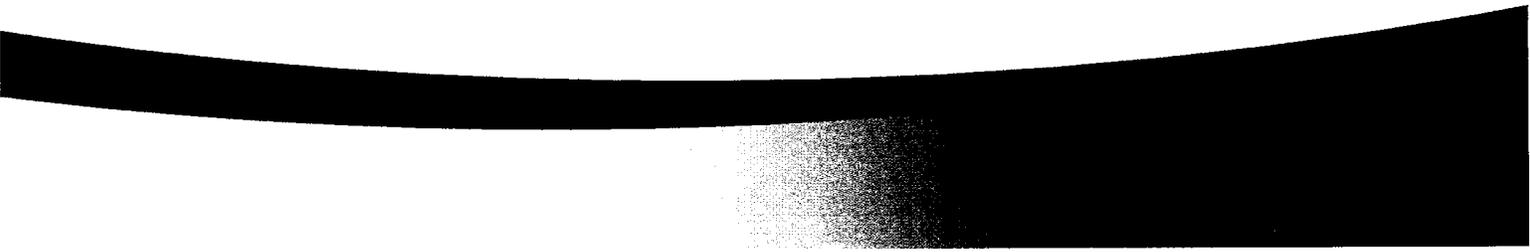




# **TECHNICAL SPECIFICATIONS**





## **SECTION 02200**

### **EARTHWORK**

#### **PART 1 - GENERAL**

##### **1.01 DESCRIPTION OF WORK**

- A. This Section of the specifications details requirements of work and materials to be used in connection with all clearing and grubbing; excavation, including borrow excavation; construction of embankments; preparation of subgrade, including spot reinforcement; grading; all hauling, wetting, rolling, compacting; and all other operations of incidental work for the construction of the roads, pipelines, ditches, ponds, canals, crossings, etc. to the lines and grades as established by the Engineer; all in accordance with the items of work shown on the Drawings and contained in the Proposal Form.

##### **1.02 REFERENCED STANDARDS**

- A. All work in this Section shall be in accordance with "Louisiana Standard Specifications for Roads and Bridges", latest edition with revisions. This standard specification will hereinafter be referred to a "LA DOTD Standards".

#### **PART 2 - PRODUCTS**

##### **2.01 BORROW (USABLE SOILS) MATERIAL**

- A. Borrow is defined as usable soils required for construction of embankments or other portions of the work in excess of usable materials available from required excavation and obtained from an approved source. Borrow may be required even though not shown on the Plans. Usable soil is defined as soil material whose composition is designated satisfactory for use in embankment construction. Moisture content has no bearing upon such determination. Compaction to conform to 90% modified Standard Proctor Density.

##### **2.02 NONPLASTIC EMBANKMENT**

- A. Nonplastic embankment materials shall be sand or shell or a sand-shell mixture and shall be in accordance with Subsection 203.09 of LA DOTD Standards.

##### **2.03 SHEETING AND BRACING**

- A. Furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures from undermining or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and solid beams or other approved methods. If the Engineer is of the opinion that any points sufficient or proper supports have not been provided, he may order additional supports put in at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no

additional expense to the Owner.

- B. The Contractor shall construct the sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressures to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected by the contractor at his own expense so as to provide the necessary clearances and dimensions.
- C. Where sheeting and bracing is required to support the sides of excavations for structures, the Contractor shall engage a Professional Geotechnical Engineer, registered in the State to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design, and certification of these designs shall be provided by the Professional Geotechnical Engineer.
- D. The Contractor shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which the Engineer may direct him in writing to leave in place at any time during the progress of the work for the purpose of preventing injury to structures, utilities, or property, whether public or private. The Engineer may direct that timber used for sheeting and bracing be cut off at any specified elevation.
- E. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed by the Engineer.
- F. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.
- G. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1 foot above the top of any pipe.

## **PART 3 - EXECUTION**

### **3.01 CLEARING AND GRUBBING**

- A. This work consists of required clearing, grubbing, removing and disposing of vegetation and debris within the limits of the right-of-way and easement areas, except such objects that are designated to remain or to be removed as shown on the plans.
- B. Clearing and grubbing shall be in accordance with Section 201 of LA DOTD Standards.

### **3.02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

- A. This work consists of removal and satisfactory disposal of all buildings, septic tanks, fences, culverts, structures, pavements, abandoned pipelines, and other obstructions not designated or permitted to remain, except obstructions to be removed under other contract items. It

shall also include salvaging of designated materials and backfilling resulting trenches, holes, and pits.

- B. Removal of structures and obstructions shall be in accordance with Section 202 of LA DOTD Standards.

### **3.03 EXCAVATION, EMBANKMENT, AND BACKFILL**

- A. This work consists of excavation, disposal, placement and compaction of all materials that are not provided under other Sections of these Specifications, including excavation and embankment construction for roadways and other structures, excavation for ditches and channels, and all other grading operations necessary for the work in accordance with these Specifications and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the Plans or established by the Engineer.
- B. The Plans may include data regarding the boring and classification of existing materials. The Owner does not guarantee the accuracy of such information and bidders should make, at their own expense, such additional investigations as they consider necessary. No additional payment will be made for any increased costs due to inaccuracy of soil boring data shown on the Plans.

### **3.04 TEMPORARY EROSION CONTROL**

- A. This work consists of providing temporary erosion control measures on the project and in areas outside the right-of-way where work is accomplished in conjunction with the project, to prevent pollution of water, detrimental effects to property adjacent to the right-of-way and damage to work on the project. These measures shall consist of construction and maintenance of temporary erosion control features shown on the Plans or as directed.
- B. Installation of temporary erosion control features shall be coordinated with construction of permanent erosion control features to the extent necessary to assure economical, effective and continuous control of erosion and water pollution throughout the life of the contract.
- C. Temporary erosion control shall be in accordance with Section 2.04 of LA DOTD Standards.

### **3.09 EXCAVATION AND TRENCHING FOR PIPEWORK**

- A. All excavation necessary for laying pipe and construction appurtenances shall be made in line and grade and to provide cover as indicated on the Plans and as specified for the type of pipe being laid.
- B. All excavation shall be open cuts with vertical sides, except in special cases where the Engineer may permit sloping sides or tunnels. If tunnels are authorized by the Engineer, they shall be of the same width throughout as open cutting and of sufficient height to allow the establishment of grades if required.
- C. The Engineer shall have the authority, at any time, to require the Contractor to discontinue the use of any excavating machine or other appliance which, in the Engineer's judgement is not adapted to the purpose for which it is used. In order to protect trees, buildings, or structures, excavation by completely manual means may be required.
- D. The Contractor shall leave a berm of at least two feet (2') in width on one side if the trench between the trench and the spoil bank to allow free passage of the Engineer and to permit the Engineer to perform work in an expeditious and satisfactory manner.

- E. No greater length of trench shall be opened in advance of the completed structure or left unfilled to the rear thereof than deemed proper by the Engineer.
- F. Where roadways, paving, or sidewalks are required to be broken in order to properly lay the pipe, then such breaking and removal shall be done in accordance with the Plans, Specifications, or Engineer's direction, and such work required shall be included in other pay items. If no specific pay item is provided, no additional compensation will be made.
- G. The width of the trench to a point two feet (2') above the top of the pipe installation shall not exceed the external diameter plus 18" maximum. Additional cost for special foundation and backfill material and requirements as a result of failure to confine the excavation to this width shall be borne by the Contractor.
- H. Unless specifically directed by the Engineer, the mechanical excavation shall be stopped above the final invert grade elevations so that the pipe may be laid on a firm, undisturbed, native earth bed. Just prior to laying the pipe, so as not to disturb subgrade, a continuous trough shall be manually excavated and accurately graded to provide uniform bedding for the bottom quadrant (90 degrees) of the pipe barrel. In addition, bell holes shall be excavated so that the bell will not come in contact with the bottom of the hole, so that the full length of the barrel be bedded as required and to allow for joints being properly made.
- I. If overdigging occurs, all loosened earth must be removed and the trench bottom brought back to grade with granular material or lean concrete without additional compensation therefore. Recomposition of overdigging shall be 92% of modified proctor maximum dry density.
- J. Where the bottom of the trench is rock, waterbearing soil, or unstable material, the Engineer may direct that the pipe be bedded in granular material or a concrete cradle and paid for as separate items. The pipe shall be bedded in a trough as provided above, but in no case shall the thickness of the bedding material be less than four inches (4") below the bottom of the pipe barrel.
- K. Granular material, where required, shall be well-graded crushed stone or graded river gravel, in accordance with A.S.T.M. Designation C-33, Gradation No. 67.
- L. Concrete for pipe foundations, where required, shall be high-early-strength proportioned to develop not less than 2,000 psi in 28 days.
- M. Other excavation and trenching requirements as specified herein before in Section 2 of these Specifications, shall be complied with.

### **3.10 BACKFILLING OF PIPE TRENCHES**

#### **A. GENERAL**

No backfilling of underground lines or conduit shall occur until all dimensions and elevations as required for as-built documentation has been performed.

All trenches and excavations shall be backfilled as specified for the type of pipe being laid. No backfilling shall commence until the Engineer has inspected the pipework and until the joints are reasonably cured, if the type of work requires. No material shall be used for backfilling that contains stone having any dimension greater than six (6") inches, frozen earth, debris, or sod.

Where any sheeting or bracing is withdrawn as backfilling progresses, all voids or spaces left thereby shall be carefully and thoroughly filled and compacted with shaped tools. The Engineer shall have the right to forbid the use of any compacting tools or machines that he so considers dangerous to the pipe or incapable of compacting the backfill properly.

Backfill and fill methods shall meet the approval of the State Highway Department where within State Highway rights-of-way and the approval of the owning railroad where within railroad rights-of-way. The requirements of the approving agency shall govern over specified requirements for backfill of pipe trenches, except in cases where the governing agency's requirements are inferior to those cited above.

The Contractor shall go over all trenches and refill all sunken trenches after every rain. Before final acceptance of the work where paving is not to be replaced over the trench, the Contractor shall go over the entire system and refill all sunken trenches, compact trenches by rolling and leave the surface of the trench slightly mounded and in a condition satisfactory to the Engineer. Any deficiency in the quantity of materials for backfilling the trenches, or for filling depressions caused by settlement, shall be supplied by the Contractor at no additional payment.

Upon completion of backfilling, all excavated material and surplus soil shall be cleared from adjacent street surfaces, gutters, sidewalks parkways, grass plots, etc. and shall be removed. The whole area affected shall be left in a tidy and acceptable condition.

The initial backfill shall be manually placed completely under the pipe haunches and around the pipe in uniform layers not exceeding six (6") inches in depth. Each layer shall then be carefully and uniformly tamped so as not to displace the pipe. The utmost care shall be taken not to disturb the pipe by stepping on them, throwing earth on them from the bank above, unequal backfilling, or unsilled compacting. There shall not be less than one man tamping to each two men shoveling for the initial backfill.

Where the Contractor uses a trenching machine for the excavation, then the initial backfill shall be brought to not less than six (6) inches above the top of the pipe, as hereinafter specified. Should the Contractor elect to use a backhoe, dragline, clam-shell bucket, or equipment other than a trenching machine, then the initial backfill shall be brought to not less than two (2) feet above the top of the pipe.

Upon written permission, and at the direction of the Engineer puddling, jetting, or flooding of porous sand or gravel may be permitted during warm weather for the intermediate backfill.

## B. COMPACTION

1. General: Control soil compaction during construction providing maximum percentage of density specified on the structural drawings for each area classification. It shall be the Contractor's responsibility to notify the Engineer in writing that penetration tests can be performed. Written notice from the Contractor shall precede completion of compaction operations by at least two working days.
2. Percentage of Maximum Density Requirements:
  - A. Compact soil to not less than the following percentages of maximum dry density in accordance with AASHTO T-180 (modified proctor).
    1. Structures and 5-feet 0-inches around Perimeter of Building: Compact top 36-inches of subgrade and each layer of backfill or fill material at 92 percent

modified proctor maximum dry density except where pavement will be installed.

2. Building Slabs: Compact top 12-inches of subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
  3. Lawn or Unpaved Areas: Compact top 6-inches subgrade and each layer of backfill or fill to the extent required to obtain a stable fill.
  4. Walkways: Compact top 6-inches of subgrade 95 percent maximum dry density.
  5. Pavements and Steps: Compact top 24-inches of subgrade at 95 percent maximum dry density.
3. Moisture Control: Condition subgrade or layer material correcting moisture content:
- a. When the material is too dry and before compaction, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during or subsequent to compaction operations.
  - b. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
  - c. Soil material that has been removed because it is too wet to permit compaction but is otherwise satisfactory may be stock-piled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.
4. Structural fill and base course in open areas, shall be placed in layers not to exceed eight inches in depth as measured before compaction. Each layer shall be compacted to the minimum dry density as stated above. Incidental compaction due to traffic by construction equipment will not be credited toward the required minimum four coverages.
5. Common fill shall be placed and compacted in a manner similar to that described above for structural fill, with the following exceptions:
- a. Layer thickness prior to compaction may be increased to 10-inches in open areas.
  - b. Common fill, except dike fill required below water level in peat excavation areas, may be placed as one lift, in-the-wet, to an elevation one foot above the water level at the time of filling.
6. Compaction equipment in open areas shall consist of medium-heavy vibrator rollers with a minimum static weight of 10 tons or other compaction equipment as approved by the Engineer.
7. Areas adjacent to structures and other confined areas inaccessible to the vibratory roller shall be compacted with approved hand guided mechanical compaction equipment. The Contractor shall also conform to additional backfilling requirements at structures as specified in Paragraph 3.04. Compaction of the fill by such means shall be to the same degree of compaction as obtained by the rubber-tired

equipment and the Engineer may make the necessary tests to determine the amount of compactive effort necessary to obtain compaction. Unless such tests indicate that modifications may be made, the fill compacted by mechanical compactors shall be placed in 6-inch layers and thoroughly tamped over the entire surface. Compaction equipment is subject to approval by the Engineer.

8. It is the intention that the fill materials with respect to moisture be used in the conditions they are excavated insofar as this is practicable. Material which is too wet shall be spread and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits.
9. If the Engineer determines that added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which will insure uniform distribution of the water over the area to be treated, and give complete and accurate control of the amount of water to be used. If too much water is added the area shall be permitted to dry before the compaction is continued.
10. The Contractor shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment, and all other materials and equipment necessary to place the water in the fill in the manner specified.

#### C. BACKFILL AND FILL

1. Backfill methods for gravity sewer trenches, as shown on the Drawings, are classified into three (3) zones; bedding, initial backfill, and final backfill.
  - a. **Bedding** is the material a minimum of six inches (6") under the pipe up to a level four inches (4') above the pipe. Bedding material shall be well graded crushed stone meeting the requirements of ASTM Designation C-33, Gradation No. 67.
  - b. **Initial backfill** is the material above the bedding material to a distance of twelve inches (12") above the pipe. Acceptable initial backfill material is useable excavated soil unless otherwise directed by the Engineer to be select earth backfill, except under paved areas where only select earth backfill shall be accepted.
  - c. **Final backfill** is the material placed above the initial backfill extending up the final grade (except under paved surfaced where crushed #610 stone shall be placed on the last 12" of the trench). Acceptable final backfill materials are useable excavated soils, unless otherwise directed by the Engineer to be select earth backfill, except under paved areas where only select earth backfill shall be accepted.
2. Definition of Acceptable Soils
  - a. **Usable Soils** shall be defined as having a PI of 25 or less, an organic content of 5 percent or less and a maximum silt content of 65 percent.
  - b. **Select Earth Backfill** shall be defined as natural soils with a maximum PI of 20, maximum Liquid Limit of 35, a maximum organic content of 5 percent, and a maximum silt content of 65 percent.
3. Backfill excavations as promptly as work permits, but not until completion of the following:

- a. Acceptance by engineer of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
  - b. Inspection, testing, approval, and recording locations of underground utilities.
  - c. Removal of concrete formwork.
  - d. Removal of shoring and bracing, and filling of voids with satisfactory materials.
  - e. Removal of trash and debris.
  - f. Placement of permanent or temporary horizontal bracing has been completed on horizontally supported walls. Layout and location of bracing shall consider loads of the structure as well as the effects of the soil and groundwater.
4. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. When existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.
5. Placement and Compaction: Place backfill and fill materials in layers not more than 9-inches loose depth for material compacted by heavy compaction equipment, and not more than 6-inches loose depth for material compacted by hand-operated tampers.
- a. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
  - b. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.
  - c. Large compaction equipment shall not be used within 5 feet of walls.

### **3.11 HANDLING AND DISPOSAL OF WATER**

- A. The Contractor shall pump, bail, well point, or otherwise remove any water which may be found or may accumulate in the excavations, and shall perform all work necessary to keep the excavations clear of water while the work is in progress. The cost of removing water by pumping or otherwise shall be included in the prices bid for various items of the work, it will not be paid for as separate pay item.

- B. Gutters and drains parallel with the trench must be maintained unobstructed. When necessary a proper platform shall be built over them and the excavated dirt placed thereon so as to permit the free passage of all drainage water.

### **3.12 CROSSINGS OF CANALS, TRACKS, ETC. - PERMITS, CHARGES, PAYMENTS, ETC.**

- A. No additional compensation will be paid for the construction of any pipe line because of its crossing under or over a drainage canal (either open or covered), a natural or artificial stream or lagoon, a railroad track, or a conduit or any such structure provided the route of the pipe line as bid on has not been changed so as to produce a crossing not to be anticipated by the Bidder. All additional compensation required because of the crossing will be paid for items entering into the construction.
- B. Natural or artificial streams or lagoons, drainage, or navigation canals, gutters or culverts, shall not be unreasonably blocked or obstructed or prevented from carrying their customary drainage or traffic, and shall be replaced by the Contractor in as good condition as they were originally, without charge.
- C. The Owner will secure the permits for crossing railroads, highways, canals, or other waterways or appurtenances, but the Contractor will be held to a strict compliance with the terms under which such permits may be issued.
- D. The Owner will pay all fees and charges of railroad companies for their supervision, their labor, and their material and services required by the railroad company in effecting the various crossing of tracks set up in the Contract.
- E. When any railway tracks are encountered in the course of the work, the Contractor shall take utmost precautions to avoid any unnecessary delays or interruptions of traffic and to avoid injury to the roadbed or tracks of such railroads. The Engineer shall have the right to forbid the use of any methods or details of construction that may be considered unsafe or unwise, but the Contractor shall be held fully responsible for all risks and damages attending such work. The Contractor shall notify the Owner or lessee of any railroad track or switch track, or any street railway track of any contemplated crossing of the track at least forty-eight (48) hours in advance.
- F. The Contractor shall receive no extra compensation for the work done crossing under tracks above the prices bid for the items entering into the construction.

### **3.13 LOCATION OF PIPE LINES**

- A. The appropriate location of the proposed lines has been indicated on the Plans. Final location of the pipe lines shall be made by the Engineer at the time of construction.
- B. It shall be the responsibility of the Contractor to locate or cause to be located, all subsurface obstructions within the trench and also underground structures which are adjacent to but outside the trench.

### **3.14 SITE GRADING**

- A. Site of all structures, embankments, ditches, streets, and roads shall be graded within the areas and to the elevations as shown on the Plans or as specified. Grading operations shall be so conducted that material shall not be removed or loosened beyond the required limits. Slopes and ditches shall be neatly trimmed and finished to conform to the slope lines shown on the Plans, or as directed by the Engineer.

### **3.15 MAINTENANCE**

- A. All areas of excavation, backfill, embankments, trenches, ditches, roadways and parking area grading shall be maintained by the Contractor in good condition and provide for proper drainage of the work site and adjoining properties at all times until final acceptance. The Engineer may require the use of gravel or other granular material for trench maintenance. All areas of the project will be seeded as directed by the Engineer.

END OF SECTION

## **SECTION 02535**

### **MANHOLES, CATCH BASINS AND VALVE VAULTS**

#### **PART 1 - GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Manholes
- B. Catch Basins
- C. Valve and Meter Vaults

##### **1.02 REFERENCES**

- A. ASTM A48 - Gray Iron Castings
- B. ASTM C 478 - Precast Reinforced Concrete Manhole Sections.
- C. ASTM C 858 - Underground Precast Concrete Utility Structures.

##### **1.03 SUBMITTALS**

- A. Submit design calculations by a registered professional engineer in the State of Louisiana for each manhole and vault installed showing concrete thickness and reinforcement requirements for the depths each structure is to be constructed.

#### **PART 2 - PRODUCTS**

##### **2.01 USABLE SOILS**

- A. Use select fill meeting AASHTO A-4 specifications for backfilling of manholes, catch basins and valve vaults.

##### **2.02 CATCH BASIN AND MANHOLE MATERIALS**

- A. Cast-In-Place Concrete: 4000 psi minimum compressive strength @ 28 days (minimum).
- B. Reinforcement: Provide under the provisions of Section 03200.
- C. Precast Manholes: ASTM C76, Wall C.
- D. Precast Valve and Meter Vaults: ASTM C858 - Precast Concrete Utility Structures.
- E. Frames, Grates and Covers: ASTM A48.
- F. Joints: Flexible plastic gaskets; Ram-Nek, Kent-Seal, or equal.

## **2.03 FABRICATION**

- A. Cast into precast manholes, catch basins and vault structures, the number and size of pipe openings as indicated for incorporation of the unit into the drainage system.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Identify required lines, levels, contours, and datum.
- B. Protect above and below grade utilities which are to remain.

### **3.02 EXCAVATION**

- A. Perform excavation operations in accordance with Section 02200.
- B. Excavate subsoil to the depths indicated on the Drawings and to a width sufficient for proper joining of pipe sections and thorough compaction of backfill material under and around pipe. Undercut, as directed, soft areas of subgrade not capable of insitu compaction or not capable of properly supporting the pipe.
- C. Excavate subsoil as required to properly construct manholes and catch basins.
- D. Dispose of material not satisfactory for backfill.

### **3.03 INSTALLATION - MANHOLES, CATCH BASINS AND VALVE VAULTS**

- A. When precast manholes, catch basins and vaults are selected, provide a minimum of six inches of bedding material beneath manhole and catch basin foundation slabs; bedding material to be approved by the Engineer; level and compact to proper grade.
- B. When selected, construct cast-in-place concrete manholes, catch basins and vaults in accordance with the provisions of Section 03300 for form work and the placing, furnishing and curing of cast-in-place concrete.
- C. Erect manholes, catch basins and vaults to the proper alignment and elevation.
- D. Set metal frames in full mortar bed.
- E. Cut pipe flush to inside face of structure.

### **3.04 BACKFILLING MANHOLES, CATCH BASINS AND VAULTS**

- A. Verify that structures have cured sufficiently.
- B. Backfill with usable soil.
- C. Place backfill at or near optimum moisture content in layers not exceeding six inches compacted thickness.
- D. Compact each layer by approved mechanical compaction equipment, to at least 95 percent

of maximum density prior to placing a subsequent layer.

- E. Maximum density will be determined in accordance with ASTM D-1557 (modified proctor) maximum density at or above optimum moisture content.

### **3.05 CLEANUP**

- A. Clean structures of silt and debris.
- B. Coat metal parts not galvanized with asphaltic varnish.

### **3.06 FIELD QUALITY CONTROL**

- A. Where compaction tests indicate work does not meet specified requirements, remove work and replace.

END OF SECTION

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## **SECTION 02951**

### **SEWER MANHOLE REHABILITATION**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. It is the intent of this portion of the Work to provide for all aspects of sewer manhole rehabilitation including type of repair, methods of repair, materials, and equipment as may be appropriate for each manhole scheduled for rehabilitation.
- B. The work described within details a complete program for manholes. This section details the methods, procedures, materials and equipment as required to produce "A Total System for Manholes". The completed system will provide a corrosion resistant liner that restores walls to original surface levels and eliminates water infiltration and exfiltration. Sealing and coating of the manhole walls and bases shall include the cone or chimney to the full depth. This work shall be bid on per one (1) vertical foot basis for a typical 48-inch diameter concrete round manhole.
- C. Manhole Bench Repair where specified on the plans will consist of cleaning and removing loose materials from the deteriorated bench and reforming the bench utilizing fast setting grout as specified in Section 2.01 (5).
- D. Manhole Structural Repair where specified on the plans will consist of filling a major void in the manhole wall. The repair will be made utilizing fast setting grout as specified in Section 2.01 (5).
- E. Reset Manhole Ring and Cover where specified on the plans will consist removing the existing grout surrounding the ring and cover, resetting and grouting in the new position.
- F. The Contractor shall be required to provide bypass pumping where ever needed to complete the work. A plan for bypass method must be submitted to the Engineer for approval prior commencing work.

##### **1.03 QUALITY ASSURANCE**

In addition to requirements of these Specifications, comply with manufacturer's instructions and recommendations for work.

##### **1.04 SUBMITTALS**

- A. Submit manufacturer's technical data and application instructions for review and approval.
- B. Submit applicator's qualifications for review and approval.

#### **PART 2 - PRODUCTS**

##### **2.01 MATERIALS AND EQUIPMENT**

###### **A. MATERIALS**

1. The materials to be utilized in the lining of manholes shall be designed and manufactured to withstand the severe effects of hydrogen sulfide in a wastewater environment. Manufacturer of corrosion protection products shall have long proven experience in the production of the lining products utilized and shall have satisfactory installation record.

Equipment for installation of lining materials shall be high quality grade and be as recommended by the manufacturer.

2. The system used shall be a multiple layer system utilizing sprayable mixed components. The liner system shall be Spectra Shield as by CCI Spectrum, Inc. or an approved equal. The system shall include a three coat process as follows:
  - a. First Coat  
Moisture Barrier – Modified Polymer
  - b. Second Coat  
Surfacer – Polyurethane/Polymeric Blend Foam
  - c. Third Coat  
Final Corrosion Barrier – Modified Polymer

The total thickness of the system shall be 500 mils.

3. The modified polymer shall be sprayable, solvent free, two-component polymeric, moisture/chemical barrier specifically developed for the corrosive wastewater environment. The chemical and physical properties are as follows:
  - a. Typical Chemical Analysis

**"A" Component**

Viscosity, 77° F, cps., ASTM D-1638	450
Physical State	Liquid
Color	Clear to amber
Hygroscopicity	Reacts with water

**"B" Component**

Viscosity, 77° F, cps., ASTM D-1638	500
Physical State	Liquid
Color	Flamingo Pink
Non-Volatile	100%

**Reaction Profile (100 grams, 175° F sample)**

Gel Time, seconds	10
Tack Free Time, seconds	20
Cure Time, seconds	90

- b. Processing

A System/B System, volume ratio 1.00/1.00

c. Typical Physical Properties

Tensile Strength, PSI	>3600
Elongation, %	>300
Tear Strength, PLI	>5000
Shore A Hardness	96
100% Modulus, PSI	>2500

4. The Polyurethane Rigid Structure Foam, low viscosity two-component, containing flame retardants. The chemical and physical properties are as follows:

a. Typical Chemical Analysis

**"A" Component**

Viscosity, 77° F, cps., ASTM D-1638	200
Physical State	Liquid
Color	Dark Brown
Hygroscopicity	Reacts with water and evolves CO2 gas

**"B" Component**

Viscosity, 77° F, cps., ASTM D-1638	660
Physical State	Liquid
Color	Transparent Dark
Hygroscopicity	Absorbs water rapidly thus changing ratio

**Reaction Profile (100 grams, 77° F sample)**

Cream Time, seconds	1-4
Tack Free time, seconds	5-8
Rise Time, seconds	6-10

b. Processing

A System/B System, volume ratio 1.00/1.00

c. Typical Physical Properties

Density, nominal, core, lbs/ft <sup>3</sup> ASTM D-1622 @ 74° F	4-10
Compression Strength, ASTM D-1621 @ 74° F parallel rise; PSI	90-150
Closed Cell Content, %-ASTM 1940 @ 74° F	Over 95
Shear Strength, PSI – ASTM C-273 @ 74° F	225-250

5. Grouting Mix

1. Strong-Seal Grout, Concrevis 1250, or equal, shall be used for stopping very active infiltration and filling voids according to the manufacturer's recommendations. The grout shall be volume stable, formulated with ASTM C150 Type I or Type III cement and shall exhibit the following physical properties:
  - a. Density at placement 65 PCF (min.)
  - b. Compressive strength (ASTM C495) 1 day - 50 psi  
28 days - 250 psi
  - c. Shrinkage (ASTM C596) 0%

6. Water

Water shall be clean and potable.

**B. EQUIPMENT:**

All equipment, materials and procedures required to establish compliance with the specifications shall be submitted to the owner/engineer for review/approval. Submittals shall include at least five (5) copies of the following:

1. Technical Data Sheet on each product used.
2. Material Safety Data Sheet (MSDS) for each product used.
3. ASTM References.
4. CIGMAT Evaluation.
5. Descriptive literature, bulletins and/or catalogs of materials.
6. Work procedures including flow diversion plan, method of repair, etc.
7. Material and method for repair of leaks or cracks in manholes.
8. Final installation report on completed manholes.

**PART 3 - EXECUTION**

**3.01 SURFACE PREPARATION**

Conduct surface preparation program to include monitoring of atmosphere for hydrogen sulfide, methane, low oxygen or other gases, approved flow control equipment, and surface preparation equipment.

Surface preparation methods may include high pressure water cleaning, hydro blasting, abrasive blasting, grinding, detergent water cleaning and shall be suited to provide a surface compatible for installation of the liner system.

Surface preparation method shall produce a cleaned, abraded and sound surface with no evidence of laitance, loose concrete, brick or mortar, contaminants or debris, and shall display a surface profile suitable for application of liner system.

After completion of surface preparation, perform the seven point check list, which is the inspection for:

- |           |                                    |
|-----------|------------------------------------|
| 1. Leaks  | 5. Ring and Cover Condition        |
| 2. Cracks | 6. Invert Condition                |
| 3. Holes  | 7. Inlet and Outlet Pipe Condition |

#### 4. Exposed Rebar

After the defects in the structure are identified, repair all leaks with a chemical or hydraulic sealant designed for use in field sealing of ground water. Severe cracks shall be "repaired with a urethane based chemical" sealant. Product to be utilized shall be as approved by owner/engineer prior to installation. Repairs to exposed rebar, defective pipe penetrations or inverts, etc. shall be repaired utilizing non-shrink grout or approved alternative method.

New Portland cement structures added riser sections or replaced sections shall have endured a minimum of 28 days since manufacture prior to commencing installation of the liner system.

### **3.02 INSTALLATION**

Applicator shall take appropriate action to comply with all local, state and federal regulations including those set forth by OSHA, EPA, the Owner and any other applicable authorities.

Prior to conducting any work, perform inspection of structure to determine need for protection against hazardous gases or oxygen depleted atmosphere and the need for flow control or flow Diversion.

Application procedures shall conform to recommendations of the manufacturer, including materials handling, mixing, environmental controls during application, safety and spray equipment.

Spray equipment shall be specifically designed to accurately ratio and apply the liner system.

Application of multi-component liner system shall be in strict accordance with manufacturer's recommendation. Final installation shall be a minimum of 500 mils. A permanent identification and date of work performed shall be affixed to the structure in a readily visible location.

Provide final written report to owner/engineer detailing the location, date of report, and description of repair.

### **3.03 MANHOLE REHABILITATION ACCEPTANCE**

After the manhole sealing and restoration operation has been completed, the manhole shall be visually inspected for the elimination of excessive infiltration by the Contractor in the presence of the Project Engineer and the work shall be satisfactory to the Engineer. The interiors shall be free of voids or pinholes and thickness shall be as specified. In addition, at the Owner's request, the Contractor may be required within one year to visually inspect the manholes that were sealed. Any sealing work that has become defective shall be resealed by the Contractor at no additional expense to the Owner.

#### **1. ACCEPTANCE TESTING**

- A. A minimum of 10% of the sewer manholes rehabilitated shall be tested by exfiltration measurement. Such testing shall be conducted no sooner than three (3) days following significant wet weather activity. All sewer lines penetrating the walls of an existing manhole to be tested shall be plugged. Where flows in the sewer warrant the use of bypass pumping, the Engineer may accept the manhole as complete without testing or may

request that the Owner provide upstream pump station flow control prior to the Contractor's testing of the manhole.

Upon plugging the sewer lines, the Contractor shall supply the necessary potable water to fill the manhole to the corbel (bottom of the manhole frame). Thereafter, measurements shall be made of the loss of water at the end of five (5) minutes.

Loss of water shall not exceed the values noted herein:

<b>4-FOOT AND 6-FOOT DIAMETER MANHOLES</b>	
<b>Manhole Depth</b>	<b>Allowable Water Loss</b>
0 - 8'	1" vertical drop of water surface
Over 8'	1/8" per foot of depth drop of water surface

- B. Where exfiltration exceeds the amounts shown herein, the manhole shall be drained and inspected by the Engineer to determine the cause of the water loss. If the Engineer determines that the exfiltration results from inadequate liner application, the Contractor shall proceed with additional work at no additional cost to the Owner. After completing additional work, the manhole shall then be retested according to this subsection.

**2. FINAL CLEANUP**

After all work has been completed and all testing acceptable, the Contractor shall clean-up the entire project area. All excess material and debris shall be disposed of by the Contractor and the area left in an acceptable manner. All manhole covers shall be replaced and a mixture of aggregate and tar placed back over those areas where a hole was created, thereby removing the possibility of vehicle damage that may be caused by such an obstruction.

**3.04 QUALITY ASSURANCE AND WARRANTIES**

1. The manufacturer and/or applicator of the total linear system of manholes shall be a company that specializes in the design, manufacture or installation of corrosion protection systems for manholes. Applicator shall be completely trained in leak repair, surface preparation and corrosion materials application on manholes. Corrosion materials/products shall be suitable for installation in a severe hydrogen sulfide environment without any deterioration to the liner.

The applicator shall be trained and certified by the manufacturer for the handling, mixing, application and inspection of the liner system as described herein.

To ensure total unit responsibility, all materials and installation thereof shall be furnished and coordinated with/by one supplier/applicator who turnkeys the work and assumes full responsibility for the entire operation.

2. The manufacturer and applicator shall warrant the liner system against failure for a period of 10 years. "Failure" will be deemed to have occurred if the protective lining fails to (a) prevent the internal damage or corrosion of the structure (b) protect the substrate and environment from contamination by effluent. If any such failure occurs within 10 years of initial completion of work on a structure, the damage will be repaired to restore the lining at no cost to the Owner within 60 days after written notification of the failure. "Failure" does not include damage resulting from mechanical or chemical abuse or act of God. Mechanical or chemical abuse means exposing the lined surfaces of the structure to any mechanical force or chemical substance not customarily present or used in connection with structures of the type involved. There are no warranties express or implied other than those specifically stated in this section. Any liability for consequential and incidental damages is expressly disclaimed. Liability is limited to and shall not exceed the purchase price paid.

END OF SECTION

## **SECTION 02951**

### **WASTEWATER MANHOLE REHABILITATION**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. It is the intent of this portion of the Work to provide for all aspects of sewer manhole rehabilitation including type of repair, methods of repair, materials, and equipment as may be appropriate for each manhole scheduled for rehabilitation.
- B. The work described within details a complete program for manholes. This section details the methods, procedures, materials and equipment as required to produce "A Total System for Manholes". The completed system will provide a corrosion resistant liner that restores walls to original surface levels and eliminates water infiltration and exfiltration. Sealing and coating of the manhole walls and bases shall include the cone or chimney to the full depth. This work shall be bid on per one (1) vertical foot basis for a typical 48-inch diameter concrete round manhole.
- C. Manhole Bench Repair where specified on the plans will consist of cleaning and removing loose materials from the deteriorated bench and reforming the bench utilizing fast setting grout as specified in Section 2.01 (5).
- D. Manhole Structural Repair where specified on the plans will consist of filling a major void in the manhole wall. The repair will be made utilizing fast setting grout as specified in Section 2.01 (5).
- E. Reset Manhole Ring and Cover where specified on the plans will consist removing the existing grout surrounding the ring and cover, resetting and grouting in the new position.
- F. The Contractor shall be required to provide bypass pumping where ever needed to complete the work. A plan for bypass method must be submitted to the Engineer for approval prior commencing work.

##### **1.03 QUALITY ASSURANCE**

In addition to requirements of these Specifications, comply with manufacturer's instructions and recommendations for work.

##### **1.04 SUBMITTALS**

- A. Submit manufacturer's technical data and application instructions for review and approval.
- B. Submit applicator's qualifications for review and approval.

#### **PART 2 - PRODUCTS**

##### **2.01 MATERIALS AND EQUIPMENT**

###### **A. MATERIALS**

1. The materials to be utilized in the lining of manholes shall be designed and manufactured to withstand the severe effects of hydrogen sulfide in a wastewater environment. Manufacturer of corrosion protection products shall have long proven experience in the production of the lining products utilized and shall have satisfactory installation record.

Equipment for installation of lining materials shall be high quality grade and be as recommended by the manufacturer.

2. The system used shall be a multiple layer system utilizing sprayable mixed components. The liner system shall be Spectra Shield as by CCI Spectrum, Inc. or an approved equal. The system shall include a three coat process as follows:
  - a. First Coat  
Moisture Barrier – Modified Polymer
  - b. Second Coat  
Surfacer – Polyurethane/Polymeric Blend Foam
  - c. Third Coat  
Final Corrosion Barrier – Modified Polymer

The total thickness of the system shall be 500 mils.

3. The modified polymer shall be sprayable, solvent free, two-component polymeric, moisture/chemical barrier specifically developed for the corrosive wastewater environment. The chemical and physical properties are as follows:
  - a. Typical Chemical Analysis

**"A" Component**

Viscosity, 77° F, cps., ASTM D-1638	450
Physical State	Liquid
Color	Clear to amber
Hygroscopicity	Reacts with water

**"B" Component**

Viscosity, 77° F, cps., ASTM D-1638	500
Physical State	Liquid
Color	Flamingo Pink
Non-Volatile	100%

**Reaction Profile (100 grams, 175° F sample)**

Gel Time, seconds	10
Tack Free Time, seconds	20
Cure Time, seconds	90

- b. Processing

A System/B System, volume ratio 1.00/1.00

c. Typical Physical Properties

Tensile Strength, PSI	>3600
Elongation, %	>300
Tear Strength, PLI	>5000
Shore A Hardness	96
100% Modulus, PSI	>2500

4. The Polyurethane Rigid Structure Foam, low viscosity two-component, containing flame retardants. The chemical and physical properties are as follows:

a. Typical Chemical Analysis

**"A" Component**

Viscosity, 77° F, cps., ASTM D-1638	200
Physical State	Liquid
Color	Dark Brown
Hygroscopicity	Reacts with water and evolves CO2 gas

**"B" Component**

Viscosity, 77° F, cps., ASTM D-1638	660
Physical State	Liquid
Color	Transparent Dark
Hygroscopicity	Absorbs water rapidly thus changing ratio

**Reaction Profile (100 grams, 77° F sample)**

Cream Time, seconds	1-4
Tack Free time, seconds	5-8
Rise Time, seconds	6-10

b. Processing

A System/B System, volume ratio 1.00/1.00

c. Typical Physical Properties

Density, nominal, core, lbs/ft3 ASTM D-1622 @ 74° F	4-10
Compression Strength, ASTM D-1621 @ 74° F parallel rise; PSI	90-150
Closed Cell Content, %-ASTM 1940 @ 74° F Over 95	
Shear Strength, PSI – ASTM C-273 @ 74° F	225-250

5. Grouting Mix

1. Strong-Seal Grout, Concrevice 1250, or equal, shall be used for stopping very active infiltration and filling voids according to the manufacturer's recommendations. The grout shall be volume stable, formulated with ASTM C150 Type I or Type III cement and shall exhibit the following physical properties:
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#### 4. Exposed Rebar

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<b>Manhole Depth</b>	<b>Allowable Water Loss</b>
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Over 8'	1/8" per foot of depth drop of water surface

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2. The manufacturer and applicator shall warrant the liner system against failure for a period of 10 years. "Failure" will be deemed to have occurred if the protective lining fails to (a) prevent the internal damage or corrosion of the structure (b) protect the substrate and environment from contamination by effluent. If any such failure occurs within 10 years of initial completion of work on a structure, the damage will be repaired to restore the lining at no cost to the Owner within 60 days after written notification of the failure. "Failure" does not include damage resulting from mechanical or chemical abuse or act of God. Mechanical or chemical abuse means exposing the lined surfaces of the structure to any mechanical force or chemical substance not customarily present or used in connection with structures of the type involved. There are no warranties express or implied other than those specifically stated in this section. Any liability for consequential and incidental damages is expressly disclaimed. Liability is limited to and shall not exceed the purchase price paid.

END OF SECTION