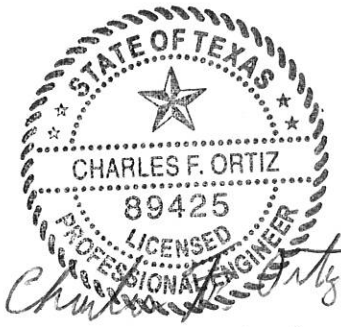
# Laguna Madre Water District

105 Port Road ~ Port Isabel, TX 78578

REQUEST FOR PROPOSALS

Pump Replacement and Miscellaneous Wastewater System Rehabilitation

Bid #: WW-17-07-01




Charles F. Ortiz, P.E.

6-17-2017

June 15, 2017

Laguna Madre Water District
105 Port Road, Port Isabel, TX 78578

**INVITATION TO BID**

**Bid # WW-17-07-01**

Laguna Madre Water District is accepting sealed bids for: 1) Pump Replacement at Lift Stations #16 ~~and #1~~, located at 399 South Shore, Port Isabel, ~~and 804 Mesquite, Laguna Vista, Texas~~, 2) an 8-inch force main tie-in and manhole rehabilitation at LS # 36, 10001 Padre Blvd @ Stables, South Padre Island, 3) manhole replacement at the intersection of Laguna Blvd. & Ling St, South Padre Island, Texas, and 4) fence replacement at Andy Bowie Wastewater Treatment Plant, 6901 Padre Blvd. Detailed specifications and information may be obtained from Charles Ortiz, District Engineer, by calling 956-943-2626, Ext. 130 and/or by viewing our website at http://lagunamadrewater.com/Bids-RFPs-RFQs.

The sealed bids labelled "**Bid # WW-17-07-01: Pump Replacement & Misc. Wastewater System Rehabilitation"** shall be received at the Office of the General Manager until 11:00 a.m. on Thursday, July 6, 2017; at which time bids will be opened. A Pre-Bid Meeting will be held on Tuesday, June 20, 2017, at 2:00 pm at 105 Port Road, Port Isabel, TX, Board Room followed by a field visit to each site.

Bidders are encouraged to attend both the Pre-Bid meeting and the bid opening, but attendance is not mandatory. Envelope for the bid should be addressed as follows:

Bid #: WW-17-07-01
Carlos J. Galvan Jr., GENERAL MANAGER
LAGUNA MADRE WATER DISTRICT
105 PORT ROAD
PORT ISABEL, TX 78578

## II. INSTRUCTION TO BIDDERS

***Notice to Bidders***

Sealed bids will be received until the time, at the location, and for the products/services specified on the attached Bid Invitation form and as further specified. These bids will be publicly opened at the Laguna Madre Water District office at 105 Port Road, Port Isabel, TX, in the presence of bidders and Administrative Staff. Bidder's attendance is optional. After tabulation and review, bids will be presented to the Board of Directors for award of contract. The District reserves the right to review all bids submitted for a period of sixty (60) days after the date of bid opening.

***How to Submit a Proposal***

All bids shall be submitted in ***sealed envelopes,*** mailed or delivered to: Laguna Madre Water District, Attention: Carlos J. Galvan Jr., 105 Port Road, Port Isabel, TX 78578, and plainly marked on the outside with ***bid number:*** It will be the sole responsibility of the bidder to ensure that the proposal reaches the location where bids are to be sent before the closing hour and date shown on the enclosed PROPOSAL-CONTRACT form.

***Purpose of Bid***

The Laguna Madre Water District intends to secure a source of supply for the product(s) and service(s) at the lowest price; satisfactory manufacture; and prompt and convenient shipment and service by the supplier to the District. Any failure on the part of the supplier to comply with the ensuing conditions and specifications shall be reason for termination of contract.

***Rejection of Bids***

The District reserves the right to reject any and all bids or to accept the bid or any part thereof which it determines to best serve the needs of the District and to waive any informalities or irregularities in the bids. While cost is a factor in any bid award, it is not the only factor and may not be the determining factor.

***Quantities***

The quantities or usage shown are estimated only unless otherwise stated. No guarantee or warranty is given or implied by the District as to the total amount that may be or may not be purchased from any resulting contracts. These quantities are for bidders information only and will be used for tabulation and presentation of bid and the District reserves the right to increase or decrease quantities as required.

***Bidding on Equivalent Products***

If and wherever in the specifications a brand name, make, name of manufacturer, trade name, or vendor catalog number is mentioned, it is the purpose of establishing a grade, quality or other specification of material only. Since the District does not wish to rule out other competition and equal brands or makes, the phrase or approved equal is added. However, if a product other than those specified is bid, it is the bidder's responsibility to name such a product within the bid, and to prove to the District that said product is equal to that specified and to submit brochures, samples, and/or other specification in detail on the item(s) bid. The District shall be the sole judge concerning the merits of bids submitted.

***Trade Discounts and Price Variances***

Bids on individual items must include unit prices, as well as total price. Where a variance exists on the bid form between the unit price and the extension or whenever other discrepancies are noted between prices on the bid form and prices quoted elsewhere in the bid package, the unit price quoted on the bid form shall prevail.

The District will consider trade discounts and other pricing features in each individual bid prior to determining the successful bidder.

The District intends to evaluate any and all cooperative purchasing options available. When preparing your bid, please include alternates for cooperative purchasing programs offered by your firm or the manufacturer's that you represent that the District would be eligible to purchase through such as HGAC, and Buyboard, etc. where available.

***Submissions***

Bidders must submit two (2) copies of PROPOSAL-CONTRACT forms.

A. Unless otherwise specified, bidders must use PROPOSAL-CONTRACT forms furnished by the District. Failure to do so may cause a bid to be rejected. Removal of any part of the bid proposal may invalidate the bid.
B. Proposals having any erasures or corrections must be initialed by bidder in ink. Bids shall be signed in longhand, in ink, by the principal authorized to make contracts. All quotations shall be typewritten or filled in with pen and ink.

***Descriptive Data***

Bidders must enclose with their bid forms two copies of data sheets, specifications, catalogs or literature completely describing the equipment, product or service to be furnished.

***Identification of Bidder***

State the full name and address of the organization and any local branches that will be used in the project. Indicate whether you operate as an individual, partnership or corporation. If a joint venture or sub-contractor relationship is contemplated, name the firms and principals involved and give all pertinent information about the organization, similar to the information you supply.

***Assignment of Contract***

The successful bidder shall not assign, transfer, convey, sublet or otherwise dispose of said contract, or his/her right, title or interest in or to same, or any part thereof, without previous consent in writing from the District Administrator, endorsed on or attached to the Contract.

***Service and Parts***

Bidders must be prepared to submit evidence to the District, in addition to that required in the attached specifications, that qualified personnel and adequate parts inventory are available to maintain all bid equipment in effective operation.

***Guarantees/Warranties***

Bidders must indicate the full guarantees and/or warranties prevailing on all equipment, parts and labor.

***Delivery and/or Completion***

Bidders shall indicate delivery or completion date of product(s) or service(s). These dates may be taken into consideration in making the award. Penalties imposed upon the District for late performance, shall be the responsibility of the vendor.

***Manuals, Instructions, Etc.***

Successful bidder must deliver with the product two (2) copies each of operation, shop and parts

manual; instructions and schematics pertaining to the equipment or product to be furnished to the District.

***Samples and/or Demonstrations***
Evidence in the form of samples may be requested if brand is other than specified. Such samples are to be furnished after the date of bid opening only upon request of the District unless otherwise stated in the Bid Documents. If samples should be requested, such samples are to be provided at the expense of the bidder and become the property of Laguna Madre Water District unless other agreement is accepted by the District.

***Quality***
All materials used for the manufacture or construction of any item(s) covered by this bid shall be new. The items bid must be new, the latest model, of the best quality and highest grade of workmanship, unless the option to include supplemental proposals for pre-owned, or demonstrator equipment or materials has been specified by the District.

***Default Provision***
In case of default by the bidder or contractor, the Laguna Madre Water District may procure the products or services from other sources and hold the bidder or contractor responsible for any excess costs occasioned or incurred thereby.

***Compliance with Law***
All goods or equipment bid shall comply with all applicable Federal, State, and local laws relative thereto including all safety related items as required by the Federal Occupational Safety and Health Act (OSHA). The successful bidder shall defend actions or claims brought and hold harmless the District from loss, cost or damage by reason of actual or alleged violations of Federal, State or local law in the design or manufacturing of equipment and/or material.

***Liability Insurance***
The successful bidder must carry Public Liability Insurance with limits of at least $500,000 to protect the Laguna Madre Water District. Said bidder shall comply with the requirements of all Federal and State Laws and Regulations relating to Social Security, Unemployment Insurance and Workmen's Compensation so that the Laguna Madre Water District will not be liable in any way for any claim evolving from said work in carrying out the contract.

***Delivery Provisions***
Bid price is to be based upon the delivery terms of Free on Board to each of the Laguna Madre Water District facilities listed on the specifications sheet. Title to the purchased goods does not pass until the item(s) is received by the District.

***Withdrawal of Bids***
A written request for the withdrawal of a bid or any part thereof will be granted if the request is received by the District Administrator prior to the specified time of opening. Formal bids, amendments thereto, or requests for withdrawal of bids received by the District Budget and Finance Director after time specified for bid opening will not be considered.

***Taxes***
The Laguna Madre Water District is exempt from Federal Excise Tax and Texas Sales Tax and same shall not be charged to the District.

***Hold Harmless Agreement***

The successful bidder shall agree to save and hold harmless and defend the Laguna Madre Water District from and against any or all claims, demands, suits and liability for death or injury to any person or damage to or loss of property, which injury, loss or damage is caused by or arises out of the execution of this contract of agreement.

***Proposal Costs***

All proposal costs are the responsibility of the bidder. Laguna Madre Water District will not be liable for any costs incurred in proposal preparation, presentation or contract negotiation.

***Further Information or Clarification***

Before submitting a proposal, bidder should carefully examine the entire Contract Document, including the specifications, and by the submission of a bid, the bidder will be understood to have read and be fully informed as to the contents of all of the bidding documents. Bidder should especially note any state or federal regulations and/or requirements in bids involving funds from respective agencies and be prepared to adhere to those requirements.

Should a bidder find any discrepancies, omissions, ambiguities, or conflicts among the contract documents, or be in doubt about their meaning, they should bring such questions to the attention of the Laguna Madre Water District, District Engineer no later than five (5) business days prior to the date of the receipt of bids. The Laguna Madre Water District, District Engineer will review the questions and, where information sought is not already indicated or specified, there will be a clarifying Addendum, which will become part of the Bid Documents. Neither the District nor the District Engineer will be responsible for any oral instructions.

Laguna Madre Water District reserves the right to request any additional information that it may deem necessary before or after the proposal has been received. Should you wish to request any additional information or clarification on this bid; you must do so in writing via email or other delivery method that shall be your sole responsibility prior to the opening of the bids. The District shall be the sole determiner of the appropriateness of your request and whether it shall issue a response.

Should the District deem it appropriate to respond to your request for additional information; both your request and the District's response will be provided to the other bidders.

Your request is to be submitted to:

Charles Ortiz, District Engineer
Email: cortiz@lmwd.org
Laguna Madre Water District
105 Port Road
Port Isabel, TX 78578
Ph: (956) 943-2626 Ext. 130

## III. REQUIREMENT AND SPECIFICATIONS

| | |
|---|---|
| Bid Number: | WW-17-07-01 |
| Items Being Bid: | Pump Replacement & Misc. Wastewater System Rehabilitation |
| Pre Bid Meeting: | Tuesday, June 20, 2017 @ 2:00 p.m. |
| Date Bids Due: | Thursday, July 6, 2017 @ 11:00 a.m. |
| Date Bids Opened: | Thursday, July 6, 2017 @ 11:00 a.m. |

### SUMMARY

This specification shall govern all labor, materials, equipment and appliances necessary for : 1) Pump Replacement at Lift Stations #16, located at 399 South Shore, Port Isabel, Texas, 2) an 8-inch force main tie-in and manhole rehabilitation at LS # 36, 10001 Padre Blvd @ Stables, South Padre Island, 3) manhole replacement at the intersection of Laguna Blvd. & Ling St, South Padre Island, Texas, and 4) fence replacement at Andy Bowie Wastewater Treatment Plant, 6901 Padre Blvd.

### SUBMITALS

### LIST OF PRINCIPALS, ASSOCIATES AND/OR EMPLOYEES, WITH CREDENTIALS, THAT WOULD PERFORM WORK ON THE PROJECT.

Provide a list of references (local in the Valley, if any) which have done business with your company in the last three years.

Insurance: The Vendor at his own expense shall purchase, maintain and keep in force such insurance that will protect him from claims set forth below which may arise out of or result from vendors operations under the contract, whether such operations be by himself or by any subcontractor or by anyone directly or indirectly employed by any of them, or by anyone whose acts may be liable:

1. Workmen's compensation claims, disability benefits and other similar employee benefit acts;

2. Claims for damages because of bodily injury, occupational sickness or disease, or death of his employees and insured by usual bodily injury liability coverage;

3. Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees and claims insured by usual bodily injury liability coverage's and;

4. Claims for damages because of injury to or destruction of tangible property, including loss of use resulting there from.

Certificate of Insurance: Before commencing the contract, the successful vendors shall file with the District a valid Certificate of Insurance acceptable to the District. Such Certificate shall contain a provision that coverage afforded under the policies will not be canceled until at least

fifteen days prior written notice has been given to the District.

**REQUIRED INFORMATION**

The responder will need to provide the following:

A time schedule for delivery

The Company's W-9

The bid items shall be delivered FOB at our address

Bidders must submit three references of similar installations

Provide a copy of the liability insurance

**All companies interested in submitting proposals must be knowledgeable and/or familiar with all of the sites described in the previously stated Summary.**

## IV. WW-17-07-01 BID FORM

| | |
|---|---|
| Bid Number: | WW-17-07-01 |
| Items Being Bid: | Pump Replacement & Misc. Wastewater System Rehabilitation |
| Date Bids Due: | Thursday, July 6, 2017 @ 11:00 a.m. |
| Date Bids Opened: | Thursday, July 6, 2017 @ 11:00 a.m. |

| | |
|---|---|
| Vendor Name: | |
| Vendor Phone & Fax: | |
| Vendor Email: | |
| Vendor Address: | |
| City, State, Zip: | |

All equipment on this list or not, shall be serviced by the successful contractor. See Exhibits "A" and "B" for listing of technical specifications, equipment, locations, details, and record drawings.

| Item No. | Description | Quantity | Unit Measure | Unit Cost | Total Cost |
|---|---|---|---|---|---|
| 1 | LS # 16, ABS Model XFP 150GCB1.6 PE 184/5 submersible non-clog wastewater pump or approved equal specified as follows:<br>- Min 24.8 HP motor connected for operation on a 460 volt, 3 phase, 60 hertz electrical supply service<br>- Pump shall be supplied with a factory new mating cast iron six-inch slide bracket designed for the existing single rail system in place at the lift station<br>- Deliver 1,110 U.S. GPM at a total dynamic head of 50 feet, &<br>- Deliver 1,300 U.S. GPM at a total dynamic head of 36 feet<br>- Shutoff head shall be 104 feet (minimum)<br>- Pump unit shall be fitted with a stainless steel lifting assembly, 35 feet long for lifting the pump;.<br>- Equip motor with 49 feet of power and control cable sized in accordance with NEC and CSA standards.<br>- 6" Discharge | 2 | EA | | |
| 2 | LS # 16, Temperature & seal failure relays into control panel | 1 | EA | | |
| 3 | LS # 16, Delivery & Installation | 1 | LS | | |
| | | | Subtotal Lift Station No. 16: | | |

| Item No. | Description | Quantity | Unit Measure | Unit Cost | Total Cost |
|---|---|---|---|---|---|
| 4 | Proposed 8" PVC (SDR 26) Force Main | 83 | LF | | |
| 5 | Proposed 8" x 8" Tee | 1 | EA | | |
| 6 | Proposed 8" Resilient Plug Valve Mueller/Milliken or approved equal | 2 | EA | | |
| 7 | Connect 8-inch Force Main to receiving manhole at LS 36 (MH 36-1) | 1 | LS | | |
| 8 | Manhole 36-1, Cementitious Manhole Restoration and Epoxy Protective Coating | 12 | VF | | |
| 9 | Laguna Blvd & Ling St, SPI – Remove manhole top, Install new fiberglass manhole liner, grout, & install new ring & cover (12' depth), including traffic control, dewatering, and clean-up | 1 | LS | | |
| Subtotal Miscellaneous Wastewater System Rehab: | | | | | |
| 10 | Andy Bowie WWTP, Furnish and Install Chain Link Fence, Height = 6 feet, plus three strands of barbed wire, 9 gauge wire mesh galvanized | 1,540 | LF | | |
| 11 | Andy Bowie WWTP, 20 FT Rolling Gate | 1 | EA | | |
| 12 | Andy Bowie WWTP, 5 FT Pedestrian Gate | 1 | EA | | |
| Subtotal Andy Bowie WWTP Fence Replacement: | | | | | |

Total Bid Amount $_____

Total Bid Amount (Handwritten): $_____

Warranty Period: _____

Estimated Delivery Date: _____

Estimated Installation Date: _____

Warranty information must be submitted with Bid; it will be a factor in evaluation and award of Bid.

Number of days required to deliver / install the pumps after receiving the order will be _____ days. Number of days and/or weeks stated on Bid proposal for complete delivery / installation will be a factor in the evaluation and award of bid.

When delay can be foreseen, successful bidder shall give prior notice to the District. Bidder must keep the District advised at all times of status of order. Default in promised delivery / installation (without acceptable reasons) or failure to meet specifications, authorizes the District to Purchase such sub-pump elsewhere and charge increase cost and handling to defaulting bidder.

Acceptable reasons for delayed delivery / installation are as follows: Acts of God (flood, tornadoes, hurricanes, etc.), Acts of Government (fire, strikes, and war), Actions beyond the control of the

successful bidder.

Note: This proposal will be considered complete once the District tests the pump and makes sure it operates properly and does not leak.

Addendum No. 1: Date: _____ Acknowledged by: _____

Addendum No. 2: Date: _____ Acknowledged by: _____

Company Name: _____

Address: _____

Phone #: _____

Signature: _____

Date: _____

**E X H I B I T "A"**

**LAGUNA MADRE WATER DISTRICT**
**PUMP REPLACEMENT & MISC. WASTEWATER SYSTEM REHABILITATION**
**TECHNICAL SPECIFICATIONS**

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LAGUNA MADRE WATER DISTRICT
SUBDIVISION AND EXTENSION STANDARDS

REQUIREMENTS

1. Utility Bonds: a. Copy of Bonds from subdivision jurisdiction

2. Warranty: a. 1 year from date of project completion

3. Engineering Report: a. Prepared by Professional Engineer b. Trench Safety Report

4. As Built Drawings: a. Furnish and Certified by PE or RPLS
5. Pre Construction Meeting required
6. Notification One Call
7. Testing requirements:
   a. To be complete after all utilities installed
   b. 150 PSI for 2 hours for Water Lines, Hydrostatic Tested
   c. 100 PSI for 2 hours for Force Main Lines, Hydrostatic Tested
   d. 4 PSI for 10 minutes for Sewer Gravity Lines, Air Tested
   e. Water Lines to be Sterilized (HTH) 24 hours, then Flushed, and Bacteriological Tested.
   f. After Bacteriological Test approved, then interconnect to main line.
8. Materials:

a. PIPES:

I. Pipe for Water shall be PVC Class 100 DR 25 or C900 Class 150
II. Pipe for Water Taps shall be Copper Tubing Type K
III. Pipe for Force Main shall be SDR 26 at 160 PSI
IV. Pipe for Gravity Sewer shall be SDR 35 or heavier
V. Identification Marking Tape for all pipelines.

b. TAPS:

I. Tapping Sleeve shall be all stainless steel including bolts and nuts on water and pressure sewer line.
II. Tapping Saddle shall be all brass and bronze bolts and nuts on water and pressure sewer line.

c. VALVES

I. Valves for Water shall be Gate, Epoxy Coated, Resilient Wedge Mueller/Milliken or approved equal.
II. Valves for Sewer shall be Gate, Epoxy Coated, Resilient Plug Mueller/Milliken or approved equal.
III. Check Valves shall be Epoxy Coated Valvematic or approved equal.

d. MANHOLES

I. Fiberglass
II. 32" Covers, Hinged Ductile Pamerex type or approved equal

e. LIFT STATIONS

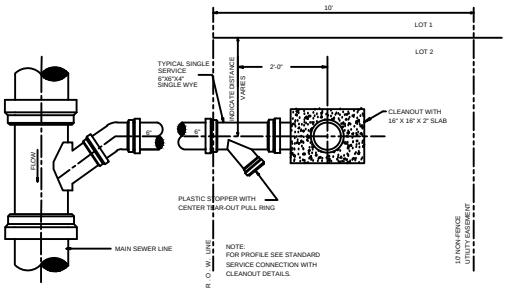
I. Pumps, Flyght, ABS, Ebarra, or approved equal
II. Plug valve and check valve to installed at all private Lift Station and Force Main Connections to be reviewed by Laguna Madre Water District.
III. Wetwells shall be fiberglass with approved 36" or larger cover (as required for pump maintenance).

f. METERS

I. Meters are provided by District paid for by developer
II. Meter box are provided by District on 5/8", 1", and 2" meters.
III. Meter vault must be installed by the developer for 4", 6", 8", 10" meters or larger .

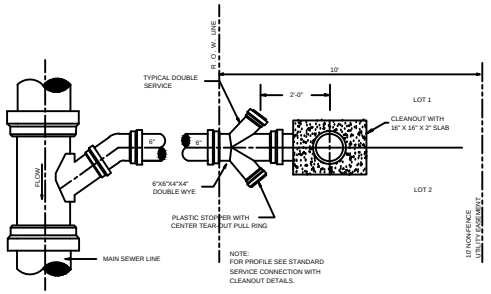
g. BACKFLOW ASSEMBLY

I. Required by District per State regulations on Fireline meters, fire protection meters, irrigations meters, Motel/Hotels over 4 stories high, Restaurants with Fountain Drinks, Assembly tested by Certified Tester when installed and once a year thereafter, report turned in to Backflow Prevention Department at District. Backflow Assembly paid by the developer installed after the meter before any spigot or sink outflow. Backflow Assembly approved by the District on each application.



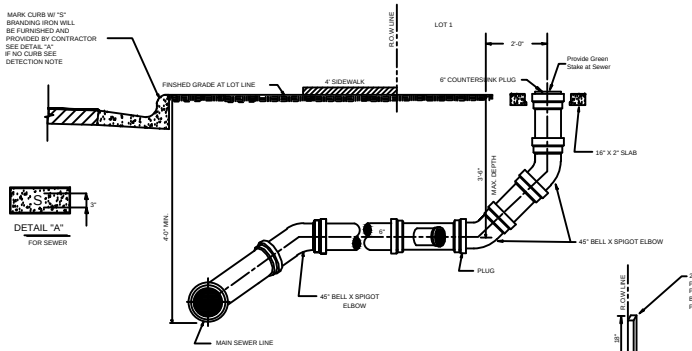

PLAN - SINGLE SERVICE

NOT TO SCALE



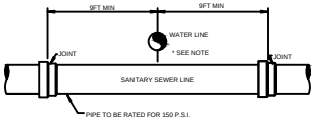

PLAN - DOUBLE SERVICE

NOT TO SCALE




TYPICAL SHORT SERVICE CONNECTION WITH STANDARD CLEANOUT

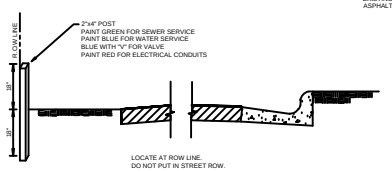
NOT TO SCALE




TYPICAL WATER & SEWER LINE CROSSING

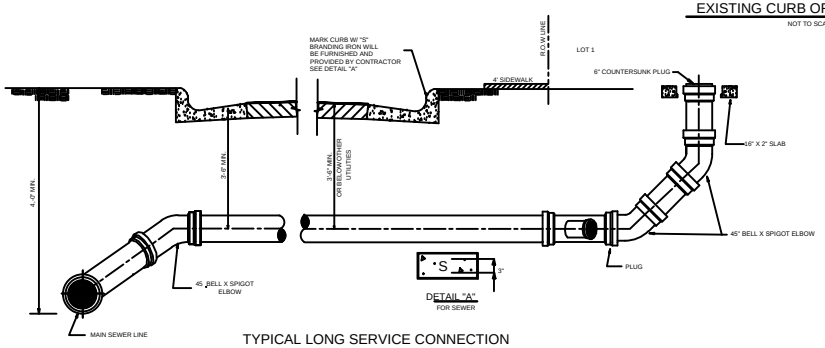
NOT TO SCALE

* NOTE:
1 FT. MIN. ELEVATION SEPARATION BETWEEN WATER AND SEWER MAINS. IF UNABLE, ENCASEMENT REQUIRED. ENCASEMENT CAN BE STEEL CASING OR CONCRETE.



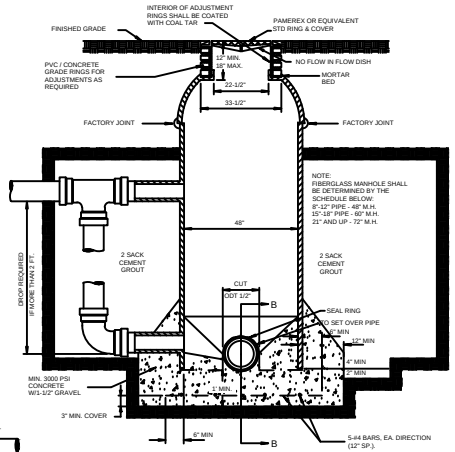

SERVICE MARKING FOR EXISTING CURB OR NO CURB

NOT TO SCALE



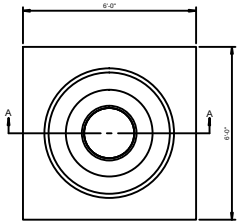

TYPICAL LONG SERVICE CONNECTION WITH STANDARD CLEANOUT

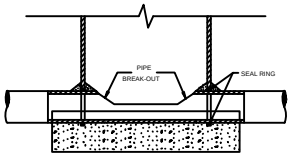
NOT TO SCALE




TYPICAL FIBERGLASS MANHOLE WITH DROP STRUCTURE SECTION A-A

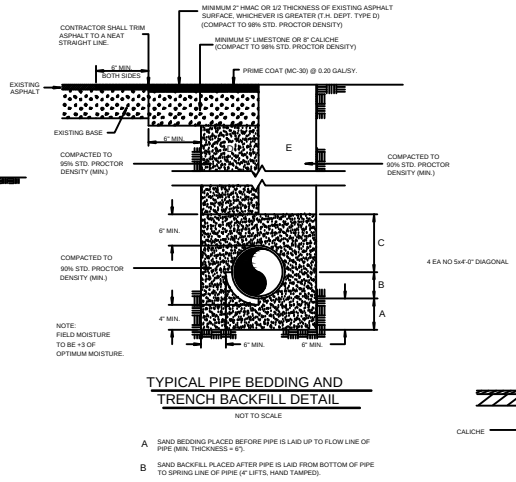
NOT TO SCALE




SECTION B-B

NOT TO SCALE




TYPICAL PIPE BEDDING AND TRENCH BACKFILL DETAIL

NOT TO SCALE

A SAND BEDDING PLACED BEFORE PIPE IS LAID UP TO FLOW LINE OF PIPE (MIN. THICKNESS = 6").

B SAND BACKFILL PLACED AFTER PIPE IS LAID FROM BOTTOM OF PIPE TO SPRING LINE OF PIPE (4" LIFTS, HAND TAMPED).

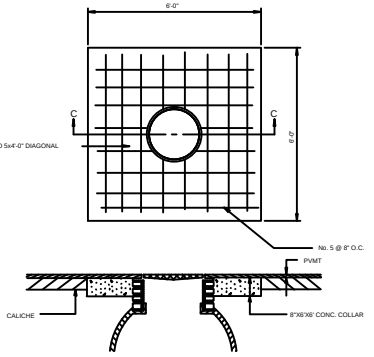
C SAND BACKFILL PLACED FROM SPRING LINE OF PIPE TO 6" ABOVE TOP OF PIPE (6" LIFTS, HAND TAMPED).

D SAND BACKFILL, CLASS "A" (6" LIFTS, MECHANICAL COMPACTION).

E EARTH BACKFILL, CLASS "B" (12" LIFTS, MECHANICAL COMPACTION).

FOUNDATION PREPERATION (WELLPOINTS, GRAVEL OR CEMENT STABILIZATION, OR APPROVED SUBSTITUTE) SHALL BE REQUIRED WHEN TRENCH BOTTOM IS STABLE.

BACKFILL AT STRUCTURES SHALL BE PLACED IN UNIFORM LAYERS, MOISTENED AS REQUIRED TO APPROXIMATE OPTIMUM MOISTURE CONTENT, AND COMPACTED TO 95% STD. PROCTOR DENSITY. THE THICKNESS OF EACH LOOSE LAYER SHALL NOT EXCEED 6". STRUCTURE BACKFILL MATERIAL SHALL BE SAND, APPROVED SITE SOIL, OR OTHER APPROVED.




TYPICAL FIBERGLASS MANHOLE IN PAVEMENT SECTION C-C

NOT TO SCALE

NOTE:
THE ENGINEER/CONTRACTOR SHALL PROVIDE BPUB WITH "CUT-SHEETS" PRIOR TO APPROVAL FOR BEGINNING CONSTRUCTION PROJECTS. THE "CUT-SHEETS" WILL BE USED TO VERIFY PIPE ELEVATIONS.


Laguna Madre Water District
105 Port Road
Port Isabel, Texas 78578
(956) 943-2626
FAX: (956) 943-0827


WASTEWATER DETAILS

LAGUNA MADRE WATER DISTRICT

Scale:
Designed by:
Drawn by:
Checked by:
Approved by:
Project #:
Date:

SHEET

OF

# SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Formwork for cast-in place concrete.
   2. Shoring, bracing, and anchorage.
   3. Form accessories.
   4. Form stripping.

B. Related Sections:
   1. Section 03 20 00 - Concrete Reinforcing.
   2. Section 03 30 00 - Cast-In-Place Concrete.

### 1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 318 - Building Code Requirements for Structural Concrete.
   2. ACI 347 - Guide to Formwork for Concrete.

B. American Forest and Paper Association:
   1. AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association:
   1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

D. ASTM International:
   1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   2. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

E. West Coast Lumber Inspection Bureau:
   1. WCLIB - Standard Grading Rules for West Coast Lumber.

### 1.3 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

### 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347.

B. For wood products furnished for work of this Section, comply with AF&PA.

C. Perform Work in accordance with Cameron County standard.

1.5 COORDINATION

A. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Form Materials: At discretion of Contractor.

2.2 PREFABRICATED FORMS

A. Manufacturers:
   1. Molded Fiber Glass Construction Products.
   2. Sonoco Products Co.
   3. Symons by Dayton Superior.
   4. Wall-Ties & Forms, Inc.
   5. Western Forms.
   6. Substitutions: Approved Equal.

B. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

D. Pan Type: Steel of size and profile required.

E. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use indicated on Drawings.

F. Form Liners: Smooth, durable, grainless and non-staining hardboard, unless otherwise indicated on Drawings.

G. Framing, Studding and Bracing: Stud or No. 3 structural light framing grade.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, fixed length, free of defects capable of leaving holes not larger than 7/8 inch in diameter.
   1. Manufacturers:
      a. Heckmann Building Products, Inc.
      b. Symons by Dayton Superior.
      c. Wall-Ties & Forms, Inc.

d. Substitutions: Approved Equal.

B. Spraders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch (25 mm) of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

C. Form Anchors and Hangers:
1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
3. Penetration of structural steel members is not permitted.

D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture.
1. Manufacturers:
   a. Architectural Concrete Chemicals, LLC
   b. Nox-Crete Products Group
   c. Substitutions: Approved Equal.

E. Flashing Reglets: Galvanized steel, 22 gage thick, longest possible lengths, with alignment splines for joints, non-filled, release tape sealed slots, anchors for securing to concrete formwork.
1. Manufacturers:
   a. Cheney Flashing Company.
   b. Fry Reglet Corporation.
   c. Heckmann Building Products, Inc.
   d. Hohmann & Barnard, Inc.
   e. O'Keeffe's Inc.
   f. W. P. Hickman Systems, Inc.
   g. Substitutions: Approved Equal.

F. Bituminous Joint Filler: ASTM D1751.

G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

H. Water Stops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, 3/8 inch wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.
1. Manufacturers:
   a. Adeka Ultra Seal/OCM, Inc.
   b. BoMetals, Inc.
   c. Greenstreak.
   d. JP Specialties, Inc.
   e. Paul Murphy Plastics Company.
   f. Vinylex Corp.
   g. WESTEC Barrier Technologies, Inc.
   h. Williams Products, Inc.
   i. Substitutions: Approved Equal.

## 2.4 COATINGS

A. Coatings for Aluminum: Polyamide epoxy finish coat with paint manufacturer's recommended primer for aluminum substrate. Apply one coat primer and one coat finish.
   1. Manufacturers:
      a. H&C Concrete Care Products, Sherwin-Williams Company (The).
      b. Increte Systems Inc.
      c. Sauereisen.
      d. Substitutions: Approved Equal.

# PART 3 EXECUTION

## 3.1 EXAMINATION

A. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

B. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

## 3.2 INSTALLATION

A. Earth Forms:
   1. Trench earth forms neatly, accurately, and at least 2 inches wider than footing widths indicated on Drawings.
   2. Trim sides and bottom of earth forms.
   3. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
   4. Form sides of footings where earth sloughs.
   5. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.

B. Formwork - General:
   1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
   2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
   3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
   4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
   5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:
   1. Use steel, plywood or lined board forms.
   2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.

3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

D. Framing, Studding and Bracing:
1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of 2 inches thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement or accidental impact.

E. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 318.

F. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

3.3 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer’s specifications. Do not coat forms for concrete indicated to receive “scored finish”. Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install water stops continuous without displacing reinforcement.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

H. Form Ties:
   1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
   2. Place ties at least 1 inch away from finished surface of concrete.
   3. Leave inner rods in concrete when forms are stripped.
   4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:
   1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
   2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
   3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
   4. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:
   1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
   2. Do not embed wood or uncoated aluminum in concrete.
   3. Obtain installation and setting information for embedded items furnished under other Specification sections.
   4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
   5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:
   1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
   2. Coordinate work to avoid cutting and patching of concrete after placement.
   3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:
   1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
   2. Slope slabs to drain where required or as shown on Drawings.

3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:
   1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
   2. Staking through membrane is not be permitted.

O. Cleanouts and Access Panels:
   1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
   2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

## 3.5 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

## 3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Engineer.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347.

## 3.7 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 318.

B. Camber slabs and beams 1/4 inch per 10 feet.

## 3.8 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Notify Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

C. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

# SECTION 03 20 00 - CONCRETE REINFORCING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Reinforcing bars.
   2. Welded wire fabric.
   3. Reinforcement accessories.

B. Related Sections:
   1. Section 03 10 00 - Concrete Forming and Accessories.
   2. Section 03 30 00 - Cast-In-Place Concrete.

### 1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 318 - Building Code Requirements for Structural Concrete.
   2. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:
   1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   2. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   3. A185 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   4. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
   5. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
   6. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   7. ASTM A704 - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
   8. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   9. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   10. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
   11. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
   12. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
   13. ASTM A996 - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

C. American Welding Society:
   1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:
   1. CRSI - Manual of Standard Practice.
   2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

A. Not Used.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.

B. Prepare shop drawings in accordance with ACI SP-66.

1.5 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months.

1.6 COORDINATION

A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Deformed and Plain Reinforcement: ASTM A706/A706M; 60 ksi yield strength, steel bars, unfinished.

B. Deformed Bar Mats: ASTM A184/A184M; fabricated from ASTM A615/A615M or ASTM A706/A706M; 60 ksi yield strength, steel bars, unfinished.

C. Plain Wire: ASTM A82/A82M; unfinished.

D. Welded Plain Wire Fabric: ASTM A185/A185M; in flat sheets; unfinished.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Stainless steel type; size and shape to meet Project conditions.

D. Reinforcing Splicing Devices: Mechanical threaded type; full tension and compression; sized to fit joined reinforcing.
   1. Manufacturers:

a. Dur-O-Wal; a Hohmann & Barnard company.
b. ERICO International Corporation.
c. Symons by Dayton Superior.
d. Substitutions: Approved Equal.

E. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.3 FABRICATION

A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice.

B. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks, as indicated on Drawings.

C. Form reinforcement bends with minimum diameters in accordance with ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form spiral column reinforcement from minimum 3/8 inch (10 mm) diameter continuous plain bar or wire.

F. Form ties and stirrups from the following:
1. For bars No. 10 and Smaller: No. 3 deformed bars.
2. For bars No. 11 and Larger: No. 4 deformed bars.

G. Weld reinforcement in accordance with AWS D1.4.

H. Galvanized Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI.

I. Locate reinforcement splices not indicated on Drawings, at point of minimum stress.

2.4 SHOP FINISHING

A. Galvanized Finish for Steel Bars: ASTM A767/A767M, Class I, hot dip galvanized after fabrication.

B. Epoxy Coated Finish for Steel Bars: ASTM A934.

C. Epoxy Coated Finish for Steel Wire: ASTM A884; Class A using ASTM A934.

PART 3 EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
1. Do not weld crossing reinforcement bars for assembly except as permitted by Engineer.

B. Do not displace or damage vapor retarder.

C. Accommodate placement of formed openings.

D. Space reinforcement bars with minimum clear spacing of one bar diameter, but not less than 1 inch.
   1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.

E. Maintain concrete cover around reinforcement in accordance with ACI 318 as follows:

| Reinforcement Location | | Minimum Concrete Cover |
|---|---|---|
| Footings and Concrete Formed Against Earth | | 3 inches |
| Concrete exposed to earth or weather | No. 6 bars and larger | 2 inches |
| | No. 5 bars and smaller | 1-1/2 inches |
| Supported Slabs, Walls, and Joists | No. 14 bars and larger | 1-1/2 inches |
| | No. 11 bars and smaller | 3/4 inches |
| Beams and Columns | | 1-1/2 inches |
| Shell and Folded Plate Members | No. 6 bars and larger | 3/4 inches |
| | No. 5 bars and smaller | 1/2 inches |

F. Splice reinforcing in accordance with splicing device manufacturer's instructions.

3.2 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

| Reinforcement Depth | Depth Tolerance | Concrete Cover Tolerance |
|---|---|---|
| Greater than 8 inches | plus or minus 3/8 inch | minus 3/8 inch |
| Less than 8 inches | plus or minus 1/2 inch | minus 1/2 inch |

C. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

3.3 FIELD QUALITY CONTROL

A. Field testing will be performed by Owner's testing laboratory in accordance with ACI 318.

B. Provide free access to Work and cooperate with appointed firm.

C. Reinforcement Inspection:

1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
2. Welding: Inspect welds in accordance with AWS D1.1.
3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
4. Weldability Inspection: Inspect for reinforcement weldability when formed from steel other than ASTM A706/A706M.
5. Continuous Weld Inspection: Inspect reinforcement as required by ACI 318.
6. Periodic Weld Inspection: Other welded connections.

END OF SECTION

# SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes cast-in-place concrete for the following:
   1. Slabs on grade.
   2. Control, expansion and contraction joint devices.
   3. Equipment pads.
   4. Light pole base.
   5. Thrust blocks.

B. Related Sections:
   1. Section 03 10 00 - Concrete Forming and Accessories:
   2. Section 03 20 00 - Concrete Reinforcing.
   3. Section 07 90 00 - Joint Protection.

### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Concrete - Miscellaneous Locations:
   1. Basis of Measurement: By the square foot.
   2. Basis of Payment: Includes concrete, placement accessories, consolidating and leveling, troweling, curing.

### 1.3 REFERENCES

A. American Concrete Institute:
   1. ACI 305 - Hot Weather Concreting.
   2. ACI 308.1 - Standard Specification for Curing Concrete.
   3. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
   1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   3. ASTM C33 - Standard Specification for Concrete Aggregates.
   4. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   5. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   6. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   7. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
   8. ASTM C150 - Standard Specification for Portland Cement.
   9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
   10. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

11. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
12. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
13. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
14. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
15. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
16. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
17. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
18. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
19. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 SUBMITTALS

A. Design Data:
   1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
      a. Hot and cold weather concrete work.
      b. Air entrained concrete work.
   2. Identify mix ingredients and proportions, including admixtures.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.

B. Conform to ACI 305 when concreting during hot weather.

C. Conform to ACI 306.1 when concreting during cold weather.

D. Acquire cement and aggregate from one source for Work.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.

1.8 COORDINATION

A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

B. Normal Weight Aggregates: ASTM C33.
   1. Coarse Aggregate Maximum Size: In accordance with ACI 318.

C. Water: ACI 318; potable, without deleterious amounts of chloride ions.

2.2 ADMIXTURES

A. Manufacturers:
   1. Axim Italcementi Group, Inc.
   2. BASF Construction Chemicals - Building Systems.
   3. Cortec Corporation.
   4. Euclid Chemical Company (The).
   5. General Resource Technology.
   6. Grace Construction Products; W.R. Grace & Co. -- Conn.
   7. Green Umbrella.
   8. Sika Corporation.
   9. Substitutions: Section 01 60 00 - Product Requirements.

B. Air Entrainment: ASTM C260.

C. Chemical: ASTM C494.

D. Fly Ash: ASTM C618 Class C.

E. Silica Fume: ASTM C1240.

2.3 ACCESSORIES

A. Bonding Agent: Polymer resin emulsion.
   1. Manufacturers:
      a. Euclid Chemical Company (The).
      b. Meadows, W.R.,Inc.
      c. Metalcrete Industries.
      d. QUIKRETE.
      e. Sika Corporation.
      f. Substitutions: Approved Equal.

B. Non-Shrink Grout: ASTM C1107/C1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days manufactured by QUIKRETE.
   a. Substitutions: Approved Equal.

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler: ASTM D994; Asphalt impregnated fiberboard or felt, 1/4 inch thick; tongue and groove profile.

B. Expansion Joint Devices: ASTM B221 alloy, extruded aluminum; resilient elastomeric filler strip with Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; cover plate, of longest manufactured length at each location, flush mounted.

C. Sealant: ASTM D6690, Type I.

2.5 CONCRETE MIX

A. Select proportions for concrete in accordance with ACI 318 trial mixtures.

B. Provide concrete to the following criteria:

| **Class of Concrete** | **Design Strength, Min. 28-day $f'_c$ (psi)** | **Coarse Aggregate Grades** | **General Usage** |
|---|---|---|---|
| A | 3,000 | 467, 57 | Curb & gutter, sidewalks, driveways |
| B | 2,000 | 467, 57, 67, 7 | Riprap, small roadside signs, Pipe Block Fill, Thrust Block |

| Material and Property | Measurement |
|---|---|
| Compressive Strength (7 day) | 2,400 psi (Class A)<br>1,600 psi (Class B) |
| Compressive Strength (28 day) | 3,000 psi (Class A)<br>2,000 psi (Class B) |
| Cement Type | ASTM C150 |
| Cement Content (minimum) | 460 pounds/cu yd |
| Aggregate Type | Normal weight |
| Water-Cement Ratio (maximum) | 0.60 by weight |
| Air Content | Moderate Exposure plus or minus 1.5 percent |
| Slump | 5inches plus or minus 1 inch |

**Coarse Aggregate Gradation Chart**

| Aggregate Grade No. | Nominal Size | Percent Passing on Each Sieve | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2” | 1-1/2” | 1” | ¾” | ½” | 3/8” | No. 4 | No. 8 |
| 467 | 1-1/2” | 100 | 95-100 | | 35-70 | | 10-30 | 0-5 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 57 | 1” | | 100 | 95-100 | | 25-60 | | 0-5 | |
| 67 | 3/4” | | | 100 | 90-100 | | 20-55 | 0-10 | 0-5 |
| 7 | 3/8” | | | | 100 | 90-100 | 40-70 | 0-15 | 0-5 |

**Air Entrainment**

| Nominal Maximum Aggregate Size, in. | % Air | |
|---|---|---|
| | Moderate Exposure | Severe Exposure |
| 3/8 | 6 | 7-1/2 |
| 3/4 | 5 | 6 |
| 1 | 4-1/2 | 6 |
| 1-1/2 | 4-1/2 | 5-1/2 |

C. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Engineer.
   1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
   2. Do not use calcium chloride nor admixtures containing calcium chloride.
   3. Use set retarding admixtures during hot weather.
   4. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing.

D. Average Compressive Strength Reduction: Not permitted.

E. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94/C94M.

F. Site Mixed Concrete: Mix concrete in accordance with ACI 318.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Verify requirements for concrete cover over reinforcement.

B. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

### 3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Remove debris from formwork, reinforcement, and concrete substrates.

D. Remove water from areas receiving concrete before concrete is placed.

## 3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 318.

B. Notify testing laboratory and Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, and formed expansion and contraction joints are not disturbed during concrete placement.

D. Separate slabs on grade from vertical surfaces with 1/4 inch thick joint filler.

E. Extend joint filler from bottom of slab to within 1/4 of finished slab surface. Conform to Section 07 90 00 for finish joint sealer requirements.

F. Install construction joint devices in coordination with pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

G. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor finish.

H. Install joint covers in longest practical length, when adjacent construction activity is complete.

I. Deposit concrete at final position. Prevent segregation of mix.

J. Place concrete in continuous operation for each panel or section determined by predetermined joints.

K. Consolidate concrete.

L. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

M. Place concrete continuously between predetermined expansion, control, and construction joints.

N. Saw cut joints within 12 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.

O. Screed slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft.

## 3.4 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure concrete in accordance with ACI 308.1 using method.

D. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 7 days.

E. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

3.5 FIELD QUALITY CONTROL

A. Field testing will be performed by Owner's testing laboratory in accordance with ACI 318.

B. Provide free access to Work and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to testing firm for review prior to commencement of Work.

D. Concrete Inspections:
   1. Continuous Placement Inspection: Inspect for proper installation procedures.
   2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

E. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.
   3. Sample concrete and make one set of three cylinders for every 150 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area for slabs and walls.
   4. When volume of concrete for any class of concrete would provide less than 5 sets of cylinders, take samples from five randomly selected batches, or from every batch when less than 5 batches are used.

F. Field Testing:
   1. Slump Test Method: ASTM C143/C143M.
   2. Air Content Test Method: ASTM C173/C173M.
   3. Temperature Test Method: ASTM C1064/C1064M.
   4. Measure slump and temperature for each compressive strength concrete sample.
   5. Measure air content in air entrained concrete for each compressive strength concrete sample.

G. Cylinder Compressive Strength Testing:
   1. Test Method: ASTM C39/C39M.
   2. Test Acceptance: In accordance with ACI 318.
   3. Test one cylinder at 7 days.
   4. Test two cylinders at 28 days.
   5. Dispose remaining cylinders when testing is not required.

H. Core Compressive Strength Testing:
   1. Sampling and Testing Procedures: ASTM C42/C42M.
   2. Test Acceptance: In accordance with ACI 318.
   3. Drill three cores for each failed strength test from concrete represented by failed strength test.

I. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

## 3.6 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections in accordance with ACI 318.

## 3.7 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION

# SECTION 07 90 00 - JOINT PROTECTION

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes sealants and joint backing, hollow gaskets, and accessories.

### 1.2 REFERENCES

A. ASTM International:
   1. ASTM C834 - Standard Specification for Latex Sealants.
   2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
   3. ASTM C1193 - Standard Guide for Use of Joint Sealants.
   4. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
   5. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
   6. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

### 1.3 SUBMITTALS

A. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

B. Warranty: Include coverage for installed sealants and accessories failing to achieve watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

### 1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

### 1.5 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

### 1.6 COORDINATION

A. Coordinate Work with sections referencing this section.

PART 2 PRODUCTS

2.1 JOINT SEALERS

A. Manufacturers:
   1. BASF Building Systems.
   2. Dow Corning Corporation.
   3. GE Construction Sealants.
   4. Sherwin-Williams Company (The).
   5. Substitutions: Approved Equal.

B. Products Description:
   1. General Purpose Exterior (Nontraffic) Sealant: Acrylic, solvent release curing; ASTM C920, Grade NS, Class 12-1/2, Uses M, G, and A; single component.
      a. Color: Standard colors matching finished surfaces.
      b. Applications: Use for:
         1) Control, expansion, and soft joints in masonry.
         2) Joints between concrete and other materials.
         3) Joints between metal frames and other materials.
         4) Other exterior nontraffic joints for which no other sealant is indicated.
   2. General Purpose Traffic Bearing Sealant: Polyurethane; ASTM C920, Grade P, Class 25, Use T; single or multi- component.
      a. Color: Standard colors matching finished surfaces.
      b. Applications: Use for exterior pedestrian and vehicular traffic bearing joints.

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify joint openings are ready to receive work.

B. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean and prime joints.

C. Perform preparation in accordance with ASTM C1193.

D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

C. Install bond breaker where joint backing is not used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave.

G. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

H. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

3.4 CLEANING

A. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect sealants until cured.

END OF SECTION

# SECTION 31 05 13 - SOILS FOR EARTHWORK

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Subsoil materials.

B. Related Sections:
   1. Section 31 05 16 - Aggregates for Earthwork.
   2. Section 31 23 17 - Trenching.
   3. Section 32 05 16 - Aggregates for Exterior Improvements.

### 1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

C. Texas Department of Transportation
   1. ITEM 132 – EMBANKMENT, TXDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004
   2. ITEM 400 – EXCAVATION AND BACKFILL FOR STRUCTURES, TXDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004

### 1.3 SUBMITTALS

A. Materials Source: Submit name of imported materials source.

### 1.4 QUALITY ASSURANCE

A. Furnish each subsoil material from single source throughout the Work.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

A. Granular Fill Type A: Conforming to Texas Department of Transportation standard specifications, Item 132. Granular material that is free from vegetation or other objectionable material and meets the requirements of Table 1.

**Table 1**
**Testing Requirements**

| Property | Test Method | Specification Limit |
|---|---|---|
| Liquid Limit | Tex-104-E | $\leq$ 45 |
| Plasticity index (PI) | Tex-106-E | $\leq$ 15 |
| Bar linear shrinkage | Tex-107-E | $\geq$ 2 |

1. The Linear Shrinkage test only needs to be performed as indicated in Tex-104-E.

B. Subsoil Type B: Conforming to Texas Department of Transportation standard specifications, Item 132.
   1. Excavated and re-used material.
   2. Graded.
   3. Materials such as rock, loam, clay, or other approved materials.
   4. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
   5. Conforming to ASTM D2487 Group Symbol(s) CL, GW, SW, GP, SP, GM, SM, GC, SC, and/or dual classifications.

2.2 SOURCE QUALITY CONTROL

A. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698. ASTM D4318. ASTM C136.

B. Testing and Analysis of Topsoil Material: Perform in accordance with ASTM D698. ASTM D4318. ASTM C136.

C. When tests indicate materials do not meet specified requirements, change material and retest.

D. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate subsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for subsoil materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for subsoil materials from site.

3.2 STOCKPILING

A. Stockpile materials on site.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Stockpile topsoil 8 feet high maximum.

E. Prevent intermixing of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

G. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

# SECTION 31 05 16 - AGGREGATES FOR EARTHWORK

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Coarse aggregate materials.
   2. Fine aggregate materials.

B. Related Sections:
   1. Section 31 05 13 - Soils for Earthwork: Fill and grading materials.
   2. Section 31 23 17 - Trenching.
   3. Section 32 05 16 - Aggregates for Exterior Improvements
   4. Section 33 34 00 – Sanitary Utility Sewerage Force Mains.

### 1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

### 1.3 SUBMITTALS

A. Not Used.

### 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Texas Department of Transportation standard.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Coarse Aggregate Type A: Conforming to Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004. Use Tex-100-E material definitions.
   1. Material: Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source. Do not use gravel or multiple sources.

B. Coarse Aggregate Type B: Conforming to Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004. Use Tex-100-E material definitions.
   1. Material: Crushed or uncrushed gravel. Blending of 2 or more sources is allowed.

C. Coarse Aggregate Type C: Conforming to Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004. Use Tex-100-E material definitions.
   1. Material: Crushed gravel with a minimum of 60% of the particles retained on a No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I. Blending of 2 or more sources is allowed.

D. Coarse Aggregate Type D: Conforming to Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004. Use Tex-100-E material definitions.
   1. Material: Type A material or crushed concrete. Crushed concrete containing gravel will be considered Type D material. Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.

E. Coarse Aggregate Type E: Conforming to Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004. Use Tex-100-E material definitions.
   1. Material: Aggregate as shown on plans.

2.2 FINE AGGREGATE MATERIALS

A. Fine Aggregate: Conforming to Texas Department of Transportation standard.

B. Granular Fill Type A: Conforming to Texas Department of Transportation standard specifications, Item 132. Granular material that is free from vegetation or other objectionable material and meets the requirements of Table 1.

**Table 1**
**Testing Requirements**

| Property | Test Method | Specification Limit |
|---|---|---|
| Liquid Limit | Tex-104-E | $\leq$ 45 |
| Plasticity index (PI) | Tex-106-E | $\leq$ 15 |
| Bar linear shrinkage | Tex-107-E | $\geq$ 2 |

1. The Linear Shrinkage test only needs to be performed as indicated in Tex-104-E.

2.3 SOURCE QUALITY CONTROL

A. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698. ASTM D4318. ASTM C136.

B. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698. ASTM D4318. ASTM C136.

C. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 STOCKPILING

A. Stockpile materials on site at locations designated by Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

# SECTION 31 23 17 - TRENCHING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Excavating trenches for utilities in public right of way.
   2. Compacted fill from top of utility bedding to either subgrade elevations or natural ground.
   3. Backfilling and compaction.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Concrete materials.
   2. Section 31 05 13 - Soils for Earthwork: Soils for fill.
   3. Section 31 05 16 - Aggregates for Earthwork: Aggregates for fill.
   4. Section 33 34 00 – Sanitary Utility Sewerage Force Mains.

### 1.2 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Trench Safety
   1. Basis of Measurement: By linear foot along the boundary of the excavation, including manholes and other structures, when trench depth exceeds 5 feet.
   2. Basis of Payment: Includes sheeting, shoring, bracing, or other protection to maintain stability of excavation subsidiary to other Bid Items. No separate pay.

### 1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   3. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

### 1.4 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

### 1.5 SUBMITTALS

A. Not Used.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Type B as specified in Section 31 05 13.

B. Granular Fill: Type A as specified in Section 31 05 13.

C. Concrete: Structural concrete as specified in Section 03 30 00 with compressive strength of 2,000 psi.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
   1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Call Local Utility Line Information service at (800) 344-8377 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control when trenching is performed in public right-of-way. Relocate controls as required during progress of Work.

## 3.3 TRENCHING

A. Excavate subsoil required for utilities to existing tie-ins.

B. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard, measured by volume.

C. Do not advance open trench more than 200 feet ahead of installed pipe.

D. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.

E. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.

F. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.

G. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls can not be sloped, provide sheeting and shoring to protect excavation as specified in this section.

H. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered.

I. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Subsoil Type B and compact to density equal to or greater than requirements for subsequent backfill material.

J. Trim excavation. Remove loose matter.

K. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

L. Remove excess subsoil not intended for reuse, from site.

## 3.4 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

## 3.5 BACKFILLING

A. Backfill trenches to contours and elevations.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.

C. Place material in continuous layers as follows:
   1. Subsoil Fill: Maximum 12 inches compacted depth.
   2. Granular Fill: Maximum 6 inches compacted depth.

D. Employ placement method that does not disturb or damage utilities in trench.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Do not leave more than 50 feet of trench open at end of working day.

G. Protect open trench to prevent danger to the public.

## 3.6 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

## 3.7 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

# SECTION 32 05 16 - AGGREGATES FOR EXTERIOR IMPROVEMENTS

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Coarse aggregate materials.
   2. Fine aggregate materials.

B. Related Sections:
   1. Section 31 05 16 - Aggregates for Earthwork.
   2. Section 31 23 17 - Trenching.
   3. Section 33 34 00 – Sanitary Utility Sewerage Force Mains.

### 1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   2. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction
   3. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   5. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   6. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

### 1.3 SUBMITTALS

A. Materials Source: Submit name of imported materials suppliers.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

### 1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with Texas Department of Transportation standard.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Coarse Aggregate Type A: Conforming to Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004. Use Tex-100-E material definitions.
   1. Material: Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source. Do not use gravel or multiple sources.

B. Coarse Aggregate Type B: Conforming to Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004. Use Tex-100-E material definitions.
   1. Material: Crushed or uncrushed gravel. Blending of 2 or more sources is allowed.

C. Coarse Aggregate Type C: Conforming to Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004. Use Tex-100-E material definitions.
   1. Material: Crushed gravel with a minimum of 60% of the particles retained on a No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I. Blending of 2 or more sources is allowed.

D. Coarse Aggregate Type D: Conforming to Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004. Use Tex-100-E material definitions.
   1. Material: Type A material or crushed concrete. Crushed concrete containing gravel will be considered Type D material. Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.

E. Coarse Aggregate Type E: Conforming to Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted June 1, 2004. Use Tex-100-E material definitions.
   1. Material: Aggregate as shown on plans.

2.2 FINE AGGREGATE MATERIALS

A. Fine Aggregate: Conforming to Texas Department of Transportation standard.

2.3 SOURCE QUALITY CONTROL

A. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D1557. ASTM D4318. ASTM C136.

B. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D1557. ASTM D4318. ASTM C136.

C. When tests indicate materials do not meet specified requirements, change material and retest.

## PART 3 EXECUTION

### 3.1 STOCKPILING

A. Stockpile materials at locations designated by Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

### 3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts.
4. Manual gates and related hardware.
5. Privacy slats.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Fencing:

1. Basis of Measurement: By linear foot to fence height specified, based on specified post spacing.
2. Basis of Payment: Includes posts, rails, tension wire, fabric, accessories, attachments.

B. Post Footings:

1. Basis of Measurement: Each unit footing, to depth specified.
2. Basis of Payment: Includes excavation, concrete placed, finishing. Subsidiary to Fencing paid by linear foot. No separate pay.

C. Gates:

1. Basis of Measurement: Each specified type.
2. Basis of Payment: Includes frame posts, fabric, accessories, hardware.

1.3 REFERENCES

A. ASTM International:

1. ASTM A121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
5. ASTM A491 - Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
6. ASTM A817 - Standard Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire.

7. A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
8. ASTM B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
9. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
10. ASTM F552 - Standard Terminology relating to Chain Link Fencing.
11. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
12. ASTM F626 - Standard Specification for Fence Fittings.
13. ASTM F668 - Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
14. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
15. ASTM F934 - Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
16. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
17. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
18. ASTM F1183 - Standard Specification for Aluminum Alloy Chain Link Fence Fabric.
19. ASTM F1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates.
20. ASTM F1345 - Standard Specification for Zinc - 5% Aluminum -Mischmetal Alloy-Coated Steel Chain-Link Fence Fabric.

B. Chain Link Fence Manufacturers Institute:

1. CLFMI - Product Manual.

## 1.4 SYSTEM DESCRIPTION

A. Fence Height: 6 feet nominal, plus three strands of barbed wire.

B. Line Post Spacing: At intervals not exceeding 10 feet.

C. Fence Post and Rail Strength: Conform to ASTM F1043 quality.

## 1.5 SUBMITTALS

A. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

B. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.

## 1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines.

B. Operation and Maintenance Data: Procedures for submittals.

1.7 QUALITY ASSURANCE

A. Perform installation according to ASTM F567.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

B. Identify each package with manufacturer's name.

C. Store fence fabric and accessories in secure and dry place.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Allied Tube & Conduit.
2. Master Halco
3. Pacific Fence and Wire Company
4. Substitutions: Approved Equal.

2.2 MATERIALS

A. Framing (Steel): ASTM F1083 Schedule 80 galvanized steel pipe, welded construction, minimum yield strength of 25 ksi; coating conforming to ASTM F1043 Type A on pipe exterior and interior.

B. Fabric Wire (Steel): ASTM A392 Class 1 zinc coated steel wire.

C. Barbed Wire: ASTM A121 Coating Type Z, galvanized steel; 12.5 gage thick wire, 3 strands, 4 points at 3 inch oc.

D. Concrete: Type specified in Section 033000.

2.3 COMPONENTS

A. Line Posts: 2.38 inch diameter.

B. Corner and Terminal Posts: 2.88 inch.

C. Gate Posts: 4.5 inch diameter.

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.66 inch diameter for welded fabrication.

F. Fabric: 2 inch diamond mesh interwoven wire, 9 gage thick, top salvage knuckle end closed, bottom selvage knuckle end closed.

G. Tension Wire: 9 gage thick steel, single strand, marcelled, spiraled or crimped, aluminum-coated tension wire conforming to ASTM A824.

H. Tension Band: 2.88 inch thick steel.

I. Tension Strap: 2.88 inch thick steel.

J. Tie Wire: Aluminum alloy steel wire.

## 2.4 ACCESSORIES

A. Caps: Galvanized pressed steel; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.

C. Extension Arms: Galvanized pressed steel, to accommodate 3 strands of barbed wire, single arm, sloped to 45 degrees.

D. Gate Hardware: Fork latch with gravity drop; 3” Bull Dog gate hinges for each leaf.

## 2.5 GATES

A. General:

1. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
2. Factory assemble gates.
3. Design gates for operation by one person.

B. Swing Gates:

1. Fabricate gates to permit 180 degree swing.
2. Gates Construction: ASTM F900 with welded corners. Use of corner fittings is not permitted.

C. Sliding Gates:

1. Framing and Posts: ASTM F1184, Class 2 for internal rollers.
2. Rollers for overhead and cantilever sliding gates: Bearing type. Furnish non-sealed bearings with grease fitting for periodic maintenance.
3. Secure rollers to post or frame without welding.

D. Cantilever Sliding Gates:

1. Fabricate gate leaf frames and tracks of aluminum conforming to ASTM B429 alloy 6063-T6 or as required to meet performance requirements of ASTM F1184.
2. Frame Members: Minimum 2 inches 0.91 lb/ft aluminum tubing welded assembly forming rigid, one piece unit.
3. Install fabric securely stretched and held in center of tubing.
4. Brace cantilever overhang frames with 3/8 inch brace rods. For gate leaf sizes greater than 23 feet, fabricate with additional lateral support rail welded adjacent to top and bottom horizontal rails.
5. Provide minimum overhang for each leaf opening size as follows:

    a. Up to 10'-0" Overhang: 6'-6".
    b. 10'-0" to 14'-0" Overhang:7'-6".
    c. 14'-1" to 22'-0" Overhang:10'-0".
    d. 22'-1" to 30'-0" Overhang:12'-0".

6. Track: Combined, integral track and rail.
7. Rail: Aluminum extrusion; minimum total weight of 3.72 lb/ft; designed to withstand reaction load of 2,000 lbs.
8. Roller Track Assembly: Two swivel type, zinc, die cast trucks having four, sealed lubricant ball bearing wheels minimum 2 inches diameter by 9/16 inches width designed for same reaction load as rail. Provide two side-rolling wheels for each gate leaf to maintain alignment of truck in track.
9. Fasten trucks to post brackets by minimum 7/8 inch diameter, 1/2 inch shank ball bolts.
10. Provide galvanized steel guide wheel assemblies consisting of two rubber wheels of minimum 4 inch diameter with oil-impregnated bearings for each supporting post.
11. Attach guide wheel assembly to post so bottom horizontal member rolls between wheels and permitting adjustment to maintain plumb gate frames and proper alignment.

## 2.6 FINISHES

A. Components and Fabric: Galvanized to ASTM A123 for components; ASTM A153 for hardware; ASTM A392 for fabric; 2.0 oz/sq ft coating.

B. Hardware: Galvanized to ASTM A153, 2.0 oz/sq ft coating.

C. Accessories: Same finish as framing.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Install framework, fabric, accessories and gates according to ASTM F567.

B. Set intermediate, terminal, and gate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

C. Line Post Footing Depth Below Finish Grade: ASTM F567 3.33 feet.

D. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567 3.33 feet.

E. Brace each gate and corner post to adjacent line post with horizontal center brace rail. Install brace rail one bay from end and gate posts.

F. Install top rail through line post tops and splice with 6 inch long rail sleeves.

G. Install brace rail on corner gate leaves.

H. Place fabric on outside of posts and rails.

I. Do not stretch fabric until concrete foundation has cured 28 days.

J. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

K. Position bottom of fabric 2 inches above finished grade.

L. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

M. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

N. Install bottom tension wire stretched taut between terminal posts.

O. Install support arms sloped outward and attach barbed wire; tension and secure.

P. Support gates from gate posts. Do not attach hinged side of gate from building wall.

Q. Install gate with fabric and barbed wire overhang to match fence. Install three hinges on each gate leaf, latch, catches, retainer and locking clamp.

R. Connect to existing fence at existing terminal post.

S. Install posts with 6 inches maximum clear opening from end posts to buildings, fences and other structures.

T. Reuse holes resulting from removal of existing post footings for installation of new posts.

U. Center and align posts. Place concrete around posts, and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

V. Extend concrete footings 1 inches above grade, and trowel, forming crown to shed water.

W. Allow footings to cure minimum 7 days before installing fabric and other materials attached to posts.

## 3.2 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From Indicated Position: 1 inch.

C. Minimum distance from property line: 6 inches.

3.3 SCHEDULES

A. Property Perimeter: 6 feet high, aluminized coated fabric, three strand barbed wire top, on 45 degree sloped arms, pointing out.

END OF SECTION 323113

# SECTION 33 01 35 - MANHOLE REHABILITATION

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Manhole rehabilitation – Cementitious Manhole Restoration and Epoxy Protective Coating.
      a. Cementitious Manhole Restoration – Cementitious materials can be Portland Cement, Microsilica enhanced, Calcium Aluminate, or Geopolymer based to have a high resistance to corrosion and attain high structural strength after curing to facilitate top-coating in a relatively short period of time.
      b. Epoxy Protective Coating – Polymer used for corrosion protection and to eliminate Inflow & Infiltration (I&I). Polymer shall be compatible with both cementitious material and existing fiberglass manhole. Follow best procedure for the application of polymer as recommended by the Manufacturer.

### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Manhole Rehabilitation:
   1. Basis of Measurement: By vertical foot.
   2. Basis of Payment: Includes cleaning manhole with high velocity water jet, removal of debris, investigation to determine leaks, cementitious manhole restoration, and epoxy protective coating.

### 1.3 REFERENCES

A. ASTM International for Cementitious Manhole Restoration:
   1. ASTM F2551 – Standard Practice for Installing a Protective Cementitious Liner System in Sanitary Sewer Manholes.
   2. ASTM C33-86 - Standard Specification for Concrete Aggregates.
   3. ASTM C78 – Standard Test Method for Flexural Strength of Concrete; Using Simple Beam with Third Point Loading
   4. ASTM C 109/C109M-05 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2- in. or 50-mm Cube Specimens).
   5. ASTM C150 - Standard Specification for Portland Cement Type I.
   6. ASTM C157 – Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
   7. ASTM C267 – Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing's and Polymer Concretes.
   8. ASTM C 293-02 – Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading).
   9. ASTM C309 – Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   10. ASTM C321-00(2005) – Standard Test Method for Bond Strength of Chemical-Resistant Mortars
   11. ASTM C348-02 – Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
   12. ASTM C494-86 – Standard Specification for Chemical Admixtures for Concrete

13. ASTM C496 – Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
14. ASTM C882-05 – Standard Test Method for Bond Strength of Epoxy-Resin systems Used with Concrete by Slant Shear.

B. ASTM International for Polymer Systems
1. ASTM D543 – Resistance of Plastics to Chemical Reagents.
2. ASTM D638 – Tensile Properties of Plastics.
3. ASTM D695 – Compressive Properties of Rigid Plastics.
4. ASTM D790 – Flexural Properties of Unreinforced and Reinforced Plastics.
5. ASTM D2240 – Standard Test Method for Rubber Property – Durometer hardness
6. ASTM D4060 – Standard Test Method for Abrasion Resistance of Organic Coatings be the Taber Abrader
7. ASTM D4414 – Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by notched Gages.
8. ASTM D7234 – Pull-off Strength of Coatings Using a Portable Adhesion Tester.
9. ASTM G210 – Severe Wastewater Analysis Test

C. SSPC: The Society for Protective Coatings / NACE: National Association of Corrosion Engineers
1. SSPC SP-13/NACE No. 6 – Surface Preparation of Concrete
2. NACE SP0188 – For performing holiday detection

D. Center for Innovative Grouting Materials and Technology (CIGMAT)
1. CIGMAT – Evaluation of Liner System for Wastewater Concrete and Clay Brick Facilities.

E. ASTM International for FRP Manhole Inserts
1. ASTM D3753-05e1 – Standard Specification for Glass-Fiber Reinforced Polyester Manholes and Wet Wells

## 1.4 SUBMITTALS

A. Product Data: Submit product data on rehabilitation component system to include the following:
1. Material type and manufacturer to be used including: catalog data sheets, ASTM references, material composition, manufacturer's recommended specifications, component physical properties and chemical resistance.
2. Manufacturer's detailed description of the recommended material installation / application process including mixing, additives, set time, cure time (return to service) and all equipment required for quality product delivery.
3. Technical data sheet describing each rehabilitation component to be applied / installed, stating the expected longevity of the component in a wastewater environment.
4. Manufacturer's detailed description of all required field testing processes and procedures.
5. Copies of independent testing performed on the rehabilitation component, indicating that the product meets the requirements as specified in these contract documents and the manufacturers design.
6. By-Pass Pumping Plan as applicable.
7. Certified statement that the contractor / installer is an approved installer.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing work of this section approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in undamaged, unopened container, bearing manufacturer's original labels. Inspect for damage.

B. Protect materials from damage by storage in secure location.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MANHOLE RESTORATION

A. General
   1. Provide a cementitious restoration material designed for structural build-back, I&I abatement, corrosion resistance, and repairing inverts to design requirements. All materials applied to a structure shall be compatible, as specified by the manufacturer.

B. Manhole Repair Materials
   1. Infiltration Control – Cementitious Material
      a. All fast setting materials furnished shall be designed specifically for leak control, to be applied in dry powder form, with no prior mixing of water, directly to active leaks under hydrostatic pressure in manholes or related structures, in accordance with the manufacturer's recommendations.
   2. Infiltration Control – Oakum Water Plugs
      a. Rapid setting, oil free oakum and hydrophilic grout to seal active water leaks prior to applying other Rehabilitation Component Systems.
      b. Oil-free oakum meeting Federal Specification HH-P-117
      c. Two-part urethane resin.
   3. Invert Repair and Patching
      a. All material furnished shall be designed to fill large voids in manhole walls and to repair or reconstruct inverts where no hydrostatic pressure exists. Material shall consist of rapid setting cements, monocrystalline quartz aggregates, and various accelerating agents. Material shall no contain chlorides or metallic particles and shall be applied in accordance with the manufacturer's recommendations.
      b. Repair and Patching Materials shall have its bond strength tested to substrate failure according to ASTM C952 and be compatible with all other material components applied to the manhole.
   4. Grouting mix:
      a. For stopping severe infiltration, provide a polymer solution that reacts freely with water to form a strong film, gel, or foam of polyurethane.
   5. Install cementitious restoration materials that shall be specifically designed for the rehabilitation of manholes and other related wastewater structures. Liner materials shall be

cement based, poly-fiber reinforced, shrinkage compensated, and enhanced with chemical admixtures and siliceous aggregates. Liner materials shall be mixed with water per manufacturer's written specifications and applied using equipment specifically designed for troweling, low-pressure spray or centrifugal spin casting application. All cementitious liners shall be troweled to densify and smooth out the surfaces.

## 2.2 POLYMER SYSTEMS

A. Existing Substrate Preparation
   1. Standard Portland cement or new concrete (not Quick setting high strength cement) must cure a minimum of 28 days prior to application of the coating product(s).
   2. Remove existing coatings prior to application of the rehabilitation component system which may affect the performance and adhesion of the rehab component.
   3. Thoroughly clean, removing all laitance and prepare existing products to effect a mechanical bond with the rehabilitation component system.
   4. Manufacturer shall recommend specific methods for surface preparation.

B. Repair and Resurfacing Products
   1. Repair products shall be used to fill voids, bug holes, and/or smooth transitions between components prior to the installation of the rehabilitation component system. Repair materials must be properly cured and must be compatible with the rehab component and shall be used and applied in accordance with the manufacturer's recommended requirements.
   2. Resurfacing products shall be used to fill large voids, lost mortar in masonry structures, smooth deteriorated surfaces and to rebuild severely deteriorated structures.
   3. The following products may be accepted and approved as compatible repair and resurfacing products for use within the specifications:
      a. 100% solids, solvent-free polymer grout specifically formulated for epoxy polymer top coating compatibility.
      b. Factory blended, rapid setting, high early strength, fiber reinforced, non-shrink repair mortar that can be troweled or pneumatically spray applied maybe approved if specifically formulated to be suitable for polymer top coating with the specified polymer product. The length of resurfacing material cure required before polymer top-coating shall be as recommended by the manufacturer.
      c. All repair and resurfacing materials should be properly cured and prepared for surface top-coat application.

C. System Application
   1. Polymer System manufacturer shall provide System application procedures and requirements.
   2. Manufacturer recommended and approved application equipment.
   3. Hard to reach areas, primer application and touch-up may be performed using hand tools.

## 2.3 FRP MANHOLE INSERTS

A. Wall Cleaning
   1. Wall Cleaning as recommended by manufacturer.

B. Bench-Forming and Repair Materials
   1. Concrete shall by Type V, in accordance with the manufacturers recommendations.

2. Leak repair material as recommended by the manufacturer.

C. FRP Insert Material
   1. Inserts shall comply with ASTM D3753 and the following:
      a. Inserts shall be single piece barrel and concentric reducer construction without seams, joints, or section, comprised of chopped strand and continuous fiber glass reinforcement within isopathic polyester resin containing finely-graded sand. Materials shall be resistant to corrosive attach from sanitary sewerage an sewer gases including sulfuric acid and shall satisfy the 100,000 hour criterion in ASTM D 3753.
      b. Interior and exterior surfaces shall be relatively smooth and be free of sharp projections and protruding glass fibers. No blisters or de-laminations shall be visible.
      c. Inserts shall be sized to fit inside existing manholes and allow grade rings and frame between the top and finish grade. Wall thickness shall provide for as AASHTP H-20 load rating and wall stiffness of 36 psi minimum.
   2. Sealants
      a. A sealant, as recommended by the manufacturer shall be inserted between the FRP reducer and frame.
      b. Sealant between FRP insert and the surfaces of the manhole base shall be a quick-setting grout as recommended by the manufacturer.
   3. Grout
      a. Grout shall meet the specifications as required by the manufacturer.

PART 3 EXECUTION

A. MANHOLE PREPARATION
   1. Bypass Pump sewage, in the manhole, as required.
   2. Clean interior surfaces of manhole of debris, dirt, oil, grease, remains of old coating materials, and any other extraneous materials.
   3. Pressure wash manhole walls to remove loose mortar, concrete and debris. Pressure washing levels, used for cleaning, shall be as recommended by the manufacturer.
   4. Repair irregularities in manhole using materials, compatible with proposed resurfacing material, as recommended by the manufacturer.
   5. Repair leakage in manhole using materials, compatible with proposed resurfacing material, specified in these contract specifications.
   6. Trim and grout incoming laterals and pipes as required and/or specified.
   7. Remove debris from manhole and incoming sewer connections.
      a. Handle cleaning water to prevent water and residue from causing damage.
      b. Do not discharge debris downstream through the sanitary sewer system.
      c. Filter solids-laden water through a de-silting device.
      d. Properly dispose of debris and residue from cleaning and other construction operations in a manner satisfactorily to Owner.

3.2 CEMENTITIOUS RESTORATION

A. General.
   1. Before starting any patch work or liner application, install a perforated device, catch bucket, or other straining device to prevent construction debris from entering down-stream pipes.

2. Provide all materials, labor, equipment, etc. required to perform the work as recommended by the manufacturer and as required by the contract documents.
3. Inspect each manhole to determine methods of stopping leaks and applying patch repairs.
4. Promptly inform Owner of errors or discrepancies between the contract documents and the field conditions found, in order that changed conditions can be evaluated and revised directives issued in a timely manner.
5. Install all products in accordance with manufacturer's instructions regarding surface preparation, product application and curing.
6. Confirm that all material to be used, for the rehabilitation of the manhole are compatible with each other. Do not use any materials that have not been verified for compatibility.

B. Sealing Active Leaks
   1. The work consists of hand applying a dry quick-setting cementitious mix designed to instantly stop running water or seepage in all types of concrete and masonry structures. The applicator shall apply material in accordance with manufacturer's recommendations in accordance with the following minimum specifications.
      a. The area to be repaired must be clean and free of all debris.
      b. Once cleaned, prepare crack or hole by chipping out loose material to a minimum depth recommended.
      c. As recommended by the manufacturer, place a generous amount of the dry quick-setting cementitious material to the active leak, with a smooth fast motion, maintaining external pressure for 30 seconds, repeat until leak is stopped.
      d. Proper application should not require any special mixing of product or special curing requirements after application.
      e. Use of Oil-free Oakum Water Plugs.
         1) Saturate oakum with resin following approved submittals.
         2) Use additives as required.
         3) Place and cure following manufacturer's recommendations.

C. Invert Repair
   1. The work consists of hand mixing and applying a rapid setting, high early strength, non-shrink patching material to fill all large voids and repair manhole channels prior to spray lining of the manhole. For invert repairs, flow must be temporarily restricted by inflatable or mechanical plugs prior to cleaning.
      a. The area to be repaired must be cleaned and free of all debris.
      b. Mix water shall be clean potable water and require no additives or admixtures for use with cementitious patching materials.
      c. Cementitious material shall be mixed in a mortar tub or 5 gallon pail with water per manufacturer's specifications. Material should be mixed in small quantities, to avoid setting prior to placement in voids or channels.
      d. Once mixed to proper consistency, the materials shall be applied to the invert or void areas by hand or trowel. In invert applications, care should be taken to not apply excessive material in the channel, which could restrict flow. Once applied, materials should be smoothed either by hand or trowel in order to facilitate flow.
      e. Flows in channels shall be re-established when material has cured enough to withstand the flow as determined by the manufacturer.

D. Application of Cementitious Manhole Liner

1. The work consists of troweling, spray applying and/or centrifugally spin-casting a cementitious based liner to the inside of the existing manhole. The necessary equipment and application methods to apply the cementitious based liner materials shall be only as recommended and approved by the material manufacturer.
2. Material shall be mixed with water in accordance with manufacturer's specifications. Once mixed to proper consistency, the materials shall be pumped via a rotor-stator style progressive cavity pump through a material plaster hose for delivery to the appropriate and / or selected application device. The equipment shall be as recommended by the manufacturer, matched for the material being applied.

E. Spray Application of Cementitious Material
   1. All material shall be applied and finished using equipment specified by the manufacturer.
      a. Material hose shall be coupled to a low-velocity spray application nozzle. Pumping of the material shall commence and the mortar shall be atomized by the introduction of air at the nozzle, creating a low-velocity spray pattern for material application.
      b. Spraying shall be performed by starting at the manhole invert and progressing up the wall.
      c. Material shall be applied to a specified uniform minimum thickness as required by the manufacturer and as necessary for proper curing and application. Material shall be applied to the bench area in such a manner as to provide for proper drainage.
      d. Material shall be troweled smooth to compact material into voids. A brush or broom finish may be applied when a top coating is desired.

F. Spin Casting Application of the Cementitious Material
   1. All material shall be applied and finished using equipment specified by the manufacturer.
      a. Material hose shall be coupled to a high speed rotating applicator device. The rotating casting applicator shall then be positioned within the center of the manhole at either the top of the manhole or the lowest point elevation corresponding to the junction of the manhole bench and walls.
      b. The high speed rotating applicator shall then be initialized and pumping of the material shall commence. As the mortar begins to be centrifugally cast evenly around the interior of the manhole, the rotating applicator head shall be raised and / or lowered at a controlled retrieval speed conducive to providing a uniform material thickness on the manhole walls.
      c. Controlled multiple passes are then made until the specified minimum finished thickness is attained. If the procedure is interrupted for any reason, simply stop the retrieval of the applicator head until flows are recommenced.
      d. Material thickness may be verified at any point with a depth gauge and shall be no less than a uniform ½-inch. If additional material is required at any level, the rotating applicator head shall be placed at that level and application shall recommence until that area is thickened.
      e. Material shall be applied only when manhole is in a saturated surface dry (SSD) state, with no visible water dripping or running over the manhole walls.
      f. The low-velocity spray nozzle and the centrifugal spin casting head may be used in conjunction to facilitate uniform application of the mortar material to irregularities in the contour of the manhole walls and bench areas.
      g. Troweling of materials shall begin immediately following the spray application. Initial troweling shall be in an upward motion, to compress the material into voids and solidify manhole wall. A brush or broom finish may be applied if top coating is desired.

h. Curing will take place once the manhole cover has been replaced. It is important that the manhole cover is replaced no more than 10-20 minutes after troweling is complete to avoid moisture loss in the material due to sunlight and winds.

G. Testing and Acceptance
1. Visual inspection – verify no infiltration, cracks, or loose material.
2. Cementitious Material Physical Property Testing

## 3.3 POLYMER LINERS

A. General
1. Any active flows shall be dammed, plugged or diverted as required to ensure all liquids and maintained below or away from the surfaces to be coated.
2. Temperature of the surface to be coated should be maintained between 40 deg F and 120 deg F or as recommended by manufacturer.
3. Specified surfaces should be shielded to avoid exposure of direct sunlight or other intense heat source. Where varying surface temperatures do exist, coating application shall be scheduled when the temperature is falling and not rising or as recommended by the manufacturer.
4. Prior to commencing surface preparation, inspect all surfaces specified to receive the coating and notify the Owner, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

B. Surface Preparation
1. Oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants which may affect the performance and adhesion of the coating to the substrate shall be entirely removed.
2. Concrete and/or mortar damaged by corrosion, chemical attach or other means of degradation shall be removed so that only sound substrate remains.
3. Choice of surface preparation method(s) should be based upon the condition of the structure and concrete or masonry surface, potential contaminants present, access to perform work, and required cleanliness and profile of the prepared surface to receive the specified polymer coating product, as recommended by the manufacturer.
4. Surface preparation methods or combination of methods that may be used include high pressure water cleaning, high pressure water jetting, abrasive blasting, shot blasting, grinding, scarifying, detergent water cleaning, hot water blasting and others as described in NACE NO. 6 / SSPC SP-13. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound clean neutralized surface with sufficient profile to promote an acceptable bond with the specified polymer coating.
5. Infiltration shall be stopped by using a material which is compatible with the repair products and is suitable for top-coating with the epoxy coating product. The manufacturer shall verify the product compatibility, in writing, to the Owner.
6. The area between the manhole and the manhole ring and the manhole casting shall be a termination point of the specified epoxy coating product.

C. Application of Repair and Resurfacing Products
1. Areas where reinforcing bars have been exposed shall be repaired in accordance with the manufacturer’s recommendations.

2. Exposed rebar shall first be prepared, then be abrasive blasted and coated with the polymer coating product specified as recommended by the manufacturer.
3. Repair products shall be used to fill voids, bugholes, and other surface defects which may affect the performance or adhesion of the epoxy coating product.
4. Resurfacing products shall be used to repair, smooth or rebuild surfaces with rough profiles to provide a concrete or masonry substrate suitable for the polymer coating product to be applied. These products shall be installed to minimum thickness as specified in the contract documents.
    a. Repair and resurfaced products shall be handled, mixed, installed and cured in accordance with manufacturer recommendations.
    b. All repaired or resurfaced surfaces shall be inspected for cleanliness and suitability to receive the coating product(s). Additional surface preparation may be required prior to coating application.

D. Application of Polymer Coating Product
1. Application procedures shall conform to the recommendation of the epoxy coating product manufacturer, including environmental controls, product handling, mixing, application equipment and methods.
2. Spray equipment shall be specifically designed to accurately ratio, apply the polymer coating product, shall be in proper working order and shall be as recommended by the product manufacturer.
3. Contractors qualified in accordance with these specifications shall perform all aspects of polymer coating product installation.
4. Prepared surfaced shall be coated by spray application of the coating product(s) described herein to a minimum as recommended by the manufacturer to meet the requirements of these contract documents. Note: Coating thickness recommendations are available through the polymer coating product manufacturer based upon project assessment.
5. Subsequent top coating or additional coats of the polymer coating product shall occur within the product's recoat time. Additional surface preparation procedures will be required if this recoat time is exceeded. The polymer manufacturer's recoat time for the specific application, based on temperature and project conditions, shall be strictly followed by the applicator.
6. The polymer coating product shall mechanically bond with adjoining construction materials throughout the manhole structure to effectively seal and protect concrete or masonry substrates from infiltration and attack by corrosive elements. Procedures and materials necessary to effect this bond shall be as recommended by the polymer coating product manufacturer. No hollow spots will be accepted.
7. Submit manufacturers recommended method for terminating a coating or lining in a manhole.
8. If required sewage flow shall be stopped, bypassed or diverted for application of the polymer coating product to the invert and interface with pipe materials.

E. Testing and Acceptance
1. Visual Inspection – Installed liner system shall be completely free of pinholes and hollow spots / voids and other defects that will reduce the life expectance of the applied system.

## 3.4 PRECAST INSERTS

A. Diversion Pumping

1. Install and operate sewage diversion pumping equipment to maintain sewage flows without backup, overflow, or spillage.

B. Cleaning and Surface Preparation
   1. Remove dirt, grease, and debris from floor and interior walls of manhole using high pressure water and cleaners and cleaning methods as recommended by the manufacturer.
   2. Deteriorated invert and bench surfaced shall be abrasive blasted to profile the surface. Compressed air shall be supplied from compressors fitted with oil/moisture separators. Surfaces shall be cleaned of dust and grit particles by dry air blast cleaning, vacuum cleaning, or wiping with a tack doth. Used abrasives shall be collected and removed without allowing any to enter the sewage flows in the manhole.

C. Repairs
   1. Active leaks, if present, shall be sealed by application of leak repair material in accordance with the manufacturer's instructions.
   2. Repair and reshape manhole inverts and benches. Inverts shall be U-shaped and have a minimum depth of ½ pipe diameter. Benches shall have smooth surfaces without defects that allow debris to accumulate.

D. Precast Insert Installation
   1. Remove pavement if present. Excavate around the manhole as necessary to prevent soil and debris from falling into manhole while frame and grade rings are removed. Set aside frame and cover for reuse in rehabilitated manhole.
   2. Cut the insert of chip the concrete benches so that the insert will be evenly supported when lowered into place. Accurately locate incoming and outgoing sewer lines and cut the insert for a close fit within 1 inch to both. Seal the cut edges with resin as recommended by the manufacturer.
   3. Lower the insert into a 4-inch deep layer of quick-setting grout mixture, making sure that the sewer lines and insert opening align.
   4. Place a 6-inch deep layer of quick-setting grout at the bottom of the annular space between the insert and the wall.
   5. Seal the sewer openings with Oakum soaked in sealing gel.
   6. Fill the remaining annular space with grout. Consolidate the grout without damage to the insert.
   7. Install the grade rings, frame, and cover, sealing the surfaces between the reducer, the grade rings, and the frame.
   8. Replace pavement if any was removed.

E. Protective Coating, Chimney Bench and Invert
   1. All oil and grease shall be removed from the chimney surface by detergent cleaning with solvent, vapor, alkali, emulsion, or steam.
   2. Follow detergent cleaning with abrasive blast cleaning to remove laitance and deteriorated concrete and to roughen the surface to manufacturer specifications.
   3. All surfaces shall be clean and dry before applying the protective coating.
   4. Apply a quick set grout to the chimney, bench and invert and seal the bottom edge of the insert. Apply two (2) coats of filler/sealer with a squeegee as necessary and as recommended by the manufacturer, to achieve a smooth void free surface. Apply additional coats of filler/sealer to achieve a total applied thickness as recommended by the manufacturer.

F. Testing and Acceptance
   1. Visual Inspection – Inserts shall be inspected for workmanship and no leakage.

END OF SECTION

SECTION 333220 – WASTEWATER SUBMERSIBLE PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Replacement of Submersible non-clog wastewater pumps.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Pump:

1. Basis of Measurement: By each.
2. Basis of Payment: Includes pump and pump brackets.

B. Control System:

1. Basis of measurement: By each.
2. Basis of Payment: Includes new relay to be installed in existing enclosure and wiring within, as well as to and from, basin.

1.3 REFERENCE STANDARDS

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 25.2 - Rolling Bearings, Linear Motion Recirculating Ball, Sleeve Type - Inch Series.

B. ASTM International:
1. ASTM A48 - Standard Specification for Gray Iron Castings.

C. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. National Fire Protection Association:

1. NFPA 70 - National Electrical Code (NEC).

1.4 SUBMITTALS

A. Product Data: Submit for each type of submersible pump.

1. Manufacturer pump catalog data, performance curve, breakaway fittings data, and access frame data.
2. Temperature & seal failure relays into existing control panel.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Support basin with nylon slings to structural lift points during handling.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide temporary end caps and closures on piping and fittings, and maintain in place until installation.
3. Provide additional protection according to manufacturer instructions.

## 1.6 WARRANTY

A. Furnish five-year prorated manufacturer's warranty for pump seals.

# PART 2 - PRODUCTS

## 2.1 SYSTEM DESCRIPTION

## 2.2 PERFORMANCE AND DESIGN CRITERIA

A. Pumping System:

1. Design Flow Rate: For LS # 16, 1,110 gpm at Total Dynamic Head (TDH) = 50 feet and 1,300 gpm at TDH = 36 feet.
2. Minimum Pump Hydraulic Efficiency: 67.8 percent at LS # 16.
3. Minimum Motor Efficiency: 93.6%
4. Discharge Connection Elbow: Permanently installed in chamber with discharge piping.
5. Connection: Automatic to discharge connection elbows when lowered into place, and easily removed for inspection or service.

## 2.3 PUMPS

A. Manufacturers:

1. ABS.

2. Substitutions: Approved Equal.

B. Description:

1. Furnish Submersible non-clog wastewater pump(s) as specified in Bid Form. The pumps shall be supplied with a factory new mating cast iron six-inch slide bracket designed for the existing single rail system in place at the lift station and be capable of delivering GPM at TDH as specified in Bid Form, as well as shutoff head requirement stated in Bid Form.

2. Discharge Size: 6 inches.

C. Pump Design

1. The heavy duty submersible wastewater pumps shall be capable of handling raw unscreened sewage, storm water, and other similar solids-laden fluids without clogging. The pump shall be driven by a Premium Efficiency motor, providing the highest levels of operational reliability and energy efficiency. Minimum Motor Efficiency shall be 93.6%.

D. Guide Rail Base Assembly (wet pit installation)

1. There shall be no need for personnel to enter the wet well to remove or reinstall the pump(s). In a wet pit installation, the discharge base & elbow assembly shall be permanently installed in the wet well and connected to the discharge piping. In order to prevent binding or separation of the pump from the guide rail system, the pump(s) shall connect to the guide rail base automatically and firmly, guided by one 2-inch guide pipe extending from the base elbow to the top of the station. Systems using guide cable in lieu of rigid guide bars or pipes shall not be considered acceptable. The sliding guide bracket shall be a separate part of the pumping unit and in new condition provided with the pump, capable of being attached to standard 6 inch ANSI class 125 or metric DN100 pump flanges, so that the pump mounting is non-proprietary, and any pump with a standard discharge flange can be mounted on the base assembly. Pump or bracket assemblies with proprietary or non-standard flange dimensions shall not be considered acceptable.
2. A field replaceable Nitrile (Buna-N) rubber profile gasket or o-ring shall accomplish positive sealing of the pump flange / guide rail bracket to the discharge elbow. Base assemblies which rely solely on metal to metal contact between the pump flange and discharge base elbow as a means of sealing are inherently leak prone, and shall not be considered equal. No portion of the pump shall bear directly on the floor of the sump. The guide rail system shall be available in an optional non-sparking version, approved by Factory Mutual for use in NEC Class 1, Division 1, Group C&D hazardous locations.

E. Pump Construction

1. Major pump components shall be of gray cast iron, EN-GJL-250 (ASTM A-48, Class 35B) with smooth surfaces devoid of porosity or other irregularities. All exposed fasteners shall be stainless steel 1.4401 (AISI type 316) construction. All metal surfaces coming into contact with the pumped media (other than the stainless-steel components) shall be protected by a factory applied spray coating of zinc phosphate primer followed by a high solid two-part epoxy paint finish on the exterior of the pump. The pump shall be equipped with an open lifting hoop suitable for attachment of standard chain fittings, or for hooking from the wet well surface. The hoop shall be stainless steel 1.4404 (AISI 316), and shall be rated to lift a minimum of four times the pump weight.

2. Sealing design for the pump/motor assembly shall incorporate machined surfaces fitted with Nitrile (Buna-N) rubber O-rings. Sealing will be the result of controlled compression of rubber O-rings in two planes of the sealing interface. Housing interfaces shall meet with metal to metal contact between machined surfaces, and sealing shall be accomplished without requiring a specific torque on the securing fasteners. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered equal. No secondary sealing compounds shall be required or used.
3. IMPELLER: The ABS ContraBlock Plus impeller, or approved equal, shall be of gray cast iron, EN-GJL-250 (ASTM A-48, Class 35B). The impeller shall be of the semi-open, non-clogging, single vane design. The impeller shall be capable of passing a minimum of 3.9-inch diameter spherical solids as are commonly found in wastewater. The impeller shall have a slip fit onto the motor shaft and drive key, and shall be securely fastened to the shaft by a stainless-steel bolt which is mechanically prevented from loosening by a positively engaged ratcheting washer assembly. The head of the impeller bolt shall be effectively recessed within the impeller bore to prevent disruption of the flow stream and loss of hydraulic efficiency. The impeller shall be dynamically balanced to the ISO 10816 standard to provide smooth vibration free operation. Impeller designs that rely on retractable impeller designs to pass 3.9 inch solids, or those that rely on fins or pins protruding into the suction path to assist in the handling of fibrous material, shall not be considered equal.
4. SELF CLEANING WEAR PLATE: The ABS ContraBlock Plus wear plate, or approved equal, shall be constructed from gray cast iron, EN-GJL-250 (ASTM A-48, Class 35B). The wear plate shall be designed with an inlet incorporating strategically placed cutting grooves and an outward spiral V-shaped groove on the side facing the impeller, to shred and force stringy solids outward from the impeller and through the pump discharge. The wear plate shall be mounted to the volute with four stainless steel securing screws and four stainless steel adjusting screws to permit close tolerance adjustment between the wear plate and impeller for maximum pump efficiency. Adjustment to allow for wear and restore peak pumping performance shall be accomplished using standard tools, and without requiring disassembly of the pump. The use of fixed of non-adjustable wear plates or rings, or systems that require disassembly of the pump or shimming of the impeller to facilitate adjustment shall not be considered equal. The suction flange shall be integrated into the wear plate and its bolt holes shall be drilled and threaded to accept standard 6 inch ANSI class 125 flanged fittings.
5. PUMP VOLUTE: The pump volute shall be single piece gray cast iron, EN-GJL-250 (ASTM A-48, Class 35B) non-concentric design with centerline discharge. Passages shall be smooth and large enough to pass any solids which may enter the impeller. Discharge size shall be as specified on the pump performance curve. The discharge flange design shall permit attachment to standard ANSI or metric flanges / appurtenances. The discharge flange shall be slotted to accept both 6 inch ANSI class 125 and metric DN100 (PN 10) metric flanged fittings. Proprietary or non-standard flange dimensions shall not be considered acceptable. The minimum working pressure of the volute and pump assembly shall be 10 bar (145 psi). Pump requiring 4” or 8” discharge shall not be acceptable.

F. Premium Efficiency Motor
1. The Premium Efficiency motor shall meet efficiency standards in accordance with IEC 60034-30, level IE3. Motor rating tests shall be conducted in accordance with IEC 60034-2-1 requirements and shall be certified accurate and correct by a third party certifying agency. A certificate shall be available upon request.

2. The Premium Efficiency motor shall be housed in a water tight gray cast iron, EN-GJL-250 (ASTM A-48, Class 35B) enclosure capable of continuous submerged operation underwater to a depth of 20 meters (65 feet), and shall have an IP68 protection rating. The motor shall be of the squirrel-cage induction design, NEMA type B, Premium Efficiency. The copper stator winding shall be insulated with moisture resistant Class H insulation materials, rated for 180°C (356°F). The stator shall be press fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is unacceptable. The rotor bars and short circuit rings shall be made of cast aluminum.
3. The motor shall be designed for continuous duty. The maximum continuous temperature of the pumped liquid shall be 40°C (104°F), and intermittently up to 50°C (122°F). The motor shall be capable of handling up to 15 evenly spaced starts per hour without overheating. The service factor (as defined by the NEMA MG1 standard) shall be 1.3. The motor shall have a voltage tolerance of +/- 10% from nominal, and a phase to phase voltage imbalance tolerance of 1%. The motor shall be FM and CSA approved for use in NEC Class, I, Division I, Groups C & D hazardous locations. The surface temperature rating shall be T3C. The motor shall meet the requirements of NEMA MG1 Part 30 and 31 for operation on PWM type Variable Frequency Drives.
4. The motor shall be capable of operating, completely submerged, partially submerged, or unsubmerged. The motor shall be self-cooling via the process fluid surrounding the motor.
5. COOLING SYSTEM: The factory installed closed loop cooling system shall be adequately designed to allow the motor to run continuously under full load while in an unsubmerged or minimally submerged condition. A cooling jacket shall surround the stator housing, and an environmentally safe non-toxic propylene glycol solution shall be circulated through the jacket by a circulating impeller attached to the main motor shaft. The coolant shall be pumped through an integrated heat exchanger in the base on the motor whenever the motor is running, allowing excess heat to be transferred to the process liquid. Cooling systems that circulate the pumped medium through the cooling jacket, or those that use a toxic cooling liquid shall not be acceptable. The use of external heat exchangers, fans, or the supply of supplemental cooling liquid shall not be required.
6. THERMAL PROTECTION: Each phase of the motor shall contain a normally closed bi-metallic temperature monitor switch imbedded in the motor windings. These thermal switches shall be connected in series and set to open at 140°C +/- 5°C (284°F). They shall be connected to the control panel to provide a high stator temperature shutdown signal, and are used in conjunction with external motor overload protection. As an option, an RTD (PT100) type temperature measuring device shall be available for the motor winding to provide actual temperature measurement of the winding. When the RTD option is supplied for the motor winding, bi-metallic switches shall also be supplied in the winding. The bi-metallic system must be connected to the control to provide positive shutdown of the motor in the event of an overheat condition. This is required in order to conform to FM and CSA rules for explosion proof equipment.
7. MECHANICAL SEALS: Each pump shall be equipped with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The mechanical seals shall be of non-proprietary design, and shall be manufactured by a major independent manufacturer specializing in the design and manufacture of mechanical seals. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary industrial duty silicon-carbide seal ring and one rotating industrial duty silicon-carbide seal ring. The stationary ring of the primary seal shall be installed in a seal holding plat of gray cast iron EN-GJL-250

(ASTM A-48, Class 35B). The seal holding plate shall be equipped with swirl disruption ribs to prevent abrasive material from prematurely wearing the seal plate. The upper, secondary seal unit, located between the lubricant chamber and motor housing, shall contain one stationary industrial duty silicon-carbide seal ring, and one rotating industrial duty silicon-carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall not require routing maintenance, or adjustment, and shall not be dependent on the direction of rotation for proper sealing. Each pump shall be provided with a lubricant chamber for the shaft sealing system which shall provide superior heat transfer and maximum seal cooling. The lubricant chamber shall be designed to prevent overfilling, and to provide lubricant expansion capacity. The drain and inspection plug shall have a positive anti-leak seal, and shall be easily accessible from the outside of the pump. The seal system shall not rely upon the pumped media for lubrication and shall not be damaged when the pump is run dry. Lubricant in the chamber shall be environmentally safe non-toxic material.

a. The following seal types shall not be considered equal: Seals of proprietary design, or seals manufactured by other than major independent seal manufacturing companies. Seals requiring set screws, pins, or other mechanical locking devices to hold the seal in place, conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces, any system requiring a pressure differential to seat the seal and ensure sealing.

8. MECHANICAL SEAL PROTECTION SYSTEM: The primary mechanical seal shall be protected from interference by particles in the wastewater, including fibrous materials, by an active Seal Protection System integrated into the impeller. The back side of the impeller shall be equipped with a sinusoidal cutting ring, forming a close clearance cutting system with the lower submersible motor housing or seal plate. The sinusoidal cutting ring shall spin with the pump impeller providing a minimum of 75 shearing actions per pump revolution. Large particles or fibrous material which attempt to lodge behind the impeller, or wrap around the mechanical seal shall be effectively sheared by the active cutting system into particles small enough to prevent interference with the mechanical seal. The Seal Protection System shall operate whenever the pump operates, and shall not r3equire adjustment of maintenance in order to function. Submersible pump designs which do not incorporate an active cutting system to protect the primary mechanical seal shall not be considered acceptable for wastewater service.

9. SEAL FAILURE EARLY WARNING SYSTEM: The integrity of the mechanical seal system shall be continuously monitored during pump operation and standby time. An electrical probe shall be provided in a sensing chamber positioned above the mechanical seals for detecting the presence of water contamination within the chamber. The sensing chamber shall be air filled, and shall have a drain / inspection plug with a positive anti-leak seal which is easily accessible from the outside of the pump. A solid-state relay mounted in the pump control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe, continuously monitoring the conductivity of the liquid in the sensing chamber. If sufficient water enters the sensing chamber through the mechanical seal system, the probe shall sense the increase in conductivity and signal the sold-state relay in the control panel. The relay shall then energize a warning light on the control panel, or optionally, cause the pump to shutdown. This system shall provide an early warning of mechanical seal leakage, thereby preventing damage to the submersible pump, and allowing scheduled rather than emergency maintenance. Systems utilizing float switches or any other monitoring devices located in the stator housing rather than in a sensing chamber between the mechanical seals are not considered to be early warning systems, and shall not be considered equal or acceptable.

10. SHAFT: The pump shaft and motor shaft shall be an integral, one piece unit adequately designed to meet the maximum torque required at any normal start-up condition or operating point in the system. The shaft shall have a full shutoff head design safety factor of 1.7, and the maximum shaft deflection shall not exceed .05 mm (.002 inch) at the lower seal during normal pump operation. Each shaft shall be stainless steel 1.4021 (AISI 420) material, and shall have a polished finish with accurately machined shoulders to accommodate bearings, seals and impeller. Carbon steel, chrome plated, or multi piece welded shafts shall not be considered adequate or equal.
11. BEARINGS: Each pump shaft shall rotate on high quality permanently lubricated, greased bearings. The upper bearing shall be a deep grooved ball bearing and the lower bearings shall be a heavy duty double row angular contact ball bearing. Bearings shall be of sufficient size and properly spaced to transfer all radial and axial loads to the pump housing and minimize shaft deflection. L-10 bearing life shall be a minimum of 100,000 hours at flows ranging from ½ of BEP flow to 1½ times BEP flow (BEP is best efficiency point). The bearings shall be manufactured by a major internationally known manufacturer of high quality bearings, and shall be stamped with the manufacturer's name and size designation on the race. Generic or unbranded bearings from other than major bearing manufacturers shall not be considered acceptable.
12. POWER CABLE: The power cables shall be sized according to NEC and CSA standards and shall be of sufficient length to reach the junction box without requiring splices. The outer jacket of the cable shall be oil and water resistant, and shall be capable of continuous submerged operation underwater to a depth of 65 feet.
13. CABLE ENTRY / JUNCTION CHAMBER: The cable entry design shall not require a specific torque to insure a watertight seal. The cable entry shall consist of cylindrical elastomer grommets, flanked by stainless steel washers. A cable cap incorporating a strain relief and bend radius limiter shall mount to the cable entry boss, compressing the grommet ID to the cable while the grommet OD seals against the bore of the cable entry. Cable entry designs which utilize potting compounds to provide a water tight seal, or those which do not allow the cable to be easily changed in the field shall not be considered equal.
    a. The junction chamber shall be isolated and sealed from the motor by means of sealing glands. Electrical connections between the power cables and motor leads shall be made via a compression or post type terminal board, allowing for easy disconnection and maintenance.

## 2.4 SOURCE QUALITY CONTROL

A. Inspection:

1. Verify that motor voltage and frequency are as shown on nameplate.
2. Verify that motor and cable insulation test for moisture content or insulation defects comply with UL 83.

B. Testing:

1. Submerged Pump Run: Test to determine that pump meets hydraulic performance requirements.
2. Document and certify testing results in written report.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify that pump can connect to existing discharge piping connections' size, location, and elevation as identified in the field.

### 3.2 INSTALLATION

A. Pumps:

1. Install pumps, including fittings, brackets, discharge piping, check valve to basin rail assembly, lifting device, and discharge.
2. Wire pump to junction box.

B. Control Panel:

1. Wiring:
    a. Comply with requirements of NEC.
    b. 16 AWG control wiring for control circuits, and white for neutral grounded conductors.
    c. Minimum 14 AWG black power wiring.
    d. Number each conductor.
    e. Tin ends of wires with 60/40 lead tin alloy solder.

2. Locate and connect direct-burial cable from control panel to basin junction box.

### 3.3 FIELD QUALITY CONTROL

A. Pre-operational Checks:

1. Check pump and motor alignment.
2. Check for proper motor rotation.
3. Check pump and drive units for proper lubrication.

B. Startup and Performance Testing:

1. Notify Operations, one day prior to flow rate testing.
2. Confirm general sequencing of pump and float operations at basin and control panel are according to performance requirements.
3. Document and certify startup results in startup report.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace system components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.
3. Document adjustments, repairs, and replacements in manufacturer's field services certification.

D. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than 1 day on Site for installation, inspection, field testing, startup, and instructing Owner's personnel in maintenance of equipment.

## 3.4 ADJUSTING

A. Adjust pump such that station operates to performance requirements and according to Specifications.

## 3.5 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 333220

# SECTION 333400 - SANITARY UTILITY SEWERAGE FORCE MAINS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Force mains.
2. Bedding and cover materials.

B. Related Requirements:

1. Section 312317 - Trenching: Excavation, backfilling, compacting, and fill over underground pipe markers.

### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Pipe and Fittings:

1. Basis of Measurement: By linear foot.
2. Basis of Payment: Includes excavation, backfill, bedding, thrust restraints, pipe, and fittings.

### 1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Water Works Association:

1. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Transmission and Distribution.

C. ASTM International:

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
3. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
4. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

## 1.4 SUBMITTALS

A. Not Used

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Storage:

1. Store materials according to manufacturer instructions.
2. Do not place materials on private property without written permission of property owner.
3. Do not stack pipe higher than recommended by pipe manufacturer.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Store gaskets for mechanical and push-on joints in cool and dry location, out of direct sunlight, and not in contact with petroleum products.
3. Provide additional protection according to manufacturer instructions.

## 1.6 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.

# PART 2 - PRODUCTS

## 2.1 FORCE MAIN

## 2.2 PVC PIPE

A. PVC Pressure Sewer Pipe and Fittings, 12-Inch Nominal Size and Smaller:

1. Comply with AWWA C900.
2. Class 235.
3. Joints: Internally restrained.

## 2.3 MATERIALS

A. Bedding and Cover:

1. Sand Bedding: Granular Fill Type A, conforming to Texas Department of Transportation (TXDOT) Standard Specifications, Item 132. Granular material that is free from vegetation or other objectionable material and meets the requirements of Table 1.

**Table 1**
**Testing Requirements**

| Property | Test Method | Specification Limit |
|---|---|---|
| Liquid Limit | Tex-104-E | $\leq$ 45 |
| Plasticity index (PI) | Tex-106-E | $\leq$ 15 |
| Bar linear shrinkage | Tex-107-E | $\geq$ 2 |

   a. The Linear Shrinkage test only needs to be performed as indicated in Tex-104-E.
2. Cover and Soil Backfill from above Pipe to Finish Grade: Subsoil Type B, conforming to TXDOT standard specifications, Item 132.
   a. Excavated and re-used material.
   b. Graded.
   c. Materials such as rock, loam, clay, or other approved materials.
   d. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
   e. Conforming to ASTM D2487 Group Symbol(s) CL, GW, SW, GP, SP, GM, SM, GC, SC, and/or dual classifications.
3. Subsoil: No rocks more than 6 inches in diameter, frozen earth, or foreign matter.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify that trench cut is ready to receive Work.

B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

### 3.2 PREPARATION

A. Correct over-excavation with fine aggregate.

B. Remove large stones or other hard matter capable of damaging pipe or of impeding consistent backfilling or compaction.

### 3.3 INSTALLATION

A. Bedding:

1. Excavate pipe trench as specified in Section 312317 - Trenching.
2. Place bedding material at trench bottom.
3. Level materials in continuous layers not exceeding 8 inches in depth.
4. Maintain optimum moisture content of bedding material to attain required compaction density.

B. Piping:

1. Install pipe, fittings, and accessories as indicated on Drawings.
2. Route piping in straight line.
3. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches.
4. Backfilling and Compacting:

    a. As specified in Section 312317 - Trenching.
    b. Do not displace or damage pipe while compacting.

5. Connect to municipal sewer system.

C. Thrust Restraints:

1. Provide pressure pipeline with restrained joints or concrete thrust blocking at bends, tees, and changes in direction.
2. Construct concrete thrust blocking as indicated on Drawings.

## 3.4 FIELD QUALITY CONTROL

A. Inspections: Request inspection by Operations prior to placing bedding.

## 3.5 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 333400

SECTION 333500 - PLUG VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes non-lubricated plug valves.

1.2 UNIT PRICES

A. Work of this Section is affected by proposed Resilient Plug Valve.
   1. Basis of Measurement and Payment: By diameter and by each.

1.3 REFERENCES

A. American Water Works Association (AWWA):
   1. C606 – Grooved and Shouldered Joints.
   2. C517 – Resilient-Seated Cast Iron Eccentric Plug Valves.

B. ASTM International (ASTM):
   1. A126 – Standard Specification for Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings.
   2. A536 – Standard Specification for Ductile Iron Castings.

C. Society for Protective Coatings (SSPC):
   1. SP 7 – Brush-Off Blast Cleaning.
   2. SP 10 – Near-White Blast Cleaning.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
   1. Clow Valve.
   2. DeZurik, “PEC”.
   3. Mueller / Milliken.

B. Design:
   1. Type: Non-lubricated eccentric type, in accordance with AWWA C517.
   2. Plug face: Resilient material that operated satisfactorily at a temperature of 180 degrees Fahrenheit continuous and 215 degrees Fahrenheit intermittent, except for valves in compressed air or digester gas service.
      a. Valves in compressed air service: Resilient material suitable for continuous duty at 250 degrees Fahrenheit.

b. Valves in digester gas service: Resilient material suitable for petroleum or digester gas at continuous duty at 180 degrees Fahrenheit.

3. Compression washer: Provide flat compression washer made of Teflon, or of a material having equal physical characteristics on valve stem between plug and bonnet.
4. Stem seals: Provide stem seals serviceable without unbolting the valve bonnet assembly.
5. Grit excluders: Provide PTFE grit excluders at upper plug journals to prevent entry of foreign solids in bearing area.
6. Clearly mark valves to indicate their open and closed positions.
7. Provide valves with ends as required by piping details indicated on the Drawings.
8. Grooved end body valves:
   a. Usage: Plug valves with grooved ends may be used in piping systems specified in the Piping Schedule to have grooved end joints and as indicated on the Drawings.
   b. Grooved end joint design: In accordance with AWWA C606.

C. MATERIALS

1. Body and plug: ASTM A126, Class B, cast-iron, with plug face of EPDM material suitable for the intended service as specified under paragraph "Design" above.
2. Body seats in valves 3 inch size and larger: Provide with overlay of not less than 90-percent nickel and minimum thickness of 1/8 inch on surfaces contacting the plug face.
3. Stem bearing and bottom bearing: Type 316 stainless steel.
4. Internal parts, except the body and plug: Type 316 stainless steel, Monel or Nickel.
5. Exposed nuts, bolts, and washers: Zinc plated. Exception: Exposed nuts, bolts, and washers for buried service: Stainless steel.

## 2.2 VALVE OPERATORS

A. Furnish valves with an operating wrench or worm gear operator:

1. Equip valves 4 inch nominal size and smaller with a lever operator.
2. Equip valves 6 inch nominal size and larger with a worm gear operator.

## 2.3 COATING

A. Coat interior metal services to apply protective lining to non-working surfaces, except stainless steel surfaces using one of the following lining types:

1. Fusion bonded epoxy:
   a. Manufacturers: One of the following or equal:
      1) 3-M Company, ScotchKote 134; certified to NSF 61 for drinking water use.
   b. Clean surfaces in accordance with SSPC SP 7 or SP 10, as recommended by epoxy manufacturer.
   c. Apply in accordance with manufacturer's published instructions.
   d. Lining thickness: 0.010 to 0.012 inches except that:
      1) Lining thickness in grooves for gaskets: 0.005 inches.
      2) Do not coat seat grooves in valves with bonded seat.
   e. Quality control:
      1) Lining thickness: Measured with a non-destructive magnetic type thickness gauge.
      2) Verify lining integrity with a wet sponge-testing unit operating at approximately 60 volts, or as recommended by the lining manufacturer.

3) Consider tests successful when lining thickness meets specified requirements and when no pinholes are found.
4) Correct defective lining disclosed by unsuccessful tests, and repeat test.
5) Repair pinholes with liquid epoxy recommended by manufacturer of the epoxy used for lining.

2. High solids epoxy:
   a. High solids epoxy (self priming) not less than 72 percent solids by volume:
      1) As manufactured by one of the following or equal:
         a) Carboline: Carboguard 891.
         b) Devoe: Bar Rust 233H.
         c) PPG Amercoat: Amerlock 2.
         d) S-W: Macropoxy 646.
         e) Tnemec: HS Epoxy Series 104.
      2) Certified in accordance with NSF 61 for drinking water use.
      3) Interior: Coat valve interior with manufacturer's equivalent high performance high solids epoxy coating system with a certifiable performance history for the service conditions and as approved by the Engineer. Manufacturer shall provide for approval, coating information sufficient to allow Engineer to assess equivalence to the specified high solids epoxy coating.
   b. Clean surfaces to meet SP-7 or SP-10, or as recommended by coating manufacturer.
   c. Quality control: After coating is cured, check coated surface for porosity with a holiday detector set at 1,800 volts, or as recommended by coating manufacturer.
      1) Repair holidays and other irregularities and retest coating.
      2) Repeat procedure until holidays and other irregularities are corrected.

## 2.4 UNDERGOUND VALVES

A. Provide underground valves with flanges, mechanical, or other type of joint required for the type of pipe to which the valve is to be connected.

B. Coating and wrapping:
   1. After installation, encase valves in 2 layers of polyethylene wrap supplied by the pipe manufacturer.
      a. Materials: Supply one of the following polyethylene encasements:
         1) 2 layers of linear low-density polyethylene (LLDPE) film, minimum thickness of 8 mils in accordance with AWWA C105; or
         2) Single layer of high-density, cross-laminated polyethylene (HDCLPE) film, minimum thickness of 4 mils in accordance with AWWA C105.
         3) Single layer of V-Bio® enhanced polyethylene ethylene encasement (3 layers of co-extruded LLDPE film with anti-microbial additive and volatile corrosion inhibitor infused on the inside surface), meeting all requirements of AWWA C105.
      b. Ascertain that polyethylene wrapping does not affect operation of valve.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Install valves as specified in the manufacturer's instructions.

B. Install valves so that in the closed position the pressure in the pipeline applies a seating head on the valves.

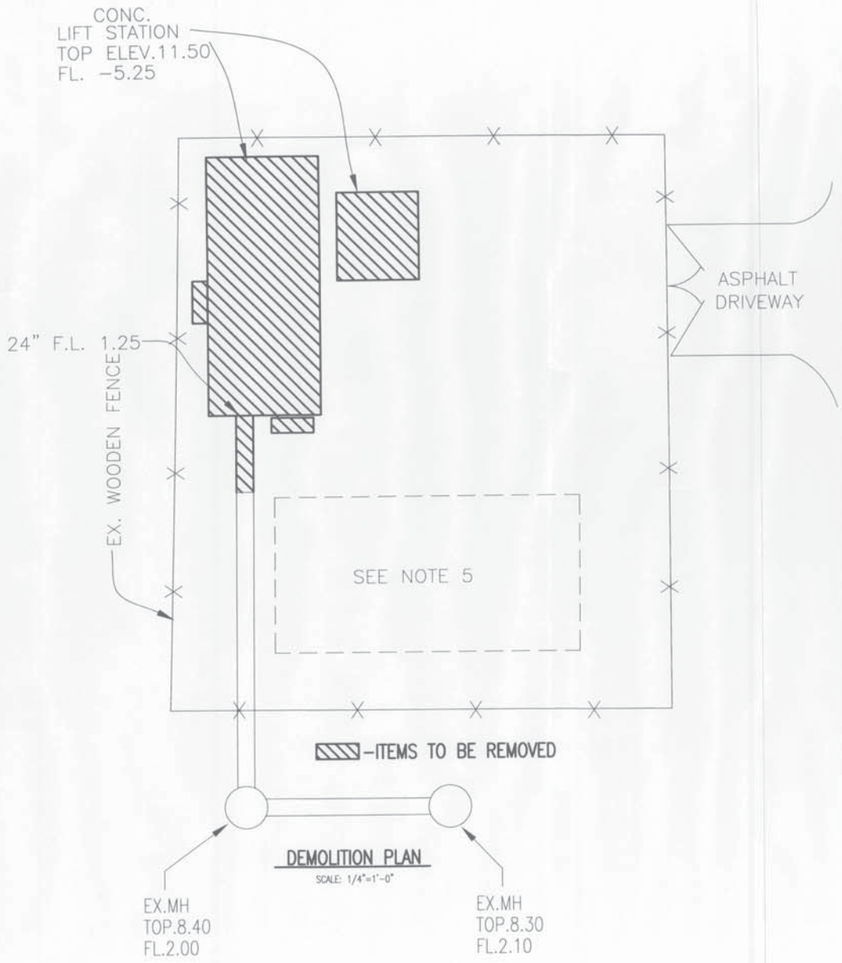
C. Lubrication: Lubricate plug valves and fill extended lubricant pipes with lubricant suitable for service intended.

D. Install valves so that in the open position the plug valve is located in the top half of the valve body.

END OF SECTION 333500

# E X H I B I T “B”

**LAGUNA MADRE WATER DISTRICT**
**PUMP REPLACEMENT & MISC. WASTEWATER SYSTEM REHABILITATION**
**PLANS AND RECORD DRAWINGS**




DEMOLITION PLAN

SCALE: 1/4"=1'-0"

DEMOLITION NOTES (EX. LIFT STATION #16)

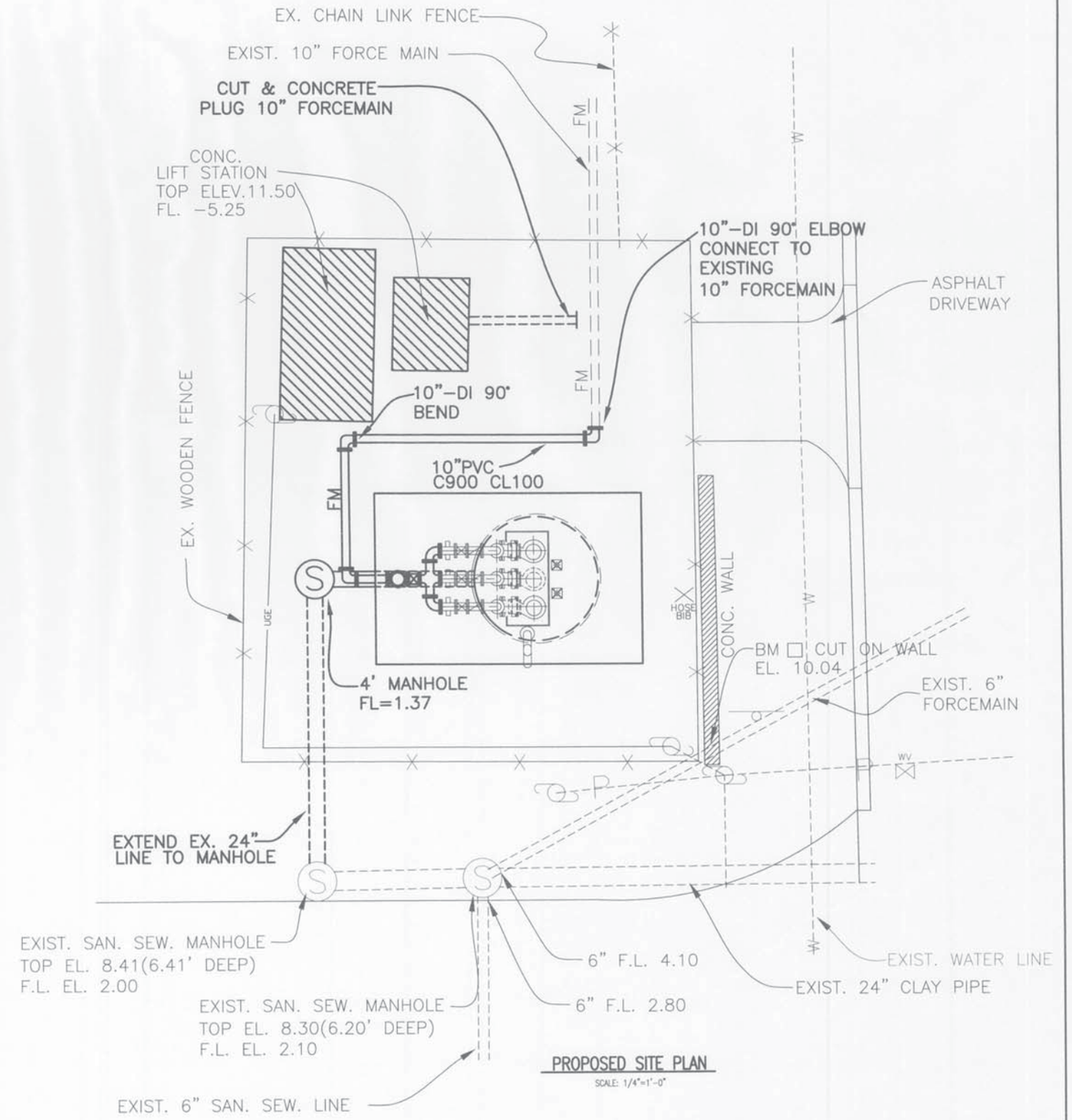
(1) REMOVE PUMPS, VALVES, FITTINGS, AND RELATED PIPING @ EX. LIFT STATION #16 RETURN TO L.M.W.D. WAREHOUSE ALL MECHANICAL EQUIPMENT SUCH AS PUMPS, MOTORS, VALVES, PUMP SUCTION COLUMNS AND FITTINGS. PROPERLY DISPOSE OF OTHER MATERIALS.

(2) RECONNECT CONTROL PANEL AND ALL RELATED ELECTRICAL CONNECTIONS AS PER ELECTRICAL PLANS AND SPECIFICATIONS.

(3) FILL EXISTING LIFT STATION AND VALVE BOX WITH SAND AND POUR A 4" CONCRETE SLAB FLUSHED WITH EXISTING TOP OF CONCRETE ELEVATION.

(4) PLUG WITH CONCRETE ALL LINES INTO EX. LIFT STATION.

(5) A LIFT STATION EXISTED IN THE AREA OF THE PROPOSED LIFT STATION. THE OLD LIFT STATION WAS FILLED WITH DIRT & CONCRETE. THE CONTRACTOR SHALL REMOVE & PROPERLY DISPOSE OF THE MATERIALS.




PROPOSED SITE PLAN

SCALE: 1/4"=1'-0"

AS BUILT

| REVISION OR ISSUE | | | REVISION OR ISSUE | | |
|---|---|---|---|---|---|
| NO. | DATE | SUBJECT | NO. | DATE | SUBJECT |
| | | | | | |

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(956) 423-7409

STATE OF TEXAS
Jesus Leal III
82006
REGISTERED PROFESSIONAL ENGINEER
SEAL

LAGUNA MADRE WATER DISTRICT
LIFT STATION NO. 16 REHABILITATION

TITLE:
REHABILITATION OF L.S. #16
EXISTING & PROPOSED SITE PLAN

| | |
|---|---|
| SCALE: AS SHOWN | DATE: OCTOBER 2002 |
| DESIGNED BY: JL | |
| DRAWN BY: JFL | |
| CHECKED BY: JL | |
| APPROVED BY: JL | |
| PROJECT NO.: CF0203 | |

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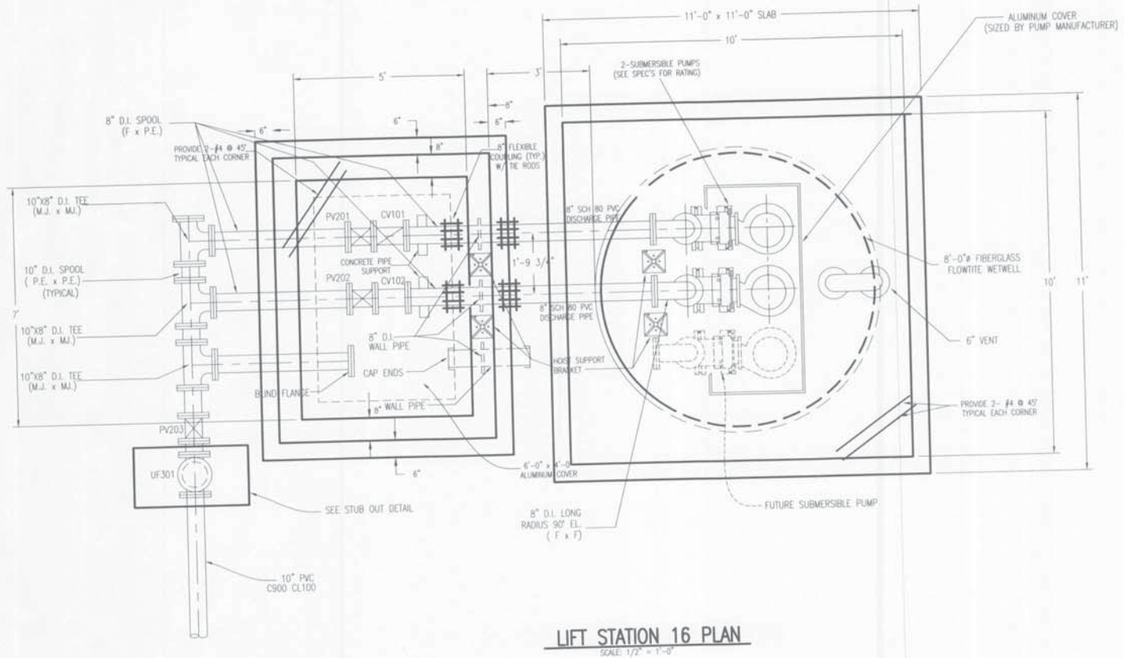
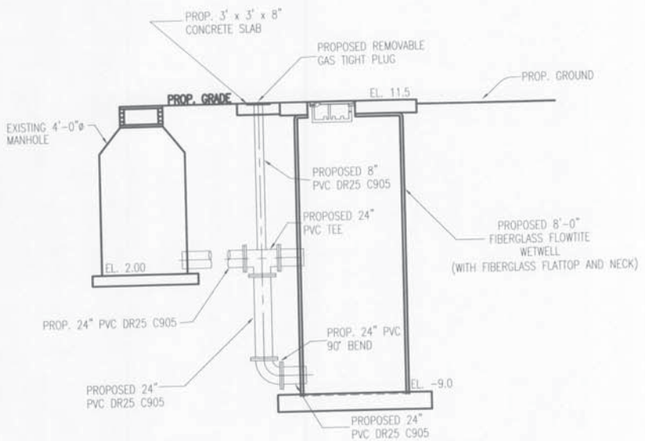
7

DATE PLOTTED: OCTOBER 10, 2002 DRAWING NAME: F:\JOBS\CF0203\SITEPLAN8.5X11.DWG




## LIFT STATION 16 PLAN

SCALE: 1/2" = 1'-0"

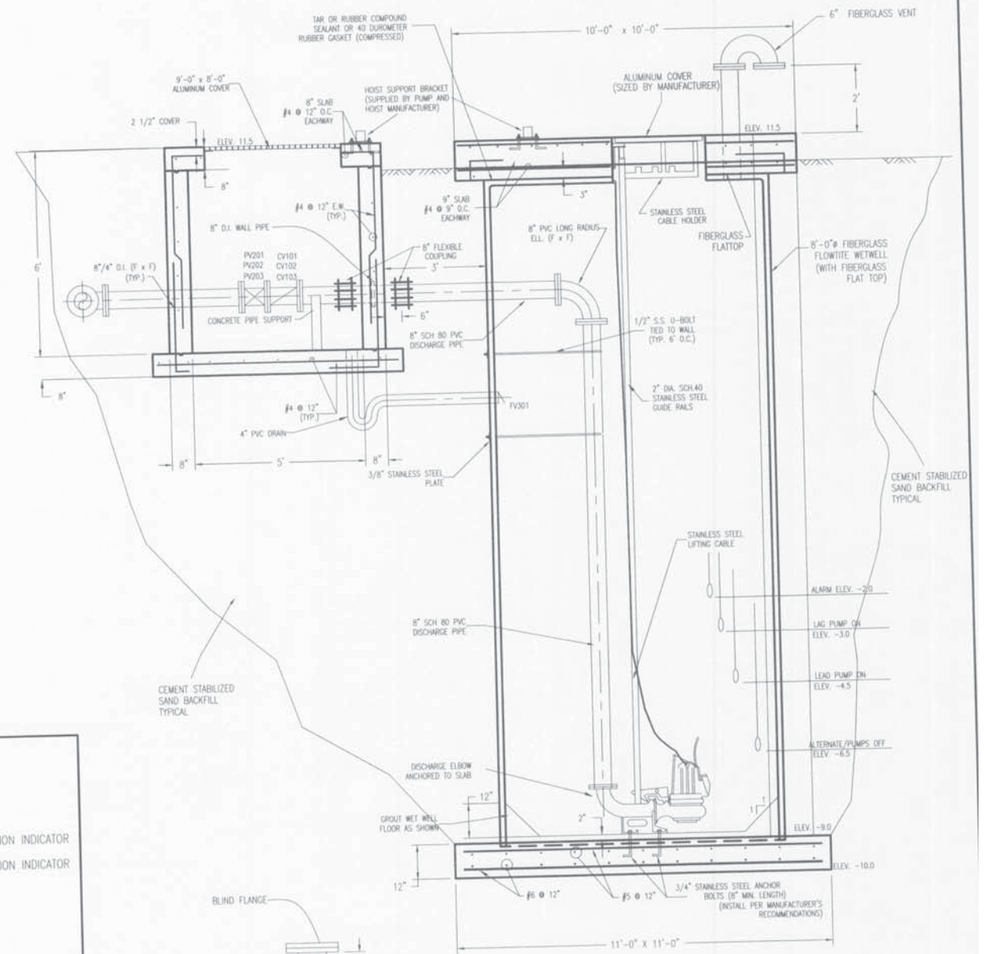



## GRAVITY LINE CONNECTION FOR 24"

SCALE: N.T.S

## VALVE SCHEDULE

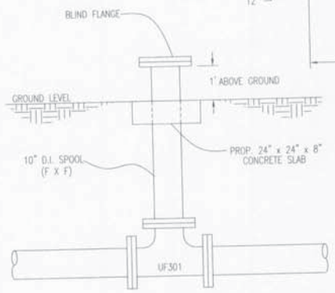
| VALVE NO. | SIZE | CONNECTION | COMMENTS |
|---|---|---|---|
| CV101 | 8" | F x F | OR VAL-MATIC SWING CHECK VALVE WITH POSITION INDICATOR |
| CV102 | 8" | F x F | OR VAL-MATIC SWING CHECK VALVE WITH POSITION INDICATOR |
| FV301 | 4" | F | FLAP VALVE |
| PV201 | 8" | F x F | PLUG VALVE WITH HANDWHEEL |
| PV202 | 8" | F x F | PLUG VALVE WITH HANDWHEEL |
| PV203 | 10" | F x F | PLUG VALVE (BURIED) |
| UF301 | 10" | F x F | UNI-FLANGE |




NOTES:
1.) EXACT LOCATION OF PUMP BASE, GUIDERAILS, AND STEEL COVER TO BE LOCATED BY PUMP MANUFACTURER.

## LIFT STATION 16 SECTION

SCALE: 1/2" = 1'-0"




## STUB OUT DETAIL

SCALE: 1/2" = 1'-0"

| REVISION OR ISSUE NO. | DATE | SUBJECT | REVISION OR ISSUE NO. | DATE | SUBJECT |
|---|---|---|---|---|---|
| | | | | | |

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STATE OF TEXAS — Jesus Leal III — 92006 — REGISTERED PROFESSIONAL ENGINEER — SEAL

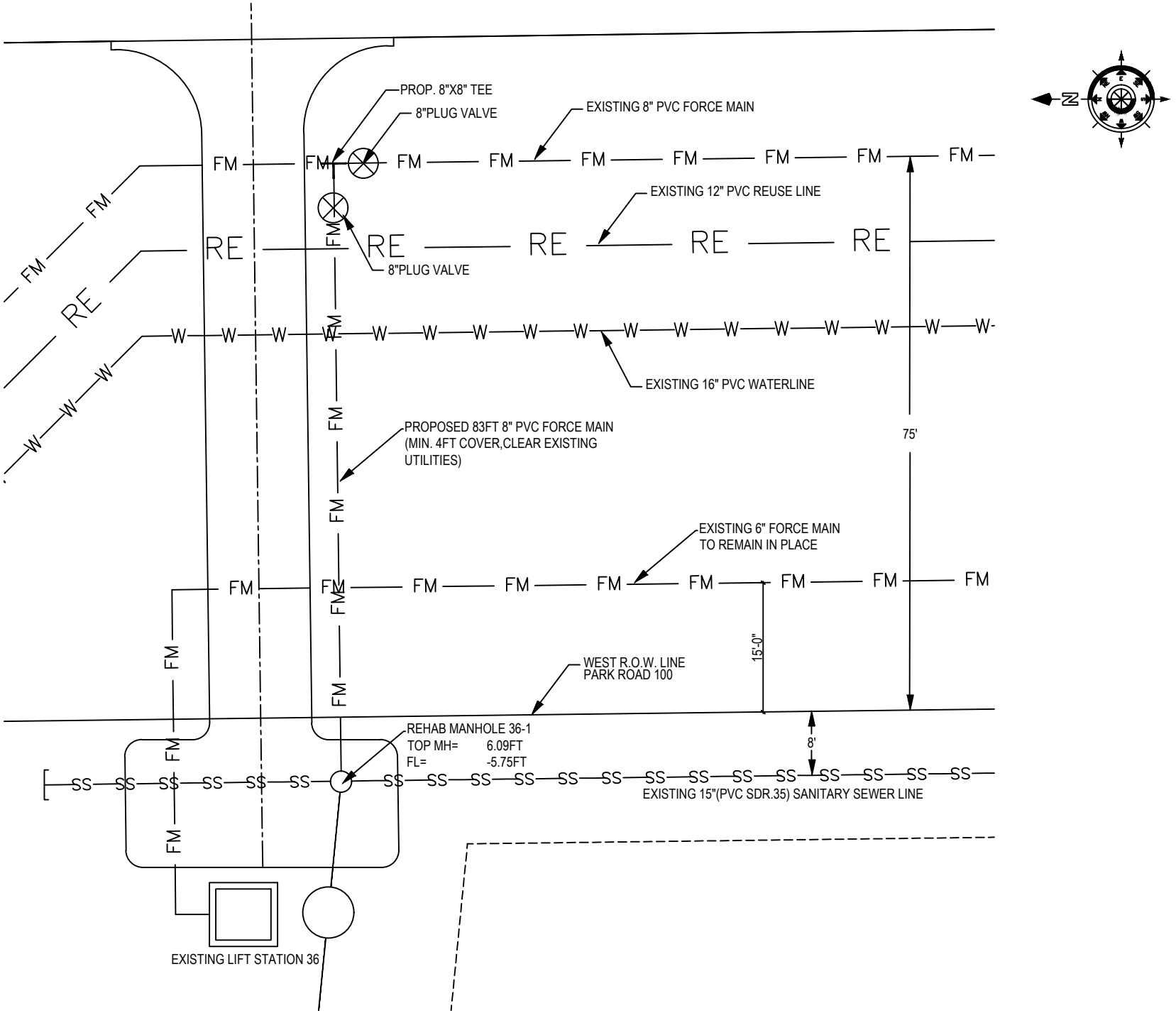
LAGUNA MADRE WATER DISTRICT
LIFT STATION NO. 16 REHABILITATION

TITLE:
LIFT STATION #16
MECHANICAL AND STRUCTURAL

| | |
|---|---|
| SCALE: AS SHOWN | DATE: OCTOBER 2002 |
| DESIGNED BY: J.L. | |
| DRAWN BY: J.F.M. | |
| CHECKED BY: J.L. | |
| APPROVED BY: J.L. | |
| PROJECT NO.: CF0203 | |

3 / 7

DATE PLOTTED: OCTOBER 10,2002 DRAWING NAME: F:\JOBS\CF0203\REHABLIFTSTATION16.I

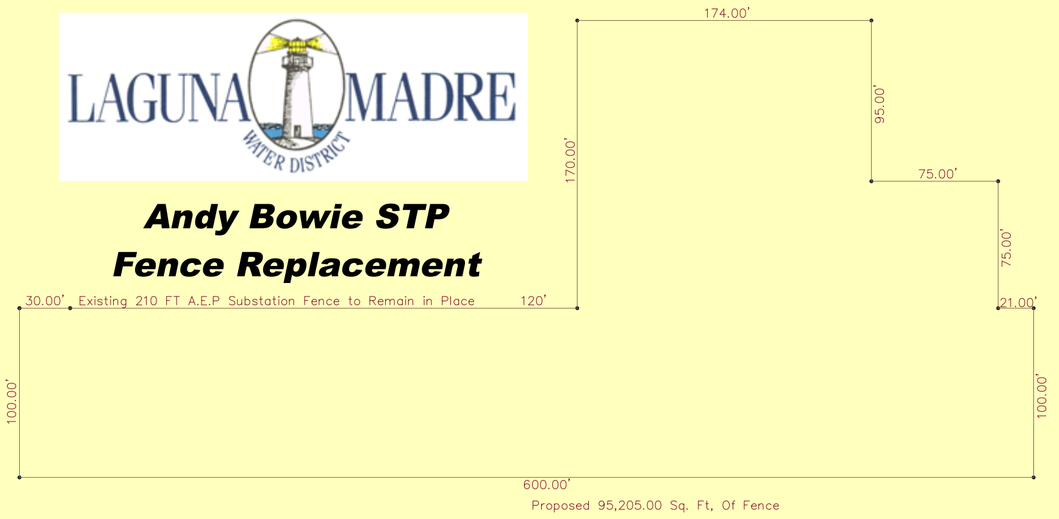



| | | |
|---|---|---|
| | Misc. Wastewater System Rehabilitation | Proposed 8" Force Main and Manhole Rehabilitation at Lift Station No. 36 |

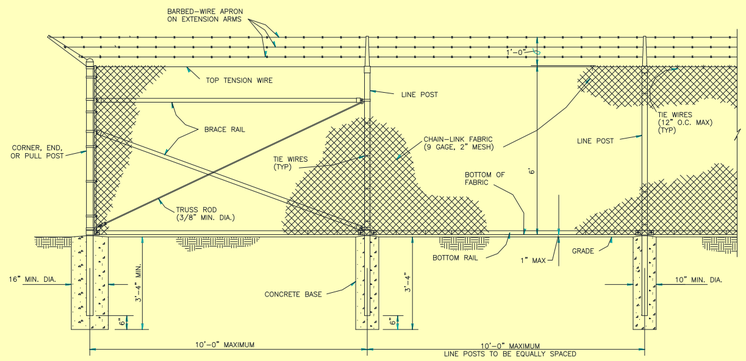
LAGUNA MADRE WATER DISTRICT

LAGUNA MADRE WATER DISTRICT

# Andy Bowie STP
# Fence Replacement

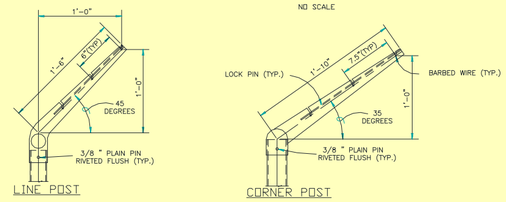



Proposed 95,205.00 Sq. Ft, Of Fence




CHAIN-LINK SECURITY FENCE DETAIL

NO SCALE




LINE POST

CORNER POST

EXTENSION ARM DETAILS

NO SCALE

(1)-PEDESTRIAN GATE

(1)-AUTOMATIC GATE(20-FT.)

PADRE