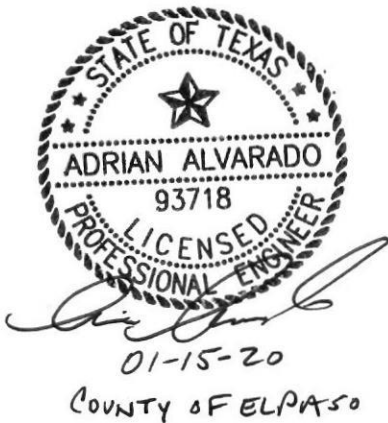


Technical Specifications for
Ascarate Park Lift Station and
Sanitary Sewer Improvements



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**Ascarate Park Lift Station
And Sanitary Sewer Improvements**

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS

DIVISION 1 – GENERAL REQUIREMENTS

01020	Scope of Work	2
01025	Payment and Measurements	2
01300	Submittals	3
01700	Contract Closeout	3

DIVISION 2 – SITE WORK

02100	Site Preparation.....	4
02200	Earthwork	7
02220	Site Demolition.....	3
02222	Protecting Existing Underground Utilities.....	2
02235	Granular Fill Materials.....	4
02310	Grading	2
02315	Excavating, Backfilling and Compacting for Utilities	5
02530	Grinder Pump Units.....	9
02531	Low Pressure Wastewater Utility Piping	9
02600	Schedule of Pipe	1
02605	Manholes	6
02622	Polyvinyl Chloride (PVC) Gravity Sewer Pipe and Fittings	7
02830	Rock Walls	2

DIVISION 3 – CONCRETE

03300	Cast-In-Place Concrete	10
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SECTION 01020 - SCOPE OF WORK

PART 1 - GENERAL

1.01 **RELATED DOCUMENTS**

Drawings sheets 1 through 7 and contract documents.

1.02 **SCOPE OF WORK**

The work covered by this section of the specifications consists of furnishing all labor equipments, supplies, materials and appurtenances necessary to perform the installation of new sanitary sewer improvements at Ascarate Park to serve the existing restroom facilities that are located along the southeastern portion of the park, adjacent to RE Thomason Loop.

Sanitary sewer improvements consist of the installation of new 6-inch PVC (SDR-35) gravity sewer pipe that will tie into the existing sewer line of an existing restroom facility located at the most upstream portion of the new sewer system. This gravity line will discharge into a new lift station. Installation of the lift station consists of a new prepackaged (Quadplex) lift station with four (4) submersible grinder pumps, piping, valves, electrical, control panel instrumentation and all required appurtenances. Low pressure piping installation that will serve to discharge the new lift station will consist of approximately 1,200 lineal feet of 2-inch PVC (Sch-40) that will be installed in a dual pipe configuration within a single utility trench which is 600 lineal feet in length. This low pressure piping from the new lift station will connect and discharge into a new concrete manhole where it will continue to flow in a gravity flow condition, via a new 6-inch PVC (SDR-35) gravity sewer piping to an existing sanitary sewer manhole located near the intersection of Joe Yarbrough Drive and N RE Thomason Loop. A total of approximately 2,120 lineal feet of 6-inch PVC (SDR-35) gravity sewer piping will be required for the new sanitary sewer improvements of this project.

Additionally, the Contractor shall remove any surfacing as required; removal and replacement of all rock walls, pavement, rip-rap, sidewalks, walking paths and landscaping that are required to be removed for installation of the sewer improvements; excavate the trenches and pits to the required dimensions; construct and maintain all required traffic control; sheet, brace, and support the adjoining ground or structures where necessary; handle all drainage or ground water; provide barricades, and warning lights; lay and test pipe, fittings, manholes, lift station and appurtenances; backfill and consolidate the trenches and pits; maintain all surfaces over the trench until surface restoration is completed; restore the surfaces; remove surplus excavated material and demolition debris and clean the site of the work.

The construction shall comply with current local and federal requirements and acceptable construction standards. The Contractor shall coordinate with the County of El Paso to ensure that this portion of Ascarate Park remains operable and accessible during the construction of the sanitary sewer improvements.

1.03 **CONTRACTUAL TIME**

The project has a construction schedule of 90 calendar days from date of notice to proceed (NTP) to reach substantial completion. At such time when Contractor feels that the project is substantially complete, he/she shall request a walk through inspection to identify any deficiencies or unacceptable work. The contractor will have 21 calendar days from date of substantial completion to achieve final acceptance of project.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

Typical workdays are considered starting work at 8:00 am to 5:00 pm, Monday through Friday. The Contractor shall request in writing for allowance to work on weekends a minimum of 1 week prior to schedule days. All County holidays shall be considered non-typical working days and will require written request one week prior to scheduled date.

PART 2 - PRODUCT - NONE

PART 3 - EXECUTION - NONE

END OF SECTION 01020

SECTION 01025 - PAYMENTS AND MEASUREMENTS

PART 1 - GENERAL

1.01 **RELATED DOCUMENTS**

Drawings and contract documents.

1.02 **LUMP SUM TOTAL**

Contractor shall familiarize him/herself with the project documents and specifications. All items included in this plan set shall be included in the bid and shall not be subject to additional cost for intended installation costs. The cost should include all labor, material, equipment and miscellaneous items required to complete the project in its entirety.

1.03 **SCOPE OF WORK**

The work covered by this section of the specifications consists of furnishing all labor equipments, supplies, materials and appurtenances necessary to perform the installation of new sanitary sewer improvements at Ascarate Park to serve the existing restroom facilities that are located along the southeastern portion of the park, adjacent to RE Thomason Loop.

Sanitary sewer improvements consist of the installation of new 6-inch PVC (SDR-35) gravity sewer pipe that will tie into the existing sewer line of an existing restroom facility located at the most upstream portion of the new sewer system. This gravity line will discharge into a new lift station. Installation of the lift station consists of a new prepackaged (Quadplex) lift station with four (4) submersible grinder pumps, piping, valves, electrical, control panel instrumentation and all required appurtenances. Low pressure piping installation that will serve to discharge the new lift station will consist of approximately 1,200 lineal feet of 2-inch PVC (Sch-40) that will be installed in a dual pipe configuration within a single utility trench which is 600 lineal feet in length. This low pressure piping from the new lift station will connect and discharge into a new concrete manhole where it will continue to flow in a gravity flow condition, via a new 6-inch PVC (SDR-35) gravity sewer piping to an existing sanitary sewer manhole located near the intersection of Joe Yarbrough Drive and N RE Thomason Loop. A total of approximately 2,120 lineal feet of 6-inch PVC (SDR-35) gravity sewer piping will be required for the new sanitary sewer improvements of this project.

Additionally, the Contractor shall remove any surfacing as required; removal and replacement of all rock walls, pavement, rip-rap, sidewalks, walking paths and landscaping that are required to be removed for installation of the sewer improvements; excavate the trenches and pits to the required dimensions; construct and maintain all required traffic control; sheet, brace, and support the adjoining ground or structures where necessary; handle all drainage or ground water; provide barricades, and warning lights; lay and test pipe, fittings, manholes, lift station and appurtenances; backfill and consolidate the trenches and pits; maintain all surfaces over the trench until surface restoration is completed; restore the surfaces; remove surplus excavated material and demolition debris and clean the site of the work.

1.04 **NONCONFORMANCE ASSESSMENT**

- A. The Contractor shall remove and replace the Work, or portion of the Work, not conforming to the Contract Documents at no expense to the Owner.
- B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct one of the following remedies:
 - 1. The nonconforming Work will remain as is, but the unit price will be adjusted to a lower price at the discretion of the Engineer.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

2. The nonconforming Work will be modified as authorized by the Engineer, and the price will be adjusted to a lower price at the discretion of the Engineer, if the modified Work is deemed to be less suitable than originally specified.
- C. Specification sections may modify these options or may identify a percentage or specific equation to be used for a price reduction.
- D. The authority of the Engineer to assess the nonconforming Work and identify payment adjustment is final.

1.05 NONPAYMENT FOR REJECTED PRODUCTS

Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable to the Engineer.
2. Products determined as nonconforming before or after placement.
3. Products not completely unloaded from transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work, unless specified otherwise.
6. Loading, hauling, and disposing of rejected products.

1.06 REQUIREMENTS

- A. The general scope of work under item includes all labor, equipment and materials required for construction of completely functional and operational facilities as shown on the Drawings and in these Specifications.
- B. All estimated quantities for bid package stipulated in the bid proposal are solely the responsibility of the Contractor and to be used only as a basis for estimating the probable cost of the work. The basis of payment for work and materials will be the actual amount of work done and material furnished as measured by the Engineer.
- C. All measurements and payments will be based on completed and accepted work performed in strict accordance with the Drawings and Specifications and in accordance with contract unit bid prices. Incidental work and items not listed in the contract documents will not be paid for separately, but will be included in the payment for the listed item or items and shall be full compensation for all labor, equipment, materials, testing and incidentals necessary to perform the work in accordance with these contract documents.
- D. Separate payment will not be made for related items of subsidiary work, but will be considered as part of the bid items in the proposal. Payment will be made for all work covered in this section and should be included in the lump sum bid item prices for items in the proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

PART 2 - PRODUCT – NONE

PART 3 - EXECUTION -NONE

END OF SECTION 01025

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

- 1.01 RELATED DOCUMENTS
Drawings and contract documents.
- 1.02 SECTION INCLUDES
- A. Submittal procedures.
 - B. Shop drawings.
 - C. Product data.
 - D. Manufacturers' instructions.
 - E. Manufacturers' certificates.
 - F. Specification Data.
- 1.03 RELATED SECTIONS
Section 01700 - Contract Closeout.
- 1.04 SUBMITTAL PROCEDURES
- A. All submittals and re-submittals shall be transmitted to the owner in hard copy forms. Contractor shall submit 5 original documents for review and/or approval.
 - B. Sequentially number the transmittal forms. Re-submittals to have original number with an alphabetic suffix.
 - C. Identify Project, Contractor, Subcontractor or supplier as appropriate.
 - D. The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall insure that the values, materials, equipment, or method of work shall be as described in the submittal.
 - E. Apply Contractor's stamp, signed or initialed, certifying that review, verification of Products required, field dimensions, adjacent construction work, and coordination of information are in accordance with the requirements of the Work and Contract Documents. If Contractor's stamp, signature or initials are not on the submittals, they will be returned without review.
 - F. Indicate on submittals any deviation or equivalent to the project requirements.
 - G. Revise and resubmit submittals as required, identifying all changes made since previous submittal.
 - H. The submittal procedures described in this Article applies to the Construction Progress Schedule, Products List, Shop Drawings, Product Data, Samples (actual samples to be submitted, not digital files), Design Data, Test Reports, Certificates, Manufacturer's Instructions and Field Reports, Erection Drawings and any other type of submittal submitted to Engineer.
- 1.05 SHOP DRAWINGS
- A. Submit 5 (five) original documents, which Contractor requires (assuming two), plus three copies which will be retained by Engineer.
 - B. Special attention is called to the fact that shop drawings shall be required for all materials, equipment and accessories required under this contract.
 - C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- 1.06 MANUFACTURER'S INSTRUCTIONS
When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

1.07 MANUFACTURER'S CERTIFICATES

Contractor shall submit documents that ensure manufacturer's standards are followed and met to ensure manufacturer's warranty is maintained and not objections are taken to void such certificates and/or warranties.

1.08 DEVIATION FROM CONTRACT DOCUMENTS

- A. A request by the Contractor to deviate from the Contract Documents shall be provided in writing to fully identify and describe the deviation(s) and state the reason the change is being requested. Any savings in cost related to the substitution is to be stated in the request for consideration. Owner may require Contractor to furnish, at Contractor's expense, a special performance bond or other surety with respect to the substitute.
- B. In the event installations of equipment or items occur during the project and do not have a completed corresponding submittal review, the Contractor shall replace the equipment or items at the Contractor's expense, if deemed necessary by the Engineer.

1.09 REQUIREMENT FOR COMPLETE SHOP DRAWINGS

- A. Material in shop drawings shall be in sufficient detail to demonstrate compliance with all requirements of the Contract Drawings. Shop drawings shall address material and/or methods of construction, design criteria, performance characteristics, and special provisions of the Specifications.
- B. Shop drawings for systems and related equipment shall include information including electrical, mechanical, and any other information required to indicate how the various components of the system function, and shall be included in the same submittal.
- C. Where statements of certification, written guarantees, extended service agreements or extended warranties are required, they will be provided with the shop drawing. The effective date of the guarantee and service agreements, however, shall not be until the date of final acceptance of the project.
- D. Shop drawings which do not have all of the information required for evaluation will be returned without benefit of review and comment.

1.10 OPERATIONS AND MAINTENANCE MANUALS

- A. For each type of equipment to be furnished and installed under this contract, the Supplier shall prepare an operation and maintenance manual covering:
 - 1. Name, address, and telephone number of nearest competent service organization who can supply parts and service.
 - 2. Equipment function, normal operating characteristics, and limiting conditions, which reflect "as-built" conditions for the equipment furnished.
 - 3. Assembly, installation, alignment, adjustment, and checking instructions, including field modification made during installation, startup and testing.
 - 4. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
 - 5. Lubrication and maintenance instructions.
 - 6. Guide to "troubleshooting."
 - 7. Parts lists, and predicted life of parts subject to wear.
 - 8. Outline, cross-section, and assembly drawings; engineering data; control schematics and point-to-point wiring diagrams, and reproductions of all equipment nameplates.
 - 9. Test data and performance curves, where applicable.
 - 10. All information supplied shall be specific to that equipment supplied for this product.
- B. The above information, as applicable, shall be provided for the equipment as indicated in individual specification sections.
- C. The operation and maintenance manuals shall be in addition to any instructions or parts listed packed with or attached to the equipment when delivered.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- D. Manuals shall be printed on heavy, first quality paper, 8 ½ x 11 inch size with standard 3-hole punching. Drawings and diagrams shall be reduced to 8 ½ x 11 inches. Where reduction is not practicable, larger drawings shall be folded separately and placed in envelopes which are bound into the manual. Each envelope shall bear suitable identification on the outside.
- E. Two preliminary copies of each manual, temporarily bound in heavy paper covers bearing suitable identification, shall be submitted to the Engineer at the time of submittal of the shop drawings. After review by the Engineer, Supplier shall prepare three (3) final copies of each operation and maintenance manual and deliver to the Engineer not later than 90 days prior to placing the equipment into operation. The final manuals shall be bound in stiff artificial black leather, metal hinged binders, 2 to 3 ½ inch capacity, three-ring style.

1.11 EQUIPMENT INSTALLATION REPORT

A written report shall be submitted by the equipment supplier performing the installation check for all major equipment. This report shall certify that:

- A. The equipment has been properly installed and lubricated,
- B. In accurate alignment,
- C. Free from any undue stress imposed by connecting piping, equipment, or anchor bolts,
- D. Has been operated under full load conditions and that it is operating satisfactorily.

END OF SECTION 01300

Ascarate Park Lift Station and
Sanitary Sewer Improvements

SECTION 01700 – CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and contract documents.

1.02 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Adjusting.
- D. Project record documents.
- E. Operation and maintenance data.
- F. Warranties.
- G. Spare parts and maintenance materials.

1.03 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.
- B. Provide submittals to Engineer that are required by governing or other authorities.
- C. Provide release of lien waivers as per Owner documents.
- D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- E. Provide maintenance procedures O&M's.
- F. Provide As-Built Documents.
- G. Provide warranty documents.

1.04 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Remove temporary labels, stains and foreign substances.
- C. Clean equipment.
- D. Clean site.
- E. Remove waste and surplus materials, rubbish, and construction facilities from the site.
- F. Repair, patch and touch-up marred surfaces to match adjacent finishes.

1.05 PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set of the following record documents; record actual revisions to the Work:
 - 1. Contract Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
- B. Store Record Documents separate from documents used for construction.
- C. Record information concurrent with construction progress.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- D. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and Modifications.
- E. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 3. Field changes of dimension and detail.
 - 4. Details not on original Contract Drawings.
 - 5. Changes made by addenda and modification.
- F. Submit documents to Engineer with claim for final Application for Payment.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit one copy 15 days prior to final inspection, bound in 8 1/2 x 11 inch text pages, three ring binders with durable plastic covers.
- B. This copy will be returned after final inspection, with Engineer comments. Review content of documents as required prior to final submittal. Retainage will not be released until final operation and maintenance manuals are approved.
- C. Submit two final volumes revised within ten days after final inspection.
- D. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- E. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- F. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified.
- G. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
- H. Part 2: Operation and maintenance instructions arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - 1. Significant design criteria.
 - 2. List of equipment.
 - 3. Parts list for each component.
 - 4. Maintenance instructions for equipment and systems.
 - 5. Maintenance instructions for finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
- I. Part 3: Project documents and certificates, including the following:
 - 1. Shop drawings and product data.
 - 2. Certificates.
 - 3. Photocopies of warranties and bonds.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

1.07 WARRANTIES

- A. Provide duplicate notarized copies.
- B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.
- C. Provide Table of Contents and assemble with metal prong binder in durable plastic presentation cover.
- D. Submit prior to final Application for Payment.
- E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.
- F. Prior to final acceptance, the Contractor shall furnish to the Owner a written general guarantee which shall provide that the Contractor shall remedy any defects in the work, and pay for any and all damages of any nature whatsoever resulting from such defects, when such defects appear within one year from the date of final acceptance of the work as a result of defective materials or workmanship, at no cost to the Owner.

1.08 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
- B. Deliver to project site and place in location as directed; obtain receipt prior to final payment.

END OF SECTION 01700

Ascarate Park Lift Station and
Sanitary Sewer Improvements

SECTION 02100 - SITE PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Protecting existing trees to remain.
2. Removing existing trees, shrubs, groundcovers, plants, and grass.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place or removing site utilities.
7. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Section 02221 "Excavation, Backfilling, and Compaction for Utilities" for soil materials, excavating, backfilling, and site grading.
4. Section 02310 "Grading" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.02 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.03 SUBMITTALS

- A. Record drawings, according to Division 1 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.04 QUALITY ASSURANCE

- A. Pre-Installation Conference: Conduct conference at Project site to comply with project requirements.

1.05 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 – PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

3.01 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.03 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within fenced area.
 - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 - 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

1. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

3.04 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 1. Arrange with utility companies to shut off indicated utilities and notify Owner not less than one week in advance.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Architect and Owner no less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.05 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 3. Schedule and coordinate initial walk through with Owner's representative to flag trees requiring removal beyond those specifically shown on the plans.
 4. Where trees are demolished, the entire stump and root structure shall be removed and backfilled to 95% density with clean soil free of debris, waste, organic material and boulders in excess of 3 inches.
 6. Contractor shall remove & replace at no cost to the Owner any tree that had its soil disrupted (within 4 feet) and died, up to 12 months after substantial completion.
 7. Use only hand methods for grubbing within tree protection zone.
 8. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
 - 2. Do not stockpile topsoil within tree protection zones.
 - 3. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.0.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.08 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02100

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. **Work Included:** Excavate and grade in the areas designated in the Contract Documents as shown on the construction plans and specified herein, which shall include but not be limited to, the following:
1. Excavation and site preparation.
 2. Grading to establish sub-grades for slabs, walks, pavements, gravel surfaces, and grassed areas.
 3. Excavation, filling and backfilling and compaction.
 4. Dewatering or addition of water as required.
 5. Placing of topsoil and finish grading.
- B. **Related Sections:** Additional Sections of the Documents which are referenced in this Section include:
1. Section 31 23 00 - Excavating, Backfilling, and Compacting for Utilities

1.02 REFERENCES

- A. **General:** The work shall comply with the most recent standards or tentative standards as published at the date of the contract and as listed in this specification using the abbreviation shown.
- B. American Society for Testing and Materials (ASTM):
1. D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft).
 2. D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 3. D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft- lbf/ft³)(2,700 kN-m/m³).
 4. D2167 - Standard Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method.
 5. D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
 6. D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 7. D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 8. D2937 - Standard Test Methods for Density of Soil in Place by the Drive-Cylinder Method.
 9. D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 10. D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.03 DEFINITIONS

- A. **Controlled Fill:** Controlled fill is required in all areas on which final grade is not placed on original excavated soil.
- B. **Unclassified Excavation:** For the purposes of payment, material shall not be classified except for those items specifically listed in the Bid Form.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- C. **Rock:** For the purposes of classified excavation, rock shall be defined as material that cannot be dislodged by a Caterpillar Model No. D-8N, heavy duty track-type tractor, rated at not less than 285 hp flywheel power and equipped with a single shank hydraulic ripper, capable of exerting not less than 45,000 lbs breakout force. Rock excavation includes up to 6 inches over-excavation below the required excavation depth. Excavated rock shall be quantified by measuring the volume of removed rock and reducing this amount by 35%. This definition of rock does not include materials such as hardpan, loose rock, concrete or other materials that can be removed by means other than drilling and blasting, but which for reasons of economy in excavating the **contractor** chooses to remove by drilling and blasting.
- D. **Trench Rock:** For the purposes of classified excavation, trench rock shall be defined as material encountered in trench excavation that cannot be dislodged by a Caterpillar Model No. 215D-LC track-type hydraulic excavator, equipped with a 42-inch wide short-tip radius rock bucket, rated at not less than 120 hp flywheel power with bucket-curling force of not less than 25,000 lbs and stick-crowd force of not less than 18,000 lbs. Trench rock excavation includes up to 6 inches over-excavation below the required excavation depth. Rock shall be quantified by measuring the extent of rock in the trench, not by measuring the volume of removed rock. This definition of trench rock does not include materials such as hardpan, loose rock, concrete or other materials that can be removed by means other than drilling and blasting, but which for reasons of economy in excavating the **contractor** chooses to remove by drilling and blasting.
- E. **Unsuitable Material:** For the purposes of classified excavation, unsuitable material shall be defined as material below sub-grade elevation that exhibits excessive pumping or that does not meet density requirements due to unsatisfactory material as determined by Geotechnical Engineer.
- F. **Satisfactory Materials:** Materials classified by ASTM D 2487 as SP-SM, SM, SC, SC-SM, GM, GC, GC-GM, GP-GM, and GP-GC are satisfactory as fill for over lot grading and are satisfactory in-situ. Materials shall have a minimum compacted density of 120 pounds per cubic foot, a liquid limit less than 35 and a plasticity index of 12 or less.

The following grading requirements shall be met:

Sieve Size (square opening)	% Passing by Weight
3-inch	100
3/4-inch	75 – 100
No. 4	45 – 100
No. 200	5 – 45

- G. **Unsatisfactory Materials:** Materials classified by ASTM D 2487 as OL, OH, MH, CH, ML, CL and PT are unsatisfactory in-situ and as fill. Unsatisfactory materials also include those materials containing roots and other organic matter, trash, debris, frozen materials, and stones larger than 3 inches. Fill materials containing stones larger than 3 inches shall not be used in the uppermost 2 feet.
- H. **Cohesion less and Cohesive Materials:** Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the minus #40 fraction has a plasticity index of zero as classified by ASTM D 4318.
- I. **Degree of Compaction:** Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 698 or ASTM D 1557 as specified, abbreviated below as a percent of laboratory maximum density.
- J. **Topsoil:** Material obtained from excavations, suitable for top soils shall consist of friable clay loam, free from roots, stones, other undesirable material and shall be capable of supporting a good growth of grass.
- K. **Geotechnical Engineer:** A representative of a commercial geotechnical testing laboratory which will be used by the CONTRACTOR to provide the required quality assurance testing.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

1.04 SUBMITTALS

- A. **General:** Submittals shall be in accordance with Division I requirements. Copies of all test results and field and office worksheets shall be furnished to the OWNER within 72 hours after the tests are complete.
- B. **Test Reports:** The testing agency shall submit following reports, in duplicate, directly to the OWNER from the testing services, with copy to the CONTRACTOR, ARCHITECT and ENGINEER
 - 1. Test report on borrow material for soil classification.
 - 2. Field density reports and map of test location.
 - 3. One optimum moisture-maximum density curve for each type of soil used for controlled fill.
 - 4. Other reports of any testing hereinafter specified deemed necessary by Soils Engineer or requested by the OWNER.
 - 5. A test location plan shall be included with each submittal.

1.05 QUALITY ASSURANCE

- A. **Geotechnical Engineer:** The OWNER'S Geotechnical Engineer and Test Laboratory shall insure that earthwork meets the requirements of the specifications for density and moisture content. The Geotechnical Engineer shall attend the Pre- Construction Conference.
- B. **Inclement Weather:** When fill operations are ceased due to weather (rain, freezing, snow, etc.), construction shall not be resumed until the Geotechnical Engineer has verified soil strength has not been adversely affected. If soil strength has been decreased, the affected portion of fill shall be scarified, moistened, or dried as required and re-compacted to the specified density.
- C. **Inspection:** The CONTRACTOR shall conduct daily inspections and more often if necessary to verify that the specifications are being met for the installation of materials.
- D. **Coordination:** The CONTRACTOR shall coordinate the work with the OWNER's Inspector by notifying the Inspector of scheduled work in advance. The CONTRACTOR shall coordinate work with other trades whose work will be affected on the site.
- E. **Utilities:** Prior to any excavation the CONTRACTOR shall verify the locations of all utilities which may be in the area.
- F. **Drainage:** The CONTRACTOR shall be responsible for the proper drainage of the site during construction of the project. Water shall not be allowed to accumulate in any of the excavated areas. Storm or ground water collecting on site during construction shall be removed by pumping, ditching, or other suitable means.

1.06 PROJECT CONDITIONS

- A. **Existing Utilities:** Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
 - 1. Should uncharted, incorrectly charted, unmarked in field, or incorrectly marked in the field, piping or other utilities be encountered during excavation, CONTRACTOR shall consult utility OWNER immediately for directions. CONTRACTOR shall cooperate with OWNER and utility companies in keeping respective services and facilities in operation, and shall repair or arrange for repair damaged utilities to satisfaction of utility owner.
 - 2. CONTRACTOR shall abandon in place all existing underground utilities as indicated on the plans and shall properly plug/seal services if lines are inactive.
- B. **Blasting:** Blasting will not normally be allowed.
- C. **Protection of Persons and Property:** Barricade open excavations occurring as part of this work and post with warning lights.
 - 1. The CONTRACTOR shall operate warning lights as recommended by authorities having jurisdiction.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

2. The CONTRACTOR shall protect structures, utilities, sidewalks, pavements, trees and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
3. The CONTRACTOR shall protect, maintain and restore bench marks, monuments, and other reference points affected by this work. If bench marks, monuments or other permanent reference points are displaced or destroyed, points shall be re-established and markers reset under supervision of a licensed Land Surveyor.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. **Materials:** All fill materials shall be free from mud, refuse, construction debris, organic material, rock or gravel greater than 3 inches in any dimension, frozen or otherwise unsuitable material. Materials for fills shall be secured from excavation after rejection of any unsuitable materials. Materials from other sources may be used upon approval by the Geotechnical Engineer. Fill materials in the uppermost 2 feet shall not have any rocks larger than 3 inches in diameter.
- B. **Borrow:** Material for use in replacing undercut areas or in construction of embankments shall be approved by the Geotechnical Engineer and obtained from approved sources.
- C. **Rock:** Rock shall be removed to a minimum depth of 12 inches below the sub-grade elevation. The excavated area shall be brought up to sub-grade with approved material placed and compacted as described herein.
- D. **Unsuitable Materials:** Areas that exhibit excessive pumping or that do not meet density requirements due to unsuitable material as determined by Geotechnical Engineer shall be undercut and replaced with approved material.

PART 3 - EXECUTION

3.01 TOPSOIL

- A. **Conservation of Topsoil:** Topsoil shall be removed as required without contamination with subsoil and stockpiled convenient to areas for later application or at locations specified. Any surplus of topsoil from excavations and grading shall be stockpiled in location approved by the OWNER. A silt fence shall be installed on the down slope side and the stockpiles seeded.
- B. **Placing Topsoil:** On areas to receive topsoil, the compacted subgrade shall be scarified to a 2 inch depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry.

3.02 EXCAVATION

- A. **Excavation:** Excavation shall be unclassified except for those items specifically indicated in the Bid Form. After topsoil removal has been completed, excavation of every description, regardless of material encountered, within the grading limits of the project shall be performed to the lines and grades indicated. Satisfactory excavation material shall be transported to and placed in fill areas within the limits of the work. All unsuitable material including any soil which is disturbed by the CONTRACTOR's operations and surplus material shall be disposed of at locations off site secured by CONTRACTOR and approved by the OWNER. Excavations carried below the depths indicated, shall, except as otherwise specified, be refilled to the proper grade with satisfactory material as directed. All additional work of this nature shall be at the CONTRACTOR's expense, unless otherwise provided for in the Bid Form. Excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Excavations shall be kept free from water while construction therein is in progress. If the CONTRACTOR fails to provide adequate drainage and any material becomes soft or otherwise unsuitable as a result, such material shall be removed

Ascarate Park Lift Station and Sanitary Sewer Improvements

and replaced with satisfactory on-site material or borrow material from approved sources, or shall be dried and re-compacted as directed by the Geotechnical Engineer at no additional cost to the OWNER.

- B. **Excavation for Utilities:** Trenches for underground utilities systems and drain lines shall be in accordance with Section 02315 - Excavating Backfilling and Compacting for Utilities.
- C. **Ditches, Gutters, and Channel Changes:** Ditches, gutters, and channel changes shall be cut accurately to the cross sections and grades indicated. All roots, stumps, rock, and foreign matter in the sides and bottom of ditches, gutters, and channel changes shall be trimmed and dressed or removed to conform to the slope, grade, and shape of the section indicated. Care shall be taken not to excavate ditches and gutters below the grades indicated. Excessive ditch and gutter excavation be backfilled to grade either with compacted to specified densities material or with suitable stone or cobble to form an adequate gutter paving as directed. All ditches and gutters excavated under this section shall be maintained until final acceptance of the work. Satisfactory material excavated from ditches and channel changes shall be placed in fill areas. Unsuitable and excess material shall be disposed of in designated waste areas or as directed.
- D. **Unauthorized Excavation:** Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific instruction from the OWNER or the Geotechnical Engineer. Under footings or foundations, fill unauthorized excavations by extending the indicated bottom elevation of the footing or base to the unauthorized excavation bottom, but in no way altering the required top elevation. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations, unless otherwise directed by the Geotechnical Engineer.
- E. **Stability of Excavations:** Maintain sides and slopes of excavations in a manner such that the excavation provides safety of personnel, protection of work, and compliance with requirements of governmental agencies having jurisdiction.

3.03 FILL

- A. **Preparation of Ground Surface for Fill:** All vegetation such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetative matter, rubbish, and other unsatisfactory material within the area upon which fill is to be placed, shall be stripped or otherwise removed before the fill is started. In no case will unsatisfactory material remain in or under the fill area. The areas shall then be scarified to a depth of at least 6 inches, moistened or aerated as required and compacted with vibratory rollers, pneumatic rollers, sheep foot rollers or other mechanical means acceptable to the Geotechnical Engineer. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped, benched, or broken up, as directed, in such manner that the fill material will bond with the existing surface. Prepared surfaces on which compacted fill is to be placed shall be wetted or dried as may be required to obtain the specified moisture content and density.
- B. **Fills and Embankments:** Fills and embankments shall be constructed at the locations and to lines and grades indicated. The completed fill shall conform to the grading plan indicated. Approved material obtained during excavation may be used in forming required fill. Fill shall be satisfactory material and shall be free from roots, other organic material. No frozen material will be permitted in the fill. Stones having a dimension greater than 3 inches shall not be permitted in the upper 2 feet of fill or horizontal embankment. The material shall be placed in successive horizontal layers of 8 inches in loose depth for the full width of the cross section and shall be compacted as specified. Each layer shall be compacted before the overlying lift is placed. Moisture content of the fill or backfill material shall be adjusted by wetting or aerating as necessary to provide the moisture content specified.

3.04 COMPACTION

- A. **Sub-grade Compaction:** The cut sub-grade material shall be compacted to 95 percent of its maximum dry density as determined by ASTM D 1557. The moisture content should be within +/-2 percentage points of the material's optimum as determined by ASTM D 2216.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- B. **Compaction:** Each layer of the fill shall be compacted to at least 95 percent of the maximum theoretical density as determined by ASTM D 1557. Moisture content shall be within +/-2 percent points of optimum as determined by ASTM D 2216. The top 1-foot of fill under pavement areas shall be compacted to 95 percent of maximum dry density as determined by ASTM D 1557.

3.05 FINISHED GRADES

- A. **General:** All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade- grader operations, except as otherwise specified. Ditches and gutters shall be finished to permit adequate drainage.
- B. **Unsatisfactory Material:** Soft or otherwise unsatisfactory material shall be replaced with satisfactory excavated material or other approved materials.
- C. **Finished Elevations:** Low areas resulting from removal of unsuitable material or from excavation of rock shall be brought up to required grade with satisfactory materials, and the entire area shall be shaped to line, grade, and cross section and shall be compacted as specified. The surface of embankments or excavated areas for road construction or other areas on which a base course or pavement is to be placed shall vary not more than 0.10 feet from the established grade and approved cross section. Surfaces other than those to be paved shall be finished not more than 0.20 feet above or below the established grade or approved cross section.

3.06 PROTECTION

- A. **Site Preservation:** The CONTRACTOR shall protect newly graded areas from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. All work shall be conducted in accordance with the Erosion Control provisions of these specifications.
- B. **Seeding:** All areas disturbed by work in this project shall be seeded or finished as shown in Landscape drawings.

3.07 FIELD QUALITY CONTROL

- A. **Testing:** Testing shall be performed by the Owner's commercial testing laboratory. Tests conforming to ASTM D 1557, shall be made by the Geotechnical Engineer or his representative on each soil type found in the areas prepared to receive fill and in the soil to be used for fill. Field Density tests shall be made by the Geotechnical Engineer or his representative in accordance with ASTM D 1556 or ASTM D2922 and ASTM D 3017 on the areas prepared to receive fill and on each layer of compacted fill. Testing shall be made by the Geotechnical Engineer, retained by the Owner as an Owner consultant. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D 2922, paragraph "ADJUSTING CALIBRATION CURVE". ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture gauges along with density calibration checks as described in ASTM D3017. ASTM D 2937 shall be used only for soft, fine-grained, cohesive soils. At least one test shall be performed on the compacted backfill. More tests shall be performed if in the judgment of the Inspector or OWNER the compactive effort of the CONTRACTOR will not result in the specified density.
- B. **Testing Frequency:** The following submittals are required.
 - 1. At least one (1) Soil Moisture-Density Relationship test (Proctor) for each type of in-situ soil and/or imported material to be used, according to ASTM D 1557. Additional soil samples for testing shall be requested by the General Contractor during the course of earthwork operations to ensure that the fill materials are maintained consistently within the specified requirements.
 - 2. At least one (1) Soil Classification (Sieve Analysis and Atterberg Limits Test) for each type of insitu soil and/or imported material to be used, according to ASTM D 6913 and D 4318. Additional soil samples for testing shall be requested by the General Contractor during the course of earthwork operations to ensure that the fill materials are maintained consistently within the specified requirements..

Ascarate Park Lift Station and
Sanitary Sewer Improvements

3. A minimum of one (1) nuclear density test per lift at 50 lineal feet spacing for pipe bedding and backfill operations, according to ASTM D 6938 or D 1556.
- C. **Visual Inspection:** Upon completion of all excavation of unsuitable material, and for all footings, the Engineer shall visually inspect the sub-grade and excavations. The visual inspection shall be conducted to assure that the data obtained from the test borings and used as a basis of design was representative of the site conditions.
- D. **Proof Rolling:** Following visual inspection, CONTRACTOR shall demonstrate to the Engineer or Engineer that the exposed sub-grade does not contain previously unidentified soft areas by proof rolling. Proof rolling shall consist of rolling the entire surface with approved mechanical equipment while observing the sub-grade for displacement or deformation.

END OF SECTION 02200

Ascarate Park Lift Station and
Sanitary Sewer Improvements

SECTION 02220 – SITE DEMOLITION

PART 1 – GENERAL

- A. Refer to plan notes and coordinate demolition operations to not interfere with park operations, utility services, and egress requirements that must remain operational during demolition. These services may include plumbing, lighting, power, communication, and building egress.
- B. Debris resulting from demolition in occupied areas shall be removed daily. No debris shall be disposed of in County of El Paso facilities, containers, or on Ascarate Park property.
- C. Contractor shall disclose all utility lines that are hit during construction immediately to County of El Paso Project Manager and Ascarate Park personnel.

1.01 RELATED SECTIONS

- A. Section 02200 – Site Preparation.

1.02 SUMMARY

- A. This Section includes demolition and related work as shown and specified.
- B. Retained Items: Carefully remove items to remain property of Owner and be reinstalled in the work.

1.03 SUBMITTALS

- A. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shutoff, capping, and continuance of utility services.
- B. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.
- C. Project Record Documents:
 - 1. General: Submit under provisions of Division 1 – Contract Closeout.
 - 2. Capped Utilities and Subsurface Obstructions: Accurately record actual locations.

1.04 QUALITY ASSURANCE

- A. Refer to standards listed in Division 1 – Control of Work.

1.05 PROJECT CONDITIONS

- A. Maintain access to existing walkways, parking spaces, recreation facilities, and other building facilities.

1.06 COORDINATION

- A. Arrange schedule to not interfere with Owner's on-site operations.

PART 2 – PRODUCTS

Not Used

Ascarate Park Lift Station and
Sanitary Sewer Improvements

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Report existence of hazardous materials or unsafe structural conditions.
- C. Verify that utilities have been disconnected and capped before starting demolition operations.

3.02 PREPARATION

- A. Scheduling
 - 1. General: Coordinate and schedule demolition work as required by the Owner and as necessary to facilitate construction progress.
- B. Existing Utilities:
 - 1. Coordinate shutting off, disconnection relocation and capping of existing gas, water, sewer, electrical, telephone, cable and security system utilities; verify work is complete before starting demolition work affecting these utilities. Do not interrupt existing utility service to operating facilities, except when authorized in writing by Owner. Provide not less than seventy two (72) hours notice to Owner if shutdown of service is required. Make provision for temporary service during interruption of existing utility service, acceptable to Owner.
- C. Rock Boulders:
 - 1. Not Used.
- D. Hazardous Materials:
 - 1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
 - 2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact the Texas Tech. Do not proceed with demolition until directed by Owner.

3.03 PROTECTION

- A. Site: Protect existing adjacent installations not scheduled for demolition from damage. Take measures to prevent damage to existing turf, trees, streets, curbs, walks, piping, sewers, etc., during demolition and construction.
- B. Safety Precautions: Prevent damage to existing elements identified to remain or to be salvaged, and prevent injury to the public and workmen engaged on site. Do not allow demolition debris to accumulate on site. Pull down hazardous work at end of each day; do not leave standing or hanging overnight or over weekends.
- C. Dust: Contain and control dust produced by operations as required by jurisdictional agencies.
- D. Selective Demolition:
 - 1. General: Prevent movement of structure; provide required bracing and shoring
 - 2. Watertight Barriers: Provide and maintain as required to prevent water intrusion and damage.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

3.04 DEMOLITION

- A. General: Perform demolition as shown and remove from the site. Use methods required to complete Work within limitations of governing regulations.
- B. Explosives: Use not permitted.
- C. Utilities: Disconnect, remove, cap and identify designated utilities within demolition areas.
- D. Selective Demolition:
 - 1. Cutting And Removal: Remove existing work as shown; cut in neat straight lines, parallel to adjacent elements or plumb to vertical surfaces; grind smooth saw cut edges of concrete slabs or walks. Neatly remove existing finish materials back to clean straight line on nearest support to facilitate installation of new materials, patches or repairs. Use methods that prevent damage to other work, and provide proper surfaces for installation of repairs and new work. Upon completion of work, leave areas in clean condition.
- E. Salvaged and Reused Items:
 - 1. Items Removed or stored by contractor: Move, store, and protect rock boulders to be reused with project.
 - 2. Items Removed by Contractor and Retained by Owner: Drain inlet boxes, equipment and pull boxes to be retained by the Owner, will be identified, removed Contractor and stored by the Owner before the beginning of demolition operations.
 - 3. General: Remove items listed below and/or as shown, without damage; coordinate with Owner for delivery to designated storage area.
- F. Disposal:
 - 1. Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.
 - 2. Burning and Burying of Materials: NOT ALLOWED.
 - 3. Haul Routes:
 - a. Obtain permits as required by jurisdictional agencies. Establish haul routes in advance; post flagmen for the safety of the public and workmen.
 - b. Keep streets free of mud, rubbish, etc.; assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.

END SECTION 02220

SECTION 02222 – PROTECTING EXISTING UNDERGROUND UTILITIES

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This section includes materials and procedures for protecting existing underground utilities.

1.02 RELATED SECTIONS

- B. Section 02315 – Excavating, Backfilling and Compacting for Utilities.

PART 2 – MATERIALS

2.01 REPLACEMENT IN KIND

- A. Except as indicated or as specifically authorized by the PROJECT ENGINEER, reconstruct utilities with new material of the same size, type, and quality as those being replaced.

PART 3 – EXECUTION

3.01 GENERAL

- A. Replace in kind street improvements, such as curbs and gutters; fences; signs; paved surfaces; etc, that are cut, removed, damaged, or otherwise disturbed by the construction.
- B. Where utilities are parallel to or cross the pipeline trench but do not conflict with the permanent work to be constructed, follow the procedures given below and as indicated on the Drawings. Notify the utility AGENCY a minimum of 72 hours in advance of the crossing construction and coordinate the construction schedule with the utility AGENCY's requirements. For utility crossings not shown on the Drawings, CONTRACTOR shall immediately notify the PROJECT ENGINEER who will promptly investigate the conditions.
- C. Determine the true location and depth of utilities and service connections which may be affected by or affect the work. Determine the type, material, size (outside diameter), and condition of these utilities. This pothole work shall take place prior to construction the water or sewer utility in order to provide sufficient lead time to resolve unforeseen conflicts, order materials and take appropriate measures to ensure that there is no delay in work. Expose utilities in advance of the pipeline construction as required by the General Provisions.

3.02 PROCEDURES

- A. Protect in Place: Protect existing utilities in place, unless abandoned, and maintain the utility in service, unless otherwise specified.
- B. Cut and Plug Ends: Cut abandoned utility lines, fill with concrete two feet into line and plug the ends with brick and mortar or concrete plug. Dispose of the cut pipe as unsuitable material.
- C. Remove and Reconstruct: Preservation of all laterals and utilities in their existing location shall govern. However, if the CONTRACTOR encounters an existing lateral or utility, which would otherwise cause the new or existing utility to not perform as it is or was intended, then the CONTRACTOR shall remove the utility and, after passage, reconstruct it

Ascarate Park Lift Station and
Sanitary Sewer Improvements

with new materials. The PROJECT ENGINEER shall decide at its sole discretion the applicability to which relocation is warranted.

- D. Provide temporary service for the disconnected utility, prior to permanent repair.

3.03 COMPACTION

- A. Utilities Protected in Place: Backfill and compact under and around the utility so that no voids are left. Where utilities are concrete encased, use the alternative construction method (2-sack cement sand slurry) for backfill around the utility.

3.04 ADJACENT PARALLEL UTILITIES

- A. Protect existing parallel utilities from any disturbances and repair the lines and associated appurtenances if they are damaged in any way. All costs incurred for protection of utilities or any costs incurred due to the presence of the lines, whether or not they lie within the new construction, shall be borne in full by the CONTRACTOR.

END OF SECTION 02222

SECTION 02235 – GRANULAR FILL MATERIAL

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, tools, superintendence and incidentals required to install, test, and perform any other specified or drawn work required to construct and install the pipeline systems under this Contract.

1.02 RELATED WORK

- A. Section 02100 – Site Preparation
- B. Section 02315 – Excavating, Backfilling, and Compaction for Utilities
- C. Section 02531 – Low Pressure Wastewater Utility Piping
- D. Section 02622 – Polyvinyl Chloride (PVC) Gravity Sewer Pipe and Fittings

1.03 SUBMITTALS

- A. Submit in accordance with Section 01300, Complete Product Data, for materials specified in this Section.
- B. Test Results
 - 1. Sieve analysis for fill and pipe embedment materials.
 - 2. Plasticity index for material proposed for use as structural or common fill.
 - 3. USCS Classification.
- C. Samples
 - 1. One 10 pound sample of each material specified herein delivered to the Owner’s Testing Laboratory together with the submittals noted in A and B above. Samples shall be delivered in a plastic sack.

1.04 REFERENCE STANDARDS

- 1. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33 Standard Specification for Concrete Aggregates
 - 2. ASTM D75 Methods for Sampling Aggregates
 - 3. ASTM C136 Method for Sieve Analyses for Fine and Coarse Aggregates
 - 4. ASTM 04318 Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - 5. ASTM D698 Standard Test Method for Moisture-Density Relations for Soils and Soil-Aggregate Mixtures, Using 5.5 pound (2.49-kg) Rammer and 12 inches (305 mm) Drop.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

2. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply

1.05 QUALITY ASSURANCE

A. Laboratory Testing

1. At least 14 days prior to the placement of any backfill and fill materials, deliver a representative sample of the proposed materials weighing at least 50 pounds to the Owner's Testing Laboratory.
2. The soil testing laboratory will perform:
 - a. Grain-size analyses and soil classification of the samples to determine their suitability for use as backfill or fill material in conformance to the material requirements specified hereinafter.
 - b. The appropriate Proctor analyses to determine the moisture density relationship curve for the material submitted.
3. Test results shall be delivered to the Engineer and to the Contractor no later than three days prior to the placement of backfill or fill materials.
4. The Contractor will pay for all tests to determine suitability of off-site or on-site excavation material proposed for use as backfill or fill.

1.06 DELIVERY, STOCKPILING, AND HANDLING

- A. The Engineer shall be notified of all deliveries of granular material a minimum of 72 hours in advance of the scheduled delivery time.
- B. Stockpile granular material within areas allowed for construction and at locations acceptable to the Engineer. The Contractor shall construct a pad of the stockpile material at the stockpile location(s) and shall utilize equipment capable of properly stacking each stockpile in a neat and regular shape. Contaminated or unsatisfactory stockpile material shall be replaced at no additional cost to the Owner. The Engineer shall be the sole authority determining the acceptability of stockpiled material.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Select Fill for the buildings should be granular and free of clay lumps, deleterious materials, cobbles or boulders over 3-inches in nominal size. Fill materials should meet requirements of this section and/or the project plans and specifications, whichever is more stringent. Select Fill materials should have a liquid limit less than 40 and a plasticity index between 4 and 15. The Select Fill shall also exhibit an optimum dry density of at least 125 pcf. Soils classified in the following list according to the USCS can be considered satisfactory for use as Select Fill or as approved by the project engineer; SM, SC, SC-SM, GW, GP, GM, GC, GP-GM and GP-GC, provided that these soils also meet the requirements above. Soils classified as SP, SP-SM, CH, CL, MH, ML, OH, OL and PT under the USCS classification are not considered suitable for use as Select Fill soil materials.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- B. Select Fill materials should be placed in accordance with this report and/or the project plans, whichever is more stringent. Select Fill should also meet the minimum gradation requirements tabulated below.

Sieve Size (square opening)	% Passing by Weight
3-inch	100
¾-inch	70 - 100
No. 4	45 - 100
No. 200	13 - 45

- C. Select Backfill behind the Lift Station walls should be free of clay lumps, deleterious materials, cobbles or boulders over 3-inches in nominal size, clean, uniform, well graded, granular sands or gravel. Class I or II type soil material is recommended to be utilized as Select Backfill or as approved by the manufacturer.
- D. Class I, Class II, Class III, Class IV and V materials may be defined as follows:
1. CLASS I material may be manufactured angular, well-graded, crushed stone per ASTM D-2321 with a maximum particle size of 1 ½ inches. The following materials shall be acceptable under this class designation: ASTM D-448 – Stone Sizes 4, 46, 5, 56, 57, and 6. Pea Gravel and other uniformly graded material are not acceptable under this class. A gradation of Class I material shall be submitted by the Contractor to the Engineer for approval prior to use.
 2. CLASS II material may be coarse sands and gravels per ASTM D-2487 with maximum particle size of 1 ½ inches, including variously graded sands and gravels, containing less than 13 percent fines (material passing the #200 sieve) generally granular, non-cohesive, non-plastic, either wet or dry. Soil types GW, GP, SW and SP are included in this class.
 3. CLASS III material may be fine sand and clayey (clay filled) gravels, per ASTM D-2487, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil types GM, GC, SM, and SC are included in this class (i.e., typically suitable above the pipe zone).
 4. CLASS IV and V material may be classified as CH, CL, MH, ML, OH, OL and PT under the USCS.
- E. Structural Fill shall consist of crushed stone or gravel aggregate base material that meets the current TXDOT Standard Specification for Construction of Highways, Streets and Bridges, Item 247, Flexible Base, Type A Grade 3. The Structural Fill should have a liquid limit less than 40 and a plasticity index between 4 and 12. The Structural Fill shall also exhibit an optimum dry density of at least 135 pcf. Soils classified in the following list according to the USCS can be considered satisfactory for use as Structural Fill: SC, SC-SM, SM, GW, GP, GM, GC, GP-GM and GP-GC. The Structural Fill should also meet the requirements below.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

Sieve Size (square opening)	% Passing by Weight
2 ½ -inch	100
1 ¾ -inch	90 - 100
7/8 - inch	-
3/8 - inch	-
No. 4	25 - 55
No. 200	15 - 50

- F. Subgrade Material Shall be Suitable Select Fill or backfill materials. The existing soils should be cleared of all asphalt, vegetation, organic matter, topsoil, construction debris and/or any foreign matter. The cleared subgrade should be thoroughly proofrolled in order to determine any weak and compressible zones. The finished subgrade should be compacted to a minimum of 95 percent of maximum dry density per ASTM D-1557 at +/- 2 percent of optimum moisture.

PART 3 EXECUTION

NOT USED

END OF SECTION 02235

Ascarate Park Lift Station and
Sanitary Sewer Improvements

SECTION 02310 - GRADING

PART 1 GENERAL

1.01 **SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
 - 1. General exterior grading, cutting and filling, including grading for building area, paving, planting areas, banks and hillsides.
 - 2. Related Sections:
 - a) Section 02200 - Site Preparation
 - b) Section 02315 - Excavating, Back-filling and Compacting for Utilities.

1.02 **SYSTEM DESCRIPTION**

- A. General:
 - 1. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.
 - 2. Before grading, contact the appropriate underground utilities locator services for information on buried utilities and pipelines.

1.03 **QUALITY ASSURANCE**

- A. Equipment: Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in a timely manner.
- B. Required: The Contractor shall fully coordinate the grading operations of this Section with that of other trades involved and with the County of El Paso.

PART 2 PRODUCTS

2.01 **MATERIALS**

- A. Materials shall conform to requirements specified in this and related sections mentioned above.
 - 1. In Landscape (planting area) fill shall not be saline or contain anything that would prevent normal plant growth.
 - 2. Fill material is subject to the final approval of the Owner.

PART 3 EXECUTION

3.01 **PREPARATION**

- A. Protect and maintain installed stakes until their removal is required for the Work. Provide replacement grade or location stakes lost or disturbed.
- B. Install grade stakes and compare to indicated grades. If discrepancies are found between existing grades and grades indicated on Drawings, do not proceed until discrepancies are resolved.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

3.02 ROUGH AND FINE GRADING

- A. Rough grade area sufficiently high to require cutting by fine grading:
 - 1. Grade area for bituminous surfacing and other paving to the indicated grades, equal to the section of the indicated base and pavement.
 - 2. Slope banks to required finish grades as cut progresses or leave cuts full and finish grade by mechanical equipment to provide grades and soil densities indicated on the Drawings.
 - 3. Rough grade, fill and compact banks beyond indicated finish grades. Finish grade banks and slopes to indicated grades and specified soil densities.
 - 4. Grade Only Areas: In areas not indicated to receive pavement, rough grade to approximate finish grades and then scarify, moisten and roll to obtain required density and indicated finish grades.
 - 5. Tolerances: Finish grades shall be within a tolerance of 0.05 inch per foot above or below grades indicated. Provide an average grade as indicated.
- B. Base or Sub-grade: After sub-grade has been constructed to approximate required grades, scarify to a depth of the dimension indicated in Geotechnical Report:
 - 1. After scarifying, process loosened material to a finely divided condition and adjust moisture content to optimum condition by addition of water, addition and blending of dry suitable material, or by drying of existing material.
 - 2. Sub-grade material shall be compacted by tamping, sheep foot rollers or pneumatic tire rollers. Required relative compaction shall be 95 percent minimum for the top 6 inches below sub-grade.
 - 3. Install base course in accordance with Section 32 11 23 Aggregate Base.
- C. Tolerance of completed grades of base or sub-grade shall not vary more than 0.03 inch per foot from grades indicated. Provide an average grade as indicated.

3.03 SHORING

- A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.
- B. Design and Calculations: Provide in accordance with requirement of governing Building Code and OSHA.
- C. Remove shoring upon completion of the Work of this section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.04 EXCESS MATERIAL DISPOSAL

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.05 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION 02310

SECTION 02315 - EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section shall govern the excavation, trenching and backfilling for sanitary sewer pipe and manholes, unless otherwise noted on the plan details and the specifications. The work shall include all necessary pumping or bailing, sheeting, drainage and the construction and removal of any required cofferdams. All existing utilities shall be protected from damage during the excavation and backfilling of trenches, and if damaged, shall be replaced by the Contractor at his expense. Unless otherwise shown on the plans and bid proposal, all excavation shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed.

1.02 EXCAVATION

- A. The Contractor shall perform all excavation of every description and of whatever substances encountered to the lines and grades shown on the plans or as determined by the Engineer. During excavation, material suitable for backfilling shall be stockpiled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted as indicated on the drawings or as directed by the Engineer. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved method. Sheeting and shoring shall be done as may be necessary for the protection of the work, adjoining property, and for the safety of the personnel. Unless otherwise indicated, excavation shall be by open cut except that short section of a trench may be tunneled if in the opinion of the Engineer the pipe or structure can be safely and properly installed or constructed, and backfill can be properly tamped in such tunnel sections
- B. The contractor is responsible for contacting local utility companies for the location of underground lines prior to any trenching and earthwork.

1.03 TRENCHING

- A. Trench walls shall be vertical and the practice of under-cutting at the bottom of flaring at the top will not be permitted unless at the Engineer's direction or if in the Contractor's opinion it is necessary for safety reasons. In special cases where trench flaring is permitted and directed by the Engineer, the trench walls shall remain vertical to a depth of at least one foot (1') above the top of the pipe. The bottom of the trench shall be square or slightly curved to the shape of the trenching machine cutters. The bottom of the trench shall be accurately graded to provide uniform bearing and support for each section of pipe on the undisturbed soil at every point along its entire length, except for the portions of pipe sections where it is necessary to excavate for bells and for the proper sealing of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded in order that pipe rest upon the prepared bottom for as nearly its full length as practicable. Whenever over-excavation occurs, the under-cut trench shall be restored to grade, to the satisfaction of the Inspector, by replacement of excavated material compacted to the same density as the surrounding natural ground. Trench bottoms for sanitary sewers shall conform to the paragraph "1.04 Backfilling" of this Technical Specification.

The width of the trench shall be at least the outside diameter of the pipe plus six inches (6") on each side of the pipe for all pipe sizes under forty-two inches (42") in diameter.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

The maximum working room for pipe forty-two inches (42") in diameter and under shall be twelve inches (12") from each side of the pipe to the face of the trench walls. Where sheeting and bracing are used, a maximum twelve inch (12") working space measured from the pipe to the face of the maximum width of the trench shall be such that the working space from the pipe to the trench wall, or sheathing as the case may be, will be a minimum of twelve inches (12"), and a maximum of twenty-four (24"). If allowable trench widths are exceeded through overshooting of rock, caving of earth trenches or over-excavation, the Contractor shall employ corrective measures or alternative designs as determined by the Engineer.

- B. Where water, silt, muck, trash, debris or rock in ledge, boulder to coarse gravel (particle size larger than 1-3/4") is encountered at the bearing level, and the Contractor shall, as directed by the Inspector, under excavate and remove such materials to a depth not less than six inches (6") below the bottom of the pipe and replace with a material conforming to the requirements of 1.04.C.1.a Bedding. Trench bottoms for sanitary sewers shall conform to the paragraph "Pipe Backfilling."

1.04 BACKFILLING

- A. General: Excavation shall not be backfilled until the construction structures or appurtenances as installed conform to the requirements specified. The excavation shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel, gravel subgrade filler, stabilized filler, flexible base or other approved materials as shown on the plans, free from large clods of earth or stones. Where pipe is specially coated for protection against corrosion care shall be taken not to damage the coating. Any excavation improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and compaction.

The use of sand backfill shall not be allowed in blasted rock excavation, except for sanitary sewers as noted herein, and as directed by the Engineer.

In these areas, use of excavated backfill material if suitable, or crushed gravel (max 3/4" size) or pea gravel only shall be used. All compaction shall be such that the apparent dry density of each layer shall be not less than ninety percent (90%) of the maximum dry density as determined by tests on samples as outlined in Texas Department of Transportation Testing Method Tex 113-E, unless otherwise shown on the plans (Class II ASTM D2321).

- B. Structure Backfilling: Structure backfilling to a point indicated on the plans.

- 1. Material for backfill shall be selected fine compactable soil material. It shall be compacted at near optimum moisture content in layers not to exceed six inches (6") in compacted thickness to a point to match natural ground. Each layer shall be compacted to the required density by approved hand or mechanical tamping equipment.

Care shall be exercised to thoroughly compact the backfill under the structure and to insure that the backfill material soil is in intimate contact with the sides. Backfill material shall be kept at the same approximate elevation on both sides of the structure.

- 2. After the backfill has been completed to a point to match natural ground, suitable rolling equipment may be used on these portions which are accessible to such equipment to obtain the compaction effect. Material for backfill shall be placed in uniform layers not more than twelve inches (12") in depth (loose measurement) and shall be compacted to the density specified herein. Each layer of backfill material, if dry, shall be wetted uniformly to the moisture content required to obtain the specified density, and shall be compacted to the required density by means of the rolling equipment. No rolling equipment shall be used which may damage the structure. Vibrator compaction equipment shall not be used.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- C. Pipe: Backfill for pipe is divided into three (3) separate zones: (a) Bedding, the material in trench bottom in direct contact with the bottom of the pipe; (b) Initial Backfill, the backfill zone extending from the surface of the bedding to a point on foot (1') above the top of the pipe; and (c) Secondary Backfill, the backfill zone extending from the initial backfill surface to the top of the trench. Materials and placement for each of the zones shall be as described herein.

1. Bedding:

- (a) Existing stable material and laying conditions encountered at the pipe bearing level which are acceptable for bedding purposes are:

Trench bottom at bearing level free of water, muck, debris and rock in boulder, ledge or coarse gravel (particular size larger than 1-3/4 inch) formations. Coarse sand and gravels with maximum particle size of 1-3/4 inch, various graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry, fine sands and clayey gravels, fine sand, sand-clay mixtures and gravel-clay mixtures which shall meet or exceed Class III under ASTM D-2321 and shall be compacted to a minimum of 85% of the maximum dry density as determined by tests on samples as outlined in Texas Department of Transportation Testing Method TEX 113-E.

- (b) Existing unstable materials and laying condition encountered at the pipe bearing level which are not acceptable for bedding purposes are:

Water, silt, muck, trash or debris at trench bottom at bearing level or rock in ledge or boulder, or coarse gravel (particle size larger than 1-3/4 inch) formation.

2. Initial Backfill: Backfill is defined as backfill having a thickness in its compacted state from the surface of the bedding to a point one foot (1') above the top of the pipe. Initial backfill shall be constructed in accordance with details shown on the plans and these specifications.

(a) Select Initial Backfill: where pipe is to be laid in a rock cut or where rock in boulder ledge or coarse gravel (particle size larger than 1-3/4 inch) formations exist in the initial backfill zone, or where trench walls or conditions are unstable as defined by Item 3(a) (2) "Bedding" above or where the pipe to be laid is Polyvinyl Chloride (PVC) Pipe, select initial backfill material shall be used. Select initial backfill material shall meet or exceeds Class II as described in ASTM 2321 and shall be compacted to 85% minimum. For sewer lines less than twenty four inches (24") in diameter select initial backfill material shall be placed in two (2) lifts. The first lift shall be spread uniformly and simultaneously on each side and under the shoulders of the pipe to the mid-point or spring line of the pipe. The first lift of select initial backfill material shall be inspected and approved prior to placement of the second lift. The second lift of select initial backfill material shall extend from the spring line of the pipe to a depth sufficient to produce a compacted depth of material a minimum of one foot (1') above the top of the pipe. The second lift shall be evenly spread in a similar manner as the first lift.

For sewer line twenty-four inches (24") in diameter and larger select initial backfill material shall be evenly and simultaneously spread alongside, under the shoulders or haunches of the pipe and over the pipe in twelve-inch (12") lifts to a point sufficient to produce a compacted depth of material a minimum of one foot (1') above the top of the pipe at a minimum of 85% compaction.

No mechanical or hand compaction will be required on an approved select initial backfill material except in the paved areas, proper compaction equipment will be required.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- (b) **Optional Select Initial Backfill:** Where the pipe to be laid is Polyvinyl Chloride (PVC) Pipe, or where unstable materials as defined by Item 3(a)(2), "Bedding" exist at the pipe bearing level or the initial backfill zone, in lieu of the material specified in Item 3(b)(1) above, an optional select initial backfill may be used by the contractor where rock in ledge, boulder or coarse gravel (particle size larger than 1-3/4 inch) formations is not present in the bedding or initial backfill zone of the trench and where water is not present at the pipe bearing level.

Optional Initial Backfill shall be clean, well graded gravels, crushed screenings or sand with 100% passing a 1/2" sieve, 95% to 100% passing a 1/4" sieve and shall meet or exceed Class III as described under ASTM D2321. The plasticity index shall not be more than 12 when tested in accordance with the Texas Department of Transportation Test Method TEX-106-E. Optional select initial backfill shall be placed around the pipe and to the defined limit for initial backfill as specified in Item 3 (b) (1) above. Sand and other materials as may be required by the Inspector shall be flooded with water to complete subsidence following the final lift. Minimum thickness of completed optional select initial backfill shall be one foot (1') above the top of the pipe compacted to 85% minimum.

No mechanical or hand compaction will be required on an approved optional select initial backfill material except in the paved areas, proper compaction equipment will be required.

- (c) **Natural Initial Backfill:** Where the pipe to be laid is Vitrified Clay Pipe, Cast Iron or Ductile Iron Pipe, and where stable materials and laying conditions as defined in Item c(1)(i) "Bedding," exist at the pipe bearing level and initial backfill zone and existing excavated materials conform those defined in Item c(1) (i), such excavated natural materials may be utilized as initial backfill material.

For pipe less than twenty-four inches (24") in diameter natural initial backfill shall be placed in two (2) lifts. The first backfill material shall be spread evenly alongside and under the shoulders of the pipe and thoroughly compacted by means of hand or mechanical tamps, to the satisfaction of the Inspector.

For pipe twenty-four inches (24") in diameter and larger natural initial backfill shall be placed alongside and over the pipe in twelve-inch (12") (loose measurement) lifts and shall be compacted in the manner prescribed above for smaller lines.

3. **Secondary Backfill:** Secondary backfill is defined as backfill from one foot (1') above the top of the pipe to the top of the trench. Secondary backfill shall be constructed in accordance with details shown on the plans and these specifications.

Secondary backfill shall generally consist of materials removed from the trench and shall be free of brush, debris, and junk. No rock or stones having any dimension larger than one half the trench width, or twelve inches (12") at the largest dimension, whichever is less, shall be used in the secondary backfill zone. In special cases where excessive width and/or depth of the trench permit, and only with approval of the Inspector, larger rocks may be incorporated into backfill provided that the surrounding compactable soil may be properly and adequately compacted. Such oversized rocks shall be used only where the pipe has at least five feet (5') of cover over the top of the pipe, and where the top of the rocks are at least two feet (2') below the street or ground surface. These large stones may be placed in the secondary backfill provided they are well separated and arranged so that no interference with backfill settlement will result. Secondary backfill material shall be composed of primarily compactable soil materials.

Only where specified as shown on the drawings, water jetting may be used. Water jetting shall be delivered under sufficient volume and pressure through an approved jetting hose and pipe nozzle. The jetting hose shall have a minimum inside dimension of two inches (2"). The jetting hose shall

Ascarate Park Lift Station and Sanitary Sewer Improvements

be connected to an approved minimum two inch (2") water pump capable of delivering water at the volume and pressure as required by the Engineer. The pipe nozzle shall be of sufficient length to introduce the water at a depth of not less than one foot (1') above the preceding lift. Points of trench jetting shall be staggered along the length of the trench and spaced at not more than three feet (3') on centers. Each five-foot (5') lift of secondary backfill shall be jetted initially at a depth of not more than one foot (1') above the preceding lift. Sufficient water shall be introduced into the secondary backfill to cause complete subsidence of the backfill and develop free standing water at the surface of each lift, except in rock construction where free standing water is not required. Water jetting is allowed only in sandy material.

After the final lift has been jetted as approved, twelve (12) hours shall be allowed for the reduction of the materials moisture content. When the backfill moisture content is acceptable for mechanical or pneumatic compaction, the surface shall be compacted with ditch tamping equipment to the satisfaction of the Inspector. The surface of the final lift of trenches subject to traffic shall be compacted by ditch tamping equipment.

Secondary backfill under streets or pavement shall be compacted in 12-inch (12") lifts with ditch tamping equipment. Water jetting under pavement areas is not allowed.

Ditch tamping equipment shall be mechanical tamping machines having a minimum of 500-pound, 12 inch square tamper, capable of developing 4000 foot-pounds at full stroke.

Secondary backfill in trenches under roadways, driveways and sidewalks shall be sand. It shall be placed in such a way as to achieve a compaction of 95% of maximum dry density.

1.05 DISPOSAL OF EXCAVATED MATERIALS

The excess material not utilized after all fill requirements have been met shall become the property of the Contractor and he shall dispose of it by hauling and wasting outside the limits of the right-of-way of this project and of public thoroughfares and water courses, in conformity with pertinent City/County ordinances and in a manner meeting the approval of the Engineer.

END SECTION 02315

Ascarate Park Lift Station and
Sanitary Sewer Improvements

SECTION 02530 – GRINDER PUMP UNITS

PART 1 GENERAL

1.01 SUMMARY

- A. This work shall include all required excavation and backfill, the disposal of any excess excavated material, installation of the duplex grinder pump assembly, installation of the electrical control/alarm panel, electrical connection between grinder pump and control panel, grinder pump connection to service pipe and stub out for Restroom 4” drain pipe.
- B. These specifications are intended to technically describe the nature of the materials, equipment, and workmanship required to complete the low pressure sewers and appurtenances shown on the plans.
- C. All labor, tools, and materials necessary to excavate, place, join, backfill, and finish the low pressure sewers and appurtenances to provide a complete and operative system shall be considered as part of the low pressure sewer system construction.
- D. Low pressure sewers shall be considered to mean pressure pipe as called for on the plans, complete with specials, fittings, valves, valve wells, valve boxes, and connections to existing sewer systems.
- E. Related Sections:
 - 1. Cast-In-Place Concrete - Section 03300.
 - 2. Low Pressure Wastewater Utility Piping - Section 02531.
 - 3. Excavating, Backfilling, and Compacting for Utilities – Section 02315

1.02 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI B2.1, Pipe Threads.
 - 2. ANSI B16.3, Malleable-Iron Screwed Fittings, 150 and 300 lb.
 - 3. ANSI C2, National Electrical Safety Code.
- B. American Society for Testing and Materials:
 - 1. ASTM A 48, Specification for Gray Iron Castings.
 - 2. ASTM A 536, Specification for Ductile Iron Castings.
 - 3. ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
 - 4. ASTM B 371, Specification for Copper-Zinc-Silicon Alloy Rod.
 - 5. ASTM B 584, Specification for Copper Alloy Sand Castings for General Applications.
 - 6. ASTM C 581, Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass Fiber Reinforced Structures, Intended for Liquid Service.
 - 7. ASTM C 582, Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion Resistant Equipment.
 - 8. ASTM D 1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 9. ASTM D 1785, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80 and 120.
 - 10. ASTM D 2241, Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series).
 - 11. ASTM D 2466, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - 12. ASTM D 3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

Ascarate Park Lift Station and Sanitary Sewer Improvements

13. ASTM D 3299, Specification for Filament-Wound Glass Fiber Reinforced Polyester Chemical-Resistant Tanks.
14. ASTM F 477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

- C. Institute of Electrical and Electronics Engineers.
- D. National Bureau of Standards: Product Standard PS 15-69, Custom Molded Reinforced Polyester Chemical Resistant Process Equipment.
- E. National Electrical Code (NEC).
- F. National Electric Manufacturer's Association (NEMA) Standards of Construction.
- G. National Fire Protection Association (NFPA): NFPA 70; National Electrical Code, and current amendments.
- H. Underwriters' Laboratories (UL) Listings and Approvals on specified Products.

1.03 SUBMITTALS

- A. Shop Drawings: Submit for approval completely dimensioned shop drawings and catalog cuts or other data as required to provide a complete description of the following:
 1. Submit shop drawings certified for construction by the manufacturer which includes location of electrical connections; wiring diagrams; anchor bolt layout; details indicating construction and materials of construction; diameter of shafting; dimensions and rated horsepower of all motors; gear and bearing ratings; service factors and weights of principal parts and completely assembled equipment.
 2. Submit evidence of Underwriters' Laboratories (UL) Listings and Approvals on the electrical control panel and grinder pump.
 2. Submit details of the Anti-Flotation Anchor indicating the size and weight required.
- B. Operation, Installation and Maintenance Manuals: Within four weeks following the receipt of approved shop drawings, submit to the Engineer for review and approval, two copies of manuals prepared by the manufacturer/supplier, or the Contractor. The submission and approval of each set of manuals will be considered to be an integral part of furnishing and installation of the respective equipment or system. Incomplete or inadequate manuals will be returned to the Contractor for correction and resubmission.
 1. Include the following elements in each manual:
 - a. Erection or installation instructions.
 - b. Start-up procedures.
 - c. Recommended and alternative procedures.
 - d. Schedule of preventive maintenance requirements.
 - e. Detailed maintenance procedures.
 - f. Schedule of lubrication requirements.
 - g. Data sheet listing pertinent equipment or system information, as well as the addresses and telephone numbers of the nearest sales and service representatives.
 - h. Provide a list of the manufacturer recommended spare parts.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualification: Consideration will be given only to manufacturers or fabricators meeting the following qualifications:
 1. Three years minimum experience producing Units of equal quality to the type specified

Ascarate Park Lift Station and Sanitary Sewer Improvements

- herein.
 - 2. Three years minimum experience of in-service, satisfactorily operating Units of the type specified herein.
 - 3. Manufactured grinder pump units shall have been tested to certify capability to perform, as specified herein, in either individual or low pressure sewer system applications.
 - 4. Historical and certified data substantiating the above qualifications available to the Engineer upon request.
- B. Design Criteria: Units shall meet accepted standards for plumbing equipment for use in or near structures, and shall operate free from noise, odor or health hazards.
- 1. Grinder: The grinder shall have capability to reduce the components in normal domestic sewage, including a reasonable amount of foreign objects, such as paper, wood, plastic, glass, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4 inch diameter discharge piping.
 - a. The grinder position shall be such that solids are fed in an upflow direction.
 - 2. Pump: Centrifugal design and progressive cavity, capable of delivering 38.2 GPM against a normal rated total dynamic head of 28.4 feet. Pump of such design to allow for removal from tank, without use of tools, to the immediate area outside of tank with electrical and control connections intact.
 - 3. Pump and motor to have the capability of running dry for extended periods of time without damage to motor or seals.
 - 4. Motor: 2 Horsepower minimum.
 - 5. Tank: Provide completely watertight tank, of 247 gallon capacity minimum, and designed to withstand the minimum depth of bury earthload at the proposed tank location. In the case of FRP tank, the tank manufacturer shall calculate the anti- flotation anchor and provide an appropriate design for the anchor.
 - a. Provide a 120-inch deep tank.
 - 6. Inlet Size: 4-inch diameter, minimum.
 - 7. Discharge Size: 1-1/4-inch diameter.
- C. County of El Paso Representative Inspections: A representative of the County of El Paso will be present during Grinder Pump Unit initial installation and testing operations. To accommodate the County of El Paso representative concerning the Inspections stated herein, the Contractor shall observe the following:
- 1. Notice: Give the County of El Paso Road & Bridges a minimum of 72 hours notice for an inspection. Call Phone No. 915- 546-2015 between the 8:00 a.m. and 5:00 p.m. prevailing time Monday through Friday. Schedule inspection appointments with the County of El Paso only between the hours of 8:00 a.m. and 3:00 p.m. prevailing time Monday through Friday.
 - a. No weekend or holiday inspection appointments allowed.
 - 2. Unit Installation and Inspection: To serve as the minimum acceptable conditions of installation throughout the Project, install the unit in the Project to demonstrate the stages of installation stated in the following sentences. The County of El Paso's representative shall inspect each of the following stages of installation:
 - a. Bedding and concrete construction.
 - b. Pipe connections to the Unit and watertightness of the complete Unit.
 - c. Proper electrical work operation of the Unit.
 - d. Proper backfilling procedures.

1.05 DELIVERY, STORAGE AND HANDLING

- A. To prevent damage and defects, transport, store and handle the units and Products specified herein

Ascarate Park Lift Station and Sanitary Sewer Improvements

in a manner recommended by the respective manufacturers.

1.06 SITE CONDITIONS

- A. Environmental Requirements: In no instance set units on subgrade containing frost or on unacceptable subgrade which condition has been determined unacceptable by the Engineer.
- B. Electrical Interface: Install or mount those electrical components or apparatus as furnished by the Product manufacturers of those Products specified herein.
 - 1. Contractor will be responsible for permanent power wiring, including final connections of such to the electrical components or apparatus of the grinder pump units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Environment One.
 - 2. Or Equal.

2.02 GRINDER PUMP UNIT

- A. General Requirements: Provide prefabricated, completely assembled Unit, suitable for conveying domestic sewage and for underground installation with the necessary accessories as specified herein and as required for a completely operational unit. Unit shall have two (Duplex) grinder pumps, as indicated on the Drawings.
 - 1. Unit shall have the sewage grinder pump(s) and other necessary accessories as specified herein, which include sewage grinder pump(s), switch level controls, discharge piping, with hydraulically sealed discharge flange(s), pump mounting plate and bottom rail supports, upper rail supports, pump guide rails and lifting chain or cable.
 - 2. Unit shall include FRP or molded high density polyethylene tank and discharge piping with hydraulically sealed discharge flange.
 - 3. Unit shall have a control panel, control panel enclosure, alarm devices and electrical wiring.
 - 4. Where exposed to wastewater, provide materials that have inherent corrosion protection (i.e., cast iron, fiberglass, stainless steel, PVC).
 - 5. Duplex installations shall permit the independent removal of each grinder pump from the sump basin for maintenance or inspection, and the return of the pump to service without draining or entering the sump basin.
- B. Pumps:
 - 1. Pump shall be custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressive cavity type with a single mechanical seal. All materials shall be suitable for domestic wastewater service.
 - 2. Operating Conditions:
 - a. The pumps shall be capable of delivering 32.8 gpm at 28.4 feet of TDH. The pumps shall also be capable of operating at negative TDH without overloading the motor.
- C. Grinder:
 - 1. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of foreign objects such as paper, wood, plastic, glass, and rubber, to finely-divided particles which

Ascarate Park Lift Station and Sanitary Sewer Improvements

- will pass freely through the passages of the pump and the discharge piping.
2. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece stainless steel shaft.
 3. The assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of operating pressures.
- D. Motor:
1. The motor shall be 1 HP, 1,725 rpm, 120/240 volt, 60 Hz, single phase.
 2. Inherent protection shall be provided for running overloads or locked rotor conditions through the use of an U.L. listed automatic reset and integral thermal overload protectors incorporated into the motor.
 3. The core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump.
- E. Wet Well and Integral Accessway
1. Wet well shall be a custom molded high density polyethylene or FRP (fiberglass reinforced polyester) as supplied by Grinder Pump manufacturer. Along with the wet well, an intergral accessway shall be high density polyethylene or FRP of a grade selected for environmental stress cracking resistance.
 2. The wet well shall be designed to accept the core units containing the 4 grinder pumps.
 3. Anti-Flotation Anchor: Provide precast or field cast concrete anchor in accordance with tank manufacturer's recommendations. The tank manufacturer shall provide the design and size of the anchor.

2.03 PIPING

- A. Discharge Piping and Fittings: Schedule 80 PVC manufactured from Class 12454-B Rigid PVC Compounds with a hydrostatic design stress of 13.8 MPa (2000 psi designated as PVC 1120) and conforming to ASTM D 1785; NPT couplings, pipe and fittings.
1. Size: 1-1/4-inch diameter on each of the two Duplex Units.
 2. Material Option: Discharge pipe may be SDR 21 PVC (Pressure Class 200 psi.) conforming to ASTM D 2241 or High Density Polyethylene (HDPE) Pressure Piping.
 - a. Pipe Joints: Push-on or compression type, joint performance conforming to ASTM D 3139, with rubber gasket suitable for domestic sewage service and conforming to ASTM F 477.
 3. The discharge piping shall include a flexible hose assembly.
 4. All vent piping and electrical conduit shall be SCH 40 PVC pipe.
- B. Valves: The package grinder pump station shall contain a pre-installed PVC check valve, anti-siphon valve, and ball valve or plug valve.

2.04 PUMP CONTROLS

- A. Controls, Quadplex Pumps: Controls shall be supplied by the pump station manufacturer. Provide four switches; one for lead pump start, one for lag pump start, one for both pumps stop and one to signal high-level sump alarm. Operation as follows:
1. On sump level rise, lower switch shall first be energized, then upper level switch shall next energize and start lead pump. With lead pump operating, sump level will lower to low switch turn-off setting and pump shall stop.
 2. Alternating relay shall index on stopping of pump so that lag pump shall start on next operation.
 3. If sump level continues to rise when lead pump is operating, override switch shall energize and start lag pump. Both lead and lag pump shall operate together until low level switch turns off

Ascarate Park Lift Station and Sanitary Sewer Improvements

both pumps.

- a. If level continues to rise when both pumps are operating, alarm switch shall energize.
4. If one pump should fail for any reason, the second pump shall operate on the override control, and if level rises above override control, signal alarm switch shall energize.
 - a. Level switches adjustable for level setting, from the surface.

2.05 CONTROL PANEL

- A. Control/alarm panel shall be factory built and supplied by the pump station manufacturer.
- B. The control panel shall be permanently mounted, preferably to a structure. The panel should be located so that the alarm horn and light are not hidden.
 1. Enclosure:
 - a. Wall mounted NEMA 4X thermoplastic electrical enclosure designed to accommodate the appropriate power requirements.
 - b. The enclosure shall be equipped with padlock facilities.
- C. Control panel installation includes the electrical wiring and connections between the panel and the pump station. Wiring shall be direct-bury cable in accordance with electrical code.

2.06 MISCELLANEOUS MATERIAL

- A. Excavating, Backfilling, and Compacting for Utilities: As specified in Section 02315.
- B. Cast-In-Place Concrete - As specified in Section 03300.
- C. Waterproof Splice Kit (Buried and Waterproof Locations): Molded rubber composition and designed to create a watertight seal on the cable jacket as well as the splice.
 1. Acceptable Manufacturers:
 - a. Elastimold Division Amerace-Esna Corp.; Fused and Single & Multi- Conductor Connector Kits.
 - b. Joy Manufacturing Company.
 - c. Or equal.
- D. Rigid Metal Conduits: Fabricated of mild steel piping, galvanized or sherardized inside and outside, and protected against corrosion by a dichromate rinse or a zinc chromate coating. Each conduit shall bear the UL label, be defect free, furnished in 10 ft. lengths minimum, and of the following type:
 1. Rigid Metal Conduit and Fittings: Products meeting requirements of NEC Article 346 for materials and uses, and Fed. Spec. WW-C-581D.
- E. Rigid PVC Conduit: High impact PVC (polyvinyl chloride) Conduit and Fittings conforming to NEMA Spec. TC-2, 90 C, UL rated and Labeled and made from compounds conforming to ASTM D 1784. Additionally, PVC conduit shall have material strengths of 5,500 psi tensile, 11,000 psi flexural and 8,600 psi compression; all at 78 degrees F.
 1. Provide schedule 40 conduit and fittings, except where required by NEC use schedule 80.
- F. Grounding Materials: Provide materials conforming to UL requirements for such use as NEC Article 250. Basic materials as follows:
 1. Ground Rods: 3/4-inch by ten foot copperweld type.
 2. Ground Conductors: Code gauge stranded copper unless otherwise indicated.
 3. Ground Clamps: Multi-bolt type, (Clamps for pipe, lugs for bars) saddle clamp or compression type for wire.

Ascarate Park Lift Station and Sanitary Sewer Improvements

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field Inspection: Examine units for defects that will adversely affect installation or cause latent defects in completed work. Inform Engineer of defects. Do not proceed with installation until defects have been corrected.
 - 1. Verify other construction work is complete to the extent that substrates on which electrical apparatus is to be installed is ready to receive same.
- B. Manufacturer Instructions: Refer to manufacturer's installation instruction manual for familiarization before proceeding with installation of units.
 - 1. Verify direction of motor rotation in equipment before making final connections to electrically operated equipment.

3.02 PREPARATION

- A. Field Measurement: The Drawings are generally indicative of the Work, but are not an exact representation of each condition involved. Therefore, set units, piping, etc. to suit actual field measurements. No extra compensation will be made for Work due to differences between indicated and actual dimensions.
 - 1. Where proposed changes to the Engineer's design are necessitated by field conditions or other causes, submit detail drawings of proposed changes to the Engineer for approval.
- B. Keep pipe and unit interiors cleared of debris as construction progresses.
- C. Earthwork: Perform earthwork for unit installation as specified in Section 02200 and according to the following:
 - 1. Make excavations for units to a nearly vertical plane and not to exceed the nominal dimensions of the concrete anchor outside diameter.
 - 2. If rock excavation is required, take rock out to limits specified previously.
 - 3. If surface pavement of any type is encountered, vehicle or pedestrian ways, cut such pavement to a rectangular shape as opposed to circular shape of unit. Make limits of cut not to exceed one-foot beyond excavation limit as specified previously.

3.03 INSTALLATION

- A. General Requirements: Install units in strict accordance with manufacturer's instruction and installation manual, and at locations and in accordance with Details indicated on the Drawings.
 - 1. Install a check valve between the unit and the main sewer piping in accordance with the Detail Drawings.
 - 2. Install units on a six inch deep compacted layer of aggregate meeting requirements of Pipe Zone Bedding. Install Pipe Zone Bedding material as backfill up to highest pipe connection.
- B. Anti-Flotation Anchor Installation, per Manufacturer's installation recommendations: Form and pour concrete anchors in accordance with requirements of Section 03300. Use Class B (3,000 psi) concrete.
 - 1. Prefabricated anchors, as qualified previously in this Section, are acceptable.
- C. Underground Electrical System: Install underground electric cable in accordance with Article 300-5 of the NEC, in accordance with previous requirements of this Section, and the following requirements exceeding NEC:
 - 1. Earthwork: Perform earthwork for buried electric cable as specified for piping under Section

Ascarate Park Lift Station and Sanitary Sewer Improvements

02200.

2. Provide two feet minimum cover over cable unless indicated otherwise on the Drawings.
3. Make electrical cable penetrations through the tank absolutely watertight.

- D. Electrical System Grounding: Perform grounding of electrical system and metal enclosures in accordance with Article 250 of the NEC.
1. In addition to grounding and bonding requirements of NEC as referenced in the preceding paragraph, the following shall also apply:
 - a. Use approved grounding connectors only. Clean the surfaces involved in the made-grounds before connecting and finish the installation with touch-up painting or other protective coating to prevent corrosion.
- E. Control Panel Installation: Fasten control panel and cable to exterior of the building or post (for post mounted) using fasteners suitable for anchoring into the particular type of surface, and fasten in accordance with current accepted trade practices. Only screw-type corrosion-resistant fasteners are acceptable.
1. Install control panel four feet above existing grade, measured to the bottom of the panel.
 2. If post mount installation, provide post of sufficient length to permit three feet of embedment in ground and the four foot clearance requirement stated above.

3.04 FIELD QUALITY CONTROL

- A. General Requirements: Upon completion of installation of the grinder pump units, including but not limited to control panel mounting, electrical work installation and connections, pressure service lateral installation, and unit backfilling, each being performed in a manner satisfactory to the Engineer, advise the unit manufacturer that the units have been installed and are ready to be inspected and tested.
1. In cooperation with the unit manufacturer, determine a mutually acceptable schedule for inspection and testing of installed units.
 2. Conduct the Performance Test specified herein prior to the propertyowner's electrical wiring and plumbing connections to the grinder pump units.
 3. Conduct tests as specified herein so that each unit installed in the Project is tested to the unit manufacturer's and Engineer's satisfaction. Provide the Owner with documentation of such manufacturer's acceptance test in the form of a letter to the Owner attesting to this test requirement.
 4. Provide tools, materials, water, temporary power, apparatus, and instruments necessary for unit testing. Conduct the specified tests in the presence of and to the satisfaction of the unit manufacturer and the Engineer.
- B. Performance Test: Demonstrate (with the Owner's Personnel, Engineer and Manufacturer's representative observing), to the satisfaction of the Engineer, the mechanical performance of each unit when operated in accordance with the design intent indicated by the Drawings and as directed and instructed by the manufacturer's service technician representative and proper procedures for such tests.
- C. Tank Watertightness Test: Perform both an exfiltration and an infiltration test of each unit in the Project. Test procedures as follows:
1. Fill the completely installed units above the highest tank wall penetration (including electrical) with clear water. Allow a one hour stabilization period and then commence a three consecutive day exfiltration test.
 2. Measure and record the water level, with the Engineer observing, both at the beginning and end of the test period.
 3. An acceptable exfiltration test will be when no water leakage in the closed unit is detectable by the measurements.

Ascarate Park Lift Station and Sanitary Sewer Improvements

4. Conduct an infiltration test of the completely installed units over a three consecutive day time period with the Engineer observing.
 5. An acceptable infiltration test will be when no water enters the closed unit.
- D. Manhole Tank Watertightness Test: Perform precast manhole test as specified in Section 02605.
- E. Installation Check and Start-Up:
1. An authorized representative of the manufacturer or supplier of each item of equipment shall visit the site of the work after installation to inspect, check, adjust if necessary, and approve the equipment's installation.
 2. Furnish the services of a qualified factory trained field service technician to visit the site in order to inspect the installation and instruct the Owner's personnel on the operation and maintenance of the pumping units. Service technician will instruct and assist in the operation of the lift station control panel and adjustment that can be made to the level controls within the lift station to meet Owner's criteria.
 3. During this initial inspection, have the manufacturer's service representative review recommended operation and maintenance procedures with the owner's personnel. Remove and reinstall all submersible pumps during first startup operation in the presence of the Owner and Engineer to ensure proper operation of the guide rail system.
 4. After nine months of operation, have the authorized factory representative make a follow-up visit to the facility to again make sure the pumps are operating properly, and conduct a second operator training and/or trouble-shooting session at no additional cost to the Owner. Perform all work in the presence of the Owner's Operator to provide additional training. Include costs associated with the follow-up visit in the Contractor's original bid price.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. Manuals: Provide two copies of Operation and Maintenance reports to the Engineer for approval
- B. Provide parts list and breakdown, Installation Care and Maintenance for pumps.

END OF SECTION 02315

Ascarate Park Lift Station and
Sanitary Sewer Improvements

SECTION 02531 – LOW PRESSURE WASTEWATER UTILITY PIPING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The work specified in this Section consists of constructing the piped low pressure wastewater sewers and appurtenance.
- B. Related Sections:
1. Cast-In-Place Concrete - Section 03300
 2. Excavating, Backfilling, and Compacting for Utilities - Section 02315
 3. Manholes: Section 02605.
 4. Polyvinyl Chloride (PVC) Gravity Sewer Pipe and Fittings: Section 02622.

1.02 REFERENCES

- A. American National Standards Institute:
1. ANSI A21.10, Gray-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.
 2. ANSI A21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
 3. ANSI A21.15, Flanged Cast-Iron and Ductile-Iron pipe with Threaded Flanges.
 4. ANSI A21.50, Thickness Design of Ductile-Iron Pipe.
 5. ANSI A21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand- Lined Molds for Water or Other Liquids.
 6. ANSI A21.53, Ductile-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
 7. ANSI B 1.1, Unified Inch Screw Threads.
 8. ANSI B2.1, USAS-Pipe Threads (except Dryseal).
 9. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
 10. ANSI B16.21, Nonmetallic Gaskets for Pipe Flanges.
 11. ANSI B18.2.1, Square and Hex Bolts and Screws, Including Askew head Bolts, Hex Cap Screws, and Lag Screws.
 12. ANSI B18.2.2, Square and Hex Nuts.
- B. American Society for Testing and Materials.
1. ASTM A36; Specification for Structural Steel.
 2. ASTM A47, Specification for Ferritic Malleable Iron Castings.
 3. ASTM A48, Specification for Gray Iron Castings.
 4. ASTM A123, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 5. ASTM A126; Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 6. ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 7. ASTM A183, Specification for Carbon Steel Track Bolts and Nuts.
 8. ASTM A240, Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
 9. ASTM A283, Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 10. ASTM A307; Specification for Carbon Steel Externally Threaded Standard Fasteners.

Ascarate Park Lift Station and Sanitary Sewer Improvements

11. ASTM A320, Specification for Alloy Steel Bolting Materials for Low- Temperature Service.
12. ASTM A536, Specification for Ductile Iron Castings.
13. ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
14. ASTM B140 Specification for Copper-Zinc-Lead (Leaded Red Brass or Hardware Bronze) Rod, Bar, and Shapes.
15. ASTM B371, Specification for Copper-Zinc-Silicon Alloy Rod.
16. ASTM B584, Specification for Copper Alloy Sand Castings for General Applications.
17. ASTM C534, Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
18. ASTM D1599, Standard Test Method for Short-Term Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.
19. ASTM D1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
20. ASTM D1785, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80 and 120.
21. ASTM D2000, Standard Classification System for Rubber Products in Automotive Applications.
22. ASTM D2241, Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR-Series).
23. ASTM D2466, Specification for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
24. ASTM D2564, Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
25. ASTM D2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
26. ASTM D3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
27. ASTM D3350, Specification for Polyethylene Plastic Pipe and Fittings Materials.
28. ASTM E84, Test Method for Surface Burning Characteristics of Building Materials.
29. ASTM F477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
30. ASTM SB800

C. American Water Works Association:

1. AWWA C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand- Lined Molds, for Water or Other Liquids.
3. AWWA C600, Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.
4. AWWA C800, Threads for Underground Service Line Fittings (with Appendix on Collected Standards for Service Line Materials).

1.03 SUBMITTALS

- A. Shop Drawings and Product Data: Submit completely dimensioned shop drawings, catalog cuts or other data as required to provide a complete descriptive information for the following:
1. Pipe and Fittings.
 2. Piping Specialties.

Ascarate Park Lift Station and Sanitary Sewer Improvements

1.04 QUALITY ASSURANCE

- A. All PVC pipe and fittings shall be from a single manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in AWWA C900 and AWWA C905 and NSF Standard No. 14, as applicable. In addition, all PVC pipe to be installed under this Contract may be inspected at the plant for compliance with the requirements specified herein by an independent testing laboratory provided by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of plant inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe, will be borne by the Owner. Final payment will be reduced by excessive costs of plan inspection of pipe, Contractor shall have no claim thereto. Excessive inspection costs are defined as the cost of inspection of that amount of pipe which exceeds 125 percent of the aggregate length of each type installed.
- B. Inspections of the pipe may also be made by the Engineer or other representative of the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though pipe may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transport, handle, and store pipe materials and the associated materials specified herein in the manner recommended by the respective materials manufacturers so as to prevent damage and defects to their respective materials.

1.06 SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Keep trenches dewatered until pipe joints have been made and concrete cradle and encasement, if any, have cured.
 - 2. Do not lay pipe in water or on bedding containing frost.
 - 3. Do not lay pipe when weather conditions are unsuitable, as determined by the Engineer, for pipe laying work.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC) SCH-40 Pipe and Fittings, Exposed Pipe: Provide pipe which is permanently marked with manufacturer's trademark, size and ASTM conformance designation. Pipe design and material requirements shall conform to ASTM D1785 Schedule 40, pressure Class 160, and manufactured from Class 1245-B Rigid PVC Compounds with a hydrostatic design stress of 13.8 MPa (2000 psi) designated as PVC 1120.
 - 1. Socket-Type Joints: Socket-Type conforming to ASTM D2564. Solvent cement for joint making shall conform ASTM D2564.
 - 2. Flanges: PVC Schedule 40 150-lb. flanges manufactured from Rigid PVC Compounds conforming to ASTM D1784.
 - a. Gaskets: Soft rubber full face flat type.
 - b. Bolts: Steel conforming to ASTM A307.

Ascarate Park Lift Station and Sanitary Sewer Improvements

3. Socket Type Fittings: ASTM D2466 manufactured from Class 12454-B Rigid PVC Compound.
4. Provide adapters, nipples, caps, etc., as required.
 - a. Acceptable Manufacturers:
 - 1) EBAA Iron, Inc.; Megalug 1100 Series.
 - 2) Or equal.

2.02 PIPING SPECIALTIES

- A. Flexible Pipe Coupling: Coupling shall consist of a steel middle ring or sleeve, two steel or malleable iron flange or follower rings, two wedge shaped resilient gaskets and sufficient number of track-head bolts and nuts.
 1. Middle Ring or Sleeve: Steel construction conforming to ASTM A283, (Grade A) requirements, fabricated in a true circular section and free of surface defect.
 2. Follower Rings or Flanges: Steel construction conforming to ASTM A47 (Grade 32510) requirements, fabricated in a true circular section and free of surface defect, and tested and sized after welding by cold expanding a minimum of one percent.
 3. Bolts and Nuts: Steel bolt conforming to ASTM A183 requirements, double radius head or buttonhead track type with rolled threads, conforming to ANSI B1.1 requirements; and steel nuts conforming to ANSI B 18.2.2 requirements, American Standard Heavy Dimension Series.
 4. Gaskets: Resilient wedge-shaped of synthetic base compound designed for raw sewage and sludge service.
 5. Shop Paint: Middle and follower rings shop painted with primer compatible with specified field coat for piping where coupling is located.
 6. Acceptable Manufacturers:
 - a. Dresser Manufacturing Division of Dresser Industries, Inc.; Dresser Style 38 or 138.
 - b. Rockwell-International.
 - c. R. H. Baker & Co., Inc.
 - d. Or equal.
- B. Stainless Steel Pipe Supports: Fabricate pipe supports and pipe straps for exposed piping using AISI Type 304 stainless steel conforming to ASTM A167. Individual pipe support and pipe strap designs are as indicated on the Drawings.
 1. Anchors and Fasteners: Provide drilled-in type expansion anchors incorporating a one-piece stud (bolt) with integral expansion wedges, nut and washer as a UL Listed assembly and meeting physical requirements of Federal Specification FF- S-325, Group II, Type 4, Class 1. Stud of AISI Type 303 or Type 304 stainless and nut and washer of AISI Type 316 stainless.
 2. Standard Bolts, Nuts and Washers: AISI Type 304 stainless steel conforming to ASTM A320.
- C. Modular, Mechanical Type Pipe Seal (LINK-SEAL): Modular, mechanical type pipe seal used for core-drilled connection of piping to existing manholes. Seal component construction as follows:
 1. The seal shall consist of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.
 2. The elastomeric element of the seal shall be sized and selected in accordance with the seal manufacturer's recommendations. Elastomeric element shall conform to ASTM D2000 requirements for EPDM material.
 3. The hardware provided in the seal shall be as recommended by the seal

Ascarate Park Lift Station and Sanitary Sewer Improvements

manufacturer for buried service such as will exist at the project site.

4. Acceptable Manufacturers:
 - a. Thunderline Corporation; Link-Seal.
 - b. Or equal.
- D. Cast-In-Place Concrete Products: As specified in Section 03300.
 1. Use Class B (3,000 psi.) quality concrete, unless indicated otherwise on the Drawings.
 2. Acceptable Manufacturers:
 - a. Val-Matic Valve And Manufacturing Corp.; Model No. 300 Series.
 - b. Or equal.

2.03 VALVES

- A. General Requirements: Provide valves of the same type by same manufacturer; suitable for the intended service. Markings shall be cast on the bonnet or body of the valve indicating manufacturer's name or mark, the year the valve casting was made, the size of the valve, directional flow arrow and designation of working water pressure.
 1. Valve pressure-temperature ratings of valve shall be not less than the design criteria applicable to the system components.
 2. Valves shall open to the left (counterclockwise). Valve shall be operated by handwheel or operating nut as indicated on the Drawings. Operating wheel shall have cast thereon an arrow indicating the direction of opening.
 3. Provide extension stems with bronze bushed stem guides where required.
 4. Valve ends as indicated on the Drawings and unless indicated otherwise shall conform to the following:
 - a. Flanged: Conforming to ANSI B16.1.
 - b. Screw End: Threaded in accordance with ANSI B2.1.
- B. Plug Valves (Straightway Type): Designed for a minimum working water pressure of 175 psi for valves through 12 in.
 1. Provide non-lubricated eccentric type plug valve with valve bodies of cast iron conforming to ASTM A126 Grade B, or valve bodies of semi-steel with coated plug suitable for wastewater and corrosion resistant seats.
 2. Provide valves with port areas sized at least 80 percent of full pipe area.
 3. Provide T-wrench for operation.
 4. Acceptable Manufacturers:
 - a. DeZurik; Series 100 Eccentric Valves.
 - b. Henry Pratt Company.
 - c. Homestead Industries, Inc.
 - d. Dresser Industries, Inc.
 - e. Or equal.

PART 3 EXECUTION

3.01 EXAMINATION

Ascarate Park Lift Station and Sanitary Sewer Improvements

- A. Field Inspection: Inspect each section of pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.
- B. Rejected Products: Remove rejected pipe from the Project site and replace with new Products at no increase in Contract Price.
 - 1. Pipe already laid and later found defective will not be accepted and shall require replacement at no increase in Contract Price.

3.02 PREPARATION

- A. As specified in Section 02220.
- B. General Requirements: Clean piping interior prior to laying pipe and following pipe laying and keep open ends of piping and pipe attachment openings capped or plugged until actual connection or actual pipe testing.
 - 1. Provide the protective means to prevent water and debris from washing into the pipe.
- C. Earthwork: Perform earthwork for sewer installation as specified in Section 02200.
 - 1. Bedding materials and concrete work for pipe bedding as specified in Section 02315.
 - 2. Excavate trenches in rock at least 25-feet in advance of pipe laying. Protect pipe ends from rock removal operations.

3.03 CONSTRUCTION

- A. General Requirements: Use proper and suitable tools and appliances for the proper and safe handling, lowering into trench and laying of pipes.
 - 1. Lay pipe proceeding upgrade true to line and grades given. Lay bell and spigot pipe with bell end upgrade. No wedging or blocking permitted in laying pipe unless by written order of Engineer.
 - 2. Unless indicated otherwise, install piping with not less than two feet of cover.
 - 3. Exercise care to insure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs along inside bottom half of pipe line.
 - 4. Before joints are made, bed each section of pipe full length of barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.
 - 5. Walking or working on the installed pipe line, except as necessary in tamping and backfilling, not permitted until trench is backfilled one-foot deep over top of pipes.
 - 6. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.
- B. Pipe Laying and Joining: Perform pipe laying and joining in strict accordance with manufacturer's installation instructions, reference standards as included, and such additional requirements as specified herein.
 - 1. Arrange and pay for pipe manufacturer's representative to be present for first installation of pipe to instruct workmen on proper installation methods.
 - 2. Make joints absolutely watertight and immediately repair detected leaks and defects. Methods of repair subject to Engineer's approval.

Ascarate Park Lift Station and Sanitary Sewer Improvements

3. Threaded Joints: Cut pipe ends square, deburr and ream to size of original bore. Cut threads to American Standard tapered pipe threads, free of oil and cuttings. Use an approved joint tape or joint paste to aid in joint lubrication and sealing. After fabrication, paint exposed threads with red lead paint.
4. Laying/Joining Specified Types of Plastic Pipe: Perform installation and joint assembly according to ASTM D2774 for Class I bedding material.
 - a. Push-on Joints. To make PVC pipe push-on joints, properly seat sealing gasket, evenly and sufficiently lubricate the spigot end of pipe, and fully enter joint until joint line is visible.
 - b. Solvent-Weld Joints: Use chemical solvent welding components to join PVC pipe. Use the type of solvents specified in manufacturer's printed recommendations.
 - c. Joint Restraints: Install joint restraints at changes in direction of pipe runs and at terminal ends of pipe runs in accordance with the following table:

PVC PIPE RESTRAINED JOINT DIMENSIONS (In feet of straight pipe for each leg)	
Fitting	1-1/2 inch through 4 inch Diameter. Pipe
Plug	25
Tee	25
Lateral	25
90 deg.	25
45 deg.	15
22 1/2 deg.	15
11 1/4 deg.	15

5. Laying/Joining Ductile Iron Pipe: Installation and joint assembly according to AWWA C600, and as follows:
 - a. Pipe Cutting: Where necessary to field cut pipe use approved pipe cutter, milling cutter or abrasive wheel saw.
 - b. Push-on Joints. To make ductile cast iron pipe push-on joints, properly seat sealing gasket, evenly and sufficiently lubricate the spigot end of pipe, and fully enter joint until joint line is visible. Make deflection, if required, only after the joint has been assembled properly.
 - c. Mechanical Joints: To make ductile iron pipe mechanical joint, position sealing gasket and gland for bolting and then enter the spigot into pipe bell end until joint line is visible. Tighten bolts evenly maintaining approximate distance between gland and face of flange at all points around the socket. Do not exceed pipe manufacturer's specifications for maximum torque applied to bolts.
6. Flanged Joints: To make ductile iron pipe flanged joint, face flanges true and fit with gaskets, and draw flanges up square and tight to insure full gasket flow and satisfactory seal.
 - a. Concrete Thrust Blocks: Provide concrete thrust blocks for each fitting, and at those locations where horizontal and vertical deflections are made in the joints of the force mains. Use Class B concrete. Provide thrust blocks of the design indicated on the Detail Drawing.
 - b. Joint Restraints: Install on buried DIP at changes in direction of pipe runs, and at terminal ends of pipe runs in accordance with the following table:

Ascarate Park Lift Station and
Sanitary Sewer Improvements

DUCTILE IRON PIPE RESTRAINED JOINT DIMENSIONS (In feet of straight pipe for each leg)		
Fitting	6 Inch Dia. Pipe	8 Inch Dia. Pipe
Plug	25	25
Tee	25	25
Lateral	25	25
90 deg.	25	25
45 deg.	15	15
22 1/2 deg.	15	15
1 1/4 deg.	15	15

- C. Pipe Connections to Existing Manholes: Make pipe connections to existing manholes in accordance with the appropriate requirements as follows:
1. Core-drill the required opening or openings using the proper equipment for the work. Make openings of sufficient size to accommodate the pipe and the Pipe Seal (LINK-SEAL). Install the Pipe Seal in accordance with the manufacturer's installation instructions. Do not permit ground water, surface water or debris to enter the existing facilities through the new connection.
 2. Run the exposed pipe (Drop Connection) within the manhole using SCH-40 PVC Pipe with Solvent Weld Socket Type joints. Run piping within the manhole as indicated on the Drawings.
 3. Anchor the exposed pipe in place within the manhole as indicated on the Drawings using Exposed Pipe Support Work. Embed the Drilled-In Expansion Anchors to four and one-half bolt diameters.

3.04 FIELD QUALITY CONTROL

- A. General Requirements: Conduct tests specified herein so that the pressure wastewater sewer installed in the Project is tested to the Engineer's satisfaction.
1. The Contractor may elect to make a leakage test prior to backfilling the trenches, for his own purposes. However, the leakage tests of pressure wastewater sewers, or sections thereof, for acceptance shall be conducted after the backfilling of the trenches has been completed.
 2. Provide tools, materials (including water), apparatus and instruments necessary for pressure wastewater sewer testing.
 3. When the length of the pressure wastewater sewer exceeds 1000 feet, test the sewer in sections, the length of each section to be determined by the Engineer.
 4. Conduct tests of every kind in the presence of and to the satisfaction of the Engineer.
- B. Testing Equipment: Use testing apparatus equipped with a control panel with necessary piping, control valves and gauges to control pressure within piping test section and to monitor pressures throughout the test.
1. To prevent accidental overloading of piping test section, provide testing apparatus with an approved pressure relief device set to relieve at ten psig.
 2. Provide an extra pressure gauge of known accuracy to frequently check test equipment and apparatus.
 3. Testing equipment and associated testing apparatus subject to Engineer's approval.
- C. Cleaning Prior to Tests: Before tests are conducted, flush piping with clean water until free of all forms of dirt and construction debris.
1. The water for the flush cleaning operation shall be from the Contractor's source.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- D. Line Acceptance Test: After the pressure wastewater sewers, or section thereof, is constructed, backfilled, and successfully cleaned, perform a hydrostatic Line Acceptance Test as follows:
1. Seal pressure wastewater sewer at downstream end with a suitable pipe plug.
 2. Fill pressure wastewater sewer with clear water.
 3. Raise hydrostatic pressure to one and one-half times the operating pressure; measured at the low point of the particular section of sewer being tested.
 4. A preliminary test period will be permitted for the removal or absorption of air from the sewer before measuring the leakage.
 5. Maintain test pressure for a period of not less than four hours.
 6. Consider pressure wastewater sewers acceptable when measured leakage does not exceed ten gallons per day per mile per inch of pipe diameter.
- E. Repair and Retest: When the pressure wastewater sewer, or sections thereof, fails to meet test requirements specified previously, determine source or sources of leakage and repair or replace defective material, and if a result of improper workmanship, correct such.
1. Conduct such additional tests required to demonstrate that pressure wastewater sewers meet specified test requirements.
- F. County of El Paso Tests: The County of El Paso reserves the right to retest, at his expense, piping throughout the duration of the Construction Period.
1. Make repairs as Work of this Section to piping found defective by such County of El Paso conducted tests.

END OF SECTION 02531

Ascarate Park Lift Station and
Sanitary Sewer Improvements

SECTION 02600 – SCHEDULE OF PIPE

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, tools, superintendence and incidentals required to install, test, and perform any other specified or drawn work required to construct and install the pipeline systems under this Contract.
- B. Only approved pipe shall be used for the construction of all pipelines and connections under this Contract. The only type of pipe that will be considered for use, and for the uses specified, are those listed in Part 2 of this Section. All pipe shall be the same type, class and manufacturer.

1.02 SUBMITTALS

- A. Before beginning fabrication of the pipe, the Contractor shall submit to the Engineer, in accordance with Section 01300, manufacturer's certification and supporting calculations that the pipe materials and thickness specified herein are adequate for the depths shown on the Drawings, and for the intended use.
- B. The gravity sewer lines of the project were designed with a Manning "n" factor of 0.013. All gravity sewer lines to be furnished and installed for this project shall have an "n" factor of 0.013 or less. Any materials with a known "n" factor of greater than 0.013 will be considered unacceptable for this project. Prior to the manufacturing of any proposed pipe for this project, the manufacturer shall submit adequate information and data substantiating that the pipe proposed for the project has an "n" factor of 0.013 or less. If the Engineer does not believe that the information submitted is adequate to substantiate the required "n" factor of 0.013 or less, the Engineer may at his option require verification testing of the "n" factor. Manufacturer shall have the option of testing existing lines in place with all testing being at no additional cost to the OWNER.

PART 2 - PRODUCTS

2.01 SCHEDULE OF PIPE

- A. Gravity Sanitary Sewer Pipeline, 4, 6 and 8 –inches in diameter (Green)
 - 1. PVC, SDR 35, ASTM D3034 Solid Wall Pipe.
- B. Low Pressure Force Main, 2-inch diameter:
 - 1. PVC, SCH-40
- C. Lift Station Piping – All Diameters
 - 1. As specified in Section 02531

PART 3 EXECUTION

NOT USED

END OF SECTION 02600

Ascarate Park Lift Station and
Sanitary Sewer Improvements

SECTION 02605 - MANHOLES

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, and equipment to install standard and drop precast concrete manholes, cast-in-place concrete manhole bases, frames and covers and appurtenances as shown on the drawings and as specified herein.

1.02 RELATED WORK

- A. Section 02315 – Excavating, Backfilling, and Compaction for Utilities
- B. Section 02235 – Granular Fill Material

1.03 SUBMITTALS

- A. Shop drawings, product data, materials of construction, and details of installation shall be submitted in accordance with Section 01300. Submittals shall include the following:
 - 1. Details of base sections, riser sections, concentric conical top sections, flat slab tops, and grade rings, with certificate indicating compliance with ASTM C478.
 - 2. Pipe connection to manhole details.
 - 3. Manhole frame and cover with certificate indicating compliance with ASTM A48, Class 30.
 - 4. Method of repair for minor damage to precast concrete sections.
- B. Design Data
 - 1. Precast concrete structures:
 - a. 5 copies plus Contractor's requirements of sections plan(s) and elevations showing dimensions, reinforcing steel placement and pipe connections to manhole.
 - b. 5 copies plus Contractor's requirements of concrete design mix.
 - c. Manhole frame cover.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A48 Specification for Gray Iron Castings
 - 2. ASTM A615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 3. ASTM C32 Specification for Sewer and Manhole Brick (made from clay or shale)
 - 4. ASTM C33 Specification for Concrete Aggregates
 - 5. ASTM C62 Standard Specifications for Building Brick (solid masonry units made from clay or shale)
 - 6. ASTM C150 Standard Specification for Portland Cement
 - 7. ASTM C207 Specification for Hydrated Lime for Masonry Purposes
 - 8. ASTM C443 Standard Specification for Joints for Circular Concrete Manhole Sections

Ascarate Park Lift Station and
Sanitary Sewer Improvements

9. ASTM C478 Standard Specification for Precast Reinforced Concrete Manhole Sections
 10. ASTM D4101 Specification for Propylene Plastic Injection and Extrusion Materials
- B. American Concrete Institute (ACI)
1. ACI 318 Building Code Requirements for Reinforced Concrete
 2. ACI 350 R Concrete Sanitary Engineering Structures
- C. American Association of State Highway and Transportation Officials (AASHTO)
1. Standard Specification for Highway Bridges
- D. Occupational Safety and Health Administration (OSHA)
- E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
- 1.05 QUALITY ASSURANCE
- A. All material shall be new and unused, and supplied by a single manufacturer for each product.
 - B. Material quality, manufacturing process, and finished sections are subject to inspection and approval by Engineer or other Owner representative. Inspection may be made at place of manufacture, at worksite following delivery, or both.
 - C. Materials will be examined for compliance with ASTM specifications, these specifications, and approved manufacturer's drawings. Additional inspection criteria shall include: appearance, dimension(s), blisters, cracks, and soundness.
 - D. Materials shall be rejected for failure to meet any specification requirement. Rejection may occur at place of manufacture, at worksite, or following installation. Mark for identification rejected materials and remove from worksite immediately. Rejected materials shall be replaced at no cost to Owner.
 - E. Repair minor damage to precast concrete sections by approved method, if repair is authorized by Engineer.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Manholes shall be El Paso Water Utilities (EPWU) Standard, Type "A1" (48" inside diameter), Type "C" (72" inside diameter) , or Drop Manhole constructed at the locations designated, in accordance with EPWU Standard Details, and as otherwise indicated in the project drawings.
- B. Manholes shall be constructed of pre-cast concrete sections, as herein specified.
- C. Provide lifting lugs or holes in each precast section for proper handling.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

2.02 PRECAST CONCRETE MANHOLE SECTIONS

- A. The manhole riser and conical section shall be designed for sewer installations in the diameter specified or shown. All manhole sections shall have a 5-inch wall thickness with tongue and groove joints. Rings shall be available in various lengths from 6 inches to 4 feet. The conical sections shall be concentric and adapted to the ring at one end and to EPWU standard cast iron frame at the other. The base ring shall have a flat bottom joint. Steps or rungs are not required. Manufacturing of manhole section(s) shall comply with ASTM C476 and any additional specifications listed hereforth:
1. Bottom slab thickness shall be 8-inches thick for depths 0-12 feet and 12-inches thick for depths greater than 12 feet.
 2. Top section shall be a concentric cone placed upon a 48" diameter section as shown in the drawings.
 3. Base, riser and top sections shall have tongue and groove joints.
 4. Sections shall be cured by an approved method, in accordance with referenced standards.
 5. Concrete shall have a minimum 28 day compressive strength of 4,000 psi. Water cement ratio shall be 0.5 or less by weight or not more than 5.5 gallons per sack.
 6. All aggregates fine and coarse other than lightweight aggregate shall conform to specifications outlined by ASTM C33. Aggregates shall be free of deleterious substances causing reactivity with oxidized hydrogen sulfide. Both types of aggregates shall be graded in order to produce a homogeneous concrete mix. All materials are to be accurately weighed at a central batching facility for mixing.
 7. All cement shall be Portland Cement conforming to ASTM C150, Type V (sulfate resistant) for sewer applications. Cement content shall be sufficient to produce a minimum strength of 4,000 psi.
 8. Design precast concrete base, riser, top, and grade ring for a minimum H-20 loading plus earth load. Calculate earth load with a unit weight of 130 pcf.
 9. Mark date of manufacture, name, and trademark for manufacture on the inside of each precast section.
 10. Install precast concrete base as shown on the drawings.
 11. Provide integrally cast knock-out panels in precast concrete manhole sections at locations and with sizes shown on drawings. Knock-out panels shall have no steel reinforcing.
 12. All concrete shall be handled from the mixer or transport vehicle to the place of final deposit in a continuous manner, as rapidly as practicable, and without segregation or loss of ingredients, until (the approved unit operation) is completed. Concrete shall be placed in layers not over two feet deep. Each layer shall be compacted by mechanical internal or external vibrating equipment. Duration of the vibration cycle shall be limited to the time necessary to produce satisfactory consolidation without causing objectionable segregation.
 13. Concrete may be heated in the mold after the initial set has taken place. The temperature shall not exceed 160 degrees and shall be raised from normal ambient temperature at a rate not to exceed 40 degrees per hour. The cured unit shall not be removed from forms until sufficient strength is obtained for the unit to withstand any structural strain that may be subjected during the form stripping operation. After the stripping of forms, further curing by means of water spraying or a membrane curing compound may be used and shall be of a clear or white type, conforming to ASTM C309.

Ascarate Park Lift Station and Sanitary Sewer Improvements

14. Reinforcing steel shall be as outlined in ASTM C478 and any additional specifications herein. The minimum steel area or 0.12 square inches shall apply to both risers and cone sections and the maximum center to center spacing of 6 inches shall apply as well. Placing of wall (the inner half part of the wall with a minimum 1-inch cover) for two lines circular displacement during the pouring operation.
15. Both tongue and groove shall contain a #4 rebar.
16. Lifters shall be designed to handle the imposed weights, and shall be placed per manufacturer's requirements.
17. All joints to be sealed using Ram-Nek joint sealer. Joint sealer to be provided in sufficient quantities by the vendor as part of the manhole section(s). Size shall be per manufacturer's recommendations. Completed joint shall withstand 15 psi internal water pressure without leakage.
18. All manholes shall be internally and externally coated with a 50 MIL coal tar epoxy coating.

2.03 MANHOLE COATING

- A. Concrete and mortar to be dry and clean with all oil, grease, form release agents, curing compounds, sealers, hardeners and other contaminants removed. Verify dryness by testing with "Tape Down Test".
- B. All manholes shall be internally and externally coated with 50 MIL coal tar epoxy coating.

2.04 MANHOLE FRAME AND COVER

- A. Manhole frames and covers shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind which render them unfit for the service for which are intended. Manhole covers and frame seats shall be machined to a true surface. Castings shall be thoroughly cleaned and subject to hammer inspection. Cast iron shall conform to ASTM A48, Class 30.
- B. No holes shall be in the cover, but edge notches for embedded rings shall be used for lifting. Mating surfaces shall be machined to assure a snug fit of the cover and frame.

2.05 PIPE CONNECTIONS TO MANHOLE

- A. At manholes, a water-tight resilient connection shall be made between the wall and the pipe. This shall be accomplished by use of a manhole water stop adaptor such as Indiana Seal Manhole Adaptor, Kor-N-Seal, or approved equal, meeting the requirements of ASTM C923. The connector must be compatible to both the type of pipe wall and manhole wall, and shall be installed in strict accordance with recommendations of the contractor manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Manhole Installation

1. The manholes shall be constructed at the location shown on the plans or as directed by the Engineer and in accordance with the details shown on the plans and as specified herein. After the excavation has been completed, the concrete base or bottom shall be poured. When the concrete has sufficiently set, the riser work may proceed. After the manhole riser has been completed, the invert shall be neatly formed in the bottom of the manhole with concrete. The invert shall have a true curve of as large a radius as the size of the manhole will permit and shall be given a smooth trowel finish. Manhole inverts containing

Ascarate Park Lift Station and Sanitary Sewer Improvements

sewer pipe passing through with no change in direction may be formed by using up to ½ of the pipe line diameter (pipe spring line) as the channel. Concrete will be placed around the pass-through pipeline, and a bench formed above the pipe sloping at ¼ -inch per foot toward the pipe.

2. The subgrade under manhole bases shall be compacted to 95 percent density in accordance with ASTM D1557. Compaction limits shall be one foot beyond the perimeter of the concrete base and shall be a minimum of one foot in depth.
3. Drop connections shall be constructed when sewer entering a manhole is more than 30- inches above the invert.
4. Set precast concrete barrel sections and structures plumb with a ¼-inch maximum out of plumb tolerance allowed. Seal joints of precast barrel sections as specified. Fill the outside and inside joint with non-shrink mortar and finished flush with the adjoining surfaces. Caulk the inside of any leaking barrel section joint with non-shrink grout to the satisfaction of the Engineer.
5. Allow joints to set for **24** hours before backfilling.
6. Plug holes in the concrete barrel sections required for handling with a non-shrinking grout or non-shrinking grout in combination with concrete plugs. Finish flush on the inside.
7. Cut holes in precast sections to accommodate pipes prior to setting manhole sections in place to prevent jarring which may loosen the mortar joints.
8. All manholes that shall be internally and externally coated with a 50 MIL Coal Tar Epoxy or Chevron Industrial Membrane.
9. Backfill carefully and evenly around manhole sections.
10. Manholes installed inside farmland shall be buried above flow depth, typically 18"-36" in height. Contractor shall provide a green painted concrete marker post at the right-of-way with an offset distance shown to the center of the manhole location. A tractor tire painted green shall be placed around manhole to protect manhole.

B. Manhole Pipe Connections

1. Construct manhole pipe connections, including any pipe stubs, as specified. Close or seal pipe stubs for future connections with a gasketed watertight plug.

C. Setting Manhole Frame and Cover

1. Set manhole covers and frames in a full mortar bed. Utilize grade rings, a maximum of eight- inches thick, to assure frame and cover are set to the finished grade. Set manhole frame and cover to final grade prior to permanent paving.

3.02 LEAKAGE TESTS

- A. Test each manhole for leakage. Engineer shall observe each test. Manholes shall be tested separately and independently of sewer lines they are attached to.

A. Vacuum Test

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- a. Vacuum testing in accordance with ASTM C1244.
- B. Test each manhole for leakage. Engineer shall observe each test.
- C. A complete write up on the vacuum testing procedure shall be presented to the Engineer for review prior to commencing any manhole testing.

3.03 CLEANING

- A. Thoroughly clean all new manholes of all silt, debris, and foreign matter of any kind, prior to final inspection.

END OF SECTION 02605

SECTION 02622 – POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE AND FITTINGS

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, and equipment, tools, superintendence, and incidentals required for the complete construction of the work shown on the drawings and as specified herein.

1.02 RELATED WORK

- A. Section 02315 – Excavating, Backfilling, and Compaction for Utilities
- B. Section 02235 – Granular Fill Material
- C. Section 02605 – Manholes
- D. Section 02600 – Schedule of Pipe

1.03 SUBMITTALS

- A. Submit no more than 15 days after receipt of the Notice of Award the name of the pipe and fittings suppliers and manufacturers, and a list of materials to be furnished. All pipe shall be manufactured in the United States.
- B. The gravity sewer lines of the project were designed with a Manning "n" factor of 0.013. All gravity sewer lines to be furnished and installed for this project shall have an "n" factor of 0.013 or less. Any materials with a known "n" factor of greater than 0.013 will be considered unacceptable for this project. Prior to the manufacturing of any proposed pipe for this project, the manufacturer shall submit adequate information and data substantiating that the pipe proposed for the project has an "n" factor of 0.013 or less. If the Engineer does not believe that the information submitted is adequate to substantiate the required "n" factor of 0.013 or less, the Engineer may at his option require verification testing of the "n" factor. Manufacturer shall have the option of testing existing lines in place with all testing being at no additional cost to the OWNER.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM F794 Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
 - 2. ASTM D1784 Standard Specifications for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 3. ASTM D2241 Poly(Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
 - 4. ASTM D2464 Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
 - 5. ASTM D2729 Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 6. ASTM D3034 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

Ascarate Park Lift Station and
Sanitary Sewer Improvements

7. ASTM D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
 8. ASTM D3212 Joints for Drain and Sewer Plastic Pressure Pipes Using Flexible Elastomeric Seals
 9. ASTM F477 Standard Specifications for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 10. ASTM D2412 Standard Test Method for External Loading Properties of Plastic Pipe by Parallel-Plate Loading.
 11. ASTM D2444 Standard Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Twp (Falling Weight).
 12. ASTM D2152 Standard Test Methods for Degree of Fusion of Extended Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion.
 13. ASTM D2321 Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
 14. ASTM F798 Type PS-46 Poly(Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings
- B. Uni-Bell Recommended Standards Practices
1. UNI-B-3 Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 inch)
 2. UNI-B-9 Recommended Performance Specification for Polyvinyl Chloride (PVC) Profile Wall Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter (Nominal Pipe Sizes 4-48 inch)
 3. UNI-B-10 Recommended Specification for Type PS46 Polyvinyl Chloride (PVC) Plastic Gravity Sewer Pipe and Fittings (Based on Performance Requirements) (Nominal Diameters 4-18 inches)
 4. UNI-B-13 Recommended Standard Performance Specification for Joint Restraint Devices for Use With Polyvinyl Chloride (PVC) Pipe
 5. UNI-PUB-6 Installation Guide for PVC Sewer Pipe
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

1.05 QUALITY ASSURANCE

- A. All PVC pipe and fittings in this section shall be from the same manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in the referenced ASTM standards as applicable. In addition, all PVC pipe to be installed under this Contract may be inspected at the plant for compliance with these specifications by an independent testing laboratory provided by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of plant inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved will be borne by the Owner. The Contractor shall reimburse the Owner for excessive inspection costs. Excessive inspection costs are defined as the costs of inspections of that amount of pipe which exceeds 125 percent of the aggregate length of pipe under this Section.
- B. Inspections of the pipe may also be made by the Engineer or other representative of the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though sample pipe may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

1.06 DELIVERY, STORAGE AND HANDLING

- A. All items shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Engineer.
- B. PVC items deteriorate in sunlight and are slightly brittle, especially at lower temperatures, so care shall be taken in loading, transporting, and unloading items to prevent injury to the items. All items shall be examined before installation and no piece shall be installed which is found to be defective. Handling and installation of pipe and fittings shall be in accordance with the manufacturer's instructions, referenced standards, and as specified herein.
- C. Any pipe or fittings showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
- D. While stored, pipe shall be adequately support off the ground and from below at not more than 3-ft intervals to prevent deformation. The pipe shall be stored in stacks no higher than 2 rows.
- E. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of the sunlight. Temporary shading as required to meet this requirement shall be the responsibility of the Contractor. Covering (Temporary Shading) of the pipe and fittings that allows direct or indirect sunlight will not be permitted.
- F. If any defective item is discovered after it has been installed, it shall be removed and replaced with an exact replacement item in a satisfactory manner by the Contractor, at the Contractor's own expense. All pipe and fittings shall be thoroughly cleaned before installation and the interior shall be kept clean until testing.
- G. In handling the items, use special devices and methods as required to achieve the results specified herein. No uncushioned devices shall be used in handling the item.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE AND FITTINGS

- A. 4" – 6" diameter gravity sewer pipe shall be:
 - 1. Poly(vinyl chloride) PVC plastic solid wall, SDR-35, pipe, with fittings in conformance with ASTM D3034 and ASTM D3212. The minimum pipe stiffness shall meet or exceed 46 psi in conformance with ASTM D2412.
- B. 8" – 12" diameter gravity sewer pipe shall be:
 - 1. Poly(vinyl chloride) PVC plastic solid wall, SDR-35 pipe, with fittings in conformance with ASTM D3034 and ASTM D3212. The minimum pipe stiffness shall meet or exceed 46 psi in conformance with ASTM D2412.
 - 2. Poly(vinyl chloride) PVC gravity sewer pipe shall be installed according to the manufacturer's recommendations. The pipe shall be furnished in either 13 – feet or 20 – feet standard lengths with no more than 10% variance of the standard length.
- C. All fittings and accessories for sewers shall have bell and/or spigot configuration compatible with the pipe.

PART 3 EXECUTION

3.01 INSTALLATION OF PVC PIPE AND FITTINGS

- A. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-inch per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.
- B. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required. PVC pipe and fittings shall be installed in accordance with requirements of the manufacturer and referenced ASTM standards.
- C. As soon as the excavation is complete to normal grade of the bottom of the trench, bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the drawings. Blocking under the pipe will not be permitted. Bedding shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Trench bedding and backfill shall conform to Sections 02315 and 02316.
- D. All pipe shall be sound and clean before installation. Good alignment shall be preserved during installation. Upon the Engineer's written approval, fittings, in addition to those shown on the drawings, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench.
- E. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a bell shall be beveled to conform to the manufactured spigot end.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- F. The Engineer may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected, marked as such, and immediately removed from the job site.
- G. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be "pulled" or "cramped."
- H. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and the inverts are matched and conform to the required grade. The pipe shall not be driven to grade by striking it.
- I. Special bedding conditions will be required whenever the invert of the pipe is less than 1.5 feet above "Normal Groundwater Table". "Normal Water Table" is defined as the groundwater elevation indicated on the Drawings. For this class of bedding a filter fabric shall be laid along the bottom of a well graded trench. Placing of the bedding material and installation of the pipe shall proceed as described above. The filter fabric shall then be lapped over the top of the bedding material and secured. Once the filter fabric has been secured, trench backfilling may proceed. Filter fabric will be installed with all pipe 8-inches in diameter and greater whenever the Normal Groundwater Table is less than 1.5 feet below the invert of the pipe.
- J. After the fabric has been placed in the trench, the bedding and pipe installation shall proceed as specified herein. Upon completion of the pipe and bedding installation of the fabric shall be lapped over itself a minimum of three feet. The material shall also be lapped a minimum of three feet in the longitudinal direction at the end of one roll and the beginning of the next. Final backfilling shall then occur to the finish grade. The Contractor shall follow the recommendations of the manufacturer for installation of the fabric.
- K. Precautions shall be taken to prevent flotation of the pipe in the trench.
- L. When moveable trench bracing such as trench boxes, moveable sheeting, shoring, or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring, or plates shall not be allowed to extend below top of the pipe. As trench boxes, moveable sheeting, shoring, or plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be re-compacted to provide uniform side support for the pipe.

3.02 JOINTING POLYVINYL CHLORIDE (PVC) SEWER PIPE AND FITTINGS

- A. PVC sewer pipe and fittings shall be jointed in accordance with the recommendations of the latest ASTM Standards and detailed instructions of the manufacturer. (The pipe manufacturer shall furnish all appropriate installation information).
- B. All manhole connections shall be as shown on the Drawings except that concrete and mortared connections shall be equipped with an integral O-ring or other sealant such that a positive watertight seal is established.

3.03 SEWER TESTING

- A. General

Ascarate Park Lift Station and Sanitary Sewer Improvements

1. Test the first section of pipeline as soon as it is installed to demonstrate that the work conforms to this Section. The initial test section shall not be less than 500-ft and not more than 1000-ft of pipeline.
2. Testing of pipe shall closely follow pipe laying.

B. Infiltration Test

1. Infiltration testing of all gravity sewer lines installed below groundwater level is mandatory, and the Contractor shall conduct a Zero-Leakage test on those lines. There will be zero tolerance for any infiltration leakage into the sewer lines and manholes. If the sewer line is beneath a roadway, the testing shall be conducted prior to resurfacing the roadway.
2. Prior to testing the sewer line for infiltration leakage all dewatering shall be discontinued in the area for a minimum of three days. Each section of sewer line to be tested shall be plugged sufficiently to prevent water from entering the line. The test shall be conducted for 48 hours. If at the end of that period there is any evidence of leakage into the sewer line, the Contractor shall correct the problem and re-conduct the test and shall continue to do so until leakage is eliminated.

C. Exfiltration Test

1. Exfiltration tests shall be performed only in instances where groundwater does not exist to an elevation of at least 2 feet above the sewer line.
2. Leakage test by exfiltration shall be made before or after backfilling at the discretion of the Engineer. The length of the pipe to be tested shall be such that the head over the crown at the upstream crown is not less than 2-ft and the head over the downstream crown is not more than 6-ft. The pipe shall be plugged by pneumatic bags or mechanical plugs in such a manner that the air can be released from the pipe while it is being filled with water. Before any measurements are made, the pipe shall be kept full of water long enough to allow the escape of any trapped air to take place. Following this, a test period of at least 1 hour shall begin. Provisions shall be made for measuring the amount of water required to maintain the water at a constant level during the test period.
3. The leakage in the section of pipeline being tested shall be zero.
4. If leakage exceeds the allowable amount, the Contractor shall immediately determine the cause and repair the broken or faulty pipe in a manner satisfactory to the Engineer.

D. Air Testing

1. An air test may be used in lieu of the exfiltration test. If air testing is selected submit the proposed method of testing to the Engineer for approval. Air testing shall be performed in accordance with the procedures described in ASTM C828. The equipment shall be specifically designed and manufactured for testing pipelines with low-pressure air and shall be provided with an air regulator valve or air safety valve set to prevent the air pressure in the pipeline from exceeding 2.6 psig. If the results of the air test are unsatisfactory, perform the exfiltration test as outlined above.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

E. Deflection Test

1. Deflection tests shall be performed on all flexible sewer pipes including cleanouts. A rigid mandrel shall be used to measure deflection for sewer lines. Adjustable or flexible mandrels are prohibited.
2. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of 5 percent of the pipe diameter. If a pipe should fail to pass the deflection test, the problem shall be corrected by the contractor and a second test shall be conducted after the corrected area has been backfilled for at least 30 days. The test shall be conducted without the use of a mechanical pulling device.
3. The mandrel shall be constructed of metal or a rigid plastic that can withstand a 200 psi force without being deformed. The mandrel shall have at least nine runners or more, as long as the number of runners is an odd number. The barrel section of the mandrel shall have a length of at least 75 percent of the inside diameter of the pipe. A proving ring shall be provided and used for each mandrel in use.
4. The rigid mandrel shall have an outside diameter equal to 95 percent of the inside diameter of the pipe. The inside diameter of the pipe shall be the average outside diameter minus two minimum wall thicknesses for OD controlled pipe, and the average inside diameter for ID controlled pipe. All dimensions shall be per appropriate standards. Statistical or tolerance methods shall not be considered in mandrel sizing.

3.04 CLEANING

- A. At the conclusion of the work, the Contractor shall thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other materials which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Engineer will examine the pipes for leaks. If any defective pipes or joints are discovered, they shall be repaired as directed by the Engineer.

END OF SECTION 02622

Ascarate Park Lift Station and
Sanitary Sewer Improvements

SECTION 02830 – ROCK WALLS

PART I - GENERAL

1.1 SCOPE:

- A. This item shall govern the construction of rock walls (aka stone masonry wall) complete with concrete foundations; at locations indicated on the plans.

PART II - PRODUCTS

2.1 STONE

- A. Stone for rock walls shall consist of quarried limestone as nearly uniform in section as is practicable.
- B. Field stone or salvaged stone from rock walls shall be used only where directed by the owners designated representative.
- C. The stone shall be dense, resistant to the action of air and water, clean of old mortar and suitable in all respects for the purpose intended.
- D. River stone will not be allowed.

2.2 MORTAR

- A. Mortar for the rock walls shall consist by volume of one (1) part Portland cement, three and one half (3½) parts of clean, hard, durable sand and one quarter (1/4) part (Mortar) lime thoroughly mixed with water.
- B. Mortar shall have a consistency such that it can be easily handled and spread by trowel.
- C. Mortar shall be Type S, ASTM Specification C270-73. Compressive strength = 1800 p.s.i. (28 days).
- D. The design strength of the mortar mix shall be evaluated by collecting 3-cube specimens for lab curing and testing in accordance with applicable ASTM procedures. At least one set of 3 mortar cubes should be collected for every day of mortar placement or as directed by the project engineer. The mortar specimens should be tested at 7 days (1 cube) and 28 days (2 cubes) for verification of the specified design strength or as directed by the project plans and specifications.

2.3 CONCRETE (ROCK WALLS)

- A. The foundation shall conform to SECTION 03300 CIP CONCRETE.

PART III - EXECUTION

3.1 FOUNDATION WORK (ROCK WALLS)

- A. Prior to placing the concrete foundation, the excavation for the rock walls shall be made to the proper section, and if considered necessary by the Engineer or his/her designated representative, the bottom of excavation shall be hand-tamped and sprinkled.
- B. The excavation area for rock walls shall be moist when the concrete is placed.
- C. Reinforcing steel shall be placed continuously as shown on the plans and properly supported throughout the placement of concrete.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- D. The surface of the concrete shall not be troweled.
- E. The concrete shall be cured to a minimum of 24 hours before any stone or mortar is placed on the foundation.
- F. The concrete shall be cured a minimum of 48 hours before more than 300 pounds per square foot of stone and mortar is placed on the foundation. Contractor shall embed the first four inches of the first layer into the fresh concrete of the footing.

3.2 STONE WORK

- A. Stone, as far as practicable, shall be selected as to size and shape in order to secure fairly large, flat-surfaced stone which may be erected with true and even surface faces and a minimum of exposed mortar.
- B. All stones shall be thoroughly cleaned, water soaked (24 hour minimum), hand placed and embedded in mortar so that no stones shall touch each other or the concrete foundation but shall be firmly bound together with mortar.
- C. The finished surface shall present a neat, clean and workmanlike and true to line of typical sections as shown in the plans.
- D. The interior of the rock wall shall be completely filled with spalls and pieces of the specified stone, completely embedded and surrounded by mortar with no voids.
- E. The spacing between stone shall be no more than 1 inch.

3.3. ERECTION

- A. The erection of the rock wall shall not be more than three feet in height for every 24 hour period to allow time for the lower portions to become sufficiently set. All stones shall be thoroughly wet before being placed in fresh mortar.
- B. The last layer of rock prior to break of construction phase shall not have any mortar on top.
- C. Fresh mortar must be used for continuation of work following erection break.

END OF SECTION 02830

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and contract documents.

1.02 SCOPE

- A. This section of the specifications covers all of the work required for constructing concrete curbs, headers, sidewalks, driveways, manhole bases, valve cover aprons, splash boxes, channels, cast-in-place manholes, thrust collars and other miscellaneous work.
- B. Concrete for this project shall conform to the requirements of this section. The Contractor shall furnish all materials, equipment, tools, labor, superintendence, and incidentals necessary to perform the work in accordance with the drawings and these specifications.

1.03 GOVERNING REFERENCE SPECIFICATIONS

- A. The latest editions of the following specifications and references govern work of this section and constitute minimum requirements. Where specific requirements in this section of the Specifications are more stringent, they shall supersede the corresponding requirements of these Referenced Specifications.

1.04 American Concrete Institute (ACI)

- A. ACI 301 Specifications for Structural Concrete Buildings
- B. ACI 301 Manual of Standard Practice for Detailing Reinforced Concrete Structures
- C. ACI 318 Building Code Requirements for Reinforced Concrete
- D. ACI 347 Recommended Practice for Concrete Formwork
- E. ACI 613 Recommended Practice for Concrete Formwork
- F. ACI 614 Recommended, Practice for Measuring, Mixing, and Placing Concrete
- G. ACI 621 Comm.Selection and Use of Aggregates for Concrete
- H. SP-7 ACI Manual of Concrete Inspection

1.05 American Society for Testing Materials (ASTM)

- A. ASTM A-82 Cold Drawn Steel Wire for Concrete Reinforcement
- B. ASTM A-615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- C. ASTM A-616 Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
- D. ASTM A-706 Low-Alloy Steel Deformed Bars for Concrete Reinforcement
- E. ASTM C-31 Making & Curing Concrete Compression and Flexure Test Specimens in the Field.
- F. ASTM C-33 Concrete Aggregates
- G. ASTM C-39 Compressive Strength of Molded Concrete Cylinders
- H. ASTM C-40 Organic Impurities In Fine Aggregates for Concrete
- I. ASTM C-42 Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- J. ASTM C-94 Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- K. ASTM C-136 Standard Method of Test for Sieve or Screen Analysis of Fine and Coarse Aggregate
- L. ASTM C-138 Standard Method of Test for Weight per Cubic Foot, Yield and Air Content (Gravimetric) of Concrete

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- M. ASTM C-143 Standard Method of Test for Slump of Portland Cement Concrete
- N. ASTM C-150 Standard Specification for Portland Cement
- O. ASTM C-171 Sheet Material for Concrete Curing
- P. ASTM C-172 Standard Method of Sampling Fresh Concrete
- Q. ASTM C-173 Air Content of Freshly Mixed Concrete by the Volumetric Method
- R. ASTM C-192 Standard Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Laboratory
- S. ASTM C-231 Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method
- T. ASTM C-260 Air-Entraining Admixture for Concrete
- U. ASTM C-309 Liquid Membrane-Forming Compounds for Curing Concrete
- V. ASTM C-494 Chemical Admixtures for Concrete
- W. ASTM C-618 Fly Ash and Raw od Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete

1.06 Portland Cement Association (PCA)

- A. Design and Control for Concrete Mixtures

1.07 American Welding Society (AWS)

- A. AWS D12.1 Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction

1.08 Latest Edition of each of the above Governing Standards shall apply

1.09 EXCAVATION AND GRADING

- A. Excavation or filling for concrete structures and other miscellaneous concrete work shall conform to the lines and grades as shown on the plans or as established in the field and shall be as specified in the contract documents and/or County of El Paso standards.

PART 2 - PRODUCTS

2.01 CEMENT

- A. Portland cement shall conform to the latest revisions of A.S.T.M. Designation C-150, Type II, and shall be of an approved brand. Only one brand of cement will be permitted in any one structure. Plant tests and certificates of conformity with the specification shall be furnished with each carload of cement.

2.02 FINE AGGREGATE

- A. Fine aggregate shall consist of hard, strong, durable and uncoated particles of natural sand, washed and screened. The aggregate shall be free from injurious amounts of clay, soft or flaky materials, loam or organic impurities and the grading shall conform to the following:

Ascarate Park Lift Station and
Sanitary Sewer Improvements

Percentage Passing Square Openings

No. 4	No. 16	No. 50	No. 100	No. 200
95-100	45-70	15-30	3-8	0-3

- B. Fineness modulus shall not vary more than plus or minus 0.20 from that of approved sample, which shall be between 2.20 and 2.90.

2.03 COARSE AGGREGATE

- A. Coarse aggregate shall consist of hard, tough, durable and uncoated particles of washed and screened gravel or crushed stone. It shall be free of vegetation, soft, friable, thin, or elongated particles.
- B. Maximum size of coarse aggregate shall be governed by the conditions of placement of the concrete and shall not be greater than 3/4 of the distance between reinforcing bars. In no case shall the maximum size be greater than 2 inches. All aggregates shall be approved before use.

2.04 WATER

- A. Water shall be potable water, clear, free from oil, acid or organic matter and free from injurious amounts of alkali, salts, or other chemicals.

2.05 SHOP DRAWINGS

- A. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required at the openings through structures. Provide full wall and beam elevations of concrete and walls showing all embedments, vertical and horizontal reinforcing and all special reinforcement. Fabrication, bar bending, cutting, etc., shall be in accordance with the requirements as specified herein.
- B. Submit manufacturers product data with application and installation instructions for proprietary materials and items including reinforcement and forming accessories, admixtures, patching compounds, joint systems, bituminous damp-proofing, curing compounds and others as requested by the Engineer. Submit manufacture's certificate of conformance with these Specifications for all proprietary materials and products.

2.06 FORMS

- A. The forms shall be of wood or metal and shall be of sufficient strength to support the concrete without bulging between supports and sufficiently water tight to hold the concrete mortar. The forms shall be constructed such that the finished concrete shall be of the form and dimensions shown on the plans. All form work for exposed surfaces shall be of such material and so constructed as to produce a smooth, even surface when the concrete is placed. All forms shall be oiled before use. In general, wall forms may be removed after the concrete has been in place for 24 hours. All exposed edges shall have a 3/4-inch chamfer whether or not shown on the details. Immediately upon removal of the forms, any honeycombed sections shall be repaired as directed.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

2.07 CONCRETE MIX

- A. Class "A" concrete shall contain not less than 5.5 sacks of cement per cubic yard. No more water shall be used than is required to produce a workable mix and in no case will the water content exceed 5.5 gallons per sack of cement. The proportioning of the constituents of the concrete shall be such as to produce a dense, and workable mixture, and the mix shall be approved before any concrete is placed. A suitable reducing admixture shall be used in proportioning the mix design.
- B. The minimum 28 day compressive strength for Class A concrete shall be 4000 psi.
- C. Pipe embedment concrete shall contain not less than 4 sacks of cement per cubic yard. No more water than 8 gallons of water per sack of cement shall be used. The proportioning of the constituents of the concrete shall be such as to produce a dense and workable mixture, and the mix shall be approved before any concrete is placed.
- D. Cement Stabilized Backfill for backfill stabilization shall contain a minimum 2 sacks of cement per cubic yard. No more water than 10 gallons per sack of cement shall be used.

PART 3 - EXECUTION

3.01 MIXING

- A. All aggregates shall be accurately weighed or measured by volume. The concrete shall be mixed in an approved batch mixer equipped with an accurate water measuring tank, and shall be mixed for one and one half minutes after all materials are in the mixer. "Ready Mixed" or "Transit Mix" concrete may be used. If used, it shall conform to these specifications and the "Standard Specifications for Ready Mixed Concrete", A.S.T.M. Serial Designation C 94.
- B. Each mixer and agitator shall have attached thereto in a prominent place, a metal plate or plates on which are plainly marked, for the various uses for which the equipment is designed, the capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum, blades or paddles. Stationary mixers shall be equipped with an acceptable timing device that will not permit the batch to be dispatched until the specified mixing time is elapsed. Truck mixers, shall be equipped with means by which the number of revolutions of the drum blades, or paddles may be readily verified.
- C. The mixer, when loaded to capacity, shall be capable of combining the ingredients of the concrete within the specified time into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactorily degree of uniformity. No mixer or agitator shall be used if the results of slump tests of individual samples taken at approximately the one quarter, and the three quarter points of the placement differ by more than 2-inches. Mixers and agitators shall be inspected frequently for changes in condition due to accumulations of hardened concrete or mortar, or to wear of blades.
- D. Truck mixers shall have adequate water supply and metering devices. No water can be added to the concrete after the initial mixing without the permission of the Engineer.
- E. After mixing, the concrete shall be transported to the forms in a manner, which will prevent separation or segregation of the aggregates and shall be placed without undue delay. It shall be deposited as nearly as practicable in its final position in order to avoid rehandling or flowing of the concrete. As the concrete is placed, it shall be vibrated by means of a vibrator of the type, which is submerged in the concrete.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

- F. Mixing at mixing speed shall begin immediately after all ingredients are in the mixer. For complete mixing in the truck, each batch shall be mixed not less than 70 or more revolutions of the drum. For partial mixing in the truck each batch shall be mixed not less than 50 or more than 100 revolutions of the drum. Mixing speed shall be as designated by the manufacturer. All revolutions after the prescribed mixing time shall be at agitating speed. The agitating speed shall be not less than one or nor more than four revolutions per minute. The drum shall be kept in continuous motion from the time mixing is started until the discharge is completed.
- G. The maximum time interval between the introduction of the mixing water to the cement and aggregates, and the placing of the concrete in the forms shall not exceed the following:

AIR OR CONCRETE TEMPERATURE (Whichever is Higher)	MAXIMUM TIME
90 degrees F. or above (Air Only)	45 minutes
75 degrees F. to 89 degrees F.	60 minutes
35 degrees F. to 74 degrees F.	90 minutes

- H. Concrete shall not be placed when the ambient temperature is less than 40 degrees Fahrenheit and falling, but may be placed if the temperature is 40 degrees Fahrenheit and rising. Concrete shall not be placed when the temperature will drop below 35 degree Fahrenheit within 24 hours after placement as projected by the National Weather Service unless properly protected. The temperature of the concrete at the time of placement in the forms shall not be less than 50 degrees Fahrenheit nor more than 90 degrees Fahrenheit. When placing concrete in freezing weather, means shall be provided for keeping the concrete at a temperature of at least 50°F for not less than 72 hours after placing or until the concrete has thoroughly hardened. Concrete shall not be placed when weather conditions are unsuitable for such work.

3.02 TRANSPORTING

- A. Concrete shall be handled from the mixer to the place of final deposit in a manner that will prevent segregation and when practicable, shall be deposited in its final position without rehandling or flowing. All equipment used in transporting concrete shall be maintained in a clean condition. Concrete shall not be delivered from hoists, by spout, by trough, or dumped into carts with a free fall of more than 4 feet. Every precaution shall be taken to prevent separation or loss of ingredients while transporting the concrete. Runways for carts or buggies shall not bear upon the reinforcing or fresh concrete. Pumping and conveying of concrete shall be done only after approval by the Engineer and with equipment that will insure a continuous flow without segregation.

3.03 PLACING

- A. Concrete shall not be placed until all reinforcement is securely and properly fastened in its correct position. Form ties shall be checked and re-tightened where necessary. Forms and reinforcement shall be inspected and approved by the Engineer prior before beginning placement of concrete. All embedded items shall be in place and clean-out openings closed before such inspection. A procedure for inspection of forms reinforcing, inserts, etc., prior to all concrete placement will be instituted and coordinated by the Engineer. At least 24 hours prior to concrete placement the Contractor shall submit an inspection sheet to the Engineer. The inspection sheet, to be developed shall show the location and quantity of concrete to be placed, the time and date schedule for placement and shall be signed by the Contractor's representative. Signing of this sheet will certify that all of the items necessary have been inspected, and that the area is ready for final review by the Engineer. If the

Ascarate Park Lift Station and Sanitary Sewer Improvements

Engineer determines that the corrections are excessive, the placement should be rescheduled and the Engineer notified 12 hours before scheduled placement after the corrections are made. A representative of the Engineer will be on the job during the placement of concrete and concrete shall not be placed unless the Engineer or his representative is present.

- B. Concrete shall be placed in a manner that will prevent segregation, thoroughly embed all reinforcement and fixtures, fill all angles in the forms and prevent formation of aggregate pockets or honeycomb. Placement in walls columns or other deep forms shall be done through openings in the forms, spaced at frequent intervals, or through tremies so that the free fall shall not exceed 4 feet. Points of depositing the concrete shall be spaced so that the concrete surfaces can be kept level without using vibrators or others equipment to cause it to flow into place.
- C. Concrete shall be placed with the aid of approved mechanical vibrating equipment. Vibration shall be applied to the concrete and shall be of sufficient intensity and duration to cause flow or settlement of the concrete, thoroughly compacting, and complete embedment of reinforcement and fixtures. Supplemental forking and spading by hand may be required to secure dense uniform surfaces and complete filling of corners and angles.
- D. Excessive spading or vibrating causing undue water gain or segregation will not be permitted. If moderate working causes excessive water gain the mix shall be adjusted. Excess water shall be removed when it appears. When concrete in floors or slabs are deposited on the ground, the subgrade shall be thoroughly compacted and moistened before placement. A grill tamp shall be used on floor slabs. Completed sections shall conform to the details on the contract drawings and the concrete shall be dense, uniform and free of aggregate pockets or honeycomb.
- E. Concrete in vertical walls shall be placed in continuous horizontal layers approximately 18 inches in depth. Not more than one hour shall elapse between the placing of successive layers of concrete in any portion of a structure included in a continuous placement.
- F. The contractor shall adhere to the requirements ACI 306 and ACI 605 for cold and hot weather concreting respectively.
- G. Concrete shall generally not be placed during high winds with blowing dust that will contaminate the surface and cause entrapment of sand and dust particles in the finished surfaces.
- H. Slump: The slump of all concrete shall be between 3 and 6 inches with the condition governing the exact slump to be used. In all cases the Engineer shall specify the slump to be used prior to placement. When a 3 inch slump is specified, the allowable tolerance shall be 1/2 inch. When the specified tolerance is greater than 3 inches the tolerance shall be 1 inch. In general flat work will require a slump of approximately 3" or more and concrete for vertical members, i.e. walls columns, etc., shall be 5 inches. Slump for concrete to be added to CMU units shall be 6 inches.

3.04 EXPOSED VERTICAL SURFACES

- A. Such surfaces shall have all tie rod holes filled, fins and rough edges removed and all defects removed or patched. Following this the surfaces shall be rubbed with carborundum stones and clean, clear water until a smooth surface, uniform in color and texture has been obtained. This finishing shall be done as soon as is practical after removal of forms. No cement slurry stucco finishing will be permitted.

Ascarate Park Lift Station and
Sanitary Sewer Improvements

3.05 UNEXPOSED VERTICAL SERVICES

- A. Such surfaces shall be finished as specified for exposed vertical surfaces except that no rubbing will be required.

3.06 FLAT SLABS

- A. Flat slabs shall be troweled, after floating, and then lightly brushed to provide a "non-skid" surface.

3.07 EMBEDDED ITEMS

- A. All bolts, pipe, pipe sleeves, inserts or other fixtures required by the plans or these specifications to be embedded in the concrete, shall be set accurately in place and maintained in such positions during concreting operations.

3.08 BAR REINFORCING

- A. Except where plain bars are specifically shown on the plans, all bar reinforcing shall be deformed bars. The deformed bar reinforcing shall conform to the requirements of ASTM A-615 Grade 60. Plain steel bars including 1/4 inch diameter bars shall conform to the requirements of ASTM A-307, grade 60. Weldable reinforcing bars shall conform to ASTM-A-706.

3.09 WELDED WIRE FABRIC

- A. Welded wire fabric shall be as designated on the drawings and shall conform to the requirements of the Texas Department of Transportation.

3.10 STORING REINFORCING

- A. Reinforcing stored at the site shall be protected from accumulation of grease, mud, or other foreign matter and from rust producing conditions. Bars shall be free from loose flaky rust, scale, oil, mud or structural defects when incorporated in the structures.

3.11 FABRICATION AND PLACING

- A. Reinforcement shall be accurately fabricated to the dimensions and shapes shown on the plans in accordance with the ACI Manual of Standard Practice unless variations are specifically shown on the plans.
- B. Reinforcement shall be accurately placed and adequately supported by concrete, metal or other approved chairs, spacers, or ties and shall be secured against displacement. Reinforcement shall be placed in specified positions within the following tolerances:
- C. Depth in structural slabs, flexural members, walls and columns: + 1/4 inch.
- D. Longitudinal location of bends and ends of bars: + 2 inches except that the required concrete cover at ends of members shall not be reduced.
- E. Unless noted otherwise on the Contract Drawings, the concrete cover for reinforcing shall be in accordance with the requirements of the ACI Building Code Requirements for Reinforced Concrete (ACI 318).

Ascarate Park Lift Station and Sanitary Sewer Improvements

- F. Splices shall be made as shown on the Contract Drawings by lapping the bars the required amount and securely wiring them together. Where details of splices are not shown or where unanticipated splices are required, they shall be made in a location approved by the Engineer and the length of lap shall be as required by the ACI Building Code Requirements for Reinforced Concrete (ACI 318).
- G. Reinforcing bars partially embedded in concrete shall not be field bent, except as indicated on the Contract Documents or permitted by the Engineer.
- H. Torch cutting of reinforcing bars will not be allowed.
- I. Mats of wire fabric shall overlap each other sufficiently to maintain a uniform strength and shall be fastened securely at the ends and edges.

3.12 JOINTS

- A. Construction and expansion joints shall be constructed at the locations and in accordance with the details shown on the drawings. If it becomes necessary to stop placement of concrete between joints, or if the Contractor desires for his own convenience to construct joints other than those shown, such joints shall be made only at locations approved by the Engineer and all such joints shall be constructed in accordance with the plans and specifications.
- B. All horizontal joints shown on the plans shall be made truly horizontal and chamfered. Vertical joints shall be truly vertical.
- C. Before concreting operations are resumed at any construction joint, or wherever fresh concrete is to be bonded to hardened concrete, the surface of the hardened concrete shall be cut or chipped to remove laitance and expose aggregate. The surface of the concrete shall be thoroughly cleaned, saturated, then sloshed with a coating of neat cement grout against which the fresh concrete shall be placed before the grout has attained initial set. Care shall be taken to insure that the first layer of new concrete contains sufficient mortar for adequate bond.

3.13 EXPANSION JOINT MATERIALS

- A. Where pre-molded expansion joint material is shown on the plans such material shall be 1/2 inch Bituminous type preformed joint filler, AASHTO M-33.

3.14 JOINT CONSTRUCTION

- A. All joints shall be constructed in a workman like manner with joints truly vertical or horizontal, as required, and at right angles to the axis of the member in which the joint occurs. Expansion joint material shall be accurately positioned and held in position during placement of concrete.

3.15 CURING AND PROTECTING

- A. All concrete work shall be covered with burlap or other suitable material as soon as it has set sufficiently to prevent marking and kept wet continuously for at least five (5) days. Care shall be taken to prevent mechanical injury to concrete work during this period and until the work is accepted. Any work damage prior to acceptance shall be repaired to the satisfaction of the Engineer.

Ascarate Park Lift Station and Sanitary Sewer Improvements

- B. All concrete work shall be protected until such time as it has set up sufficiently to prevent damage by vandals.
- C. In lieu of the above method of curing, the concrete may be cured by applying a liquid membrane coating to all exposed surfaces, provided the materials and method of application are first approved by the Engineer. The coating shall conform to A.S.T.M. Designation C-309.
- D. Suitable means shall be provided to prevent concrete from freezing for not less than 72 hours after placing. Any concrete damaged by freezing shall be removed and replaced by the Contractor at his expense. The addition of any admixture of chemicals to the concrete to prevent freezing shall not be allowed, unless specifically approved by the Engineer.

3.16 DEFECTIVE WORK

- A. Any defective work disclosed after the forms have been removed shall be immediately removed and replaced. If any dimensions are deficient, or if any section is not constructed to the proper grade, or if the surface of the concrete is bulged, uneven, or shows honeycomb, which in the opinion of the Engineer cannot be repaired satisfactorily, the entire section shall be removed and replaced at the expense of the Contractor.

3.17 FORMWORK

- A. Forms may be removed only upon approval by the ENGINEER. In general, removal of wall forms shall not be permitted within 24-hours. Adequate reshoring shall be placed when forms are removed and backfilling is begun, and shall remain in place until the design 28 day compressive strength is attained. The attained strength shall be determined from standard test cylinders molded, cured and broken in accordance with ASTM C31. The strength of the concrete shall be assumed to be the average strength of the two cylinders tested. If the Contractor wishes to determine the strength of the concrete prior to the 28 day tests, the Contractor shall bear the cost as well as the responsibility of obtaining additional cylinders as well as the tests.
- B. It shall be the responsibility of the Contractor, in all form removal, to prevent damage or marring of the concrete surfaces.

3.18 BACKFILLING

- A. Backfill material behind and adjacent to all concrete work shall meet structural fill requirements. This material shall be free from organic material such as leaves, grass, roots and other unsuitable materials and free of rocks or stones. The Contractor shall provide a smooth, even slope between the existing ground and the top of curb or other concrete structure.
- B. Care shall be taken during the backfill and cleanup process not to scrape, chip, crack or otherwise damage the concrete including tire marks from equipment or trucks. Any damaged concrete and/or asphalt will be removed and replaced at the expense of the Contractor.

3.19 PAYMENT

- A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. For items not specifically addressed by unit price per unit nor included in a lump sum price per job, payment shall be included in the Contractor's Bid Price for the work. Such payments shall be complete

Ascarate Park Lift Station and
Sanitary Sewer Improvements

compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

END OF SECTION 03300