brush to ensure a tight seal of the gaskets against the pipe.

3.5 Before each sleeve is installed, the pipe barrel to be tapped shall be measured and the actual measured pipe O.D. shall be within the range recommended for the sleeve used.

3.6 The actual size of the hole cut in the pipe barrel shall be not more than 1/2 inch smaller than the nominal size of the branch connection (e.g., not less than 5 1/2 inches for a 6 inch tap). The drilling machine and shell cutter head used shall be specifically recommended for the type of pipe being tapped.

3.7 After the tap is complete and the tapping valve closed, the sleeve shall be bled of air and then visually checked for leakage before backfilling.

3.8 Connections made to existing pipe shall be made as specified under Item for Water Distribution System. Necessary adapter fittings, glands, or special gaskets shall be furnished as needed to properly connect to the type of existing pipe or fitting encountered.

3.9 The Owner will assist Contractor by locating existing valves necessary to isolate sections of existing water main. Contractor shall provide 48 hours advance notice to Owner and any customers affected by connection. Contractor shall also provide advance notification to Owner's water and fire departments. The Contractor may be requested by Owner to schedule some connections for a specific time of day or night, to reduce inconvenience to customers. Refer to Section 02660, Paragraph 3.9.5 for coordination with Owner for new connections.

4.0 METHOD OF MEASUREMENT

4.1 Tapping valves and sleeves will be measured per each, as the number of valve sleeve combinations of the size and type specified actually furnished and installed, field measure.

5.0 PAYMENT

5.1 Payment will be made under PAY ITEM NO.

02662-A _____" x _____" Tapping Sleeve and _____" Valve

$ _____ per each

02665 . . . . . CROSS CONNECTION CONTROL FOR POTABLE WATER SYSTEMS

1.0 SCOPE OF WORK

1.1 Pursuant to the Mississippi State Department of Health (MSHD) Environmental Regulations, Division 300, Part 301, it is the responsibility of the Hancock County Utility Authority to protect its potable water system by instituting and enforcing a cross connection control program. Therefore, work under this section will provide for the installation of appropriate cross connection control devices to prevent backflow and potential contamination of the potable water system.

2.0 MATERIALS

2.1 As a general guide, Appendix B of the Mississippi State Board of Health 1998 publication Cross Connection Control Program Reference Manual for Public Water Systems has been attached at the end of this section. Contractor will select an appropriate backflow prevention assembly from the list and will confirm with the proper Utility Authority official that the device is approved prior to installation.

3.0 INSTALLATION REQUIREMENTS

3.1 Contractor will install the backflow prevention assembly in conformance with the manufacturer's recommendations and the MSHD's reference manual.

4.0 METHOD OF MEASUREMENT

4.1 Backflow Prevention Assemblies in place and accepted, will be measured by the specified unit, per each, and will be total compensation for completing the work.

5.0 PAYMENT

5.1 Payment will be made under PAY ITEM NO.

02665-A BACKFLOW PREVENTION ASSEMBLY
(Model: _____, Size: _____)

$_____ per each

CROSS CONNECTION CONTROL PROGRAM REFERENCE MANUAL FOR PUBLIC WATER SYSTEM, MISSISSIPPI STATE DEPARTMENT OF HEALTH, DIVISION OF WATER SUPPLY, JULY 1998

APPENDIX B: APPROVED BACKFLOW PREVENTION ASSEMBLIES

APPENDIX B: APPROVED BACKFLOW PREVENTION ASSEMBLIES

DOUBLE CHECK VALVE ASSEMBLIES

Double Check Valve Assemblies (DCVAs) can only be used in low hazard applications where the possible contaminant does not pose a health risk. DCVAs must be installed in a manner and location that permits the assembly to be tested and require a minimum clearance of 12" on all sides. By-pass piping is allowed only if the by-pass line is equipped with the same type backflow prevention assembly. Approval is granted for the complete assembly only.

COMPANY	MODEL	SIZE (INCHES)
Ames	DC	4, 6, 8
	2000B	1/2, 3/4, 1, 1¼, 1½, 2
	2000-DC	10
	2000-G-DC	10
	2000-DCA	4, 6, 8
	2000-G-DCA	4, 6, 8
	2000 SE	2½, 6, 8
	2000 SS	3/4, 1, 1¼, 1½, 2, 2½, 3,,4 6, 8
	2000 SS-M	4, 6
Beeco- See Hersey/Grinnell		
Buckner	24100 thru 24104	3/4, 1, 1¼, 1½, 2
Cla-Val	D2	3/4, 1, 1¼, 1½
	D4	2, 2½, 3, 4, 6, 8, 10
	DC6LB	3/4,
	DC6LW	3/4, 1, 1½, 2
	DC7LW	2½, 3, 4, 6, 8, 10
	DC7LY	2½, 3, 4, 6, 8, 10
	DC8LW	4, 6, 8
	DC8LY	4, 6, 8
	DC8NW	2½, 3, 4, 6, 8, 10
	DC8NY	2½, 3, 4, 6, 8, 10
	DC8VW	2½, 3, 4, 6, 10
	DC8VY	2½, 3, 4, 6, 10

Approved Double Check Assemblies, Continued

COMPANY	MODEL	SIZE (INCHES)
Conbraco	40-103-02	1/2
	40-104-02, 40-104-A2, 40-104-A2T, 40-104-99T	3/4
	40-105-02, 40-105-A2, 40-105-A2T, 40-105-99T	1
	40-106-02, 40-106-A2, 40-106-A2T, 40-106-99T	1¼
	40-107-02, 40-107-A2, 40-107-A2T, 40-107-99T	1½
	40-108-02, 40-108-A2, 40-108-A2T, 40-108-99T	2
	40-109-02, 40-109-03	2½
	40-100-02, 40-100-03	3
	40-10A-02, 40-10A-03	4
	40-10C-02, 40-10C-03	6
	40-10E-02, 40-10E-03	8
	40-10G-02, 40-10G-03	10
Febco	805	3/4, 1, 1½, 2, 3, 4
	805Y	3/4, 1, 1½, 2, 2½ 3, 4, 6, 8, 10
	805YR	3/4, 1
	805YB	3/4
	805YD	2½, 3, 4, 6, 8, 10
	850	1/2, 3/4, 1, 1¼, 1½, 2, 2½, 3, 4, 6, 8
	870	2½, 3, 4, 6, 8, 10
	870V	2½, 3, 4, 6, 8, 10
Flomatic	DCV	3/4, 1, 1½, 2, 2½, 3
Hersey/Grinnell	#2	3, 4, 6, 8, 10
	E-1	4, 6
	FDC	3/4, 1, 1½, 2
	HDC	3/4, 1, 1½, 2

Approved Double Check Assemblies, Continued

COMPANY	MODEL	SIZE (INCHES)
Kennedy	1373	4, 6, 8, 10
Mueller	H-9505	4, 6, 8, 10
Neptune- See Wilkins		
Orion	80-0070	1½
	9-2930	2
	BDC	3/4, 1, 3, 4
Rain Bird	DCA-075-R, DC-QT-075	3/4
	DCA-100-R, DC-QT-100	1
	DCA-150-R, DC-QT-150	1½
	DCA-200-R, DC-QT-200	2
	DCA-250-R	2½
	DCA-300-R	3
	DCA-400-R	4
	DCA-600-R	6
	DCA-800-R	8
	DCA-1000-R	10
Richwell- see Wilkins		
SMR- see Wilkins		
Toro- see Orion		
Viking	A-1	4, 6, 8, 10
Watts	007	2½, 3
	007QT	1/2, 3/4, 1, 1½, 2 8, 10
	007PCQT	1/2, 1½, 2
	007M1QT	3/4, 1, 1½, 2
	007M1PCQT	3/4, 1, 1½, 2
	007M2QT	3/4, 1¼, 1½
	007M2PCQT	1¼, 1½
	007NRS	4, 6
	007SSQT	3/4, 1, 1½, 2
	007SSPCQT	1½, 2
	007SSM1QT	3/4, 1
	007SSM1PCQT	3/4, 1
	U007QT	3/4, 1, 1½, 2
	U007PCQT	3/4, 1, 1½, 2
	U007M1AQT	3/4, 2
	U007M1APCQT	3/4, 2
	U007M1PCQT	3/4, 1, 1½, 2
	U007M1QT	3/4, 1, 1½, 2
	U007M2AQT	1¼, 1½
	U007M2QT	1½

Approved Double Check Assemblies, Continued

COMPANY	MODEL	SIZE (INCHES)
Watts, continued	U007SSQT	3/4, 1, 1½, 2
	U007SSPCQT	3/4, 1, 1½, 2
	770	4, 8
	770 QT-FDA	4, 8
	772	4, 10
	774	3/4, 1, 1¼, 1½, 2, 2½, 3, 4,6, 8
	774X	2½, 6, 8
Wilkins	550	3/4, 1, 1¼, 1½, 2, 2½ 3, 4, 6
	550A	3/4, 1
	550-M8	8
	550-M10	10
	950	3/4, 1, 1¼, 1½, 2, 2½ 3, 4, 6, 8, 10
	950XL	3/4, 1, 1¼, 1½, 2
	950XLT	3/4, 1
	950XLU	3/4, 1, 1½, 2
	950A	3/4, 1, 1¼, 1½, 2

DOUBLE CHECK VALVE DETECTOR ASSEMBLIES

Double Check Valve Detector Assemblies (DCDAs) are DCVAs with a factory installed and protected by-pass line with a water meter. DCDAs are used in low hazard fire flow lines where a meter is desired to detect unauthorized water usage. Home-made DCDAs shall not be installed. Approval is granted for the complete assembly only.

COMPANY	MODEL	SIZE (INCHES)
Ames	DCDC	4, 6, 8
	3000 DCDC, 3000-G-DCDC	10
	3000 DCDA, 3000-G-DCDA	4
	3000 DCDA, 3000-G-DCDA	6
	3000 DCDA, 3000-G-DCDA	8
	3000SE	2½, 6, 8
	3000SE-A	8
	3000SS	2½, 3, 4, 6, 8
	3000SS-A	6
	3000SS-M	4, 6
	3000SS-WM1	2½, 3, 4
	3000SE-WM1	6
Cla-Val	DD7LY	3, 4, 6, 8, 10
	DD8LY	4, 6, 8
	DD8NY	2½, 3, 4, 6, 8, 10
	DD8VY	2½, 3, 4, 6, 10
Conbraco	40-600-C3, 40-600-E3	3
	40-60A-C3, 40-60A-E3	4
	40-60C-C3, 40-60C-E3	6
	40-60E-C3, 40-60E-E3	8
	40-60G-C3, 40-60G-E3	10
Febco	806	4, 6, 8, 10
	806YD	3, 4, 6, 8, 10
	856	2½, 3, 4, 6, 8
	876	2½, 3, 4, 6, 8, 10
	876V	2½, 3, 4, 6, 8, 10
Hersey/Grinnell	DDC-II	3, 4, 6, 8, 10
Watts	007 DCDA	2, 2½, 3, 4, 6
	709 DCDA	3, 4, 6, 8, 10
	770 DCDA	4, 8
	772 DCDA	4, 10
	774 DCDA	2½, 3, 4, 6, 8
	774XDCDA	2½, 6, 8
	DCDA	2½, 3, 4, 6
Wilkins	950 DA	2½, 3, 4, 6, 8, 10

REDUCED PRESSURE PRINCIPLE ASSEMBLIES

Reduced pressure principle assemblies (RPs) are used in high hazard applications where the potential contaminant is a threat to public health. RPs shall be installed so that the relief port will never be submerged. This prohibits installation in a valve pit that cannot be drained by gravity to the surface of the ground. RPs shall be installed in a manner and location that permits the assembly to be tested and require a minimum clearance of 12" on all sides. Any by-pass around the assembly must also contain an RP. Approval is granted for the complete assembly only.

COMPANY	MODEL	SIZE (INCHES)
Ames	4000B	1/2, 3/4, 1, 1¼, 1½, 2
	4000SS	2½, 3, 4, 6
	4000-RP	4, 6, 8, 10
Beeco-see Hersey/Grinnell		
Buckner	24000 thru 24004	3/4, 1, 1¼, 1½, 2
Cla-Val	RP-2	3/4, 1, 1¼, 1½
	RP-4	2, 2½, 3, 4, 6, 8, 10
	RP-4V	4
	RP-6LW	3/4, 1, 1¼, 1½, 2
	RP-6VW	3/4, 1, 1½, 2
	RP-7LW	2½, 3, 4, 6, 8, 10
	RP-7LY	2½, 3, 4, 6, 8, 10
	RP-8LW	2½, 3, 4, 6, 8
	RP-8LY	2½, 3, 4, 6, 8,
	RP-8NW	2½, 3, 4, 6, 8, 10
	RP-8NY	2½, 3, 4, 6, 8, 10
	RP-8VW	2½, 3, 4, 6, 10
	RP-8VY	2½, 3, 4, 6, 10
Conbraco	40-204-A2Z, 40-204-A2 40-204-A2S	3/4
	40-205-A2U, 40-205-A2Z, 40-205-A2, 40-205-A2S, 40-205-02	1
	40-206-A2U, 40-206-A2Z, 40-206-02, 40-206-A2	1¼
	40-207-A2U, 40-207-A2Z, 40-207-02, 40-207-A2	1½
	40-208-02, 40-208-A2	2
	40-209-02, 40-209-03	2½
	40-200-02, 40-200-03	3

Approved Reduced Pressure Assemblies, Continued

COMPANY	MODEL	SIZE (INCHES)
Conbraco, continued	40-20A-02, 40-20A-03	4
	40-20C-02, 40-20C-03	6
	40-20E-02, 40-20E-03	8
	40-20G-02, 40-20G-03	10
Febco	825	2½, 3, 4, 6, 8, 10
	825D	2½, 3, 4, 6, 8, 10
	825Y	3/4, 1, 1¼, 1½, 2
	825YA	3/4, 1, 1½, 2
	825YAR	3/4, 1, 1½, 2
	825YD	2½, 3, 4, 6, 8, 10
	825YR	3/4, 1, 1½, 2
	845	3/4, 1
	860	3/4, 1, 2½, 3, 4, 6, 8
	880	2½, 3, 4, 6, 8, 10
	880V	2½, 3, 4, 6, 8, 10
Flomatic	RPZ	3/4, 1, 1½, 2, 2½, 3
	RPZ-II	1/2, 3/4
Hersey/Grinnell	6CM	2½, 3, 4, 6, 8, 10
	FRP-II	3/4, 1, 1¼, 1½, 2
	6CM-Bronze	2½, 3, 4, 6
Mueller	H-9506	4, 6, 8, 10
Neptune- see Wilkins		
Orion	80-0069	1½
	BRP	3/4, 1, 2, 3, 4
	9-2929	2
Rain Bird	RPA	3/4, 1, 1¼, 1½, 2, 2½, 3, 4, 6, 8, 10
	RP-QT	3/4, 1, 1½, 2
Richwell- see Wilkins		
Toro- see Orion		
Watts	909	2½, 3, 4, 6, 8, 10
	909QT	3/4, 1
	909HWQT	3/4, 1

Approved Reduced Pressure Assemblies, Continued

COMPANY	MODEL	SIZE (INCHES)
Watts, continued	909HWM1QT	1¼, 1½, 2
	909M1	8, 10
	909M1QT	1¼, 1½, 2
	909BB	2½, 3
	909PCHWM1QT	1¼, 1½, 2
	909PCHWQT	3/4, 1
	909PCM1QT	1¼, 1½, 2
	909QTFDA	2½, 3, 4, 6
	909M1QTFDA	8, 10
	009	2½, 3, 4, 6
	009M1QT	1¼, 1½, 2
	009M1PCQT	1¼, 1½,2
	009M2QT	3/4, 1¼, 1½, 2
	009M2PCQT	1¼, 1½, 2
	009PCQT	1/2, 3/4, 1, 1¼, 1½, 2
	009QT	1/4, 3/8, 1/2, 3/4, 1, 1¼, 1½, 2
	009SSM1QT	2
	009SSM1PCQT	2
	009SSPCQT	3/4, 1, 1¼, 1½, 2
	009SSQT	3/4, 1, 1¼, 1½, 2
	009M1 and M2QT	3/4, 1, 1¼, 1½, 2
	990	4, 8
	990QTFDA	4, 8
	992	4, 10
	994	2½, 3, 4, 6
	FAE909QT	1¼, 1½, 2
	FAE909HWQT	1¼, 1½, 2
	U009APCQT	3/4, 1
	U009AQT	3/4, 1
	U009M1APCQT	1½, 2
	U009M1AQT	1½, 2
	U009M1PCQT	1¼, 1½, 2
	U009M1QT	1¼, 1½, 2
	U009M2APCQT	1½, 2
	U009M2AQT	1½, 2
	U009M2PCQT	1½, 2
	U009M2QT	3/4, 1½, 2
	U009PCQT	1/2, 3/4, 1, 1¼, 1½, 2
	U009QT	1/2, 3/4, 1, 1¼, 1½, 2
	U009SSPCQT	3/4, 1, 1¼, 1½, 2
	U009SSQT	3/4, 1, 1¼, 1½, 2
	U909QT	3/4, 1
	U909HWQT	3/4, 1

Approved Reduced Pressure Assemblies, Continued

COMPANY	MODEL	SIZE (INCHES)
Wilkins	575	3/4, 1, 1¼, 1½, 2, 2½ 3, 4, 6, 8, 10
	575A	3/4, 1
	975	3/4, 1, 1¼, 1½, 2, 2½ 3, 4, 6, 8, 10
	975A	3/4, 1, 1¼, 1½, 2
	975BMS	2½, 3, 4, 6, 8, 10
	975MS	2½, 3, 4, 6, 8, 10
	975XL	1/4, 3/8, 1/2, 3/4, 1 1¼, 1½, 2
	975XLBMS	3/4, 1, 1¼, 1½, 2
	975XLU	3/4, 1, 1½, 2
	975XLV	3/4, 1

REDUCED PRESSURE PRINCIPLE DETECTOR ASSEMBLIES

Reduced Pressure Principle Detector Assemblies (RPDAs) are RPs with a factory installed and protected by-pass line with a water meter. RPDAs are used in high hazard fire flow lines where a meter is desired to detect unauthorized water usage. Home-made RPDAs shall not be installed. Approval is granted for the complete assembly only.

COMPANY	MODEL	SIZE (INCHES)
Ames	5000	4, 6, 8, 10
Cla-Val	RD7LY	2½, 3, 4, 6, 8, 10
	18-4	10
Conbraco	40-700-C3, 40-700E3	3
	40-70A-C3, 40-70A-E3	4
	40-70C-C3, 40-70C-E3	6
	40-70E-C3, 40-70E-E3	8
	40-70G-C3, 40-70G-E3	10
Febco	826YD	2½, 3, 4, 6, 8, 10
Hersey/Grinnell	6CMDA	4, 6, 8, 10
Watts	009NRS RPDA	4, 6
	0090SY RPDA	4, 6
	909 RPDA	3, 4, 6, 8, 10
	990 RPDA	4, 8
	992 RPDA	4, 10
Wilkins	975 DA	2½, 3, 4, 6, 8, 10

PRESSURE VACUUM BREAKERS

Pressure vacuum breakers are used in low or high hazard applications that are not subject to backpressure. PVBs must be installed twelve (12) inches above the highest point of downstream use. PVBs must be installed in a location that provides adequate acess for testing and repair.

COMPANY	MODEL	SIZE
Ames	A200	1/2, 3/4, 1, 2
Buckner	24199 thru 24204	1/2, 3/4, 1, 1¼, 1½, 2
	24199/25 thru 24204/25	1/2, 3/4, 1, 1¼, 1½, 2
Conbraco	40-503-02 thru 40-508-02	1/2, 3/4, 1, 1¼, 1½, 2
Febco	765	1/2, 3/4, 1, 1¼, 1½, 2
	745	3/4, 1
Flowmatic	PVB	3/4, 1
Neptune- see Wilkins		
Rain Bird	PVB-075-R thru PVB-200-R	3/4, 1, 1¼, 1½, 2
Watts	800 QT	3/4, 1, 1¼, 1½, 2
	800MQT	1/2, 3/4
	800CMQT	1/2, 3/4
	800M2QT	1/2, 3/4, 1, 1¼, 1½, 2
	800M3QT	1/2, 3/4
	800M4FR	3/4, 1, 1¼, 1½, 2
	800M4QT	1/2, 3/4, 1, 1¼, 1½, 2
Wilkins	720A	1/2, 3/4, 1, 1¼, 1½, 2

02723 .....HIGH DENSITY POLYETHYLENE PIPE

1.0 SCOPE OF WORK

1.1 This work shall consist of the furnishing and installation of high density polyethylene (HDPE) pipe, end sections, and perforated pipe underdrains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans or established. It shall also consist of furnishing all materials and joining the work to other pipe, catch basins, manholes, inlets, etc., as may be required to complete the work as designated.

1.2 HDPE pipe shall be installed only in locations outside of a road right-of-way such as easements between or through lots.

1.3 SPECIFIED ELSEWHERE. Select Bedding & Foundation Material – 02221

2.0 MATERIALS

2.1 CORRUGATED HIGH DENSITY POLYETHYLENE (HDPE) PIPE

2.1.1 HDPE pipe shall be equal to the ADS N-12 pipe manufactured by Advanced Drainage Systems, Inc. (ADS), 3300 Riverside Drive, Columbus, OH 43221, or approved equivalent and shall conform to the requirements of AASHTO Designation M 294.

2.1.2 When perforated HDPE pipe is specified (sizes 15" through 48"), it shall be provided in a knitted polyester sock with a minimum weight of two and one-half (2½) ounces per square yard, a minimum burst strength (ASTM D 3786) of 100 psi, and a minimum melt temperature (ASTM D 276) of 258°C (496°F).

2.2 The pipe and fittings shall be made of virgin polyethylene compounds which conform to the requirements of Type III, Category 5, Grade P 34, Class C of ASTM Designation D 1248.

2.3 HDPE perforated pipe for underdrains shall be flexible corrugated drainage pipe with perforations as manufactured by ADS or an approved equivalent. This perforated pipe shall be totally encapsulated in a nylon "sock" in such a manner to allow only water to pass through the perforations of the sock.

2.4 Gravel used in the construction of underdrains shall be washed gravel meeting the gradation requirements of Size No. 57, Section 703.03.2.4, MDOT Specifications.

3.0 CONSTRUCTION REQUIREMENTS

3.1 EXCAVATION

3.1.1 Excavation shall include the loosening, loading, removing, transporting, and disposing of all materials, wet or dry, above or below ground, within the allowable limits necessary to be removed to install all pipe included in this contract to the lines, grades, and dimensions specified in the plans.

3.1.2 Excavation shall be incidental and included in the cost of the pipe.

3.1.3 The maximum allowable trench width at the ground or pavement surface is 2 x depth of cut, plus the pipe O.D.

3.1.4 The bottom width of the trench shall be within the limits detailed in the plans. Overdigging is not permitted unless authorized by Engineer.

3.2 LAYING PIPE. Begin at the downstream end. The lower segment of the pipe shall be in contact with the shaped bedding throughout its full length. Bell or groove ends shall face upstream.

3.3 JOINING PIPE. Joints shall be made with a neoprene gasket with the coupling to provide a soil tight joint. Where allowed by Engineer, split couplings, corrugated to engage the pipe corrugations, may be used. Installation shall be in accordance with ASTM Recommended Practice D 2321.

3.4 PIPE EMBEDMENT AND BACKFILL

3.4.1 Embedment of pipe and placement of backfill shall proceed as detailed in the plans.

3.4.2 Should Engineer determine that the native material at the bottom of the trench is not suitable foundation for the pipe, he may authorize overdigging the trench a depth of six (6) inches and replace with a select foundation material.

3.4.3 Generally, loose material left by the excavator on the trench bottom and soft material shaved from the trench excavation will be adequate for bedding the pipe so that it is fully supported.

3.4.4 The haunching material shall be native material secured from the trench excavation and thoroughly compacted to the spring line of the pipe and extending to the side walls of the trench. A minimum eighty-five percent (85%) Standard Proctor will be considered adequate compaction.

3.4.5 The initial backfill (native material secured from the trench excavation) may then proceed to a height of twelve (12) inches above the top of the pipe and be mechanically tamped. Further backfill shall not proceed until initial backfill has been observed by Engineer.

3.4.6 Should Engineer determine that the native material secured from the trench excavation is not suitable for embedment, he may authorize the use of a select bedding material.

3.4.7 Further backfill utilizing material from trench excavation may then proceed to the original ground surface in twelve (12)-inch lifts, compacted to eliminate air voids. In areas where the ground surface is to receive pavement, a minimum ninety-five percent (95%) Standard Proctor for each lift shall be considered adequate compaction.

3.4.8 Contractor shall maintain trench backfill at ground surface until final acceptance of the work.

3.4.9 All surplus materials not used in backfilling shall be removed and disposed of by Contractor at his own expense in accordance with Section 02660, paragraph 3.1.11.

4.0 METHOD OF MEASUREMENT

4.1 The lengths of pipe, complete in place, will be measured by the linear foot by multiplying the number of commercial lengths by the nominal length per section.

4.2 End sections will be measured by the number of units of the kind and size specified.

4.3 Perforated underdrain installed at the locations shown on the plans with gravel as specified shall be measured by the linear foot, field measure.

4.4 There shall be no separate measurement for washed gravel used in the construction of underdrains. Payment for washed gravel shall be included in the bid price for perforated underdrains.

4.5 There shall be no separate measurement or payment for work under 02762. Cleaning and inspections shall be included in the bid price for the pipe.

5.0 PAYMENT

5.1 Payment shall be made in accordance with Pay Item No.

02723-A ___" Perforated HDPE Pipe

$_____per linear foot

02723-B ___" HDPE Pipe

$_____per linear foot

02723-C ___" Perforated HDPE Underdrain in Gravel Bed

$_____per linear foot

02730 ..... GRAVITY SEWER PIPE

1.0 SCOPE OF WORK

1.1 This work shall consist of all labor, materials, equipment, tools and services required for the furnishing, installing, and testing of all gravity sewer pipe in accordance with these specifications and/or as detailed in the drawings.

1.2 Work in this section shall be in accordance with applicable State and OSHA Safety and Health Standards for Construction.

1.3 SPECIFIED ELSEWHERE. Manholes – 02731
Inspection of Underground Pipes – 02762

2.0 MATERIALS

2.1 PVC PIPE & FITTINGS

2.1.1 Solid wall polyvinyl chloride (PVC) sewer pipe and fittings conforming to ASTM D-3034, (4" – 15") or ASTM F-679 (18" – 27"), elostomeric gasket joint.

2.1.2 Ribbed wall polyvinyl chloride (PVC) sewer pipe having a homogeneous, smooth interior wall with a solid cross-section rib exterior. Exterior ribs shall be perpendicular to the pipe axis. Pipe shall conform to the performance requirements of ASTM F794 and Uni-Bell B-9. PVC material shall conform to ASTM D1784, cell classification 12454-B. Pipe joints shall employ a factory-installed elastomeric gasket (ASTM F477) located between two ribs. Minimum pipe stiffness (F/Y at 5% deflection shall be 60 psi, per ASTM D2412.

2.1.3 All fittings shall be pipe-manufacturer's standard fittings. Pipe manufacturer shall supply solid-wall adapters for use where pipe connects to manhole pipe entry gaskets.

2.2 DUCTILE IRON PIPE & FITTINGS

2.2.1 Where ductile iron pipe is required by the Drawings or where directed by the Engineer, use ductile iron pipe conforming to AWWA C-150, manufactured in accordance to AWWA C-151, Grade 60-42-10 Ductile Iron, thickness Class 52 minimum, rubber ring joint. Pipe interior shall be coated with 40 mils of ceramic epoxy such as Protecto 401, or approved

equal. Pipe exterior shall be lined with bituminous outside coating. Ductile iron fittings shall be used with ductile iron pipe.

2.2.2 Mechanical joints shall meet the requirements of ASA A-21.11 except as amended by ASA A-21.51.

2.2.3 Fittings for ductile iron pipe shall be mechanical joint ductile iron castings with a coal tar coating in accordance with ANSI-AWWA C110/A21.10.

2.2.4 Bolting shall be of the type recommended by the pipe supplier and shall be of a material with a minimum 45,000 psi tensile strength, with semi-finished heavy nuts in accordance with ANSI/AWWA C111/A21.11.

2.3 METALLIC MARKING TAPE. Marking tape shall be three (3) inch wide metallic tape with the words "CAUTION SEWER LINE BURIED BELOW" printed on it along its entire length for all sanitary sewer service lines and sanitary sewer gravity lines. Marking tape shall be Detect Tape as manufactured by Allen Systems, Inc., which is handled by the Mavor Kelly Company in New Orleans, or approved equal.

2.4 LOCATOR WIRE. Locator wire shall be fourteen (14) gauge solid copper insulated locator wire.

3.0 CONSTRUCTION REQUIREMENTS

3.1 GENERAL

3.1.1 Contractor shall be responsible for laying out his own work and for the preparation of cut sheets. Cut sheets shall be submitted to the Engineer for review and approval prior to beginning work.

3.1.2 Contractor may use laser beam for establishing grade of sewer, but he will be entirely responsible for the accuracy of the work. If laser beam is used, Contractor shall check the grade with level and rod each 100 feet and at each manhole and anytime a new set up is made in the same section. The grade as shown on the plans is that of invert and to which the work must conform. Any variation from the line or grade will be deemed sufficient reason to cause the work to be rejected and rebuilt at Contractor's expense.

3.2 EXCAVATION - GENERAL

3.2.1 Excavation shall include the clearing of the work site, the loosening, loading, removing, transporting and disposing of all materials, wet or dry, above or below ground necessary to be removed to construct all pipes

included in this contract to the lines, grades and locations shown on the Drawings. Excavation shall be incidental and included in the cost of other items.

3.2.2 The bottom width and depth of the trench shall be within the limits detailed in the plans. Overdigging is not permitted unless authorized by Engineer.

3.2.3 No burying or burning of trees, stumps, roots, or other debris will be allowed.

3.2.4 Where directed by Engineer or shown on drawings, the Contractor shall remove with care all shrubbery, plants, trees, flowers or other vegetation. These items shall be set aside, watered, and kept alive and reset to pre-construction conditions. The Contractor shall furnish and install, to Engineer's satisfaction, replacement plants which die as a result of construction operations.

3.2.5 In areas where sewer main will be installed in close proximity to trees designated to remain, the major root systems of the trees shall be protected from damage. Where necessary, contractor shall install sewer main by tunneling underneath the tree roots.

3.2.6 The Contractor shall, at his own expense furnish and install all temporary sheeting, shoring, timbering and bracing required to maintain the excavation in a condition to furnish safe working conditions and to permit the safe and efficient installation of all items of contract work. The Contractor shall further, at his own expense, shore up or otherwise protect all fences, buildings, walls, walks, curbs, or other property adjacent to any excavation which might be disturbed during the progress of the work, except those facilities designated for removal and restoration.

3.2.7 Temporary supports must be removed by the Contractor at his own expense after or concurrently with the completion of the permanent facility.

3.2.8 The Contractor shall do all ditching, pumping, well pointing and bailing, build all drains, and do all other work necessary to keep the excavation clear of ground water, sewage or storm water during the progress of the work and until the finished work is safe from injury. Where the excavation is wet sand, and suitable construction conditions cannot be obtained by other methods, the Contractor shall install and operate, at his own expense, a pumping system connected with well points, so as to drain the same effectually. All well point holes shall be backfilled with sand after removal. No masonry or pipe shall be laid in water, and water shall not be allowed to rise over masonry until concrete or masonry has set at least 48 hours. All water pumped or drained from the work shall be disposed of in a manner that will not damage adjacent property or other work under

construction. Necessary precautions shall be taken to protect all construction against flooding. This work shall be incidental and included in the cost of other items.

3.2.9 Whenever the excavation is carried beyond the lines and grades shown on the drawings, the Contractor shall, at this own expense, refill all such excavated space with such material and in such manner as may be directed by the Engineer.

3.2.10 Unsuitable and surplus excavated material not incorporated in the work shall be disposed of by the Contractor at his own expense.

3.2 11 Contractor shall provide Engineer and Owner with proposed location for disposal of materials and adequate certification that proves the disposal site is permitted to receive the material for disposal. Contractor shall also provide Engineer and Owner with adequate proof that the materials were delivered to the approved site prior to payment.

3.2.12 In the event that any existing gas pipe, water pipes, conduits, sewers, tile drains or poles are blocked or interfered with by the excavation required on this project, the Contractor shall maintain them in continuous operation, and restore them to the pre-construction conditions. Gas pipes or electrical power distribution facilities which are disturbed in any way shall be inspected and repaired (if necessary) by the utility owner. This work shall be incidental and included in the cost of other items.

3.2.13 Where shown on the plans, or directed by Engineer, existing sewer pipes may be removed to allow installation of new pipe, manholes, and facilities. The removal and disposal of those existing pipes shall be included in this item. Where existing pipes are partially removed, the exposed ends shall be completely plugged. This work shall be incidental and included in the cost of other items.

3.2.14 Any culvert pipe joint exposed by excavation shall be wrapped with an approved geotextile filter fabric, three feet in width, before backfilling. This work shall be incidental and included in the cost of other items.

3.3 TRENCH EXCAVATION

3.3.1 The ground shall be excavated in open trenches, of sufficient width and depth to provide ample room within the limits of the excavation, or lines of sheeting and bracing, for the proper construction of the sewer.

3.3.2 Mechanical excavation of trenches shall be stopped above the final invert grade elevation so that the pipe may be laid on a firm, undisturbed native earth bed.

3.3.3 The width of the trench at the top of the pipe shall not exceed the outside diameter of the pipe plus two feet. The maximum allowable trench width at the ground surface shall not exceed the outside diameter of the pipe, plus twice the depth of cut. Restoration of disturbed facilities as a pay item will only be allowed within these limits.

3.4 BEDDING

3.4.1 When the native bedding material encountered in the trench bottom consists of a material deemed by the Engineer to be unsuitable for pipe bedding, the Contractor shall overdig to a depth as specified in the Drawings and replace with select foundation material. Should overdigging occur where a suitable native soil exists for bedding purposes, the Contractor shall fill the area of over-excavation with select foundation material, but at his own expense.

3.4.2 Trenches shall be dry when the trench bottom is prepared. A continuous trough shall be pared or excavated to receive the bottom quadrant of the pipe barrel. In addition, bell holes shall be excavated so that after placement, only the barrel of the pipe receives bearing pressure from the trench bottom.

3.4.3 Preparation of the trench bottom and placement of the pipe shall be carefully made so that when in final position, the pipe is true to line and grade.

3.5 LAYING PIPE

3.5.1 Pipe shall be protected during handling against impact shocks and free fall. Pipe shall be kept clean at all times, and no pipe shall be used in the work that does not conform to the appropriate specifications.

3.5.2 The laying of pipe in finished trenches shall be commenced at the lowest point, with the spigot ends pointing in the direction of the flow.

3.5.3 All pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered, so that when laid they will form a sewer with a uniform invert.

3.5.4 Pipe shall be laid accurately, to the line and grade as designated on the drawings. Preparatory to making pipe joints, all surfaces of the portions of the pipe to be jointed or of the factory-made jointing material shall be clean and dry. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturers' specifications. The jointing materials or factory fabricated joints shall then be placed, fitted,

joined and adjusted in such a workmanlike manner as to obtain the degree of water-tightness required.

3.5.5 Trenches shall be kept water-free and as dry as possible during bedding, laying and jointing and for as long a period as required. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to offset conditions that might tend to move the pipe off line and grade.

3.5.6 Service wye report forms will be furnished by the Engineer. These must be accurately completed by Contractor and submitted prior to payment for the service.

3.5.7 Where sewers cross water mains, Contractor shall adjust sewer laying lengths so that sewer joints are equidistant and as far as possible from the water main joints.

3.5 8 Where required by the Drawings or by job conditions, new sewer pipe shall be connected to existing sewer mains by means of an appropriate flexible PVC coupling.

3.5.9 Where existing sewers are to be replaced or abandoned, the Contractor shall locate all existing active sewer services which connect to such sewers to be replaced by probing, excavation, or other approved means. Each of these shall be reconnected to the new sewer main with a new service wye and service pipe constructed to the right-of-way or easement line, complete with a cleanout assembly at that point.

3.5.10 Existing sewage flow must not be impeded to the point that sewage may back up into homes or overflow into the environment. If necessary, suitable reliable bypass pumping equipment must be provided, operated, and maintained.

3.5.11 All sewer mains and services shall be installed with metallic tape placed directly over and on the center of the facility at a depth of one (1) foot over the line for its entire length. Tape must be connected to all facilities or appurtenances. This work shall be incidental and included in cost of other work.

3.5.12 All sewer mains and services shall be installed with locator wire placed directly on the center of the main for its entire length. Wire shall be tied to an appurtenance at each end of the main or service, and shall be a continuous piece of wire for its entire length. The Contractor shall supply splice kits and other accessories necessary for one continuous locator wire. This work shall be incidental and included in cost of other items.

3.5.13 All sewer mains and service lines must be installed with metallic tape placed directly over and on the center of the facility approximately twelve (12) inches above the pipe for its entire length. Tape must be attached to all facilities or appurtenances. No additional compensation will be allowed for this operation.

3.5.14 All sewer mains and service lines shall be installed with locator wire placed directly on the center of the pipe for its entire length. Wire shall be tied to an appurtenance at the start of a new main and shall be a continuous piece of wire for its entire length. Contractor shall supply splice kits and other necessary accessories in order to ensure a continuous wire. No additional compensation shall be allowed for this operation.

3.6 BACKFILLING

3.6.1 Backfilling shall be made with the native excavated soil from the trench provided that the excavated material is suitable for backfilling. Suitable materials shall be construed as material that will compact readily when the usual methods of mechanical tamping are used.

3.6.2 Where the native excavated soil does not meet the requirement for select bedding material, the Engineer may authorize the replacement for such unsuitable material with select bedding material. All surplus or unsuitable material not used in backfilling shall be disposed of off-site by Contractor.

3.6.3 All backfill material shall be free from cinders, ashes, roots, refuse, vegetative matter, excess organic material, rocks, stones or other unsuitable materials.

3.6.4 All trenches shall be backfilled by hand or by approved mechanical methods from the bottom of the trench to a depth of one foot (1') above the pipe with fill placed in layers of six inches (6") and compacted by tamping to ninety-five percent (95%) density in accordance with ASTM D 1557, so as to insure that the backfill is well placed and compacted beneath the haunches of the pipe. Backfilling material shall be deposited in the trench for its full width of each side of the pipe, fittings, and appurtenances simultaneously. Care shall be exercised to prevent distortion or damage to the pipe. The Contractor shall use special care in placing this portion of the backfill so as to avoid injuring or moving pipe.

3.6.5 From one foot (1') above the pipe to the grade shown on the drawings or specified herein, the trench shall be backfilled in layers which do not exceed twelve inches (12") before compaction and shall be compacted with approved mechanical equipment to ninety-five percent (95%) density in accordance with ASTM D 1557, unless approved otherwise by the Engineer or his authorized representative.

3.6.6 The Engineer or his authorized representative shall have the right to forbid the use of any compacting tools or machines that he considers dangerous to the pipe or incapable of compacting the backfill properly.

3.6.7 The Contractor shall take random density tests in the trench lines to assure that proper compaction has been achieved.

3.6.8 Where any sheathing or bracing is withdrawn as the backfilling progresses, all voids or spaces left thereby shall be carefully and thoroughly filled and compacted with properly shaped tools.

3.6.9 After completion of backfilling, all materials not used therein, including any excess excavation shall be removed and disposed of and all roads, shoulders, and other places in the line of work shall be left free, clean and in good order.

3.7 TESTING

3.7.1 General

3.7.1.1 All projects shall be tested upon completion of installation. The Engineer will designate the locations and type of tests and extent of the system to be tested. Equipment for performing tests and making measurements shall be furnished by the Contractor. All sewers shall be subject to a visual inspection, deflection test, and either an infiltration or air test. Sections of sewer which fail to pass the tests shall have defects located and repaired or replaced at the Contractor's expense and be retested until within the specified allowance.

3.7.2 Visual Inspection

3.7.2.1 All sewer lines shall be inspected to verify accuracy of alignment and freedom from debris and obstructions. The full diameter of the pipe for straight alignments shall be visible when viewed between consecutive manholes. The method of test shall be either photography, closed circuit television, or visually lamping with mirrors and lights. Contractor shall video inspect all pipe and manholes and provide a copy of video in DVD format to the Owner.

3.7.3 Deflection Test

3.7.3.1 Deflection tests shall be performed on all flexible pipe. Not less than 30 days after placing of the backfill, a deflection test shall be made in the presence of the Engineer to demonstrate that deflection of the flexible sewer pipe does not exceed five percent of the pipe diameter. A fixed-

diameter multi-vane mandrel having an outside diameter of not less than 95 percent of the actual inside diameter of the pipe shall be pulled through the pipe without encountering restriction. The test shall be performed without mechanical pulling devices.

3.7.4 Infiltration Test

3.7.4.1 The Contractor shall furnish, install and maintain a V-notch sharp crested weir in a wood frame tightly secured at the entrance to the junction manhole to demonstrate to the Engineer the amount of infiltration. The maximum allowable infiltration shall be 100 gallons per inch of pipe diameter per mile per day for any section of the system between consecutive manholes.

3.7.5 Air Test

3.7.5.1 Low pressure air testing shall conform to the test procedure described in ASTM F1417. All air used shall pass through a single control panel, equipped with sufficient valves and gauges to monitor air pressure and control the flow of air at all times. All pneumatic plugs shall be seal tested before being used in the actual test. Low pressure air shall be introduced into the sealed section of sewer to be tested until the internal air pressure reaches 4 psig greater than the average back pressure of any ground water that may be over the pipe.

3.8 SEPARATION BETWEEN SEWER AND WATER LINES

3.8.1 Horizontal and Vertical Separation

Sewer mains (including force mains) shall be laid at least 10 feet horizontally and 18 inches vertically from any existing or proposed water main. The distance shall be measured edge to edge. Sewer lines should always be installed below water lines and the bottom of the water line should be at least 18 inches from the top of the sewer line.

3.8.2 Special Conditions

Where local conditions prevent adequate horizontal and vertical separation, the appropriate reviewing agency may allow the sewer line to be laid closer to the water line if supported by adequate data from the design engineer. Each situation will be reviewed on a case by case basis. In this situation, all three of the following conditions must be met:

A. If the 10 foot horizontal separation between water and sewer lines cannot be maintained then the water line should be ductile iron with water joints located at the maximum distance possible from sewer

line joints. PVC pipe may be used if it is protected by a steel casing. Also the water and sewer lines must be in separate trenches with adequate space for maintenance. In some cases, special sewer line construction procedures may be required.

B. Where the 10 foot horizontal and 18 inch vertical separation cannot be maintained, condition A. must be met and the sewer line shall be constructed according to water main standards.

C. Where sewer lines cross under water lines, the pipe segments should be centered to provide maximum spacing of joints of both water and sewer lines. A vertical separation of at least 18 inches should be maintained (water over sewer).

4.0 METHOD OF MEASUREMENT

4.1 Sewer pipe of the sized and type specified shall be measured by the number of linear feet of pipe in place as measured horizontally from center to center of manholes, or inside wall of pump station wet wells. Depth of cut shall be calculated as the average depth of the upstream and downstream structure, measured from the pipe invert to top of structure.

4.2 Sewer service assembly shall be measured per each. Compensation shall include cleanout, bends and connection to existing service pipe and main line wye.

4.3 Main line wyes shall be measured by the unit, in place, per each.

4.4 Cleanout Assembly installed on existing service pipe, shall be measured by the unit, in place, per each, including bends, pipe, cap, and plugs.

4.5 Locate and connect to existing service shall be measured as the number of existing sanitary sewer services actually located and then reconnected to new sanitary sewers constructed under this contract, per each.

5.0 PAYMENT

5.1 Payment will be made under PAY ITEM NO.

02730-A ___" PVC Sewer Pipe (__' to __' Cut)

$ _____per linear foot

02730-B Single Sewer Service Assembly

$ _____per each

02730-C Double Sewer Service Assembly

$ _____per each

02730-D Sewer Cleanout Assembly

$ _____per each

02730-E _____" Sewer Main Wye

$ _____per each

02730-F Locate and Connect Existing Service

$ _____per each

02730-G _____" Ductile Iron Sewer Pipe
(___' to ___' Cut)

$ _____per linear foot

02731 ..... MANHOLES

1.0 SCOPE OF WORK

1.1 This work shall consist of all labor, materials, and equipment to install precast manholes as designated in these specifications and in reasonably close conformity with the lines and grades specified on the plans.

1.2 SPECIFIED ELSEWHERE. Gravity Sewer Pipe – 02730

2.0 MATERIALS

2.1 Precast concrete risers, eccentric cone sections, flat slab top (where required), base section, and adjusting rings shall conform to the requirements of ASTM Designation C-478. Manholes will have a minimum wall thickness of 5 inches, a minimum base thickness of 6 inches for 4-foot diameter manholes and 8 inches for 5-foot diameter manholes, and a minimum base diameter 12 inches greater than the outside diameter of the riser section. Both cone shaped top sections and flat slab tops shall be designed to withstand H-20 wheel loadings in accordance with AASHTO requirements. The nominal inside diameter of manholes shall be 48 inches, unless otherwise designated.

2.2 Joints and castings shall be sealed with either a preformed joint compound such as RAMNEK or a rubber gasket. Preformed joint compound shall meet Federal Specification SS-S00210 (210-A) and AASHTO Specification M-198. Rubber gaskets shall meet ASTM Designation C-443.

2.3 CASTINGS

2.3.1 Standard castings shall consist of cast iron frames and covers shall conform to the plans in all essentials of design. All castings shall be made of clean, even grain, tough gray cast iron. The quality of iron in the castings shall conform to the current ASTM Specification A-48 for Class 30 Gray Iron Castings. Frames and covers shall weigh not less than that shown on the plans. The castings shall be smooth, true to pattern and free from projections, sand holes or defects and shall properly fit the manhole opening. The portion of the frame and cover which forms the cover seal shall be machined so that no rocking of the cover is possible. The castings shall be coated with coal tar pitch varnish. The cover shall have non-penetrating pick holes. Standard castings shall be DF-24 Manhole Ring and Cover as manufactured by Dews Foundry, model no.

V-1339 as manufactured by East Jordan Iron Works, Inc., or an approved equivalent. All manholes shall be furnished with standard castings unless otherwise specified on the plans.

2.3.2 Watertight castings shall meet the requirements of subparagraph 2.3.1 above and shall also be furnished with a watertight assembly consisting of a neoprene gasket (for the cover), bolts (4) to secure the cover to the frame, and bolts (4) to secure the frame to the manhole. Watertight castings shall be model no. 1040 as manufactured by East Jordan Iron Works, Inc., or an approved equivalent.

2.3.3 All manhole covers shall be marked "SEWER" or "SANITARY SEWER".

2.4 Manhole steps are required in manholes over four feet in depth and shall have a minimum tread width of 12 inches, 5 3/4 inch projection, integrally cast with manhole section, and constructed of 1/2 inch Grade 60 steel reinforcement encapsuled in a copolymer polypropylene plastic, molded to form a slip-proof manhole step.

2.5 Concrete (other than precast) shall conform to requirements for Class B concrete, MDOT Standard Specifications.

2.6 Reinforcement shall be Grade 40 or Grade 60 billet steel conforming to ASTM A-615.

2.7 One hundred percent (100%) solids epoxy shall be in accordance with this paragraph, and shall be paid for in addition to the manhole. Where indicated on the drawings, manholes will be coated with an interior protective coating system to be field-applied to all interior surfaces of the designated manholes, in lieu of the interior coal tar epoxy system. The coal tar epoxy system shall still be applied to the exterior surfaces of the manholes as specified above. The interior protective coating system shall be an approved one hundred percent (100%) solids epoxy coating system, or a 100% solids polyurethane system, that is specifically recommended by the coating manufacturer to protect concrete and other surfaces against corrosion from hydrogen sulfide gas and other substances common in raw domestic sewage.

2.7.1 The product must have the following minimum characteristics:

a. Minimum Compressive Strength per ASTM D695 = 12,000 psi
b. Minimum Tensile Strength per ASTM D638 = 7,200 psi
c. Minimum Flexural Strength per ASTM D790 = 13,000 psi
d. Minimum Bond Strength per ASTM D4541 = 900 psi
e. Minimum Corrosion Resistance per ASTM D543 = pH 0.5 or higher

2.7.2 Product shall be Warren Environmental System one hundred percent (100%) Solids Epoxy, Raven 405 Lining System or an approved equivalent.

2.7.3 A minimum thickness of one hundred fifty (150) mils of one hundred percent (100%) Solids Epoxy shall be applied where specified.

2.7.4 In lieu of one hundred percent (100%) solids epoxy liner, a one hundred percent (100%) polyurethane liner may be substituted.

2.7.5 One hundred percent (100%) solids polyurethane liner shall be in accordance with this paragraph, and shall be paid for in addition to the manhole. Where indicated on the drawings, manholes will be coated with an interior protective coating system to be field-applied to all interior surfaces of the designated manholes, in lieu of the interior coal tar epoxy system. The coal tar epoxy system shall still be applied to the exterior surfaces of the manholes as specified above. The interior protective coating system shall be an approved one hundred percent (100%) solids polyurethane coating system, which is specifically recommended by the coating manufacturer to protect concrete and other surfaces against corrosion from hydrogen sulfide gas and other substances common in raw domestic sewage.

2.7.6 Product shall be Spectra-Shield Liner System or an approved equivalent.

2.7.7 Polyurethane liner must have the following minimum characteristics:

a. Minimum Tensile Strength per ASTM D412 = 3600 psi
b. Minimum Tear Strength per ASTM D2240 = 5000 psi
c. Minimum Elongation per ASTM D 412 = 300%
d. Minimum Corrosion Resistance per ASTM D543 = pH 0.5 or higher

2.7.8 A minimum thickness of five hundred (500) mils of polyurethane liner shall be applied where specified.

2.8 Flexible watertight manhole pipe connectors shall be provided at all pipe openings and shall consist of a neoprene rubber boot designed to clamp securely into an opening in the manhole wall and to clamp around the barrel of the sewer pipe. Openings in the manhole wall shall be made by a coring machine or by a hole formed during the manufacturing process. Rubber material shall conform to the requirements of ASTM C-923 and be a minimum of 3/8 inches thick. External and internal clamps shall be all type 304 stainless steel conforming to ASTM A-167. Gasket shall be similar to "Kor-N-Seal Boot" as manufactured by the National Pollution Control Systems, Inc., Milford, New Hampshire, or approved equal.

2.9 Water stops shall be commercially available rubber, employing ribs to engage the PVC pipe and large fins to engage the grout. The stop ring shall be clamped to the pipe by an all-stainless steel worm clamp.

2.10 A water proofing admixture, such as Xypex or approved equal, shall be applied to all manholes by incorporation into the concrete mix. The admixture shall be mixed into the concrete at a rate of 0.8% to 1.0% by weight of cementitous material.

3.0 CONSTRUCTION REQUIREMENTS

3.1 Excavation for manholes shall conform to same requirements as adjoining sewers to which they are connected. No additional allowance in allowable trench width will be made for manholes and cleanouts.

3.2 In some cases, existing manholes within the allowable construction limits will be removed to allow installation of new pipe, manholes, and facilities. In this case, the removal and disposal of those existing manholes shall be included in this item.

3.3 Precast manhole base sections shall be set, true and plumb, on a prepared, firm subgrade, free of water. When the native subgrade material encountered consists of a material deemed by the Engineer to be unsuitable, the Contractor shall excavate an additional 12 inches and replace with select foundation material. The native material and/or the select foundation material under manholes will be completed to 95% Standard Proctor Density.

3.4 The method of joining precast concrete riser and cone sections shall be such that the ends are fully entered and the inner surfaces are reasonably flush and even. The finished manhole shall be free of visible evidence of leakage. Not more than two (2) adjusting rings shall be allowed per manhole.

3.5 Where necessary to construct a manhole with a poured-in-place bottom, it shall be not less than 12 inches thick and not less than 12 inches in diameter larger than the outside of the precast riser section conforming to details shown in the plans.

3.6 Reinforcement shall conform accurately to the dimensions and details indicated on the drawings. Before being placed in any concrete work, it shall be cleaned thoroughly of all rust, mill scale, mortar, oil, dirt, or coating of any character which would be likely to destroy, reduce or impair its proper bonding with the concrete.

3.7 Concrete shall conform accurately to the dimensions and details indicated on the plans. Concrete shall not be permitted to fall more than six feet without the use of pipe or tremies at least six inches in diameter. Concrete shall be thoroughly consolidated in a manner that will encase the reinforcement and inserts, fill the forms, and produce a surface or even texture free of rock pockets and excessive voids.

3.8 Contractor shall form invert channels smooth and shape to semi-circular bottom conforming to the inside of the adjacent sewer section. Inverts shall extend up at least half of the diameter of the pipe. Changes in direction of the sewer and entering branches shall have a true curve of as large a radius as the size of the manhole will permit.

3.9 The annular space between the pipe and the pipe entry gasket boot shall be sealed at the interior manhole wall with a manufactured rubber sealer ring or by other approved means to prevent invert grout or debris from entering the boot.

3.10 Lifting holes in manhole walls shall be sealed with a non-shrink grout and shall have no visible evidence of leakage.

3.11 Manhole steps shall be a straight alignment so as to form a continuous ladder with a maximum distance of twelve (12) inches between steps.

3.12 Manhole frame casting shall be set on top of concrete cone section or adjusting ring, to line and grade, and in such a manner that subsequent adjustments will not be necessary. Castings shall be sealed with a preformed joint compound or a rubber gasket on paved streets, the frame and cover shall be set flush with and in the plane of the final paved surface course.

3.13 Backfill may proceed as soon as manholes have developed sufficient strength to resist backfilling loads and forces. Backfill for manholes shall be in the same manner as the adjoining sewers to which they are connected.

3.14 Where indicated on the plans, drop manhole connections shall be assembled using pipe and fittings of the same type as the sewer main and in accordance with the details in the Drawings.

3.15 Contractor shall verify manhole dimensions relative to pipe sizes prior to installation. Sewer main connections to manhole shall not exceed manufacturer's recommendations.

3.16 CONNECTION TO EXISTING SYSTEM

3.16.1 The point at which the proposed system is to be connected to existing lines are designated on the plans. Connections shall be made into existing lines at existing manholes or by construction of new manholes over existing lines. When the plans indicate connections to existing manholes, these connections shall be watertight and all work performed in an acceptable manner. Openings thru manhole walls shall be bored or shall be made with a small pneumatic device. Use of mauls or large pneumatic hammers likely to crack the manhole wall is prohibited. The size of the opening cut in the existing manhole wall shall be restricted to a nominal diameter sufficient only to insert the sewer pipe. After insertion of the sewer pipe, the void between the outside of the pipe and the manhole wall shall be packed with a non-shrink grout.

3.16.2 The Contractor shall not interfere with the functioning of the existing sewers and shall not allow debris to enter these sewers as a result of his work. When sewage flow quantities in the existing system are large and/or when the time of interruption of flow affects the operations of upstream mains and service lines, by-pass pumping will be necessary. No discharge will be permitted onto surface areas. Bypass Pumping shall be considered incidental and included in the cost of other items.

4.0 METHOD OF MEASUREMENT

4.1 Manholes will be measured by the completed unit, in place, per each. The depth of manholes will be measured as the distance from the manhole invert to the top of the manhole lid or cover.

4.2 Connections to existing manholes or pump stations shall be measured as the number of such connections satisfactorily made, per each.

4.3 Solids liner coating of manholes shall be measured by the vertical foot from the invert of the outlet pipe to the top of the casting, regardless of material.

4.4 Where watertight castings are required by the Drawings or where use is directed by the Engineer, the payment will be in addition to payment under Pay Items for manholes.

4.5 Drop Assemblies shall be measured as a unit, per each and paid for in addition to the manhole which it accompanies.

5.0 PAYMENT

5.1 Payment shall be made under PAY ITEM NO.

02731-A Sewer Manholes

$ _____ per each

02731-B Solids One Hundred Percent (100%) Liner Coating

$ _____ per vertical foot

02731-C Watertight Manhole Cover

$ _____ per each

02731-D Drop Assembly

$ _____ per each

02731-E Connection to Existing Sewer Manholes

$ _____ per each

02732 ..... PRECAST SEWAGE PUMP STATION

1.0 SCOPE OF WORK

1.1 This work shall consist of all labor, materials, equipment, tools and services required for the furnishing, installing and testing of precast wet pit type sewage pump stations, including related controls, operation devices, piping, valves and related appurtenances, and all related site construction shown on the site plan in accordance with these specifications and as detailed in the Drawings.

1.2 SPECIFIED ELSEWHERE. Pressure Sewer Main & Appurtenances - Section 02733
Gravity Sewer Pipe - Section 02730
Manholes - Section 02731

2.0 MATERIALS

2.1 WET PIT

2.1.1 Large diameter precast concrete round manhole and flat slab top conforming to ASTM C-478. For superior resistance to sewer gases, cement shall be Portland Cement Type II, and course aggregates shall be crushed limestone. Wet Pits shall be 72 inches (6 ft.) or larger in diameter. A waterproofing admixture, such as Xypex or approved equal, shall be applied to all wet pits by incorporation into the concrete mix. The admixture shall be mixed into the concrete at a rate of 0.8% to 1.0% by weight of cementitous material.

2.1.2 Joints for the precast concrete sections shall be tongue and groove and shall be sealed with a preformed joint compound conforming to Federal Specification SS-S00210 (210-A) and ASHTO Specification M-198.

2.1.3 Interior protective coating system to be field-applied to all interior surfaces of all new wet wells, including certain existing wet wells to be renovated as designated in the Drawings, and all discharge piping inside the wet wells, shall be an approved 100% solids epoxy coating system, or 100% solids polyurethane system, that is specifically recommended by the coating manufacturer to protect concrete and other surfaces against corrosion from Hydrogen Sulfide gas and other substances common in raw domestic sewage.

1. The product must have the following minimum characteristics:

a. Minimum Compressive Strength per ASTM D695 = 12,000 psi
b. Minimum Tensile Strength per ASTM D638 = 7,200 psi
c. Minimal Flexural Strength per ASTM D790 = 13,000 psi
d. Minimum Bond Strength per ASTM D4541 = 900 psi
e. Minimum Corrosion Resistance per ASTM D543 = pH 0.5 or higher.

2. Product shall be Warren Environmental System 100% Solids Epoxy, Raven 405 Lining System, or approved equal.

2.1.4 In lieu of one hundred percent (100%) solids epoxy liner, a one hundred percent (100%) polyurethane liner may be substituted.

2.1.5 One hundred percent (100%) solids polyurethane liner shall be in accordance with this paragraph, and shall be paid for in addition to the manhole. Where indicated on the drawings, manholes will be coated with an interior protective coating system to be field-applied to all interior surfaces of the designated manholes, in lieu of the interior coal tar epoxy system. The coal tar epoxy system shall still be applied to the exterior surfaces of the manholes as specified above. The interior protective coating system shall be an approved one hundred percent (100%) solids polyurethane coating system, which is specifically recommended by the coating manufacturer to protect concrete and other surfaces against corrosion from hydrogen sulfide gas and other substances common in raw domestic sewage.

2.1.6 Product shall be Spectra-Shield Liner System or an approved equivalent.

2.1.7 Polyurethane liner must have the following minimum characteristics:

a. Minimum Tensile Strength per ASTM D412 = 3600 psi
b. Minimum Tear Strength per ASTM D2240 = 5000 psi
c. Minimum Elongation per ASTM D 412 = 300%
d. Minimum Corrosion Resistance per ASTM D543 = pH 0.5 or higher

2.1.8 A minimum thickness of five hundred (500) mils of polyurethane liner shall be applied where specified.

2.1.9 Flexible watertight manhole pipe connectors shall be provided at all pipe openings and shall consist of a neoprene rubber boot designed to clamp securely into an opening in the manhole wall and to clamp around the barrel of the sewer pipe. Openings in the manhole wall shall be made by a coring machine or by a hole formed during the manufacturing process. Rubber material shall conform to the requirements of ASTM C-923 and be a minimum of 3/8 inches thick. External and internal clamps shall be all type 304 stainless steel conforming to ASTM A-167. Gasket shall be "Kor-N-Seal Boot" as manufactured by the National Pollution Control Systems, Inc., Milford, New Hampshire, or approved equal.

2.1.10 Water stops shall be commercially available rubber, employing ribs to engage the PVC pipe and large fins to engage the grout. The stop ring shall be clamped to the pipe by an all-stainless steel worm clamp.

2.1.11 Vent pipe assembly shall be 6" minimum stainless steel pipe with stainless steel screen or aluminum pipe with an aluminum screen.

2.1.12 Access hatches shall be aluminum frame of 1/4" thick, one-piece extruded aluminum designed for embedment in a concrete slab. Door panel shall be 1/4" thick aluminum diamond plate, to withstand a live load of not less than 300 P.S.F., with a safety factor of 3. Hinges and all hardware shall be stainless steel. Doors shall hold open at 90 degrees and provisions shall be provided to lock the door in the closed position. Door shall close flush with the top of the frame, which shall be installed flush with the concrete slab, and provided with a locking mechanism in the closed position. Manufacturer shall apply bituminous coating to exterior of frame where in contact with concrete. Frames and covers shall be furnished with a written 10-year guarantee against defects in materials and/or workmanship. Doors shall be Type SD150 as manufactured by Halliday Products, Orlando, Florida, Type K as manufactured by the Bilco Company, New Haven, Connecticut, or approved equal.

2.2 VALVE PIT

2.2.1 All discharge valves and check valves shall be in a valve pit. The valve pit will have a concrete bottom with concrete or masonry sides.

2.2.2 A drain from the bottom of the valve pit to the well pit will be installed to allow drainage of rainwater. The bottom of the valve pit will be sloped to allow for proper drainage.

2.2.3 The valve pit will be of sufficient size to allow for maintenance of the valves enclosed. This includes sufficient space to remove the check valve shaft from either side.

2.2.4 Access to the valve pit will be through a hatch meeting the same specifications of the wet pit hatch or 1" x 4" galvanized steel grating where allowed.

2.2.5 All hardware in the valve pit will be stainless steel unless specifically stated otherwise.

2.3 FALL PROTECTION SYSTEM / EMERGENCY EXTRACTION SYSTEM. All wet well lids will have a three (3) inch diameter hole either cast into the lid or made by a coring machine, for use with the fall protection / emergency evacuation system. The center of the hole will be no less than fifteen (15) inches from the edge of the wet well access hatch.

2.4 CONCRETE AND MASONRY STRUCTURES

2.4.1 Concrete (used where not exposed to sewer gases) shall conform to Mississippi Department of Transportation Standard Specification, Class B.

2.4.2 Reinforcing steel shall be grade 40 or grade 60 billet steel conforming to ASTM A-615.

2.4.3 Steel wire fabric shall conform to the requirements of the Standard Specifications for Welded Steel Wire Fabric for Concrete Reinforcement, AASHO Designation: M-55.

2.4.4 Curing materials shall conform to the requirements set out in the Standard Specifications for Liquid Membrane Forming Compounds for Curing Concrete, AASHO Designation: M-148, Type 2 (White Pigmented).

2.4.5 Expansion joint material shall conform to Standard Specifications for Preformed Expansion Joint Fillers for Concrete (non-extruding and resilient types), AASHO Designation M-213.

2.4.6 Concrete Masonry Units (CMU) shall conform to ASTM C-90, Grade N, Type I, shall be hollow, 8" X 16" blocks.

2.4.7 Mortar shall be one (1) part Portland Cement, three (3) parts Mortar Sand, Hydrated Lime in proportion of one-tenth (1/10) part of volume of the cement and sufficient water to provide consistency so that it can be easily handled and spread with a trowel.

2.4.8 Valve vault cover shall be as specified above for access hatches.

2.5 SEWAGE PUMPS AND MOTORS

2.5.1 A minimum of two (2) pumping units will be required. Each pump and motor unit shall be of the fully submersible type, capable of discharging raw, unscreened sewage at the rate, head conditions, maximum pump speed, motor horsepower as shown on the schedules in the Drawings. Motors shall operate on 3 phase, 60 hertz, 240 volt A.C. current, unless otherwise designated in the Drawings.

2.5.2 Each unit shall be equipped with a single hypalon jacketed type SPC electric cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards, and shall contain conductors for the power leads and all control functions.

2.5.3 The pump impeller shall be cast iron, dynamically balanced, and shall easily pass a 3 inch diameter solid sphere. The impeller shall be keyed to the motor shaft and secured by a bolt.

2.5.4 All internal case clearances shall equal the discharge pipe diameter so that any object which can enter the pump and pass through the discharge can pass through the pump without clogging.

2.5.5 Each pump shall be of the centerline flanged discharge type and shall be supplied with a mating cast iron discharge elbow and base, which shall be permanently installed in the wet well along with the discharge piping. The pump shall be simply and automatically connected to the discharge elbow when lowered into place without need for personnel to enter the wet well. Sealing of the pump to the discharge elbow shall be accomplished by a simple linear downward motion of the pump resulting in a tight metal-to-metal connection without reliance of diaphragms, O-rings, or other sealing devices. The pump shall be positively guided into position by two (2) schedule 40 stainless steel guide rails (minimum 1 ¼" diameter), extending from the pump base to the access hatch frame.

2.5.6 Major pump components shall be of gray cast iron, Class 30, without visible irregularities. All exposed hardware shall be of type 304 or 316 stainless steel or brass. All surfaces in contact with wastewater shall be coated with an approved wastewater resistant coating. Watertight seals between pump sections shall be made with nitrile rubber O-rings between machined and fitted surfaces.

2.5.7 Each pumping unit shall include a large stainless steel pull-up lifting ball with a fixed connection to the motor housing and designed with adequate strength to lift the entire pumping unit.

2.5.8 The entire pump assembly shall be capable of continuous satisfactory operation submerged to a depth of 65 feet.

2.5.9 Pumping units which utilize and depend on recirculation of the pumped media for cooling purposes or provide connections for external cooling water are not acceptable.

2.5.10 Each pump shall be provided with a tandem mechanical shaft seal system, each of which shall be independently capable of sealing the pumped liquid from the stator housing. The upper seal shall consist of a stationary tungsten carbon ring and a driven carbon ring. The lower seal shall consist of two (2) tungsten carbon rings. Each pump shall contain a detecting probe which shall activate its respective "moisture detect" pilot light on the control panel.

2.5.11 The pump motor shall be a squirrel-cage, induction, shell type design, without brushes or other arc-producing mechanisms, and shall be designed for submersible service in water or raw sewage. The unit shall be listed with Underwriters Laboratories for use in Class I, Group D,

Division I locations (explosion proof). All electric parts shall be housed in an air-filled, watertight enclosure, separated from the outside with two (2) "O" ring seals and rabbet joints with a large overlap. One seal shall be inside an oil chamber, and one outside.

2.5.12 Two internal moisture sensing probes shall detect any leakage of a conductive liquid past the outer seal, to provide a warning of seal failure. Cable leads shall be sealed with epoxy.

2.5.13 The motor shaft and all external hardware including the motor nameplate shall be of stainless steel. Motor bearings shall be pre-lubricated at the factory for a long maintenance-free service life. Bearings shall be designed to resist high thrust loads.

2.5.14 Motor windings shall employ a Class B insulation with Class F materials. Automatically resetting thermal overloads shall be installed in adjacent phases of the motor winding for protection against overheating.

2.5.15 The pump manufacturer shall warrant to the Owner the pumping units against defects in workmanship and material for a period of five years or 10,000 hours under normal municipal use.

2.5.16 The pump manufacturer or supplier must have qualified field service representatives readily available for hire by Contractor or the Owner for consultation and/or repair services. Replacement parts and components for the supplied pumps shall be available from manufacturer's stock, ready for immediate shipment upon order.

2.5.17 Sewage pumps shall be as manufactured by WEMCO, ESSCO, or approved equivalent, and shall meet each of the specified performance requirements stated in the Drawings.

2.5.18 The actual pumping units to be furnished shall each be tested prior to shipment to the job site. Each pump shall be tested at a facility provided by the pump manufacturer in accordance with the standards of the Hydraulic Institute. Flow, head, motor current draw, and input KW shall be measured and recorded for operating conditions throughout the head/capacity range for the pump, including at "Shutoff", design flow with one pump operating, and minimum ("worst case") TDH (see system head curves tabulated in Drawings). Certified test reports shall be furnished with each pump. The Owner and/or Engineer reserve the right to witness the pump tests and/or arrange for the services of an independent testing laboratory to witness the pump tests at the pump manufacturer's facility.

2.5.19 After field installation, the Contractor shall perform flow testing to verify that each pump performs according to its certified curve. The Contractor shall furnish all equipment and materials required for the flow test.

2.5.20 Full operation and maintenance manuals and parts lists shall be provided in triplicate.

2.6 STATION PIPING AND VALVES

2.6.1 Ductile iron pipe shall conform to ANSI A21.51 (AWWA C-151) thickness Class 50, cement mortar lined per ANSI A21.4 (AWWA C-104).

2.6.2 Ductile fittings shall conform to ANSI A21.10 (AWWA C-110), cement mortar lined per ANSI A21.4 (AWWA C-104).

2.6.3 Gaskets for ductile iron pipe shall conform to material requirements of ANSI A-21.11 mechanical joint gaskets, suitable for water working pressures of up to 350 p.s.i.

2.6.4 Gate valves shall be of the resilient seat type, conforming to AWWA C-509, epoxy coated inside and outside to AWWA C-550. End connections shall be Class 125 flange. Valves shall be rated for zero leakage to 200 p.s.i., and 400 p.s.i. hydrostatic test pressure. Valves shall be of the non-rising stem design, employing two O-ring stem seals. Gates shall be encapsulated in rubber where exposed to line velocity and shall be field replaceable. Hand wheels shall be provided.

2.6.5 Check valves shall be "Full-Flow", bronze flapper design utilizing outside lever and weight or spring, conforming to AWWA C-508. Check valves will have the ability to mount lever on either side. Check valves shall be positioned in the valve vault such that the flapper shaft may be removed without removing the check valve itself.

2.6.6 Isolation gate valves, not located in the valve vault shall have a valve box.

2.6.7 Plug Valves shall be of the tight closing, resilient faced, non-lubricating variety and shall be of eccentric design such that the valves pressure member (plug) rises off the body seat contact area immediately upon shaft rotation during the opening movement. Valves shall be drop-tight at the rated pressure (175 psi through 12", 150 psi 14" and above) and shall be satisfactory for applications involving throttling service as well as frequent or infrequent on-off service. The valve closing member should rotate approximately 90 degrees from the full-open to full-close position and vice-versa. The valve body shall be constructed of cast iron (semi-steel) conforming to ASTM A126, Class B. Body ends shall be flanged with dimensions, facing, and drilling in full conformance with ANSI B 16.1, Class 125, this including flange thickness. Mechanical Joint to meet the requirements of AWWA C111/ANSI A21.11. Eccentric Plug Valves shall have a rectangular shaped port. Port areas for 3" through 20" valves shall be a minimum 80% of full pipe area. Valve seat surface shall be welded-in overlay, cylindrically shaped of not less than 90% pure nickel. Seat area

shall be raised, with raised area completely covered with weld to insure proper seat contact. The machined seat area shall be a minimum of .125" thick and .500" wide. The valve plug shall be constructed of cast iron (semi-steel) conforming to ASTM A126, Class B. The plug shall have a cylindrical seating surface that is offset from the center of the plug shafts. The plug shafts shall be integral. The entire plug shall be 100% encapsulated with Buna-N rubber in all valve sizes. The rubber compound shall be approximately 70 (Shore A) durometer hardness. The rubber to metal bond must withstand 75 lbs. pull under test procedure ASTM D-429-73 Method B.

2.6.8 Pressure gauges shall measure from 0 - 60 P.S.I., and also in corresponding feet of water. Pressure gauges shall be oil filled.

2.6.9 All hardware in the wet well and valve vault shall be grade 316 stainless steel unless specifically stated otherwise.

2.6.10 All stations will have emergency bypass piping installed. A Valve on the force main and bypass line will be installed and the bypass connection will be located above grade sealed with a blind flange.

2.7 PUMP CONTROL SYSTEM

2.7.1 An automatic Pump Control System shall be furnished to automatically operate the sewage pumps in accordance with variation in the level of the wet well. The Control System shall employ either four (4) float switches, or a system with an electronic transducer, one high level float switch, and one off float switch, specified as follows:

2.7.2 Float Switch System (Less Than 250 GPM or 15 hp Pumps)

2.7.2.1 The Control System shall employ four (4) float switches and a pump controller to detect level control points in the wet well and operate the pump motor starters. No pump controls using mechanical linkage, cables, tapes, etc., between the float and control or using sliding floats, shall be considered.

2.7.2.2 Float switches shall be of Type 316 stainless steel, 5-½ inch diameter. Cable shall be forty (40) feet in length, Type SO with Nitrile PVC jacket, containing three (3) #14 AWG fine-stranded conductors for heavy flexing and underwater service. Floats shall contain a sealed mercury switch rated for 20 amps at 115 volts. Float switches shall be furnished complete with stainless steel clamp tube, bracket and bolts to clamp to vertical one (1) inch aluminum pipe, which is to be furnished and installed in wet well as detailed. Consolidated Model 9G float switch, Anchor Scientific Roto-Float-SS Type P, or an approved equal.

2.7.2.3 Floats will detect off, lead pump, lag pump and high level conditions. The high level float will work independently of all other floats and, if in the up position, the alarm light will flash and SCADA will send a high level alarm, and turn one pump on.

2.7.2.4 The aluminum pipe with the float switches installed will be suspended vertically from a hook in the wet well lid. It will be suspended from a hook with ½" stainless steel cable to permit extraction of the pole and float switches.

2.7.3 Electronic Transducer System (For 250 GPM or 15 hp Pumps or Greater)

2.7.3.1 The Control System shall employ an electronic transducer to monitor the liquid level, one (1) high level float switch which shall activate the high level alarm and turn on one (1) pump, and one (1) off level float switch which shall turn all pumps off.

2.7.3.2 Submersible pressure/level transducer (4 to 20 milliamp) shall be contained within a rugged stainless steel housing and shall incorporate features, to protect the solid state sensor from viscous liquids and slurries, including raw sewage. Range shall be zero to 35 feet (0-15 psi). The excitation voltage and analog signal output shall be compatible with the digital meter/controller to be specified hereinafter. The operating temperature shall be from -40°F to 176°F. Sensor shall be furnished with polyethylene shielded cable, 50 feet in length. Transducer and cable shall be secured with stainless steel hook.

2.7.4 A pump controller/sequencer module shall use the signals generated from either the Float Switch System or the Electronic Transducer System and shall incorporate the following features:

2.7.4.1 Level meter/controller shall be an electronic solid state proportional device which accepts input from the previously specified submersible pressure/level transducer, conditions the signal, displays the level reading digitally, in feet, and performs discrete on/off contact closures at six (6) or more field-adjustable set-points. The setting of each set-point shall be able to be displayed on the digital readout at any time. A means shall be provided to manually ramp the meter/controller up and down through its entire range, to test the operation of the system.

2.7.4.2 A pump controller/sequencer module shall use the signals generated from either the Float Switch System or the Electronic Transducer System and shall incorporate the following features:

2.7.4.3 Manual-Off-Automatic selector switch, green running pilot light, red failure pilot light, and red seal failure pilot light for each pump on control panel.

2.7.4.4 A PUMP NO. 1 LEAD – ALTERNATE - PUMP NO. 2 LEAD sequence selector switch to select either pump as lead pump or select that the pumps alternate as lead pump on each call for cycle.

2.7.4.5 A field adjustable failure time delay for each pump. Controls to start the lag pump at the lead pump start level if the lead pump fails or if the lead pump selector switch is placed in the off position. If a pump fails, the remaining functional pump shall remain the lead pump on future cycles. The failure pump shall only be called to operate at the lag pump operating level. Normal pump alternation shall resume when failure condition is corrected and pump has been reset.

2.7.4.6 Soft stop feature to require the pumps to stop three (3) seconds apart during the condition that both pumps are running when signaled to stop to prevent water hammer. Soft start feature to require the pumps to start three (3) seconds apart during conditions that the lead and lag pumps are called for simultaneously.

2.7.4.7 Individual field adjustable time controls to delay starting each pump in the automatic mode after power failure or during initial startup.

2.7.4.8 Pump failure, pump seal failure and high water alarm red pilot lights shall flash when activated.

2.7.4.9 A vandal resistant common exterior alarm light with red Lexan lens shall be furnished and mounted on a suitable support to make it visible above the fence. It shall burn dimly during normal conditions to indicate power on the lamp good, and shall flash brightly during high water level, pump failure, or seal failure. An additional normally open common alarm output contact shall be energized by these alarm conditions. The light will NOT be mounted to the top of the electrical panel box.

2.7.4.10 Individual pump-run-time meters with a reading accuracy of 1/100 hour shall be provided for each pump.

2.7.4.11 Lightning arrestors and protection will be properly installed in all electrical control systems. Pump Station site will be tested and proper grounding methods utilized.

2.7.4.12 A power monitor with eight (8) pin base will be installed in all electrical control panel enclosures. For 240 volt systems, a Time Mark 258B or equivalent will be installed, for 480 volt systems, a Motor Saver 102A or equivalent will be installed.

2.7.4.13 Provide properly sized (per NEMA standards) circuit breaker combination starter with NEMA class ten (10) ambient compensated overload protection for each pump.

2.7.4.14 Circuit breakers will be of the line & load type with tabs/lugs for using lockout/tagout procedures. Starters will be of a type that have replaceable components such as contactors, coil, heaters, etc.

2.8 CONTROLLER ENCLOSURE

2.8.1 The main controller enclosure shall be generously oversized (not less than 30"W x 36" H x 12" D) to accommodate the system phase monitor, pump circuit breaker combination starters, control components (except for pressure transducer and float switch), GFI convenience receptacle, panel heater with thermostat, and related components. Lighting arrestors shall be provided to protect the pump control components. Additional space shall be provided for SCADA units or other future accessories.

2.8.2 The enclosure shall be sturdily constructed of stainless steel, rated, NEMA 4X, with a driphood. A single lockable handle which simultaneously operates three (3) latches located at top, middle, and bottom of door (Three Point Latch) shall be provided. No penetrations through the top of the enclosure will be permitted.

2.8.3 All selector switches, pilot lights, hours meters, Dallas key reader and other controls shall be mounted on an interior anodized aluminum or stainless steel deadfront panel with a continuous aluminum or stainless steel hinge. Circuit breakers shall be operable through the deadfront panel.

2.8.4 An automatic fluorescent panel light and thermostatically controlled electric panel heater shall be installed within each enclosure.

2.8.5 A 110 volt GFI duplex receptacle shall be provided inside the control panel and mounted through the interior dead front panel.

***Note to Designer: Choose either Automatic or Real-Time System depending on floats or transducer. Specify only one.**

2.9 *AUTOMATIC ALARM SYSTEM (FOR USE WITH PUMP STATIONS USING FLOAT SWITCHES)

2.9.1 The equipment shall be MISSION Communications Model 110 RTU. Contractor's bid price shall include five (5) years of prepaid monitoring service, with no option for additional costs to be paid by Owner during this five (5) year period.

2.9.2 Full operation and maintenance manuals and parts lists shall be provided in triplicate.

2.9.3 M-110 unit will report the following:

a. Individual Pump Runtime
b. Cumulative Pump Runtime
c. High Level Alarm
d. Pump Failure Alarm
e. AC Power Fault Alarm
f. Communications Failure Alarm

2.9 *REAL-TIME ALARM SYSTEM (FOR USE WITH PUMP STATIONS USING PRESSURE TRANSDUCERS)

2.9.1 The equipment shall be MISSION Communications Model 800 RTU. Contractor's bid price shall include five (5) years of prepaid monitoring service, with no option for additional costs to be paid by Owner during this five (5) year period.

2.9.2 M-800 unit will report the following:

a. Individual Pump Runtime
b. Cumulative Pump Runtime
c. High Level Alarm
d. Pump Failure Alarm
e. AC Power Fault Alarm
f. Communications Failure Alarm

2.9.3 The M-800 will report in real time the status of pumps, communications, alarms, wet well level.

2.9.4 Full operation and maintenance manuals and parts lists shall be provided in triplicate.

2.10 MANUAL TRANSFER SWITCH. For stations with pumps 10 HP or greater, a three (3) position transfer switch that allows Off, Auxiliary, and On positions. On smaller less than 10 HP, the switch can be a two (2) position, On/Off. Switch will be mounted between power meter and control panel and will completely isolate electrical power to control panel when in any position other than On. Switch will be mounted in a NEMA 4X stainless steel enclosure.

2.11 ELECTRICAL WIRING

2.11.1 All electrical devices and wiring shall conform to applicable National, State, and Local electrical codes. All equipment shall be new and shall bear the inspection label of the Underwriter's Laboratories, Inc.

2.11.2 Primary power shall be either 240 or 480 volts, 3-Phase, as designated in the drawings, with sufficient ampacity to power all electrical equipment without objectionable voltage drop.

2.11.3 All wiring shall be within rigid PVC conduit of adequate size to freely receive the wiring without binding. Conduit in concrete slabs or underground may be schedule 40 PVC (equipment ground conductor required).

2.11.4 Separate conduit will be used for the motor leads and float switch/transducer leads. Motor lead conduit will be a minimum of 2.0" diameter, float switch/transducer conduit will be minimum of 2.0" diameter.

2.11.5 Each conduit will have a seal off between the control panel and wet well. All electrical connections will terminate in the control panel. Junction boxes are not allowed.

2.11.6 All conductors shall be copper with 600 volt, THW insulation or better. Minimum conductor size shall be #12 AWG for lighting and power circuits and #14 AWG for control wiring. All motor leads, float switch leads and transducer leads will terminate in the control panel.

2.11.7 All wiring device cover plates shall be stainless steel or PVC and weatherproof.

2.11.8 Outside security lights shall be 50 watt, 110 volt high pressure sodium fixtures designated for surface mounting, complete with photo-cell. The outside security light will have a separate circuit breaker located in the electrical panel box and will be accessible through the deadfront panel.

2.11.9 Service pole shall be Southern Yellow Pine, 25 feet minimum length, Class 5, treated with Chromated Copper Arsenate (CCA) to not less than 0.60 pounds per cubic foot by ASSAY, with penetration not less than four (4) inches. Should service line to the pole span more than fifty (50) feet, a guy wire will be applied to the service pole.

2.12 SITEWORK

2.12.1 All pump stations will have a two (2) inch water service terminating within twenty (20) feet of the wet pit. The stand pipe shall be a flush valve type stand pipe. The water service will terminate with a two (2) inch cam lock type fitting and a ¾" hose bib.

2.12.2 Water service tubing shall be polybutylene plastic conforming to ASTM 2666, or polyethylene plastic conforming to ASTM 2737, NSF approved, dimensions to fit standard CTS fittings, SDR 9, 250 psi.

2.12.3 Crushed limestone for use as driveway material and surface at the pump station site, for a minimum distance of ten (10) feet from the pump station wet well and valve vault structures (for inside the fenced area, if provided) as detailed in the drawings. Crushed limestone shall be dense-graded crushed domestic limestone, plant-mixed to conform to Size No. 610 or 825A, MDOT Specifications. A geotextile fabric shall be place under all limestone surfaces. The geotextile fabric shall be 600X as manufactured by Mirifi or an approved equivalent.

2.13 WOOD FENCE

2.13.1 Wood boards shall be No. 2 grade, ¾" x 6" dog eared Western Red Cedar fencing. Wood rails shall be No. 2 grade S4S Southern Pine pressure treated with waterborne salts in accordance with American Wood Preserves institute Standard C2 and bearing their quality mark LP2. Dry wood to ten (10) percent of less moisture content after treatment. Furnish treating material for treating cut ends.

2.13.2 Wood posts shall be 4" x 4" x 8' osmose treated timbers. Gate shall be two piece, each Section 6" wide on 2 x 4 frame, cross braced with 2 x 4's. Nails shall be #6 galvanized ring shank.

2.13.3 Bolts shall be ¼ inch galvanized A307 with washer and nut.

2.13.4 Hardware shall be black wrought iron. Hinges shall be eight (8) inch "T" hinge to permit 180 degrees opening of gate. Latch shall be heavy duty hasp latch, capable of receiving of number 2 padlock. Concrete shall be approved ready mix source, 3,000 psi minimum.

2.14 CHAIN LINK FENCE. Chain link fence will be minimum of six (6) feet high with three (3) strands of barbed wire or razor wire. All posts and framing shall conform to schedule 20 galvanized steel. Steel wire shall be zinc coated fabric (galvanized after weaving) #9 gauge, 2" mesh required. Concrete shall be MDOT Class "B".

3.0 CONSTRUCTION REQUIREMENTS

3.1 EXCAVATION - GENERAL

3.1.1 Excavation shall include the clearing of the site of the work, the loosening, loading, removing, transporting and disposing of all materials, wet or dry, above or below ground necessary to be removed for all construction included in this contract to the lines, grades and locations shown on the Drawings. Excavation shall be incidental and included in the cost of other items.

3.1.2 No burying or burning of trees, stumps, roots or other debris will be allowed.

3.1.3 Mechanical excavation shall be stopped above the foundation base elevation so that the concrete foundation may be constructed to a firm, undisturbed native earth bed.

3.1.4 The Contractor shall, at his own expense furnish and install all temporary sheeting, shoring, timbering and bracing required to maintain the excavation in a condition to furnish safe working conditions and to permit the safe and efficient installation of all items of contract work. The Contractor shall further, at his own expense, shore up or otherwise protect all fences, buildings, walls, walks, curbs, or other property adjacent to any excavation which might be disturbed during the progress of the work.

3.1.5 Temporary supports must be removed by the Contractor at his own expense after or concurrently with the completion of the permanent facility.

3.1.6 The Contractor shall do all ditching, pumping, well pointing and bailing, build all drains, and do all other work necessary to keep the excavation clear of ground water, sewage or storm water during the progress of the work and until the finished work is safe from injury. Where the excavation is wet sand, and suitable construction conditions cannot be obtained by other methods, the Contractor shall install and operate, at his own expense, a pumping system connected with well points, so as to drain the same effectually. All well point holes shall be backfilled with sand after removal. No masonry or pipe shall be laid in water, and water shall not be allowed to rise over masonry until concrete or masonry has set at least 48 hours. All water pumped or drained from the work shall be disposed of in a manner that will not damage adjacent property or other work under construction. Necessary precautions shall be taken to protect all construction against flooding. This work shall be incidental and included in the cost of other work.

3.1.7 Whenever the excavation is carried beyond the lines and grades shown on the Drawings, the Contractor shall, at this own expense, refill all such excavated space with such material and in such manner as may be directed by Engineer.

3.1.8 Unsuitable and surplus excavated material not incorporated in the work shall be disposed of by the Contractor at his own expense.

3.1.9 Contractor shall provide Engineer and Owner with proposed location for disposal of materials and adequate certification that proves the disposal site is permitted to receive the material for disposal. Contractor shall also provide Engineer and Owner with adequate proof that the materials were delivered to the approved site prior to payment.

3.1.10 In the event that any existing gas pipe, water pipes, conduits, sewers, tile drains or poles are blocked or interfered with by the excavation required on this project, the Contractor shall maintain them in continuous operation. In case of unavoidable or accidental damage, notify utility owner. Water and sewer lines must be repaired by contractor.

3.2 INSTALLATION OF WET PIT

3.2.1 Reinforcement shall conform accurately to the dimensions and details indicated on the Drawings. Before being placed in any concrete work, it shall be thoroughly cleaned of all rust, mill scale, mortar, oil, dirt or coating of any character which would be likely to destroy, reduce or impair its proper bonding with the concrete.

3.2.2 Concrete shall conform accurately to the dimensions and details indicated on the Drawings. Concrete shall not be permitted to fall more than 6 feet without the use of pipes or tremmies at least 6 inches in diameter. Concrete shall be thoroughly consolidated in a manner that will encase the reinforcement and inserts, fill the forms, and produce a surface of even texture free of rock pockets and excessive voids.

3.2.3 Install wet pit (concrete pipe), wet pit top, valve vault, equipment, piping and related appurtenances in accordance with the details in the Drawings and as specified herein.

3.2.4 All openings cut into the walls of the wet pit liner for piping and conduit shall be carefully grouted and sealed so that there is no visible evidence of infiltration. Provide a rubber water stop ring at all points where PVC pipes penetrate the wet well wall.

3.3 MECHANICAL

3.3.1 Pumps, piping, and fittings shall be fitted, assembled, and supported in a manner to avoid strain upon the components.

3.3.2 Flanged connections shall be made up with full-sized bolts, without resorting to prying to achieve proper alignment.

3.3.3 Installation of pumps and auxiliary equipment shall be as recommended by the pump manufacturer.

3.4 ELECTRICAL

3.4.1 All electrical installation shall fully conform with all requirements of the National Electrical Safety Code, the National Electrical Code and all other applicable codes, as well as the requirements specified herein.

3.4.2 Run exposed conduit parallel or perpendicular to supporting structure. Support at intervals of five feet minimum. Underground installation shall be buried with a minimum cover of 12".

3.4.3 No splices will be permitted in any conductors except within junction boxes.

3.4.4 Slack loops of at least 18" in length shall be left in each conductor at each splice. Slack loops of not less than 6" shall also be provided in each conductor within the pump controller enclosure.

3.4.5 Flexible electrical cables within the wetwell shall be supported by a suitable strain relief device to allow disconnection from outside the wetwell. The pump power cable shall conform to the requirements of the Mine Safety and Health Administration for trailing cables. Ground fault interruption protection shall be used.

3.4.6 Paint all galvanized steel conduit in contact with earth with approved asphaltic paint.

3.5 CONCRETE AND MASONRY

3.5.1 Forms shall be of wood or metal, straight, free from warp, of sufficient strength to resist the pressure of the concrete without springing, and shall be cleaned thoroughly and oiled before concrete is placed against them. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

3.5.2 Reinforcement shall be placed in exact positions shown on the plans and firmly held during the placing and setting of concrete. Metal devices in contact with exterior surface of the structure shall be galvanized. The use of gravel, pieces of broken stone or brick, metal pipe and wooden blocks as spacers will not be permitted.

3.5.3 Surfaces shall receive a broom finish. After the final finish, but before the concrete has taken its initial set, all edges shall be worked with an approved tool.

3.5.4 Cure with white pigmented liquid membrane, conforming to ASTM C-309. Spray uniformly at a rate of one gallon to not more than 150 square feet by mechanical sprayer immediately after finishing operation is completed.

3.5.5 Mortar not used within forty-five (45) minutes after water has been added will be wasted.

3.6 LIMESTONE. Crushed limestone mixture for use at the pump station site in the locations as indicated in the Drawings and as specified herein, shall be placed upon a prepared subbase and compacted to 95% Standard Proctor Density to a uniform thickness of six (6) inches. The surface shall be graded and shaped to drain.

3.7 FENCE

3.7.1 Installation of fence shall be by skilled and experienced workmen in accordance with the details in the Drawings.

3.7.2 All fencing shall be installed plumb. The top of the fence shall be level throughout. All items to be set in ground shall be set in concrete.

3.8 GENERAL

3.8.1 All workmanship and materials throughout shall be of the highest quality.

3.8.2 Upon completion of work at site, remove excess excavation and restore disturbed areas in such a manner as to insure positive drainage. Seed all disturbed areas and maintain to insure living growth of vegetation.

3.8.3 Contractor shall guarantee all materials, equipment, controls and structures for a period of one year against defects in materials and workmanship.

3.8.4 Operation and maintenance manuals shall be provided in triplicate, for pumps, motors, controls, and valves.

4.0 METHOD OF MEASUREMENT

4.1 Pump Stations shall be measured for payment as one lump sum for complete sewage pump station in place, including all structures, pumps, electrical controls, valves, piping, fencing, site work, and related work as shown in the Drawings, and as specified herein. Partial payments will be allowed, based upon Engineer's estimation of the value of work completed.

5.0 PAYMENT

5.1 Payment shall be made under PAY ITEM NO.

02732-A Sewage Pump Station and Appurtenances

$ _____ per lump sum

02733 ..... PRESSURE SEWER MAIN & APPURTENANCES

1.0 SCOPE OF WORK

1.1 This work shall consist of all labor, materials, equipment, tools and services required to furnish and install sewage force mains, fittings, valves, thrust blocks and restrained joints at sites and locations as designated in these specifications and in reasonably close conformity with the lines and grades specified in the Drawings.

1.2 Work in this section shall be in accordance with applicable State requirements and OSHA Safety and Health Standards for Construction.

1.3 SPECIFIED ELSEWHERE. Precast Sewage Pump Station - Section 02732
Grinder Pump Stations – Section 02734
Air Valves & Manholes for Pressure Sewer Mains - Section 02735

2.0 MATERIALS

2.1 POLYVINYL CHLORIDE (PVC) WATER PIPE. Polyvinyl Chloride (PVC) Pipe shall conform to AWWA C-900 or AWWA C-905, Class 150, DR 18. Pipe shall be made to cast iron O.D.'s. Each length of pipe shall be stamped with approval of National Sanitation Foundation and Underwriters Laboratories, Inc. for transporting potable water. Pipe couplings or joints shall be an integral part of the pipe barrel, consisting of an expanded bell with a groove to retain a rubber sealing ring conforming to the requirements of AWWA C-111. Pipe shall be furnished in standard lengths (minimum 20 feet) with integrally cast bells or couplings using elastomeric gaskets that meet the requirements of ASTM D-1869 and F-477. All necessary adapters for connection to fittings shall be provided.

2.2 DUCTILE IRON PIPE. Where ductile iron pipe is required by the Drawings or where directed by the Engineer, use ductile iron pipe conforming to AWWA C-150, manufactured in accordance to AWWA C-151, Grade 60-42-10 Ductile Iron, thickness Class 52 minimum, rubber ring joint. Pipe interior shall be coated with 40 mils of ceramic epoxy such as Protecto 401, or approved equal. Pipe exterior shall be lined with bituminous outside coating. Ductile iron fittings shall be used with ductile iron pipe.

2.3 GATE VALVES

2.3.1 Gate valves (16" and smaller) shall be of the "resilient seat" type, conforming to AWWA C-509, epoxy coated inside and outside to AWWA C550. End connections shall be standard mechanical joint, complete with restrained glands as specified herein. Valves shall be rated for zero leakage to 200 p.s.i. and 400 p.s.i. hydrostatic test pressure. Valves shall be of the non-rising stem (NRS) design. Gates shall be encapsulated in rubber where exposed to line velocity and shall be field replaceable. Each valve shall have a 2 inch square operating nut and shall open to the left. The entire valve shall be designed and recommended by the manufacturer for application with raw sewage.

2.3.2 Gate valves (18" and larger) shall be of the "resilient seat" type, conforming to AWWA C-509, epoxy coated inside and outside to AWWA C550. End connections shall be standard mechanical joint, complete with restrained glands as specified herein. Valves shall be rated for zero leakage to 200 p.s.i. and 400 p.s.i. hydrostatic test pressure. Valves shall be of the non-rising stem (NRS) design. Gates shall be encapsulated in rubber where exposed to line velocity and shall be field replaceable. Each valve shall have a 2 inch square operating nut and shall open to the left. Valves shall include a gearing mechanism to assist in opening and closing of the valve. The entire valve shall be designed and recommended by the manufacturer for application with raw sewage.

2.3.3 Valve boxes shall be supplied for all buried valves. Valve boxes shall be made of good quality cast iron and shall be of the sectional type. The lower section shall be a minimum of five (5) inches in diameter, enlarged to fit around the bonnet of the valve if a two section box is used, or to fit a circular or oval base section if a three section box is used. The upper section shall be arranged to slide or screw down over the adjoining lower section and shall be provided with cast iron lids or covers. Lids or covers shall be marked "Sewer".

2.4 FITTINGS

2.4.1 Cast Iron Fittings are not allowed.

2.4.2 Ductile Iron conforming with ANSI A-21.10 (AWWA C-110), 350 p.s.i. rated.

2.4.3 Compact Ductile Iron Fittings conforming with ANSI A-21.53 (AWWA C-153), 350 p.s.i. rated.

2.4.4 All fittings shall be cement mortar lined per ANSI A21.4 (AWWA C-104). All fittings shall be of the mechanical joint type.

2.5 JOINT RESTRAINTS

2.5.1 Mechanical Joint Retainer Glands shall be used for all connections of pipe to fittings and shall be made with a suitable restrained joint system, meeting any one of the following specifications:

2.5.2 For Ductile or PVC Pipe, a suitable ductile iron retainer gland, designed and recommended by the gland manufacturer, for the type of pipe used. Gland shall be manufactured entirely of 60-42-10 ductile iron conforming to ASTM A536-80. Glands shall attach to the pipe barrel through a plurality of individually activated gripping surfaces (wedges). EBAA Iron "Megalug" series or equal.

2.5.3 For PVC Pipe, a heavy ductile iron or fused epoxy coated structural steel (ASTM A36) clamp which employs serrations on its inside surface to firmly grip the outside of the PVC pipe barrel. Clamp shall be specifically designed and recommended for use with the size and thickness class of pipe used. All hardware shall be ductile iron. Uni-flange Series 1300 or approved equal.

2.5.4 For Ductile Pipe only, a ductile iron mechanical joint retainer gland employing cupped-end threaded set screws which conform with the pipe manufacturer's guidelines as to number of set screws and torque to be applied to properly restrain the joint to a rating of not less than 250 p.s.i.

2.5.5 Pipe Joint Restraint (applicable only for pipe joints within specified distances from fittings--see schedule in Drawings): Use two glands similar in design and materials to the joint retainer glands previously specified, one immediately behind the joint bell and one on the pipe spigot, connected by two or more ductile iron rods spanning across the pipe joint. For ductile pipe, it is also permissible to use mechanical joint pipe with restrained retainer gland, or special "lock-ring" pipe joints.

2.6 METALLIC MARKING TAPE. Marking tape shall have a three-inch (3") width and the words "SEWER FORCEMAIN" should be printed on it along its entire length. Tape shall be Detect tape as manufactured by Allen Systems, Inc., which is handled by the Mavor Kelly Company in New Orleans or approved equal.

2.7 CONCRETE. Concrete shall conform to requirements for Class B concrete, MDOT Standard Specifications.

2.8 REINFORCEMENT. Reinforcement shall be grade 40 or grade 60 billet steel conforming to ASTM A-615.

3.0 CONSTRUCTION REQUIREMENTS

3.1 EXCAVATION - GENERAL

3.1.1 Excavation shall include the clearing of the work site, the loosening, loading, removing, transporting and disposing of all materials, wet or dry, above or below ground necessary to be removed to construct all pipes included in this contract to the lines, grades and locations shown on the Drawings. Excavation shall be incidental and included in the cost of other items.

3.1.2 The bottom width and depth of the trench shall be within the limits detailed in the plans. Overdigging is not permitted unless authorized by Engineer.

3.1.3 No burying or burning of trees, stumps, roots, or other debris will be allowed.

3.1.4 Where directed by Engineer or shown on drawings, the Contractor shall remove with care all shrubbery, plants, trees, flowers or other vegetation. These items shall be set aside, watered, and kept alive and reset to pre-construction conditions. The Contractor shall furnish and install, to Engineer's satisfaction, replacement plants which die as a result of construction operations.

3.1.5 In areas where force main will be installed in close proximity to trees designated to remain, the major root systems of the trees shall be protected from damage. Where necessary, contractor shall install force main by tunneling underneath the tree roots.

3.1.6 The Contractor shall, at his own expense furnish and install all temporary sheeting, shoring, timbering and bracing required to maintain the excavation in a condition to furnish safe working conditions and to permit the safe and efficient installation of all items of contract work. The Contractor shall further, at his own expense, shore up or otherwise protect all fences, buildings, walls, walks, curbs, or other property adjacent to any excavation which might be disturbed during the progress of the work, except for such facilities which are within the allowable trench limits and are designated for removal and restoration.

3.1.7 Temporary supports must be removed by the Contractor at his own expense after or concurrently with the completion of the permanent facility.

3.1.8 The Contractor shall do all ditching, pumping, well pointing, and bailing, build all drains, and do all other work necessary to keep the excavation clear of ground water, sewage or storm water during the progress of the work, and until the finished work is safe from injury. Where the excavation is wet sand, and suitable construction conditions cannot be obtained by

other methods, the Contractor shall install and operate, at his own expense, a pumping system connected with well points, so as to drain the same effectually. All well point holes shall be backfilled with sand after removal. No masonry or pipe shall be laid in water, and water shall not be allowed to rise over masonry until concrete or masonry has set at least 48 hours. All water pumped or drained from the work shall be disposed of in a manner that will not damage adjacent property or other work under construction. Necessary precautions shall be taken to protect all construction against flooding. This work is incidental and included in the cost of other items.

3.1.9 Whenever the excavation is carried beyond the lines and grades shown on the Drawings, the Contractor shall, at his own expense, refill all such excavated space with such material and in such manner as may be directed by the Engineer.

3.1.10 Unsuitable and surplus excavated material not incorporated in the work shall be disposed of by the Contractor at his own expense.

3.1.11 Contractor shall provide Engineer and Owner with proposed location for disposal of materials and adequate certification that proves the disposal site is permitted to receive the material for disposal. Contractor shall also provide Engineer and Owner with adequate proof that the materials were delivered to the approved site prior to payment.

3.1.12 In the event that any existing gas pipe, water pipes, conduits, sewers, tile drains or poles are blocked or interfered with by the excavation required on this project, the Contractor shall maintain them in continuous operation, and restore them to pre-construction conditions. Gas pipes or electrical power distribution facilities which are disturbed in any way shall be inspected and repaired (if necessary) by the utility owner. This work shall be incidental and included in the cost of other items.

3.1.13 Any culvert pipe joint exposed by excavation shall be wrapped with an approved geotextile filter fabric, three feet in width, before backfilling. This work shall be incidental and included in the cost of other items.

3.2 TRENCH EXCAVATION

3.2.1 The ground shall be excavated in open trenches, of sufficient width and depth to provide ample room within the limits of the excavation, or lines of sheeting and bracing, for the proper construction of the force main.

3.2.2 Mechanical excavation of trenches shall be stopped above the final invert grade elevation so that the pipe may be laid on a firm, undisturbed native earth bed.

3.2.3 The width of the trench at the top of the pipe shall not exceed the outside diameter of the pipe plus two feet. The maximum allowable trench width at the ground surface shall not exceed the outside diameter of the pipe, plus twice the depth of cut. Restoration of disturbed facilities as a pay item will only be allowed within these limits.

3.3 BEDDING

3.3.1 When the native bedding material encountered in the trench bottom consists of a material deemed by the Engineer to be unsuitable for pipe bedding, the Contractor shall overdig to a depth as specified in the Drawings and replace with select foundation material. Should overdigging occur where a suitable native soil exists for bedding purposes, the Contractor shall fill the area of over-excavation with select foundation material, at his own expense.

3.3.2 Trenches shall be dry when the trench bottom is prepared. A continuous trough shall be pared or excavated to receive the bottom quadrant of the pipe barrel. In addition, bell holes shall be excavated so that after placement, only the barrel of the pipe receives bearing pressure from the trench bottom.

3.3.3 Preparation of the trench bottom and placement of the pipe shall be carefully made so that when in final position, the pipe is true to line and grade.

3.4 LAYING PIPE

3.4.1 Pipe shall be protected during handling against impact shocks and free fall. Pipe shall be clean at all times, and no pipe shall be used in the work that does not conform to the appropriate specifications.

3.4.2 Pipe shall be laid accurately, to the line and grades with fittings and valves at the required locations as designated in the Drawings. Preparatory to making pipe joints, all surfaces of the portions of the pipe to be jointed or of the factory-made jointing material shall be clean and dry. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a workmanlike manner as to obtain the degree of water-tightness required.

3.4.3 Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing and for as long a period as required. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to offset conditions that might tend to move the pipe off line and grade.

3.4.4 Wherever necessary to deflect pipe from a straight line, either in the horizontal or vertical plane, the degree of deflection shall not exceed maximum permissible deflections as recommended by pipe manufacturer.

3.4.5 Where force mains cross water mains, adjust force main laying lengths so that sewer joints are equidistant and as far as possible from the water main joints.

3.5 BACKFILLING

3.5.1 All trenches and excavation shall be backfilled as soon as the work has developed sufficient strength to resist backfilling loads and forces and the work shall be prosecuted expeditiously after it has commenced.

3.5.2 No pipe shall be backfilled above the top of the pipe until the pipe elevation, alignment and joints have been checked, inspected and approved by the Engineer.

3.5.3 All pipes as soon as laid shall have the space between the pipe and the bottom and the sides of the trench backfilled to the spring line of the pipe with select bedding material. This material shall be thoroughly compacted by hand or mechanical means.

3.5.4 Backfill shall then proceed with the placement of select bedding material in six (6) inch layers to one (1) foot above the top of the pipe.

3.5.5 Remaining trench shall be backfilled with native excavated soil in 12" lifts.

3.5.6 Where the native excavated soil does not meet the requirement for select bedding material, the Engineer may authorize the replacement for such unsuitable material with select bedding material. All surplus or unsuitable material not used in backfilling shall be disposed of off-site by Contractor.

3.6 COMPACTION OF PIPE TRENCHES

3.6.1 In areas where pipe trenches are not under or immediately adjacent to existing or proposed structures, roads, driving surfaces, or sidewalks, as determined by the Engineer, the backfill material will be compacted to 90% Standard Proctor Density.

3.6.2 In areas where pipe trenches are under or immediately adjacent to existing or proposed structures, roads, driving surfaces, or sidewalks, as determined by the Engineer, the backfill material will be compacted to 95% Standard Proctor Density.

3.6.3 Where the native excavated soil does not meet the requirement for select bedding material, the Engineer may authorize the replacement for such

unsuitable material with select bedding material. All surplus or unsuitable material not used in backfilling shall be disposed of off-site by Contractor

3.7 METALLIC MARKING TAPE FOR PVC PIPE. All force mains and service lines must be installed with metallic tape place directly over and on the center of the facility approximately 12-inch above the pipe for its entire length. Tape must be connected to all facilities or appurtenances. No additional compensation will be allowed for this operation.

3.8 LOCATOR WIRE. All force mains and service lines shall be installed with locator wire place directly on the center of the pipe for its entire length. Wire shall be tied to an appurtenance at the start of a new main and shall be a continuous piece of wire for its entire length. Contractor shall supply splice kits and other necessary accessories in order to ensure a continuous wire. No additional compensation will be allowed for this operation.

3.9 GATE VALVES. Gate valves, with valve boxes, shall be installed on force mains in the locations and as detailed in the Drawings, and in strict accordance with manufacturer's recommendations. Gate valves and boxes shall meet all requirements of Section 02660 of these specifications.

3.10 CONNECTIONS TO EXISTING FACILITIES

3.10.1 Connections to existing facilities and force mains shall conform with the Drawings.

3.10 2 All pump stations shall remain in continuous operation throughout the construction period, except possible brief periods, during which time the necessary new piping connections may possibly be made. Contractor must coordinate these shut-down periods at least 24 hours in advance with the Owner's operating personnel and accurately determine the duration of the possible shut-down for each affected pump station.

3.10.3 All work affecting the operation of existing pump stations, force mains, or other facilities must be scheduled so that interruption of the normal operation of the existing system occurs during a sustained dry weather period, so that overflows or bypasses do not occur at upstream pump stations or systems. The Contractor shall provide, as necessary, temporary pumping equipment, force mains, and/or pumping trucks to maintain continual service. All by-pass pumping around portions of the system will be performed in a manner to insure all sewer is contained within the sanitary sewer system. This work shall be incidental and should be included in cost of other items.

3.11 GENERAL REQUIREMENTS

3.11.1 All connections between pipe and fittings shall be made with an approved restrained joint system. In addition, all pipe joints within a distance which is tabulated in the Drawings from a fitting must also employ an approved restrained joint system. The assembly and installation of each restrained joint system shall be in strict accordance with the manufacturer's printed instructions and in the presence of a representative of the Engineer.

3.11.2 Concrete thrust blocks shall also be installed in addition to any type of joint restraint system. Concrete thrust blocks are to be installed according to the plan dimensions and details, placed between the fittings and undisturbed earth. Thrust blocks are also required at all bends of 11 1/2 degrees or more, unless specifically waived by the Engineer because of unusual conditions at a specific fitting.

3.11.3 For all pipe sizes and types, install only full lengths of pipe adjacent to fittings, except where authorized by Engineer.

3.12 TESTING. Pressure testing shall be conducted on all pipe and fittings by the Contractor at his expense and in the presence of the Engineer or his representative. The test shall be conducted by filling the pipe with water from an approved source under a pressure of not less than 100 p.s.i. as measured at the average elevation of the pipe to be tested. There shall be no visible leakage at any point, and the total amount of leakage shall not exceed 20 gallons per 24 hours per inch diameter per mile as measured over a period of two hours.

3.13 SEPARATION BETWEEN SEWER AND WATER LINES

3.13.1 Horizontal and Vertical Separation

3.13.1.1 Sewer mains (including force mains) shall be laid at least 10 feet horizontally and 18 inches vertically from any existing or proposed water main. The distance shall be measured edge to edge. Sewer lines should always be installed below water lines and the bottom of the water line should be at least 18 inches from the top of the sewer line.

3.13.2 Special Conditions

3.13.2.1 Where local conditions prevent adequate horizontal and vertical separation, the appropriate reviewing agency may allow the sewer line to be laid closer to the water line if supported by adequate data from the design engineer. Each situation will be reviewed on a case by case basis. In this situation, all three of the following conditions must be met:

3.13.2.2 If the 10 foot horizontal separation between water and sewer lines cannot be maintained then the water line should be ductile iron with water joints located at the maximum distance possible from sewer line joints. PVC pipe may be used if it is protected by a steel casing. Also the water and sewer lines must be in separate trenches with adequate space for maintenance. In some cases, special sewer line construction procedures may be required.

3.13.2.3 Where sewer lines cross under water lines, the pipe segments should be centered to provide maximum spacing of joints of both water and sewer lines. A vertical separation of at least 18 inches should be maintained (water over sewer).

3.13.2.4 Where the 10 foot horizontal and 18 inch vertical separation cannot be maintained, condition 3.13.2.2. must be met and the sewer line shall be constructed according to water main standards.

4.0 METHOD OF MEASUREMENT

4.1 Pressure sewer main of the size and type specified, shall be measured by the linear foot of pipe in place and accepted, field measure.

4.2 Force main fittings shall be measured by the ton (2000 pounds) of fittings in place, including restrained glands, bolts, and gaskets computed upon unit weights listed in AWWA C-110. Payment for glands will be based upon standard glands per AWWA C-110, regardless of the actual weight of the glands used.

4.3 Restrained pipe joints will not be measured separately for payment.

4.4 Gate valves and valve boxes shall be measured by the number of each nominal size installed, and accepted, as a complete unit, in place.

5.0 PAYMENT

5.1 Payment will be made under PAY ITEM NO.

02733-A ___" PVC Pressure Sewer Main

$ _____per linear foot

02733-B ___" Ductile Iron Pressure Sewer Main

$ _____per linear foot

02733-C Force Main Fittings

$ _____per ton

02733-D ___" Gate Vale & Box

$ _____per each

SECTION 02734 . . . . . GRINDER PUMP STATIONS

1.0 SCOPE OF WORK

1.1 This work shall consist of providing all materials, equipment, tools, and services for constructing a new grinder pump station. This includes the furnishing, installing, testing of a simplex grinder pump system, complete with a fiberglass wetwell, related controls, operation devices, piping, and related appurtenances in accordance with these specifications and as detailed in the plans.

1.2 GENERAL DESCRIPTION. The Manufacturer shall furnish complete Grinder Pump Station(s), consisting of a grinder pump, a tank, NEMA 6P electrical quick disconnect, pump removal system, discharge piping assembly with shut-off valve, anti-siphon valve, check valve, electrical alarm/disconnect panel, and all necessary internal wiring and controls. All components and materials shall be in accordance with paragraphs 2.01 through 2.12 of this Section. For ease of serviceability, all pump motor/grinder units shall be of like type and horsepower.

1.3 SUBMITTALS. Submit shop drawings, product data, and catalog cut sheets for all materials used in this section prior to ordering any material.

1.4 SHOP DRAWINGS. After receipt of notice to proceed, the Contractor shall furnish a minimum of six (6) sets of shop drawings detailing the equipment to be furnished including dimensional data and materials of construction. The Engineer shall promptly review this data, and return two (2) copies as accepted, or with requested modifications.

1.5 MANUFACTURER. The equipment specified shall be a product of a company with experience in the design and manufacture of grinder pumps for specific use in low pressure sewage systems. The company shall submit detailed installation and user instructions for its product; submit evidence of an established service program including complete parts and service manuals, and be responsible for maintaining a continuing inventory of grinder pump replacement parts. All mechanical and electrical components shall be supplied with the wet well basin as a prefabricated assembly and shall be E-one Series 1000 or equal.

1.6 OPERATING CONDITIONS. The pump(s) must be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create a false apparent head. All pumps shall delivery flow in the following ranges:

0' TDH	15 gpm
138' TDH	9 to 10 gpm

1.7 WARRANTY. The Contractor shall provide a part(s) and labor warranty on each complete station, accessories and control panel for a period of twelve (12) months after notice of Owner's acceptance. Any defects found during the warranty period will be reported to the Contractor by the Owner. The Contractor shall also provide a 12-month warranty on all spare parts, pumps, and panels supplied.

2.0 MATERIALS

2.1 PUMP. The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with mechanical seal. The rotor shall be constructed of stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. Buna-N is not acceptable as a stator material. The material shall be suited for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, good aging properties, and outstanding wear resistance.

2.2 GRINDER. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece stainless steel motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft. The grinder will be of the rotating type with a stamped, stainless steel shredder ring assembly spaced in accurate, close annular alignment with the driven impeller assembly, which shall carry two (2) hardened, 400 series stainless steel cutter bars.

2.2.1 This assembly shall be dynamically balanced and operate without vibration over the entire range of specified operating pressures. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions, including pump starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks, which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:

1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.

2. The grinder inlet shroud shall have a diameter no less than five (5) inches.

3. At maximum flow, the average inlet velocity must not exceed 0.2 feet per second.

4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.

2.2.3 The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper wood, plastic, glass, rubber and the like, to finely divided particles that will pass freely through the passages of the pump and the discharge piping.

2.3 ELECTRIC MOTOR. The motor shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, squirrel cage induction type with a low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor.

2.4 MECHANICAL SEAL. The pump shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.5 WETWELL BASINS

2.5.1 Simplex Basin: Fiberglass Construction. The 24" diameter basin shall consist of a single wall, laminated fiberglass construction. The resin used shall be of a commercial grade suitable for the environment. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin. The inner surface shall have a smooth finish and be free of cracks and crazing. The exterior basin surface shall be relatively smooth with no exposed fiber or sharp projections present.

2.5.1.1 The basin wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified burial depth for each available basin height. All station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth. The basin bottom shall be reinforced with a fiberglass plate extending beyond the basin walls to support concrete anchoring, as required, to prevent flotation.

2.5.1.2 The basin shall be furnished with PVC inlet flange to accept a 4.50" OD DWV (SCH40) pipe. Basin capacities shall be as shown on the contract drawings.

2.5.1.3 The simplex basin shall include a lockable cover assembly providing low profile mounting and watertight capability with field added modifications.

2.5.1.4 Access way design and construction shall facilitate field adjustment of station height in increments of 4" or less without the use of any adhesives or sealants requiring cure time before installation can be completed.

2.5.2 Duplex Basin: Fiberglass Construction. The 42" diameter basin shall consist of a single wall, laminated fiberglass construction. The resin used shall be of a commercial grade suitable for the environment. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin. The inner surface shall have a smooth finish and be free of cracks and crazing. The exterior basin surface shall be relatively smooth with no exposed fiber or sharp projections present.

2.5.2.1 The basin wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified burial depth for each available basin height. All station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth. The basin bottom shall be reinforced with a fiberglass plate extending beyond the basin walls to support concrete anchoring, as required, to prevent flotation.

2.5.2.2 Duplex basins shall include an aluminum checker plate cover, secured with threaded stainless steel fasteners, providing low profile mounting. This cover shall be a 1/3 - 2/3 split hinged lockable cover for ease of access and pump removal. The cover shall also be vented to prevent sewage gases from accumulating in the basin.

2.6 DISCHARGE HOSE AND DISCONNECT / VALVE. All discharge fittings and piping shall be constructed of 304 Series stainless steel, polypropylene, EPDM, or PVC. The discharge hose assembly shall include a shut-off valve rated for 200 psi WOG and a quick disconnect feature to simplify installation and pump removal. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.

2.7 ELECTRICAL QUICK DISCONNECT. The grinder pump unit shall include a single NEMA 6P electrical quick disconnect (EQD) for all power and control functions. An integral tube shall allow venting of the control compartment to assure proper operation of the pressure switch level system. The grinder pump will be furnished with a length of 6-conductor, 14-gauge, type-SJOW cable, pre-wired and watertight to meet UL requirements.

2.8 ANTI-SIPHON VALVE. The pump discharge shall be equipped with a factory-installed gravity-operated, flapper-type integral anti-siphon valve built into the discharge assembly. Moving parts will be made of 300 series stainless steel and fabric-reinforced synthetic elastomer to ensure

corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at very low pressure. The valve body shall be injection-molded from a glass-filled thermoplastic resin. Holes or ports in the discharge piping are not acceptable anti-siphon devices, due to their tendency to clog from the solids in the slurry being pumped.

2.9 CHECK VALVE

2.9.1 The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve secured to the stainless steel pump discharge elbow. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than six (6) inches of water at maximum rated flow. Working parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back pressure. The valve body shall be injection-molded parts made of glass filled thermoplastic.

2.9.2 Provision by the installing party shall be made for the supply and installation of a separate check valve in the service lateral between the grinder pump station and the sewer main, preferably next to the gate valve.

2.10 CORE UNIT. The Grinder Pump Station shall have an easily removable core assembly consisting of the pump, motor grinder, all motor controls, check valve, anti-siphon valve, EQD and wiring. The watertight integrity of the core unit shall be established by 100 percent factory test at a minimum of 5 PSIG.

2.11 CONTROLS

2.11.1 All necessary controls shall be located in the control cover of the core unit. The control cover will be attached with stainless steel fasteners. The grinder pump will be furnished with a length of six (6) conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements. Non-fouling waste water level detection for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air-bell level sensor connected to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater. High-level sensing will be accomplished in the manner detailed above by a second, independent, air-bell sensor and pressure switch of the same type.

2.11.2 To assure reliable operation of the pressure sensitive switches, each core shall be equipped with a breather assembly, complete with a suitable means to prevent entry of water into the motor compartment.

2.12 ALARM PANEL

2.12.1 Each grinder pump station shall include a NEMA 4X, UL-listed ALARM PANEL suitable for wall mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic to assure corrosion resistance. The enclosure shall include a hinged, lockable cover, pad lock, and secured dead front. The enclosure shall not exceed 11.38"W x 13.5"H x 5.63"D.

2.12.2 For each core, the panel shall contain one (1) 15-amp, double-pole circuit breaker for the power circuit and one (1) 15-amp, single-pole circuit breaker for the alarm circuit. The panel shall contain terminal blocks, integral power bus, push to run feature and a complete alarm circuit.

2.12.3 The Alarm Panel shall include the following features: audio & visual alarm, and push to run switch. The alarm sequence is to be as follows:

1. Simplex Models: The alarm sequence will be as follows:

   a. When liquid level in the sewage wet-well rises above the alarm level, visual and audio alarms will be activated. The contacts on the alarm pressure switch will close. The redundant pump starting system will be energized.
   b. The audio alarm may be silenced by means of the externally mounted, push-to-silence button.
   c. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.

2. Duplex Models: The alarm sequence will be as follows:

   a. When liquid level in the sewage wet-well rises above the alarm level, the contacts on the alarm pressure switch will close. The second, redundant pump starting system will be also energized. Four minutes after contact closure, the visual and audio alarms will be activated.
   b. The audio alarm may be silenced by means of the externally mounted, push-to-silence button.
   c. Visual alarm remains illuminated until the sewage level in the basin drops below the "off" setting of the alarm pressure switch on both pumps.

2.12.4 The visual alarm lamp shall be inside a red fluted lens at least 2 5/8" in

diameter and 1 11/16" in height. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating.

2.12.5 The audio alarm shall be a printed circuit board in conjunction with an 86 dB buzzer with quick mounting terminal strip mounted in the interior of the enclosure. The audio alarm shall be capable of being deactivated by depressing a push-type switch which is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure.

2.12.6 The entire Alarm Panel as manufactured shall be listed by Underwriters Laboratories, Inc.

2.13 SERVICEABILITY. The grinder pump core unit shall be furnished with polypropylene lifting harness connected to the pump body to facilitate easy removal when necessary. All mechanical and electrical connections must provide each disconnect accessibility for core unit removal and installation.

2.14 OSHA CONFINED SPACE. All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station (as per OSHA 1910.146 Permit-required confined spaces). "Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space."

2.15 SAFETY. The Grinder Pump Station shall be free from objectionable noise, odor, or health hazards, in its capability to perform as specified in either individual or low pressure sewer system applications.

2.16 CORROSION PROTECTION. All materials exposed to waste water shall have inherent corrosion protection. Acceptable corrosion protection includes epoxy powder-coated cast iron, fiberglass, stainless steel, polyethylene, nylon and PVC.

3.0 CONSTRUCTION REQUIREMENTS

3.1 FACTORY TEST. Each grinder pump shall be submerged and operated for five (5) minutes (minimum). Included in this procedure will be the testing of all ancillary components such as the anti-siphon valve, check valve, level sensors and each unit's dedicated controls. All factory tests shall incorporate each of the above listed items. Certified test results shall be available upon request showing the operation of each grinder pump at two (2) different points on its curve, with the maximum discharge pressure no less than 60 psi. The Engineer reserves the right to inspect such

testing procedures with representatives of the Owner, at the Grinder Pump Manufacturer's facility.

3.2 INSTALLATION

3.2.1 Excavation and backfill shall be in accordance with Section 02732, Sewage Force Mains. The Contractor shall be responsible for handling ground water to provide a firm dry subgrade for the structure, and shall guard against flotation or other damage resulting from general ground water or flooding. The Grinder Pump Stations shall not be set into the excavation until the installation procedures and excavation have been approved by the Engineer.

3.2.2 All materials shall be inspected upon delivery to ensure there is no damage due to shipping. The tank shall not be dropped, rolled or laid on its side for any reason. Remove any packing material. User instructions MUST be given to the Owner.

3.2.3 Installation of the grinder pump station shall be performed in accordance with the Installation Instruction Manual provided with the grinder pump station. Installation shall require the use of a suitable backfill foundation or concrete pad to provide a firm, level base for the tank. The preferred method of excavation for the tank basins, when applicable, shall be the utilization of an auger type machine.

3.2.4 Anchoring of the tank to prevent buoyancy and tank backfill shall be completed in accordance with the Project Drawings. Installation shall be accomplished so that 1" of the tank extends above the finished grade line. The tank lid shall not be located below grade. The finished grade shall slope away from the unit.

3.2.5 All restoration will be the responsibility of the Contractor. The properties shall be restored to the original condition in all respects.

3.2.6 The electrical enclosure shall be installed and wired to the Grinder Pump Station by the Contractor. An alarm device is required on every installation; there shall be no exceptions. It will be the responsibility of the Contractor and the Engineer to coordinate with the individual property owner(s) to determine the optimum location for the Alarm/Disconnect Panel.

3.2.7 The Contractor shall mount the alarm device in a conspicuous location, as per national and local codes. The Alarm/Disconnect Panel will be connected to the Grinder Pump Station by a length of six (6) conductor 12 gauge TC type cable as shown on the contract drawings. The power and alarm circuits must be on separate power circuits.

3.3 START-UP AND FIELD TESTING

3.3.1 The Manufacturer shall provide the services of qualified factory-trained technician(s) who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct the Owner's personnel in the operation and maintenance of the equipment before the stations are accepted by the Owner. All equipment and materials necessary to perform testing shall be the responsibility of the Owner or Installing Contractor. This will include, as a minimum, a portable generator (if temporary power is required) and water in each basin.

3.3.2 The services of a trained factory-authorized technician shall be provided at a rate of one (1) four (4) day week for each 100 grinder pump stations supplied. Each day shall be ten (10) person hours in duration.

3.3.3 Upon completion of the installation, the authorized factory technicians will perform the following test on each station:

1. Make certain the discharge shut-off valve is fully open. This valve must not be closed when the pump is operating. In some installations, there may be a valve(s) at the street main that must also be open.

2. Turn ON the alarm power circuit.

3. Fill the tank with water to a depth sufficient to verify the high level alarm is operating. Shut off water.

4. Close the pump power circuit breaker. The pump should immediately turn ON. Within one (1) minute the alarm light will turn OFF. Within three (3) minutes the pump will run OFF.

3.3.4 Upon completion of the start-up and testing, the Manufacturer shall submit to the Engineer the start-up authorization form describing the results of the tests performed for each Grinder Pump Station. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed.

3.4 OPERATION AND MAINTENANCE

3.4.1 Spare Core. The Manufacturer will supply 10 spare grinder pump core(s) complete with all operating controls level sensors, check valve, anti-siphon valve, pump/motor unit and grinder.

3.4.2 Manuals. The Manufacturer shall supply five (5) copies of Operation and Maintenance Manuals to the Engineer.

4.0 METHOD OF MEASUREMENT

4.1 Grinder pumping stations shall be measured on a "per each" basis for various basin depths as referenced in the Pay Items. Basin depth shall be measured from the basin invert to the top of the cover.

4.2 Grinder pumping stations shall include all equipment, supplies, labor, and equipment, including the grinder pump(s), the pump basin, disconnect panel, pump quick disconnect system, discharge piping, shut off valve, anti-siphon valve, check valve, alarm system, concrete ballast, foundation material, equipment testing and startup, and all other mechanical components required to produce a complete, fully functioning pump station.

4.3 Also included shall be the excavation and backfilling required to construct the pump station. If the excavated soil is unsuitable for use as backfill, then removing the existing material and supplying select material shall also be included. Site cleanup and final grading in the vicinity of the pump station shall also be included in this pay item.

4.4 Testing and startup by the Contractor and the pump manufacturer's representative shall be included.

4.5 Spare core units shall be measured on a "per each" basis and shall include the pump, motor, grinder assembly, all motor controls, check valve, anti-siphon valve, electrical quick disconnect, and factory manufactured wiring.

4.6 All pay items requiring excavation shall also include cleanup and final grading. Payment for bid items requiring excavation shall not be authorized beyond reimbursement of the cost for properly stored materials and equipment until final grading and cleanup has been completed.

4.7 All electrical work associated with the installation of a grinder pump shall be measured and paid for under Section 16700.

5.0 PAYMENT

5.1 Payment shall be made in accordance with Pay Item No.

02734-A Simplex Grinder Pump Station –
6' Basin Depth

$_____ per each

02734-B Simplex Grinder Pump Station –
8' Basin Depth

$_____ per each

02734-C Simplex Grinder Pump Station –
10' Basin Depth

$_____ per each

02734-D Duplex Grinder Pump Station –
6' Basin Depth

$_____ per each

02734-E Spare Core Units

$_____ per each

02735 ..... AIR RELEASE VALVES FOR PRESSURE SEWER MAINS

1.0 SCOPE OF WORK

1.1 This work shall consist of all labor, materials, equipment, tools and services to furnish and install air release valves of the types and sizes required.

1.2 SPECIFIED ELSEWHERE. Pressure Sewer Main & Appurtenances - Section 02733
Precast Sewage Pump Station Appurtenances - Section 02732
Manholes - Section 02731

2.0 MATERIALS

2.1 COMBINATION AIR VALVES

2.1.1 Combination Air Valves shall be Single Body, Automatic Float Operated Valve. Designed to release accumulated air from pipeline (force main) during system operation and designed to allow large quantities of air to exhaust the pipeline during filing and admit air during draining. Valve must be designed for use with wastewater applications. The Valve Body will be 316 stainless steel. Body will have a conical shape to maintain maximum air gap and a spring loaded float and seal plug connection shall combine to ensure no contact between the sewage and the seal. Valve will have a funnel shaped lower body to ensure sewage will not come in contact with working parts of valve and sewage matter will fall back into the system. The top internal float shall be foamed polypropylene. The bottom internal float and all other internal parts shall be 316 stainless steel. Valve will be supplied with a rolling resilient seal to provide smooth positive opening, closing and leak free sealing over a wide range of pressure differentials. Combination air valves shall be model no. D-020 (or model no. D-025 for limited height locations) as manufactured by ARI or an approved equivalent.

2.1.2 A five (5) year warranty shall be provided for combination air valve assemblies regardless of other project or contract warranties.

2.2 Combination Air Valves two (2) inches and smaller shall be connected to the force main pipe with a double strap ductile or malleable iron saddle, designed and recommended for use with the type of pipe used. Combination air valves larger than two (2) inches shall be connected to

the force main pipe with a flanged connection which will require a tee on the force main pipe.

2.3 Pipe and fittings shall be stainless steel, Schedule 40. Pipe and fittings in contact with the earth or washed gravel fill shall be field coated with approved asphaltic paint.

2.4 Joints shall be sealed with either a pre-formed joint compound or a rubber gasket. Pre-formed joint compound shall meet Federal Specification SS-S00210 (210-A) and ASHTO Specification M-198. Rubber gaskets shall meet ASTM Designation C-443.

3.0 CONSTRUCTION REQUIREMENTS

3.1 Air valves shall be installed at or slightly downstream of each high point in the force main, approximately where indicated in the Drawings.

3.2 If pipeline gradeline changes are directed by the Engineer, additional air valves may be authorized and paid for at the unit prices bid. If gradeline changes are made for Contractor's convenience or due to Contractor's error, additional air valves shall be furnished and installed at resulting new high point locations at Contractor's expense.

3.3 Teflon tape shall be used to lubricate all threaded pipe connections.

3.4 Excavation and backfill for air valve vaults shall conform to the same requirements as apply for force main pipe.

4.0 METHOD OF MEASUREMENT

4.1 Air release valves will be measured as the actual number of valves of each type and size installed.

5.0 PAYMENT

5.1 Payment will be made under PAY ITEM NO.

02735-A ___" Air Release Valve

$ _____per each

02762 ..... INSPECTION OF UNDERGROUND PIPES

1.0 SCOPE OF WORK

1.1 This work shall consist of the cleaning, lamping, and inspection of all gravity sewer mains and drainage culverts constructed under this contract. All underground pipes to be inspected shall be lamped between manholes, junction boxes, and inlets; cleaned; and either video-inspected or visually-inspected, depending on the size of the pipe.

1.2 SPECIFIED ELSEWHERE. Concrete Culvert Pipe – 02722
High Density Polyethylene Pipe – 02723
Gravity Sanitary Sewers – 02730

2.0 MATERIALS AND EQUIPMENT

2.1 Contractor shall provide adequate battery-powered lights and mirrors for use during the lamp inspection.

2.2 Contractor shall use a closed circuit video system to remotely inspect the pipe. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. The television camera shall be capable of 360° rotation to allow for more detailed views of pipe joints and connections. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, video recorder, and other components of the video system shall be capable of producing the picture and quality required to properly evaluate the condition of the pipe being inspected.

3.0 CONSTRUCTION REQUIREMENTS

3.1 CLEANING

3.1.1 Underground pipes shall be cleaned with high pressure water cleaning equipment utilizing a vacuum truck or other suitable method for removing debris from the pipe.

3.1.2 Cleaning shall continue until there is no debris in sewer mains or a maximum of one (1)-inch depth of sand / silt in drainage culverts.

3.1.3 Contractor shall dispose of debris at an approved location and in accordance with all laws regulating such disposal.

3.2 VIDEO INSPECTION

3.2.1 All gravity sewer mains, drainage culverts forty-eight (48) inches in diameter and smaller (round) or seventy-three (73) inches x forty-five (45) inches and smaller (arch) shall be lamped and video inspected. Contractor shall notify the Design Engineer and City Engineer at least forty-eight (48) hours in advance of a scheduled inspection. The Design Engineer and/or the City Engineer or their designees shall be allowed to witness the inspection.

3.2.2 Underground pipes shall be lamped between structures (manholes, inlets, junction boxes, etc.) to verify that they are straight and properly graded without curves or sags.

3.2.3 Contractor shall make a video inspection of the underground pipe and deliver copies of inspection video on a VHS cassette tape to both the Design Engineer and the City Engineer.

3.2.4 If defects of the underground pipe are found, Contractor shall correct the defect at his own expense and then shall clean and video inspect the defected run of pipe as required above. This procedure shall be repeated until the defect is corrected and the pipe segment is accepted.

3.3 VISUAL INSPECTION

3.3.1 Drainage culverts larger than the sizes specified in paragraph 3.2.1 above may be visually inspected by the Design Engineer and/or the City Engineer.

3.4 WARRANTY INSPECTION

3.4.1 No sooner than ten (10) months and no later than eleven (11) months after Substantial Inspection, the Contractor shall clean and video inspect all underground pipes requiring video inspection. This cleaning and video inspection shall be in accordance with paragraph 3.1 and 3.2 above.

3.4.2 If defects of the underground pipe are found, Contractor shall correct the defect at his own expense and then shall clean and video inspect the defective run of pipe as required above. This procedure shall be repeated until the defect is corrected and the Contractor is released from maintenance.

4.0 METHOD OF MEASUREMENT

4.1 There shall be no separate measurement for lamping, cleaning, inspection, or repair of underground pipes, and the cost for this work shall be included in other items bid.

5.0 PAYMENT

5.1 There shall be no separate payment for work under this section.

16600..... STANDBY GENERATOR SYSTEM

1.0 SCOPE OF WORK

1.1 This work shall include furnishing, installation and testing of a standby electric power generation system consisting of: a diesel fueled engine set, generator control system, battery charger, automatic transfer switch, above ground fuel tank with piping, and other accessories as specified.

2.0 EQUIPMENT

2.1 STANDBY GENERATOR SYSTEM

2.1.1 The Contractor shall furnish, install and test a standby electric power system at the sewage pump station, consisting of: diesel fueled engine driven generating set, a generator control system, battery charger, automatic transfer switch, aboveground fuel tank with piping, and other accessories as specified herein. All generators and transfer switches supplied on this contract shall be supplied by a single supplier to ensure compatibility and uniformity of design.

2.1.2 The generating set shall include a diesel fueled engine, a three phase alternator, a battery rack and batteries, an exhaust silencer, and associated wiring and piping.

2.1.3 Each generator set shall have a standby rating of not less than the capacity as indicated in the Drawings when operating at 1800 RPM. The output of the generator shall be three phase alternating current, 480/277 volts WYE, 60 hertz. Additional capacity shall be provided if necessary to satisfactorily operate the sewage pumping units installed.

2.1.4 The manufacturer shall completely assemble and test the unit before shipment. The test shall consist of incremental loading at ¼, ½, ¾, and full load. The test shall also include functional testing of all control and safety devices. Certified copies of factory test reports of this unit shall be furnished prior to shipment.

2.1.5 The engine shall be diesel fueled, two or four-cycle, water-cooled with mounted radiator, fan, and water pump. It shall have not less than 12 cylinders and adequate horsepower to drive the supplied generator at full output without overloading or overheating. A unit-mounted electric solenoid valve, flex fuel line, and secondary fuel pressure regulation valve shall be supplied. Full pressure lubrication shall be supplied by a positive

displacement lube oil pump with cartridge filter. The engine shall have air cleaner, coolant, fuel and air filters with replaceable elements. Engine speed shall be governed by a mechanical governor to maintain alternator frequency within 5 percent from no load to full load alternator output. The engine shall have a battery charging DC alternator with a transistorized voltage regulator. Engine starting and shutdown shall be by a single key switch.

2.1.6 The alternator shall be a four-pole, revolving field design with temperature compensated solid state voltage regulator and brushless rotating rectifier exciter system. No brushes shall be allowed. The stator shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a semi-flexible driving flange to ensure permanent alignment. The insulation system shall be NEMA Class H, with epoxy varnish.

2.1.7 The silencer shall be "critical" type rated to reduce engine exhaust noise by not less than 25 dB(A). Silencer shall be furnished complete with stainless steel flexile connection from the engine, mounting hardware and suitable piping through the building wall. Silencer must be mounted in a safe manner, within the generator room.

2.1.8 Two heavy duty 12 volt marine batteries shall be furnished with the engine-generator set, rack mounted on the engine base.

2.1.9 Line circuit breaker of the size indicated in drawings, 3-poles, 600 volt rated, U.L. Molded Case type, mounted on the generator.

2.1.10 Engine block heater with thermostatic control, per NEMA-99 and NFPA-110, Level 1.

2.1.11 The generator control system shall consist of control and metering units mounted on individual chassis, separately installed in a drip proof metal cabinet of unitized construction. All control and metering units shall be contained within a basic cabinet, which shall be shock-mounted on the generator set, with provisions to relocate panel to either side of generator unit. The generator control system shall contain the following modular control and metering units:

2.1.11.1 Voltmeter, ± 2% accuracy, at full scale 3½ " meter or digital with 4 position switch "OFF"; V1-2, V2-3, V3-1.

2.1.11.2 A.C. Ammeter, with 3 current transformers and 4 position switch: "OFF", A, B, C.

2.1.11.3 Digital Frequency meter, 58-62 cps in 0.5 cps steps.

2.1.11.4 Digital run-time meter.

2.1.11.5 3-position (Auto-Off-Test) selector switch.

2.1.11.6 Voltage regulator to control output voltage to within 1%.

2.1.11.7 Controls to automatically shut down engine upon loss of oil pressure, high engine temperature, or failure to start. An alarm panel shall display the cause of shutdown until manually reset.

2.1.12 A solid state fully automatic float and equalize battery charger shall be supplied and mounted on the generator unit or at a nearby location. 120 VAC input, 10 amp - 12 VDC regulated output. Current limited to prevent damage during engine cranking or electrical short. Volt and amp meters are required.

2.1.13 A metal shroud and an automatic louver shall be provided and installed, to direct air discharged from the radiator out of the building. The size of the louver shall be as required for proper cooling, but not less than the size of the supplied radiator.

2.1.14 A complete diesel fuel supply system shall be furnished, including a 500 gallon minimum above ground steel fuel storage tank, and all necessary piping.

2.1.14.1 Fuel storage tank shall be U.L. labeled, complete with fittings for fill, vent, supply, return, and drain.

2.1.14.2 Supply and return lines shall be high-grade flexible fuel lines, fully protected from external drainage. Fuel lines shall be sized per manufacturer's recommendations, but shall be not less than ¾" size. The supply pipe within the tank shall extend to within 2 inches of the tank bottom and shall include a foot valve.

2.1.15 Service and parts shall be readily available from a commercial source within 150 miles of the project site.

2.1.16 Full operation and maintenance manuals and parts lists shall be provided in triplicate. The manuals must be received by the Engineer prior to any payment on this item.

2.2 AUTOMATIC POWER TRANSFER SWITCH

2.2.1 Switch and associated control system shall automatically start the standby generator and then transfer the electrical load to the generator upon failure of the normal electrical service, and then stop the generator and

transfer back again upon restoration of normal power.

2.2.2 The switch shall be mechanically held and electrically operated by a single solenoid mechanism energized solely from the power source to be switched to. The switch shall be mechanically interlocked to ensure that the normal power source can never by directly connected to the emergency source.

2.2.3 All main contacts (normal and emergency) shall be of silver composition, and shall be designed and rated for continuous duty, repetitive switching, or transfer between two active power sources. Rating shall be as indicated in Drawings, 480 volts, 60 Hz A.C.

2.2.4 All contacts, coils, springs, and control elements shall be conveniently inspected and removed from the front without major disassembly.

2.2.5 A manual operating handle shall be supplied and stored within the enclosure, to permit manual switching if required.

2.2.6 A separate control module shall perform all sensing and timing functions, utilizing a built-in microprocessor circuit with non-volatile eeprom memory. The control module shall connect to the transfer switch by an interconnecting wiring harness with keyed disconnect plug. The control module shall be enclosed for safety and environmental protection.

2.2.7 Automatic transfer to emergency source shall occur when voltage on any phase drops to 80%* of the nominal voltage, and re-transfer when voltage on all phases exceeds 90%* of nominal.

2.2.8 Load transfer to emergency source shall not occur until emergency source voltage exceeds 80%* of nominal and emergency source frequency exceed 80%* of nominal.

2.2.9 Engine start shall not occur until 6* seconds after normal source dropout.

2.2.10 Transfer to emergency source shall not occur until 30* seconds after emergency source pickup.

2.2.11 Transfer back to normal source shall not occur until 2* minutes after normal source pickup, unless a failure of the emergency source has occurred, in which case transfer such occur immediately upon normal source pickup.

2.2.12 Emergency source engine shall run unloaded 10* minutes after transfer to normal source (cool-down) and shall run 10* minutes minimum after engine start.

2.2.13 Provisions shall be provided to prevent or control the effects of motor inrush currents during transfer. This may consist of a 5* second time delay neutral period to hold contactor in neutral position as transfer is made, or an inphase monitor to control time of transfer so that if both sources are available and within 2 Hz of nominal frequency and 70% of nominal voltage, transfer will occur when sources are within 60 electrical degrees of each other.

*These values may vary slightly, to conform with manufacturer's standards and shall be capable of field adjustments.

2.2.14 A remote (front of panel) switch or switches shall be provided to perform the following functions.

- TEST (simulates normal source dropout)
- AUTO (normal position - ready to operate)
- FF (disables auto transfer)

2.2.15 Panel mounted pilot lights shall signal the availability of each power source, as determined by the voltage sensing pickups provided in the controller. Two additional pilot lights shall be installed, to signal which of the two power sources is connected to the load.

2.2.16 Not less than two sets of auxiliary contacts shall be provided on each transfer switch. One of these will be used to signal the automatic alarm system that the station is operating on generator power.

2.2.17 The entire system provided shall comply with Underwriter's Laboratories UL-1008 and NEMA Standard IC10, and any applicable local codes.

2.2.18 All components shall be mounted within a NEMA 3R enclosure. Provisions shall be made to lock the enclosure with a padlock.

3.0 CONSTRUCTION REQUIREMENTS

3.1 EMERGENCY GENERATOR

3.1.2 The installation of the emergency generator and appurtenances shall be in accordance with the manufacturer's written instructions.

3.1.3 Supplier of generator shall provide the services of a factory-trained installer to assist in the connection, startup, and field testing of the generator and transfer switch. He shall also provide not less than four hours field training of operating personnel.

3.1.4 The Contractor shall install or have installed all necessary fuel supply piping, and shall pay all costs associated with this.

3.2 EXAMINATION

3.2.1 Verify that surfaces are ready to receive work and field dimensions are as shown on Drawings.

3.2.2 Verify that required utilities are available in proper location and ready for use.

3.2.3 Beginning of installation means installer accepts existing conditions.

3.3 INSTALLATION

3.3.1 Install in accordance with manufacturer's instructions.

3.3.2 Install fuel oil storage and piping systems in full compliance with EPA and other regulatory standards.

3.4 FIELD QUALITY CONTROL

3.4.1 Field inspection and testing will be performed.

3.4.2 Provide full load testing utilizing system for 4 hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown, and return to normal. Provide fuel for test and top off fuel tank at completion of testing.

3.4.3 During test, record the following at 20 minute intervals:

3.4.3.1 Kilowatts

3.4.3.2 Amperes

3.4.3.3 Voltage

3.4.3.4 Coolant temperature

3.4.3.5 Frequency

3.4.3.6 Oil pressure

3.4.4 Test alarm and shutdown circuits by simulating conditions.

3.5 MANUFACTURER'S FIELD SERVICES

3.5.1 Prepare, start, test, and adjust systems.

3.5.2 Provide systems demonstration.

3.5.3 Describe load connected to emergency system and restrictions for future load additions.

3.5.4 Simulate power outage by interrupting normal source, and demonstrate that system operates to provide emergency power.

3.5.5 Adjust generator output voltage and engine speed.

3.5.6 Clean engine and generator surfaces. Replace oil and fuel filters.

4.0 MEASUREMENT

4.1 Measurement for the emergency generator, including all accessories as described herein and connecting to other work shall be made as a lump sum.

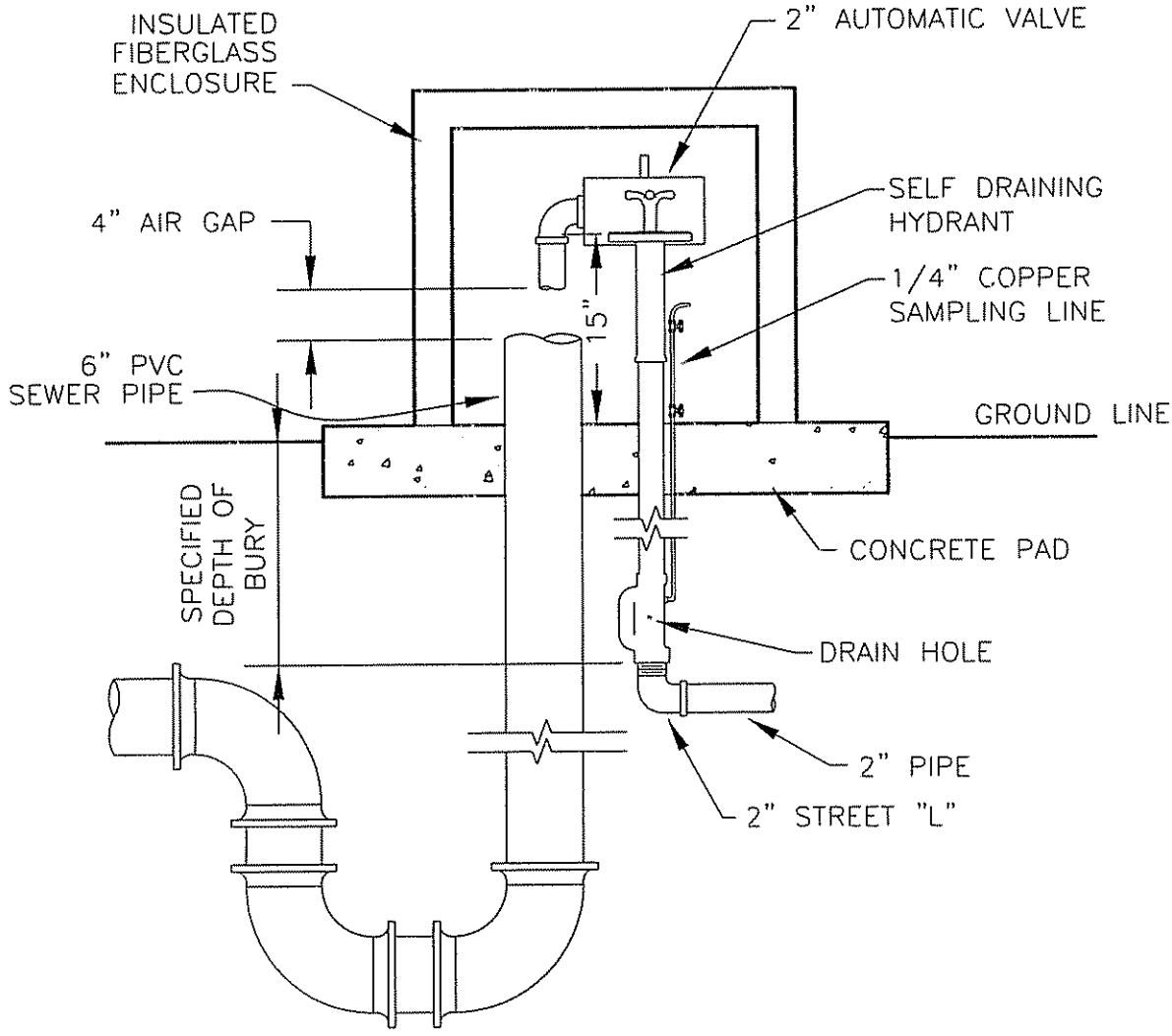
5.0 PAYMENT

5.1 Payment shall be made under Pay Item No.

16600-A Standby Generator System

$_____ per lump sum

INDEX SHEET – STANDARD DETAILS



AUTOMATIC FLUSHING ASSEMBLY

DATE: 12/29/06	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02660			
DR. BY: KED	FILE: FLUSHASSEMBLY			

HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS

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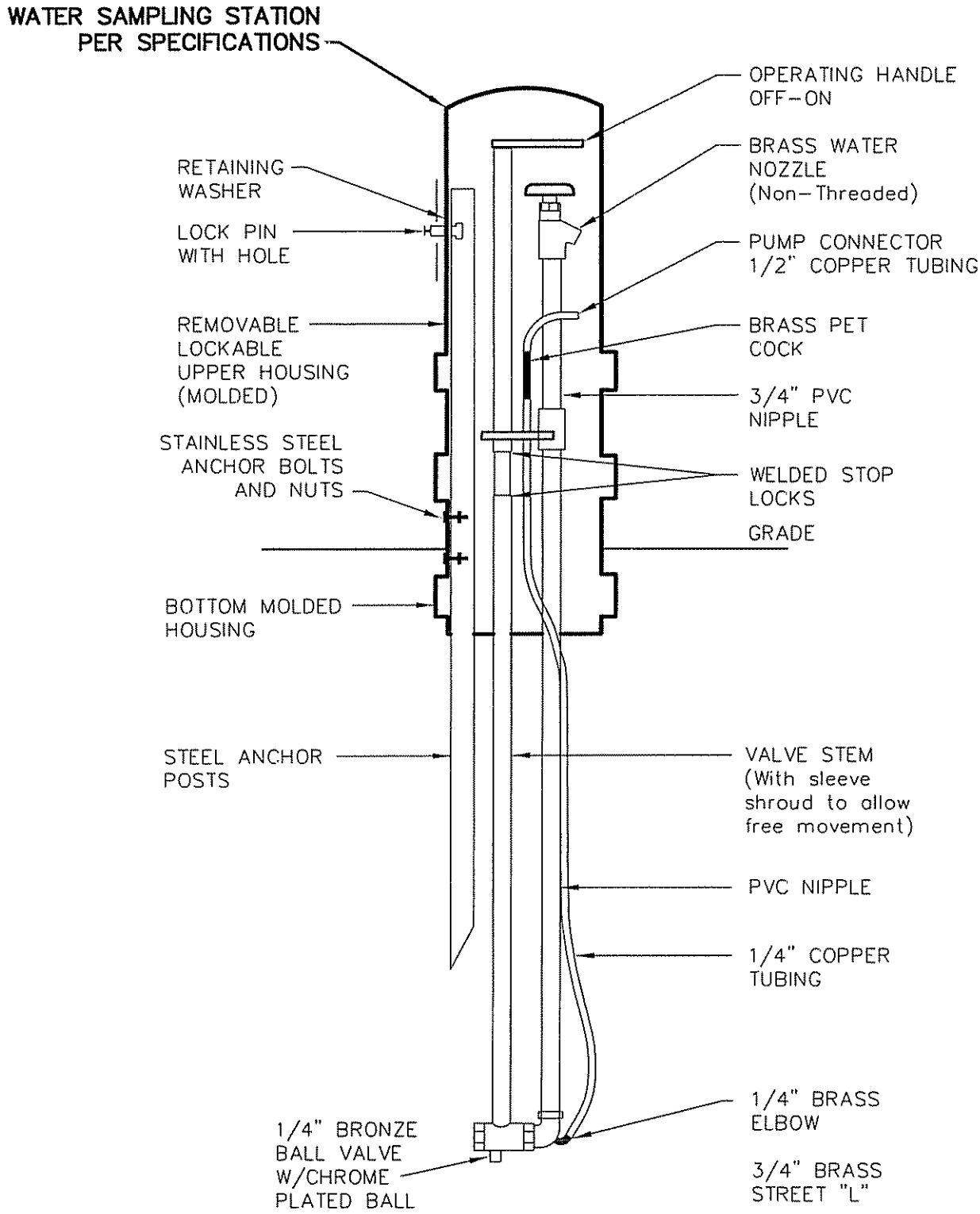

WATER SAMPLING STATION

DATE: 12/29/06	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02660			
DR. BY: KED	FILE: SAMPLESTA			

HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS

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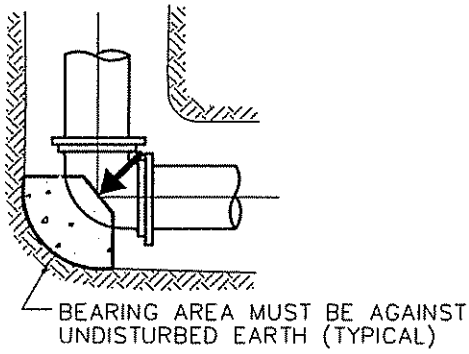
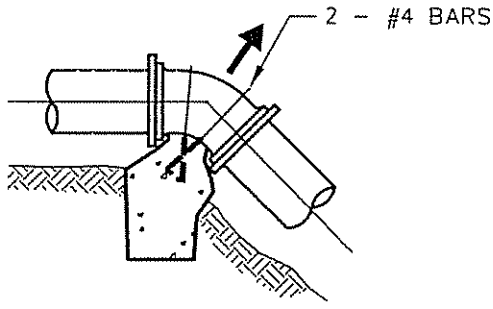
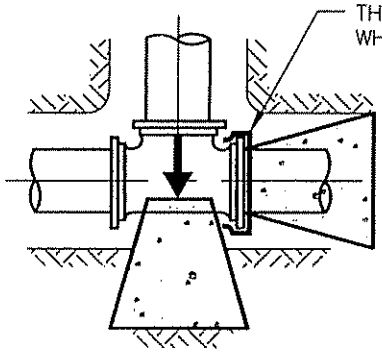


HORIZONTAL BEND

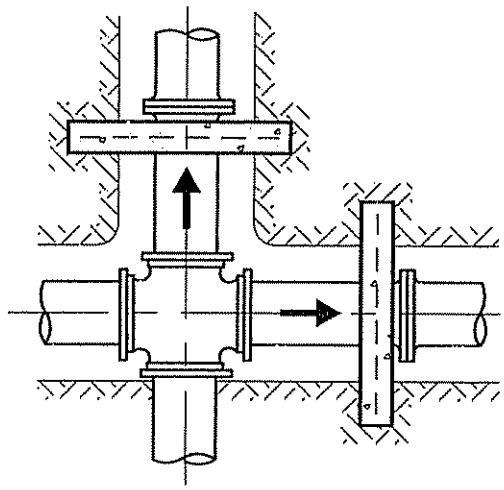


VERTICAL BEND



TEE

NOTE: ALL FITTINGS SHALL BE COVERED WITH A GEOTEXTILE FABRIC PRIOR TO POURING CONCRETE THRUST BLOCKING



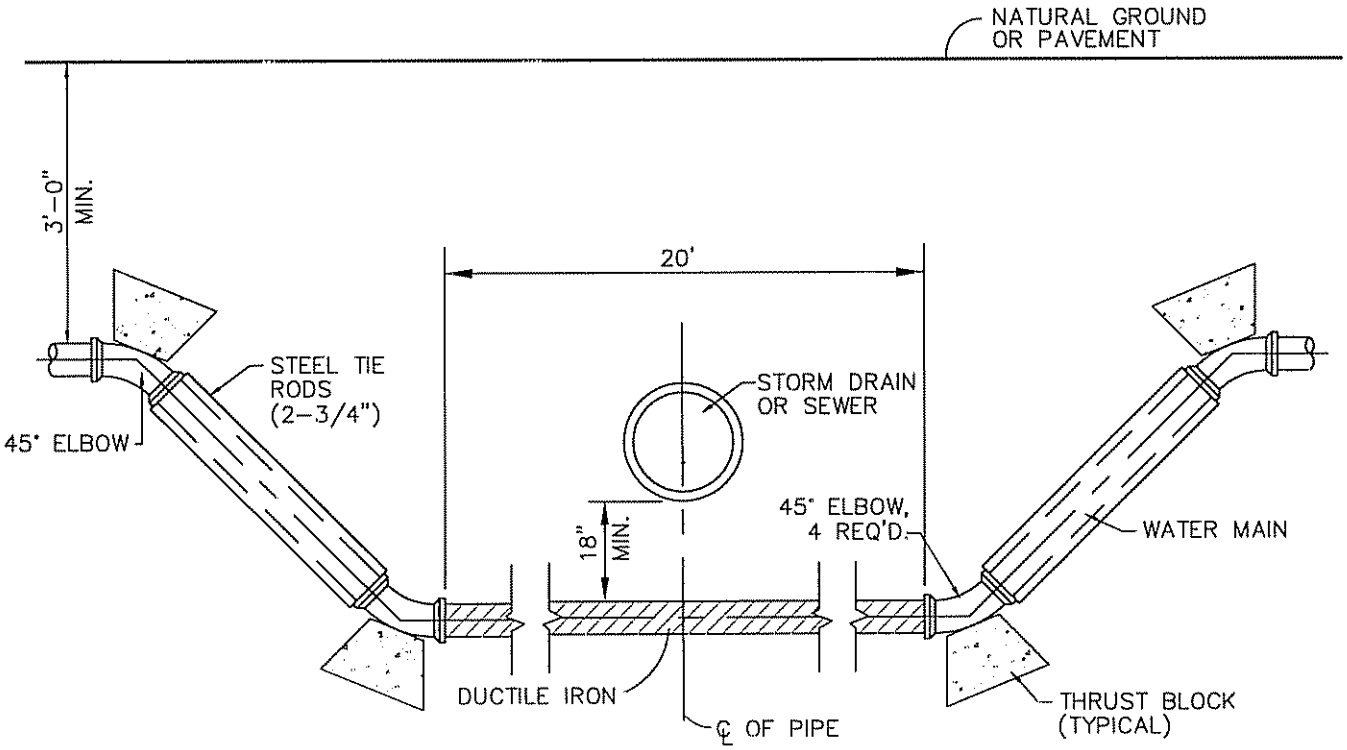
CROSS

BEARING AREAS FOR THRUST BLOCKING IN SQUARE FEET						
FITTING:	4" DIA.	6" DIA.	8" DIA.	10" DIA.	12" DIA.	14" DIA.
TEES	2.0	2.5	4.7	5.0	7.0	9.0
90°	2.0	2.7	6.7	7.2	10.4	12.7
45°	1.0	1.5	3.6	3.9	5.6	6.9
22 1/2°	1.0	1.0	1.8	2.0	2.9	3.5

WATER MAIN THRUST BLOCKING

DATE: 9/27/97	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02660 DWG.-2	REPLACED ISOMETRIC DETAIL W/ CROSS DETAIL	5/12/00	SJ
DR. BY:	FILE: BLOCKING			

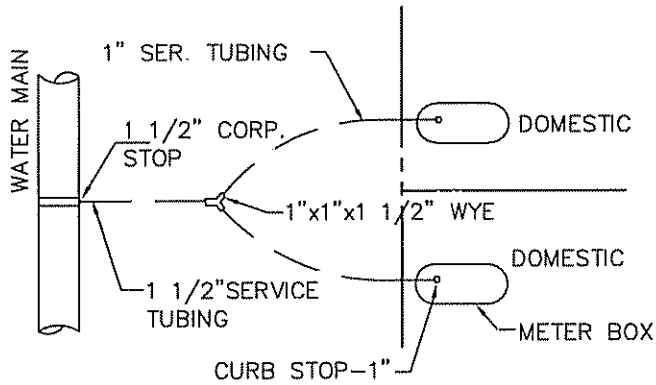
HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS



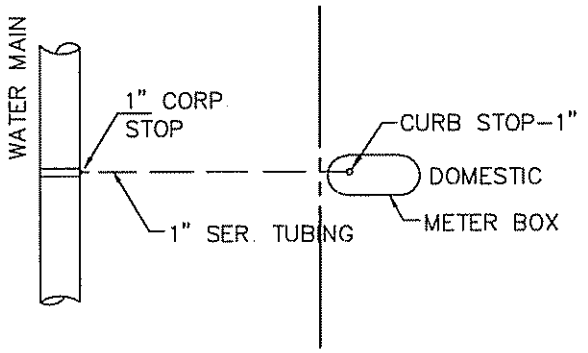
WATER MAIN ADJUSTMENT

DATE: 1/10/94	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02660 DWG.-3	ADDED THRUST BLOCKS AND STEEL TIE RODS	5/15/00	SJ
DR. BY:	FILE: WTRADJUST			

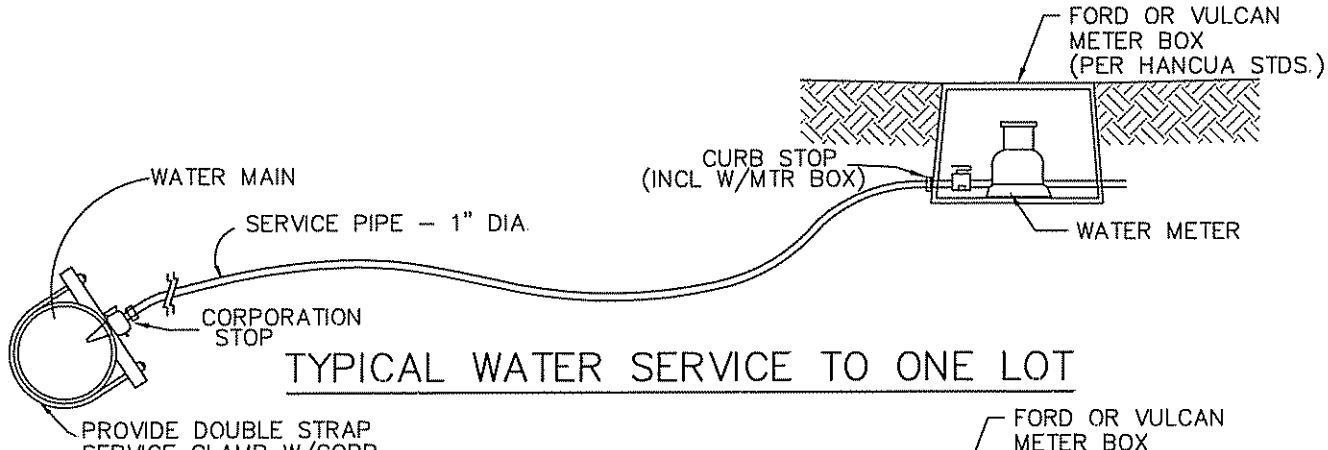
HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS



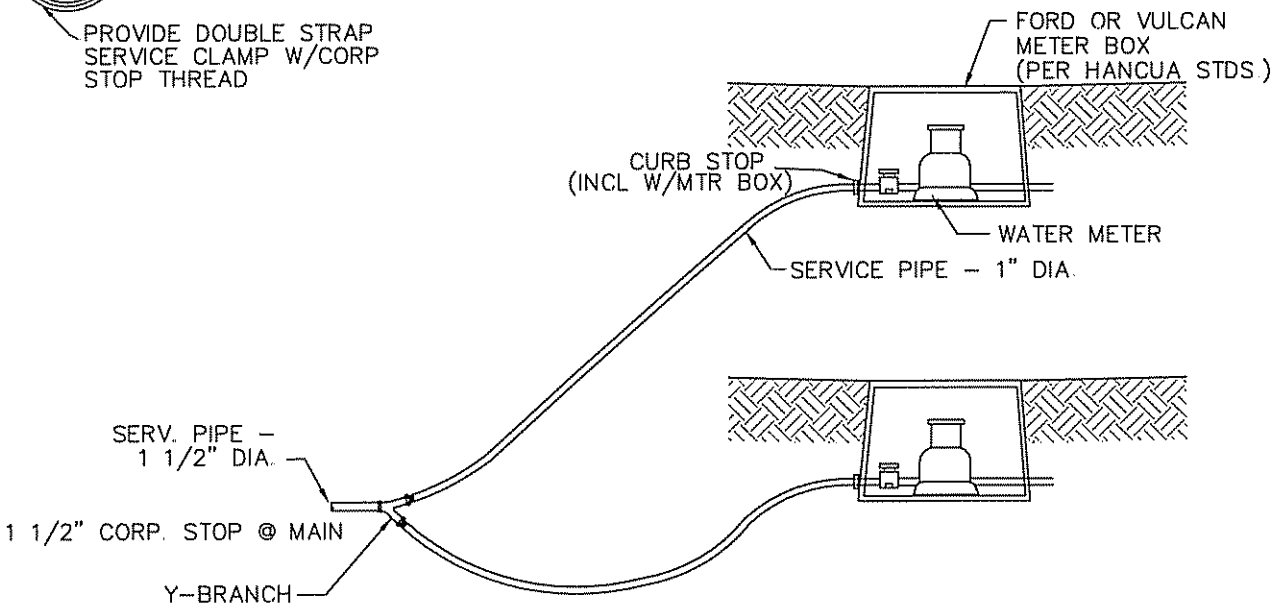
PLAN–TYPICAL DOUBLE SERVICE



PLAN–TYPICAL SINGLE SERVICE



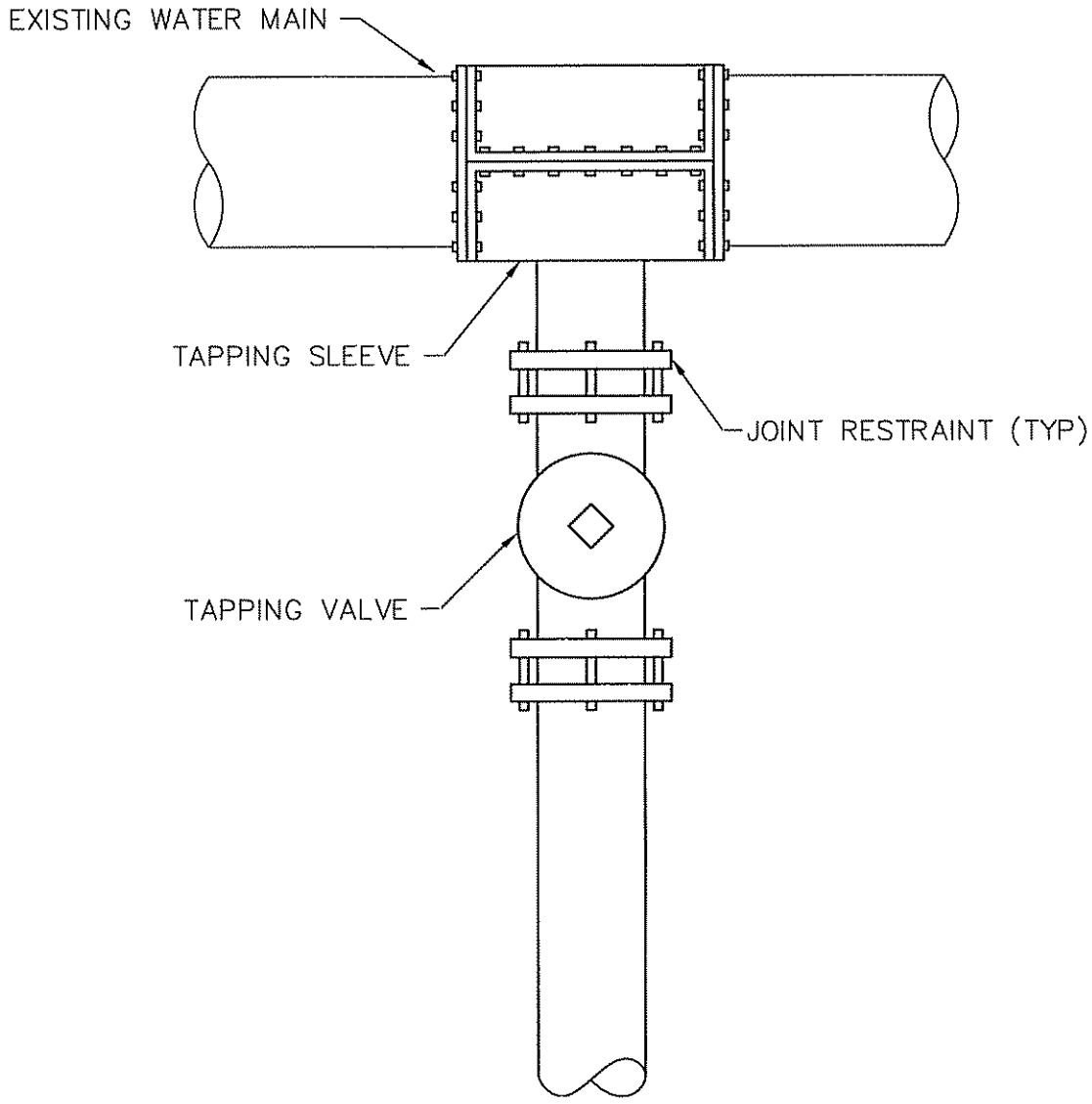
TYPICAL WATER SERVICE TO ONE LOT



TYPICAL WATER SERVICE TO TWO LOTS

TYPICAL WATER SERVICES				
DATE: 8/20/99	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02661 DWG.–1	REVISE DOUBLE LOT SERVICE	5/12/00	SJ
DR. BY:	FILE: WTRSRV	GENERAL	5/21/08	

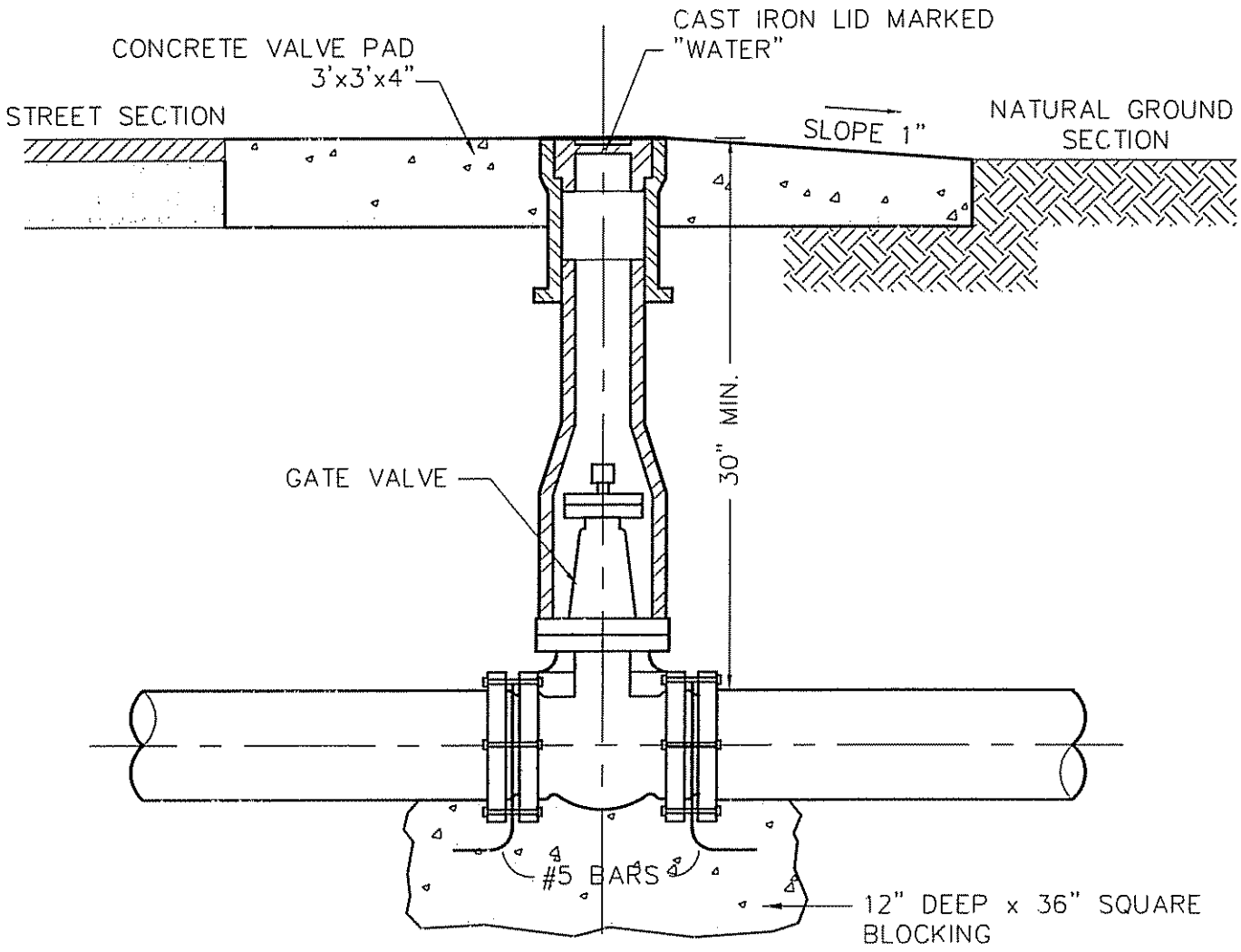
HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS



TAPPING VALVE & SLEEVE

DATE: 1/8/98	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02662 DWG.-1			
DR. BY:	FILE: TAPVALVE			

HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS



TYPICAL GATE VALVE ASSEMBLY

DATE: 1/30/97	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02663 DWG.-1	ADDED STREET SECTION AND NOTES	5/15/00	SJ
DR. BY:	FILE: GATEVALVE			

HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS

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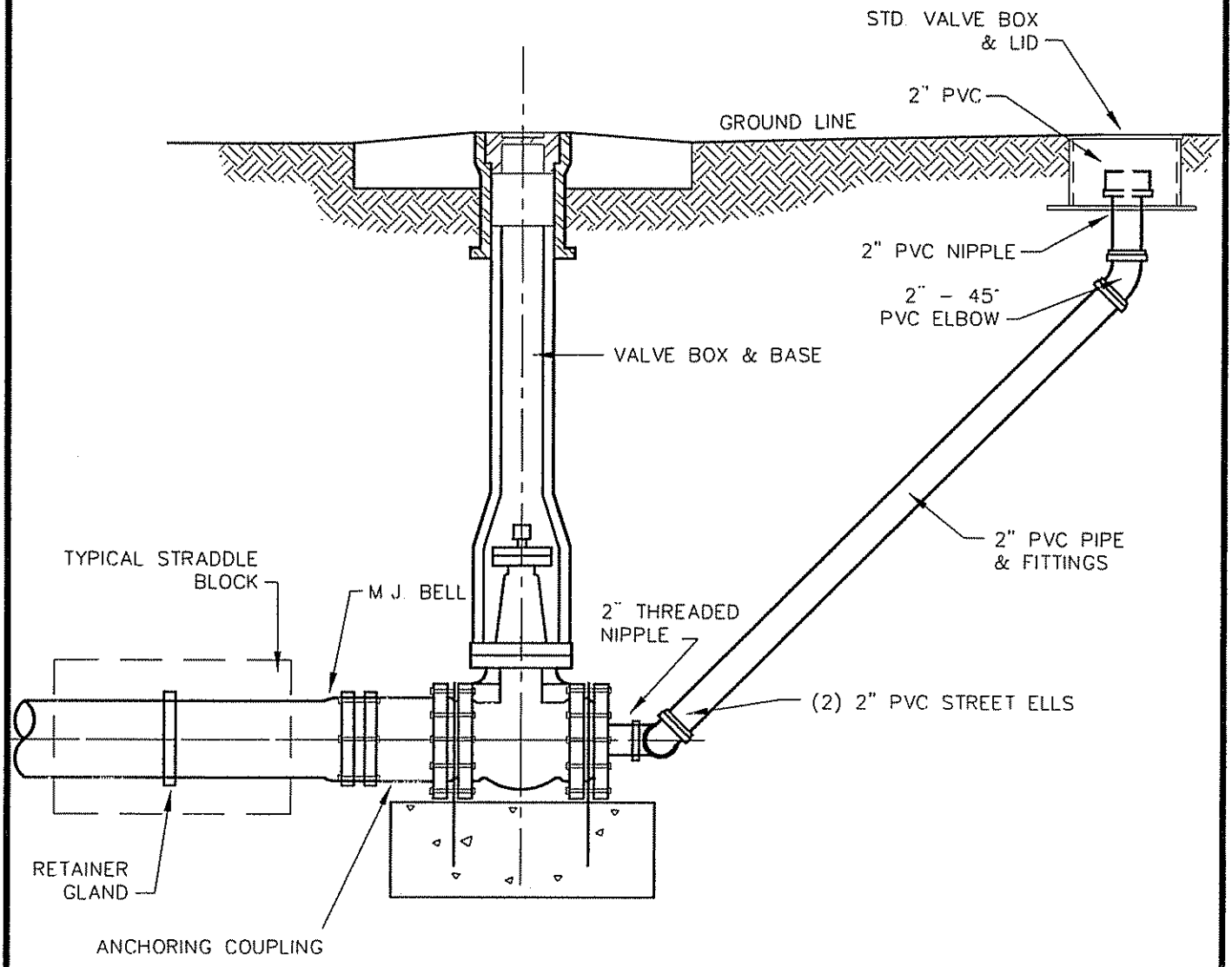


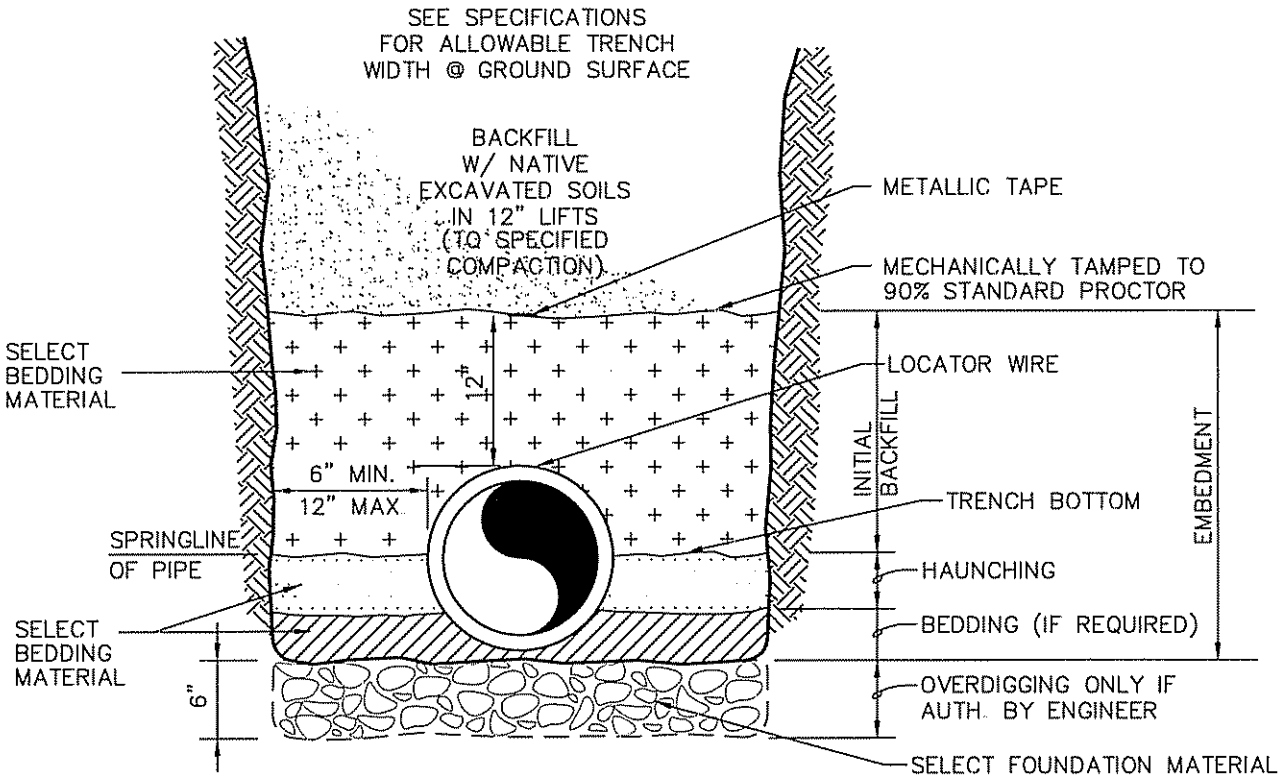
NOTE

ON DISCHARGE SIDE OF FLUSHING ASSEMBLY, DRAINAGE SHOULD BE PROVIDED BY DRILLING A 1/8" HOLE IN STREET ELL.

FLUSHING VALVE

DATE: 8/12/97	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02663 DWG.-2			
DR. BY:	FILE: FLUSH			

HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS



FOR WATER MAINS, FORCE MAINS, GRAVITY SEWERS & CULVERT PIPE

PIPE EMBEDMENT AND BACKFILL

Should Engineer determine that the native material at the bottom of the trench is not a suitable foundation for the pipe, he may authorize overdigging the trench a depth of 6 inches and replace with select foundation material which is included in the contract as a pay item.

The haunching material shall be select bedding material and thoroughly compacted to the spring line of the pipe and extending to the side walls of the trench. A minimum 90 percent Standard Proctor will be considered adequate compaction.

The initial backfill (select bedding material) may then proceed in 6" lifts to a height of 12 inches above the top of the pipe and mechanically tamped. Further backfill shall not proceed until initial backfill has been observed by Engineer.

Should Engineer determine that the select material secured from the trench excavation is not suitable for embedment and/or backfill, he may authorize the use of select bedding material, which is included in the contract as a pay item. Further backfill may then proceed to the original ground surface in 12 inch lifts compacted to eliminate air voids. In areas where the ground surface is to receive pavement, a minimum 95 percent Standard Proctor for each lift shall be considered adequate compaction.

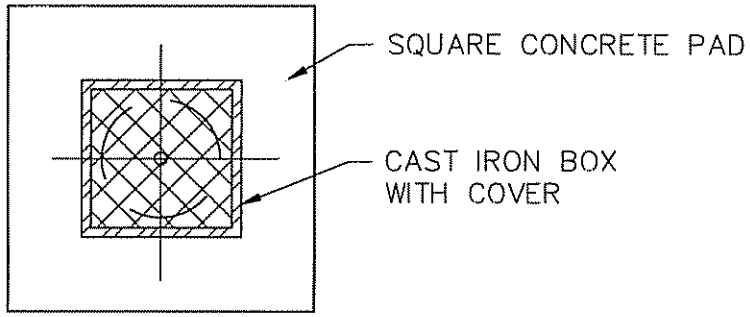
Contractor shall maintain trench backfill at original ground surface until final acceptance of the Work.

All surplus materials not used in backfilling shall be removed and disposed of by Contractor at his own expense.

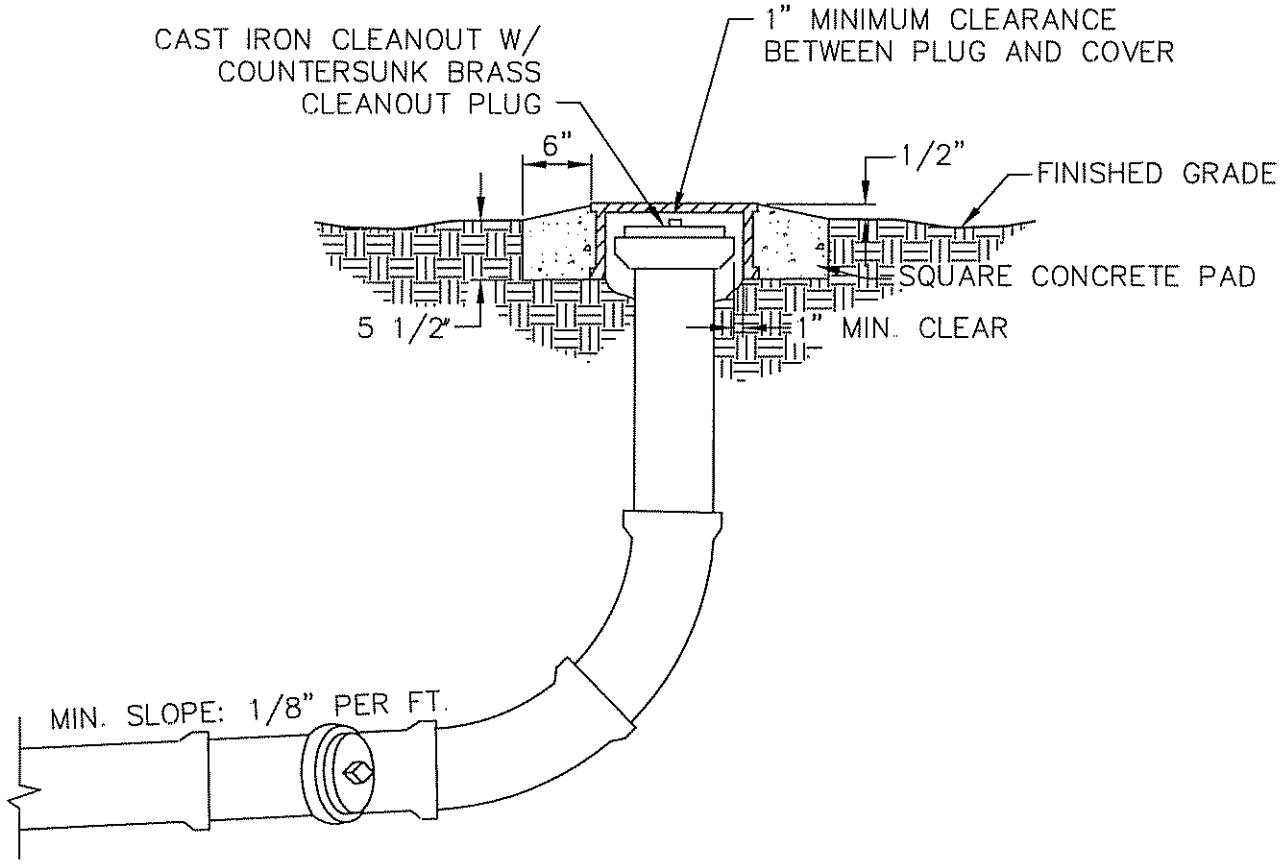
Metallic tape will be placed in the backfill 12 inches above the top of PVC water mains, sanitary sewer mains and sewage force mains with lettering facing up.

PIPE EMBEDMENT & BACKFILL				
DATE: 7/31/97	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02730 DWG.-1	REVISED TO MATCH SPECS.	4-11-08	JKO
DR. BY:	FILE: PIPEBED			

HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS



PLAN



SEWER CLEANOUT ASSEMBLY

DATE: 2/18/00	APPR. BY: BCM	REVISION	DATE	BY
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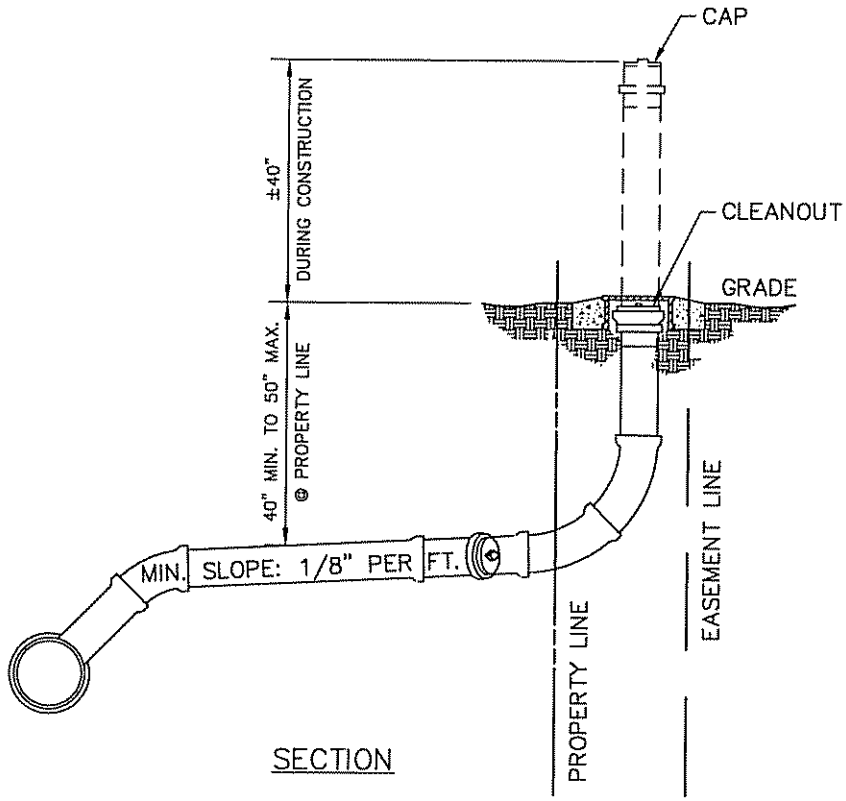
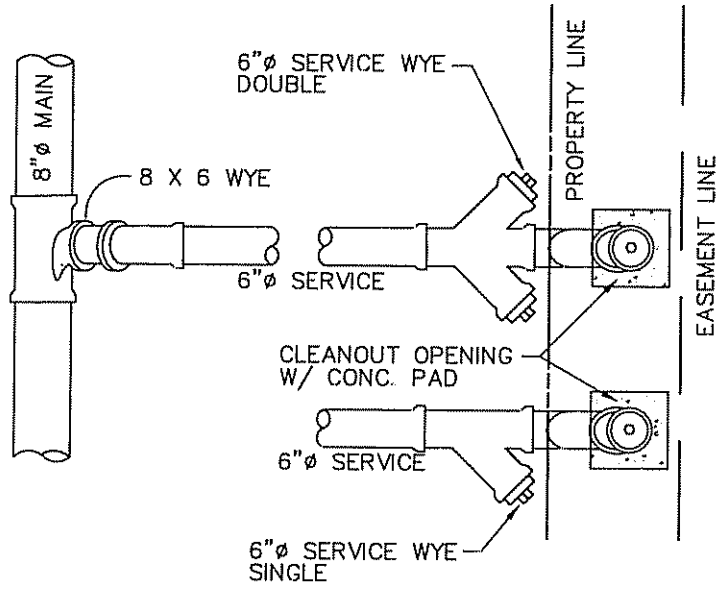
DR. BY: NK	FILE: CLEANOUT			

HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS



SECTION

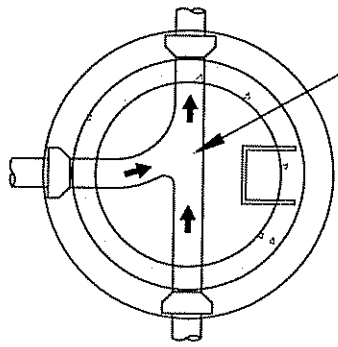


PLAN

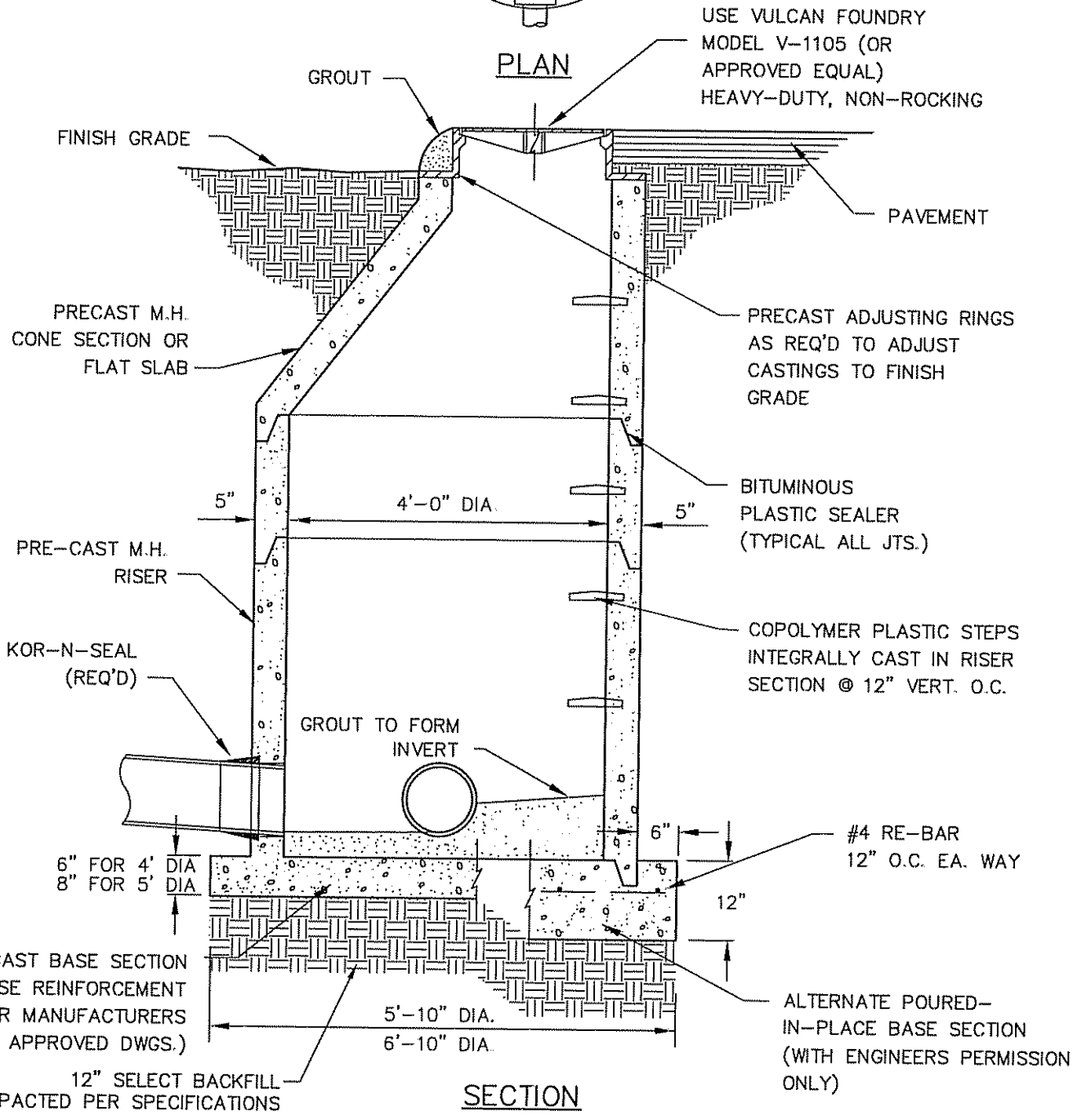
TYPICAL SEWER SERVICE ASSEMBLY

DATE: 8/20/99	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02730 DWG.-3			
DR. BY:	FILE: SWRSRV			

HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS



PLAN

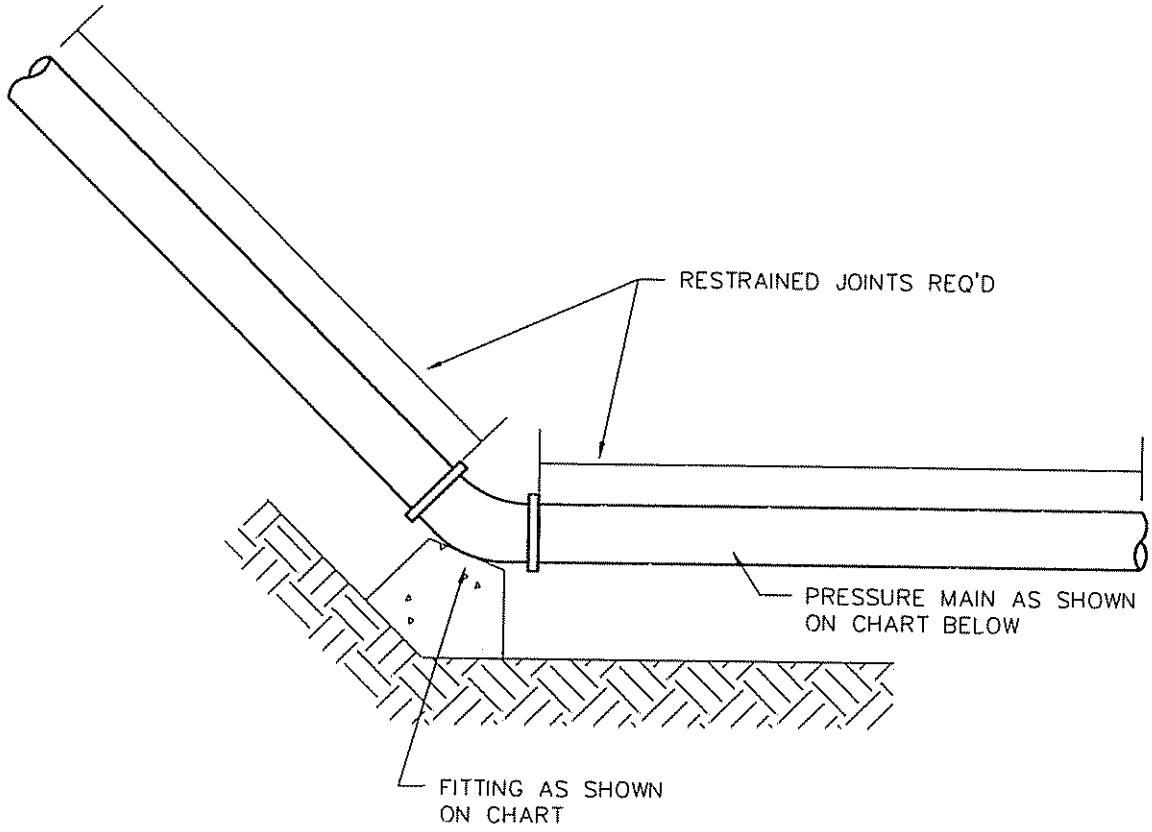


SECTION

SANITARY SEWER MANHOLE

DATE: 12/2/98	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02731 DWG.-1	DRAFTED PLAN VIEW	5/18/00	SJ
DR. BY:	FILE: MANHOLE			

HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS

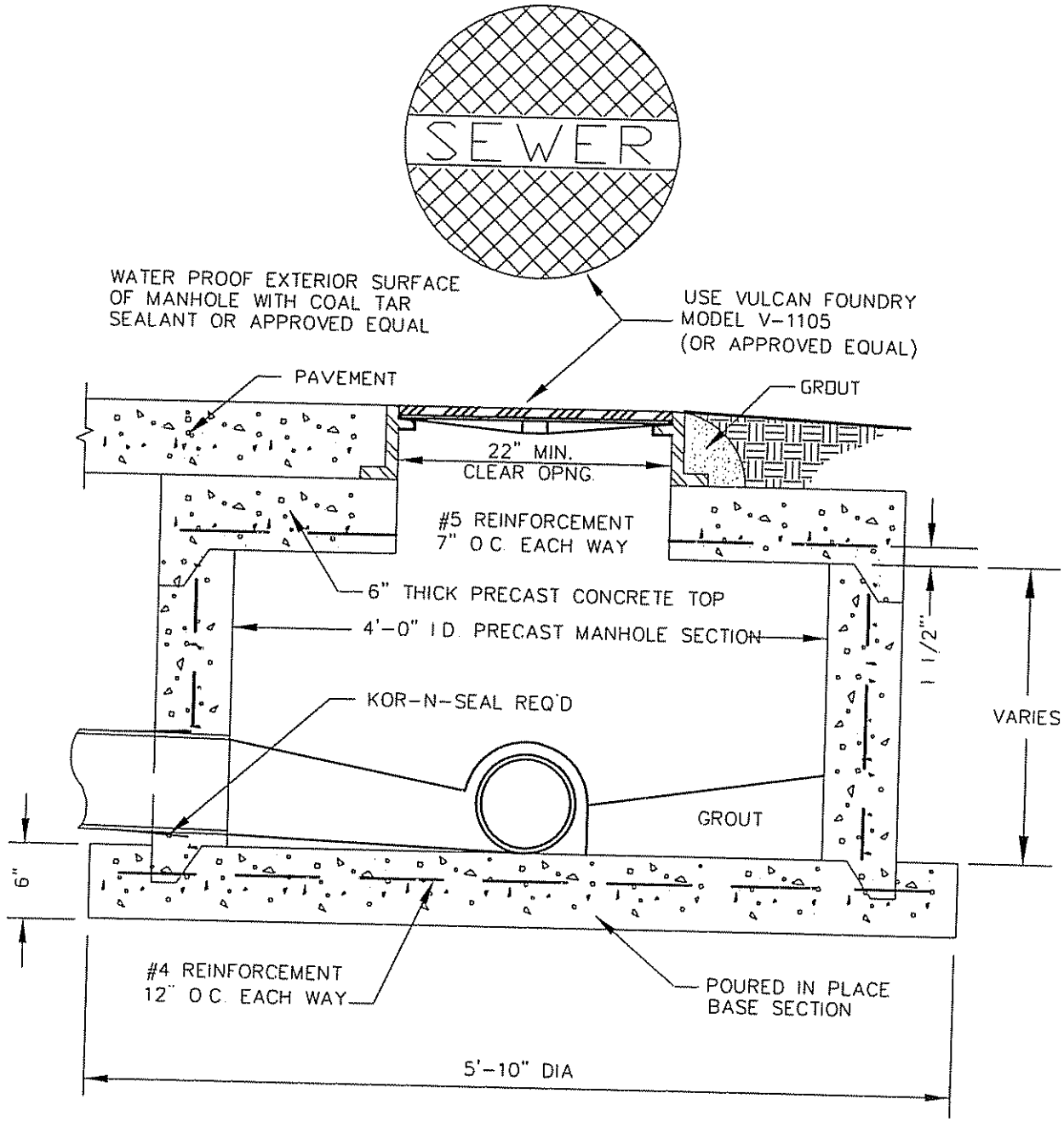


DISTANCE REQUIREMENTS								
FITTINGS	6"	8"	10"	12"	14"	16"	18"	24"
90° BEND	14'	18'	25'	28'	29'	33'	37'	47'
45° BEND	6'	7'	10'	12'	12'	14'	15'	20'
22.5° BEND	3'	4'	5'	6'	6'	7'	7'	10'
11.25° BEND	0'	2'	3'	3'	3'	4'	4'	5'
45° VERT. DOWN	0'	4'	4'	6'	7'	10'	13'	23'
DEAD END	32'	49'	60'	79'	69'	78'	87'	112'

RESTRAINED JOINTS

DATE: 5/15/00	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02733 DWG.-1			
DR. BY: SJ	FILE: SWRJNT			

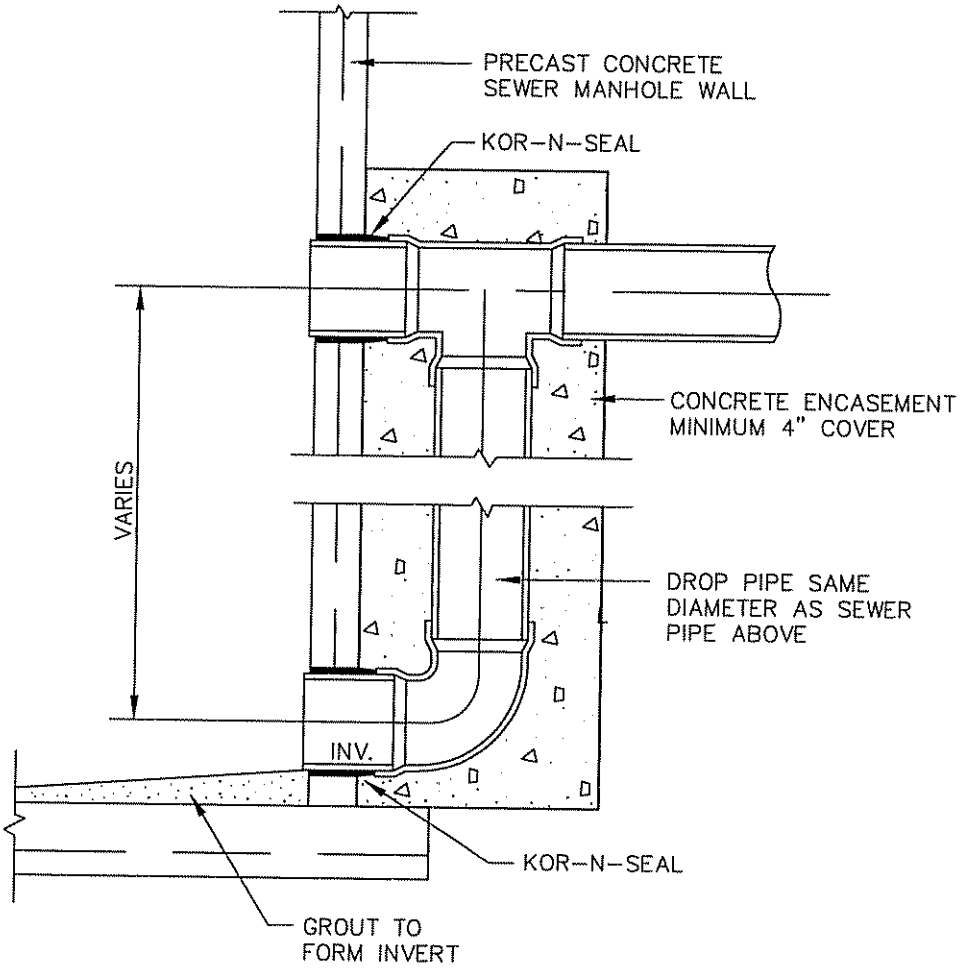
HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS



SHALLOW SEWER MANHOLE

DATE: 10/17/90	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02731 DWG.-2			
DR. BY:	FILE: SHORTMH			

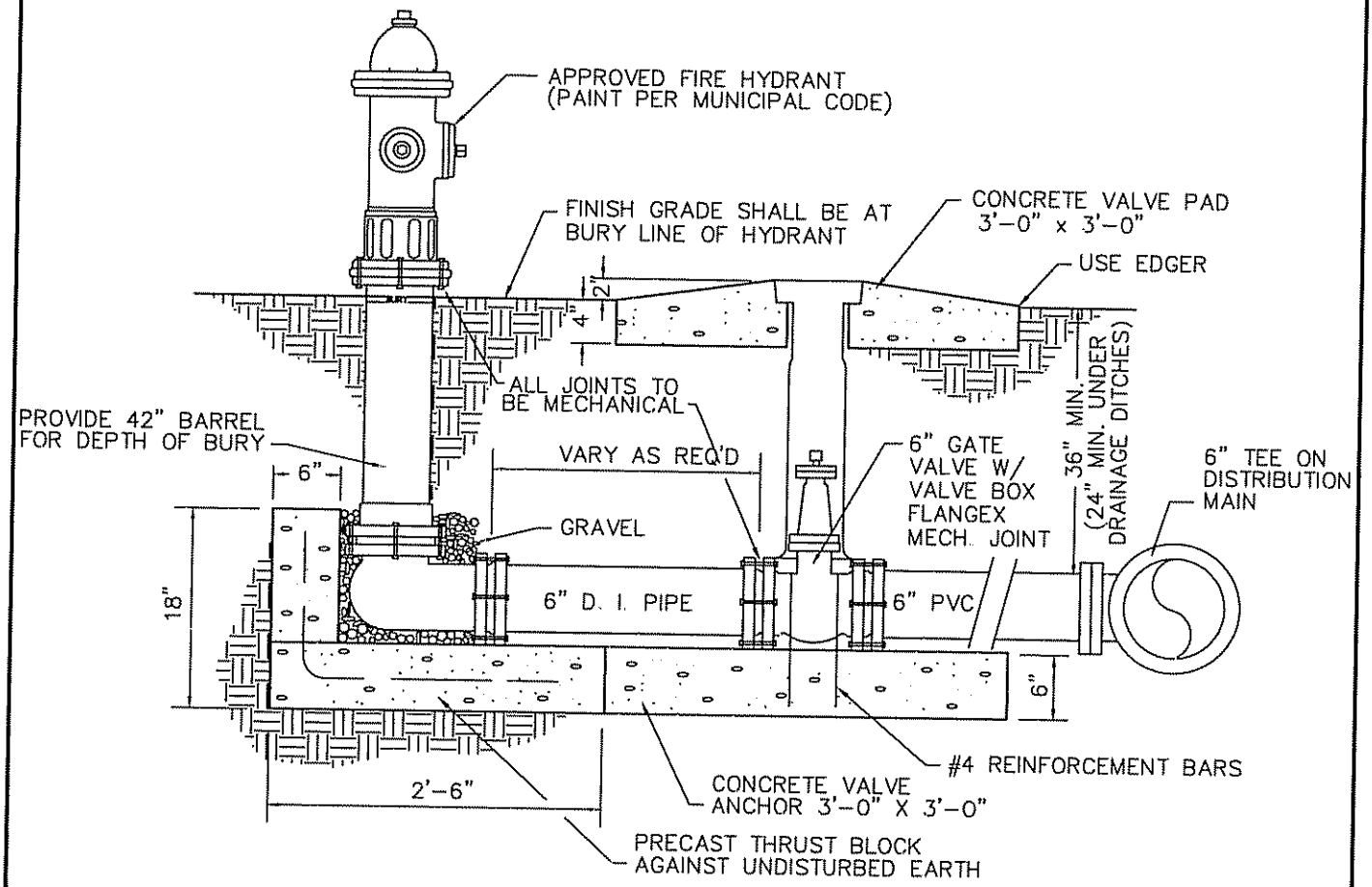
HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS

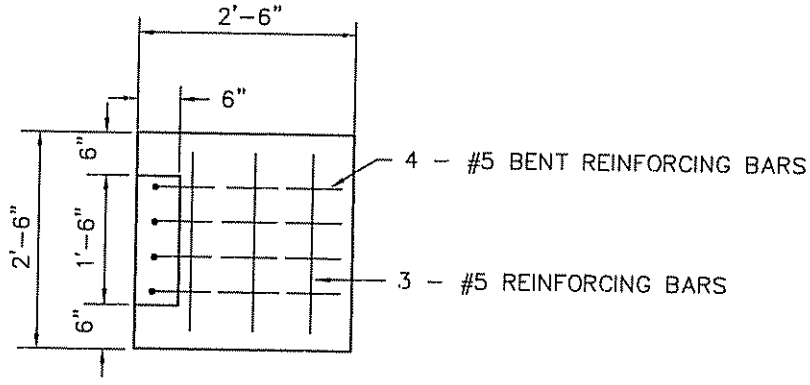


DROP MANHOLE ASSEMBLY

DATE: 10/18/90	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02731 DWG.-3			
DR. BY:	FILE: DROPMH			

HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS





THRUST BLOCK PLAN

FIRE HYDRANT ASSEMBLY

DATE: 10/18/90	APPR. BY: BCM	REVISION	DATE	BY
SCALE: N.T.S.	DR. NO.: 02731 DWG.-3	REVISED NOTES	4/15/08	SJ
DR. BY:	FILE: DROPMH			

HANCOCK COUNTY UTILITY AUTHORITY
STANDARD CONSTRUCTION DETAILS