

# Georgia Department of Natural Resources

2 MLK, Jr. Drive SE, East Floyd Tower, Atlanta, Georgia 30334

Reply To:  
Drinking Water Permitting & Engineering Program  
Suite 1362, East Floyd Tower  
2 MLK, Jr. Drive SE  
Atlanta, Georgia 30334

Noel Holcomb, Commissioner  
Carol A. Couch, Ph.D., Director  
Environmental Protection Division

February 15, 2005

Mr. Gene Mathis, General Manager  
Walker County Water and Sewerage Authority  
PO Box 248  
Flintstone, GA 30725

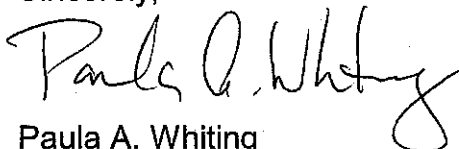
**RE: Water System Design and Construction Standards**  
Walker County Water and Sewerage Authority (WSID# 2950003)  
Walker County, Georgia

Dear Mr. Mathis:

The Standard Policy on Public Water and Sewer Extensions submitted has been reviewed by the Drinking Water Permitting & Engineering Program of the Environmental Protection Division and are hereby approved.

If you have any questions, please contact this office at the number below.

Sincerely,



Paula A. Whiting  
Environmental Engineer  
Drinking Water Permitting & Engineering Program  
(404) 651-8427

cc: Mr. Al Pierce, PE, Consolidated Technologies, Inc.  
File: WSID# 2950003

G04010



# Walker County WATER & SEWERAGE AUTHORITY

P.O. BOX 248 • FLINTSTONE, GEORGIA 30725  
PHONE (706) 820-1455 • FAX (706) 820-9369

**COPY**

**COPY**

February 2, 2005

Paula Whiting  
Drinking Water Permitting and Engineering Program  
Georgia Natural Department Resources  
Suite 1362, Floyd Towers East  
2 Martin Luther King Jr. Drive S.E.  
Atlanta, Ga. 30334

Ref: Amendments To The Standards Policy

Enclosed are the resolutions # 01-05 per your request.

WCWSA's Board of Directors adopted on January 11, 2005 policies of amendments to the Standard Policy on Public Drinking Water and Sewer Extensions.

- 1 - Disinfection Procedure: Section 15041-2, Part 3.1, paragraph "A".
- 2 - Field Testing : Section 15061-10, Part 3.4, paragraph " A ".
- 3 - Pressure and Leak Testing: Section 15064-5, Part 3.2, paragraph " A ".

If you have any further questions, please feel free to call 706-820-1455.

Sincerely,

Gene Mathis  
General Mgr.

# Walker County Water and Sewerage Authority

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## Standard Policy on Public Water and Sewer Extensions



CTI Engineers, Inc.  
1122 Riverfront Parkway  
Chattanooga, TN 37402  
423.267.7613

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Checklist for Developments

Development Name: \_\_\_\_\_

Developer: \_\_\_\_\_ Designer: \_\_\_\_\_

Date File Opened: \_\_\_\_\_ Date of Final Acceptance: \_\_\_\_\_

Yes	No	NA	
___	___	___	<b>Plan Review Fee Paid</b>
___	___	___	Water
___	___	___	Sewer
___	___	___	<b>Two (2) Sets of Preliminary Plans</b>
___	___	___	<b>EPD Sanitary Sewer Submittal</b>
___	___	___	<b>EPD Drinking Water Submittal</b>
			<b>Flow Tests</b>
___	___	___	1. 24-hour Hydrant Pressure Study
___	___	___	2. Open Hydrant Flow Test, in Gallons Per Minute (GPM)
___	___	___	3. Open Hydrant Pressure Test @ House Beyond Hydrant
___	___	___	4. Sewer Capacity Calculations (including Inflow and Infiltration)
___			<b>Preliminary Plans Reviewed and Returned to Developer or or Designer for Corrections or Finalization</b>
___	___	___	<b>Three (3) Sets of Final Plans and Documents Submitted to Authority Prior to EPD Submittal</b>
			<b>Letters Issued by Authority:</b>
___	___	___	1. Planning Commission Letter
___	___	___	2. Drinking Water Letter
___	___	___	3. Sewer Capacity and Treatment Letter
___	___	___	4. Landfill Certification Letter
___	___	___	<b>EPD Approval for Water Extension</b>
___	___	___	<b>EPD Approval for Sewer Extension</b>
___	___	___	<b>EPD Approved/Stamped Copy Placed in File</b>
___	___	___	<b>Inspection Agreement Executed</b>
___	___	___	<b>Final Test Reports from Inspector</b>
___	___	___	1. Punch List to be Completed
___	___	___	2. Verified Punch List Completed
			<b>Record Drawings (As-Builts) Submitted to Authority</b>
___	___	___	1 set of Reproducible Drawings
___	___	___	1 set in Digital Format (compatible with Walker County 911)
___	___	___	<b>Request from Developer to Take Over System (80% Build-out), (all easements and deeds to accompany request)</b>
___	___	___	<b>All Deficiencies Noted by Take-Over Inspection Corrected</b>
___	___	___	<b>Final Acceptance Letter from WCWSA</b>



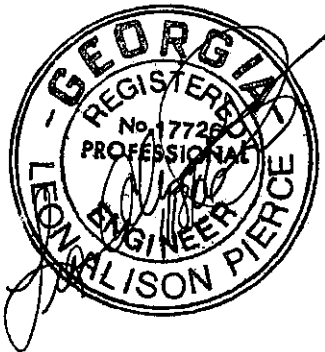
**STANDARD POLICY ON  
PUBLIC WATER AND SEWER EXTENSIONS**

WALKER COUNTY WATER AND SEWERAGE AUTHORITY

Board Members

Bebe Heiskell, Chairman  
David Ashburn  
Lawrence J. Berry  
John Culpepper  
William E. Kinser

David Ashburn, General Manager  
Brandon Whitley, Project Manager



Prepared by:

CONSOLIDATED TECHNOLOGIES, INC.  
*Engineers in Water and Earth Sciences*  
Dalton, Georgia  
CTI Project No. 93045/G04010

January 2006

**STANDARD POLICY ON  
PUBLIC WATER AND SEWER EXTENSIONS**

**WALKER COUNTY WATER AND SEWERAGE AUTHORITY**

Board Members

Burton Brown, Chairman

Lawrence J. Berry, Jr.

John Culpepper

Karless Hays, Jr.

William E. Kincer

Gene Mathis, General Manager  
Brandon Whitley, Project Manager



Prepared by:

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June 2003

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**CHAPTER 1**  
**Policy on Public Water and Sewer Extensions**

# **POLICY ON PUBLIC WATER AND SEWER EXTENSIONS**

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## **1.0 POLICY ON PUBLIC WATER AND SEWER EXTENSIONS**

### **1.1 Applicability**

1.1.1 This policy shall apply to the design and construction of all public water and sewer extensions of the Walker County Water and Sewerage Systems.

1.1.2 Deviations from this policy may be granted only with the consent of the Walker County Authority Board.

### **1.2 Definitions**

1.2.1 The following definitions apply to this policy:

1. **Developer.** The individual or company requesting approval to extend the Walker County Water and Sewerage Systems.
2. **EPD.** The Environmental Protection Division of the Georgia Department of Natural Resources.
3. **Off-Site Extension.** That portion of the public water or sewer extension that does not adjoin the tracts or properties which the developer desires to serve.
4. **Public Sewer Extension.** An expansion of the existing public sewer system that will serve additional users and that, upon completion, will be owned, operated, and maintained by the Authority.
5. **Public Water Extension.** An expansion of the existing public water system that will serve additional users and that, upon completion, will be owned, operated, and maintained by the Authority.
6. **Authority Manager.** The person designated by the Authority Board to manage and supervise the operation of the Authority's water and sewer systems.

### **1.3 Approval Required**

1.3.1 No construction shall begin until the developer has received written approval of the plans and specifications from the Authority Manager and EPD and the developer has obtained all easements and all required permits from agencies having jurisdiction.

**1.3.2** Public water and sewer extension approvals shall become invalid if construction has not begun within one (1) year after the date of issuance. Plans and specifications must be re-submitted for approval.

**1.3.3** The developer shall comply with all applicable provisions of the Walker County Sewer Use Ordinance and the Walker County Erosion and Sedimentation Control Ordinance.

**1.4 Costs**

**1.4.1** Except as noted herein, all costs associated with the public water extension or public sewer extension, including surveys, design, construction, inspection, testing, easements, permits, land-disturbing activity plans, and as-built drawings, shall be borne by the developer.

**1.4.2** The developer and the construction contractor shall indemnify and hold harmless the Authority, its officials, employees, and agents, from and against any and all claims for damages and injuries occurring as a result of the developer's or contractor's activities in constructing the water or sewer extension.

**1.5 Location**

**1.5.1** All public water extensions shall be located off the shoulder of the roadway between the edge of the pavement and the right-of-way boundary.

**1.5.2** All public sewer extensions shall be located within the edges of the pavement of the roadway, with the manholes located in the center of the roadway or the center of a driving lane. Any variance shall be approved by the Authority Manager.

**1.5.3** The location of all water and sewer extensions must be approved by the Authority Manager. Where possible, extensions will be required to be located according to current master planning.

**1.6 Plans and Specifications**

**1.6.1** Two copies of preliminary plans, profiles, details, specifications, and flow calculations shall be submitted to the Authority Manager for review. Plans may be submitted along with preliminary subdivision plats, if applicable. Plans and specifications shall comply with the attached design standards, as applicable. The

attached standard specifications and details are included as a guide. The developer may substitute standard specifications and details which differ from but are functionally equivalent to those included in this policy manual.

1.6.2 Following receipt of the above documents and payment of the plan review fee as set by the Authority, the Authority Manager will respond in writing to the developer, noting any required changes necessary as a condition for approval.

1.6.3 Three copies of final plans and specifications shall be submitted to the Authority Manager for approval. These plans shall incorporate all changes required by the Authority, EPD, or any other federal, State, or local agencies having jurisdiction. One copy of the approval letter and stamped, approved plans and specifications from EPD must be submitted to the Authority Manager before the public water or sewer extension will be approved by the Authority.

1.6.4 No changes or variations to the approved water or sewer extension plans and specifications shall be made during construction without the approval of the Authority Manager.

1.6.5 One complete set of reproducible drawings and one copy in a digital format compatible with Walker County's 911 GIS indicating the actual as-built plans, profiles, and details of the public water or sewer extension, including the location of all service tees, laterals, and taps, shall be submitted to the Authority Manager upon completion of construction. The as-built drawings will be reviewed for accuracy by the Authority's inspector prior to final acceptance.

## 1.7 Easements and Permits

1.7.1 For public water and sewer extensions that are not to be located totally within dedicated City, County, or State public road rights-of-way, the developer shall deed to the Authority a minimum 15-foot-wide permanent maintenance easement with access from a public road right-of-way. Wider easements may be required for sewers over 15 feet deep. Easements shall be in a form acceptable to the Authority's attorney and shall be made a part of subdivision plats, if applicable. Additional on-site easements may be required by the Authority Manager for future extensions of the water or sewer system. Water or sewer easements must be free of all obstructions, including other utilities.

1.7.2 The developer shall be responsible for obtaining the necessary easements and/or right-of way encroachment permits for the construction and maintenance of public water or sewer extensions in public or private property and right-of-way.

1.7.3 The developer shall be responsible for obtaining all necessary environmental permits and approvals for construction of the extension, including permits for utility crossings of streams and wetlands.

**1.8 Additional Requirements at the Authority's Option**

The Authority may, at its option, elect to pay for any design modifications (i.e., increases in size, depth, location, pump capacity, etc.) required to meet its future needs. The Authority may, at its option, elect to contract the construction of off-site public water or sewer extensions for the developer. In such cases, the developer will pay the Authority for the cost of construction, excluding the cost of service line stub-outs on the extension, before construction begins.

**1.9 Sewer Service Tees and Service Line Stub-Outs**

The construction of public sewer extensions shall include the provision of either service tees and service line stub-outs for each tract and/or structure abutting both on-site and off-site portions of the extension as shown by plat and/or property records. Service line stub-outs shall extend from the tee to the property line of the served tract or lot. The Authority may, at its option, elect to pay the developer of the sewer extension the exact cost for the provision of tees and service line stub-outs to off-site tracts and/or structures, not to exceed \$500 per lateral.

**1.10 Water Service Taps and Meter Boxes**

1.10.1 The Authority will construct all taps on the public water extension and all service extensions to the property lines for each tract and/or structure to be served. The Authority will also set the meter boxes and yokes.

1.10.2 The developer shall provide the Authority access following construction of the public water extension for installation of taps and service line extensions.

**1.11 Hydrants**

1.11.1 The construction of public water extensions shall include the provision of fire hydrants at locations approved by the Authority Manager, provided that the existing public



water system can provide fire flows while maintaining required residual pressures. The developer shall provide documentation in the form of flow calculations and flow tests that verify the adequacy of the existing system to provide fire flows.

1.11.2 Generally, fire hydrants shall be installed so that the distance from any tract and/or structure to the nearest hydrant does not exceed 500 feet. In cul-de-sacs, the hydrant shall be located at the end of the cul-de-sac.

**1.12 Water and Sewer Service Line Connections**

1.12.1 All service line connections shall be performed by the Authority.

1.12.2 No service lines shall be connected to the public water or sewer extension until the service line has been inspected and approved by the Authority and the applicable water or sewer connection fee has been paid to the Authority.

**1.13 Protection of Existing Water and Sewer Facilities**

1.13.1 No connection to the existing public sewer shall be made until the sewer extension lines have been inspected, tested, cleaned, and accepted in writing by the Authority Manager. No debris of any nature that would obstruct the flow in sewers or interfere with the proper operation of the sewage works shall be permitted to enter the public sewer.

1.13.2 No surface water, storm water, or ground water during the construction of the sewer extension or water or other fluids used to flush and clean the sewer extension shall be permitted to enter the existing public sewer.

1.13.3 No interruption of the operation of any existing water or sewage works shall be permitted without the approval of the Authority Manager.

1.13.4 No connection to the existing public water line shall be made until the water extension lines have been inspected, tested, disinfected, flushed, and accepted in writing by the Authority Manager.

**1.14 Inspections**

1.14.1 The Authority will provide inspection of public water or sewer extensions during construction. The Authority, at its discretion, may utilize its own employees or may subcontract inspection services to the Authority's engineer.

1.14.2 No public water or sewer extensions shall be backfilled until the pipe installation has been inspected by the Authority's designated inspector. The Authority Manager may require any line that has been backfilled without inspection to be uncovered for inspection at the developer's expense.

1.14.3 The developer shall notify the Authority Manager at least 30 days prior to the start of construction so that inspection services can be scheduled. The Authority will attempt to accommodate the contractor's construction schedule to the extent practical.

1.14.4 The developer shall reimburse the Authority for the cost of inspection and review of as-built drawings, not to exceed an amount equal to 10 percent of the fair market cost of the extension. The applicant shall provide a contractor's written certification of the fair market cost of the extension. The above limit on inspection fees shall not apply to overtime for inspection after normal business hours or on weekends.

1.14.5 Neither the activities nor the presence of the Authority's employees or agents at the job site shall imply any responsibility for the developer's or construction contractor's methods of work performance, superintendence, sequencing of construction, or safety on or about the job site.

**1.15 Final Acceptance**

1.15.1 Final acceptance of public water and sewer extensions will be granted by the Authority Manager only after satisfactory completion of all of the requirements of this policy manual, including submittal of satisfactory as-built drawings, full reimbursement for inspection services, and provision of suitable warranty deposit or maintenance bond.

1.15.2 Public water or sewer extensions which do not comply with the requirements of this policy manual shall not be accepted by the Authority Manager on behalf of the Authority, and no service line connection permits will be issued for premises served by the extension.

**1.16 Warranty**

**1.16.1** All new developments will not be considered for acceptance and continued maintenance by the Authority until the following conditions have been met.

- i. 80% of all phases of the developments will have been completed Residential/Commercial building.
- ii. A camera inspection of all sewer lines will be performed by the Authority.
- iii. An evaluation of all lift and/or pump stations will be evaluated by the Authority.
- iv. The Authority must have all utility easements on file.
- v. Any deficiency in the system must be repaired and brought up to the Authority's standards before the system will be taken over by the Authority.

Once these requirements have been met, the Authority will issue the developer a letter of acceptance and assume maintenance responsibility from that time forward.

Prior to this all maintenance will be the developer's responsibility.

**1.16.2** The developer shall provide, in a form acceptable to the Authority's attorney, a cash deposit, an irrevocable letter of credit on a Georgia bank, or a maintenance bond in the amount of 50 percent of the fair-market value of the extension as surety for the satisfactory performance of warranty obligations until the project is accepted by the Authority as defined above.

**1.16.3** The developer shall immediately repair or cause to be repaired at no cost to the Authority all breaks, leaks, ground settlement, erosion, or defects of any type whatsoever arising from any cause (except those causes totally outside the control of the developer) prior to project acceptance by the Authority. Should the developer fail to make the necessary repairs immediately on all breaks and leaks and within a reasonable period for all other defects following notification (not to exceed 30 days,

weather permitting), the Authority may make the repair and recover the cost thereof from the developers's surety.

**1.17 Multi-family Housing Units**

**1.17.1** For all multi-family housing unit new construction within the service area of Walker County Water & Sewerage Authority (WCWSA) as defined by the County-wide service delivery area agreement, separate water and sewer plumbing is required for each residence.

**1.17.2** Water tap and deposit are required for each residence.

- i. Upon sewer service availability, sewer tap is required for each residence.
- ii. The developer shall be responsible for the costs to design, prepare plans for review by WCWSA and GA EPD, install and inspect all water main and service line extensions required to provide service to each unit of residence. WCWSA shall furnish meter box, meter and setter for customer connection.
- iii. The developer shall be responsible for the costs to design, prepare plans for review by WCWSA and GA EPD, install and inspect all sewer mains, manholes, service line extensions and appurtenances required to provide service to each unit of residence.
- iv. If the development does not have sewer service available at the time of construction, units will be required to have water and wastewater systems installed separate for each unit. Prior to public sewer availability, wastewater systems may be connected to a common subsurface disposal system upon approval by the State of Georgia Environmental Services. The development will be required to abandon said subsurface disposal system within 60 days of public sewer availability and connect to the public wastewater system. Costs for connections shall be the responsibility of the developer or home owner, whichever is applicable.

**CHAPTER 2**  
**Design Standards - Public Water Extensions**

# **DESIGN STANDARDS - PUBLIC WATER EXTENSIONS**

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## **2.0 DESIGN STANDARDS - PUBLIC WATER EXTENSIONS**

### **2.1 System Design**

#### **2.1.1 Minimum Pipe Size**

1. The minimum size of pipe for principal water mains and for water mains where fire hydrants are to be attached shall be 6 inches in diameter.
2. Size of water mains shall be justified by hydraulic analysis. Two-inch water mains will only be considered for short cul-de-sacs and permanent dead-ends where future growth is not feasible. The length of 2-inch mains shall be restricted to 3,000 feet in any one direction.
3. All water mains, including those not designed to provide fire protection, shall be sized after a hydraulic analysis based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of 20 pounds per square inch (psi) at ground level at all points in the distribution system under all conditions of flow.
4. Wide variations in pressure above the minimum requirement of 20 psi may be inherent in the design of a distribution system, but pressures no greater than 100 psi should be delivered to the customer (unless higher pressures are requested). The 100-psi maximum pressure requirement can be met by pressure-reducing valves in the vicinity of each customer's source line, or by designing the distribution system to limit the maximum pressure.
5. All assumptions and any flow data used must be clearly documented and submitted with the hydraulic analysis. If actual flow data is not available, theoretical calculations shall be based on all storage facilities being half-full and the Hazen-Williams friction factor appropriate for the type of pipe being used but in no case greater than 130.
6. Water mains and distribution systems should be sized for an instantaneous peak demand of 2 gallons per minute (gpm) per connection or according to Appendix I.

### **2.1.2 Fire Protection**

1. The minimum pipe size to which a fire hydrant may be connected is 6 inches.
2. Ordinarily, fire hydrants shall not be connected to water mains which are not capable of providing a flow of 500 gpm at 20 psi.
3. When fire protection is to be provided, system design should consider the recommendations of the State's Insurance Services Office.
4. Fire hydrants shall meet current AWWA Standard C502.

### **2.1.3 Dead Ends**

1. Dead ends shall be minimized.
2. Where dead-end mains occur, they should be provided with a fire hydrant, when fire flows are available, or blow-off for flushing purposes. The blow-off shall be at least 2 inches in diameter, but should provide flushing velocities of 2.5 feet per second or greater.
3. No flushing device shall be directly connected to any sewer nor be subject to flooding or plugging.

## **2.2 Installation of Mains**

**2.2.1** Adequate support shall be provided for all pipes.

**2.2.2** A continuous and uniform bedding shall be provided in the trench for all buried pipe.

**2.2.3** Stones found in the trench shall be removed for a depth of at least 6 inches below the bottom of the pipe.

**2.2.4** All distribution mains shall be provided with sufficient earth or other suitable cover to prevent freezing. This shall not be less than 2.5 feet measured above the top of the pipe.

### **2.2.5 Hydrostatic Tests**

1. Pressure and leakage tests shall be performed in accordance with current AWWA Standard C600 and/or manufacturer's installation procedures.

2. The test pressure of the installed pipe shall be a minimum of 150 psi or 1.5 times the working pressure, whichever is greater.
3. Allowable leakage shall be no greater than as calculated in the following:

$$L = SD\sqrt{P} \quad (1)$$

Where: L = Allowable leakage in gallons per hour.  
 S = Length of pipe tested in feet.  
 D = Pipe diameter in inches.  
 P = Test pressure in psi.

**2.2.6** The specifications shall include detailed procedures for the adequate flushing, disinfection, and (total coliform) bacteriological testing of all new water mains. Disinfection as described in current AWWA Standard C651 will be accepted.

**2.2.7** Disinfection of existing mains requiring cuts or repairs:

1. Disinfection shall be performed when mains are wholly or partially dewatered.
2. Disinfection shall follow current AWWA C651 procedures, including trench treatment, swabbing with hypochlorite solution, flushing and/or slug chlorination as appropriate.
3. Bacteriological testing should be done after repairs are complete, but the water main may be returned to service prior to completion of testing to minimize the time customers are out of water.
4. Leaks or breaks that are repaired with clamping devices while mains remain full of water under pressure require no disinfection.

**2.2.8** When non-metallic pipe is installed, detection tape or other acceptable means of detection shall be installed.

**2.3 Separation of Water Mains and Sewers**

**2.3.1** General - The following factors should be considered in providing adequate separation:

1. Materials and type of joints for water and sewer pipes.
2. Soil conditions.
3. Service and branch connections into the water main and sewer line.



4. Compensating variations in the horizontal and vertical separations.
5. Space for repair and alterations of water and sewer pipes.
6. Offsetting of pipes around manholes.
7. Water mains and sanitary or storm sewers shall not be laid in the same trench.

### 2.3.2 Parallel Installation

1. Normal Conditions - Water mains shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer, or sewer manhole, whenever possible. The distance shall be measured edge-to-edge.
2. Unusual Conditions - When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a storm or sanitary sewer, provided that:
  - a. The bottom of the water main is at least 18 inches above the top of the sewer.
  - b. Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling.

### 2.3.3 Crossings

1. Normal Conditions - Water mains crossing house sewers, storm sewers, or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer, whenever possible.
2. Unusual Conditions - When local conditions prevent a vertical separation as described above, the following construction shall be used:
  - a. Sewers passing over or under water mains should be constructed of ductile iron or cast iron pipe.
  - b. Water mains passing under sewers shall, in addition, be protected by providing:
    - (1) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main.

- (2) Adequate structural support for the sewers to prevent excessive deflection of joints and settling that could cause the water mains to break.
- (3) That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.
- (4) Both the sewer and water main shall be constructed of water pipe and tested in accordance with Section 2.2.5 above.

#### **2.3.4 Sewer Manholes**

No water pipe shall pass through or come into contact with any part of a sewer or sewer manhole.

#### **2.4 Surface Water Crossings**

Surface water crossings, both over and under water, present special problems which should be discussed with the Authority Manager before final plans are prepared.

##### **2.4.1 Above-Water Crossings**

The pipe shall be:

1. Adequately supported.
2. Protected from damage and freezing.
3. Accessible for repair or replacement.

##### **2.4.2 When crossing under water courses which are greater than 15 feet in width:**

1. The pipe shall be of special construction, having flexible, watertight joints.
2. Valves shall be provided at both ends of the water crossing so that the section can be isolated for test or repair. The valves shall be easily accessible and not subject to flooding.
3. Sampling taps should be available at each end of the crossing.
4. Permanent taps should be made for testing and locating leaks.

**2.5 Cross Connections**

2.5.1 There shall be no physical connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water and other contaminating materials may be discharged or drawn into the system.

2.5.2 The approval of the Authority Manager shall be obtained for interconnections between potable water supplies.

2.5.3 Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the potable water supply.

**2.6 Water Services and Plumbing**

Water services and plumbing shall conform to relevant local and/or State plumbing codes, or to the Standard Plumbing Code.

**2.7 Materials - General**

2.7.1 Pipe selected shall have been manufactured in conformity with the latest standards issued by AWWA and ASTM and the standard specifications included with this policy manual.

2.7.2 Gaskets and jointing materials used in the joints of pipe shall meet the latest standards of the AWWA or ASTM and the standard specifications included in this policy manual.

2.7.3 Mechanical joints or slip-on joints with rubber gaskets are preferred.

**2.8 Pipe**

2.8.1 Ductile iron and cast iron pipe shall meet the latest requirements of ANSI/AWWA -C106 or C108 for cast iron pipe and C151 for DIP.

## **2.8.2 PVC Pipe - 2 through 12 inches:**

1. PVC pipe meeting the standards set forth in AWWA C-900 (latest edition) will be accepted for those working pressures as designated by class. (Note that C-900 refers only to 4- through 12-inch pipe.)
2. SDR 21, Class 200 pressure-rated pipe may be used where the working pressure does not exceed 135 psi. The pipe must meet all the requirements set forth in ASTM Standard D 2241 for 2- through 12-inch pipe designated SDR 21. The pipe must bear the National Sanitation Foundation Testing Laboratories, Inc., seal of approval for potable water, or an approved equal.
3. Provision must be made for contraction and expansion at each joint with flexible ring gaskets made from rubber or other suitable material. Gasket materials shall meet the requirements established in ASTM F477.
4. Joints for PR 200 (pressure-rated) pipe (ASTM D 2241) shall be manufactured in accordance with ASTM D 3139. Section 5.3.1 of this standard refers to 2,000-hour tests. If pipe is manufactured in accordance with that section, the testing must be done by an independent laboratory with the results being furnished to the Authority Manager. Note also that a separate test is required for each different type of gasket provided.
5. All fittings such as tees, ells, etc., using welded joints shall be factory-welded and shall meet the same specifications as the welded bell section.
6. Lubricants shall be non-toxic and shall not promote biological growth.
7. Solvent cemented joints in the field are not permitted.
8. Forty-foot lengths will be permitted when the engineering specifications contain special conditions for handling such pipe lengths. These conditions shall include provisions for transporting pipe from storage areas to the installation area on specially designed racks to prevent the ends of the pipe from dragging.
9. This policy does not apply to plastic service lines.

## **2.9 Valve, Air Relief, Meter, and Blow-Off Chambers**

- 2.9.1** Sediment accumulations may be removed through a standard fire hydrant, and compressed air and pumping may be used for dewatering mains through hydrants.

**2.9.2** At high points in water mains where air can accumulate, provisions shall be made to remove the air by means of hydrants or air relief valves. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.

**2.9.3** Chambers or pits containing valves, blow-offs, meters, or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blow-offs or air-relief valves be connected directly to any sewer.

**2.9.4** Such chambers or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water, or to absorption pits underground.

**2.9.5** Valves are to be placed at all intersections of water mains but at no time greater than 1,000 feet apart.

**2.9.6** Gate valves shall meet current AWWA standards.

## **2.10 Hydrants**

### **2.10.1 Location and Spacing**

Hydrants should be provided at each street intersection and at intermediate points between intersections as recommended by the State's Insurance Services Office. Generally, hydrant spacing may range from 350 to 600 feet, depending on the area being served.

### **2.10.2 Valves and Nozzles**

Fire hydrants should have a bottom valve size of at least 5 inches, one 4-1/2-inch pumper nozzle, and two 2-1/2-inch nozzles. Threads shall be compatible with local fire department equipment.

### **2.10.3 Hydrant Leads**

The hydrant lead shall be a minimum of 6 inches in diameter. Isolation valves shall be installed in all hydrant leads.

2.10.4 Drainage

A gravel pocket or dry well shall be provided unless the natural soils will provide adequate drainage. Hydrant drains shall not be connected to or located within 10 feet of sanitary sewers or storm drains.

<b>INSTANTANEOUS (PEAK DEMAND) FOR RESIDENTIAL COMMUNITIES</b>	
<u>Number of Connections</u>	<u>Gallons per Minute</u>
10	40
15	50
20	58
25	66
30	73
35	80
40	85
45	91
50	96
55	101
60	106
70	115
80	124
90	132
100	140
125	160
150	175
175	191
200	205
250	230
300	255
400	295
500	335
1000	500

**CHAPTER 3**  
**Design Standards - Public Sewer Extensions**

# DESIGN STANDARDS - PUBLIC SEWER EXTENSIONS

## 3.0 DESIGN STANDARDS - PUBLIC SEWER EXTENSIONS

### 3.1 Design Flow

#### 3.1.1 Per Capita Flow

New sewer systems shall be designed on the basis of an average daily per capita flow of sewage of not less than 100 gallons per day (gpd). This figure is assumed to cover normal infiltration, but an additional allowance should be made where conditions are unfavorable.

#### 3.1.2 Peak Design Flow

New sanitary sewers shall be designed on a peak design flow basis using a ratio of peak flow to average flow determined as follows:

$$Q_{\max} / Q_{\text{ave}} = \frac{11 + \sqrt{P}}{1 + \sqrt{P}} \quad \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

Where:

$Q_{\max}$	=	Maximum rate of sewage flow (peak hourly flow).
$Q_{\text{ave}}$	=	Average daily sewage flow.
$P$	=	Population in thousands.

## 3.2 Design and Construction Details

### 3.2.1 Gravity Sewers

1. Minimum Size - No conventional gravity sewer shall be less than 8 inches in diameter.
2. Depth - Sewers shall not be less than 3 feet deep (measured to the top of the pipe), should be sufficiently deep to prevent physical damage, and should receive sewage from existing dwellings by gravity. Sewers located in roadways shall be not less than 4 feet deep. As a general rule, in roadways where cover is less than 4 feet, DIP or concrete encasement shall be used. For structural reasons, DIP, concrete encasement, or relocation shall be required when culverts or other conduits are laid such that the top of the sewer is less than 18 inches below the bottom of the culvert or conduit.



3. **Roughness Coefficient** - The roughness coefficient should be documented for the type of pipe used. However, for ease of calculation, an "n" value of 0.013 may be used in Manning's formula for the design of all sewer facilities.
4. **Slope** - All conventional gravity sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2 feet per second. The following minimum slopes should be provided; however, slopes greater than these are desirable:

Table 3.1

Minimum Slope for Sewer Lines

Sewer Size (inches)	Minimum Slope (feet per 100 feet)
8	0.40
10	0.28
12	0.22

Sewers shall be laid with uniform slope between manholes. "Sewers on 20 percent slope or greater shall be anchored securely with concrete anchors or equal. Anchors shall be at maximum intervals of 20 feet or behind each pipe bell, whichever is closer."

5. **Alignment** - Gravity sewers shall be designed with straight alignment between manholes.
6. **Increasing Size** - Where a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to place the 0.8-depth point of both sewers at the same elevation.
7. **High-Velocity Protection** - Where velocities greater than 15 feet per second are expected, special provisions shall be made to protect against internal erosion or displacement by shock.

### 3.2.2 Materials

1. **Pipe**
  - a. **Semi-Rigid Pipe - DIP.** All pipe should meet appropriate ASTM and/or ANSI specifications.
  - b. **Solid-Wall, Polyvinyl Chloride (PVC) Pipe.** PVC pipe should have a maximum standard dimension ratio (SDR) of 35. Flexible pipe deflection under earth loading may be calculated using the formula presented in the ASCE/WPCF publication, *Design and Construction of Sanitary and Storm*

**Sewers.** All pipe should meet appropriate ASTM and/or ANSI specifications. Detection tape shall be used with all non-metallic pipe.

**2. Storage**

The pipe interior, sealing surfaces, fittings, and other accessories should be kept clean. Store pipe bundles on flat surfaces with uniform support. Stored pipe should be protected from prolonged exposure (six months or more) to sunlight with a suitable covering (canvas or other opaque material). Air circulation should be provided under the covering. Gaskets should not be exposed to oil, grease, ozone (produced by electric motors), excessive heat, or direct sunlight. Consult with the manufacturer for specific storage and handling recommendations.

**3.2.3 Pipe Bedding**

1. All sewers shall be designed to prevent damage from superimposed loads. Proper allowance shall be made for loads on the sewer because of the width and depth of trench. Trench widths should be kept to a minimum. Backfill material up to 3 feet above the top of the pipe should not exceed 6 inches in diameter at its greater dimension.
2. Uncased borings are not permitted for pipe larger than 3 inches.
3. **Bedding**
  - a. DIP - Bedding Classes I, II, III or IV (ML and CL only) as described in ASTM D2321 shall be used for all DIP provided with the specified bedding to support the anticipated load. DIP shall be installed as per ASTM A746.
  - b. PVC Pipe - Bedding Classes I, II, or III as described in ASTM D2321 (with the exception that all particles shall be smaller than 3/4-inch) shall be used for all PVC pipe, provided the proper strength pipe is used with the specified bedding to support the anticipated load. Bedding, haunching, initial backfill, and backfill shall be placed in accordance with ASTM D2321.
  - c. Deflection Testing - Deflection testing of all flexible pipe as described in ASTM D3034 shall be required. The test shall be conducted after the backfill has been in place at least 24 hours. No pipe shall exceed a deflection of 5 percent. The test shall be run with a rigid ball or an engineer-approved nine-arm mandrel having a diameter equal to 95 percent of the inside diameter of the pipe. The test must be performed by manually pulling the test device through the line.

**3.2.4 Joints**

Elastomeric gaskets or other types of pre-molded (factory made) joints are required. Cement mortar joints are not acceptable. Field-solvent welds for PVC pipe and fittings are not acceptable.

### 3.2.5 Leakage Testing

Low-pressure air testing for all pipe shall be performed according to ASTM C828. The time required for the pressure to drop from the stabilized 3.5 psig to 2.5 psig should be greater than or equal to the minimum calculated test time. (The test criteria should be based on the air loss rate.) The testing method should take into consideration the range in groundwater elevations projected and the situation during the test. The height of the groundwater should be measured from the top of the invert (one foot of H<sub>2</sub>O = 0.433 psi).

Table 3.2 gives the minimum test times and allowable air loss values for various pipe sizes per 100 feet:

TABLE 3.2  
Allowable Test Times and Loss Values

Pipe Size (inches)	Time (sec/100 feet)	Allowable Air Loss (ft <sup>3</sup> /minute)
6	42	2.0
8	72	2.0
10	90	2.5
12	108	3.0

### 3.2.6 Low-Pressure Systems

1. Application - Low-pressure systems may be considered for situations in which gravity sewers are extremely costly or impractical, such as in areas with rock or a high groundwater table, and only with the written approval of the Authority Manager.
2. Grinder Pumps - All raw wastewater should be collected from individual buildings/dwellings and transported to the pressure or gravity system by appropriately sized grinder pumps. Grinder pumps do not require a septic tank. All pumps shall have operating curves that do not allow backflow under maximum head conditions. Pump units shall be watertight and located above the seasonal groundwater table where possible. Odor considerations must be evaluated. Electrical power should be supplied through the main circuit box to a separate circuit box installed on the exterior wall of the building, near the grinder pump.
3. Provisions for Maintenance - Approval of a low-pressure sewer system shall be contingent on the following minimum provisions being made for operation and maintenance:

- a. At least a 5 percent reserve stock of replacement pumping units shall be provided to the Authority.
  - b. Qualified grinder pump maintenance personnel shall be available as long as the system exists.
  - c. There shall be a written service agreement with the manufacturer assuring the availability of factory-trained maintenance personnel, the continued availability of standby equipment and replacement parts, provisions assuring the Authority that breakdowns will be repaired within 24 hours, and a written preventive maintenance plan.
  - d. The owner of each tract or building served by a grinder pump shall grant an easement and/or right-of-way to the Authority for maintenance and inspection services if required.
4. **Minimum Velocity** - The minimum operating velocity in the pressure system shall be 2 feet per second.
  5. **Flushing** - There shall be a means of cleaning the system, particularly to clear any settleable solids or grease accumulation.
  6. **Pressure Testing** - There shall be means for isolating and pressurizing sections of the system to detect and locate leaks.
  7. **Alarms** - There should be a dual audio and visual warning system on the pump control panel, indicating malfunction of the pump and high level (in storage tank).
  8. **Cleanouts** - Cleanouts should be provided at maximum 400-foot intervals.
  9. **Ventilation** - Ventilation of the pump station should be provided via house vents where allowable or through a separate system.
  10. **Service Line Connection** - At the point of property line entry at the public right-of-way, a gate valve, clean-out and check valve will be installed on each service line. Valves and clean-out will be installed within a standard 2-inch meter box.

### **3.2.7 Manholes**

1. **Location** - Manholes shall be installed at the end of each line of 8-inch diameter or greater unless the 8-inch line is expected to be extended in the foreseeable future, in which case a cleanout shall be installed at the end of the line; at all changes in grade, size, or alignment; at all intersections; and at distances not greater than 400 feet for sewers 15 inches or less.
2. **Drop Connection** - An outside drop connection shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert should be filleted to prevent solids deposition.

3. Diameter - The minimum diameter of manholes should be 48 inches; larger diameters are preferable. The minimum clear opening in the manhole frame should be 24 inches to provide safe access for emergencies.
4. Flow Channels - Flow channels in manholes shall be of such shape and slope to provide smooth transition between inlet and outlet sewers and to minimize turbulence. A minimum slope of 0.1-foot drop across the bottom of the manhole must be provided for cleaning and to maintain the hydraulic gradient. Channeling height shall be to the crowns of the sewers. Benches shall be sloped from the manhole wall toward the channel to prevent accumulation of solids.
5. Watertightness - Watertight manhole covers shall be used wherever the manhole tops may be flooded. Brick and segmented block are not appropriate materials for manhole construction where groundwater conditions are unfavorable.
6. Connections - Line connections directly to the manholes or to short stubs integral with the manholes should be made with flexible joints. Flexible joints are joints which permit the manholes to settle without destroying the watertight integrity of the line connections.
7. Ventilation - Ventilation of gravity sewer systems should be considered for continuous watertight sections greater than 1,000 feet in length. Vent height and construction must consider flood conditions.
8. Frames, Covers, and Steps - Frames, covers, and steps shall be of suitable material and designed to accommodate prevailing site conditions and to provide for a safe installation. Materials used for manhole steps should be highly corrosion-resistant. The use of galvanized steel should be avoided, and aluminum or plastic with reinforcing bar is preferred.

### **3.3 Special Details**

#### **3.3.1 Protection of Water Supplies**

1. Water Supply Interconnections - There shall be no physical connection between a public or private potable water supply system and a sewer or appurtenance thereto.
2. Relation to Waterworks Structures - It is generally recognized that sewers shall be kept remote from public water supply wells or other water supply sources and structures.
3. Relation to Water Mains
  - a. Horizontal Separation: Whenever practical, sewers should be laid at least 10 feet horizontally from any existing or proposed water main. The distance should be measured edge to edge. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if it is laid in a separate trench and if the elevation of

the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.

- b. Vertical Separation: Whenever sewers must cross under water mains, the sewer shall be laid at such elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirement, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.
- c. When it is impractical to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be designed and constructed equal to the water main pipe and shall be pressure-tested to assure watertightness (see water extension criteria). Such arrangements are discouraged and adequate reason shall be provided to justify the design.

### 3.3.2 Sewers in Relation to Streams

#### 1. Location of Sewers in Streams

The top of all sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the streambed to protect the sewer line. In general, the following cover requirements must be met:

- a. One (1) foot of cover (poured-in-place concrete) is required where the sewer is located in rock.
- b. Three (3) feet of cover is required in stabilized stream channels.
- c. Seven (7) feet of cover or more is required in shifting stream channels.

Sewers located along streams shall be located outside the streambed and sufficiently removed therefrom to minimize disturbance or root damage to streamside trees and vegetation.

Sewer outfalls, headwalls, manholes, gateboxes or other structures shall be located so they do not interfere with the free discharge of flow of the stream.

Sewers crossing streams shall be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be free from change in grade. To prevent the French drain effect of the sewer crossing the stream, check dams must be installed upstream and downstream in the pipe conduit trench. This must be separate from any concrete encasement.

2. Construction - Sewers entering or crossing streams shall be constructed of DIP with mechanical joints, concrete encased, or shall be so otherwise constructed that they will remain watertight and free from changes in alignment or grade. Sewer systems shall be designed to minimize the number of stream crossings. Uncased borings are not permitted.
3. Special Construction Requirements - Special design requirements shall be employed to prevent stream drainage from sinking at the crossing and following along the sewer pipe bedding. This can be accomplished with an in-trench impounding structure of compacted clay or other impermeable materials. Other proposals will be considered.
4. Aerial Crossings - Sewers laid on piers across ravines or streams shall be allowed when it can be demonstrated that no other practical alternative exists or, in the design engineer's judgment, other methods will not be as reliable. Support shall be provided for all joints. All supports shall be designed to prevent frost heave, overturning, or settlement. Precautions against freezing, such as insulation or increased slope, shall be provided. Expansion jointing shall be provided between aboveground and belowground sewers. The impact of flood waters and debris shall be considered. The bottom of the pipe should be placed no lower than the elevation of the 50-year flood stage.
5. Permits - It is the owner's responsibility to obtain all necessary permits along streams or rivers (i.e., Corps of Engineers, TVA, or EPD).

### 3.3.3 Inverted Siphons

Inverted siphons shall not be used.

### 3.3.4 Line Disturbance

Any pipe that has its alignment, grade, or joints disturbed after installation shall be removed and re-laid.

### 3.3.5 Bypasses

The bypassing of raw wastewater onto the ground or a receiving stream is strictly prohibited.

**CHAPTER 4**  
**Contract Conditions and Specifications**



# CONTRACT CONDITIONS AND SPECIFICATIONS

## 4.0 CONTRACT CONDITIONS AND SPECIFICATIONS

The following standard contract conditions and specifications (or functional equivalents) may be used for public water and sewer extensions which will be assumed by the Authority. Conditions and specifications should be edited by the designer where appropriate to accommodate project-specific conditions or exclude inapplicable provisions.

CSI Section	Title
<b>Contract Regulations</b>	
00700	General Conditions
00800	Supplemental General Conditions
<b>Specifications</b>	
01080	Applicable Codes and Standards
01090	Abbreviations
01340	Shop Drawings, Product Data, and Samples
01380	Construction Photographs
01400	Quality Control Services
01700	Project Closeout
01730	Operating and Maintenance Data
01740	Warranties and Bonds
02200	Earthwork
02270	Slope Protection and Erosion Control
02280	Utility Line Crossings of Streams
02485	Seeding
02500	New and Replacement Paving
02560	Sewer Manholes and Covers
02930	Riprap
02951	Railroad and Highway Crossings
03300	Cast-in-Place Concrete
11311	Submersible Pumps and Accessories
15041	Disinfection of Potable Water Lines and Water Storage Tanks
15061	Steel and Alloy Piping and Copper Tubing
15062	Ductile Iron Pipe and Fittings
15064	Polyvinyl Chloride Pipe for Water and Pressure Sewer Applications
15074	Polyvinyl Chloride Pipe for Gravity Sewers
15090	Pipe Couplings and Expansion Joints
15101	Valves
15109	Hydrants
15182	Water Services

# **CONTRACT REGULATIONS**

## GENERAL CONDITIONS

1. Definitions
2. Additional Instructions and Detail Drawings
3. Schedules, Reports and Records
4. Drawings and Specifications
5. Shop Drawings
6. Materials, Services and Facilities
7. Inspection and Testing
8. Substitutions
9. Patents -
10. Surveys, Permits, Regulations
11. Protection of Work, Property and Persons
12. Supervision by Contractor
13. Changes in the Work
14. Changes in Contract Price
15. Time for Completion and Liquidated Damages
16. Correction of Work
17. Subsurface Conditions
18. Suspension of Work, Termination and Delay
19. Payments to Contractor
20. Acceptance of Final Payment as Release
21. Insurance
22. Contract Security
23. Assignments
24. Indemnification
25. Separate Contracts
26. Subcontracting
27. Engineer's Authority
28. Land and Rights-of-Way
29. Guaranty
30. Arbitration
31. Taxes

### 1. DEFINITIONS

1.1 Wherever used in the CONTRACT DOCUMENTS, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

1.2 ADDENDA - Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the CONTRACT DOCUMENTS, DRAWINGS, AND SPECIFICATIONS by additions, deletions, clarifications or corrections.

1.3 BID - The offer or proposal of the BIDDER submitted on the prescribed form setting forth the prices for the Work to be performed.

1.4 BIDDER - Any person, firm or corporation submitting a BID for the WORK.

1.5 BONDS - Bid, Performance, and Payment Bonds and other instruments of security, furnished by the CONTRACTOR and his surety in accordance with the CONTRACT DOCUMENTS.

1.6 CHANGE ORDER - A written order to the CONTRACTOR authorizing an addition, deletion or revision in the WORK within the general scope of the CONTRACT DOCUMENTS, or authorizing an adjustment in the CONTRACT PRICE OR CONTRACT TIME.

1.7 CONTRACT DOCUMENTS - The contract, including Advertisement For Bids, Information For Bidders, BID, Bid Bond, Agreement, Payment Bond, Performance Bond, NOTICE OF AWARD,

NOTICE TO PROCEED, CHANGE ORDER, DRAWINGS, SPECIFICATIONS, and ADDENDA.

1.8 CONTRACT PRICE - The total monies payable to the CONTRACTOR under the terms and conditions of the CONTRACT DOCUMENTS.

1.9 CONTRACT TIME - The number of calendar days stated in the CONTRACT DOCUMENTS for the completion of the WORK.

1.10 CONTRACTOR - The person, firm, or corporation with whom the OWNER has executed the Agreement.

1.11 DRAWINGS - The part of the CONTRACT DOCUMENTS which show the characteristics and scope of the WORK to be performed and which have been prepared or approved by the ENGINEER.

1.12 ENGINEER - The person, firm, or corporation named as such in the CONTRACT DOCUMENTS.

1.13 FIELD ORDER - A written order effecting a change in the WORK not involving an adjustment in the CONTRACT PRICE or an extension of the CONTRACTOR during construction.

1.14 NOTICE OF AWARD - The written notice of the acceptance of the BID from the OWNER to the successful BIDDER.

1.15 NOTICE TO PROCEED - Written communication issued by the OWNER to the CONTRACTOR authorizing him to proceed with

the WORK and establishing the date of commencement of the WORK.

1.16 OWNER - A public or quasi-public body or authority, corporation, association, partnership, or individual for whom the WORK is to be performed.

1.17 PROJECT - The undertaking to be performed as provided in the CONTRACT DOCUMENTS.

1.18 RESIDENT PROJECT REPRESENTATIVE- The authorized representative of the OWNER who is assigned to the PROJECT site or any part thereof.

1.19 SHOP DRAWINGS - All drawings, diagrams, illustrations, brochures, schedules, and other data which are prepared by the CONTRACTOR, a SUBCONTRACTOR, manufacturer, SUPPLIER, or distributor, which illustrate how specific portions of the WORK shall be fabricated or installed.

1.20 SPECIFICATIONS - A part of the CONTRACT DOCUMENTS consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards, and workmanship.

1.21 SUBCONTRACTOR - An individual, firm or corporation having a direct contract with the CONTRACTOR or with any other SUBCONTRACTOR for the performance of a part of the WORK at the site.

1.22 SUBSTANTIAL COMPLETION - That date as certified by the ENGINEER when the construction of the PROJECT or a specified part thereof is sufficiently completed, in accordance with the CONTRACT DOCUMENTS, so that the PROJECT or specified part can be utilized for the purposes for which it is intended.

1.23 SUPPLEMENTAL GENERAL CONDITIONS - Modifications to General Conditions required by a Federal agency for participation in the PROJECT and approved by the agency in writing prior to inclusion in the CONTRACT DOCUMENTS, or such requirements that may be imposed by applicable state laws.

1.24 SUPPLIER - Any person or organization who supplies materials or equipment for the WORK, including that fabricated to a specific design, but who does not perform labor at the site.

1.25 WORK - All labor necessary to produce the

construction required by the CONTRACT DOCUMENTS, and all materials and equipment incorporated or to be incorporated in the PROJECT.

1.26 WRITTEN NOTICE - Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address or delivered in person to said party or his authorized representative on the WORK.

## 2. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

2.1 The CONTRACTOR may be furnished additional instructions and detail drawings, by the ENGINEER, as necessary to carry out the WORK required by the CONTRACT DOCUMENTS.

2.2 The additional drawings and instruction thus supplied will become a part of the CONTRACT DOCUMENTS. The CONTRACTOR shall carry out the WORK in accordance with the additional detail drawings and instructions.

## 3. SCHEDULES, REPORTS, AND RECORDS

3.1 The CONTRACTOR shall submit to the OWNER such schedule of quantities and costs, progress schedules payrolls, reports, estimates, records and other data where applicable as are required by the CONTRACT DOCUMENTS for the WORK to be performed.

3.2 Prior to the first partial payment estimate the CONTRACTOR shall submit construction progress schedules showing the order in which he proposes to carry on the WORK, including dates at which he will start the various parts of the WORK, estimated date of completion of each part and, as applicable:

3.2.1 The dates at which special detail drawings will be required; and

3.2.2 Respective dates for submission of SHOP DRAWINGS, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.

3.3 The CONTRACTOR shall also submit a schedule of payments that he anticipates he will earn during the course of the WORK.

#### 4. DRAWINGS AND SPECIFICATIONS

4.1 The intent of the DRAWINGS and SPECIFICATIONS is that the CONTRACTOR shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the WORK in accordance with the CONTRACT DOCUMENTS and all incidental work necessary to complete the PROJECT in an acceptable manner, ready for use, occupancy or operation by the OWNER.

4.2 In case of conflict between the DRAWINGS and SPECIFICATIONS, the SPECIFICATIONS shall govern. Figure dimensions on DRAWINGS shall govern over scale dimensions, and detailed DRAWINGS shall govern over general DRAWINGS.

4.3 Any discrepancies found between the DRAWINGS and SPECIFICATIONS and site conditions or any inconsistencies or ambiguities in the DRAWINGS or SPECIFICATIONS shall be immediately reported to the ENGINEER, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. WORK done by the CONTRACTOR after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the CONTRACTOR'S risk.

#### 5. SHOP DRAWINGS

5.1 The CONTRACTOR shall provide SHOP DRAWINGS as may be necessary for the prosecution of the WORK as required by the CONTRACT DOCUMENTS. The ENGINEER shall promptly review all SHOP DRAWINGS. The ENGINEER'S approval of any SHOP DRAWING shall not release the CONTRACTOR from responsibility for deviations from the CONTRACT DOCUMENTS. The approval of any SHOP DRAWING which substantially deviates from the requirement of the CONTRACT DOCUMENTS shall be evidenced by a CHANGE ORDER.

5.2 When submitted for the ENGINEER'S review, SHOP DRAWINGS shall bear the CONTRACTOR'S certification that he has reviewed, checked, and approved the SHOP DRAWINGS and that they are in conformance with the requirements of the CONTRACT DOCUMENTS.

5.3 Portions of the WORK requiring a SHOP DRAWING or sample submission shall not begin until the SHOP DRAWING or submission has been approved by the ENGINEER. A copy of each approved SHOP DRAWING and each approved sample shall be kept in good order by the

CONTRACTOR at the site and shall be available to the ENGINEER.

#### 6. MATERIALS, SERVICES AND FACILITIES

6.1 It is understood that, except as otherwise specifically stated in the CONTRACT DOCUMENTS, the CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the WORK within the specified time.

6.2 Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the WORK. Stored materials and equipment to be incorporated in the WORK shall be located so as to facilitate prompt inspection.

6.3 Manufactured supplies, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the manufacturer.

6.4 Material, supplies, and equipment shall be in accordance with samples submitted by the CONTRACTOR and approved by the ENGINEER.

6.5 Materials, supplies, or equipment to be incorporated into the WORK shall not be purchased by the CONTRACTOR or the SUB-CONTRACTOR subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.

#### 7. INSPECTION AND TESTING

7.1 All materials and equipment used in the construction of the PROJECT shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the CONTRACT DOCUMENTS.

7.2 The OWNER shall provide all inspection and testing services not required by the CONTRACT DOCUMENTS.

7.3 The CONTRACTOR shall provide at his expense the testing and inspection services required by the CONTRACT DOCUMENTS.

7.4 If the CONTRACT DOCUMENTS, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction require any WORK to specifically be inspected, tested, or approved by someone other than the

CONTRACTOR, the CONTRACTOR will give the ENGINEER timely notice of readiness. The CONTRACTOR will then furnish the ENGINEER the required certificates of inspection, testing, or approval.

7.5 Inspections, tests, or approvals by the engineer or others shall not relieve the CONTRACTOR from his obligations to perform the WORK in accordance with the requirements of the CONTRACT DOCUMENTS.

7.6 The ENGINEER and his representatives will at all times have access to the WORK. In addition, authorized representatives and agents of any participating Federal or state agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The CONTRACTOR will provide proper facilities for such access and observation of the WORK and also for any inspection or testing thereof.

7.7 If any WORK is covered contrary to the written instructions of the ENGINEER it must, if requested by the ENGINEER, be uncovered for his observation and replaced at the CONTRACTOR'S expense.

7.8 If the ENGINEER considers it necessary or advisable that covered WORK be inspected or tested by others, the CONTRACTOR, at the ENGINEER'S request will uncover, expose, or otherwise make available for observation, inspection or testing as the ENGINEER may require, that portion of the WORK in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such WORK is defective, the CONTRACTOR will bear all the expenses of such uncovering, exposure, observation, inspection, and testing and of satisfactory reconstruction. If, however, such WORK is not found to be defective, the CONTRACTOR will be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction, and an appropriate CHANGE ORDER shall be issued.

## 8. SUBSTITUTIONS

8.1 Whenever a material, article, or piece of equipment is identified on the DRAWINGS or SPECIFICATIONS by reference to brand name or catalogue number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and

that other products of equal capacities, quality, and function shall be considered. The CONTRACTOR may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the CONTRACT DOCUMENTS by reference to brand name or catalogue number, and if, in the opinion of the ENGINEER, such material, article, or piece of equipment is of equal substance and function to that specified, the ENGINEER may approve its substitution and use by the CONTRACTOR. Any cost differential shall be deductible from the CONTRACT PRICE and the CONTRACT DOCUMENTS shall be appropriately modified by CHANGE ORDER. The CONTRACTOR warrants that if substitutes are approved, no major changes in the function or general design of the PROJECT will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the CONTRACTOR without a change in the CONTRACT PRICE or CONTRACT TIME.

## 9. PATENTS

9.1 The CONTRACTOR shall pay all applicable royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and save the OWNER harmless from loss on account thereof. Except that the OWNER shall be responsible for any such loss when a particular process, design, or the product of a particular manufacturer or manufacturers is specified, however, if the CONTRACTOR has reason to believe that the design process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the ENGINEER.

## 10. SURVEYS, PERMITS, REGULATIONS

10.1 The OWNER shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the WORK together with a suitable number of bench marks adjacent to the WORK as shown in the CONTRACT DOCUMENTS. From the information provided by the OWNER, unless otherwise specified in the CONTRACT DOCUMENTS, the CONTRACTOR shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pile locations and other working points, lines, elevations, and cut sheets.

10.2 The CONTRACTOR shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, he shall be

charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

10.3 Permits and licenses of a temporary nature necessary for the prosecution of the WORK shall be secured and paid for by the CONTRACTOR unless otherwise stated in the SUPPLEMENTAL GENERAL CONDITIONS. Permits, licenses, and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the OWNER, unless otherwise specified. The CONTRACTOR shall give all notices and comply with all laws, ordinances, rules, and regulations bearing on the conduct of the WORK as drawn and specified. If the CONTRACTOR observes that the CONTRACT DOCUMENTS are at variance therewith, he shall promptly notify the ENGINEER in writing and any necessary changes shall be adjusted as provided in Section 13. CHANGES IN THE WORK.

## 11. PROTECTION OF WORK, PROPERTY AND PERSONS

11.1 The CONTRACTOR will be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the WORK. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the WORK and other persons who may be affected thereby, all the WORK and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation or replacement in the course of construction.

11.2 The CONTRACTOR will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. He will erect and maintain, as required by the conditions and progress of the WORK, all necessary safeguards for safety and protection. He will notify owners of adjacent utilities when prosecution of the WORK may affect them. The CONTRACTOR will remedy all damage, injury, or loss to any property caused, directly or indirectly, in whole or in part, by the CONTRACTOR, any SUBCONTRACTOR or anyone directly or indirectly employed by any of them or anyone for whose acts any of them be liable, except damage or loss attributable to the fault of the CONTRACT DOCUMENTS or to the acts or omissions of the OWNER or the ENGINEER or anyone employed

by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the CONTRACTOR.

11.3 In emergencies affecting the safety of persons or the WORK or property at the site or adjacent thereto, the CONTRACTOR, without special instruction or authorization from the ENGINEER or OWNER, shall act to prevent threatened damage, injury, or loss. He will give the ENGINEER prompt WRITTEN NOTICE of any significant changes in the WORK or deviations from the CONTRACT DOCUMENTS caused thereby, and a CHANGE ORDER shall be issued covering the changes and deviations involved.

## 12. SUPERVISION BY CONTRACTOR

12.1 The CONTRACTOR will supervise and direct the WORK. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The CONTRACTOR will employ and maintain on the WORK a qualified supervisor or superintendent who shall have been designated in writing by the CONTRACTOR as the CONTRACTOR'S representative at the site. The supervisor shall have full authority to act on behalf of the CONTRACTOR and all communications given to the supervisor shall be as binding as if given to the CONTRACTOR. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the WORK.

## 13. CHANGES IN THE WORK

13.1 The OWNER may at any time, as the need arises, order changes within the scope of the WORK without invalidating the Agreement. If such changes increase or decrease the amount due under the CONTRACT DOCUMENTS, or in the time required for performance of the WORK, an equitable adjustment shall be authorized by CHANGE ORDER.

13.2 The ENGINEER, also, may at any time, by issuing a FIELD ORDER, make changes in the details of the WORK. The CONTRACTOR shall proceed with the performance of any changes in the WORK so ordered by the ENGINEER unless the CONTRACTOR believes that such FIELD ORDER entitles him to a change in CONTRACT PRICE or TIME, or both, in which event he shall give the ENGINEER WRITTEN NOTICE thereof within seven (7) days after the receipt of the ordered change. Thereafter the CONTRACTOR shall document the basis for the change in

CONTRACT PRICE or TIME within thirty (30) days. The CONTRACTOR shall not execute such changes pending the receipt of an executed CHANGE ORDER or further instruction from the OWNER.

#### 14. CHANGES IN CONTRACT PRICE

14.1 The CONTRACT PRICE may be changed only by a CHANGE ORDER. The value of any WORK covered by a CHANGE ORDER or of any claim for increase or decrease in the CONTRACT PRICE shall be determined by one or more of the following methods in the order of precedence listed below:

- (a) Unit prices previously approved.
- (b) An agreed lump sum.
- (c) The actual cost for labor, direct overhead, materials, supplies, equipment, and other services necessary to complete the work. In addition there shall be added an amount to be agreed upon but not to exceed fifteen (15) percent of the actual cost of the WORK to cover the cost of general overhead and profit.

#### 15. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

15.1 The date of beginning and the time for completion of the WORK are essential conditions of the CONTRACT DOCUMENTS and the WORK embraced shall be commenced on a date specified in the NOTICE TO PROCEED.

15.2 The CONTRACTOR will proceed with the WORK at such rate of progress to insure full completion within the CONTRACT TIME. It is expressly understood and agreed, by and between the CONTRACTOR and the OWNER, that the CONTRACT TIME for the completion of the WORK described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the WORK.

15.3 If the CONTRACTOR shall fail to complete the WORK within the CONTRACT TIME, or extension of time granted by the OWNER, then the CONTRACTOR will pay to the OWNER the amount for liquidated damages as specified in the BID for each calendar day that the CONTRACTOR shall be in default after the time stipulated in the CONTRACT DOCUMENTS.

15.4 The CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the WORK is due to the following, and the CONTRACTOR has promptly

given WRITTEN NOTICE of such delay to the OWNER or ENGINEER.

15.4.1 To any preference, priority, or allocation order duly issued by the OWNER.

15.4.2 To unforeseeable causes beyond the control and without the fault or negligence of the CONTRACTOR, including but not restricted to, acts of God or of the public enemy, acts of the OWNER, acts of another CONTRACTOR in the performance of a CONTRACT with the OWNER, fires, floods, epidemics, quarantine, restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and

15.4.3 To any delays of SUBCONTRACTORS occasioned by any of the causes specified in paragraphs 15.4.1 and 15.4.2 of this article.

#### 16. CORRECTION OF WORK

16.1 The CONTRACTOR shall promptly remove from the premises all WORK rejected by the ENGINEER for failure to comply with the CONTRACT DOCUMENTS, whether incorporated in the construction or not and the CONTRACTOR shall promptly replace and re-execute the WORK in accordance with the CONTRACT DOCUMENTS and without expense to the OWNER and shall bear the expense of making good all WORK of other CONTRACTORS destroyed or damaged by such removal or replacement.

16.2 All removal and replacement WORK shall be done at the CONTRACTOR'S expense. If the CONTRACTOR does not take action to remove such rejected WORK within ten (10) days after receipt of WRITTEN NOTICE, the OWNER may remove such WORK and store the materials at the expense of the CONTRACTOR.

#### 17. SUBSURFACE CONDITIONS

17.1 The CONTRACTOR shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the OWNER by WRITTEN NOTICE of:

17.1.1 Subsurface or latent physical conditions at the site differing materially from those indicated in the CONTRACT DOCUMENTS; or

17.1.2 Unknown physical conditions at the site, of an unusual nature, differing materially from



those ordinarily encountered and generally recognized as inherent in WORK of the character provided for in the CONTRACT DOCUMENTS.

17.2 The OWNER shall promptly investigate the conditions, and if he finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the WORK, an equitable adjustment shall be made and the CONTRACT DOCUMENTS shall be modified by a CHANGE ORDER. Any claim of the CONTRACTOR for adjustment hereunder shall not be allowed unless he has given the required WRITTEN NOTICE: provided that the OWNER may, if he determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

#### 18. SUSPENSION OF WORK, TERMINATION AND DELAY

18.1 The OWNER may suspend the WORK or any portion thereof for a period of not more than ninety days or such further time as agreed upon by the CONTRACTOR, by WRITTEN NOTICE to the CONTRACTOR and the ENGINEER which notice shall fix the date on which WORK shall be resumed. The CONTRACTOR will resume that WORK on the date so fixed. The CONTRACTOR will be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributable to any suspension.

18.2 If the CONTRACTOR is adjudged a bankrupt or insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or receiver is appointed for the CONTRACTOR or for any of his property, or if he files a petition to take advantage of any debtor's act, or to reorganized under the bankruptcy or applicable laws, or if he repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or if he repeatedly fails to make prompt payments to SUBCONTRACTORS or for labor, materials, or equipment or if he disregards laws, ordinances, rules, regulations, or orders of any public body having jurisdiction of the WORK or if he disregards the authority of the ENGINEER, or if he otherwise violates any provision of the CONTRACT DOCUMENTS, then the OWNER may, without prejudice to any other right or remedy and after giving the CONTRACTOR and his surety a minimum of ten (10) days from delivery of a WRITTEN NOTICE, terminate the services of the CONTRACTOR and take possession of the PROJECT and of all materials, equipment, tools, construction equipment, and machinery thereon owned by the CONTRACTOR, and finish the

WORK by whatever method he may deem expedient. In such case the CONTRACTOR shall not be entitled to receive any further payment until the WORK is finished. If the unpaid balance of the CONTRACT PRICE exceeds the direct and indirect costs of completing the PROJECT, including compensation for additional professional services, such excess SHALL BE PAID TO THE CONTRACTOR. If such costs exceed such unpaid balance, the CONTRACTOR will pay the difference to the OWNER. Such costs incurred by the OWNER will be determined by the ENGINEER and incorporated in a CHANGE ORDER.

18.3 Where the CONTRACTOR'S services have been so terminated by the OWNER, said termination shall not affect any right of the OWNER against the CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of monies by the OWNER due the CONTRACTOR will not release the CONTRACTOR from compliance with the CONTRACT DOCUMENTS.

18.4 After ten (10) days from delivery of a WRITTEN NOTICE to the CONTRACTOR and the ENGINEER, the OWNER may without cause and without prejudice to any other right or remedy, elect to abandon the PROJECT and terminate the Contract. In such case, the CONTRACTOR shall be paid for all WORK executed and any expense sustained plus reasonable profit.

18.5 If, through no act or fault of the CONTRACTOR, the WORK is suspended for a period of more than ninety (90) days by the OWNER or under an order of court or other public authority, or the ENGINEER fails to act on any request for payment within thirty (30) days after it is submitted, or the OWNER fails to pay the CONTRACTOR substantially the sum approved by the ENGINEER or awarded by arbitrators within thirty (30) days of its approval and presentation, then the CONTRACTOR may, after ten (10) days from delivery of a WRITTEN NOTICE to the OWNER and the ENGINEER, terminate the CONTRACT and recover from the OWNER payment for all WORK executed and all expenses sustained. In addition, and in lieu of terminating the CONTRACT, if the ENGINEER has failed to act on a request for payment or if the OWNER has failed to make any payment as aforesaid, the CONTRACTOR may upon then (10) days WRITTEN NOTICE to the OWNER and the ENGINEER stop the WORK until he has been paid all amounts then due, in which event and upon resumption of the WORK, CHANGE ORDERS shall be issued for adjusting the CONTRACT PRICE or extending the CONTRACT

TIME or both to compensate for the costs and delays attributable to the stoppage of the WORK.

18.6 If the performance of all or any portion of the WORK is suspended, delayed, or interrupted as a result of a failure of the OWNER or ENGINEER to act within the time specified in the CONTRACT DOCUMENTS, or if no time is specified, within a reasonable time, an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, shall be made by CHANGE ORDER to compensate the CONTRACTOR for the costs and delays necessarily caused by the failure of the OWNER or ENGINEER.

## 19. PAYMENTS TO CONTRACTOR

19.1 At least ten (10) days before each progress payment falls due (but not more often than once a month), the CONTRACTOR will submit to the ENGINEER a partial payment estimate filled out and signed by the CONTRACTOR covering the WORK performed during the period covered by the partial payment estimate and supported by such data as the ENGINEER may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the WORK but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the OWNER, as will establish the OWNER'S title to the material and equipment and protect his interest therein, including applicable insurance. The ENGINEER will, within ten (10) days after receipt of each partial payment estimate, either indicate in writing his approval of payment and present the partial payment estimate to the OWNER, or return the partial payment estimate to the CONTRACTOR indicating in writing his reasons for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the partial payment estimate. The OWNER will, within ten (10) days of presentation of him of an approved partial payment estimate, pay the CONTRACTOR a progress payment on the basis of the approved partial payment estimate. The OWNER shall retain ten (10) percent of the amount of each payment until final completion and acceptance of all work covered by the CONTRACT DOCUMENTS. The OWNER at any time, however, after fifty (50) percent of the WORK has been completed, if he finds that satisfactory progress is being made, shall reduce retainage to five (5%) percent on the current and remaining estimates. When the WORK is substantially complete (operational or beneficial occupancy), the retained amount may be further reduced below five (5) percent to only

that amount necessary to assure completion. On completion and acceptance of a part of the WORK on which the price is stated separately in the CONTRACT DOCUMENTS, payment may be made in full, including retained percentages, less authorized deductions.

19.2 The request for payment may also include an allowance for the cost of such major materials and equipment which are suitably stored either at or near the site.

19.3 Prior to SUBSTANTIAL COMPLETION, the OWNER, with the approval of the ENGINEER and with the concurrence of the CONTRACTOR, may use any completed or substantially completed portions of the WORK. Such use shall not constitute an acceptance of such portions of the WORK.

19.4 The OWNER shall have the right to enter the premises for the purpose of doing work not covered by the CONTRACT DOCUMENTS. This provision shall not be construed as relieving the CONTRACTOR of the sole responsibility for the care and protection of the WORK, or the restoration of any damaged WORK except such as may be caused by agents or employees of the OWNER.

19.5 Upon completion and acceptance of the WORK, the ENGINEER shall issue a certificate attached to the final payment request that the WORK has been accepted by him under the conditions of the CONTRACT DOCUMENTS. The entire balance found to be due the CONTRACTOR, including the retained percentages, but except such sums as may be lawfully retained by the OWNER, shall be paid to the CONTRACTOR within thirty (30) days of completion and acceptance of the WORK.

19.6 The CONTRACTOR will indemnify and save the OWNER or the OWNER'S agents harmless from all claims growing out of the lawful demands of SUBCONTRACTORS, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the WORK. The CONTRACTOR shall, at the OWNER'S request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If the CONTRACTOR fails to do so the OWNER may, after having notified the CONTRACTOR, either pay unpaid bills or withhold from the CONTRACTOR'S unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful

claims until satisfactory evidence is furnished that all liabilities have been fully discharged where upon payment to the CONTRACTOR shall be resumed, in accordance with the terms of the CONTRACT DOCUMENTS, but in no event shall the provisions of this sentence be construed to impose any obligations upon the OWNER to either the CONTRACTOR, his Surety, or any third party. In paying any unpaid bills of the CONTRACTOR, any payment so made by the OWNER shall be considered as a payment made under the CONTRACT DOCUMENTS by the OWNER to the CONTRACTOR and the OWNER shall not be liable to the CONTRACTOR for any such payments made in good faith.

19.7 If the OWNER fails to make payment thirty (30) days after approval by the ENGINEER, in addition to other remedies available to the CONTRACTOR, there shall be added to each such payment interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by the CONTRACTOR.

## 20. ACCEPTANCE OF FINAL PAYMENT AS RELEASE

20.1 The acceptance by the CONTRACTOR of final payment shall be and shall operate as a release to the OWNER of all claims and all liability to the CONTRACTOR other than claims in stated amounts as may be specifically excepted by the CONTRACTOR for all things done or furnished in connection with this WORK and for every act and neglect of the OWNER and others relating to or arising out of this WORK. Any payment, however, final or otherwise, shall not release the CONTRACTOR or his sureties from any obligations under the CONTRACT DOCUMENTS or the Performance BOND and Payment BONDS.

## 21. INSURANCE

21.1 The CONTRACTOR shall purchase and maintain such insurance as will protect him from claims set forth below which may arise out of or result from the CONTRACTOR'S execution of the WORK, whether such execution be by himself or by any SUBCONTRACTOR or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

21.1.1 Claims under workmen's compensation, disability benefit, and other similar employee benefit acts:

21.1.2 Claims for damages because of

bodily injury, occupational sickness or disease, or death of his employees:

21.1.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees:

21.1.4 Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the CONTRACTOR, or (2) by any other person; and

21.1.5 Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom.

21.2 Certificates of Insurance acceptable to the OWNER shall be filed with the OWNER prior to commencement of the WORK. These Certificates shall contain a provision that coverages afforded under the policies will not be canceled unless at least fifteen (15) days prior WRITTEN NOTICE has been given to the OWNER.

21.3 The CONTRACTOR shall procure and maintain, at his own expense, during the CONTRACT TIME, liability insurance as hereinafter specified:

21.3.1 CONTRACTOR'S General Public Liability and Property Damage Insurance including vehicle coverage issued to the CONTRACTOR and protecting him from all claims for personal injury, including death, and all claims for destruction of or damage to property, arising out of or in connection with any operations under the CONTRACT DOCUMENTS, whether such operations be by himself or by any SUBCONTRACTOR under him, or anyone directly or indirectly employed by the CONTRACTOR or by a SUBCONTRACTOR under him. Insurance shall be written with a limit of liability of not less than \$500,000 for all damages arising out of bodily injury, including death, at any time resulting therefrom, sustained by any one person in any one accident; and a limit of liability of not less than \$500,000 aggregate for any such damages sustained by two or more persons in any one accident. Insurance shall be written with a limit of liability of not less than \$200,000 for all property damage sustained by any one person in any one accident; and a limit of liability of not less than \$200,000 aggregate for any such damage sustained by two or more persons in any one accident.

21.3.2 The CONTRACTOR shall acquire

and maintain, if applicable, Fire and Extended Coverage insurance upon the PROJECT to the full insurable value thereof for the benefit of the OWNER, the CONTRACTOR, and SUBCONTRACTORS as their interest may appear. This provision shall in no way release the CONTRACTOR or CONTRACTOR'S surety from obligations under the CONTRACT DOCUMENTS to fully complete the PROJECT.

21.4 The CONTRACTOR shall procure and maintain, at his own expense, during the CONTRACT TIME, in accordance with the provisions of the laws of the state in which the work is performed. Workmen's Compensation Insurance, including occupational disease provisions, for all of his employees at the site of the PROJECT and in case any work is sublet, the CONTRACTOR shall require such SUBCONTRACTOR similarly to provide Workmen's Compensation Insurance, including occupational disease provisions for all of the latter's employees unless such employees are covered by the protection afforded by the CONTRACTOR. In case any class of employees engaged in hazardous work under this contract at the site of the PROJECT is not protected under Workmen's Compensation statute, the CONTRACTOR shall provide, and shall cause each SUBCONTRACTOR to provide, adequate and suitable insurance for the protection of his employees not otherwise protected.

21.5 The CONTRACTOR shall secure, if applicable, "All Risk" type Builder's Risk Insurance for WORK to be performed. Unless specifically authorized by the OWNER, the amount of such insurance shall not be less than the CONTRACT PRICE totaled in the BID. The policy shall cover not less than the losses due to fire, explosion, hail, lightning, vandalism, malicious mischief, wind, collapse, riot, aircraft, and smoke during the CONTRACT TIME, and until the WORK is accepted by the OWNER. The policy shall name as the insured the CONTRACTOR, the ENGINEER, and the OWNER.

## 22. CONTRACT SECURITY

22.1 The CONTRACTOR shall within ten (10) days after the receipt of the NOTICE OF AWARD furnish the OWNER with a Performance Bond and a Payment Bond in penal sums equal to the amount of the CONTRACT PRICE, conditioned upon the performance by the CONTRACTOR of all undertakings, covenants, terms, conditions, and agreements of the CONTRACT DOCUMENTS, and upon the prompt payment by

the CONTRACTOR to all persons supplying labor and materials in the prosecution of the WORK provided by the CONTRACT DOCUMENTS. Such BONDS shall be executed by the CONTRACTOR and a corporate bonding company licensed to transact such business in the state in which the WORK is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these BONDS shall be borne by the CONTRACTOR. If at any time a surety on any such BOND is declared a bankrupt or loses its right to do business in the state in which the WORK is to be performed or is removed from the list of Surety Companies accepted on Federal BONDS, CONTRACTOR shall within ten (10) days after notice from the OWNER to do so, substitute an acceptable BOND (or BONDS) in such form and sum and signed by such other surety or sureties as may be satisfactory to the OWNER. The premiums on such BOND shall be paid by the CONTRACTOR. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable BOND to the OWNER.

## 23. ASSIGNMENTS

23.1 Neither the CONTRACTOR nor the OWNER shall sell, transfer, assign, or otherwise dispose of the Contract or any portion thereof, or of his right, title, or interest therein, or his obligations thereunder, without written consent of the other party.

## 24. INDEMNIFICATION

24.1 The CONTRACTOR will indemnify and hold harmless the OWNER and the ENGINEER and their agents and employees from and against all claims, damages, losses, and expenses including attorney's fees arising out of or resulting from the performance of the WORK, provided that any such claims, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom: and is caused in whole or in part by any negligent or willful act or omission of the CONTRACTOR, and SUBCONTRACTOR, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

24.2 In any and all claims against the OWNER or the ENGINEER, or any of their agents or employees, by any employee of the CONTRACTOR, any SUBCONTRACTOR,

anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the CONTRACTOR or any SUBCONTRACTOR under workmen's compensation acts, disability benefit acts or other employee benefits acts.

24.3 The obligation of the CONTRACTOR under this paragraph shall not extend to the liability of the ENGINEER, his agents or employees arising out of the preparation or approval of maps, DRAWINGS, opinions, reports, surveys, CHANGE ORDERS, designs, or SPECIFICATIONS.

## 25. SEPARATE CONTRACTS

25.1 The OWNER reserves the right to let other contracts in connection with this PROJECT. The CONTRACTOR shall afford other CONTRACTORS reasonable opportunity for the introduction and storage of their materials and the execution of their WORK, and shall properly connect and coordinate his WORK with theirs. If the proper execution or results of any part of the CONTRACTOR'S WORK depends upon the WORK of any other CONTRACTOR, the CONTRACTOR shall inspect and promptly report to the ENGINEER any defects in such WORK that render it unsuitable for such proper execution and results.

25.2 The OWNER may perform additional WORK related to the PROJECT by himself, or he may let other contracts containing provisions similar to these. The CONTRACTOR will afford the other CONTRACTORS who are parties to such Contracts (or the OWNER, if he is performing the additional WORK himself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of WORK, and shall properly connect and coordinate his WORK with theirs.

25.3 If the performance of additional WORK by other CONTRACTORS or the OWNER is not noted in the CONTRACT DOCUMENTS prior to the execution of the CONTRACT, written notice thereof shall be given to the CONTRACTOR prior to starting any such additional WORK. If the CONTRACTOR believes that the performance of such additional WORK by the OWNER or others involves him in additional expense or entitles him to an extension of the CONTRACT TIME, he may make a claim therefor as provided in Sections 14 and 15.

## 26. SUBCONTRACTING

26.1 The CONTRACTOR may utilize the services of specialty SUBCONTRACTORS on those parts of the WORK which, under normal contracting practices, are performed by specialty SUBCONTRACTORS.

26.2 The CONTRACTOR shall not award WORK to SUBCONTRACTOR(S), in excess of fifty (50%) percent of the CONTRACT PRICE, without prior written approval of the OWNER.

26.3 The CONTRACTOR shall be fully responsible to the OWNER for the acts and omissions of his SUBCONTRACTORS, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

26.4 The CONTRACTOR shall cause appropriate provisions to be inserted in all subcontracts relative to the WORK to bind SUBCONTRACTORS to the CONTRACTOR by the terms of the CONTRACT DOCUMENTS in so far as applicable to the WORK of SUBCONTRACTORS and to give the CONTRACTOR the same power as regards terminating any subcontract that the OWNER may exercise over the CONTRACTOR under any provision of the CONTRACT DOCUMENTS.

26.5 Nothing contained in this CONTRACT shall create any contractual relation between any SUBCONTRACTOR and the OWNER.

## 27. ENGINEER'S AUTHORITY

27.1 The ENGINEER shall act as the OWNER'S representative during the construction period. He shall decide questions which may arise as to quality and acceptability of materials furnished and WORK performed. He shall interpret the intent of the CONTRACT DOCUMENTS in a fair and unbiased manner. The ENGINEER will make visits to the site and determine if the WORK is proceeding in accordance with the CONTRACT DOCUMENTS.

27.2 The CONTRACTOR will be held strictly to the intent of the CONTRACT DOCUMENTS in regard to the quality of materials, workmanship, and execution of the WORK. Inspections may be made at the factory or fabrication plant of the source of material supply.

27.3 The ENGINEER will not be responsible for

the construction means, controls, techniques, sequences, procedures, or construction safety.

27.4 The ENGINEER shall promptly make decisions relative to interpretation of the CONTRACT DOCUMENTS.

## 28. LAND AND RIGHTS-OF-WAY

28.1 Prior to issuance of NOTICE TO PROCEED, the OWNER shall obtain all land and rights-of-way necessary for carrying out and for the completion of the WORK to be performed pursuant to the CONTRACT DOCUMENTS, unless otherwise mutually agreed.

28.2 The OWNER shall provide to the CONTRACTOR information which delineates and describes the lands owned and rights-of-way acquired.

28.3 The CONTRACTOR shall provide at his own expense and without liability to the OWNER any additional land and access thereto that the CONTRACTOR may desire for temporary construction facilities, or for storage of materials.

## 29. GUARANTY

29.1 The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION. The CONTRACTOR warrants and guarantees for a period of one (1) year from the date of SUBSTANTIAL COMPLETION of the system that the completed system is free from all defects due to faulty materials or workmanship and the CONTRACTOR shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. The OWNER will give notice of observed defects with reasonable promptness. In the event that the CONTRACTOR should fail to make such

repairs, adjustments, or other WORK that may be made necessary by such defects, the OWNER may do so and charge the CONTRACTOR the cost thereby incurred. The Performance BOND shall remain in full force and effect through the guarantee period.

## 30. ARBITRATION

30.1 All claims, disputes, and other matters in question arising out of or relating to the CONTRACT DOCUMENTS or the breach thereof, except for claims which have been waived by the making and acceptance of final payment as provided by Section 20, shall be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association. This agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgement may be entered upon it in any court having jurisdiction thereof.

30.2 Notice of the demand for arbitration shall be filed in writing with the other party to the CONTRACT DOCUMENTS and with the American Arbitration Association, and a copy shall be filed with the ENGINEER. Demand for arbitration shall in no event be made on any claim, dispute or other matter in question which would be barred by the applicable statute of limitations.

30.3 The CONTRACTOR will carry on the WORK and maintain the progress schedule during any arbitration proceedings, unless otherwise mutually agreed in writing.

## 31. TAXES

31.1 The CONTRACTOR will pay all sales, consumer, use and other similar taxes required by the law of the place where the WORK is performed.

## SUPPLEMENTAL GENERAL CONDITIONS

### 1. DEFINITIONS

1.1 The following shall be added to the definitions listed in the General Conditions:

- (a) **APPROVED** - shall mean as approved, directed, required or permitted by the Engineer, unless specified otherwise.
- (b) **CONTRACT DOCUMENTS** - The Contract Documents shall also include Certificate of Owner's Attorney, General Conditions, Supplemental General Conditions, Labor Standards, and all other certificates, regulations and documents herein bound.
- (c) **ENGINEER** - Consolidated Technologies, Inc., or its lawfully designated successor.
- (d) **SUBSTANTIAL COMPLETION** - The determination as to whether the project is sufficiently complete so it can be utilized for its intended purposes will be based upon a consideration of completion items and submittals specified in the Specifications.
- (e) **SUPPLEMENTAL GENERAL CONDITIONS** - Also such modifications to the General Conditions as the Owner or Engineer may deem necessary.
- (f) **OWNER** - Walker County Water and Sewerage Authority.
- (g) **OWNER'S ATTORNEY** - David Cunningham, or his lawfully designated successor or assistant.

### 2. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

(RESERVED)

### 3. SCHEDULES, REPORTS, AND RECORDS

- 3.1 Each such schedule is to be subject to change from time to time in accordance with the progress of the work.
- 3.2 The Contractor shall also furnish on forms to be supplied by the Owner and/or his Engineer:
  - (a) a detailed estimate giving a complete breakdown of a lump sum contract price and
  - (b) periodic itemized estimates of work done for the purpose of making partial payments thereon.

The costs employed in making up any of these schedules will be used only for determining the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the Contract Price.

#### 4. DRAWINGS AND SPECIFICATIONS

- 4.1 Work under this Contract shall comply with all applicable specification requirements set forth under "Specifications."
- 4.2 The Drawings, Specifications and Addenda shall form part of this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth. The table of contents, titles, headings, running headlines and marginal notes contained in the Contract Documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit, or cast light on the interpretation of the provisions to which they refer.
- 4.3 Upon award of the Contract, the Contractor upon request will be supplied free of charge up to six complete sets of the Drawings and Specifications. If the Contractor requests additional prints or specifications, they will be furnished to him at cost at the Contractor's expense.
- 4.4 The Contractor shall keep on the job a copy of the Drawings and Specifications and shall at all times give the Owner and Engineer access thereto. Anything mentioned in the Specifications and not shown on the Drawings or shown on the Drawings and not mentioned in the Specifications shall be of like effect as if shown or mentioned in both.
- 4.5 The Contractor shall not take advantage of any errors or omission which may exist in the Drawings and Specifications, but shall immediately call them to the attention of the Engineer whose prompt interpretation or correction thereof shall be conclusive.

#### 5. SHOP DRAWINGS

- 5.1 After checking and verifying all field measurements, the Contractor shall submit to the Engineer for review seven copies of all Shop Drawings, which shall have been checked by and stamped with the approval of Contractor and identified as the Engineer may require. The data shown on the Shop Drawings will be complete with respect to dimensions, design criteria, materials of construction and the like to enable the Engineer to review the information as required.
- 5.2 The Contractor shall also submit for the Engineer's review with such promptness as to cause no delay in work, all samples required by the Contract Documents. All samples will have been checked by and stamped with the approval of the Contractor, identified clearly as to material, manufacturer, any pertinent catalog numbers and the use for which intended.
- 5.3 At the time of each submission, the Contractor shall in writing call the Engineer's attention to any deviations that the Shop Drawing or sample may have from the requirements of the Contract Documents.



- 5.4 The Engineer will review with reasonable promptness those Shop Drawings and samples submitted in accordance with the Contractor's approved Submittal Schedule, but his review shall be only for general conformance with the information given in the Contract Documents. The Contractor shall make any corrections required by the Engineer and shall return the required number of corrected copies of Shop Drawings and resubmit new samples. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections called for by the Engineer on previous submissions. Contractor's stamp of approval on any Shop Drawing or sample shall constitute a representation to the Owner and the Engineer that the Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or he assumes full responsibility for doing so, and that he has reviewed or coordinated each Shop Drawing or sample with the requirements of the work and the Contract Documents.
- 5.5 Engineer's review of Shop Drawings or samples shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless the Contractor has in writing called the Engineer's attention to such deviation at the time of submission and the Engineer has concurred in writing with the specific deviation, nor shall any review by the Engineer relieve the Contractor from responsibility for errors or omissions in the Shop Drawings.

## 6. MATERIALS, SERVICES AND FACILITIES

- 6.1 Any work necessary to be performed after regular working hours, on Sundays or on legal holidays, shall be performed without additional expense to the Owner.
- 6.2 The Contractor warrants that he has good title to all materials, supplies, and equipment used by him in the work.
- 6.3 All materials required in the work may be stored on the site upon which the project is to be constructed, subject to approval by the Engineer, but all such materials, tools, and machinery shall be neatly and compactly stored in such a manner as to not interfere with traffic and to cause the least inconvenience to the property owners. All fire hydrants must at all times be kept free and unobstructed, and water and gas shut-off boxes, underground power and telephone line manholes must not be covered by such materials.
- 6.4 Materials, tools, and machinery shall not be piled or placed against trees unless the trees shall be amply protected against injury therefrom. All materials, tools, machinery, etc., stored upon public thoroughfares must be provided with warning lights at night to warn the traffic of such obstruction.
- 6.5 The Contractor shall make his own arrangements for delivery and handling of equipment and materials as he may require for the prosecution of the work. The location of all temporary lines, roadways and similar facilities shall be subject to the approval of the Engineer, and these shall be located and operated so as not to interfere with other work carried on by the Owner or by other contractors.
- 6.6 It is agreed that any temporary power lines, roadways or other facilities which the Contractor furnishes, installs, maintains, and removes at the completion of the work, may be used by the Owner or any of its contractors at such reasonable time or times

as may be directed by the Engineer. Likewise it is provided that similar facilities of other contracts will become available to the Contractor under similar conditions.

- 6.7 Adequate sanitary facilities shall be provided by the Contractor. All such sanitary facilities shall conform to the requirements of the respective State and County Departments of Public Health.
- 6.8 Contractor shall furnish office space for the Resident Project Representative. Space shall be at least 14 feet by 14 feet in area and shall be located conveniently to the center of the work. Office shall be furnished with a desk, drafting table, applicable chairs, drawing rack, surveying instrument storage, telephone service, lights, heat, air conditioning, windows and one door with cylinder lock. Office space must be provided before the Contractor's first partial payment estimate will be approved. No separate payment shall be made for office space. Any additional requirements are noted in Section 01590, Field Offices and Sheds.
- 6.9 Contractor shall furnish six hard hats which shall be made available to authorized representatives and agents of the Owner and any interested governmental agency while visiting the job site.

## 7. INSPECTION AND TESTING

- 7.1 All materials and equipment used in the construction of the Project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be approved by the Owner. The cost of all inspection and testing of all materials and equipment for determination of source suitability, applicability, all certified mill tests, etc., shall be included in the contract price for supplying the applicable materials and equipment, as no separate payment will be made for these services.
- 7.2 Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended. The Owner will pay for the inspection and testing directly and not as a part of the Contract.
- 7.3 Where mill tests of materials are found by the Engineer to be acceptable, Contractor shall furnish certified copies of such mill tests. The cost of furnishing such certified copies shall be borne by the Contractor, with no separate payment allowed.
- 7.4 Where shop equipment performance tests are specified, the Engineer shall be permitted to witness such tests. In the absence of a witnessed test, certified copies of shop tests shall be submitted at the discretion of the Engineer. Cost of Engineer's services in this test will be borne by the Owner.
- 7.5 No payment will be made to the Contractor for samples taken for tests such as concrete cylinders, etc.

**8. SUBSTITUTIONS**

- 8.1** The Contract is based on the materials, equipment, and methods described in the Contract Documents.
- 8.2** The Owner, through the Engineer, will consider proposals for substitution of materials, equipment, and methods only when such proposals are accompanied by full and complete technical data and all other information required to evaluate the proposed substitution.
- 8.3** The Contractor shall not substitute materials, equipment, or methods unless such substitution has been specifically approved for this project by the Engineer.

**9. PATENTS**

- 9.1** License and/or royalty fees for the use of a process which is authorized by the Owner of the project must be reasonable and paid to the holder of the patent, or his authorized licensee, directly by the Owner and not by or through the Contractor.

**10. SURVEYS, PERMITS, REGULATIONS**

- 10.1** The Contractor shall procure all permits and licenses, pay all charges or fees, and give all notices necessary for the completion of the work.
- 10.2** The Contractor shall provide an as-constructed survey for preparing the record documents.

**11. PROTECTION OF WORK, PROPERTY AND PERSONS**

- 11.1** In order to protect the lives and health of his employees under the Contract, the Contractor shall comply with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., and shall maintain an accurate record of all cases of death, occupational disease and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the Contract.
- 11.2** The Contractor alone shall be responsible for the safety, efficiency, and adequacy of his plant, appliances and methods, and for any damage which may result from their failure or their improper construction, maintenance, or operation.
- 11.3** The Contractor shall, at his own expense, shore up and protect any buildings, bridges, or other public or private structures which may be encountered or endangered in the prosecution of the work, and that may not be otherwise provided for, and he shall repair and make good any damages to such property by reason of his operations. All existing fences which were removed by the Contractor due to prosecution of the work shall be replaced by the Contractor. No extra payment will be made for said work or materials.

- 11.4 Contractor shall repair or replace at his own expense any existing water pipes, power and communication lines, or other public utilities, roads, drain pipes, sewers, drainage ditches and all plantings (including grass) that are damaged during construction. The site shall be left in its present condition after all cleanup work has been done. Any damage to drainage or water pipes, local sewers, or plantings (including grass, utilities, roads, parking space, or other structures) shall be repaired and replaced immediately in the condition found. Such repairs and replacement shall be at the expense of the Contractor.
- 11.5 Contractor shall preserve all governmental markers (e.g. U.S.G.S., T.V.A., etc.), and none such will be removed or disturbed without prior approval of the Engineer. Any removal and replacement of such markers shall be at the expense of the Contractor.
- 11.6 The Contractor shall employ watchmen on the work as necessary to protect the work from damage, vandalism, etc., and shall, when necessary, erect and maintain such strong and suitable barriers and such lights as will effectually prevent the happening of any accident to health, limb or property. Lights shall be maintained between the hours of one-half hour before sunset and one-half hour after sunrise.
- 11.7 Contractor will be required, at his own expense, to do every thing necessary to support, protect and sustain all sewer, water or gas pipe; service pipes; electric lights; power, telephone, or telegraph poles; conduits; and other fixtures laid across or along the site of the work. The Engineer, as well as the company or the corporation owning said poles, pipes or conduits, must be notified by the Contractor before any such fixtures are removed or molested. In case any of the said sewer, gas, or water pipes; service pipes; electric lights; power, telephone or telegraph poles; conduits; or other fixtures are damaged, they shall be repaired by the authorities having control of the same, and the expense of said repairs shall be deducted from the monies due or to become due the Contractor under this Contract.
- 11.8 Should it become necessary to temporarily change the position or remove any poles, electric conduits, water pipes, gas pipes, or other pipes or wires, the Contractor shall notify the Engineer and company or the corporation owning said poles, pipes or conduits of the location and circumstances, and shall cease work if necessary until satisfactory arrangements have been made by the owners of the said poles, pipes, conduits, or wires to properly care for the same. No claims for damages will be allowed on account of any delay occasioned thereby. The entire cost of such temporary changes or removal must be included in the unit or lump sum prices bid for the various items of work under this Contract.
- 11.9 In the event of temporary suspension of work, or during inclement weather, or whenever the Engineer shall direct, the Contractor will, and will cause his subcontractors to protect carefully his and their work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any of his subcontractors to so protect the work, such materials shall be removed and replaced at the expense of the Contractor.
- 11.10 Before, during, and after installation, the Contractor shall furnish and maintain satisfactory protection to all equipment against injury by weather, flood or breakage, thereby permitting the work to be left in a perfect condition at the completion of the contract. No extra payment will be made for this work but the entire cost of the same

shall be included in the price bid for the construction of the work done under this contract.

11.11 All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall strictly conform with the manufacturer's instructions.

11.12 Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

## 12. SUPERVISION BY CONTRACTOR

12.1 It is understood that the Contractor's representative shall be one who can be continued in that capacity for the particular job involved unless he ceases to be on the Contractor's payroll.

## 13. CHANGES IN THE WORK

13.1 All Change Orders, including a change in technical design or an increase in cost, must be approved by the Owner, the Engineer and those governmental agencies whose approval is required.

13.2 Before executing any Change Order involving adjustment of the contract price, where necessary and desirable, the Contractor shall first obtain the consent of his surety.

13.3 No claim for extra work or cost shall be allowed unless the same was done in pursuance of a written order of the Engineer approved by the Owner. When the work is performed under the terms of the General Conditions, the Contractor shall furnish satisfactory bills, payrolls, and vouchers covering all items of cost and when requested by the Owner, give the Owner access to accounts relating thereto.

13.4 The location of utility lines, pavements, and other appurtenant construction shown on the Drawings may be raised or lowered, may be moved from one location to another, or may be lengthened or shortened by the Owner because of clearances needed, easement changes, design changes, or any other reason. In such case, the Contractor shall be entitled to payment for the work based on the unit prices shown in the Bid Schedule. No additional payment will be allowed because of such changes unless the Contractor notifies the Owner in writing prior to commencing that portion of the work and an appropriate change order is prepared.

13.5 If additional time is requested on account of a change in the work, the documentation of the basis for the requested time shall include a detailed justification and calculation for the additional time. Generally, for changes that do not directly affect work elements on the critical path of the project, additional time will be granted only in proportion to the cost of the change over the original contract price.

13.6 Failure to submit the written notice or failure to document the basis for the change in contract price or time within the times specified shall bar the Contractor from all future claims for a change in contract price or an extension of time on account of the change.

#### 14. CHANGES IN CONTRACT PRICE

(RESERVED)

#### 15. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

15.1 The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain, and said amount shall be retained from time to time by the Owner from current periodic estimates.

15.2 The Owner will suffer financial loss if the project is not "substantially completed" on the date set forth in the Contract Documents. The Contractor and his Surety shall be liable for and shall pay to the Owner the sums stipulated in the Bid or Contract as fixed, agreed, and liquidated damages for each calendar day of delay until the project is "substantially completed."

#### 16. CORRECTION OF WORK

16.1 If, in the opinion of the Engineer, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the Contract Documents, the compensation to be paid to the Contractor hereunder shall be reduced by such amount as, in the judgment of the Engineer, shall be equitable.

#### 17. SUBSURFACE CONDITIONS

17.1 Owner makes no representations about any subsurface conditions that may be encountered within the scope of the project. The Contractor should satisfy himself/herself by on-site inspections, core-drillings or other methods of the subsurface conditions that may be encountered. The risk of encountering and correcting such subsurface conditions shall be borne solely by the Contractor, and the Contract price shall include the cost of performing the work complete-in-place.

17.2 The Engineer may have made certain subsurface explorations in the vicinity of the work to be constructed under this Contract. These borings were made only for the Engineer's information in designing the project. Copies of these logs of borings and their locations may be purchased from the Engineer at the cost of one dollar (\$1.00) per sheet. These logs of borings are furnished only as information to Bidders for whatever interpretation and use they desire to make of conditions found when the borings were made. The Owner and Engineer do not warrant that the same conditions exist between borings and the Bidder shall satisfy himself as to the nature of the subsurface conditions throughout the project. If the Bidder wishes to make borings at

any location, he shall be afforded the opportunity to do so. Cost of such borings shall be at the Bidder's expense.

## **18. SUSPENSION OF WORK, TERMINATION, AND DELAY**

- 18.1** In the event a portion of the work is delayed or interrupted, the Contractor shall continue to prosecute those portions of the work unaffected by the delay or interruption.
- 18.2** In the event of a delay or interruption in the work, the Contractor shall make reasonable and appropriate adjustments in his job site resources (manpower and equipment) to minimize the overall cost impact of the delay or interruption.
- 18.3** In the event of a delay or interruption in the work due to the failure of the Owner or Engineer to act within the time specified in the Contract Documents, or if no time is specified, within a reasonable time, the Contractor shall so notify the Engineer in writing immediately upon becoming aware of the delay. The Contractor shall submit a detailed justification for any claim for adjustment in contract price or extension in contract time on account of the delay or interruption as soon as the price or time impact can be quantified, but in no case later than 30 days following the end of the delay or interruption. Failure to submit the written notification or the justification within the time specified shall bar the Contractor from all future claims for adjustment in contract price or time on account of the delay.

## **19. PAYMENTS TO CONTRACTOR**

- 19.1** No separate payment will be made for any items specified in the General Conditions or Supplemental General Conditions. Payments for such items shall be included in the unit price and lump sum prices bid by the Contractor for items listed in the Bid Schedule.

## **20. ACCEPTANCE OF FINAL PAYMENT AS RELEASE**

(RESERVED)

## **21. INSURANCE**

- 21.1** Each insurance policy shall be renewed at least 15 days before the expiration date thereof.
- 21.2** Insurance must be carried by a recognized insurance company licensed to do business in the state in which the project is constructed and approved by the Owner's Attorney.
- 21.3** The Contractor's and his Subcontractor's Public Liability and Property Damage Insurance shall provide protection in the amounts specified in Paragraph 21.3.1 of the General Conditions and as further specified in the Special Conditions (if included) against the following special hazards:

Blasting  
Damage to existing structures  
Damage to private driveways, walks, shrubbery, plantings, etc.  
Damage to public utilities, electric, water, telephone, gas, sewerage, etc.  
Damage to U.S. Government markers.

The insurance certificates themselves must contain the naming of the aforesated special hazards.

21.4 The Contractor shall not commence work under this Contract until he has obtained all the insurance required and such insurance has been approved by the Owner, nor shall the Contractor allow any subcontractor to commence work on his subcontract until the insurance required of the subcontractor has been so obtained and approved.

21.5 In the event any insurance coverage should be canceled or allowed to lapse, Contractor will not be permitted to work until adequate and satisfactory insurance is in effect. Failure to keep insurance policies in effect WILL NOT be cause for any claims for extension of time under this Contract.

21.6 Limits of liability for general public liability and property damage insurance shall not be less than:

Bodily Injury	\$ 500,000	each person
	1,000,000	each occurrence
Property Damage	\$ 250,000	each occurrence
	500,000	aggregate

21.7 Limits of liability for comprehensive motor vehicle liability and property damage insurance.

Bodily Injury	\$ 250,000	each person
	500,000	each occurrence
Property Damage	\$ 100,000	each occurrence

21.8 The Contractor shall provide builder's risk insurance to protect the Contractor and the Owner against risks of damage to buildings, structures, materials, and equipment not otherwise covered under installation floater insurance, from the perils of fire and lightning, the perils included in the standard extended coverage endorsement, and the perils of vandalism and malicious mischief. The amount of such insurance shall be not less than the insurable value of the work at completion less the value of the materials and equipment insured under installation floater insurance. If the work does not include the construction of building structures, builder's risk insurance may be omitted providing the installation floater insurance fully covers the work.

21.9 The Contractor shall provide installation floater insurance to protect the Contractor and the Owner from all insurable risks of physical loss or damage to materials, products and equipment not otherwise covered under builder's risk insurance while in warehouses or storage areas, during installation, during testing, and after the work is completed. Equipment such as pumps, motors, engine-generators, compressors, process equipment, switchgear, transformers, panel boards, control equipment, and



other similar equipment shall be insured under installation floater insurance when the aggregate value of the equipment exceeds \$10,000.

**22. CONTRACT SECURITY**

- 22.1** A Payment Bond in the amount of 100 percent of the contract price and a Performance Bond in the amount of 100 percent of the contract price shall be required in the form set forth in the Contract Documents.
- 22.2** Whenever a Construction and Maintenance or Maintenance Bond may be required in these Contract Documents, the same shall be the Performance Bond included herein.

**23. ASSIGNMENTS**

- 23.1** In case the Contractor assigns all or any part of any monies due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in this contract.

**24. INDEMNIFICATIONS**

(RESERVED)

**25. SEPARATE CONTRACTS**

(RESERVED)

**26. SUBCONTRACTING**

- 26.1** The Contractor shall not award any work to any Subcontractor without prior written approval of the Owner, which approval will not be given until the Contractor submits to the Owner a written statement concerning the proposed award to the Subcontractor, which statement shall contain such information as the Owner may require.

**27. ENGINEER'S AUTHORITY**

- 27.1** The Engineer may appoint such resident project representatives as he may desire. Scope of the resident project representative's authority will extend to all parts of the work and to the preparation and manufacture of the materials to be used. A resident project representative is placed on the work to keep the Engineer and Owner informed as to the progress of construction and the manner in which it is being done and also to call to the attention of the Contractor any deviation from the Drawings and Specifications.

- 27.2 The resident project representatives have the authority to reject defective material or work that is being improperly done subject to the final decision of the Engineer. The resident project representatives are not authorized to revoke, alter, enlarge, or relax the provisions of these conditions, nor are they authorized to approve or accept any portion of the completed work, or to issue instructions contrary to the Drawings and Specifications.
- 27.3 The Contractor may request written instructions from the Engineer upon any important items which lie within the resident project representative's jurisdiction.

28. LAND AND RIGHTS-OF-WAY

- 28.1 In the event all land and rights-of-way have not been obtained as herein contemplated before construction begins, the Contractor shall begin the work upon such land and rights-of-way as the Owner may have previously acquired, and no claim for damages whatsoever will be allowed by reason of the delay in obtaining the remaining land and rights-of-way. Should the Owner be prevented or enjoined from proceeding with the work, or from authorizing its prosecution, either before or after the commencement, by reason of any litigation, or by reason of its inability to procure any lands or rights-of-way for the work, the Contractor shall not be entitled to make or assert claim for damage by reason of said delay, or to withdraw from the Contract except by consent of the Owner; but time for completion of the work will be extended to such time as the Owner determines will compensate for the time lost by such delay such determination to be set forth in writing.

29. GUARANTY  
(RESERVED)

30. ARBITRATION  
(RESERVED)

31. TAXES  
(RESERVED)

32. CONFLICTING CONDITIONS

- 32.1 Any provision in any of the Contract Documents which may be in conflict or inconsistent with any of the paragraphs in the General Conditions or the Federal Regulations shall be void to the extent of such conflict or inconsistency except if when and as clarified by the Supplemental General Conditions. Interpretations of any conflicts not clarified may be requested by the Contractor in writing to the Engineer. In the event of conflicts between funding agency documents, the more restrictive will apply.

**32.2** In case of unresolved conflict between items of the Contract Documents, the following order of precedence shall govern, with the higher item taking precedence over a lower item:

- Contract (including Supplemental Agreements and Change Orders thereto)
- Addenda
- Bid Proposal
- Supplemental General Conditions
- General Conditions
- Specifications
- Governing Standard Specifications
- Schedules on Drawings
- Notes on Drawings
- Details on Drawings
- Large Scale Drawings
- Small Scale Drawings
- Dimensions Given in Figures
- Scaled Dimensions

**32.3** In the event of any discrepancy between any drawing and the figure written thereon, the figures, unless obviously incorrect, shall be taken as correct.

### **33. REQUIRED PROVISIONS DEEMED INSERTED**

**33.1** Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party the Contract shall forthwith be physically amended to make such insertion or correction.

### **34. PROHIBITED INTEREST**

**34.1** No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this Contract or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this Contract if made with a corporation for its general benefit.

**34.2** No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the Project, shall become directly or indirectly interested personally in this Contract or in any part hereof. No officer, employee, architect, attorney, engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the Project, shall become directly or indirectly interested personally in this contract or in any part thereof, any material, supply contract, subcontract, insurance contract, or any other contract pertaining to the Project.

35. USE OF PREMISES AND REMOVAL OF DEBRIS

35.1 The Contractor expressly undertakes at his own expense:

- (a) To take every precaution against injuries to persons or damage to property;
- (b) To store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the work as will not unduly interfere with the progress of his work or the work of any other contractors;
- (c) To place upon the Work or any part thereof only such loads as are consistent with the safety of that portion of the Work;
- (d) To clean up frequently all refuse, rubbish, scrap materials and debris caused by these operations, to the end that at all times the site of the Work shall present a neat, orderly and workmanlike appearance;
- (e) Before final payment to remove all surplus material, false work, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations, and to put the site in a neat, orderly condition;
- (f) To effect all cutting, fitting or patching of his work required to make the same to conform to the Drawings and Specifications and, except with the consent of the Engineer, not to cut or otherwise alter the work of any other contractor.

36. ESTIMATE OF QUANTITIES

36.1 Wherever the estimated quantities of work to be done and materials to be furnished under this Contract are shown in any of the Contract Documents including the proposal, they are given for use in comparing Bids, and the right is especially reserved except as herein otherwise specifically limited, to increase or diminish them as may be deemed reasonably necessary or desirable by the Owner to complete the Work contemplated by this Contract, and such increase or decrease shall in no way nullify this Contract, nor shall any such increase or decrease give cause for claims or liability for damages.

37. CONTRACTOR'S OBLIGATIONS

37.1 The Contractor shall in good workmanlike manner perform all work and furnish all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary or proper to perform and complete the Work required by this Contract, within the time herein specified, in accordance with the provisions of this Contract and said Specifications and in accordance with the Drawings covered by this Contract and all supplemental drawings, and in accordance with the directions of the Engineer as given from time to time during the progress of the Work. He shall furnish, erect, maintain and remove such construction plant and such temporary works as may be required. The Contractor shall observe, comply with and be subject to all terms, conditions, requirements, and limitations of the Contract and

Specifications and shall do, carry on, and complete the entire work to the satisfaction of the Engineer and the Owner.

- 37.2** The Contractor shall restore disturbed areas to original or better condition.
- 37.3** When work performed under this Contract is in areas where easements and working agreements have been obtained by the Owner on private properties, it shall be the responsibility of the Contractor to protect trees, shrubs, gardens, etc., insomuch as is possible and to restore said properties to the satisfaction of the property owners, said protection and restoration shall include but not be limited to the fencing off of trees and shrubs, transplanting of trees and shrubs, etc., replacing topsoil removed with topsoil of equal or better quality, regrassing, and replacing fences. All expenses for said protection and restoration shall be borne by the Contractor, and no separate payment shall be made for this work.

When work is done on private property in easements and working agreements obtained by the Owner, the Contractor shall furnish affidavits from the property owners attesting to the fact that their property has been satisfactorily restored before that portion of the work will be considered for final payment.

#### **38. PAYMENTS BY CONTRACTOR**

- 38.1** The Contractor shall pay (a) for all transportation and utility services not later than the 20th day of the calendar month following that in which services are rendered, (b) for all materials, tools, and other expendable equipment to the extent of 90 percent of the cost thereof, not later than the 20th day of the calendar month following that in which such materials, tools, and equipment are delivered at the site of the Project, and the balance of the cost thereof not later than the 30th day following the completion of that part of the Work in or on which such materials, tools, and equipment are incorporated or used, and (c) to each of his subcontractors, not later than the 5th day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his subcontractors to the extent of each subcontractor's interest therein.

#### **39. INFORMATION TO BE FURNISHED**

- 39.1** Contractor shall fill out all questionnaire forms completely in preparing his Bid and after award shall supply to the Engineer all pertinent information required.

#### **40. WAIVER**

- 40.1** It is expressly understood and agreed that any waiver granted by the Engineer or the Owner of any term, provision or covenant of this Contract shall not constitute a precedent nor breach of the same or any other terms, provisions or covenants of this Contract.
- 40.2** Neither the acceptance of the Work by the Owner nor the payment of all or any part of the sum due the Contractor hereunder shall constitute a waiver by the Owner of any

claim which the Owner may have against the Contractor or surety under this Contract or otherwise.

#### 41. CONNECTING OF EXISTING WORK

- 41.1 Contractor shall remove such existing masonry and piping as is necessary in order to make the proper connections to these structures at the locations shown. Also, he shall make the necessary pipeline, roadway, and other connections at the several points in order that on completion of the Contract, all required flows may flow through the several pipelines and structures. No extra payment shall be made for this work, but the entire cost of the same shall be included in the price bid for the various items of the Work to be done under this Contract.

#### 42. PROGRAM AND METHOD OF CONSTRUCTION

- 42.1 The order or sequence of execution of the Work and the general arrangements of the construction plant to be installed shall at all times be subject to the review of the Engineer. If at any time before the commencement or during the progress of the Work, or any part of it, such features, and appliances used or to be used appear to the Engineer as insufficient, or improper, he may order the Contractor to improve their character, and the Contractor shall conform to such orders, but the failure of the Engineer to demand any increase of safety, efficiency, adequacy, or any improvement shall not release the Contractor from his obligation to secure the safe conduct and quality of the Work specified.

#### 43. BUILDINGS AND SHANTIES

- 43.1 No shanties, camps, or buildings for the housing of men employed on the Work shall be erected on land owned or leased by the Owner unless a permit, in writing, is secured from the Owner allowing their construction. Should permission be asked and granted, the Contractor must comply with all regulations regarding the construction and maintenance of such buildings.

#### 44. "OR EQUAL" CLAUSE

- 44.1 Any reference to an item of equipment or material by a specific manufacturer's brand or trade name in these Contract Documents is intended merely as a standard. Products or materials of other manufacturers which, in the opinion of the Engineer, are the equal of that specified considering quality, workmanship, and economy of operation and are suitable for the purpose intended, will be accepted.
- 44.2 Where the phrase "or equal" occurs in the Contract Documents, the Contractor shall not assume that materials, equipment, or methods will be approved by the Engineer unless the item has been specifically approved for this project by the Engineer.
- 44.3 The decision of the Engineer shall be final.

- 44.4 The Contractor shall provide all data required by the Engineer to verify the equality of items which the Contractor may wish to substitute for the specified items.
- 44.5 The Contractor shall verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the project.
- 44.6 In the event specified items will not be so available, the Contractor shall notify the Engineer prior to receipt of bids.
- 44.7 Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back charged as necessary and shall not be borne by the Owner.
- 44.8 In cases where experience clauses are used, an alternate bond or cash deposit may be accepted from manufacturers which do not meet the specified experience period. The bond or cash deposit provided by the manufacturer or supplier will guarantee replacement of the equipment or process in the event of failure or unsatisfactory service. The period of time for which the bond or cash deposit is required shall be the same as the experience period of the time specified.

#### 45. CONSTRUCTION METHODS AND PROTECTION OF PROPERTIES

45.1 Cooperation with Utilities - The Contractor shall be cooperative at all times with all utilities, or their duly authorized agent or contractor, installing or connecting new services and shall coordinate all phases of the work with said utilities to avoid unnecessary delays or complications.

#### 45.2 Damage to Property

- (a) The Contractor is warned to prevent excessive dust or air pollution that may disfigure or soil any public or private facilities. The use of water sprinklers or other approved devices to reduce dust will be necessary if such is the case. Additionally, in cases of heavy rains or storms, every effort shall be made to prevent mud or water which may result due to the construction from accumulating on or damaging any property or any private owner.
- (b) Contractor shall use special care in working in areas where the right-of-way crosses private property. Contractor shall also replace, at his/her own expense, any existing water pipes, power lines, communication lines, or other public utilities, roads, drain pipes, sewers, drainage ditches, and all plantings including grass and/or sod on private property. The site shall be left in its present condition after all cleanup work has been done. Any damage to drainage pipes, water pipes, local sewers, plantings (including grass and/or sod), utilities, roads, parking space, or other structures shall be repaired and replaced immediately in the condition found. Such repairs and replacement shall be at the expense of the Contractor.

#### 45.3 Existing Sanitary, Combined and/or Storm Sewers

- (a) Whenever existing sewers are broken or damaged as a result of traffic or excavation by the Contractor, the maintenance, replacement, and/or repairs to

the damaged existing sanitary, combined, and/or storm sewer shall be the Contractor's responsibility, except as otherwise provided for on the Drawings and in the Contract Documents, or as authorized by the Engineer, and the expense of maintaining, repairing, replacing, or connecting to existing sewers shall be borne by the Contractor.

- (b) No separate payment will be made for handling sewage from existing sewers or interrupted connections, since it shall be the responsibility of the Contractor to maintain services until such time as the proposed or relocated sewers can be constructed. If the Contractor should damage any existing sewer, such that it affects the public interest, health, or general welfare, the Contractor shall replace or repair that sewer at his/her own expense as directed by the Engineer.
- (c) Contractor shall make all connections to existing sewerage facilities as shown on the Drawings.

#### 46. SEWAGE, SURFACE, AND FLOOD FLOWS

- 46.1 The Contractor shall furnish all the necessary equipment, shall take all necessary precautions and shall assume the entire cost of handling any sewage, seepage, storm, surface, and flood flows which may be encountered at any time during the construction of the Work. The manner of providing for these flows shall meet the approval of the Engineer, and the entire cost of said work shall be included in prices bid for the various items of the Work to be done under this Contract.
- 46.2 The Contractor will minimize siltation and bank erosion during construction.
- 46.3 During the period of construction the Contractor shall cooperate with the Owner's employees in maintaining all existing collection, pumping, and treatment facilities in operation. The cost of any temporary conveyances or bypass pumping shall be included in the price bid for other items of work under this Contract, as no separate payment will be made.
- 46.4 The Contractor shall not discharge or allow discharge of pollutants, as defined in the Clean Water Act, including fill and sediment, into waters of the State or United States, including wetlands, unless authorized by an appropriate State or Federal permit. This prohibition specifically applies to silt and sediment in storm water runoff and in water pumped from trenches and excavations.
- 46.5 In the event that pollutants are discharged or otherwise released to the environment as the result of the Contractor's negligence or unlawful conduct, it is understood and agreed that the Contractor shall bear all risks associated with such release(s), shall indemnify the Owner and the Engineer from any liabilities resulting from the release(s), and shall not make any claim for additional compensation for delays or damage resulting from such release(s).

#### 47. OBSTRUCTIONS ENCOUNTERED

- 47.1 In addition to showing the structures to be built under this Contract, the Drawings show certain information obtained by the Owner regarding the pipelines and other structures



which exist along the site of the Work, both at and below the surface of the ground. The Owner expressly disclaims any responsibility for the accuracy or completeness of the information given on the Drawings with regard to existing structures and pipelines, and the Contractor will not be entitled to any extra compensation on account of inaccuracy or incompleteness of such information, said structures and pipelines being shown only for the convenience of the Contractor who must verify the information to his own satisfaction. The giving of this information upon the Drawings will not relieve the Contractor of his obligations to support and protect all pipelines and other structures which may be encountered during the construction of the work and to make good all damages done to such pipelines and structures as provided in these Supplemental General Conditions.

#### 48. USE OF STREETS

- 48.1 During the progress of the Work, the Contractor shall make ample provision for both vehicular and foot traffic on any public road, and shall indemnify and save harmless the Owner from any expense whatsoever due to his operations over said roadways. The Contractor shall also provide free access to all fire hydrants, water and gas valves located along the line of his work. Gutters and waterways must be kept open or other provisions made for the removal of storm water. Street intersections may be blocked only one-half at a time, and the Contractor shall lay and maintain temporary driveways, bridges and crossings such as in the opinion of the Engineer are necessary to reasonably accommodate the public and to provide access to needed private driveways. In the event of the Contractor's failure to comply with these provisions, the Owner may cause the same to be done and will deduct the cost of such work from any monies due or to become due the Contractor under this Contract, but the performance of such work by the Owner or at its insistence shall serve in no wise to release the Contractor from his general or particular liability for the safety of the public or the Work.
- 48.2 Required line crossings of all streets and roads shall be done in accordance with the applicable state Department of Transportation procedures.
- 48.3 Contractor will be permitted to close a street when necessary for the proper prosecution of the work. The Contractor shall keep the Police and Fire Department continuously informed as to his intentions to close streets and give the Police Department sufficient notice in order that "No Parking" signs may be placed at the proper time to clear the street for construction.
- 48.4 The Contractor shall maintain property barricades and flagmen to detour traffic.
- 48.5 At all times the Contractor is responsible for damage to city and county streets as a result of their use in this project. The streets must be kept clear of all dirt, stone, or other debris. All debris, dirt, etc., whether caused by rains, storms, spillage from trucks or otherwise, shall be kept out of sewers. The Contractor is responsible for and may not plead ignorance of city and county ordinances and amendments thereto that may affect this use of streets or sewers.

49. CONSULTING AND RESIDENT OBSERVATION SERVICES DURING CONSTRUCTION

49.1 In providing the Owner with consulting services and resident project representation during construction, the Engineers and their employees do not assume any duty to supervise construction means or methods and safety procedures followed by any contractor, subcontractor and/or their respective employees or to any other person; nor for any public liability or for property damage caused through acts of the Contractor, subcontractor and/or their respective employees or any other person.

50. SAFETY AND HEALTH REGULATIONS

50.1 The Contractor shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54).

50.2 Contractor shall allow free access to any Department of Labor Representative for inspection purposes.

51. ACCESS BY REPRESENTATIVES OF GOVERNMENTAL AGENCIES

51.1 The authorized representatives and agents of all governmental agencies involved in this project shall have access to the work at all times and shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. Contractor shall provide proper facilities for the access and inspection of the work by such persons.

52. LOCAL AND STATE LAWS

52.1 The Contractor shall abide by all local and State laws or ordinances to the extent that such requirements do not conflict with Federal laws or regulations.

53. NEW JOB OPPORTUNITIES

53.1 The Contractor shall:

(a) To the maximum extent practicable, follow hiring and employment practices which will assure that performance of the Work results in new job opportunities for the unemployed and the underemployed; and

(b) Insert or cause to be inserted the same or similar provisions in each construction subcontract.

54. CONSTRUCTION RESTRICTIONS

54.1 Heavy construction machinery shall not be used within 500 feet of residential areas between the hours of 10:00 p.m. and 7:30 a.m.

54.2 No blasting or drilling shall be performed within 500 feet of residential areas between the hours of 10:00 p.m. and 7:30 a.m.

55. LEAD BASE PAINT AND JOINT SEALERS

55.1 No lead-based paints, protective coatings or joint sealers may be used on this project.

56. SUSPENSION AND RESUMPTION OF CONTRACT

56.1 Pursuant to the conditions as set out in the Specifications for hot asphaltic concrete binder and surface courses with particular reference to the limitations or temperature and weather conditions, the Owner may at its option and upon written notice, suspend the Contract over the winter and bad weather months. The Contract may then be resumed when weather conditions will permit the application of the above pavement, at the discretion of the Engineer. The notice to resume said contract shall be in writing. The suspended period will in no way be counted against the Contractor's allotted time to do the entire work.

56.2 This provision does not relieve the Contractor of the responsibility to maintain existing work already completed or any other responsibilities of the Contract; nor shall the Contractor, upon the basis of this fair notice herein; be eligible to make claim for or receive any damages for loss of overhead, plant expense, or anticipated profits, nor any other expenses incurred due to delay.

57. ABANDONMENT OR TERMINATION OF CONTRACT

57.1 For contracts over \$10,000, the Owner reserves the right to abandon the Contract if it will be in the Owner's best interest. The Contractor will be paid a fair payment, as negotiated with the Owner, for the work completed to date.

58. EVIDENCE OF PAYMENT

58.1 Contractor may be asked to present acceptable evidence from time to time that all bills have been paid for labor, materials, and equipment for which payment on account has been made in monthly estimates. Before final payment is made, Contractor shall, if required by the Owner, present sworn affidavit that all labor, materials, equipment, and service engaged for the work have been paid in full and that there are no outstanding debts or liens on any portions of the work.

59. ACCESSIBILITY OF RECORDS

59.1 The Owner, representatives of applicable federal agencies, the Comptroller General of the United States, or any of their duly authorized representatives, for a period of 3 years beyond completion of the Contract, shall have access to any books, documents, papers, and records of the Contractor which are directly pertinent to this Project for the purpose of making audit, examination, excerpts, and transcriptions of contracts in excess of \$10,000.

60. WORK WEEK, OVERTIME PAY, SHOW-UP PAY, AND ON-CALL PAY

- 60.1 All work performed under this Contract shall be performed on a 40-hour work week basis and shall include not only the prime Contractor but any and all subcontractors. The 40-hour work week shall be established by the Contractor at the Preconstruction Conference. Any deviation from the established work week will be approved in advance in writing by the Owner. Any additional cost incurred by the Owner due to deviations from the established work week will be borne by the Contractor. The Contractor shall provide written acknowledgment that he will pay any overtime cost incurred by the Owner at the time of requesting an increase in the 40-hour work week.
- 60.2 The Contractor will be assessed for each hour of overtime incurred by the Engineer's field representative(s) as a result of extended work hours (i.e., a total of more than 40 hours per calendar week) by the Contractor or his subcontractors.
- 60.3 If the Contractor advises the Engineer's field representative(s) that he will work on a particular day and subsequently decides not to work and does not so advise the representative(s) before he departs for the job site, the Contractor will be assessed an amount equal to 2 hours of the representative's time for "show-up" pay plus round-trip travel time and mileage. Show-up pay will not be assessed in the event of inability to work due to unanticipated inclement weather.
- 60.4 If the Contractor requests that the Engineer's field representative(s) be available to work on a weekend or a holiday but does not actually commit to work, the Contractor will be assessed an amount equal to 2 hours of the representative's time for "on-call" pay for each day that the Contractor so requests.
- 60.5 The above assessments for field representative's overtime pay, show-up pay, and on-call pay will be deducted as a separate line item on the Contractor's next progress payment request. Unless otherwise stated, the Engineer's field representative's time will be assessed at \$40.00 per hour for regular time and \$60.00 per hour for overtime.

END OF SECTION

# **SPECIFICATIONS**



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SECTION 01080

APPLICABLE CODES AND STANDARDS

PART 1 - GENERAL

1.1 GENERAL

- A. All materials, equipment, fabrication, and installation practices shall comply with the following applicable codes and standards, unless the Contractor's quality standards establish more stringent quality requirements, as determined by the Engineer.

1. *Pressure Piping and Tubing*

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
AWWA	American Water Works Association
NAPF	National Association of Piping Fabricators
NSF	NSF International

2. *Materials*

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials

3. *Painting and Surface Preparation*

NACE	National Association of Corrosion Engineers
SSPC	SSPC: The Society for Protective Coatings

4. *Gear Reducers and Bearings*

AFBMA	Anti-friction Bearing Manufacturers Association
AGMA	American Gear Manufacturers Association

5. *Ventilating Fans*

AMCA	Air Moving and Conditioning Association
PFMA	Power Fan Manufacturers Association

6. *Electrical and Instrumentation*

EIA	Electronic Industries Association
IEEE	Institute of Electrical and Electronic Engineers
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
NEMA	National Electrical Manufacturers Association

NFPA National Fire Protection Association  
UL Underwriter's Laboratories

7. *Aluminum Structures*

AA Aluminum Association  
AAMA Architectural Aluminum Manufacturers Association

8. *Steel Structures*

AISC American Institute of Steel Construction  
API American Petroleum Institute  
AWWA American Water Works Association  
SJI Steel Joist Institute

9. *Concrete Structures*

ACI American Concrete Institute

10. *Welding*

ASME American Society of Mechanical Engineers  
AWS American Welding Society

11. *Safety*

OSHA Occupational Safety and Health Act

12. *General Building Construction*

FM Factory Mutual Fire Insurance Corporation  
NFPA National Fire Protection Association  
SBC Southern Building Code Congress International, Inc.

13. *Subgrades and Pavement*

SSCRB Standard Specification Construction of Roads and Bridges,  
Department of Transportation, State of Georgia, 1993 Edition, and  
Supplemental Specifications  
SSRBC Standard Specifications for Road and Bridge Construction,  
Tennessee Department of Transportation

14. *Ductwork and Sheet Metal Work*

SMACNA Sheet Metal and Air Conditioning Contractors National  
Association

15. *Plumbing*

AGA American Gas Association  
NSF NSF International  
PDI Plumbing Drainage Institute



SPC SBCC Standard Plumbing Code

16. *Refrigeration, Heating, and Air Conditioning*

ARI American Refrigeration Institute

ASHRAE American Society of Heating, Refrigeration, and Air Conditioning Engineers

17. *Pressure Vessels*

ASME American Society of Mechanical Engineers

In addition, all work shall comply with the applicable requirements of local codes, utilities, and other authorities having jurisdiction.

- B. All material and equipment, for which a UL Standard, an AGA approval, or an ASME requirement is established, shall be so approved and labeled or stamped. Label or stamp shall be conspicuous and not covered, painted, or otherwise obscured from visual inspection.

END OF SECTION



## SECTION 01090

### ABBREVIATIONS

#### PART 1 - GENERAL

##### 1.1 GENERAL

- A. Wherever in these Specifications and Contract Documents the abbreviations, or pronouns in place of them are used, the intent and meaning shall be interpreted as specified herein.

##### 1.2 ABBREVIATIONS

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies
AFBMA	Anti-Friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
AMCA	Air Moving and Conditioning Association
APA	American Plywood Association
APHA	American Public Health Association
API	American Petroleum Institute
APWA	American Public Works Association
ARC	Appalachian Regional Commission
AREA	American Railroad Engineering Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BIA	Brick Institute of America
CFR	Code of Federal Regulations
CRSI	Concrete Reinforcing Steel Institute
CTI	Cooling Tower Institute
DIPRA	Ductile Iron Pipe Research Association
EIA	Electronic Industries Association
EPA	Environmental Protection Agency

FM	Factory Mutual
FmHA	Farmers Home Administration
FS	Federal Specifications
HEI	Heat Exchange Institute
IEEE	Institute of Electronic and Electrical Engineers
IES	Illuminating Engineering Society
IPCEA	Insulated Power Cable Engineers Association
IPC	Institute of Printed Circuits
ISA	Instrument Society of America
MBMA	Metal Building Manufacturers Association
MSS	Manufacturers Standardization Society of the Valve and Fitting Industry
MUTCD	Manual on Uniform Traffic Control Devices
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NAPF	National Association of Piping Fabricators
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NRMA	National Ready-Mix Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
SBC	Southern Building Code Congress International, Inc.
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	SSPC: The Society for Protective Coatings
SSCRB	Standard Specification Construction of Roads and Bridges, Department of Transportation, State of Georgia
SSRBC	Standard Specifications for Road and Bridge Construction, Tennessee Department of Transportation
TCA	Tile Council of America
TDEC	Tennessee Department of Environment and Conservation
TEMA	Tubular Exchangers Manufacturers Association
UBC	Uniform Building Code
UL	Underwriters Laboratories
USDC	United States Department of Commerce
WEF	Water Environment Federation (Formerly WPCF)
WPCF	Water Pollution Control Federation

END OF SECTION

## SECTION 01340

### SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. *This section specifies administrative and procedural requirements for submittal of shop drawings, product data, and samples to verify that products, materials, and systems proposed for use comply with provisions of the Contract Documents.*
- B. *Shop drawings are required for all materials, products, and equipment furnished on this project, unless otherwise specified.*
- C. *Standard information prepared without specific reference to the project is not considered to be shop drawings.*
- D. *Coordination drawings are a special type of shop drawing that show the relationship and integration of different construction elements that require close and careful coordination during fabrication or during installation to fit in the restricted space provided or to function as intended.*
- E. *Product data include, but are not limited to, the following:*
  - 1. *Manufacturer's product specifications.*
  - 2. *Manufacturer's installation instructions.*
  - 3. *Standard color charts.*
  - 4. *Catalog cuts.*
  - 5. *Roughing-in diagrams and templates.*
  - 6. *Standard wiring diagrams.*
  - 7. *Printed performance curves.*
  - 8. *Operational range diagrams.*
  - 9. *Mill reports.*
  - 10. *Standard product operating and maintenance manuals.*
- F. *Samples include, but are not limited to, the following:*
  - 1. *Partial sections of manufactured or fabricated components.*
  - 2. *Small cuts or containers of materials.*
  - 3. *Complete units of repetitively used materials.*
  - 4. *Swatches showing color, texture, and pattern.*
  - 5. *Color range sets.*
  - 6. *Components used for independent inspection and testing.*
- G. *Administrative Submittals. Refer to other Division 1 sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:*
  - 1. *Permits.*
  - 2. *Applications for payment.*

3. Performance and payment bonds.
4. Insurance certificates.
5. Listing of subcontractors.

H. *Project Photographs.* Submittal of project photographs is included under Section 01380, Construction Photographs.

I. *Inspection and Test Reports.* Submittal of inspection and test reports is included under Section 01400, Quality Control Services.

## 1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplemental Conditions or General Provisions and other Division 1 specification sections, apply to this section.

## 1.3 CONTRACTOR'S RESPONSIBILITY

A. *It is the duty of the Contractor to check all drawings, data, and samples prepared by or for him before submitting them to the Engineer for review. Each and every copy of the Drawings and data shall bear Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the Contract Documents.*

B. *The Contractor shall determine and verify:*

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with Specifications.

C. *Do not begin any of the work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and accepted by the Engineer.*

D. *Submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than 21 calendar days for checking and appropriate action from the time the Engineer receives them.*

E. *Stagger shop drawing submittals and indicate priority for critical delivery items on the shop drawing submittal schedule.*

F. *Submit four copies for the Engineer plus the number of copies the Contractor requires of descriptive or product data submittals to complement shop drawings (up to a maximum of eight copies). The Engineer will retain four sets. All blueprint shop drawings shall be submitted with one set of reproducible and only four sets of prints. The Engineer will review the blueprints and return to the Contractor the set of marked-up prints with appropriate review comments.*

- G. *Contractor shall be responsible for and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of the work prior to the review by Engineer of the necessary shop drawings.*

#### 1.4 ENGINEER'S REVIEW OF SHOP DRAWINGS

- A. *The Engineer's review of drawings, data, and samples submitted by the Contractor is for general conformance with the design concept of the project and for general compliance with the information given in the Contract Documents. The Engineer's review and exception, if any, will not constitute an approval of dimensions, quantities, and details of the material, equipment, device, or item shown.*
- B. *The review of drawings and schedules shall not be construed:*
1. *As permitting any departure from the Contract requirements;*
  2. *As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;*
  3. *As approving departures from details furnished by the Engineer, except as otherwise provided herein.*
- C. *If the drawings or schedules as submitted describe variations and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in contract price or time for performance, the Engineer may return the reviewed drawings without noting an exception.*
- D. *When reviewed by the Engineer, each of the shop drawings will be identified as having received such review, being so stamped and dated. Shop drawings stamped "REVISE AND RESUBMIT" and with required corrections shown will be returned to the Contractor for correction and resubmittal.*
- E. *Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing or on resubmitted shop drawings, to revisions other than the corrections requested by the Engineer on previous submissions. Make any corrections required by the Engineer.*
- F. *If the Contractor considers any correction indicated on the Drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer.*
- G. *The Engineer will review a submittal/resubmittal a maximum of 3 times, after which the cost of review will be borne by the Contractor. The cost of engineering will be equal to the Engineer's charges to the Owner under the terms of the Engineer's agreement with the Owner.*
- H. *When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.*

- I. *No partial submittals will be reviewed.* Submittals not complete will be returned to the Contractor, and will be considered "Rejected" until resubmitted.

## 1.5 SUBMITTAL PROCEDURES

- A. *Coordination.* Coordinate preparation and processing of submittals with performance of the work. Transmit each submittal to the Engineer sufficiently in advance of scheduled performance of related construction activities to avoid delay.

1. *Coordinate each submittal* with other submittals and related activities that require sequential activity including:

- a. Testing.
- b. Purchasing.
- c. Fabrication.
- d. Delivery.

2. *Coordinate transmittal* of different types of submittals for the same element of the work and different elements of related parts of the work so that processing will not be delayed by the Engineer's need to review submittals concurrently for coordination.

- a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are forthcoming.

- b. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Engineer sufficiently in advance of the work to permit processing.

- B. *Submittal Preparation.* Prepare and submit shop drawings in accordance with the following:

1. Attach a submittal cover sheet to each copy of a shop drawing. The submittal cover sheet shall contain the following information:

- a. Project name and Owner's name.
- b. Contractor's name and address.
- c. Engineer's name and address.
- d. Specification section and title.
- e. Drawing reference number.
- f. Submittal number.
- g. Space to indicate the results of the Contractor's review.
- h. Space to indicate any deviations from the Contract Documents or comments by the Contractor.
- i. Space approximately 8 inches wide and 4 inches high for the Engineer to indicate the results of his review and any comments.

2. Each shop drawing submittal shall be assigned a sequential number, beginning with the number 1. Resubmittals shall be identified by a letter suffix (i.e., 1A, 1B, etc.).



- C. *Submittal Transmittal.* Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer, and to other destinations, as indicated, by use of a transmittal form. Submittals received from sources other than the Contractor will be returned to the sender without action. A separate transmittal shall be used for each shop drawing submittal.

## 1.6 SHOP DRAWINGS

- A. *The term "shop drawings,"* when used in the Contract Documents, shall be considered to mean Contractor's plans for material and equipment which become an integral part of the Project. These drawings shall be complete and detailed. Shop drawings shall consist of fabrication, erection and setting drawings and schedule drawings, manufacturer's scale drawings, and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature, and performance and test data, shall be considered only as support to required shop drawings as defined above.
- B. *Drawings and schedules* shall be checked and coordinated with the work of all trades involved before they are submitted for review by the Engineer. Contractor shall indicate whether the shop drawing complies with or deviates from the requirement of the Contract Documents.
- C. *If drawings show deviations* from Contract requirements because of standard shop practice or for other reasons, the Contractor shall clearly mark and describe such deviation in his letter of transmittal. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility for executing the Work in accordance with the Contract, even though such drawings have been reviewed.
- D. *Data on materials and equipment* include, without limitation, materials and equipment lists, catalog data sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material. Materials and equipment lists shall give, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.
- E. *Installation List.* When requested by the Engineer, manufacturers or equipment suppliers who propose to furnish equipment or products under Divisions 11, 15, and 16 shall submit an installation list to the Engineer along with the required shop drawings. The installation list shall include at least five installations where identical equipment has been installed and has been in operation for a period of at least 1 year.
- F. *Color.* Only the Engineer will utilize the color "red" in marking shop drawing submittals.
- G. *Before final payment is made,* the Contractor shall furnish to Engineer five sets of record drawings, all clearly revised, complete and up-to-date showing the permanent construction as actually made for all reinforcing and structural steel, miscellaneous metals, process and mechanical equipment, yard piping, electrical system and instrument system.

## 1.7 SAMPLES

- A. *Furnish, for the approval of the Engineer,* samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials

or equipment for which samples are required shall not be used in work until approved by the Engineer.

## 1.8 SPECIFIC SUBMITTAL REQUIREMENTS

- A. *Submit coordination drawings* where required for integration of different construction elements. Show construction sequences and relationships of separate components where necessary to avoid conflicts in utilization of the space available.
- B. *Highlight, encircle, or otherwise indicate deviations* from the Contract Documents on the shop drawings.
- C. *Do not permit shop drawing copies* without an appropriate final stamp or other marking indicating the action taken by the Engineer to be used in connection with construction.
- D. *Sheet Size:* Except for templates, patterns, and similar full-size drawings, submit shop drawings on sheets at least 8½ by 11 inches but no larger than 30 by 40 inches.

## 1.9 PRODUCT DATA

- A. *Collect product data* into a single submittal for each element of construction or system. Mark each copy to show which choices and options are applicable to the Project.
- B. *Where product data have been printed* to include information on several similar products, some of which are not required for use on the project, or are not included in this submittal, mark copies to clearly indicate which information is applicable.
- C. *Where product data must be specially prepared* for required products, materials, or systems, because standard printed data are not suitable for use, submit as "shop drawings," not "product data."
- D. *Include the following information in product data:*
  - 1. Manufacturer's printed recommendations.
  - 2. Compliance with recognized trade association standards.
  - 3. Compliance with recognized testing agency standards.
  - 4. Application of testing agency labels and seals.
  - 5. Notation of dimensions verified by field measurement.
  - 6. Notation of coordination requirements.
- E. *Submittals.* Submit two copies of each required product data submittal; submit two additional copies where copies are required for maintenance manuals. The Engineer will retain one copy, and will return the other marked with the action taken and corrections or modifications required.
- F. *Distribution.* Furnish copies of final product data submittal to manufacturers, subcontractors, suppliers, fabricators, installers, governing authorities and others as required for performance of the construction activities. Show distribution on transmittal forms.
  - 1. Do not proceed with installation of materials, products and systems until a copy of product data applicable to the installation is in the installer's possession.

2. Do not permit use of unmarked copies of project data in connection with construction.

#### 1.10 ENGINEER'S ACTION

- A. *Action Stamp:* The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
  1. *Final Unrestricted Release:* Where submittals are marked "NO EXCEPTIONS," that part of the work covered by the submittal may proceed, provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
  2. *Final-But-Restricted Release:* When submittals are marked "EXCEPTIONS AS NOTED," that part of the work covered by the submittal may proceed, provided it complies with both the Engineer's notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
  3. *Returned for Resubmittal:* When submittal is marked "REVISE AND RESUBMIT," do not proceed with that part of the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Engineer's notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
    - a. Do not permit submittals marked "REVISE AND RESUBMIT" to be used at the project site, or elsewhere where construction is in progress.
  4. *Rejected:* When submittal is marked "REJECTED," the materials, equipment, and/or methods identified in the submittal do not comply with the Contract requirements and shall not be incorporated into the work. No resubmittal of the same materials, equipment, and/or methods shall be made.
  5. *Other Action:* Where a submittal is primarily for information or record purposes, for special processing or other Contractor activity, the submittal will be returned, marked "Action Not Required."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION



SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.1 SUMMARY

- A. *General.* This section specifies administrative and procedural requirements for construction photographs.
- B. *Costs.* Costs for photographs, album pages, and album shall be included in the lump sum bid price or unit prices contained for other items of work. No separate payment shall be allowed, with the exception of additional photographs, which is addressed elsewhere in this section.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplemental Conditions or General Provisions and other Division 1 specification sections, apply to this section.

1.3 SUBMITTALS

- A. *Prints.* Submit 3 prints of at least 4 views but not more than 8 views, directly to the Engineer with each monthly Application for Payment. The Engineer will distribute prints as follows:
  - 1. One print shall be retained in the project site field office of the Engineer's field representative and shall be available at all times for reference.
  - 2. One print to the Owner as the Owner's permanent record.
  - 3. One print shall be retained in the Engineer's files.
- B. *Extra Prints.* When requested by the Engineer, the photographer shall submit extra prints of photographs, with distribution directly to designated parties who will pay the costs for the extra prints directly to the photographer.
- C. *Negatives.* With each submittal, include photographic negatives, in protective envelopes, identified by date photographs were taken. The negatives shall be ready for transmittal to the Owner and for the Owner's unrestricted use. DO NOT CUT NEGATIVE from 3-4 negative grouping.
- D. *Digitally Stored Photographs.* In lieu of providing negatives, Contractor may provide digital photographs stored in standard format on standard CDs or diskettes.
- E. *Photograph Albums.* Provide 3-ring loose leaf, notebook type photo albums with the first Application for Payment. Albums shall be provided as required, if more than one volume of photographs is required to contain the photographs over the length of the construction contract. The front cover of each photo album shall contain the following:

1. Project Name
2. Owner's Name and Contract Number
3. Engineer's Name and Project Number
4. Volume Number
5. Contractor's Name

F. *Album Pages.* Album pages shall be punched for standard 3-ring binder. Allow 1-inch-wide margin on the left edge.

#### 1.4 QUALITY ASSURANCE

- A. *Engage* a qualified, experienced photographer to take photographs during construction.
- B. *Associated Services.* Cooperate with the photographer's work. Provide reasonable auxiliary services as requested, including access to and use of temporary facilities including temporary lighting.

### PART 2 - PRODUCTS

#### 2.1 PHOTOGRAPHIC COPIES

- A. Provide 4-by-6-inch smooth surface, glossy color prints on single-weight, commercial-grade stock, contained in a photo album page. The photographs shall be taken with a 35 mm or digital camera capable of being programmed to show the date the photo was taken on the front of the photograph.
- B. *Identification.* Provide date on front of the photo per the previous paragraph. On the back of each print provide an applied label or rubber stamped impression with the following information:
  1. Name of the Project.
  2. Name and address of the photographer.
  3. Name of the Engineer.
  4. Name of the Contractor.
  5. Provide notation of vantage point marked for location and direction of shot on a key plan of the site.

### PART 3 - EXECUTION

#### 3.1 PHOTOGRAPHIC REQUIREMENTS

- A. Take at least 4 but no more than 8 color photographs in accordance with requirements indicated, to best show the status of construction and progress since taking the previous photographs.
  1. *Frequency.* Take photographs monthly, coinciding with the cutoff date associated with each Application for Payment.

2. *Vantage Points:* The photographer shall select the vantage points for each shot each month to best show the status of construction and progress since the last photographs were taken.
  3. *Description:* A description of each photograph in album shall be noted below or to the side of the photograph.
- B. *Additional Photographs.* From time to time the Engineer may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by the Owner or Engineer, and are not included in the contract sum or an allowance.

END OF SECTION





## SECTION 01400

### QUALITY CONTROL SERVICES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. *This section specifies* administrative and procedural requirements for quality control services.
- B. *Quality control services* include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include contract enforcement activities performed by the Engineer.
- C. *Inspection and testing services are required* to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
  - 1. *Specific quality control requirements* for individual construction activities are specified in the sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
  - 2. *Inspections, tests, and related actions* specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
  - 3. *Requirements* for the Contractor to provide quality control services required by the authorities having jurisdiction are not limited by provisions of this section.

##### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplemental Conditions or General Provisions and other Division 1 specification sections, apply to this section.

##### 1.3 RESPONSIBILITIES

- A. *Contractor Responsibilities.* Provide inspections, tests, and similar quality control services, specified in individual specification sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the contract sum.
  - 1. Employ and pay an independent agency to perform specified quality control services.
  - 2. The Owner will engage and pay for the services of an independent agency to perform inspections and tests specified as the Owner's responsibility.

3. *Retesting*: The Contractor is responsible for retesting where results of required inspections, tests, or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.

4. *Associated Services*: Cooperate with agencies performing required inspections, tests, and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:

a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.

b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.

c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.

d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

e. Security and protection of samples and test equipment at the project site.

B. *Owner Responsibilities*. The Owner will employ and pay for the services of an independent agency, testing laboratory, or other qualified firm to perform services which are the Owner's responsibility.

C. *Duties of the Testing Agency*. The independent testing agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual specification sections shall cooperate with the Engineer and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Engineer and Contractor promptly of irregularities or deficiencies observed in the work during performance of its services.

2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents, or approve or accept any portion of the work.

3. The agency shall not perform any duties of the Contractor.

D. *Coordination*. The Contractor and each agency engaged to perform inspections, tests, and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

#### 1.4 SUBMITTALS

- A. *The independent testing agency* shall submit to the Engineer, in duplicate, a certified written report of each inspection, test, or similar service.

1. *Submit* additional copies of each written report directly to the governing authority, when the authority so directs.
2. *Report Data:* Written reports of each inspection, test, or similar service shall include, but not be limited to:
  - a. Date of issue.
  - b. Project title and number.
  - c. Name, address, and telephone number of testing agency.
  - d. Dates and locations of samples and tests or inspections.
  - e. Names of individuals making the inspection or test.
  - f. Designation of the work and test method.
  - g. Identification of product and specification section.
  - h. Complete inspection or test data.
  - i. Test results and an interpretation of test results.
  - j. Ambient conditions at the time of sample-taking and testing.
  - k. Comments or professional opinion as to whether inspected or tested work complies with Contract Document requirements.
  - l. Name and signature of laboratory inspector.
  - m. Recommendations on retesting.

#### 1.5 QUALITY ASSURANCE

- A. *Qualification for Service Agencies.* Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state in which the project is located.

#### PART 2 - PRODUCTS (Not Applicable)

#### PART 3 - EXECUTION

##### 3.1 REPAIR AND PROTECTION

- A. *General.* Upon completion of inspection, testing, sample-taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.

- B. *Protect* construction exposed by or for quality control service activities, and protect repaired construction.
- C. *Repair and protection* is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION

SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 SUMMARY

- A. *This section* specifies administrative and procedural requirements for project closeout, including but not limited to:
1. Inspection procedures.
  2. Project record document submittal.
  3. Operating and maintenance manual submittal.
  4. Submittal of warranties.
  5. Final cleaning.
- B. *Closeout* requirements for specific construction activities are included in the appropriate sections in Divisions 2 through 16.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplemental Conditions or General Provisions and other Division 1 specification sections, apply to this section.

1.3 SUBSTANTIAL COMPLETION

- A. *Preliminary Procedures.* Before requesting inspection for certification of substantial completion, complete the following. List exceptions in the request.
1. *Advise* Owner of pending insurance change-over requirements.
  2. *Complete start-up testing* of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
  3. *Complete final clean up* requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. *Inspection Procedures.* On receipt of a request for inspection, the Engineer will either proceed with inspection or advise the Contractor of unfulfilled requirements. The Engineer will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
1. The Engineer will repeat inspection when requested and assured that the work has been substantially completed.

2. Results of the completed inspection will form the basis of requirements for substantial completion.

C. *Reinspection Procedure.* The Engineer will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.

1. Upon completion of reinspection, the Engineer will prepare a certificate of final acceptance or advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, reinspection will be repeated.

#### 1.4 FINAL ACCEPTANCE

A. *Preliminary Procedures.* Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the contract sum.
3. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Engineer.
4. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
5. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates, and similar releases.
6. Submit record drawings, final project photographs, damage or settlement survey, property survey, and similar final record information.
7. Deliver any specified tools, spare parts, extra stock, and similar items.
8. Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.
9. Submit all project close out forms completed and executed.
10. Submit operation and maintenance data.
11. Submit spare parts list.

12. Submit project record drawings (mark-up of plans showing revisions during construction).
13. Submit a final liquidated damages settlement statement, if required.
14. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 CLOSEOUT PROCEDURES

- A. *Operating and Maintenance Instructions.* Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
  1. Maintenance manuals.
  2. Record documents.
  3. Spare parts and materials.
  4. Tools.
  5. Lubricants.
  6. Fuels.
  7. Identification systems.
  8. Control sequences.
  9. Hazards.
  10. Cleaning.
  11. Warranties and bonds.
  12. Maintenance agreements and similar continuing commitments.
- B. *A list of available instruction dates* shall be submitted to the Owner through the Engineer at least two weeks in advance of the earliest proposed date for each instruction program. The Engineer will, within three business days, notify the Contractor of the Owner's preferred date. To the maximum extent possible, instruction of related equipment systems will be conducted concurrently. The final coordination of the instruction is the sole responsibility of the Contractor.
- C. *Demonstrate the following procedures* as part of instruction for operating equipment.
  1. Start-up.
  2. Shutdown.
  3. Emergency operations.
  4. Noise and vibration adjustments.
  5. Safety procedures.
  6. Economy and efficiency adjustments.
  7. Effective energy utilization.

### 3.2 FINAL CLEANING

- A. *General.* General cleaning during construction is required by the General Conditions.
- B. *Cleaning.* Employ experienced workers or professional cleaners for final cleaning. Clean all work areas to original condition or to satisfaction of Owner and Engineer.
  - 1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
  - 2. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C. *Removal of Protection.* Remove temporary protection and facilities installed for protection of the work during construction.
- D. *Compliance.* Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
  - 1. Where extra materials of value remaining after completion of associated work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION



## SECTION 01730

### OPERATING AND MAINTENANCE DATA

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. *This section specifies* administrative and procedural requirements for operating and maintenance manuals including the following:
1. Preparation and submittal of operating and maintenance manuals for building operating systems or equipment.
  2. Preparation and submittal of instruction manuals covering the care, preservation, and maintenance of architectural products and finishes.
  3. Instruction of the Owner's operating personnel in operation and maintenance of building systems and equipment.
- B. *Special operating and maintenance data* requirements for specific pieces of equipment or building operating systems are included in the appropriate sections of Divisions 2 through 16.
- C. *Preparation of shop drawings and product data* are included in Section 01340, Shop Drawings, Product Data and Samples.
- D. *General closeout* requirements are included in Section 01700, Project Closeout.
- E. *General requirements for submittal of project record documents* are included in Section 01720, Project Record Documents.

##### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplemental Conditions or General Provisions and other Division 1 specification sections, apply to this section.

##### 1.3 QUALITY ASSURANCE

- A. *Operation and Maintenance Manual Preparation.* In preparation of operation and maintenance manuals, use personnel thoroughly trained and experienced in operation and maintenance of the equipment or system involved.
1. Where written instructions are required, use personnel skilled in technical writing to the extent necessary for communication of essential data.
  2. Where Drawings or diagrams are required, use drafters capable of preparing Drawings clearly in an understandable format.

- B. *Instructions for the Owner's Personnel.* For instruction of the Owner's operating and maintenance personnel, use experienced instructors thoroughly trained and experienced in the operation and maintenance of the building equipment or system involved.

#### 1.4 SUBMITTALS

- A. *Submittal Schedule.* Comply with the following schedule for submittal of operating and maintenance manuals.

1. Prior to the 80 percent completion point on the work, submit two draft copies of each manual to the Engineer for review. Include a complete index or table of contents of each manual.
2. Prior to substantial completion, make corrections or modifications to comply with the Engineer's comments and submit the specified number of copies of each approved manual to the Engineer.
3. Number: Six final copies of each manual.

- B. *Form of Submittal.* Prepare operating and maintenance manuals in the form of an instructional manual for use by the Owner's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.

1. *Binders:* For each manual, provide heavy-duty, commercial quality, 3-ring, vinyl-covered loose-leaf binders, in thickness necessary to accommodate contents, sized to receive 8½- by 11-inch paper. Provide a clear plastic sleeve on the spine to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
  - a. Where two or more binders are necessary to accommodate data, correlate data in each binder into related groupings in accordance with the project manual Table of Contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.
  - b. Identify each binder on the front and spine, with the typed or printed title "OPERATION AND MAINTENANCE MANUAL," project title or name, and subject matter covered. Indicate the volume number for multiple-volume sets of manuals.
2. *Dividers:* Provide heavy paper dividers with celluloid covered tabs for each separate section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the section on each divider.
3. *Protective Plastic Jackets:* Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.

4. *Text Material:* Where written material is required as part of the manual, use the manufacturer's standard printed material, or if it is not available, specially prepared data, neatly typewritten, on 8½- by 11-inch, 20-pound white bond paper.
5. *Drawings:* Where drawings or diagrams are required as part of the manual, provide reinforced, punched binder tabs on the drawings and bind in with the text.
  - a. Where oversized drawings are necessary, fold the drawings to the same size as the text pages and use as a fold-out.
  - b. If drawings are too large to be used practically as a fold-out, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a typewritten page indicating the drawing title, description of contents, and drawing location at the appropriate location in the manual.

## 1.5 MANUAL CONTENT

- A. *In each manual include* information specified in the individual specification section, and the following information for each major component of building equipment and its controls:

1. General system or equipment description.
2. Design factors and assumptions.
3. Copies of applicable shop drawings and product data.
4. System or equipment identification, including:
  - a. Name of manufacturer.
  - b. Model number.
  - c. Serial number of each component.
5. Operating instructions.
6. Emergency instructions.
7. Wiring diagrams.
8. Inspection and test procedures.
9. Maintenance procedures and schedules.
10. Precautions against improper use and maintenance.
11. Copies of warranties.
12. Repair instructions including spare parts listing.
13. Sources of required maintenance materials and related services.
14. Manual index.

- B. *Organize each manual* into separate sections for each piece of related equipment. As a minimum, each manual shall contain a title page, a table of contents, copies of product data supplemented by drawings and written text, and copies of each warranty, bond, and service contract issued.

1. *Title Page:* Provide a title page in a transparent plastic envelope as the first sheet of each manual. Provide the following information:
  - a. Subject matter covered by the manual.
  - b. Name and address of the project.
  - c. Date of submittal.
  - d. Name, address, and telephone number of the Contractor.
  - e. Name and address of the Engineer.

- f. Cross reference to related systems in other operating and maintenance manuals.
2. *Table of Contents:* After the Title Page, include a typewritten table of contents for each volume, arranged systematically according to the project manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.
  - a. Where more than one volume is required to accommodate data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.
3. *General Information:* Provide a general information section immediately following the Table of Contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the subcontractor or installer, and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. In addition, list a local source for replacement parts and equipment.
4. *Product Data:* Where manufacturer's standard printed data is included in the manuals, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one item in a tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data applicable to the installation and delete references to information that is not applicable.
5. *Written Text:* Where manufacturer's standard printed data is not available, and information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement data included in the manual, prepare written text to provide necessary information. Organize the text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure.
6. *Drawings:* Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems, or to provide control or flow diagrams. Coordinate these drawings with information contained in project record drawings to ensure correct illustration of the completed installation.
7. *Do not use original record documents* as part of the operating and Maintenance Manuals.
8. *Warranties, Bonds, and Service Contracts:* Provide a copy of each warranty, bond, or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to be followed in the event of product failure. List circumstances and conditions that would affect validity of the warranty or bond.

## 1.6 MATERIAL AND FINISHES MAINTENANCE MANUAL

A. *Unless otherwise specified, submit three copies of each manual on material and finishes, in final form, to the Engineer for distribution. Provide one section for architectural products, including applied materials and finishes, and a second for products designed for moisture-protection and products exposed to the weather.*

1. Refer to individual specification sections for additional requirements on care and maintenance of materials and finishes.

B. *Architectural Products: Provide manufacturer's data and instructions on care and maintenance of architectural products, including applied materials and finishes.*

1. *Manufacturer's Data: Provide complete information on architectural products, including the following, as applicable:*

- a. Manufacturer's catalog number.
- b. Size.
- c. Material composition.
- d. Color.
- e. Texture.
- f. Reordering information for specially manufactured products.

2. *Care and Maintenance Instructions: Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information regarding cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.*

C. *Moisture-Protection and Weather-Exposed Products: Provide complete manufacturer's data with instructions on inspection, maintenance, and repair of products exposed to the weather or designed for moisture-protection purposes.*

1. *Manufacturer's Data: Provide manufacturer's data giving detailed information, including the following, as applicable:*

- a. Applicable standards.
- b. Chemical composition.
- c. Installation details.
- d. Inspection procedures.
- e. Maintenance information.
- f. Repair procedures.

## 1.7 EQUIPMENT AND SYSTEMS OPERATION AND MAINTENANCE MANUAL

A. *Unless otherwise noted, submit six copies of each completed manual on equipment and systems, in final form, to the Engineer for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.*

1. Refer to specification sections for additional requirements on operating and maintenance of the various pieces of equipment and operating systems.

**B. Equipment and Systems.** Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.

1. *Description:* Provide a complete description of each unit and related component parts, including the following:
  - a. Equipment or system function.
  - b. Operating characteristics.
  - c. Limiting conditions.
  - d. Performance curves.
  - e. Engineering data and tests.
  - f. Complete nomenclature and number of replacement parts.
2. *Manufacturer's Information:* For each manufacturer of a component part or piece of equipment, provide the following:
  - a. Printed operating and maintenance instructions.
  - b. Assembly drawings and diagrams required for maintenance.
  - c. List of items recommended to be stocked as spare parts.
3. *Maintenance Procedures:* Provide information detailing essential maintenance procedures, including the following:
  - a. Routine operations.
  - b. Trouble-shooting guide.
  - c. Disassembly, repair, and reassembly
  - d. Alignment, adjusting, and checking.
4. *Operating Procedures:* Provide information on equipment and system operating procedures, including the following:
  - a. Start-up procedures.
  - b. Equipment or system break-in.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Instructions on stopping.
  - f. Shut-down and emergency instructions.
  - g. Summer and winter operating instructions.
  - h. Required sequences for electric or electronic systems.
  - i. Special operating instructions.
5. *Servicing Schedule:* Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
6. *Controls:* Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.
7. *Coordination Drawings:* Provide each contractor's coordination drawings.
  - a. Provide as-installed, color-coded piping diagrams, where required for identification.

8. *Valve Tags*: Provide charts of valve tag numbers, with the location and function of each valve.
9. *Circuit Directories*: For electric and electronic systems, provide complete circuit directories of panelboards, including the following:
  - a. Electric service.
  - b. Controls.
  - c. Communication.

#### 1.8 INSTRUCTION OF THE OWNER'S PERSONNEL

- A. *Prior to substantial completion*, instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Provide instruction at mutually agreed upon times.
  1. For equipment that requires seasonal operation, provide similar instruction during other seasons.
  2. Use operation and maintenance manuals as the basis of instruction for each piece of equipment or system. Review contents in detail to explain all aspects of operation and maintenance.
- B. *Training* shall be conducted by an experienced, authorized service representative of the manufacturer (not a sales representative).

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION





## SECTION 01740

### WARRANTIES AND BONDS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. *This section specifies* general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
1. General closeout requirements are included in Section 01700, Project Closeout.
  2. Specific requirements for warranties for the work and products and installations that are specified to be warranted, are included in the individual sections of Divisions 2 through 16.
- B. *Disclaimers and Limitations.* Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- C. *Separate Prime Contracts:* Each Prime Contractor is responsible for warranties related to its own contract.

##### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplemental Conditions or General Provisions and other Division 1 specification sections, apply to this section.

##### 1.3 DEFINITIONS

- A. *Standard product warranties* are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. *Special warranties* are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

##### 1.4 WARRANTY REQUIREMENTS

- A. *Standard Warranty:* Warrant all equipment, materials, products, and workmanship provided under these Contract Documents for a period of 12 months after the date of substantial completion established by the Engineer or the date established in Sewer Use Ordinance Section 4.3, whichever date establishes the greater warranty period.
- B. *Related Damages and Losses:* When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.

- C. *Reinstatement of Warranty:* When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty.
- D. *Replacement Cost:* Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents. Complete warranty work as soon as possible after receipt of notice from the Owner for a warranty claim. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.
- E. *Owner's Recourse:* Written warranties made to the Owner are in addition to implied warranties; and shall not limit the duties, obligations, rights, and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
1. *Rejection of Warranties:* The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
  2. *If the required repairs or replacements have not been completed* or if positive and good faith efforts have not been made to complete the repairs or replacements within 30 consecutive calendar days after receipt of notice from the Owner of the warranty claim, the Owner shall be authorized to proceed with the repairs or replacements and the cost thereof shall be assessed against the Contractor's Performance Bond. Evidence of positive and good faith efforts shall include, as a minimum, joint visits by the Contractor and affected equipment vendors and manufacturers, and certified copies of purchase orders or invoices.
- F. *The Owner reserves the right to refuse* to accept work for the project where a special warranty, certification, or similar commitment is required on such work or part of the work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- G. *Multiple Equipment Failures.* In the event of multiple equipment failures of major consequence prior to the expiration of the one-year warranty described above, disassemble, inspect, and modify or replace the affected equipment as necessary to prevent further occurrences. As used herein, "multiple equipment failures" shall be interpreted to mean two or more successive failures of the same kind in the same item of equipment or failures of the same kind in two or more items of similar equipment. Major equipment failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts or structural members, broken or chipped gear teeth, overheating, premature bearing failure, excessive wear, or excessive leakage around seals. Should multiple equipment failures occur in a given item or type of equipment, disassemble, inspect, modify or replace, as necessary, all equipment of the same size and type, and rewarrant for 12 months.

## 1.5 SUBMITTALS

- A. *Submit written warranties* to the Engineer prior to the date certified for substantial completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of substantial completion for the work, or a designated portion of the work, submit written warranties upon request of the Engineer.
1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the work.
- B. *When a special warranty* is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier, or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.
1. Refer to individual sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.
- C. *Form of Submittal.* At final completion, compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Contract Documents.
1. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION



## SECTION 02200

### EARTHWORK

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *This section includes earthwork and related operations, including but not limited to clearing and grubbing the construction site; dewatering; excavating all classes of material encountered; pumping, draining, and handling of water encountered in the excavations; handling, storage, transportation, and disposal of all excavated and unsuitable material; construction of fills and embankments; backfilling around structures and pipe; backfilling all trenches and pits; compacting; all sheeting, shoring, and bracing; preparation of subgrades; surfacing and grading; and any other similar, incidental, or appurtenant earthwork operation which may be necessary to properly complete the work.*
- B. *Provide all services, labor, materials, and equipment required for all earthwork and related operations necessary or convenient to the Contractor for furnishing a complete work as shown on the Drawings or specified in these Contract Documents.*

##### 1.2 GENERAL

- A. *The elevations shown on the Drawings as existing are taken from the best available data and are intended to give reasonable, accurate information about the existing elevations. They are not precise, and the Contractor should satisfy himself as to the exact quantities of excavation and fill required.*
- B. *Perform earthwork operations in a safe and proper manner taking appropriate precautions against all hazards.*
- C. *Maintain in good condition at all times all excavated and fill areas for structures, trenches, fills, topsoil areas, embankments, and channels until final acceptance by the Owner. Repair all damage caused by erosion or other construction operations using material of the same type as the damaged materials.*
- D. *If soil borings are available for the area of this work, they will be on file at the Owner's address where they will be made available for review. This information is made available for such use as Contractor may choose to make of it in the preparation of his bid, but the Owner gives no guarantee, either expressed or implied, that it represents a true or complete cross section of all of the material to be encountered in performing the excavation and earthwork on this project.*
- E. *Earthwork operations within the rights-of-way of the State Department of Transportation, the County Road Department, and the respective cities shall be conducted in accordance with the requirements and provisions of the permits issued by those agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence over and supersede the provisions of these Specifications.*

- F. *Control grading* to prevent water running into excavations. Obstruction of surface drainage shall be avoided and a means shall be provided whereby storm water can be uninterrupted in existing gutters, other surface drains, or temporary drains. Material for backfill or for protection of excavation in public roads from surface drainage shall be neatly placed and kept shaped so as to cause the least possible interference with public travel. Free access must be provided to all fire hydrants, valves, meters, and private drives.
- G. *No classification of excavated materials* will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.
- H. *Tests for compaction and density* shall be conducted by the Engineer or by an independent testing laboratory selected by him. Costs of compaction tests performed by an independent testing laboratory shall be paid for directly by the Owner and not as a part of this contract. Make all necessary excavations and supply any samples of materials necessary for conducting compaction and density tests. Pay the cost of all retests made necessary by the failure of materials to conform to the requirements of these Contract Documents.
- I. *All earthwork operations* shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, "Excavations, Trenching, and Shoring," and Subpart O, "Motor Vehicles, Mechanized Equipment, and Marine Operations," and shall be conducted in a manner acceptable to the Engineer.
- J. *It is understood and agreed* that a thorough investigation by the Contractor has been made of the surface and subsurface conditions of the site and any special construction problems which might arise as a result of nearby watercourses and floodplains, particularly in areas where construction activities may encounter water-bearing sands and gravels or limestone solution channels. Provide all services, labor, equipment, and materials necessary or convenient for completing the work.

## PART 2 - EXECUTION

### 2.1 INITIAL SITE PREPARATION

- A. *Preparatory to beginning construction operations*, remove from the site all vegetative growth, trees, brush, stumps, roots, debris, and any other objectionable matter, including fences, buildings, and other structures shown on the Drawings in the construction areas which are designated for removal or which, if left in place, would interfere with the proper performance or completion of the contemplated work, would impair its subsequent use, or would form obstructions therein.
- B. *Grub and remove stumps and roots* to a depth not less than 5 feet below grade. Fill all holes or cavities which extend below the subgrade elevation of the proposed work with compacted layers of crushed rock or earth backfill conforming to the requirements specified here for backfill. Do not incorporate organic material from clearing operations in excavation backfill or embankment material.

- C. *Exercise special precautions* for the protection and preservation of trees, cultivated shrubs, sod, fences, buildings, and other structures located in the construction area but not within designated clearing limits as shown on the Drawings or within the limits of embankments, excavations, or proposed structures. Repair or replace any of the aforementioned items damaged by Contractor's operation or construction activities.
- D. *Remove and dispose* of any excess material resulting from clearing or site preparation operations. Dispose of such materials in a manner acceptable to the Engineer and at an approved location where such materials can be lawfully placed.

## 2.2 DEWATERING

- A. *Provide and maintain* at all times during construction ample means and devices with which to promptly remove and properly dispose of all water from any source entering the excavations or other parts of the work. Dewatering shall be accomplished by methods which will ensure a dry excavation and preservation of the final lines and grades of the bottoms of excavations. Methods of dewatering may include sump pumps, well points, deep wells, or other suitable methods which do not damage or weaken structures, foundations, or subgrades. Shallow excavations may be dewatered using open ditches, provided such ditches are kept open and free-draining at all times. The actual dewatering methods used shall be acceptable to the Engineer.
- B. *Do not place concrete or mortar* in water nor allow water to rise over newly placed concrete or mortar for at least 24 hours after placement, unless specifically authorized by the Engineer. No concrete structure shall be exposed to unequal hydrostatic forces until the concrete has reached its specified 28-day strength. Do not allow water to rise above bedding during pipe-laying operations. Exercise care to prevent damage to pipelines or structures resulting from flotation, undermining, or scour. Dewatering operations shall commence when ground or surface water is first encountered and shall be continuous until water can safely be allowed to rise in accordance with the provisions of this section. Protect excavations from the entrance of surface water to the extent possible by the use of dikes and/or covers.
- C. *Standby pumping equipment* shall be on the jobsite. A minimum of 1 standby unit (a minimum of 1 for each 10 in the event well points are used) shall be available for immediate installation should any pumping unit fail. The design and installation of well points or deep wells shall be suitable for the accomplishment of the work. Submit drawings or diagrams on proposed well point or deep well dewatering systems to the Engineer for review.
- D. *If foundation soils are disturbed or loosened* by the upward seepage of water or an uncontrolled flow of water, excavate and replace the affected areas with crushed rock at no cost to the Owner.
- E. *Dispose of the water* from the work in a suitable manner without damage to adjacent property. Conveyance of the water shall not interfere with traffic flow or treatment facilities operation. Do not drain water into work built or under construction without prior consent of the Engineer. The Contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

- F. *Provide sedimentation and desilting basins* as necessary or when directed by the Engineer to prevent the entrance of excessive or injurious amounts of sand and silt from surface runoff or dewatering operations into storm drains or receiving waters. The system used for desanding or desilting the water shall be a baffled structure and shall provide not less than 5 minutes detention time and shall be designed to have a "flow-through" velocity not exceeding 0.2 foot per second at the anticipated peak flow. The method of desanding or desilting and the point of disposal shall be subject to the approval of the Engineer.
- G. *Dispose of water safely* and in accordance with applicable Environmental Protection Agency, U.S. Army Corps of Engineers, and State Water Quality Control Division standards and permits.

### 2.3 SHEETING, SHORING, AND BRACING

- A. *The sides of all excavations* shall be sufficiently sheeted, shored, and braced as necessary to prevent slides, cave-ins, settlement, or movement of the banks; to maintain the excavation clear of all obstructions; and to provide safe working conditions. Wood or steel sheeting shall be used in wet, saturated, or flowing ground. All sheeting, shoring, and bracing shall have sufficient strength and rigidity to withstand the pressure exerted and to maintain shape and position under all circumstances.
- B. *Correctly assessing the need for sheeting, analyzing the stresses induced, and maintaining regulatory compliances* shall be totally the responsibility of the Contractor. Since the Engineer does not dictate or determine the Contractor's sequence or limits of excavation, the Engineer assumes no responsibility for sheeting and shoring. The Contractor must employ or otherwise provide for adequate professional structural and geotechnical engineering supervision to assess the need for sheeting and shoring and design same. Results of sheeting and shoring analysis and design shall be submitted to the Engineer on request.
- C. *Excavations adjacent to existing or proposed buildings and structures, or in paved streets or alleys, shall be sheeted, shored, and braced adequately* to prevent undermining beneath or subsequent settlement of such structures or pavements. Underpinning of adjacent structures shall be done when necessary to maintain structures in safe condition. Any damage to structures or pavements occurring through settlements, water or earth pressures, slides, caves, or other causes due to failure or lack of sheeting or bracing, or improper bracing or occurring through negligence or fault of the Contractor in any other manner shall be repaired by the Contractor at his own expense.
- D. *Sheeting, shoring, or bracing materials* shall not be left in place unless otherwise specified or shown on the Drawings or ordered by the Engineer in writing. Such materials shall be removed in such manner that no danger or damage will occur to new or existing structures or property, public or private, and so that cave-ins or slides will not take place. Trench sheeting shall be left in place until backfill has been brought to a level 12 inches above the top of the pipe. It shall then be cut off and the upper portion removed. Sheeting for structures shall be left in place until backfill has been brought to a level 12 inches above the top of the bottom footing. It shall then be cut off and the upper portion removed.



- E. *All holes and voids* left in the work by the removal of sheeting, shoring, or bracing shall be filled and thoroughly compacted.

## 2.4 EXCAVATION

### A. *General*

1. *Excavation* shall include the removal of all material from an area necessary for the construction of a pipeline or structure. Excavations shall provide adequate working space and clearances for the work to be performed therein.
2. *All material excavated* below the bottom of concrete walls, footings, and foundations shall be replaced, by and at the expense of the Contractor, with Class B concrete to the lines and grades shown on the Drawings, except where otherwise shown on the Drawings, specified herein, or authorized by the Engineer.
3. *Where quicksand, soft clay, spongy or swampy earth,* or other materials unsuitable for subgrade or foundation purposes are encountered below the excavation limits, they shall be removed and disposed of to the level of suitable material. Areas so excavated shall be backfilled with Class B concrete or with compacted layers of crushed rock, sand, or other approved material conforming to the requirements specified herein for backfill to the lines and grades shown on the Drawings.
4. *Place barriers* at each end of all excavation and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Place lights along excavations from sunset each day to sunrise of the next day until the excavations are backfilled. Barricade all excavations in such a manner as to prevent persons from falling or walking into any excavation.

### B. *Rock Excavation*

1. *Rock encountered* in the process of excavation for structures shall be uncovered and stripped of all loose materials over the entire limits of excavation. Rock encountered for removal in a trench section shall be uncovered for a distance of not less than 50 feet.
2. *Excavate rock and large boulders in trenches* over the horizontal limits of excavation and to depths as shown on the Drawings.
3. *Backfill the space below grade for pipelines* to the proper grade with compacted layers of crushed rock or sand conforming to the requirements specified herein for backfill. Where pipe sewers are constructed on concrete cradles, excavate rock to the bottom of the cradle as shown on the Drawings.
4. *Excavate rock under structures* to lines and grades shown on the Drawings. Unless specified otherwise, where rock excavation has been carried below grade, the Contractor shall backfill to grade with Class B concrete at his own expense.
5. *Where rock foundation is obtained at grade for over 50 percent* of the area of any one structure, the portion of the foundation that is not rock shall be excavated

below grade to reach a satisfactory foundation of rock. The portion below grade shall be backfilled with Class B concrete.

6. *Where rock foundation is obtained at grade for less than 50 percent of any one structure and satisfactory rock cannot be found over the remaining area by reasonable additional excavation, the rock shall be removed for a depth of 12 inches below grade and the space below grade shall be backfilled to the proper grade with compacted layers of crushed rock conforming to the requirements specified herein for backfill.*
7. *Drilling and blasting operations shall be conducted with due regard for the safety of persons and property in the vicinity and in strict conformity with requirements of all ordinances, laws, and regulations governing blasting and the use of explosives. Conduct rock excavation near existing pipelines or other structures with the utmost care to avoid damage. Promptly repair injury or damage to other structures and properties to the satisfaction of the Owner by the Contractor at his own expense. The Contractor is advised to hire qualified consultants to perform a "preblast survey" in area where damage could occur due to blasting; all expenses for such survey must be borne by the Contractor, and no separate payment for same will be made.*
8. *Complete rock excavation for all structures and adjacent trenches under this Contract and any other rock excavation directed by the Engineer before construction of any structure is started in the vicinity.*

#### C. *Borrow Excavation*

1. *Wherever the backfill of excavated areas or the placement of embankments or other fills requires specified material not available at the site or material in excess of suitable material available from the authorized excavations, such materials shall be obtained from other sources. This may require the opening of borrow pits at points not immediately accessible from the work. In such cases make suitable arrangements with the property owner and pay all costs incident to the borrowed material including royalties, if any, for the use of the material. Before a borrow pit is opened, the quality and suitability of the material to be obtained therefrom shall be approved by the Engineer.*
2. *Borrow pits shall be cleared, grubbed, and finish-graded in accordance with the requirements specified herein.*

D. *Roadway Excavation.* Roadway excavation shall consist of excavation for roadways and parking areas in conformity with lines, grades, cross sections, and dimensions shown on the Drawings. After shaping to line, grade, and cross section, the subgrade shall be rolled until compacted to a depth of at least 6 inches to 100 percent of the maximum density at optimum water content as determined by AASHTO T99, Method A. This operation shall include any reshaping and wetting required to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material.

## E. Trench Excavation

1. *Trench excavation* shall consist of the removal of materials necessary for the construction of water, sewer, and other pipelines and all appurtenant facilities including manholes, inlets, outlets, headwalls, collars, concrete saddles, piers, and pipe protection called for on the Drawings.
2. *Excavation for pipelines* shall be made in open cut unless shown otherwise on the Drawings. Trenches shall be cut true to the lines and grades shown on the Drawings or established by the Engineer on the ground. The banks of trenches shall be cut in vertical, parallel planes equidistant from the pipe centerline. From an elevation 12 inches above the top of the pipe to the bottom of the trench, the horizontal distances between vertical planes for different sizes of pipe shall not exceed those shown on the Drawings. When sheeting is used, the width of the trench shall be considered as the distance between the inside faces of the sheeting. The bottom of the trench shall be cut carefully to the required grade of the pipe except where bedding materials or cradles are shown, in which case the excavation shall extend to the bottom of the bedding or cradles as shown on the Drawings. Minimum pipe cover shall be as shown on the Drawings or specified in these Contract Documents.
3. *The use of a motor-powered trenching machine* will be permitted, but full responsibility for the preservation, replacement, and/or repair of damage to any existing utility services and private property shall rest with the Contractor.
4. *Bell holes* for bell and spigot pipe and/or mechanical joint pipe shall be excavated at proper intervals so the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper installation of all joints in the pipe. Bell holes shall not be excavated more than 10 joints ahead of pipe laying. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.
5. *Excavation* for manholes, outlets, collars, saddles, piers, and other pipeline structures shall conform to the additional requirements specified herein for structural excavation.
6. *Pipe trenches* shall not be excavated more than 400 feet in advance of pipe laying and all work shall be performed to cause the least possible inconvenience to the public. Adequate temporary bridges or crossings shall be constructed and maintained where required to permit uninterrupted vehicular and pedestrian traffic.
7. *Wherever pipe trenches are excavated* below the elevation shown on the Drawings, the Contractor, at his own expense, shall fill the void thus made at the proper grade with Class B concrete or with compacted layers of crushed rock or sand conforming to the requirements specified herein for backfill, unless otherwise specified herein or shown on the Drawings.
8. *In all cases where materials are deposited along open trenches*, they shall be placed so that no damage will result to the work and/or adjacent property in case of rain or other surface wash.

## F. *Structural Excavation*

1. *Structural excavation* shall consist of the removal of all materials necessary for the construction of structures, including tanks, foundations, footings, wet wells, dry wells, box culverts, flumes, channels, buildings, and other miscellaneous structures.
2. *The bottoms of structural excavations* shall be true to the lines and grades shown on the Drawings. Faces of excavations shall not be undercut for extended footings. Except as provided herein for excavation of unsuitable material or rock, where the excavation is carried below the grade elevation shown on the Drawings, the Contractor shall backfill the void thus made to the proper grade with Class B concrete at his own expense.

## 2.5 BACKFILLING

### A. *Materials for backfilling* shall conform to the following requirements:

1. *Select Earth Backfill*: Fine, sound, loose earth containing optimum moisture content for compaction to 90 percent of maximum density, free from all wood, vegetable matter, debris, and other objectionable material, and having scattered clods, stones, or broken concrete less than 2 inches in maximum dimension except that the maximum particle size shall be 3/4 inch when used with PVC or other flexible thermoplastic pipe.
2. *Common Earth Backfill*: Sound, loose earth containing optimum moisture content for compaction to 90 percent of maximum density, free from all wood, vegetable matter, debris, and other objectionable material, and having scattered clods, stones, or broken concrete and pavement less than 6 inches in maximum dimension.
3. *Sand*: Natural or imported sand conforming to ASTM D 1073.
4. *Crushed Rock*: Crushed rock conforming to Section 903.22, Size 7 (1/2-inch to No. 4) of the SSRBC.
5. *Class B Concrete*: Class B concrete as specified elsewhere in these Specifications or on the Drawings.

### B. *General*

1. *Earth backfill* shall be compacted to not less than 90 percent of the maximum density as determined by ASTM D 698 at a moisture content within 3 percentage points, unless otherwise specified herein. Crushed stone and sand shall be compacted to not less than 83 percent of the solid volume density as determined from the bulk specific gravity by AASHTO T-84 and T-85 and the dry weight of the aggregate.
2. *Material that is too dry* for adequate compaction shall receive a prior admix of sufficient water to secure optimum moisture content. Material having excessive water content shall not be placed at any time.

3. *Backfill material* required to be compacted shall be placed in horizontal layers not to exceed 6 inches in thickness (before compaction) and compacted in place by ramming, tamping, or rolling, unless otherwise specified herein. Compaction shall be accomplished by power-driven tools and machinery wherever possible. Compaction and consolidation of sand and crushed stone backfill shall be accomplished using vibrating equipment in a manner acceptable to the Engineer.

### C. *Backfilling Trenches*

1. *The backfilling of sewers, water, and other pipeline trenches* shall be started immediately after the construction of same has been inspected and approved by the Engineer. Select backfill or crushed stone as shown on the Drawings shall be placed in the trench under and on each side of the pipe in 6-inch layers for the full width of the trench and thoroughly and uniformly compacted by ramming and/or tamping to a minimum of 90 percent of the maximum density determined as specified herein. Select earth backfilling or crushed stone as shown on the Drawings shall start above the pipe bedding. Sufficient select backfill or crushed stone as shown on the Drawings shall be placed around the pipe and compacted to provide a cover of not less than 12 inches over the top of the pipe. Mechanical compactors or tampers shall not be used within 12 inches of pipe. Compaction in this area shall be accomplished by hand methods. Sand or specified crushed stone bedding material shall be substituted for select earth backfill when the pipe material is other than ductile iron or when crushed stone trench backfill is required. Backfilling shall proceed simultaneously on both sides of the pipe to prevent lateral displacement.
2. *Caution shall be used* during backfill operations for PVC or other flexible thermoplastic pipe to prevent pipe deformation. PVC or other flexible thermoplastic pipe shall not be subjected to roller or wheel loads until a minimum of 30 inches of backfill has been placed over the top of the pipe. A hydrohammer shall NOT be used until a minimum depth of 48 inches of backfill has been placed over the top of the pipe.
3. *Backfilling of PVC pressure pipe* or other flexible thermoplastic pipe (water pipe) shall be as described in Paragraph 1 above.
4. *In streets and alleys, across sidewalks and driveways, and at any other places subject to vehicular traffic or other superimposed loads, crushed rock backfill* shall be placed and compacted in 12-inch layers from the bottom of the trench upward for the full depth of the trench. Crushed rock backfill shall be compacted by use of a hydrohammer or approved vibratory compactor. The top 6 inches of the finished subgrade shall be equal to not less than 100 percent of the maximum density as determined by ASTM D 698 at a moisture content of within 3 percentage points of optimum. When field tests show failure to meet the density requirement, the subgrade shall be loosened by disking, harrowing, or other approved methods to a depth of not less than 6 inches, then reshaped and recompacted as indicated in this paragraph.
5. *Trenches under concrete slabs and footings* of structures shall be completely backfilled with compacted sand or crushed rock or filled with Class B concrete as shown on the Drawings.

6. *All backfilling* shall be done in such a manner that the pipe or structure over or against which it is being placed will not be disturbed or injured. Any pipe or structure injured, damaged, or moved from its proper line or grade during backfilling operations shall be removed and repaired to the satisfaction of the Engineer and then rebackfilled.

#### D. *Backfilling Around Structures*

1. *Backfilling around structures* shall consist of common earth backfill placed in 6-inch layers and compacted by tamping to a minimum of 90 percent of the maximum density determined as specified herein for the full depth of the excavation from the bottom to the finished grade. No backfill shall be placed against concrete structures until the concrete has reached its specified 28-day compressive strength. Where practical, compaction of structural backfill shall be accomplished by power-driven tamping equipment.
2. *Where crushed rock mats under slabs and foundations* are called for on the Drawings, excavate below grade to the depth of the crushed rock mat as shown on the Drawings and install a compacted crushed rock bed. This shall be finished to a true line or plane and even with the subgrade of the concrete foundations, piers, footings, or slabs. Before placing any crushed stone, remove all loose earth or debris. This crushed rock mat shall extend 12 inches beyond all slabs and foundations or to edges of sheet piling.
3. *Crushed rock mats 12 inches or less in thickness* shall be constructed of compacted layers of crushed rock conforming to Section 903.23, Size 7 (½-inch to No. 4), of the SSRBC.
4. *Crushed rock mats of thickness greater than 12 inches* shall have the top 12 inches constructed of compacted layers of crushed rock as specified above. That portion below the top 12 inches shall be constructed of compacted layers of crushed rock conforming to section 903.05, Class A, with a modified gradation of 6 inches to dust as received from the crusher.
5. *The use of earth backfill* to support footings, foundations, and structures shall not be permitted, unless otherwise shown on the Drawings.

## 2.6 FILLS AND EMBANKMENTS

- A. *Fills and embankments* shall consist of all earth fills except backfills in trenches or around structures. Unless special material is specified or shown on the Drawings, material for fills and embankments shall consist of excavated material from structures or of a mixture of such excavated materials and materials borrowed from other sources by the Contractor. All material used for fills and embankments shall be free from wood, vegetable matter, debris, soft or spongy earth or clay, large rock, or other objectionable material and shall be acceptable to the Engineer.
- B. *Materials* shall be placed in the fill or embankment in successive layers 8 inches or less in thickness before compaction, each layer being approximately horizontal and extending to the full limit of the required cross section, and shall be compacted over the entire surface to not less than 95 percent of the maximum density as determined by ASTM D 698 at a moisture content of within 3 percentage points of optimum. The

process shall be repeated for each layer of material until the fill or embankment conforms to the plan lines, grades, and cross sections. The degree of compaction and moisture content required, the method of tamping, and the equipment used shall be approved by the Engineer.

- C. *The area over which the fill or embankment is to be constructed shall first be cleared of all vegetation, debris, and other objectionable material and, if the ground is in a loose, uncompacted condition, it shall be compacted to a minimum 95 percent of maximum density determined as specified herein.*
- D. *No material shall be placed beyond the sloping lines of embankment unless so ordered by the Engineer. Material allowed to be placed beyond the lines of embankment shown on the Drawings will be compacted as required above unless otherwise authorized by the Engineer.*
- E. *Material for embankments or roadway fills shall be placed in 6-inch maximum lifts and shall be compacted by rolling with power rollers weighing not less than 10 tons, with sheepfoot rollers, with vibrating rollers, or with pneumatic tire rollers, as required to accomplish the work. While and as each layer is deposited, water shall be applied in sufficient amount to ensure optimum moisture to secure the compaction specified.*
- F. *The use of trucks, carryalls, scrapers, tractors, or other heavy hauling equipment shall not be considered as rolling in lieu of rollers, but the traffic of such hauling equipment shall be distributed over the fill in such a manner as to make the use of the compaction afforded thereby as an addition to compaction by the use of rollers.*
- G. *Wherever a trench passes through a fill or embankment, the fill or embankment material shall be placed as compacted to an elevation 12 inches above the top of the pipe before the trench is excavated.*
- H. *Subgrades for all roadbeds shall meet the requirements of Subsection 2.5 C.4.*

## 2.7 DISPOSAL OF WASTE AND UNSUITABLE MATERIALS

- A. *All materials removed by excavation which are suitable for the purpose shall be used to the extent possible for backfilling pipe trenches, foundations, and footings and for making embankment fills or for such other purposes as may be shown on the Drawings. All materials not used for such purposes shall be considered as waste materials and the disposal thereof shall be made in a manner and at locations approved by the Engineer.*
- B. *Waste materials shall be spread in uniform layers and neatly leveled and shaped. Spoil banks shall be provided with sufficient and adequate openings to permit surface drainage of adjacent lands.*
- C. *Unsuitable materials, consisting of wood, vegetable matter, debris, soft or spongy clay, peat, and other objectionable material so designated by the Engineer, shall be removed from the work site and disposed of in a manner and at a location approved by the Engineer.*

- D. *No unsuitable or waste material* shall be dumped on private property unless written permission is furnished by the owner of the property and unless a dumping permit is issued from the local jurisdiction.
- E. *The Contractor is responsible* for any and all permits and other requirements, such as sediment runoff control necessitated by the disposal of waste material.

## 2.8 FINAL GRADING

- A. *After other earthwork operations* have been completed, the sites of all structures, roads, and embankments shall be graded within the limits and to the elevations shown on the Drawings. Grading operations shall be so conducted that materials shall not be removed or loosened beyond the required limits. The finished surfaces shall be left in smooth and uniform planes such as are normally obtainable from the use of hand tools. If Contractor is able to obtain the required degree of evenness by means of mechanical equipment, the use of hand labor methods will not be required. Neatly trim and finish slopes and ditches to slopes shown on the Drawings unless otherwise approved by the Engineer.
- B. *Grade and dress all finished ground surfaces* to present a surface varying not more than plus or minus 0.10 foot as regards local humps or depressions, unless otherwise specified or shown on the Drawings, and shall be acceptable to the Engineer.

## 2.9 TOPSOIL

- A. *All areas to be planted with trees or shrubs*, or with sprigged grass as shown on the plans, shall be prepared by grading to a smooth, even surface to a level 4 inches below the elevation of the finished grade shown on the Drawings. It shall then be brought to a neat and finished grade by the addition of 4 inches of approved topsoil.
- B. *Topsoil removed* from the construction area may be stockpiled and reused or topsoil may be obtained from approved borrow areas. If obtained from borrow areas, make suitable arrangements with the property owner and pay all costs incident to the borrowed material including royalties.

## 2.10 SETTLEMENT

- A. *The Contractor shall be responsible* for all settlement of backfill, fills, and embankments which may occur within 1 year after final acceptance of the work by the Owner.
- B. *Make, or cause to be made*, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from the Engineer or Owner.

END OF SECTION



## SECTION 02270

### SLOPE PROTECTION AND EROSION CONTROL

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *This section shall consist of temporary control measures as shown in the plans or directed by the Engineer during the life of the Contract to control erosion and water pollution through the use of berms, dikes, dams, sediment basins, fiber mats, netting, mulches, grasses, slope drains, temporary silt fences, and other control devices.*
- B. *The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features to assure economical, effective, and continuous erosion control throughout the construction and post-construction periods.*
- C. *All designs will conform to and all work will be performed in accordance with the standards and specifications of the publication entitled "Manual for Erosion and Sediment Control in Georgia."*

#### PART 2 - PRODUCTS

##### 2.1 TEMPORARY BERMS

- A. *A temporary berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes or transverse to centerline on fills.*
- B. *These berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.*

##### 2.2 TEMPORARY SLOPE DRAINS

- A. *A temporary slope drain is a facility consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe, sod, or other material acceptable to the Engineer that may be used to carry water down slopes to reduce erosion.*

##### 2.3 SEDIMENT STRUCTURES

- A. *Sediment basins, ponds, and traps are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect properties and stream channels below the construction areas from excessive siltation.*

##### 2.4 CHECK DAMS

- A. *Check dams are barriers composed of logs and poles, large stones, sand bags, or other materials placed across a natural or constructed drainway.*

- B. *Stone check dams* shall not be utilized where the drainage area exceeds 50 acres. Log and pole structures shall not be used where the drainage area exceeds five acres.

## 2.5 TEMPORARY SEEDING AND MULCHING

- A. *Temporary seeding and mulching* are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes, including waste sites and borrow pits, shall be seeded when and where necessary to eliminate erosion.

## 2.6 BRUSH BARRIERS

- A. *Brush barriers* shall consist of brush, tree trimmings, shrubs, plants, and other approved refuse from the clearing and grubbing operation.
- B. *Brush barriers* are placed on natural ground at the bottom of fill slopes, where the most likely erodible areas are located, to restrain sedimentation particles.

## 2.7 BALED HAY OR STRAW CHECKS

- A. *Baled hay or straw erosion checks* are temporary measures to control erosion and prevent siltation. Bales shall be either hay or straw containing 5 cubic feet or more of material.
- B. *Baled hay or straw checks* shall be used where the existing ground slopes toward or away from the embankment along the toe of slopes, in ditches, or other areas where siltation, erosion, or water run-off is a problem.

## 2.8 TEMPORARY SILT FENCES

- A. *Silt fences* shall be Type C utilizing woven wire reinforcement attached to posts with filter cloth composed of plastic filter fabric attached to the upstream side of the fence to retain the suspended silt particles in the run-off water. Fence and fabric shall meet the minimum standards set forth in the Department of Transportation, State of Georgia, Standard Specification, current edition.

# PART 3 - EXECUTION

## 3.1 PRECONSTRUCTION CONFERENCE

- A. *At the Preconstruction Conference*, submit for acceptance the schedule for accomplishment of temporary and permanent erosion control work as applicable for clearing and grubbing, grading, bridges and other structures at watercourses, construction, and paving. Also submit for acceptance the proposed method of erosion control on haul roads and borrow pits and the plan for disposal of waste materials. No work shall be started until the erosion control schedules and methods of operation have been accepted by the Engineer.

## 3.2 CONSTRUCTION REQUIREMENTS

- A. *The Engineer has the authority* to limit the surface area of erodible earth material exposed by clearing and grubbing, and the surface of erodible earth material exposed

by excavation, borrow, and fill operations and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds, or other water impoundment. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, or slope drains, and the use of temporary mulches, mats, seeding, or other control devices or methods as necessary to control erosion. Cut and fill slopes shall be seeded and mulched as the excavation proceeds to the extent directed by the Engineer.

- B. *Incorporate all permanent erosion control features* into the project at the earliest practicable time as outlined in the accepted schedule. Temporary pollution control measures shall be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.
- C. *Where erosion is likely to be a problem*, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise, erosion control measures may be required between successive construction stages. Preconstruction vegetation ground cover shall not be destroyed, removed, or disturbed more than 20 calendar days prior to grading or earth moving unless approval is granted otherwise.
- D. *The Engineer will limit the area of excavation, borrow, and embankment operations* in progress commensurate with the Contractor's capability and progress to keep the finish grading, mulching, seeding, and other such permanent pollution control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.
- E. *Under no conditions* shall the amount of surface area or erodible earth material exposed at one time by excavation or fill within the project area exceed 50,000 square feet without prior approval by the Engineer.
- F. The Engineer may increase or decrease the amount of surface area of erodible earth material to be exposed at one time by clearing and grubbing, excavation, and borrow and fill operations as determined by his analysis of project conditions.
- G. *In the event of conflict* between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

### 3.3 CONSTRUCTION MANAGEMENT TECHNIQUES

- A. *Clearing and grubbing* must be held to the minimum necessary for grading and equipment operation.
- B. *Construction must be sequenced* to minimize the exposure time of cleared surface area.

- C. *Construction must be staged or phased* for large projects. Areas of one phase must be stabilized before another phase can be initiated. Stabilization shall be accomplished by temporarily or permanently protecting the disturbed soil surface from rainfall impacts and runoff.
- D. *Erosion and sediment control measures* must be in place and functional before earth moving operations begin, and must be constructed and maintained throughout the construction period. Temporary measures may be removed at the beginning of the work day, but must be replaced at the end of the work day.
- E. *All control measures shall be checked, and repaired* as necessary, weekly in dry periods and within 24 hours after any rainfall of 0.5 inch within a 24-hour period. During prolonged rainfall, daily checking and repairing is necessary. The permittee shall maintain records of checks and repairs.
- F. *A specific individual shall be designated* to be responsible for erosion and sediment controls on each project site.

### 3.4 CONSTRUCTION OF STRUCTURES

- A. *Temporary Berms.* A temporary berm shall be constructed of compacted soil, with a minimum width of 24 inches at the top and a minimum height of 12 inches with or without a shallow ditch, constructed at the top of fill slopes or transverse to centerline on fills. Temporary berms shall be graded so as to drain to a compacted outlet at a slope drain. The area adjacent to the temporary berm in the vicinity of the slope drain must be properly graded to enable this inlet to function efficiently and with minimum ponding in this area. All transverse berms required on the downstream side of a slope drain shall extend across the grade to the highest point at approximately a 10 degree angle with a perpendicular to centerline. The top width of these berms may be wider and the side slope flatter on transverse berms to allow equipment to pass over these berms with minimum disruptions. When practical and until final roadway elevations are approached, embankments should be constructed with a gradual slope to one side of the embankment to permit the placement of temporary berms and slope drains on only one side of the embankment.
- B. *Temporary Slope Drains*
  - 1. *Temporary slope drains shall consist* of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe, flexible rubber, or other materials which can be used as temporary measures to carry water accumulating in the cuts and on the fills down the slopes prior to installation of permanent facilities or growth of adequate ground cover on the slopes.
  - 2. *Fiber matting and plastic sheeting* shall not be used on slopes steeper than 4:1 except for short distances of 20 feet or less.
  - 3. *All temporary slope drains* shall be adequately anchored to the slope to prevent disruption by the force of the water flowing in the drains. The base for temporary slope drains shall be compacted and concavely formed to channel the water or hold the slope drain in place. The inlet end shall be properly constructed to channel water into the temporary slope drain. Energy dissipaters, sediment basins, or other approved devices shall be constructed at the outlet end of the

slope drains to reduce erosion downstream. An ideal dissipater would be dumped rock or a small sediment basin which would slow the water as well as pick up some sediment. All temporary slope drains shall be removed when no longer necessary and the site restored to match the surroundings.

**C. Sediment Structures**

1. *Sediment structures shall be utilized to control sediment at the foot of embankments where slope drains outlet, at the bottom as well as in the ditchlines atop waste sites, and in the ditchlines or borrow pits. Sediment structures may be used in most drainage situations to prevent excessive siltation of pipe structures. All sediment structures shall be at least twice as long as they are wide.*
2. *When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed, and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural or intended condition.*

**D. Check Dam**

1. *Utilize check dams to retard stream flow and catch small sediment loads. Materials utilized to construct check dams are varied and should be clearly illustrated or explained in the Contractor's erosion control plan.*
2. *Key all check dams into the sides and bottom of the channel a minimum depth of 2 feet. A design is not needed for check dams but some typical designs are shown in the standard plans.*
3. *Do not use stone check dams where the drainage area exceeds 50 acres. Log and pole structures should generally not be used where the drainage area exceeds five acres.*

**E. Temporary Seeding and Mulching.** Perform seeding and mulching in accordance with Section 02485, Seeding.

**F. Brush Barriers.** Brush barriers shall consist of brush, tree trimmings, shrubs, plants, and other approved refuse from the clearing and grubbing operation. The brush barriers shall be constructed approximately parallel to original ground contour. Each brush barrier shall be compressed to an approximate height of 3 to 5 feet and approximate width of 5 to 10 feet. The embankment shall not be supported by the construction of brush barriers.

**G. Baled Hay or Straw Erosion Checks.** Hay or straw shall be embedded in the ground 4 to 6 inches to prevent water flowing underneath. The bales shall also be anchored securely to the ground by wooden stakes driven through the bales into the ground. Bales can remain in place until they rot, or be removed after they have served their purpose, as determined by the Engineer. Keep the checks in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean-out will be considered routine maintenance.

## H. *Temporary Silt Fences*

1. *Temporary silt fences* shall be placed on the natural ground, at the bottom of fill slopes, in ditches, or other areas where siltation is a problem. Silt fences are constructed of wire mesh fence with a covering of burlap or some other suitable material on the upper grade side of the fence and anchored into the soil.
2. *Maintain the silt fence* in a satisfactory condition for the duration of the project or until its removal is requested by the Engineer. The silt accumulation at the fence may be left in place and seeded, removed, etc., as directed by the Engineer. The silt fence becomes the property of the Contractor whenever the fence is removed.

### 3.5 MAINTENANCE

- A. *The temporary erosion control features* installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.
- B. *In the event that temporary erosion and pollution control measures* are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of work as scheduled, and are ordered by the Engineer, such work shall be performed by the Contractor at his own expense.
- C. *Where the work to be performed* is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls and falls within the specifications for a work item that has a contract price, the units of work shall be paid for at the proper contract prices.

### 3.6 EROSION CONTROL OUTSIDE PROJECT AREA

- A. *Temporary erosion control* shall include construction work outside the project area where such work is necessary as a result of construction such as borrow pit operations, haul roads, and equipment storage sites. Bid price in such cases shall include all necessary clearing and grubbing, construction incidentals, maintenance, and site restoration when no longer needed.

END OF SECTION

## SECTION 02280

### UTILITY LINE CROSSINGS OF STREAMS

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *When the activity is located in waters which are not navigable pursuant to Section 10 of the Rivers and Harbors Act of 1899, excavation and fill activities shall be separated from flowing waters. All surface water flowing toward the excavation or fill work shall be diverted, piped, or flumed to the downstream side of the work. This can be accomplished through utilization of cofferdams or constructed berms in conjunction with a pipe or flume. Cofferdams must be constructed of sand bags, clean rock, steel sheeting, or other non-erodible material.*
- B. *Where the activity is located in waters defined as navigable pursuant to Section 10 of the Rivers and Harbors Act of 1899, excavation and fill work may be accomplished within the water column.*
- C. *New utility line crossings shall be located such as to avoid permanent alteration or damage to the integrity of the stream channel. Large trees, steep banks, rock outcroppings, etc., should be avoided.*
- D. *In case of proposed gravity sewer lines and other utility lines which follow the stream gradient or otherwise parallel the stream channel, the number of crossings shall be minimized.*
- E. *The alignment of new utility line crossings shall intersect the stream channel as close to 90 degrees or as perpendicular as possible, and in no case less than a 45 degree angle from the center line of the stream.*
- F. *In case of small streams with a bedrock stream bed which must be blasted to form a trench, provision shall be made to prevent the loss of stream flow to fracturing of the bedrock. These provisions shall include as a minimum sealing the bottom of the trench with concrete and complete concrete encasement of the pipeline.*
- G. *Temporary erosion control measures must be in place before earthmoving operations begin, maintained throughout the construction period and repaired, if necessary, after rainfall. Straw or hay bales and/or silt fence must be installed along the base of all fills and cuts, on the downhill side of stock piled soil, and along stream banks in cleared areas to prevent erosion into streams. They must be installed parallel to the stream channel, entrenched and staked, and extend the width of the area to be cleared. The bales and/or silt fence may be removed at the beginning of the work day, but must be replaced at the end of the workday.*
- H. *Backfill activities must be accomplished in a manner which stabilizes the stream bed and banks to prevent erosion. Backfill materials shall consist of suitable materials free of contaminants. All contours must be returned to pre-project conditions. The completed work may not disrupt or impound stream flow.*

- I. *Slurry water* pumped from work areas and excavations must be held in settling basins or treated by filtration prior to its discharge into surface waters. Water must be held in sediment basins until at least as clear as the receiving waters. Sedimentation basins shall not be located closer than 25 feet from the top bank of a stream. Sediment basins and traps shall be properly designed according to the size of the drainage areas or volume of water to be treated.
- J. *Checkdams* shall be utilized where run-off is concentrated. Clean rock, log, sandbag, or straw bale checkdams shall be properly constructed to detain run-off and trap sediment.
- K. *Clearing, grubbing, and other disturbance* to riparian vegetation shall be limited to the minimum necessary for slope construction and equipment operations. Unnecessary vegetation removal is prohibited. All disturbed areas shall be properly stabilized as soon as practicable.
- L. *Streams* shall not be used as transportation routes for heavy equipment. Crossings must be limited to one point and erosion control measures must be utilized where the stream banks are disturbed. Where the stream bed is not composed of rock, a pad of clean rock must be used at the crossing point. All temporary fill must be completely removed after the work is completed.
- M. *Construction debris* must be kept from entering the stream channel.
- N. *All spills* of petroleum products or other chemical pollutants must be reported to the appropriate emergency management agency and measures shall be taken immediately to prevent the pollution of waters of the State, including groundwater.
- O. *Upon achievement* of final grade, the disturbed streambank shall be stabilized with riprap or other suitable material. All other disturbed soils must be stabilized and re-vegetated within 30 days by sodding or seeding and mulching. Seed to be utilized shall include combination of annual grains and grasses, legumes, and perennial grasses. Lime and fertilizer shall be applied as needed to achieve a vegetative cover.
- P. *Upon completion* of construction, the stream shall be returned as nearly as possible to its original, natural conditions.

## 1.2 LIABILITY FOR NONCOMPLIANCE

- A. *The Contractor* shall be liable to the Owner for any civil penalties or damages incurred by the Owner resulting from the Contractor's failure to comply with this section.

END OF SECTION



## SECTION 02485

### SEEDING

#### PART 1 - GENERAL

##### 1.1 SCOPE

A. *The work covered by this section consists of furnishing all labor, equipment, and material required to place topsoil, seed, commercial fertilizer, agricultural limestone, and mulch material, including seedbed preparation, harrowing, compacting, and other placement operations on graded earthen areas as described herein and/or shown on the Drawings. In general, seeding operations shall be conducted on all newly graded earthen areas not covered by structures, pavement, or sidewalks; all cleared or grubbed areas which are to remain as finish grade surfaces; and on all existing turf areas which are disturbed by construction operations and which are to remain as finish grade surfaces. Areas disturbed by borrow activities shall also be seeded according to these Specifications.*

##### B. *Temporary Seeding and Erosion Control*

1. This practice is applicable on areas subject to erosion for up to 12 months or until establishment of finished grade or permanent vegetative cover. Temporary vegetative measures shall be coordinated with permanent measures to assure economical and effective stabilization.
2. Temporary seeding shall be applied to exposed soil surfaces which are not to be fine-graded for periods from 30 days to one year. Such areas include denuded areas, soil stockpiles, dikes, dams, sides of sediment basins, temporary roadbanks, backfilled and rough graded utility line trenches, and disturbed areas along utility lines, etc.
3. Temporary seeding shall be in accordance with the temporary seeding schedule and shall meet the same requirements for seed bed preparation and mulching with the exception that lime and fertilizer need not be applied unless the soil is very low fertility and low pH.

##### 1.2 QUALITY ASSURANCE

A. *Prior to seeding operations, furnish to the Engineer labels or certified laboratory reports from an accredited commercial seed laboratory or a state seed laboratory showing the analysis and germination of the seed to be furnished. Acceptance of the seed test reports shall not relieve the Contractor of any responsibility or liability for furnishing seed meeting the requirements of this section.*

B. *Prior to topsoil operations, obtain representative samples and furnish soil test certificates including textural, pH, and organic ignition analysis from the State University Agricultural Extension Services or other certified testing laboratory.*

## PART 2 - PRODUCTS

### 2.1 TOPSOIL

- A. *Place* a minimum of 4 inches of topsoil over all graded earthen areas and over any other areas to be seeded. Sources of topsoil shall be approved by the Engineer prior to disturbance.
- B. *Topsoil shall be a friable loam* containing a large amount of humus and shall be original surface soil of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than 1/2 inch in diameter, lime, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips, or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and perennial weed seeds, and shall not contain objectionable plant material, toxic amounts of either acid or alkaline elements, or vegetable debris undesirable or harmful to plant life.
- C. *Topsoil shall be natural topsoil* without admixture of subsoil material, and shall be classifiable as loam, silt loam, clay loam, sandy loam, or a combination thereof. The pH shall range from 5.5 to 7.0. Topsoil shall contain not less than 5 percent nor more than 20 percent, by weight, of organic matter as determined by loss on ignition of samples oven-dried to 65°C.

### 2.2 SEED

- A. *Deliver* seed in new bag or bags that are sound and labeled in accordance with the U.S. Department of Agriculture Federal Seed Act.
- B. *All seed* shall be from the last crop available at time of purchase and shall not be moldy, wet, or otherwise damaged in transit or storage.
- C. *Seed* shall bear the grower's analysis testing to 98 percent for purity and minimum 85 percent for germination. At the discretion of the Engineer, samples of seed may be taken for check against the grower's analysis.
- D. *Species, rate of seeding, fertilization,* and other requirements are shown in the Seeding Requirements Table.

### 2.3 FERTILIZER AND LIMING MATERIALS

- A. *Fertilizer and liming materials* shall comply with applicable state, local, and federal laws concerned with their production and use.

PERMANENT SEEDING REQUIREMENTS TABLE					
Area	Sowing Season	Species	Rates per 1,000 Square Feet		
			Seed	Fertilizer	Limestone
Flat to rolling terrain with slopes less than 3:1	3/1 to 6/1	Kentucky 31 Fescue Ladino White Clover*	4 lbs. 1/4 lb.	30 lbs. 6-12-12	100 lbs.
	8/1 to 11/1	Kentucky 31 Fescue Ladino White Clover* Annual Ryegrass	4 lbs. 1/4 lb. 2 lbs.	30 lbs. 6-12-12	100 lbs.
Embankments with slopes greater than 3:1	3/1 to 6/1	Hulled Sericea Lespedeza* Kentucky 31 Fescue Weeping Lovegrass	1 lb. 3 lbs. 1/4 lb.	30 lbs. 6-12-12	100 lbs.
	8/1 to 11/1	Unhulled Sericea Lespedeza* Kentucky 31 Fescue Annual Ryegrass	1 lb. 3 lbs. 2 lbs.	30 lbs. 6-12-12	100 lbs.

\*Requires inoculation.

TEMPORARY SEEDING REQUIREMENTS TABLE					
Area	Sowing Season	Species	Rates per 1,000 Square Feet		
			Seed	Fertilizer*	Limestone**
All Areas	4/15 to 8/15	Sudangrass (Sorghum Sudanese)	1.5 lbs.	10 lbs. 10-20-20	100 lbs.
	8/16 to 4/14	Annual Ryegrass (Lolium Temulentum)	1 lb.	10 lbs. 10-20-20	100 lbs.

\*Fertilizer is not required on fertile soils. Apply on very low fertility soil.  
\*\*Apply limestone on highly acidic soils (pH 5.5 and lower).

- B. *Commercial fertilizer* shall be a ready-mixed material and shall be equivalent to the grade or grades specified in the Seeding Requirements Table. Container bags shall be labeled with the name and address of the manufacturer, brand name, net weight, and chemical composition.
- C. *Agricultural limestone* shall be a pulverized limestone with a calcium carbonate content not less than 85 percent by weight. Agricultural limestone shall be crushed so that at least 85 percent of the material will pass a No. 10 mesh screen and 50 percent will pass a No. 40 mesh screen.

## 2.4 MULCH MATERIAL

- A. *All mulch materials* shall be air-dried and reasonably free of noxious weeds and weed seeds or other materials detrimental to plant growth.
- B. *Mulch* shall be composed of wood fiber, straw, or stalks, as specified herein. Mulch shall be suitable for spreading with standard mulch-blowing equipment.
- C. *Wood fiber mulch* shall be as manufactured by Conwed Corporation, or equal.
- D. *Straw mulch* shall be partially decomposed stalks of wheat, rye, oats, or other approved grain crops.

- E. *Stalks* shall be the partially decomposed, shredded residue of corn, cane, sorghum, or other approved standing field crops.

## 2.5 MULCH BINDER

- A. *Mulch* on slopes exceeding a 3 to 1 ratio shall be held in place by the use of an approved erosion control fabric, such as Curlex I as manufactured by American Excelsior Company, or approved equal. Fabric shall consist of strips of biodegradable paper interwoven with yarn that is subject to degradation by ultraviolet light.

## 2.6 INOCULANTS FOR LEGUMES

- A. *All leguminous seed* shall be inoculated prior to seeding with a standard culture of nitrogen-fixing bacteria that is adapted to the particular seed involved.

## 2.7 WATER

- A. *Water* shall be clean, clear, and free from any objectionable or harmful chemical qualities or organisms and shall be furnished by the Contractor.

# PART 3 - EXECUTION

## 3.1 SECURING AND PLACING TOPSOIL

- A. *Topsoil* shall be secured from areas where topsoil has not been previously removed, either by erosion or mechanical methods. Topsoil shall not be removed to a depth in excess of the depth approved by the Engineer.
- B. *The area or areas from which topsoil is secured* shall possess such uniformity of soil depth, color, texture, drainage, and other characteristics as to offer assurance that when removed the product will be homogeneous in nature and will conform to the requirements of these Specifications.
- C. *All areas from which topsoil is to be secured* shall be cleaned of all sticks, boards, stones, lime, cement, ashes, cinders, slag, concrete, bitumen or its residue, and any other refuse which will hinder or prevent growth.
- D. *When securing topsoil* from a designated pit or elsewhere, should strata or seams of material occur which do not come under the requirements for topsoil, such material shall be removed from the topsoil or if required by the Engineer, the pit shall be abandoned.
- E. *Before placing or depositing topsoil* upon any area, all improvements within the area shall be completed, unless otherwise approved by the Engineer.
- F. *The areas in which topsoil is to be placed or incorporated* shall be prepared before securing topsoil for use.

### 3.2 SEEDBED PREPARATION

- A. *Before fertilizing and seeding*, the topsoil surfaces shall be trimmed and worked to true line free from unsightly variations, bumps, ridges, and depressions, and all detrimental material, roots, and stones larger than 3 inches in any dimension shall be removed from the soil.
- B. *Not earlier than 24 hours* before the seed is to be sown, the soil surface to be seeded shall be thoroughly cultivated to a depth of not less than 2 inches with a weighted disc, tiller, pulvimixer, or other equipment, until the surface is smooth and in a condition acceptable to the Engineer.
- C. *If the prepared surface becomes eroded* as a result of rain or for any other reason, or becomes crusted before the seed is sown, the surface shall again be placed in a condition suitable for seeding.
- D. *Ground preparation operations* shall be performed only when the ground is in a tillable and workable condition, as determined by the Engineer.

### 3.3 FERTILIZATION AND LIMING

- A. *Following seedbed preparation*, fertilizer shall be applied to all areas to be seeded so as to achieve the application rates shown in the Seeding Requirements Table.
- B. *Fertilizer shall be spread evenly* over the seedbed and shall be lightly harrowed, raked, or otherwise incorporated into the soil for a depth of 1/2 inch.
- C. *Fertilizer need not be incorporated* in the soil as specified above when mixed with seed in water and applied with power sprayer equipment. The seed shall not remain in water containing fertilizer for more than 30 minutes when a hydraulic seeder is used.
- D. *Agricultural limestone* shall be thoroughly mixed into the soil according to the rates in the Seeding Requirements Table. The specified rate of application of limestone may be reduced by the Engineer if pH tests indicate this to be desirable. It is the responsibility of the Contractor to obtain such tests and submit the results to the Engineer for adjustment in rates.

### 3.4 SEEDING

- A. *Seed of the specified group shall be sown* as soon as preparation of the seedbed has been completed. No seed shall be sown during high winds, nor until the surface is suitable for working and is in a proper condition. Seeding shall be performed during the dates shown in the Seeding Requirements Table unless otherwise approved by the Engineer. Seed mixtures may be sown together, provided they are kept in a thoroughly mixed condition during the seeding operation.
- B. *Seeds shall be uniformly sown* by any approved mechanical method to suit the slope and size of the areas to be seeded, preferably with a broadcast type seeder, windmill hand seeder, or approved mechanical power-drawn seed drills. Hydroseeding and hydromulching may be used on steep embankments, provided full coverage is obtained. Care shall be taken to adjust the seeder to the proper rate before seeding

operations are started and to maintain the adjustment during seeding. Seed in hoppers shall be agitated to prevent segregation of the various seeds in a seeding mixture.

- C. *Immediately after sowing*, the seeds shall be covered and compacted to a depth of 1/8 to 3/8 inch by a cultipacker or suitable roller.
- D. *Leguminous seeds* shall be inoculated prior to seeding with an approved and compatible nitrogen-fixing inoculant in accordance with the manufacturer's mixing instructions.

### 3.5 MULCHING

- A. *All seeded areas* shall be uniformly mulched in a continuous blanket immediately after seeding. The mulch shall be applied so as to permit some sunlight to penetrate and air to circulate, and at the same time shade the ground, reduce erosion, and conserve soil moisture. Approximately 25 percent of the ground shall be visible through the mulch blanket.
- B. *One of the following mulches* shall be spread evenly over the seeded areas at the following application rates:
  - 1. Wood Fiber                      1,400 lbs/acre
  - 2. Straw                                4,000 lbs/acre
  - 3. Stalks                                4,000 lbs/acre

These rates may be adjusted at the discretion of the Engineer at no additional cost to the Owner, depending on the texture and condition of the mulch material and the characteristics of the seeded area.

- C. *Mulch on slopes* greater than a 3 to 1 ratio shall be held in place by the use of an approved erosion control fabric. Fabric shall be installed immediately after seeding and fertilizing area (mulch shall not be used under fabric).
- D. *Erosion control fabric* shall be installed and applied in accordance with the manufacturer's recommendations. Any fabric which becomes torn, broken loose from securing staples, or undermined shall be immediately and satisfactorily repaired. Areas where seed is washed out before germination shall be fertilized, reseeded, and restored. Any required restoration work shall be performed without additional compensation.

### 3.6 WATERING

- A. *Maintain the proper moisture content* of the soil to ensure adequate plant growth until a satisfactory stand is obtained. If necessary, watering shall be performed to maintain an adequate water content in the soil.
- B. *Watering* shall be accomplished by hoses, tank truck, or sprinklers in such a way to prevent erosion, excessive runoff, and overwatered spots.

### 3.7 MAINTENANCE

- A. *Upon completion of seeding operations, the Contractor shall clear the area of all equipment, debris, and excess material, and the premises shall be left in a neat and orderly condition.*
- B. *Maintain all seeded areas without additional payment until final acceptance of the work by the Owner. Regrading, refertilizing, reliming, reseeding, or remulching shall be done at Contractor's expense. Seeding work shall be repeated on defective areas until a satisfactory uniform stand is achieved. Damage resulting from erosion, gulleys, washouts, or other causes shall be repaired by filling with topsoil, compacting, and repeating the seeding work.*

END OF SECTION





## SECTION 02500

### NEW AND REPLACEMENT PAVING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. *This section includes provisions for hot-mixed asphalt paving and mineral aggregate subbase over prepared subgrade for trench width, full pavement width paving, and other areas as shown on the Drawings.*
- B. *Prepared subgrade is specified in Section 02200, Earthwork.*
- C. *Proof rolling of prepared subgrade is included in this section.*
- D. *Saw-cutting of edges of existing pavement is required to minimize subsidence of the pavement into the trench and to minimize the width of pavement replacement.*

##### 1.2 RELATED DOCUMENTS

- A. *Drawings and general provisions of Contract, including General and Supplemental Conditions and Division 1 Specification sections, apply to this section.*

##### 1.3 SUBMITTALS

- A. *Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.*
  - 1. *Material certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.*
  - 2. *Pavement marking plan indicating lane separations and defined parking spaces. Note dedicated handicapped spaces with international graphics symbol.*

##### 1.4 SITE CONDITIONS

- A. *Weather Limitations.* Apply prime and tack coats when ambient temperature is above 50°F (10°C) and when temperature has not been below 35°F (1°C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.
- B. *Construct hot-mixed asphalt surface course when atmospheric temperature is above 40°F (4°C) and when base is dry. Base course may be placed when air temperature is above 30°F (-1°C) and rising.*
- C. *Grade Control.* Establish and maintain required lines and elevations.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. *General.* Use locally available materials and gradations that exhibit a satisfactory record of previous installations.
- B. *Coarse Aggregate.* Sound, angular crushed stone, crushed gravel, or properly cured crushed blast furnace slag, complying with ASTM D 692-88.
- C. *Fine Aggregate.* Sharp-edged natural sand or sand prepared from stone, properly cured blast furnace slag, gravel, or combinations thereof, complying with ASTM D 1073.
- D. *Mineral Filler.* Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D 242.
- E. *Asphalt Cement.* ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.
- F. *Prime Coat.* Cut-back asphalt type, ASTM D 2027; MC-30, MC-70, or MC-250.
- G. *Tack Coat.* Emulsified asphalt; ASTM D 977.
- H. *Mineral Aggregate Subbase.* SSRBC, Section 303, Type A (Class A aggregate, Grading D).
- I. *Geotextile Fabric.* 6 oz/sy, woven, polypropylene fabric; Mirafi, Inc., Type 600x, or equal.
- J. *Lane Marking Paint.* Alkyd-resin type, ready-mixed complying with AASHTO M 248, Type I.
  - 1. Color: White.
  - 2. Color: Yellow.

### 2.2 TYPES OF PAVEMENT

- A. *Replace all existing pavement* in streets, driveways, or parking areas which is removed, destroyed, or damaged by construction of sewage or water works as specified below, **as shown on the Drawings**, or as called for in the Bid Schedule. Unless otherwise shown or specified, all paved surfaces shall be replaced using the applicable pavement replacement Type 1 through 5 as shown on the Drawings. Pavement shown or specified to be replaced for the full width of the street shall be Type 6, 7, or 8 as applicable and as shown on the Drawings. Materials, equipment, and construction methods used for paving work shall conform to the Specifications applicable to the particular type required for replacement, repair, or new pavements.
  - 1. *Type 1 asphaltic concrete pavement* for heavy-duty use shall have a minimum thickness of 3 inches placed in two equal layers. Type 1 pavement shall be composed of plant mix, asphaltic concrete Grading E conforming to "Asphaltic Concrete Surface (Hot Mix)," Section 411, SSRBC.

2. *Type 2* asphaltic concrete pavement for light-duty use shall have a minimum thickness of 2 inches placed in one layer. Type 2 pavements shall be composed of hot plant mix base Grading C conforming to Section 307, "Bituminous Plant Mix Base (Hot Mix)," SSRBC.
3. *Type 3* pavement replacement shall consist of 2 inches of asphaltic concrete over a portland cement concrete base and shall be constructed according to the detail shown on the Drawings.
  - a. *Replace portland cement concrete base courses* with Class "A" concrete in accordance with Georgia Department of Transportation standard specifications. The surface of the replaced concrete base course shall be left rough. The slab shall be of depth equivalent to the existing concrete base course, but in no case less than 7 inches thick. Replace expansion joints removed. Concrete base courses shall be reinforced and conform to details shown on the Drawings and applicable specifications of Section 306, "Portland Cement Concrete Base," SSRBC.
  - b. *Asphaltic concrete* shall be constructed on one layer and shall be the same as described for Type 2 paving above or Type 8 paving below.
4. *Type 4* bituminous penetration pavement shall be a minimum of 1 inch in thickness and shall conform to Section 404, "Double Bituminous Surface Treatment," SSRBC.
5. *Type 5* portland cement concrete pavement shall be Class "A" concrete conforming to Georgia Department of Transportation standard specifications. The surface finish of the concrete pavement replaced shall conform to that of the existing pavement. The slab shall be of depth equivalent to the existing concrete pavement, but in no case less than 7 inches thick. Replace expansion joints removed. Concrete pavements shall be reinforced and shall conform to details shown on the Drawings and applicable specifications of Section 501, "Portland Cement Concrete Pavement," SSRBC.
6. *Type 6* asphaltic concrete pavement for heavy-duty use for full street width replacement shall consist of one 2-inch layer of bituminous plant mix base (hot mix), Grading C, conforming to Section 307, "Bituminous Plant Mix Base (Hot Mix)," SSRBC, and one 1-inch layer of asphaltic concrete pavement, Grading E, 100 percent limestone conforming to Section 411, "Asphaltic Concrete Surface (Hot Mix)," SSRBC.
7. *Type 7* asphaltic concrete pavement for light-duty use where designated by Engineer for full street width replacement shall consist of one 2-inch layer of Grading C, conforming to Section 411, "Asphaltic Concrete Surface (Hot Mix)," SSRBC.
8. *Type 8* asphaltic concrete pavement for light-duty use where designated by Engineer for full-width replacement shall consist of one 2-inch layer of asphaltic concrete pavement, Grading E (100 percent limestone), conforming to Section 411, "Asphaltic Concrete Surface (Hot Mix)," SSRBC.

9. *Where sewerage or water lines and appurtenances are constructed in or across unpaved, chert, or crushed stone surfaced streets, roadways, driveways, or parking areas, repair or replace the surface removed or damaged with a minimum of 6 inches of crushed stone in accordance with Section 401, "Mineral Aggregate Surface," SSRBC.*
  10. *Temporary paving shall consist of a single application of bituminous surface treatment. The bituminous surface treatment pavement shall conform to Section 404, "Double Bituminous Surface Treatment," SSRBC, except under Section 404.06, "Applications of Bituminous Material and Mineral Aggregate;" eliminate the second application of bituminous material and mineral aggregate.*
- B. *In no case shall paving repair be commenced without prior approval of the Engineer of the type of pavement, the equipment to be used, and the method or procedure to be used. The designation of "light-duty" or "heavy-duty" use as applied to Type 1, Type 2, Type 6, Type 7, or Type 8 pavement replacement shall be determined by the Engineer.*
- C. *The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, firm, properly cured, dry, and the tack coat has been applied.*

### PART 3 - EXECUTION

#### 3.1 SURFACE PREPARATION

- A. *Remove loose material from compacted subgrade surface immediately before applying subbase.*
- B. *Roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction.*
- C. *Do not begin paving work until deficient subgrade areas have been corrected and are ready to receive subbase.*
- D. *Place mineral aggregate subbase and compact in accordance with the applicable SSRBC specifications to provide a minimum of 6 inches or as shown on Drawings. Subbase thickness greater than 8 inches shall be placed in two or more layers.*
- E. *Roll prepared subbase surface to check for unstable areas and areas requiring additional compaction.*
- F. *Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.*
- G. *Prime Coat. Apply at rate of 0.20 to 0.50 gallon per square yard over compacted subbase. Apply material to penetrate and seal, but not flood, surface. Cure and dry as long as necessary to attain penetration and evaporation of volatile components.*

H. *Tack Coat.* Apply to contact surfaces of previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into hot-mixed asphalt pavement. Distribute at rate of 0.05 to 0.15 gallon per square yard of surface.

I. *Allow to dry* until at proper condition to receive paving.

J. *Exercise care* in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

### 3.2 PLACING MIX

A. *General.* Place hot-mixed asphalt mixture on prepared surface, spread, and strike off. Spread mixture at minimum temperature of 225°F (107°C). Place areas inaccessible to equipment by hand. Place each course to required grade, cross-section, and compacted thickness.

B. *Paver Placing.* Place in strips not less than 10 feet wide, unless otherwise acceptable to Engineer. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.

C. *Immediately correct* surface irregularities in finish course behind paver. Remove excess material forming high spots with shovel or lute.

D. *Joints.* Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of hot-mixed asphalt course. Clean contact surfaces and apply tack coat.

E. *Curbs.* Construct curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust.

F. *Place curb materials* to cross-section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms as soon as material has cooled.

### 3.3 ROLLING

A. *General.* Begin rolling when mixture will bear roller weight without excessive displacement.

B. *Compact mixture* with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. *Breakdown Rolling.* Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling, if required, with hot material.

D. *Second Rolling.* Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been evenly compacted.

- E. *Finish Rolling.* Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained 95 percent laboratory density.
- F. *Patching.* Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot-mixed asphalt. Compact by rolling to specified surface density and smoothness.
- G. *Protection.* After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. *Erect barricades* to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.4 TRAFFIC AND LANE MARKINGS

- A. *General.* Provide traffic and lane markings in all areas where markings have been damaged due to trench width pavement. On full width pavement, provide markings in all areas where markings were present at beginning of project or where markings are designated to be provided on the Drawings.
- B. *Cleaning.* Sweep and clean surface to eliminate loose material and dust.
- C. *Striping.* Use chlorinated-rubber base traffic lane-marking paint, factory-mixed, quick-drying, and nonbleeding.
- D. *Do not apply* traffic and lane marking paint until layout and placement have been verified with Engineer.
- E. *Apply paint* with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates to provide minimum 12 to 15 mils dry thickness.

### 3.5 WHEEL STOPS

- A. *General.* Secure wheel stops to hot-mixed asphalt surface with not less than two ¾-inch-diameter galvanized steel dowels embedded in precast concrete at ½ points. Size length of dowel to penetrate at least ½ hot-mixed asphalt depth.

### 3.6 FIELD QUALITY CONTROL

- A. *General.* Testing in-place hot-mixed asphalt courses for compliance with requirements for thickness and surface smoothness will be done by Owner's testing laboratory. Repair or remove and replace unacceptable paving as directed by Engineer.
- B. *Thickness.* In-place compacted thickness tested in accordance with ASTM D 3549 will not be acceptable if exceeding following allowable variations:
  - 1. *Base Course:* Plus or minus ½ inch.
  - 2. *Surface Course:* Plus or minus ¼ inch.
- C. *Surface Smoothness:* Test finished surface of each hot-mixed asphalt course for smoothness, using 10-foot straightedge applied parallel with and at right angles to

centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:

1. *Base Course Surface:* 1/4 inch.
2. *Wearing Course Surface:* 3/16 inch.
3. *Crowned Surfaces:* Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

D. *Check surface areas* at intervals as directed by Engineer.

END OF SECTION



1234





SECTION 02560

SEWER MANHOLES AND COVERS

PART 1 - GENERAL

1.1 SCOPE

- A. Contractor shall furnish all labor, materials, equipment, and incidentals required to install round precast concrete sewer manhole sections, covers, pipe connectors, inverts, and accessories as specified herein.

1.2 REFERENCES

- A. *Prestressed Concrete Institute*. Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.
- B. *National Precast Concrete Association*. Quality Control Manual for Precast Concrete Plants.
- C. *American Society for Testing and Materials (ASTM)*
  - 1. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
  - 2. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
  - 3. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
  - 4. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipe and Laterals.
  - 5. ASTM C913 - Standard Specifications for Precast Concrete Water and Wastewater Structures.
- D. *American Association of State Highway and Transportation Officials* Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets (AASHTO M198).
- E. *American Concrete Institute* Building Code Requirements for Reinforced Concrete (ACI 318).
- F. *Occupational Safety and Health Administration* Standard 1926.704 - Requirements for Precast Concrete.

1.3 SUBMITTALS

- A. *Copy of certificate or report* showing that the precast concrete manufacturer conforms to Article 1.4 - Qualifications.

B. *Detail of each precast concrete section to be provided showing or charting the following:*

1. *Manufacturer's part number or catalog number.*
2. *Inside diameter.*
3. *Lay length excluding base slab.*
4. *Wall thickness and base or top thickness where applicable.*
5. *Handling weight.*
6. *Wire size, spacing, and area provided per vertical foot.*
7. *Reinforcing bar size and spacing.*
8. *Design load for flat slab or transition tops.*
9. *Step locations.*
10. *Concrete mix number and design strength.*
11. *Height, width, slope, and annular space of the tongue and groove.*

C. *Step detail and material specifications.*

D. *Pipe connector details and material specifications.*

E. *Joint material detail, material specifications and calculations showing that the joint material cross section is greater than the joint's annular space times its height.*

F. *Lifting device and hole detail.*

G. *Submit the following at the request of the Engineer or Owner:*

1. *Structural analysis and design calculations for flat slab top and transition top precast components, performed in accordance with applicable codes and standards, showing that allowable stresses will not be exceeded. All calculations must be sealed by a registered professional engineer.*
2. *Calculations or test results verifying that the lifting device components and holes are designed in accordance with OSHA Standard 1926.704.*
3. *Concrete 28-day compression strength results for every day production of precast components for the project was performed showing the required strength according to the guidelines established in ACI 318.*
4. *Reinforcing and cement mill reports for materials used in the manufacture of precast components for this project.*
5. *The above test reports for similar precast components recently produced, submitted prior to production of precast components for this project.*

#### 1.4 QUALIFICATIONS

A. *The precast manufacturer shall comply with one of the following requirements:*

1. *Manufacture precast components for the project in a plant certified in the Prestressed Concrete Institute's (PCI) Plant Certification Program.*

2. *Manufacture precast components for the project in a plant certified in the National Precast Concrete Association's (NPCA) Plant Certification Program.*
  3. *Retain an independent testing or consulting engineering firm approved by the Engineer for precast plant inspection. The basis for plant inspection shall be the National Precast Concrete Association Quality Control Manual or the Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products. The above firm shall inspect the precast plant 2 weeks prior to and at 1 week intervals during production of materials for this project and issue a report, certified by a registered engineer that materials, methods, products, and quality control meet the requirements of the above quality control manuals.*
- B. *The precast manufacturer shall have a recognized quality improvement process installed at the manufacturing facility.*
- C. *The precast manufacturer shall provide engineering certification as to the structural adequacy of any precast component, if requested.*
- D. *All concrete compressive strength testing shall be performed in a laboratory inspected by the CCRL of the National Bureau of Standards.*
- 1.5 ENVIRONMENTAL REQUIREMENTS
- A. *Maintain materials and surrounding air temperature to minimum 50°F prior to, during, and 48 hours after completion of masonry, grouting or concreting work.*

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. *Concrete shall conform to ASTM C 478 and as follows:*
1. *Compressive Strength: 4,000 psi minimum at 28 days.*
  2. *Air Content: 4 percent minimum.*
  3. *Alkalinity: Adequate to provide a life factor,  $A_z = \text{Calcium carbonate equivalent times cover over reinforcement}$ , no less than 0.35 for bases, risers and cones.*
  4. *Cementitious Materials: Minimum of 564 pounds per cubic yard.*
  5. *Coarse Aggregates: ASTM C 33. Sound, crushed, angular stone only. Smooth or rounded stone shall not be used.*
  6. *Fine Aggregates: ASTM C 33. Free from organic impurities.*
  7. *Chemical Admixtures: ASTM C 494. Calcium chloride or admixtures containing calcium chloride shall not be used.*
  8. *Air Entraining Admixtures: ASTM C 260.*

- B. *Reinforcing steel* shall be ASTM A615 Grade 60 deformed bar, ASTM A82 wire or ASTM A185 welded wire fabric.
- C. *Lifting loops* shall be ASTM A416 steel strand. Lifting loops made from deformed bars shall not be allowed.
- D. *Flexible joint sealants* shall be butyl rubber based conforming to Federal Specification SS-S-210A, AASHTO M-198, Type B butyl rubber or as follows: maximum of 1% volatile matter and suitable for application temperatures between 10 and 100°F.
- E. *Epoxy gels* used for interior patching of wall penetrations shall be a 2-component, solvent-free, moisture-insensitive, high modulus, high-strength, structural epoxy paste adhesive meeting ASTM C881, Type I and II, Grade 3 Class B and C, Epoxy Resin Adhesive.

## 2.2 COMPONENTS

- A. *Precast component* fabrication and manufacture shall be as described in this paragraph and as described in the paragraphs for the specific components.
  - 1. *Precast components* shall be manufactured in conformance with ASTM C478. Wall and inside slab finishes resulting from casting against forms standard for the industry shall be acceptable. Exterior slab surfaces shall have a float finish. Small surface holes, normal color variations, normal form joint marks, minor depressions, chips and spalls will be tolerated. Dimensional tolerances shall be those set forth in the appropriate references and specified below.
  - 2. *Joint surfaces* for joints between bases, risers, and cones shall be manufactured to the joint surface design and tolerance requirements of ASTM C361. The maximum slope of the vertical surface shall be 2 degrees. The maximum annular space at the base of the joint shall be 0.10 inch. The minimum height of the joint shall be 4 inches.
  - 3. *Lift holes and inserts* used for handling precast components shall be sized for a precision fit with the lift devices, shall not penetrate through the manhole wall, and shall comply with OSHA Standard 1926.704.
  - 4. *Step holes* shall be cast or drilled in the bases, risers, and cones to provide a uniform step spacing of 16 inches. Cast step holes shall be tapered to match the taper of the steps.
- B. *Precast base sections* shall have the base slab cast monolithically with the walls, or have and approved galvanized or PVC waterstop cast in the cold joint between the base slab and the walls. Where extended base manholes are required, the width of the base extensions shall be no less than the base slab thickness. The bottom step in base sections shall be a maximum of 26 inches from the top of the base slab.
- C. *The minimum lay length* of precast riser sections shall be 16 inches.
- D. *Precast cone sections* shall have an inside diameter at the top of 24 inches. The width of the top ledge shall be no less than the wall thickness required for the cone section. Concentric cones shall be used only for shallow manholes.

- E. *Precast transition cone sections* shall provide an eccentric transition from 60 inch and larger manholes to 48-inch-diameter risers, cones, and flat slab top sections. The minimum slope angle for the cone wall shall be 45 degrees.
- F. *Precast transition top sections* shall provide an eccentric transition from 60-inch and larger manholes to 48-inch-diameter risers, cones, and flat slab top sections. Transition top sections shall be furnished with vents as shown on the manhole details. The maximum amount of fill over the transition top section shall be 20 feet. Transition tops shall not be used in areas subject to vehicle traffic.
- G. *Standard precast flat slab top sections* shall have an inside diameter at the top of 24 inches and shall be designed for HS-20 traffic loadings as defined in ASTM C 890. Items to be cast into special flat slab tops shall be sized to fit within the manhole inside diameter and the top and bottom surfaces.
- H. *Precast grade rings* shall be used to adjust ring and covers to finished grade. No more than 10 vertical inches of grade rings will be allowed per manhole. Grade rings shall conform to ASTM C478 and shall be no less than 4 inches in height.
- I. *Precast inverts* shall meet the following requirements:
1. *Pipe openings* shall provide clearance for pipe projecting a minimum of 2 inches inside the manhole. The height of the transition from the pipe opening to the invert trough shall be equal to  $\frac{1}{2}$  of the opening inside diameter minus pipe inside diameter, plus or minus  $\frac{1}{4}$  inch. The crown of small inside diameter pipe shall be no lower than the crown of the outlet pipe. When the fall between the inlet and the outlet holes is greater than 4 inches, the inlet end of the trough shall be below the inlet pipe invert and aligned horizontally within 1 inch.
  2. *Troughs* shall be formed and finished to provide a consistent slope from the pipe outlet to the inlets up to 4-inch fall. The minimum fall shall be 1 inch. The minimum bending radius of the trough centerline is to be 1.5 times the pipe inside diameter. Provide a  $\frac{1}{2}$  inch radius at the intersection of 2 or more channels. The minimum concrete thickness from the bottom of the trough to the bottom of the base shall be 7 inches.
  3. *Float finish benches* to provide a uniform  $2\frac{1}{2}$  inch slope, plus or minus 1 inch, from the high point at the manhole wall to the low point at invert trough. Provide a  $\frac{1}{4}$ -inch radius at the edge of the bench and trough.
  4. *Depressions, high spots, voids, chips, or fractures* over  $\frac{1}{4}$ -inch in diameter or depth shall be filled with a sand cement paste and finished to a texture reasonably consistent with that of the formed surface.
- J. *Provide steps* in bases, risers, cones, transition cones, and transition top sections aligned vertically on 16-inch centers. Secure steps to the wall with a compression fit in tapered holes or cast in place. Steps shall not be vibrated or driven into freshly cast concrete or grouted in place. The reinforced plastic steps shall be copolymer polypropylene plastic or equal, reinforced with a  $\frac{1}{2}$ -inch diameter Grade 60 bar and have serrated tread and tall end lugs. Cast iron steps shall be Neenah Foundry Company No. R-1980-E or equal. Step pullout strength shall be a minimum of 2,000 pounds when tested according to ASTM C497.

- K. *Pipe to manhole connectors* shall conform to ASTM C923. On large diameter flexible pipes, provisions for control of the pipe outside diameter to within the tolerances of the connector shall be made.
- L. *Joints shall be sealed internally* between the tongue and the groove and additionally around the external perimeter of the joint as follows:
  - 1. *Internal seals* shall consist of a plastic or paper-backed butyl rubber rope no less than 28 feet long and having a cross-sectional area no less than the annular space times the height of the joint.
  - 2. *Internal seals* may consist of an O-ring gasket conforming to ASTM C443, installed according to the precast manufacturer's recommendation, at the option of the Contractor.
- M. *Manhole rings and covers* shall be equal to those shown on the manhole details. Materials shall be gray cast iron Class 30, suitable for highway traffic loads or 16,000 pound wheel loads.
- N. *Lifting devices* complying with OSHA Standard 1926.704 for handling the precast components shall be provided by the precast manufacturer.
- O. *The interior/exterior* of the manhole walls shall be coated with 21 mils of coal tar epoxy, Koppers 300M or equal, where shown on the plans. The coating shall be spray applied according to the manufacturer's recommendations. The joints between precast sections shall not be coated. Use butyl rubber rope as specified above to seal the interior horizontal joint surface.

## 2.3 CONFIGURATION

- A. *Manholes* are to be constructed as specified in the Bid Schedule and as shown on the detail drawings.
- B. *The number of joints* shall be minimized. Do not use riser sections for manholes up to 12 feet tall and no more than 1 riser for each additional 5 feet in height. One additional section will be allowed for transition manholes.
- C. *Where service lines enter manholes*, locate them above the bench of the invert.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. *Inspect* manhole components prior to unloading from the delivery truck.

### 3.2 DELIVERY, STORAGE, AND HANDLING

- A. *Coordinate delivery* with the manufacturer. Handle and store the manhole components in accordance with ASTM C 891 and the manufacturer's recommendations using methods that will prevent damage to the components and their joint surfaces.

### 3.3 PLACING MANHOLE SECTIONS

- A. *Excavate* the required depth and remove materials that are unstable or unsuitable for a good foundation. Prepare a level, compacted foundation extending 6 inches beyond the manhole base.
- B. *Set base* plumb and level, aligning manhole invert with pipe invert.
- C. *Thoroughly clean* bells and spigots to remove dirt and other foreign materials that may prevent sealing. Unroll the butyl sealant rope directly against base of spigot. Leave protective wrapper attached until sealant is entirely unrolled against spigot. Do not stretch. Overlap from side to side -- not top to bottom.
- D. *Set risers and cones* so that steps align, taking particular care to clean, prepare and seal joints.
- E. *After joining* manhole sections, apply the butyl sealant sheet around the outside perimeter of the joint.
- F. *Lift holes* leaving less than 2 inches of wall thickness shall be plugged from the outside using a sand cement mortar. Lift holes penetrating the wall shall be additionally sealed with an interior application of an epoxy gel 1/8 inch thick extending 2 inches beyond the penetration.
- G. *Vacuum test* the assembled manholes after completing pipe connections and sealing but before backfilling or placing frame and cover as follows:
  - 1. *Plug pipes* with suitably sized and rated pneumatic or mechanical pipeline plugs. Place plugs a minimum of 6 inches beyond the manhole wall and brace to prevent displacement of the plugs or pipes during testing.
  - 2. *Position* the vacuum tester head assembly to seal against the interior surface of the top of the cone section and inflate according to the manufacturer's recommendations.
  - 3. *Draw a vacuum* of 5 psi, close the valve on the vacuum line, and shut off the vacuum pump.
  - 4. *Measure the time* for the vacuum to drop to 4 psi. The manhole shall pass when the time to drop to 4 psi meets or exceeds the following:

Manhole I.D. (inches)	48	60	72	84	96	120
Seconds	60	75	90	105	120	150
  - 5. *If the manhole fails* the test, remove the head assembly and coat the manhole interior with a soap and water solution and repeat the vacuum test for approximately 30 seconds. Leaking areas will have soapy bubbles. Repairs may only be made with Sika Set Plug. After the necessary repairs are made, repeat the test until the manhole passes.
- H. *Set the manhole frames* to the required elevation using no more than 10 inches of precast concrete grade rings, sealing all joints between cone, adjusting rings, and manhole frame with the butyl sealant rope and sheet.

- I. *Perform the final finishing* to the manhole interior by filling all chips or fractures greater than ½ inch in length, width or depth and depressions more than ½ inch deep in inverts with a high strength grout equal to SikaSet Plug. Do not fill the joints between the precast concrete sections. Clean the interior of the manhole, removing all dirt, spills, or other foreign matter.

END OF SECTION



## SECTION 02930

### RIPRAP

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *The work covered by this section includes furnishing all labor, materials, and equipment required to furnish, place, and set rock riprap, concrete block riprap, and sacked sand-cement riprap as shown on the Drawings and/or specified herein.*
- B. *Riprap shall be placed on slopes of embankments or other surfaces or around structures as protection against the erosive action of water.*
- C. *A filter blanket course of crushed rock, sand and gravel, or an approved filter fabric shall be placed under the riprap, where shown on the Drawings.*

##### 1.2 SUBMITTALS

- A. *Provide the Engineer with written evidence in the form of mill test reports or test reports from a qualified testing laboratory that all sands, cements, and filter blanket materials used conform to the applicable requirements of this Specification section.*
- B. *Furnish representative samples of rock riprap material for classification, gradation, or other tests as the Engineer may direct, when requested by the Engineer.*

#### PART 2 - PRODUCTS

##### 2.1 ROCK RIPRAP

- A. *Rock riprap shall be constructed using sound, dense, durable stones or rock fragments, free from cracks, pyrite intrusions, and other structural defects. Stones which will be used with mortar shall be free from dirt, oil, or other material that might prevent good adhesion with the mortar. Stones with a laminated structure shall be avoided. Field stones shall not be used as a source of rock for riprap. Only rock that has been approved by the Engineer shall be used for riprap.*
- B. *When the crushed aggregate is subjected to 5 alternations of the sodium sulfate soundness test, the weighted percentage of loss shall be not more than 12 percent.*
- C. *Shape of the stones shall be generally rectangular or cubic. Flat or elongated stones having a small dimension less than 1/3 of the large dimension shall not be used.*
- D. *At least 50 percent of the stones or rock fragments for plain rock riprap shall weigh 150 pounds or more. The sizes of the stones shall be well graded from the smaller to the larger.*

- E. *At least 90 percent of the stones or rock fragments for hand-placed rock riprap shall weigh 100 pounds or more and shall be not less than 12 inches long, 12 inches deep, and 8 inches wide.*

## 2.2 FILTER BLANKET MATERIAL

- A. *Filter blanket material shall consist of fragments of sound, durable stone or crushed rock, free from disintegrated stone, alkali, salt, vegetable matter, or adherent coating. Aggregate shall be reasonably free from thin or elongated pieces. The percentage of wear of the aggregate as outlined in AASHTO Test No. T-96 shall not exceed 7 percent.*
- B. *Aggregate shall have the following gradation:*

<u>Sieve Size</u>	<u>Total Percent Passing by Weight</u>
1 1/4"	100
1"	95 - 100
3/4"	70 - 100
3/8"	50 - 85
No. 4	33 - 65
No. 10	20 - 45
No. 40	8 - 25
No. 200	0 - 10

- C. *Material finer than the No. 10 sieve shall be of such characteristics and gradation that will prevent the mass from setting up or becoming cemented together. Stone or crushed rock may be used, provided the percentage of aggregate passing the No. 100 sieve is less than 10 percent.*

## PART 3 - EXECUTION

### 3.1 EQUIPMENT

- A. *All equipment necessary for the satisfactory performance of the work shall be on hand and approved by the Engineer before construction will be permitted to begin.*
- B. *The equipment shall include wooden or metal tamps of sufficient weight and number to properly compact the slopes on which the riprap or slope pavement is to be placed.*
- C. *Wooden hand tamps, having a tamping face not greater than 1 square foot, and of sufficient weight and number to properly tamp the riprap, shall be furnished when sacked sand-cement is used.*
- D. *Equipment for mixing cement grout or sand cement shall include a mechanical mixer or, if the Engineer approves hand mixing for cement grout, a watertight mixing platform or mixing box of adequate size.*

### 3.2 PREPARATION OF FOUNDATION

- A. *Immediately prior to the construction of riprap*, the slopes or ground surface shall be trimmed within reasonably close conformity to the lines and grades indicated on the Drawings or as directed by the Engineer, and shall be thoroughly compacted by the use of hand or mechanical tamps.
- B. *On slopes*, the bottom of the riprap shall be placed at least 2 feet below the natural ground surface, unless otherwise shown or directed.
- C. *No material shall be placed on a frozen or otherwise unsuitable slope.*

### 3.3 PLACEMENT OF FILTER BLANKET

- A. *A filter blanket course shall be placed under the riprap on the prepared subgrade, where shown on the Drawings.*
- B. *Filter blanket shall be placed immediately prior to placement of riprap. Compaction of the filter blanket is not required except where called for on the Drawings.*
- C. *A synthetic filter fabric may be substituted for the filter blanket course, where specifically permitted by the Engineer. Filter fabric shall be especially designed for use as slope stabilization under riprap and shall be acceptable to the Engineer. Placement of filter fabric shall be in strict conformance with the manufacturer's written instructions and recommendations.*

### 3.4 CONSTRUCTION OF PLAIN ROCK RIPRAP

- A. *Plain rock riprap shall be constructed using a crane and clam-shell or other suitable equipment approved by the Engineer, unless otherwise shown or specified. The rock shall be placed as nearly as practicable in final position using powered equipment. If necessary, larger rocks shall be worked up to the surface when the material on the surface does not meet the weight specification or when the voids next to the foundation material are too large.*
- B. *The quantity of small stones shall be kept as low as possible, sufficient only to fill the voids between the larger stones. Care shall be taken that this small material is well distributed throughout the mass and not allowed to segregate or form pockets of small stone. All bridging shall be broken down. Large interstices, open channels, or voids shall be filled by chinking or otherwise manipulating the stones.*
- C. *When riprap is to be built on existing riprap, special care shall be taken to provide positive anchorage of the new riprap to the existing riprap.*
- D. *The finished riprap surface shall in general conform to the slope lines shown on the Drawings. No objectionable, hazardous, or unsightly projections above the general plane surface will be permitted.*

### 3.5 CONSTRUCTION OF HAND-PLACED, PLAIN ROCK RIPRAP

- A. *Hand-placed, plain rock riprap shall be constructed upon the prepared foundation by hand placing so that the stones shall be as close together as is practicable in order to*

reduce the voids to a minimum. Construction of riprap on sloped surfaces shall begin at the bottom and shall progress upward in approximately horizontal layers.

- B. *When rock riprap is constructed in more than one layer, it shall be so placed that it will be thoroughly tied together, with the larger stones protruding from one layer into the other.*
- C. *The standard depth of rock riprap shall be 12 inches unless otherwise indicated or directed and in no instance shall be less than 10 inches in depth. Rock riprap shall have an average depth for each 25 square feet of surface of not less than the depth indicated on the Drawings or directed by the Engineer, or the standard depth required in these Specifications.*
- D. *Each stone shall be so placed that the depth will be perpendicular to the surface upon which it is set. The length shall be placed so that it will be against the adjoining stones. The stones shall be placed in such a manner as to stagger all joints as far as it is possible and practicable.*
- E. *The main stones shall be thoroughly chinked and filled with the smaller stones by throwing them over the surface in any manner that is practicable for the smaller stones to fill the voids. This work shall continue with the progress of the construction. Tamping of the stones will not be required if the stones have been placed in a reasonable and satisfactory manner.*
- F. *Knapping of the stones will not be required except for stone protruding more than 4 inches above what is considered the normal surface of the stones, in which case these stones shall be broken down to come within 4 inches of the normal surface.*

### 3.6 PROTECTION OF STRUCTURES

- A. *All structures shall be carefully protected from damage by equipment or impact of stones or blocks. All damage shall be corrected by the Contractor at his own expense and in a manner acceptable to the Engineer.*

END OF SECTION

## SECTION 02951

### RAILROAD AND HIGHWAY CROSSINGS

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *The work covered by this section includes furnishing all labor, materials, service, and equipment required to properly complete sewer and/or water pipeline construction under railroads and federal or state highways, as described herein and/or shown on the Drawings.*

##### 1.2 SHOP DRAWINGS AND ENGINEERING DATA

- A. *Complete engineering data and product information shall be submitted to the Engineer in accordance with the requirements of these Specifications.*

##### 1.3 STORAGE AND DELIVERY

- A. *All materials shall be stored and protected with strict conformance to the manufacturer's recommendations and as approved by the Engineer.*

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. *Steel casing pipe for sizes 6 inches and smaller shall conform to ASTM A 120 (standard weight), of the latest standard specifications.*
- B. *Steel casing pipe, sizes 8 inches through 54 inches, shall be straight-seam welded steel pipe conforming to ASTM A 139, Grade B of the latest standard specification.*
- C. *Steel casing pipe for railroad crossings shall be bituminous coated inside and out.*
- D. *Structural steel liner plates shall be used for excavated tunnels where the casing pipe is 54 inches or greater in diameter. Liner plates shall be of the thickness shown on the Drawings. The liner plates shall be of the two-flange, lap-joint type. The corrugations shall be 3½ inches center to center. Bolts and nuts used shall be a minimum of 5/8-inch diameter and shall conform to the latest revision of ASTM A 307 for plate thickness less than 0.209 inch, and ASTM A 449 for plate thickness equal to or greater than 0.209 inch. Each plate shall have one 2-inch-diameter half coupling and plug for grouting.*
- E. *The void behind the casing pipe shall be filled with sand-cement grout. The sand-cement content shall be 1 part portland cement to 3 parts fine aggregate. The water-cement ratio shall be 0.62 by weight.*

- F. *An end-of-casing boot* shall be used on each end of the casing to seal the space between the carrier and casing pipe. End seals shall be Cascade Model CCES End Seal or equal.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. *Any solidification* of embankments, boring headings, or tunnel headings or sides shall be the Contractor's responsibility and shall be done at his own expense.
- B. *Bored installations* shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed.
- C. *The casing pipe* shall be jacked into the boring as soon as possible after the boring is made. Lengths of casing pipe as long as practical shall be used. Joints between sections shall be completely welded as recommended for joining the particular type of pipe.
- D. *Once the jacking procedure has begun*, it should be continued without stopping until completed, subject to weather and conditions beyond the control of the Contractor.
- E. *Any replacement of carrier pipe* in an existing casing shall be considered a new installation, subject to the applicable requirements of these Specifications.
- F. *Open-cut installations*, where permitted, shall be in accordance with the details and procedures shown on the Drawings.
- G. *Steel liner plates* shall be installed in excavated tunnels when called for on the Drawings. The liner plates shall be installed progressively as excavation proceeds. Excavation shall not continue more than 24 inches past the end of the liner plate already in place. At this time, an additional section of liner shall be installed before excavation shall continue. Grout shall be placed under pressure in the annular void as the excavation proceeds. Grout should be continuously placed as close to the heading as possible, using grout stops if necessary. Grout shall be injected in the lower holes first, moving upward as the back space is filled. Threaded plugs shall be installed after filling each grout hole.
- H. *Care shall be taken* to ensure that casing pipe installed by boring and jacking or open-cut method will be at the proper alignment and grade.
- I. *Maintain and operate* pumps, well points, and drainage system equipment to keep work dewatered at all times.
- J. *Adequate sheeting, shoring, and bracing* for embankments, operating pits, and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, the sheeting, shoring, and bracing shall be left in place, cut off, or removed, as designated by the Engineer.

- K. *Trench excavation*; mining for tunnels; all classes and types of excavation; the removal of rock, muck, and debris; the excavation of all working pits; and backfill requirements of Section 02200, Earthwork, are included under this section.
- L. *Carrier pipe* for all lines 4 inches and larger shall have push-on joints and fittings.
- M. *After the casing pipe or tunnel liner is installed*, install the carrier pipe, exercising care at all times to protect the interior of the casing pipe and to maintain tight, full-seated joints in the carrier pipe. The carrier pipe shall be installed at the proper line and grade without any sags or high spots.
- N. *The carrier pipe* shall be held concentric with the casing pipe by the use of blocks spaced radially around the pipe and secured together so that they remain firmly in place. The spacing of such blocks longitudinally in the casing pipe may not be greater than 10 feet. Blocks used with sand or grout fill may be hardwood. Approved stainless steel blocks must be used when no sand or grout fill is used.
- O. *Sand or grout* shall be forced under pressure into the annular space between the carrier pipe and the casing pipe, except where prohibited. This shall begin at the center of the crossing and completely fill the space to each end. Care shall be exercised at all times to maintain the carrier pipe at its proper line and grade.

### 3.2 RAILROAD CROSSINGS

- A. *Secure permission from the railroads* to schedule work so as not to interfere with the operation of the railroads. All work will be done under the supervision of the Engineer and the railroads involved. Furnish the railroads with such additional insurance as may be required, cost of the same to be borne by the Contractor.
- B. *The casing pipe* shall extend no less than 25 feet from the centerline of outside track to the end of the pipe. The casing pipe shall extend beyond the railway right-of-way limits, if necessary, to obtain this distance.
- C. *All work on railway right-of-way*, including necessary supporting of tracks, safety of operations, and other standard and incidental operation procedures, shall be under the supervision of the appropriate authorized representative of the railway system affected, and any decisions of this representative pertaining to construction and/or operations shall be final; constructions must be governed by such decisions.
- D. *If it becomes necessary*, in the opinion of the railway company, to provide flagging protection, watchmen, removal or replacement of tracks, or the performance of any other work in order to keep the tracks safe for traffic, the Contractor shall reimburse the railroad in cash for such services, in accordance with accounting procedures agreed upon by the Contractor and affected railway company before construction is started.

### 3.3 HIGHWAY CROSSINGS

- A. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the state highway right-of-way.

- B. *Work along or across the state highway department rights-of-way shall be under the supervision of the Engineer and state highway department engineer.*
- C. *All water and sewer pipelines installed under paved roads and paved crossroads within the rights-of-way of the state highway department shall be encased. This includes, but is not limited to, all water and sewer service lines.*
- D. *For open trench cut installations, make satisfactory arrangements to detour traffic around the area of highway where work is in progress, with minimum inconvenience placed on the traveling public. Provide suitable flagmen, watchmen, safety devices, and other services and facilities as may be required by the state highway department. The cost of the same shall be borne by the Contractor.*
- E. *Encasement shall be installed with 4 feet of cover below pavement and roadway surface and shall extend 5 feet beyond the highway embankment or back of side ditch, unless otherwise shown. On curbed portions of conventional highways, the casing pipe shall extend 3 feet beyond the back of curb or sidewalk.*
- F. *For open trench cut installations, the Contractor shall be responsible for scheduling and coordinating all construction work. All work at one particular crossing shall be completed, with the trench backfilled, compacted, and a temporary crushed stone surface provided for traffic, before any work is started on another such crossing.*
- G. *All installations shall be designed to leave free flows in drainage ditches, pipes, culverts, or other surface drainage facilities of the highway, street, or its connections.*
- H. *Where sodding is disturbed by excavation or backfilling operation, such areas shall be replaced by mulch sodding on slopes 5 percent or less. All slopes over 5 percent shall be replaced with block sodding. No separate payment shall be made for sodding, which shall be included in the bid prices for installation of pipe.*
- I. *All trench excavation within the right-of-way, but not under pavement, shall be backfilled by tamping in 6-inch layers.*
- J. *All surplus material shall be removed from the right-of-way and the excavation finished flush with surrounding ground.*
- K. *Grout backfill shall be used for unused holes or abandoned pipes.*
- L. *Boring, jacking, or driving of carrier or casing pipes under existing highways shall be accomplished without jetting, sluicing, or wet-boring.*
- M. *No excavated material or equipment shall be placed on the pavement or shoulders of the highway without the express approval of the state highway department engineer.*
- N. *In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed which are placed on the right-of-way in advance of construction shall be placed in such a manner as not to interfere with the safe operation of the highway.*

END OF SECTION



## SECTION 11311

### DUPLEX SUBMERSIBLE GRINDER PUMPS AND ACCESSORIES

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *Provide and install pumping systems with accessories as shown on the Drawings and detailed in these Specifications. The equipment shall be complete with vertical submersible grinder pumps, station control cabinet with circuit breakers and fuses/motor circuit protectors, motor starters, control system, etc.*

##### 1.2 QUALITY ASSURANCE

- A. *All equipment furnished under this section shall be new, unused, and same as the manufacturer's current production model. Assemblies, subassemblies, and component parts shall be standard and completely interchangeable between units furnished. The equipment must conform with all applicable federal, state, and local regulations.*

##### 1.3 SHOP DRAWINGS AND ENGINEERING DATA

- A. *Submit in digital and hardcopy format complete shop drawings and engineering data, as applicable, to the Engineer in accordance with the requirements of Section 01340, Shop Drawings, Product Data, and Samples.*

##### 1.4 STORAGE AND PROTECTION

- A. *Store and protect pumps, motors, and accessories in accordance with the requirements of Section 01630, Storage and Protection.*
- B. *Special Storage Requirement*
  - 1. *Store all mechanical and electrical equipment covered by this section in an enclosed warehouse at a minimum constant temperature of 60°F and a maximum humidity of 38 percent, from the time of receipt to the time of installation. Take special care to prevent dust or moisture contamination of electrical or electronic equipment.*
  - 2. *Do not deliver or install equipment until authorized in writing by the Engineer.*

##### 1.5 SHOP PAINTING

- A. *Clean, shop prime, and shop paint pumps, motors, and accessories in accordance with the requirements of Section 01600, Materials and Equipment, or as specified.*

##### 1.6 OPERATION AND MAINTENANCE DATA

- A. *Submit complete operation and maintenance data on the pumps and motors in accordance with the requirements of Section 01730, Operating and Maintenance Data.*

## 1.7 FACTORY TESTS

- A. *Test the pumps* at the place of manufacture in accordance with the standards of the Hydraulic Institute for testing of pumps. When tested, each pump shall be driven by a certified, calibrated motor.
- B. *Before shipment, furnish* to the Engineer the pump manufacturer's certified test reports on each pump. The test reports to be certified by a corporate officer of the manufacturer and cover the following items:
  1. Capacity versus head curve U.S. gallons per minute and feet.
  2. Efficiency versus flow curve in percent.
  3. Brake horsepower versus flow curve.
  4. Speed of rotation.
  5. Impeller size and number.
  6. Required NPSH versus flow rate.
  7. Torque versus speed.
- C. *Submit* four copies of all test reports.
- D. *If factory tests results fail* to demonstrate compliance with the requirements of this section, modify and/or replace the deficient pump(s) as necessary at no additional cost to the Owner and resubmit certified factory test reports on each modified or replacement pump.

## 1.8 NAMEPLATES

- A. *Supply equipment* with stainless steel embossed nameplates mounted in easily visible locations, and containing as a minimum the following information.
  1. *Pumps*
    - a. Manufacturer
    - b. Model designation
    - c. Maximum speed (rpm)
    - d. Maximum horsepower required
    - e. Bearing type and lubrication
    - f. Design flow and head
    - g. Net weight
  2. *Motors*
    - a. Manufacturer
    - b. Model designation
    - c. Rated horsepower
    - d. Electrical specifications per current NEMA standards
    - e. NEMA frame designation
    - f. Bearing type and lubrication
    - g. Speed (rpm)
    - h. Net weight
    - i. Voltage and amp
    - j. NEMA code
    - k. Service factor

## 1.9 GUARANTEE

- A. *Provide a guarantee against defective equipment and workmanship in accordance with the requirements of Section 01740, Warranties and Bonds.*

## PART 2 - PRODUCTS

### 2.1 PUMPS AND MOTORS

- A. The following specifications are provided to set a minimum standard for small duplex pump stations. Each pump station must be designed to meet the hydraulic, energy and septicity requirements of each individual project. Grinder pumps may be used in lieu of non-clog pumps only on small developments that do not develop sufficient flow to use non-clog pumps. Contact the Authority for approved models and manufacturers. *Submersible sewage pumps shall meet or exceed the following requirements:*

1. Number of Units	2 each
2. Type	Grinder
3. Pump Speed	3,600 rpm
4. Maximum Motor Horsepower	7.5
5. Minimum Pump Efficiency	42 percent
6. Discharge Flange Diameter (ASA 125 pound)	3 inches
7. Initial Pumping Conditions	
a. Design Flow	80 gpm
b. Total Dynamic Head (at design flow)	80 feet

B. *Materials of Construction*

1. Volute, Case and Base Elbow	Cast iron, ASTM A 48, Class 30
2. Motor Housing	Cast iron, ASTM A 48, Class 30 (epoxy enamel coated)
3. Impeller	Cast Iron, ASTM A 48, Class 30 or Ductile Iron ASTM A 536, Class 65
4. Motor Shaft	Stainless Steel, ASTM 416
5. Shaft Sleeve	Hardened Stainless Steel
6. Seal Faces	Tungsten Carbide or Silicon Carbide
7. All Fasteners	Stainless Steel
8. Wear Rings	Brass

- C. *Provide two grinder sewage pumps. Both pumps shall be of the same design and capacity.*

- D. *Pump system* shall be vertical, submersible grinder. Mount each pump on a twin stainless steel rail system designed to permit removal without manually disconnecting discharge piping.
- E. *Submersible pump motor* to be constructed with open winding and designed to operate in a clean dry dielectric oil for cooling windings and lubricating motor bearings or to operate in an air filled chamber or water jacketed cooling system. The motor and pump cooling system shall be designed to provide sufficient cooling under all conditions such that the motor can run under full load in a totally dry condition. Motors shall be maximum 3600 rpm, 230 volts, 60 hertz, 3 phase, submersible type meeting UL Class 1, Group D, Division 1 - Explosion Proof Requirements with 1.15 service factor. Motor shall be suitable for continuous operation and capable of sustaining a minimum of 20 starts per hour. Motor shaft and housing to be sealed with a balanced tandem mechanical seal cartridge or approved equal. All leads are to be provided with watertight seals. Moisture sensing probes and thermal protectors shall be furnished on each pump. These shall be used in conjunction with and supplemental to external motor overload. Motor shall be supplied with a sufficient length of multiconductor power cable and control cable to extend the control cabinet without being spliced (approximately 50 feet). Motor insulation shall be compatible Class B rated system with Class F materials rated for continuous duty in 40°C liquids. All hardware shall be stainless steel. Motor shall be non-overloading at any point on the pump curve.
- F. *The pump volute and impeller* for the raw sewage pumps shall be constructed of close grain cast iron (or ductile iron), and be designed to pass solids and unscreened liquids. Impellers shall be statically and dynamically balanced and secured on the shaft by means of a key and locknut with set screw or threaded fastener. Volute is to be of one-piece design with bottom suction and centerline discharge. Install a hardened stainless steel or brass wear ring between the volute and impeller to provide efficient sealing. Wear rings shall have a minimum Brinnell hardness of 220.
- G. *The pump shaft shall rotate* on two permanently lubricated bearings with a B-10 bearing life of a minimum of 40,000 hours at design conditions.
- H. *Design each pump for automatic connection* to a permanently-mounted discharge elbow. The connection between the pump and discharge elbow shall allow zero leakage.
- I. *Furnish a mounting plate* for the submersible pumps. The plate shall include adjustable guide rail supports and discharge elbow with flange to align with pump hydraulic sealing flange. Cast discharge elbow with standard 125-pound flange. Coat mounting plate with two coats of tar base epoxy paint.
- J. *The guide rails* shall be 2-inch Schedule 40 stainless steel pipe secured at the top with a guide rail cap attached, as shown on the Drawings. A slide assembly with yoke shall attach to the pump and slide freely between the guide rails. A length of stainless steel chain of adequate strength shall be provided for raising and lowering pump. Attach chain to the pump with suitable eye bolt and properly secure attaching bracket in a convenient location near the top of the wetwell from the frame of the access cover. All materials used in the pump lifting system shall be stainless steel.

- K. *The pump station wet well top shall be fitted with a double door access lid and frame assemblies, as shown on Drawings. Access doors shall be constructed of ¼-inch diamond pattern aluminum plate. Frames shall be ¼-inch-thick, one-piece, mill finish, extruded aluminum and anchored to the wet well top, as shown on Drawings. The valve vault top shall be designed to fit the 5-foot-diameter concrete section as shown on the Drawings. Access lids shall be fitted with stainless steel hinges bolted to the underside and pivoting on torsion bars. All other hardware shall be stainless steel. The minimum live load capacity shall be 300 pounds per square foot. The frame may support the guide rails and electrical wiring channel. Door shall be fitted with spring-loaded snap lock operable from the outside by a removable handle and from below by a fixed turn handle and shall have a recessed staple for padlocking. Access hatches shall be Halliday Products or approved equivalent.*
- L. *Control panel for pumps shall have a NEMA 3R stainless steel enclosure with three-point latch suitable for pedestal mounting with weatherhood, as shown on Drawings, and shall be dead front with separate removable inside panel to protect electrical equipment. A lock hasp shall be provided on the outside door. Provide UL service entrance labeled main circuit breaker, branch circuit breakers, reduced voltage solid state motor controller, elapsed time meter, telephone alarm dialer, controller, loss of phase protection, alternator, a magnetic starter with overload protection device and incoming power lightning arrestor and contain within the control panel. Main circuit breaker trip rating to be determined by the control panel vendor and approved by the Engineer. Branch circuit breakers serving sewage pumps shall be adjustable, motor-circuit protector type, Square D Mag-Gard or equal. Motor controllers shall be by Nordic Controls, Square D or equal. Sizing shall be by control panel manufacturer and shall allow startup using the Authority's generator. Motor status run light shall be provided along with a terminal strip for connecting pump power and control wires. Additional terminals shall be provided to connect alarm, heat sensors, and seal failure wires. A single weatherproof ground fault protected duplex convenience outlet shall be provided on the side of the control panel enclosure. Control panel shall be provided with an internal condensation heater with adjustable thermostat. A warning label against electric shock shall be permanently affixed to the outer door. Control panel shall also be provided with an automatic pump alternator which shall alternate the pumps after each pumping cycle. Each pump shall be provided with a H-O-A switch and an elapsed time meter. Control panel shall be equivalent in all respects to Model 7100 as manufactured by Consolidated Electric.*

The control panel shall be equipped with a weatherproof, single phase, 3-wire receptacle, interior light fixture, and manual transfer switch to facilitate emergency operation of one sewage pump in the HAND position. Ampacity of switch and receptacle to be determined by control panel vendor and approved by the Engineer. Pump shall not operate in the AUTO position under emergency power conditions.

All conduits, fittings, or connections shall enter the enclosure through the bottom only for outdoor enclosure. An incoming power block terminal shall be supplied at the bottom of the enclosure to facilitate bottom conduit entry and to ensure sound electrical integrity of the incoming power connections.

- M. *Furnish in the control panel a transient voltage surge suppressor (TVSS) to protect AS electrical circuits and electronic equipment from the effects of lightning induced surges and twitching transients. The TVSS shall protect all modes, shall comply with UL 1449 and UL 1283, and shall comply with the following:*

1. The TVSS shall have a single impulse surge current rating of at least 160,000 amps per phase (80,000 amps per mode). The UL 1449 suppressed voltage rating shall not exceed 400 volts for 120/208V and 800 volts for 277/480V configurations. The device must be certified to withstand a minimum of 15,000 Category C3 impulses with less than 10% change in the baseline let-through voltage. Device shall meet UL 1449 fault current test with a surge rating of 200,000 AIC.
  2. Visual indication of proper operation shall be displayed on the front panel, including suppression circuit status, phase status, phase loss, reduced protection level, and suppression fault. A set of dry contacts shall be provided for remote monitoring. TVSS shall be equipped with audible alarm with mute, reset, and acknowledge features.
  3. Diagnostics shall be displayed on an LCD panel display and shall include information on phase loss, surge/transient event count, stored surge/transient event history, and technical support information.
  4. A suitable single-phase disconnect device shall be furnished. TVSS shall be installed as close as possible to the phase conductors and shall be connected directly to a grounding electrode.
  5. TVSS shall have a manufacturer's warranty of 20 years and shall be Innovative Technology, Inc., Protector PTE160.
- N. A *wiring channel* shall be mounted below the pump well cover for the pumps and shall provide cord grip holders for the pump cords and the control cords. The channel box shall have a removable cover for easy adjustment of cords. All cords shall extend from one end of the box and be taken through conduit in the sump cover to the control panel. No splices shall be made in the wiring channel. Continuous cords must be used from the control panel to the pumps and controls. Wiring channel shall mount on supports fastened to access cover frame.

O. *Liquid Level Sensing*

1. *The liquid level sensing* of the control system shall be accomplished by means of a pressure transducer equivalent to Model A 1000 control as manufactured by Consolidated Electric.
2. *The transducer* shall sense water level (pressure) variations and transform these variations directly into a standard process signal of 1 to 5 volts DC over the desired level range (span). Transducer(s) shall be completely solid state, with no mechanical linkages or moving parts. Supply voltage shall be between 10.5 and 25 volts DC.
3. *The transducer* shall incorporate a variable-capacitance transducer element to convert the sensed pressure to a corresponding electrical value. The sensed media shall exert bubbler system back pressure against the transducer pressure sensing elements. The transducer internal ceramic diaphragm shall flex minutely with response to media level/pressure so as to vary its proximity to a ceramic substrate to vary the capacitance of an electrical field created between the two

surfaces. A stable, hybrid, operational amplifier assembly shall be incorporated in the transducer to excite and demodulate the sensing mechanism. The transducer shall incorporate laser-trimmed, temperature compensation and high quality components and construction to provide a precise, reliable, stable output signal directly proportional to the sensed pressure over a factory-calibrated range.

4. *Transducer* shall be provided with two mounting clamps suitable to attach a 1-inch stainless steel pipe to clamp to the wet well wall.
5. *Transducer* shall have an intrinsically safe barrier between the upper and lower assemblies. The barrier shall render the transducer suitable for Class 1, Division 1, Groups A, B, C, and D; Class 2, Division 1, Groups E, F, and G; and Class 3, Division 1 hazardous locations.

**P. Pump Controller**

1. *Control panel* shall be equipped with a duplex pump control system which includes an LED display of liquid level with a range of 0 to 10 feet in 6-inch increments. Pump and alarm adjustments shall be easily made with plug-in pins or by other means at the pump control panel. Control system shall include automatic duplex pump alternator, alternator override switch, and level simulation switch.
2. *Pump controls* shall be equivalent to Model D152 as manufactured by Consolidated Electric.

**Q. Switches**

1. *Supply five sealed float-type mercury switches* as a redundant system for low-level alarm, pump cutoff, lead, lag and high wet well alarm as shown on the Drawings. The mercury type switches shall be sealed in a solid polyurethane float for corrosion and shock resistance. The support wire shall have a heavy neoprene jacket and a weight shall be attached to the cord above the float to hold the switch in place in the sump. The weight shall be above the float to prevent sharp bends in the cord when the float operates under water. The float switches shall hang and be supported only by the chord that is held to the wiring channel.
2. *Interface float switches* to the control circuitry via an intrinsically safe module. The module shall provide an intrinsically safe interface for up to six sensors located in a hazardous area rated Class 1, Groups A, B, C, and D; and Class 2, Groups E, F, and G. The module shall contain an LED indicator for each of up to six sensor inputs, providing visible indication of sensor actuation as well as an LED to indicate barrier "Power On" status. The intrinsic safety barrier shall be UL listed.

**R. The pump manufacturer** shall warrant the pump system to be supplied to the Owner for a period of five years. Warranty shall include 100 percent coverage for shop labor and parts the first year and 50 percent coverage through the fifth year.

**S. All piping and valves** constructed as part of this installation shall meet all the requirements of the applicable sections of these Specifications.

T. *Automatic Telephone Dialer*

1. *Provide* in the control cabinet a UL listed automatic dialing alarm and telephone communication system, microprocessor based, employing digital speech technology.
  - a. Power Requirements 115 volts AC, 15 watts
  - b. Battery Back-Up 12 hours
  - c. Power Outage Detection Time 60 seconds
  - d. Temperature -10°F to +130°F
2. *The telephone system* shall be FCC registered for direct interconnect using a standard rotary pulse or touch-tone dial-up phone line and have a built-in speaker phone. Connection shall be through FCC-approved 4-pin modular jack (RJ-11).
  - a. Dialing Capacity 8 number, 32 digits
  - b. Answer Delay Programmable 2 or 8 rings with automatic or manual switching
  - c. Call Acknowledge Method Tone or callback
  - d. Surge and Environmental Protection Per FCC Part 68
3. *The dialer* shall detect a fault by the presence of either a normally open or closed contact.
  - a. Fault Integration Time Constant 1 to 60 seconds
  - b. Programming Local or remote keyboard
  - c. Memory Non-volatile
4. *Manufacturer.* Raco "Chatter Box," or approved equal.
5. *Dialer* shall signal for the following conditions:
  - a. Low Level.
  - b. High Level.
  - c. Power Abnormality.
  - d. Seal Fail Pump No. 1.
  - e. Seal Fail Pump No. 2.
  - f. Motor Over-Temperature (either pump).
  - g. Pump Failure to Start or Run.

- U. *Rate all components and wiring* within the control panel to withstand available utility fault current. The electrical contractor shall coordinate with NGEMC and the Engineer prior to equipment ordering.

PART 3 - EXECUTION

3.1 INSPECTION

- A. *Inspect equipment* for factory defects or transportation/handling damage prior to installation. Replace or repair damaged equipment.



### 3.2 INSTALLATION

- A. *Install equipment* in accordance with manufacturer's recommendations and installation drawings.
- B. *Install pressure gauge* with shut-off valve on discharge of each pump.

### 3.3 START UP AND OPERATION

- A. *Manufacturer(s) shall furnish the services of a factory-trained field engineer* specializing in this work to inspect and adjust the equipment after installation, to test the equipment, supervise start-up, and instruct the Owner's personnel in its proper use. Provide a minimum of two days operator training for both operation and routine maintenance requirements for the pumps, motors, and control system. Include verification of all factory installed parameters for the performance of the pumps as well as pump start/stop points based upon pump efficiency and system flow.
- B. *Field Tests*
  - 1. *Manufacturer's field engineer* to test each unit under actual operating conditions to show that each pump unit operates satisfactorily without cavitation, overheating, or overloading, and free from excessive vibration and noise throughout the complete head and capacity range at rated speed.
  - 2. *Allow Engineer to observe field tests.* Give Engineer a 10-day written notice before performing tests.
  - 3. *Demonstrate successful operation* to the satisfaction of the Engineer. Field test shall include startup and operation of the pumps using the Authority's portable generator. Coordinate with Owner for using the generator. Make, at Contractor's expense, all necessary changes, modifications, and/or adjustments required to assure satisfactory and efficient operation.
  - 4. *Pump and control system manufacturer's authorized representative(s)* to provide a written report to the Engineer noting that pumps, motors, and the control system have been installed in accordance with manufacturer's recommendations, are in conformance with project performance requirements, and are ready for operation.

END OF SECTION



## SECTION 15041

### DISINFECTION OF POTABLE WATER LINES AND WATER STORAGE TANKS

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *The work covered by this section includes furnishing all labor, equipment, materials, and chemicals required to disinfect all potable water lines and water storage tanks in accordance with the procedures specified herein.*
- B. *Disinfect all plant units, piping, pumps and connections thereto, all distribution system piping and storage tanks and any surfaces that shall be in contact with potable water, upon completion of the construction and installation of equipment.*
- C. *No portion of new work shall be placed in service until disinfection has been completed and approved by the Engineer. Should the initial treatment fail to result in acceptable water, the chlorination procedure shall be repeated until satisfactory results are obtained.*

##### 1.2 STANDARDS

- A. *Procedures for disinfecting potable water lines, unless otherwise modified herein, shall conform to the requirements of AWWA C651.*
- B. *Procedures for disinfecting water storage facilities, unless otherwise modified herein, shall conform to the requirements of AWWA C652.*

#### PART 2 - PRODUCTS

##### 2.1 DISINFECTION AGENT

- A. *The disinfection agent shall be free chlorine or chlorine compound. The method of application and type of disinfecting agent shall both be acceptable to the Engineer.*

#### PART 3 - EXECUTION

##### 3.1 DISINFECTION PROCEDURE

- A. *All new water mains, as well as those taken out of service for inspection, repair or other activities that might lead to contamination of water shall be disinfected before they are placed in or returned to service. Disinfection of the new mains and the disposal of the heavily chlorinated water, following the disinfection, shall be accomplished in accordance with the latest edition of AWWA Standard C651. The "tablet method" of disinfection which consists of placing calcium hypochlorite granules or tablets in the water main as it is being installed and then filling the main with potable water when installation is complete is not allowed. Before the main is chlorinated, it shall be filled*

to eliminate air pockets and shall be flushed to remove particulates. A flushing velocity of not less than 2.5 feet/second is usually maintained in pipe sizes less than 24 inches in diameter. For larger diameter mains, alternative to flushing, such as broom-sweeping of the main, is acceptable prior to chlorinating the main. During disinfection of the water mains, an appropriate cross-connection control device, consistent with the degree of hazard, shall be provided for backflow protection of the active distribution system. Quality of the water used during the disinfection procedures shall meet the required drinking water standards.

*The chlorine solution* used for disinfection of water mains shall have a free chlorine residual concentration not less than 25 mg/L. This heavily chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants shall be operated to ensure disinfection of the appurtenances. At the end of the 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine. Re-chlorinate if required results are not obtained on all samples.

After the applicable retention period, the heavily chlorinated water must not be disposed in a manner that will harm the environment. Neutralizing chemicals, such as Sulfur Dioxide, Sodium Bisulfite, Sodium Sulfite or Sodium Thiosulfate can be used to neutralize the chlorine residual remaining in the water to be wasted. Flush all lines until residual is equal to existing system. After final flushing and before the water main is placed into service, water samples shall be collected from the main and tested for microbiological quality in accordance with the Georgia Rules for Safe Drinking Water, Chapter 391-3-5. The laboratory results must show the absence of coliform organisms in the water. Reflush and re-disinfect the lines, as necessary, until satisfactory bacteriological results are obtained.

- B. *Prior to disinfection*, all surfaces shall be thoroughly flushed with clear water. Disinfection of water storage facilities (including clearwells) shall be accomplished by the following AWWA standard method:
1. *Chlorination Method No. 3*. Water and chlorine shall be added to the storage facility in amounts such that initially the solution will contain 50 mg/l available chlorine and will fill approximately 5 percent of the total storage volume. This solution shall be held in the storage facility for a period of not less than 6 hours. The storage facility shall then be filled to the overflow level by flowing potable water into the highly chlorinated water. It shall be held full for a period of not less than 24 hours. The actual volume of the 50 mg/l chlorine solution shall be such that, after the solution is mixed with filling water and the storage facility is held full for 24 hours, there will be a free chlorine residual of not less than 2 mg/l.
- C. *Following these procedures*, two bacteriological tests shall be taken and the results of the tests be negative before the facility is put into service. If either of the samples is positive, the disinfection procedure must be repeated.
- D. *In the process of chlorinating newly constructed units and newly installed pipe*, all valves or other appurtenances shall be operated at least five times while the units and pipelines are filled with the chlorinating agent.

END OF SECTION

## SECTION 15061

### STEEL AND ALLOY PIPING AND COPPER TUBING

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *The work covered* by this section includes furnishing all labor, equipment, and materials required to furnish, install, and test steel pipe, alloy pipe, stainless steel pipe, and copper tubing, including all fittings, sleeves, unions, and accessories, as specified herein and/or shown on the Drawings.
- B. *The Contractor's attention* is called to the fact that all steel and alloy piping or copper tubing is not necessarily shown completely on the Drawings, which are more or less schematic. However, the Contractor shall furnish and install all pipe and fittings and do all piping work indicated or required for the proper operation of all equipment and services requiring such piping.

##### 1.2 GENERAL DESIGN REQUIREMENTS

- A. *All such work shall be done* by competent workmen in a thorough workmanlike manner according to best practice and in compliance with all codes and applicable regulations, with proper provisions for uncoupling, draining, expansion, and contraction.
- B. *Process piping furnished* as an integral part of an item of equipment shall conform to the requirements of the latest edition of ANSI B16.3, "Code for Petroleum Refining Piping," or ANSI B16.4, "Code for Refrigeration Piping," as applicable.

##### 1.3 QUALITY CONTROL

- A. *Prior to its incorporation into the work*, submit to the Engineer written evidence that the pipe furnished under this Specification is in conformance with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the pipe supplier may be considered evidence of compliance, provided such tests are performed in accordance with the appropriate ASTM, AWWA, or NSF testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on samples of pipe materials.

##### 1.4 SHOP DRAWINGS AND ENGINEERING DATA

- A. *Complete shop drawings and engineering data* on fabricated piping shall be submitted to the Engineer in accordance with the requirements of these Specifications.

##### 1.5 STORAGE AND PROTECTION

- A. *Piping and accessories* shall be stored and protected in accordance with the requirements of these Specifications.

- B. *All piping, tubing, and accessories* shall be stored above ground fully supported so as not to bend or deflect excessively under their own weight. Piping shall be stored with slope so as to be free draining.

## 1.6 SHOP PAINTING

- A. *All ferrous piping* not specified to be galvanized or otherwise coated shall be cleaned and shop primed or coated in accordance with the requirements of these Specifications.

## 1.7 GUARANTEE

- A. *Provide a guarantee* against defective equipment and workmanship in accordance with the requirements of Section 01740, Warranties and Bonds.

# PART 2 - PRODUCTS

## 2.1 GENERAL

- A. Unless otherwise shown or specified on the Drawings, all piping 2½ inches and smaller shall be copper tubing, except that Schedule 40 red brass threaded nipples with 125-pound forged bronze threaded fittings per ANSI B16.15 are acceptable for short branches to pressure gages and drains. Unless otherwise shown or specified, pipe 3 inches and larger shall be alloy pipe or ductile iron pipe, as specified. Carbon steel pipe shall be used only where approved by the Engineer or where specifically indicated on the Drawings.
- B. *No broken, cracked, deformed, misshapen, imperfectly coated, or otherwise damaged or defective pipe or fittings* shall be used. All such materials shall be removed from the site of the work.

## 2.2 ALLOY PIPE

- A. *Alloy pipe shall be nickel-copper alloy steel pipe* conforming to the requirements of ASTM A 714, Grade IV or V, Class 4. Alloy pipe in sizes 2 inches and larger shall be seamless.
- B. *Alloy pipe 6 inches and smaller* shall be screwed, Schedule 40. Alloy pipe for process piping in sizes 3 inches through 6 inches shall be welded, Schedule 40. Alloy pipe in sizes 8 inches through 14 inches shall be welded, Schedule 20 exposed, Schedule 40 buried.
- C. *Screwed fittings* shall be of 150-pound malleable iron conforming to ASTM A 197 and ANSI B16.3 or 3,000-pound forged nickel-copper alloy steel conforming to ANSI B16.11. Unions shall be 300-pound malleable iron.
- D. *Welded fittings* shall be wrought nickel-copper alloy steel of the same composition as the pipe and shall conform to ANSI B16.9.
- E. *Alloy pipe and fittings* shall be hot-dip galvanized in accordance with the requirements of ASTM A 153, unless otherwise shown or specified. Exposed alloy piping shall be field

primed and painted after installation in accordance with the requirements of these Specifications.

## 2.3 STEEL PIPE

- A. *Steel pipe in sizes 2½ inches and smaller* shall be seamless carbon steel pipe conforming to the requirements of ASTM A 120. Steel pipe in sizes 3 inches through 10 inches shall be seamless carbon steel pipe conforming to the requirements of ASTM A 53, Grade B.
- B. *Steel pipe 6 inches and smaller* shall be screwed, Schedule 40, unless otherwise specified or shown. Steel pipe for process piping in sizes 3 inches through 6 inches shall be welded, Schedule 40. Steel pipe in sizes 8 inches through 10 inches shall be welded, Schedule 20 exposed, Schedule 40 buried.
- C. *Screwed fittings 2½ inches and smaller* shall be 150-pound malleable iron conforming to ASTM A 197 and ANSI B16.3. Unions shall be 300-pound malleable iron.
- D. *Welded fittings shall be of the butt-welded type* of wrought carbon steel conforming to ASTM A 234, Grade WPB and ANSI B16.9. Reducing branch connections shall be made using threadolets or weldolets.
- E. *Flanges* shall be 150-pound forged steel conforming to ASTM A 181, Grade I, and ANSI B16.5. Bolts shall be ASTM A 307, Grade B, cadmium plated. Nuts shall be heavy hex nuts conforming to ASTM A 307, Grade B, cadmium plated. Gaskets shall be of red rubber or compressed asbestos, 1/16 inch thick, conforming to ANSI B16.21. Gaskets for piping operating at temperatures in excess of 150°F shall be compressed asbestos or soft corrugated metal.
- F. *Steel pipe and fittings 6 inches and smaller in size* shall be hot-dip galvanized in accordance with the requirements of ASTM A 153, unless otherwise shown or specified. Exposed steel piping shall be field primed and painted in accordance with the requirements of these Specifications.

## 2.4 STAINLESS STEEL PIPE

- A. *Stainless steel pipe in sizes 10 inches and smaller* shall be seamless stainless steel pipe conforming to the requirements of ASTM A 312, Type 304.
- B. *Stainless steel pipe 1½ inches and smaller* shall be screwed, Schedule 40S, unless otherwise specified or shown. Steel pipe in sizes 2 through 10 inches shall be welded, Schedule 10S.
- C. *Screwed fittings and unions 1½ inches and smaller* shall be 3,000-pound forged stainless steel conforming to ASTM A 182, Grade F304 and ANSI B16.11.
- D. *Welded fittings* shall be of the butt-welded type of wrought stainless steel conforming to ASTM A 403, Grade WP304 and ANSI B16.9. Reducing branch connections shall be made using threadolets or weldolets.
- E. *Flanges* shall be 150-pound, forged stainless steel conforming to ASTM A 182, Grade 304 and ANSI B16.5. Bolts shall be heavy hex conforming to ASTM A 193, Grade B8.

Nuts shall be heavy hex conforming to ASTM A 194, Grade 8. Gaskets shall be red rubber or compressed asbestos, 1/16 inch thick, conforming to ANSI B16.21. Gaskets for piping operating at temperatures in excess of 150°F shall be compressed asbestos or soft corrugated metal.

## 2.5 COPPER TUBING

- A. *Exposed copper tubing for water or gas* shall be seamless hard-drawn copper tube conforming to the requirements of ASTM B 88, Type L. Buried copper tubing shall be seamless, annealed copper tube conforming to the requirements of ASTM B 88, Type K. Annealed copper tube may be furnished in straight lengths or coils.
- B. *Copper tubing for instrument air service* in sizes 5/8-inch O.D. and smaller shall be coated, seamless, bright annealed copper tube conforming to ASTM B 68, Type DHP. Wall thickness of copper tube shall be as follows:

Tube O.D. <u>(inch)</u>	Wall Thickness <u>(inch)</u>
1/4	0.030
3/8	0.032
1/2	0.035
5/8	0.040

Instrument air tubing shall be factory coated with a layer of black PVC meeting the requirements of ASTM D 1047, IPCEA S-61-402, and applicable UL standards. Minimum coating thickness shall be 0.032 inch. Unless otherwise shown, minimum size of instrument air tubing shall be 3/8-inch O.D.

- C. *Fittings for copper tube* shall be wrought copper conforming to ASTM B 75 and ANSI B16.22 for silver brazed joints. Fittings for annealed copper tube in instrument air service shall be of the flareless, compression type, Hoke "Gyrolok," Crawford "Swagelok," Parker "Tribble-Lok," or equal, conforming to ASTM B 16 or B 124.

## 2.6 STAINLESS STEEL TUBING

- A. *Stainless steel tubing* for sample and process leads shall be seamless, bright annealed stainless steel tube conforming to ASTM A 269, Type 316 with minimum 3/8-inch O.D. and 0.035-inch wall thickness.
- B. *Fittings for stainless steel tubing* shall be of the flareless, compression type of Type 316 stainless steel.
- C. *Where process leads or sample tubing* are specified to be heat traced, furnish preinsulated factory traced and jacketed tubing with 4-watt-per-foot, parallel, self-regulating, electric tracing, glass fiber insulation and black, 105° PVC jacket overall. Tubing shall conform to Part 2.6.A above. Product shall be factory mutual approved for Class I, Division 2 locations and shall operate on 120-volt, 60-hertz, single phase power. All necessary termination and splicing accessories shall be furnished by the tubing manufacturer.



## 2.7 UNIONS

- A. *Unions* shall be of the ground joint type. Unions in carbon steel and alloy steel piping shall be 300-pound galvanized malleable iron conforming to ASTM A 197 and ANSI B16.3 with bronze to iron seats. Unions in stainless steel piping shall be 3,000-pound forged stainless steel conforming to ASTM A 182, Grade F304 and ANSI B16.11. Unions in copper piping shall be cast red bronze with bronze-to-bronze seats.

## 2.8 PIPE DOPE

- A. *All threaded connections* shall be made up using Teflon pipe dope applied to the male threads only.
- B. *Virgin Teflon thread tape* shall be Hercules Packing Company "Herculon," 3-M Company "Scotch No. 48," Crane Packing Company "Teflon Thread Tape," or equal.
- C. *Teflon thread paste* may be used in place of tape on very large or very small joints.

## 2.9 EXPANSION COUPLINGS

- A. *Expansion couplings for steel and alloy pipe* shall conform to the requirements of these Specifications.
- B. *Expansion couplings* shall be furnished where shown on the Drawings, required, or directed by the Engineer.

## 2.10 LININGS

- A. *Steel piping* shall have a cement mortar lining which has been factory-applied at thickness recommended by the manufacturer.
- B. *The manufacturers of the lined pipe and field lining materials* shall furnish the Engineer written certifications that the pipe lining systems conform to all applicable requirements of AWWA C 203 or AWWA C 209, as appropriate.

## 2.11 COATINGS

- A. *Buried steel piping* shall be furnished with a coal tar enamel coating or cold-applied, plastic tape wrap coating as described herein.
- B. *Coal tar enamel coatings* shall consist of a primer, a hot-applied coating of coal tar enamel, a bonded wrap of coal tar saturated asbestos felt, and a protective wrapping of 75-pound Kraft paper. Pipe to be coated shall be given a solvent cleaning followed by a commercial blast cleaning in accordance with SSPC SP-6. Primer shall be applied immediately after blasting. Except for specials, fittings, and field joints, all pipe shall be coated in the shop by mechanical means. Coal tar enamel coatings shall conform to the requirements of AWWA C 203.
- C. *Cold-applied, plastic tape wrap coatings* shall consist of a primer, a cold-applied wrap of laminated polyethylene tape, and a protective wrapping of 90-pound Kraft paper or 50-50-50-pound laminated Kraft paper. Pipe to be coated shall be given a solvent cleaning followed by a commercial blast cleaning in accordance with SSPC SP-6.

Primer shall be applied immediately after blasting. Laminated tape wrap shall have an overall thickness of not less than 30 mils and shall overlap each preceding wrap by at least ½ inch. Except for specials, fittings, and field joints, all pipe shall be coated in the shop by mechanical means. Cold-applied plastic tape wrap coatings shall comply with the requirements of AWWA C 210. Plastic tape coatings and materials shall be as manufactured by the Tapecoat Company, Republic Steel Corporation, Polyken Division of Kendall Company, or equal, subject, however, to the requirements of these Specifications.

- D. *The manufacturers of the coated pipe and field coating materials shall provide the Engineer with written certifications that the pipe coating systems conform to all applicable requirements of AWWA C 203 or AWWA C 210, as appropriate.*

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. *All exposed piping shall be firmly anchored and supported by pipe supports or anchors as shown or required. Pipe supports shall be furnished as shown on the Drawings or in accordance with the requirements of these Specifications. All pipe shall be carefully placed to the proper lines and grades as shown on the Drawings.*
- B. *Full lengths of pipe shall be used wherever possible. Short lengths of pipe with couplings will not be permitted. Pipe shall be cut to exact measurement and shall be installed without forcing or springing.*
- C. *Lines which slope shall have the right-of-way over lines whose elevations can be changed. Offsets, transitions, and changes in direction in pipes shall be made as required to maintain proper head room, slope, etc.*
- D. *Piping shall be installed in such manner and at such times as will require a minimum of cutting and repairing of building structures. In case any such cutting or repairing is necessary, it shall be done only with the permission of the Engineer. Cutting and repairing shall be performed by craftsmen of the trade which originally executed the work, and repairs shall match the original condition.*
- E. *Except for annealed tubing, all changes in direction in piping systems shall be made with suitable fittings. Annealed tubing shall be bent using suitable bending tools.*
- F. *When storing and installing piping, care shall be taken to prevent damage to the pipe coatings. Steel pipe with an exterior bituminous or plastic coating or wrapping shall be handled using rubber or canvas slings. All damaged coatings shall be repaired to the satisfaction of the Engineer.*
- G. *A liberal number of unions and/or flanged joints shall be used to permit the ready removal of any section. Unions shall be installed in all piping connections to equipment, to regulating valves, and wherever necessary to facilitate the dismantling of piping and removal of valves and other items requiring maintenance. Flanges on equipment may be considered as unions.*

- H. *Installed piping* shall not interfere with the operation of or accessibility to doors and/or windows; shall not encroach on aisles, passageways, and equipment; and shall not interfere with the servicing or maintenance of any equipment.
- I. *The interior of all piping* shall be free from obstructions and protrusions. All burrs shall be removed from the inside and outside edges of all cut pipe by reaming. Cutting shall be done in such a manner so as to leave a smooth end at right angles to pipe threads. Tool marks and unnecessary pipe threads shall be avoided. Cuttings and other foreign material shall be removed from the inside of the pipe prior to installation.
- J. *Piping and tubing laid underground* shall have a minimum cover over the top of the pipe as follows, unless otherwise shown on the Drawings:
- |   |           |
|---|-----------|
| 1. Located in Roadway                                     | 48 inches |
| 2. Located in Other Paved Areas                           | 36 inches |
| 3. Water, Gas, and Drain Piping, 4-inch I.D. and Larger   | 30 inches |
| 4. Water, Gas, and Drain Piping, 3½-inch I.D. and Smaller | 24 inches |
| 5. Located Under Building                                 | 6 inches  |
- K. *Suitable galvanized steel pipe sleeves* of adequate inside diameter shall be provided where piping or tubing passes through walls and floors of buildings and structures. Inside diameter of sleeve shall be approximately ½ inch larger than outside diameter of pipe or insulation. A welded steel plate waterstop with a minimum dimension 4 inches larger than outside diameter of sleeve shall be furnished for use in underground walls. Sleeves shall be built into the concrete or masonry wall or floor. Under no circumstances will blocking out or breaking of walls be permitted for later insertion. After installation of piping, the space between the pipe and the sleeve shall be caulked airtight and watertight. Caulking shall be oakum and lead in concrete and masonry construction, and rope asbestos in wood or plaster construction.
- L. *After installation, the interior of all piping shall be cleaned* as necessary to remove flux, slag, scale, rust, dirt, oil, and other foreign material. As piping is installed, open ends shall be covered or plugged as necessary to prevent the entrance of foreign matter and to maintain the required cleanliness.
- M. *Piping laid underground* shall be fully supported along its entire length by a compacted layer of select earth backfill or sand in accordance with the requirements of the Section 02200, Earthwork. Select earth backfill (or sand, in the case of coated or wrapped steel pipe) shall also be placed and compacted around the piping to provide a cover of not less than 12 inches over the top of the pipe.
- N. *Piping and tubing* shall be supported as shown on the Drawings and/or specified in these Specifications.
- O. *Changes in pipe size* shall be made using reducing fittings, not bushings. If centerline elevation is not specified, use eccentric reducers in horizontal piping. On liquid lines, eccentricity shall be down with top of pipe level. On vapor and gas lines, eccentricity shall be up with bottom level.
- P. *Indicated locations and sizes of equipment connections are approximate*; exact locations and sizes of piping, valves, etc., shall conform to approved shop drawings.

Connection sizes shall not be smaller than scheduled size or equipment outlet size, whichever is larger.

### 3.2 INSTALLATION OF STEEL AND ALLOY PIPING

- A. *Pipe threads* shall be concentric with the outside of the pipe and shall conform to ANSI B2.1. When threading stainless steel pipe, dies shall have 20° to 30° hook. Finished joints shall have no more than three threads exposed. Before assembly, pipe ends and threads shall be inspected and any defective pieces replaced. All joints shall be properly aligned before connection to prevent thread damage. Pipe dope shall be used on the male threads of all threaded connections. Teflon thread tape shall be applied two threads back from the end of the pipe or fitting to prevent shredding. Excess pipe dope shall be trimmed or cleaned off to provide adherence for paints or coatings. After joining, exposed threads in underground piping shall be given a heavy coat of bituminous paint or other suitable protective compound prior to backfilling.
- B. *All flanges* shall be faced and drilled and shall be true and perpendicular to the axis of the pipe. Flanges shall be cleaned of all burrs, deformations, or other imperfections before joining. Flanged joints shall be installed so as to ensure uniform gasket compression. All bolting shall be pulled up to the specified torque by crossover sequence. Where screwed flanges are used, the pipe edge shall not extend beyond the face of the flange, and the flange neck shall completely cover the threaded portion of the pipe. Where slip-on flanges are used, the distance from the end of the pipe to the gasket face of the flange shall not exceed "t" plus ¼ inch, where "t" is the pipe wall thickness. Unless otherwise required, bolt holes shall straddle the vertical and horizontal axes of the pipe. Connections to equipment shall be made in such a way that no strain is placed on the equipment flanges.
- C. *For flanged connections* between steel or alloy piping and cast or ductile iron piping or valves, steel flanges shall be flat-faced and furnished with full-face gaskets, insulating bushings, and, when buried, stainless steel bolts.
- D. *Where steel or alloy pipe is connected* to copper tubing, insulating bushings or couplings shall be used to prevent galvanic corrosion.

### 3.3 INSTALLATION OF COPPER TUBING

- A. *Annealed copper tubing* shall be cut square, and ends reamed using suitable tools. Bending tools shall be used in making bends. Minimum bend radii shall be 1 inch for ¼-inch O.D. tubing and 1½ inches for tubing ¾-inch O.D. and larger. Compression fittings shall be installed in conformance with the manufacturer's instructions. Plastic coatings shall be cut back only far enough to permit installation of fittings. When a section of tubing is cut from a coil, the end of the unused portion shall be crimped closed.
- B. *Hard drawn copper tubing and fittings* shall be assembled using silver brazing alloy and flux as recommended by the manufacturers. Tubing shall be properly cut square, ends reamed, and both fitting and tubing polished with steel wool before fluxing. Joints shall be properly heated, care being taken not to overheat. After the brazing alloy has been run in, the joint shall be wiped clean. Brazing wire shall be fluxed before using. Unless otherwise specified, copper tubing shall be installed in conformance with the manufacturer's instructions.

### 3.4 FIELD TESTING

- A. *Testing.* Pressure and leakage tests shall be performed in accordance with the latest edition of AWWA Standard C600.
- B. *After all piping has been placed and backfilled between the joints,* each run of newly laid pipe, or any valved section thereof, shall be tested by the Contractor in the presence of the Engineer, and tests shall be continued until all leaks have been made tight to the satisfaction of the Engineer.
- C. *All piping carrying liquids under pressure* shall be subjected to a hydrostatic gauge pressure of 150 percent of the maximum expected operating pressure or 150 psig, whichever is greater, based on the elevation of the lowest point of the section under test, corrected to the elevation of the pressure gauge. All piping carrying air shall be subjected to a hydrostatic gauge pressure of at least 150 percent of the maximum expected operating pressure or 15 psig, whichever is greater. The above pressures shall be maintained for a minimum of two consecutive hours. No leakage will be allowed. Leakage may be determined by loss of pressure, soap solution, or other methods approved by the Engineer.
- D. *Process piping,* designed in accordance with ANSI B16.3 or ANSI B16.4, shall be tested in accordance with the requirements contained therein.
- E. *Take all precautions necessary* to protect any equipment that might be damaged by the pressures used in the tests. Delicate equipment shall be valved off, removed, or otherwise protected.
- F. *All piping shall be securely anchored and restrained* against movement prior to application of test pressures. Prior to the pressure test, pipe laid in trenches shall be partially backfilled to adequately secure the pipe during the test. All joints, fittings, and valves will be left open where possible. All exposed pipe, fittings, valves, and joints shall be carefully examined during the pressure test.
- G. *Before applying the specified test pressure* during a test using water as the pressurizing medium, all air shall be expelled from the pipe. If hydrants, blow-offs, or air release valves are not available at the high places, the Contractor shall make the necessary taps at points of highest elevation before the test is made and insert plugs after the test has been completed.
- H. *Subject welded joints* to hammer tests while under pressure.
- I. *Any leakage developing during the test* shall be corrected at the Contractor's expense by tightening, replacing packing or gaskets, or replacing defective portions of the piping system. No caulking will be permitted. If the defective portion cannot be located, the Contractor, at his expense, shall remove and reconstruct as much of the original work as necessary to obtain a piping system tested without leakage.
- J. *After all tests on any section have been completed* to the satisfaction of the Engineer, carefully clean, blow out, and drain the line of all water to prevent freezing of the same. Demonstrate to the satisfaction of the Engineer that any and all lines are free from obstructions and foreign material.

- K. *The Contractor shall bear the complete cost of the tests, including set-up, labor, temporary piping, blocking, gauges, bulkheads, water, air soap solutions, and other materials required to conduct the tests.*

### 3.5 FIELD PAINTING

- A. *All exposed piping shall be field primed and painted, following installation and testing, in accordance with the requirements of these Specifications.*

### 3.6 DISINFECTION

- A. *Potable water lines shall be disinfected, following installation and testing, in accordance with the requirements of these Specifications.*

END OF SECTION

## SECTION 15062

### DUCTILE IRON PIPE AND FITTINGS

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *The work covered by this section includes furnishing all labor, equipment, and materials required to furnish, install, and test ductile iron piping, including all fittings, wall pipe and sleeves, couplings, toppings, anchor blocks, and accessories, as specified herein and/or shown on the Drawings.*

##### 1.2 QUALITY ASSURANCE

- A. *Submit to the Engineer written evidence that the pipe furnished under this Specification is in conformance with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the pipe supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate ASTM or AWWA testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on samples of pipe materials.*
- B. *Clearly mark each ductile iron pipe length and fitting with the pressure rating, metal thickness class, heat mark, net weight (excluding lining or coating), and name of the manufacturer. In addition, each item of piping shall be marked with an identifying mark corresponding to the appropriate mark on the shop drawings for that particular item of piping.*

##### 1.3 SHOP DRAWINGS AND ENGINEERING DATA

- A. *Submit complete shop drawings and engineering data on all piping and accessories to the Engineer in accordance with the requirements of Section 01340, Shop Drawings, Product Data, and Samples.*
- B. *Shop drawings shall indicate piping layout in plan and elevations as may be required and shall be completely dimensioned. The Drawings shall include a complete schedule of all pipe, fittings, specials, hangers, and supports. Special castings shall be clearly detailed showing all pertinent dimensions.*
- C. *Furnish the Engineer with lists, in duplicate, of all pieces of pipe and fittings in each shipment received. These lists shall give the serial or mark number, weight, class, size, and description of each item received.*

##### 1.4 STORAGE AND PROTECTION

- A. *Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending between supports. Items such as pipe, structural steel, and sheet construction products shall be stored with one end elevated to facilitate drainage.*

1.5 SHOP PAINTING

- A. *All ductile iron pipe and fittings shall be cleaned and provided with a bituminous coating and cement lining applied at the factory, unless otherwise specified herein.*

1.6 GUARANTEE

- A. *Provide a guarantee against defective materials and workmanship in accordance with the requirements of Section 01740, Warranties and Bonds.*

1.7 ACCEPTABLE MANUFACTURERS

- A. *Ductile iron pipe and fittings must be the products of member companies of the Ductile Iron Pipe Research Association (DIPRA). Products from manufacturers who are not DIPRA member companies shall not be utilized in the work covered by these Specifications.*

PART 2 - PRODUCTS

2.1 GENERAL

- A. No broken, cracked, deformed, misshapen, imperfectly coated, or otherwise damaged or defective pipe or fittings shall be used. All such material shall be removed from the site of the work.
- B. *Minimum pipe wall thickness and pressure class of pipe shall be as follows, unless otherwise shown on the Drawings or directed by the Engineer:*

<u>Pipe Size</u>	<u>Pressure Class (psi)</u>	<u>Metal Wall Thickness in Inches</u>
3-Inch Ductile Iron	350	0.25
4-Inch Ductile Iron	350	0.25
6-Inch Ductile Iron	350	0.25
8-Inch Ductile Iron	350	0.25
10-Inch Ductile Iron	350	0.26
12-Inch Ductile Iron	350	0.28
14-Inch Ductile Iron	350	0.31
16-Inch Ductile Iron	350	0.34
18-Inch Ductile Iron	300	0.34
20-Inch Ductile Iron	300	0.36
24-Inch Ductile Iron	250	0.37
30-Inch Ductile Iron	250	0.42
36-Inch Ductile Iron	250	0.47
42-Inch Ductile Iron	250	0.52
48-Inch Ductile Iron	250	0.58
54-Inch Ductile Iron	250	0.65
60-Inch Ductile Iron	250	0.68
64-Inch Ductile Iron	250	0.72



## 2.2 DUCTILE IRON PIPE

- A. *Ductile iron pipe shall be designed* in accordance with ANSI/AWWA C150/A21.50, "Thickness Design of Ductile Iron Pipe," using 60,000-psi tensile strength, 42,000-psi yield strength, and 10 percent elongation. Additionally, ring bending stress is limited to 48,000 psi to provide a 2.0 safety factor based upon ultimate bending stress.
- B. *Ductile iron pipe shall be manufactured* in accordance with ANSI/AWWA C151/A21.51, "Ductile Iron Pipe Centrifugally Cast for Water," and shall be made of ductile iron having a minimum tensile strength of 60,000 psi, a minimum yield strength of 42,000 psi, and 10 percent minimum elongation.

## 2.3 DUCTILE IRON FITTINGS

- A. *All fittings shall conform* in every respect to ANSI/AWWA C110/A21.10, "Ductile Iron Compact Fittings for Water Service" or ANSI/AWWA C153/A21.53, "3 Inch through 16 Inch for Water and Other Liquids."
- B. *All fittings shall be for pressure rating of 250 psi, unless otherwise shown on the Drawings, directed, or specified.*
- C. *Flanged fittings, in general, shall be ANSI pattern using long radius elbows except where space limitations prohibit the use of same. Design of all fittings, whether long or short pattern, shall be as indicated or dimensioned on the Drawings. Special fittings, wall pipes, and sleeves shall conform to the dimensions and details shown on the Drawings.*

## 2.4 JOINTS FOR DUCTILE IRON PIPE AND FITTINGS

### A. *General*

- 1. *Joints for ductile iron pipe and fittings shall be mechanical joints, flanged joints, push-on joints, or bell and spigot joints, as shown on the Drawings or specified herein.*
- 2. *All ductile iron pipe laid underground shall be joined using mechanical joints or push-on type joints, unless otherwise shown on the Drawings, specified, or directed.*

### B. *Mechanical Joints*

- 1. *Mechanical joints shall consist of a bolt joint of the stuffing box type as detailed in ANSI A21.10 and described in ANSI A21.11.*
- 2. *Mechanical joints shall be thoroughly bolted in accordance with the manufacturer's recommendations with Tee Head Bolts and bolts of high strength, low-alloy steel having a minimum yield point strength of 40,000 psi and an ultimate tensile strength of 70,000 psi.*
- 3. *Gaskets, bolts, and nuts shall conform to ANSI A21.11. Gaskets shall be of neoprene or rubber of such quality that they will not be damaged by the liquid or gases with which they will come into contact.*

4. *Glands* shall be of high strength ductile iron.

### C. *Flanged Joints*

1. *Flanged joints* shall conform to ANSI B16.1, Class 125, in accordance with Table 10.23 of ANSI A21.10.
2. *Flanged joints* shall be bolted with through stud or tap bolts of required size as directed. Bolts and nuts shall conform in dimensions to the American Standard heavy series. Nuts shall be hexagonal, cold pressed. Bolts and nuts shall be cadmium plated, cold pressed, steel machine bolts, conforming to ASTM A 307, Grade B. Cadmium plating shall be by an approved process and shall be between 0.003 and 0.0005 inch thick. After each joint has been made, all bolts, heads, and nuts shall be coated with two coats of coal tar epoxy (total of 16 mil thickness D.F.T.), or approved equal coating.
3. *Gaskets* shall be full face type, 1/16 inch thick, conforming to the requirements of AWWA C111.
4. *Flanged ductile iron pipe* approximately 12 inches or less in length shall have flanges cast solidly to the pipe barrel. Flanges on ductile iron pipe longer than 12 inches may be of the screw type. Pipe threads shall be of such length that with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be machined to give a flush finish to the pipe and the flange and surface shall be normal to the axis of the pipe. Ductile iron flanges shall be of such design that the flange neck completely covers the threaded portion of the pipe to protect same against corrosion. All pipe with screw type flanges shall be assembled, faced, and drilled at the point of manufacture, unless otherwise approved by the Engineer.
5. *Where tap or stud bolts are required*, flanges shall be drilled and tapped accordingly.

### D. *Push-On Joints*

1. *Push-on joints* shall conform to ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer's standard practice.
2. *Gaskets* shall be in accordance with ANSI A21.11 and shall be of such quality that they will not be damaged by the liquid or gases with which they will come into contact.

## 2.5 PIPE COATING AND LINING

- A. *All ductile iron pipe and fittings buried underground* shall have a standard bituminous outside coating conforming to ANSI A21.6 or A21.51. All exposed ductile iron pipe and fittings shall have an outside shop coating of Rust Oleum 950 rust inhibitive primer.
- B. *All ductile iron pipe used for water or wastewater* shall have cement mortar lining of standard thickness in accordance with ANSI A21.4. Cement mortar lining for ductile iron fittings shall be double the standard thickness under ANSI A21.4.

- C. *No lining shall be provided for ductile iron pipe and fittings used for air.*
- D. *Where a special lining is indicated on the Drawings for resistance to corrosive wastewaters, pipe and fittings shall be furnished with a minimum 20-mil-thick lining of chemically inert, abrasion-resistant polyethylene. The lining shall be a blend of high density and low density polyethylene powders complying with ASTM D 1248 compounded with carbon black to provide resistance to ultraviolet rays during storage above ground. The pipe shall be preheated in a furnace (to ensure uniformity of heat distribution) to an adequate temperature to provide uniform fusing of the polyethylene powders and proper bonding to the pipe. The lining shall be unaffected by hydrogen sulfide, detergents, grease, oil, inorganic acids, alkalis, and most organic materials found in municipal wastewaters and shall be suitable for service at operating temperatures of up to 180°F. The lining shall have a Hazen-Williams "C" coefficient of approximately 150 and a Manning "n" coefficient of approximately 0.010. Polyethylene-lined ductile iron pipe shall be U.S. Pipe "Polylined," American Cast Iron Pipe "Polybond," or equal.*

## 2.6 PIPE COUPLINGS

- A. *Pipe couplings shall be installed where shown on the Drawings, required for installation, or directed by the Engineer.*
- B. *Pipe couplings shall conform to the requirements of Section 15090, Pipe Couplings and Expansion Joints.*

## 2.7 WALL PIPE AND WALL SLEEVES

- A. *Furnish and install ductile iron wall pipe or wall sleeves where ductile iron piping connects with or passes through concrete walls or floors and in locations where small piping and electric wiring and conduits connect with or pass through concrete walls or floors.*
- B. *Where wall pipes or sleeves are to be installed flush with the wall or slab, the flange or bell shall be tapped for studs. Where the flange or bell will project beyond the wall, the projection shall be sufficient to allow for installation of connecting bolts.*

## 2.8 SPARE PARTS

- A. *Furnish 4 spare gaskets for each size and type of joint requiring the use of a gasket. Furnish 8 bolts and nuts of each size and type used for ductile iron pipe joints.*

# PART 3 - EXECUTION

## 3.1 LAYING

- A. *Proper and suitable tools and appliances for safe and convenient handling and laying of pipe and fittings shall be used. Great care shall be taken to prevent the pipe coating from being damaged, particularly cement linings on the inside of the pipes and fittings. Any damage shall be remedied as directed by the Engineer.*

- B. *Carefully examine* all pipe and fittings for defects just before laying and no pipe or fitting shall be laid which is defective. If any defective pipe or fitting is discovered after having been laid, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor at his own expense.
- C. *Thoroughly clean* all pipes and fittings before they are laid and keep clean until they are used in the completed work. Open ends of pipe shall be kept plugged with a bulkhead during construction.
- D. *Pipe laid in trenches* shall be laid true to line and grade on a firm and even bearing for its full length at depths and grades as shown on the Drawings. Adequate precautions shall be taken to prevent flotation of pipelines prior to backfilling. Installation of ductile iron pipe in underground pressure piping systems shall conform to the requirements of AWWA C600. Excavation of trenches and backfilling around pipes shall conform to the requirements of the Section 02200, Earthwork.
- E. *All ductile iron piping laid underground* shall have a minimum of 36 inches of cover above the top of the pipe unless otherwise shown on the Drawings.
- F. *All elbows, tees, branches, crosses, and reducers* in pressure piping systems shall be adequately restrained against thrust. Underground pressure piping shall be restrained by thrust restrained joints (EBAA Meg-a-Lug Series 1100SD, or approved equal). Install restraints in accordance with manufacturer's recommendations. Install number of restraints recommended by manufacturer for size of pipe, type of fitting, and type of soil. In lieu of restrained joints, Contractor may use thrust blocks of size shown on the Drawings.
- G. *All ductile iron pipes entering buildings or basins* shall be adequately supported between the structure and undisturbed earth as shown on the Drawings to prevent breakage resulting from settlement of backfill around the structure.
- H. *Wall pipe and wall sleeves* shall be accurately located and securely fastened in place before concrete is poured. All wall pipe and wall sleeves shall have wall collars properly located to be in the center of the wall where the respective pipes are to be installed.
- I. *Wall pipe and wall sleeves* shall be installed when the wall or slab is constructed. Blocking out or breaking of the wall for later insertion shall not be permitted.
- J. *Cutting or weakening* of structural members to facilitate pipe installation shall not be permitted. All piping shall be installed in place without springing or forcing.
- K. *Sufficient couplings and flanged joints* shall be provided to facilitate equipment installation and removal.
- L. *Exposed ductile iron piping* shall be supported as shown on the Drawings.

### 3.2 CUTTING

- A. *Whenever pipe requires cutting* to fit the lines, the work shall be done in such manner as to leave a smooth end at right angles to the axis of the pipe. When a piece of pipe is cut to fit into the line, no payment will be made for the portion cut off and not used.

- B. *Whenever existing pipe requires cutting* to install new fittings, the work shall be done in such manner as to leave a smooth end at right angles to the axis of the pipe and special care shall be exercised to guard against breaking or splitting the existing piping.
- C. *All cutting of ductile iron pipe* shall be done with a cutting saw. All burrs shall be removed from the inside and outside edges of all cut pipe.

### 3.3 JOINING

#### A. *Mechanical Joints*

1. *The successful operation of the mechanical joint* specified requires that the spigot be centrally located in the bell and that adequate anchorage be provided where abrupt changes in direction and dead ends occur.
2. *The surfaces with which the rubber gasket comes in contact* shall be brushed thoroughly with a wire brush just prior to assembly to remove all loose rust or foreign material which may be present and to provide clean surfaces which shall be brushed with a liberal amount of soapy water or other approved lubricant just prior to slipping the gasket over the spigot end and into the bell. Lubricant shall be brushed over the gasket prior to installation to remove loose dirt and lubricate the gasket as it is forced into its retaining space.
3. *Joint bolts* shall be tightened by the use of approved wrenches and to a tension recommended by the pipe manufacturer. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This may be done by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and last, the remaining bolts. This cycle shall be repeated until all bolts are within the range of acceptable torques. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation shall not be permitted.
4. *After installation, bolts and nuts in buried or submerged piping* shall be given 2 heavy coats of a bituminous paint.

#### B. *Flanged Joints*

1. *All flanges* shall be true and perpendicular to the axis of the pipe. Flanges shall be cleaned of all burrs, deformations, or other imperfections before joining. Flanged joints shall be installed so as to ensure uniform gasket compression. All bolting shall be pulled up to the specified torque by crossover sequence. Where screwed flanges are used, the finished pipe edge shall not extend beyond the face of the flange, and the flange neck shall completely cover the threaded portion of the pipe.
2. *Connections to equipment* shall be made in such a way that no strain is placed on the equipment flanges. Connecting flanges must be in proper position and alignment and no external force may be used to bring them together properly.

3. *After installation, bolts and nuts in buried or submerged piping shall be given 2 heavy coats of a bituminous paint.*

C. *Push-On Joints*

1. *The inside of the bell and the outside of the pipe from the plain end to the guide stripe must be wiped clean immediately before assembling the pipe joint. Then the rubber gasket shall be inserted into a groove or shaped recess in the bell. Both the bell and spigot ends to be joined shall be wiped again to ensure they are thoroughly clean. A liberal coating of special lubricant furnished by the pipe manufacturer shall be applied to the outside of the pipe from the plain end to the yellow guide stripe and to the inside of the gasket. The plain end shall be centered in the bell and the spigot pushed home. Wherever possible the pipe shall be socketed by hand; however, jacking may be required to push the spigot in place on the larger sizes of pipe. The completed joint shall be permanently sealed and watertight.*
2. *Whenever the pipe is cut in the field, the cut end shall be conditioned so it can be used in making up a joint by filing or grinding the cut end to remove burrs or sharp edges that might damage the gasket.*

D. *Permissible Deflection of Joints*

1. *Deflection of ductile iron pipe at joints for long radius curves or for avoiding obstacles shall be permitted only upon approval of the Engineer.*
2. *Where deflection of joints is permitted, such deflection shall be made in accordance with and shall not exceed limits provided in Section 9b.5 and Section 9c.4, as applicable, of AWWA C600.*

- E. *Joints of Dissimilar Metals.* When a flanged joint consists of a ductile iron flange mated to a steel or alloy flange, the steel flanges shall be flat-faced and furnished with full-faced gaskets, insulating bushings, and stainless steel bolts.

3.4 SERVICE CONNECTIONS

- A. *Small service lines and branches shall connect to larger ductile iron mains using ductile iron tapped tees and crosses, in general and unless otherwise shown.*
- B. *Tapped tees and crosses shall have minimum 2-inch NPT branch connections and shall be furnished with mechanical joint ends.*

3.5 CUT-INS TO EXISTING PIPING

- A. *Cut-ins to existing ductile iron piping for installation of new mechanical joint fittings and valves shall be made using ductile iron cutting-in sleeves, in general and unless otherwise shown.*
- B. *Cutting-in sleeves shall have a pressure rating not less than that of the existing pipeline and shall be furnished with a mechanical joint end on one end and a plain end on the other.*

### 3.6 DRILLING AND TAPPING

- A. *Wherever required, ductile iron pipe and fittings shall be drilled and tapped to receive drainage or any other piping. All holes shall be drilled accurately at right angles to the axis of any pipe or fitting. Where plugs are drilled, holes shall be at right angles to the face of the plug.*
- B. *Where the size of the pipe to be connected is such as to require bosses for connection and when the pipe wall thickness is too thin to permit the effective length of pipe threads to be utilized as necessary for the size pipe being connected by threads, furnish such pipe with cast-on bosses suitable for drilling, tapping, and connecting such pipe. Alternately, where shown or specified, a tapped saddle clamp may be used in lieu of a cast-on boss. Saddle clamp shall be of the heavy-duty type with O-ring gaskets and 2 heavy U-bolt clamps.*
- C. *All tapping shall be carefully and neatly done by skilled workmen with suitable tools.*
- D. *Where connections are made between new and old piping, the connections shall be made in a thorough and workmanlike manner using proper fittings and specials to suit actual conditions.*
- E. *Cut-ins to existing and operating pipelines shall be done at times agreeable to the Owner upon approval of the Engineer.*
- F. *Existing pipelines that may be cut or damaged during the performance of work under this item shall be repaired, reconnected, and returned to service in equal or better condition in which they were found and in accordance with the requirements of this Specification.*
- G. *No separate payment will be made for drilling, tapping, making connections, cut-ins, repairs to damaged existing pipelines, and reconnections in existing pipelines.*

### 3.7 FIELD TESTING

- A. *After all piping has been placed and backfilled between the joints, each run of newly laid pipe, or any valved section thereof, shall be tested by the Contractor in the presence of the Engineer, and tests shall be continued until all leaks have been made tight to the satisfaction of the Engineer.*
- B. *All piping shall be subject to a hydrostatic gauge pressure equal to 150 percent of the maximum operating pressure of the pipe section under test or 150 psig, whichever is greater, based on the elevation of the lowest point of the section of pipe under test and corrected to the elevation of the test gauge. The above pressures shall be maintained for a minimum of two consecutive hours. No leakage will be allowed. Leakage may be determined by loss of pressure or other methods approved by the Engineer.*
- C. *Take all precautions necessary to protect any equipment that might be damaged by the pressures used in the tests. Delicate equipment shall be valved off, removed, or otherwise protected.*
- D. *Securely anchor and restrain all piping against movement prior to application of test pressures. Prior to the pressure test, pipe laid in trenches shall be partially backfilled*

to adequately secure the pipe during the test. All joints, fittings, and valves will be left open where possible. All exposed pipe, fittings, valves, and joints shall be carefully examined during the pressure test.

- E. *Expel all air from the pipe* before applying the specified test pressure. If hydrants, blow-offs, or air release valves are not available at the high places, make the necessary taps at points of highest elevation before the test is made and insert plugs after the test has been completed.
- F. *After satisfactory completion of the pressure test, a leakage test shall be performed on each section of pipe in accordance with Section 5.2 of AWWA C600 at a hydrostatic pressure equal to the maximum operating pressure of the pipe section under test, based on the elevation of the lowest point of the line or lowest point of the section under test and corrected to the elevation of the gauge.*
- G. *Any leakage developing during the test shall be corrected at the Contractor's expense by tightening, replacing packing or gaskets, or replacing defective portions of the piping system. Caulking will not be permitted. If the defective portion cannot be located, the Contractor, at his expense, shall remove and reconstruct as much of the original work as necessary to obtain a facility tested without leakage.*
- H. *Carefully clean, blow out, and drain the line of all water to prevent freezing, after all tests on any section have been completed to the satisfaction of the Engineer. Demonstrate to the satisfaction of the Engineer that any and all lines are free from obstructions and foreign material.*
- I. *The Contractor shall bear the complete cost of the tests, including set-up, labor, temporary piping, blocking, gauges, bulkheads, water, air, soap solutions, and any other materials required to conduct the tests.*

### 3.8 DISINFECTION

- A. *Potable water lines shall be disinfected in accordance with the requirements of Section 15041, Disinfection of Potable Water Lines and Water Storage Tanks, following installation and testing.*

END OF SECTION



## SECTION 15064

### POLYVINYL CHLORIDE PIPE FOR WATER

#### PART 1 - GENERAL

##### 1.1 SCOPE OF WORK

- A. *Furnish* all labor, materials, equipment and incidentals required and install in the locations as shown on the Drawings the plastic piping as specified herein.

##### 1.2 RELATED WORK

- A. Section 15062: Ductile Iron Pipe and Fittings.
- B. Section 15101: Valves.

##### 1.3 DESCRIPTION OF SYSTEM

- A. *Plastic pipe* shall be used for water main piping.
- B. *Piping* shall be installed in the locations as shown on the Drawings.

##### 1.4 QUALIFICATIONS

- A. *All plastic pipe* shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The equipment shall be designed, constructed, and installed in accordance with ASTM and AWWA methods and shall comply with these Specifications.

##### 1.5 SUBMITTAL

- A. *Shop drawings* shall be submitted to the Engineer for approval in accordance with these Specifications and shall include dimensioning and technical specification for all piping to be furnished.
- B. *Submit samples* of all materials specified herein to the Engineer for approval when requested.

##### 1.6 PIPE MARKING

- A. *All PVC pipe* shall be marked with the following information:
  1. Manufacturer's name or trademark.
  2. Nominal pipe size and OD base.
  3. AWWA or ASTM material code designation.
  4. Dimension ratio.
  5. AWWA pressure class.
  6. AWWA or ASTM specification designation (AWWA C900, ASTM D 2241).
  7. Product record code.
  8. Certification seal(s), if required.

## 1.7 RECEIVING, HANDLING, AND STORAGE

- A. *Receiving, handling, and storage* of PVC pipe shall be in accordance with AWWA Manual No. M23, "PVC Pipe Design and Installation," except that all PVC pipe which is stored longer than 1 week shall be covered with an opaque material.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. *Pipe* shall meet ASTM D 2241, "Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR)," class as shown on Drawings; or AWWA C900, class as shown on Drawings. Length shall be 20 feet.
- B. *Potable water service* certification shall be NSF No. 14, "National Sanitation Foundation Standard No. 14 for Thermoplastic Materials, Pipe, Fittings, Valves, Traps and Joining Materials."
- C. *Gasket* shall be ASTM F 477, "Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe." Gaskets for pipe 6 inch and larger shall be supplied with retainer rings.
- D. *Push-on joint* shall be ASTM D 3139, "Standard Specification for Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals."
- E. *PVC material 12454-B (PVC 1120)* shall be ASTM D 1784, "Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPC) Compounds."
- F. *Fittings* shall be short or long body ductile iron and shall be equipped with EBAA Series 2000 PV restrainers, or approved equivalent.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. *Alignment and Grade.* All pipe shall be laid to, and maintained at, the established lines and grades. Fittings, valves, air vents, and hydrants shall be installed at the required locations with valve and hydrant stems plumb.
- B. *Trench Construction*
  - 1. *Stockpiling Excavated Material:* All excavated material shall be stockpiled in a manner that will not endanger the work or obstruct sidewalks and driveways. Hydrants under pressure, valve-pit covers, valve boxes, curb-stop boxes, fire and police call boxes, and other utility controls shall be kept accessible.

## 2. Trench Width

- a. *Trench width at the ground surface* may vary depending on depth, type of soil, and position of surface structures. The minimum clear width of the trench, sheeted or unsheeted, measured at the springline of the pipe shall be 1 foot greater than the outside diameter of the pipe. The maximum recommended clear width of the trench at the top of the pipe is equal to the pipe outside diameter plus 2 feet. If the maximum recommended trench width must be exceeded or if the pipe is installed in a compacted embankment, then pipe embedment shall be compacted to a point of at least  $2\frac{1}{2}$  pipe diameters from the pipe on both sides of the pipe or to the trench walls, whichever is less.
  - b. *Construction with a Trencher*
    - 1) Provide at least 2 inches of clear space on each side of pipe to allow for pipe placement and embedment.
    - 2) For 1½- and 2-inch pipe, a trench width of 6 inches is recommended.
    - 3) For 3-, 4-, and 6-inch pipe, a trench width of 12 inches is recommended.
    - 4) For 8-, 10-, and 12-inch pipe, a trench width of 18 inches is recommended.
  - c. Quantities of crushed stone embedment in rock trenches shall be based upon the actual width of trench, not to exceed 2 feet plus the pipe outside diameter, unless authorized by the Engineer.
3. *Dewatering:* Where conditions are such that running or standing water occurs in the trench bottom or the soil in the trench bottom displays a "quick" tendency, the water shall be removed by pumps and other suitable means (such as well points or pervious underdrain bedding) until the pipe has been installed and the backfill has been placed to a sufficient height to prevent flotation of pipe. Generally, a depth of backfill over the top of the pipe equal to  $1\frac{1}{2}$  pipe diameters is sufficient to prevent flotation.
4. *Preparation of Trench Bottom:* The trench bottom shall be constructed to provide a firm, stable, and uniform support for the full length of the pipe. Bell holes shall be provided at each joint to permit proper assembly and pipe support. Any part of the trench bottom excavated below grade shall be backfilled to grade and shall be compacted as required to provide firm pipe support. When an unstable subgrade condition is encountered that could provide inadequate pipe support, additional trench depth shall be excavated and refilled with suitable foundation material. Ledge rock, boulders, and large stones shall be removed to provide 6 inches of cushion on all sides of the pipe and accessories.
5. *Laying of Pipe:* To prevent damage, proper implements, tools, and equipment shall be used for placement of the pipe in the trench. Under no circumstances shall pipe or accessories be dropped into the trench. All foreign matter or dirt shall be removed from the pipe interior. Pipe joints shall be assembled with care. Field cut ends of pipe shall be beveled. Use factory bevel as a guide in preparing field

cuts. Round off any sharp edges on the leading edge of the bevel. Sharp edges and improper field beveling can result in cut gaskets or gasket push outs. Apply lubricant to beveled spigot only or as recommended by the pipe manufacturer. Align spigot and bell and apply firm steady pressure by hand or by bar and block assembly until spigot easily slips through the gasket. Insert spigot up to the insertion mark. Do not over insert spigot or disturb previously assembled pipe joints. When pipe laying is not in progress, open ends of installed pipe shall be closed to prevent entrance of trench water, dirt, foreign matter, or small animals into the pipeline.

6. *Restrained Joints:* Unless otherwise shown, restraint devices shall be provided at each hydrant, valve, bend, tee, and at reducers and fittings where changes occur in pipe diameter or direction and for the distance shown on the Drawings in all directions from the joints. For joining PVC pipe to ductile iron MJ fittings, restraining devices shall be EBAA Series 2000PV, Ford Uni-Flange Series 1300, or approved equal. For joining together PVC pipe, restraining devices shall be EBAA Series 1600 or 6500, Ford Uni-Flange 1350, or approved equal. Install restraints in accordance with manufacturer's recommendations. Install number of restraints recommended by manufacturer for size of pipe, type of fitting, and type of soil. Thrust blocks may be required in addition to restraint devices where specifically shown on the Drawings.
7. *Pipe Embedment:* PVC pipe shall be installed with crushed stone (less than ¾-inch diameter), select earth backfill, or sand bedding providing uniform longitudinal support under the pipe. Backfill material shall be worked under the sides of the pipe to provide satisfactory haunching. Initial backfill material shall be crushed stone and shall be placed to a minimum depth of 12 inches over the top of the pipe as shown on the Drawings. All pipe embedment material shall be selected and placed carefully. Sharp stones and crushed rock (larger than ¾ inch) which could cause significant scratching or abrasion of the pipe, shall be excluded from the embedment material. Bedding and initial backfill shall be compacted to a minimum of 90 percent standard proctor.
8. *Final Backfill:* After placement and compaction of pipe embedment materials and initial backfill, the balance of backfill materials may be machined placed. The material shall contain no large stones or rocks, frozen material or debris. Proper compaction procedures shall be exercised to provide required 90 percent density, standard proctor.

### 3.2 TESTING

- A. *Testing.* Pressure and leakage tests shall be performed in accordance with the latest edition of AWWA Standard C600.
- B. *After all piping has been placed and backfilled between the joints,* each run of newly laid pipe, or any valved section thereof, shall be tested by the Contractor in the presence of the Engineer, and tests shall be continued until all leaks have been made tight to the satisfaction of the Engineer.
- C. *To prevent floating* of the pipe, sufficient backfill shall be placed prior to filling pipe with water and subsequent field testing. Where local conditions require that the trenches

be backfilled immediately after the pipe has been laid, the testing may be carried out after backfilling has been completed, but before placement of permanent surface.

At least seven days shall elapse after the last concrete thrust or reaction blocking, if used, has been cast with normal (Type I) portland cement. The elapsed time may be reduced to three days with the use of a high-early-strength (Type III) portland cement. It is suggested that testing be conducted first on short lengths of installed pipe line, thereby permitting the installer to verify that proper installation and joint assembly techniques have been employed.

1. *Filling, Drainage, and Air Relief of Mains:* Water mains shall be drained through drainage branches or blow-offs. Drainage branches and blow-offs shall be provided with valves and shall be located at low points and dead ends. Drainage branches or blow-offs must not be connected to any sewer, submerged in any stream, or be installed in any other manner that can permit back siphonage into the distribution system. Permanent air vents shall be installed at all high points. If permanent air vents are not required at all high points, the installer shall install corporation cocks at all such points to expel air during initial filling and pressure testing of the lines. Lines shall be filled slowly with maximum velocity of 2 fps, preferably 1 fps, while venting all air. After filling, lines shall be flushed at hydrants, blow-offs, and dead ends at minimum velocity of 2.5 fps. Valves shall be closed very slowly to prevent surges.
2. *Procedure:* The following procedure is based on the assumption that the pressure and leakage tests will be performed at the same time. Separate tests may be made if desired, in which case the pressure test shall be performed first. The specified test pressure shall be applied by means of a pump connected to the pipe. The test pressure shall be maintained (by additional pumping if necessary) for the specified time. While the line is under pressure, the system and all exposed pipe, fittings, valves, and hydrants shall be carefully examined for leakage. All defective elements shall be repaired or replaced and the test repeated until all visible leakage has been stopped and the allowable leakage requirements have been met.
3. *Test Method:* The installer may perform simultaneous pressure and leakage tests, or he may perform separate pressure and leakage tests on the installed system at test durations and pressures specified below.

## SYSTEM TEST METHODS

Procedure	Pressure	Test Duration (hours)
Simultaneous pressure and leaking tests	150% of working pressure at point of test, but not less than 125% of normal working pressure at highest elevation or the rated pressure of the pipe, whichever is greater	2
Separate pressure test	150% of working pressure at point of test, but not less than 125% of normal working pressure at highest elevation or the rated pressure of the pipe, whichever is greater	1
Separate leakage test	150% of normal average working pressure of segment tested, but not less than the rated pressure of the pipe	2

Source: Recommended Standard for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe, UNI-B-3, Uni-Bell Plastic Pipe Association as modified by FmHA Instruction 1942-A, Paragraph 1942.18(d)(15)

4. *Allowable Leakage.* The duration of each leakage test shall be 2 hours, unless otherwise specified, and during the test the main shall be subjected to the pressure required in the following table.

Allowable Leakage Per 1,000 Feet or 50 Joints (gal/hr)										
Nominal Pipe Size (inches)	Average Test Pressure in Line (psi)									
	100	110	120	130	135	140	150	175	200	250
4	0.28	0.29	0.30	0.31	0.32	0.32	0.32	0.32	0.32	0.32
6	0.41	0.43	0.45	0.47	0.48	0.48	0.48	0.48	0.48	0.48
8	0.55	0.57	0.60	0.62	0.63	0.64	0.64	0.64	0.64	0.64
10	0.68	0.71	0.75	0.78	0.79	0.79	0.79	0.79	0.79	0.79
12	0.82	0.86	0.89	0.93	0.95	0.95	0.95	0.95	0.95	0.95

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 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air in the pipeline has been expelled. For all test pressures less than 137 psi, no installation shall be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{ND\sqrt{P}}{7400}$$

Where: L = allowable leakage, gph  
 N = number of joints in the length of pipeline tested  
 D = nominal diameter of the pipe, inch  
 P = average test pressure during the leakage test, psig

For all test pressures equal to or exceeding 137 psi, pipeline leakage shall not exceed 10 gallons per nominal inch of pipe diameter per mile of pipe per 24 hours when tested at the specified test pressure.

Leakage values determined by the above formulas are to be found in the preceding table.

### 3.3 DISINFECTION

- A. *All PVC potable water piping* shall be flushed, disinfected, and bacteriologically tested prior to use in accordance with AWWA Standard C651, latest revision.

END OF SECTION





## SECTION 15074

### POLYVINYL CHLORIDE PIPE FOR GRAVITY SEWER

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *Contractor shall furnish* all labor, materials, equipment and incidentals required to install the plastic piping in the locations as shown on the Drawings the plastic piping as specified herein.

##### 1.2 RELATED WORK

- A. Section 15062, Ductile Iron Pipe and Fittings.

##### 1.3 DESCRIPTION OF SYSTEM

- A. *Plastic pipe* shall be used for gravity sewer main and service line piping.
- B. *Piping shall be installed* in the locations as shown on the Drawings.

##### 1.4 QUALIFICATIONS

- A. *All plastic pipe* shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The equipment shall be designed, constructed, and installed in accordance with ASTM and Uni-Bell methods and shall comply with these Specifications.

##### 1.5 SUBMITTAL

- A. *Shop drawings* shall be submitted to the Engineer for approval in accordance with these Specifications and shall include dimensioning and technical specification for all piping to be furnished.
- B. *Submit to the Engineer*, for approval when requested, samples of all materials specified herein.

##### 1.6 PIPE MARKING

- A. *All PVC pipe* shall be marked with the following information:
  1. Manufacturer's name or trademark.
  2. Nominal pipe size.
  3. ASTM material code designation.
  4. ASTM specification designation (ASTM D 3034, ASTM F 679).

## 1.7 RECEIVING, HANDLING, AND STORAGE

- A. *Receiving, handling, and storage* of PVC pipe shall be in accordance with AWWA Manual No. M23, "PVC Pipe Design and Installation," except that all PVC pipe which is stored longer than 1 week shall be covered with an opaque material.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. *Pipe and fittings* shall meet the requirements of:
  1. ASTM D 3034 "Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings," SDR35, in sizes 4"-15".
  2. ASTM F 679 "Standard Specification for Polyvinyl Chloride (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings" T-1, SDR35, in sizes 18"-27".
- B. *Gasket* shall be ASTM F 477, "Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe." Gaskets shall be factory installed and positively retained by means of a stainless steel, polypropylene or PVC ring.
- C. *Push-on joint* shall meet ASTM D 3212, "Standard Specification for Joints for Drain and Sewer Pipes Using Flexible Elastomeric Seals."
- D. *PVC material* shall be 12454-B, 12454-C, or 13343-C as defined in ASTM D 1784, "Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPC) Compounds."

## PART 3 - EXECUTION

### 3.1 EXISTING UTILITIES

- A. *Carefully protect* from damage at all times all existing sewers, water lines, gas lines, underground conduits, telephone lines, sidewalks, curbs, gutters, pavements, electric lines, or other utilities or structures in the vicinity of the work. Where it is necessary for the proper accomplishment of the work to repair, remove and/or replace any such utility, the work shall be done under the provisions set forth in the General Conditions. No separate payment shall be made for removing and replacing and/or repairing damaged existing sewers; water, gas, electric, telephone lines or conduits; or other utilities, culverts, drains, or conduits of similar existing services or structures. Similar repair and replacement of sidewalks, curbs, gutters, and pavements are provided elsewhere in these Specifications.
- B. *Sewers to be installed parallel* to any existing or proposed water main shall be laid at least 10 feet, horizontally, from the water main. If conditions prevent the 10-foot separation, the sewer may be constructed closer to a water main if it is laid in a separate trench and if the bottom of the water main is at least 18 inches above the top of the sewer.

- C. *When sewers cross under water mains*, the top of the sewer shall be at least 18 inches below the bottom of the water main. If necessary, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint ductile iron pipe for a distance of 10 feet on each side of the sewer. One full length of water main shall be centered over the sewer so that both joints will be as far from the sewer as possible.
- D. *When it is impossible to obtain proper horizontal and vertical separation* as stipulated above, both water main and sewer shall be constructed of mechanical-joint ductile iron pipe and shall be pressure tested to assure water tightness.
- E. *When sewer lines cross under culverts* where the sewer and the culvert are less than 18 inches apart, the sewer line shall be encased in concrete as shown on the Standard Drawings.

### 3.2 INSTALLATION

- A. *Alignment and Grade.* All pipe shall be laid to, and maintained at, the established lines and grades. The Contractor may set line and grade for the sewer by using a laser beam coaxially through the sewer being laid.
- B. *Trench Construction*
  - 1. *Stockpiling Excavated Material:* All excavated material shall be stockpiled in a manner that will not endanger the work or obstruct sidewalks and driveways. Hydrants under pressure, valve-pit covers, valve boxes, curb-stop boxes, fire and police call boxes, and other utility controls shall be kept accessible.
  - 2. *Dewatering:* Where conditions are such that running or standing water occurs in the trench bottom or the soil in the trench bottom displays a "quick" tendency, the water shall be removed by pumps and other suitable means (such as well points or pervious underdrain bedding) until the pipe has been installed and the backfill has been placed to a sufficient height to prevent flotation of pipe. Generally, a depth of backfill over the top of the pipe equal to 1½ pipe diameters is sufficient to prevent flotation.
  - 3. *Preparation of Trench Bottom:* The trench bottom shall be constructed to provide a firm, stable, and uniform support for the full length of the pipe. Bell holes shall be provided at each joint to permit proper assembly and pipe support. Any part of the trench bottom excavated below grade shall be backfilled to grade and shall be compacted as required to provide firm pipe support. When an unstable subgrade condition is encountered that could provide inadequate pipe support, additional trench depth shall be excavated and refilled with suitable foundation material. Ledge rock, boulders, and large stones shall be removed to provide 6 inches of cushion on all sides of the pipe and accessories.
  - 4. *Laying of Pipe:* To prevent damage, proper implements, tools, and equipment shall be used for placement of the pipe in the trench. Under no circumstances shall pipe or accessories be dropped into the trench. All foreign matter or dirt shall be removed from the pipe interior. Pipe joints shall be assembled with care. When pipe laying is not in progress, open ends of installed pipe shall be closed to prevent entrance of trench water, dirt, foreign matter, or small animals into the pipeline.

5. *Pipe Embedment:* PVC pipe shall be installed with crushed stone (less than ¾-inch diameter or washed No. 7 stone as designated on the Drawings) or sand bedding providing uniform longitudinal support under the pipe. Backfill material shall be worked under the sides of the pipe to provide satisfactory haunching. Initial backfill material shall be crushed stone and shall be placed to a minimum depth of 12 inches over the top of the pipe as shown on the Drawings. All pipe embedment material shall be selected and placed carefully. Sharp stones and crushed rock (larger than ¾ inch) which could cause significant scratching or abrasion of the pipe, shall be excluded from the embedment material. Bedding and initial backfill shall be compacted to a minimum of 90 percent standard Proctor.
  
6. *Final Backfill:* After placement and compaction of pipe embedment materials and initial backfill, the balance of backfill materials may be machined placed. The material shall contain no large stones or rocks, frozen material or debris. Proper compaction procedures shall be exercised to provide required 90 percent density, standard Proctor.

### 3.3 TESTING

- A. *The maximum allowable deflection* for PVC pipe is 5 percent. No less than one week after installation and backfill, all PVC pipe, 8-inch and larger, shall be checked by pulling an Engineer-approved 9-arm mandrel sized at 95 percent of the actual pipe inside diameter through the pipe. Any pipe not passing shall be replaced and retested.
  
- B. *Infiltration* shall be limited to 25 gallons per day per inch of pipe diameter per mile of pipe. The test to determine this limit shall be low pressure air exfiltration test meeting UNI-BELL recommended practice. If the elapsed time for a 0.5 psig pressure drop equals or exceeds those listed in Table 1, the section being tested shall have passed. The beginning test pressure shall be 3.5 psig plus the average vertical height, in feet, of ground water above the sewer pipe invert, divided by 2.31.

TABLE 1  
Minimum Time Required for a 0.5 psig Pressure Drop  
for Size and Length of Pipe Indicated

Pipe Dia. (in.)	Min. Time (min/sec)	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
8	3:47	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54

- C. *Contractor shall furnish* all supplies, materials, labor, services, equipment, etc., needed to make the tests required in these Specifications.

END OF SECTION



## SECTION 15090

### PIPE COUPLINGS AND EXPANSION JOINTS

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *The work covered by this section includes furnishing all labor, equipment, and materials required to furnish and install pipe couplings and expansion joints, including grooved couplings, flanged adaptors, expansion couplings, and rubber expansion joints, as shown on the Drawings, specified herein, and/or required for proper installation of piping and equipment.*

##### 1.2 SHOP DRAWINGS AND ENGINEERING DATA

- A. *Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of the Section 01340, Shop Drawings, Product Data and Samples.*

##### 1.3 STORAGE AND PROTECTION

- A. *Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending between supports. Items such as pipe, structural steel, and sheet construction products shall be stored with one end elevated to facilitate drainage.*

##### 1.4 SHOP PAINTING

- A. *Clean, shop prime, and shop paint all pipe couplings as specified herein.*

##### 1.5 GUARANTEE

- A. *Provide a guarantee against defective materials and workmanship in accordance with the requirements of the applicable provisions of Section 01740, Warranties and Bonds.*

#### PART 2 - PRODUCTS

##### 2.1 EXPANSION COUPLINGS

- A. *Unless otherwise shown or specified, expansion couplings shall be of a gasketed, short sleeve type, with a diameter to fit the pipe properly. Expansion couplings shall have a working pressure of not less than 150 psig.*
- B. *Each short sleeve coupling for joining ductile iron or steel pipe shall consist of one cylindrical steel middle ring without pipe stop, two steel follower rings, two rubber-compound, wedge section gaskets, and a sufficient number of track head, electroplated steel bolts to compress the gaskets properly. Steel couplings shall be Dresser Style 38, Rockwell Style 411, or equal.*

- C. *Where expansion couplings are required for joining ductile iron pipe to steel pipe of the same nominal size, steel transition couplings, Dresser Style 62, Rockwell Style 413, or equal, shall be used.*
- D. *Rubber gaskets shall be composed of a resilient synthetic rubber compound suitable for use in wastewater containing oil and grease.*

## 2.2 GROOVED COUPLINGS

- A. *Grooved couplings for ductile iron pipe shall consist of two or more ductile iron housing clamps, a single rubber-compound gasket and electroplated oval-neck track bolts with heavy hex nuts. Housing shall be ribbed for strength and self-centering. Rubber gasket shall be composed of a resilient synthetic rubber compound suitable for use in wastewater containing oil and grease.*
- B. *Grooved couplings shall provide for a pipe end separation of not less than 3/32-inch and a deflection of not less than 0°45'.*
- C. *Grooved couplings shall engage two circumferential grooves cut at the ends of the pipe sections to be joined. The grooves shall provide a positive mechanical grip that locks the pipe ends together such that they cannot blow apart under pressure, vibration, or sag. Grooves shall be cut with a radius at the inside corners of the grooves.*
- D. *Grooved couplings for joining ductile iron pipe shall be Vitaulic Style 31, Gustin-Bacon Gruvajoint No. 500, or equal.*

## 2.3 FLANGED ADAPTORS

- A. *Flanged adaptors shall be used for joining plain end ductile iron pipe to flanged valves, pumps, and fittings. Flanged adaptors shall be suitable for working pressures to 150 psig.*
- B. *Flanged adaptors in sizes 12-inch and smaller shall consist of an ASTM A 126, Class B cast iron flanged body drilled to mate with a 125-pound cast iron flange per ANSI B16.1, a cast iron follower ring, a rubber-compound, wedge section gasket, and a sufficient number of track head, electroplated steel bolts to compress the gasket properly.*
- C. *Flanged adaptors in sizes 14-inch and larger shall consist of a high strength steel flanged body drilled to mate with a 125-pound cast iron flange per ANSI B16.1, a high strength steel follower ring, a rubber-compound, wedge section gasket, and a sufficient number of electroplated steel bolts to compress the gasket properly.*
- D. *Rubber gasket shall be composed of a resilient synthetic rubber compound suitable for use in wastewater containing oil and grease.*

## 2.4 FLANGED RUBBER EXPANSION JOINTS

- A. *Flanged rubber expansion joints shall be standard spool-type single or multiple arch expansion joints constructed of abrasion-resistant rubber reinforced with high tensile strength synthetic fabric and steel rings.*



- B. *Ends of the expansion joint* shall be integral with the body and shall be full faced and drilled per ANSI B16.1 for 125-pound flanges. Beveled and split, galvanized steel retaining rings shall be provided to prevent damage to flanges and to distribute bolting stresses during assembly.
- C. *Tube, body, and flanges* shall be constructed using Buna-N for wastewater, natural rubber for clean water, and Buna-N or neoprene for air. For working temperatures in excess of 180°F or for chemical service, tube, body, and flanges shall be constructed of Viton. The exterior of the expansion joint shall be coated with Hypalon to resist weathering.
- D. *When used to convey slurries, raw water, or untreated wastewater* in horizontal piping, arches shall be filled with a special soft rubber compound integrally cured in the arches.
- E. *In unrestrained piping systems* or pipe systems subject to excessive longitudinal deflection, joints shall be furnished with two plated steel control rods fitted with nuts to limit compression and extension and prevent damage to the joint.
- F. *Rubber expansion joints* shall be "Redflex," as manufactured by Red Valve Company, "Invincible Expansion Joint," as manufactured by Mercer Rubber Company, or equal, subject to the requirements of this section.

**2.5 SLIP-ON RUBBER EXPANSION JOINTS**

- A. *Slip-on rubber expansion joints* for low pressure applications (less than 15 psig) up through 6-inch diameter in size shall be sleeve-type, single-arch expansion joints constructed of abrasion resistant rubber reinforced with high tensile strength synthetic fabric.
- B. *Ends of the joint* shall be designed to slip over pipe ends and shall be secured in place with adjustable stainless steel clamps. Two (2) clamps shall be provided on each end of the joint.
- C. *Joint shall be constructed of Buna-N* for wastewater and Buna-N or neoprene for air at working temperatures up to 180°F.

**2.6 SHOP COATINGS**

- A. *Couplings and adaptors* shall have finish as follows:

<u>Material</u>	<u>Location</u>	<u>Primer</u>	<u>Finish</u>
Ductile Iron	Buried, Submerged, or Exposed	Epoxy Primer Interior	Epoxy
Ductile Iron	Buried, Submerged, or Exposed	Epoxy Primer (Exterior)	Epoxy
Steel	Buried, Submerged, or Exposed	Epoxy Primer Interior	Epoxy Finish

<u>Material</u>	<u>Location</u>	<u>Primer</u>	<u>Finish</u>
Steel	Buried, Submerged, or Exposed	Epoxy Primer (Exterior)	Coal Tar Epoxy

- B. *Coatings used for couplings and adaptors in potable water shall be approved for use with potable water.*

## 2.7 SPARE PARTS

- A. *Furnish 2 spare gasket sets and 2 spare track head bolt sets for each size and type of coupling.*

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. *Pipe couplings and expansion joints shall be installed where shown on the Drawings, required, or directed by the Engineer. Couplings and joints shall be installed in strict conformance with the manufacturer's instructions.*
- B. *Pipe ends shall be cleaned, brushed, or filed to produce a mating surface for the gasket that is free from dirt, rust, chuck marks, mill scores, dents, burrs or other foreign substances that would impede proper gasket seating.*
- C. *Grooves for grooved couplings shall be accurately located and cut with a suitable grooving tool.*
- D. *A lubricant recommended by the coupling manufacturer shall be used in seating all gaskets.*
- E. *On expansion couplings and flanged adaptors, bolts shall be tightened diametrically opposite each other and in progression so that the inner rims project an equal distance over the flares of the middle ring at all points. Bolts shall be tightened sufficiently to ensure a watertight joint but shall not be tightened beyond the point of stretching.*
- F. *On grooved couplings, bolts shall be tightened alternately and uniformly so the housing clamps come together evenly and the gasket is not pinched. Bolts shall be tightened until the housing clamps meet.*
- G. *Couplings shall be field painted, following installation and testing, in accordance with the requirements listed previously in this section. Rubber expansion joints shall not be painted.*

END OF SECTION

## SECTION 15101

### VALVES

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *The work covered by this section includes furnishing all labor, equipment, and materials required to furnish and install all metal valves, including operators, boxes, and accessories, as specified herein, shown on the Drawings, or required for proper completion of the work under these Contract Documents.*
- B. *The Contractor's attention is called to the fact that all valves, especially in the smaller sizes, are not necessarily shown completely on the Drawings, which are more or less schematic. Furnish and install all valves indicated or required for proper operation of the equipment or services requiring such valves.*

##### 1.2 SHOP DRAWINGS AND ENGINEERING DATA

- A. *Submit complete shop drawings and engineering data to the Engineer in accordance with the requirements of Section 01340, Shop Drawings, Product Data and Samples.*

##### 1.3 STORAGE AND PROTECTION

- A. *Store and protect valves and accessories in accordance with the requirements of the valve manufacturer or as directed by the Engineer.*
- B. *Completely drain valves prior to shipment. Protect ends of flanged and mechanical joint valves with full size wooden baffles securely bolted to the valve ends. Size of baffles shall be at least equal to outside diameter of flange. Secure valves 24 inches in size and larger to a wooden skid to facilitate handling and storage.*

##### 1.4 SHOP PAINTING

- A. *Clean, shop prime, and shop paint valves and accessories in accordance with the requirements of these Specifications.*
- B. *All interior and exterior nonmachined, nonbearing ferrous surfaces on iron body valves, gates, and accessories shall be blast-cleaned and painted at the factory with two coats of asphaltic varnish conforming to Federal Specification TT-V-51c, unless otherwise specified. Exterior nonmachined, nonbearing ferrous surfaces on valve operators and on nonsubmerged or nonburied butterfly and eccentric plug valves shall be blast-cleaned and painted at the factory with one coat of zinc chromate primer conforming to Federal Specification TT-P-645 and one coat of compatible alkyd enamel. Other paint systems may be proposed by the valve supplier, subject to the Engineer's approval.*

## 1.5 OPERATION AND MAINTENANCE DATA

- A. *Submit complete operation and maintenance data* on the valves in accordance with the requirements of Section 01730, Operating and Maintenance Data.

## 1.6 QUALITY ASSURANCE

- A. *The valve manufacturers shall furnish a written certification* to the Engineer that all valves and operators furnished comply with all applicable requirements of the governing AWWA standards specified herein.

## 1.7 GUARANTEE

- A. *Provide a guarantee* against defective equipment and workmanship in accordance with the requirements of Section 01740, Warranties and Bonds.

# PART 2 - PRODUCTS

## 2.1 GENERAL

- A. *All castings*, regardless of material, shall be free from surface defects, swells, lumps, blisters, sandholes, or other imperfections.
- B. *All valves* shall have the name of the manufacturer, rated working pressure, and size of the valve cast upon the body or bonnet in raised letters. Alternately, the name of the valve manufacturer, rated working pressure, and size may be stamped on a stainless steel identification plate permanently attached to the valve body or bonnet. Valves specified to conform with AWWA requirements shall have the letters "AWWA" cast upon the valve body or bonnet in raised letters.
- C. *Valves and operating mechanisms* shall be of the proper size and dimensions to fit the pipe connections thereto and shall be installed in the position and within the space shown on the Drawings.
- D. *The direction of rotation of the operator to open the valve* shall be to the left (counterclockwise), unless otherwise specified. Each valve body or operator shall have cast thereon the word OPEN and an arrow indicating the direction to open.
- E. *A union or coupling* shall be provided within 2 feet on each side of a threaded end valve unless the valve can be otherwise easily removed from the piping. This shall not apply to soldered end valves in copper plumbing.
- F. *All exposed bolts and nuts* on buried or submerged valves and operators shall be brass or stainless steel for corrosion resistance. Exposed bolts and nuts on exposed valves and operators shall be of corrosion-resistant materials or shall be zinc or cadmium plated.
- G. *Valves and operators* shall be of the proper size to fit the pipe connections and shall fit in the position and space as shown on the Drawings.

- H. *Valve operators* shall be of sufficient size and capacity to seat, unseat, and operate the valve under the maximum specified differential pressure. Where no maximum differential pressure is specified, the operator shall be designed for a differential pressure equal to the maximum working pressure of the valve. Additional allowances shall be made for the lubricating and/or scale-forming tendencies of the fluid.

## 2.2 GATE VALVES

- A. *All gate valves* smaller than 2 inches and those larger than 24 inches shall be of the single disc, double sealed, solid tapered wedge type, unless otherwise specified. Gate valves in sizes 2 through 24 inches shall be of the single disc, resilient seated type, unless otherwise specified. Valves shall have non-rising stems and be capable of being repacked under pressure when valve is fully open. Minimum working pressures shall be 200 psi for valves through 14 inches in size and 150 psi for valves 16 inches and larger.
- B. *Gate valves smaller than 2 inches* shall be bronze body, bronze fitted valves, and have 150-pound, cast bronze body, union bonnet, Teflon-impregnated asbestos packing, and threaded ends per ANSI B2.1. Bronze shall conform to ASTM B62. Brass for nuts and gland shall conform to ASTM V16. Valve discs shall be reversible. Bronze gate valves shall be Stockham Fig. B-130, Nibco Fig. T-136, or equal. For use in copper plumbing, furnish gate valves with solder ends per ANSI B16.18.
- C. *Gate valves larger than 24 inches in water and wastewater* shall be iron body, bronze mounted valves conforming in all respects to the applicable material and dimensional requirements of AWWA C500. Gate valves shall have an O-ring or self-adjusting chevron packing stem seal, and 125-pound flanged ends per ANSI B16.1, except for valves to be buried underground, which shall have mechanical joint ends per ANSI A21.11 (AWWA C111). Body seat rings shall be ASTM B62 bronze and be screwed into the body so as to be field replaceable. Disc faces and all moving parts shall be bronze or bronze mounted. Cast iron for body and bonnet shall conform to ASTM A126, Grade B. Iron body gate valves with solid wedge discs shall be M&H (Dresser) Fig. 2067, or equal. Iron body gate valves with double discs shall be M&H (Dresser) Fig. 67, Mueller Fig. A-2380, or equal.
- D. *Gate valves in sizes 2 through 24 inches for use in water and wastewater* shall be of the ductile iron body, resilient seated type, manufactured in conformance with AWWA C509. Gate shall be of ductile iron with bonded resilient seat and integral flush drain. Minimum working pressure shall be 200 psi when unbalanced pressure is applied to either side of the gate. Gate valves shall have a minimum of two O-ring stem seals; one above and one below the integral stem collar. The area between the O-rings shall be filled with permanent lubricant. Valve shall have no metal fasteners or screws exposed in the wetted portion of the valve. All ferrous surfaces shall be shot-blasted to a white metal finish. All interior and exterior valve surfaces, including the interior of the gate and all bolt holes shall be coated with an epoxy coating in accordance with AWWA C550. The minimum thickness of the coating shall be 8 mils. Valve ends shall be of the type required for the installation as specified herein or shown on the Drawings and meet the requirements as specified in Paragraph C of this section.
- E. *Gate valves 3 inches in size and larger in steam service* shall have 125-pound cast iron body, bronze trim, and outside stem and yoke.

- F. *Furnish gate valves* with nut, wrench, chain, or handwheel operators as shown on the Drawings. Unless otherwise shown or specified, valves shall have operators as specified in this section. Extension stems, floor stands, and valve boxes and covers shall be furnished where shown or required.
- G. *Resilient wedge valves* for buried service 16-inch-diameter and larger shall have bevel gear operators, unless otherwise noted.

**2.3 BUTTERFLY VALVES**

- A. *Unless otherwise shown or specified, butterfly valves shall be of the resilient seated, tight-closing type and conform in all respects to the applicable material and dimensional requirements of AWWA C504. Wafer-type butterfly valves in sizes 24 inches and larger shall conform to all general requirements of AWWA C504 except laying length. Butterfly valves shall operate from fully open to fully closed with a 90-degree rotation of the valve stem.*
- B. *Valves shall be designed for the working pressures and/or pressure class designations shown on the Drawings or specified in these Specifications. If a working pressure or pressure rating is not given, the following requirements shall apply:*

Service	AWWA Pressure Rating
Low Pressure Air	25B
Wastewater or Sludge	150B
Potable or Plant Water	150B

Wafer type valves shall have a pressure rating of not less than 150 psi. Valves shall be drip-tight and bubble-tight at rated pressure differential across the valve in both directions.

- C. *Valve body shall be one-piece, constructed of cast iron conforming to ASTM A126, Class B. The diameter of the opening shall be not less than the diameter of the corresponding pipe size. Unless otherwise specified, valve body shall be of the short-body style in accordance with Table 2 of AWWA C504. This requirement shall not apply to wafer type valves. No part of the valve internals shall extend beyond the valve ends when the valve is in the closed position. Short-body valves shall have 125-pound flanged ends per ANSI B16.1. Wafer type valves shall be designed to fit between 125-pound flanges per ANSI B16.1.*
- D. *Disc shall be cast bronze conforming to ASTM B143, Alloy 1A, cast iron conforming to ASTM A126, Class B, Ni-resist cast iron conforming to ASTM A436, Type 1 or 2, or Ni-resist ductile iron conforming to ASTM A439, Type D2. When used in wastewater or raw water, disc shall be streamlined with no exterior ribbing or openings.*
- E. *Shafts shall be polished stainless steel conforming to ASTM A276, Type 304 or Type 316. All keys and pins used in securing valve disc to shafts shall be stainless steel or monel.*
- F. *Valve seat shall be one-piece, molded synthetic rubber, Buna-N (Hycar) for wastewater and Buna-N or neoprene for air. Where temperatures exceed 180°F, EPT or Viton seats shall be used. Retaining rings, if used, shall be stainless steel. The method of*

mounting valve seat shall conform to the applicable requirements of AWWA C504, Section 3.5. Valve seats in sizes 24 inches and larger shall be field replaceable without necessity of chipping, burning, or cutting. Seats secured with retaining rings shall be fully adjustable. Metal seat mating surfaces shall be smoothly contoured and polished 18-8 stainless steel or monel. Alloy cast iron will not be acceptable as a seat mating surface. Sprayed or plated seat mating surfaces will not be acceptable.

G. *Shaft seals* shall be O-ring or self-adjusting chevron packing of Buna-N or neoprene. Shaft seals shall conform to the requirements of AWWA C504, Section 3.7, and shall be of a design that allows replacement of the seal without removing the valve shaft. Alternately, pull-down packing is acceptable if the packing is adjustable and replaceable without removing valve operator.

H. *Valve bearings* shall be self-lubricating, sleeve-type bearings of corrosion resistant materials. Bearing load shall not exceed 2,500 psi. Provide valves 24 inches in size and larger with an adjustable, two-way thrust bearing to center the disc in the valve and allow the valve to be installed with the valve stem vertical. Bearing shall be easily accessible for adjustment.

I. *Where the valve is installed adjacent to a fitting, flow meter, another valve, or similar items, furnish a spool piece or adaptor coupling as a spacer so that valve disc does not interfere with the operation of the adjacent meter or valve or contact cement linings on pipe or fittings.*

J. *Furnish valve with a lever operator, rotary manual operator, electric motor operator, or pneumatic cylinder operator as shown on the Drawings. Unless otherwise shown or specified, furnish a lever operator on valves 6 inches and smaller and a rotary manual operator on valves 8 inches and larger. Furnish extension stem and floorstand where shown or required.*

K. *Butterfly valves for drinking water service shall be coated interior and exterior with 10 mils, minimum, of TNEMEC Potapox 20, fully compliant with AWWA C550.*

L. *Butterfly valves shall be as manufactured by Dezurik, Pratt, or equal.*

## 2.4 CURB STOPS AND CORPORATION STOPS

A. *Curb stops* shall be of all-bronze construction with straight-through unobstructed pattern flow, Teflon-coated plug, top and bottom O-ring plug seals, O-ring port seals, and solid tee handle. Valves shall be suitable for 175-psi minimum working pressure. A quarter turn shall operate the valve from fully open to fully closed position. Valves shall comply with the applicable requirements of AWWA C800.

B. *Furnish curb stops* with cast iron foot pieces to permit the curb box to rest on a solid surface without bearing on the curb stop or piping.

C. *Curb boxes* shall be of cast iron, have a 2-inch inside diameter, and be of the extension type with lid and plug. One compatible steel shut-off rod of suitable length shall be furnished. Coat curb boxes and bases with a suitable bituminous coating.

D. *Corporation stops* for service line connections shall be precision fitted, individually lapped, ground joint key stops of all bronze construction. For tapped connections to

water mains, inlet threads shall be of the steep taper, corporation stop type. Corporation stops shall conform to the applicable requirements of AWWA C800.

## 2.5 AIR RELEASE VALVES

- A. *Air release valves* shall have cast iron body and cover, stainless steel float, stainless steel or bronze trim, and Buna-N seat. All other attaching parts or internal parts shall be stainless steel or bronze.
- B. *Valve shall be designed* for a working pressure of 0 to 150 psi unless otherwise shown or specified and shall be equipped with an orifice appropriate to the venting needs of the pipeline.
- C. *Sewage valves* shall be equipped with an elongated body, a 2-inch NPT inlet connection, and a ½-inch NPT outlet connection and shall be provided with 2-inch inlet shut-off valve, 1-inch blow-off valve, and ½-inch back-flush valve with quick-disconnect coupling and flushing hose with quick-disconnect connections.
- D. *Pressure water valves* shall be installed in valve pit, complete with tapping saddle and connecting line to main, gate valve, etc., and at the location(s) shown on the Drawings. Clean, prime, and paint valve exterior with bituminous paint. Valves 2 inches and smaller shall have NP screwed inlet. Combination air vacuum/air release valve shall be Valve and Primer Corporation, APCO Air Release Valve (Standard), Crispin Universal Air Valve, or equal.

## 2.6 PRESSURE REDUCING VALVES FOR WATER

- A. *Pressure reducing valves* shall automatically reduce a higher inlet pressure to a preset, steady outlet pressure. The reducing valve shall be very sensitive to slight pressure changes and immediately control the main valve to maintain the desired pressure. Valve outlet pressure shall be adjustable between 3 and 30 psi.
- B. *The main valve* shall be direct acting, single seated, spring-loaded, diaphragm-actuated, globe type valve. When the downstream pressure exceeds the pressure setting, the main valve shall close drip-tight. Piston actuators will not be acceptable. Main valve shall be guided at two locations. No external packing glands shall be used and the diaphragm shall not be used as a seating surface.
- C. *Pressure reducing valves sized 2 inches and smaller* shall have cast bronze body; stainless steel seat ring; Teflon, Buna-N, or composition disc and diaphragm; and outside screw adjustment. Valves shall be suitable for 230-psi inlet pressure. Valves shall be furnished with threaded ends per ANSI B2.1. Bronze pressure reducing valves shall be Watts Regulator No. 223S-LP, or equal.
- D. *Pressure reducing valves 2½ inches and larger* shall have cast iron body, bronze trim, bolted cover, and pilot-controlled main valve. The pilot control system shall be external, connected to the valve with union fittings. Pressure setting shall be adjustable by a single screw adjustment enclosed in a tamperproof housing. Valve shall be suitable for an inlet pressure of not less than 175 psi. Valves sized 2½ inches shall have threaded ends per ANSI B2.1. Valves 3 inches and larger shall have 125-pound, flanged ends per ANSI B16.1. Valve body and cover shall be of cast iron conforming to ASTM A48. Valve trim and pilot control shall be of ASTM B61 or B62 bronze. Pilot



control trim shall be stainless steel. Valve shall be supplied with an integral strainer constructed of heavy and fine mesh monel screens to protect the pilot control system from foreign particles. Pilot-controlled valves shall be Clayton Fig. 90G-01, GA Industries Fig. 45-D, or equal.

- E. *A separate Y-pattern strainer* with threaded or bolted cleanout shall be furnished and installed immediately upstream of each pressure reducing valve. Area through the screen shall be not less than 4 times the full pipe area. Strainers shall have a pressure rating not less than that of the protected pressure regulating valve.
- F. *A 2-inch pressure gauge* with tee-head, bronze gauge cock shall be installed on the upstream and downstream side of each pressure regulating valve unit. Pressure gauges on the upstream side shall have a range of approximately 0 to 160 psi. Pressure gauges on the downstream side shall have a range of approximately 0 to 80 psi.

## 2.7 CHECK VALVES

- A. *Check valves shall be of the swing type* suitable for use in either horizontal or vertical piping, unless otherwise shown or specified. Disc shall swing entirely clear of the path of flow when in the open position. All internal parts shall be readily accessible and easily replaced in the field.
- B. *Check valves in sizes 2½ inches and smaller* shall be Y-pattern, regrinding, bronze body, bronze mounted valves. Valves shall have 200-pound cast bronze body, renewable bronze disc, screwed cap, and threaded ends per ANSI B2.1. Bronze for body and cap shall conform to ASTM B61. Brass nuts and pin shall conform to ASTM B16. Valves shall have a hinge bumper capable of preventing the valve from sticking in the open position and an arrow cast on the valve body to indicate direction of flow. Bronze check valves shall be Powell Fig. 560Y, Stockham Fig. B-345, Nibco Fig. T-453-B, or equal.
- C. *Check valves in sizes 3 inches and larger* shall be iron body, bronze mounted valves conforming to AWWA C508, epoxy-coated inside and outside. Valves shall have 125-pound cast iron body, bolted and gasketed cover, stainless steel or bronze hinge pin, rubber faced, renewable, bronze or cast iron resilient disc, renewable bronze seat ring, outside lever and adjustable weight, and 125-pound flanged ends per ANSI B16.1. Cast iron for body and cap shall conform to ASTM A126, Grade B. Bronze for disc and seats shall conform to ASTM B584. Iron body check valves shall be Mueller Fig. A2600-6-01, Clow F-5345, or equal.
- D. *Valves shall be installed with pressure under the disc.*
- E. *Check valves in air or gas piping sized 2½ inches or smaller* shall be bronze, swing type check valves conforming to the requirements of Item B above, except that the disc shall have a replaceable, resilient seat of Buna-N or Teflon. Bronze check valves for air or gas service shall be Nibco Fig. T-453-W, Kennedy Fig. 442, or equal.
- F. *Check valves in air or gas piping sized 3 inches and larger* shall be of the double plate, spring-loaded, clapper type with cast iron body, aluminum bronze or bronze plates, stainless steel hinge pin and springs, and Buna-N seats. When operating temperatures exceed 180°F, Viton seats shall be used. Check valves shall be wafer style bodies

suitable for mounting between two 125-pound ANSI B16.1 flanges. Check valves shall be rated for a working pressure of not less than 150 psi. Clapper style check valves shall be Mission "Duo-Check," FMC, or equal. Install clapper style check valves in horizontal piping with the pin in a vertical position.

## 2.8 HOSE BIBBS

- A. *Hose bibbs* shall be angle hose valves of bronze construction suitable for 125 psi minimum working pressure. Valves shall have a renewable Teflon or resilient disc and shall be furnished with a ¾-inch male hose outlet connection. Body and bonnet shall be ASTM B62 bronze. Valves shall be furnished with a suitable cap and chain. Inlet connection shall be threaded per ANSI B2.1.

## 2.9 ALTITUDE VALVES

- A. *Altitude valves* shall be single-acting, hydraulically operated, pilot actuated, diaphragm or piston type globe valves designed for ground level control of water level in storage tanks. Valve shall be of the non-throttling differential type and shall be air and water cushioned on closing to prevent surges on shutoff. Valve shall be suitable for 175 psi working pressure. Operating point and closing speed shall be adjustable.
- B. *Valve shall have* a cast iron body and bolted bonnet conforming to ASTM A126, Class B, bronze pilot control valve and main valve trim, resilient seat disc, stainless steel pilot trim, and reinforced synthetic rubber diaphragm. Seat ring, disc, and diaphragm shall be removable without removing the valve from the line. Piston type valves shall be constructed with removable resilient seals and guides to prevent metal-to-metal contact. No external packing glands shall be used and the diaphragm shall not be used as a seating surface. Main valve stem shall be guided at both ends. Pilot control shall be three-way, hydraulically balanced, diaphragm type.
- C. *An indicator rod* shall be provided to show valve position. A fine mesh stainless steel or Monel strainer shall be provided in the control piping. A 4½-inch pressure gauge calibrated in both psi and feet of water shall be provided on both sides of the altitude valve.
- D. *Valve shall be furnished* with flanged ends drilled per ANSI B16.1.
- E. *A standard repair kit* shall be supplied for the altitude valve. Kit shall include liner cap, seat ring, cover gasket, indicator packing, vent packing, and piston cup for main valve, seat ring, lower packing, upper packing, stem gasket, and diaphragm for pilot.
- F. *Altitude valves* shall be GA Industries Figure 3200-D; Clayton Figure 206, OCV Series 3331; or approved equal.

## 2.10 MANUAL VALVE OPERATORS

- A. *All gate valves shall be furnished with manual operators* as follows, unless otherwise shown or specified:
1. Buried Extension stem and valve box with standard operating nut

2. Submerged or Located in Deep Vault      Extension stem with floor stand and handwheel operator

- B. *Operating nuts* for buried or submerged valves shall be standard 2-inch-square nuts and shall conform to AWWA C500, Section 19. Extension stems, valve boxes, and stem guides shall be furnished where shown, specified, or required for proper operation.
- C. *Manual rotary operators* for buried or submerged service shall be totally enclosed and completely sealed to prevent the entrance of water and dirt. Buried or submerged operators shall be finished on the outside with a bituminous or other approved coating. Rotary operators for buried or submerged service shall be capable of withstanding 300 foot-pounds of torque on the operating nut or handwheel. A corrosion-resistant, dial type valve position indicator shall be provided at the operating nut on the extension stem of buried operators to provide a remote indication of valve position.
- D. *All manual rotary and lever operators* shall be capable of seating or unseating the valve disc under the most adverse conditions in the particular application with not more than an 80-pound pull on the handwheel or lever. Valve operators shall be capable of holding the valve in any position between fully open and fully closed without creeping or fluttering. Operators shall be provided with adjustable, mechanical, stop-limiting devices to prevent over-travel of the valve disc in the open and closed positions. Manual rotary and lever operators shall comply with all applicable requirements of AWWA C540, Sections 11.1, 11.2, and 11.3.

## 2.11 VALVE BOXES

- A. *All buried valves* shall be provided with three-piece, cast iron, extension sleeve type valve boxes suitable for the depth of cover shown on the Drawings.
- B. *Valve boxes* shall not be less than 5 inches in diameter, shall have a minimum thickness of 3/16 inch at any point, and shall be provided with suitable cast iron bases and covers. Covers shall have cast thereon an appropriate name designating the service for which the valve is intended ("W" for water, "S" for drain or waste lines). Covers in roadways shall be of the deep locking type.
- C. *All parts of valve boxes, bases, and covers* shall be heavily coated with a suitable bituminous finish.
- D. *Valves and boxes shall be set plumb.* Each valve box shall be placed directly over the valve it serves with the top of the box flush with the finished grade.
- E. *Valve box lids* shall be provided with the word "Water" embossed in the lid surface.

## 2.12 T-HANDLE OPERATING WRENCH

- A. *Furnish* two T-handle, steel valve operating wrenches with sockets compatible with standard 2-inch-square valve operating nuts.
- B. *The operating wrenches* shall be at least 36 inches in length.

## 2.13 SPARE PARTS

A. *Furnish the following spare parts where applicable for the valves specified herein:*

- |   |   |
|---|---|
| 1. Stem packing   | One set each type and size of valve       |
| 2. Renewable stainless steel or bronze seat ring                            | One each type and size of valve           |
| 3. O-ring stem or shaft seals   | One set each type and size of valve       |
| 4. Resilient seat or disc   | One each type and size of valve           |
| 5. Shaft bearings or bushings   | One set each type and size of valve       |
| 6. Hinge pin, disc, spring, and disc bolts                                  | One set each type and size of check valve |
| 7. Gaskets  | One set each type and size of valve       |
| 8. Special tool or seat wrench required for valve servicing and maintenance | One each                                  |

B. *Suitably protect spare parts against corrosion and impact to withstand long-term storage. All parts shall be clearly labeled and identified by manufacturer's name and number and the valve to which they belong.*

## PART 3 - EXECUTION

### 3.1 FACTORY TESTS

- A. *Test all valves at the point of manufacture for proper and unobstructed operation and for leakage and adequacy of design.*
- B. *Test iron body gate valves in accordance with AWWA C500, Section 5.*
- C. *Test butterfly and plug valves in accordance with AWWA C504, Section 5.*
- D. *Test iron body check valves in accordance with AWWA C508, Section 5.*
- E. *All other valves shall be given an operation test, a leakage test at rated pressure differential, and a hydrostatic test at two times rated pressure. During the hydrostatic test, there shall be no leakage through the metal, the end joints, or the shaft or stem seal, nor shall any part be permanently deformed. During the leakage test, leakage shall not exceed that permitted by ANSI B16.104, Class IV for metal seated valves and Class VI for resiliently seated valves.*

### 3.2 INSTALLATION

- A. *Install all valves in strict conformance with the Drawings and approved shop drawings and manufacturer's instructions.*
- B. *Install all underground valves using a concrete valve box with cast iron frame and cover or in a cast iron valve box as specified herein.*

- C. *Install valves* in such a way that operators and packing are easily accessible. Valves with field replaceable seats shall be installed with sufficient clearance to permit removal of valve bonnet and stem without removing valve from the line.

### 3.3 FIELD TESTING

- A. *Following installation, test all valves* under the anticipated operating conditions. The ability of the valves to operate properly without leakage, binding, sticking, fluttering, or excessive operating torque shall be demonstrated to the satisfaction of the Engineer. At Contractor's expense, adjust and/or replace any valve as necessary to ensure satisfactory operation.

END OF SECTION



## SECTION 15109

### HYDRANTS

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. *The work covered by this section includes furnishing all materials, labor, and equipment required to furnish, install, and test fire hydrants and yard hydrants and accessories as specified herein and/or shown on the Drawings.*

##### 1.2 QUALITY ASSURANCE

- A. *The manufacturer of the fire hydrants shall furnish a written certification to the Engineer that all hydrants furnished comply with all applicable requirements of AWWA C502, latest edition.*

#### PART 2 - PRODUCTS

##### 2.1 FIRE HYDRANTS

- A. *Fire hydrants shall be of the dry-barrel, compression type and shall conform to the applicable requirements of AWWA C502, latest edition. Fire hydrants shall be cast iron, bronze mounted, suitable for a working pressure of 150 psi. The name of the manufacturer and size of the main valve shall be cast upon the hydrant in raised letters.*
- B. *Hydrants shall be constructed in a manner that will permit withdrawal of internal working parts without disturbing the barrel or casing. Valve shall be compression type, opening against pressure and so constructed that the main valve will remain closed should the hydrant be broken off by traffic accident. Valve opening shall be at least 5¼ inches in diameter and shall have a net area of waterway at the smallest part of not less than 120 percent of the valve opening when the valve is wide open. There shall be no chattering or water hammer under any conditions of operation.*
- C. *Barrel shall be made in two pieces with flanged joint above the finished grade or ground line. Lower barrel shall be fluted for strength and tapered to prevent frost heave. Ground live flange shall be of the break-away type. Two positive acting, bronze fitted drain valves shall be provided in the hydrant shoe automatically to open and provide rapid and complete drainage of the hydrant barrel when the main valve is closed.*
- D. *Hydrant bonnet shall be designed to protect the operating head against rust, corrosion, and dirt. The stuffing box shall be bronze glands and O-ring seal. Suitable means shall be provided for lubricating the stem threads. O-ring, and bearing surfaces in the bonnet.*
- E. *The main valve rod shall be of steel and shall be bronze sheathed where it passes through the stuffing box. Stem shall be equipped with a two-piece safety or breakable*

stem coupling to prevent damage to the stem when hydrant is hit by a vehicle. A positive stop shall be provided to permit full opening of the valve and prevent overtravel of the stem.

- F. *Direction of opening* shall be counterclockwise and shall be cast on the head. Operating nut shall be National Standard, 1½-inch, pentagon shaped.
- G. *Two 2½-inch hose nozzles and one 4½-inch pumper nozzle* shall be provided on each hydrant. Hose and pumper nipples shall be of bronze or noncorrosive metal, and threads shall be National Standard in accordance with NFPA Standard No. 1963. Nipple caps shall be securely chained to the barrel with galvanized, non-kinking chains.
- H. *Hydrants that are to be connected to ductile iron pipe* shall be equipped with mechanical joint inlet with gland, gaskets, bolts, and nuts. Suitable ringtight or fluidtight inlets shall be provided on hydrants that are to be connected to cement asbestos pipe. Inlet bell shall have two lugs for harness restraint.
- I. *After fabrication*, all exterior above-ground ferrous surfaces shall be blast-cleaned and painted at the shop with one coat of zinc chromate primer conforming to Federal Specification TT-P-636 and one coat of compatible alkyd enamel. Color shall be fire hydrant red. All interior and below ground, nonmachined ferrous surfaces shall be blast-cleaned and painted at the shop with two coats of asphaltic varnish conforming to Federal Specification TT-V-51c.
- J. *Fire hydrants shall be as manufactured by Mueller, M&H (Dresser), Kennedy, or equal.*

## 2.2 YARD HYDRANTS

- A. *Yard hydrants* shall be nonfreezing, compression, post type hydrant with self-draining barrel suitable for 150 psi working pressure.
- B. *Yard hydrants* shall have a cast iron bonnet and base, bronze seats, resilient-faced disc, O-ring stem seal, bronze or stainless steel stem, and galvanized steel barrel.
- C. *Furnish yard hydrants* with 1-inch threaded inlet connection per ANSI B2.1 and threaded 1-inch male outlet hose connection with suitable cap and chain. Furnish a ball-wheel handle to operate the valve.
- D. *All internal working parts* shall be readily accessible and removable through the top for ease of maintenance.
- E. *Shop primed and paint hydrant* in accordance with Part 2.1 I. of this section.

## PART 3 - EXECUTION

### 3.1 FACTORY TESTING

- A. *Each hydrant* shall be tested at the factory at a hydrostatic pressure of 300 psig in accordance with AWWA C502, Section 5. Hydrants shall be tested in both the open and closed positions. Hydrants shall be completely drained and closed before shipment.



### 3.2 INSTALLATION

- A. *Hydrants shall be installed* at the locations and in the manner shown on the Drawings. Hydrants shall be inspected, cleaned, and tested for operation prior to installation.
- B. *Fire hydrants shall be isolated* from the water supply main with a buried gate valve not less than 6 inches in size. Hydrants shall be installed in a suitable rock drain and anchored against thrust as shown on the Drawings. Upper barrel joint shall be located approximately 2 inches above ground level. Barrel extensions shall be furnished as necessary.
- C. *Isolate each yard hydrant* from the water supply by a 1-inch curb stop as shown on the Drawings.
- D. *After installation*, each valve shall be tested in the presence of the Engineer for proper operation and leaktightness. Any leaks shall be corrected.
- E. *Following installation and testing*, exposed ferrous surfaces of hydrants shall be field painted with alkyd system ferrous metal finish.

END OF SECTION



SECTION 15182  
WATER SERVICES

PART 1 - GENERAL

1.1 SCOPE

- A. *The work described by this section includes furnishing all labor, materials, and equipment required to install new water meters, including all meter boxes and covers, meter yokes, valves, fittings, accessories, etc., as specified herein and/or shown on the Drawings.*

PART 2 - PRODUCTS

A. COPPER SERVICE TUBING

- B. *Copper service tubing shall be seamless Type K soft copper, ASTM B88.*

2.1 METER FITTINGS AND ACCESSORIES

- A. *Service saddles shall be utilized in connecting corporation stops and service lines to all ductile iron, cast iron, or PVC water mains. Service saddles shall be Dresser Style 194 with 1-inch outlet, or equivalent.*
- B. *Corporation stops shall be provided on each service connection to the water main. Corporation stops shall be of the plug type and shall be designed and manufactured in accordance with AWWA Standard C800 and shall be constructed of red brass. Corporation stop shall be McDonald Series F-1000, or equivalent, for 1-inch service and shall have compression fittings.*
- C. *Install McDonald, B-41 Series curb stop or equivalent and plastic cap protector.*

PART 3 - EXECUTION

- A. *A complete meter service shall be installed on each existing connection (where applicable) and all new connections to the water distribution system. Service lines shall be installed between the water main and the property line. Meter boxes shall be 18-inch round concrete boxes with cast iron lids as manufactured by Michael Wade, Rock Springs, GA. Meters shall be Badger Model 25 in gallons or cubic feet as noted by the Owner. Meter setters shall be McDonald VH71-7 for cubic feed application and VH72 for gallon applications. Meter boxes shall be set at the property line by the Utility and connected to the new service line. The exact field location of the meter box shall be determined by the Utility and shall be located to provide easy access to the meter reader and serviceman; not be a hazard to the customer or public; and be reasonably well protected against frost, mechanical damage, and tampering.*

- B. *Water meters* shall not be installed in meter boxes until construction of the residence has been completed and all pipelines have been flushed clean of all mud and grit deposits, and have been disinfected.
- C. *Meter boxes and meters* shall be installed in a neat and workmanlike manner. The elevation of the boxes shall be carefully adjusted so that the lid is flush with the ground surface or sidewalk. Soil around the meter box shall be tamped or settled in place so that hazard is eliminated and further settling is minimized.

END OF SECTION

**CHAPTER 5**  
**Standard Details**

**5.0 STANDARD DETAILS**

The following standard details (or functional equivalents) may be used for public water and sewer extensions which will be assumed by the Authority.

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- Control Panel Electrical Schematic
- Control Panel Electrical Schematic
- Control Panel Electrical Schematic

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- Thrust Block Detail
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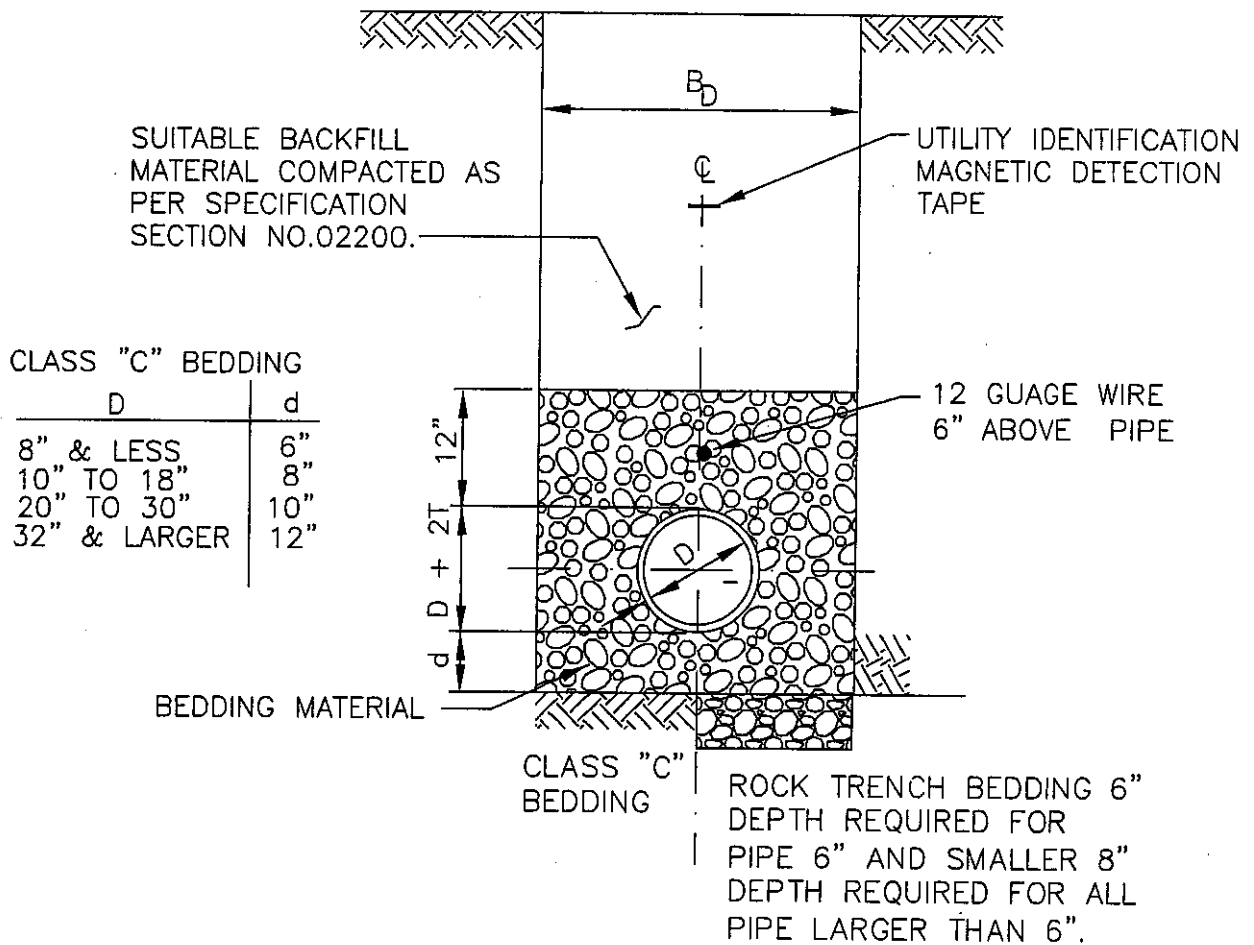
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**STANDARD SEWER DETAIL**



BEDDING FOR PVC, PE, & FIBERGLASS PIPE

NOTE: ONLY 1/2-INCH OR SMALLER CRUSHED GRAVEL OR ROCK IS ACCEPTABLE FOR PVC BEDDING.

TYPICAL TRENCH DETAILS  
NOT TO SCALE



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STANDARD SEWER DETAIL

**BEDDING FOR PVC, PE, & FIBERGLASS PIPE**

NOT TO SCALE

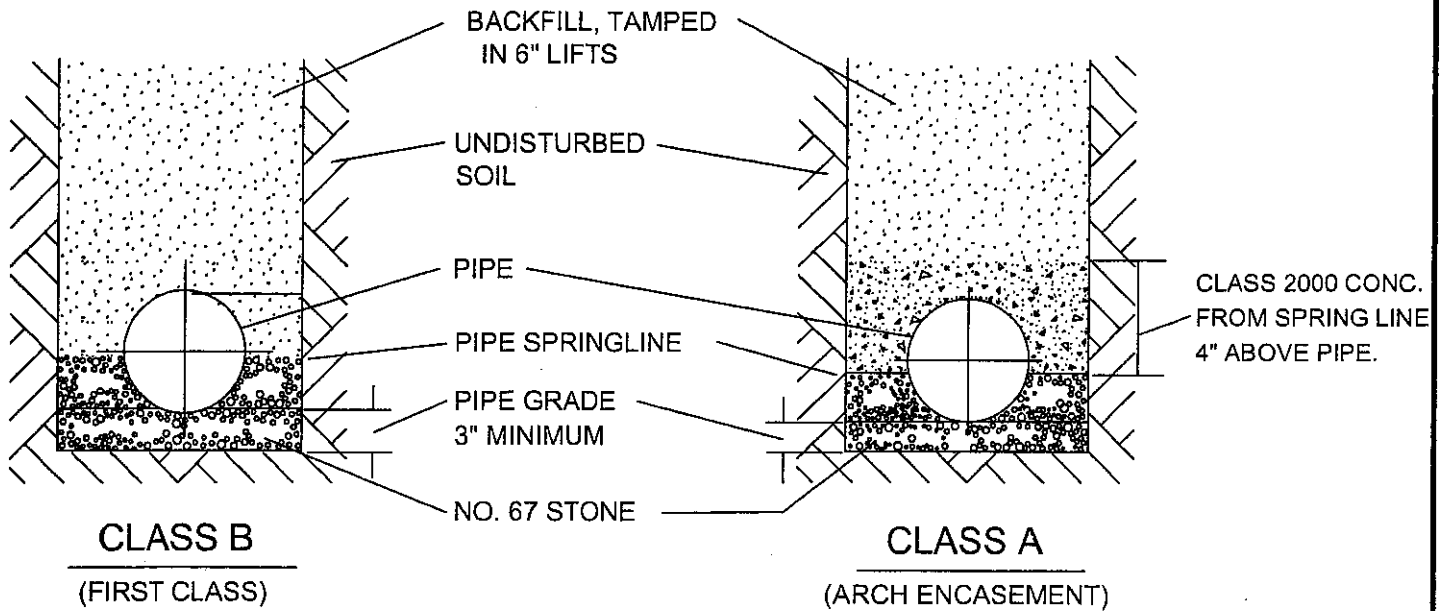
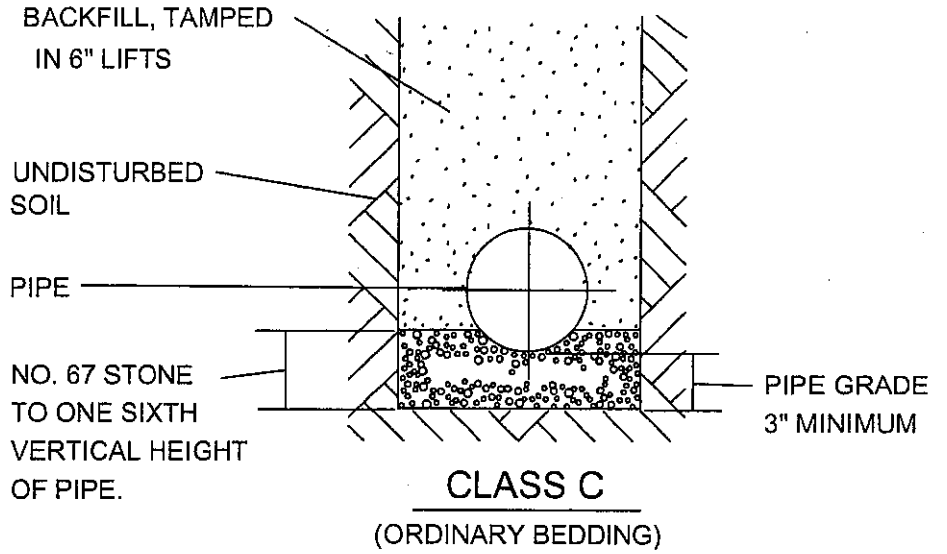


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S:\2004\SG04010 WALKER COUNTY GENERAL\WC STD DETAIL\SBEDDING DETAIL.dwg Jan 06, 2006

NOTE: SEE STANDARD DETAIL S-4  
AND S-5 FOR TRENCH BOTTOM  
DIMENSIONS FOR VARIOUS  
TYPES OF PIPE.



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STANDARD SEWER DETAIL

GENERAL BEDDING DETAILS

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SCHEDULE OF BEDDING  
 PERMISSIBLE DEPTH (IN FEET)  
 TO BOTTOM OF PIPE FOR SATURATED CLAY EARTH LOAD  
 130 LBS/CU.FT. (SATURATED CLAY)

PIPE DIA. INCHES	TRENCH WIDTH TOP OF PIPE BD. FT. +.	CONC. PIPE CLASS III	CONC. PIPE CLASS IV. AWWA C-301	PIPE, GLASS, & PVC 1-3/4" TO 6" 79%
CLASS "C" BEDDING (STANDARD BEDDING)				
4"	2.00	—	—	—
6"	2.00	—	—	—
8"	2.33	—	—	—
10	2.50	—	—	—
12	2.67	—	—	—
15	3.00	—	—	—
18	3.25	—	—	—
21	3.54	—	—	—
24	3.83	—	—	—
27	4.08	—	—	—
30	4.42	—	—	—
33	4.75	—	—	—
36	5.67	—	—	—
42	6.25	—	—	—
48	6.83	—	—	—
54	7.42	—	—	—
60	8.00	—	—	—
66	8.58	—	—	—
72	9.17	—	—	—
78	9.75	—	—	—
84	10.33	—	—	—
CLASS "B" BEDDING				
4"		—	—	—
6"		—	—	—
8"		—	—	—
10	SEE ABOVE	—	—	—
12		—	—	—
15		—	—	—
18		—	—	—
21		—	—	—
24		—	—	—
27		—	—	—
30		—	—	—
33		—	—	—
36		—	—	—
42		—	—	—
48		—	—	—
54		—	—	—
60		—	—	—
66		—	—	—
72		—	—	—
78		—	—	—
84		—	—	—
CLASS "A" BEDDING				
4"		—	—	—
6"		—	—	—
8"		—	—	—
10	SEE ABOVE	—	—	—
12		—	—	—
15		—	—	—
18		—	—	—
21		—	—	—
24		—	—	—
27		—	—	—
30		—	—	—
33		—	—	—
36		—	—	—
42		—	—	—
48		—	—	—
54		—	—	—
60		—	—	—
66		—	—	—
72		—	—	—
78		—	—	—
84		—	—	—

BD = MAXIMUM TRENCH WIDTH AT 12" ABOVE TOP OF PIPE  
 IF DITCH IS CUT WIDER THAN BD SHOWN THE  
 CONTRACTOR WILL BE REQUIRED TO INCREASE  
 BEDDING TO COMPENSATE FOR ADDITIONAL  
 LOAD ON PIPE AT HIS OWN EXPENSE.



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STANDARD SEWER DETAIL

GENERAL BEDDING DETAILS

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QUANTITY FOR CLASS B AND ROCK TRENCH BEDDING ARE THE QUANTITIES IN EXCESS OF THOSE REQUIRED FOR CLASS C BEDDING.

PIPE SIZE "D" IN. (IN.)	TRENCH WIDTH "BD" IN. (FT.)	TRENCH VOL. PER FT. OF DEPTH *	CLASS "C" BEDDING FOR CONC. & D.I.		CLASS "B" BEDDING	QTY. (CY) OF ROCK TRENCH BEDDING	
			QTY. (CY)	"S" IN(IN.)	QTY. (CY)	CONC. & D.I.	PVC,ETC.
6	2.00	.074	0.025	4-1/4	0.018	0.025	.037
8	2.33	.086	0.030	4-1/2	0.025	0.030	.043
10	2.50	.093	0.036	5-0	0.027	0.049	.062
12	2.67	.099	0.039	5-1/4	0.034	0.054	.066
15	3.00	.111	0.046	5-3/4	0.043	0.063	.074
18	3.25	.120	0.053	6-1/4	0.054	0.069	.080
24	3.83	.142	0.072	7-1/2	0.085	0.108	.118
30	4.42	.164	0.098	9-0	0.118	0.121	.137
36	5.67	.210	0.148	10-1/2	0.199	0.194	--
42	6.25	.231	0.184	12-0	0.248	0.209	--
48	6.83	.253	0.223	13-1/2	0.302	0.223	--
54	7.42	.275	0.266	15-0	0.361	0.236	--
60	8.00	.296	0.312	16-1/2	0.424	0.247	--
66	8.58	.318	0.362	18-0	0.491	0.258	--
72	9.17	.340	0.416	19-1/2	0.563	0.268	--
78	9.75	.361	0.458	20-1/2	0.655	0.291	--
84	10.33	.383	0.510	21-3/4	0.744	0.315	--
96	11.50	.426	0.604	23-3/4	0.958	0.365	--

\* ALL VOLUMES IN CUBIC YARDS/LINEAR FOOT.

\*\* QUANTITIES AND DIMENSIONS FOR 6" SERVICE LINE SHALL APPLY TO 4" SERVICE LINE ALSO.

**CLASS "A" BEDDING**

MATERIAL SHALL BE CLASS "B" CONCRETE CRADLES. THE PIPE SHALL BE LAID ON CONCRETE SADDLES CONSTRUCTED TO PROVIDE VERTICAL AND LATERAL SUPPORT FOR THE PIPE WHILE THE CRADLE IS BEING PLACED. PIPE SUPPORTS OF WOOD BLOCKS, LOOSE BRICK, ETC WILL NOT BE PERMITTED. THE CRADLE SHALL BE PROUD AFTER THE JOINTS HAVE BEEN MADE, CARE BEING TAKEN TO PREVENT MOVEMENT OF THE PIPE. WHENEVER THE CONTRACTOR PLACES CONCRETE OUTSIDE THE DIMENSIONS SHOWN ON THE DRAWINGS, THE COST OF SUCH CONCRETE WILL BE AT THE CONTRACTOR'S EXPENSE.

**CLASS "B" BEDDING**

MATERIAL SHALL BE 1/2"-INCH OR SMALLER CRUSHED ROCK OR GRAVEL, SAND OR OTHER APPROVED MATERIALS. MATERIAL SHALL BE CAREFULLY PLACED AND THOROUGHLY COMPACTED BY TAMPING. QUANTITIES LISTED FOR PAYMENT UNDER CLASS "B" BEDDING ARE THE AMOUNTS IN EXCESS OF THOSE REQUIRED FOR CLASS "C" BEDDING.

**CLASS "C" BEDDING (STANDARD BEDDING)**

MATERIAL SHALL BE SAME AS FOR CLASS "B" BEDDING AND SHALL BE PLACED AS SHOWN BY STANDARD DETAILS FOR THE TYPE OF PIPE USED. THE BEDDING SHALL BE INCLUDED FOR PAYMENT IN THE UNIT PRICE BID PER LINEAR FOOT OF PIPE FOR VARIOUS TYPES, SIZES AND DEPTHS LISTED IN THE BID SCHEDULE.

**ROCK TRENCH BEDDING**

MATERIAL SHALL BE SAME AS FOR CLASS "B" BEDDING AND SHALL BE PLACED AS SHOWN BY STANDARD DETAILS FOR THE TYPE OF PIPE USED. QUANTITIES FOR ROCK TRENCH BEDDING ARE THE AMOUNTS IN EXCESS OF THOSE REQUIRED FOR CLASS "C" BEDDING.



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STANDARD SEWER DETAIL  
**QUANTITY TABLE FOR  
TRENCH BEDDING**

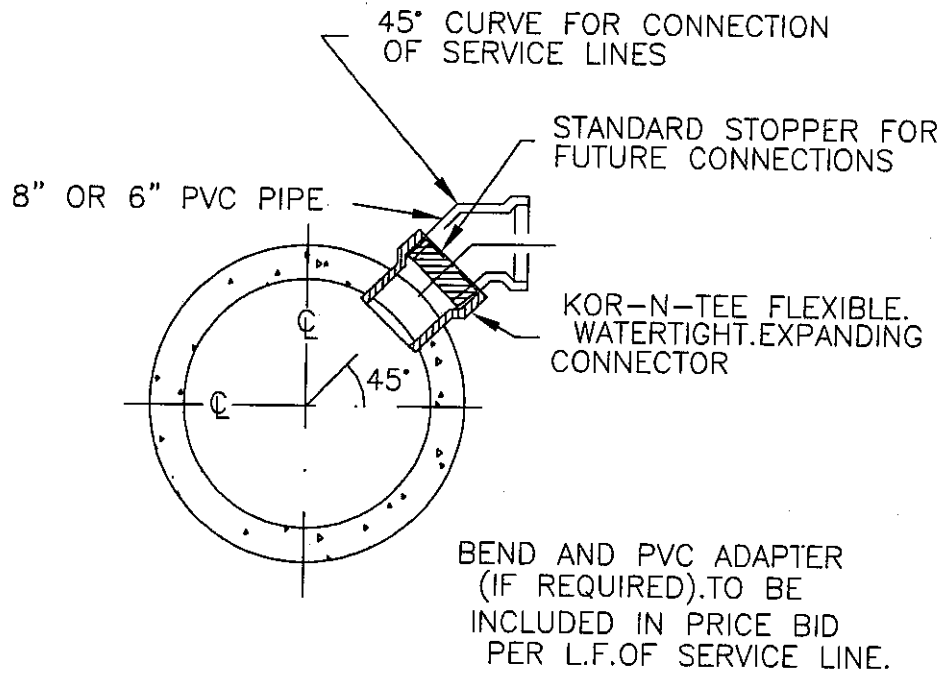
3 OF 3

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NOTE:  
THIS CONNECTION APPLICABLE TO  
18" AND LARGER R.C. PIPE.

STANDARD CONNECTION  
TO R.C. PIPE



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STANDARD SEWER DETAIL

STANDARD CONNECTION  
TO R.C. PIPE

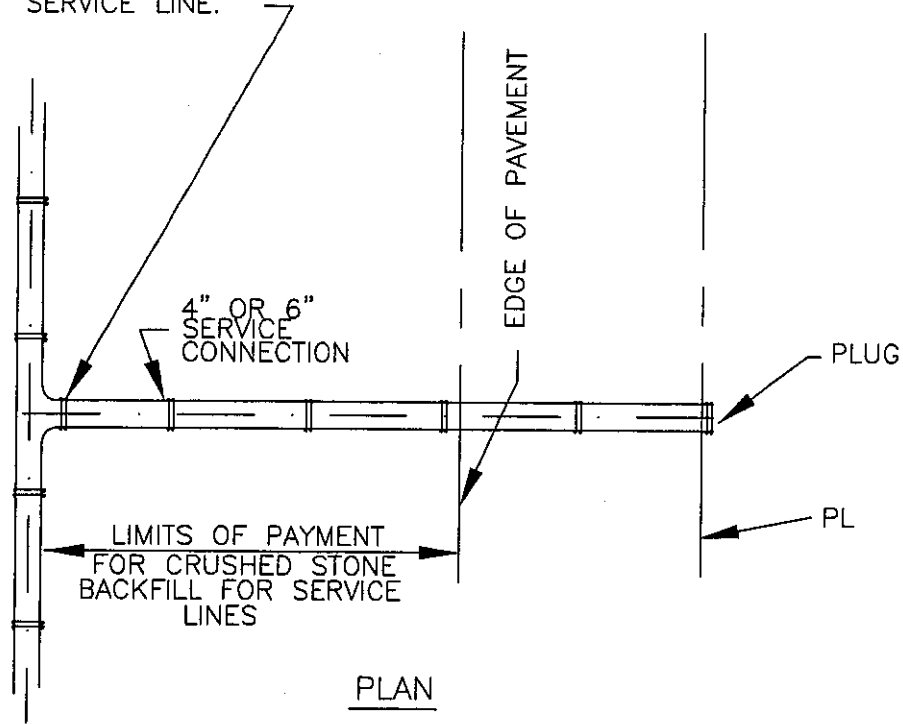
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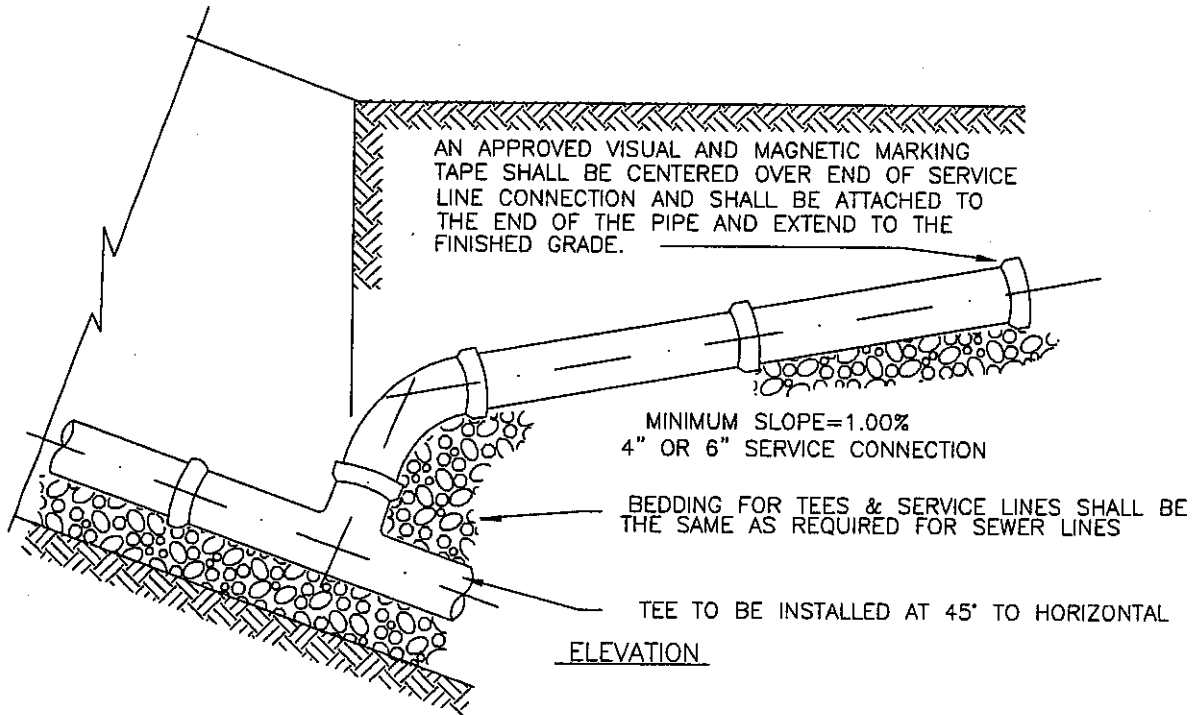
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INCLUDE COST OF ELBOW IN PRICE BID PER L.F. FOR SERVICE LINE.



PLAN



TYPICAL SERVICE CONNECTION

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STANDARD SEWER DETAIL

STANDARD CONNECTION TO  
R.C. PIPE DETAIL

NOT TO SCALE



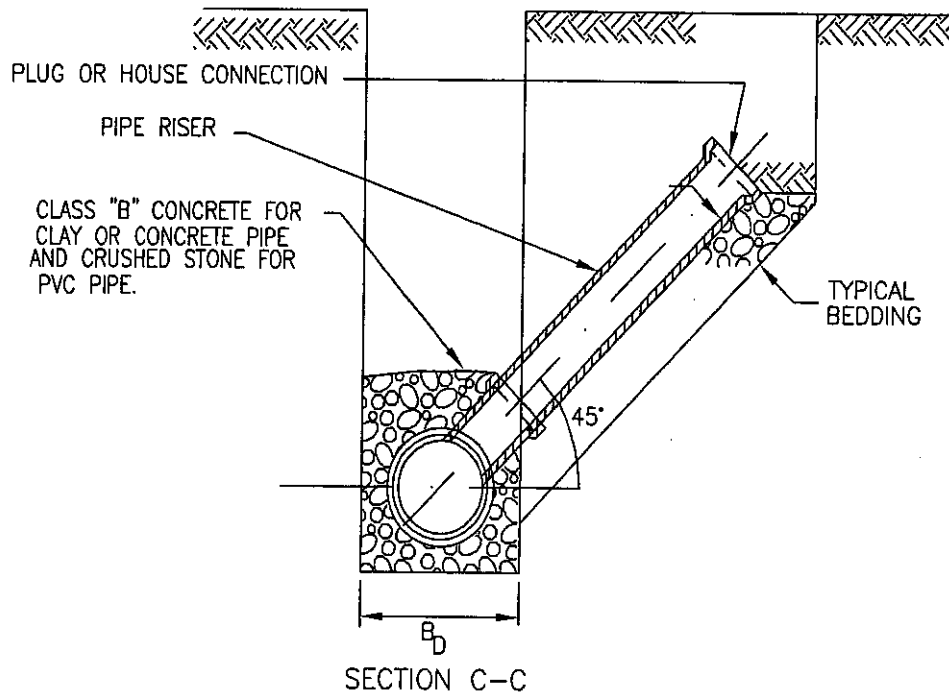
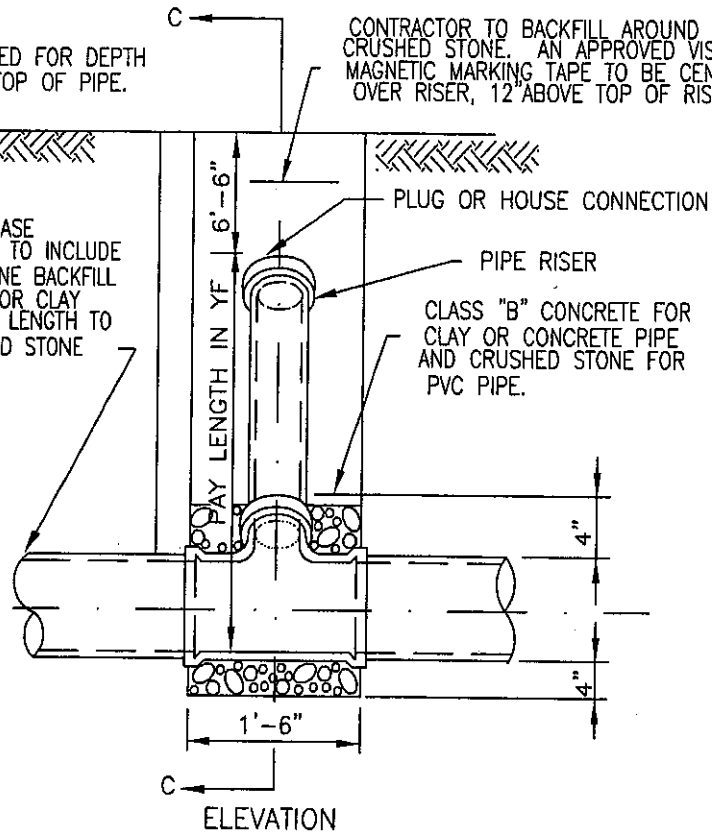
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RISER CONNECTION REQUIRED FOR DEPTH GREATER THAN 7'-0" TO TOP OF PIPE.

CONTRACTOR TO BACKFILL AROUND RISER WITH CRUSHED STONE. AN APPROVED VISUAL AND MAGNETIC MARKING TAPE TO BE CENTERED OVER RISER, 12" ABOVE TOP OF RISER.

PIPE AND TEE PAID FOR SAME AS CASE WITHOUT RISER. RISER PAY LENGTH TO INCLUDE CLASS "B" CONCRETE, CRUSHED STONE BACKFILL AND VERTICAL PIPE FOR CONCRETE OR CLAY SEWERS. FOR PVC PIPE, RISER PAY LENGTH TO INCLUDE VERTICAL PIPE AND CRUSHED STONE BACKFILL.



TYPICAL RISER FOR SERVICE CONNECTION

NOT TO SCALE



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STANDARD SEWER DETAIL

TYPICAL SERVICE CONNECTION DETAIL

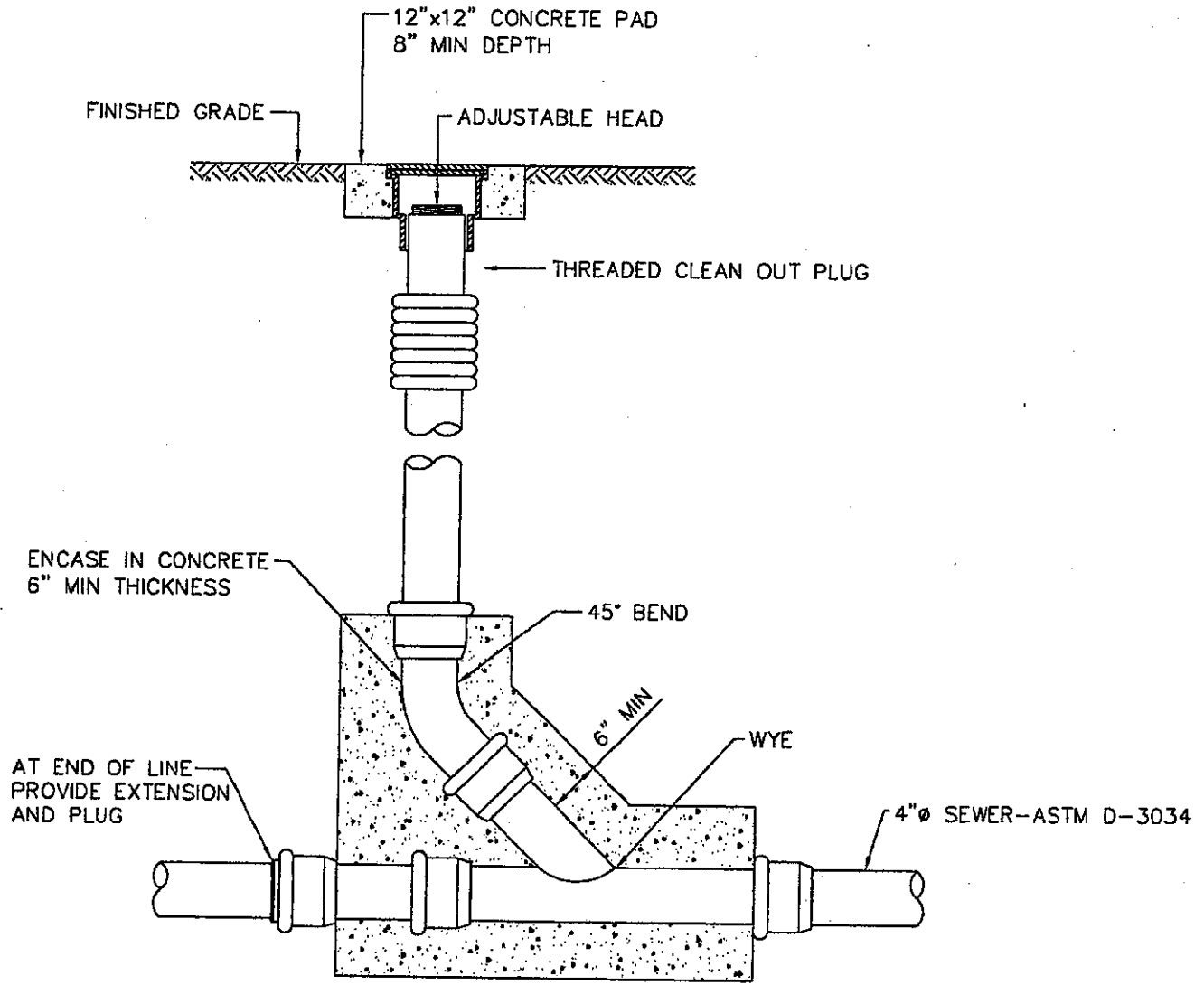
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**TYPICAL LINE CLEANOUT**

NOTE:  
CONCRETE IS REQUIRED ONLY IN  
AREAS OF TRAFFIC LOADING.



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STANDARD SEWER DETAIL	
TYPICAL LINE CLEANOUT DETAIL	
NOT TO SCALE	
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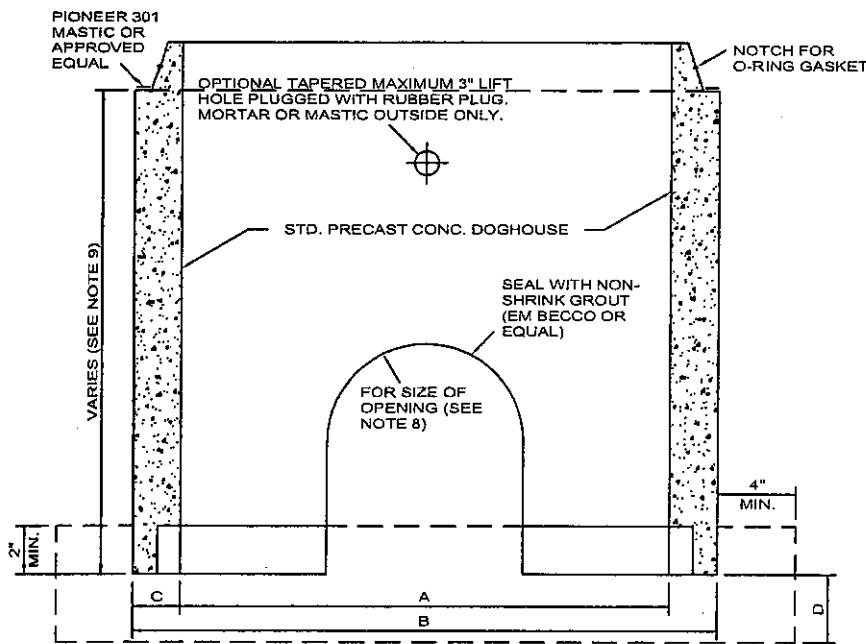


CHART "A"

MINIMUM DIMENSIONS			
MH	4'-0"	5'-0"	6'-0"
A	48"	60"	72"
B	58"	72"	86"
C	5"	6"	7"
D	6"	8"	10"

DIMENSIONS OF "D" SHALL BE TAKEN FROM BOTTOM OF KEY (SEE DRAWING)

NOTES:

1. CONCRETE TO BE CLASS "C"
2. ALL REINFORCING TO MEET REQUIREMENTS OF CURRENT A.S.T.M. SPECIFICATION C-478.
3. MANHOLE SECTIONS TO MEET REQUIREMENTS OF CURRENT A.S.T.M. SPECIFICATION C-478.
4. TAPERED JOINT WITH O-RING GASKET TO MEET CURRENT A.S.T.M. SPECIFICATION C-361.
5. DOGHOUSE OPENING MAY ONLY BE USED WHEN PLACING A NEW MANHOLE OVER AN EXISTING LINE; OTHERWISE, THE OPENING MUST BE CAST. SIZE, LOCATION AND ANGLE OF ENTRY SHALL BE AS REQUIRED BY THE PLANS.
7. JOINT CONFIGURATION MAY BE CAST BELL-UP OR SPIGOT-UP.
8. HOLES IN PRECAST UNITS ARE TO BE 4" MIN. TO 8" MAX. LARGER THAN THE OUTSIDE DIAMETER OF THE PROPOSED PIPE.
9. BASE SECTION TO PROVIDE 6" MIN. CLEARANCE BETWEEN TOP OF PIPE OPENING AND BOTTOM OF BELL AND SPIGOT JOINT.



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STANDARD SEWER DETAIL

PRECAST CONCRETE  
MANHOLE DOG HOUSE BASE

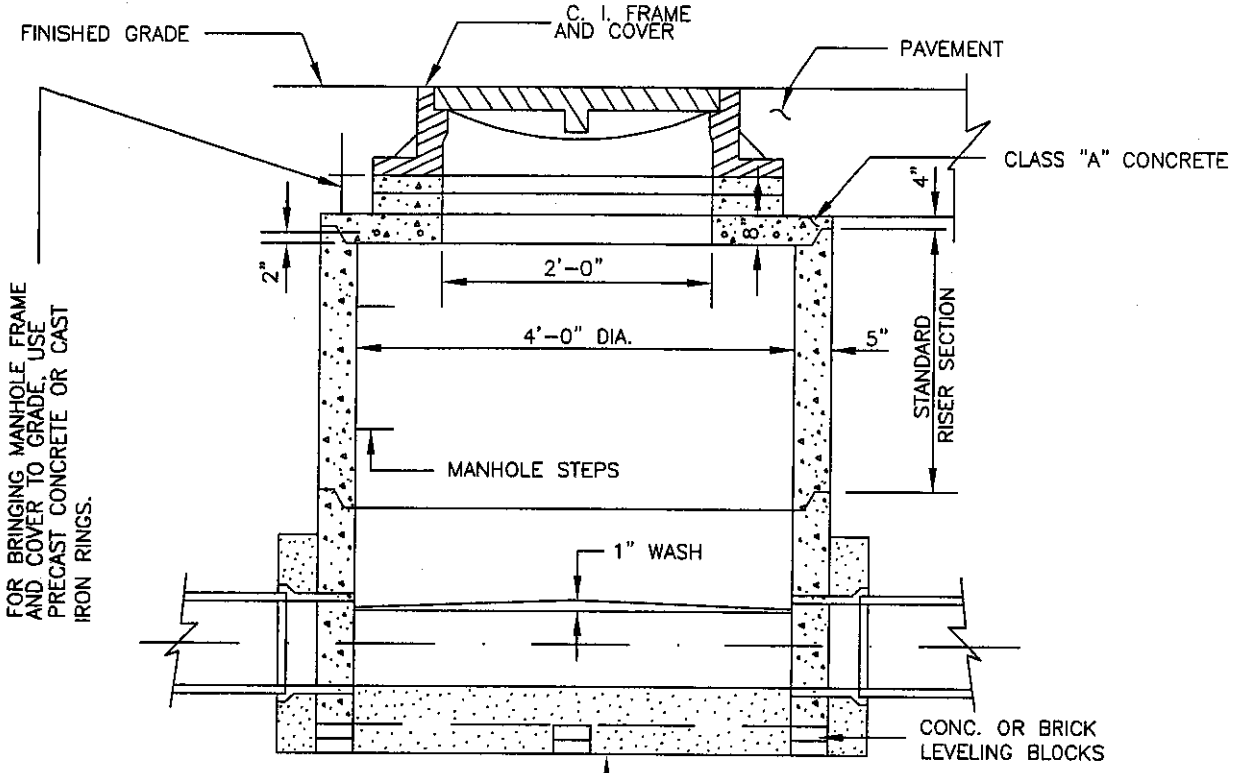
NOT TO SCALE



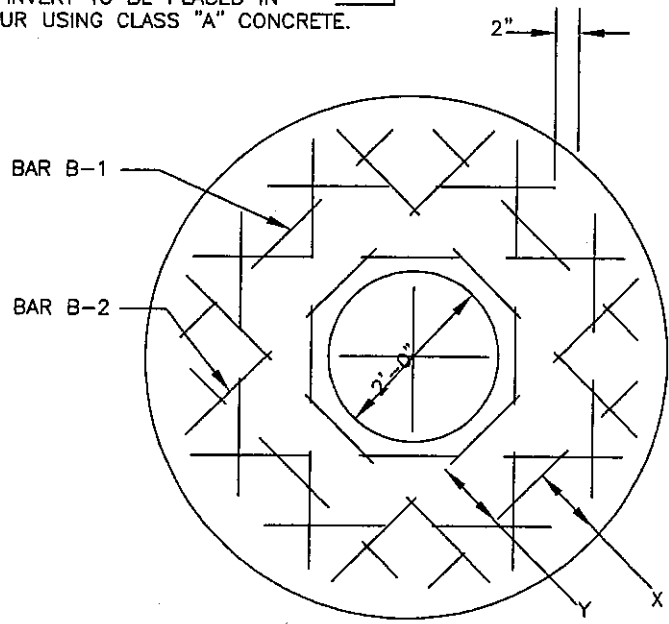
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MANHOLE BASE & INVERT TO BE PLACED IN A MONOLITHIC POUR USING CLASS "A" CONCRETE.

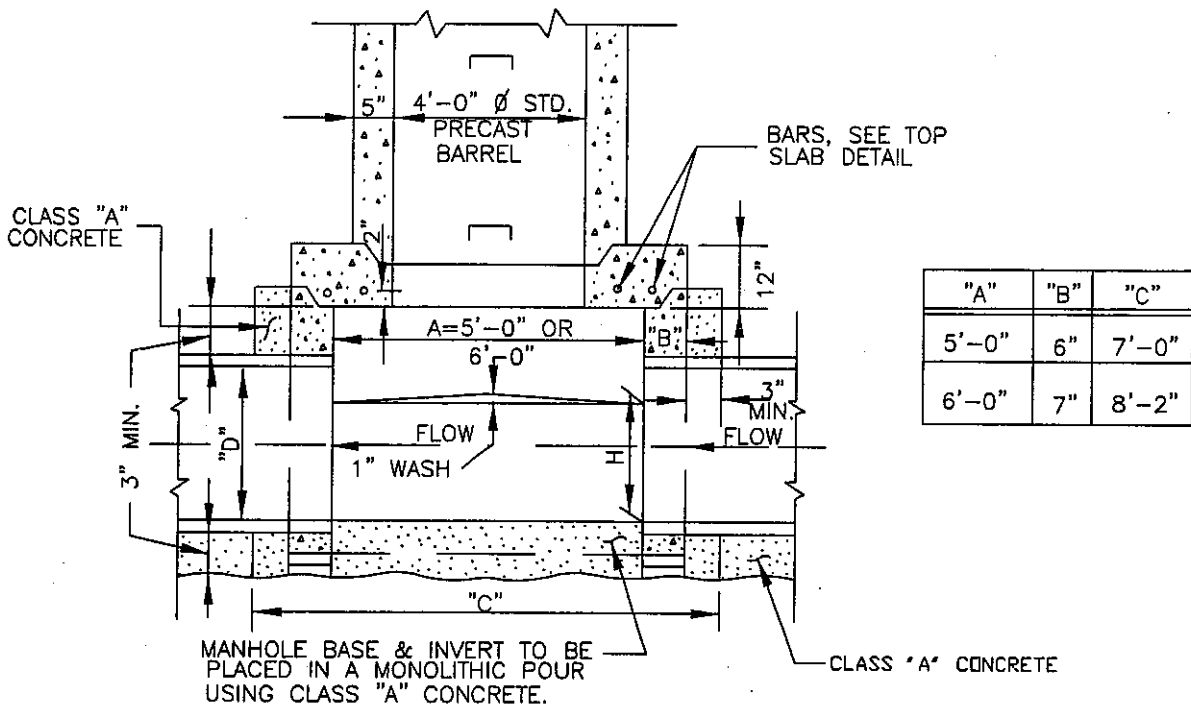


TOP SLAB DETAIL

COST OF FURNISHING & PLACING CONCRETE & REINFORCING STEEL FOR SLAB TO BE INCLUDED IN PRICE BID FOR MANHOLE.

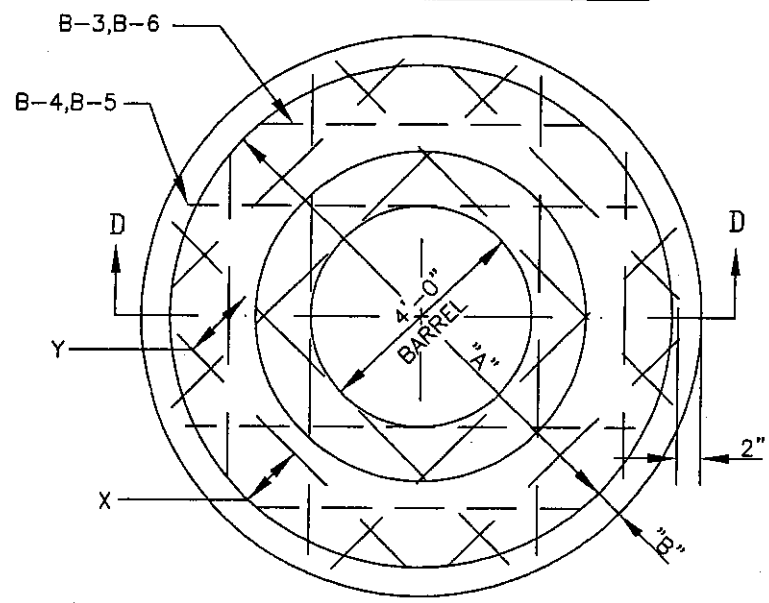
  
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STANDARD SEWER DETAIL	
<b>STANDARD PRECAST MANHOLE FOR DEPTH OF LESS THAN 5'-0"DETAIL</b>	
NOT TO SCALE	
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MANHOLE BASE & INVERT TO BE PLACED IN A MONOLITHIC POUR USING CLASS "A" CONCRETE.

SECTION D-D



TOP SLAB DETAIL  
 COST OF FURNISHING & PLACING CONCRETE & REINFORCING STEEL FOR SLAB TO BE INCLUDED IN PRICE BID FOR MANHOLE.

NOTE:  
 "H" & "T" dimensions apply at both the upstream & downstream edge of M.H.

TABLE I		
"D"	"T"	"H"
Inside Dia. pipe	Vertical Tangent	Height of Wa. Table
8"	2 1/2"	6 1/2"
10"	3"	8"
12"	3 1/2"	9 1/2"
15"	4 1/2"	12"
18"	5 1/2"	14 1/2"
21"	6 1/2"	17"
24"	7 1/2"	19 1/2"
30"	9"	24"
36"	11"	29"

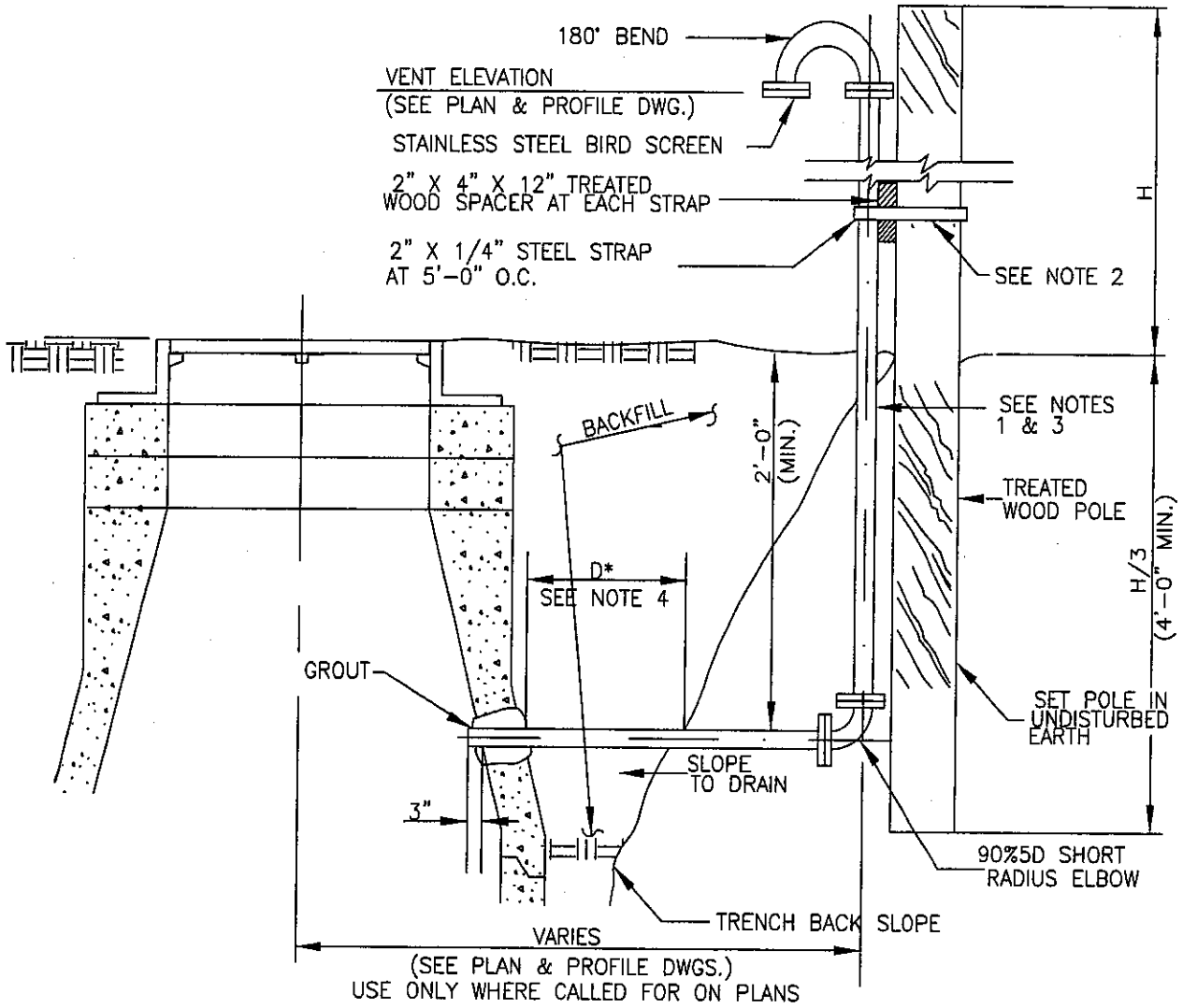
STANDARD PRECAST MANHOLE BASES (5'-0" & LARGER)

NOT TO SCALE

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STANDARD SEWER DETAIL  
**STANDARD CONCENTRIC CONE**  
 FOR ALL DIAMETER MANHOLE  
 DETAILS  
 NOT TO SCALE

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**REMOTE VENT**  
NOT TO SCALE

**MANHOLE VENT NOTES:**

1. ALL PIPING SHALL BE 3"Ø DUCTILE IRON WITH FLANGED JOINTS COATED INSIDE AND OUT.
2. PAINT ALL STRAPPING WITH 2 COATS OF COAL TAR EPOXY.
3. PAINT ALL EXPOSED PIPING WITH 2 COATS OF COAL FOR EPOXY.
4. IF D IS OVER 10 FEET, SUPPORT PIPE WITH UNIFORMLY SPACED WOOD PILES, OR H-BEAM PILES, MAXIMUM SPACING 10 FEET.
5. NO SEPARATE PAYMENT WILL BE MADE FOR THIS WORK, BUT THE COST OF SAME SHALL, BE INCLUDED IN PRICE BID FOR MANHOLE 0.0' TO 6.0' DEEP.



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STANDARD SEWER DETAIL

STANDARD CONCENTRIC CONE  
ALL DIAMETER MANHOLE DETAILS  
NOT TO SCALE



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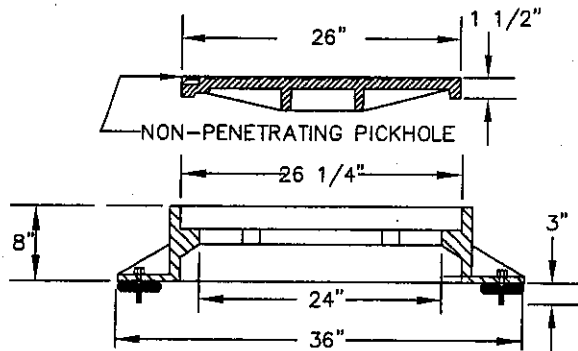
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TABLE II  
GOVERNING DIMENSIONS FOR MANHOLES

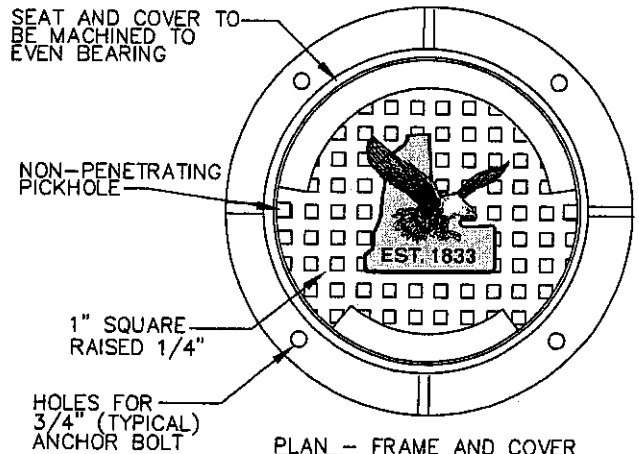
D-PIPE SIZE	△ ANGLE	BASE DIAMETER	"R" *
8" - 12"	0° TO 90°	4'	1' - 6"
15"	0° TO 60°	4'	1' - 10"
15"	60° TO 90°	4'	1' - 10"
18"	0° TO 60°	4'	2' - 3"
18"	60° TO 90°	4'	1' - 10"
21"	0° TO 60°	4'	2' - 7"
21"	60° TO 90°	5'	2' - 4"
24"	0° TO 45°	4'	3' - 0"
24"	45° TO 90°	5'	2' - 3"
30"	0° TO 60°	5'	3' - 9"
30"	60° TO 90°	6'	2' - 8"
36"	0° TO 30°	6'	4' - 6"
LARGER THAN 36"	0° TO 90°	CAST IN PLACE MANHOLE BASE OR PRE-BED PIPE M.H. BASE & ELBOW UNITS.	

GENERAL NOTES:

1. FOR ALL PIPE MATERIALS 12" IN DIAMETER AND SMALLER, PROVIDE JOINTS AT THE OUTSIDE FACE OF THE MANHOLE AS SHOWN.
2. FOR PIPES LARGER THAN 12", PROVIDE A FLEXIBLE JOINT AS CLOSE TO THE OUTSIDE FACE AS THE SHORTEST LENGTH AVAILABLE WILL PERMIT.
3. WHERE LATERAL SEWERS ARE SHOWN FOR FUTURE CONSTRUCTION, INSTALL A PLUGGED STUB OR DROP CONNECTION WITH PLUGGED STUB AS CALLED FOR ON PLAN-PROFILE DRAWINGS.
4. MANHOLE STEPS SHALL BE ACHESON FOUNDRY CO. NO. A-1984-D (STEEL REINFORCED RUBBER) OR EQUAL.
5. FOR BRINGING MANHOLE FRAME AND COVER TO GRADE, USE PRECAST CONCRETE OR CAST IRON RINGS.
6. PLASTIC BUTYL SEALANT TO BE FURNISHED AND INSTALLED BETWEEN MANHOLE CONE AND FRAME AND LEVELING RINGS COST TO BE INCLUDED IN THE UNIT PRICE BID FOR MANHOLES 0.0' TO 6.0' DEEP. NO SEPARATE PAYMENT ALLOWED.
7. ALL MANHOLES SHALL USE STANDARD CONCENTRIC CONES.
8. ALL MANHOLES SHALL BE VACUUM TESTED AFTER INSTALLATION.



**SECTION**  
**STANDARD FRAME AND COVER**



**PLAN - FRAME AND COVER**  
ACHESON FOUNDRY (STANDARD) A-2024-81H  
ACHESON FOUNDRY (WATER-TIGHT) A-2624-71H  
OR APPROVED EQUAL

**NOTES**

1. MANUFACTURER SHALL CERTIFY TRAFFIC BEARING CAPACITY OF FRAMES AND COVERS.
2. MANHOLES IN PAVED AREAS MAY NOT REQUIRE ANCHOR BOLTS.
3. BEARING SURFACES BETWEEN COVER AND FRAME SHALL BE MACHINED TO PREVENT ROCKING.

	SPECIFIED MINIMUM WEIGHTS	
	STANDARD	WATER-TIGHT
COVER	165 LBS.	190 LBS.
FRAME	185 LBS.	400 LBS.
TOTAL	350 LBS.	590 LBS.

**MANHOLE FRAME AND COVER**



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SEWER DETAIL

**MANHOLE FRAME & COVER  
DETAIL**

NOT TO SCALE

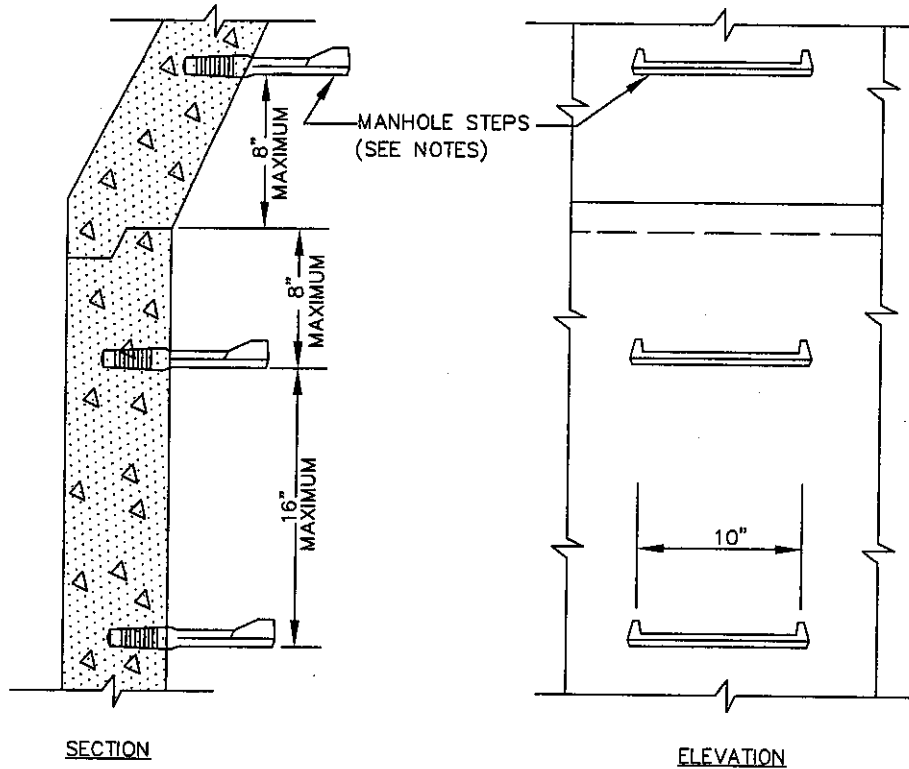


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**NOTES**

- 1. STEPS OF 3/8" STEEL REINFORCED ROD ENCAPSULATED IN POLYPROPYLENE PLASTIC.
- 2. RISER SECTIONS SHALL BE SET SO THAT STEPS ALIGN VERTICALLY.



**MANHOLE STEPS**



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SEWER DETAIL

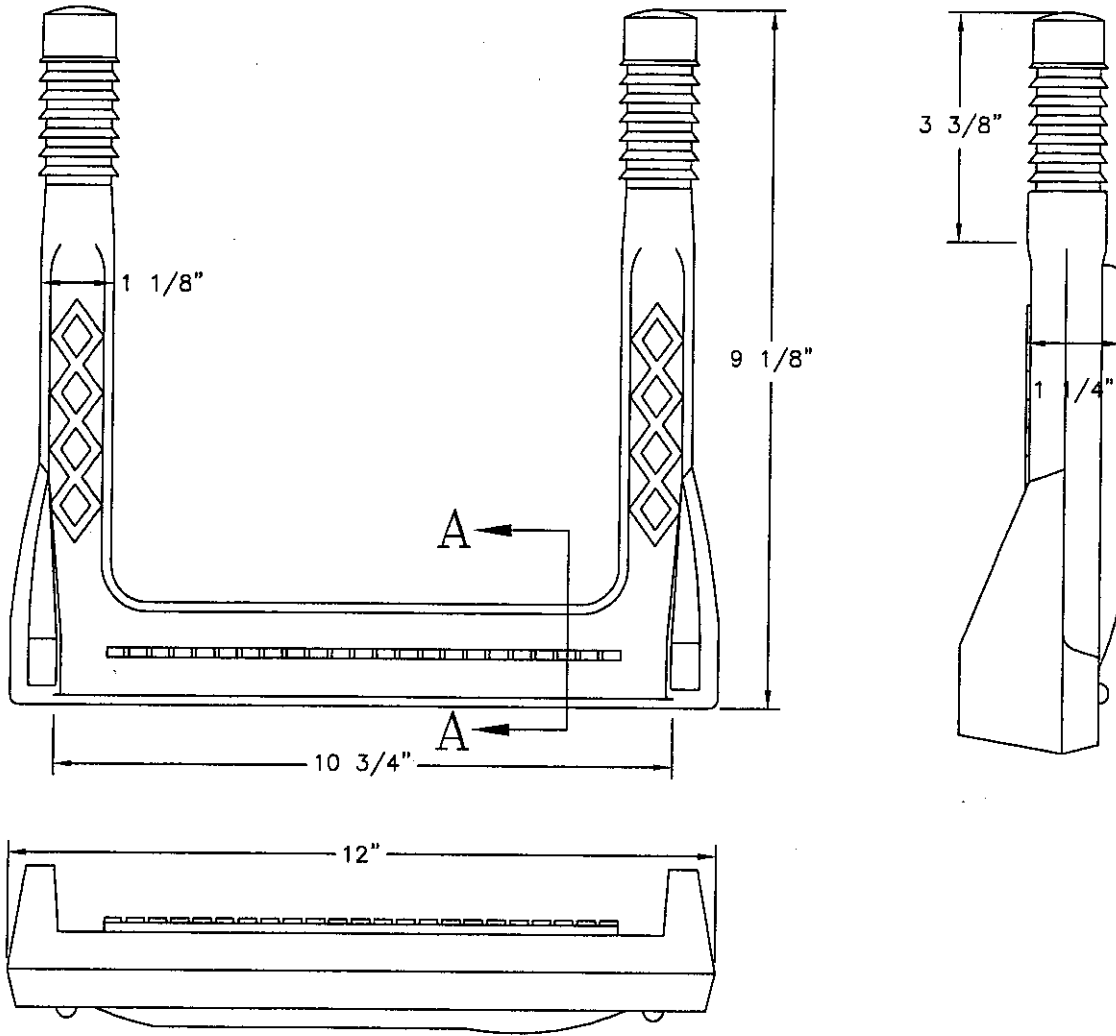
**MANHOLE STEPS DETAIL**  
NOT TO SCALE



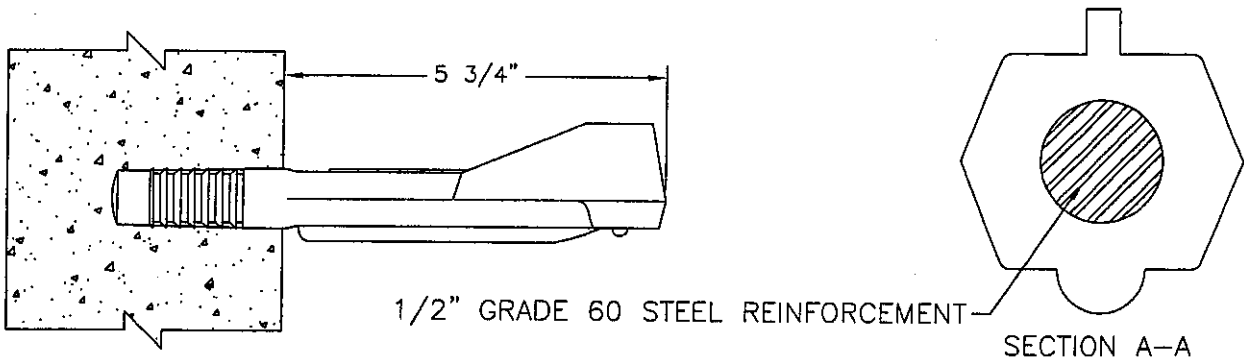
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COPOLYMER POLYPROPYLENE PLASTIC



  
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STANDARD SEWER DETAIL

MANHOLE STEP

NOT TO SCALE

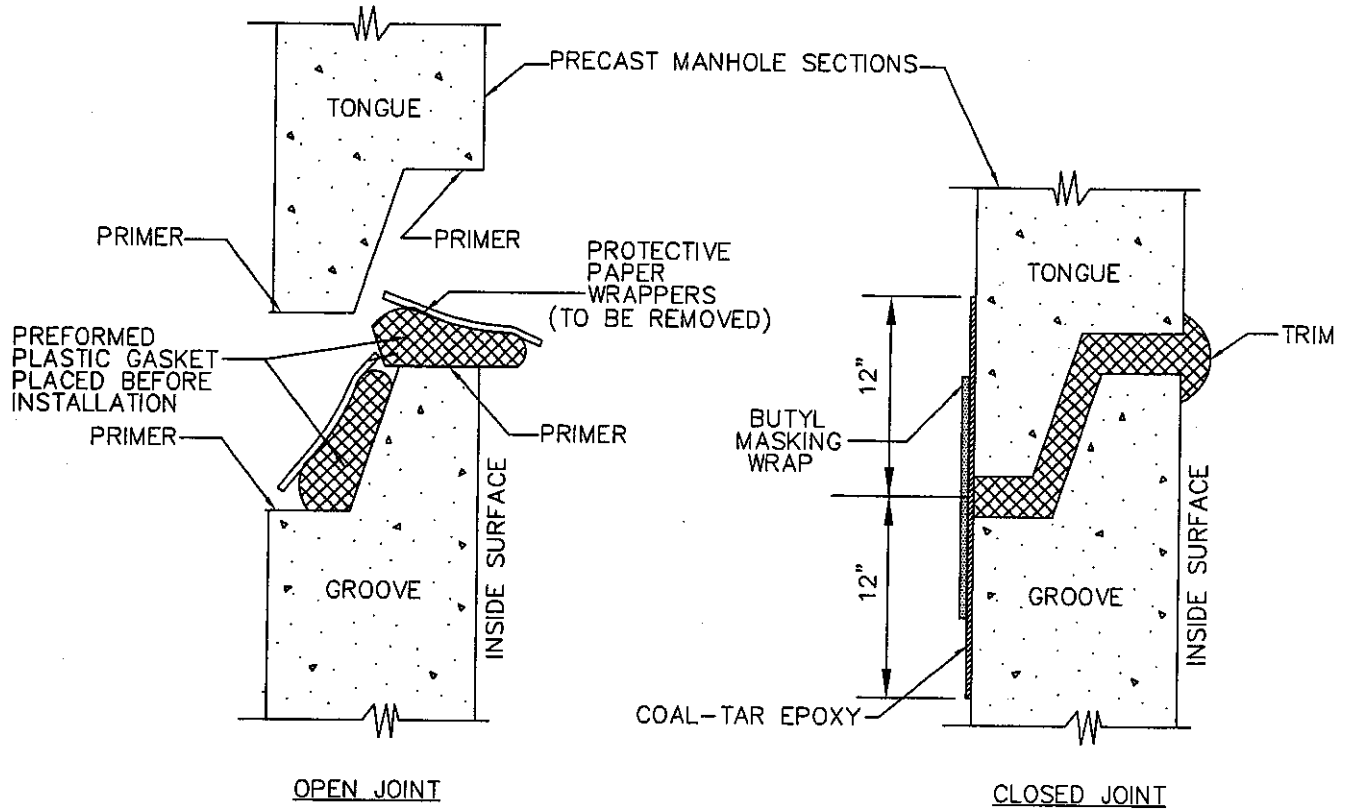


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NOTES

1. TRIM PROTRUDING GASKET INSIDE AND OUTSIDE.
2. CLEAN ALL DEBRIS FROM JOINTS PRIOR TO GASKET APPLICATION.



**JOINT AND GASKET FOR  
PRECAST MANHOLE SECTIONS**



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SEWER DETAIL

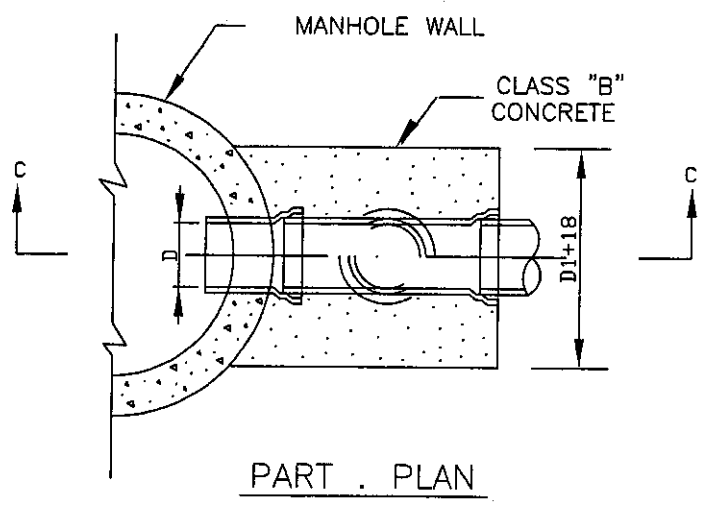
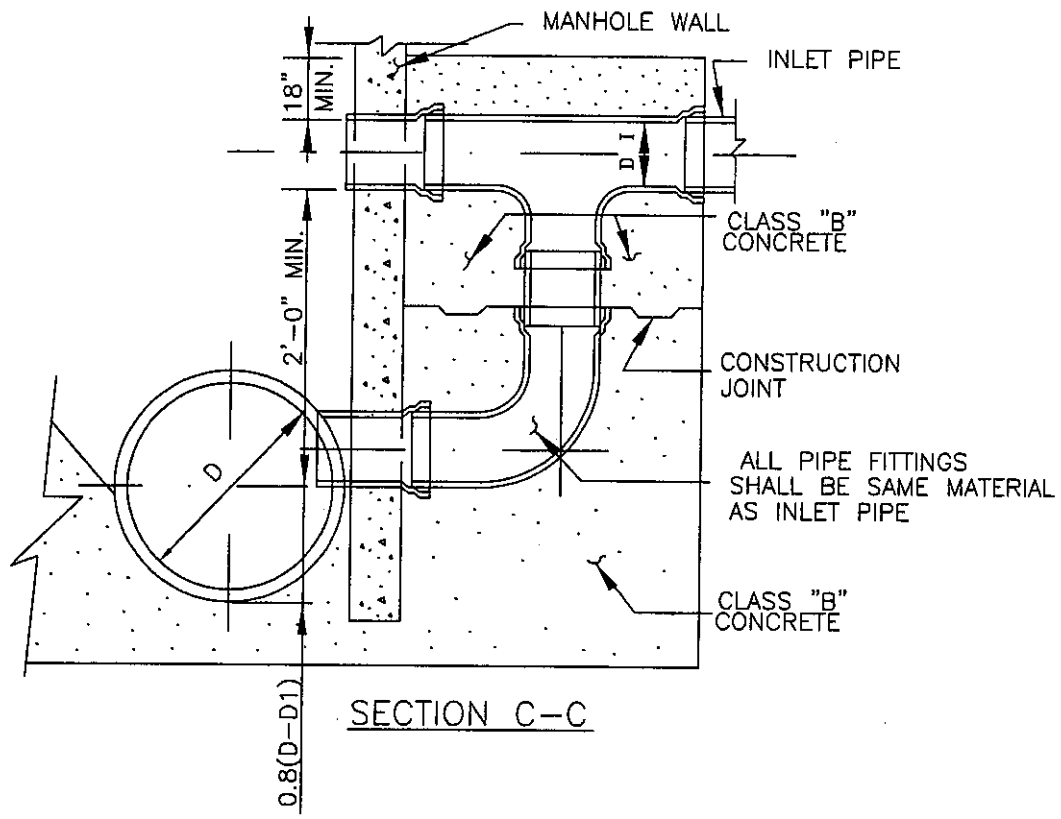
**JOINT & GASKET FOR PRECAST  
MANHOLE SECTIONS DETAIL**

NOT TO SCALE



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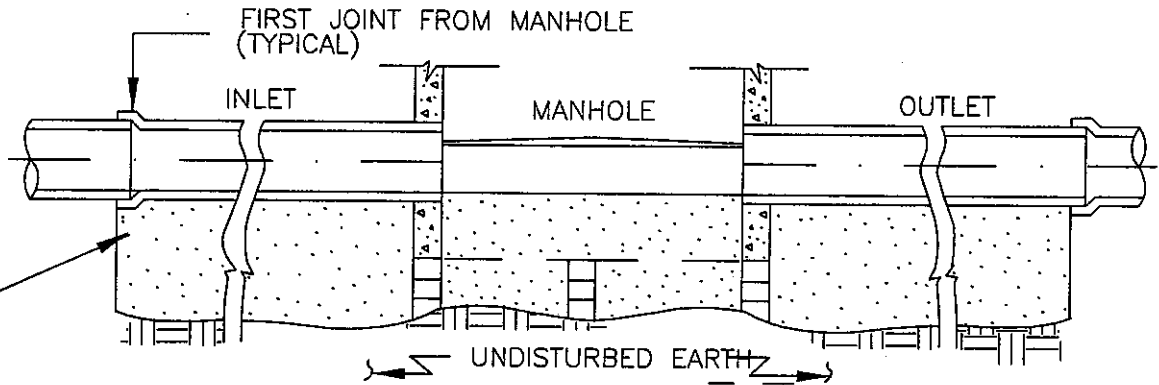
  
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STANDARD SEWER DETAIL  
TYPICAL VERTICAL DROP INLET  
AT MANHOLE DETAIL  
NOT TO SCALE



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CLASS "A" CONCRETE  
 TYPICAL INLET DETAIL FOR CLAY PIPE  
 15" AND LARGER AND CONCRETE  
 PIPE 12" AND LARGER.

TYPICAL OUTLET DETAIL FOR CLAY  
 PIPE 15" AND LARGER AND  
 CONCRETE PIPE 12" AND LARGER.

### TYPICAL CONCRETE CRADLE DETAILS FOR PIPE AT MANHOLES

NOT TO SCALE

(PAYMENT FOR CRADLE TO BE INCLUDED IN ]  
 THE UNIT PRICE FOR MANHOLE)

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STANDARD SEWER DETAIL

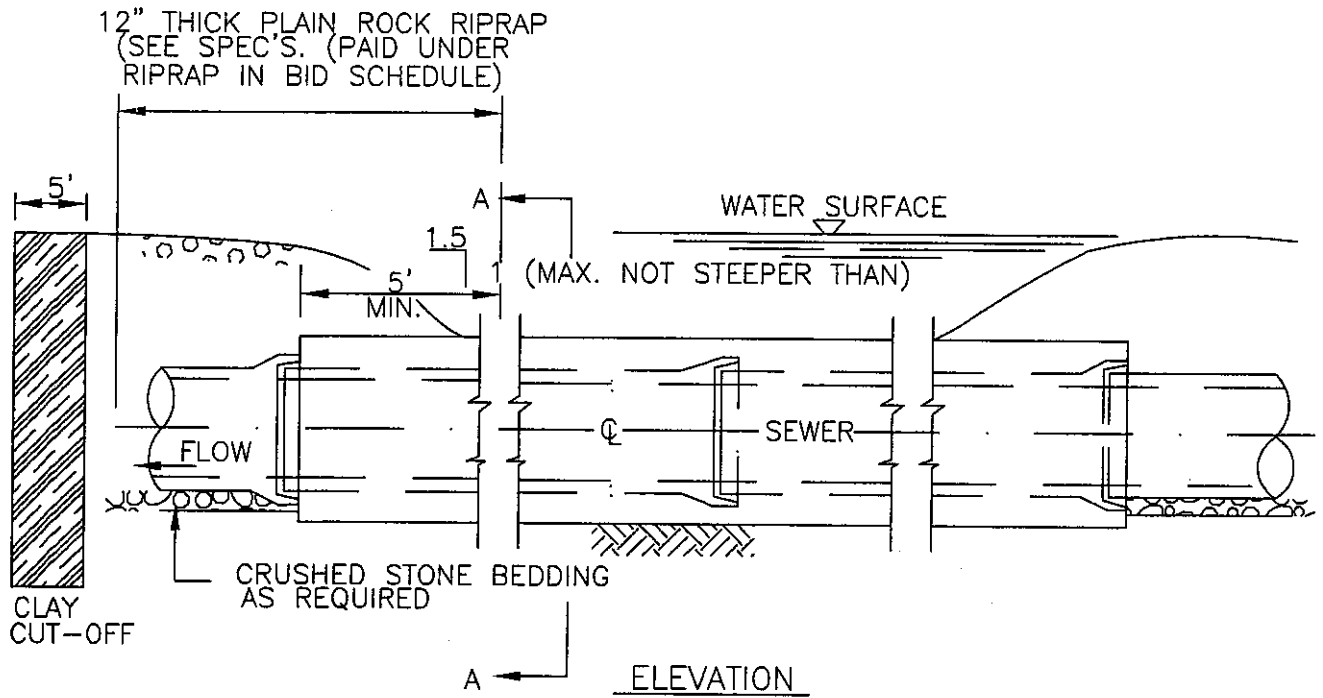
TYPICAL CONCRETE  
 CRADLE DETAIL

NOT TO SCALE

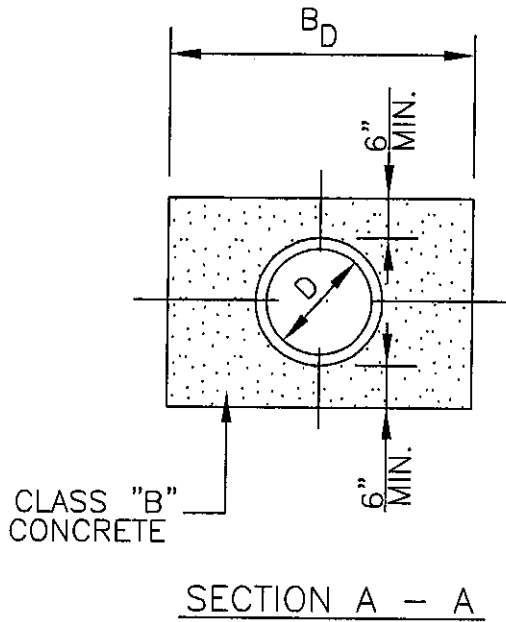


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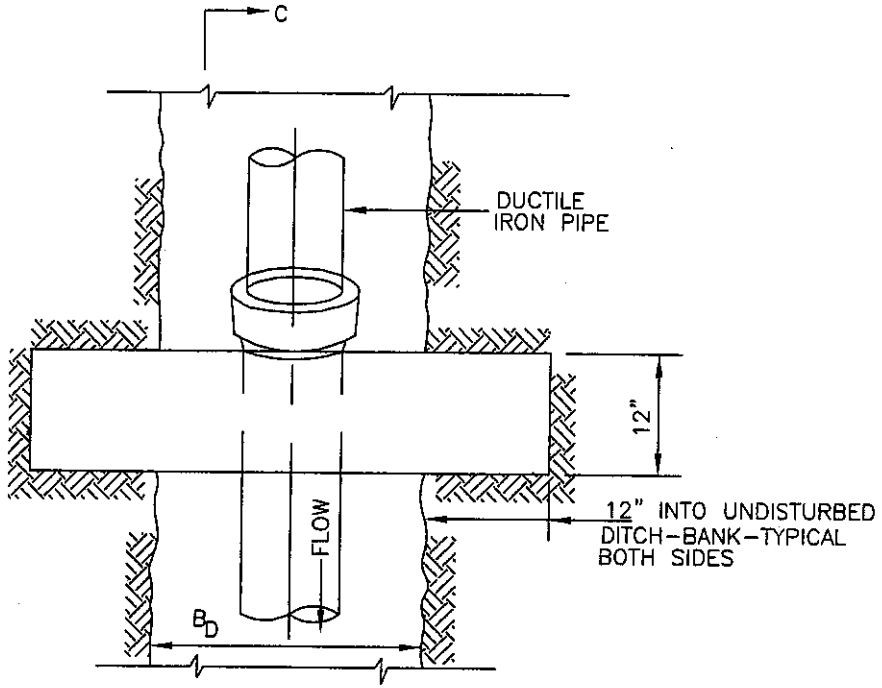
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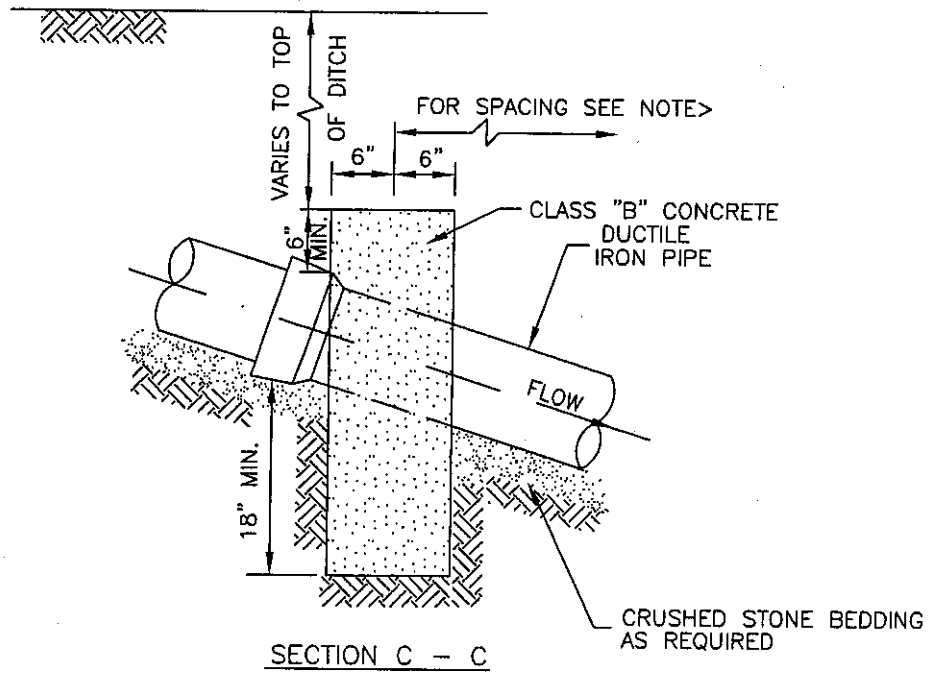
(REQ'D. PER CREEK CROSSING  
DOWN STREAM SIDE ONLY)  
BACKFILL WITH CLAY MATERIAL (NO  
ORGANIC MATERIAL) (NO SEPARATE  
PAYMENT ALLOWED); FROM BOTTOM OF  
TRENCH TO TOP OF GROUND.)



(REQ'D. AT ALL CREEK CROSSINGS)



NOTE:  
SEWERS ON 18.8% SLOPE OR GREATER SHALL BE ANCHORED SECURELY WITH CONCRETE ANCHORS OR EQUAL, SPACED AT A MAXIMUM OF 20' CENTER TO CENTER



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STANDARD SEWER DETAIL

CONCRETE ANCHOR BLOCK DETAIL  
FOR PIPES ON STEEP SLOPES

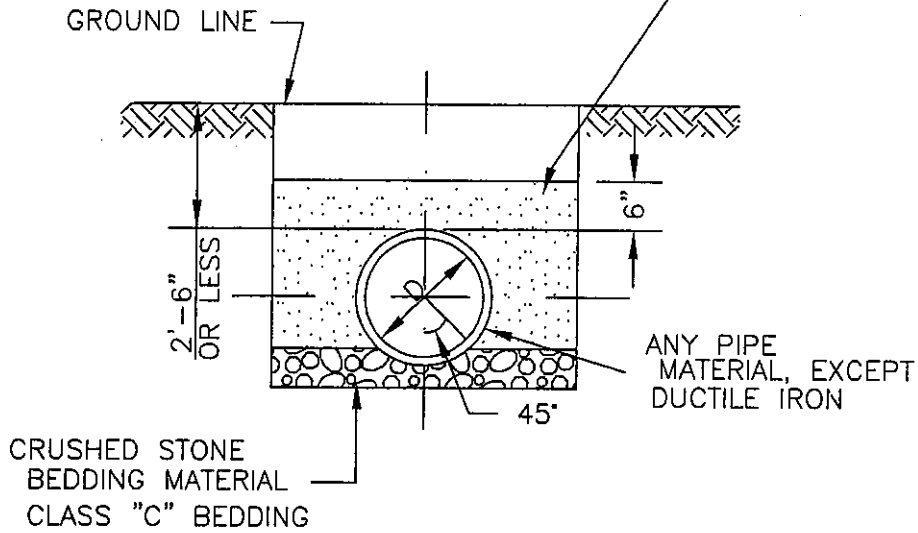
NOT TO SCALE



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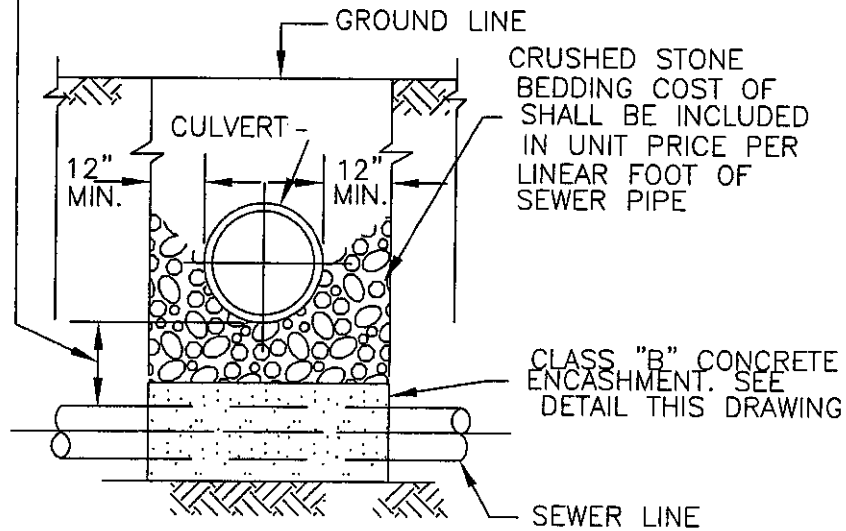
CLASS "B" CONCRETE TO BE PLACED 36 HOURS BEFORE BACKFILL PLACED AND IN SUCH A MANNER AS TO PREVENT PIPE FROM FLOATING



TYPICAL SECTION CONCRETE PROTECTION

NOT TO SCALE (FOR PIPE 2 FT. -6 IN. DEEP & LESS)

WHEN THIS DIMENSION IS LESS THAN 18", SEWER LINE SHALL BE ENCASED



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STANDARD SEWER DETAIL

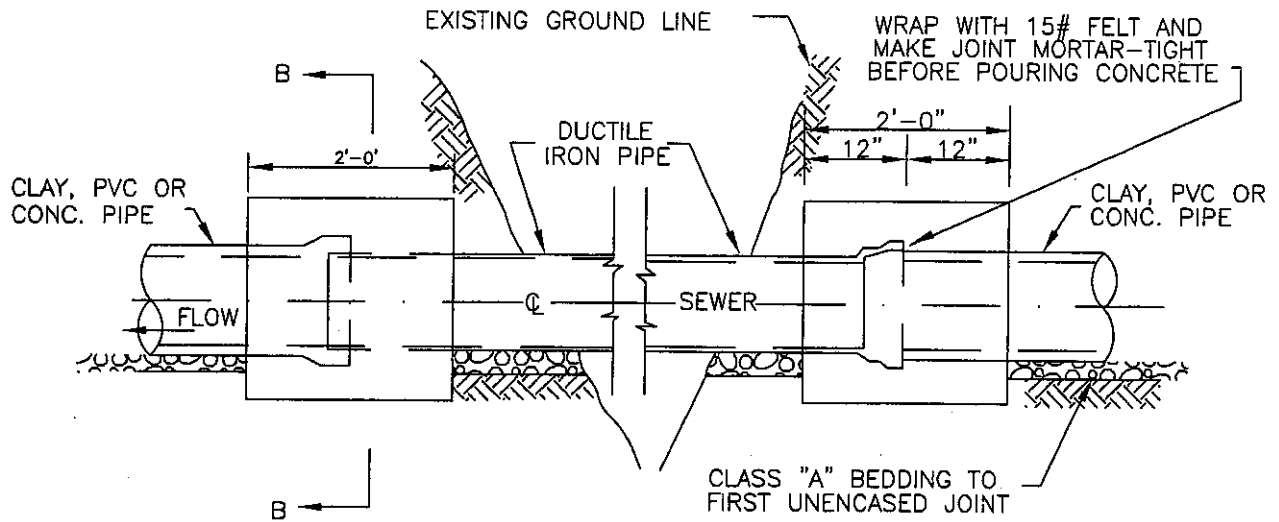
ENCASEMENT DETAIL AT  
LINE CROSSING

NOT TO SCALE



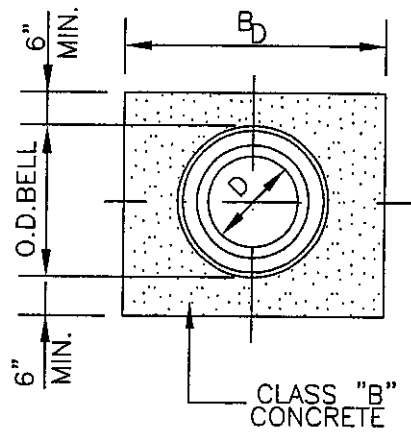
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ELEVATION

NOTE:  
 THIS DETAIL SHALL ALSO APPLY WHEN  
 DUCTILE IRON PIPE IS JOINED TO  
 CLAY, PVC OR CONCRETE PIPE



SECTION B - B



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STANDARD SEWER DETAIL

TYPICAL DITCH CROSSING  
 DETAIL

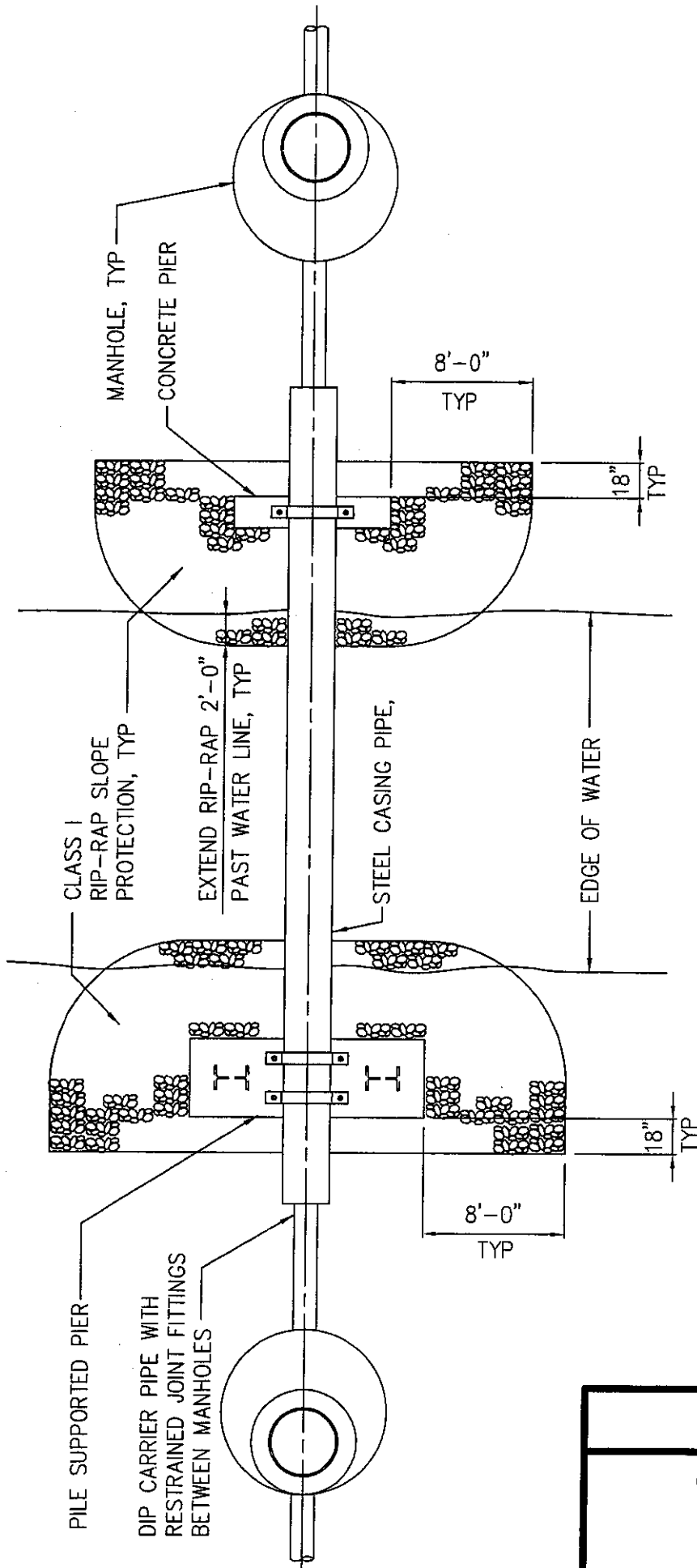
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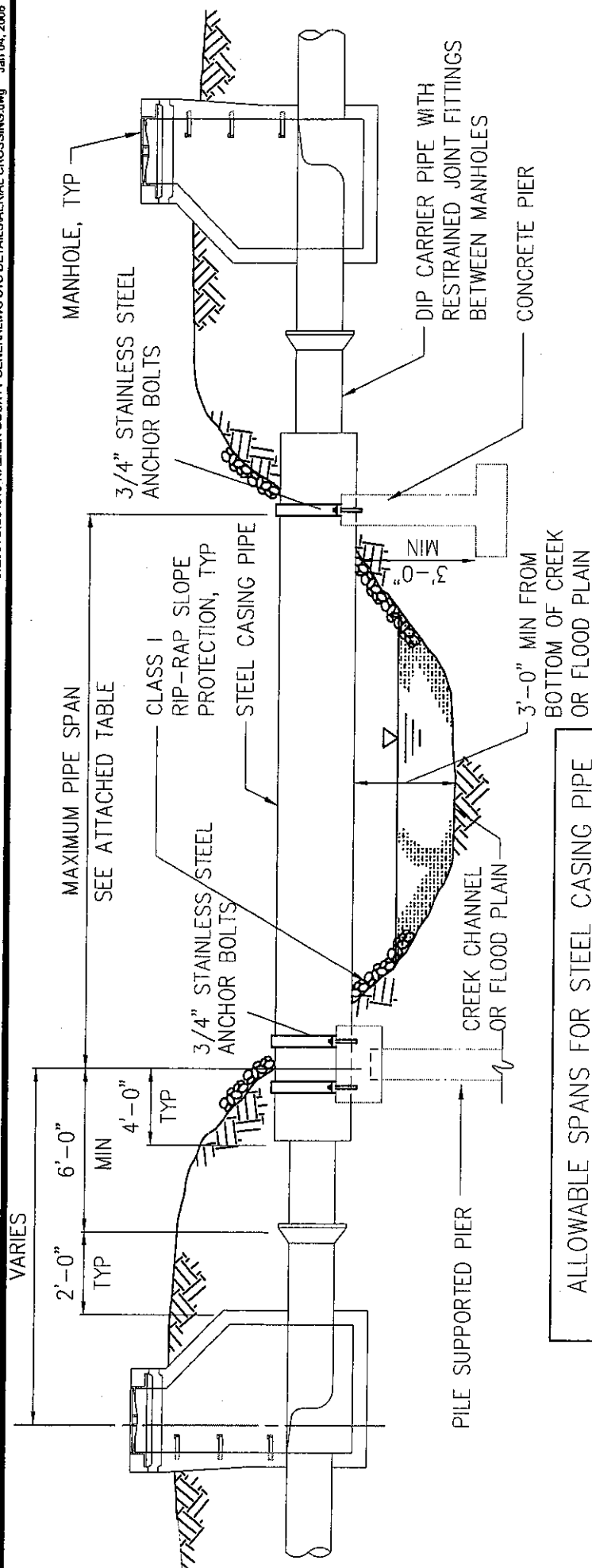




NOTES:

1. RIP RAP WITH PLASTIC FILTER FABRIC FOR SLOPE PROTECTION SHALL BE PLACED IN ACCORDANCE WITH SECTION 603 OF THE GEORGIA DEPARTMENT OF TRANSPORTATION'S "STANDARD SPECIFICATIONS".
2. SUPPORT TYPE FOR PIERS SHALL BE DETERMINED BY ENGINEER BASED ON SUBGRADE CONDITIONS AT SITE. SEE AERIAL PIER DETAIL FOR SUBGRADE PARAMETERS FOR EACH TYPE OF FOUNDATION.
4. WHERE STEEL PIPE IS USED FOR CARRIER PIPE, STEEL CARRIER PIPE SHALL BE INSTALLED UTILIZING PIPE ALIGNMENT GUIDES SPACED WITHIN PIPE AT DISTANCES NOT TO EXCEED 25 FEET. JOINT INDICATED 2 FEET FROM MANHOLE IS NOT REQUIRED FOR STEEL CARRIER PIPE.

STANDARD SEWER DETAIL	
<b>CONCRETE FOOTING FOR AERIAL CROSSING</b>	
NOT TO SCALE	
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**NOTES:**

1. STEEL PIPE SHALL BE EITHER SPIRAL WELDED OR SMOOTH WALL SEAMLESS WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI BY SECTION 535 AND 870 OF THE GEORGIA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATION BOOK.
2. DUCTILE IRON PIPE SHALL BE SUPPORTED WITH TWO SPIDERS AT EVERY JOINT WITHIN THE CASING PIPE USING APPROVED PIPE ALIGNMENT GUIDE. ALL JOINTS SHALL BE RESTRAINED JOINT.
3. SUPPORT TYPE FOR PIERS SHALL BE DETERMINED BY ENGINEER BASED ON SUBGRADE CONDITIONS AT SITE. SEE AERIAL PIER DETAIL FOR SUBGRADE PARAMETERS FOR EACH TYPE OF FOUNDATION.
4. BOTTOM OF PIPE TO BE AT A MINIMUM OF 1' ABOVE THE 25 YEAR FLOOD ELEVATION.

ALLOWABLE SPANS FOR STEEL CASING PIPE			
CARRIER PIPE, DIP DIAMETER (IN.)	CASING PIPE, STEEL DIAMETER (IN.)	MINIMUM CASING PIPE WALL THICKNESS (IN.)	ALLOWABLE SPAN (FT.)
6	14	0.2500	40
8	16	0.2500	45
10	18	0.3125	50
12	20	0.3125	50
14	24	0.3125	55
16	26	0.3750	55
18	30	0.3750	60
20	32	0.3750	60
24	36	0.4375	65
30	42	0.4375	65
36	48	0.4375	65
42	56	0.5000	65

STANDARD SEWER DETAIL

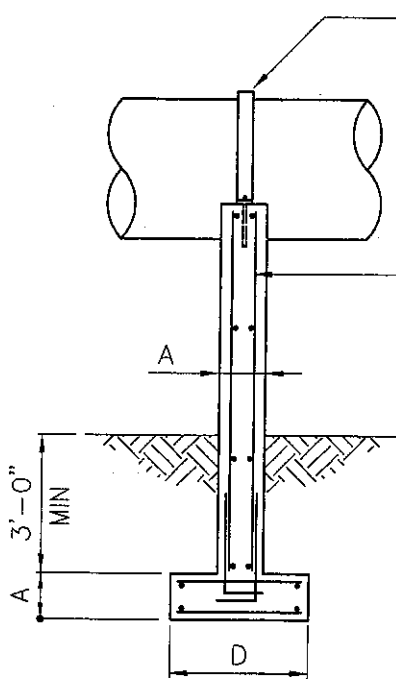
**AERIAL CROSSING**

1 OF 2

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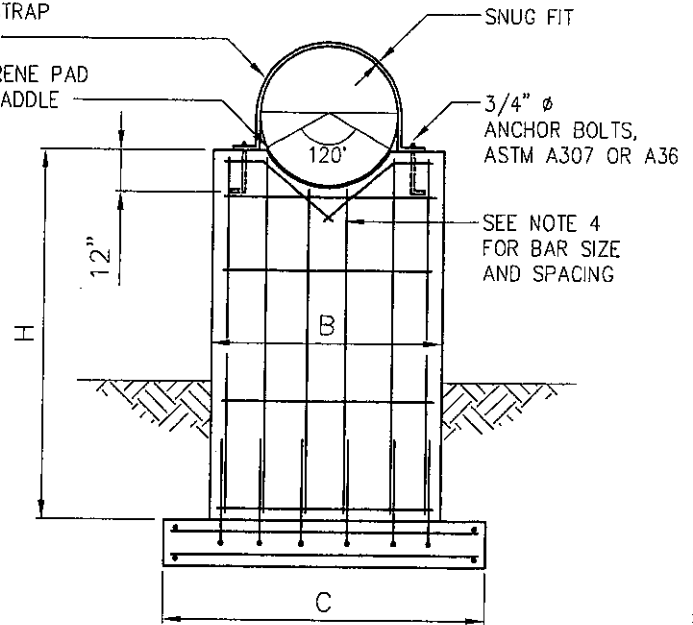
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1/4"x3" GALV. STRAP WITH  
1/4"x2 1/2" NEOPRENE PAD  
ADHERED TO STRAP  
(SEE NOTE 5)

1/4"x6" NEOPRENE PAD  
ADHERED TO SADDLE

SEE NOTE 4  
FOR BAR SIZE  
AND SPACING



SNUG FIT

3/4"  $\phi$   
ANCHOR BOLTS,  
ASTM A307 OR A36

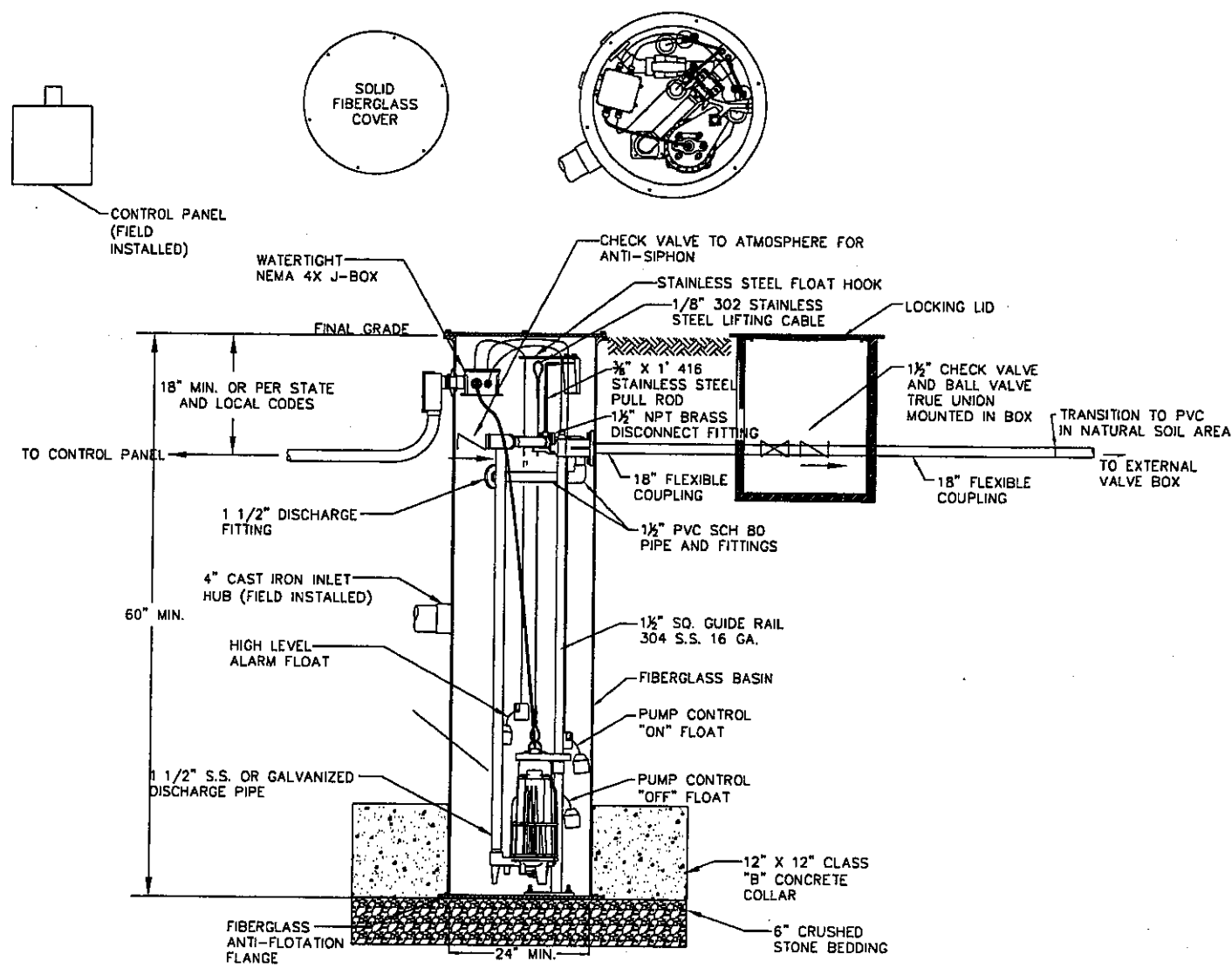
SEE NOTE 4  
FOR BAR SIZE  
AND SPACING

CASING PIPE DIA. "D" (IN.)	"H" (FT.)	THICKNESS "A" (IN.)	PIER WIDTH "B" (FT.)	FOOTING LENGTH "C" (FT.)	FOOTING WIDTH "D" (FT.)
6-12	≤ 6	12	2'-4"	5'-6"	3'-0"
	8	12	2'-4"	6'-3"	3'-0"
	10	12	2'-4"	6'-8"	3'-0"
	12	12	2'-4"	7'-2"	3'-0"
14-20	≤ 6	12	3'-0"	8'-0"	3'-0"
	8	12	3'-0"	9'-0"	3'-0"
	10	12	3'-0"	9'-10"	3'-0"
	12	14	3'-0"	10'-6"	3'-0"
22-28	≤ 6	14	3'-8"	8'-9"	4'-0"
	8	14	3'-8"	10'-0"	4'-0"
	10	14	3'-8"	11'-0"	4'-0"
	12	14	3'-8"	11'-10"	4'-0"
30-36	≤ 6	18	4'-4"	9'-0"	4'-0"
	8	18	4'-4"	10'-6"	4'-0"
	10	18	4'-4"	11'-6"	4'-0"
	12	18	4'-4"	12'-4"	4'-0"
38-48	≤ 6	18	5'-4"	9'-6"	5'-0"
	8	18	5'-4"	11'-0"	5'-0"
	10	18	5'-4"	12'-0"	5'-0"
	12	18	5'-4"	12'-10"	5'-0"
51-56	≤ 6	18	6'-4"	9'-10"	5'-0"
	8	18	6'-4"	11'-4"	5'-0"
	10	18	6'-4"	12'-4"	5'-0"
	12	18	6'-4"	13'-2"	5'-0"

**NOTES:**

- SHALLOW FOUNDATION DESIGN SHOWN ON THIS DETAIL IS BASED ON THE FOLLOWING PARAMETERS:  
ALLOWABLE SOIL BEARING CAPACITY = 2000 PSF  
CONCRETE COMPRESSIVE STRENGTH = 4000 PSI  
GRADE 60 REINFORCING STEEL  
MAXIMUM STREAM VELOCITY = 10 FT/SEC  
MAXIMUM SUPPORT HEIGHT (H) = 12'-0"  
IF FIELD CONDITIONS REQUIRE ANY DEVIATION FROM THESE PARAMETERS, THE FOUNDATION DESIGN SHALL BE REVIEWED BY THE ENGINEER.
- IF SUBGRADE AT LOCATION OF SUPPORTS IS DEEMED UNABLE TO WITHSTAND 2000 PSF BEARING PRESSURE, A PILE SUPPORTED FOUNDATION SHALL BE UTILIZED AS PER DRAWING S-15.
- IF BEDROCK IS ENCOUNTERED WHICH WILL PREVENT 3-FOOT MINIMUM COVER OVER FOOTING, DOWELS SHALL BE DRILLED INTO BEDROCK PRIOR TO PLACING FOUNDATION. SEE DRAWING S-16.
- TWELVE-INCH AND FOURTEEN-INCH WIDE PIERS AND FOOTINGS SHALL BE REINFORCED WITH #5 BARS AT 12 INCHES OC IN EACH DIRECTION ON EACH FACE. EIGHTEEN-INCH WIDE PIERS AND FOOTINGS SHALL BE REINFORCED WITH #7 BARS AT 12 INCHES OC IN EACH DIRECTION ON EACH FACE.
- EIGHTEEN-INCH WIDE PIERS SHALL REQUIRE TWO STRAPS OVER THE PIPE INSTEAD OF ONE (AS SHOWN).

**STANDARD PRESSURE SEWER DETAIL**




NOTE: CONTACT WALKER COUNTY WATER & SEWERAGE AUTHORITY FOR THE APPROVED SYSTEM FOR PROJECT AREA.

**GRINDER PUMP DETAIL**

SCALE: NONE

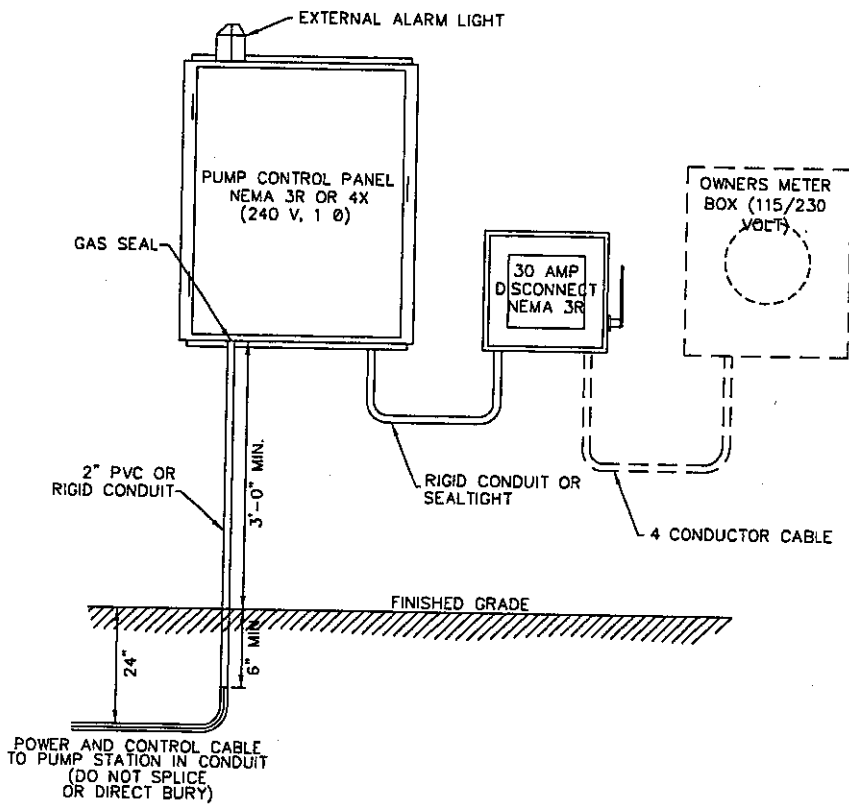


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STANDARD PRESSURE SEWER DETAIL	
GRINDER PUMP DETAILS	
1 OF 3	
NOT TO SCALE	
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NOTES:

1. GRINDER PUMP AND FLOAT SWITCH WIRES WILL GO TO THE JUNCTION BOX. SPLICE BEFORE GOING TO THE CONTROL PANEL.
2. IF THE WIRES FOR THE FLOATS ARE LONG ENOUGH TO GO TO THE CONTROL PANEL, IT WILL NOT BE NECESSARY TO SPLICE THEM.
3. ALL CONNECTIONS FROM THE PUMP AND SWITCHES TO THE JUNCTION BOX AND CONTROL PANEL SHALL COMPLY WITH COUNTY BUILDING INSPECTION, NEC, AND LOCAL CODES.
4. INSTALLATION REQUIRES ELECTRICAL PERMIT AND TAP-ON PERMIT.
5. FINAL INSPECTION TO BE PERFORMED BY LOCAL AUTHORITIES.
6. MUST RUN 4 CONDUCTOR CABLE FROM SERVICE PANEL TO DISCONNECT.



CONTROL PANEL INFORMATION



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STANDARD PRESSURE SEWER DETAIL

GRINDER PUMP DETAILS

2 OF 3

NOT TO SCALE



WALKER COUNTY WATER &  
SEWER AUTHORITY

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GENERAL NOTES:

1. INSTALL CONTROL PANEL ON SIDE OF BUILDING IN VIEW OF GRINDER PUMP STATION. INSTALL WITH ELECTRICAL DISCONNECT AND RUN DEDICATED 220-VOLT LINE FROM CUSTOMER'S POWER METER TO DISCONNECT. INSTALLATION REQUIRES LICENSED ELECTRICIAN AND ELECTRICAL PERMIT.
2. THE GRINDER PUMP STATION IS TO BE INSTALLED DOWNSLOPE OF THE GRAVITY SERVICE LINE EXITING THE BUILDING TO FACILITATE GRAVITY FLOW TO THE PUMP STATION WETWELL (SEE PROFILE).

PLUMBING NOTES:

1. INSTALLATION MUST COMPLY, IN GENERAL, WITH THE STANDARD PLUMBING CODE PUBLISHED BY THE SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL, LATEST REVISION REQUIREMENTS.
2. PUMP AND BASIN SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S PRINTED INSTALLATION MANUAL.
3. GRAVITY SEWER LINES SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S PRINTED INSTRUCTION MANUAL.
4. PUMP DISCHARGE SERVICE LINES SHALL BE INSTALLED WITH A MINIMUM COVER OF 24 INCHES.
5. DISCHARGE SERVICE LINES SHALL BE 1-1/2" CLASS 200 PVC WITH GLUE-ON JOINTS.
6. GRINDER PUMP SYSTEM AND DISCHARGE SERVICE LINES SHALL BE TESTED AS FOLLOWS:
  - A) PRIOR TO BACKFILLING;
    1. CLOSE ISOLATION BALL VALVE AT PROPERTY LINE.
    2. FILL PUMP BASIN WITH WATER.
    3. TURN PUMP ON AND OBSERVE OPERATION.
    4. OBSERVE DISCHARGE SERVICE LINES FOR LEAKS.
  - B) AFTER BACKFILLING;
    1. CLOSE ISOLATION BALL VALVE AT PROPERTY LINE.
    2. REMOVE CHECK VALVE AT PROPERTY AND INSTALL PRESSURE GAUGE APPARATUS WITH FLUSHING VALVE.
    3. FILL PUMP BASIN AND DISCHARGE LINE WITH WATER.
    4. TURN ON GRINDER PUMP TO PRESSURIZE LINE. CLOSE PUMP STATION ISOLATION VALVE AND TURN PUMP OFF.
    5. OBSERVE PRESSURE GAUGE FOR SIGNS OF LEAKAGE.
    6. AFTER TESTING HAS BEEN COMPLETED, REINSTALL THE CHECK VALVE.



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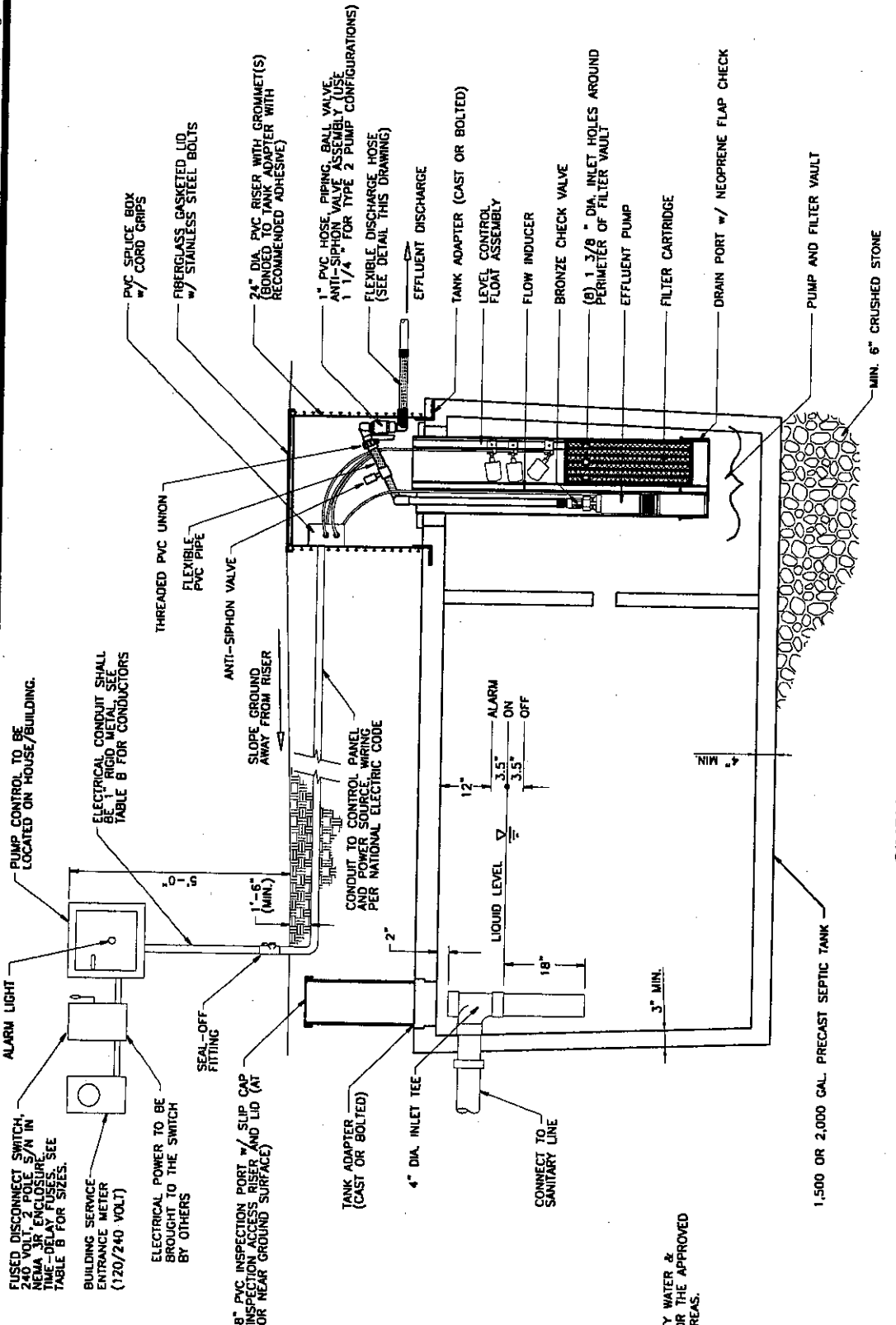
STANDARD PRESSURE SEWER DETAIL

**GRINDER PUMP DETAILS**  
**3 OF 3**  
NOT TO SCALE



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SEWER AUTHORITY

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STANDARD PRESSURE SEWER DETAIL

STEP SYSTEM DETAILS  
1 OF 3  
NOT TO SCALE

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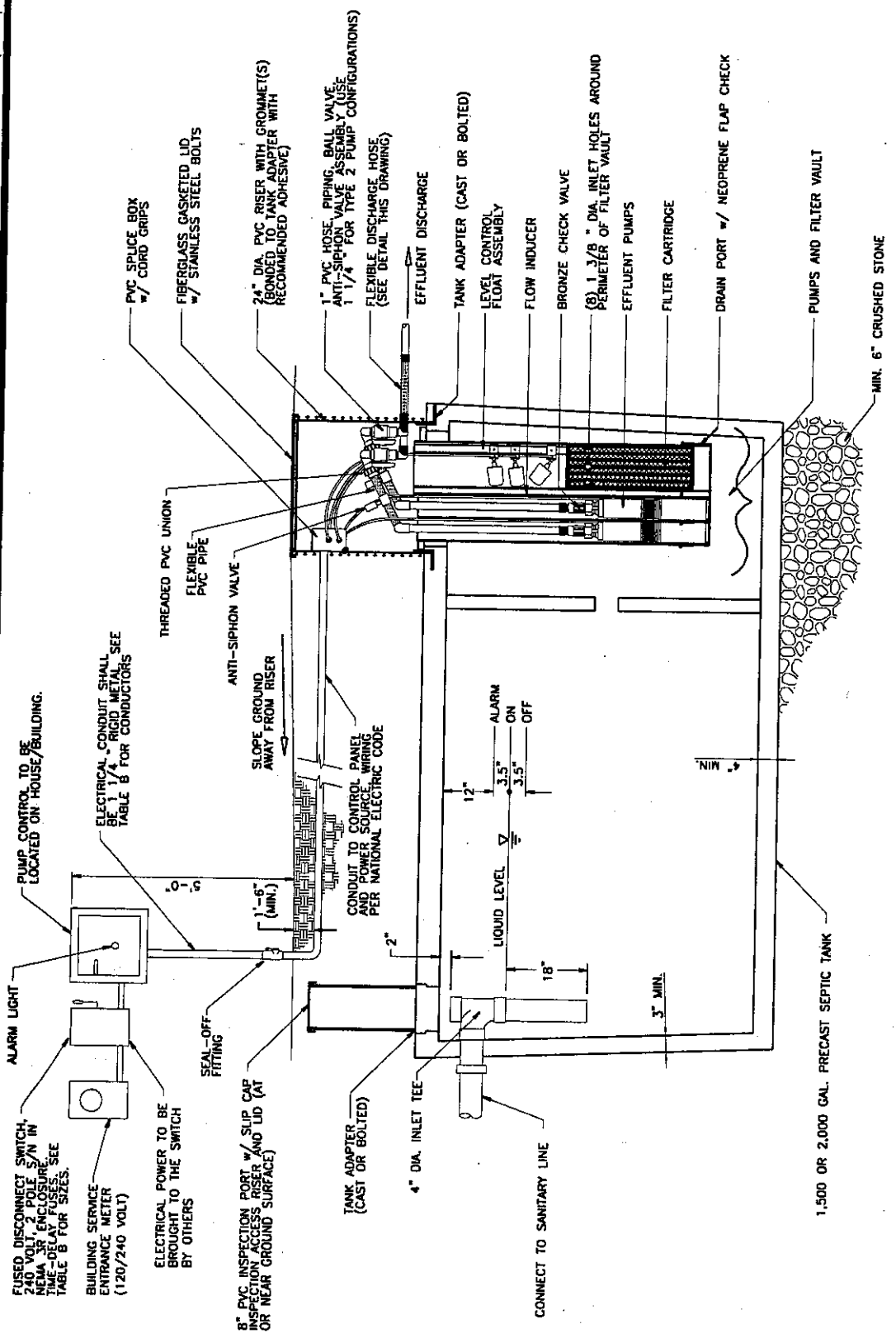
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SIMPLEX PUMP SYSTEM  
NOT TO SCALE

NOTE:  
CONTACT WALKER COUNTY WATER & SEWERAGE AUTHORITY FOR THE APPROVED SYSTEM FOR PROJECT AREAS.





DUPLEX PUMP SYSTEM  
NOT TO SCALE

NOTE:  
CONTACT WALKER COUNTY WATER &  
SEWERAGE AUTHORITY FOR THE  
APPROVED SYSTEM FOR PROJECT  
AREAS.

STANDARD PRESSURE SEWER DETAIL

STEP SYSTEM DETAILS

2 OF 3  
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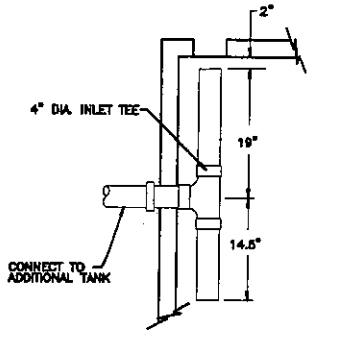
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**TABLE B ELECTRICAL INFORMATION**

PUMP	BRANCH CIRCUIT RATING (AMPS)	BREAKER OR FUSE SIZE (AMPS)	BRANCH CIRCUIT CONDUCTORS	PUMP CONDUCTORS	SEAL-FAIL ALARM CONDUCTORS	FLOAT SWITCH CONDUCTORS
SIMPLEX, 1/2 HP	20	15	3 - #12	2 - #12, #12 GND	2 - #14	6 - #14
DUPLEX, 1/2 HP	30	25	3 - #10	4 - #12, #10 GND	4 - #14	6 - #14
DUPLEX, 1HP	40	40	3 - #8	4 - #10, #10 GND	4 - #14	6 - #14

**TABLE A STEP SYSTEM CONFIGURATIONS**

PEAK FLOW RANGE (GPM)	DAILY FLOW RANGE (GPD)	PUMP TYPE	NO. OF PUMPS	TANK SIZE (GAL.)	NO. OF TANKS
2 TO 10	< 1500	1/2	S	1500	1
	1500 TO 2000	1/2	S	2000	1
	2000 TO 3000	1/2	D	1500	2
	3000 TO 4000	1/2	D	2000	2
	4000 TO 6000	1/2	D	2000	3
10 TO 30	1500 TO 2000	3/4	D	2000	1
	2000 TO 3000	3/4	D	1500	2
	3000 TO 4000	3/4	D	2000	2
	4000 TO 6000	3/4	D	2000	3
	6000 TO 10,000	3/4	D	2,000	5



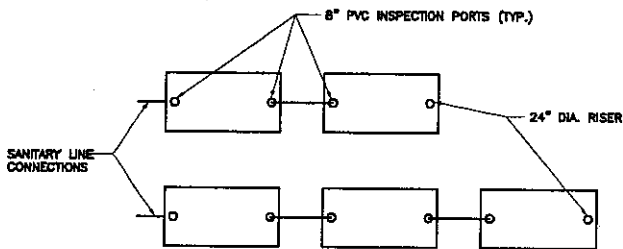
**INLET/OUTLET TEE CONNECTION BETWEEN TANKS DETAIL**  
NOT TO SCALE

**GENERAL NOTES:**

- INSTALL CONTROL PANEL ON SIDE OF BUILDING IN VIEW OF STEP PUMP UNIT. INSTALL WITH ELECTRICAL DISCONNECT, GENERATOR RECEPTACLE AND RUN DEDICATED 240-VOLT LINE FROM CUSTOMERS POWER METER TO DISCONNECT. INSTALLATION REQUIRES LICENSED ELECTRICIAN AND ELECTRICAL PERMIT.

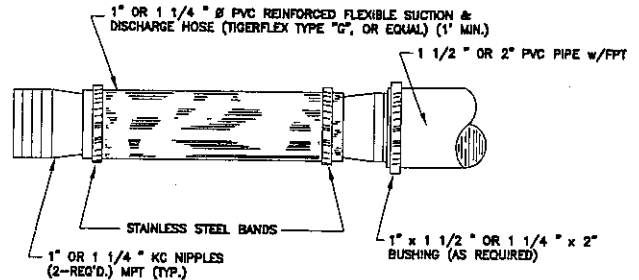
**PLUMBING NOTES:**

- INSTALLATION MUST COMPLY, IN GENERAL, WITH THE STANDARD PLUMBING CODE PUBLISHED BY THE SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL, LATEST REVISION REQUIREMENTS.
- PUMP UNIT AND SEPTIC TANK(S) SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S PRINTED INSTALLATION MANUAL.
- PUMP DISCHARGE SERVICE LINES SHALL BE INSTALLED WITH A MINIMUM COVER OF 24 INCHES.
- DISCHARGE SERVICE LINES SHALL BE 1-1/2" CLASS 200 PVC WITH PUSH-ON JOINTS.
- STEP PUMP SYSTEM AND DISCHARGE SERVICE LINES SHALL BE TESTED AS FOLLOWS:
  - PRIOR TO BACKFILLING:
    - CLOSE ISOLATION BALL VALVE AT PROPERTY LINE.
    - FILL SEPTIC TANK WITH WATER.
    - TURN PUMP ON AND OBSERVE OPERATION.
    - OBSERVE DISCHARGE SERVICE LINES FOR LEAKS.
  - AFTER BACKFILLING:
    - CLOSE ISOLATION BALL VALVE AT PROPERTY LINE.
    - REMOVE CHECK VALVE AT PROPERTY AND INSTALL PRESSURE GAUGE APPARATUS WITH FLUSHING VALVE.
    - FILL SEPTIC TANK AND DISCHARGE LINE WITH WATER.
    - TURN ON STEP PUMP TO PRESSURIZE LINE. CLOSE PUMP UNIT ISOLATION VALVE AND TURN PUMP OFF.
    - OBSERVE PRESSURE GAUGE FOR SIGNS OF LEAKAGE.
    - AFTER TESTING HAS BEEN COMPLETED, REINSTALL THE CHECK VALVE.



NOTE:  
PROVIDE 2" FALL BETWEEN TANKS

**TYPICAL LAYOUTS FOR MULTIPLE TANKS**  
NOT TO SCALE



**FLEXIBLE DISCHARGE PIPE DETAIL**  
NOT TO SCALE



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STANDARD PRESSURE SEWER DETAIL

STEP SYSTEM DETAILS

3 OF 3

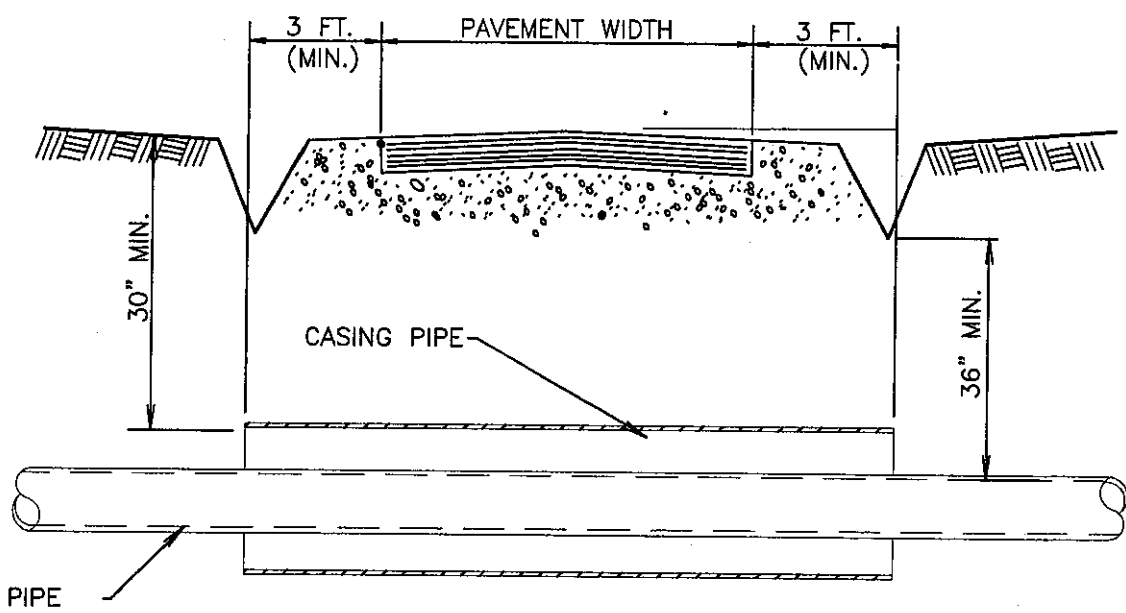
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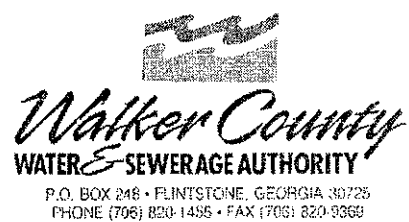
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ROAD CROSSING DETAIL  
NOT TO SCALE


SDR 21 PVC CARRIER SIZE	SDR 11 HIGH DENSITY POLETHYLENE	
	CASING SIZE	WALL THICKNESS OF CASING PIPE
1 1/4"	3"	0.318
1 1/2"	3"	0.318
2"	4"	0.409
3"	6"	0.602



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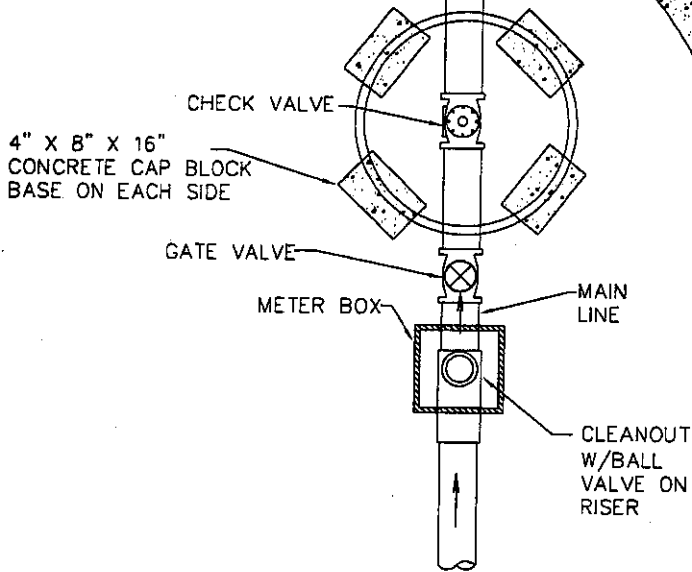
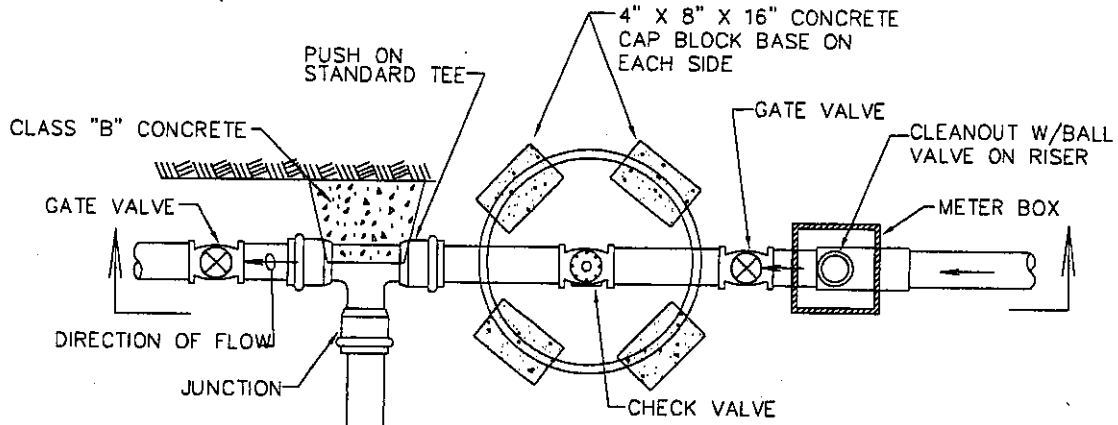
STANDARD PRESSURE SEWER DETAIL

**ROAD CROSSING DETAIL**  
NOT TO SCALE



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PLAN



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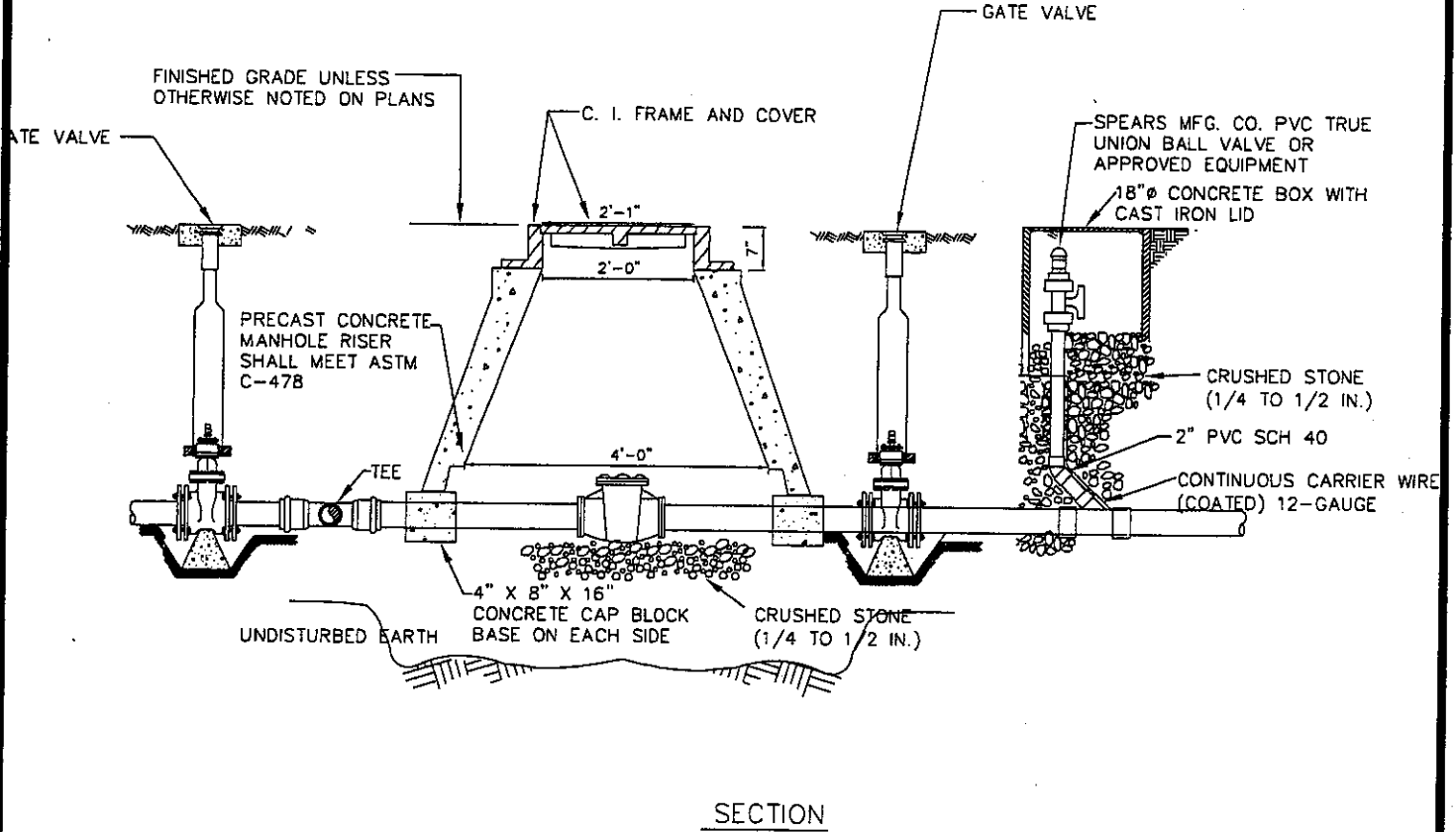
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STANDARD PRESSURE SEWER DETAIL

PRESSURE MAIN JUNCTION  
AND CLEANOUT  
SHEET 1 OF 2



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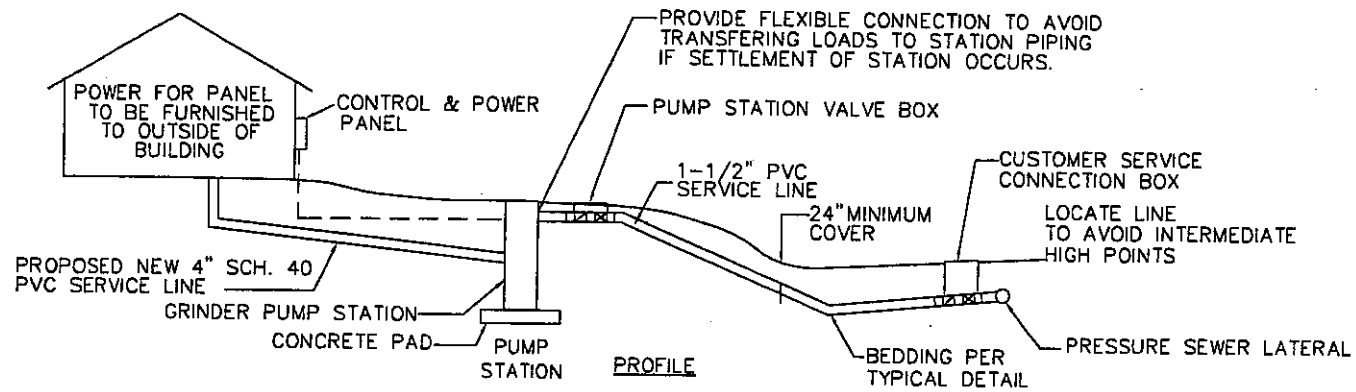
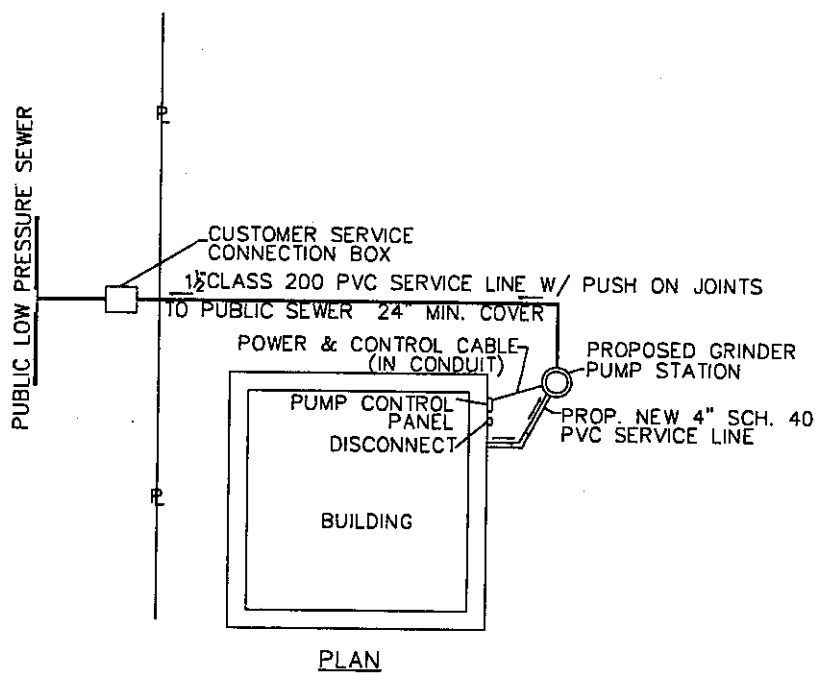
  
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STANDARD PRESSURE SEWER DETAIL

PRESSURE MAIN JUNCTION  
AND CLEANOUT  
SHEET 2 OF 2



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**GRINDER PUMP SERVICE INSTALLATION**



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STANDARD PRESSURE SEWER DETAIL

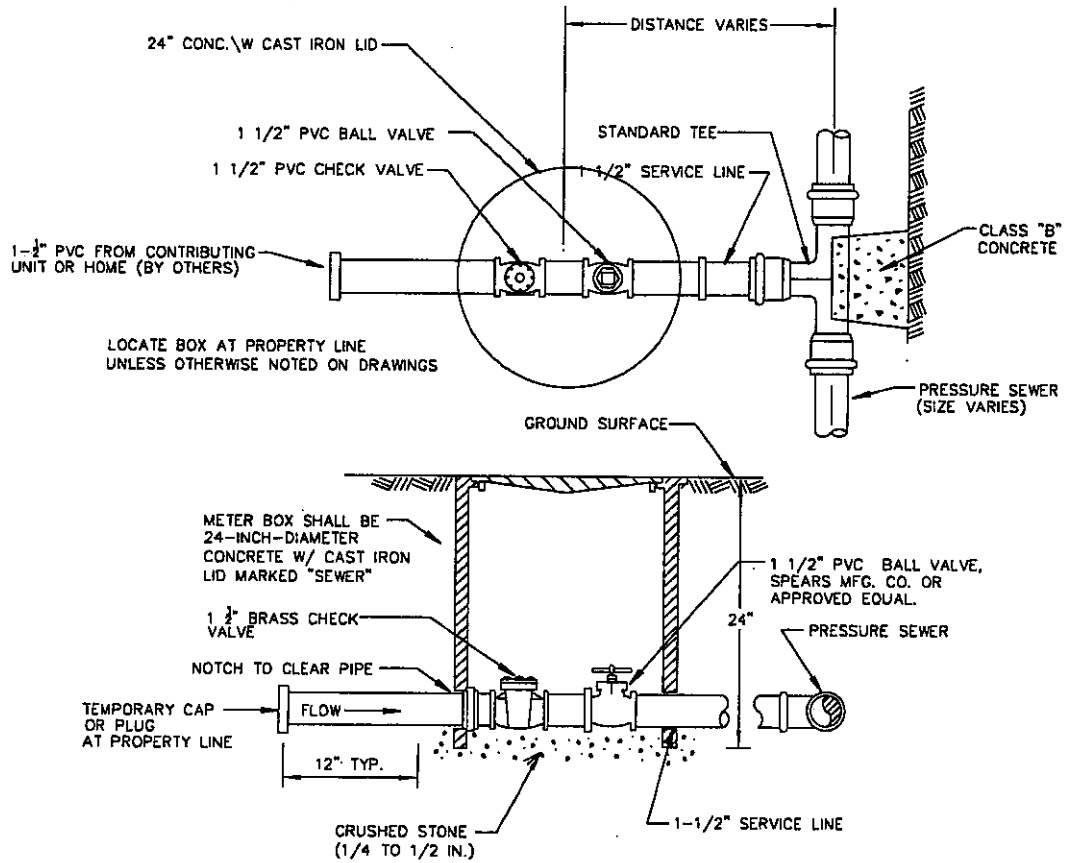
**GRINDER PUMP SERVICE  
 INSTALLATION**

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**PRESSURE SEWER  
CUSTOMER SERVICE CONNECTION BOX DETAIL**  
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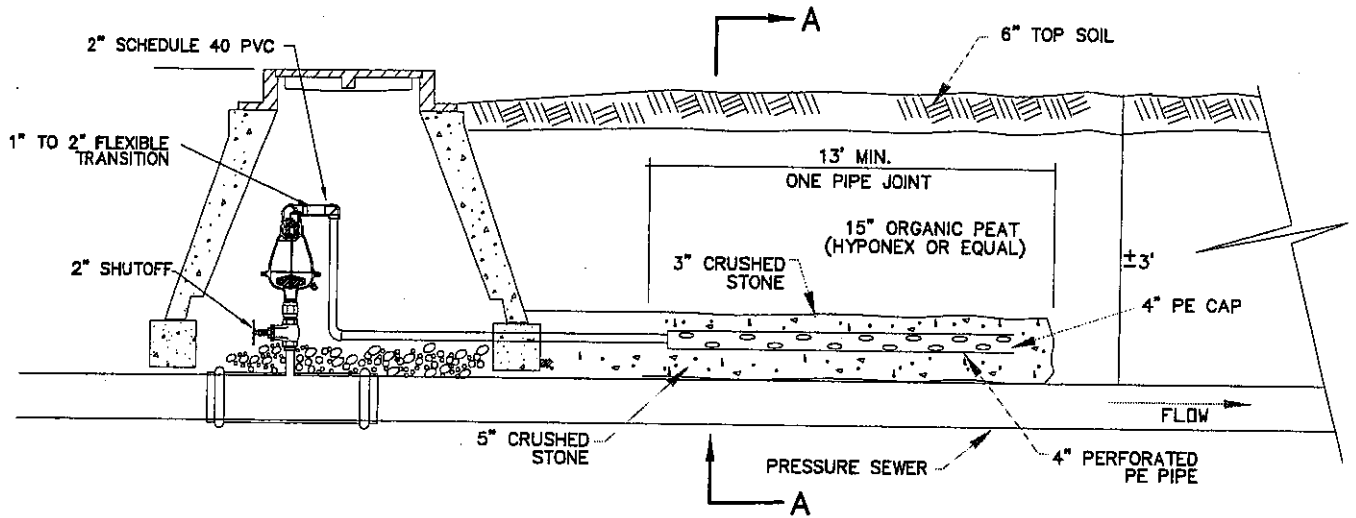
STANDARD PRESSURE SEWER DETAIL

CUSTOMER SERVICE  
CONNECTION BOX DETAIL



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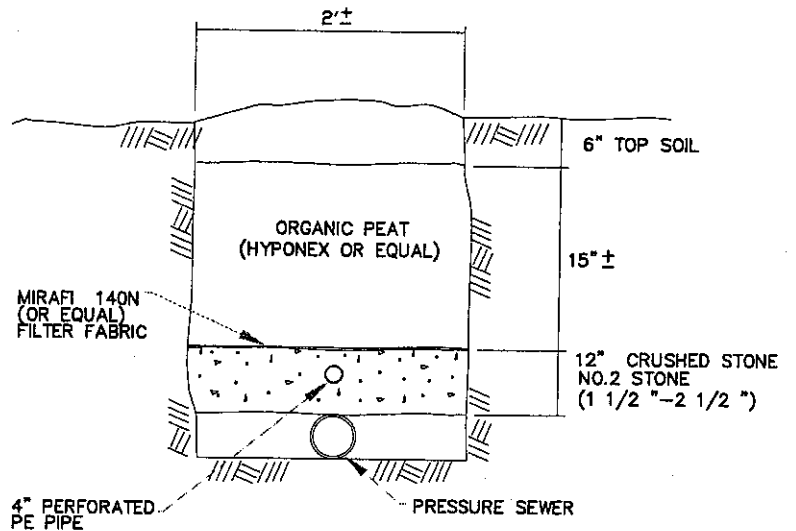
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**2" ARID-025 COMBINATION AIR VALVE**

**ODOR CONTROL SOIL BED**

(TO BE CONNECTED TO AIR RELEASE OR COMBINATION AIR VALVES)  
NOT TO SCALE



**SECTION A - A**

- NOTES:
1. PLACE DOWN STREAM OF AIR/VACUUM VALVE.
  2. LOCATE ENTIRELY WITHIN RIGHT-OF-WAY



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STANDARD PRESSURE SEWER DETAIL

ODOR CONTROL SOIL BED  
DETAIL

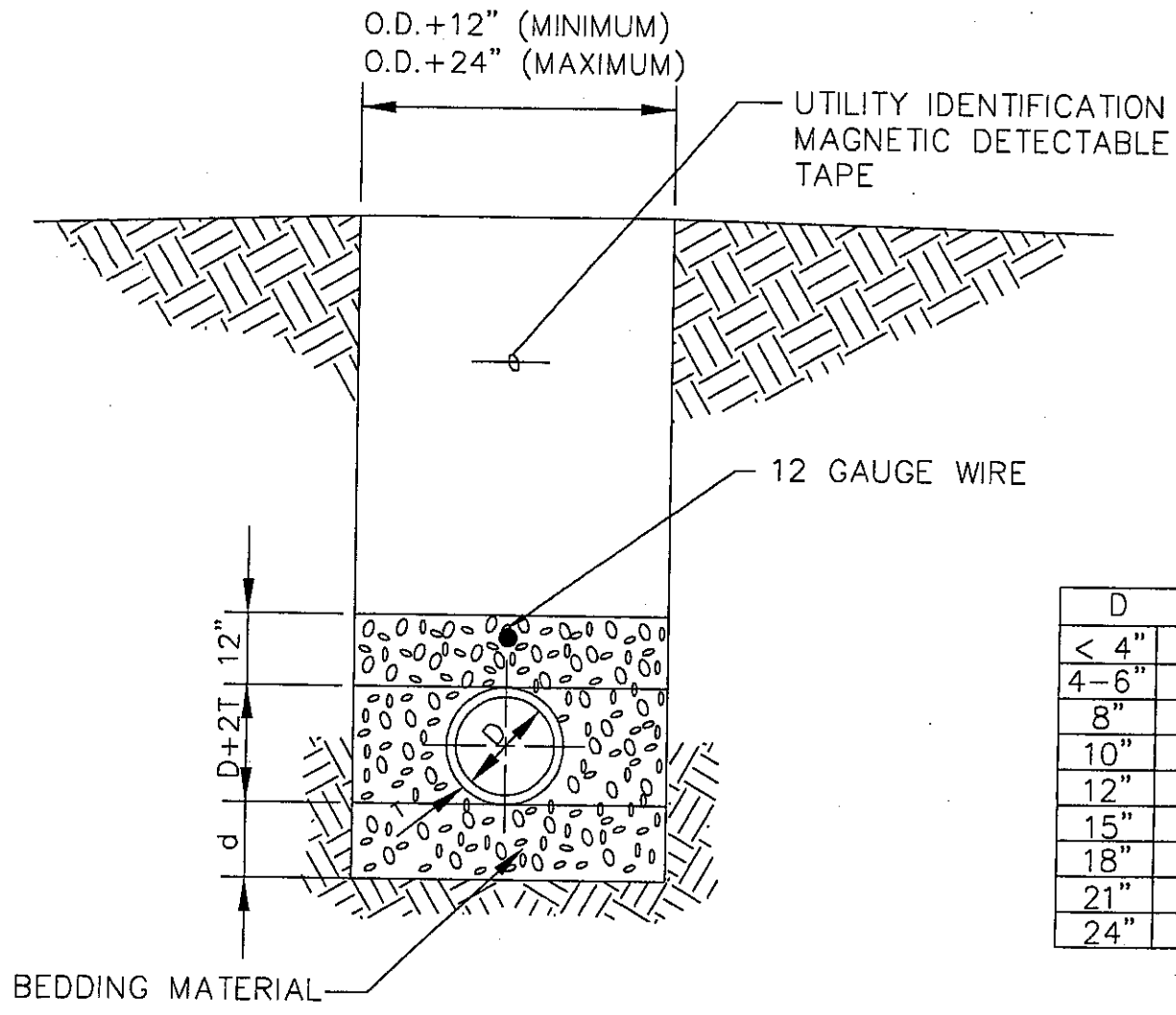
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D	d
< 4"	4"
4-6"	6"
8"	6"
10"	8"
12"	8"
15"	8"
18"	8"
21"	10"
24"	10"

**TYPICAL TRENCH AND BEDDING**  
**FOR ALL PIPE**




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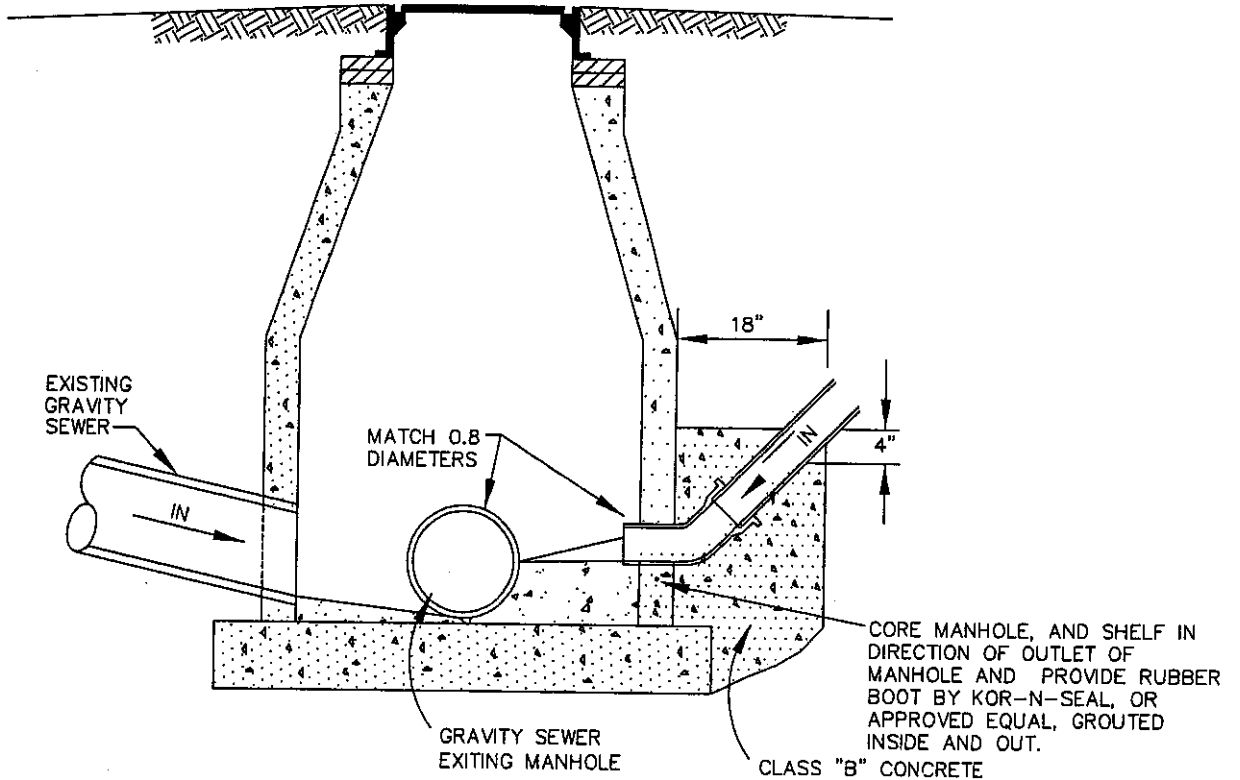
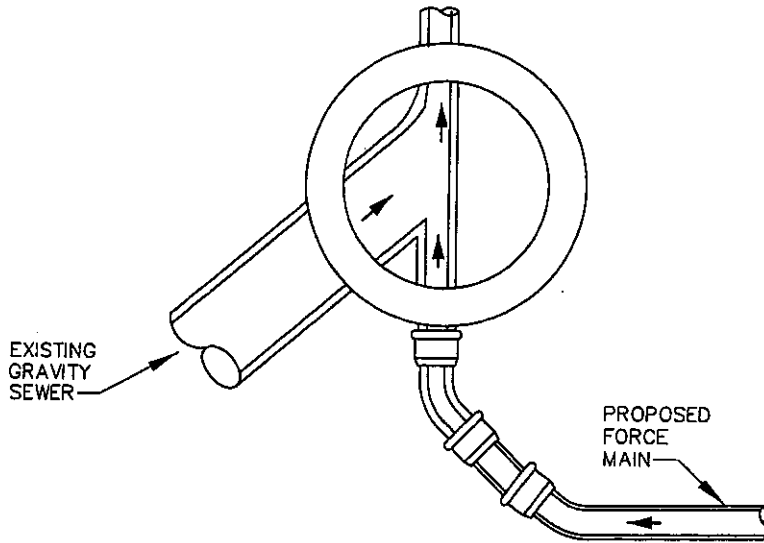
STANDARD PRESSURE SEWER DETAIL

**TYPICAL TRENCH & BEDDING DETAIL**

NOT TO SCALE



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STANDARD CONNECTION OF  
FORCE MAIN TO MANHOLE DETAIL  
N.T.S.



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STANDARD PRESSURE SEWER DETAIL

STANDARD CONNECTION OF  
FORCE MAIN TO MANHOLE DETAIL

NOT TO SCALE

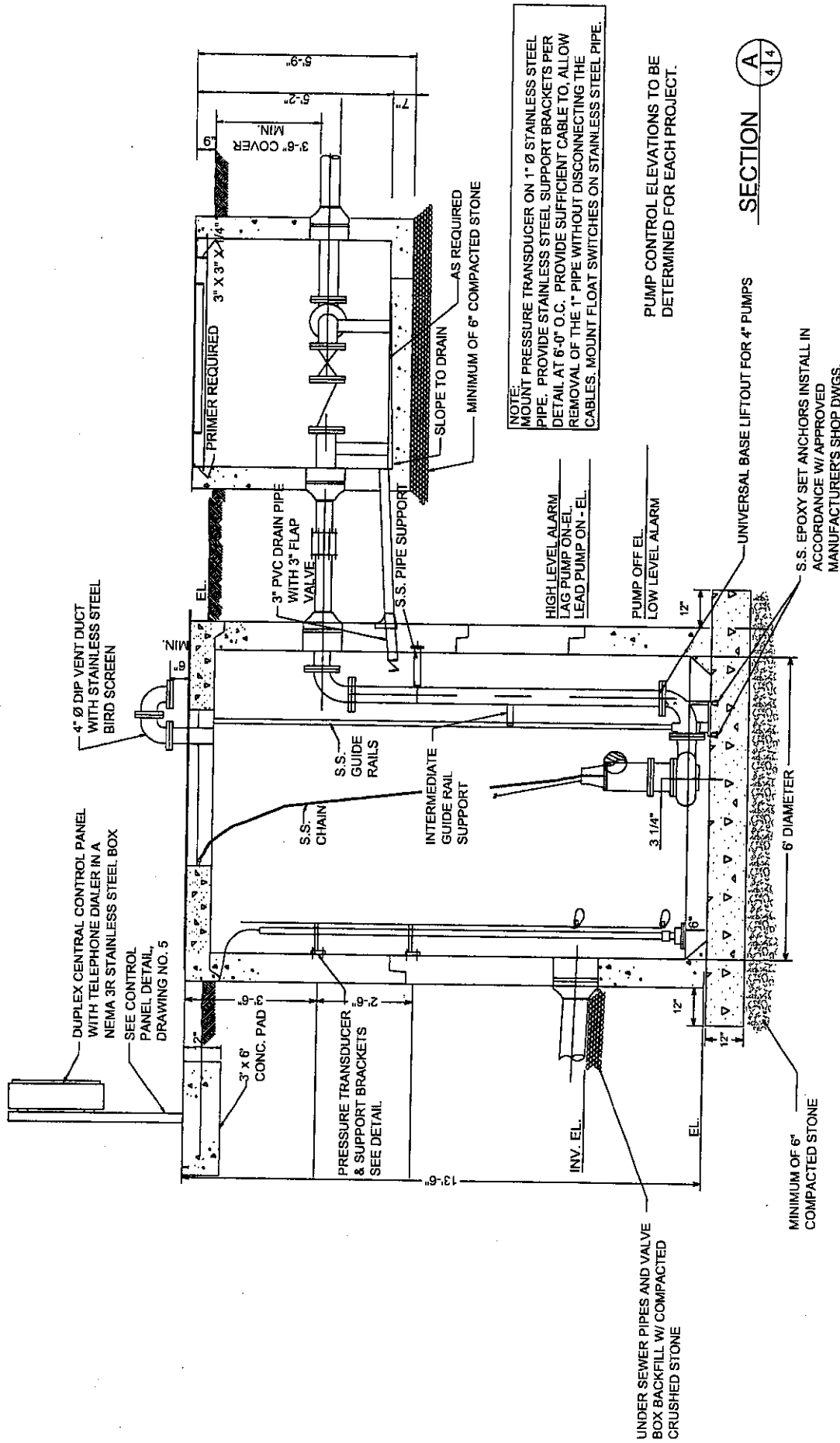


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## **DUPLEX PUMP STATION DETAILS**

**Note:** The following details are provided to set a minimum standard for small duplex pump stations. Each pump station must be designed to meet the hydraulic, energy and septicity requirements of each individual project. Grinder pumps may be used in lieu of non-clog pumps only on small developments that do not develop sufficient flow to use non-clog pumps.



**NOTE:**  
 MOUNT PRESSURE TRANSDUCER ON 1" Ø STAINLESS STEEL PIPE. PROVIDE STAINLESS STEEL SUPPORT BRACKETS PER DETAIL AT 6'-0" O.C. PROVIDE SUFFICIENT CABLE TO ALLOW REMOVAL OF THE 1" PIPE WITHOUT DISCONNECTING THE CABLES. MOUNT FLOAT SWITCHES ON STAINLESS STEEL PIPE.

PUMP CONTROL ELEVATIONS TO BE DETERMINED FOR EACH PROJECT.

**SECTION A**

UNIVERSAL BASE LIFTOUT FOR 4" PUMPS

S.S. EPOXY SET ANCHORS INSTALL IN ACCORDANCE W/ APPROVED MANUFACTURER'S SHOP DWGS.

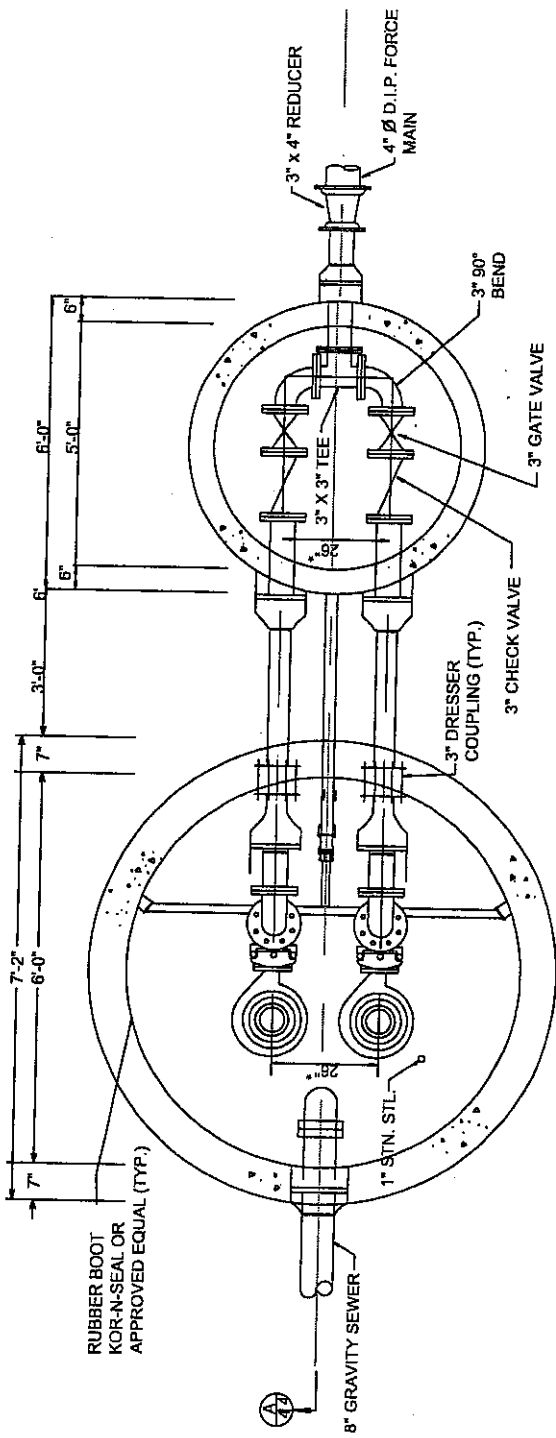
UNDER SEWER PIPES AND VALVE BOX BACKFILL W/ COMPACTED CRUSHED STONE

MINIMUM OF 6" COMPACTED STONE

**DUPLEX GRINDER PUMP STATION DETAIL**

**ELEVATION DETAIL**  
 NOT TO SCALE

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NOTE:  
 PROVIDE CONCRETE VALVE SUPPORTS  
 AS REQUIRED.  
 DIMENSIONS MARKED WITH \*MAY VARY  
 DEPENDING ON PUMP MANUFACTURERS  
 RECOMMENDATIONS

PLAN VIEW

DUPLEX GRINDER PUMP STATION DETAIL

PLAN VIEW DETAIL  
 NOT TO SCALE



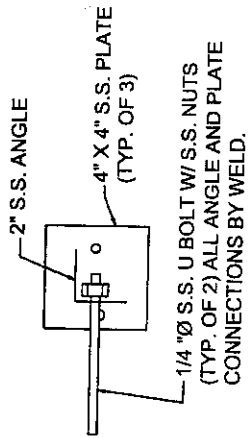
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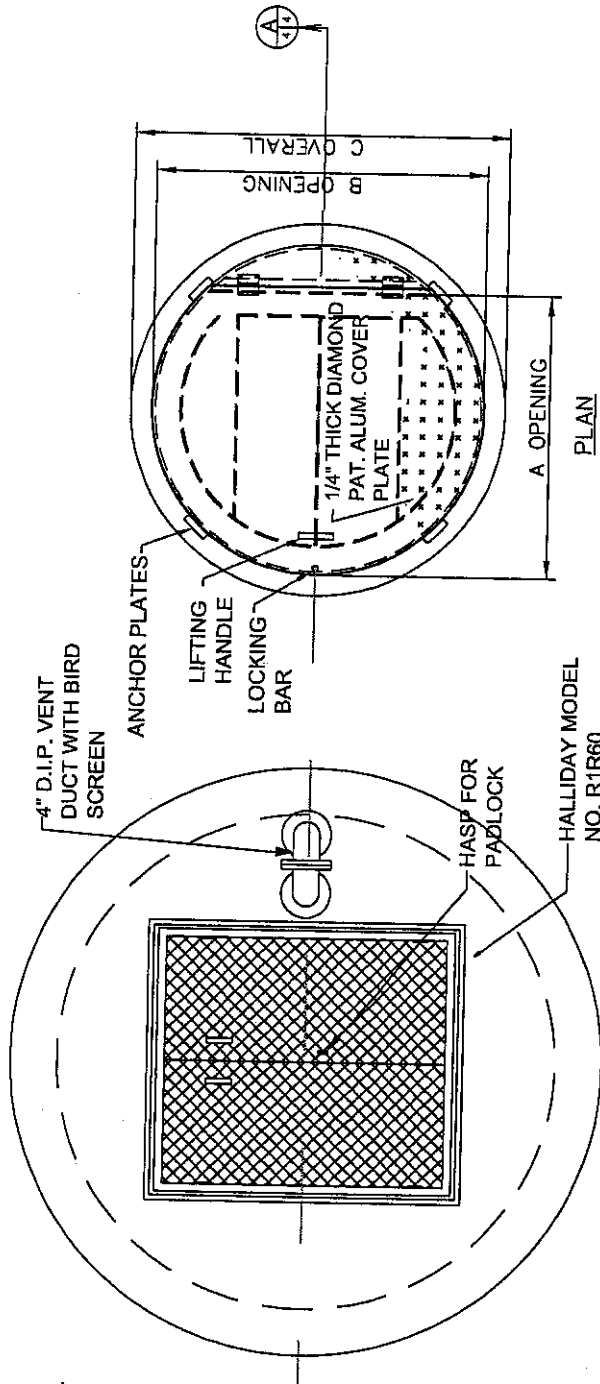
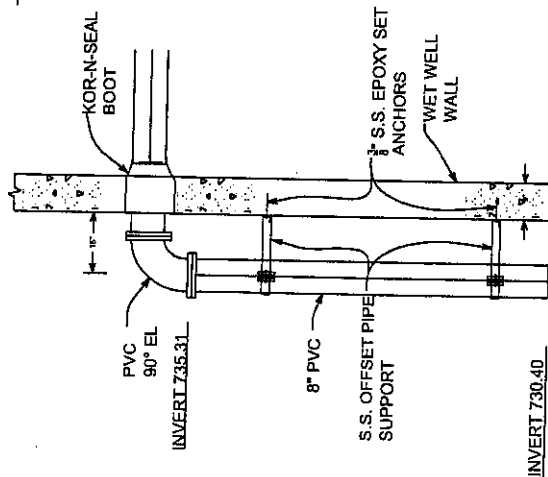


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**S.S. PIPE SUPPORT**  
N.T.S.



**TOP VIEW**

DUPLEX GRINDER PUMP STATION DETAIL

PLAN VIEW DETAIL  
NOT TO SCALE

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SECTION **B**  
4/3

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### GENERAL NOTES

1. ALL PIPING IN STATION AND VALVE PIT SHALL BE DUCTILE IRON. THE PIPING SHALL BE COATED USING THE COAL TAR EPOXY SYSTEM TNEMEC 46H - 413 HI-BUILD TNEMEC - TAR (19-25 MIL) COLOR SHALL BE BLACK.
2. INSIDE OF WETWELL SHALL BE COATED WITH EPOXY/URETHANE SYSTEM TNEMEC SERIES 69H. BUILD EPOXOLINE II (4-6) MIL. TNEMEC SERIES 262 ELASTO-SHIELD (50 MIL) COLOR SHALL BE WHITE.
3. CHECK VALVES SHALL BE IN CONFORMANCE WITH AWWA C508. VALVES SHALL BE MUELLER FIG-A2600-01.
4. GATE VALVES SHALL BE IN CONFORMANCE WITH AWWA C509. VALVES SHALL BE MUELLER FIG-A2360.
5. GUIDE RAILS, LIFTING CHAINS, NUTS, BOLTS, WASHERS, BRACKETS, CLIPS, ETC. SHALL BE STAINLESS STEEL.
6. CONTRACTOR TO SUPPLY LOCKS DURING CONSTRUCTION. THE AUTHORITY WILL PROVIDE LOCKS AFTER PROJECT COMPLETION.
7. FOR CONTROL PANEL, ALL SUPPORTS AND MOUNTING BRACKETS, BOLTS, NUTS, WASHERS, ETC. SHALL BE STAINLESS STEEL. PAINTED STEEL BRACKETS, ETC. MAY BE USED INSIDE PANEL PROVIDED THEY ARE MOUNTED TO THE PANEL WITH STAINLESS STEEL FASTENERS.
8. CHECK VALVES ARE TO BE NON-PACKED SWING CHECK VALVES. ISOLATION VALVES SHALL BE PLUG VALVES.
9. A 1-INCH WATER LINE AND A 3/4-INCH NON-FREEZING COMPRESSION YARD HYDRANT WITH VACUUM BREAKER SHALL BE PROVIDED FOR WASH DOWN PURPOSES. (SEE DETAIL)
10. WATER MAIN TAP AND METER BY WALKER COUNTY WATER & SEWERAGE AUTHORITY. ALL COST AND FEES TO BE THE RESPONSIBILITY OF THE CONTRACTOR.
11. PRECAST WETWELL AND VALVE BOX STRUCTURES SHALL BE IN ACCORDANCE WITH ASTM C-478 AND SHALL BE CLASS "A" CONCRETE.
12. PROVIDE 10" x 14" WARNING SIGNS ON FRONT AND REAR OF CONTROL PANEL BAKED ENAMEL ON 20 GA. ALUM. " DANGER - HIGH VOLTAGE "
13. DIMENSIONS MARKED WITH AN \*TO BE DETERMINED AFTER EQUIPMENT SELECTION.
14. ALL PIPING WITHIN THE WETWELL AND VALVE VAULT SHALL HAVE FLANGED FITTINGS WITH STAINLESS STEEL BOLTS.
15. LIFT STATION AND PIPING DIMENSION SHALL BE DETERMINED TO MEET PROJECT HYDRAULIC REQUIREMENTS.



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DUPLEX GRINDER PUMP STATION DETAIL

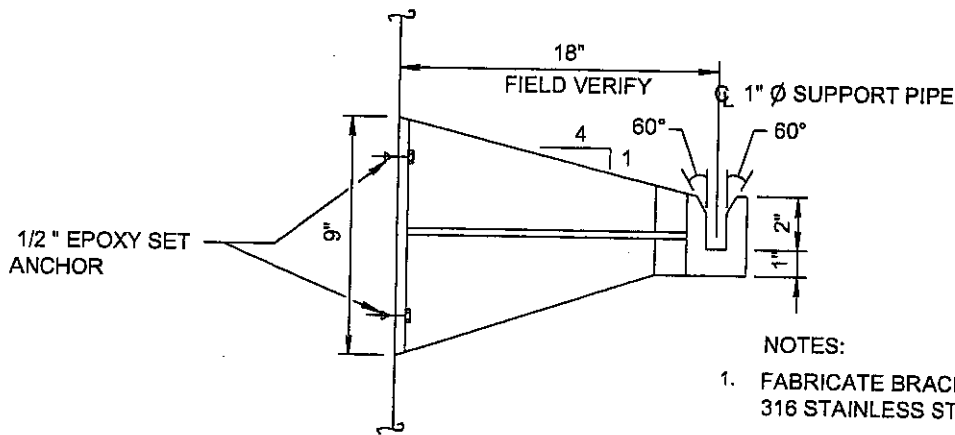
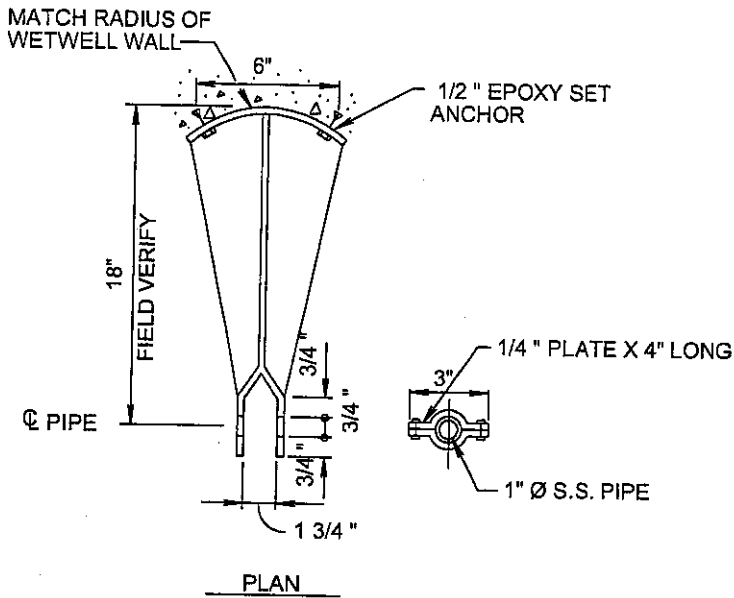
**GRINDER PUMP STATION  
NOTES**

NOT TO SCALE



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- NOTES:
1. FABRICATE BRACKET FROM 1/4" 316 STAINLESS STEEL
  2. LOCATE BRACKETS SO PIPE CAN BE REMOVED THROUGH HATCH OPENING

**ELEVATION**

**PRESSURE TRANSDUCER AND FLOAT SUPPORT BRACKET (2 REQUIRED)**

N.T.S.



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DUPLEX GRINDER PUMP STATION DETAIL

ELEVATION DETAIL  
 NOT TO SCALE

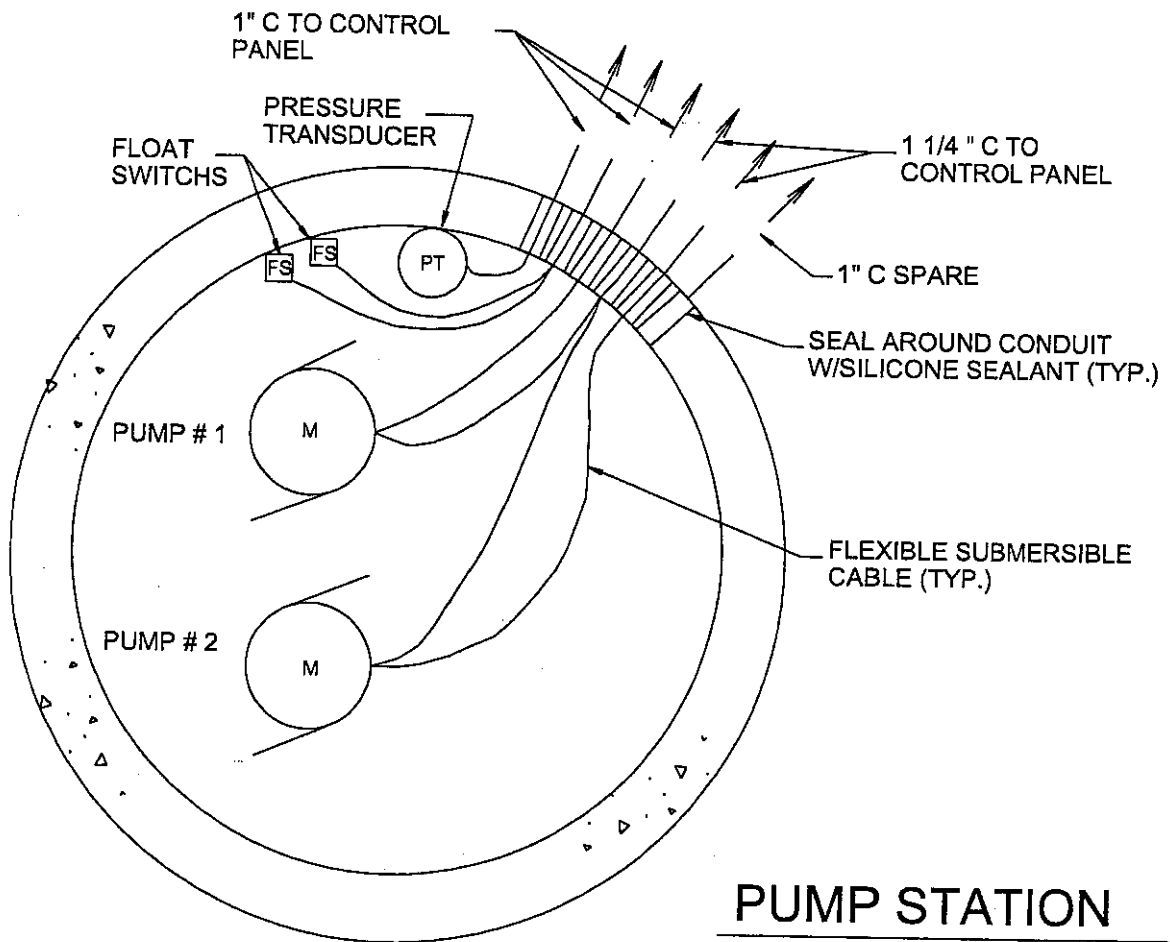


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DUPLEX GRINDER PUMP STATION DETAIL

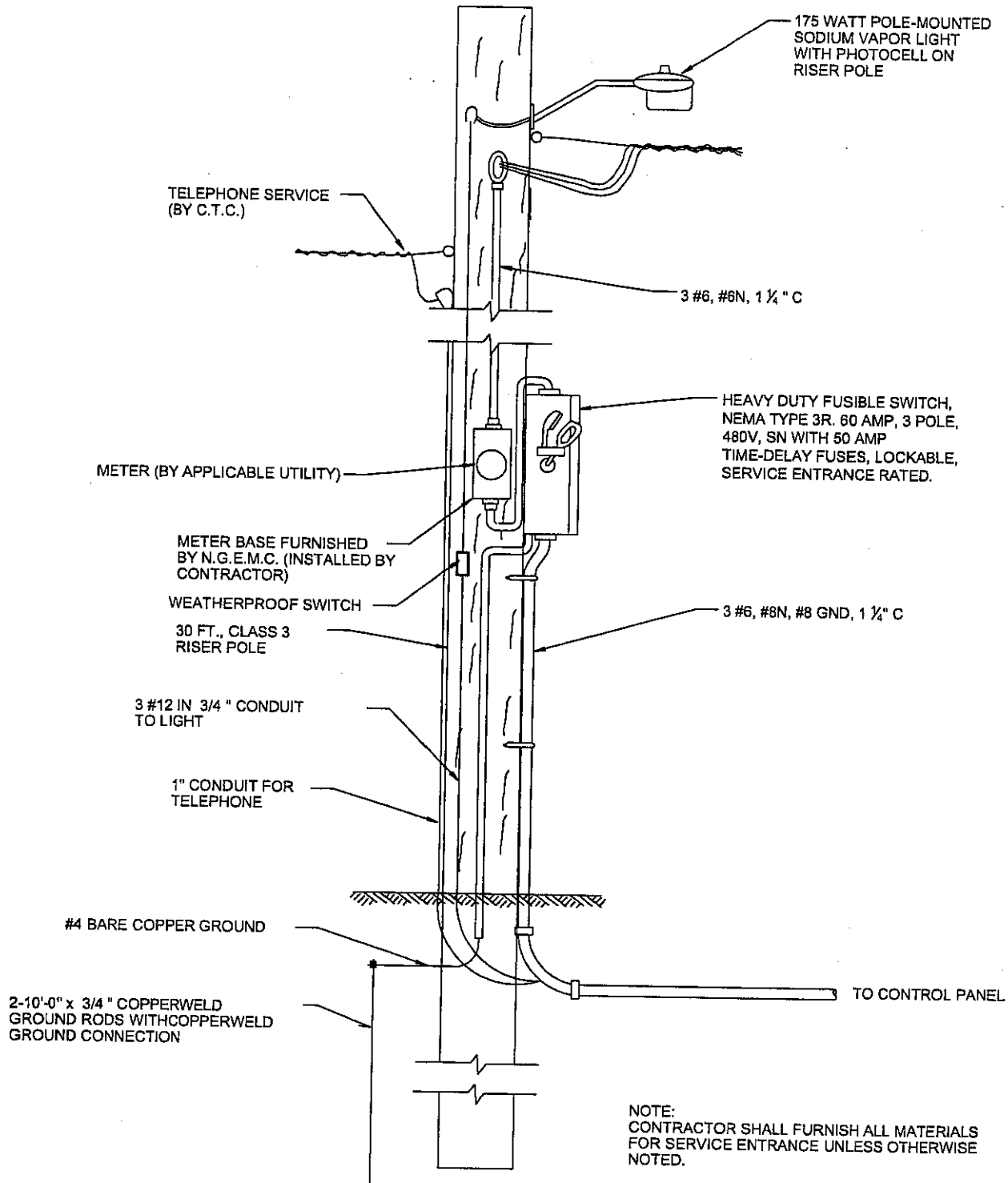
**PUMP STATION DETAIL**  
NOT TO SCALE



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### CLASS 3 RISER POLE DETAIL

NOT TO SCALE



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DUPLEX GRINDER PUMP STATION DETAIL

RISER POLE DETAIL

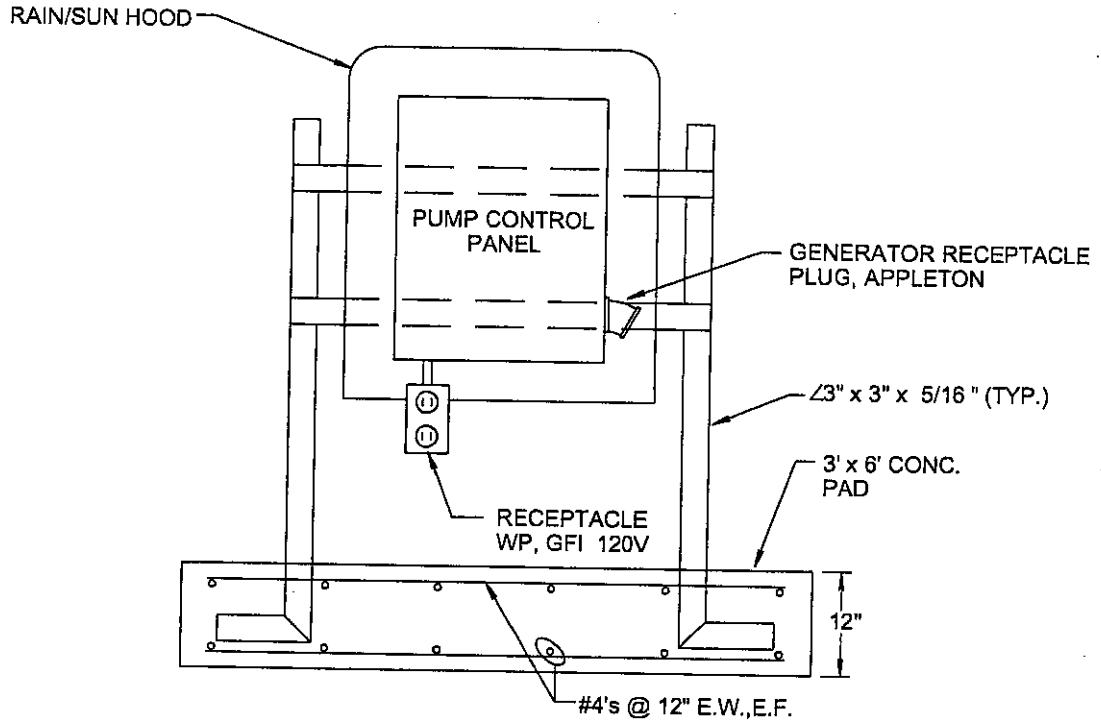
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SEWER AUTHORITY

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**CONTROL PANEL  
PAD DETAIL**

  
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DUPLEX GRINDER PUMPSTATION DETAILS

**CONTROL PANEL PAD  
DETAIL**  
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## GENERAL NOTES:

1. FLEXIBLE SUBMERSIBLE CABLES SHALL BE CONTINUOUS FROM PUMPS, FLOAT SWITCHES AND TRANSDUCER TO CONTROL PANEL
2. PROVIDE SEAL-OFF FITTINGS IN ALL CONDUITS LEADING FROM WETWELL TO CONTROL PANEL. WETWELL IS A CLASS 1, DIVISION 1, HAZARDOUS LOCATION.
3. PROVIDE WATERTIGHT COMPRESSION FITTINGS WHERE CABLES EMERGE FROM CONDUITS IN WETWELL.
4. SUPPORT FLEXIBLE CABLES AT TOP OF WETWELL INDEPENDENT OF CONDUITS.
5. SEE SPECIFICATIONS FOR REQUIRED CONTROL PANEL FUNCTIONS AND ACCESSORIES.
6. DEMONSTRATE PUMP STATION START-UP WITH OWNER'S PORTABLE EMERGENCY GENERATOR. CONTRACTOR SHALL ENSURE THAT SPECIFIED GENERATOR RECEPTACLE PLUG ADAPTS TO AUTHORITY'S GENERATOR.
7. PROVIDE 10"x 14" WARNING SIGN ON FRONT AND REAR OF CONTROL PANEL. BAKED ENAMEL ON 20GA. ALUM. "WARNING HIGH-VOLTAGE"
8. UNLESS OTHERWISE NOTED ALL ELECTRICAL CONDUIT AND RELATED FITTINGS SHALL BE PVC-COATED, RIGID GALVANIZED STEEL. ENCASED, BURIED CONDUIT BETWEEN CONTROL PANEL SERVICE ENTRANCE POLE SHALL BE SCHEDULE 40 PVC. EXPOSED CONDUIT ON SERVICE ENTRANCE POLE SHALL BE RIGID GALVANIZED STEEL. POLE SHALL PROVIDE LIGHTING FOR PUMP STATION.
9. CONTROL PANEL SUPPORTS SHALL BE STAINLESS STEEL OR ALUMINUM. ALL BOLTS, SCREWS, AND MOUNTING ACCESSORIES SHALL BE STAINLESS STEEL.
10. ALL ELECTRICAL CONDUIT AND WIRING SHALL BE UL LISTED.
11. ALL ELECTRICAL WORK SHALL COMPLY WITH NEC AND APPLICABLE STATE AND LOCAL CODES.
12. CONTRACTOR SHALL COORDINATE ALL ELECTRICAL CONNECTIONS AND PHONE CONNECTIONS WITH APPROPRIATE AGENCIES AND PAY ALL COSTS ASSOCIATED WITH THE RELOCATION AND RECONNECTION OF EACH UTILITY. COSTS SHALL BE INCLUDED IN LUMP SUM PRICE FOR PUMP STATION.



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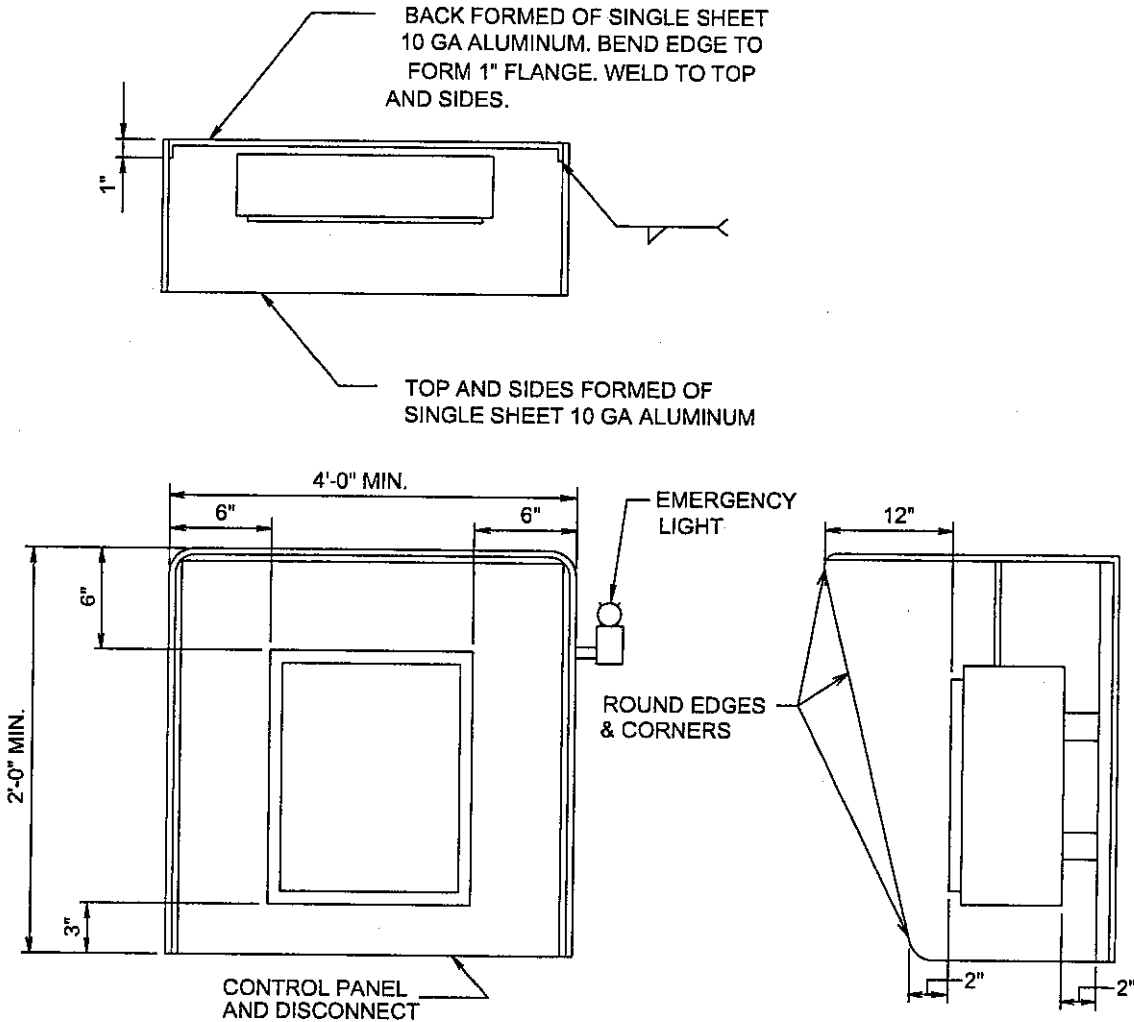
DUPLEX GRINDER PUMP STATION DETAIL

CONTROL PANEL  
ELECTRICAL SCHEMATIC  
NOT TO SCALE



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NOTES:

1. ALL EXPOSED EDGES TO BE GROUND SMOOTH AND BURR FREE.
2. MOUNT RAIN/SUN HOOD BETWEEN EQUIPMENT AND STANCHION.  
USE STAINLESS STEEL BOLTS AND INSULATING WASHERS AND SLEEVES.

**RAIN/SUN HOOD DETAIL**

NOT TO SCALE



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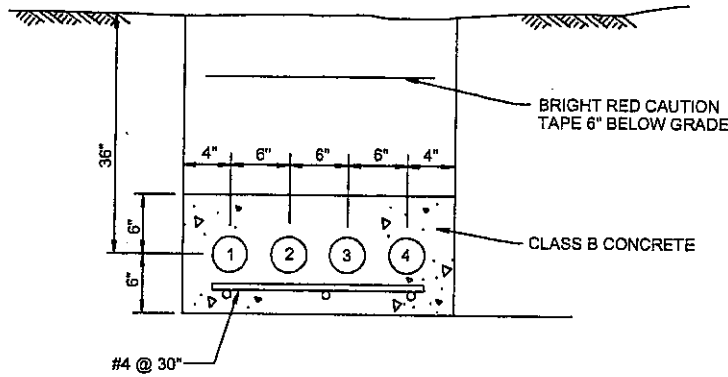
DUPLEX GRINDER PUMP STATION DETAIL

**CONTROL PANEL  
ELECTRICAL SCHEMATIC**  
NOT TO SCALE



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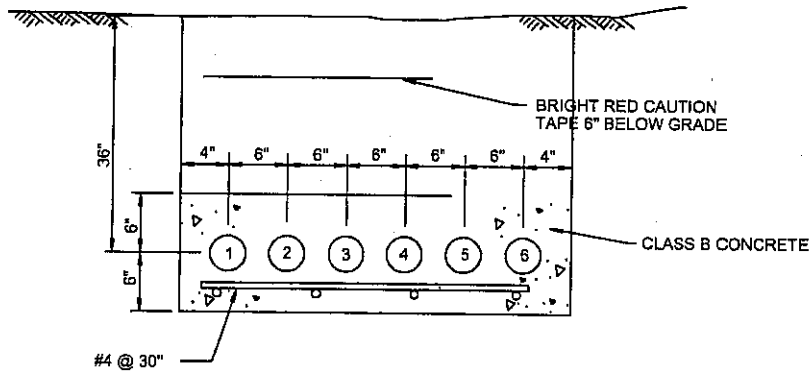


CONDUIT SCHEDULE DUCT BANK

- ① 3 #6, #8N, #8 GND, 1½" C
- ② SPARE 1¼" C W/PULL WIRE
- ③ 2 # 12, #12 GND, ¾" C
- ④ 1" TELEPHONE

**SERVICE ENTRANCE DUCT BANK DETAIL**

NOT TO SCALE



CONDUIT SCHEDULE DUCT BANK

- ① 1" C TRANSDUCER CABLE
- ② 1" C FLOAT SWITCH CABLES (2)
- ③ 1¼" C PUMP NO. 1 POWER CABLE
- ④ 1¼" C PUMP NO. 2 POWER CABLE
- ⑤ 1" WITH 3 - #12 HOT BOX HEATER
- ⑥ 1" C SPARE-W/PULL WIRE

**WETWELL DUCT BANK DETAIL**

NOT TO SCALE



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DUPLEX GRINDER PUMP STATION DETAIL

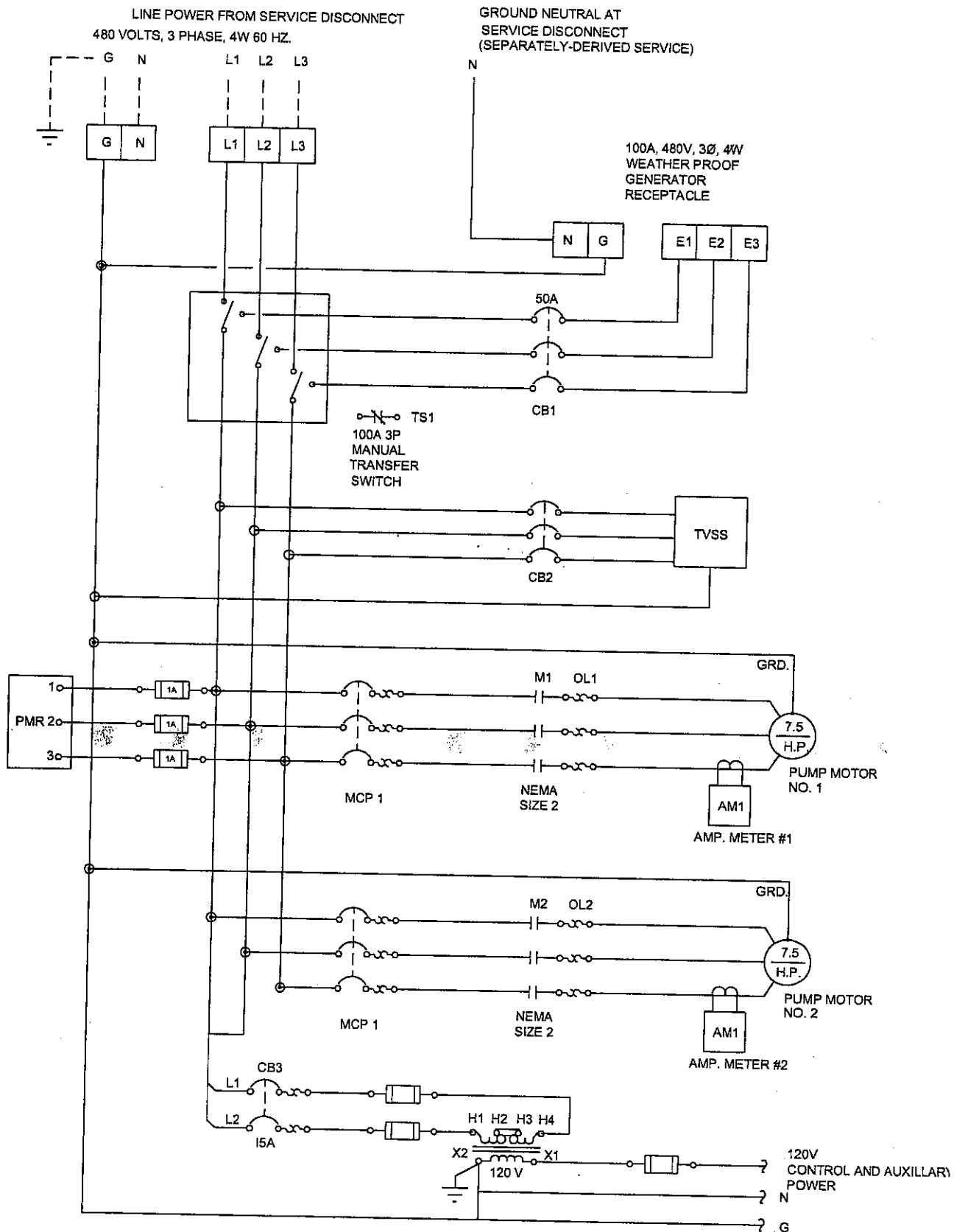
**CONTROL PANEL  
ELECTRICAL SCHEMATIC**  
NOT TO SCALE



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DUPLEX GRINDER PUMP STATION DETAIL

**CONTROL PANEL**  
**ELECTRICAL SCHEMATIC**  
 NOT TO SCALE

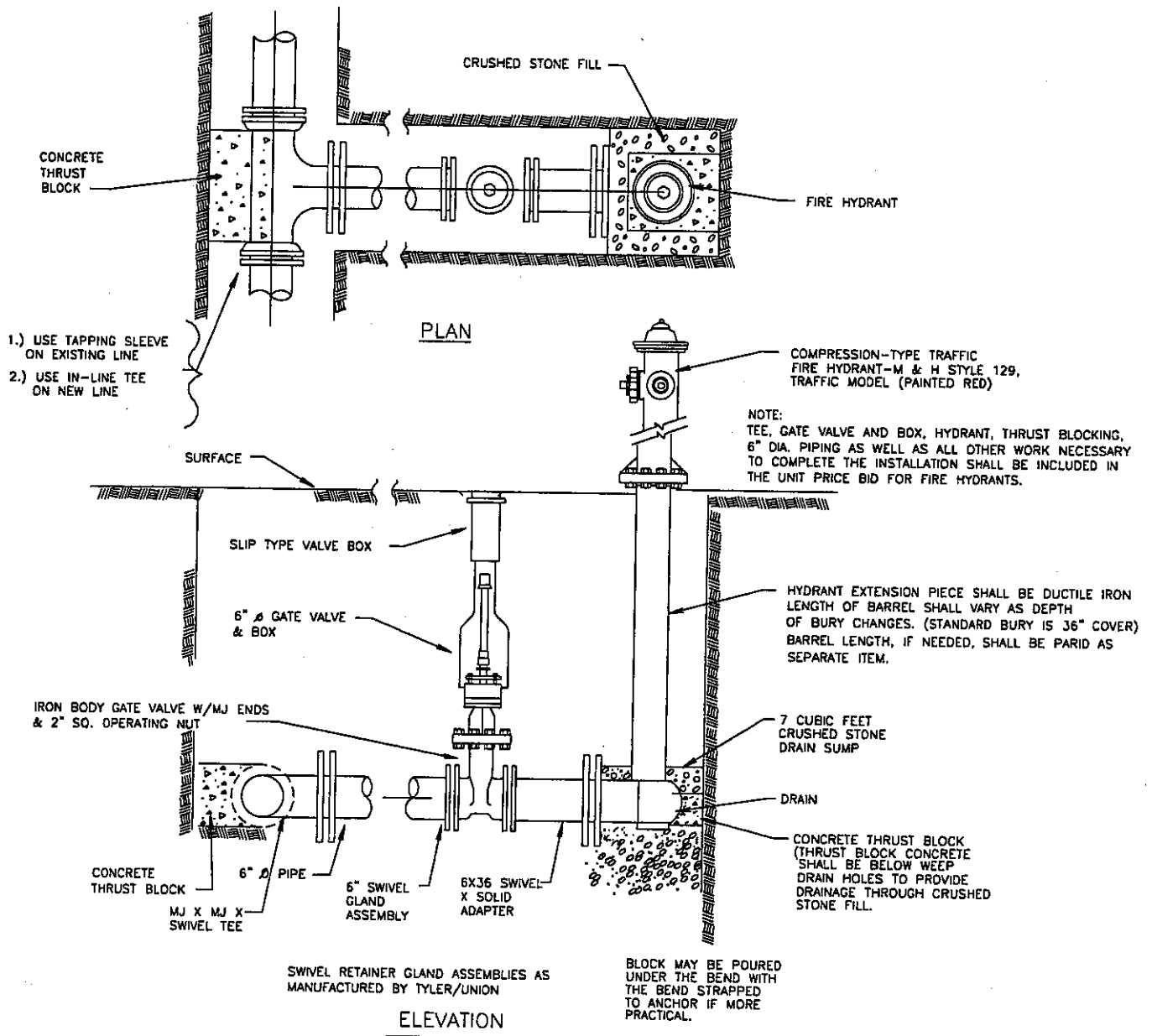


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**STANDARD WATER DETAIL**





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STANDARD WATER DETAIL

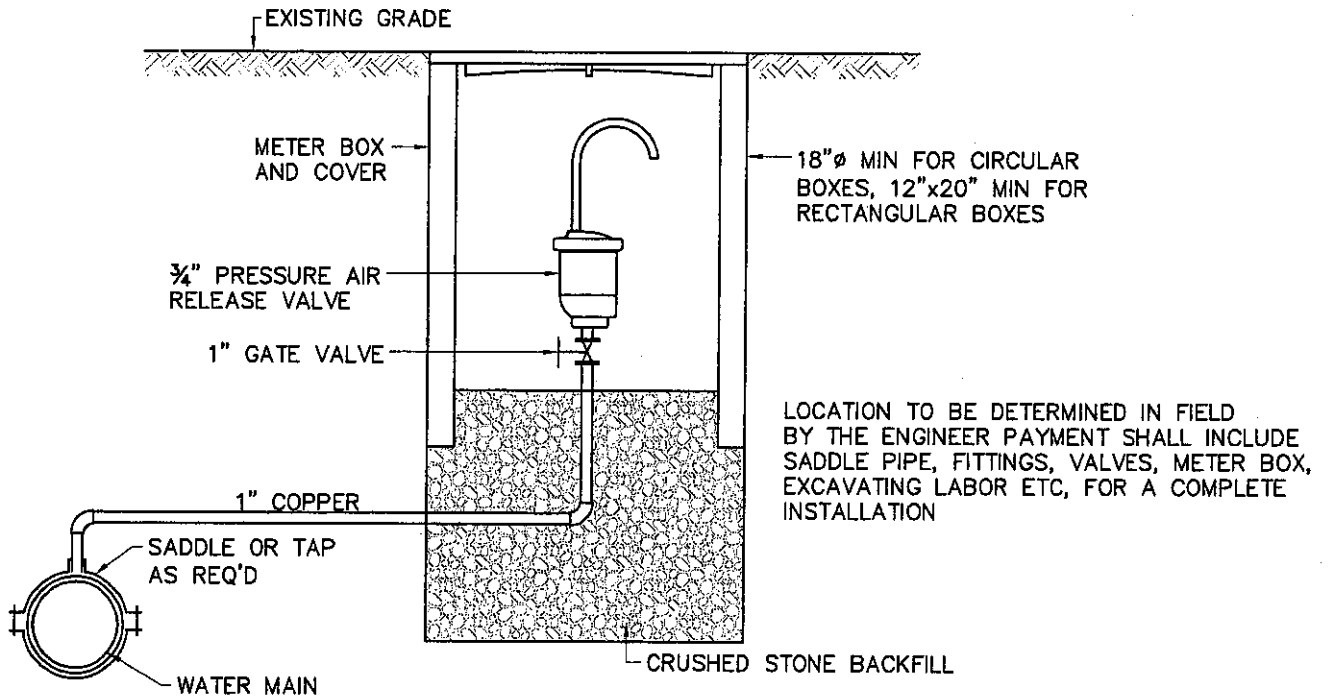
**FIRE HYDRANT  
INSTALLATION DETAIL**


NOT TO SCALE



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STANDARD WATER DETAIL

AIR RELEASE VALVE DETAIL

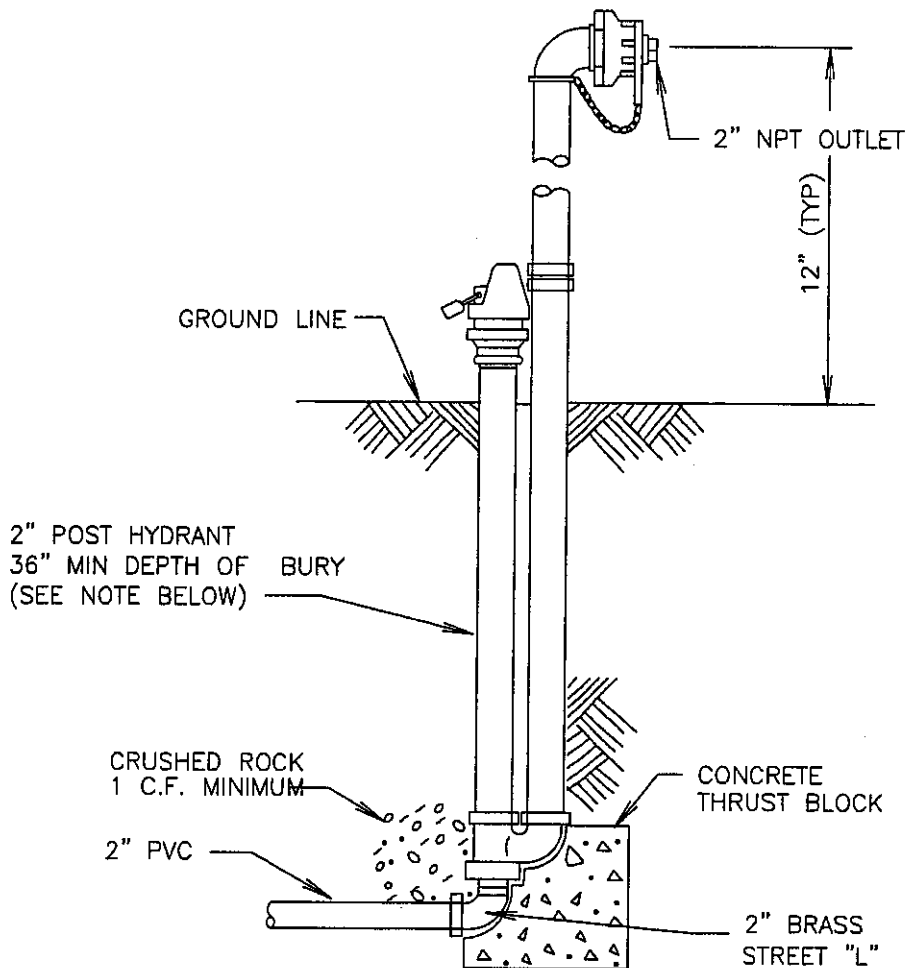
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### 2" BLOW-OFF DETAIL

NOT TO SCALE

NOTE: HYDRANTS SHALL BE NON-FREEZING, SELF-DRAINING TYPE WITH A 36" BURY. PROVIDE WITH 2" FIP INLET, NON-TURNING OPERATING ROD. HYDRANT SHALL OPEN TO THE LEFT. ALL WORKING PARTS SHALL BE OF BRONZE-TO BRONZE DESIGN, AND BE SERVICEABLE FROM ABOVE GRADE WITH NO DIGGING. THE OUTLET SHALL ALSO BE BRONZE AND BE 2-1/2" NST. HYDRANTS SHALL BE LOCKABLE TO PREVENT UNAUTHORIZED USE. POST HYDRANT SHALL BE MODEL NO. 77 AS MANUFACTURED BY KUPFERLE FOUNDRY CO., ST. LOUIS, MO., OR APPROVED EQUAL.



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STANDARD WATER DETAIL

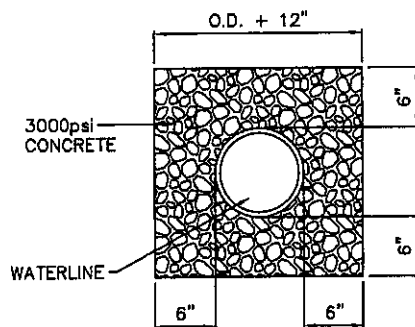
2" BLOW-OFF DETAIL

NOT TO SCALE

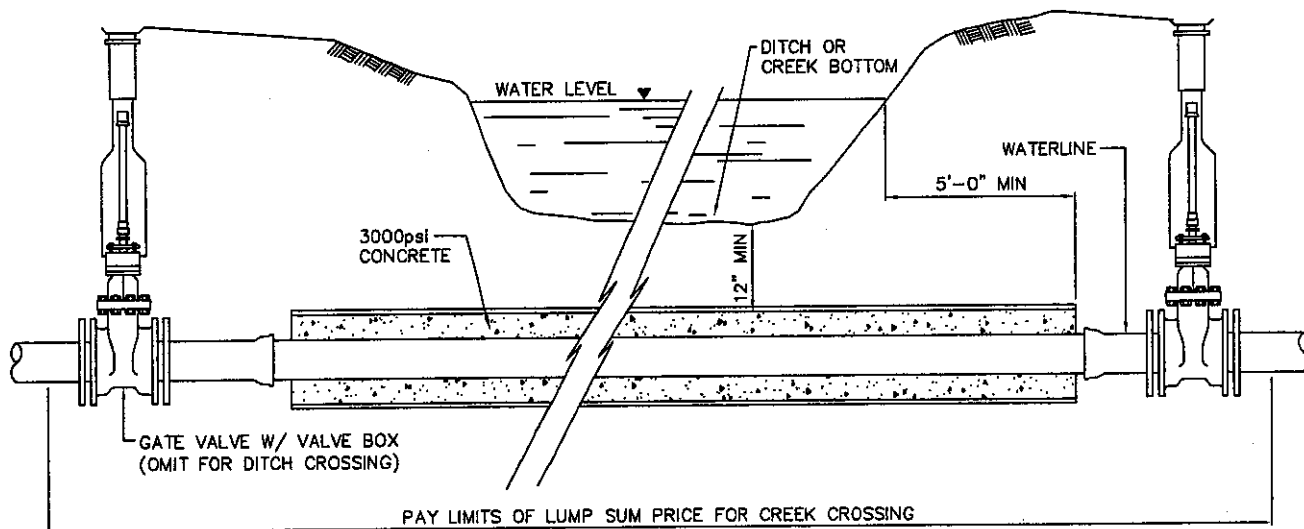


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**SECTION**



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STANDARD WATER DETAIL

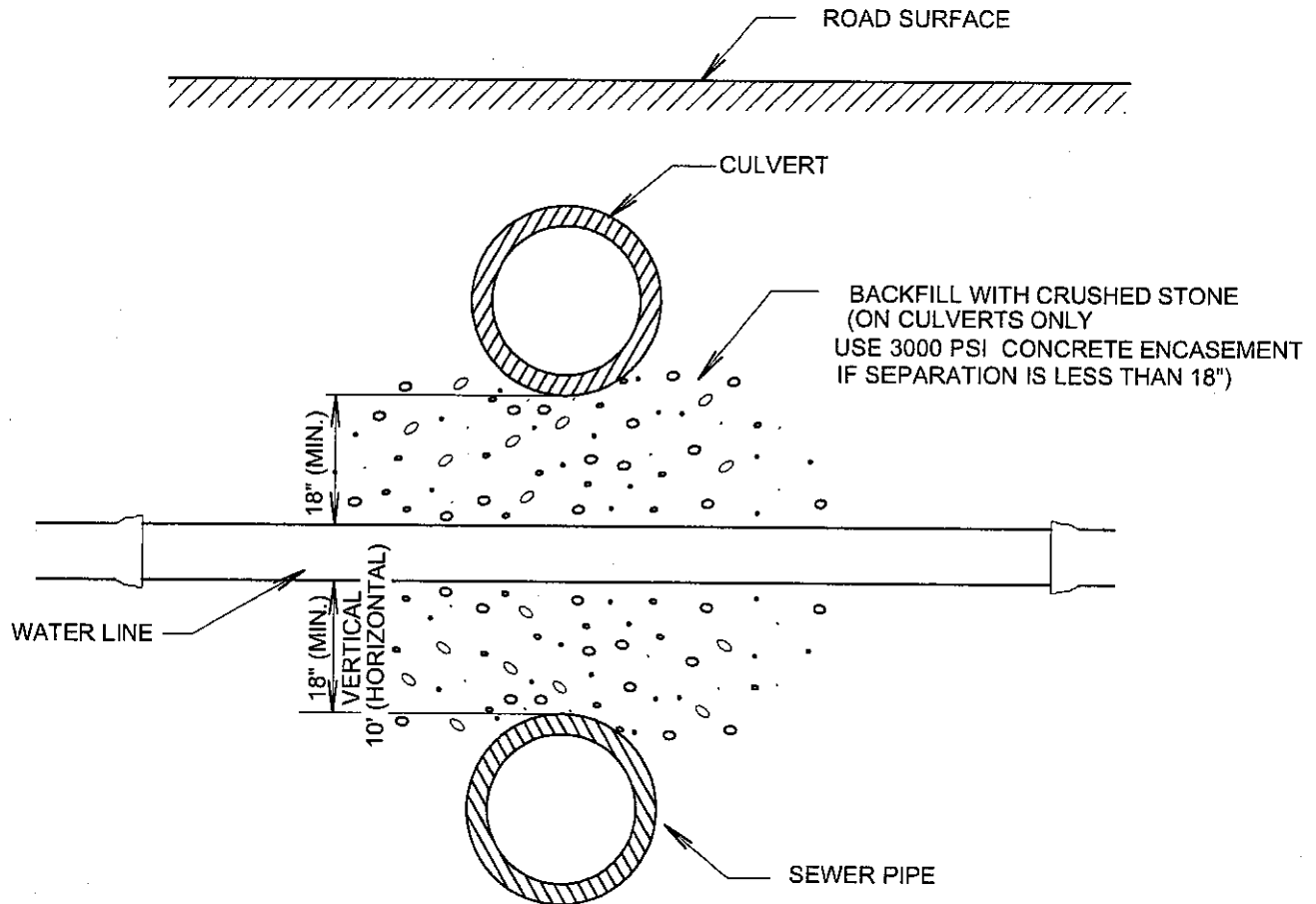
CREEK OR DITCH CROSSING  
DETAIL

NOT TO SCALE



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STANDARD WATER DETAIL

INSTALLATION UNDER  
CULVERT OR PIPE DETAIL

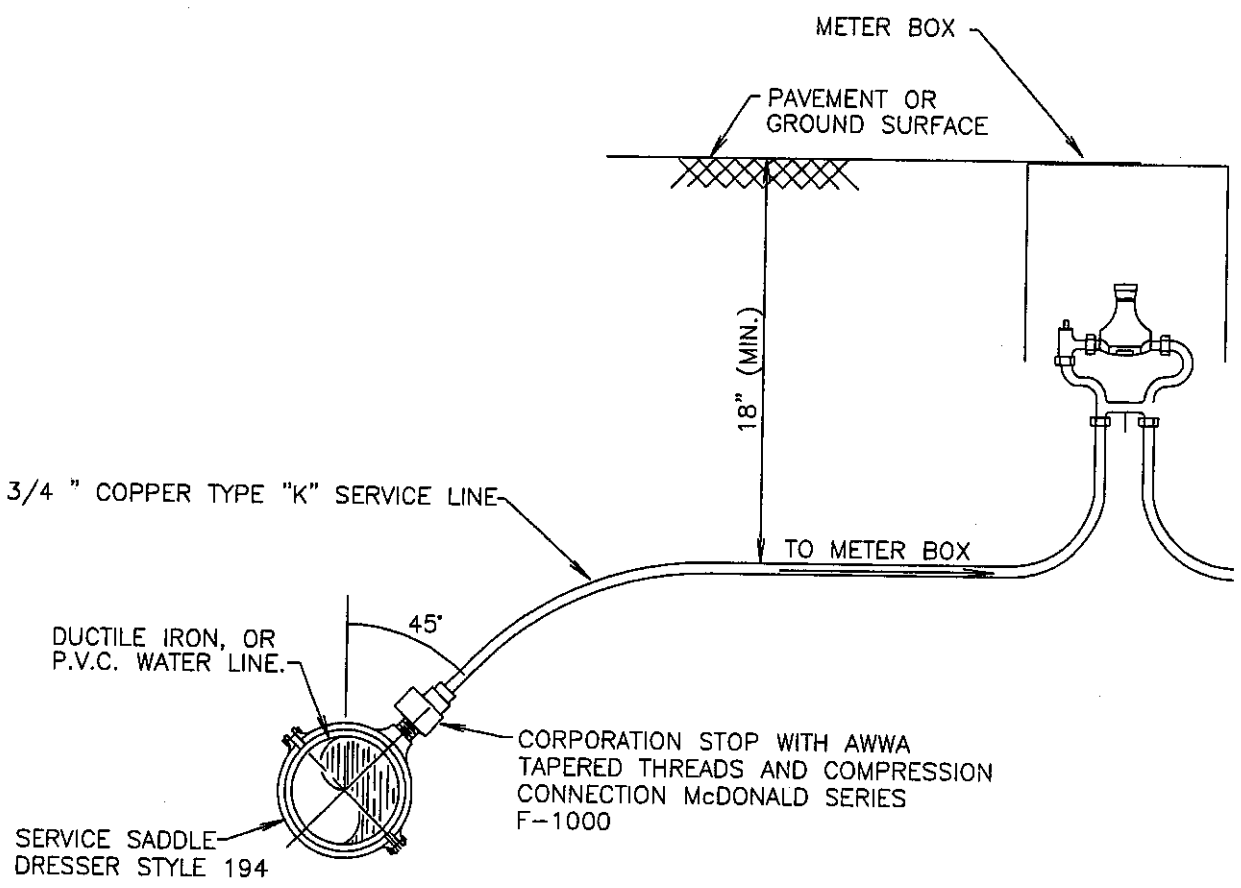
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SEWER AUTHORITY


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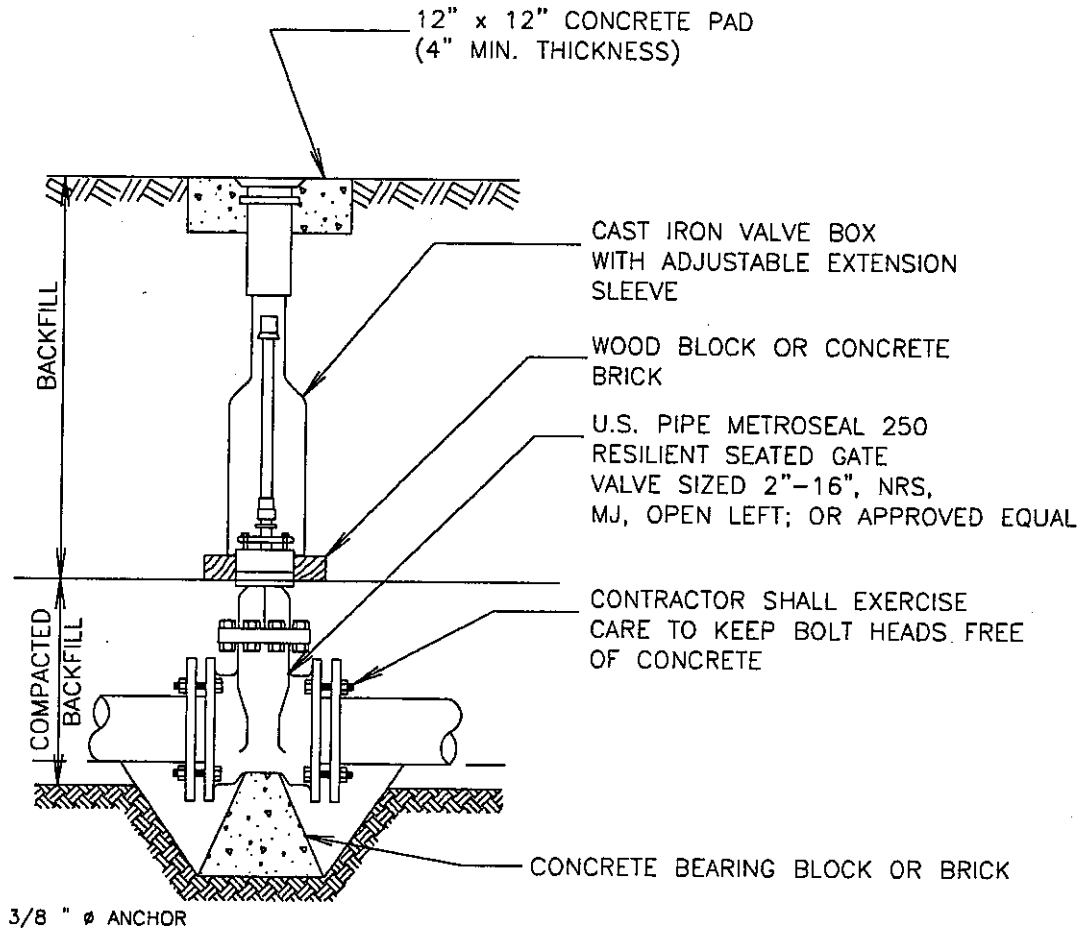


(METERS 1" AND SMALLER)

  
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STANDARD WATER DETAIL	
SERVICE INSTALLATION DETAIL	
NOT TO SCALE	
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**STANDARD WATER & PRESSURE SEWER DETAIL**



  
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STANDARD WATER & PRESSURE SEWER DETAIL

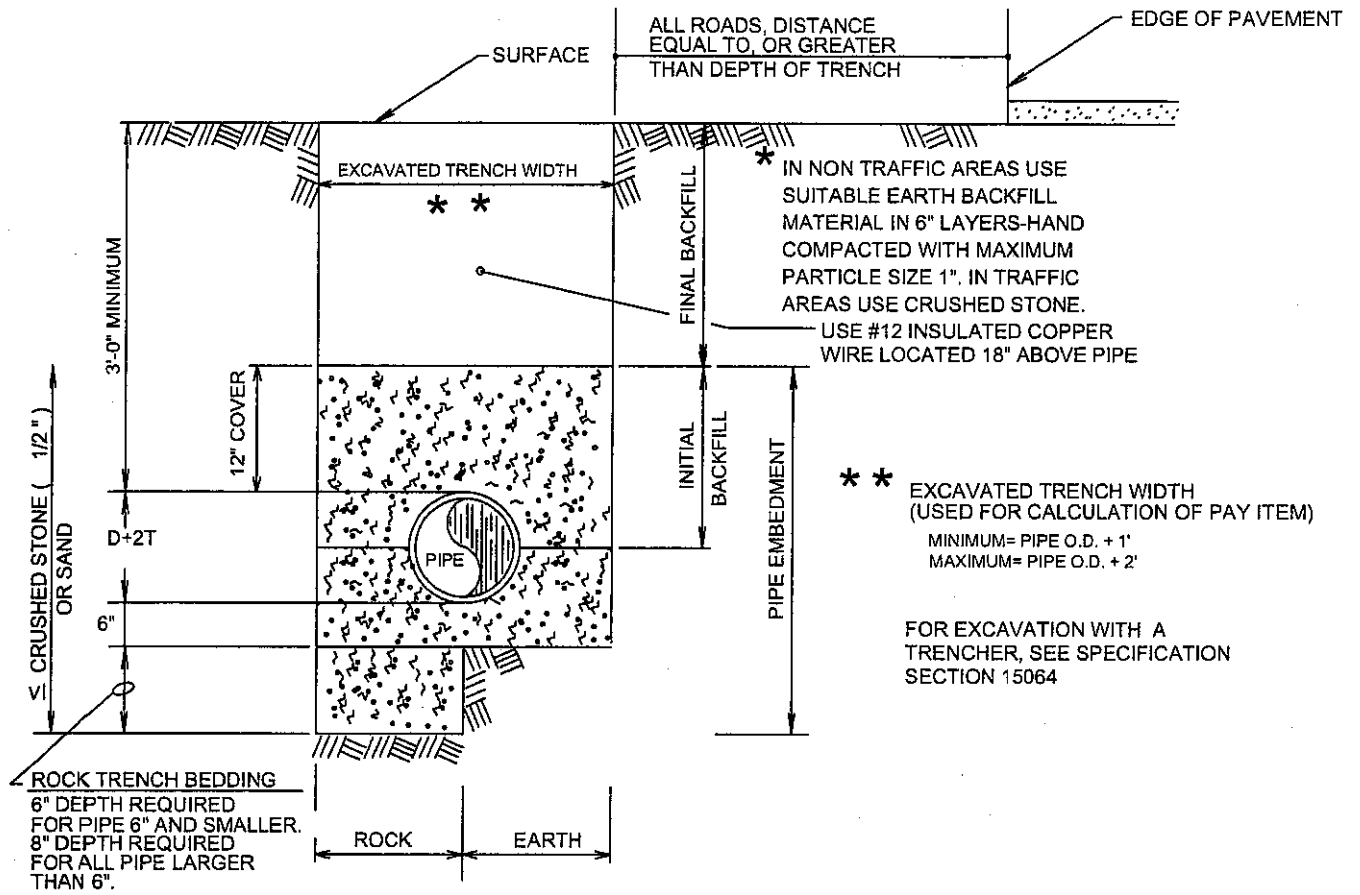
**GATE VALVE INSTALLATION  
DETAIL**  
NOT TO SCALE



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STANDARD WATER & PRESSURE SEWER DETAIL

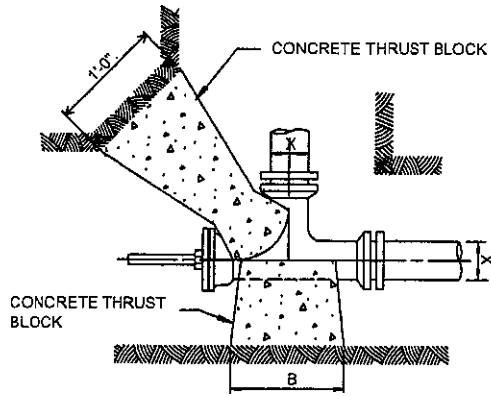
**PVC PIPE INSTALLATION  
 DETAIL**

NOT TO SCALE

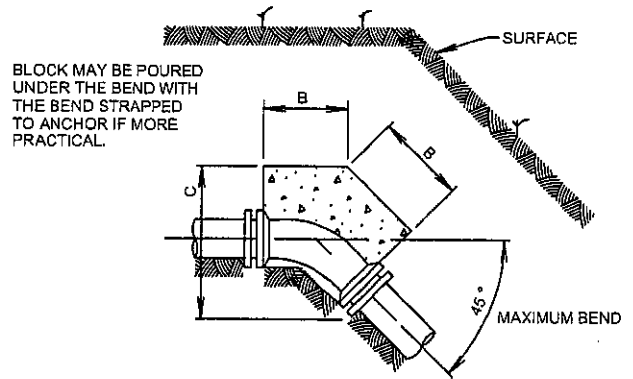


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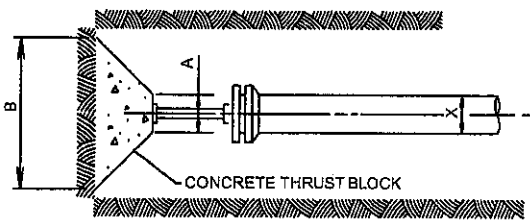
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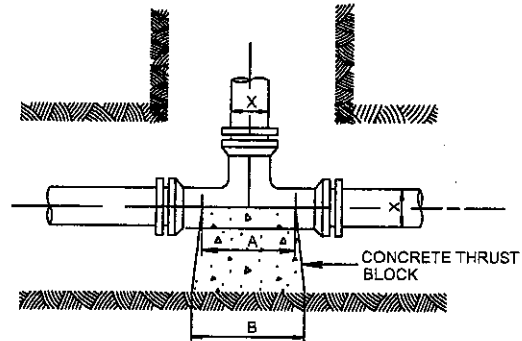
**PLAN-UNBALANCED TEE**  
NOT TO SCALE



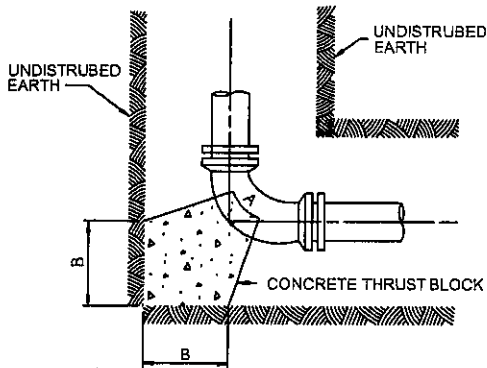
**PLAN-TYPICAL VERTICAL BEND**  
NOT TO SCALE



**PLAN-TYPICAL PLUG**  
NOT TO SCALE



**PLAN-TYPICAL TEE**  
NOT TO SCALE



**PLAN-TYPICAL HORIZONTAL BEND**  
NOT TO SCALE

TABLE OF DIMENSIONS FOR HORIZONTAL & VERTICAL BENDS

PLUG & TEE					PIPE SIZE X	A	B	DEPTH C
16"	12"	10"	8"	4"				
3'-0"	2'-0"	1'-9"	1'-0"	1'-0"	90° BEND & UNBALANCED TEE	4'-0"	3'-0"	2'-0"
4'-9"	4'-0"	3'-0"	2'-8"	2'-0"		4'-0"	3'-0"	2'-0"
2'-9"	2'-3"	1'-6"	1'-6"	1'-0"		3'-0"	2'-2"	1'-8"
2'-9"	2'-3"	1'-6"	1'-6"	1'-0"		3'-0"	2'-2"	1'-8"
2'-9"	2'-3"	1'-6"	1'-6"	1'-0"		3'-0"	2'-2"	1'-8"
0.58	0.34	0.22	0.14	0.08	45° BEND	4'-0"	3'-0"	2'-0"
0.14	0.08	0.04				4'-0"	3'-0"	2'-0"
						3'-0"	2'-2"	1'-8"
						3'-0"	2'-2"	1'-8"
						3'-0"	2'-2"	1'-8"
					22 1/2° BEND	4'-0"	3'-0"	2'-0"
						4'-0"	3'-0"	2'-0"
						3'-0"	2'-2"	1'-8"
						3'-0"	2'-2"	1'-8"
						3'-0"	2'-2"	1'-8"

NOTE: ALL CONCRETE FOR THRUST BLOCKS SHALL BE READY-MIXED 3000 psi (MINIMUM) CLASS "B" MIX DESIGN SHALL BE SUBMITTED TO ENGINEER FOR APPROVAL PRIOR TO USE. THRUST BLOCKS BASED ON 225 psi & 2000lb/ft<sup>2</sup> SOIL RESISTANCE TYPICAL FOR UNDISTURBED SAND AND GRAVEL CEMENTED WITH CLAY. FOR OTHER SOILS THE BEARING FACE OF THE THRUST BLOCKS SHOULD BE INCREASED BY THE FOLLOWING FACTORS.

SAND 2  
SAND & GRAVEL 1.33  
SHALE 0.4

SOFT CLAY, MUCK AND PEAT SHALL USE RESTRAINED JOINTS IN LIEU OF THRUST BLOCKS.



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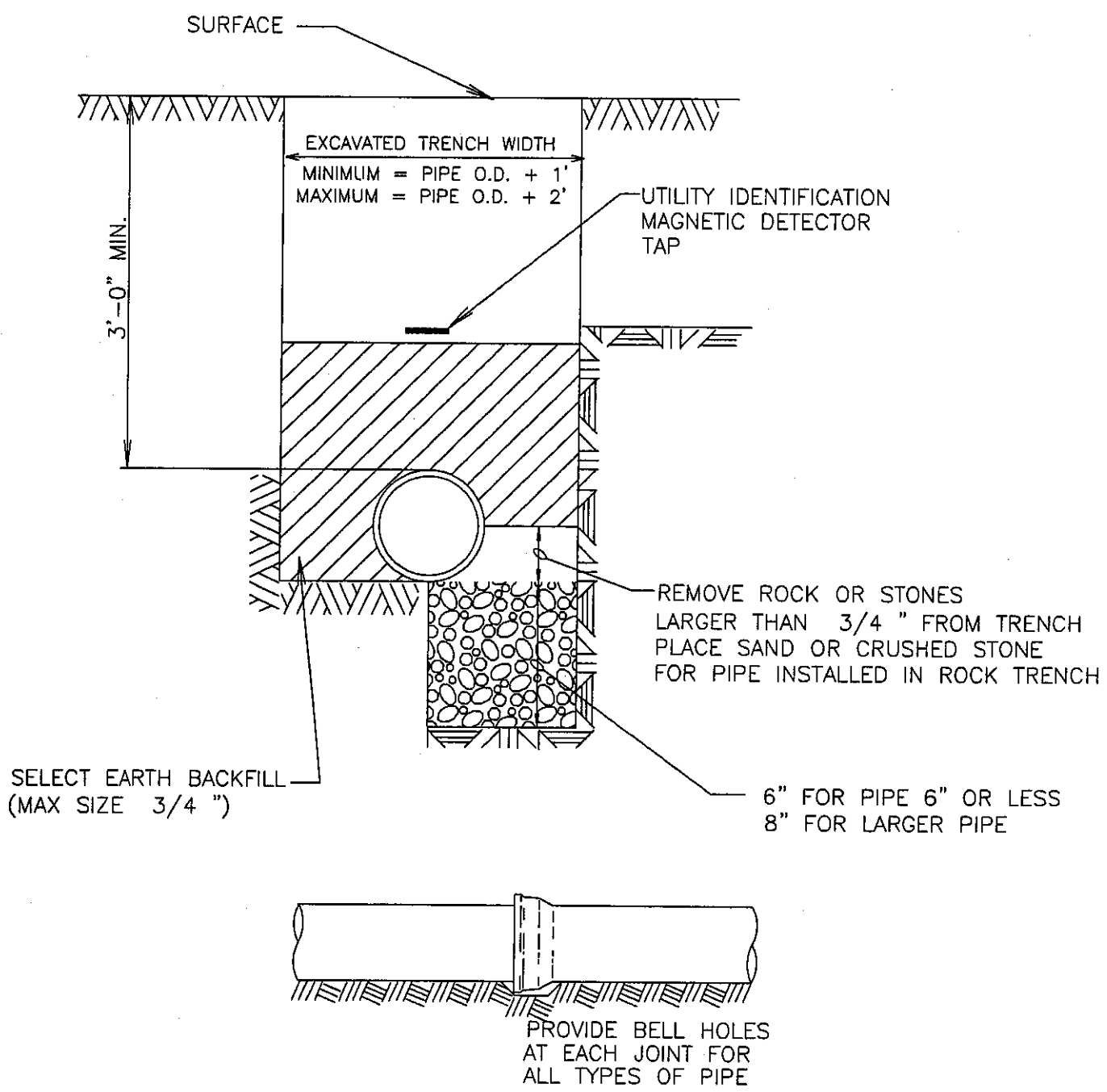
STANDARD WATER & PRESSURE SEWER DETAIL


THRUST BLOCK DETAIL  
NOT TO SCALE



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STANDARD WATER & PRESSURE SEWER DETAIL

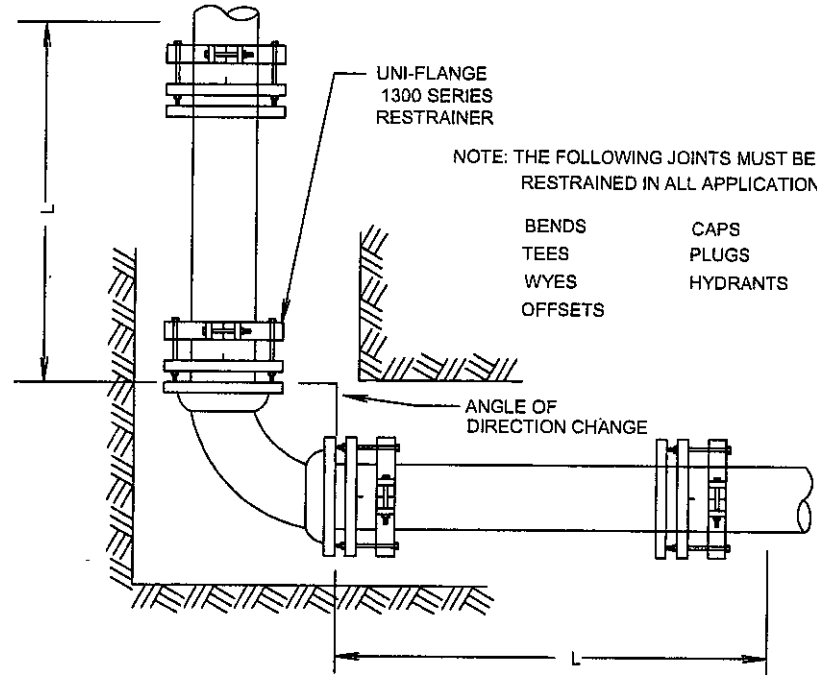
**DUCTILE IRON PIPE  
INSTALLATION DETAIL**

NOT TO SCALE



WALKER COUNTY WATER &  
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PLAN

L = MINIMUM LENGTH TO BE RESTRAINED ON EACH SIDE OF FITTING (FT.) \*

NOM. PIPE SIZE	CLAY					COHESIVE GRANULAR MAT.					SAND					SILT, MUCK, PEAT				
	ELBOWS (DEG.)				VALVES TEES DEAD ENDS	ELBOWS (DEG.)				VALVES TEES DEAD ENDS	ELBOWS (DEG.)				VALVES TEES DEAD ENDS	ELBOWS (DEG.)				VALVES TEES DEAD ENDS
	11 1/4	22 1/2	45	90		11 1/4	22 1/2	45	90		11 1/4	22 1/2	45	90		11 1/4	22 1/2	45	90	
2	1	2	3	5	4	2	3	4	7	6	2	3	5	8	6	2	4	6	11	9
3	2	2	4	7	5	3	4	5	9	7	3	4	7	10	8	3	5	8	13	10
4	2	3	5	8	6	3	5	7	11	8	3	5	8	12	9	4	6	11	17	13
6	3	4	6	9	7	4	6	9	14	10	4	6	10	15	11	4	6	10	15	11
8	3	5	7	10	8	4	7	11	19	13	4	7	13	20	14	5	10	16	26	18
10	4	6	9	13	11	5	10	15	22	15	5	9	15	25	18	6	11	20	32	22
12	4	8	11	15	13	6	11	17	26	18	6	10	17	29	21	7	14	24	39	27

\* RESTRAIN JOINT BEYOND MINIMUM LENGTH.



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STANDARD WATER AND PRESSURE SEWER DETAIL

RESTRAINED JOINT DETAIL

NOT TO SCALE

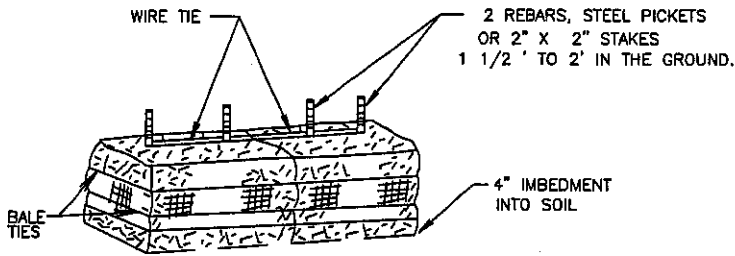


WALKER COUNTY WATER & SEWER AUTHORITY

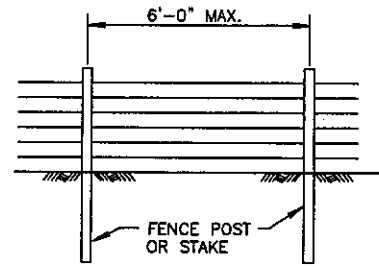
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**EROSION CONTROL DETAIL**

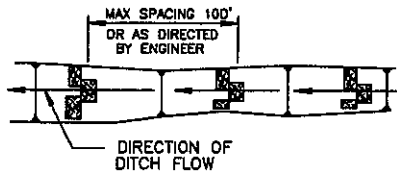
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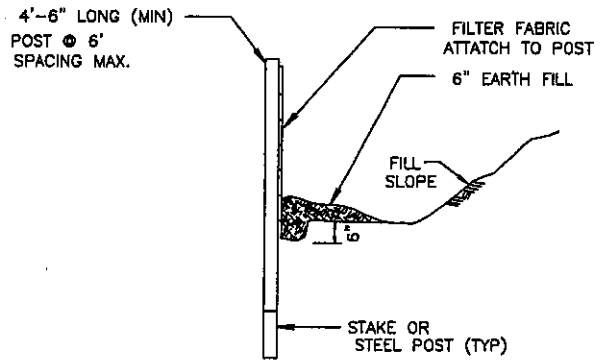
**EROSION CONTROL HAYBALES**



**FRONT ELEVATION**



**HAYBALE PLACEMENT**  
NOT TO SCALE



**SIDE ELEVATION**

**TYPICAL SILT FENCE**  
NOT TO SCALE

**EROSION CONTROL DETAILS**

NOT TO SCALE

WHERE WATER LINE IS INSTALLED IN DITCHES, PARALLEL WITH SLOPES, OR OTHER AREAS SUSCEPTIBLE TO EROSION, RIP RAP AND/OR CHECKDAMS SHALL BE PLACED AS DIRECTED BY THE ENGINEER. ALSO, SAID MEASURES SHALL BE MAINTAINED UNTIL AN ACCEPTABLE STAND OF GRASS IS ESTABLISHED, AS DIRECTED BY THE ENGINEER.

**Notes:**

The escape of sediment from the site shall be prevented by the installation of erosion control measures and practices prior to, or concurrent with, land-disturbing activities.

Maintenance Statement: Erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source.

**DISTURBED AREAS OUTSIDE OF THE PIPELINE DITCH, SHALL NOT BE EXPOSED FOR MORE THAN 14 DAYS. AREAS THAT ARE TO REMAIN DISTURBED FOR MORE THAN 14 DAYS ARE TO BE TEMPORARILY MULCHED AND GRASSED.**



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EROSION CONTROL DETAIL

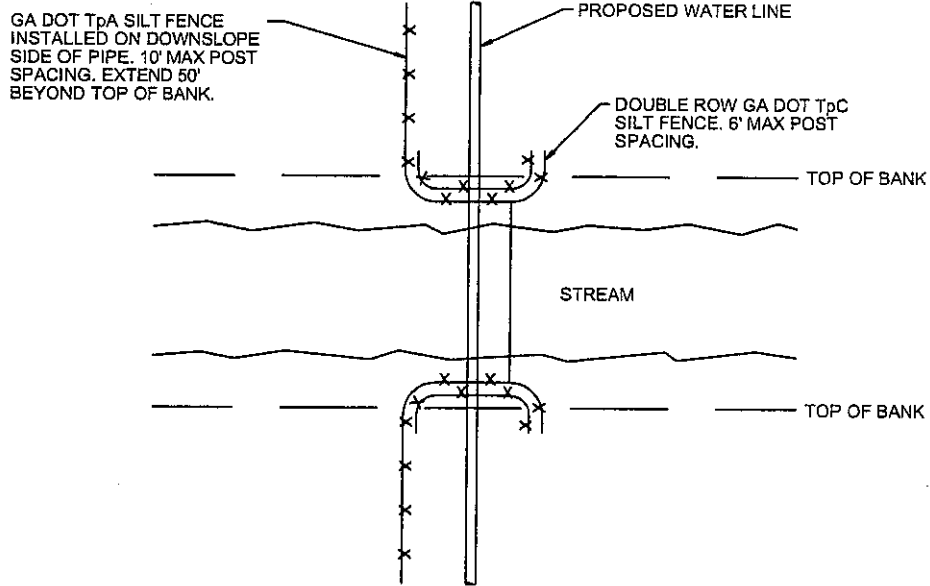
**TYPICAL SILT FENCE  
DETAIL**  
NOT TO SCALE



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**TYPICAL STREAM CROSSING EROSION CONTROL**  
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EROSION CONTROL DETAIL

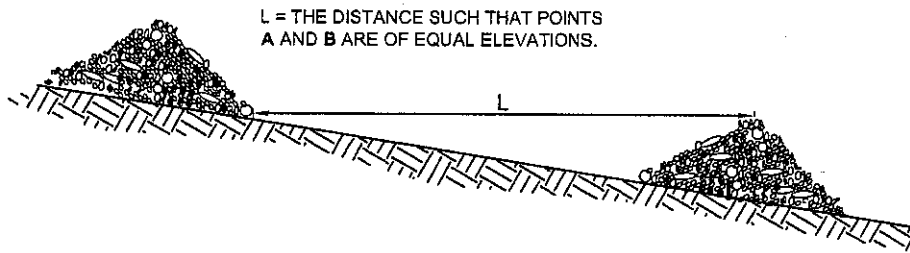
**TYPICAL STREAM  
CROSSING DETAIL**  
NOT TO SCALE



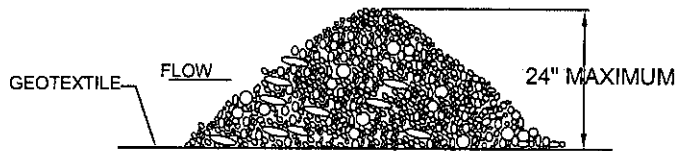
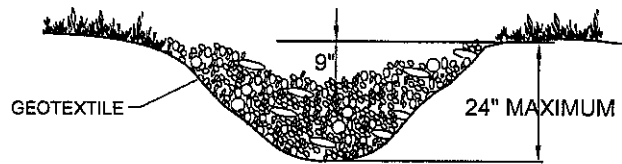
**WALKER COUNTY WATER &  
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SPACING BETWEEN CHECK DAMS



STONE CHECK DAM (Cd-S)  
SCALE: NONE



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EROSION CONTROL DETAIL

**STONE CHECK DAM DETAIL**

NOT TO SCALE



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# CONSTRUCTION SCHEDULE YEAR

## CONSTRUCTION PERIOD

EROSION & SEDIMENTATION CONTROL CLEARING AND GRUBBING PIPELINE CONSTRUCTION FINAL GRADING, INCLUDING GRAVEL SURFACE MAINTAIN EROSION & SEDIMENTATION CONTROL GRASSING	
--	--

PERMANENT SEEDING REQUIREMENTS TABLE					
AREA	SOWING SEASON	SPECIES	RATES PER 1,000 SQUARE FEET		
			SEED	FERTILIZER	LIMESTONE
FLAT TO ROLLING TERRAIN WITH SLOPES LESS THAN 3:1	3/1 TO 6/1	KENTUCKY 31 FESCUE LADINO WHITE CLOVER *	4 lbs. 1/4 lb.	30 lbs. 6-12-12	100 lbs.
	8/1 TO 11/1	KENTUCKY 31 FESCUE LADINO WHITE CLOVER * ANNUAL RYE GRASS	4 lbs. 1/4 lb. 2 lbs.	30 lbs. 6-12-12	100 lbs.
EMBANKMENTS WITH SLOPES GREATER THAN 3:1	3/1 TO 6/1	HULLED SERICEA LESPEDEZA * KENTUCKY 31 FESCUE WEEPING LOVEGRASS	1.25 lb. 3 lbs. 1/4 lb.	30 lbs. 6-12-12	100 lbs.
	8/1 TO 11/1	UNHULLED SERICEA LESPEDEZA * KENTUCKY 31 FESCUE ANNUAL RYEGRASS	2 lbs. 3 lbs. 2 lbs.	30 lbs. 6-12-12	100 lbs.

\* REQUIRES INOCULATION.

TEMPORARY SEEDING REQUIREMENTS TABLE					
AREA	SOWING SEASON	SPECIES	RATES PER 1,000 SQUARE FEET		
			SEED	FERTILIZER *	LIMESTONE **
ALL AREAS	4/15 TO 8/15	SUDANGRASS (SORGHUM SUDANESE)	1.5 lbs.	10 lbs. 10-20-20	100 lbs.
	8 /16 TO 4/14	ANNUAL RYEGRASS (LOLIUM TEMULENTUM)	1 lb.	10 lbs. 10-20-20	100 lbs.

\* FERTILIZER IS NOT REQUIRED ON FERTILE SOILS. APPLY ON VERY LOW FERTILITY SOIL.  
 \*\* APPLY LIMESTONE ON HIGHLY ACIDIC SOILS (pH 5.5 AND LOWER).

Cd	CHECKDAM			A SMALL TEMPORARY BARRIER OR DAM CONSTRUCTED ACROSS A SWALE, DRAINAGE DITCH OR AREA OF CONCENTRATED FLOW.
Co	CONSTRUCTION EXIT			A CRUSHED STONE PAD LOCATED AT THE CONSTRUCTION SITE EXIT TO PROVIDE A PLACE FOR REMOVING MUD FROM TYRES THEREBY PROTECTING PUBLIC STREETS.
Ds1	DISTURBED AREA STABILIZATION (WITH MULCHING ONLY)			ESTABLISHING TEMPORARY PROTECTION FOR DISTURBED AREAS WHERE SEEDINGS MAY NOT HAVE A SUITABLE GROWING SEASON TO PRODUCE AN EROSION RETARDING COVER.
Ds2	DISTURBED AREA STABILIZATION (WITH TEMPORARY SEEDING)			ESTABLISHING A TEMPORARY VEGETATIVE COVER WITH FAST GROWING SEEDINGS ON DISTURBED AREAS.
Ds3	DISTURBED AREA STABILIZATION (WITH PERMANENT VEGETATION)			ESTABLISHING A PERMANENT VEGETATIVE COVER SUCH AS TREES, SHRUBS, VINES, GRASSES, SOO OR LEGUMES ON DISTURBED AREAS.
Sd1	SEDIMENT BARRIER			A BARRIER TO PREVENT SEDIMENT FROM LEAVING THE CONSTRUCTION SITE. IT MAY BE SANDBAGS, BALES OF STRAW OR HAY, BRUSH, LOGS AND POLES, GRAVEL, OR A SILT FENCE.



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EROSION CONTROL DETAIL

SEED, SCHEDULE &  
 LEGEND DETAIL

NOT TO SCALE










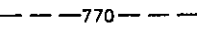
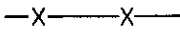
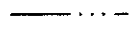

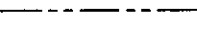
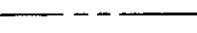


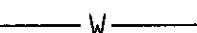
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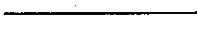

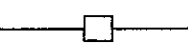


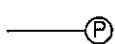


**STANDARD DETAIL**

### GENERAL LEGEND

EXISTING

	WATER METER
	IRON (SET/FOUND)
	POWER POLE
	GUY WIRE
	TREE
	SANITARY MANHOLE
	TREE LINE
	CONTOUR LINE
	FENCE LINE
	STREAM BRANCH
	HEADWALL
	PROPERTY LINE
	RIGHT-OF-WAY
	GAS
	TELEPHONE
	WATER LINE

PROPOSED

	PROPOSED PRESSURE SEWER
	SERVICE CONNECTION
	MID-LINE CLEANOUT OR JUNCTION CLEANOUT
	AIR RELEASE VALVE
	END-OF-LINE CLEANOUT
	PUMP UNIT
	CHECK VALVE
	BALL VALVE OR GATE VALVE



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STANDARD DETAIL

### GENERAL LEGEND

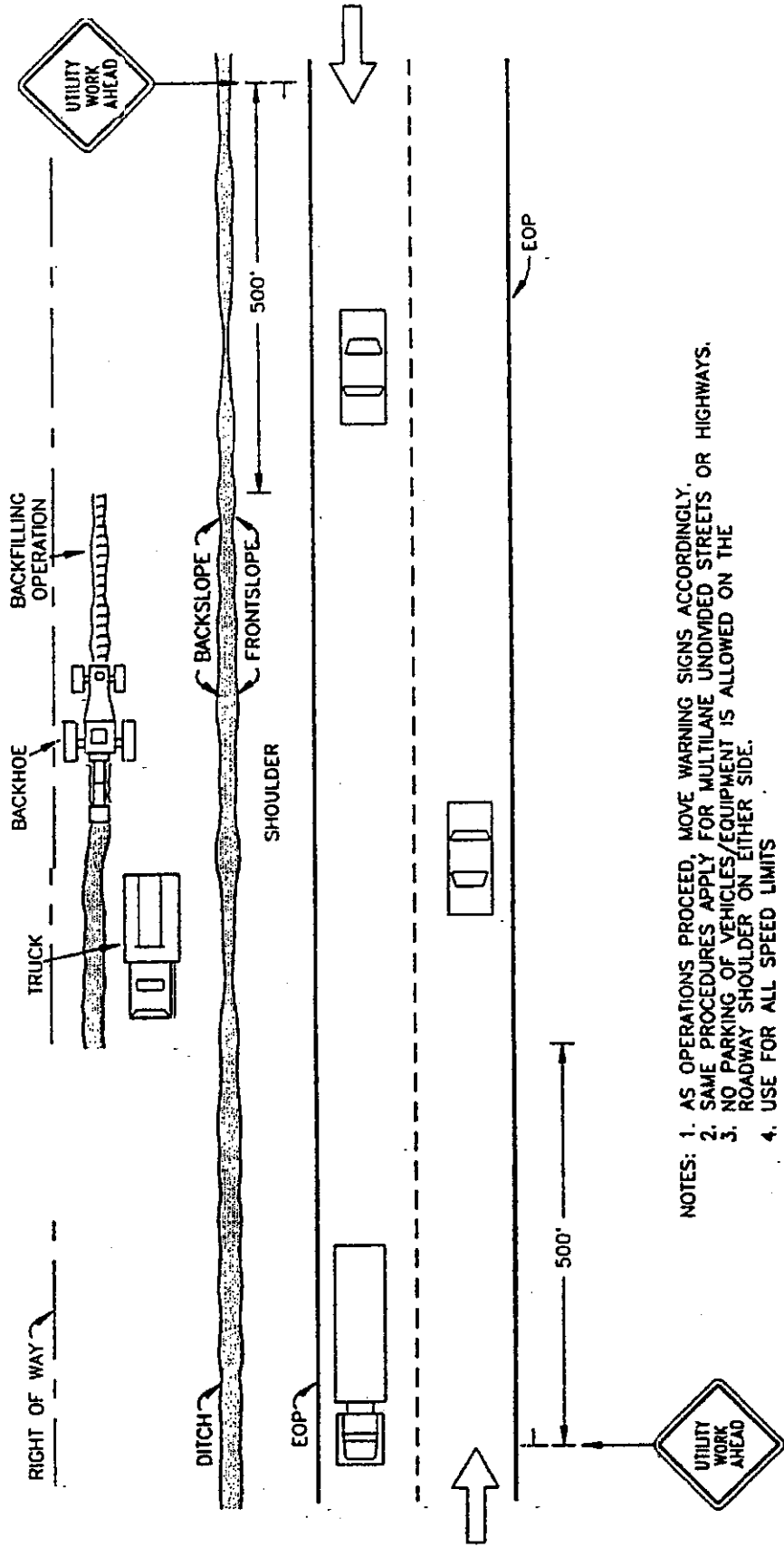
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TWO-LANE STREET OR HIGHWAY  
 TRAFFIC CONTROL DEVICE PLACEMENT  
 WORK AREA BETWEEN DITCH AND BACK OF RIGHT-OF-WAY



- NOTES:
1. AS OPERATIONS PROCEED, MOVE WARNING SIGNS ACCORDINGLY.
  2. SAME PROCEDURES APPLY FOR MULTILANE UNDIVIDED STREETS OR HIGHWAYS.
  3. NO PARKING OF VEHICLES/EQUIPMENT IS ALLOWED ON THE ROADWAY SHOULDER ON EITHER SIDE.
  4. USE FOR ALL SPEED LIMITS



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STANDARD DETAIL

TRAFFIC CONTROL DETAILS

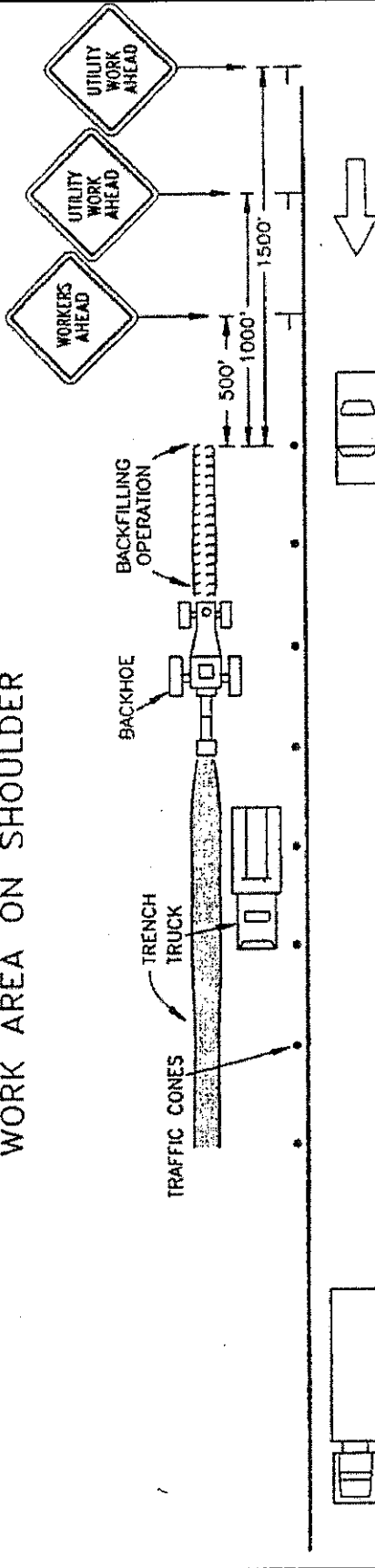
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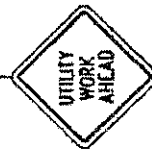
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## TWO-LANE STREET OR HIGHWAY TRAFFIC CONTROL DEVICE PLACEMENT WORK AREA ON SHOULDER



USE FOR ALL SPEED LIMITS

500'



- NOTES: 1. AS OPERATIONS PROCEED, MOVE WARNING SIGNS ACCORDINGLY.  
 2. NO PARKING OF VEHICLES/EQUIPMENT IS ALLOWED ON THE ROADWAY SHOULDER OPPOSITE OF THE WORK AREA.  
 3. DIAGRAM SHOWN FOR SPEED LIMIT OF 55 MPH; FOR OTHER SPEED LIMITS, SEE CHART.

CONE AND WARNING SIGN SPACING AND TAPER LENGTHS

Speed Limit (mph)	Cone Spacing (ft)	Taper Length (ft)	Number of Cones Req'd	Warning Sign Spacing (ft)	Minimum Sign Size
25	25	125	6	250	36" X 36"
35	35	245	6	250	36" X 36"
45	45	540	1.3	500	48" X 48"
55	55	660	1.3	500	48" X 48"
Interstate, Expressway and Limited-Access Roadways					48" X 48"
					2640
					5280



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STANDARD DETAIL

TRAFFIC CONTROL DETAILS

2 OF 3

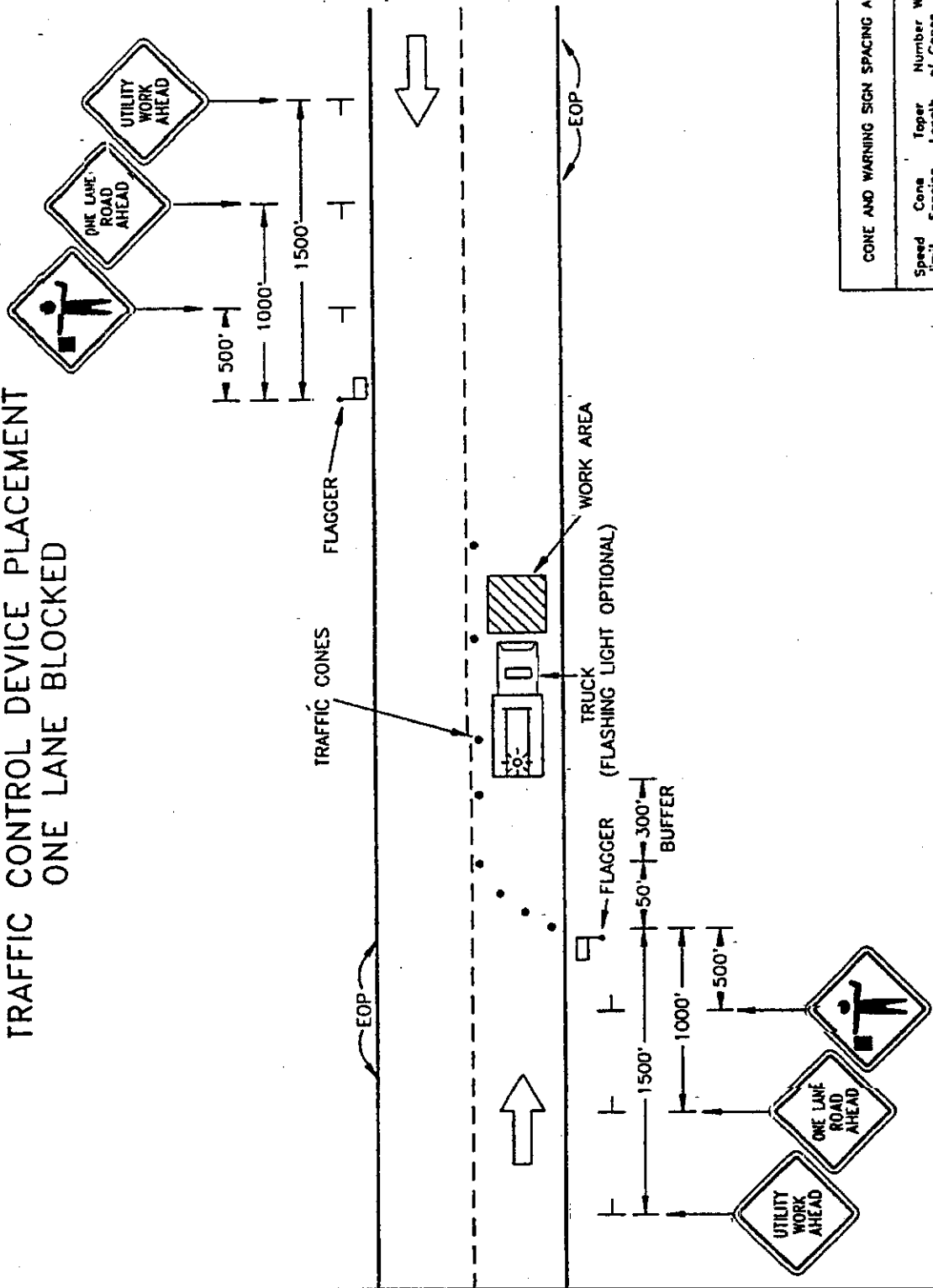
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# TWO-LANE STREET OR HIGHWAY TRAFFIC CONTROL DEVICE PLACEMENT ONE LANE BLOCKED



- NOTES:
1. NO PARKING OF VEHICLES/EQUIPMENT IS ALLOWED ON THE ROADWAY SHOULDER OPPOSITE OF THE WORK AREA.
  2. A DAYTIME OPERATION WITH GOOD VISIBILITY AND LOW-VOLUME STREET MAY USE A SINGLE FLAGGER
  3. DIAGRAM SHOWN FOR SPEED LIMIT OF 55 MPH; FOR OTHER SPEED LIMITS, SEE CHART.

CONE AND WARNING SIGN SPACING AND TAPER LENGTHS					
Speed limit (mph)	Cone Spacing (ft)	Taper Length (ft)	Number of Cones Req'd	Warning Sign Spacing (ft)	Minimum Sign Size
25	25	125	6	250	36" X 36"
35	35	245	8	250	36" X 36"
45	45	540	13	500	48" X 48"
55	55	660	13	500	48" X 48"
Interstate, Expressway and Limited-Access Roadways					48" X 48"
					2640
					5280



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STANDARD DETAIL

## TRAFFIC CONTROL DETAILS

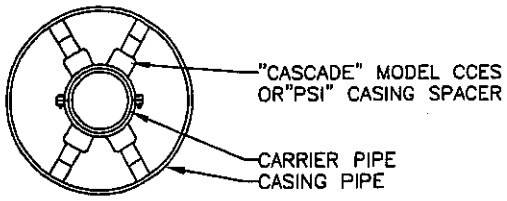
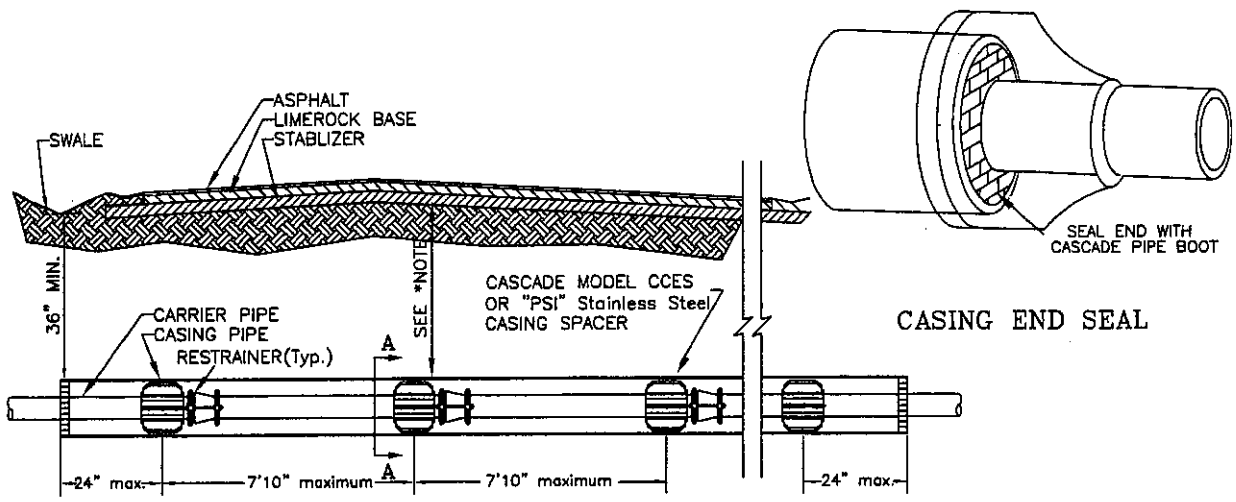
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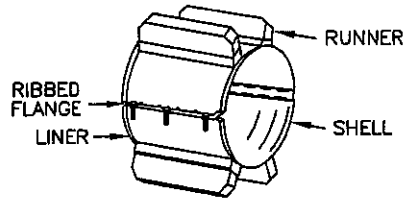


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**\*NOTE:**  
 UNDERGROUND CROSSINGS REQUIRE A MINIMUM VERTICLE CLEARANCE OF 48" BELOW PAVEMENT SURFACE FOR FREEWAYS, 48" FOR OTHER HIGHWAYS OR 36" BELOW UNPAVED GROUND INCLUDING DITCH GRADE PER G.D.O.T.



**SPACER**

**STAINLESS STEEL SPACERS**

SPACERS SHALL BE BOLT-ON STYLE WITH A TWO PIECE SOLID SHELL OR A MINIMUM 14 GA. MILD STEEL THICKNESS. THE SHELL SHALL BE LINED WITH A RIBBED PVC SHEET OF 0.090" THICKNESS THAT OVERLAPS THE EDGES. RUNNERS MADE FROM UHMW POLYMER, SHALL BE ATTACHED TO RISERS AT APPROPRIATE POSITIONS TO PROPERLY LOCATE THE CARRIER WITHIN THE CASING AND TO EASE INSTALLATION. RISERS SHALL BE MADE FROM A MINIMUM 14GA MILD STEEL THICKNESS AND SHALL BE ATTACHED TO THE SHELL BY ELECT. WELDING. ALL WELDS SHALL BE FULLY PASSIVATED. ALL FASTENERS SHALL BE MADE FROM A MINIMUM 14GA. MILD STEEL. CASING SPACERS SHALL BE MODEL CCS AS MANUFACTURED BY "CASCADE" (Cascade Water Works Mfg. Company of Yorkville Ill.), or "PSI"(Pipeline Seal & Insulator, Inc., Houston, Texas.)

**PLACEMENT OF SPACERS ON CARRIER PIPE**

- 1) GENERAL- ONE SPACER SHALL BE PLACED NOT MORE THAN TWO FEET FROM EACH END OF CASING. SUBSEQUENT SPACERS SHALL BE PLACED AT 6'-10" INTERVALS WITHIN THE CASING, OR IN ACCORDANCE WITH PIPE MANUFACTURER'S RECOMMENDATIONS.
- 2) PVC CARRIER- ONE SPACER SHALL BE PLACED ON THE SPIGOT END OF EACH SEGMENT AT THE LINE MARKING THE LIMIT OF INSERTION INTO THE BELL. WHEN THE JOINT IS COMPLETE, THE SPACER SHALL BE IN CONTACT WITH THE BELL OF THE JOINT SO THAT THE SPACER PUSHES THE JOINT AND RELIEVES COMPRESSION WITHIN THE JOINT. SUBSEQUENT SPACERS SHALL BE PLACED AT 6'-0" INTERVALS, OR IN ACCORDANCE WITH MANUFACTURER'S RECCOMENDATIONS.

**STANDARD NO. OF RUNNER REQ'D.**

- UP TO 14" CARRIER PIPE - 4 REQ'D.
- OVER 14" THROUGH 36" CARRIER PIPE - 6 REQ'D.
- OVER 36" THROUGH 48" CARRIER PIPE - 7 REQ'D.

CARRIER PIPE DIA. (IN.)	CASING (IN.)	MIN. STDS. HIGHWAY THICKNESS (IN.)	INTERSTATE & RAILWAY THICKNESS (IN.)
2	4	3/16"	1/4"
4	10	1/4"	1/4"
6	12	1/4"	1/4"
8	14	1/4"	5/16"
10	16	1/4"	5/16"
12	20	1/4"	3/8"
14	24	1/4"	7/16"
16	24	1/4"	7/16"
18	30	5/16"	1/2"
20	30	5/16"	1/2"
24	36	3/8"	9/16"
30	42	1/2"	9/16"
36	48	1/2"	9/16"

**CARRIER PIPE**

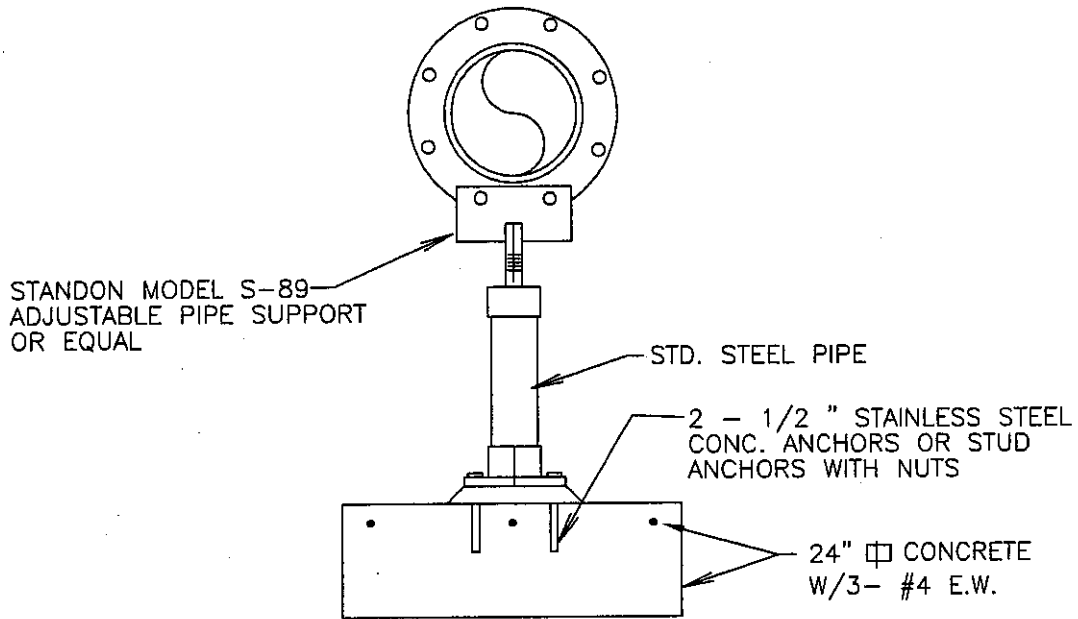
CARRIER PIPE SHALL BE CENTERED WITHIN CASING BY USE OF MODEL CCS STAINLESS STEEL CASING SPACERS AS MANUFACTURED BY CASCADE WATER WORKS MFG. COMPANY OR APPROVED EQUAL. SPACERS FOR PIPES OVER 48" MAY REQUIRE THREE PIECE SHELLS. SHELL CONNECTORS ABOVE 48" WILL BE RECEIVER BAR/ WASHER PLATE TYPE.

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STANDARD DETAIL

**JACK AND BORE DETAIL**  
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**ADJUSTABLE FLANGE PIPE  
SUPPORT DETAIL**

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STANDARD DETAIL

**ADJUSTABLE FLANGE PIPE  
SUPPORT DETAIL**

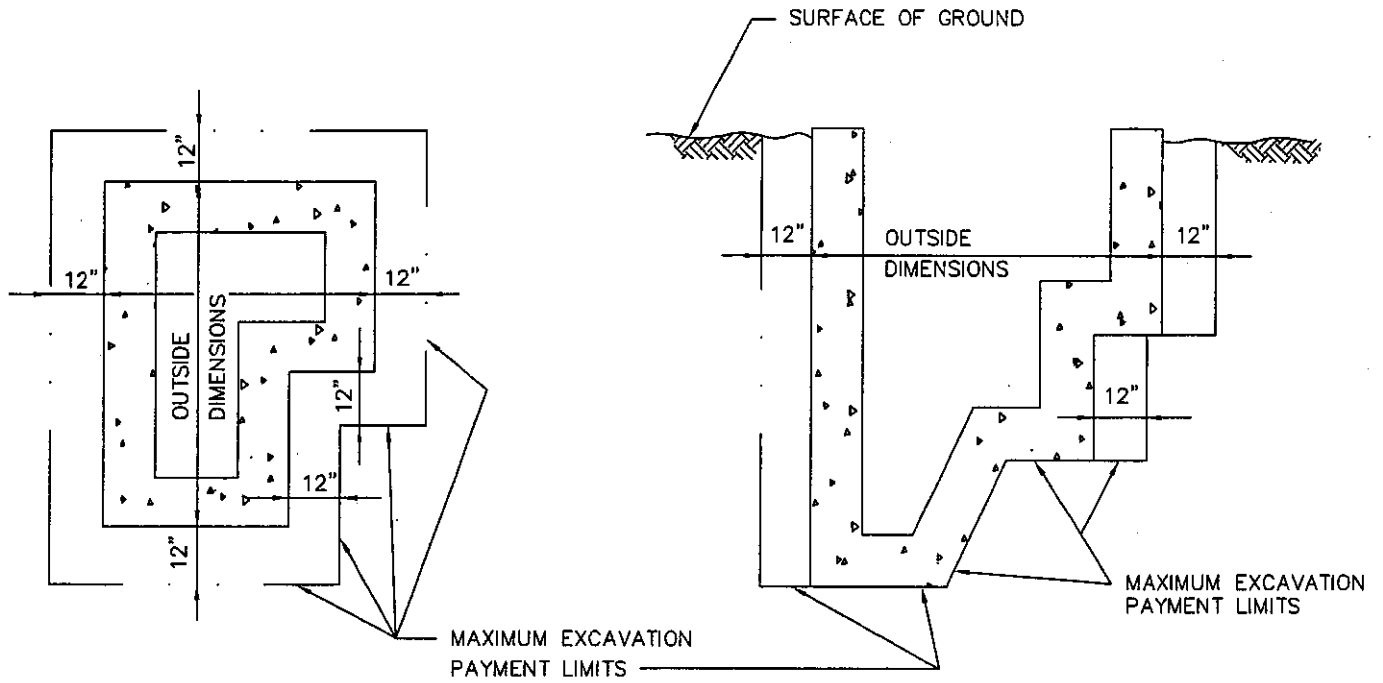
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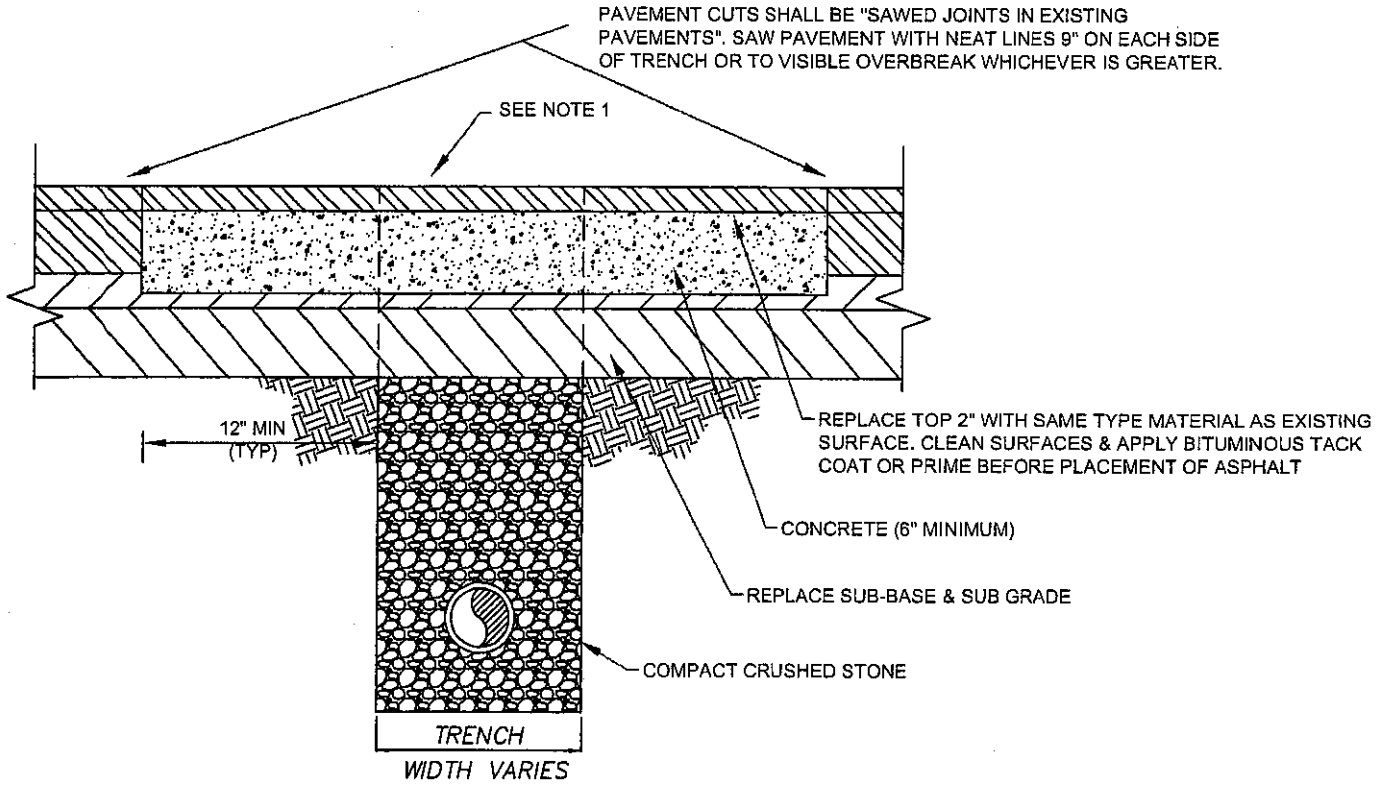
PLAN

SECTION

EXCAVATION PAYMENT LIMITS FOR STRUCTURES  
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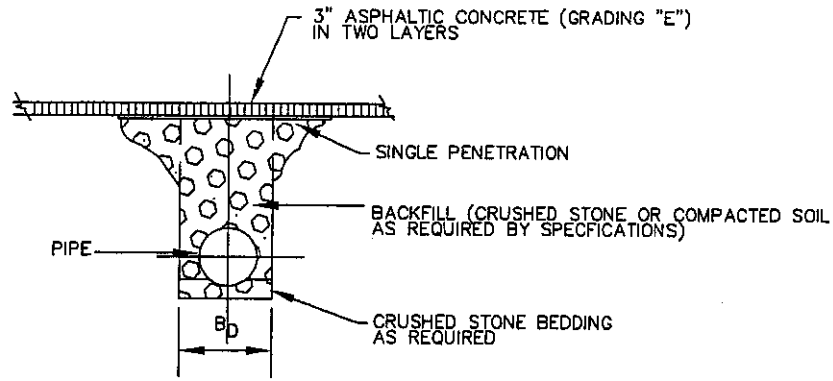
  
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STANDARD DETAIL	
EXCAVATION PAYMENT LIMITS FOR STRUCTURES NOT TO SCALE	
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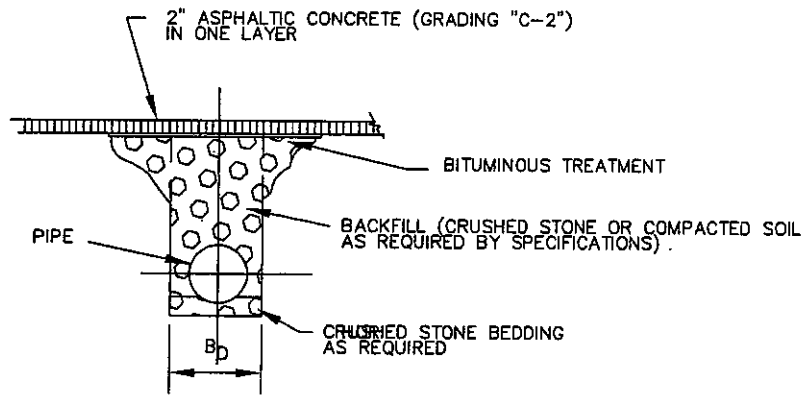


1. COVER PAVEMENT CUTS WITH STEEL PLATES OR SUFFICIENT THICKNESS TO SPAN THE CUT AND SAFELY CARRY TRAFFIC. KEEP PLATES IN PLACE 24 HOURS MINIMUM AFTER PLACING CONCRETE.
2. USE READY-MIX CONCRETE WITH 3000 psi STRENGTH @ 28 DAYS.
3. COMPLY WITH SPECIFIC REQUIREMENTS OF APPLICABLE

NOTE:  
REQUIRED FOR APPROVED CUTS ON ALL COUNTY MAINTAINED ROADWAYS



TYPE 1  
ASPHALTIC CONCRETE  
FOR HEAVY DUTY USE



TYPE 2  
ASPHALTIC CONCRETE  
FOR LIGHT DUTY USE



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STANDARD DETAIL

PAVEMENT REPLACEMENT DETAILS

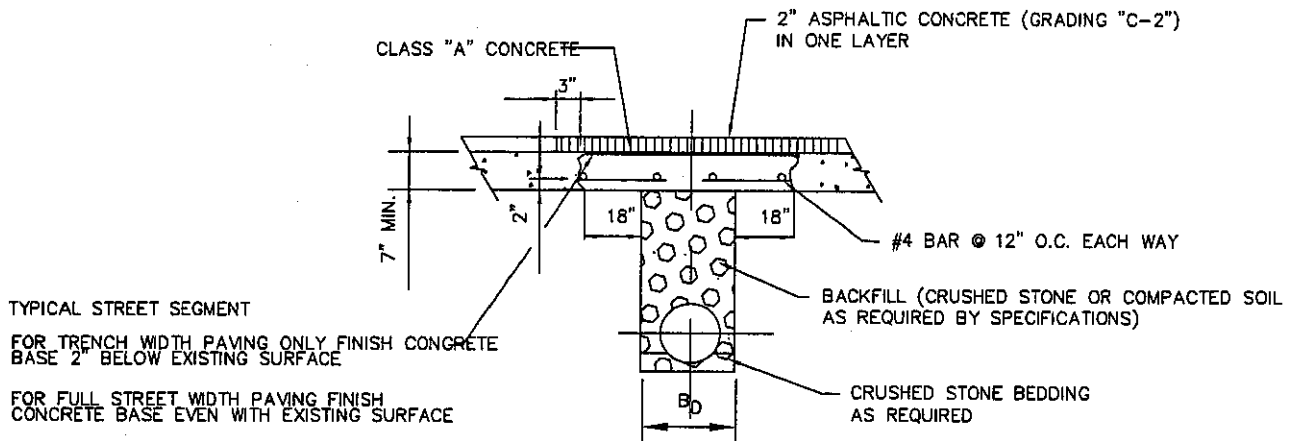
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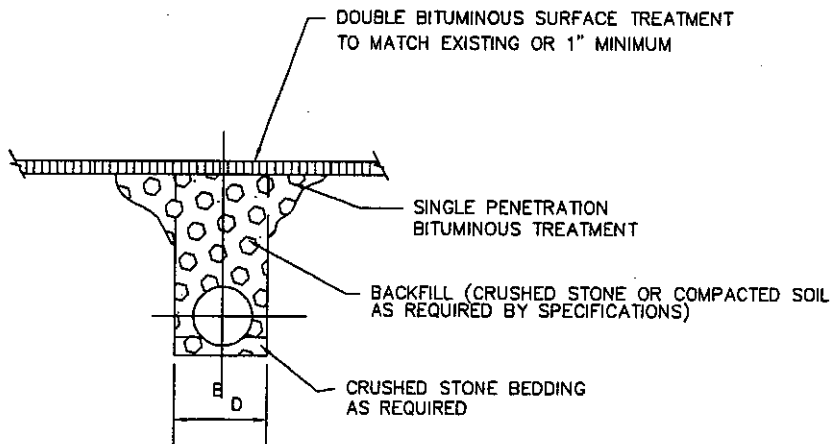


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TYPE 3  
ASPHALTIC CONCRETE  
OVER CEMENT CONCRETE BASE



TYPE 4  
BITUMINOUS PENETRATION



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STANDARD DETAIL

PAVEMENT REPLACEMENT DETAILS

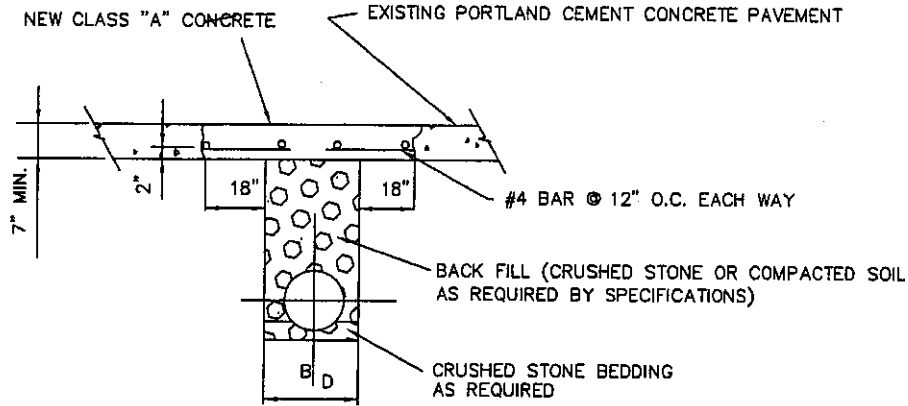
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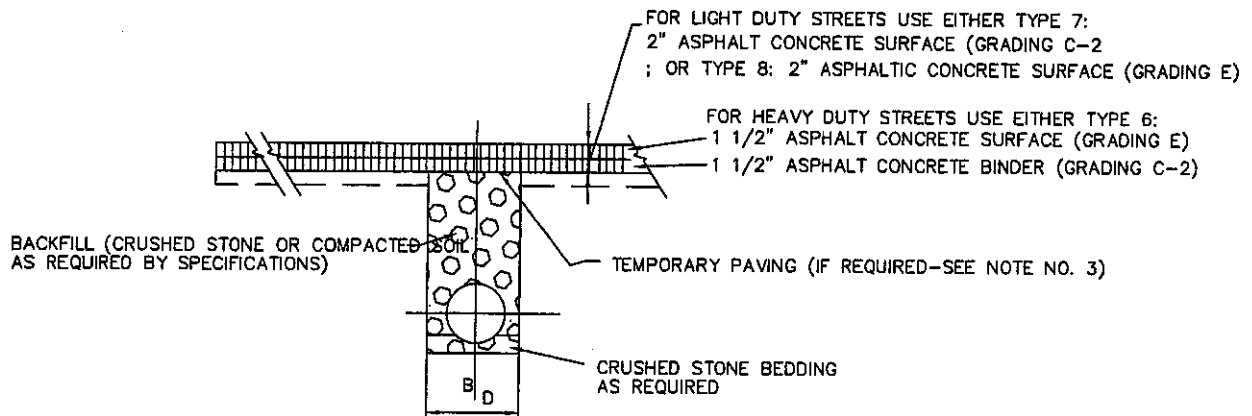


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TYPE 5  
CEMENT CONCRETE



TYPES 6,7,& 8  
PAVEMENT OF FULL WIDTH OF STREET

TYPES 1 - 8 PAVEMENT SHALL BE USED ON PRIVATE ROADS AND PARKING LOTS TO MATCH EXISTING PAVEMENT STRUCTURES



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STANDARD DETAIL

PAVEMENT REPLACEMENT DETAILS

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